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Contents

1.1 libnfnetlink 1.0.0

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the "copyright" line and a pointer to where the full notice is found.

  <one line to give the program's name and a brief idea of what it does.>
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1.3 bzip2 1.0.6

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jseward@acm.org
bzip2/libbzip2 version 1.0.2 of 30 December 2001

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/*
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    libbz2.dll test program.
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  usage: minibz2 [-d] [-{1,2,..9}] [[srcfilename] destfilename]
*/

1.4 ncurses 5.9

1.4.1 Available under license :

Upstream source http://invisible-island.net/ncurses/ncurses-examples.html

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   from scratch. It can only install one file at a time, a restriction
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1.5 glib 2.42.1

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 Because
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 This option is useful when you wish to copy part of the code of
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 4. You may copy and distribute the Library (or a portion or
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 5. A program that contains no derivative of any portion of the
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 However, linking a "work that uses the Library" with the Library
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Section 6 states terms for distribution of such executables.

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 If such an object file uses only numerical parameters, data
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 library `Frob' (a library for tweaking knobs) written by James Random Hacker.

 <signature of Ty Coon>, 1 April 1990
 Ty Coon, President of Vice

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must be
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 If distribution of object code is made by offering access to copy
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  the
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 1. Source Code.

 The "source code" for a work means the preferred form of the work
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 A "Standard Interface" means an interface that either is an official
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 The

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produce the work, or an object code interpreter used to run it.

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for this service if you wish); that you receive source code or can get
it if you want it; that you can change the software and use pieces of it
in new free programs; and that you are informed that you can do these
things.

 To protect your rights, we need to make restrictions that forbid
distributors to deny you these rights or to ask you to surrender these
rights. These restrictions translate to certain responsibilities for
you if you distribute copies of the library or if you modify it.

 For example, if you distribute copies of the library, whether gratis
or for a fee, you must give the recipients all the rights that we gave
you. You must make sure that they, too, receive or can get the source
code. If you link other code with the library, you must provide
complete object files to the recipients, so that they can relink them
with the library after making changes to the library and recompiling
it. And you must show them these terms so they know their rights.

 We protect your rights with a two-step method: (1) we copyright the
library, and (2) we offer you this license, which gives you legal
permission to copy, distribute and/or modify the library.

 To protect each distributor, we want to make it very clear that
there is no warranty for the free library. Also, if the library is
modified by someone else and passed on, the recipients should know
that what they have is not the original version, so that the original

author's reputation will not be affected by problems
 that might be
introduced by others.

 Finally, software patents pose a constant threat to the existence of
any free program. We wish to make sure that a company cannot
effectively restrict the users of a free program by obtaining a
restrictive license from a patent holder. Therefore, we insist that
any patent license obtained for a version of the library must be
consistent with the full freedom of use specified in this license.

 Most GNU software, including some libraries, is covered by the
ordinary GNU General Public License. This license, the GNU Lesser
General Public License, applies to certain designated libraries, and
is quite different from the ordinary General Public License. We use
this license for certain libraries in order to permit linking those
libraries into non-free programs.

 When a program is linked with a library, whether statically or using
a shared library, the combination of the two is legally speaking a
combined work, a derivative of the original library.
  The ordinary
General Public License therefore permits such linking only if the
entire combination fits its criteria of freedom. The Lesser General
Public License permits more lax criteria for linking other code with
the library.

 We call this license the @dfn{Lesser} General Public License because it
does @emph{Less} to protect the user's freedom than the ordinary General
Public License. It also provides other free software developers Less
of an advantage over competing non-free programs. These disadvantages
are the reason we use the ordinary General Public License for many
libraries. However, the Lesser license provides advantages in certain
special circumstances.

 For example, on rare occasions, there may be a special need to
encourage the widest possible use of a certain library, so that it becomes
a de-facto standard. To achieve this, non-free programs must be
allowed to use the library. A more frequent case is that a free
library does the same job as widely used non-free
 libraries. In this
case, there is little to gain by limiting the free library to free
software only, so we use the Lesser General Public License.

 In other cases, permission to use a particular library in non-free
programs enables a greater number of people to use a large body of
free software. For example, permission to use the GNU C Library in
non-free programs enables many more people to use the whole GNU

operating system, as well as its variant, the GNU/Linux operating
system.

 Although the Lesser General Public License is Less protective of the
users' freedom, it does ensure that the user of a program that is
linked with the Library has the freedom and the wherewithal to run
that program using a modified version of the Library.

 The precise terms and conditions for copying, distribution and
modification follow. Pay close attention to the difference between a
``work based on the library'' and a ``work that uses the library''. The
former contains code derived from the
 library, whereas the latter must
be combined with the library in order to run.

@iftex
@appendixsubsec TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION
@end iftex
@ifinfo
@center GNU LESSER GENERAL PUBLIC LICENSE
@center TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION
@end ifinfo

@enumerate 0
@item
This License Agreement applies to any software library or other program
which contains a notice placed by the copyright holder or other
authorized party saying it may be distributed under the terms of this
Lesser General Public License (also called ``this License''). Each
licensee is addressed as ``you''.

 A ``library'' means a collection of software functions and/or data
prepared so as to be conveniently linked with application programs
(which use some of those functions and data) to form executables.

 The ``Library'', below, refers to any such software library or work
which has been distributed under these terms. A ``work based on the
Library'' means
 either the Library or any derivative work under
copyright law: that is to say, a work containing the Library or a
portion of it, either verbatim or with modifications and/or translated
straightforwardly into another language. (Hereinafter, translation is
included without limitation in the term ``modification''.)

 ``Source code'' for a work means the preferred form of the work for
making modifications to it. For a library, complete source code means
all the source code for all modules it contains, plus any associated
interface definition files, plus the scripts used to control compilation

and installation of the library.

 Activities other than copying, distribution and modification are not
covered by this License; they are outside its scope. The act of
running a program using the Library is not restricted, and output from
such a program is covered only if its contents constitute a work based
on the Library (independent of the use of the Library in a tool for
writing it). Whether
 that is true depends on what the Library does
and what the program that uses the Library does.

@item
You may copy and distribute verbatim copies of the Library's
complete source code as you receive it, in any medium, provided that
you conspicuously and appropriately publish on each copy an
appropriate copyright notice and disclaimer of warranty; keep intact
all the notices that refer to this License and to the absence of any
warranty; and distribute a copy of this License along with the
Library.

 You may charge a fee for the physical act of transferring a copy,
and you may at your option offer warranty protection in exchange for a
fee.

@item
You may modify your copy or copies of the Library or any portion
of it, thus forming a work based on the Library, and copy and
distribute such modifications or work under the terms of Section 1
above, provided that you also meet all of these conditions:

@enumerate a
@item
The modified work must itself be a software library.

@item
You must cause
 the files modified to carry prominent notices
stating that you changed the files and the date of any change.

@item
You must cause the whole of the work to be licensed at no
charge to all third parties under the terms of this License.

@item
If a facility in the modified Library refers to a function or a
table of data to be supplied by an application program that uses
the facility, other than as an argument passed when the facility
is invoked, then you must make a good faith effort to ensure that,

in the event an application does not supply such function or
table, the facility still operates, and performs whatever part of
its purpose remains meaningful.

(For example, a function in a library to compute square roots has
a purpose that is entirely well-defined independent of the
application. Therefore, Subsection 2d requires that any
application-supplied function or table used by this function must
be optional: if the application does not supply it, the square
root function must still
 compute square roots.)
@end enumerate

These requirements apply to the modified work as a whole. If
identifiable sections of that work are not derived from the Library,
and can be reasonably considered independent and separate works in
themselves, then this License, and its terms, do not apply to those
sections when you distribute them as separate works. But when you
distribute the same sections as part of a whole which is a work based
on the Library, the distribution of the whole must be on the terms of
this License, whose permissions for other licensees extend to the
entire whole, and thus to each and every part regardless of who wrote
it.

Thus, it is not the intent of this section to claim rights or contest
your rights to work written entirely by you; rather, the intent is to
exercise the right to control the distribution of derivative or
collective works based on the Library.

In addition, mere aggregation of another work not based on the Library
with the Library (or with a work
 based on the Library) on a volume of
a storage or distribution medium does not bring the other work under
the scope of this License.

@item
You may opt to apply the terms of the ordinary GNU General Public
License instead of this License to a given copy of the Library. To do
this, you must alter all the notices that refer to this License, so
that they refer to the ordinary GNU General Public License, version 2,
instead of to this License. (If a newer version than version 2 of the
ordinary GNU General Public License has appeared, then you can specify
that version instead if you wish.) Do not make any other change in
these notices.

 Once this change is made in a given copy, it is irreversible for
that copy, so the ordinary GNU General Public License applies to all
subsequent copies and derivative works made from that copy.

This option is useful when you wish to copy part of the code of
the Library into a program that is not a library.

@item
You may copy and distribute the Library
 (or a portion or
derivative of it, under Section 2) in object code or executable form
under the terms of Sections 1 and 2 above provided that you accompany
it with the complete corresponding machine-readable source code, which
must be distributed under the terms of Sections 1 and 2 above on a
medium customarily used for software interchange.

 If distribution of object code is made by offering access to copy
from a designated place, then offering equivalent access to copy the
source code from the same place satisfies the requirement to
distribute the source code, even though third parties are not
compelled to copy the source along with the object code.

@item
A program that contains no derivative of any portion of the
Library, but is designed to work with the Library by being compiled or
linked with it, is called a ``work that uses the Library''. Such a
work, in isolation, is not a derivative work of the Library, and
therefore falls outside the scope of this License.

 However,
 linking a ``work that uses the Library'' with the Library
creates an executable that is a derivative of the Library (because it
contains portions of the Library), rather than a ``work that uses the
library''. The executable is therefore covered by this License.
Section 6 states terms for distribution of such executables.

 When a ``work that uses the Library'' uses material from a header file
that is part of the Library, the object code for the work may be a
derivative work of the Library even though the source code is not.
Whether this is true is especially significant if the work can be
linked without the Library, or if the work is itself a library. The
threshold for this to be true is not precisely defined by law.

 If such an object file uses only numerical parameters, data
structure layouts and accessors, and small macros and small inline
functions (ten lines or less in length), then the use of the object
file is unrestricted, regardless of whether it is legally a derivative
work.
 (Executables containing this object code plus portions of the
Library will still fall under Section 6.)

Otherwise, if the work is a derivative of the Library, you may
distribute the object code for the work under the terms of Section 6.
Any executables containing that work also fall under Section 6,
whether or not they are linked directly with the Library itself.

@item
As an exception to the Sections above, you may also combine or
link a ``work that uses the Library'' with the Library to produce a
work containing portions of the Library, and distribute that work
under terms of your choice, provided that the terms permit
modification of the work for the customer's own use and reverse
engineering for debugging such modifications.

You must give prominent notice with each copy of the work that the
Library is used in it and that the Library and its use are covered by
this License. You must supply a copy of this License. If the work
during execution displays copyright notices,
 you must include the
copyright notice for the Library among them, as well as a reference
directing the user to the copy of this License. Also, you must do one
of these things:

@enumerate a
@item
Accompany the work with the complete corresponding
machine-readable source code for the Library including whatever
changes were used in the work (which must be distributed under
Sections 1 and 2 above); and, if the work is an executable linked
with the Library, with the complete machine-readable ``work that
uses the Library'', as object code and/or source code, so that the
user can modify the Library and then relink to produce a modified
executable containing the modified Library. (It is understood
that the user who changes the contents of definitions files in the
Library will not necessarily be able to recompile the application
to use the modified definitions.)

@item
Use a suitable shared library mechanism for linking with the Library. A
suitable mechanism is one that (1) uses at run time
 a copy of the
library already present on the user's computer system, rather than
copying library functions into the executable, and (2) will operate
properly with a modified version of the library, if the user installs
one, as long as the modified version is interface-compatible with the
version that the work was made with.

@item
Accompany the work with a written offer, valid for at

least three years, to give the same user the materials
specified in Subsection 6a, above, for a charge no more
than the cost of performing this distribution.

@item
If distribution of the work is made by offering access to copy
from a designated place, offer equivalent access to copy the above
specified materials from the same place.

@item
Verify that the user has already received a copy of these
materials or that you have already sent this user a copy.
@end enumerate

 For an executable, the required form of the ``work that uses the
Library'' must include any data and utility programs needed for
reproducing
 the executable from it. However, as a special exception,
the materials to be distributed need not include anything that is
normally distributed (in either source or binary form) with the major
components (compiler, kernel, and so on) of the operating system on
which the executable runs, unless that component itself accompanies the
executable.

 It may happen that this requirement contradicts the license
restrictions of other proprietary libraries that do not normally
accompany the operating system. Such a contradiction means you cannot
use both them and the Library together in an executable that you
distribute.

@item
You may place library facilities that are a work based on the
Library side-by-side in a single library together with other library
facilities not covered by this License, and distribute such a combined
library, provided that the separate distribution of the work based on
the Library and of the other library facilities is otherwise
permitted, and provided that
 you do these two things:

@enumerate a
@item
Accompany the combined library with a copy of the same work
based on the Library, uncombined with any other library
facilities. This must be distributed under the terms of the
Sections above.

@item
Give prominent notice with the combined library of the fact

that part of it is a work based on the Library, and explaining
where to find the accompanying uncombined form of the same work.
@end enumerate

@item
You may not copy, modify, sublicense, link with, or distribute
the Library except as expressly provided under this License. Any
attempt otherwise to copy, modify, sublicense, link with, or
distribute the Library is void, and will automatically terminate your
rights under this License. However, parties who have received copies,
or rights, from you under this License will not have their licenses
terminated so long as such parties remain in full compliance.

@item
You are not required to accept this License, since you have not
signed it. However,
 nothing else grants you permission to modify or
distribute the Library or its derivative works. These actions are
prohibited by law if you do not accept this License. Therefore, by
modifying or distributing the Library (or any work based on the
Library), you indicate your acceptance of this License to do so, and
all its terms and conditions for copying, distributing or modifying
the Library or works based on it.

@item
Each time you redistribute the Library (or any work based on the
Library), the recipient automatically receives a license from the
original licensor to copy, distribute, link with or modify the Library
subject to these terms and conditions. You may not impose any further
restrictions on the recipients' exercise of the rights granted herein.
You are not responsible for enforcing compliance by third parties with
this License.

@item
If, as a consequence of a court judgment or allegation of patent
infringement or for any other reason (not limited to patent issues),
conditions
 are imposed on you (whether by court order, agreement or
otherwise) that contradict the conditions of this License, they do not
excuse you from the conditions of this License. If you cannot
distribute so as to satisfy simultaneously your obligations under this
License and any other pertinent obligations, then as a consequence you
may not distribute the Library at all. For example, if a patent
license would not permit royalty-free redistribution of the Library by
all those who receive copies directly or indirectly through you, then
the only way you could satisfy both it and this License would be to
refrain entirely from distribution of the Library.

If any portion of this section is held invalid or unenforceable under any
particular circumstance, the balance of the section is intended to apply,
and the section as a whole is intended to apply in other circumstances.

It is not the purpose of this section to induce you to infringe any
patents or other property right claims
 or to contest validity of any
such claims; this section has the sole purpose of protecting the
integrity of the free software distribution system which is
implemented by public license practices. Many people have made
generous contributions to the wide range of software distributed
through that system in reliance on consistent application of that
system; it is up to the author/donor to decide if he or she is willing
to distribute software through any other system and a licensee cannot
impose that choice.

This section is intended to make thoroughly clear what is believed to
be a consequence of the rest of this License.

@item
If the distribution and/or use of the Library is restricted in
certain countries either by patents or by copyrighted interfaces, the
original copyright holder who places the Library under this License may add
an explicit geographical distribution limitation excluding those countries,
so that distribution is permitted only in or among countries not thus
excluded.
  In such case, this License incorporates the limitation as if
written in the body of this License.

@item
The Free Software Foundation may publish revised and/or new
versions of the Lesser General Public License from time to time.
Such new versions will be similar in spirit to the present version,
but may differ in detail to address new problems or concerns.

Each version is given a distinguishing version number. If the Library
specifies a version number of this License which applies to it and
``any later version'', you have the option of following the terms and
conditions either of that version or of any later version published by
the Free Software Foundation. If the Library does not specify a
license version number, you may choose any version ever published by
the Free Software Foundation.

@item
If you wish to incorporate parts of the Library into other free
programs whose distribution conditions are incompatible with these,
write to the author to ask for permission. For software

which is
copyrighted by the Free Software Foundation, write to the Free
Software Foundation; we sometimes make exceptions for this. Our
decision will be guided by the two goals of preserving the free status
of all derivatives of our free software and of promoting the sharing
and reuse of software generally.

@center NO WARRANTY

@item
BECAUSE THE LIBRARY IS LICENSED FREE OF CHARGE, THERE IS NO
WARRANTY FOR THE LIBRARY, TO THE EXTENT PERMITTED BY APPLICABLE LAW.
EXCEPT WHEN OTHERWISE STATED IN WRITING THE COPYRIGHT HOLDERS AND/OR
OTHER PARTIES PROVIDE THE LIBRARY ``AS IS'' WITHOUT WARRANTY OF ANY
KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE
IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR
PURPOSE. THE ENTIRE RISK AS TO THE QUALITY AND PERFORMANCE OF THE
LIBRARY IS WITH YOU. SHOULD THE LIBRARY PROVE DEFECTIVE, YOU ASSUME
THE COST OF ALL NECESSARY SERVICING, REPAIR OR CORRECTION.

@item
IN NO EVENT UNLESS REQUIRED BY APPLICABLE LAW OR AGREED
 TO IN
WRITING WILL ANY COPYRIGHT HOLDER, OR ANY OTHER PARTY WHO MAY MODIFY
AND/OR REDISTRIBUTE THE LIBRARY AS PERMITTED ABOVE, BE LIABLE TO YOU
FOR DAMAGES, INCLUDING ANY GENERAL, SPECIAL, INCIDENTAL OR
CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE
LIBRARY (INCLUDING BUT NOT LIMITED TO LOSS OF DATA OR DATA BEING
RENDERED INACCURATE OR LOSSES SUSTAINED BY YOU OR THIRD PARTIES OR A
FAILURE OF THE LIBRARY TO OPERATE WITH ANY OTHER SOFTWARE), EVEN IF
SUCH HOLDER OR OTHER PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH
DAMAGES.
@end enumerate

@iftex
@heading END OF TERMS AND CONDITIONS
@end iftex
@ifinfo
@center END OF TERMS AND CONDITIONS
@end ifinfo

@page
@appendixsubsec How to Apply These Terms to Your New Libraries

 If you develop a new library, and you want it to be of the greatest
possible use to the public, we recommend making it free software that
everyone can redistribute and change. You can do so by permitting
redistribution under these terms (or, alternatively,

under the terms of the
ordinary General Public License).

 To apply these terms, attach the following notices to the library. It is
safest to attach them to the start of each source file to most effectively
convey the exclusion of warranty; and each file should have at least the
``copyright'' line and a pointer to where the full notice is found.

@smallexample
@var{one line to give the library's name and an idea of what it does.}
Copyright (C) @var{year} @var{name of author}

This library is free software; you can redistribute it and/or modify it
under the terms of the GNU Lesser General Public License as published by
the Free Software Foundation; either version 2.1 of the License, or (at
your option) any later version.

This library is distributed in the hope that it will be useful, but
WITHOUT ANY WARRANTY; without even the implied warranty of
MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU
Lesser General Public License for more details.

You should
 have received a copy of the GNU Lesser General Public
License along with this library; if not, write to the Free Software
Foundation, Inc., 51 Franklin Street, Fifth Floor, Boston, MA 02110-1301,
USA.
@end smallexample

Also add information on how to contact you by electronic and paper mail.

You should also get your employer (if you work as a programmer) or your
school, if any, to sign a ``copyright disclaimer'' for the library, if
necessary. Here is a sample; alter the names:

@smallexample
Yoyodyne, Inc., hereby disclaims all copyright interest in the library
`Frob' (a library for tweaking knobs) written by James Random Hacker.

@var{signature of Ty Coon}, 1 April 1990
Ty Coon, President of Vice
@end smallexample

That's all there is to it!
@ignore
@c Set file name and title for man page.
@setfilename gpl
@settitle GNU General Public License

@c man begin SEEALSO

gfdl(7), fsf-funding(7).

@c man end

@c man begin COPYRIGHT

Copyright @copyright{} 2007 Free Software Foundation, Inc. @url{http://fsf.org/}

Everyone is permitted to copy and distribute verbatim copies of this

license document, but changing it is not allowed.

@c man end

@end ignore

@node Copying

@c man begin DESCRIPTION

@appendix GNU GENERAL PUBLIC LICENSE

@c The GNU General Public License.

@center Version 3, 29 June 2007

@c This file is intended to be included within another document,

@c hence no sectioning command or @node.

@display

Copyright @copyright{} 2007 Free Software Foundation, Inc. @url{http://fsf.org/}

Everyone is permitted to copy and distribute verbatim copies of this

license document, but changing it is not allowed.

@end display

@heading Preamble

The GNU General Public License is a free, copyleft license for

software and other kinds of works.

The
 licenses for most software and other practical works are designed

to take away your freedom to share and change the works. By contrast,

the GNU General Public License is intended to guarantee your freedom

to share and change all versions of a program---to make sure it remains

free software for all its users. We, the Free Software Foundation,

use the GNU General Public License for most of our software; it

applies also to any other work released this way by its authors. You

can apply it to your programs, too.

When we speak of free software, we are referring to freedom, not

price. Our General Public Licenses are designed to make sure that you

have the freedom to distribute copies of free software (and charge for

them if you wish), that you receive source code or can get it if you

want it, that you can change the software or use pieces of it in new

free programs, and that you know you can do these things.

To protect your rights, we need to prevent others from denying you these rights
 or asking you to surrender the rights. Therefore, you
have certain responsibilities if you distribute copies of the
software, or if you modify it: responsibilities to respect the freedom
of others.

For example, if you distribute copies of such a program, whether
gratis or for a fee, you must pass on to the recipients the same
freedoms that you received. You must make sure that they, too,
receive or can get the source code. And you must show them these
terms so they know their rights.

Developers that use the GNU GPL protect your rights with two steps:
(1) assert copyright on the software, and (2) offer you this License
giving you legal permission to copy, distribute and/or modify it.

For the developers' and authors' protection, the GPL clearly explains
that there is no warranty for this free software. For both users' and
authors' sake, the GPL requires that modified versions be marked as
changed, so that their problems will not be attributed erroneously to
authors of previous
 versions.

Some devices are designed to deny users access to install or run
modified versions of the software inside them, although the
manufacturer can do so. This is fundamentally incompatible with the
aim of protecting users' freedom to change the software. The
systematic pattern of such abuse occurs in the area of products for
individuals to use, which is precisely where it is most unacceptable.
Therefore, we have designed this version of the GPL to prohibit the
practice for those products. If such problems arise substantially in
other domains, we stand ready to extend this provision to those
domains in future versions of the GPL, as needed to protect the
freedom of users.

Finally, every program is threatened constantly by software patents.
States should not allow patents to restrict development and use of
software on general-purpose computers, but in those that do, we wish
to avoid the special danger that patents applied to a free program
could make it effectively proprietary.
  To prevent this, the GPL
assures that patents cannot be used to render the program non-free.

The precise terms and conditions for copying, distribution and
modification follow.

@heading TERMS AND CONDITIONS

@enumerate 0
@item Definitions.

``This License'' refers to version 3 of the GNU General Public License.

``Copyright'' also means copyright-like laws that apply to other kinds
of works, such as semiconductor masks.

``The Program'' refers to any copyrightable work licensed under this
License. Each licensee is addressed as ``you''.  ``Licensees'' and
``recipients'' may be individuals or organizations.

To ``modify'' a work means to copy from or adapt all or part of the work
in a fashion requiring copyright permission, other than the making of
an exact copy. The resulting work is called a ``modified version'' of
the earlier work or a work ``based on'' the earlier work.

A ``covered work'' means either the unmodified Program or a work based
on the Program.

To ``propagate'' a
 work means to do anything with it that, without
permission, would make you directly or secondarily liable for
infringement under applicable copyright law, except executing it on a
computer or modifying a private copy. Propagation includes copying,
distribution (with or without modification), making available to the
public, and in some countries other activities as well.

To ``convey'' a work means any kind of propagation that enables other
parties to make or receive copies. Mere interaction with a user
through a computer network, with no transfer of a copy, is not
conveying.

An interactive user interface displays ``Appropriate Legal Notices'' to
the extent that it includes a convenient and prominently visible
feature that (1) displays an appropriate copyright notice, and (2)
tells the user that there is no warranty for the work (except to the
extent that warranties are provided), that licensees may convey the
work under this License, and how to view a copy of this License. If
the interface
 presents a list of user commands or options, such as a
menu, a prominent item in the list meets this criterion.

@item Source Code.

The ``source code'' for a work means the preferred form of the work for
making modifications to it. ``Object code'' means any non-source form

of a work.

A ``Standard Interface'' means an interface that either is an official
standard defined by a recognized standards body, or, in the case of
interfaces specified for a particular programming language, one that
is widely used among developers working in that language.

The ``System Libraries'' of an executable work include anything, other
than the work as a whole, that (a) is included in the normal form of
packaging a Major Component, but which is not part of that Major
Component, and (b) serves only to enable use of the work with that
Major Component, or to implement a Standard Interface for which an
implementation is available to the public in source code form. A
``Major Component'', in this context,
 means a major essential component
(kernel, window system, and so on) of the specific operating system
(if any) on which the executable work runs, or a compiler used to
produce the work, or an object code interpreter used to run it.

The ``Corresponding Source'' for a work in object code form means all
the source code needed to generate, install, and (for an executable
work) run the object code and to modify the work, including scripts to
control those activities. However, it does not include the work's
System Libraries, or general-purpose tools or generally available free
programs which are used unmodified in performing those activities but
which are not part of the work. For example, Corresponding Source
includes interface definition files associated with source files for
the work, and the source code for shared libraries and dynamically
linked subprograms that the work is specifically designed to require,
such as by intimate data communication or control flow between those
subprograms
 and other parts of the work.

The Corresponding Source need not include anything that users can
regenerate automatically from other parts of the Corresponding Source.

The Corresponding Source for a work in source code form is that same
work.

@item Basic Permissions.

All rights granted under this License are granted for the term of
copyright on the Program, and are irrevocable provided the stated
conditions are met. This License explicitly affirms your unlimited
permission to run the unmodified Program. The output from running a
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  (For example, a function in a library to compute square roots has
  a purpose that is entirely well-defined independent of the
  application. Therefore, Subsection 2d requires that any
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Section 6 states terms for distribution of such executables.

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functions (ten lines or less in length), then the use of the object
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1.11 libogg 1.3.2
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1.12 zlib 1.2.3
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/* zlib.h -- interface of the 'zlib' general purpose compression library
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1.13 zlib 1.2.8

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1.14 ethtool 3.14

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1.17 avahi 0.6.32

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1.21 binutils 2.24.51

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+++++++++++++++++

Dean Elsner wrote the original gas for vax. [more details?]

Jay Fenlason maintained gas for a while, adding support for

gdb-specific debug information and the 68k series machines, most of
the preprocessing pass, and extensive changes in messages.c,
input-file.c, write.c.

K. Richard Pixley maintained gas for a while, adding various
enhancements and many bug fixes, including merging support for several
processors, breaking gas up to handle multiple object file format
backends (including heavy rewrite, testing, an integration of the coff
and b.out backends), adding configuration
 including heavy testing and
verification of cross assemblers and file splits and renaming,
converted gas to strictly ansi C including full prototypes, added
support for m680[34]0 & cpu32, considerable work on i960 including a
coff port (including considerable amounts of reverse engineering), a
sparc opcode file rewrite, decstation, rs6000, and hp300hpux host
ports, updated "know" assertions and made them work, much other
reorganization, cleanup, and lint.

Ken Raeburn wrote the high-level BFD interface code to replace most of
the code in format-specific I/O modules.

The original Vax-VMS support was contributed by David L. Kashtan.
Eric Youngdale and Pat Rankin have done much work with it since.

The Intel 80386 machine description was written by Eliot Dresselhaus.

Minh Tran-Le at IntelliCorp contributed some AIX 386 support.

The Motorola 88k machine description was contributed by Devon Bowen of
Buffalo University and Torbjorn Granlund of the Swedish Institute of
Computer Science.

Keith
 Knowles at the Open Software Foundation wrote the original MIPS
back end (tc-mips.c, tc-mips.h), and contributed Rose format support
that hasn't been merged in yet. Ralph Campbell worked with the MIPS
code to support a.out format.

Support for the Zilog Z8k and Hitachi H8/300, H8/500 and SH processors
(tc-z8k, tc-h8300, tc-h8500, tc-sh), and IEEE 695 object file format
(obj-ieee), was written by Steve Chamberlain of Cygnus Solutions.
Steve also modified the COFF back end (obj-coffbfd) to use BFD for
some low-level operations, for use with the Hitachi, 29k and Zilog
targets.

John Gilmore built the AMD 29000 support, added .include support, and
simplified the configuration of which versions accept which
pseudo-ops. He updated the 68k machine description so that Motorola's

opcodes always produced fixed-size instructions (e.g. jsr), while
synthetic instructions remained shrinkable (jbsr). John fixed many
bugs, including true tested cross-compilation support, and one bug in
relaxation
 that took a week and required the proverbial one-bit fix.

Ian Lance Taylor of Cygnus Solutions merged the Motorola and MIT
syntaxes for the 68k, completed support for some COFF targets (68k,
i386 SVR3, and SCO Unix), wrote the ECOFF support based on Michael
Meissner's mips-tfile program, wrote the PowerPC and RS/6000 support,
and made a few other minor patches. He handled the binutils releases
for versions 2.7 through 2.9.

David Edelsohn contributed fixes for the PowerPC and AIX support.

Steve Chamberlain made gas able to generate listings.

Support for the HP9000/300 was contributed by Glenn Engel of HP.

Support for ELF format files has been worked on by Mark Eichin of
Cygnus Solutions (original, incomplete implementation), Pete
Hoogenboom at the University of Utah (HPPA mainly), Michael Meissner
of the Open Software Foundation (i386 mainly), and Ken Raeburn of
Cygnus Solutions (sparc, initial 64-bit support).

Several engineers at Cygnus Solutions have also provided many
 small
bug fixes and configuration enhancements.

The initial Alpha support was contributed by Carnegie-Mellon
University. Additional work was done by Ken Raeburn of Cygnus
Solutions. Richard Henderson then rewrote much of the Alpha support.

Ian Dall updated the support code for the National Semiconductor 32000
series, and added support for Mach 3 and NetBSD running on the PC532.

Klaus Kaempf ported the assembler and the binutils to openVMS/Alpha.

Steve Haworth contributed the support for the Texas Instruction c30
(tms320c30).

H.J. Lu has contributed many patches and much testing.

Alan Modra reworked much of the i386 backend, improving the error
checking, updating the code, and improving the 16 bit support, using
patches from the work of Martynas Kunigelis and H.J. Lu.

Many others have contributed large or small bugfixes and enhancements. If

you've contributed significant work and are not mentioned on this list, and
want to be, let us know. Some of the history has been lost;
 we aren't
intentionally leaving anyone out.

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 library `Frob' (a library for tweaking knobs) written by James Random Hacker.

 <signature of Ty Coon>, 1 April 1990
 Ty Coon, President of Vice

That's all there is to it!
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       Version 2, June 1991

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[This is the first released version of the library GPL. It is
numbered 2 because it goes with version 2 of the ordinary GPL.]

     Preamble

 The licenses for most software are designed to take away your
freedom to share and change it. By contrast, the GNU General Public
Licenses are intended to guarantee your freedom to share and change
free software--to make sure the software is free for all its users.

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 To protect your rights, we need to make restrictions that forbid
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These restrictions translate to certain responsibilities for you if
you distribute copies of the library, or if you modify it.

 For example, if you distribute copies of the library, whether gratis
or for a fee, you must give the recipients all the rights that we gave
you. You must make sure that they, too, receive or can get the source

code. If you link a program with the library, you must provide
complete object files to the recipients so that they can relink them
with the library, after making
 changes to the library and recompiling
it. And you must show them these terms so they know their rights.

 Our method of protecting your rights has two steps: (1) copyright
the library, and (2) offer you this license which gives you legal
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 Also, for each distributor's protection, we want to make certain
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want its recipients to know that what they have is not the original
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the original authors' reputations.

 Finally, any free program is threatened constantly by software
patents. We wish to avoid the danger that companies distributing free
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transforming the program into proprietary software. To prevent this,
we have made it clear that any patent must be licensed
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 Most GNU software, including some libraries, is covered by the ordinary
GNU General Public License, which was designed for utility programs. This
license, the GNU Library General Public License, applies to certain
designated libraries. This license is quite different from the ordinary
one; be sure to read it in full, and don't assume that anything in it is
the same as in the ordinary license.

 The reason we have a separate public license for some libraries is that
they blur the distinction we usually make between modifying or adding to a
program and simply using it. Linking a program with a library, without
changing the library, is in some sense simply using the library, and is
analogous to running a utility program or application program. However, in
a textual and legal sense, the linked executable is a combined work, a
derivative of the original library, and the ordinary General Public License
treats it as such.

 Because
 of this blurred distinction, using the ordinary General
Public License for libraries did not effectively promote software
sharing, because most developers did not use the libraries. We
concluded that weaker conditions might promote sharing better.

 However, unrestricted linking of non-free programs would deprive the

users of those programs of all benefit from the free status of the
libraries themselves. This Library General Public License is intended to
permit developers of non-free programs to use free libraries, while
preserving your freedom as a user of such programs to change the free
libraries that are incorporated in them. (We have not seen how to achieve
this as regards changes in header files, but we have achieved it as regards
changes in the actual functions of the Library.) The hope is that this
will lead to faster development of free libraries.

 The precise terms and conditions for copying, distribution and
modification follow. Pay close attention to the difference
 between a
"work based on the library" and a "work that uses the library". The
former contains code derived from the library, while the latter only
works together with the library.

 Note that it is possible for a library to be covered by the ordinary
General Public License rather than by this special one.

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 0. This License Agreement applies to any software library which
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party saying it may be distributed under the terms of this Library
General Public License (also called "this License"). Each licensee is
addressed as "you".

 A "library" means a collection of software functions and/or data
prepared so as to be conveniently linked with application programs
(which use some of those functions and data) to form executables.

 The "Library", below, refers to any such software library or work
which has been distributed
 under these terms. A "work based on the
Library" means either the Library or any derivative work under
copyright law: that is to say, a work containing the Library or a
portion of it, either verbatim or with modifications and/or translated
straightforwardly into another language. (Hereinafter, translation is
included without limitation in the term "modification".)

 "Source code" for a work means the preferred form of the work for
making modifications to it. For a library, complete source code means
all the source code for all modules it contains, plus any associated
interface definition files, plus the scripts used to control compilation
and installation of the library.

 Activities other than copying, distribution and modification are not

covered by this License; they are outside its scope. The act of
running a program using the Library is not restricted, and output from
such a program is covered only if its contents constitute a work based
on the Library (independent
 of the use of the Library in a tool for
writing it). Whether that is true depends on what the Library does
and what the program that uses the Library does.

 1. You may copy and distribute verbatim copies of the Library's
complete source code as you receive it, in any medium, provided that
you conspicuously and appropriately publish on each copy an
appropriate copyright notice and disclaimer of warranty; keep intact
all the notices that refer to this License and to the absence of any
warranty; and distribute a copy of this License along with the
Library.

 You may charge a fee for the physical act of transferring a copy,
and you may at your option offer warranty protection in exchange for a
fee.

 2. You may modify your copy or copies of the Library or any portion
of it, thus forming a work based on the Library, and copy and
distribute such modifications or work under the terms of Section 1
above, provided that you also meet all of these conditions:

  a) The modified work must
 itself be a software library.

  b) You must cause the files modified to carry prominent notices
   stating that you changed the files and the date of any change.

  c) You must cause the whole of the work to be licensed at no
   charge to all third parties under the terms of this License.

  d) If a facility in the modified Library refers to a function or a
   table of data to be supplied by an application program that uses
   the facility, other than as an argument passed when the facility
   is invoked, then you must make a good faith effort to ensure that,
   in the event an application does not supply such function or
   table, the facility still operates, and performs whatever part of
   its purpose remains meaningful.

   (For example, a function in a library to compute square roots has
   a purpose that is entirely well-defined independent of the
   application. Therefore, Subsection 2d requires that any
   application-supplied function or table used by this
 function must
   be optional: if the application does not supply it, the square

root function must still compute square roots.)

These requirements apply to the modified work as a whole. If
identifiable sections of that work are not derived from the Library,
and can be reasonably considered independent and separate works in
themselves, then this License, and its terms, do not apply to those
sections when you distribute them as separate works. But when you
distribute the same sections as part of a whole which is a work based
on the Library, the distribution of the whole must be on the terms of
this License, whose permissions for other licensees extend to the
entire whole, and thus to each and every part regardless of who wrote
it.

Thus, it is not the intent of this section to claim rights or contest
your rights to work written entirely by you; rather, the intent is to
exercise the right to control the distribution of derivative or
collective works based on the Library.

In addition,
 mere aggregation of another work not based on the Library
with the Library (or with a work based on the Library) on a volume of
a storage or distribution medium does not bring the other work under
the scope of this License.

 3. You may opt to apply the terms of the ordinary GNU General Public
License instead of this License to a given copy of the Library. To do
this, you must alter all the notices that refer to this License, so
that they refer to the ordinary GNU General Public License, version 2,
instead of to this License. (If a newer version than version 2 of the
ordinary GNU General Public License has appeared, then you can specify
that version instead if you wish.) Do not make any other change in
these notices.

 Once this change is made in a given copy, it is irreversible for
that copy, so the ordinary GNU General Public License applies to all
subsequent copies and derivative works made from that copy.

 This option is useful when you wish to copy part of the code of
the
 Library into a program that is not a library.

 4. You may copy and distribute the Library (or a portion or
derivative of it, under Section 2) in object code or executable form
under the terms of Sections 1 and 2 above provided that you accompany
it with the complete corresponding machine-readable source code, which
must be distributed under the terms of Sections 1 and 2 above on a
medium customarily used for software interchange.

If distribution of object code is made by offering access to copy
from a designated place, then offering equivalent access to copy the
source code from the same place satisfies the requirement to
distribute the source code, even though third parties are not
compelled to copy the source along with the object code.

 5. A program that contains no derivative of any portion of the
Library, but is designed to work with the Library by being compiled or
linked with it, is called a "work that uses the Library". Such a
work, in isolation, is not a derivative
 work of the Library, and
therefore falls outside the scope of this License.

 However, linking a "work that uses the Library" with the Library
creates an executable that is a derivative of the Library (because it
contains portions of the Library), rather than a "work that uses the
library". The executable is therefore covered by this License.
Section 6 states terms for distribution of such executables.

 When a "work that uses the Library" uses material from a header file
that is part of the Library, the object code for the work may be a
derivative work of the Library even though the source code is not.
Whether this is true is especially significant if the work can be
linked without the Library, or if the work is itself a library. The
threshold for this to be true is not precisely defined by law.

 If such an object file uses only numerical parameters, data
structure layouts and accessors, and small macros and small inline
functions (ten lines or less in length), then the use of
 the object
file is unrestricted, regardless of whether it is legally a derivative
work. (Executables containing this object code plus portions of the
Library will still fall under Section 6.)

 Otherwise, if the work is a derivative of the Library, you may
distribute the object code for the work under the terms of Section 6.
Any executables containing that work also fall under Section 6,
whether or not they are linked directly with the Library itself.

 6. As an exception to the Sections above, you may also compile or
link a "work that uses the Library" with the Library to produce a
work containing portions of the Library, and distribute that work
under terms of your choice, provided that the terms permit
modification of the work for the customer's own use and reverse
engineering for debugging such modifications.

 You must give prominent notice with each copy of the work that the
Library is used in it and that the Library and its use are covered by

this License. You must supply
 a copy of this License. If the work
during execution displays copyright notices, you must include the
copyright notice for the Library among them, as well as a reference
directing the user to the copy of this License. Also, you must do one
of these things:

  a) Accompany the work with the complete corresponding
  machine-readable source code for the Library including whatever
  changes were used in the work (which must be distributed under
  Sections 1 and 2 above); and, if the work is an executable linked
  with the Library, with the complete machine-readable "work that
  uses the Library", as object code and/or source code, so that the
  user can modify the Library and then relink to produce a modified
  executable containing the modified Library. (It is understood
  that the user who changes the contents of definitions files in the
  Library will not necessarily be able to recompile the application
  to use the modified definitions.)

  b) Accompany the
work with a written offer, valid for at
  least three years, to give the same user the materials
  specified in Subsection 6a, above, for a charge no more
  than the cost of performing this distribution.

  c) If distribution of the work is made by offering access to copy
  from a designated place, offer equivalent access to copy the above
  specified materials from the same place.

  d) Verify that the user has already received a copy of these
  materials or that you have already sent this user a copy.

 For an executable, the required form of the "work that uses the
Library" must include any data and utility programs needed for
reproducing the executable from it. However, as a special exception,
the source code distributed need not include anything that is normally
distributed (in either source or binary form) with the major
components (compiler, kernel, and so on) of the operating system on
which the executable runs, unless that component itself accompanies
the executable.

  It may happen that this requirement contradicts the license
restrictions of other proprietary libraries that do not normally
accompany the operating system. Such a contradiction means you cannot
use both them and the Library together in an executable that you
distribute.

 7. You may place library facilities that are a work based on the

Library side-by-side in a single library together with other library
facilities not covered by this License, and distribute such a combined
library, provided that the separate distribution of the work based on
the Library and of the other library facilities is otherwise
permitted, and provided that you do these two things:

   a) Accompany the combined library with a copy of the same work
   based on the Library, uncombined with any other library
   facilities. This must be distributed under the terms of the
   Sections above.

   b) Give prominent notice with the combined library of the fact
   that part of it is a work based on the
 Library, and explaining
   where to find the accompanying uncombined form of the same work.

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END OF TERMS AND CONDITIONS

Appendix: How to Apply These Terms to Your New Libraries

If you develop a new library, and you want it to be of the greatest possible use to the public, we recommend making it free software that everyone can redistribute and change. You can do so by permitting redistribution under these terms (or, alternatively, under the terms of the ordinary General Public License).

To apply these terms, attach the following notices to the library. It is safest to attach them to the start of each source file to most effectively convey the exclusion of warranty; and each file should have at least the

"copyright" line and a pointer to where the full notice is found.

    <one line to give the library's name and a brief idea of what it does.>
    Copyright (C) <year>
  <name of author>

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Also add information on how to contact you by electronic and paper mail.

You should also get your employer (if you work as a programmer) or your
school, if any, to sign a "copyright disclaimer" for the library, if
necessary.
    Here is a sample; alter the names:

  Yoyodyne, Inc., hereby disclaims all copyright interest in the
  library `Frob' (a library for tweaking knobs) written by James Random Hacker.

  <signature of Ty Coon>, 1 April 1990
  Ty Coon, President of Vice

That's all there is to it!
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                   Version 3, 29 June 2007

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 The licenses for most software and other practical works are designed

to take away your freedom to share and change the works. By contrast, the GNU General Public License is intended to guarantee your freedom to share and change all versions of a program--to make sure it remains free software for all its users. We, the Free Software Foundation, use the GNU General Public License for most of our software; it applies also to any other work released this way by its authors. You can apply it to your programs, too.

 When we speak of free software, we are referring to
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 To protect your rights, we need to prevent others from denying you these rights or asking you to surrender the rights. Therefore, you have certain responsibilities if you distribute copies of the software, or if you modify it: responsibilities to respect the freedom of others.

 For example, if you distribute copies of such a program, whether gratis or for a fee, you must pass on to the recipients the same freedoms that you received. You must make sure that they, too, receive or can get the source code. And you must show them these terms so they know their rights.

 Developers that use the GNU GPL protect your rights with two steps:
(1)
 assert copyright on the software, and (2) offer you this License giving you legal permission to copy, distribute and/or modify it.

 For the developers' and authors' protection, the GPL clearly explains that there is no warranty for this free software. For both users' and authors' sake, the GPL requires that modified versions be marked as changed, so that their problems will not be attributed erroneously to authors of previous versions.

 Some devices are designed to deny users access to install or run modified versions of the software inside them, although the manufacturer can do so. This is fundamentally incompatible with the aim of protecting users' freedom to change the software. The systematic pattern of such abuse occurs in the area of products for individuals to use, which is precisely where it is most unacceptable. Therefore, we have designed this version of the GPL to prohibit the practice for those products. If such problems arise substantially in other domains, we stand

ready to extend this provision to those domains in future versions
of the GPL, as needed to protect the freedom of users.

 Finally, every program is threatened constantly by software patents.
States should not allow patents to restrict development and use of
software on general-purpose computers, but in those that do, we wish to
avoid the special danger that patents applied to a free program could
make it effectively proprietary. To prevent this, the GPL assures that
patents cannot be used to render the program non-free.

 The precise terms and conditions for copying, distribution and
modification follow.

                    TERMS AND CONDITIONS

 0. Definitions.

 "This License" refers to version 3 of the GNU General Public License.

 "Copyright" also means copyright-like laws that apply to other kinds of
works, such as semiconductor masks.

 "The Program" refers to any copyrightable work licensed under this
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 and
"recipients" may be individuals or organizations.

 To "modify" a work means to copy from or adapt all or part of the work
in a fashion requiring copyright permission, other than the making of an
exact copy. The resulting work is called a "modified version" of the
earlier work or a work "based on" the earlier work.

 A "covered work" means either the unmodified Program or a work based
on the Program.

 To "propagate" a work means to do anything with it that, without
permission, would make you directly or secondarily liable for
infringement under applicable copyright law, except executing it on a
computer or modifying a private copy. Propagation includes copying,
distribution (with or without modification), making available to the
public, and in some countries other activities as well.

 To "convey" a work means any kind of propagation that enables other
parties to make or receive copies. Mere interaction with a user through
a computer network, with no transfer of a copy, is
 not conveying.

 An interactive user interface displays "Appropriate Legal Notices"

to the extent that it includes a convenient and prominently visible
feature that (1) displays an appropriate copyright notice, and (2)
tells the user that there is no warranty for the work (except to the
extent that warranties are provided), that licensees may convey the
work under this License, and how to view a copy of this License. If
the interface presents a list of user commands or options, such as a
menu, a prominent item in the list meets this criterion.

  1. Source Code.

  The "source code" for a work means the preferred form of the work
for making modifications to it. "Object code" means any non-source
form of a work.

  A "Standard Interface" means an interface that either is an official
standard defined by a recognized standards body, or, in the case of
interfaces specified for a particular programming language, one that
is widely used among developers working in that language.

  The
  "System Libraries" of an executable work include anything, other
than the work as a whole, that (a) is included in the normal form of
packaging a Major Component, but which is not part of that Major
Component, and (b) serves only to enable use of the work with that
Major Component, or to implement a Standard Interface for which an
implementation is available to the public in source code form. A
"Major Component", in this context, means a major essential component
(kernel, window system, and so on) of the specific operating system
(if any) on which the executable work runs, or a compiler used to
produce the work, or an object code interpreter used to run it.

  The "Corresponding Source" for a work in object code form means all
the source code needed to generate, install, and (for an executable
work) run the object code and to modify the work, including scripts to
control those activities. However, it does not include the work's
System Libraries, or general-purpose tools or generally
 available free
programs which are used unmodified in performing those activities but
which are not part of the work. For example, Corresponding Source
includes interface definition files associated with source files for
the work, and the source code for shared libraries and dynamically
linked subprograms that the work is specifically designed to require,
such as by intimate data communication or control flow between those
subprograms and other parts of the work.

  The Corresponding Source need not include anything that users
can regenerate automatically from other parts of the Corresponding
Source.

The Corresponding Source for a work in source code form is that same work.

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  more than your reasonable cost of physically performing this
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1.22 libdaemon 0.14

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  in the event an application does not supply such function or
  table, the facility still operates, and performs whatever part of
  its purpose remains meaningful.

  (For example, a function in a library to compute square roots has
  a purpose that is entirely well-defined independent of the
  application. Therefore, Subsection 2d requires that any
  application-supplied function or table used by this function must
  be optional: if the application does not supply it, the square
  root function must still compute square roots.)

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 This option is useful when you wish to copy part of the code of
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it with the complete corresponding
 machine-readable source code, which
must be distributed under the terms of Sections 1 and 2 above on a
medium customarily used for software interchange.

 If distribution of object code is made by offering access to copy
from a designated place, then offering equivalent access to copy the
source code from the same place satisfies the requirement to
distribute the source code, even though third parties are not
compelled to copy the source along with the object code.

 5. A program that contains no derivative of any portion of the
Library, but is designed to work with the Library by being compiled or

linked with it, is called a "work that uses the Library". Such a
work, in isolation, is not a derivative work of the Library, and
therefore falls outside the scope of this License.

 However, linking a "work that uses the Library" with the Library
creates an executable that is a derivative of the Library (because it
contains portions of the Library), rather than a "work that uses
 the
library". The executable is therefore covered by this License.
Section 6 states terms for distribution of such executables.

 When a "work that uses the Library" uses material from a header file
that is part of the Library, the object code for the work may be a
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Whether this is true is especially significant if the work can be
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threshold for this to be true is not precisely defined by law.

 If such an object file uses only numerical parameters, data
structure layouts and accessors, and small macros and small inline
functions (ten lines or less in length), then the use of the object
file is unrestricted, regardless of whether it is legally a derivative
work. (Executables containing this object code plus portions of the
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 Otherwise, if the work is a derivative of the Library, you may
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 code for the work under the terms of Section 6.
Any executables containing that work also fall under Section 6,
whether or not they are linked directly with the Library itself.

 6. As an exception to the Sections above, you may also combine or
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  a) Accompany the

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with the Library, with the complete machine-readable "work that
uses the Library", as object code and/or source code, so that the
user can modify the Library and then relink to produce a modified
executable containing the modified Library. (It is understood
that the user who changes the contents of definitions files in the
Library will not necessarily be able to recompile the application
to use the modified definitions.)

b) Use a suitable shared library mechanism for linking with the
Library. A suitable mechanism is one that (1) uses at run time a
copy of the library already present on the user's computer system,
rather than copying library functions into the executable, and (2)
will operate properly
with a modified version of the library, if
the user installs one, as long as the modified version is
interface-compatible with the version that the work was made with.

c) Accompany the work with a written offer, valid for at least
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1.23 libnss-mdns 0.10

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its purpose remains meaningful.

(For example, a function in a library to compute square roots has
a purpose that is entirely well-defined independent of the
application. Therefore, Subsection 2d requires that any
application-supplied function or table used by this function must
be optional: if the application does not supply it, the square
root function must still compute square roots.)

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 This option is useful when you wish to copy part of the code of
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 machine-readable source code, which
must be distributed under the terms of Sections 1 and 2 above on a
medium customarily used for software interchange.

 If distribution of object code is made by offering access to copy
from a designated place, then offering equivalent access to copy the
source code from the same place satisfies the requirement to
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compelled to copy the source along with the object code.

 5. A program that contains no derivative of any portion of the
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therefore falls outside the scope of this License.

 However, linking a "work that uses the Library" with the Library
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 the
library". The executable is therefore covered by this License.
Section 6 states terms for distribution of such executables.

 When a "work that uses the Library" uses material from a header file
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derivative work of the Library even though the source code is not.
Whether this is true is especially significant if the work can be
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 If such an object file uses only numerical parameters, data
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file is unrestricted, regardless of whether it is legally a derivative
work. (Executables containing this object code plus portions of the
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 6. As an exception to the Sections above, you may also combine or

link a "work that uses the Library" with the Library to produce a
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  a) Accompany the
 work with the complete corresponding
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   Sections 1 and 2 above); and, if the work is an executable linked
   with the Library, with the complete machine-readable "work that
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   Library will not necessarily be able to recompile the application
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  b) Use a suitable shared library mechanism for linking with the
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   copy of the library already present on the user's computer system,
   rather than copying library functions into the executable, and (2)
   will operate properly
 with a modified version of the library, if
   the user installs one, as long as the modified version is
   interface-compatible with the version that the work was made with.

  c) Accompany the work with a written offer, valid for at least
   three years, to give the same user the materials specified in
   Subsection 6a, above, for a charge no more than the cost of
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1.24 perl 5.20.0

1.24.1 Available under license :

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                     The End

---
abstract: 'Build and install Perl modules'
author:
 - 'Ken Williams <kwilliams@cpan.org>'
 - "Development questions, bug reports, and patches should be sent to the\nModule-Build mailing list at <module-build@perl.org>."
build_requires:
 File::Temp: 0.15
 Test::Harness: 3.16
 Test::More: 0.49
generated_by: 'Module::Build version 0.3608'
license: gpl
meta-spec:
 url: http://module-build.sourceforge.net/META-spec-v1.4.html
 version: 1.4
name: Module-Build
resources:
 MailingList: mailto:module-build@perl.org
 license: http://dev.perl.org/licenses/
 repository: http://github.com/dagolden/module-build/
version: 3

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Julian Seward, jseward@bzip.org
bzip2/libbzip2 version 1.0.6 of 6 September 2010

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<signature of Ty Coon>, 1 April 1989
Ty Coon, President of Vice

That's all there is to it!
#!perl

=head1 NAME

copyright.t

=head1 DESCRIPTION

Tests that the latest copyright years in the top-level README file and the
C<perl -v> output match each other.

If the test fails, update at least one of README and perl.c so that they match
reality.

Optionally you can pass the C<--now> option to check they are at the current
year. This isn't checked by default, so that it doesn't fail for people
working on older releases. It should be run before making a new release.

=cut

```perl
use strict;
use Config;
BEGIN { require './test.pl' }

if ( $Config{usecrosscompile} ) {
 skip_all( "Not all files are available during cross-compilation" );
}

my ($opt) = @ARGV;

my $readme_year = readme_year();
my $v_year = v_year();

# Check that both copyright dates are up-to-date, but only if requested, so
# that tests still pass for people intentionally working on older versions:
if ($opt eq '--now')
{
 my $current_year = (gmtime)[5] + 1900;
 is $v_year, $current_year, 'perl -v copyright includes current
 year';
 is $readme_year, $current_year, 'README copyright includes current year';
}

# Otherwise simply check that the two copyright dates match each other:
else
{
 is $readme_year, $v_year, 'README and perl -v copyright dates match';
}

done_testing;


sub readme_year
```

```perl
# returns the latest copyright year from the top-level README file
{

 open my $readme, '<', '../README' or die "Opening README failed: $!";

 # The copyright message is the first paragraph:
 local $/ = '';
 my $copyright_msg = <$readme>;

 my ($year) = $copyright_msg =~ /.*\b(\d{4,})/s
    or die "Year not found in README copyright message '$copyright_msg'";

 $year;
}


sub v_year
# returns the latest copyright year shown in perl -v
{

 my $output = runperl switches => ['-v'];
 my ($year) = $output =~ /copyright 1987.*\b(\d{4,})/i
    or die "Copyright statement not found in perl -v output '$output'";

 $year;
}
```
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1.25 libffi 3.2.1

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1.26 attr 2.4.47

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  is invoked, then you must make a good faith effort to ensure that,
  in the event an application does not supply such function or
  table, the facility still operates, and performs whatever part of
  its purpose remains meaningful.

  (For example, a function in a library to compute square roots has
  a purpose that is entirely well-defined independent of the

application. Therefore, Subsection 2d requires that any
application-supplied function or table used by this function
must
be optional: if the application does not supply it, the square
root function must still compute square roots.)

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medium customarily used for software interchange.

  If distribution of object code is made by offering access to copy
from a designated place, then offering equivalent access to copy the
source code from the same place satisfies the requirement to
distribute the source code, even though third parties are not
compelled to copy the source along with the object code.

  5. A program that contains no derivative of any portion of the
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work, in isolation, is not a derivative work of
 the Library, and
therefore falls outside the scope of this License.

  However, linking a "work that uses the Library" with the Library
creates an executable that is a derivative of the Library (because it
contains portions of the Library), rather than a "work that uses the
library". The executable is therefore covered by this License.
Section 6 states terms for distribution of such executables.

  When a "work that uses the Library" uses material from a header file
that is part of the Library, the object code for the work may be a
derivative work of the Library even though the source code is not.
Whether this is true is especially significant if the work can be
linked without the Library, or if the work is itself a library. The
threshold for this to be true is not precisely defined by law.

  If such an object file uses only numerical parameters, data
structure layouts and accessors, and small macros and small inline
functions (ten lines or less in length), then the use of the object
file
 is unrestricted, regardless of whether it is legally a derivative
work. (Executables containing this object code plus portions of the
Library will still fall under Section 6.)

  Otherwise, if the work is a derivative of the Library, you may
distribute the object code for the work under the terms of Section 6.
Any executables containing that work also fall under Section 6,
whether or not they are linked directly with the Library itself.

  6. As an exception to the Sections above, you may also combine or
link a "work that uses the Library" with the Library to produce a
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modification of the work for the customer's own use and reverse

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directing the user to the copy of this License. Also, you must do one
of these things:

  a) Accompany the work with the complete corresponding
  machine-readable source code for the Library including whatever
  changes were used in the work (which must be distributed under
  Sections 1 and 2 above); and, if the work is an executable linked
  with the Library, with the complete machine-readable "work that
  uses the Library", as object code and/or source code, so that the
  user can modify the Library and then relink to produce a modified
  executable containing the modified Library. (It is understood
  that the user who changes the contents of definitions files in the
  Library will not necessarily be able to recompile the application
  to use the modified definitions.)

  b) Use a suitable shared library
 mechanism for linking with the
  Library. A suitable mechanism is one that (1) uses at run time a
  copy of the library already present on the user's computer system,
  rather than copying library functions into the executable, and (2)
  will operate properly with a modified version of the library, if
  the user installs one, as long as the modified version is
  interface-compatible with the version that the work was made with.

  c) Accompany the work with a written offer, valid for at
  least three years, to give the same user the materials
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  For an executable, the required form of the "work that uses the
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reproducing the executable from it. However, as a special exception,
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normally distributed (in either source or binary form) with the major
components (compiler, kernel, and so on) of the operating system on
which the executable runs, unless that component itself accompanies
the executable.

It may happen that this requirement contradicts the license
restrictions of other proprietary libraries that do not normally
accompany the operating system. Such a contradiction means you cannot
use both them and the Library together in an executable that you
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/opt/cola/permits/1010755998_1700034597.0719445/0/hostapd-2-5-devel-bin-zip/hostapd-2.5-
devel/bin/eapol_test.exe: binary file matches

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Found in path(s):
* /bin/grep

1.29 dnsmasq 2.73

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  6. Conveying Non-Source Forms.

 You may convey a covered work in object code form under the terms
of sections 4 and 5, provided that you also convey the
machine-readable Corresponding Source under the terms of this License,
in one of these ways:

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  (including a physical distribution medium), accompanied by the
  Corresponding Source fixed on a durable physical medium
  customarily used for software interchange.

  b) Convey the object code in, or embodied in, a physical product
  (including a physical distribution medium), accompanied by a
  written offer, valid for at least three years
and valid for as
  long as you offer spare parts or customer support for that product
  model, to give anyone who possesses the object code either (1) a
  copy of the Corresponding Source for all the software in the
  product that is covered by this License, on a durable physical
  medium customarily used for software interchange, for a price no
  more than your reasonable cost of physically performing this
  conveying of source, or (2) access to copy the
  Corresponding Source from a network server at no charge.

  c) Convey individual copies of the object code with a copy of the
  written offer to provide the Corresponding Source. This
  alternative is allowed only occasionally and noncommercially, and
  only if you received the object code with such an offer, in accord
  with subsection 6b.

  d) Convey the object code by offering access from a designated
  place (gratis or for a charge), and offer equivalent access to the
  Corresponding Source in
the same way through the same place at no
  further charge. You need not require recipients to copy the
  Corresponding Source along with the object code. If the place to
  copy the object code is a network server, the Corresponding Source
  may be on a different server (operated by you or a third party)
  that supports equivalent copying facilities, provided you maintain
  clear directions next to the object code saying where to find the
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you inform other peers where the object code and Corresponding
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   its purpose remains meaningful.

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medium customarily used for software interchange.

 If distribution of object code is made by offering access to copy
from a designated place, then offering equivalent access to copy the
source code from the same place satisfies the requirement to
distribute the source code, even though third parties are not
compelled to copy the source along with the object code.

 5. A program that contains no derivative of any portion of the
Library, but is designed to work with the Library by being compiled or
linked with it, is called a "work that uses the Library". Such a
work, in isolation, is not a derivative work of the Library, and
therefore falls outside the scope of this License.

 However, linking a "work that uses the Library" with the Library
creates an executable that is a derivative of the Library (because it
contains portions of the Library), rather than a "work that
 uses the
library". The executable is therefore covered by this License.

Section 6 states terms for distribution of such executables.

 When a "work that uses the Library" uses material from a header file
that is part of the Library, the object code for the work may be a
derivative work of the Library even though the source code is not.
Whether this is true is especially significant if the work can be
linked without the Library, or if the work is itself a library. The
threshold for this to be true is not precisely defined by law.

 If such an object file uses only numerical parameters, data
structure layouts and accessors, and small macros and small inline
functions (ten lines or less in length), then the use of the object
file is unrestricted, regardless of whether it is legally a derivative
work. (Executables containing this object code plus portions of the
Library will still fall under Section 6.)

 Otherwise, if the work is a derivative of the Library, you may
distribute the
 object code for the work under the terms of Section 6.
Any executables containing that work also fall under Section 6,
whether or not they are linked directly with the Library itself.

 6. As an exception to the Sections above, you may also combine or
link a "work that uses the Library" with the Library to produce a
work containing portions of the Library, and distribute that work
under terms of your choice, provided that the terms permit
modification of the work for the customer's own use and reverse
engineering for debugging such modifications.

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during execution displays copyright notices, you must include the
copyright notice for the Library among them, as well as a reference
directing the user to the copy of this License. Also, you must do one
of these things:

  a) Accompany
 the work with the complete corresponding
   machine-readable source code for the Library including whatever
   changes were used in the work (which must be distributed under
   Sections 1 and 2 above); and, if the work is an executable linked
   with the Library, with the complete machine-readable "work that
   uses the Library", as object code and/or source code, so that the
   user can modify the Library and then relink to produce a modified
   executable containing the modified Library. (It is understood
   that the user who changes the contents of definitions files in the
   Library will not necessarily be able to recompile the application

to use the modified definitions.)

b) Use a suitable shared library mechanism for linking with the
Library. A suitable mechanism is one that (1) uses at run time a
copy of the library already present on the user's computer system,
rather than copying library functions into the executable, and (2)
will operate
properly with a modified version of the library, if
the user installs one, as long as the modified version is
interface-compatible with the version that the work was made with.

c) Accompany the work with a written offer, valid for at
least three years, to give the same user the materials
specified in Subsection 6a, above, for a charge no more
than the cost of performing this distribution.

d) If distribution of the work is made by offering access to copy
from a designated place, offer equivalent access to copy the above
specified materials from the same place.

e) Verify that the user has already received a copy of these
materials or that you have already sent this user a copy.

For an executable, the required form of the "work that uses the
Library" must include any data and utility programs needed for
reproducing the executable from it. However, as a special exception,
the materials to be distributed need not include anything that is
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distributed (in either source or binary form) with the major
components (compiler, kernel, and so on) of the operating system on
which the executable runs, unless that component itself accompanies
the executable.

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restrictions of other proprietary libraries that do not normally
accompany the operating system. Such a contradiction means you cannot
use both them and the Library together in an executable that you
distribute.

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That's all there is to it!

1.34 minidlna 1.1.3

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1.35 libjpeg 8b

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* Modified 2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file exists to provide a single place to fix any problems with
* including the wrong system include files. (Common problems are taken
* care of by the standard jconfig symbols, but on really weird systems
* you may have to edit this file.)
*
* NOTE: this file is NOT intended to be included by applications using the
* JPEG library. Most applications need only include jpeglib.h.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jinclude.h
No license file was found, but licenses were detected in source scan.

/*
* jmemnobs.c
*
* Copyright (C) 1992-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file provides a really simple implementation of the system-
* dependent portion of the JPEG memory manager. This implementation
* assumes that no backing-store files are needed: all required space
* can be obtained from malloc().
* This is very portable in the sense that it'll compile on almost anything,
* but you'd better have lots of main memory (or virtual memory) if you want
* to process big images.

* Note that the max_memory_to_use option is ignored by this implementation.

*/

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jmemnobs.c

No license file was found, but licenses were detected in source scan.

/*

* wrbmp.c

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* Modified 2017 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains routines to write output images in Microsoft "BMP"

* format (MS Windows 3.x and OS/2 1.x flavors).

* Either 8-bit colormapped or 24-bit full-color format can be written.

* No compression is supported.

*

* These routines may need modification for non-Unix environments or

* specialized applications. As they stand, they assume output to

* an ordinary stdio stream.

*

* This code contributed by James Arthur Boucher.

*/

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/wrbmp.c

No license file was found, but licenses were detected in source scan.

/*

* jcmainct.c

*

* Copyright (C) 1994-1996, Thomas G. Lane.

* Modified 2003-2012 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains the main buffer controller for compression.

* The main buffer lies between the pre-processor and the JPEG

* compressor proper; it holds downsampled data in the JPEG colorspace.

*/

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jcmainct.c

No license file was found, but licenses were detected in source scan.

/*
* rdtarga.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modified 2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to read input images in Targa format.
*
* These routines may need modification for non-Unix environments or
* specialized applications. As they stand, they assume input from
* an ordinary stdio stream. They further assume that reading begins
* at the start of the file; start_input may need work if the
* user interface has already read some data (e.g., to determine that
* the file is indeed Targa format).
*
* Based on code contributed by Lee Daniel Crocker.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/rdtarga.c
No license file was found, but licenses were detected in source scan.

/*
* jdmarker.c
*
* Copyright (C) 1991-1998, Thomas G. Lane.
* Modified 2009-2013 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to decode JPEG datastream markers.
* Most of the complexity arises from our desire to support input
* suspension: if not all of the data for a marker is available,
* we must exit back to the application. On resumption, we reprocess
* the marker.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jdmarker.c
No license file was found, but licenses were detected in source scan.

/*
* jmemsys.h
*
* Copyright (C) 1992-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This include file defines the interface between the system-independent

* and system-dependent portions of the JPEG memory manager. No other

* modules need include it. (The system-independent portion is jmemmgr.c;

* there are several different versions of the system-dependent portion.)

*

* This file works as-is for the system-dependent memory managers supplied

* in the IJG distribution. You may need to modify it if you write a

* custom memory manager. If system-dependent changes are needed in

* this file, the best method is to #ifdef them based on a configuration

* symbol supplied in jconfig.h, as we have done with USE_MSDOS_MEMMGR

* and USE_MAC_MEMMGR.

*/

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jmemsys.h

No license file was found, but licenses were detected in source scan.

/*

* cdjpeg.c

*

* Copyright (C) 1991-1997, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains common support routines used by the IJG application

* programs (cjpeg, djpeg, jpegtran).

*/

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/cdjpeg.c

No license file was found, but licenses were detected in source scan.

/*

* rdppm.c

*

* Copyright (C) 1991-1997, Thomas G. Lane.

* Modified 2009-2017 by Bill Allombert, Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains routines to read input images in PPM/PGM format.

* The extended 2-byte-per-sample raw PPM/PGM formats are supported.

* The PBMPLUS library is NOT required to compile this software

* (but it is highly useful as a set of PPM image manipulation programs).

*

* These routines may need modification for non-Unix environments or

* specialized applications. As they stand, they assume input from
* an ordinary stdio stream. They further assume that reading begins
* at the start of the file; start_input may need work if the
* user interface has already read some data (e.g., to determine that
* the file is indeed PPM format).
*/
/* Portions
 of this code are based on the PBMPLUS library, which is:
**
** Copyright (C) 1988 by Jef Poskanzer.
**
** Permission to use, copy, modify, and distribute this software and its
** documentation for any purpose and without fee is hereby granted, provided
** that the above copyright notice appear in all copies and that both that
** copyright notice and this permission notice appear in supporting
** documentation. This software is provided "as is" without express or
** implied warranty.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/rdppm.c
No license file was found, but licenses were detected in source scan.

/*
* jversion.h
*
* Copyright (C) 1991-2018, Thomas G. Lane, Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains software version identification.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jversion.h
No license file was found, but licenses were detected in source scan.

/*
* jcdctmgr.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2003-2013 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the forward-DCT management logic.
* This code selects a particular DCT implementation to be used,
* and it performs related housekeeping chores including coefficient

* quantization.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jcdctmgr.c
No license file was found, but licenses were detected in source scan.

/*
* jfdctfst.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2003-2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a fast, not so accurate integer implementation of the
* forward DCT (Discrete Cosine Transform).
*
* A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT
* on each column. Direct algorithms are also available, but they are
* much more complex and seem not to be any faster when reduced to code.
*
* This implementation is based on Arai, Agui, and Nakajima's algorithm for
* scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in
* Japanese, but the algorithm is described in the Pennebaker & Mitchell
* JPEG textbook (see REFERENCES section in file README). The following code
* is based directly on figure 4-8 in P&M.
 * While an 8-point DCT cannot be done in less than 11 multiplies, it is
* possible to arrange the computation so that many of the multiplies are
* simple scalings of the final outputs. These multiplies can then be
* folded into the multiplications or divisions by the JPEG quantization
* table entries. The AA&N method leaves only 5 multiplies and 29 adds
* to be done in the DCT itself.
* The primary disadvantage of this method is that with fixed-point math,
* accuracy is lost due to imprecise representation of the scaled
* quantization values. The smaller the quantization table entry, the less
* precise the scaled value, so this implementation does worse with high-
* quality-setting files than with low-quality ones.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jfdctfst.c
No license file was found, but licenses were detected in source scan.

/*
* jutils.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.

* Modified 2009-2011 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains tables and miscellaneous utility routines needed
* for both compression and decompression.
* Note we prefix all global names with "j" to minimize conflicts with
* a surrounding application.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jutils.c
No license file was found, but licenses were detected in source scan.

/*
* jdatasrc.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2009-2015 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains decompression data source routines for the case of
* reading JPEG data from memory or from a file (or any stdio stream).
* While these routines are sufficient for most applications,
* some will want to use a different source manager.
* IMPORTANT: we assume that fread() will correctly transcribe an array of
* JOCTETs from 8-bit-wide elements on external storage. If char is wider
* than 8 bits on your machine, you may need to do some tweaking.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jdatasrc.c
No license file was found, but licenses were detected in source scan.

/*
* jdhuff.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modified 2006-2016 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains Huffman entropy decoding routines.
* Both sequential and progressive modes are supported in this single module.
*
* Much of the complexity here has to do with supporting input suspension.
* If the data source module demands suspension, we want to be able to back

* up to the start of the current MCU. To do this, we copy state variables
* into local working storage, and update them back to the permanent
* storage only upon successful completion of an MCU.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jdhuff.c
No license file was found, but licenses were detected in source scan.

The Independent JPEG Group's JPEG software
===

README for release 9c of 14-Jan-2018
===================================

This distribution contains the ninth public release of the Independent JPEG
Group's free JPEG software. You are welcome to redistribute this software and
to use it for any purpose, subject to the conditions under LEGAL ISSUES, below.

This software is the work of Tom Lane, Guido Vollbeding, Philip Gladstone,
Bill Allombert, Jim Boucher, Lee Crocker, Bob Friesenhahn, Ben Jackson,
Julian Minguillon, Luis Ortiz, George Phillips, Davide Rossi, Ge' Weijers,
and other members of the Independent JPEG Group.

IJG is not affiliated with the ISO/IEC JTC1/SC29/WG1 standards committee
(previously known as JPEG, together with ITU-T SG16).

DOCUMENTATION ROADMAP
=====================

This file contains the following sections:

OVERVIEW   General description of
 JPEG and the IJG software.
LEGAL ISSUES   Copyright, lack of warranty, terms of distribution.
REFERENCES   Where to learn more about JPEG.
ARCHIVE LOCATIONS   Where to find newer versions of this software.
ACKNOWLEDGMENTS   Special thanks.
FILE FORMAT WARS   Software *not* to get.
TO DO   Plans for future IJG releases.

Other documentation files in the distribution are:

User documentation:
 install.txt   How to configure and install the IJG software.
 usage.txt   Usage instructions for cjpeg, djpeg, jpegtran,
                  rdjpgcom, and wrjpgcom.

*.1   Unix-style man pages for programs (same info as usage.txt).
wizard.txt   Advanced usage instructions for JPEG wizards only.
change.log   Version-to-version change highlights.
Programmer and internal documentation:
libjpeg.txt   How to use the JPEG library in your own programs.
example.c   Sample code for calling the JPEG library.
structure.txt
Overview of the JPEG library's internal structure.
filelist.txt   Road map of IJG files.
coderules.txt   Coding style rules --- please read if you contribute code.

Please read at least the files install.txt and usage.txt. Some information
can also be found in the JPEG FAQ (Frequently Asked Questions) article. See
ARCHIVE LOCATIONS below to find out where to obtain the FAQ article.

If you want to understand how the JPEG code works, we suggest reading one or
more of the REFERENCES, then looking at the documentation files (in roughly
the order listed) before diving into the code.

OVERVIEW
========

This package contains C software to implement JPEG image encoding, decoding,
and transcoding. JPEG (pronounced "jay-peg") is a standardized compression
method for full-color and grayscale images.

This software implements JPEG baseline, extended-sequential, and progressive
compression processes. Provision is made for supporting all variants of these
processes, although some uncommon
 parameter settings aren't implemented yet.
We have made no provision for supporting the hierarchical or lossless
processes defined in the standard.

We provide a set of library routines for reading and writing JPEG image files,
plus two sample applications "cjpeg" and "djpeg", which use the library to
perform conversion between JPEG and some other popular image file formats.
The library is intended to be reused in other applications.

In order to support file conversion and viewing software, we have included
considerable functionality beyond the bare JPEG coding/decoding capability;
for example, the color quantization modules are not strictly part of JPEG
decoding, but they are essential for output to colormapped file formats or
colormapped displays. These extra functions can be compiled out of the
library if not required for a particular application.

We have also included "jpegtran", a utility for lossless transcoding between
different JPEG processes, and "rdjpgcom" and "wrjpgcom",

two simple
applications for inserting and extracting textual comments in JFIF files.

The emphasis in designing this software has been on achieving portability and
flexibility, while also making it fast enough to be useful. In particular,
the software is not intended to be read as a tutorial on JPEG. (See the
REFERENCES section for introductory material.) Rather, it is intended to
be reliable, portable, industrial-strength code. We do not claim to have
achieved that goal in every aspect of the software, but we strive for it.

We welcome the use of this software as a component of commercial products.
No royalty is required, but we do ask for an acknowledgement in product
documentation, as described under LEGAL ISSUES.

LEGAL ISSUES
============

In plain English:

1. We don't promise that this software works. (But if you find any bugs,
   please let us know!)
2. You can use this software for whatever you want. You don't have to pay us.
3. You may not pretend that you wrote
 this software. If you use it in a
   program, you must acknowledge somewhere in your documentation that
   you've used the IJG code.

In legalese:

The authors make NO WARRANTY or representation, either express or implied,
with respect to this software, its quality, accuracy, merchantability, or
fitness for a particular purpose. This software is provided "AS IS", and you,
its user, assume the entire risk as to its quality and accuracy.

This software is copyright (C) 1991-2018, Thomas G. Lane, Guido Vollbeding.
All Rights Reserved except as specified below.

Permission is hereby granted to use, copy, modify, and distribute this
software (or portions thereof) for any purpose, without fee, subject to these
conditions:
(1) If any part of the source code for this software is distributed, then this
README file must be included, with this copyright and no-warranty notice
unaltered; and any additions, deletions, or changes to the original files
must be clearly indicated in accompanying documentation.
(2)
 If only executable code is distributed, then the accompanying
documentation must state that "this software is based in part on the work of

the Independent JPEG Group".

(3) Permission for use of this software is granted only if the user accepts
full responsibility for any undesirable consequences; the authors accept
NO LIABILITY for damages of any kind.

These conditions apply to any software derived from or based on the IJG code,
not just to the unmodified library. If you use our work, you ought to
acknowledge us.

Permission is NOT granted for the use of any IJG author's name or company name
in advertising or publicity relating to this software or products derived from
it. This software may be referred to only as "the Independent JPEG Group's
software".

We specifically permit and encourage the use of this software as the basis of
commercial products, provided that all warranty or liability claims are
assumed by the product vendor.

The Unix configuration script "configure"
 was produced with GNU Autoconf.
It is copyright by the Free Software Foundation but is freely distributable.
The same holds for its supporting scripts (config.guess, config.sub,
ltmain.sh). Another support script, install-sh, is copyright by X Consortium
but is also freely distributable.

The IJG distribution formerly included code to read and write GIF files.
To avoid entanglement with the Unisys LZW patent (now expired), GIF reading
support has been removed altogether, and the GIF writer has been simplified
to produce "uncompressed GIFs". This technique does not use the LZW
algorithm; the resulting GIF files are larger than usual, but are readable
by all standard GIF decoders.

REFERENCES
==========

We recommend reading one or more of these references before trying to
understand the innards of the JPEG software.

The best short technical introduction to the JPEG compression algorithm is
 Wallace, Gregory K. "The JPEG Still Picture Compression Standard",
 Communications of
 the ACM, April 1991 (vol. 34 no. 4), pp. 30-44.
(Adjacent articles in that issue discuss MPEG motion picture compression,
applications of JPEG, and related topics.) If you don't have the CACM issue
handy, a PDF file containing a revised version of Wallace's article is
available at http://www.ijg.org/files/Wallace.JPEG.pdf. The file (actually

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Open Source Used In EM74x1 Modem FW Version 01.14.03.00, 01.14.20.00, and 01.14.22.00
EM7431_01.14.22.00_Based_FW 464

a preprint for an article that appeared in IEEE Trans. Consumer Electronics)
omits the sample images that appeared in CACM, but it includes corrections
and some added material. Note: the Wallace article is copyright ACM and IEEE,
and it may not be used for commercial purposes.

A somewhat less technical, more leisurely introduction to JPEG can be found in
"The Data Compression Book" by Mark Nelson and Jean-loup Gailly, published by
M&T Books (New York), 2nd ed. 1996, ISBN 1-55851-434-1. This book provides
good explanations and example C code for a multitude of compression methods
including JPEG. It is an excellent source if you are comfortable
 reading C
code but don't know much about data compression in general. The book's JPEG
sample code is far from industrial-strength, but when you are ready to look
at a full implementation, you've got one here...

The best currently available description of JPEG is the textbook "JPEG Still
Image Data Compression Standard" by William B. Pennebaker and Joan L.
Mitchell, published by Van Nostrand Reinhold, 1993, ISBN 0-442-01272-1.
Price US$59.95, 638 pp. The book includes the complete text of the ISO JPEG
standards (DIS 10918-1 and draft DIS 10918-2).
Although this is by far the most detailed and comprehensive exposition of
JPEG publicly available, we point out that it is still missing an explanation
of the most essential properties and algorithms of the underlying DCT
technology.
If you think that you know about DCT-based JPEG after reading this book,
then you are in delusion. The real fundamentals and corresponding potential
of DCT-based JPEG are not publicly known so far, and that
 is the reason for
all the mistaken developments taking place in the image coding domain.

The original JPEG standard is divided into two parts, Part 1 being the actual
specification, while Part 2 covers compliance testing methods. Part 1 is
titled "Digital Compression and Coding of Continuous-tone Still Images,
Part 1: Requirements and guidelines" and has document numbers ISO/IEC IS
10918-1, ITU-T T.81. Part 2 is titled "Digital Compression and Coding of
Continuous-tone Still Images, Part 2: Compliance testing" and has document
numbers ISO/IEC IS 10918-2, ITU-T T.83.
IJG JPEG 8 introduced an implementation of the JPEG SmartScale extension
which is specified in two documents: A contributed document at ITU and ISO
with title "ITU-T JPEG-Plus Proposal for Extending ITU-T T.81 for Advanced
Image Coding", April 2006, Geneva, Switzerland. The latest version of this
document is Revision 3. And a contributed document ISO/IEC JTC1/SC29/WG1 N
5799 with title "Evolution of JPEG", June/July
 2011, Berlin, Germany.
IJG JPEG 9 introduces a reversible color transform for improved lossless
compression which is described in a contributed document ISO/IEC JTC1/SC29/
WG1 N 6080 with title "JPEG 9 Lossless Coding", June/July 2012, Paris,
France.

The JPEG standard does not specify all details of an interchangeable file
format. For the omitted details we follow the "JFIF" conventions, version 2.
JFIF version 1 has been adopted as Recommendation ITU-T T.871 (05/2011) :
Information technology - Digital compression and coding of continuous-tone
still images: JPEG File Interchange Format (JFIF). It is available as a
free download in PDF file format from http://www.itu.int/rec/T-REC-T.871.
A PDF file of the older JFIF document is available at
http://www.w3.org/Graphics/JPEG/jfif3.pdf.

The TIFF 6.0 file format specification can be obtained by FTP from
ftp://ftp.sgi.com/graphics/tiff/TIFF6.ps.gz. The JPEG incorporation scheme
found in the TIFF 6.0 spec of 3-June-92 has a number of serious
 problems.
IJG does not recommend use of the TIFF 6.0 design (TIFF Compression tag 6).
Instead, we recommend the JPEG design proposed by TIFF Technical Note #2
(Compression tag 7). Copies of this Note can be obtained from
http://www.ijg.org/files/. It is expected that the next revision
of the TIFF spec will replace the 6.0 JPEG design with the Note's design.
Although IJG's own code does not support TIFF/JPEG, the free libtiff library
uses our library to implement TIFF/JPEG per the Note.

ARCHIVE LOCATIONS
=================

The "official" archive site for this software is www.ijg.org.
The most recent released version can always be found there in
directory "files". This particular version will be archived as
http://www.ijg.org/files/jpegsrc.v9c.tar.gz, and in Windows-compatible
"zip" archive format as http://www.ijg.org/files/jpegsr9c.zip.

The JPEG FAQ (Frequently Asked Questions) article is a source of some
general information about JPEG.
It is available on the World Wide Web
 at http://www.faqs.org/faqs/jpeg-faq/
and other news.answers archive sites, including the official news.answers
archive at rtfm.mit.edu: ftp://rtfm.mit.edu/pub/usenet/news.answers/jpeg-faq/.
If you don't have Web or FTP access, send e-mail to mail-server@rtfm.mit.edu
with body
 send usenet/news.answers/jpeg-faq/part1
 send usenet/news.answers/jpeg-faq/part2

ACKNOWLEDGMENTS
===============

Thank to Juergen Bruder for providing me with a copy of the common DCT

algorithm article, only to find out that I had come to the same result
in a more direct and comprehensible way with a more generative approach.

Thank to Istvan Sebestyen and Joan L. Mitchell for inviting me to the
ITU JPEG (Study Group 16) meeting in Geneva, Switzerland.

Thank to Thomas Wiegand and Gary Sullivan for inviting me to the
Joint Video Team (MPEG & ITU) meeting in Geneva, Switzerland.

Thank to Thomas Richter and Daniel Lee for inviting me to the
ISO/IEC JTC1/SC29/WG1 (previously known as JPEG, together with ITU-T SG16)
meeting
 in Berlin, Germany.

Thank to John Korejwa and Massimo Ballerini for inviting me to
fruitful consultations in Boston, MA and Milan, Italy.

Thank to Hendrik Elstner, Roland Fassauer, Simone Zuck, Guenther
Maier-Gerber, Walter Stoeber, Fred Schmitz, and Norbert Braunagel
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Thank to Nico Zschach and Dirk Stelling of the technical support team
at the Digital Images company in Halle for providing me with extra
equipment for configuration tests.

Thank to Richard F. Lyon (then of Foveon Inc.) for fruitful
communication about JPEG configuration in Sigma Photo Pro software.

Thank to Andrew Finkenstadt for hosting the ijg.org site.

Thank to Thomas G. Lane for the original design and development of
this singular software package.

Thank to Lars Goehler, Andreas Heinecke, Sebastian Fuss, Yvonne Roebert,
Andrej Werner, and Ulf-Dietrich Braumann for support and public relations.

FILE FORMAT WARS
================

The ISO/IEC JTC1/SC29/WG1 standards
 committee (previously known as JPEG,
together with ITU-T SG16) currently promotes different formats containing
the name "JPEG" which is misleading because these formats are incompatible
with original DCT-based JPEG and are based on faulty technologies.
IJG therefore does not and will not support such momentary mistakes
(see REFERENCES).
There exist also distributions under the name "OpenJPEG" promoting such

kind of formats which is misleading because they don't support original
JPEG images.
We have no sympathy for the promotion of inferior formats. Indeed, one of
the original reasons for developing this free software was to help force
convergence on common, interoperable format standards for JPEG files.
Don't use an incompatible file format!
(In any case, our decoder will remain capable of reading existing JPEG
image files indefinitely.)

The ISO committee pretends to be "responsible for the popular JPEG" in their
public reports which is not true because they don't respond to actual
requirements
 for the maintenance of the original JPEG specification.
Furthermore, the ISO committee pretends to "ensure interoperability" with
their standards which is not true because their "standards" support only
application-specific and proprietary use cases and contain mathematically
incorrect code.

There are currently different distributions in circulation containing the
name "libjpeg" which is misleading because they don't have the features and
are incompatible with formats supported by actual IJG libjpeg distributions.
One of those fakes is released by members of the ISO committee and just uses
the name of libjpeg for misdirection of people, similar to the abuse of the
name JPEG as described above, while having nothing in common with actual IJG
libjpeg distributions and containing mathematically incorrect code.
The other one claims to be a "derivative" or "fork" of the original libjpeg,
but violates the license conditions as described under LEGAL ISSUES above
and violates
 basic C programming properties.
We have no sympathy for the release of misleading, incorrect and illegal
distributions derived from obsolete code bases.
Don't use an obsolete code base!

According to the UCC (Uniform Commercial Code) law, IJG has the lawful and
legal right to foreclose on certain standardization bodies and other
institutions or corporations that knowingly perform substantial and
systematic deceptive acts and practices, fraud, theft, and damaging of the
value of the people of this planet without their knowing, willing and
intentional consent.
The titles, ownership, and rights of these institutions and all their assets
are now duly secured and held in trust for the free people of this planet.
People of the planet, on every country, may have a financial interest in
the assets of these former principals, agents, and beneficiaries of the
foreclosed institutions and corporations.
IJG asserts what is: that each man, woman, and child has unalienable value
and rights granted
 and deposited in them by the Creator and not any one of
the people is subordinate to any artificial principality, corporate fiction

or the special interest of another without their appropriate knowing,
willing and intentional consent made by contract or accommodation agreement.
IJG expresses that which already was.
The people have already determined and demanded that public administration
entities, national governments, and their supporting judicial systems must
be fully transparent, accountable, and liable.
IJG has secured the value for all concerned free people of the planet.

A partial list of foreclosed institutions and corporations ("Hall of Shame")
is currently prepared and will be published later.

TO DO
=====

Version 9 is the second release of a new generation JPEG standard
to overcome the limitations of the original JPEG specification,
and is the first true source reference JPEG codec.
More features are being prepared for coming releases...

Please send bug reports, offers of
 help, etc. to jpeg-info@jpegclub.org.

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/README
No license file was found, but licenses were detected in source scan.

/*
* jdapimin.c
*
* Copyright (C) 1994-1998, Thomas G. Lane.
* Modified 2009-2013 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains application interface code for the decompression half
* of the JPEG library. These are the "minimum" API routines that may be
* needed in either the normal full-decompression case or the
* transcoding-only case.
*
* Most of the routines intended to be called directly by an application
* are in this file or in jdapistd.c. But also see jcomapi.c for routines
* shared by compression and decompression, and jdtrans.c for the transcoding
* case.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jdapimin.c

No license file was found, but licenses were detected in source scan.

/*
* jdpostct.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the decompression postprocessing controller.
* This controller manages the upsampling, color conversion, and color
* quantization/reduction steps; specifically, it controls the buffering
* between upsample/color conversion and color quantization/reduction.
*
* If no color quantization/reduction is required, then this module has no
* work to do, and it just hands off to the upsample/color conversion code.
* An integrated upsample/convert/quantize process would replace this module
* entirely.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jdpostct.c
No license file was found, but licenses were detected in source scan.

/*
* wrrle.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modified 2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to write output images in RLE format.
* The Utah Raster Toolkit library is required (version 3.1 or later).
*
* These routines may need modification for non-Unix environments or
* specialized applications. As they stand, they assume output to
* an ordinary stdio stream.
*
* Based on code contributed by Mike Lijewski,
* with updates from Robert Hutchinson.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/wrrle.c
No license file was found, but licenses were detected in source scan.

/*

* jerror.c
*
* Copyright (C) 1991-1998, Thomas G. Lane.
* Modified 2012-2015 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains simple error-reporting and trace-message routines.
* These are suitable for Unix-like systems and others where writing to
* stderr is the right thing to do. Many applications will want to replace
* some or all of these routines.
*
* If you define USE_WINDOWS_MESSAGEBOX in jconfig.h or in the makefile,
* you get a Windows-specific hack to display error messages in a dialog box.
* It ain't much, but it beats dropping error messages into the bit bucket,
* which is what happens to output to stderr under most Windows C compilers.
*
* These routines are used by both the compression and decompression code.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jerror.c
No license file was found, but licenses were detected in source scan.

/*
* rdcolmap.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file implements djpeg's "-map file" switch. It reads a source image
* and constructs a colormap to be supplied to the JPEG decompressor.
*
* Currently, these file formats are supported for the map file:
*   GIF: the contents of the GIF's global colormap are used.
*   PPM (either text or raw flavor): the entire file is read and
*   each unique pixel value is entered in the map.
* Note that reading a large PPM file will be horrendously slow.
* Typically, a PPM-format map file should contain just one pixel
* of each desired color. Such a file can be extracted from an
* ordinary image PPM file with ppmtomap(1).
*
* Rescaling a PPM that has a maxval unequal to MAXJSAMPLE is not
* currently implemented.
*/
/* Portions of this code are based on the PBMPLUS library, which is:
**

** Copyright (C) 1988 by Jef Poskanzer.
**
** Permission to use, copy, modify, and distribute this software and its
** documentation for any purpose and without fee is hereby granted, provided
** that the above copyright notice appear in all copies and that both that
** copyright notice and this permission notice appear in supporting
** documentation. This software is provided "as is" without express or
** implied warranty.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/rdcolmap.c
No license file was found, but licenses were detected in source scan.

/*
* jcapimin.c
*
* Copyright (C) 1994-1998, Thomas G. Lane.
* Modified 2003-2010 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains application interface code for the compression half
* of the JPEG library. These are the "minimum" API routines that may be
* needed in either the normal full-compression case or the transcoding-only
* case.
*
* Most of the routines intended to be called directly by an application
* are in this file or in jcapistd.c. But also see jcparam.c for
* parameter-setup helper routines, jcomapi.c for routines shared by
* compression and decompression, and jctrans.c for the transcoding case.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jcapimin.c
No license file was found, but licenses were detected in source scan.

/*
* wrjpgcom.c
*
* Copyright (C) 1994-1997, Thomas G. Lane.
* Modified 2015-2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a very simple stand-alone application that inserts
* user-supplied text as a COM (comment) marker in a JFIF file.
* This may be useful as an example of the minimum logic needed to parse

* JPEG markers.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/wrjpgcom.c
No license file was found, but licenses were detected in source scan.

/*
* jcprepct.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the compression preprocessing controller.
* This controller manages the color conversion, downsampling,
* and edge expansion steps.
*
* Most of the complexity here is associated with buffering input rows
* as required by the downsampler. See the comments at the head of
* jcsample.c for the downsampler's needs.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jcprepct.c
No license file was found, but licenses were detected in source scan.

/*
* transupp.h
*
* Copyright (C) 1997-2013, Thomas G. Lane, Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains declarations for image transformation routines and
* other utility code used by the jpegtran sample application. These are
* NOT part of the core JPEG library. But we keep these routines separate
* from jpegtran.c to ease the task of maintaining jpegtran-like programs
* that have other user interfaces.
*
* NOTE: all the routines declared here have very specific requirements
* about when they are to be executed during the reading and writing of the
* source and destination files. See the comments in transupp.c, or see
* jpegtran.c for an example of correct usage.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/transupp.h

No license file was found, but licenses were detected in source scan.

/*
* jmemmgr.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modified 2011-2012 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the JPEG system-independent memory management
* routines. This code is usable across a wide variety of machines; most
* of the system dependencies have been isolated in a separate file.
* The major functions provided here are:
*   * pool-based allocation and freeing of memory;
*   * policy decisions about how to divide available memory among the
*   virtual arrays;
*   * control logic for swapping virtual arrays between main memory and
*   backing storage.
* The separate system-dependent file provides the actual backing-storage
* access code, and it contains the policy decision about how much total
* main memory to use.
* This file is
 system-dependent in the sense that some of its functions
* are unnecessary in some systems. For example, if there is enough virtual
* memory so that backing storage will never be used, much of the virtual
* array control logic could be removed. (Of course, if you have that much
* memory then you shouldn't care about a little bit of unused code...)
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jmemmgr.c
No license file was found, but licenses were detected in source scan.

; For conditions of distribution and use, see the accompanying README file.

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jmemdosa.asm
No license file was found, but licenses were detected in source scan.

/*
* jfdctflt.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2003-2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*

* This file contains a floating-point implementation of the
* forward DCT (Discrete Cosine Transform).
*
* This implementation should be more accurate than either of the integer
* DCT implementations. However, it may not give the same results on all
* machines because of differences in roundoff behavior. Speed will depend
* on the hardware's floating point capacity.
*
* A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT
* on each column. Direct algorithms are also available, but they are
* much more complex and seem not to be any faster when reduced to code.
*
* This implementation is based on Arai, Agui, and Nakajima's algorithm for
* scaled
 DCT. Their original paper (Trans. IEICE E-71(11):1095) is in
* Japanese, but the algorithm is described in the Pennebaker & Mitchell
* JPEG textbook (see REFERENCES section in file README). The following code
* is based directly on figure 4-8 in P&M.
* While an 8-point DCT cannot be done in less than 11 multiplies, it is
* possible to arrange the computation so that many of the multiplies are
* simple scalings of the final outputs. These multiplies can then be
* folded into the multiplications or divisions by the JPEG quantization
* table entries. The AA&N method leaves only 5 multiplies and 29 adds
* to be done in the DCT itself.
* The primary disadvantage of this method is that with a fixed-point
* implementation, accuracy is lost due to imprecise representation of the
* scaled quantization values. However, that problem does not arise if
* we use floating point arithmetic.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jfdctflt.c
No license file was found, but licenses were detected in source scan.

/*
* rdgif.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to read input images in GIF format.
*
****
* NOTE: to avoid entanglements with Unisys' patent on LZW compression,   *
* the ability to read GIF files has been removed from the IJG distribution. *
* Sorry about that.   *
****

```
*
* We are required to state that
*    "The Graphics Interchange Format(c) is the Copyright property of
*    CompuServe Incorporated. GIF(sm) is a Service Mark property of
*    CompuServe Incorporated."
*/
```

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/rdgif.c

No license file was found, but licenses were detected in source scan.

```
/*
* jdmerge.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2013-2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains code for merged upsampling/color conversion.
*
* This file combines functions from jdsample.c and jdcolor.c;
* read those files first to understand what's going on.
*
* When the chroma components are to be upsampled by simple replication
* (ie, box filtering), we can save some work in color conversion by
* calculating all the output pixels corresponding to a pair of chroma
* samples at one time.  In the conversion equations
* R = Y           + K1 * Cr
* G = Y + K2 * Cb + K3 * Cr
* B = Y + K4 * Cb
* only the Y term varies among the group of pixels corresponding to a pair
* of chroma samples, so the rest of the terms can be calculated just
 once.
* At typical sampling ratios, this eliminates half or three-quarters of the
* multiplications needed for color conversion.
*
* This file currently provides implementations for the following cases:
* YCC => RGB color conversion only (YCbCr or BG_YCC).
* Sampling ratios of 2h1v or 2h2v.
* No scaling needed at upsample time.
* Corner-aligned (non-CCIR601) sampling alignment.
* Other special cases could be added, but in most applications these are
* the only common cases.  (For uncommon cases we fall back on the more
* general code in jdsample.c and jdcolor.c.)
*/
```

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jdmerge.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jmemansi.c
 *
 * Copyright (C) 1992-1996, Thomas G. Lane.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file provides a simple generic implementation of the system-
 * dependent portion of the JPEG memory manager.  This implementation
 * assumes that you have the ANSI-standard library routine tmpfile().
 * Also, the problem of determining the amount of memory available
 * is shoved onto the user.
 */
```

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jmemansi.c

No license file was found, but licenses were detected in source scan.

IJG JPEG LIBRARY: FILE LIST

Copyright (C) 1994-2017, Thomas G. Lane, Guido Vollbeding.

This file is part of the Independent JPEG Group's software.

For conditions of distribution and use, see the accompanying README file.

Here is a road map to the files in the IJG JPEG distribution. The
distribution includes the JPEG library proper, plus two application
programs ("cjpeg" and "djpeg") which use the library to convert JPEG
files to and from some other popular image formats. A third application
"jpegtran" uses the library to do lossless conversion between different
variants of JPEG. There are also two stand-alone applications,
"rdjpgcom" and "wrjpgcom".

THE JPEG LIBRARY
================

Include files:

jpeglib.h JPEG library's exported data and function declarations.
jconfig.h Configuration declarations. Note: this file is not present
  in the distribution; it is generated during installation.
jmorecfg.h Additional
 configuration declarations; need not be changed
  for a standard installation.

jerror.h Declares JPEG library's error and trace message codes.
jinclude.h Central include file used by all IJG .c files to reference
   system include files.
jpegint.h JPEG library's internal data structures.
jdct.h Private declarations for forward & reverse DCT subsystems.
jmemsys.h Private declarations for memory management subsystem.
jversion.h Version information.

Applications using the library should include jpeglib.h (which in turn
includes jconfig.h and jmorecfg.h). Optionally, jerror.h may be included
if the application needs to reference individual JPEG error codes. The
other include files are intended for internal use and would not normally
be included by an application program. (cjpeg/djpeg/etc do use jinclude.h,
since its function is to improve portability of the whole IJG distribution.
Most other applications will directly include the system include files they
want, and hence won't need
 jinclude.h.)

C source code files:

These files contain most of the functions intended to be called directly by
an application program:

jcapimin.c Application program interface: core routines for compression.
jcapistd.c Application program interface: standard compression.
jdapimin.c Application program interface: core routines for decompression.
jdapistd.c Application program interface: standard decompression.
jcomapi.c Application program interface routines common to compression
   and decompression.
jcparam.c Compression parameter setting helper routines.
jctrans.c API and library routines for transcoding compression.
jdtrans.c API and library routines for transcoding decompression.

Compression side of the library:

jcinit.c Initialization: determines which other modules to use.
jcmaster.c Master control: setup and inter-pass sequencing logic.
jcmainct.c Main buffer controller (preprocessor => JPEG compressor).
jcprepct.c Preprocessor buffer controller.
jccoefct.c Buffer controller
 for DCT coefficient buffer.
jccolor.c Color space conversion.
jcsample.c Downsampling.
jcdctmgr.c DCT manager (DCT implementation selection & control).
jfdctint.c Forward DCT using slow-but-accurate integer method.
jfdctfst.c Forward DCT using faster, less accurate integer method.
jfdctflt.c Forward DCT using floating-point arithmetic.

jchuff.c Huffman entropy coding.

jcarith.c Arithmetic entropy coding.

jcmarker.c JPEG marker writing.

jdatadst.c Data destination managers for memory and stdio output.

Decompression side of the library:

jdmaster.c Master control: determines which other modules to use.

jdinput.c Input controller: controls input processing modules.

jdmainct.c Main buffer controller (JPEG decompressor => postprocessor).

jdcoefct.c Buffer controller for DCT coefficient buffer.

jdpostct.c Postprocessor buffer controller.

jdmarker.c JPEG marker reading.

jdhuff.c Huffman entropy decoding.

jdarith.c Arithmetic entropy decoding.

jddctmgr.c IDCT manager (IDCT implementation
 selection & control).

jidctint.c Inverse DCT using slow-but-accurate integer method.

jidctfst.c Inverse DCT using faster, less accurate integer method.

jidctflt.c Inverse DCT using floating-point arithmetic.

jdsample.c Upsampling.

jdcolor.c Color space conversion.

jdmerge.c Merged upsampling/color conversion (faster, lower quality).

jquant1.c One-pass color quantization using a fixed-spacing colormap.

jquant2.c Two-pass color quantization using a custom-generated colormap.
  Also handles one-pass quantization to an externally given map.

jdatasrc.c Data source managers for memory and stdio input.

Support files for both compression and decompression:

jaricom.c Tables for common use in arithmetic entropy encoding and
  decoding routines.

jerror.c Standard error handling routines (application replaceable).

jmemmgr.c System-independent (more or less) memory management code.

jutils.c Miscellaneous utility routines.

jmemmgr.c relies on a system-dependent memory management module. The IJG
distribution
 includes the following implementations of the system-dependent
module:

jmemnobs.c "No backing store": assumes adequate virtual memory exists.

jmemansi.c Makes temporary files with ANSI-standard routine tmpfile().

jmemname.c Makes temporary files with program-generated file names.

jmemdos.c Custom implementation for MS-DOS (16-bit environment only):
   can use extended and expanded memory as well as temp files.

jmemmac.c Custom implementation for Apple Macintosh.

Exactly one of the system-dependent modules should be configured into an installed JPEG library (see install.txt for hints about which one to use). On unusual systems you may find it worthwhile to make a special system-dependent memory manager.

Non-C source code files:

jmemdosa.asm 80x86 assembly code support for jmemdos.c; used only in
  MS-DOS-specific configurations of the JPEG library.

CJPEG/DJPEG/JPEGTRAN
====================

Include files:

cdjpeg.h Declarations shared by cjpeg/djpeg/jpegtran modules.
cderror.h Additional
 error and trace message codes for cjpeg et al.
transupp.h Declarations for jpegtran support routines in transupp.c.

C source code files:

cjpeg.c Main program for cjpeg.
djpeg.c Main program for djpeg.
jpegtran.c Main program for jpegtran.
cdjpeg.c Utility routines used by all three programs.
rdcolmap.c Code to read a colormap file for djpeg's "-map" switch.
rdswitch.c Code to process some of cjpeg's more complex switches.
  Also used by jpegtran.
transupp.c Support code for jpegtran: lossless image manipulations.

Image file reader modules for cjpeg:

rdbmp.c BMP file input.
rdgif.c GIF file input (now just a stub).
rdppm.c PPM/PGM file input.
rdrle.c Utah RLE file input.
rdtarga.c Targa file input.

Image file writer modules for djpeg:

wrbmp.c BMP file output.
wrgif.c GIF file output (a mere shadow of its former self).
wrppm.c PPM/PGM file output.
wrrle.c Utah RLE file output.
wrtarga.c Targa file output.

RDJPGCOM/WRJPGCOM

=================

C source
 code files:

rdjpgcom.c Stand-alone rdjpgcom application.
wrjpgcom.c Stand-alone wrjpgcom application.

These programs do not depend on the IJG library. They do use
jconfig.h and jinclude.h, only to improve portability.

ADDITIONAL FILES

================

Documentation (see README for a guide to the documentation files):

README Master documentation file.
*.txt Other documentation files.
*.1 Documentation in Unix man page format.
change.log Version-to-version change highlights.
example.c Sample code for calling JPEG library.

Configuration/installation files and programs (see install.txt for more info):

configure Unix shell script to perform automatic configuration.
configure.ac Source file for use with Autoconf to generate configure.
ltmain.sh Support scripts for configure (from GNU libtool).
config.guess
config.sub
depcomp
missing
ar-lib
compile
install-sh Install shell script for those Unix systems lacking one.
Makefile.in Makefile input for configure.
Makefile.am Source file
 for use with Automake to generate Makefile.in.
ckconfig.c Program to generate jconfig.h on non-Unix systems.
jconfig.txt Template for making jconfig.h by hand.
mak*.* Sample makefiles for particular systems.
jconfig.* Sample jconfig.h for particular systems.
libjpeg.map Script to generate shared library with versioned symbols.
libjpeg.pc.in libjpeg.pc pkg-config file input for configure.
aclocal.m4 M4 macro definitions for use with Autoconf.

Test files (see install.txt for test procedure):

test*.* Source and comparison files for confidence test.
  These are binary image files, NOT text files.

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/filelist.txt
No license file was found, but licenses were detected in source scan.

/*
* jdapistd.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2002-2013 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains application interface code for the decompression half
* of the JPEG library. These are the "standard" API routines that are
* used in the normal full-decompression case. They are not used by a
* transcoding-only application. Note that if an application links in
* jpeg_start_decompress, it will end up linking in the entire decompressor.
* We thus must separate this file from jdapimin.c to avoid linking the
* whole decompression library into a transcoder.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jdapistd.c
No license file was found, but licenses were detected in source scan.

/*
* jerror.h
*
* Copyright (C) 1994-1997, Thomas G. Lane.
* Modified 1997-2012 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file defines the error and message codes for the JPEG library.
* Edit this file to add new codes, or to translate the message strings to
* some other language.
* A set of error-reporting macros are defined too. Some applications using
* the JPEG library may wish to include this file to get the error codes
* and/or the macros.
*/

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jerror.h

No license file was found, but licenses were detected in source scan.

```
/*
 * jidctflt.c
 *
 * Copyright (C) 1994-1998, Thomas G. Lane.
 * Modified 2010-2017 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains a floating-point implementation of the
 * inverse DCT (Discrete Cosine Transform).  In the IJG code, this routine
 * must also perform dequantization of the input coefficients.
 *
 * This implementation should be more accurate than either of the integer
 * IDCT implementations.  However, it may not give the same results on all
 * machines because of differences in roundoff behavior.  Speed will depend
 * on the hardware's floating point capacity.
 *
 * A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT
 * on each row (or vice versa, but it's more convenient to emit a row at
 * a time).  Direct algorithms are also available, but they
 are much more
 * complex and seem not to be any faster when reduced to code.
 *
 * This implementation is based on Arai, Agui, and Nakajima's algorithm for
 * scaled DCT.  Their original paper (Trans. IEICE E-71(11):1095) is in
 * Japanese, but the algorithm is described in the Pennebaker & Mitchell
 * JPEG textbook (see REFERENCES section in file README).  The following code
 * is based directly on figure 4-8 in P&M.
 * While an 8-point DCT cannot be done in less than 11 multiplies, it is
 * possible to arrange the computation so that many of the multiplies are
 * simple scalings of the final outputs.  These multiplies can then be
 * folded into the multiplications or divisions by the JPEG quantization
 * table entries.  The AA&N method leaves only 5 multiplies and 29 adds
 * to be done in the DCT itself.
 * The primary disadvantage of this method is that with a fixed-point
 * implementation, accuracy is lost due to imprecise representation of the
 * scaled quantization values.  However,
 that problem does not arise if
 * we use floating point arithmetic.
 */
```

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jidctflt.c

No license file was found, but licenses were detected in source scan.

/*
* jdatadst.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2009-2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains compression data destination routines for the case of
* emitting JPEG data to memory or to a file (or any stdio stream).
* While these routines are sufficient for most applications,
* some will want to use a different destination manager.
* IMPORTANT: we assume that fwrite() will correctly transcribe an array of
* JOCTETs into 8-bit-wide elements on external storage. If char is wider
* than 8 bits on your machine, you may need to do some tweaking.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jdatadst.c
No license file was found, but licenses were detected in source scan.

/*
* jcinit.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modified 2003-2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains initialization logic for the JPEG compressor.
* This routine is in charge of selecting the modules to be executed and
* making an initialization call to each one.
*
* Logically, this code belongs in jcmaster.c. It's split out because
* linking this routine implies linking the entire compression library.
* For a transcoding-only application, we want to be able to use jcmaster.c
* without linking in the whole library.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jcinit.c
No license file was found, but licenses were detected in source scan.

/*
* jmemmac.c
*
* Copyright (C) 1992-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.

```
* For conditions of distribution and use, see the accompanying README file.
*
* jmemmac.c provides an Apple Macintosh implementation of the system-
* dependent portion of the JPEG memory manager.
*
* If you use jmemmac.c, then you must define USE_MAC_MEMMGR in the
* JPEG_INTERNALS part of jconfig.h.
*
* jmemmac.c uses the Macintosh toolbox routines NewPtr and DisposePtr
* instead of malloc and free.  It accurately determines the amount of
* memory available by using CompactMem.  Notice that if left to its
* own devices, this code can chew up all available space in the
* application's zone, with the exception of the rather small "slop"
* factor computed in jpeg_mem_available().  The application can ensure
* that more space is left over by reducing max_memory_to_use.
*
* Large images
 are swapped to disk using temporary files and System 7.0+'s
* temporary folder functionality.
*
* Note that jmemmac.c depends on two features of MacOS that were first
* introduced in System 7: FindFolder and the FSSpec-based calls.
* If your application uses jmemmac.c and is run under System 6 or earlier,
* and the jpeg library decides it needs a temporary file, it will abort,
* printing error messages about requiring System 7.  (If no temporary files
* are created, it will run fine.)
*
* If you want to use jmemmac.c in an application that might be used with
* System 6 or earlier, then you should remove dependencies on FindFolder
* and the FSSpec calls.  You will need to replace FindFolder with some
* other mechanism for finding a place to put temporary files, and you
* should replace the FSSpec calls with their HFS equivalents:
*
*    FSpDelete    -> HDelete
*    FSpGetFInfo  -> HGetFInfo
*    FSpCreate    -> HCreate
*    FSpOpenDF    -> HOpen
  *** Note: not HOpenDF ***
*    FSMakeFSSpec -> (fill in spec by hand.)
*
* (Use HOpen instead of HOpenDF.  HOpen is just a glue-interface to PBHOpen,
* which is on all HFS macs.  HOpenDF is a System 7 addition which avoids the
* ages-old problem of names starting with a period.)
*
* Contributed by Sam Bushell (jsam@iagu.on.net) and
* Dan Gildor (gyld@in-touch.com).
*/
```

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jmemmac.c

No license file was found, but licenses were detected in source scan.

```
/*
 * jdcolor.c
 *
 * Copyright (C) 1991-1997, Thomas G. Lane.
 * Modified 2011-2017 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains output colorspace conversion routines.
 */
```

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jdcolor.c

No license file was found, but licenses were detected in source scan.

IJG JPEG LIBRARY: CODING RULES

Copyright (C) 1991-1996, Thomas G. Lane.
This file is part of the Independent JPEG Group's software.
For conditions of distribution and use, see the accompanying README file.

Since numerous people will be contributing code and bug fixes, it's important
to establish a common coding style. The goal of using similar coding styles
is much more important than the details of just what that style is.

In general we follow the recommendations of "Recommended C Style and Coding
Standards" revision 6.1 (Cannon et al. as modified by Spencer, Keppel and
Brader). This document is available in the IJG FTP archive (see
jpeg/doc/cstyle.ms.tbl.Z, or cstyle.txt.Z for those without nroff/tbl).

Block comments should be laid out thusly:

```
/*
 *  Block comments in this style.
 */
```

We indent statements in K&R style, e.g.,
```
 if (test) {
   then-part;
 } else {
   else-part;
 }
```
with two spaces per indentation

level. (This indentation convention is
handled automatically by GNU Emacs and many other text editors.)

Multi-word names should be written in lower case with underscores, e.g.,
multi_word_name (not multiWordName). Preprocessor symbols and enum constants
are similar but upper case (MULTI_WORD_NAME). Names should be unique within
the first fifteen characters. (On some older systems, global names must be
unique within six characters. We accommodate this without cluttering the
source code by using macros to substitute shorter names.)

We use function prototypes everywhere; we rely on automatic source code
transformation to feed prototype-less C compilers. Transformation is done
by the simple and portable tool 'ansi2knr.c' (courtesy of Ghostscript).
ansi2knr is not very bright, so it imposes a format requirement on function
declarations: the function name MUST BEGIN IN COLUMN 1. Thus all functions
should be written in the following style:

```
LOCAL(int *)
function_name (int a, char
 *b)
{
   code...
}
```

Note that each function definition must begin with GLOBAL(type), LOCAL(type),
or METHODDEF(type). These macros expand to "static type" or just "type" as
appropriate. They provide a readable indication of the routine's usage and
can readily be changed for special needs. (For instance, special linkage
keywords can be inserted for use in Windows DLLs.)

```
ansi2knr does not transform method declarations (function pointers in
structs).  We handle these with a macro JMETHOD, defined as
 #ifdef HAVE_PROTOTYPES
#define JMETHOD(type,methodname,arglist)  type (*methodname) arglist
#else
#define JMETHOD(type,methodname,arglist)  type (*methodname) ()
#endif
which is used like this:
 struct function_pointers {
   JMETHOD(void, init_entropy_encoder, (int somearg, jparms *jp));
   JMETHOD(void, term_entropy_encoder, (void));
 };
```
Note the set of parentheses surrounding the parameter list.

A similar solution is used for forward and external function declarations
(see the EXTERN
 and JPP macros).

If the code is to work on non-ANSI compilers, we cannot rely on a prototype
declaration to coerce actual parameters into the right types. Therefore, use
explicit casts on actual parameters whenever the actual parameter type is not
identical to the formal parameter. Beware of implicit conversions to "int".

It seems there are some non-ANSI compilers in which the sizeof() operator
is defined to return int, yet size_t is defined as long. Needless to say,
this is brain-damaged. Always use the SIZEOF() macro in place of sizeof(),
so that the result is guaranteed to be of type size_t.

The JPEG library is intended to be used within larger programs. Furthermore,
we want it to be reentrant so that it can be used by applications that process
multiple images concurrently. The following rules support these requirements:

1. Avoid direct use of file I/O, "malloc", error report printouts, etc;
pass these through the common routines provided.

2. Minimize global namespace
 pollution. Functions should be declared static
wherever possible. (Note that our method-based calling conventions help this
a lot: in many modules only the initialization function will ever need to be
called directly, so only that function need be externally visible.) All
global function names should begin with "jpeg_", and should have an
abbreviated name (unique in the first six characters) substituted by macro
when NEED_SHORT_EXTERNAL_NAMES is set.

3. Don't use global variables; anything that must be used in another module
should be in the common data structures.

4. Don't use static variables except for read-only constant tables. Variables
that should be private to a module can be placed into private structures (see
the system architecture document, structure.txt).

5. Source file names should begin with "j" for files that are part of the
library proper; source files that are not part of the library, such as cjpeg.c
and djpeg.c, do not begin with "j". Keep source file names
 to eight
characters (plus ".c" or ".h", etc) to make life easy for MS-DOSers. Keep
compression and decompression code in separate source files --- some
applications may want only one half of the library.

Note: these rules (particularly #4) are not followed religiously in the
modules that are used in cjpeg/djpeg but are not part of the JPEG library
proper. Those modules are not really intended to be used in other
applications.

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/coderules.txt
No license file was found, but licenses were detected in source scan.

/*
* ckconfig.c
*
* Copyright (C) 1991-1994, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/ckconfig.c
No license file was found, but licenses were detected in source scan.

/*
* jcarith.c
*
* Developed 1997-2013 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains portable arithmetic entropy encoding routines for JPEG
* (implementing the ISO/IEC IS 10918-1 and CCITT Recommendation ITU-T T.81).
*
* Both sequential and progressive modes are supported in this single module.
*
* Suspension is not currently supported in this module.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jcarith.c
No license file was found, but licenses were detected in source scan.

/*
* jcapistd.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2013 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains application interface code for the compression half
* of the JPEG library. These are the "standard" API routines that are
* used in the normal full-compression case. They are not used by a
* transcoding-only application. Note that if an application links in
* jpeg_start_compress, it will end up linking in the entire compressor.
* We thus must separate this file from jcapimin.c to avoid linking the

* whole compression library into a transcoder.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jcapistd.c
No license file was found, but licenses were detected in source scan.

/*
* jaricom.c
*
* Developed 1997-2011 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains probability estimation tables for common use in
* arithmetic entropy encoding and decoding routines.
*
* This data represents Table D.3 in the JPEG spec (D.2 in the draft),
* ISO/IEC IS 10918-1 and CCITT Recommendation ITU-T T.81, and Table 24
* in the JBIG spec, ISO/IEC IS 11544 and CCITT Recommendation ITU-T T.82.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jaricom.c
No license file was found, but licenses were detected in source scan.

/*
* jquant2.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modified 2011 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains 2-pass color quantization (color mapping) routines.
* These routines provide selection of a custom color map for an image,
* followed by mapping of the image to that color map, with optional
* Floyd-Steinberg dithering.
* It is also possible to use just the second pass to map to an arbitrary
* externally-given color map.
*
* Note: ordered dithering is not supported, since there isn't any fast
* way to compute intercolor distances; it's unclear that ordered dither's
* fundamental assumptions even hold with an irregularly spaced color map.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jquant2.c

No license file was found, but licenses were detected in source scan.

```
/*
 * wrtarga.c
 *
 * Copyright (C) 1991-1996, Thomas G. Lane.
 * Modified 2015-2017 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains routines to write output images in Targa format.
 *
 * These routines may need modification for non-Unix environments or
 * specialized applications.  As they stand, they assume output to
 * an ordinary stdio stream.
 *
 * Based on code contributed by Lee Daniel Crocker.
 */
```

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/wrtarga.c
No license file was found, but licenses were detected in source scan.

```
/*
 * cjpeg.c
 *
 * Copyright (C) 1991-1998, Thomas G. Lane.
 * Modified 2003-2013 by Guido Vollbeding.
 * This file is part of the Independent JPEG Group's software.
 * For conditions of distribution and use, see the accompanying README file.
 *
 * This file contains a command-line user interface for the JPEG compressor.
 * It should work on any system with Unix- or MS-DOS-style command lines.
 *
 * Two different command line styles are permitted, depending on the
 * compile-time switch TWO_FILE_COMMANDLINE:
 * cjpeg [options]  inputfile outputfile
 * cjpeg [options]  [inputfile]
 * In the second style, output is always to standard output, which you'd
 * normally redirect to a file or pipe to some other program.  Input is
 * either from a named file or from standard input (typically redirected).
 * The second style is convenient on Unix but is unhelpful on systems that
 * don't support pipes.  Also, you MUST use the
 first style if your system
 * doesn't do binary I/O to stdin/stdout.
 * To simplify script writing, the "-outfile" switch is provided.  The syntax
 * cjpeg [options]  -outfile outputfile  inputfile
 * works regardless of which command line style is used.
```

```
*/
```

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/cjpeg.c

No license file was found, but licenses were detected in source scan.

```
/*
* jcomapi.c
*
* Copyright (C) 1994-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains application interface routines that are used for both
* compression and decompression.
*/
```

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jcomapi.c

No license file was found, but licenses were detected in source scan.

```
/*
* cderror.h
*
* Copyright (C) 1994-1997, Thomas G. Lane.
* Modified 2009-2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file defines the error and message codes for the cjpeg/djpeg
* applications.  These strings are not needed as part of the JPEG library
* proper.
* Edit this file to add new codes, or to translate the message strings to
* some other language.
*/
```

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/cderror.h

No license file was found, but licenses were detected in source scan.

```
/*
* jdtrans.c
*
* Copyright (C) 1995-1997, Thomas G. Lane.
* Modified 2000-2009 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
```

* This file contains library routines for transcoding decompression,
* that is, reading raw DCT coefficient arrays from an input JPEG file.
* The routines in jdapimin.c will also be needed by a transcoder.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jdtrans.c
No license file was found, but licenses were detected in source scan.

/*
* rdrle.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to read input images in Utah RLE format.
* The Utah Raster Toolkit library is required (version 3.1 or later).
*
* These routines may need modification for non-Unix environments or
* specialized applications. As they stand, they assume input from
* an ordinary stdio stream. They further assume that reading begins
* at the start of the file; start_input may need work if the
* user interface has already read some data (e.g., to determine that
* the file is indeed RLE format).
*
* Based on code contributed by Mike Lijewski,
* with updates from Robert Hutchinson.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/rdrle.c
No license file was found, but licenses were detected in source scan.

/*
* jcmarker.c
*
* Copyright (C) 1991-1998, Thomas G. Lane.
* Modified 2003-2013 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to write JPEG datastream markers.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jcmarker.c

No license file was found, but licenses were detected in source scan.

/*
* rdjpgcom.c
*
* Copyright (C) 1994-1997, Thomas G. Lane.
* Modified 2009 by Bill Allombert, Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a very simple stand-alone application that displays
* the text in COM (comment) markers in a JFIF file.
* This may be useful as an example of the minimum logic needed to parse
* JPEG markers.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/rdjpgcom.c
No license file was found, but licenses were detected in source scan.

/*
* jfdctint.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modification developed 2003-2015 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a slow-but-accurate integer implementation of the
* forward DCT (Discrete Cosine Transform).
*
* A 2-D DCT can be done by 1-D DCT on each row followed by 1-D DCT
* on each column. Direct algorithms are also available, but they are
* much more complex and seem not to be any faster when reduced to code.
*
* This implementation is based on an algorithm described in
*   C. Loeffler, A. Ligtenberg and G. Moschytz, "Practical Fast 1-D DCT
*   Algorithms with 11 Multiplications", Proc. Int'l. Conf. on Acoustics,
*   Speech, and Signal Processing 1989 (ICASSP '89), pp. 988-991.
* The primary algorithm described there uses 11 multiplies
 and 29 adds.
* We use their alternate method with 12 multiplies and 32 adds.
* The advantage of this method is that no data path contains more than one
* multiplication; this allows a very simple and accurate implementation in
* scaled fixed-point arithmetic, with a minimal number of shifts.
*
* We also provide FDCT routines with various input sample block sizes for
* direct resolution reduction or enlargement and for direct resolving the

* common 2x1 and 1x2 subsampling cases without additional resampling: NxN
* (N=1...16), 2NxN, and Nx2N (N=1...8) pixels for one 8x8 output DCT block.
*
* For N<8 we fill the remaining block coefficients with zero.
* For N>8 we apply a partial N-point FDCT on the input samples, computing
* just the lower 8 frequency coefficients and discarding the rest.
*
* We must scale the output coefficients of the N-point FDCT appropriately
* to the standard 8-point FDCT level by 8/N per 1-D pass. This scaling
* is folded into the constant multipliers
 (pass 2) and/or final/initial
* shifting.
*
* CAUTION: We rely on the FIX() macro except for the N=1,2,4,8 cases
* since there would be too many additional constants to pre-calculate.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jfdctint.c
No license file was found, but licenses were detected in source scan.

/*
* jpegtran.c
*
* Copyright (C) 1995-2013, Thomas G. Lane, Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a command-line user interface for JPEG transcoding.
* It is very similar to cjpeg.c, and partly to djpeg.c, but provides
* lossless transcoding between different JPEG file formats. It also
* provides some lossless and sort-of-lossless transformations of JPEG data.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jpegtran.c
No license file was found, but licenses were detected in source scan.

/*
* jddctmgr.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2002-2013 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the inverse-DCT management logic.
* This code selects a particular IDCT implementation to be used,

* and it performs related housekeeping chores. No code in this file
* is executed per IDCT step, only during output pass setup.
*
* Note that the IDCT routines are responsible for performing coefficient
* dequantization as well as the IDCT proper. This module sets up the
* dequantization multiplier table needed by the IDCT routine.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jddctmgr.c
No license file was found, but licenses were detected in source scan.

/*
* djpeg.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modified 2009-2015 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a command-line user interface for the JPEG decompressor.
* It should work on any system with Unix- or MS-DOS-style command lines.
*
* Two different command line styles are permitted, depending on the
* compile-time switch TWO_FILE_COMMANDLINE:
* djpeg [options] inputfile outputfile
* djpeg [options] [inputfile]
* In the second style, output is always to standard output, which you'd
* normally redirect to a file or pipe to some other program. Input is
* either from a named file or from standard input (typically redirected).
* The second style is convenient on Unix but is unhelpful on systems that
* don't support pipes. Also, you MUST use the
 first style if your system
* doesn't do binary I/O to stdin/stdout.
* To simplify script writing, the "-outfile" switch is provided. The syntax
* djpeg [options] -outfile outputfile inputfile
* works regardless of which command line style is used.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/djpeg.c
No license file was found, but licenses were detected in source scan.

/*
* jmorecfg.h
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modified 1997-2013 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains additional configuration options that customize the
* JPEG software for special applications or support machine-dependent
* optimizations. Most users will not need to touch this file.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jmorecfg.h
No license file was found, but licenses were detected in source scan.

/*
* jquant1.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modified 2011 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains 1-pass color quantization (color mapping) routines.
* These routines provide mapping to a fixed color map using equally spaced
* color values. Optional Floyd-Steinberg or ordered dithering is available.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jquant1.c
No license file was found, but licenses were detected in source scan.

IJG JPEG LIBRARY: SYSTEM ARCHITECTURE

Copyright (C) 1991-2013, Thomas G. Lane, Guido Vollbeding.
This file is part of the Independent JPEG Group's software.
For conditions of distribution and use, see the accompanying README file.

This file provides an overview of the architecture of the IJG JPEG software;
that is, the functions of the various modules in the system and the interfaces
between modules. For more precise details about any data structure or calling
convention, see the include files and comments in the source code.

We assume that the reader is already somewhat familiar with the JPEG standard.
The README file includes references for learning about JPEG. The file
libjpeg.txt describes the library from the viewpoint of an application
programmer using the library; it's best to read that file before this one.
Also, the file coderules.txt describes the coding style conventions we use.

In this document, JPEG-specific

terminology follows the JPEG standard:
 A "component" means a color channel, e.g., Red or Luminance.
 A "sample" is a single component value (i.e., one number in the image data).
 A "coefficient" is a frequency coefficient (a DCT transform output number).
 A "block" is an array of samples or coefficients.
 An "MCU" (minimum coded unit) is an interleaved set of blocks of size
 determined by the sampling factors, or a single block in a
 noninterleaved scan.
We do not use the terms "pixel" and "sample" interchangeably. When we say
pixel, we mean an element of the full-size image, while a sample is an element
of the downsampled image. Thus the number of samples may vary across
components while the number of pixels does not. (This terminology is not used
rigorously throughout the code, but it is used in places where confusion would
otherwise result.)

*** System features ***

The IJG distribution contains two parts:
 * A subroutine library for JPEG compression and decompression.
  * cjpeg/djpeg, two sample applications that use the library to transform
    JFIF JPEG files to and from several other image formats.
cjpeg/djpeg are of no great intellectual complexity: they merely add a simple
command-line user interface and I/O routines for several uncompressed image
formats. This document concentrates on the library itself.

We desire the library to be capable of supporting all JPEG baseline, extended
sequential, and progressive DCT processes. The library does not support the
hierarchical or lossless processes defined in the standard.

Within these limits, any set of compression parameters allowed by the JPEG
spec should be readable for decompression. (We can be more restrictive about
what formats we can generate.) Although the system design allows for all
parameter values, some uncommon settings are not yet implemented and may
never be; nonintegral sampling ratios are the prime example. Furthermore,
we treat 8-bit vs. 12-bit data precision as a
 compile-time switch, not a
run-time option, because most machines can store 8-bit pixels much more
compactly than 12-bit.

By itself, the library handles only interchange JPEG datastreams --- in
particular the widely used JFIF file format. The library can be used by
surrounding code to process interchange or abbreviated JPEG datastreams that
are embedded in more complex file formats. (For example, libtiff uses this
library to implement JPEG compression within the TIFF file format.)

The library includes a substantial amount of code that is not covered by the
JPEG standard but is necessary for typical applications of JPEG. These

functions preprocess the image before JPEG compression or postprocess it after
decompression. They include colorspace conversion, downsampling/upsampling,
and color quantization. This code can be omitted if not needed.

A wide range of quality vs. speed tradeoffs are possible in JPEG processing,
and even more so in decompression postprocessing. The decompression
 library
provides multiple implementations that cover most of the useful tradeoffs,
ranging from very-high-quality down to fast-preview operation. On the
compression side we have generally not provided low-quality choices, since
compression is normally less time-critical. It should be understood that the
low-quality modes may not meet the JPEG standard's accuracy requirements;
nonetheless, they are useful for viewers.

*** Portability issues ***

Portability is an essential requirement for the library. The key portability
issues that show up at the level of system architecture are:

1. Memory usage. We want the code to be able to run on PC-class machines
with limited memory. Images should therefore be processed sequentially (in
strips), to avoid holding the whole image in memory at once. Where a
full-image buffer is necessary, we should be able to use either virtual memory
or temporary files.

2. Near/far pointer distinction. To run efficiently on 80x86 machines, the
code
 should distinguish "small" objects (kept in near data space) from
"large" ones (kept in far data space). This is an annoying restriction, but
fortunately it does not impact code quality for less brain-damaged machines,
and the source code clutter turns out to be minimal with sufficient use of
pointer typedefs.

3. Data precision. We assume that "char" is at least 8 bits, "short" and
"int" at least 16, "long" at least 32. The code will work fine with larger
data sizes, although memory may be used inefficiently in some cases. However,
the JPEG compressed datastream must ultimately appear on external storage as a
sequence of 8-bit bytes if it is to conform to the standard. This may pose a
problem on machines where char is wider than 8 bits. The library represents
compressed data as an array of values of typedef JOCTET. If no data type
exactly 8 bits wide is available, custom data source and data destination
modules must be written to unpack and pack the chosen JOCTET datatype into
8-bit
 external representation.

*** System overview ***

The compressor and decompressor are each divided into two main sections:
the JPEG compressor or decompressor proper, and the preprocessing or
postprocessing functions. The interface between these two sections is the
image data that the official JPEG spec regards as its input or output: this
data is in the colorspace to be used for compression, and it is downsampled
to the sampling factors to be used. The preprocessing and postprocessing
steps are responsible for converting a normal image representation to or from
this form. (Those few applications that want to deal with YCbCr downsampled
data can skip the preprocessing or postprocessing step.)

Looking more closely, the compressor library contains the following main
elements:

 Preprocessing:
   * Color space conversion (e.g., RGB to YCbCr).
   * Edge expansion and downsampling. Optionally, this step can do simple
     smoothing --- this is often helpful for low-quality
 source data.
 JPEG proper:
   * MCU assembly, DCT, quantization.
   * Entropy coding (sequential or progressive, Huffman or arithmetic).

In addition to these modules we need overall control, marker generation,
and support code (memory management & error handling). There is also a
module responsible for physically writing the output data --- typically
this is just an interface to fwrite(), but some applications may need to
do something else with the data.

The decompressor library contains the following main elements:

 JPEG proper:
   * Entropy decoding (sequential or progressive, Huffman or arithmetic).
   * Dequantization, inverse DCT, MCU disassembly.
 Postprocessing:
   * Upsampling. Optionally, this step may be able to do more general
     rescaling of the image.
   * Color space conversion (e.g., YCbCr to RGB). This step may also
     provide gamma adjustment [currently it does not].
   * Optional color quantization (e.g., reduction to 256 colors).
   * Optional
 color precision reduction (e.g., 24-bit to 15-bit color).
     [This feature is not currently implemented.]

We also need overall control, marker parsing, and a data source module.
The support code (memory management & error handling) can be shared with
the compression half of the library.

There may be several implementations of each of these elements, particularly in the decompressor, where a wide range of speed/quality tradeoffs is very useful. It must be understood that some of the best speedups involve merging adjacent steps in the pipeline. For example, upsampling, color space conversion, and color quantization might all be done at once when using a low-quality ordered-dither technique. The system architecture is designed to allow such merging where appropriate.

Note: it is convenient to regard edge expansion (padding to block boundaries) as a preprocessing/postprocessing function, even though the JPEG spec includes it in compression/decompression. We do this because
 downsampling/upsampling
can be simplified a little if they work on padded data: it's not necessary to have special cases at the right and bottom edges. Therefore the interface buffer is always an integral number of blocks wide and high, and we expect compression preprocessing to pad the source data properly. Padding will occur only to the next block (block_size-sample) boundary. In an interleaved-scan situation, additional dummy blocks may be used to fill out MCUs, but the MCU assembly and disassembly logic will create or discard these blocks internally. (This is advantageous for speed reasons, since we avoid DCTing the dummy blocks. It also permits a small reduction in file size, because the compressor can choose dummy block contents so as to minimize their size in compressed form. Finally, it makes the interface buffer specification independent of whether the file is actually interleaved or not.)
Applications that wish to deal directly with the downsampled data must provide similar
 buffering and padding for odd-sized images.

*** Poor man's object-oriented programming ***

It should be clear by now that we have a lot of quasi-independent processing steps, many of which have several possible behaviors. To avoid cluttering the code with lots of switch statements, we use a simple form of object-style programming to separate out the different possibilities.

For example, two different color quantization algorithms could be implemented as two separate modules that present the same external interface; at runtime, the calling code will access the proper module indirectly through an "object".

We can get the limited features we need while staying within portable C.
The basic tool is a function pointer. An "object" is just a struct containing one or more function pointer fields, each of which corresponds to a method name in real object-oriented languages. During initialization we fill in the function pointers with references to whichever module we have determined

we need to use in this run. Then invocation of the module is done
by indirecting through a function pointer; on most machines this is no more
expensive than a switch statement, which would be the only other way of
making the required run-time choice. The really significant benefit, of
course, is keeping the source code clean and well structured.

We can also arrange to have private storage that varies between different
implementations of the same kind of object. We do this by making all the
module-specific object structs be separately allocated entities, which will
be accessed via pointers in the master compression or decompression struct.
The "public" fields or methods for a given kind of object are specified by
a commonly known struct. But a module's initialization code can allocate
a larger struct that contains the common struct as its first member, plus
additional private fields. With appropriate pointer casting, the module's
internal functions can access these private fields.
  (For a simple example,
see jdatadst.c, which implements the external interface specified by struct
jpeg_destination_mgr, but adds extra fields.)

(Of course this would all be a lot easier if we were using C++, but we are
not yet prepared to assume that everyone has a C++ compiler.)

An important benefit of this scheme is that it is easy to provide multiple
versions of any method, each tuned to a particular case. While a lot of
precalculation might be done to select an optimal implementation of a method,
the cost per invocation is constant. For example, the upsampling step might
have a "generic" method, plus one or more "hardwired" methods for the most
popular sampling factors; the hardwired methods would be faster because they'd
use straight-line code instead of for-loops. The cost to determine which
method to use is paid only once, at startup, and the selection criteria are
hidden from the callers of the method.

This plan differs a little bit from usual object-oriented structures,
 in that
only one instance of each object class will exist during execution. The
reason for having the class structure is that on different runs we may create
different instances (choose to execute different modules). You can think of
the term "method" as denoting the common interface presented by a particular
set of interchangeable functions, and "object" as denoting a group of related
methods, or the total shared interface behavior of a group of modules.

*** Overall control structure ***

We previously mentioned the need for overall control logic in the compression
and decompression libraries. In IJG implementations prior to v5, overall
control was mostly provided by "pipeline control" modules, which proved to be
large, unwieldy, and hard to understand. To improve the situation, the

control logic has been subdivided into multiple modules. The control modules
consist of:

1. Master control for module selection and initialization. This has two
responsibilities:

 1A. Startup
 initialization at the beginning of image processing.
    The individual processing modules to be used in this run are selected
    and given initialization calls.

 1B. Per-pass control. This determines how many passes will be performed
    and calls each active processing module to configure itself
    appropriately at the beginning of each pass. End-of-pass processing,
 where necessary, is also invoked from the master control module.

 Method selection is partially distributed, in that a particular processing
 module may contain several possible implementations of a particular method,
 which it will select among when given its initialization call. The master
 control code need only be concerned with decisions that affect more than
 one module.

2. Data buffering control. A separate control module exists for each
 inter-processing-step data buffer. This module is responsible for
 invoking the processing steps that write or read that data buffer.

Each
 buffer controller sees the world as follows:

input data => processing step A => buffer => processing step B => output data
                | | |
               ------------------ controller ------------------
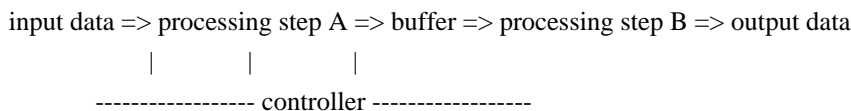
The controller knows the dataflow requirements of steps A and B: how much data
they want to accept in one chunk and how much they output in one chunk. Its
function is to manage its buffer and call A and B at the proper times.

A data buffer control module may itself be viewed as a processing step by a
higher-level control module; thus the control modules form a binary tree with
elementary processing steps at the leaves of the tree.

The control modules are objects. A considerable amount of flexibility can
be had by replacing implementations of a control module. For example:
* Merging of adjacent steps in the pipeline is done by replacing a control
 module and its pair of processing-step modules with a single processing-
 step module.
 (Hence the possible merges are determined by the tree of
 control modules.)

* In some processing modes, a given interstep buffer need only be a "strip"
  buffer large enough to accommodate the desired data chunk sizes. In other
  modes, a full-image buffer is needed and several passes are required.
  The control module determines which kind of buffer is used and manipulates
  virtual array buffers as needed. One or both processing steps may be
  unaware of the multi-pass behavior.

In theory, we might be able to make all of the data buffer controllers
interchangeable and provide just one set of implementations for all. In
practice, each one contains considerable special-case processing for its
particular job. The buffer controller concept should be regarded as an
overall system structuring principle, not as a complete description of the
task performed by any one controller.

*** Compression object structure ***

Here is a sketch of the logical structure of the JPEG compression
 library:

```
                                |-- Colorspace conversion
          |-- Preprocessing controller --|
          |                     |-- Downsampling
Main controller --|
          |                     |-- Forward DCT, quantize
          |-- Coefficient controller --|
                                |-- Entropy encoding
```

This sketch also describes the flow of control (subroutine calls) during
typical image data processing. Each of the components shown in the diagram is
an "object" which may have several different implementations available. One
or more source code files contain the actual implementation(s) of each object.

The objects shown above are:

* Main controller: buffer controller for the subsampled-data buffer, which
  holds the preprocessed input data. This controller invokes preprocessing to
  fill the subsampled-data buffer, and JPEG compression to empty it. There is
  usually no need
  for a full-image buffer here; a strip buffer is adequate.

* Preprocessing controller: buffer controller for the downsampling input data
  buffer, which lies between colorspace conversion and downsampling. Note
  that a unified conversion/downsampling module would probably replace this
  controller entirely.

* Colorspace conversion: converts application image data into the desired
  JPEG color space; also changes the data from pixel-interleaved layout to

separate component planes. Processes one pixel row at a time.

* Downsampling: performs reduction of chroma components as required.
Optionally may perform pixel-level smoothing as well. Processes a "row
group" at a time, where a row group is defined as Vmax pixel rows of each
component before downsampling, and Vk sample rows afterwards (remember Vk
differs across components). Some downsampling or smoothing algorithms may
require context rows above and below the current row group; the
preprocessing controller is responsible
for supplying these rows via proper
buffering. The downsampler is responsible for edge expansion at the right
edge (i.e., extending each sample row to a multiple of block_size samples);
but the preprocessing controller is responsible for vertical edge expansion
(i.e., duplicating the bottom sample row as needed to make a multiple of
block_size rows).

* Coefficient controller: buffer controller for the DCT-coefficient data.
This controller handles MCU assembly, including insertion of dummy DCT
blocks when needed at the right or bottom edge. When performing
Huffman-code optimization or emitting a multiscan JPEG file, this
controller is responsible for buffering the full image. The equivalent of
one fully interleaved MCU row of subsampled data is processed per call,
even when the JPEG file is noninterleaved.

* Forward DCT and quantization: Perform DCT, quantize, and emit coefficients.
Works on one or more DCT blocks at a time. (Note: the coefficients
are now
emitted in normal array order, which the entropy encoder is expected to
convert to zigzag order as necessary. Prior versions of the IJG code did
the conversion to zigzag order within the quantization step.)

* Entropy encoding: Perform Huffman or arithmetic entropy coding and emit the
coded data to the data destination module. Works on one MCU per call.
For progressive JPEG, the same DCT blocks are fed to the entropy coder
during each pass, and the coder must emit the appropriate subset of
coefficients.

In addition to the above objects, the compression library includes these
objects:

* Master control: determines the number of passes required, controls overall
and per-pass initialization of the other modules.

* Marker writing: generates JPEG markers (except for RSTn, which is emitted
by the entropy encoder when needed).

* Data destination manager: writes the output JPEG datastream to its final
destination (e.g., a file). The destination manager supplied

with the
library knows how to write to a stdio stream or to a memory buffer;
for other behaviors, the surrounding application may provide its own
destination manager.

* Memory manager: allocates and releases memory, controls virtual arrays
(with backing store management, where required).

* Error handler: performs formatting and output of error and trace messages;
determines handling of nonfatal errors. The surrounding application may
override some or all of this object's methods to change error handling.

* Progress monitor: supports output of "percent-done" progress reports.
This object represents an optional callback to the surrounding application:
if wanted, it must be supplied by the application.

The error handler, destination manager, and progress monitor objects are
defined as separate objects in order to simplify application-specific
customization of the JPEG library. A surrounding application may override
individual methods or supply its own all-new implementation
 of one of these
objects. The object interfaces for these objects are therefore treated as
part of the application interface of the library, whereas the other objects
are internal to the library.

The error handler and memory manager are shared by JPEG compression and
decompression; the progress monitor, if used, may be shared as well.

*** Decompression object structure ***

Here is a sketch of the logical structure of the JPEG decompression library:


```
                        |-- Entropy decoding
         |-- Coefficient controller --|
         |                      |-- Dequantize, Inverse DCT
Main controller --|
         |                      |-- Upsampling
         |-- Postprocessing controller --|   |-- Colorspace conversion
                             |-- Color quantization
                             |-- Color precision reduction
```
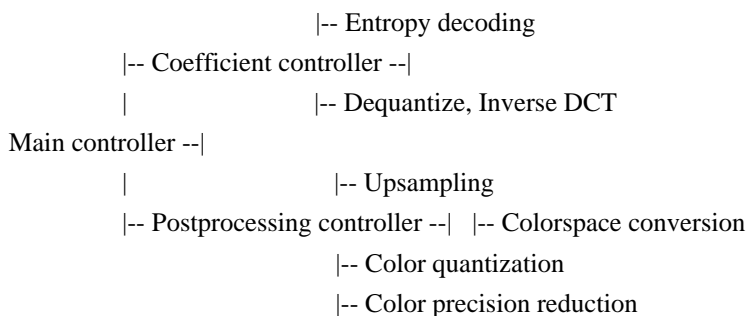

As before, this diagram
also represents typical control flow. The objects
shown are:

* Main controller: buffer controller for the subsampled-data buffer, which
holds the output of JPEG decompression proper. This controller's primary

task is to feed the postprocessing procedure. Some upsampling algorithms
may require context rows above and below the current row group; when this
is true, the main controller is responsible for managing its buffer so as
to make context rows available. In the current design, the main buffer is
always a strip buffer; a full-image buffer is never required.

* Coefficient controller: buffer controller for the DCT-coefficient data.
This controller handles MCU disassembly, including deletion of any dummy
DCT blocks at the right or bottom edge. When reading a multiscan JPEG
file, this controller is responsible for buffering the full image.
(Buffering DCT coefficients, rather than samples, is necessary to support
progressive JPEG.) The equivalent of one
fully interleaved MCU row of
subsampled data is processed per call, even when the source JPEG file is
noninterleaved.

* Entropy decoding: Read coded data from the data source module and perform
Huffman or arithmetic entropy decoding. Works on one MCU per call.
For progressive JPEG decoding, the coefficient controller supplies the prior
coefficients of each MCU (initially all zeroes), which the entropy decoder
modifies in each scan.

* Dequantization and inverse DCT: like it says. Note that the coefficients
buffered by the coefficient controller have NOT been dequantized; we
merge dequantization and inverse DCT into a single step for speed reasons.
When scaled-down output is asked for, simplified DCT algorithms may be used
that need fewer coefficients and emit fewer samples per DCT block, not the
full 8x8. Works on one DCT block at a time.

* Postprocessing controller: buffer controller for the color quantization
input buffer, when quantization is in use. (Without
quantization, this
controller just calls the upsampler.) For two-pass quantization, this
controller is responsible for buffering the full-image data.

* Upsampling: restores chroma components to full size. (May support more
general output rescaling, too. Note that if undersized DCT outputs have
been emitted by the DCT module, this module must adjust so that properly
sized outputs are created.) Works on one row group at a time. This module
also calls the color conversion module, so its top level is effectively a
buffer controller for the upsampling->color conversion buffer. However, in
all but the highest-quality operating modes, upsampling and color
conversion are likely to be merged into a single step.

* Colorspace conversion: convert from JPEG color space to output color space,
and change data layout from separate component planes to pixel-interleaved.
Works on one pixel row at a time.

* Color quantization: reduce the data to colormapped form, using
either an
externally specified colormap or an internally generated one. This module
is not used for full-color output. Works on one pixel row at a time; may
require two passes to generate a color map. Note that the output will
always be a single component representing colormap indexes. In the current
design, the output values are JSAMPLEs, so an 8-bit compilation cannot
quantize to more than 256 colors. This is unlikely to be a problem in
practice.

* Color reduction: this module handles color precision reduction, e.g.,
generating 15-bit color (5 bits/primary) from JPEG's 24-bit output.
Not quite clear yet how this should be handled... should we merge it with
colorspace conversion???

Note that some high-speed operating modes might condense the entire
postprocessing sequence to a single module (upsample, color convert, and
quantize in one step).

In addition to the above objects, the decompression library includes these
objects:

* Master control: determines
the number of passes required, controls overall
and per-pass initialization of the other modules. This is subdivided into
input and output control: jdinput.c controls only input-side processing,
while jdmaster.c handles overall initialization and output-side control.

* Marker reading: decodes JPEG markers (except for RSTn).

* Data source manager: supplies the input JPEG datastream. The source
manager supplied with the library knows how to read from a stdio stream
or from a memory buffer; for other behaviors, the surrounding application
may provide its own source manager.

* Memory manager: same as for compression library.

* Error handler: same as for compression library.

* Progress monitor: same as for compression library.

As with compression, the data source manager, error handler, and progress
monitor are candidates for replacement by a surrounding application.

*** Decompression input and output separation ***

To support efficient incremental display of progressive

JPEG files, the
decompressor is divided into two sections that can run independently:

1. Data input includes marker parsing, entropy decoding, and input into the
   coefficient controller's DCT coefficient buffer. Note that this
   processing is relatively cheap and fast.

2. Data output reads from the DCT coefficient buffer and performs the IDCT
   and all postprocessing steps.

For a progressive JPEG file, the data input processing is allowed to get
arbitrarily far ahead of the data output processing. (This occurs only
if the application calls jpeg_consume_input(); otherwise input and output
run in lockstep, since the input section is called only when the output
section needs more data.) In this way the application can avoid making
extra display passes when data is arriving faster than the display pass
can run. Furthermore, it is possible to abort an output pass without
losing anything, since the coefficient buffer is read-only as far as the
output section is concerned. See
 libjpeg.txt for more detail.

A full-image coefficient array is only created if the JPEG file has multiple
scans (or if the application specifies buffered-image mode anyway). When
reading a single-scan file, the coefficient controller normally creates only
a one-MCU buffer, so input and output processing must run in lockstep in this
case. jpeg_consume_input() is effectively a no-op in this situation.

The main impact of dividing the decompressor in this fashion is that we must
be very careful with shared variables in the cinfo data structure. Each
variable that can change during the course of decompression must be
classified as belonging to data input or data output, and each section must
look only at its own variables. For example, the data output section may not
depend on any of the variables that describe the current scan in the JPEG
file, because these may change as the data input section advances into a new
scan.

The progress monitor is (somewhat arbitrarily) defined to treat
 input of the
file as one pass when buffered-image mode is not used, and to ignore data
input work completely when buffered-image mode is used. Note that the
library has no reliable way to predict the number of passes when dealing
with a progressive JPEG file, nor can it predict the number of output passes
in buffered-image mode. So the work estimate is inherently bogus anyway.

No comparable division is currently made in the compression library, because
there isn't any real need for it.

*** Data formats ***

Arrays of pixel sample values use the following data structure:

```
typedef something JSAMPLE;  a pixel component value, 0..MAXJSAMPLE
typedef JSAMPLE *JSAMPROW;  ptr to a row of samples
typedef JSAMPROW *JSAMPARRAY; ptr to a list of rows
typedef JSAMPARRAY *JSAMPIMAGE; ptr to a list of color-component arrays
```

The basic element type JSAMPLE will typically be one of unsigned char,
(signed) char, or short. Short will be used if samples wider than 8 bits are
to be
 supported (this is a compile-time option). Otherwise, unsigned char is
used if possible. If the compiler only supports signed chars, then it is
necessary to mask off the value when reading. Thus, all reads of JSAMPLE
values must be coded as "GETJSAMPLE(value)", where the macro will be defined
as "((value) & 0xFF)" on signed-char machines and "((int) (value))" elsewhere.

With these conventions, JSAMPLE values can be assumed to be >= 0. This helps
simplify correct rounding during downsampling, etc. The JPEG standard's
specification that sample values run from -128..127 is accommodated by
subtracting 128 from the sample value in the DCT step. Similarly, during
decompression the output of the IDCT step will be immediately shifted back to
0..255. (NB: different values are required when 12-bit samples are in use.
The code is written in terms of MAXJSAMPLE and CENTERJSAMPLE, which will be
defined as 255 and 128 respectively in an 8-bit implementation, and as 4095
and 2048 in a 12-bit
 implementation.)

We use a pointer per row, rather than a two-dimensional JSAMPLE array. This
choice costs only a small amount of memory and has several benefits:
* Code using the data structure doesn't need to know the allocated width of
 the rows. This simplifies edge expansion/compression, since we can work
 in an array that's wider than the logical picture width.
* Indexing doesn't require multiplication; this is a performance win on many
 machines.
* Arrays with more than 64K total elements can be supported even on machines
 where malloc() cannot allocate chunks larger than 64K.
* The rows forming a component array may be allocated at different times
 without extra copying. This trick allows some speedups in smoothing steps
 that need access to the previous and next rows.

Note that each color component is stored in a separate array; we don't use the
traditional layout in which the components of a pixel are stored together.
This simplifies coding of modules that work on
 each component independently,
because they don't need to know how many components there are. Furthermore,
we can read or write each component to a temporary file independently, which

is helpful when dealing with noninterleaved JPEG files.

In general, a specific sample value is accessed by code such as
 GETJSAMPLE(image[colorcomponent][row][col])
where col is measured from the image left edge, but row is measured from the
first sample row currently in memory. Either of the first two indexings can
be precomputed by copying the relevant pointer.

Since most image-processing applications prefer to work on images in which
the components of a pixel are stored together, the data passed to or from the
surrounding application uses the traditional convention: a single pixel is
represented by N consecutive JSAMPLE values, and an image row is an array of
(# of color components)*(image width) JSAMPLEs. One or more rows of data can
be represented by a pointer of type JSAMPARRAY in this scheme.
  This scheme is
converted to component-wise storage inside the JPEG library. (Applications
that want to skip JPEG preprocessing or postprocessing will have to contend
with component-wise storage.)

Arrays of DCT-coefficient values use the following data structure:

    typedef short JCOEF; a 16-bit signed integer
    typedef JCOEF JBLOCK[DCTSIZE2]; an 8x8 block of coefficients
    typedef JBLOCK *JBLOCKROW; ptr to one horizontal row of 8x8 blocks
    typedef JBLOCKROW *JBLOCKARRAY; ptr to a list of such rows
    typedef JBLOCKARRAY *JBLOCKIMAGE; ptr to a list of color component arrays

The underlying type is at least a 16-bit signed integer; while "short" is big
enough on all machines of interest, on some machines it is preferable to use
"int" for speed reasons, despite the storage cost. Coefficients are grouped
into 8x8 blocks (but we always use #defines DCTSIZE and DCTSIZE2 rather than
"8" and "64").

The contents of a coefficient block may be in either "natural" or zigzagged
order,
 and may be true values or divided by the quantization coefficients,
depending on where the block is in the processing pipeline. In the current
library, coefficient blocks are kept in natural order everywhere; the entropy
codecs zigzag or dezigzag the data as it is written or read. The blocks
contain quantized coefficients everywhere outside the DCT/IDCT subsystems.
(This latter decision may need to be revisited to support variable
quantization a la JPEG Part 3.)

Notice that the allocation unit is now a row of 8x8 coefficient blocks,
corresponding to block_size rows of samples. Otherwise the structure
is much the same as for samples, and for the same reasons.

On machines where malloc() can't handle a request bigger than 64Kb, this data structure limits us to rows of less than 512 JBLOCKs, or a picture width of 4000+ pixels. This seems an acceptable restriction.

On 80x86 machines, the bottom-level pointer types (JSAMPROW and JBLOCKROW) must be declared as "far" pointers, but
 the upper levels can be "near"
(implying that the pointer lists are allocated in the DS segment).
We use a #define symbol FAR, which expands to the "far" keyword when compiling on 80x86 machines and to nothing elsewhere.

*** Suspendable processing ***

In some applications it is desirable to use the JPEG library as an incremental, memory-to-memory filter. In this situation the data source or destination may be a limited-size buffer, and we can't rely on being able to empty or refill the buffer at arbitrary times. Instead the application would like to have control return from the library at buffer overflow/underrun, and then resume compression or decompression at a later time.

This scenario is supported for simple cases. (For anything more complex, we recommend that the application "bite the bullet" and develop real multitasking capability.) The libjpeg.txt file goes into more detail about the usage and limitations of this capability; here we address the implications for library structure.

The
 essence of the problem is that the entropy codec (coder or decoder) must be prepared to stop at arbitrary times. In turn, the controllers that call the entropy codec must be able to stop before having produced or consumed all the data that they normally would handle in one call. That part is reasonably straightforward: we make the controller call interfaces include "progress counters" which indicate the number of data chunks successfully processed, and we require callers to test the counter rather than just assume all of the data was processed.

Rather than trying to restart at an arbitrary point, the current Huffman codecs are designed to restart at the beginning of the current MCU after a suspension due to buffer overflow/underrun. At the start of each call, the codec's internal state is loaded from permanent storage (in the JPEG object structures) into local variables. On successful completion of the MCU, the permanent state is updated. (This copying is not very expensive, and may even
lead to *improved* performance if the local variables can be registerized.)
If a suspension occurs, the codec simply returns without updating the state,

thus effectively reverting to the start of the MCU. Note that this implies leaving some data unprocessed in the source/destination buffer (ie, the compressed partial MCU). The data source/destination module interfaces are specified so as to make this possible. This also implies that the data buffer must be large enough to hold a worst-case compressed MCU; a couple thousand bytes should be enough.

In a successive-approximation AC refinement scan, the progressive Huffman decoder has to be able to undo assignments of newly nonzero coefficients if it suspends before the MCU is complete, since decoding requires distinguishing previously-zero and previously-nonzero coefficients. This is a bit tedious but probably won't have much effect on performance. Other variants of Huffman decoding need not worry about this,
 since they will just store the same values
again if forced to repeat the MCU.

This approach would probably not work for an arithmetic codec, since its modifiable state is quite large and couldn't be copied cheaply. Instead it would have to suspend and resume exactly at the point of the buffer end.

The JPEG marker reader is designed to cope with suspension at an arbitrary point. It does so by backing up to the start of the marker parameter segment, so the data buffer must be big enough to hold the largest marker of interest. Again, a couple KB should be adequate. (A special "skip" convention is used to bypass COM and APPn markers, so these can be larger than the buffer size without causing problems; otherwise a 64K buffer would be needed in the worst case.)

The JPEG marker writer currently does *not* cope with suspension.
We feel that this is not necessary; it is much easier simply to require
the application to ensure there is enough buffer space before starting. (An empty 2K
 buffer is more than sufficient for the header markers; and ensuring
there are a dozen or two bytes available before calling jpeg_finish_compress()
will suffice for the trailer.) This would not work for writing multi-scan
JPEG files, but we simply do not intend to support that capability with
suspension.

*** Memory manager services ***

The JPEG library's memory manager controls allocation and deallocation of memory, and it manages large "virtual" data arrays on machines where the operating system does not provide virtual memory. Note that the same memory manager serves both compression and decompression operations.

In all cases, allocated objects are tied to a particular compression or decompression master record, and they will be released when that master

record is destroyed.

The memory manager does not provide explicit deallocation of objects.
Instead, objects are created in "pools" of free storage, and a whole pool
can be freed at once. This approach helps prevent storage-leak
 bugs, and
it speeds up operations whenever malloc/free are slow (as they often are).
The pools can be regarded as lifetime identifiers for objects. Two
pools/lifetimes are defined:
 * JPOOL_PERMANENT lasts until master record is destroyed
 * JPOOL_IMAGE lasts until done with image (JPEG datastream)
Permanent lifetime is used for parameters and tables that should be carried
across from one datastream to another; this includes all application-visible
parameters. Image lifetime is used for everything else. (A third lifetime,
JPOOL_PASS = one processing pass, was originally planned. However it was
dropped as not being worthwhile. The actual usage patterns are such that the
peak memory usage would be about the same anyway; and having per-pass storage
substantially complicates the virtual memory allocation rules --- see below.)

The memory manager deals with three kinds of object:
1. "Small" objects. Typically these require no more than 10K-20K total.
2. "Large" objects. These may
 require tens to hundreds of K depending on
  image size. Semantically they behave the same as small objects, but we
  distinguish them for two reasons:
    * On MS-DOS machines, large objects are referenced by FAR pointers,
      small objects by NEAR pointers.
    * Pool allocation heuristics may differ for large and small objects.
  Note that individual "large" objects cannot exceed the size allowed by
  type size_t, which may be 64K or less on some machines.
3. "Virtual" objects. These are large 2-D arrays of JSAMPLEs or JBLOCKs
  (typically large enough for the entire image being processed). The
  memory manager provides stripwise access to these arrays. On machines
  without virtual memory, the rest of the array may be swapped out to a
  temporary file.

(Note: JSAMPARRAY and JBLOCKARRAY data structures are a combination of large
objects for the data proper and small objects for the row pointers. For
convenience and speed, the memory manager provides single routines
 to create
these structures. Similarly, virtual arrays include a small control block
and a JSAMPARRAY or JBLOCKARRAY working buffer, all created with one call.)

In the present implementation, virtual arrays are only permitted to have image
lifespan. (Permanent lifespan would not be reasonable, and pass lifespan is
not very useful since a virtual array's raison d'etre is to store data for
multiple passes through the image.) We also expect that only "small" objects
will be given permanent lifespan, though this restriction is not required by

the memory manager.

In a non-virtual-memory machine, some performance benefit can be gained by
making the in-memory buffers for virtual arrays be as large as possible.
(For small images, the buffers might fit entirely in memory, so blind
swapping would be very wasteful.) The memory manager will adjust the height
of the buffers to fit within a prespecified maximum memory usage. In order
to do this in a reasonably optimal fashion, the manager
 needs to allocate all
of the virtual arrays at once. Therefore, there isn't a one-step allocation
routine for virtual arrays; instead, there is a "request" routine that simply
allocates the control block, and a "realize" routine (called just once) that
determines space allocation and creates all of the actual buffers. The
realize routine must allow for space occupied by non-virtual large objects.
(We don't bother to factor in the space needed for small objects, on the
grounds that it isn't worth the trouble.)

To support all this, we establish the following protocol for doing business
with the memory manager:
  1. Modules must request virtual arrays (which may have only image lifespan)
     during the initial setup phase, i.e., in their jinit_xxx routines.
  2. All "large" objects (including JSAMPARRAYs and JBLOCKARRAYs) must also be
     allocated during initial setup.
  3. realize_virt_arrays will be called at the completion of initial setup.
     The above conventions ensure that
 sufficient information is available
     for it to choose a good size for virtual array buffers.
Small objects of any lifespan may be allocated at any time. We expect that
the total space used for small objects will be small enough to be negligible
in the realize_virt_arrays computation.

In a virtual-memory machine, we simply pretend that the available space is
infinite, thus causing realize_virt_arrays to decide that it can allocate all
the virtual arrays as full-size in-memory buffers. The overhead of the
virtual-array access protocol is very small when no swapping occurs.

A virtual array can be specified to be "pre-zeroed"; when this flag is set,
never-yet-written sections of the array are set to zero before being made
available to the caller. If this flag is not set, never-written sections
of the array contain garbage. (This feature exists primarily because the
equivalent logic would otherwise be needed in jdcoefct.c for progressive
JPEG mode; we may as well make it available
 for possible other uses.)

The first write pass on a virtual array is required to occur in top-to-bottom
order; read passes, as well as any write passes after the first one, may
access the array in any order. This restriction exists partly to simplify
the virtual array control logic, and partly because some file systems may not

support seeking beyond the current end-of-file in a temporary file. The main
implication of this restriction is that rearrangement of rows (such as
converting top-to-bottom data order to bottom-to-top) must be handled while
reading data out of the virtual array, not while putting it in.

*** Memory manager internal structure ***

To isolate system dependencies as much as possible, we have broken the
memory manager into two parts. There is a reasonably system-independent
"front end" (jmemmgr.c) and a "back end" that contains only the code
likely to change across systems. All of the memory management methods
outlined above are implemented by the front end.
  The back end provides
the following routines for use by the front end (none of these routines
are known to the rest of the JPEG code):

jpeg_mem_init, jpeg_mem_term system-dependent initialization/shutdown

jpeg_get_small, jpeg_free_small interface to malloc and free library routines
    (or their equivalents)

jpeg_get_large, jpeg_free_large interface to FAR malloc/free in MSDOS machines;
    else usually the same as
    jpeg_get_small/jpeg_free_small

jpeg_mem_available estimate available memory

jpeg_open_backing_store create a backing-store object

read_backing_store, manipulate a backing-store object
write_backing_store,
close_backing_store

On some systems there will be more than one type of backing-store object
(specifically, in MS-DOS a backing store file might be an area of extended
memory as well as a disk file). jpeg_open_backing_store is responsible for
choosing how to implement a given object. The read/write/close routines
are method pointers in the structure that describes
 a given object; this
lets them be different for different object types.

It may be necessary to ensure that backing store objects are explicitly
released upon abnormal program termination. For example, MS-DOS won't free
extended memory by itself. To support this, we will expect the main program
or surrounding application to arrange to call self_destruct (typically via
jpeg_destroy) upon abnormal termination. This may require a SIGINT signal
handler or equivalent. We don't want to have the back end module install its

own signal handler, because that would pre-empt the surrounding application's
ability to control signal handling.

The IJG distribution includes several memory manager back end implementations.
Usually the same back end should be suitable for all applications on a given
system, but it is possible for an application to supply its own back end at
need.

*** Implications of DNL marker ***

Some JPEG files may use a DNL marker to postpone definition of the image
height
 (this would be useful for a fax-like scanner's output, for instance).
In these files the SOF marker claims the image height is 0, and you only
find out the true image height at the end of the first scan.

We could read these files as follows:
1. Upon seeing zero image height, replace it by 65535 (the maximum allowed).
2. When the DNL is found, update the image height in the global image
   descriptor.
This implies that control modules must avoid making copies of the image
height, and must re-test for termination after each MCU row. This would
be easy enough to do.

In cases where image-size data structures are allocated, this approach will
result in very inefficient use of virtual memory or much-larger-than-necessary
temporary files. This seems acceptable for something that probably won't be a
mainstream usage. People might have to forgo use of memory-hogging options
(such as two-pass color quantization or noninterleaved JPEG files) if they
want efficient conversion of such files.
  (One could improve efficiency by
demanding a user-supplied upper bound for the height, less than 65536; in most
cases it could be much less.)

The standard also permits the SOF marker to overestimate the image height,
with a DNL to give the true, smaller height at the end of the first scan.
This would solve the space problems if the overestimate wasn't too great.
However, it implies that you don't even know whether DNL will be used.

This leads to a couple of very serious objections:
1. Testing for a DNL marker must occur in the inner loop of the decompressor's
   Huffman decoder; this implies a speed penalty whether the feature is used
   or not.
2. There is no way to hide the last-minute change in image height from an
   application using the decoder. Thus *every* application using the IJG
   library would suffer a complexity penalty whether it cared about DNL or
   not.

We currently do not support DNL because of these problems.

A different approach is to insist that DNL-using
 files be preprocessed by a
separate program that reads ahead to the DNL, then goes back and fixes the SOF
marker. This is a much simpler solution and is probably far more efficient.
Even if one wants piped input, buffering the first scan of the JPEG file needs
a lot smaller temp file than is implied by the maximum-height method. For
this approach we'd simply treat DNL as a no-op in the decompressor (at most,
check that it matches the SOF image height).

We will not worry about making the compressor capable of outputting DNL.
Something similar to the first scheme above could be applied if anyone ever
wants to make that work.

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/structure.txt
No license file was found, but licenses were detected in source scan.

/*
* jcsample.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains downsampling routines.
*
* Downsampling input data is counted in "row groups". A row group
* is defined to be max_v_samp_factor pixel rows of each component,
* from which the downsampler produces v_samp_factor sample rows.
* A single row group is processed in each call to the downsampler module.
*
* The downsampler is responsible for edge-expansion of its output data
* to fill an integral number of DCT blocks horizontally. The source buffer
* may be modified if it is helpful for this purpose (the source buffer is
* allocated wide enough to correspond to the desired output width).
* The caller (the prep controller) is responsible for vertical padding.
*
* The downsampler may request
 "context rows" by setting need_context_rows
* during startup. In this case, the input arrays will contain at least
* one row group's worth of pixels above and below the passed-in data;
* the caller will create dummy rows at image top and bottom by replicating
* the first or last real pixel row.
*
* An excellent reference for image resampling is
*   Digital Image Warping, George Wolberg, 1990.

```
*   Pub. by IEEE Computer Society Press, Los Alamitos, CA. ISBN 0-8186-8944-7.
*
* The downsampling algorithm used here is a simple average of the source
* pixels covered by the output pixel.  The hi-falutin sampling literature
* refers to this as a "box filter".  In general the characteristics of a box
* filter are not very good, but for the specific cases we normally use (1:1
* and 2:1 ratios) the box is equivalent to a "triangle filter" which is not
* nearly so bad.  If you intend to use other sampling ratios, you'd be well
* advised to improve this code.
*
* A simple input-smoothing
 capability is provided.  This is mainly intended
* for cleaning up color-dithered GIF input files (if you find it inadequate,
* we suggest using an external filtering program such as pnmconvol).  When
* enabled, each input pixel P is replaced by a weighted sum of itself and its
* eight neighbors.  P's weight is 1-8*SF and each neighbor's weight is SF,
* where SF = (smoothing_factor / 1024).
* Currently, smoothing is only supported for 2h2v sampling factors.
*/
```

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jcsample.c
No license file was found, but licenses were detected in source scan.

```
/*
* cdjpeg.h
*
* Copyright (C) 1994-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains common declarations for the sample applications
* cjpeg and djpeg.  It is NOT used by the core JPEG library.
*/
```

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/cdjpeg.h
No license file was found, but licenses were detected in source scan.

```
/*
* jccolor.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modified 2011-2013 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains input colorspace conversion routines.
```

*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jccolor.c
No license file was found, but licenses were detected in source scan.

USING THE IJG JPEG LIBRARY

Copyright (C) 1994-2013, Thomas G. Lane, Guido Vollbeding.
This file is part of the Independent JPEG Group's software.
For conditions of distribution and use, see the accompanying README file.

This file describes how to use the IJG JPEG library within an application
program. Read it if you want to write a program that uses the library.

The file example.c provides heavily commented skeleton code for calling the
JPEG library. Also see jpeglib.h (the include file to be used by application
programs) for full details about data structures and function parameter lists.
The library source code, of course, is the ultimate reference.

Note that there have been *major* changes from the application interface
presented by IJG version 4 and earlier versions. The old design had several
inherent limitations, and it had accumulated a lot of cruft as we added
features while trying to minimize application-interface
 changes. We have
sacrificed backward compatibility in the version 5 rewrite, but we think the
improvements justify this.

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You should read at least the overview and basic usage sections before trying
to program with the library.
 The sections on advanced features can be read
if and when you need them.

OVERVIEW
========

Functions provided by the library

The IJG JPEG library provides C code to read and write JPEG-compressed image
files. The surrounding application program receives or supplies image data a
scanline at a time, using a straightforward uncompressed image format. All
details of color conversion and other preprocessing/postprocessing can be
handled by the library.

The library includes a substantial amount of code that is not covered by the
JPEG standard but is necessary for typical applications of JPEG. These
functions preprocess the image before JPEG compression or postprocess it after
decompression. They include colorspace conversion, downsampling/upsampling,
and color quantization. The application indirectly selects use of this code
by specifying the format in which it wishes to supply or receive image data.
For example, if colormapped output is requested,
 then the decompression
library automatically invokes color quantization.

A wide range of quality vs. speed tradeoffs are possible in JPEG processing,
and even more so in decompression postprocessing. The decompression library
provides multiple implementations that cover most of the useful tradeoffs,
ranging from very-high-quality down to fast-preview operation. On the
compression side we have generally not provided low-quality choices, since
compression is normally less time-critical. It should be understood that the
low-quality modes may not meet the JPEG standard's accuracy requirements;

nonetheless, they are useful for viewers.

A word about functions *not* provided by the library. We handle a subset of
the ISO JPEG standard; most baseline, extended-sequential, and progressive
JPEG processes are supported. (Our subset includes all features now in common
use.) Unsupported ISO options include:
 * Hierarchical storage
 * Lossless JPEG
 * DNL marker
 * Nonintegral subsampling ratios
We
 support 8-bit to 12-bit data precision, but this is a compile-time choice
rather than a run-time choice; hence it is difficult to use different
precisions in a single application.

By itself, the library handles only interchange JPEG datastreams --- in
particular the widely used JFIF file format. The library can be used by
surrounding code to process interchange or abbreviated JPEG datastreams that
are embedded in more complex file formats. (For example, this library is
used by the free LIBTIFF library to support JPEG compression in TIFF.)

Outline of typical usage

The rough outline of a JPEG compression operation is:

 Allocate and initialize a JPEG compression object
 Specify the destination for the compressed data (eg, a file)
 Set parameters for compression, including image size & colorspace
 jpeg_start_compress(...);
 while (scan lines remain to be written)
  jpeg_write_scanlines(...);
 jpeg_finish_compress(...);
 Release the JPEG compression
 object

A JPEG compression object holds parameters and working state for the JPEG
library. We make creation/destruction of the object separate from starting
or finishing compression of an image; the same object can be re-used for a
series of image compression operations. This makes it easy to re-use the
same parameter settings for a sequence of images. Re-use of a JPEG object
also has important implications for processing abbreviated JPEG datastreams,
as discussed later.

The image data to be compressed is supplied to jpeg_write_scanlines() from
in-memory buffers. If the application is doing file-to-file compression,
reading image data from the source file is the application's responsibility.

The library emits compressed data by calling a "data destination manager", which typically will write the data into a file; but the application can provide its own destination manager to do something else.

Similarly, the rough outline of a JPEG decompression operation is:

```
Allocate and initialize
a JPEG decompression object
Specify the source of the compressed data (eg, a file)
Call jpeg_read_header() to obtain image info
Set parameters for decompression
jpeg_start_decompress(...);
while (scan lines remain to be read)
 jpeg_read_scanlines(...);
jpeg_finish_decompress(...);
Release the JPEG decompression object
```

This is comparable to the compression outline except that reading the datastream header is a separate step. This is helpful because information about the image's size, colorspace, etc is available when the application selects decompression parameters. For example, the application can choose an output scaling ratio that will fit the image into the available screen size.

The decompression library obtains compressed data by calling a data source manager, which typically will read the data from a file; but other behaviors can be obtained with a custom source manager. Decompressed data is delivered into in-memory buffers passed to jpeg_read_scanlines().

It
 is possible to abort an incomplete compression or decompression operation by calling jpeg_abort(); or, if you do not need to retain the JPEG object, simply release it by calling jpeg_destroy().

JPEG compression and decompression objects are two separate struct types. However, they share some common fields, and certain routines such as jpeg_destroy() can work on either type of object.

The JPEG library has no static variables: all state is in the compression or decompression object. Therefore it is possible to process multiple compression and decompression operations concurrently, using multiple JPEG objects.

Both compression and decompression can be done in an incremental memory-to-memory fashion, if suitable source/destination managers are used. See the section on "I/O suspension" for more details.

BASIC LIBRARY USAGE

===================

Data formats

Before diving into procedural details, it is helpful to understand the
image data format that the JPEG library expects
 or returns.

The standard input image format is a rectangular array of pixels, with each
pixel having the same number of "component" or "sample" values (color
channels). You must specify how many components there are and the colorspace
interpretation of the components. Most applications will use RGB data
(three components per pixel) or grayscale data (one component per pixel).
PLEASE NOTE THAT RGB DATA IS THREE SAMPLES PER PIXEL, GRAYSCALE ONLY ONE.
A remarkable number of people manage to miss this, only to find that their
programs don't work with grayscale JPEG files.

There is no provision for colormapped input. JPEG files are always full-color
or full grayscale (or sometimes another colorspace such as CMYK). You can
feed in a colormapped image by expanding it to full-color format. However
JPEG often doesn't work very well with source data that has been colormapped,
because of dithering noise. This is discussed in more detail in the JPEG FAQ
and the other references mentioned
 in the README file.

Pixels are stored by scanlines, with each scanline running from left to
right. The component values for each pixel are adjacent in the row; for
example, R,G,B,R,G,B,R,G,B,... for 24-bit RGB color. Each scanline is an
array of data type JSAMPLE --- which is typically "unsigned char", unless
you've changed jmorecfg.h. (You can also change the RGB pixel layout, say
to B,G,R order, by modifying jmorecfg.h. But see the restrictions listed in
that file before doing so.)

A 2-D array of pixels is formed by making a list of pointers to the starts of
scanlines; so the scanlines need not be physically adjacent in memory. Even
if you process just one scanline at a time, you must make a one-element
pointer array to conform to this structure. Pointers to JSAMPLE rows are of
type JSAMPROW, and the pointer to the pointer array is of type JSAMPARRAY.

The library accepts or supplies one or more complete scanlines per call.
It is not possible to process part of a row at a
 time. Scanlines are always
processed top-to-bottom. You can process an entire image in one call if you
have it all in memory, but usually it's simplest to process one scanline at
a time.

For best results, source data values should have the precision specified by

BITS_IN_JSAMPLE (normally 8 bits). For instance, if you choose to compress
data that's only 6 bits/channel, you should left-justify each value in a
byte before passing it to the compressor. If you need to compress data
that has more than 8 bits/channel, compile with BITS_IN_JSAMPLE = 9 to 12.
(See "Library compile-time options", later.)

The data format returned by the decompressor is the same in all details,
except that colormapped output is supported. (Again, a JPEG file is never
colormapped. But you can ask the decompressor to perform on-the-fly color
quantization to deliver colormapped output.) If you request colormapped
output then the returned data array contains a single JSAMPLE per pixel;
its value is an index
 into a color map. The color map is represented as
a 2-D JSAMPARRAY in which each row holds the values of one color component,
that is, colormap[i][j] is the value of the i'th color component for pixel
value (map index) j. Note that since the colormap indexes are stored in
JSAMPLEs, the maximum number of colors is limited by the size of JSAMPLE
(ie, at most 256 colors for an 8-bit JPEG library).

Compression details

Here we revisit the JPEG compression outline given in the overview.

1. Allocate and initialize a JPEG compression object.

A JPEG compression object is a "struct jpeg_compress_struct". (It also has
a bunch of subsidiary structures which are allocated via malloc(), but the
application doesn't control those directly.) This struct can be just a local
variable in the calling routine, if a single routine is going to execute the
whole JPEG compression sequence. Otherwise it can be static or allocated
from malloc().

You will also need a structure representing
 a JPEG error handler. The part
of this that the library cares about is a "struct jpeg_error_mgr". If you
are providing your own error handler, you'll typically want to embed the
jpeg_error_mgr struct in a larger structure; this is discussed later under
"Error handling". For now we'll assume you are just using the default error
handler. The default error handler will print JPEG error/warning messages
on stderr, and it will call exit() if a fatal error occurs.

You must initialize the error handler structure, store a pointer to it into
the JPEG object's "err" field, and then call jpeg_create_compress() to
initialize the rest of the JPEG object.

Typical code for this step, if you are using the default error handler, is

```
struct jpeg_compress_struct cinfo;
struct jpeg_error_mgr jerr;
...
cinfo.err = jpeg_std_error(&jerr);
jpeg_create_compress(&cinfo);
```

jpeg_create_compress allocates a small amount of memory, so it could fail
if you are out of memory. In that case it will
exit via the error handler;
that's why the error handler must be initialized first.

2. Specify the destination for the compressed data (eg, a file).

As previously mentioned, the JPEG library delivers compressed data to a
"data destination" module. The library includes one data destination
module which knows how to write to a stdio stream. You can use your own
destination module if you want to do something else, as discussed later.

If you use the standard destination module, you must open the target stdio
stream beforehand. Typical code for this step looks like:

```
FILE * outfile;
...
if ((outfile = fopen(filename, "wb")) == NULL) {
    fprintf(stderr, "can't open %s\n", filename);
    exit(1);
}
jpeg_stdio_dest(&cinfo, outfile);
```

where the last line invokes the standard destination module.

WARNING: it is critical that the binary compressed data be delivered to the
output file unchanged. On non-Unix systems the stdio library may perform
newline translation or otherwise corrupt
binary data. To suppress this
behavior, you may need to use a "b" option to fopen (as shown above), or use
setmode() or another routine to put the stdio stream in binary mode. See
cjpeg.c and djpeg.c for code that has been found to work on many systems.

You can select the data destination after setting other parameters (step 3),
if that's more convenient. You may not change the destination between
calling jpeg_start_compress() and jpeg_finish_compress().

3. Set parameters for compression, including image size & colorspace.

You must supply information about the source image by setting the following
fields in the JPEG object (cinfo structure):

    image_width Width of image, in pixels
    image_height Height of image, in pixels
    input_components Number of color channels (samples per pixel)
    in_color_space Color space of source image

The image dimensions are, hopefully, obvious. JPEG supports image dimensions
of 1 to 64K pixels in either direction. The input color space is typically
RGB
 or grayscale, and input_components is 3 or 1 accordingly. (See "Special
color spaces", later, for more info.) The in_color_space field must be
assigned one of the J_COLOR_SPACE enum constants, typically JCS_RGB or
JCS_GRAYSCALE.

JPEG has a large number of compression parameters that determine how the
image is encoded. Most applications don't need or want to know about all
these parameters. You can set all the parameters to reasonable defaults by
calling jpeg_set_defaults(); then, if there are particular values you want
to change, you can do so after that. The "Compression parameter selection"
section tells about all the parameters.

You must set in_color_space correctly before calling jpeg_set_defaults(),
because the defaults depend on the source image colorspace. However the
other three source image parameters need not be valid until you call
jpeg_start_compress(). There's no harm in calling jpeg_set_defaults() more
than once, if that happens to be convenient.

Typical
 code for a 24-bit RGB source image is

    cinfo.image_width = Width; /* image width and height, in pixels */
    cinfo.image_height = Height;
    cinfo.input_components = 3; /* # of color components per pixel */
    cinfo.in_color_space = JCS_RGB; /* colorspace of input image */

    jpeg_set_defaults(&cinfo);
    /* Make optional parameter settings here */

4. jpeg_start_compress(...);

After you have established the data destination and set all the necessary
source image info and other parameters, call jpeg_start_compress() to begin
a compression cycle. This will initialize internal state, allocate working
storage, and emit the first few bytes of the JPEG datastream header.

Typical code:

```
jpeg_start_compress(&cinfo, TRUE);
```

The "TRUE" parameter ensures that a complete JPEG interchange datastream
will be written. This is appropriate in most cases. If you think you might
want to use an abbreviated datastream, read the section on abbreviated
datastreams, below.

Once you have called jpeg_start_compress(),
 you may not alter any JPEG
parameters or other fields of the JPEG object until you have completed
the compression cycle.

5. while (scan lines remain to be written)
 jpeg_write_scanlines(...);

Now write all the required image data by calling jpeg_write_scanlines()
one or more times. You can pass one or more scanlines in each call, up
to the total image height. In most applications it is convenient to pass
just one or a few scanlines at a time. The expected format for the passed
data is discussed under "Data formats", above.

Image data should be written in top-to-bottom scanline order. The JPEG spec
contains some weasel wording about how top and bottom are application-defined
terms (a curious interpretation of the English language...) but if you want
your files to be compatible with everyone else's, you WILL use top-to-bottom
order. If the source data must be read in bottom-to-top order, you can use
the JPEG library's virtual array mechanism to invert the data efficiently.
Examples
 of this can be found in the sample application cjpeg.

The library maintains a count of the number of scanlines written so far
in the next_scanline field of the JPEG object. Usually you can just use
this variable as the loop counter, so that the loop test looks like
"while (cinfo.next_scanline < cinfo.image_height)".

Code for this step depends heavily on the way that you store the source data.
example.c shows the following code for the case of a full-size 2-D source
array containing 3-byte RGB pixels:

```
JSAMPROW row_pointer[1]; /* pointer to a single row */
int row_stride;   /* physical row width in buffer */

row_stride = image_width * 3; /* JSAMPLEs per row in image_buffer */
```

```
  while (cinfo.next_scanline < cinfo.image_height) {
     row_pointer[0] = & image_buffer[cinfo.next_scanline * row_stride];
     jpeg_write_scanlines(&cinfo, row_pointer, 1);
  }
```

jpeg_write_scanlines() returns the number of scanlines actually written.
This will normally be equal to the number
 passed in, so you can usually
ignore the return value. It is different in just two cases:
 * If you try to write more scanlines than the declared image height,
   the additional scanlines are ignored.
 * If you use a suspending data destination manager, output buffer overrun
   will cause the compressor to return before accepting all the passed lines.
   This feature is discussed under "I/O suspension", below. The normal
   stdio destination manager will NOT cause this to happen.
In any case, the return value is the same as the change in the value of
next_scanline.

6. jpeg_finish_compress(...);

After all the image data has been written, call jpeg_finish_compress() to
complete the compression cycle. This step is ESSENTIAL to ensure that the
last bufferload of data is written to the data destination.
jpeg_finish_compress() also releases working memory associated with the JPEG
object.

Typical code:

 jpeg_finish_compress(&cinfo);

If using the stdio destination manager,
 don't forget to close the output
stdio stream (if necessary) afterwards.

If you have requested a multi-pass operating mode, such as Huffman code
optimization, jpeg_finish_compress() will perform the additional passes using
data buffered by the first pass. In this case jpeg_finish_compress() may take
quite a while to complete. With the default compression parameters, this will
not happen.

It is an error to call jpeg_finish_compress() before writing the necessary
total number of scanlines. If you wish to abort compression, call
jpeg_abort() as discussed below.

After completing a compression cycle, you may dispose of the JPEG object
as discussed next, or you may use it to compress another image. In that case
return to step 2, 3, or 4 as appropriate. If you do not change the

destination manager, the new datastream will be written to the same target.
If you do not change any JPEG parameters, the new datastream will be written
with the same parameters as before. Note that you can change
 the input image
dimensions freely between cycles, but if you change the input colorspace, you
should call jpeg_set_defaults() to adjust for the new colorspace; and then
you'll need to repeat all of step 3.

7. Release the JPEG compression object.

When you are done with a JPEG compression object, destroy it by calling
jpeg_destroy_compress(). This will free all subsidiary memory (regardless of
the previous state of the object). Or you can call jpeg_destroy(), which
works for either compression or decompression objects --- this may be more
convenient if you are sharing code between compression and decompression
cases. (Actually, these routines are equivalent except for the declared type
of the passed pointer. To avoid gripes from ANSI C compilers, jpeg_destroy()
should be passed a j_common_ptr.)

If you allocated the jpeg_compress_struct structure from malloc(), freeing
it is your responsibility --- jpeg_destroy() won't. Ditto for the error
handler structure.

Typical code:

 jpeg_destroy_compress(&cinfo);

8.
 Aborting.

If you decide to abort a compression cycle before finishing, you can clean up
in either of two ways:

* If you don't need the JPEG object any more, just call
 jpeg_destroy_compress() or jpeg_destroy() to release memory. This is
 legitimate at any point after calling jpeg_create_compress() --- in fact,
 it's safe even if jpeg_create_compress() fails.

* If you want to re-use the JPEG object, call jpeg_abort_compress(), or call
 jpeg_abort() which works on both compression and decompression objects.
 This will return the object to an idle state, releasing any working memory.
 jpeg_abort() is allowed at any time after successful object creation.

Note that cleaning up the data destination, if required, is your
responsibility; neither of these routines will call term_destination().
(See "Compressed data handling", below, for more about that.)

jpeg_destroy() and jpeg_abort() are the only safe calls to make on a JPEG
object that has reported
 an error by calling error_exit (see "Error handling"
for more info). The internal state of such an object is likely to be out of
whack. Either of these two routines will return the object to a known state.

Decompression details

Here we revisit the JPEG decompression outline given in the overview.

1. Allocate and initialize a JPEG decompression object.

This is just like initialization for compression, as discussed above,
except that the object is a "struct jpeg_decompress_struct" and you
call jpeg_create_decompress(). Error handling is exactly the same.

Typical code:

```
 struct jpeg_decompress_struct cinfo;
 struct jpeg_error_mgr jerr;
 ...
 cinfo.err = jpeg_std_error(&jerr);
 jpeg_create_decompress(&cinfo);
```

(Both here and in the IJG code, we usually use variable name "cinfo" for
both compression and decompression objects.)

2. Specify the source of the compressed data (eg, a file).

As previously mentioned, the JPEG library reads compressed data from
 a "data
source" module. The library includes one data source module which knows how
to read from a stdio stream. You can use your own source module if you want
to do something else, as discussed later.

If you use the standard source module, you must open the source stdio stream
beforehand. Typical code for this step looks like:

```
 FILE * infile;
 ...
 if ((infile = fopen(filename, "rb")) == NULL) {
    fprintf(stderr, "can't open %s\n", filename);
    exit(1);
 }
```

jpeg_stdio_src(&cinfo, infile);

where the last line invokes the standard source module.

WARNING: it is critical that the binary compressed data be read unchanged.
On non-Unix systems the stdio library may perform newline translation or
otherwise corrupt binary data. To suppress this behavior, you may need to use
a "b" option to fopen (as shown above), or use setmode() or another routine to
put the stdio stream in binary mode. See cjpeg.c and djpeg.c for code that
has been found to work on many systems.

You may not
 change the data source between calling jpeg_read_header() and
jpeg_finish_decompress(). If you wish to read a series of JPEG images from
a single source file, you should repeat the jpeg_read_header() to
jpeg_finish_decompress() sequence without reinitializing either the JPEG
object or the data source module; this prevents buffered input data from
being discarded.

3. Call jpeg_read_header() to obtain image info.

Typical code for this step is just

 jpeg_read_header(&cinfo, TRUE);

This will read the source datastream header markers, up to the beginning
of the compressed data proper. On return, the image dimensions and other
info have been stored in the JPEG object. The application may wish to
consult this information before selecting decompression parameters.

More complex code is necessary if
 * A suspending data source is used --- in that case jpeg_read_header()
   may return before it has read all the header data. See "I/O suspension",
   below. The normal stdio source manager
 will NOT cause this to happen.
 * Abbreviated JPEG files are to be processed --- see the section on
   abbreviated datastreams. Standard applications that deal only in
   interchange JPEG files need not be concerned with this case either.

It is permissible to stop at this point if you just wanted to find out the
image dimensions and other header info for a JPEG file. In that case,
call jpeg_destroy() when you are done with the JPEG object, or call
jpeg_abort() to return it to an idle state before selecting a new data
source and reading another header.

4. Set parameters for decompression.

jpeg_read_header() sets appropriate default decompression parameters based on
the properties of the image (in particular, its colorspace). However, you
may well want to alter these defaults before beginning the decompression.
For example, the default is to produce full color output from a color file.
If you want colormapped output you must ask for it. Other options allow the
returned image
 to be scaled and allow various speed/quality tradeoffs to be
selected. "Decompression parameter selection", below, gives details.

If the defaults are appropriate, nothing need be done at this step.

Note that all default values are set by each call to jpeg_read_header().
If you reuse a decompression object, you cannot expect your parameter
settings to be preserved across cycles, as you can for compression.
You must set desired parameter values each time.

5. jpeg_start_decompress(...);

Once the parameter values are satisfactory, call jpeg_start_decompress() to
begin decompression. This will initialize internal state, allocate working
memory, and prepare for returning data.

Typical code is just

 jpeg_start_decompress(&cinfo);

If you have requested a multi-pass operating mode, such as 2-pass color
quantization, jpeg_start_decompress() will do everything needed before data
output can begin. In this case jpeg_start_decompress() may take quite a while
to complete. With a single-scan
 (non progressive) JPEG file and default
decompression parameters, this will not happen; jpeg_start_decompress() will
return quickly.

After this call, the final output image dimensions, including any requested
scaling, are available in the JPEG object; so is the selected colormap, if
colormapped output has been requested. Useful fields include

 output_width image width and height, as scaled
 output_height
 out_color_components # of color components in out_color_space
 output_components # of color components returned per pixel
 colormap the selected colormap, if any
 actual_number_of_colors number of entries in colormap

output_components is 1 (a colormap index) when quantizing colors; otherwise it

equals out_color_components. It is the number of JSAMPLE values that will be
emitted per pixel in the output arrays.

Typically you will need to allocate data buffers to hold the incoming image.
You will need output_width * output_components JSAMPLEs per scanline in your
output
 buffer, and a total of output_height scanlines will be returned.

Note: if you are using the JPEG library's internal memory manager to allocate
data buffers (as djpeg does), then the manager's protocol requires that you
request large buffers *before* calling jpeg_start_decompress(). This is a
little tricky since the output_XXX fields are not normally valid then. You
can make them valid by calling jpeg_calc_output_dimensions() after setting the
relevant parameters (scaling, output color space, and quantization flag).

6. while (scan lines remain to be read)
 jpeg_read_scanlines(...);

Now you can read the decompressed image data by calling jpeg_read_scanlines()
one or more times. At each call, you pass in the maximum number of scanlines
to be read (ie, the height of your working buffer); jpeg_read_scanlines()
will return up to that many lines. The return value is the number of lines
actually read. The format of the returned data is discussed under "Data
formats", above. Don't forget
 that grayscale and color JPEGs will return
different data formats!

Image data is returned in top-to-bottom scanline order. If you must write
out the image in bottom-to-top order, you can use the JPEG library's virtual
array mechanism to invert the data efficiently. Examples of this can be
found in the sample application djpeg.

The library maintains a count of the number of scanlines returned so far
in the output_scanline field of the JPEG object. Usually you can just use
this variable as the loop counter, so that the loop test looks like
"while (cinfo.output_scanline < cinfo.output_height)". (Note that the test
should NOT be against image_height, unless you never use scaling. The
image_height field is the height of the original unscaled image.)
The return value always equals the change in the value of output_scanline.

If you don't use a suspending data source, it is safe to assume that
jpeg_read_scanlines() reads at least one scanline per call, until the
bottom of the image
 has been reached.

If you use a buffer larger than one scanline, it is NOT safe to assume that
jpeg_read_scanlines() fills it. (The current implementation returns only a

few scanlines per call, no matter how large a buffer you pass.) So you must
always provide a loop that calls jpeg_read_scanlines() repeatedly until the
whole image has been read.

7. jpeg_finish_decompress(...);

After all the image data has been read, call jpeg_finish_decompress() to
complete the decompression cycle. This causes working memory associated
with the JPEG object to be released.

Typical code:

 jpeg_finish_decompress(&cinfo);

If using the stdio source manager, don't forget to close the source stdio
stream if necessary.

It is an error to call jpeg_finish_decompress() before reading the correct
total number of scanlines. If you wish to abort decompression, call
jpeg_abort() as discussed below.

After completing a decompression cycle, you may dispose of the JPEG object as
discussed next, or you may use
 it to decompress another image. In that case
return to step 2 or 3 as appropriate. If you do not change the source
manager, the next image will be read from the same source.

8. Release the JPEG decompression object.

When you are done with a JPEG decompression object, destroy it by calling
jpeg_destroy_decompress() or jpeg_destroy(). The previous discussion of
destroying compression objects applies here too.

Typical code:

 jpeg_destroy_decompress(&cinfo);

9. Aborting.

You can abort a decompression cycle by calling jpeg_destroy_decompress() or
jpeg_destroy() if you don't need the JPEG object any more, or
jpeg_abort_decompress() or jpeg_abort() if you want to reuse the object.
The previous discussion of aborting compression cycles applies here too.

Mechanics of usage: include files, linking, etc

Applications using the JPEG library should include the header file jpeglib.h
to obtain declarations of data types and routines. Before
 including
jpeglib.h, include system headers that define at least the typedefs FILE and
size_t. On ANSI-conforming systems, including <stdio.h> is sufficient; on
older Unix systems, you may need <sys/types.h> to define size_t.

If the application needs to refer to individual JPEG library error codes, also
include jerror.h to define those symbols.

jpeglib.h indirectly includes the files jconfig.h and jmorecfg.h. If you are
installing the JPEG header files in a system directory, you will want to
install all four files: jpeglib.h, jerror.h, jconfig.h, jmorecfg.h.

The most convenient way to include the JPEG code into your executable program
is to prepare a library file ("libjpeg.a", or a corresponding name on non-Unix
machines) and reference it at your link step. If you use only half of the
library (only compression or only decompression), only that much code will be
included from the library, unless your linker is hopelessly brain-damaged.
The supplied makefiles build libjpeg.a automatically
 (see install.txt).

While you can build the JPEG library as a shared library if the whim strikes
you, we don't really recommend it. The trouble with shared libraries is that
at some point you'll probably try to substitute a new version of the library
without recompiling the calling applications. That generally doesn't work
because the parameter struct declarations usually change with each new
version. In other words, the library's API is *not* guaranteed binary
compatible across versions; we only try to ensure source-code compatibility.
(In hindsight, it might have been smarter to hide the parameter structs from
applications and introduce a ton of access functions instead. Too late now,
however.)

On some systems your application may need to set up a signal handler to ensure
that temporary files are deleted if the program is interrupted. This is most
critical if you are on MS-DOS and use the jmemdos.c memory manager back end;
it will try to grab extended memory for temp
 files, and that space will NOT be
freed automatically. See cjpeg.c or djpeg.c for an example signal handler.

It may be worth pointing out that the core JPEG library does not actually
require the stdio library: only the default source/destination managers and
error handler need it. You can use the library in a stdio-less environment
if you replace those modules and use jmemnobs.c (or another memory manager of
your own devising). More info about the minimum system library requirements

may be found in jinclude.h.

ADVANCED FEATURES
=================

Compression parameter selection

This section describes all the optional parameters you can set for JPEG
compression, as well as the "helper" routines provided to assist in this
task. Proper setting of some parameters requires detailed understanding
of the JPEG standard; if you don't know what a parameter is for, it's best
not to mess with it! See REFERENCES in the README file for pointers to
more info
 about JPEG.

It's a good idea to call jpeg_set_defaults() first, even if you plan to set
all the parameters; that way your code is more likely to work with future JPEG
libraries that have additional parameters. For the same reason, we recommend
you use a helper routine where one is provided, in preference to twiddling
cinfo fields directly.

The helper routines are:

jpeg_set_defaults (j_compress_ptr cinfo)
 This routine sets all JPEG parameters to reasonable defaults, using
 only the input image's color space (field in_color_space, which must
 already be set in cinfo). Many applications will only need to use
 this routine and perhaps jpeg_set_quality().

jpeg_set_colorspace (j_compress_ptr cinfo, J_COLOR_SPACE colorspace)
 Sets the JPEG file's colorspace (field jpeg_color_space) as specified,
 and sets other color-space-dependent parameters appropriately. See
 "Special color spaces", below, before using this. A large number of
 parameters, including all per-component parameters,
 are set by this
 routine; if you want to twiddle individual parameters you should call
 jpeg_set_colorspace() before rather than after.

jpeg_default_colorspace (j_compress_ptr cinfo)
 Selects an appropriate JPEG colorspace based on cinfo->in_color_space,
 and calls jpeg_set_colorspace(). This is actually a subroutine of
 jpeg_set_defaults(). It's broken out in case you want to change
 just the colorspace-dependent JPEG parameters.

jpeg_set_quality (j_compress_ptr cinfo, int quality, boolean force_baseline)
 Constructs JPEG quantization tables appropriate for the indicated

quality setting. The quality value is expressed on the 0..100 scale
recommended by IJG (cjpeg's "-quality" switch uses this routine).
Note that the exact mapping from quality values to tables may change
in future IJG releases as more is learned about DCT quantization.
If the force_baseline parameter is TRUE, then the quantization table
entries are constrained to the range 1..255 for full JPEG baseline
compatibility.
 In the current implementation, this only makes a
difference for quality settings below 25, and it effectively prevents
very small/low quality files from being generated. The IJG decoder
is capable of reading the non-baseline files generated at low quality
settings when force_baseline is FALSE, but other decoders may not be.

jpeg_set_linear_quality (j_compress_ptr cinfo, int scale_factor,
    boolean force_baseline)
Same as jpeg_set_quality() except that the generated tables are the
sample tables given in the JPEC spec section K.1, multiplied by the
specified scale factor (which is expressed as a percentage; thus
scale_factor = 100 reproduces the spec's tables). Note that larger
scale factors give lower quality. This entry point is useful for
conforming to the Adobe PostScript DCT conventions, but we do not
recommend linear scaling as a user-visible quality scale otherwise.
force_baseline again constrains the computed table entries to 1..255.

int jpeg_quality_scaling
 (int quality)
Converts a value on the IJG-recommended quality scale to a linear
scaling percentage. Note that this routine may change or go away
in future releases --- IJG may choose to adopt a scaling method that
can't be expressed as a simple scalar multiplier, in which case the
premise of this routine collapses. Caveat user.

jpeg_default_qtables (j_compress_ptr cinfo, boolean force_baseline)
Set default quantization tables with linear q_scale_factor[] values
(see below).

jpeg_add_quant_table (j_compress_ptr cinfo, int which_tbl,
      const unsigned int *basic_table,
      int scale_factor, boolean force_baseline)
Allows an arbitrary quantization table to be created. which_tbl
indicates which table slot to fill. basic_table points to an array
of 64 unsigned ints given in normal array order. These values are
multiplied by scale_factor/100 and then clamped to the range 1..65535
(or to 1..255 if force_baseline is TRUE).
CAUTION: prior to library version
6a, jpeg_add_quant_table expected
the basic table to be given in JPEG zigzag order. If you need to
write code that works with either older or newer versions of this

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routine, you must check the library version number. Something like
"#if JPEG_LIB_VERSION >= 61" is the right test.

jpeg_simple_progression (j_compress_ptr cinfo)
 Generates a default scan script for writing a progressive-JPEG file.
 This is the recommended method of creating a progressive file,
 unless you want to make a custom scan sequence. You must ensure that
 the JPEG color space is set correctly before calling this routine.

Compression parameters (cinfo fields) include:

boolean arith_code
 If TRUE, use arithmetic coding.
 If FALSE, use Huffman coding.

int block_size
 Set DCT block size. All N from 1 to 16 are possible.
 Default is 8 (baseline format).
 Larger values produce higher compression,
 smaller values produce higher quality.
 An exact DCT stage is possible with 1 or 2.
 With the default quality
 of 75 and default Luminance qtable
 the DCT+Quantization stage is lossless for value 1.
 Note that values other than 8 require a SmartScale capable decoder,
 introduced with IJG JPEG 8. Setting the block_size parameter for
 compression works with version 8c and later.

J_DCT_METHOD dct_method
 Selects the algorithm used for the DCT step. Choices are:
 JDCT_ISLOW: slow but accurate integer algorithm
 JDCT_IFAST: faster, less accurate integer method
 JDCT_FLOAT: floating-point method
 JDCT_DEFAULT: default method (normally JDCT_ISLOW)
 JDCT_FASTEST: fastest method (normally JDCT_IFAST)
 The FLOAT method is very slightly more accurate than the ISLOW method,
 but may give different results on different machines due to varying
 roundoff behavior. The integer methods should give the same results
 on all machines. On machines with sufficiently fast FP hardware, the
 floating-point method may also be the fastest. The IFAST method is
 considerably less accurate than the other two; its
 use is not
 recommended if high quality is a concern. JDCT_DEFAULT and
 JDCT_FASTEST are macros configurable by each installation.

unsigned int scale_num, scale_denom
 Scale the image by the fraction scale_num/scale_denom. Default is

1/1, or no scaling. Currently, the supported scaling ratios are
M/N with all N from 1 to 16, where M is the destination DCT size,
which is 8 by default (see block_size parameter above).
(The library design allows for arbitrary scaling ratios but this
is not likely to be implemented any time soon.)

J_COLOR_SPACE jpeg_color_space
int num_components
The JPEG color space and corresponding number of components; see
"Special color spaces", below, for more info. We recommend using
jpeg_set_colorspace() if you want to change these.

J_COLOR_TRANSFORM color_transform
Internal color transform identifier, writes LSE marker if nonzero
(requires decoder with inverse color transform support, introduced
with IJG JPEG 9).
Two values are currently possible:
JCT_NONE and JCT_SUBTRACT_GREEN.
Set this value for lossless RGB application *before* calling
jpeg_set_colorspace(), because entropy table assignment in
jpeg_set_colorspace() depends on color_transform.

boolean optimize_coding
TRUE causes the compressor to compute optimal Huffman coding tables
for the image. This requires an extra pass over the data and
therefore costs a good deal of space and time. The default is
FALSE, which tells the compressor to use the supplied or default
Huffman tables. In most cases optimal tables save only a few percent
of file size compared to the default tables. Note that when this is
TRUE, you need not supply Huffman tables at all, and any you do
supply will be overwritten.

unsigned int restart_interval
int restart_in_rows
To emit restart markers in the JPEG file, set one of these nonzero.
Set restart_interval to specify the exact interval in MCU blocks.
Set restart_in_rows to specify the interval in MCU rows. (If
restart_in_rows
is not 0, then restart_interval is set after the
image width in MCUs is computed.) Defaults are zero (no restarts).
One restart marker per MCU row is often a good choice.
NOTE: the overhead of restart markers is higher in grayscale JPEG
files than in color files, and MUCH higher in progressive JPEGs.
If you use restarts, you may want to use larger intervals in those
cases.

const jpeg_scan_info * scan_info
int num_scans

By default, scan_info is NULL; this causes the compressor to write a
single-scan sequential JPEG file. If not NULL, scan_info points to
an array of scan definition records of length num_scans. The
compressor will then write a JPEG file having one scan for each scan
definition record. This is used to generate noninterleaved or
progressive JPEG files. The library checks that the scan array
defines a valid JPEG scan sequence. (jpeg_simple_progression creates
a suitable scan definition array for progressive JPEG.) This is
discussed further under "Progressive
JPEG support".

boolean do_fancy_downsampling
 If TRUE, use direct DCT scaling with DCT size > 8 for downsampling
 of chroma components.
 If FALSE, use only DCT size <= 8 and simple separate downsampling.
 Default is TRUE.
 For better image stability in multiple generation compression cycles
 it is preferable that this value matches the corresponding
 do_fancy_upsampling value in decompression.

int smoothing_factor
 If non-zero, the input image is smoothed; the value should be 1 for
 minimal smoothing to 100 for maximum smoothing. Consult jcsample.c
 for details of the smoothing algorithm. The default is zero.

boolean write_JFIF_header
 If TRUE, a JFIF APP0 marker is emitted. jpeg_set_defaults() and
 jpeg_set_colorspace() set this TRUE if a JFIF-legal JPEG color space
 (ie, YCbCr or grayscale) is selected, otherwise FALSE.

UINT8 JFIF_major_version
UINT8 JFIF_minor_version
 The version number to be written into the JFIF marker.
 jpeg_set_defaults() initializes the version to
 1.01 (major=minor=1).
 You should set it to 1.02 (major=1, minor=2) if you plan to write
 any JFIF 1.02 extension markers.

UINT8 density_unit
UINT16 X_density
UINT16 Y_density
 The resolution information to be written into the JFIF marker;
 not used otherwise. density_unit may be 0 for unknown,
 1 for dots/inch, or 2 for dots/cm. The default values are 0,1,1
 indicating square pixels of unknown size.

boolean write_Adobe_marker
 If TRUE, an Adobe APP14 marker is emitted. jpeg_set_defaults() and

jpeg_set_colorspace() set this TRUE if JPEG color space RGB, CMYK,
or YCCK is selected, otherwise FALSE. It is generally a bad idea
to set both write_JFIF_header and write_Adobe_marker. In fact,
you probably shouldn't change the default settings at all --- the
default behavior ensures that the JPEG file's color space can be
recognized by the decoder.

JQUANT_TBL * quant_tbl_ptrs[NUM_QUANT_TBLS]
 Pointers to coefficient quantization tables, one per table slot,
 or NULL if no table is
 defined for a slot. Usually these should
 be set via one of the above helper routines; jpeg_add_quant_table()
 is general enough to define any quantization table. The other
 routines will set up table slot 0 for luminance quality and table
 slot 1 for chrominance.

int q_scale_factor[NUM_QUANT_TBLS]
 Linear quantization scaling factors (percentage, initialized 100)
 for use with jpeg_default_qtables().
 See rdswitch.c and cjpeg.c for an example of usage.
 Note that the q_scale_factor[] fields are the "linear" scales, so you
 have to convert from user-defined ratings via jpeg_quality_scaling().
 Here is an example code which corresponds to cjpeg -quality 90,70:

 jpeg_set_defaults(cinfo);

 /* Set luminance quality 90. */
 cinfo->q_scale_factor[0] = jpeg_quality_scaling(90);
 /* Set chrominance quality 70. */
 cinfo->q_scale_factor[1] = jpeg_quality_scaling(70);

 jpeg_default_qtables(cinfo, force_baseline);

 CAUTION: You must also set 1x1 subsampling for efficient separate
 color
 quality selection, since the default value used by library
 is 2x2:

 cinfo->comp_info[0].v_samp_factor = 1;
 cinfo->comp_info[0].h_samp_factor = 1;

JHUFF_TBL * dc_huff_tbl_ptrs[NUM_HUFF_TBLS]
JHUFF_TBL * ac_huff_tbl_ptrs[NUM_HUFF_TBLS]
 Pointers to Huffman coding tables, one per table slot, or NULL if
 no table is defined for a slot. Slots 0 and 1 are filled with the
 JPEG sample tables by jpeg_set_defaults(). If you need to allocate
 more table structures, jpeg_alloc_huff_table() may be used.
 Note that optimal Huffman tables can be computed for an image

by setting optimize_coding, as discussed above; there's seldom
any need to mess with providing your own Huffman tables.

The actual dimensions of the JPEG image that will be written to the file are
given by the following fields. These are computed from the input image
dimensions and the compression parameters by jpeg_start_compress(). You can
also call jpeg_calc_jpeg_dimensions() to obtain the values that will result
from
 the current parameter settings. This can be useful if you are trying
to pick a scaling ratio that will get close to a desired target size.

JDIMENSION jpeg_width Actual dimensions of output image.
JDIMENSION jpeg_height

Per-component parameters are stored in the struct cinfo.comp_info[i] for
component number i. Note that components here refer to components of the
JPEG color space, *not* the source image color space. A suitably large
comp_info[] array is allocated by jpeg_set_defaults(); if you choose not
to use that routine, it's up to you to allocate the array.

int component_id
 The one-byte identifier code to be recorded in the JPEG file for
 this component. For the standard color spaces, we recommend you
 leave the default values alone.

int h_samp_factor
int v_samp_factor
 Horizontal and vertical sampling factors for the component; must
 be 1..4 according to the JPEG standard. Note that larger sampling
 factors indicate a higher-resolution component; many people find
 this
 behavior quite unintuitive. The default values are 2,2 for
 luminance components and 1,1 for chrominance components, except
 for grayscale where 1,1 is used.

int quant_tbl_no
 Quantization table number for component. The default value is
 0 for luminance components and 1 for chrominance components.

int dc_tbl_no
int ac_tbl_no
 DC and AC entropy coding table numbers. The default values are
 0 for luminance components and 1 for chrominance components.

int component_index
 Must equal the component's index in comp_info[]. (Beginning in

release v6, the compressor library will fill this in automatically;
you don't have to.)

Decompression parameter selection

Decompression parameter selection is somewhat simpler than compression
parameter selection, since all of the JPEG internal parameters are
recorded in the source file and need not be supplied by the application.
(Unless you are working with abbreviated files, in which case see
"Abbreviated
 datastreams", below.) Decompression parameters control
the postprocessing done on the image to deliver it in a format suitable
for the application's use. Many of the parameters control speed/quality
tradeoffs, in which faster decompression may be obtained at the price of
a poorer-quality image. The defaults select the highest quality (slowest)
processing.

The following fields in the JPEG object are set by jpeg_read_header() and
may be useful to the application in choosing decompression parameters:

JDIMENSION image_width   Width and height of image
JDIMENSION image_height
int num_components   Number of color components
J_COLOR_SPACE jpeg_color_space Colorspace of image
boolean saw_JFIF_marker   TRUE if a JFIF APP0 marker was seen
 UINT8 JFIF_major_version Version information from JFIF marker
 UINT8 JFIF_minor_version
 UINT8 density_unit   Resolution data from JFIF marker
 UINT16 X_density
 UINT16 Y_density
boolean saw_Adobe_marker TRUE if an Adobe APP14 marker was seen

 UINT8 Adobe_transform   Color transform code from Adobe marker

The JPEG color space, unfortunately, is something of a guess since the JPEG
standard proper does not provide a way to record it. In practice most files
adhere to the JFIF or Adobe conventions, and the decoder will recognize these
correctly. See "Special color spaces", below, for more info.

The decompression parameters that determine the basic properties of the
returned image are:

J_COLOR_SPACE out_color_space
 Output color space. jpeg_read_header() sets an appropriate default
 based on jpeg_color_space; typically it will be RGB or grayscale.

The application can change this field to request output in a different
colorspace. For example, set it to JCS_GRAYSCALE to get grayscale
output from a color file. (This is useful for previewing: grayscale
output is faster than full color since the color components need not
be processed.) Note that not all possible color space transforms are
currently implemented; you may
need to extend jdcolor.c if you want an
unusual conversion.

unsigned int scale_num, scale_denom
 Scale the image by the fraction scale_num/scale_denom. Currently,
 the supported scaling ratios are M/N with all M from 1 to 16, where
 N is the source DCT size, which is 8 for baseline JPEG. (The library
 design allows for arbitrary scaling ratios but this is not likely
 to be implemented any time soon.) The values are initialized by
 jpeg_read_header() with the source DCT size. For baseline JPEG
 this is 8/8. If you change only the scale_num value while leaving
 the other unchanged, then this specifies the DCT scaled size to be
 applied on the given input. For baseline JPEG this is equivalent
 to M/8 scaling, since the source DCT size for baseline JPEG is 8.
 Smaller scaling ratios permit significantly faster decoding since
 fewer pixels need be processed and a simpler IDCT method can be used.

boolean quantize_colors
 If set TRUE, colormapped output will be delivered. Default is
 FALSE,
 meaning that full-color output will be delivered.

The next three parameters are relevant only if quantize_colors is TRUE.

int desired_number_of_colors
 Maximum number of colors to use in generating a library-supplied color
 map (the actual number of colors is returned in a different field).
 Default 256. Ignored when the application supplies its own color map.

boolean two_pass_quantize
 If TRUE, an extra pass over the image is made to select a custom color
 map for the image. This usually looks a lot better than the one-size-
 fits-all colormap that is used otherwise. Default is TRUE. Ignored
 when the application supplies its own color map.

J_DITHER_MODE dither_mode
 Selects color dithering method. Supported values are:
  JDITHER_NONE no dithering: fast, very low quality
  JDITHER_ORDERED ordered dither: moderate speed and quality
  JDITHER_FS Floyd-Steinberg dither: slow, high quality
 Default is JDITHER_FS. (At present, ordered dither is implemented
 only in the

single-pass, standard-colormap case. If you ask for
ordered dither when two_pass_quantize is TRUE or when you supply
an external color map, you'll get F-S dithering.)

When quantize_colors is TRUE, the target color map is described by the next
two fields. colormap is set to NULL by jpeg_read_header(). The application
can supply a color map by setting colormap non-NULL and setting
actual_number_of_colors to the map size. Otherwise, jpeg_start_decompress()
selects a suitable color map and sets these two fields itself.
[Implementation restriction: at present, an externally supplied colormap is
only accepted for 3-component output color spaces.]

JSAMPARRAY colormap
 The color map, represented as a 2-D pixel array of out_color_components
 rows and actual_number_of_colors columns. Ignored if not quantizing.
 CAUTION: if the JPEG library creates its own colormap, the storage
 pointed to by this field is released by jpeg_finish_decompress().
 Copy the colormap somewhere else first, if
 you want to save it.

int actual_number_of_colors
 The number of colors in the color map.

Additional decompression parameters that the application may set include:

J_DCT_METHOD dct_method
 Selects the algorithm used for the DCT step. Choices are the same
 as described above for compression.

boolean do_fancy_upsampling
 If TRUE, use direct DCT scaling with DCT size > 8 for upsampling
 of chroma components.
 If FALSE, use only DCT size <= 8 and simple separate upsampling.
 Default is TRUE.
 For better image stability in multiple generation compression cycles
 it is preferable that this value matches the corresponding
 do_fancy_downsampling value in compression.

boolean do_block_smoothing
 If TRUE, interblock smoothing is applied in early stages of decoding
 progressive JPEG files; if FALSE, not. Default is TRUE. Early
 progression stages look "fuzzy" with smoothing, "blocky" without.
 In any case, block smoothing ceases to be applied after the first few
 AC coefficients are known
 to full accuracy, so it is relevant only
 when using buffered-image mode for progressive images.

boolean enable_1pass_quant

boolean enable_external_quant
boolean enable_2pass_quant
 These are significant only in buffered-image mode, which is
 described in its own section below.

The output image dimensions are given by the following fields. These are
computed from the source image dimensions and the decompression parameters
by jpeg_start_decompress(). You can also call jpeg_calc_output_dimensions()
to obtain the values that will result from the current parameter settings.
This can be useful if you are trying to pick a scaling ratio that will get
close to a desired target size. It's also important if you are using the
JPEG library's memory manager to allocate output buffer space, because you
are supposed to request such buffers *before* jpeg_start_decompress().

JDIMENSION output_width Actual dimensions of output image.
JDIMENSION output_height
int out_color_components Number of color
 components in out_color_space.
int output_components Number of color components returned.
int rec_outbuf_height Recommended height of scanline buffer.

When quantizing colors, output_components is 1, indicating a single color map
index per pixel. Otherwise it equals out_color_components. The output arrays
are required to be output_width * output_components JSAMPLEs wide.

rec_outbuf_height is the recommended minimum height (in scanlines) of the
buffer passed to jpeg_read_scanlines(). If the buffer is smaller, the
library will still work, but time will be wasted due to unnecessary data
copying. In high-quality modes, rec_outbuf_height is always 1, but some
faster, lower-quality modes set it to larger values (typically 2 to 4).
If you are going to ask for a high-speed processing mode, you may as well
go to the trouble of honoring rec_outbuf_height so as to avoid data copying.
(An output buffer larger than rec_outbuf_height lines is OK, but won't
provide any material speed improvement
 over that height.)

Special color spaces

The JPEG standard itself is "color blind" and doesn't specify any particular
color space. It is customary to convert color data to a luminance/chrominance
color space before compressing, since this permits greater compression. The
existing JPEG file interchange format standards specify YCbCr or GRAYSCALE
data (JFIF version 1), GRAYSCALE, RGB, YCbCr, CMYK, or YCCK (Adobe), or BG_RGB
or BG_YCC (big gamut color spaces, JFIF version 2). For special applications
such as multispectral images, other color spaces can be used,

but it must be understood that such files will be unportable.

The JPEG library can handle the most common colorspace conversions (namely
RGB <=> YCbCr and CMYK <=> YCCK). It can also deal with data of an unknown
color space, passing it through without conversion. If you deal extensively
with an unusual color space, you can easily extend the library to understand
additional color spaces and perform
 appropriate conversions.

For compression, the source data's color space is specified by field
in_color_space. This is transformed to the JPEG file's color space given
by jpeg_color_space. jpeg_set_defaults() chooses a reasonable JPEG color
space depending on in_color_space, but you can override this by calling
jpeg_set_colorspace(). Of course you must select a supported transformation.
jccolor.c currently supports the following transformations:
 RGB => YCbCr
 RGB => GRAYSCALE
 RGB => BG_YCC
 YCbCr => GRAYSCALE
 YCbCr => BG_YCC
 CMYK => YCCK
plus the null transforms: GRAYSCALE => GRAYSCALE, RGB => RGB,
BG_RGB => BG_RGB, YCbCr => YCbCr, BG_YCC => BG_YCC, CMYK => CMYK,
YCCK => YCCK, and UNKNOWN => UNKNOWN.

The file interchange format standards (JFIF and Adobe) specify APPn markers
that indicate the color space of the JPEG file. It is important to ensure
that these are written correctly, or omitted if the JPEG file's color space
is not one of the ones supported by the interchange
 standards.
jpeg_set_colorspace() will set the compression parameters to include or omit
the APPn markers properly, so long as it is told the truth about the JPEG
color space. For example, if you are writing some random 3-component color
space without conversion, don't try to fake out the library by setting
in_color_space and jpeg_color_space to JCS_YCbCr; use JCS_UNKNOWN.
You may want to write an APPn marker of your own devising to identify
the colorspace --- see "Special markers", below.

When told that the color space is UNKNOWN, the library will default to using
luminance-quality compression parameters for all color components. You may
well want to change these parameters. See the source code for
jpeg_set_colorspace(), in jcparam.c, for details.

For decompression, the JPEG file's color space is given in jpeg_color_space,
and this is transformed to the output color space out_color_space.
jpeg_read_header's setting of jpeg_color_space can be relied on if the file
conforms to JFIF

or Adobe conventions, but otherwise it is no better than a
guess. If you know the JPEG file's color space for certain, you can override
jpeg_read_header's guess by setting jpeg_color_space. jpeg_read_header also
selects a default output color space based on (its guess of) jpeg_color_space;
set out_color_space to override this. Again, you must select a supported
transformation. jdcolor.c currently supports
 YCbCr => RGB
 YCbCr => GRAYSCALE
 BG_YCC => RGB
 BG_YCC => GRAYSCALE
 RGB => GRAYSCALE
 GRAYSCALE => RGB
 YCCK => CMYK
as well as the null transforms. (Since GRAYSCALE=>RGB is provided, an
application can force grayscale JPEGs to look like color JPEGs if it only
wants to handle one case.)

The two-pass color quantizer, jquant2.c, is specialized to handle RGB data
(it weights distances appropriately for RGB colors). You'll need to modify
the code if you want to use it for non-RGB output color spaces. Note that
jquant2.c is used to map to an application-supplied colormap as well
 as for
the normal two-pass colormap selection process.

CAUTION: it appears that Adobe Photoshop writes inverted data in CMYK JPEG
files: 0 represents 100% ink coverage, rather than 0% ink as you'd expect.
This is arguably a bug in Photoshop, but if you need to work with Photoshop
CMYK files, you will have to deal with it in your application. We cannot
"fix" this in the library by inverting the data during the CMYK<=>YCCK
transform, because that would break other applications, notably Ghostscript.
Photoshop versions prior to 3.0 write EPS files containing JPEG-encoded CMYK
data in the same inverted-YCCK representation used in bare JPEG files, but
the surrounding PostScript code performs an inversion using the PS image
operator. I am told that Photoshop 3.0 will write uninverted YCCK in
EPS/JPEG files, and will omit the PS-level inversion. (But the data
polarity used in bare JPEG files will not change in 3.0.) In either case,
the JPEG library must not invert the data itself, or else
 Ghostscript would
read these EPS files incorrectly.

Error handling

When the default error handler is used, any error detected inside the JPEG
routines will cause a message to be printed on stderr, followed by exit().
You can supply your own error handling routines to override this behavior
and to control the treatment of nonfatal warnings and trace/debug messages.

The file example.c illustrates the most common case, which is to have the
application regain control after an error rather than exiting.

The JPEG library never writes any message directly; it always goes through
the error handling routines. Three classes of messages are recognized:
 * Fatal errors: the library cannot continue.
 * Warnings: the library can continue, but the data is corrupt, and a
   damaged output image is likely to result.
 * Trace/informational messages. These come with a trace level indicating
   the importance of the message; you can control the verbosity of the
   program by adjusting
 the maximum trace level that will be displayed.

You may, if you wish, simply replace the entire JPEG error handling module
(jerror.c) with your own code. However, you can avoid code duplication by
only replacing some of the routines depending on the behavior you need.
This is accomplished by calling jpeg_std_error() as usual, but then overriding
some of the method pointers in the jpeg_error_mgr struct, as illustrated by
example.c.

All of the error handling routines will receive a pointer to the JPEG object
(a j_common_ptr which points to either a jpeg_compress_struct or a
jpeg_decompress_struct; if you need to tell which, test the is_decompressor
field). This struct includes a pointer to the error manager struct in its
"err" field. Frequently, custom error handler routines will need to access
additional data which is not known to the JPEG library or the standard error
handler. The most convenient way to do this is to embed either the JPEG
object or the jpeg_error_mgr struct
 in a larger structure that contains
additional fields; then casting the passed pointer provides access to the
additional fields. Again, see example.c for one way to do it. (Beginning
with IJG version 6b, there is also a void pointer "client_data" in each
JPEG object, which the application can also use to find related data.
The library does not touch client_data at all.)

The individual methods that you might wish to override are:

error_exit (j_common_ptr cinfo)
 Receives control for a fatal error. Information sufficient to
 generate the error message has been stored in cinfo->err; call
 output_message to display it. Control must NOT return to the caller;
 generally this routine will exit() or longjmp() somewhere.
 Typically you would override this routine to get rid of the exit()
 default behavior. Note that if you continue processing, you should
 clean up the JPEG object with jpeg_abort() or jpeg_destroy().

output_message (j_common_ptr cinfo)
 Actual output of any JPEG message.

Override this to send messages
somewhere other than stderr. Note that this method does not know
how to generate a message, only where to send it.

format_message (j_common_ptr cinfo, char * buffer)
Constructs a readable error message string based on the error info
stored in cinfo->err. This method is called by output_message. Few
applications should need to override this method. One possible
reason for doing so is to implement dynamic switching of error message
language.

emit_message (j_common_ptr cinfo, int msg_level)
Decide whether or not to emit a warning or trace message; if so,
calls output_message. The main reason for overriding this method
would be to abort on warnings. msg_level is -1 for warnings,
0 and up for trace messages.

Only error_exit() and emit_message() are called from the rest of the JPEG
library; the other two are internal to the error handler.

The actual message texts are stored in an array of strings which is pointed to
by the field err->jpeg_message_table.
 The messages are numbered from 0 to
err->last_jpeg_message, and it is these code numbers that are used in the
JPEG library code. You could replace the message texts (for instance, with
messages in French or German) by changing the message table pointer. See
jerror.h for the default texts. CAUTION: this table will almost certainly
change or grow from one library version to the next.

It may be useful for an application to add its own message texts that are
handled by the same mechanism. The error handler supports a second "add-on"
message table for this purpose. To define an addon table, set the pointer
err->addon_message_table and the message numbers err->first_addon_message and
err->last_addon_message. If you number the addon messages beginning at 1000
or so, you won't have to worry about conflicts with the library's built-in
messages. See the sample applications cjpeg/djpeg for an example of using
addon messages (the addon messages are defined in cderror.h).

Actual
 invocation of the error handler is done via macros defined in jerror.h:
 ERREXITn(...) for fatal errors
 WARNMSn(...) for corrupt-data warnings
 TRACEMSn(...) for trace and informational messages.
These macros store the message code and any additional parameters into the
error handler struct, then invoke the error_exit() or emit_message() method.
The variants of each macro are for varying numbers of additional parameters.
The additional parameters are inserted into the generated message using
standard printf() format codes.

See jerror.h and jerror.c for further details.

Compressed data handling (source and destination managers)

The JPEG compression library sends its compressed data to a "destination manager" module. The default destination manager just writes the data to a memory buffer or to a stdio stream, but you can provide your own manager to do something else. Similarly, the decompression library calls a
 "source
manager" to obtain the compressed data; you can provide your own source manager if you want the data to come from somewhere other than a memory buffer or a stdio stream.

In both cases, compressed data is processed a bufferload at a time: the destination or source manager provides a work buffer, and the library invokes the manager only when the buffer is filled or emptied. (You could define a one-character buffer to force the manager to be invoked for each byte, but that would be rather inefficient.) The buffer's size and location are controlled by the manager, not by the library. For example, the memory source manager just makes the buffer pointer and length point to the original data in memory. In this case the buffer-reload procedure will be invoked only if the decompressor ran off the end of the datastream, which would indicate an erroneous datastream.

The work buffer is defined as an array of datatype JOCTET, which is generally "char" or "unsigned char". On a machine
 where char is not exactly 8 bits
wide, you must define JOCTET as a wider data type and then modify the data source and destination modules to transcribe the work arrays into 8-bit units on external storage.

A data destination manager struct contains a pointer and count defining the next byte to write in the work buffer and the remaining free space:

 JOCTET * next_output_byte; /* => next byte to write in buffer */
 size_t free_in_buffer;   /* # of byte spaces remaining in buffer */

The library increments the pointer and decrements the count until the buffer is filled. The manager's empty_output_buffer method must reset the pointer and count. The manager is expected to remember the buffer's starting address and total size in private fields not visible to the library.

A data destination manager provides three methods:

init_destination (j_compress_ptr cinfo)

Initialize destination. This is called by jpeg_start_compress()
before any data is actually written. It must initialize
next_output_byte
and free_in_buffer. free_in_buffer must be
initialized to a positive value.

empty_output_buffer (j_compress_ptr cinfo)
This is called whenever the buffer has filled (free_in_buffer
reaches zero). In typical applications, it should write out the
entire buffer (use the saved start address and buffer length;
ignore the current state of next_output_byte and free_in_buffer).
Then reset the pointer & count to the start of the buffer, and
return TRUE indicating that the buffer has been dumped.
free_in_buffer must be set to a positive value when TRUE is
returned. A FALSE return should only be used when I/O suspension is
desired (this operating mode is discussed in the next section).

term_destination (j_compress_ptr cinfo)
Terminate destination --- called by jpeg_finish_compress() after all
data has been written. In most applications, this must flush any
data remaining in the buffer. Use either next_output_byte or
free_in_buffer to determine how much
data is in the buffer.

term_destination() is NOT called by jpeg_abort() or jpeg_destroy(). If you
want the destination manager to be cleaned up during an abort, you must do it
yourself.

You will also need code to create a jpeg_destination_mgr struct, fill in its
method pointers, and insert a pointer to the struct into the "dest" field of
the JPEG compression object. This can be done in-line in your setup code if
you like, but it's probably cleaner to provide a separate routine similar to
the jpeg_stdio_dest() or jpeg_mem_dest() routines of the supplied destination
managers.

Decompression source managers follow a parallel design, but with some
additional frammishes. The source manager struct contains a pointer and count
defining the next byte to read from the work buffer and the number of bytes
remaining:

const JOCTET * next_input_byte; /* => next byte to read from buffer */
size_t bytes_in_buffer;   /* # of bytes remaining in buffer */

The library increments the pointer
and decrements the count until the buffer
is emptied. The manager's fill_input_buffer method must reset the pointer and
count. In most applications, the manager must remember the buffer's starting
address and total size in private fields not visible to the library.

A data source manager provides five methods:

init_source (j_decompress_ptr cinfo)
 Initialize source. This is called by jpeg_read_header() before any
 data is actually read. Unlike init_destination(), it may leave
 bytes_in_buffer set to 0 (in which case a fill_input_buffer() call
 will occur immediately).

fill_input_buffer (j_decompress_ptr cinfo)
 This is called whenever bytes_in_buffer has reached zero and more
 data is wanted. In typical applications, it should read fresh data
 into the buffer (ignoring the current state of next_input_byte and
 bytes_in_buffer), reset the pointer & count to the start of the
 buffer, and return TRUE indicating that the buffer has been reloaded.
 It is not necessary to fill the buffer
 entirely, only to obtain at
 least one more byte. bytes_in_buffer MUST be set to a positive value
 if TRUE is returned. A FALSE return should only be used when I/O
 suspension is desired (this mode is discussed in the next section).

skip_input_data (j_decompress_ptr cinfo, long num_bytes)
 Skip num_bytes worth of data. The buffer pointer and count should
 be advanced over num_bytes input bytes, refilling the buffer as
 needed. This is used to skip over a potentially large amount of
 uninteresting data (such as an APPn marker). In some applications
 it may be possible to optimize away the reading of the skipped data,
 but it's not clear that being smart is worth much trouble; large
 skips are uncommon. bytes_in_buffer may be zero on return.
 A zero or negative skip count should be treated as a no-op.

resync_to_restart (j_decompress_ptr cinfo, int desired)
 This routine is called only when the decompressor has failed to find
 a restart (RSTn) marker where one is expected. Its
 mission is to
 find a suitable point for resuming decompression. For most
 applications, we recommend that you just use the default resync
 procedure, jpeg_resync_to_restart(). However, if you are able to back
 up in the input data stream, or if you have a-priori knowledge about
 the likely location of restart markers, you may be able to do better.
 Read the read_restart_marker() and jpeg_resync_to_restart() routines
 in jdmarker.c if you think you'd like to implement your own resync
 procedure.

term_source (j_decompress_ptr cinfo)
 Terminate source --- called by jpeg_finish_decompress() after all
 data has been read. Often a no-op.

For both fill_input_buffer() and skip_input_data(), there is no such thing
as an EOF return. If the end of the file has been reached, the routine has
a choice of exiting via ERREXIT() or inserting fake data into the buffer.
In most cases, generating a warning message and inserting a fake EOI marker
is the best course of action --- this will allow the
 decompressor to output
however much of the image is there. In pathological cases, the decompressor
may swallow the EOI and again demand data ... just keep feeding it fake EOIs.
jdatasrc.c illustrates the recommended error recovery behavior.

term_source() is NOT called by jpeg_abort() or jpeg_destroy(). If you want
the source manager to be cleaned up during an abort, you must do it yourself.

You will also need code to create a jpeg_source_mgr struct, fill in its method
pointers, and insert a pointer to the struct into the "src" field of the JPEG
decompression object. This can be done in-line in your setup code if you
like, but it's probably cleaner to provide a separate routine similar to the
jpeg_stdio_src() or jpeg_mem_src() routines of the supplied source managers.

For more information, consult the memory and stdio source and destination
managers in jdatasrc.c and jdatadst.c.

I/O suspension

Some applications need to use the JPEG library as an incremental memory-to-
memory
 filter: when the compressed data buffer is filled or emptied, they want
control to return to the outer loop, rather than expecting that the buffer can
be emptied or reloaded within the data source/destination manager subroutine.
The library supports this need by providing an "I/O suspension" mode, which we
describe in this section.

The I/O suspension mode is not a panacea: nothing is guaranteed about the
maximum amount of time spent in any one call to the library, so it will not
eliminate response-time problems in single-threaded applications. If you
need guaranteed response time, we suggest you "bite the bullet" and implement
a real multi-tasking capability.

To use I/O suspension, cooperation is needed between the calling application
and the data source or destination manager; you will always need a custom
source/destination manager. (Please read the previous section if you haven't
already.) The basic idea is that the empty_output_buffer() or
fill_input_buffer() routine
 is a no-op, merely returning FALSE to indicate
that it has done nothing. Upon seeing this, the JPEG library suspends
operation and returns to its caller. The surrounding application is

responsible for emptying or refilling the work buffer before calling the
JPEG library again.

Compression suspension:

For compression suspension, use an empty_output_buffer() routine that returns
FALSE; typically it will not do anything else. This will cause the
compressor to return to the caller of jpeg_write_scanlines(), with the return
value indicating that not all the supplied scanlines have been accepted.
The application must make more room in the output buffer, adjust the output
buffer pointer/count appropriately, and then call jpeg_write_scanlines()
again, pointing to the first unconsumed scanline.

When forced to suspend, the compressor will backtrack to a convenient stopping
point (usually the start of the current MCU); it will regenerate some output
data when restarted. Therefore, although
 empty_output_buffer() is only
called when the buffer is filled, you should NOT write out the entire buffer
after a suspension. Write only the data up to the current position of
next_output_byte/free_in_buffer. The data beyond that point will be
regenerated after resumption.

Because of the backtracking behavior, a good-size output buffer is essential
for efficiency; you don't want the compressor to suspend often. (In fact, an
overly small buffer could lead to infinite looping, if a single MCU required
more data than would fit in the buffer.) We recommend a buffer of at least
several Kbytes. You may want to insert explicit code to ensure that you don't
call jpeg_write_scanlines() unless there is a reasonable amount of space in
the output buffer; in other words, flush the buffer before trying to compress
more data.

The compressor does not allow suspension while it is trying to write JPEG
markers at the beginning and end of the file. This means that:
 * At the beginning of
 a compression operation, there must be enough free
   space in the output buffer to hold the header markers (typically 600 or
   so bytes). The recommended buffer size is bigger than this anyway, so
   this is not a problem as long as you start with an empty buffer. However,
   this restriction might catch you if you insert large special markers, such
   as a JFIF thumbnail image, without flushing the buffer afterwards.
 * When you call jpeg_finish_compress(), there must be enough space in the
   output buffer to emit any buffered data and the final EOI marker. In the
   current implementation, half a dozen bytes should suffice for this, but
   for safety's sake we recommend ensuring that at least 100 bytes are free
   before calling jpeg_finish_compress().

A more significant restriction is that jpeg_finish_compress() cannot suspend.
This means you cannot use suspension with multi-pass operating modes, namely

Huffman code optimization and multiple-scan output. Those modes write the
whole file during jpeg_finish_compress(), which will certainly result in
buffer overrun. (Note that this restriction applies only to compression,
not decompression. The decompressor supports input suspension in all of its
operating modes.)

Decompression suspension:

For decompression suspension, use a fill_input_buffer() routine that simply
returns FALSE (except perhaps during error recovery, as discussed below).
This will cause the decompressor to return to its caller with an indication
that suspension has occurred. This can happen at four places:
 * jpeg_read_header(): will return JPEG_SUSPENDED.
 * jpeg_start_decompress(): will return FALSE, rather than its usual TRUE.
 * jpeg_read_scanlines(): will return the number of scanlines already
 completed (possibly 0).
 * jpeg_finish_decompress(): will return FALSE, rather than its usual TRUE.
The surrounding application must recognize these cases, load more data into
the input buffer, and repeat the call. In the case
 of jpeg_read_scanlines(),
increment the passed pointers past any scanlines successfully read.

Just as with compression, the decompressor will typically backtrack to a
convenient restart point before suspending. When fill_input_buffer() is
called, next_input_byte/bytes_in_buffer point to the current restart point,
which is where the decompressor will backtrack to if FALSE is returned.
The data beyond that position must NOT be discarded if you suspend; it needs
to be re-read upon resumption. In most implementations, you'll need to shift
this data down to the start of your work buffer and then load more data after
it. Again, this behavior means that a several-Kbyte work buffer is essential
for decent performance; furthermore, you should load a reasonable amount of
new data before resuming decompression. (If you loaded, say, only one new
byte each time around, you could waste a LOT of cycles.)

The skip_input_data() source manager routine requires special care in a
suspension scenario.
  This routine is NOT granted the ability to suspend the
decompressor; it can decrement bytes_in_buffer to zero, but no more. If the
requested skip distance exceeds the amount of data currently in the input
buffer, then skip_input_data() must set bytes_in_buffer to zero and record the
additional skip distance somewhere else. The decompressor will immediately
call fill_input_buffer(), which should return FALSE, which will cause a
suspension return. The surrounding application must then arrange to discard
the recorded number of bytes before it resumes loading the input buffer.
(Yes, this design is rather baroque, but it avoids complexity in the far more
common case where a non-suspending source manager is used.)

If the input data has been exhausted, we recommend that you emit a warning and insert dummy EOI markers just as a non-suspending data source manager would do. This can be handled either in the surrounding application logic or within fill_input_buffer(); the latter is probably
more efficient. If
fill_input_buffer() knows that no more data is available, it can set the pointer/count to point to a dummy EOI marker and then return TRUE just as though it had read more data in a non-suspending situation.

The decompressor does not attempt to suspend within standard JPEG markers; instead it will backtrack to the start of the marker and reprocess the whole marker next time. Hence the input buffer must be large enough to hold the longest standard marker in the file. Standard JPEG markers should normally not exceed a few hundred bytes each (DHT tables are typically the longest). We recommend at least a 2K buffer for performance reasons, which is much larger than any correct marker is likely to be. For robustness against damaged marker length counts, you may wish to insert a test in your application for the case that the input buffer is completely full and yet the decoder has suspended without consuming any data --- otherwise, if this situation did occur, it would
lead to an endless loop. (The library can't
provide this test since it has no idea whether "the buffer is full", or even whether there is a fixed-size input buffer.)

The input buffer would need to be 64K to allow for arbitrary COM or APPn markers, but these are handled specially: they are either saved into allocated memory, or skipped over by calling skip_input_data(). In the former case, suspension is handled correctly, and in the latter case, the problem of buffer overrun is placed on skip_input_data's shoulders, as explained above. Note that if you provide your own marker handling routine for large markers, you should consider how to deal with buffer overflow.

Multiple-buffer management:

In some applications it is desirable to store the compressed data in a linked list of buffer areas, so as to avoid data copying. This can be handled by having empty_output_buffer() or fill_input_buffer() set the pointer and count to reference the next available buffer; FALSE is returned only
if no more
buffers are available. Although seemingly straightforward, there is a pitfall in this approach: the backtrack that occurs when FALSE is returned could back up into an earlier buffer. For example, when fill_input_buffer() is called, the current pointer & count indicate the backtrack restart point. Since fill_input_buffer() will set the pointer and count to refer to a new buffer, the restart position must be saved somewhere else. Suppose a second call to fill_input_buffer() occurs in the same library call, and no additional input data is available, so fill_input_buffer must return FALSE. If the JPEG library has not moved the pointer/count forward in the current

buffer, then *the correct restart point is the saved position in the prior buffer*. Prior buffers may be discarded only after the library establishes a restart point within a later buffer. Similar remarks apply for output into a chain of buffers.

The library will never attempt to backtrack over a skip_input_data() call,
so any skipped data can be permanently discarded. You still have to deal with the case of skipping not-yet-received data, however.

It's much simpler to use only a single buffer; when fill_input_buffer() is called, move any unconsumed data (beyond the current pointer/count) down to the beginning of this buffer and then load new data into the remaining buffer space. This approach requires a little more data copying but is far easier to get right.

Progressive JPEG support

Progressive JPEG rearranges the stored data into a series of scans of increasing quality. In situations where a JPEG file is transmitted across a slow communications link, a decoder can generate a low-quality image very quickly from the first scan, then gradually improve the displayed quality as more scans are received. The final image after all scans are complete is identical to that of a regular (sequential) JPEG file of the same quality setting. Progressive JPEG files are often
 slightly smaller than equivalent
sequential JPEG files, but the possibility of incremental display is the main reason for using progressive JPEG.

The IJG encoder library generates progressive JPEG files when given a suitable "scan script" defining how to divide the data into scans.
Creation of progressive JPEG files is otherwise transparent to the encoder.
Progressive JPEG files can also be read transparently by the decoder library.
If the decoding application simply uses the library as defined above, it will receive a final decoded image without any indication that the file was progressive. Of course, this approach does not allow incremental display.
To perform incremental display, an application needs to use the decoder library's "buffered-image" mode, in which it receives a decoded image multiple times.

Each displayed scan requires about as much work to decode as a full JPEG image of the same size, so the decoder must be fairly fast in relation to the data transmission rate in
 order to make incremental display useful. However,
it is possible to skip displaying the image and simply add the incoming bits to the decoder's coefficient buffer. This is fast because only Huffman

decoding need be done, not IDCT, upsampling, colorspace conversion, etc.
The IJG decoder library allows the application to switch dynamically between
displaying the image and simply absorbing the incoming bits. A properly
coded application can automatically adapt the number of display passes to
suit the time available as the image is received. Also, a final
higher-quality display cycle can be performed from the buffered data after
the end of the file is reached.

Progressive compression:

To create a progressive JPEG file (or a multiple-scan sequential JPEG file),
set the scan_info cinfo field to point to an array of scan descriptors, and
perform compression as usual. Instead of constructing your own scan list,
you can call the jpeg_simple_progression() helper routine to create a
recommended
 progression sequence; this method should be used by all
applications that don't want to get involved in the nitty-gritty of
progressive scan sequence design. (If you want to provide user control of
scan sequences, you may wish to borrow the scan script reading code found
in rdswitch.c, so that you can read scan script files just like cjpeg's.)
When scan_info is not NULL, the compression library will store DCT'd data
into a buffer array as jpeg_write_scanlines() is called, and will emit all
the requested scans during jpeg_finish_compress(). This implies that
multiple-scan output cannot be created with a suspending data destination
manager, since jpeg_finish_compress() does not support suspension. We
should also note that the compressor currently forces Huffman optimization
mode when creating a progressive JPEG file, because the default Huffman
tables are unsuitable for progressive files.

Progressive decompression:

When buffered-image mode is not used, the decoder library will
 read all of
a multi-scan file during jpeg_start_decompress(), so that it can provide a
final decoded image. (Here "multi-scan" means either progressive or
multi-scan sequential.) This makes multi-scan files transparent to the
decoding application. However, existing applications that used suspending
input with version 5 of the IJG library will need to be modified to check
for a suspension return from jpeg_start_decompress().

To perform incremental display, an application must use the library's
buffered-image mode. This is described in the next section.

Buffered-image mode

In buffered-image mode, the library stores the partially decoded image in a

coefficient buffer, from which it can be read out as many times as desired.
This mode is typically used for incremental display of progressive JPEG files,
but it can be used with any JPEG file. Each scan of a progressive JPEG file
adds more data (more detail) to the buffered image. The application can
display in
 lockstep with the source file (one display pass per input scan),
or it can allow input processing to outrun display processing. By making
input and display processing run independently, it is possible for the
application to adapt progressive display to a wide range of data transmission
rates.

The basic control flow for buffered-image decoding is

```
jpeg_create_decompress()
set data source
jpeg_read_header()
set overall decompression parameters
cinfo.buffered_image = TRUE; /* select buffered-image mode */
jpeg_start_decompress()
for (each output pass) {
    adjust output decompression parameters if required
    jpeg_start_output()  /* start a new output pass */
    for (all scanlines in image) {
        jpeg_read_scanlines()
        display scanlines
    }
    jpeg_finish_output() /* terminate output pass */
}
jpeg_finish_decompress()
jpeg_destroy_decompress()
```

This differs from ordinary unbuffered decoding in that there is an additional
level of looping. The application
 can choose how many output passes to make
and how to display each pass.

The simplest approach to displaying progressive images is to do one display
pass for each scan appearing in the input file. In this case the outer loop
condition is typically
 while (! jpeg_input_complete(&cinfo))
and the start-output call should read
 jpeg_start_output(&cinfo, cinfo.input_scan_number);
The second parameter to jpeg_start_output() indicates which scan of the input
file is to be displayed; the scans are numbered starting at 1 for this
purpose. (You can use a loop counter starting at 1 if you like, but using
the library's input scan counter is easier.) The library automatically reads
data as necessary to complete each requested scan, and jpeg_finish_output()
advances to the next scan or end-of-image marker (hence input_scan_number

will be incremented by the time control arrives back at jpeg_start_output()).
With this technique, data is read from the input file only as needed, and
input and output
 processing run in lockstep.

After reading the final scan and reaching the end of the input file, the
buffered image remains available; it can be read additional times by
repeating the jpeg_start_output()/jpeg_read_scanlines()/jpeg_finish_output()
sequence. For example, a useful technique is to use fast one-pass color
quantization for display passes made while the image is arriving, followed by
a final display pass using two-pass quantization for highest quality. This
is done by changing the library parameters before the final output pass.
Changing parameters between passes is discussed in detail below.

In general the last scan of a progressive file cannot be recognized as such
until after it is read, so a post-input display pass is the best approach if
you want special processing in the final pass.

When done with the image, be sure to call jpeg_finish_decompress() to release
the buffered image (or just use jpeg_destroy_decompress()).

If input data arrives faster than it can
 be displayed, the application can
cause the library to decode input data in advance of what's needed to produce
output. This is done by calling the routine jpeg_consume_input().
The return value is one of the following:
  JPEG_REACHED_SOS: reached an SOS marker (the start of a new scan)
  JPEG_REACHED_EOI: reached the EOI marker (end of image)
  JPEG_ROW_COMPLETED: completed reading one MCU row of compressed data
  JPEG_SCAN_COMPLETED: completed reading last MCU row of current scan
  JPEG_SUSPENDED: suspended before completing any of the above
(JPEG_SUSPENDED can occur only if a suspending data source is used.) This
routine can be called at any time after initializing the JPEG object. It
reads some additional data and returns when one of the indicated significant
events occurs. (If called after the EOI marker is reached, it will
immediately return JPEG_REACHED_EOI without attempting to read more data.)

The library's output processing will automatically call jpeg_consume_input()
whenever
 the output processing overtakes the input; thus, simple lockstep
display requires no direct calls to jpeg_consume_input(). But by adding
calls to jpeg_consume_input(), you can absorb data in advance of what is
being displayed. This has two benefits:
 * You can limit buildup of unprocessed data in your input buffer.
 * You can eliminate extra display passes by paying attention to the
   state of the library's input processing.

The first of these benefits only requires interspersing calls to

jpeg_consume_input() with your display operations and any other processing you may be doing. To avoid wasting cycles due to backtracking, it's best to call jpeg_consume_input() only after a hundred or so new bytes have arrived. This is discussed further under "I/O suspension", above. (Note: the JPEG library currently is not thread-safe. You must not call jpeg_consume_input() from one thread of control if a different library routine is working on the same JPEG object in another
 thread.)

When input arrives fast enough that more than one new scan is available before you start a new output pass, you may as well skip the output pass corresponding to the completed scan. This occurs for free if you pass cinfo.input_scan_number as the target scan number to jpeg_start_output(). The input_scan_number field is simply the index of the scan currently being consumed by the input processor. You can ensure that this is up-to-date by emptying the input buffer just before calling jpeg_start_output(): call jpeg_consume_input() repeatedly until it returns JPEG_SUSPENDED or JPEG_REACHED_EOI.

The target scan number passed to jpeg_start_output() is saved in the cinfo.output_scan_number field. The library's output processing calls jpeg_consume_input() whenever the current input scan number and row within that scan is less than or equal to the current output scan number and row. Thus, input processing can "get ahead" of the output processing but is not allowed to "fall behind".
  You can achieve several different effects by
manipulating this interlock rule. For example, if you pass a target scan number greater than the current input scan number, the output processor will wait until that scan starts to arrive before producing any output. (To avoid an infinite loop, the target scan number is automatically reset to the last scan number when the end of image is reached. Thus, if you specify a large target scan number, the library will just absorb the entire input file and then perform an output pass. This is effectively the same as what jpeg_start_decompress() does when you don't select buffered-image mode.) When you pass a target scan number equal to the current input scan number, the image is displayed no faster than the current input scan arrives. The final possibility is to pass a target scan number less than the current input scan number; this disables the input/output interlock and causes the output processor to simply display whatever it finds in the
 image buffer, without
waiting for input. (However, the library will not accept a target scan number less than one, so you can't avoid waiting for the first scan.)

When data is arriving faster than the output display processing can advance through the image, jpeg_consume_input() will store data into the buffered image beyond the point at which the output processing is reading data out again. If the input arrives fast enough, it may "wrap around" the buffer to the point where the input is more than one whole scan ahead of the output.

If the output processing simply proceeds through its display pass without
paying attention to the input, the effect seen on-screen is that the lower
part of the image is one or more scans better in quality than the upper part.
Then, when the next output scan is started, you have a choice of what target
scan number to use. The recommended choice is to use the current input scan
number at that time, which implies that you've skipped the output scans
corresponding
 to the input scans that were completed while you processed the
previous output scan. In this way, the decoder automatically adapts its
speed to the arriving data, by skipping output scans as necessary to keep up
with the arriving data.

When using this strategy, you'll want to be sure that you perform a final
output pass after receiving all the data; otherwise your last display may not
be full quality across the whole screen. So the right outer loop logic is
something like this:

```
 do {
     absorb any waiting input by calling jpeg_consume_input()
     final_pass = jpeg_input_complete(&cinfo);
     adjust output decompression parameters if required
     jpeg_start_output(&cinfo, cinfo.input_scan_number);
     ...
     jpeg_finish_output()
 } while (! final_pass);
```

rather than quitting as soon as jpeg_input_complete() returns TRUE. This
arrangement makes it simple to use higher-quality decoding parameters
for the final pass. But if you don't want to use special parameters for
the
 final pass, the right loop logic is like this:

```
 for (;;) {
     absorb any waiting input by calling jpeg_consume_input()
     jpeg_start_output(&cinfo, cinfo.input_scan_number);
     ...
     jpeg_finish_output()
     if (jpeg_input_complete(&cinfo) &&
        cinfo.input_scan_number == cinfo.output_scan_number)
       break;
 }
```

In this case you don't need to know in advance whether an output pass is to
be the last one, so it's not necessary to have reached EOF before starting
the final output pass; rather, what you want to test is whether the output
pass was performed in sync with the final input scan. This form of the loop
will avoid an extra output pass whenever the decoder is able (or nearly able)
to keep up with the incoming data.

When the data transmission speed is high, you might begin a display pass,
then find that much or all of the file has arrived before you can complete
the pass. (You can detect this by noting the JPEG_REACHED_EOI return code

from jpeg_consume_input(),
 or equivalently by testing jpeg_input_complete().)
In this situation you may wish to abort the current display pass and start a
new one using the newly arrived information. To do so, just call
jpeg_finish_output() and then start a new pass with jpeg_start_output().

A variant strategy is to abort and restart display if more than one complete
scan arrives during an output pass; this can be detected by noting
JPEG_REACHED_SOS returns and/or examining cinfo.input_scan_number. This
idea should be employed with caution, however, since the display process
might never get to the bottom of the image before being aborted, resulting
in the lower part of the screen being several passes worse than the upper.
In most cases it's probably best to abort an output pass only if the whole
file has arrived and you want to begin the final output pass immediately.

When receiving data across a communication link, we recommend always using
the current input scan number for the output target scan number;
 if a
higher-quality final pass is to be done, it should be started (aborting any
incomplete output pass) as soon as the end of file is received. However,
many other strategies are possible. For example, the application can examine
the parameters of the current input scan and decide whether to display it or
not. If the scan contains only chroma data, one might choose not to use it
as the target scan, expecting that the scan will be small and will arrive
quickly. To skip to the next scan, call jpeg_consume_input() until it
returns JPEG_REACHED_SOS or JPEG_REACHED_EOI. Or just use the next higher
number as the target scan for jpeg_start_output(); but that method doesn't
let you inspect the next scan's parameters before deciding to display it.

In buffered-image mode, jpeg_start_decompress() never performs input and
thus never suspends. An application that uses input suspension with
buffered-image mode must be prepared for suspension returns from these
routines:
* jpeg_start_output()
 performs input only if you request 2-pass quantization
 and the target scan isn't fully read yet. (This is discussed below.)
* jpeg_read_scanlines(), as always, returns the number of scanlines that it
 was able to produce before suspending.
* jpeg_finish_output() will read any markers following the target scan,
 up to the end of the file or the SOS marker that begins another scan.
 (But it reads no input if jpeg_consume_input() has already reached the
 end of the file or a SOS marker beyond the target output scan.)
* jpeg_finish_decompress() will read until the end of file, and thus can
 suspend if the end hasn't already been reached (as can be tested by
 calling jpeg_input_complete()).
jpeg_start_output(), jpeg_finish_output(), and jpeg_finish_decompress()
all return TRUE if they completed their tasks, FALSE if they had to suspend.

In the event of a FALSE return, the application must load more input data
and repeat the call. Applications that use non-suspending data sources
 need
not check the return values of these three routines.

It is possible to change decoding parameters between output passes in the
buffered-image mode. The decoder library currently supports only very
limited changes of parameters. ONLY THE FOLLOWING parameter changes are
allowed after jpeg_start_decompress() is called:
* dct_method can be changed before each call to jpeg_start_output().
 For example, one could use a fast DCT method for early scans, changing
 to a higher quality method for the final scan.
* dither_mode can be changed before each call to jpeg_start_output();
 of course this has no impact if not using color quantization. Typically
 one would use ordered dither for initial passes, then switch to
 Floyd-Steinberg dither for the final pass. Caution: changing dither mode
 can cause more memory to be allocated by the library. Although the amount
 of memory involved is not large (a scanline or so), it may cause the
 initial max_memory_to_use specification to
 be exceeded, which in the worst
 case would result in an out-of-memory failure.
* do_block_smoothing can be changed before each call to jpeg_start_output().
 This setting is relevant only when decoding a progressive JPEG image.
 During the first DC-only scan, block smoothing provides a very "fuzzy" look
 instead of the very "blocky" look seen without it; which is better seems a
 matter of personal taste. But block smoothing is nearly always a win
 during later stages, especially when decoding a successive-approximation
 image: smoothing helps to hide the slight blockiness that otherwise shows
 up on smooth gradients until the lowest coefficient bits are sent.
* Color quantization mode can be changed under the rules described below.
 You *cannot* change between full-color and quantized output (because that
 would alter the required I/O buffer sizes), but you can change which
 quantization method is used.

When generating color-quantized output, changing quantization method is
 a
very useful way of switching between high-speed and high-quality display.
The library allows you to change among its three quantization methods:
1. Single-pass quantization to a fixed color cube.
  Selected by cinfo.two_pass_quantize = FALSE and cinfo.colormap = NULL.
2. Single-pass quantization to an application-supplied colormap.
  Selected by setting cinfo.colormap to point to the colormap (the value of
  two_pass_quantize is ignored); also set cinfo.actual_number_of_colors.
3. Two-pass quantization to a colormap chosen specifically for the image.
  Selected by cinfo.two_pass_quantize = TRUE and cinfo.colormap = NULL.
  (This is the default setting selected by jpeg_read_header, but it is
  probably NOT what you want for the first pass of progressive display!)

These methods offer successively better quality and lesser speed. However,
only the first method is available for quantizing in non-RGB color spaces.

IMPORTANT: because the different quantizer methods have very different
working-storage
 requirements, the library requires you to indicate which
one(s) you intend to use before you call jpeg_start_decompress(). (If we did
not require this, the max_memory_to_use setting would be a complete fiction.)
You do this by setting one or more of these three cinfo fields to TRUE:
 enable_1pass_quant Fixed color cube colormap
 enable_external_quant Externally-supplied colormap
 enable_2pass_quant Two-pass custom colormap
All three are initialized FALSE by jpeg_read_header(). But
jpeg_start_decompress() automatically sets TRUE the one selected by the
current two_pass_quantize and colormap settings, so you only need to set the
enable flags for any other quantization methods you plan to change to later.

After setting the enable flags correctly at jpeg_start_decompress() time, you
can change to any enabled quantization method by setting two_pass_quantize
and colormap properly just before calling jpeg_start_output(). The following
special rules apply:
1. You must
 explicitly set cinfo.colormap to NULL when switching to 1-pass
  or 2-pass mode from a different mode, or when you want the 2-pass
  quantizer to be re-run to generate a new colormap.
2. To switch to an external colormap, or to change to a different external
  colormap than was used on the prior pass, you must call
  jpeg_new_colormap() after setting cinfo.colormap.
NOTE: if you want to use the same colormap as was used in the prior pass,
you should not do either of these things. This will save some nontrivial
switchover costs.
(These requirements exist because cinfo.colormap will always be non-NULL
after completing a prior output pass, since both the 1-pass and 2-pass
quantizers set it to point to their output colormaps. Thus you have to
do one of these two things to notify the library that something has changed.
Yup, it's a bit klugy, but it's necessary to do it this way for backwards
compatibility.)

Note that in buffered-image mode, the library generates any requested colormap
during
 jpeg_start_output(), not during jpeg_start_decompress().

When using two-pass quantization, jpeg_start_output() makes a pass over the
buffered image to determine the optimum color map; it therefore may take a
significant amount of time, whereas ordinarily it does little work. The
progress monitor hook is called during this pass, if defined. It is also
important to realize that if the specified target scan number is greater than
or equal to the current input scan number, jpeg_start_output() will attempt

to consume input as it makes this pass. If you use a suspending data source,
you need to check for a FALSE return from jpeg_start_output() under these
conditions. The combination of 2-pass quantization and a not-yet-fully-read
target scan is the only case in which jpeg_start_output() will consume input.

Application authors who support buffered-image mode may be tempted to use it
for all JPEG images, even single-scan ones. This will work, but it is
inefficient: there is
 no need to create an image-sized coefficient buffer for
single-scan images. Requesting buffered-image mode for such an image wastes
memory. Worse, it can cost time on large images, since the buffered data has
to be swapped out or written to a temporary file. If you are concerned about
maximum performance on baseline JPEG files, you should use buffered-image
mode only when the incoming file actually has multiple scans. This can be
tested by calling jpeg_has_multiple_scans(), which will return a correct
result at any time after jpeg_read_header() completes.

It is also worth noting that when you use jpeg_consume_input() to let input
processing get ahead of output processing, the resulting pattern of access to
the coefficient buffer is quite nonsequential. It's best to use the memory
manager jmemnobs.c if you can (ie, if you have enough real or virtual main
memory). If not, at least make sure that max_memory_to_use is set as high as
possible. If the JPEG memory manager has to use
 a temporary file, you will
probably see a lot of disk traffic and poor performance. (This could be
improved with additional work on the memory manager, but we haven't gotten
around to it yet.)

In some applications it may be convenient to use jpeg_consume_input() for all
input processing, including reading the initial markers; that is, you may
wish to call jpeg_consume_input() instead of jpeg_read_header() during
startup. This works, but note that you must check for JPEG_REACHED_SOS and
JPEG_REACHED_EOI return codes as the equivalent of jpeg_read_header's codes.
Once the first SOS marker has been reached, you must call
jpeg_start_decompress() before jpeg_consume_input() will consume more input;
it'll just keep returning JPEG_REACHED_SOS until you do. If you read a
tables-only file this way, jpeg_consume_input() will return JPEG_REACHED_EOI
without ever returning JPEG_REACHED_SOS; be sure to check for this case.
If this happens, the decompressor will not read any more input until you
 call
jpeg_abort() to reset it. It is OK to call jpeg_consume_input() even when not
using buffered-image mode, but in that case it's basically a no-op after the
initial markers have been read: it will just return JPEG_SUSPENDED.

Abbreviated datastreams and multiple images

A JPEG compression or decompression object can be reused to process multiple images. This saves a small amount of time per image by eliminating the "create" and "destroy" operations, but that isn't the real purpose of the feature. Rather, reuse of an object provides support for abbreviated JPEG datastreams. Object reuse can also simplify processing a series of images in a single input or output file. This section explains these features.

A JPEG file normally contains several hundred bytes worth of quantization and Huffman tables. In a situation where many images will be stored or transmitted with identical tables, this may represent an annoying overhead.
The JPEG
 standard therefore permits tables to be omitted. The standard
defines three classes of JPEG datastreams:
 * "Interchange" datastreams contain an image and all tables needed to decode
   the image. These are the usual kind of JPEG file.
 * "Abbreviated image" datastreams contain an image, but are missing some or
   all of the tables needed to decode that image.
 * "Abbreviated table specification" (henceforth "tables-only") datastreams
   contain only table specifications.
To decode an abbreviated image, it is necessary to load the missing table(s) into the decoder beforehand. This can be accomplished by reading a separate tables-only file. A variant scheme uses a series of images in which the first image is an interchange (complete) datastream, while subsequent ones are abbreviated and rely on the tables loaded by the first image. It is assumed that once the decoder has read a table, it will remember that table until a new definition for the same table number is encountered.

It
 is the application designer's responsibility to figure out how to associate the correct tables with an abbreviated image. While abbreviated datastreams can be useful in a closed environment, their use is strongly discouraged in any situation where data exchange with other applications might be needed.
Caveat designer.

The JPEG library provides support for reading and writing any combination of tables-only datastreams and abbreviated images. In both compression and decompression objects, a quantization or Huffman table will be retained for the lifetime of the object, unless it is overwritten by a new table definition.

To create abbreviated image datastreams, it is only necessary to tell the compressor not to emit some or all of the tables it is using. Each quantization and Huffman table struct contains a boolean field "sent_table", which normally is initialized to FALSE. For each table used by the image, the header-writing process emits the table and sets sent_table = TRUE
 unless it is
already TRUE. (In normal usage, this prevents outputting the same table

definition multiple times, as would otherwise occur because the chroma
components typically share tables.) Thus, setting this field to TRUE before
calling jpeg_start_compress() will prevent the table from being written at
all.

If you want to create a "pure" abbreviated image file containing no tables,
just call "jpeg_suppress_tables(&cinfo, TRUE)" after constructing all the
tables. If you want to emit some but not all tables, you'll need to set the
individual sent_table fields directly.

To create an abbreviated image, you must also call jpeg_start_compress()
with a second parameter of FALSE, not TRUE. Otherwise jpeg_start_compress()
will force all the sent_table fields to FALSE. (This is a safety feature to
prevent abbreviated images from being created accidentally.)

To create a tables-only file, perform the same parameter setup that you
normally would, but instead of calling jpeg_start_compress()
 and so on, call
jpeg_write_tables(&cinfo). This will write an abbreviated datastream
containing only SOI, DQT and/or DHT markers, and EOI. All the quantization
and Huffman tables that are currently defined in the compression object will
be emitted unless their sent_tables flag is already TRUE, and then all the
sent_tables flags will be set TRUE.

A sure-fire way to create matching tables-only and abbreviated image files
is to proceed as follows:

 create JPEG compression object
 set JPEG parameters
 set destination to tables-only file
 jpeg_write_tables(&cinfo);
 set destination to image file
 jpeg_start_compress(&cinfo, FALSE);
 write data...
 jpeg_finish_compress(&cinfo);

Since the JPEG parameters are not altered between writing the table file and
the abbreviated image file, the same tables are sure to be used. Of course,
you can repeat the jpeg_start_compress() ... jpeg_finish_compress() sequence
many times to produce many abbreviated image files matching the table file.

You
 cannot suppress output of the computed Huffman tables when Huffman
optimization is selected. (If you could, there'd be no way to decode the
image...) Generally, you don't want to set optimize_coding = TRUE when
you are trying to produce abbreviated files.

In some cases you might want to compress an image using tables which are

not stored in the application, but are defined in an interchange or
tables-only file readable by the application. This can be done by setting up
a JPEG decompression object to read the specification file, then copying the
tables into your compression object. See jpeg_copy_critical_parameters()
for an example of copying quantization tables.

To read abbreviated image files, you simply need to load the proper tables
into the decompression object before trying to read the abbreviated image.
If the proper tables are stored in the application program, you can just
allocate the table structs and fill in their contents directly. For example,
to load a fixed quantization
 table into table slot "n":

```
  if (cinfo.quant_tbl_ptrs[n] == NULL)
    cinfo.quant_tbl_ptrs[n] = jpeg_alloc_quant_table((j_common_ptr) &cinfo);
  quant_ptr = cinfo.quant_tbl_ptrs[n]; /* quant_ptr is JQUANT_TBL* */
  for (i = 0; i < 64; i++) {
   /* Qtable[] is desired quantization table, in natural array order */
   quant_ptr->quantval[i] = Qtable[i];
  }
```

Code to load a fixed Huffman table is typically (for AC table "n"):

```
  if (cinfo.ac_huff_tbl_ptrs[n] == NULL)
    cinfo.ac_huff_tbl_ptrs[n] = jpeg_alloc_huff_table((j_common_ptr) &cinfo);
  huff_ptr = cinfo.ac_huff_tbl_ptrs[n]; /* huff_ptr is JHUFF_TBL* */
  for (i = 1; i <= 16; i++) {
   /* counts[i] is number of Huffman codes of length i bits, i=1..16 */
   huff_ptr->bits[i] = counts[i];
  }
  for (i = 0; i < 256; i++) {
   /* symbols[] is the list of Huffman symbols, in code-length order */
   huff_ptr->huffval[i] = symbols[i];
  }
```

(Note that trying to set cinfo.quant_tbl_ptrs[n]
 to point directly at a
constant JQUANT_TBL object is not safe. If the incoming file happened to
contain a quantization table definition, your master table would get
overwritten! Instead allocate a working table copy and copy the master table
into it, as illustrated above. Ditto for Huffman tables, of course.)

You might want to read the tables from a tables-only file, rather than
hard-wiring them into your application. The jpeg_read_header() call is
sufficient to read a tables-only file. You must pass a second parameter of
FALSE to indicate that you do not require an image to be present. Thus, the
typical scenario is

```
create JPEG decompression object
set source to tables-only file
jpeg_read_header(&cinfo, FALSE);
set source to abbreviated image file
jpeg_read_header(&cinfo, TRUE);
set decompression parameters
jpeg_start_decompress(&cinfo);
read data...
jpeg_finish_decompress(&cinfo);
```

In some cases, you may want to read a file without knowing whether it contains
an image
 or just tables. In that case, pass FALSE and check the return value
from jpeg_read_header(): it will be JPEG_HEADER_OK if an image was found,
JPEG_HEADER_TABLES_ONLY if only tables were found. (A third return value,
JPEG_SUSPENDED, is possible when using a suspending data source manager.)
Note that jpeg_read_header() will not complain if you read an abbreviated
image for which you haven't loaded the missing tables; the missing-table check
occurs later, in jpeg_start_decompress().

It is possible to read a series of images from a single source file by
repeating the jpeg_read_header() ... jpeg_finish_decompress() sequence,
without releasing/recreating the JPEG object or the data source module.
(If you did reinitialize, any partial bufferload left in the data source
buffer at the end of one image would be discarded, causing you to lose the
start of the next image.) When you use this method, stored tables are
automatically carried forward, so some of the images can be abbreviated images
that
 depend on tables from earlier images.

If you intend to write a series of images into a single destination file,
you might want to make a specialized data destination module that doesn't
flush the output buffer at term_destination() time. This would speed things
up by some trifling amount. Of course, you'd need to remember to flush the
buffer after the last image. You can make the later images be abbreviated
ones by passing FALSE to jpeg_start_compress().

Special markers

Some applications may need to insert or extract special data in the JPEG
datastream. The JPEG standard provides marker types "COM" (comment) and
"APP0" through "APP15" (application) to hold application-specific data.
Unfortunately, the use of these markers is not specified by the standard.
COM markers are fairly widely used to hold user-supplied text. The JFIF file

format spec uses APP0 markers with specified initial strings to hold certain
data. Adobe applications use APP14 markers beginning
 with the string "Adobe"
for miscellaneous data. Other APPn markers are rarely seen, but might
contain almost anything.

If you wish to store user-supplied text, we recommend you use COM markers
and place readable 7-bit ASCII text in them. Newline conventions are not
standardized --- expect to find LF (Unix style), CR/LF (DOS style), or CR
(Mac style). A robust COM reader should be able to cope with random binary
garbage, including nulls, since some applications generate COM markers
containing non-ASCII junk. (But yours should not be one of them.)

For program-supplied data, use an APPn marker, and be sure to begin it with an
identifying string so that you can tell whether the marker is actually yours.
It's probably best to avoid using APP0 or APP14 for any private markers.
(NOTE: the upcoming SPIFF standard will use APP8 markers; we recommend you
not use APP8 markers for any private purposes, either.)

Keep in mind that at most 65533 bytes can be put into one marker, but you
can
 have as many markers as you like.

By default, the IJG compression library will write a JFIF APP0 marker if the
selected JPEG colorspace is grayscale or YCbCr, or an Adobe APP14 marker if
the selected colorspace is RGB, CMYK, or YCCK. You can disable this, but
we don't recommend it. The decompression library will recognize JFIF and
Adobe markers and will set the JPEG colorspace properly when one is found.

You can write special markers immediately following the datastream header by
calling jpeg_write_marker() after jpeg_start_compress() and before the first
call to jpeg_write_scanlines(). When you do this, the markers appear after
the SOI and the JFIF APP0 and Adobe APP14 markers (if written), but before
all else. Specify the marker type parameter as "JPEG_COM" for COM or
"JPEG_APP0 + n" for APPn. (Actually, jpeg_write_marker will let you write
any marker type, but we don't recommend writing any other kinds of marker.)
For example, to write a user comment string pointed to
 by comment_text:
 jpeg_write_marker(cinfo, JPEG_COM, comment_text, strlen(comment_text));

If it's not convenient to store all the marker data in memory at once,
you can instead call jpeg_write_m_header() followed by multiple calls to
jpeg_write_m_byte(). If you do it this way, it's your responsibility to
call jpeg_write_m_byte() exactly the number of times given in the length
parameter to jpeg_write_m_header(). (This method lets you empty the
output buffer partway through a marker, which might be important when
using a suspending data destination module. In any case, if you are using

a suspending destination, you should flush its buffer after inserting
any special markers. See "I/O suspension".)

Or, if you prefer to synthesize the marker byte sequence yourself,
you can just cram it straight into the data destination module.

If you are writing JFIF 1.02 extension markers (thumbnail images), don't
forget to set cinfo.JFIF_minor_version = 2 so that the encoder will write the
correct
 JFIF version number in the JFIF header marker. The library's default
is to write version 1.01, but that's wrong if you insert any 1.02 extension
markers. (We could probably get away with just defaulting to 1.02, but there
used to be broken decoders that would complain about unknown minor version
numbers. To reduce compatibility risks it's safest not to write 1.02 unless
you are actually using 1.02 extensions.)

When reading, two methods of handling special markers are available:
1. You can ask the library to save the contents of COM and/or APPn markers
into memory, and then examine them at your leisure afterwards.
2. You can supply your own routine to process COM and/or APPn markers
on-the-fly as they are read.
The first method is simpler to use, especially if you are using a suspending
data source; writing a marker processor that copes with input suspension is
not easy (consider what happens if the marker is longer than your available
input buffer). However, the second method
 conserves memory since the marker
data need not be kept around after it's been processed.

For either method, you'd normally set up marker handling after creating a
decompression object and before calling jpeg_read_header(), because the
markers of interest will typically be near the head of the file and so will
be scanned by jpeg_read_header. Once you've established a marker handling
method, it will be used for the life of that decompression object
(potentially many datastreams), unless you change it. Marker handling is
determined separately for COM markers and for each APPn marker code.

To save the contents of special markers in memory, call
 jpeg_save_markers(cinfo, marker_code, length_limit)
where marker_code is the marker type to save, JPEG_COM or JPEG_APP0+n.
(To arrange to save all the special marker types, you need to call this
routine 17 times, for COM and APP0-APP15.) If the incoming marker is longer
than length_limit data bytes, only length_limit bytes will be saved; this
parameter
 allows you to avoid chewing up memory when you only need to see the
first few bytes of a potentially large marker. If you want to save all the
data, set length_limit to 0xFFFF; that is enough since marker lengths are only

16 bits. As a special case, setting length_limit to 0 prevents that marker
type from being saved at all. (That is the default behavior, in fact.)

After jpeg_read_header() completes, you can examine the special markers by
following the cinfo->marker_list pointer chain. All the special markers in
the file appear in this list, in order of their occurrence in the file (but
omitting any markers of types you didn't ask for). Both the original data
length and the saved data length are recorded for each list entry; the latter
will not exceed length_limit for the particular marker type. Note that these
lengths exclude the marker length word, whereas the stored representation
within the JPEG file includes it. (Hence the maximum data length is really
only 65533.)

It
 is possible that additional special markers appear in the file beyond the
SOS marker at which jpeg_read_header stops; if so, the marker list will be
extended during reading of the rest of the file. This is not expected to be
common, however. If you are short on memory you may want to reset the length
limit to zero for all marker types after finishing jpeg_read_header, to
ensure that the max_memory_to_use setting cannot be exceeded due to addition
of later markers.

The marker list remains stored until you call jpeg_finish_decompress or
jpeg_abort, at which point the memory is freed and the list is set to empty.
(jpeg_destroy also releases the storage, of course.)

Note that the library is internally interested in APP0 and APP14 markers;
if you try to set a small nonzero length limit on these types, the library
will silently force the length up to the minimum it wants. (But you can set
a zero length limit to prevent them from being saved at all.) Also, in a
16-bit environment,
 the maximum length limit may be constrained to less than
65533 by malloc() limitations. It is therefore best not to assume that the
effective length limit is exactly what you set it to be.

If you want to supply your own marker-reading routine, you do it by calling
jpeg_set_marker_processor(). A marker processor routine must have the
signature
 boolean jpeg_marker_parser_method (j_decompress_ptr cinfo)
Although the marker code is not explicitly passed, the routine can find it
in cinfo->unread_marker. At the time of call, the marker proper has been
read from the data source module. The processor routine is responsible for
reading the marker length word and the remaining parameter bytes, if any.
Return TRUE to indicate success. (FALSE should be returned only if you are
using a suspending data source and it tells you to suspend. See the standard
marker processors in jdmarker.c for appropriate coding methods if you need to
use a suspending data source.)

If you override the default
 APP0 or APP14 processors, it is up to you to
recognize JFIF and Adobe markers if you want colorspace recognition to occur
properly. We recommend copying and extending the default processors if you
want to do that. (A better idea is to save these marker types for later
examination by calling jpeg_save_markers(); that method doesn't interfere
with the library's own processing of these markers.)

jpeg_set_marker_processor() and jpeg_save_markers() are mutually exclusive
--- if you call one it overrides any previous call to the other, for the
particular marker type specified.

A simple example of an external COM processor can be found in djpeg.c.
Also, see jpegtran.c for an example of using jpeg_save_markers.

Raw (downsampled) image data

Some applications need to supply already-downsampled image data to the JPEG
compressor, or to receive raw downsampled data from the decompressor. The
library supports this requirement by allowing the application to write
 or
read raw data, bypassing the normal preprocessing or postprocessing steps.
The interface is different from the standard one and is somewhat harder to
use. If your interest is merely in bypassing color conversion, we recommend
that you use the standard interface and simply set jpeg_color_space =
in_color_space (or jpeg_color_space = out_color_space for decompression).
The mechanism described in this section is necessary only to supply or
receive downsampled image data, in which not all components have the same
dimensions.

To compress raw data, you must supply the data in the colorspace to be used
in the JPEG file (please read the earlier section on Special color spaces)
and downsampled to the sampling factors specified in the JPEG parameters.
You must supply the data in the format used internally by the JPEG library,
namely a JSAMPIMAGE array. This is an array of pointers to two-dimensional
arrays, each of type JSAMPARRAY. Each 2-D array holds the values for one
color component.
  This structure is necessary since the components are of
different sizes. If the image dimensions are not a multiple of the MCU size,
you must also pad the data correctly (usually, this is done by replicating
the last column and/or row). The data must be padded to a multiple of a DCT
block in each component: that is, each downsampled row must contain a
multiple of block_size valid samples, and there must be a multiple of
block_size sample rows for each component. (For applications such as

conversion of digital TV images, the standard image size is usually a
multiple of the DCT block size, so that no padding need actually be done.)

The procedure for compression of raw data is basically the same as normal
compression, except that you call jpeg_write_raw_data() in place of
jpeg_write_scanlines(). Before calling jpeg_start_compress(), you must do
the following:
 * Set cinfo->raw_data_in to TRUE. (It is set FALSE by jpeg_set_defaults().)
   This notifies the library that you will
 be supplying raw data.
   Furthermore, set cinfo->do_fancy_downsampling to FALSE if you want to use
   real downsampled data. (It is set TRUE by jpeg_set_defaults().)
 * Ensure jpeg_color_space is correct --- an explicit jpeg_set_colorspace()
   call is a good idea. Note that since color conversion is bypassed,
   in_color_space is ignored, except that jpeg_set_defaults() uses it to
   choose the default jpeg_color_space setting.
 * Ensure the sampling factors, cinfo->comp_info[i].h_samp_factor and
   cinfo->comp_info[i].v_samp_factor, are correct. Since these indicate the
   dimensions of the data you are supplying, it's wise to set them
   explicitly, rather than assuming the library's defaults are what you want.

To pass raw data to the library, call jpeg_write_raw_data() in place of
jpeg_write_scanlines(). The two routines work similarly except that
jpeg_write_raw_data takes a JSAMPIMAGE data array rather than JSAMPARRAY.
The scanlines count passed to and returned
 from jpeg_write_raw_data is
measured in terms of the component with the largest v_samp_factor.

jpeg_write_raw_data() processes one MCU row per call, which is to say
v_samp_factor*block_size sample rows of each component. The passed num_lines
value must be at least max_v_samp_factor*block_size, and the return value
will be exactly that amount (or possibly some multiple of that amount, in
future library versions). This is true even on the last call at the bottom
of the image; don't forget to pad your data as necessary.

The required dimensions of the supplied data can be computed for each
component as
 cinfo->comp_info[i].width_in_blocks*block_size samples per row
 cinfo->comp_info[i].height_in_blocks*block_size rows in image
after jpeg_start_compress() has initialized those fields. If the valid data
is smaller than this, it must be padded appropriately. For some sampling
factors and image sizes, additional dummy DCT blocks are inserted to make
the image a multiple of the MCU dimensions.
  The library creates such dummy
blocks itself; it does not read them from your supplied data. Therefore you
need never pad by more than block_size samples. An example may help here.
Assume 2h2v downsampling of YCbCr data, that is
 cinfo->comp_info[0].h_samp_factor = 2 for Y

cinfo->comp_info[0].v_samp_factor = 2
cinfo->comp_info[1].h_samp_factor = 1 for Cb
cinfo->comp_info[1].v_samp_factor = 1
cinfo->comp_info[2].h_samp_factor = 1 for Cr
cinfo->comp_info[2].v_samp_factor = 1

and suppose that the nominal image dimensions (cinfo->image_width and
cinfo->image_height) are 101x101 pixels. Then jpeg_start_compress() will
compute downsampled_width = 101 and width_in_blocks = 13 for Y,
downsampled_width = 51 and width_in_blocks = 7 for Cb and Cr (and the same
for the height fields). You must pad the Y data to at least 13*8 = 104
columns and rows, the Cb/Cr data to at least 7*8 = 56 columns and rows. The
MCU height is max_v_samp_factor = 2 DCT rows so you must pass at least 16
scanlines
 on each call to jpeg_write_raw_data(), which is to say 16 actual
sample rows of Y and 8 each of Cb and Cr. A total of 7 MCU rows are needed,
so you must pass a total of 7*16 = 112 "scanlines". The last DCT block row
of Y data is dummy, so it doesn't matter what you pass for it in the data
arrays, but the scanlines count must total up to 112 so that all of the Cb
and Cr data gets passed.

Output suspension is supported with raw-data compression: if the data
destination module suspends, jpeg_write_raw_data() will return 0.
In this case the same data rows must be passed again on the next call.

Decompression with raw data output implies bypassing all postprocessing.
You must deal with the color space and sampling factors present in the
incoming file. If your application only handles, say, 2h1v YCbCr data,
you must check for and fail on other color spaces or other sampling factors.
The library will not convert to a different color space for you.

To obtain raw data output,
 set cinfo->raw_data_out = TRUE before
jpeg_start_decompress() (it is set FALSE by jpeg_read_header()). Be sure to
verify that the color space and sampling factors are ones you can handle.
Furthermore, set cinfo->do_fancy_upsampling = FALSE if you want to get real
downsampled data (it is set TRUE by jpeg_read_header()).
Then call jpeg_read_raw_data() in place of jpeg_read_scanlines(). The
decompression process is otherwise the same as usual.

jpeg_read_raw_data() returns one MCU row per call, and thus you must pass a
buffer of at least max_v_samp_factor*block_size scanlines (scanline counting
is the same as for raw-data compression). The buffer you pass must be large
enough to hold the actual data plus padding to DCT-block boundaries. As with
compression, any entirely dummy DCT blocks are not processed so you need not
allocate space for them, but the total scanline count includes them. The
above example of computing buffer dimensions for raw-data compression is
equally valid for decompression.

Input
 suspension is supported with raw-data decompression: if the data source
module suspends, jpeg_read_raw_data() will return 0. You can also use
buffered-image mode to read raw data in multiple passes.

Really raw data: DCT coefficients

It is possible to read or write the contents of a JPEG file as raw DCT
coefficients. This facility is mainly intended for use in lossless
transcoding between different JPEG file formats. Other possible applications
include lossless cropping of a JPEG image, lossless reassembly of a
multi-strip or multi-tile TIFF/JPEG file into a single JPEG datastream, etc.

To read the contents of a JPEG file as DCT coefficients, open the file and do
jpeg_read_header() as usual. But instead of calling jpeg_start_decompress()
and jpeg_read_scanlines(), call jpeg_read_coefficients(). This will read the
entire image into a set of virtual coefficient-block arrays, one array per
component. The return value is a pointer
 to an array of virtual-array
descriptors. Each virtual array can be accessed directly using the JPEG
memory manager's access_virt_barray method (see Memory management, below,
and also read structure.txt's discussion of virtual array handling). Or,
for simple transcoding to a different JPEG file format, the array list can
just be handed directly to jpeg_write_coefficients().

Each block in the block arrays contains quantized coefficient values in
normal array order (not JPEG zigzag order). The block arrays contain only
DCT blocks containing real data; any entirely-dummy blocks added to fill out
interleaved MCUs at the right or bottom edges of the image are discarded
during reading and are not stored in the block arrays. (The size of each
block array can be determined from the width_in_blocks and height_in_blocks
fields of the component's comp_info entry.) This is also the data format
expected by jpeg_write_coefficients().

When you are done using the virtual arrays, call jpeg_finish_decompress()
to
 release the array storage and return the decompression object to an idle
state; or just call jpeg_destroy() if you don't need to reuse the object.

If you use a suspending data source, jpeg_read_coefficients() will return
NULL if it is forced to suspend; a non-NULL return value indicates successful
completion. You need not test for a NULL return value when using a
non-suspending data source.

It is also possible to call jpeg_read_coefficients() to obtain access to the

decoder's coefficient arrays during a normal decode cycle in buffered-image
mode. This frammish might be useful for progressively displaying an incoming
image and then re-encoding it without loss. To do this, decode in buffered-
image mode as discussed previously, then call jpeg_read_coefficients() after
the last jpeg_finish_output() call. The arrays will be available for your use
until you call jpeg_finish_decompress().

To write the contents of a JPEG file as DCT coefficients, you must provide
the
 DCT coefficients stored in virtual block arrays. You can either pass
block arrays read from an input JPEG file by jpeg_read_coefficients(), or
allocate virtual arrays from the JPEG compression object and fill them
yourself. In either case, jpeg_write_coefficients() is substituted for
jpeg_start_compress() and jpeg_write_scanlines(). Thus the sequence is
 * Create compression object
 * Set all compression parameters as necessary
 * Request virtual arrays if needed
 * jpeg_write_coefficients()
 * jpeg_finish_compress()
 * Destroy or re-use compression object
jpeg_write_coefficients() is passed a pointer to an array of virtual block
array descriptors; the number of arrays is equal to cinfo.num_components.

The virtual arrays need only have been requested, not realized, before
jpeg_write_coefficients() is called. A side-effect of
jpeg_write_coefficients() is to realize any virtual arrays that have been
requested from the compression object's memory manager. Thus, when obtaining
the
 virtual arrays from the compression object, you should fill the arrays
after calling jpeg_write_coefficients(). The data is actually written out
when you call jpeg_finish_compress(); jpeg_write_coefficients() only writes
the file header.

When writing raw DCT coefficients, it is crucial that the JPEG quantization
tables and sampling factors match the way the data was encoded, or the
resulting file will be invalid. For transcoding from an existing JPEG file,
we recommend using jpeg_copy_critical_parameters(). This routine initializes
all the compression parameters to default values (like jpeg_set_defaults()),
then copies the critical information from a source decompression object.
The decompression object should have just been used to read the entire
JPEG input file --- that is, it should be awaiting jpeg_finish_decompress().

jpeg_write_coefficients() marks all tables stored in the compression object
as needing to be written to the output file (thus, it acts like
jpeg_start_compress(cinfo,
 TRUE)). This is for safety's sake, to avoid
emitting abbreviated JPEG files by accident. If you really want to emit an

abbreviated JPEG file, call jpeg_suppress_tables(), or set the tables'
individual sent_table flags, between calling jpeg_write_coefficients() and
jpeg_finish_compress().

Progress monitoring

Some applications may need to regain control from the JPEG library every so
often. The typical use of this feature is to produce a percent-done bar or
other progress display. (For a simple example, see cjpeg.c or djpeg.c.)
Although you do get control back frequently during the data-transferring pass
(the jpeg_read_scanlines or jpeg_write_scanlines loop), any additional passes
will occur inside jpeg_finish_compress or jpeg_start_decompress; those
routines may take a long time to execute, and you don't get control back
until they are done.

You can define a progress-monitor routine which will be called periodically
by the library. No guarantees
 are made about how often this call will occur,
so we don't recommend you use it for mouse tracking or anything like that.
At present, a call will occur once per MCU row, scanline, or sample row
group, whichever unit is convenient for the current processing mode; so the
wider the image, the longer the time between calls. During the data
transferring pass, only one call occurs per call of jpeg_read_scanlines or
jpeg_write_scanlines, so don't pass a large number of scanlines at once if
you want fine resolution in the progress count. (If you really need to use
the callback mechanism for time-critical tasks like mouse tracking, you could
insert additional calls inside some of the library's inner loops.)

To establish a progress-monitor callback, create a struct jpeg_progress_mgr,
fill in its progress_monitor field with a pointer to your callback routine,
and set cinfo->progress to point to the struct. The callback will be called
whenever cinfo->progress is non-NULL. (This pointer is
 set to NULL by
jpeg_create_compress or jpeg_create_decompress; the library will not change
it thereafter. So if you allocate dynamic storage for the progress struct,
make sure it will live as long as the JPEG object does. Allocating from the
JPEG memory manager with lifetime JPOOL_PERMANENT will work nicely.) You
can use the same callback routine for both compression and decompression.

The jpeg_progress_mgr struct contains four fields which are set by the library:
 long pass_counter; /* work units completed in this pass */
 long pass_limit; /* total number of work units in this pass */
 int completed_passes; /* passes completed so far */
 int total_passes; /* total number of passes expected */
During any one pass, pass_counter increases from 0 up to (not including)
pass_limit; the step size is usually but not necessarily 1. The pass_limit

---

value may change from one pass to another. The expected total number of
passes is in total_passes, and the number of passes already completed
 is in
completed_passes. Thus the fraction of work completed may be estimated as
  completed_passes + (pass_counter/pass_limit)
  ----
    total_passes
ignoring the fact that the passes may not be equal amounts of work.

When decompressing, pass_limit can even change within a pass, because it
depends on the number of scans in the JPEG file, which isn't always known in
advance. The computed fraction-of-work-done may jump suddenly (if the library
discovers it has overestimated the number of scans) or even decrease (in the
opposite case). It is not wise to put great faith in the work estimate.

When using the decompressor's buffered-image mode, the progress monitor work
estimate is likely to be completely unhelpful, because the library has no way
to know how many output passes will be demanded of it. Currently, the library
sets total_passes based on the assumption that there will be one more output
pass if the input file end hasn't yet been read
 (jpeg_input_complete() isn't
TRUE), but no more output passes if the file end has been reached when the
output pass is started. This means that total_passes will rise as additional
output passes are requested. If you have a way of determining the input file
size, estimating progress based on the fraction of the file that's been read
will probably be more useful than using the library's value.

Memory management

This section covers some key facts about the JPEG library's built-in memory
manager. For more info, please read structure.txt's section about the memory
manager, and consult the source code if necessary.

All memory and temporary file allocation within the library is done via the
memory manager. If necessary, you can replace the "back end" of the memory
manager to control allocation yourself (for example, if you don't want the
library to use malloc() and free() for some reason).

Some data is allocated "permanently" and will not be freed until the JPEG
object
 is destroyed. Most data is allocated "per image" and is freed by
jpeg_finish_compress, jpeg_finish_decompress, or jpeg_abort. You can call the
memory manager yourself to allocate structures that will automatically be
freed at these times. Typical code for this is
 ptr = (*cinfo->mem->alloc_small) ((j_common_ptr) cinfo, JPOOL_IMAGE, size);
Use JPOOL_PERMANENT to get storage that lasts as long as the JPEG object.

Use alloc_large instead of alloc_small for anything bigger than a few Kbytes.
There are also alloc_sarray and alloc_barray routines that automatically
build 2-D sample or block arrays.

The library's minimum space requirements to process an image depend on the
image's width, but not on its height, because the library ordinarily works
with "strip" buffers that are as wide as the image but just a few rows high.
Some operating modes (eg, two-pass color quantization) require full-image
buffers. Such buffers are treated as "virtual arrays": only the current strip
need be in
 memory, and the rest can be swapped out to a temporary file.

If you use the simplest memory manager back end (jmemnobs.c), then no
temporary files are used; virtual arrays are simply malloc()'d. Images bigger
than memory can be processed only if your system supports virtual memory.
The other memory manager back ends support temporary files of various flavors
and thus work in machines without virtual memory. They may also be useful on
Unix machines if you need to process images that exceed available swap space.

When using temporary files, the library will make the in-memory buffers for
its virtual arrays just big enough to stay within a "maximum memory" setting.
Your application can set this limit by setting cinfo->mem->max_memory_to_use
after creating the JPEG object. (Of course, there is still a minimum size for
the buffers, so the max-memory setting is effective only if it is bigger than
the minimum space needed.) If you allocate any large structures yourself, you
must allocate
 them before jpeg_start_compress() or jpeg_start_decompress() in
order to have them counted against the max memory limit. Also keep in mind
that space allocated with alloc_small() is ignored, on the assumption that
it's too small to be worth worrying about; so a reasonable safety margin
should be left when setting max_memory_to_use.

If you use the jmemname.c or jmemdos.c memory manager back end, it is
important to clean up the JPEG object properly to ensure that the temporary
files get deleted. (This is especially crucial with jmemdos.c, where the
"temporary files" may be extended-memory segments; if they are not freed,
DOS will require a reboot to recover the memory.) Thus, with these memory
managers, it's a good idea to provide a signal handler that will trap any
early exit from your program. The handler should call either jpeg_abort()
or jpeg_destroy() for any active JPEG objects. A handler is not needed with
jmemnobs.c, and shouldn't be necessary with jmemansi.c or jmemmac.c
 either,
since the C library is supposed to take care of deleting files made with
tmpfile().

Memory usage

Working memory requirements while performing compression or decompression
depend on image dimensions, image characteristics (such as colorspace and
JPEG process), and operating mode (application-selected options).

As of v6b, the decompressor requires:
1. About 24K in more-or-less-fixed-size data. This varies a bit depending
   on operating mode and image characteristics (particularly color vs.
   grayscale), but it doesn't depend on image dimensions.
2. Strip buffers (of size proportional to the image width) for IDCT and
   upsampling results. The worst case for commonly used sampling factors
   is about 34 bytes * width in pixels for a color image. A grayscale image
   only needs about 8 bytes per pixel column.
3. A full-image DCT coefficient buffer is needed to decode a multi-scan JPEG
   file (including progressive JPEGs), or whenever you select buffered-image
   mode. This takes 2 bytes/coefficient. At typical 2x2 sampling, that's
   3 bytes per pixel for a color image. Worst case (1x1 sampling) requires
   6 bytes/pixel. For grayscale, figure 2 bytes/pixel.
4. To perform 2-pass color quantization, the decompressor also needs a
   128K color lookup table and a full-image pixel buffer (3 bytes/pixel).
This does not count any memory allocated by the application, such as a
buffer to hold the final output image.

The above figures are valid for 8-bit JPEG data precision and a machine with
32-bit ints. For 9-bit to 12-bit JPEG data, double the size of the strip
buffers and quantization pixel buffer. The "fixed-size" data will be
somewhat smaller with 16-bit ints, larger with 64-bit ints. Also, CMYK
or other unusual color spaces will require different amounts of space.

The full-image coefficient and pixel buffers, if needed at all, do not
have to be fully RAM resident; you can have the library use temporary
files instead
 when the total memory usage would exceed a limit you set.
(But if your OS supports virtual memory, it's probably better to just use
jmemnobs and let the OS do the swapping.)

The compressor's memory requirements are similar, except that it has no need
for color quantization. Also, it needs a full-image DCT coefficient buffer
if Huffman-table optimization is asked for, even if progressive mode is not
requested.

If you need more detailed information about memory usage in a particular
situation, you can enable the MEM_STATS code in jmemmgr.c.

Library compile-time options

A number of compile-time options are available by modifying jmorecfg.h.

The IJG code currently supports 8-bit to 12-bit sample data precision by
defining BITS_IN_JSAMPLE as 8, 9, 10, 11, or 12.
Note that a value larger than 8 causes JSAMPLE to be larger than a char,
so it affects the surrounding application's image data.
The sample applications cjpeg and djpeg can support deeper than 8-bit
 data
only for PPM and GIF file formats; you must disable the other file formats
to compile a 9-bit to 12-bit cjpeg or djpeg. (install.txt has more
information about that.)
Run-time selection and conversion of data precision are currently not
supported and may be added later.
Exception: The transcoding part (jpegtran) supports all settings in a
single instance, since it operates on the level of DCT coefficients and
not sample values.
(If you need to include an 8-bit library and a 9-bit to 12-bit library for
compression or decompression in a single application, you could probably do
it by defining NEED_SHORT_EXTERNAL_NAMES for just one of the copies. You'd
have to access the 8-bit and the 9-bit to 12-bit copies from separate
application source files. This is untested ... if you try it, we'd like to
hear whether it works!)

Note that the standard Huffman tables are only valid for 8-bit data precision.
If you selected more than 8-bit data precision, cjpeg uses arithmetic coding
by default.
  The Huffman encoder normally uses entropy optimization to
compute usable tables for higher precision. Otherwise, you'll have to
supply different default Huffman tables. You may also want to supply your
own DCT quantization tables; the existing quality-scaling code has been
developed for 8-bit use, and probably doesn't generate especially good tables
for 9-bit to 12-bit.

The maximum number of components (color channels) in the image is determined
by MAX_COMPONENTS. The JPEG standard allows up to 255 components, but we
expect that few applications will need more than four or so.

On machines with unusual data type sizes, you may be able to improve
performance or reduce memory space by tweaking the various typedefs in
jmorecfg.h. In particular, on some RISC CPUs, access to arrays of "short"s
is quite slow; consider trading memory for speed by making JCOEF, INT16, and
UINT16 be "int" or "unsigned int". UINT8 is also a candidate to become int.
You probably don't want to make
 JSAMPLE be int unless you have lots of memory
to burn.

You can reduce the size of the library by compiling out various optional
functions. To do this, undefine xxx_SUPPORTED symbols as necessary.

You can also save a few K by not having text error messages in the library; the standard error message table occupies about 5Kb. This is particularly reasonable for embedded applications where there's no good way to display a message anyway. To do this, remove the creation of the message table (jpeg_std_message_table[]) from jerror.c, and alter format_message to do something reasonable without it. You could output the numeric value of the message code number, for example. If you do this, you can also save a couple more K by modifying the TRACEMSn() macros in jerror.h to expand to nothing; you don't need trace capability anyway, right?

Portability considerations

The JPEG library has been written to be extremely portable; the sample applications cjpeg and djpeg
 are slightly less so. This section summarizes
the design goals in this area. (If you encounter any bugs that cause the library to be less portable than is claimed here, we'd appreciate hearing about them.)

The code works fine on ANSI C, C++, and pre-ANSI C compilers, using any of the popular system include file setups, and some not-so-popular ones too. See install.txt for configuration procedures.

The code is not dependent on the exact sizes of the C data types. As distributed, we make the assumptions that
 char is at least 8 bits wide
 short is at least 16 bits wide
 int is at least 16 bits wide
 long is at least 32 bits wide
(These are the minimum requirements of the ANSI C standard.) Wider types will work fine, although memory may be used inefficiently if char is much larger than 8 bits or short is much bigger than 16 bits. The code should work equally well with 16- or 32-bit ints.

In a system where these assumptions are not met, you may be able to make the code work by
 modifying the typedefs in jmorecfg.h. However, you will probably have difficulty if int is less than 16 bits wide, since references to plain int abound in the code.

char can be either signed or unsigned, although the code runs faster if an unsigned char type is available. If char is wider than 8 bits, you will need to redefine JOCTET and/or provide custom data source/destination managers so that JOCTET represents exactly 8 bits of data on external storage.

The JPEG library proper does not assume ASCII representation of characters. But some of the image file I/O modules in cjpeg/djpeg do have ASCII dependencies in file-header manipulation; so does cjpeg's select_file_type() routine.

The JPEG library does not rely heavily on the C library. In particular, C stdio is used only by the data source/destination modules and the error handler, all of which are application-replaceable. (cjpeg/djpeg are more heavily dependent on stdio.) malloc and free are called only from the memory manager
 "back end" module, so you can use a different memory allocator by replacing that one file.

The code generally assumes that C names must be unique in the first 15 characters. However, global function names can be made unique in the first 6 characters by defining NEED_SHORT_EXTERNAL_NAMES.

More info about porting the code may be gleaned by reading jconfig.txt, jmorecfg.h, and jinclude.h.

Notes for MS-DOS implementors

The IJG code is designed to work efficiently in 80x86 "small" or "medium" memory models (i.e., data pointers are 16 bits unless explicitly declared "far"; code pointers can be either size). You may be able to use small model to compile cjpeg or djpeg by itself, but you will probably have to use medium model for any larger application. This won't make much difference in performance. You *will* take a noticeable performance hit if you use a large-data memory model (perhaps 10%-25%), and you should avoid "huge" model if at all possible.

The
 JPEG library typically needs 2Kb-3Kb of stack space. It will also malloc about 20K-30K of near heap space while executing (and lots of far heap, but that doesn't count in this calculation). This figure will vary depending on selected operating mode, and to a lesser extent on image size. There is also about 5Kb-6Kb of constant data which will be allocated in the near data segment (about 4Kb of this is the error message table). Thus you have perhaps 20K available for other modules' static data and near heap space before you need to go to a larger memory model. The C library's static data will account for several K of this, but that still leaves a good deal for your needs. (If you are tight on space, you could reduce the sizes of the I/O buffers allocated by jdatasrc.c and jdatadst.c, say from 4K to 1K. Another possibility is to move the error message table to far memory; this should be doable with only localized hacking on jerror.c.)

About 2K of the near heap space is "permanent"
 memory that will not be
released until you destroy the JPEG object. This is only an issue if you
save a JPEG object between compression or decompression operations.

Far data space may also be a tight resource when you are dealing with large
images. The most memory-intensive case is decompression with two-pass color
quantization, or single-pass quantization to an externally supplied color
map. This requires a 128Kb color lookup table plus strip buffers amounting
to about 40 bytes per column for typical sampling ratios (eg, about 25600
bytes for a 640-pixel-wide image). You may not be able to process wide
images if you have large data structures of your own.

Of course, all of these concerns vanish if you use a 32-bit flat-memory-model
compiler, such as DJGPP or Watcom C. We highly recommend flat model if you
can use it; the JPEG library is significantly faster in flat model.

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/libjpeg.txt
No license file was found, but licenses were detected in source scan.

/*
* jdarith.c
*
* Developed 1997-2015 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains portable arithmetic entropy decoding routines for JPEG
* (implementing the ISO/IEC IS 10918-1 and CCITT Recommendation ITU-T T.81).
*
* Both sequential and progressive modes are supported in this single module.
*
* Suspension is not currently supported in this module.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jdarith.c
No license file was found, but licenses were detected in source scan.

/*
* transupp.c
*
* Copyright (C) 1997-2017, Thomas G. Lane, Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains image transformation routines and other utility code

* used by the jpegtran sample application. These are NOT part of the core
* JPEG library. But we keep these routines separate from jpegtran.c to
* ease the task of maintaining jpegtran-like programs that have other user
* interfaces.
*/

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* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/transupp.c
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/*
* rdswitch.c
*
* Copyright (C) 1991-1996, Thomas G. Lane.
* Modified 2003-2015 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains routines to process some of cjpeg's more complicated
* command-line switches. Switches processed here are:
* -qtables file Read quantization tables from text file
* -scans file Read scan script from text file
* -quality N[,N,...] Set quality ratings
* -qslots N[,N,...] Set component quantization table selectors
* -sample HxV[,HxV,...] Set component sampling factors
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/rdswitch.c
No license file was found, but licenses were detected in source scan.

/*
* jchuff.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modified 2006-2013 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains Huffman entropy encoding routines.
* Both sequential and progressive modes are supported in this single module.
*
* Much of the complexity here has to do with supporting output suspension.
* If the data destination module demands suspension, we want to be able to
* back up to the start of the current MCU. To do this, we copy state
* variables into local working storage, and update them back to the
* permanent JPEG objects only upon successful completion of an MCU.
*

* We do not support output suspension for the progressive JPEG mode, since

* the library currently does not allow multiple-scan files to be written

* with output suspension.

*/

Found

 in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jchuff.c

No license file was found, but licenses were detected in source scan.

/*

* jmemname.c

*

* Copyright (C) 1992-1997, Thomas G. Lane.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file provides a generic implementation of the system-dependent

* portion of the JPEG memory manager. This implementation assumes that

* you must explicitly construct a name for each temp file.

* Also, the problem of determining the amount of memory available

* is shoved onto the user.

*/

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jmemname.c

No license file was found, but licenses were detected in source scan.

/*

* jccoefct.c

*

* Copyright (C) 1994-1997, Thomas G. Lane.

* Modified 2003-2011 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains the coefficient buffer controller for compression.

* This controller is the top level of the JPEG compressor proper.

* The coefficient buffer lies between forward-DCT and entropy encoding steps.

*/

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jccoefct.c

No license file was found, but licenses were detected in source scan.

/*

* jdsample.c

*

* Copyright (C) 1991-1996, Thomas G. Lane.
* Modified 2002-2015 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains upsampling routines.
*
* Upsampling input data is counted in "row groups". A row group
* is defined to be (v_samp_factor * DCT_v_scaled_size / min_DCT_v_scaled_size)
* sample rows of each component. Upsampling will normally produce
* max_v_samp_factor pixel rows from each row group (but this could vary
* if the upsampler is applying a scale factor of its own).
*
* An excellent reference for image resampling is
*   Digital Image Warping, George Wolberg, 1990.
*   Pub. by IEEE Computer Society Press, Los Alamitos, CA. ISBN 0-8186-8944-7.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jdsample.c
No license file was found, but licenses were detected in source scan.

/*
* jdct.h
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2002-2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This include file contains common declarations for the forward and
* inverse DCT modules. These declarations are private to the DCT managers
* (jcdctmgr.c, jddctmgr.c) and the individual DCT algorithms.
* The individual DCT algorithms are kept in separate files to ease
* machine-dependent tuning (e.g., assembly coding).
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jdct.h
No license file was found, but licenses were detected in source scan.

/*
* jdmainct.c
*
* Copyright (C) 1994-1996, Thomas G. Lane.
* Modified 2002-2016 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.

*
* This file contains the main buffer controller for decompression.
* The main buffer lies between the JPEG decompressor proper and the
* post-processor; it holds downsampled data in the JPEG colorspace.
*
* Note that this code is bypassed in raw-data mode, since the application
* supplies the equivalent of the main buffer in that case.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jdmainct.c
No license file was found, but licenses were detected in source scan.

/*
* jmemdos.c
*
* Copyright (C) 1992-1997, Thomas G. Lane.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file provides an MS-DOS-compatible implementation of the system-
* dependent portion of the JPEG memory manager. Temporary data can be
* stored in extended or expanded memory as well as in regular DOS files.
*
* If you use this file, you must be sure that NEED_FAR_POINTERS is defined
* if you compile in a small-data memory model; it should NOT be defined if
* you use a large-data memory model. This file is not recommended if you
* are using a flat-memory-space 386 environment such as DJGCC or Watcom C.
* Also, this code will NOT work if struct fields are aligned on greater than
* 2-byte boundaries.
*
* Based on code contributed by Ge' Weijers.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jmemdos.c
No license file was found, but licenses were detected in source scan.

/*
* jidctint.c
*
* Copyright (C) 1991-1998, Thomas G. Lane.
* Modification developed 2002-2016 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a slow-but-accurate integer implementation of the
* inverse DCT (Discrete Cosine Transform). In the IJG code, this routine

* must also perform dequantization of the input coefficients.
*
* A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT
* on each row (or vice versa, but it's more convenient to emit a row at
* a time). Direct algorithms are also available, but they are much more
* complex and seem not to be any faster when reduced to code.
*
* This implementation is based on an algorithm described in
*   C. Loeffler, A. Ligtenberg and G. Moschytz, "Practical Fast 1-D DCT
*   Algorithms with 11 Multiplications",
 Proc. Int'l. Conf. on Acoustics,
*   Speech, and Signal Processing 1989 (ICASSP '89), pp. 988-991.
* The primary algorithm described there uses 11 multiplies and 29 adds.
* We use their alternate method with 12 multiplies and 32 adds.
* The advantage of this method is that no data path contains more than one
* multiplication; this allows a very simple and accurate implementation in
* scaled fixed-point arithmetic, with a minimal number of shifts.
*
* We also provide IDCT routines with various output sample block sizes for
* direct resolution reduction or enlargement and for direct resolving the
* common 2x1 and 1x2 subsampling cases without additional resampling: NxN
* (N=1...16), 2NxN, and Nx2N (N=1...8) pixels for one 8x8 input DCT block.
*
* For N<8 we simply take the corresponding low-frequency coefficients of
* the 8x8 input DCT block and apply an NxN point IDCT on the sub-block
* to yield the downscaled outputs.
* This can be seen as direct low-pass downsampling
 from the DCT domain
* point of view rather than the usual spatial domain point of view,
* yielding significant computational savings and results at least
* as good as common bilinear (averaging) spatial downsampling.
*
* For N>8 we apply a partial NxN IDCT on the 8 input coefficients as
* lower frequencies and higher frequencies assumed to be zero.
* It turns out that the computational effort is similar to the 8x8 IDCT
* regarding the output size.
* Furthermore, the scaling and descaling is the same for all IDCT sizes.
*
* CAUTION: We rely on the FIX() macro except for the N=1,2,4,8 cases
* since there would be too many additional constants to pre-calculate.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jidctint.c
No license file was found, but licenses were detected in source scan.

INSTALLATION INSTRUCTIONS for the Independent JPEG Group's JPEG software

Copyright (C) 1991-2017, Thomas G. Lane, Guido Vollbeding.
This file is part of the Independent JPEG Group's software.
For conditions of distribution and use, see the accompanying README file.

This file explains how to configure and install the IJG software. We have
tried to make this software extremely portable and flexible, so that it can be
adapted to almost any environment. The downside of this decision is that the
installation process is complicated. We have provided shortcuts to simplify
the task on common systems. But in any case, you will need at least a little
familiarity with C programming and program build procedures for your system.

If you are only using this software as part of a larger program, the larger
program's installation procedure may take care of configuring the IJG code.
For example, Ghostscript's installation script
 will configure the IJG code.
You don't need to read this file if you just want to compile Ghostscript.

If you are on a Unix machine, you may not need to read this file at all.
Try doing
 ./configure
 make
 make test
If that doesn't complain, do
 make install
(better do "make -n install" first to see if the makefile will put the files
where you want them). Read further if you run into snags or want to customize
the code for your system.

TABLE OF CONTENTS

BEFORE YOU START
================

Before installing the software you must unpack the distributed source code.
Since you are reading this file, you have probably already succeeded in this
task. However, there is a potential for error if you needed
 to convert the
files to the local standard text file format (for example, if you are on
MS-DOS you may have converted LF end-of-line to CR/LF). You must apply
such conversion to all the files EXCEPT those whose names begin with "test".
The test files contain binary data; if you change them in any way then the
self-test will give bad results.

Please check the last section of this file to see if there are hints for the
specific machine or compiler you are using.

CONFIGURING THE SOFTWARE
========================

To configure the IJG code for your system, you need to create two files:
 * jconfig.h: contains values for system-dependent #define symbols.
 * Makefile: controls the compilation process.
(On a non-Unix machine, you may create "project files" or some other
substitute for a Makefile. jconfig.h is needed in any environment.)

We provide three different ways to generate these files:
 * On a Unix system, you can just run the "configure" script.
 * We provide sample jconfig
 files and makefiles for popular machines;
   if your machine matches one of the samples, just copy the right sample
   files to jconfig.h and Makefile.
 * If all else fails, read the instructions below and make your own files.

Configuring the software using the automatic "configure" script
----

If you are on a Unix machine, you can just type
 ./configure
and let the configure script construct appropriate configuration files.
If you're using "csh" on an old version of System V, you might need to type
 sh configure
instead to prevent csh from trying to execute configure itself.
Expect configure to run for a few minutes, particularly on slower machines;
it works by compiling a series of test programs.

Configure was created with GNU Autoconf and it follows the usual conventions
for GNU configure scripts. It makes a few assumptions that you may want to
override. You can do this by providing optional switches to configure:

*
 Configure will build both static and shared libraries, if possible.
If you want to build libjpeg only as a static library, say
 ./configure --disable-shared
If you want to build libjpeg only as a shared library, say
 ./configure --disable-static
Configure uses GNU libtool to take care of system-dependent shared library
building methods.

* Configure will use gcc (GNU C compiler) if it's available, otherwise cc.
To force a particular compiler to be selected, use the CC option, for example
 ./configure CC='cc'
The same method can be used to include any unusual compiler switches.
For example, on HP-UX you probably want to say
 ./configure CC='cc -Aa'
to get HP's compiler to run in ANSI mode.

* The default CFLAGS setting is "-g" for non-gcc compilers, "-g -O2" for gcc.
You can override this by saying, for example,
 ./configure CFLAGS='-O2'
if you want to compile without debugging support.

* Configure will set up the makefile so that "make install" will install files
into /usr/local/bin,
 /usr/local/man, etc. You can specify an installation
prefix other than "/usr/local" by giving configure the option "--prefix=PATH".

* If you don't have a lot of swap space, you may need to enable the IJG
software's internal virtual memory mechanism. To do this, give the option
"--enable-maxmem=N" where N is the default maxmemory limit in megabytes.
This is discussed in more detail under "Selecting a memory manager", below.
You probably don't need to worry about this on reasonably-sized Unix machines,
unless you plan to process very large images.

Configure has some other features that are useful if you are cross-compiling
or working in a network of multiple machine types; but if you need those
features, you probably already know how to use them.

Configuring the software using one of the supplied jconfig and makefile files
----

If you have one of these systems, you can just use the provided configuration
files:

Makefile jconfig

file System and/or compiler

makefile.manx jconfig.manx Amiga, Manx Aztec C
makefile.sas jconfig.sas Amiga, SAS C
makeproj.mac jconfig.mac Apple Macintosh, Metrowerks CodeWarrior
mak*jpeg.st jconfig.st Atari ST/STE/TT, Pure C or Turbo C
makefile.bcc jconfig.bcc MS-DOS or OS/2, Borland C
makefile.dj jconfig.dj MS-DOS, DJGPP (Delorie's port of GNU C)
makefile.mc6 jconfig.mc6 MS-DOS, Microsoft C (16-bit only)
makefile.wat jconfig.wat MS-DOS, OS/2, or Windows NT, Watcom C
makefile.vc jconfig.vc Windows, MS Visual C++
makefile.vs jconfig.vc Windows, MS Visual C++ 6 Developer Studio
make*.vc6
makefile.vs jconfig.vc Windows, Visual Studio 2017 (v15)
make*.v15
makefile.b32 jconfig.vc Windows, Borland C++ 32-bit (bcc32)
makefile.mms jconfig.vms Digital VMS, with MMS software
makefile.vms jconfig.vms Digital VMS, without MMS software

Copy the proper jconfig file to jconfig.h and the makefile to Makefile (or
whatever your system uses as the standard makefile name). For
 more info see
the appropriate system-specific hints section near the end of this file.

Configuring the software by hand

First, generate a jconfig.h file. If you are moderately familiar with C,
the comments in jconfig.txt should be enough information to do this; just
copy jconfig.txt to jconfig.h and edit it appropriately. Otherwise, you may
prefer to use the ckconfig.c program. You will need to compile and execute
ckconfig.c by hand --- we hope you know at least enough to do that.
ckconfig.c may not compile the first try (in fact, the whole idea is for it
to fail if anything is going to). If you get compile errors, fix them by
editing ckconfig.c according to the directions given in ckconfig.c. Once
you get it to run, it will write a suitable jconfig.h file, and will also
print out some advice about which makefile to use.

You may also want to look at the canned jconfig files, if there is one for a
system similar to yours.

Second, select a makefile
 and copy it to Makefile (or whatever your system
uses as the standard makefile name). The most generic makefiles we provide
are
 makefile.ansi: if your C compiler supports function prototypes
 makefile.unix: if not.

(You have function prototypes if ckconfig.c put "#define HAVE_PROTOTYPES"
in jconfig.h.) You may want to start from one of the other makefiles if
there is one for a system similar to yours.

Look over the selected Makefile and adjust options as needed. In particular
you may want to change the CC and CFLAGS definitions. For instance, if you
are using GCC, set CC=gcc. If you had to use any compiler switches to get
ckconfig.c to work, make sure the same switches are in CFLAGS.

If you are on a system that doesn't use makefiles, you'll need to set up
project files (or whatever you do use) to compile all the source files and
link them into executable files cjpeg, djpeg, jpegtran, rdjpgcom, and wrjpgcom.
See the file lists in any of the makefiles to find out which files
 go into
each program. Note that the provided makefiles all make a "library" file
libjpeg first, but you don't have to do that if you don't want to; the file
lists identify which source files are actually needed for compression,
decompression, or both. As a last resort, you can make a batch script that
just compiles everything and links it all together; makefile.vms is an example
of this (it's for VMS systems that have no make-like utility).

Here are comments about some specific configuration decisions you'll
need to make:

Command line style

These programs can use a Unix-like command line style which supports
redirection and piping, like this:
 cjpeg inputfile >outputfile
 cjpeg <inputfile >outputfile
 source program | cjpeg >outputfile
The simpler "two file" command line style is just
 cjpeg inputfile outputfile
You may prefer the two-file style, particularly if you don't have pipes.

You MUST use two-file style on any system that doesn't cope well with binary
data
 fed through stdin/stdout; this is true for some MS-DOS compilers, for
example. If you're not on a Unix system, it's safest to assume you need
two-file style. (But if your compiler provides either the Posix-standard
fdopen() library routine or a Microsoft-compatible setmode() routine, you
can safely use the Unix command line style, by defining USE_FDOPEN or
USE_SETMODE respectively.)

To use the two-file style, make jconfig.h say "#define TWO_FILE_COMMANDLINE".

Selecting a memory manager

The IJG code is capable of working on images that are too big to fit in main
memory; data is swapped out to temporary files as necessary. However, the
code to do this is rather system-dependent. We provide five different
memory managers:

* jmemansi.c This version uses the ANSI-standard library routine tmpfile(),
  which not all non-ANSI systems have. On some systems
  tmpfile() may put the temporary file in a non-optimal
  location; if you don't like what it does,
 use jmemname.c.

* jmemname.c This version creates named temporary files. For anything
  except a Unix machine, you'll need to configure the
  select_file_name() routine appropriately; see the comments
  near the head of jmemname.c. If you use this version, define
  NEED_SIGNAL_CATCHER in jconfig.h to make sure the temp files
  are removed if the program is aborted.

* jmemnobs.c (That stands for No Backing Store :-).) This will compile on
  almost any system, but it assumes you have enough main memory
  or virtual memory to hold the biggest images you work with.

* jmemdos.c This should be used with most 16-bit MS-DOS compilers.
  See the system-specific notes about MS-DOS for more info.
  IMPORTANT: if you use this, define USE_MSDOS_MEMMGR in
  jconfig.h, and include the assembly file jmemdosa.asm in the
  programs. The supplied makefiles and jconfig files for
  16-bit MS-DOS compilers already do both.

* jmemmac.c Custom version for Apple Macintosh; see the system-specific
  notes
 for Macintosh for more info.

To use a particular memory manager, change the SYSDEPMEM variable in your
makefile to equal the corresponding object file name (for example, jmemansi.o
or jmemansi.obj for jmemansi.c).

If you have plenty of (real or virtual) main memory, just use jmemnobs.c.
"Plenty" means about ten bytes for every pixel in the largest images
you plan to process, so a lot of systems don't meet this criterion.
If yours doesn't, try jmemansi.c first. If that doesn't compile, you'll have
to use jmemname.c; be sure to adjust select_file_name() for local conditions.
You may also need to change unlink() to remove() in close_backing_store().

Except with jmemnobs.c or jmemmac.c, you need to adjust the DEFAULT_MAX_MEM
setting to a reasonable value for your system (either by adding a #define for

DEFAULT_MAX_MEM to jconfig.h, or by adding a -D switch to the Makefile).
This value limits the amount of data space the program will attempt to
allocate. Code and static data space isn't
 counted, so the actual memory
needs for cjpeg or djpeg are typically 100 to 150Kb more than the max-memory
setting. Larger max-memory settings reduce the amount of I/O needed to
process a large image, but too large a value can result in "insufficient
memory" failures. On most Unix machines (and other systems with virtual
memory), just set DEFAULT_MAX_MEM to several million and forget it. At the
other end of the spectrum, for MS-DOS machines you probably can't go much
above 300K to 400K. (On MS-DOS the value refers to conventional memory only.
Extended/expanded memory is handled separately by jmemdos.c.)

BUILDING THE SOFTWARE
=====================

Now you should be able to compile the software. Just say "make" (or
whatever's necessary to start the compilation). Have a cup of coffee.

Here are some things that could go wrong:

If your compiler complains about undefined structures, you should be able to
shut it up by putting "#define INCOMPLETE_TYPES_BROKEN" in jconfig.h.

If
 you have trouble with missing system include files or inclusion of the
wrong ones, read jinclude.h. This shouldn't happen if you used configure
or ckconfig.c to set up jconfig.h.

There are a fair number of routines that do not use all of their parameters;
some compilers will issue warnings about this, which you can ignore. There
are also a few configuration checks that may give "unreachable code" warnings.
Any other warning deserves investigation.

If you don't have a getenv() library routine, define NO_GETENV.

Also see the system-specific hints, below.

TESTING THE SOFTWARE
====================

As a quick test of functionality we've included a small sample image in
several forms:
 testorig.jpg Starting point for the djpeg tests.
 testimg.ppm The output of djpeg testorig.jpg
 testimg.bmp The output of djpeg -bmp -colors 256 testorig.jpg

testimg.jpg The output of cjpeg testimg.ppm
testprog.jpg Progressive-mode equivalent of testorig.jpg.
testimgp.jpg The output of cjpeg -progressive
-optimize testimg.ppm
(The first- and second-generation .jpg files aren't identical since the
default compression parameters are lossy.) If you can generate duplicates
of the testimg* files then you probably have working programs.

With most of the makefiles, "make test" will perform the necessary
comparisons.

If you're using a makefile that doesn't provide the test option, run djpeg
and cjpeg by hand and compare the output files to testimg* with whatever
binary file comparison tool you have. The files should be bit-for-bit
identical.

If the programs complain "MAX_ALLOC_CHUNK is wrong, please fix", then you
need to reduce MAX_ALLOC_CHUNK to a value that fits in type size_t.
Try adding "#define MAX_ALLOC_CHUNK 65520L" to jconfig.h. A less likely
configuration error is "ALIGN_TYPE is wrong, please fix": defining ALIGN_TYPE
as long should take care of that one.

If the cjpeg test run fails with "Missing Huffman code table entry", it's a
good bet that you needed to define RIGHT_SHIFT_IS_UNSIGNED.
 Go back to the
configuration step and run ckconfig.c. (This is a good plan for any other
test failure, too.)

If you are using Unix (one-file) command line style on a non-Unix system,
it's a good idea to check that binary I/O through stdin/stdout actually
works. You should get the same results from "djpeg <testorig.jpg >out.ppm"
as from "djpeg -outfile out.ppm testorig.jpg". Note that the makefiles all
use the latter style and therefore do not exercise stdin/stdout! If this
check fails, try recompiling with USE_SETMODE or USE_FDOPEN defined.
If it still doesn't work, better use two-file style.

If you chose a memory manager other than jmemnobs.c, you should test that
temporary-file usage works. Try "djpeg -bmp -colors 256 -max 0 testorig.jpg"
and make sure its output matches testimg.bmp. If you have any really large
images handy, try compressing them with -optimize and/or decompressing with
-colors 256 to make sure your DEFAULT_MAX_MEM setting is not too large.

NOTE:
 this is far from an exhaustive test of the JPEG software; some modules,
such as 1-pass color quantization, are not exercised at all. It's just a
quick test to give you some confidence that you haven't missed something
major.

INSTALLING THE SOFTWARE
=======================

Once you're done with the above steps, you can install the software by
copying the executable files (cjpeg, djpeg, jpegtran, rdjpgcom, and wrjpgcom)
to wherever you normally install programs. On Unix systems, you'll also want
to put the man pages (cjpeg.1, djpeg.1, jpegtran.1, rdjpgcom.1, wrjpgcom.1)
in the man-page directory. The pre-fab makefiles don't support this step
since there's such a wide variety of installation procedures on different
systems.

If you generated a Makefile with the "configure" script, you can just say
 make install
to install the programs and their man pages into the standard places.
(You'll probably need to be root to do this.) We recommend first saying
 make -n install
to see
 where configure thought the files should go. You may need to edit
the Makefile, particularly if your system's conventions for man page
filenames don't match what configure expects.

If you want to install the IJG library itself, for use in compiling other
programs besides ours, then you need to put the four include files
 jpeglib.h jerror.h jconfig.h jmorecfg.h
into your include-file directory, and put the library file libjpeg.a
(extension may vary depending on system) wherever library files go.
If you generated a Makefile with "configure", it will do what it thinks
is the right thing if you say
 make install-lib

OPTIONAL STUFF
==============

Progress monitor:

If you like, you can #define PROGRESS_REPORT (in jconfig.h) to enable display
of percent-done progress reports. The routine provided in cdjpeg.c merely
prints percentages to stderr, but you can customize it to do something
fancier.

Utah RLE file format support:

We distribute the software with support for RLE image files
 (Utah Raster
Toolkit format) disabled, because the RLE support won't compile without the
Utah library. If you have URT version 3.1 or later, you can enable RLE

support as follows:
 1. #define RLE_SUPPORTED in jconfig.h.
 2. Add a -I option to CFLAGS in the Makefile for the directory
      containing the URT .h files (typically the "include"
      subdirectory of the URT distribution).
 3. Add -L... -lrle to LDLIBS in the Makefile, where ... specifies
      the directory containing the URT "librle.a" file (typically the
      "lib" subdirectory of the URT distribution).

Support for 9-bit to 12-bit deep pixel data:

The IJG code currently allows 8, 9, 10, 11, or 12 bits sample data precision.
(For color, this means 8 to 12 bits per channel, of course.) If you need to
work with deeper than 8-bit data, you can compile the IJG code for 9-bit to
12-bit operation.
To do so:
 1. In jmorecfg.h, define BITS_IN_JSAMPLE as 9, 10, 11, or 12 rather than 8.
 2. In jconfig.h, undefine BMP_SUPPORTED,
 RLE_SUPPORTED, and TARGA_SUPPORTED,
      because the code for those formats doesn't handle deeper than 8-bit data
      and won't even compile. (The PPM code does work, as explained below.
      The GIF code works too; it scales 8-bit GIF data to and from 12-bit
      depth automatically.)
 3. Compile. Don't expect "make test" to pass, since the supplied test
      files are for 8-bit data.

Currently, 9-bit to 12-bit support does not work on 16-bit-int machines.

Run-time selection and conversion of data precision are currently not
supported and may be added later.
Exception: The transcoding part (jpegtran) supports all settings in a
single instance, since it operates on the level of DCT coefficients and
not sample values.

The PPM reader (rdppm.c) can read deeper than 8-bit data from either
text-format or binary-format PPM and PGM files. Binary-format PPM/PGM files
which have a maxval greater than 255 are assumed to use 2 bytes per sample,
MSB first (big-endian order). As of early
 1995, 2-byte binary format is not
officially supported by the PBMPLUS library, but it is expected that a
future release of PBMPLUS will support it. Note that the PPM reader will
read files of any maxval regardless of the BITS_IN_JSAMPLE setting; incoming
data is automatically rescaled to maxval=MAXJSAMPLE as appropriate for the
cjpeg bit depth.

The PPM writer (wrppm.c) will normally write 2-byte binary PPM or PGM
format, maxval=MAXJSAMPLE, when compiled with BITS_IN_JSAMPLE>8. Since this
format is not yet widely supported, you can disable it by compiling wrppm.c

with PPM_NORAWWORD defined; then the data is scaled down to 8 bits to make a
standard 1-byte/sample PPM or PGM file. (Yes, this means still another copy
of djpeg to keep around. But hopefully you won't need it for very long.
Poskanzer's supposed to get that new PBMPLUS release out Real Soon Now.)

Of course, if you are working with 9-bit to 12-bit data, you probably have
it stored in some other, nonstandard format. In
 that case you'll probably
want to write your own I/O modules to read and write your format.

Note:
The standard Huffman tables are only valid for 8-bit data precision. If
you selected more than 8-bit data precision, cjpeg uses arithmetic coding
by default. The Huffman encoder normally uses entropy optimization to
compute usable tables for higher precision. Otherwise, you'll have to
supply different default Huffman tables.

Removing code:

If you need to make a smaller version of the JPEG software, some optional
functions can be removed at compile time. See the xxx_SUPPORTED #defines in
jconfig.h and jmorecfg.h. If at all possible, we recommend that you leave in
decoder support for all valid JPEG files, to ensure that you can read anyone's
output. Taking out support for image file formats that you don't use is the
most painless way to make the programs smaller. Another possibility is to
remove some of the DCT methods: in particular, the "IFAST" method may not be
enough faster than
 the others to be worth keeping on your machine. (If you
do remove ISLOW or IFAST, be sure to redefine JDCT_DEFAULT or JDCT_FASTEST
to a supported method, by adding a #define in jconfig.h.)

OPTIMIZATION
============

Unless you own a Cray, you'll probably be interested in making the JPEG
software go as fast as possible. This section covers some machine-dependent
optimizations you may want to try. We suggest that before trying any of
this, you first get the basic installation to pass the self-test step.
Repeat the self-test after any optimization to make sure that you haven't
broken anything.

The integer DCT routines perform a lot of multiplications. These
multiplications must yield 32-bit results, but none of their input values
are more than 16 bits wide. On many machines, notably the 680x0 and 80x86
CPUs, a 16x16=>32 bit multiply instruction is faster than a full 32x32=>32
bit multiply. Unfortunately there is no portable way to specify such a
multiplication in C, but some

compilers can generate one when you use the
right combination of casts. See the MULTIPLYxxx macro definitions in
jdct.h. If your compiler makes "int" be 32 bits and "short" be 16 bits,
defining SHORTxSHORT_32 is fairly likely to work. When experimenting with
alternate definitions, be sure to test not only whether the code still works
(use the self-test), but also whether it is actually faster --- on some
compilers, alternate definitions may compute the right answer, yet be slower
than the default. Timing cjpeg on a large PGM (grayscale) input file is the
best way to check this, as the DCT will be the largest fraction of the runtime
in that mode. (Note: some of the distributed compiler-specific jconfig files
already contain #define switches to select appropriate MULTIPLYxxx
definitions.)

If your machine has sufficiently fast floating point hardware, you may find
that the float DCT method is faster than the integer DCT methods, even
after tweaking the integer multiply macros. In that
 case you may want to
make the float DCT be the default method. (The only objection to this is
that float DCT results may vary slightly across machines.) To do that, add
"#define JDCT_DEFAULT JDCT_FLOAT" to jconfig.h. Even if you don't change
the default, you should redefine JDCT_FASTEST, which is the method selected
by djpeg's -fast switch. Don't forget to update the documentation files
(usage.txt and/or cjpeg.1, djpeg.1) to agree with what you've done.

If access to "short" arrays is slow on your machine, it may be a win to
define type JCOEF as int rather than short. This will cost a good deal of
memory though, particularly in some multi-pass modes, so don't do it unless
you have memory to burn and short is REALLY slow.

If your compiler can compile function calls in-line, make sure the INLINE
macro in jmorecfg.h is defined as the keyword that marks a function
inline-able. Some compilers have a switch that tells the compiler to inline
any function it thinks is profitable (e.g.,
 -finline-functions for gcc).
Enabling such a switch is likely to make the compiled code bigger but faster.

In general, it's worth trying the maximum optimization level of your compiler,
and experimenting with any optional optimizations such as loop unrolling.
(Unfortunately, far too many compilers have optimizer bugs ... be prepared to
back off if the code fails self-test.) If you do any experimentation along
these lines, please report the optimal settings to jpeg-info@jpegclub.org so
we can mention them in future releases. Be sure to specify your machine and
compiler version.

HINTS FOR SPECIFIC SYSTEMS
==========================

We welcome reports on changes needed for systems not mentioned here. Submit
'em to jpeg-info@jpegclub.org. Also, if configure or ckconfig.c is wrong
about how to configure the JPEG software for your system, please let us know.

Acorn RISC OS:

(Thanks to Simon Middleton for these hints on compiling with Desktop C.)
After renaming the files according
 to Acorn conventions, take a copy of
makefile.ansi, change all occurrences of 'libjpeg.a' to 'libjpeg.o' and
change these definitions as indicated:

CFLAGS= -throwback -IC: -Wn
LDLIBS=C:o.Stubs
SYSDEPMEM=jmemansi.o
LN=Link
AR=LibFile -c -o

Also add a new line '.c.o:; $(cc) $< $(cflags) -c -o $@'. Remove the
lines '$(RM) libjpeg.o' and '$(AR2) libjpeg.o' and the 'jconfig.h'
dependency section.

Copy jconfig.txt to jconfig.h. Edit jconfig.h to define TWO_FILE_COMMANDLINE
and CHAR_IS_UNSIGNED.

Run the makefile using !AMU not !Make. If you want to use the 'clean' and
'test' makefile entries then you will have to fiddle with the syntax a bit
and rename the test files.

Amiga:

SAS C 6.50 reportedly is too buggy to compile the IJG code properly.
A patch to update to 6.51 is available from SAS or AmiNet FTP sites.

The supplied config files are set up to use jmemname.c as the memory
manager, with temporary files being created on the device named by
"JPEGTMP:".

Atari ST/STE/TT:

Copy
 the project files makcjpeg.st, makdjpeg.st, maktjpeg.st, and makljpeg.st
to cjpeg.prj, djpeg.prj, jpegtran.prj, and libjpeg.prj respectively. The
project files should work as-is with Pure C. For Turbo C, change library
filenames "pc..." to "tc..." in each project file. Note that libjpeg.prj

selects jmemansi.c as the recommended memory manager. You'll probably want to
adjust the DEFAULT_MAX_MEM setting --- you want it to be a couple hundred K
less than your normal free memory. Put "#define DEFAULT_MAX_MEM nnnn" into
jconfig.h to do this.

To use the 68881/68882 coprocessor for the floating point DCT, add the
compiler option "-8" to the project files and replace pcfltlib.lib with
pc881lib.lib in cjpeg.prj and djpeg.prj. Or if you don't have a
coprocessor, you may prefer to remove the float DCT code by undefining
DCT_FLOAT_SUPPORTED in jmorecfg.h (since without a coprocessor, the float
code will be too slow to be useful). In that case, you can delete
pcfltlib.lib from the project
 files.

Note that you must make libjpeg.lib before making cjpeg.ttp, djpeg.ttp,
or jpegtran.ttp. You'll have to perform the self-test by hand.

We haven't bothered to include project files for rdjpgcom and wrjpgcom.
Those source files should just be compiled by themselves; they don't
depend on the JPEG library. You can use the default.prj project file
of the Pure C distribution to make the programs.

There is a bug in some older versions of the Turbo C library which causes the
space used by temporary files created with "tmpfile()" not to be freed after
an abnormal program exit. If you check your disk afterwards, you will find
cluster chains that are allocated but not used by a file. This should not
happen in cjpeg/djpeg/jpegtran, since we enable a signal catcher to explicitly
close temp files before exiting. But if you use the JPEG library with your
own code, be sure to supply a signal catcher, or else use a different
system-dependent memory manager.

Cray:

Should you be so fortunate
 as to be running JPEG on a Cray YMP, there is a
compiler bug in old versions of Cray's Standard C (prior to 3.1). If you
still have an old compiler, you'll need to insert a line reading
"#pragma novector" just before the loop
    for (i = 1; i <= (int) htbl->bits[l]; i++)
      huffsize[p++] = (char) l;
in fix_huff_tbl (in V5beta1, line 204 of jchuff.c and line 176 of jdhuff.c).
[This bug may or may not still occur with the current IJG code, but it's
probably a dead issue anyway...]

HP-UX:

If you have HP-UX 7.05 or later with the "software development" C compiler, you should run the compiler in ANSI mode. If using the configure script, say
 ./configure CC='cc -Aa'
(or -Ae if you prefer). If configuring by hand, use makefile.ansi and add "-Aa" to the CFLAGS line in the makefile.

If you have a pre-7.05 system, or if you are using the non-ANSI C compiler delivered with a minimum HP-UX system, then you must use makefile.unix (and do NOT add -Aa); or just run configure without
 the CC option.

On HP 9000 series 800 machines, the HP C compiler is buggy in revisions prior to A.08.07. If you get complaints about "not a typedef name", you'll have to use makefile.unix, or run configure without the CC option.

Macintosh, generic comments:

The supplied user-interface files (cjpeg.c, djpeg.c, etc) are set up to provide a Unix-style command line interface. You can use this interface on the Mac by means of the ccommand() library routine provided by Metrowerks CodeWarrior or Think C. This is only appropriate for testing the library, however; to make a user-friendly equivalent of cjpeg/djpeg you'd really want to develop a Mac-style user interface. There isn't a complete example available at the moment, but there are some helpful starting points:
1. Sam Bushell's free "To JPEG" applet provides drag-and-drop conversion to JPEG under System 7 and later. This only illustrates how to use the compression half of the library, but it does a very nice job of that part. The
 CodeWarrior source code is available from http://www.pobox.com/~jsam.
2. Jim Brunner prepared a Mac-style user interface for both compression and decompression. Unfortunately, it hasn't been updated since IJG v4, and the library's API has changed considerably since then. Still it may be of some help, particularly as a guide to compiling the IJG code under Think C. Jim's code is available from the Info-Mac archives, at sumex-aim.stanford.edu or mirrors thereof; see file /info-mac/dev/src/jpeg-convert-c.hqx.

jmemmac.c is the recommended memory manager back end for Macintosh. It uses NewPtr/DisposePtr instead of malloc/free, and has a Mac-specific implementation of jpeg_mem_available(). It also creates temporary files that follow Mac conventions. (That part of the code relies on System-7-or-later OS functions. See the comments in jmemmac.c if you need to run it on System 6.) NOTE that USE_MAC_MEMMGR must be defined in jconfig.h to use jmemmac.c.

You can also use jmemnobs.c, if
 you don't care about handling images larger
than available memory. If you use any memory manager back end other than

jmemmac.c, we recommend replacing "malloc" and "free" by "NewPtr" and
"DisposePtr", because Mac C libraries often have peculiar implementations of
malloc/free. (For instance, free() may not return the freed space to the
Mac Memory Manager. This is undesirable for the IJG code because jmemmgr.c
already clumps space requests.)

Macintosh, Metrowerks CodeWarrior:

The Unix-command-line-style interface can be used by defining USE_CCOMMAND.
You'll also need to define TWO_FILE_COMMANDLINE to avoid stdin/stdout.
This means that when using the cjpeg/djpeg programs, you'll have to type the
input and output file names in the "Arguments" text-edit box, rather than
using the file radio buttons. (Perhaps USE_FDOPEN or USE_SETMODE would
eliminate the problem, but I haven't heard from anyone who's tried it.)

On 680x0 Macs, Metrowerks defines type "double" as a 10-byte IEEE extended
float.
  jmemmgr.c won't like this: it wants sizeof(ALIGN_TYPE) to be a power
of 2. Add "#define ALIGN_TYPE long" to jconfig.h to eliminate the complaint.

The supplied configuration file jconfig.mac can be used for your jconfig.h;
it includes all the recommended symbol definitions. If you have AppleScript
installed, you can run the supplied script makeproj.mac to create CodeWarrior
project files for the library and the testbed applications, then build the
library and applications. (Thanks to Dan Sears and Don Agro for this nifty
hack, which saves us from trying to maintain CodeWarrior project files as part
of the IJG distribution...)

Macintosh, Think C:

The documentation in Jim Brunner's "JPEG Convert" source code (see above)
includes detailed build instructions for Think C; it's probably somewhat
out of date for the current release, but may be helpful.

If you want to build the minimal command line version, proceed as follows.
You'll have to prepare project files for the programs;
 we don't include any
in the distribution since they are not text files. Use the file lists in
any of the supplied makefiles as a guide. Also add the ANSI and Unix C
libraries in a separate segment. You may need to divide the JPEG files into
more than one segment; we recommend dividing compression and decompression
modules. Define USE_CCOMMAND in jconfig.h so that the ccommand() routine is
called. You must also define TWO_FILE_COMMANDLINE because stdin/stdout
don't handle binary data correctly.

On 680x0 Macs, Think C defines type "double" as a 12-byte IEEE extended float.

jmemmgr.c won't like this: it wants sizeof(ALIGN_TYPE) to be a power of 2.
Add "#define ALIGN_TYPE long" to jconfig.h to eliminate the complaint.

jconfig.mac should work as a jconfig.h configuration file for Think C,
but the makeproj.mac AppleScript script is specific to CodeWarrior. Sorry.

MIPS R3000:

MIPS's cc version 1.31 has a rather nasty optimization bug. Don't use -O
if you have that compiler version.
  (Use "cc -V" to check the version.)
Note that the R3000 chip is found in workstations from DEC and others.

MS-DOS, generic comments for 16-bit compilers:

The IJG code is designed to work well in 80x86 "small" or "medium" memory
models (i.e., data pointers are 16 bits unless explicitly declared "far";
code pointers can be either size). You may be able to use small model to
compile cjpeg or djpeg by itself, but you will probably have to use medium
model for any larger application. This won't make much difference in
performance. You *will* take a noticeable performance hit if you use a
large-data memory model, and you should avoid "huge" model if at all
possible. Be sure that NEED_FAR_POINTERS is defined in jconfig.h if you use
a small-data memory model; be sure it is NOT defined if you use a large-data
model. (The supplied makefiles and jconfig files for Borland and Microsoft C
compile in medium model and define NEED_FAR_POINTERS.)

The DOS-specific memory manager, jmemdos.c,
 should be used if possible.
It needs some assembly-code routines which are in jmemdosa.asm; make sure
your makefile assembles that file and includes it in the library. If you
don't have a suitable assembler, you can get pre-assembled object files for
jmemdosa by FTP from ftp.uu.net:/graphics/jpeg/jdosaobj.zip. (DOS-oriented
distributions of the IJG source code often include these object files.)

When using jmemdos.c, jconfig.h must define USE_MSDOS_MEMMGR and must set
MAX_ALLOC_CHUNK to less than 64K (65520L is a typical value). If your
C library's far-heap malloc() can't allocate blocks that large, reduce
MAX_ALLOC_CHUNK to whatever it can handle.

If you can't use jmemdos.c for some reason --- for example, because you
don't have an assembler to assemble jmemdosa.asm --- you'll have to fall
back to jmemansi.c or jmemname.c. You'll probably still need to set
MAX_ALLOC_CHUNK in jconfig.h, because most DOS C libraries won't malloc()
more than 64K at a time. IMPORTANT: if you use

jmemansi.c or jmemname.c,
you will have to compile in a large-data memory model in order to get the
right stdio library. Too bad.

wrjpgcom needs to be compiled in large model, because it malloc()s a 64KB
work area to hold the comment text. If your C library's malloc can't
handle that, reduce MAX_COM_LENGTH as necessary in wrjpgcom.c.

Most MS-DOS compilers treat stdin/stdout as text files, so you must use
two-file command line style. But if your compiler has either fdopen() or
setmode(), you can use one-file style if you like. To do this, define
USE_SETMODE or USE_FDOPEN so that stdin/stdout will be set to binary mode.
(USE_SETMODE seems to work with more DOS compilers than USE_FDOPEN.) You
should test that I/O through stdin/stdout produces the same results as I/O
to explicitly named files... the "make test" procedures in the supplied
makefiles do NOT use stdin/stdout.

MS-DOS, generic comments for 32-bit compilers:

None of the above comments about memory models apply if you
 are using a
32-bit flat-memory-space environment, such as DJGPP or Watcom C. (And you
should use one if you have it, as performance will be much better than
8086-compatible code!) For flat-memory-space compilers, do NOT define
NEED_FAR_POINTERS, and do NOT use jmemdos.c. Use jmemnobs.c if the
environment supplies adequate virtual memory, otherwise use jmemansi.c or
jmemname.c.

You'll still need to be careful about binary I/O through stdin/stdout.
See the last paragraph of the previous section.

MS-DOS, Borland C:

Be sure to convert all the source files to DOS text format (CR/LF newlines).
Although Borland C will often work OK with unmodified Unix (LF newlines)
source files, sometimes it will give bogus compile errors.
"Illegal character '#'" is the most common such error. (This is true with
Borland C 3.1, but perhaps is fixed in newer releases.)

If you want one-file command line style, just undefine TWO_FILE_COMMANDLINE.
jconfig.bcc already includes #define USE_SETMODE to make
 this work.
(fdopen does not work correctly.)

MS-DOS, Microsoft C:

makefile.mc6 works with Microsoft C, DOS Visual C++, etc. It should only
be used if you want to build a 16-bit (small or medium memory model) program.

If you want one-file command line style, just undefine TWO_FILE_COMMANDLINE.
jconfig.mc6 already includes #define USE_SETMODE to make this work.
(fdopen does not work correctly.)

Note that this makefile assumes that the working copy of itself is called
"makefile". If you want to call it something else, say "makefile.mak",
be sure to adjust the dependency line that reads "$(RFILE) : makefile".
Otherwise the make will fail because it doesn't know how to create "makefile".
Worse, some releases of Microsoft's make utilities give an incorrect error
message in this situation.

Old versions of MS C fail with an "out of macro expansion space" error
because they can't cope with the macro TRACEMS8 (defined in jerror.h).
If this happens to you, the easiest solution is to change
 TRACEMS8 to
expand to nothing. You'll lose the ability to dump out JPEG coefficient
tables with djpeg -debug -debug, but at least you can compile.

Original MS C 6.0 is very buggy; it compiles incorrect code unless you turn
off optimization entirely (remove -O from CFLAGS). 6.00A is better, but it
still generates bad code if you enable loop optimizations (-Ol or -Ox).

MS C 8.0 crashes when compiling jquant1.c with optimization switch /Oo ...
which is on by default. To work around this bug, compile that one file
with /Oo-.

Microsoft Windows (all versions), generic comments:

Some Windows system include files define typedef boolean as "unsigned char".
The IJG code also defines typedef boolean, but we make it an "enum" by default.
This doesn't affect the IJG programs because we don't import those Windows
include files. But if you use the JPEG library in your own program, and some
of your program's files import one definition of boolean while some import the
other, you can get all
 sorts of mysterious problems. A good preventive step
is to make the IJG library use "unsigned char" for boolean. To do that,
add something like this to your jconfig.h file:
 /* Define "boolean" as unsigned char, not enum, per Windows custom */
 #ifndef __RPCNDR_H__ /* don't conflict if rpcndr.h already read */
 typedef unsigned char boolean;
 #endif
 #ifndef FALSE /* in case these macros already exist */
 #define FALSE 0 /* values of boolean */

#endif
#ifndef TRUE
#define TRUE 1
#endif
#define HAVE_BOOLEAN /* prevent jmorecfg.h from redefining it */
(This is already in jconfig.vc, by the way.)

windef.h contains the declarations
#define far
#define FAR far
Since jmorecfg.h tries to define FAR as empty, you may get a compiler
warning if you include both jpeglib.h and windef.h (which windows.h
includes). To suppress the warning, you can put "#ifndef FAR"/"#endif"
around the line "#define FAR" in jmorecfg.h.
(Something like this is already in jmorecfg.h, by the way.)

When using
the library in a Windows application, you will almost certainly
want to modify or replace the error handler module jerror.c, since our
default error handler does a couple of inappropriate things:
 1. it tries to write error and warning messages on stderr;
 2. in event of a fatal error, it exits by calling exit().

A simple stopgap solution for problem 1 is to replace the line
fprintf(stderr, "%s\n", buffer);
(in output_message in jerror.c) with
 MessageBox(GetActiveWindow(),buffer,"JPEG Error",MB_OK|MB_ICONERROR);
It's highly recommended that you at least do that much, since otherwise
error messages will disappear into nowhere. (Beginning with IJG v6b, this
code is already present in jerror.c; just define USE_WINDOWS_MESSAGEBOX in
jconfig.h to enable it.)

The proper solution for problem 2 is to return control to your calling
application after a library error. This can be done with the setjmp/longjmp
technique discussed in libjpeg.txt and illustrated in example.c. (NOTE:
some
 older Windows C compilers provide versions of setjmp/longjmp that
don't actually work under Windows. You may need to use the Windows system
functions Catch and Throw instead.)

The recommended memory manager under Windows is jmemnobs.c; in other words,
let Windows do any virtual memory management needed. You should NOT use
jmemdos.c nor jmemdosa.asm under Windows.

For Windows 3.1, we recommend compiling in medium or large memory model;
for newer Windows versions, use a 32-bit flat memory model. (See the MS-DOS
sections above for more info about memory models.) In the 16-bit memory
models only, you'll need to put

#define MAX_ALLOC_CHUNK 65520L /* Maximum request to malloc() */
into jconfig.h to limit allocation chunks to 64Kb. (Without that, you'd
have to use huge memory model, which slows things down unnecessarily.)
jmemnobs.c works without modification in large or flat memory models, but to
use medium model, you need to modify its jpeg_get_large and jpeg_free_large
routines to
 allocate far memory. In any case, you might like to replace
its calls to malloc and free with direct calls on Windows memory allocation
functions.

You may also want to modify jdatasrc.c and jdatadst.c to use Windows file
operations rather than fread/fwrite. This is only necessary if your C
compiler doesn't provide a competent implementation of C stdio functions.

You might want to tweak the RGB_xxx macros in jmorecfg.h so that the library
will accept or deliver color pixels in BGR sample order, not RGB; BGR order
is usually more convenient under Windows. Note that this change will break
the sample applications cjpeg/djpeg, but the library itself works fine.

Many people want to convert the IJG library into a DLL. This is reasonably
straightforward, but watch out for the following:

 1. Don't try to compile as a DLL in small or medium memory model; use
large model, or even better, 32-bit flat model. Many places in the IJG code
assume the address of a local variable is an ordinary
 (not FAR) pointer;
that isn't true in a medium-model DLL.

 2. Microsoft C cannot pass file pointers between applications and DLLs.
(See Microsoft Knowledge Base, PSS ID Number Q50336.) So jdatasrc.c and
jdatadst.c don't work if you open a file in your application and then pass
the pointer to the DLL. One workaround is to make jdatasrc.c/jdatadst.c
part of your main application rather than part of the DLL.

 3. You'll probably need to modify the macros GLOBAL() and EXTERN() to
attach suitable linkage keywords to the exported routine names. Similarly,
you'll want to modify METHODDEF() and JMETHOD() to ensure function pointers
are declared in a way that lets application routines be called back through
the function pointers. These macros are in jmorecfg.h. Typical definitions
for a 16-bit DLL are:
 #define GLOBAL(type) type _far _pascal _loadds _export
 #define EXTERN(type) extern type _far _pascal _loadds
 #define METHODDEF(type) static type _far _pascal
 #define JMETHOD(type,methodname,arglist)
 \
 type (_far _pascal *methodname) arglist
For a 32-bit DLL you may want something like

```
#define GLOBAL(type)   __declspec(dllexport) type
#define EXTERN(type)  extern __declspec(dllexport) type
```
Although not all the GLOBAL routines are actually intended to be called by
the application, the performance cost of making them all DLL entry points is
negligible.

The unmodified IJG library presents a very C-specific application interface,
so the resulting DLL is only usable from C or C++ applications. There has
been some talk of writing wrapper code that would present a simpler interface
usable from other languages, such as Visual Basic. This is on our to-do list
but hasn't been very high priority --- any volunteers out there?

Microsoft Windows, Borland C:

The provided jconfig.bcc should work OK in a 32-bit Windows environment,
but you'll need to tweak it in a 16-bit environment (you'd need to define
NEED_FAR_POINTERS and MAX_ALLOC_CHUNK). Beware that makefile.bcc
 will need
alteration if you want to use it for Windows --- in particular, you should
use jmemnobs.c not jmemdos.c under Windows.

Borland C++ 4.5 fails with an internal compiler error when trying to compile
jdmerge.c in 32-bit mode. If enough people complain, perhaps Borland will fix
it. In the meantime, the simplest known workaround is to add a redundant
definition of the variable range_limit in h2v1_merged_upsample(), at the head
of the block that handles odd image width (about line 268 in v6 jdmerge.c):
```
 /* If image width is odd, do the last output column separately */
 if (cinfo->output_width & 1) {
   register JSAMPLE * range_limit = cinfo->sample_range_limit; /* ADD THIS */
   cb = GETJSAMPLE(*inptr1);
```
Pretty bizarre, especially since the very similar routine h2v2_merged_upsample
doesn't trigger the bug.
Recent reports suggest that this bug does not occur with "bcc32a" (the
Pentium-optimized version of the compiler).

Another report from a user of Borland C 4.5 was that
 incorrect code (leading
to a color shift in processed images) was produced if any of the following
optimization switch combinations were used:
```
 -Ot -Og
 -Ot -Op
 -Ot -Om
```
So try backing off on optimization if you see such a problem. (Are there
several different releases all numbered "4.5"??)

Microsoft Windows, Microsoft Visual C++:

jconfig.vc should work OK with any Microsoft compiler for a 32-bit memory
model. makefile.vc is intended for command-line use. (If you are using
the Developer Studio environment, you may prefer the DevStudio project
files; see below.)

IJG JPEG 7 adds extern "C" to jpeglib.h. This avoids the need to put
extern "C" { ... } around #include "jpeglib.h" in your C++ application.
You can also force VC++ to treat the library as C++ code by renaming
all the *.c files to *.cpp (and adjusting the makefile to match).
In this case you also need to define the symbol DONT_USE_EXTERN_C in
the configuration to prevent jpeglib.h from using extern "C".

Microsoft Windows,
 Microsoft Visual C++ 6 Developer Studio:

We include makefiles that should work as project files in Developer Studio
6.0 or later. There is a library makefile that builds the IJG library as
a static Win32 library, and application makefiles that build the sample
applications as Win32 console applications. (Even if you only want the
library, we recommend building the applications so that you can run the
self-test.)

To use:
1. Open the command prompt, change to the main directory and execute the
  command line
 NMAKE /f makefile.vs setup-vc6
  This will move jconfig.vc to jconfig.h and makefiles to project files.
  (Note that the renaming is critical!)
2. Open the workspace file jpeg.dsw, build the library project.
  (If you are using Developer Studio more recent than 6.0, you'll
  probably get a message saying that the project files are being updated.)
3. Open the workspace file apps.dsw, build the application projects.
4. To perform the self-test, execute the command line
 NMAKE
 /f makefile.vs test-build
5. Move the application .exe files from `app`\Release to an
  appropriate location on your path.

Microsoft Windows, Visual Studio 2017 (v15):

We include makefiles that should work as project files in Visual Studio
2017 (v15) or later. There is a library makefile that builds the IJG
library as a static Win32 library, and application makefiles that build
the sample applications as Win32 console applications. (Even if you only
want the library, we recommend building the applications so that you can

run the self-test.)

To use:
1. Open the Developer Command Prompt, change to the main directory and
   execute the command line
 NMAKE /f makefile.vs setup-v15
  This will move jconfig.vc to jconfig.h and makefiles to project files.
  (Note that the renaming is critical!)
2. Open the solution file jpeg.sln, build the library project.
   a) If you are using Visual Studio more recent than
 2017 (v15), you'll probably get a message saying
 that the project
 files are being updated.
   b) If necessary, open the project properties and
 adapt the Windows Target Platform Version in
 the Configuration Properties, General section;
 we support the latest version at the time of release.
3. Open the solution file apps.sln, build the application projects.
4. To perform the self-test, execute the command line
 NMAKE /f makefile.vs test-build
5. Move the application .exe files from `app`\Release to an
  appropriate location on your path.

OS/2, Borland C++:

Watch out for optimization bugs in older Borland compilers; you may need
to back off the optimization switch settings. See the comments in
makefile.bcc.

SGI:

On some SGI systems, you may need to set "AR2= ar -ts" in the Makefile.
If you are using configure, you can do this by saying
 ./configure RANLIB='ar -ts'
This change is not needed on all SGIs. Use it only if the make fails at the
stage of linking the completed programs.

On the MIPS R4000 architecture (Indy, etc.), the compiler
 option "-mips2"
reportedly speeds up the float DCT method substantially, enough to make it
faster than the default int method (but still slower than the fast int
method). If you use -mips2, you may want to alter the default DCT method to
be float. To do this, put "#define JDCT_DEFAULT JDCT_FLOAT" in jconfig.h.

VMS:

On an Alpha/VMS system with MMS, be sure to use the "/Marco=Alpha=1" qualifier with MMS when building the JPEG package.

VAX/VMS v5.5-1 may have problems with the test step of the build procedure reporting differences when it compares the original and test images. If the error points to the last block of the files, it is most likely bogus and may be safely ignored. It seems to be because the files are Stream_LF and Backup/Compare has difficulty with the (presumably) null padded files. This problem was not observed on VAX/VMS v6.1 or AXP/VMS v6.1.

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/install.txt
No license file was found, but licenses were detected in source scan.

```
/*
* jcmaster.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modified 2003-2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains master control logic for the JPEG compressor.
* These routines are concerned with parameter validation, initial setup,
* and inter-pass control (determining the number of passes and the work
* to be done in each pass).
*/
```

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jcmaster.c
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```
/*
* jctrans.c
*
* Copyright (C) 1995-1998, Thomas G. Lane.
* Modified 2000-2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains library routines for transcoding compression,
* that is, writing raw DCT coefficient arrays to an output JPEG file.
* The routines in jcapimin.c will also be needed by a transcoder.
*/
```

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jctrans.c

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/*
* jdinput.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modified 2002-2013 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains input control logic for the JPEG decompressor.
* These routines are concerned with controlling the decompressor's input
* processing (marker reading and coefficient decoding). The actual input
* reading is done in jdmarker.c, jdhuff.c, and jdarith.c.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jdinput.c
No license file was found, but licenses were detected in source scan.

/*
* jdcoefct.c
*
* Copyright (C) 1994-1997, Thomas G. Lane.
* Modified 2002-2011 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains the coefficient buffer controller for decompression.
* This controller is the top level of the JPEG decompressor proper.
* The coefficient buffer lies between entropy decoding and inverse-DCT steps.
*
* In buffered-image mode, this controller is the interface between
* input-oriented processing and output-oriented processing.
* Also, the input side (only) is used when reading a file for transcoding.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jdcoefct.c
No license file was found, but licenses were detected in source scan.

/*
* jcparam.c
*
* Copyright (C) 1991-1998, Thomas G. Lane.
* Modified 2003-2013 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.

```
*
* This file contains optional default-setting code for the JPEG compressor.
* Applications do not have to use this file, but those that don't use it
* must know a lot more about the innards of the JPEG code.
*/
```

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jcparam.c
No license file was found, but licenses were detected in source scan.

```
/*
* jconfig.txt
*
* Copyright (C) 1991-1994, Thomas G. Lane.
* Modified 2009-2013 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file documents the configuration options that are required to
* customize the JPEG software for a particular system.
*
* The actual configuration options for a particular installation are stored
* in jconfig.h.  On many machines, jconfig.h can be generated automatically
* or copied from one of the "canned" jconfig files that we supply.  But if
* you need to generate a jconfig.h file by hand, this file tells you how.
*
* DO NOT EDIT THIS FILE --- IT WON'T ACCOMPLISH ANYTHING.
* EDIT A COPY NAMED JCONFIG.H.
*/



/*
* These symbols indicate the properties of your machine or compiler.
* #define the symbol if yes, #undef it if no.
*/

/* Does your compiler
 support function prototypes?
* (If not, you also need to use ansi2knr, see install.txt)
*/
#define HAVE_PROTOTYPES

/* Does your compiler support the declaration "unsigned char" ?
* How about "unsigned short" ?
*/
#define HAVE_UNSIGNED_CHAR
#define HAVE_UNSIGNED_SHORT
```

```
/* Define "void" as "char" if your compiler doesn't know about type void.
 * NOTE: be sure to define void such that "void *" represents the most general
 * pointer type, e.g., that returned by malloc().
 */
/* #define void char */

/* Define "const" as empty if your compiler doesn't know the "const" keyword.
 */
/* #define const */

/* Define this if an ordinary "char" type is unsigned.
 * If you're not sure, leaving it undefined will work at some cost in speed.
 * If you defined HAVE_UNSIGNED_CHAR then the speed difference is minimal.
 */
#undef CHAR_IS_UNSIGNED

/* Define this if your system has an ANSI-conforming <stddef.h> file.
 */
#define HAVE_STDDEF_H

/* Define this if your system has an ANSI-conforming <stdlib.h>
 file.
 */
#define HAVE_STDLIB_H

/* Define this if your system does not have an ANSI/SysV <string.h>,
 * but does have a BSD-style <strings.h>.
 */
#undef NEED_BSD_STRINGS

/* Define this if your system does not provide typedef size_t in any of the
 * ANSI-standard places (stddef.h, stdlib.h, or stdio.h), but places it in
 * <sys/types.h> instead.
 */
#undef NEED_SYS_TYPES_H

/* For 80x86 machines, you need to define NEED_FAR_POINTERS,
 * unless you are using a large-data memory model or 80386 flat-memory mode.
 * On less brain-damaged CPUs this symbol must not be defined.
 * (Defining this symbol causes large data structures to be referenced through
 * "far" pointers and to be allocated with a special version of malloc.)
 */
#undef NEED_FAR_POINTERS

/* Define this if your linker needs global names to be unique in less
 * than the first 15 characters.
 */
#undef NEED_SHORT_EXTERNAL_NAMES
```

```
/* Although a real ANSI C compiler can deal perfectly well with pointers to
* unspecified
 structures (see "incomplete types" in the spec), a few pre-ANSI
* and pseudo-ANSI compilers get confused.  To keep one of these bozos happy,
* define INCOMPLETE_TYPES_BROKEN.  This is not recommended unless you
* actually get "missing structure definition" warnings or errors while
* compiling the JPEG code.
*/
#undef INCOMPLETE_TYPES_BROKEN


/* Define "boolean" as unsigned char, not enum, on Windows systems.
*/
#ifdef _WIN32
#ifndef __RPCNDR_H__   /* don't conflict if rpcndr.h already read */
typedef unsigned char boolean;
#endif
#ifndef FALSE   /* in case these macros already exist */
#define FALSE 0  /* values of boolean */
#endif
#ifndef TRUE
#define TRUE 1
#endif
#define HAVE_BOOLEAN  /* prevent jmorecfg.h from redefining it */
#endif



/*
* The following options affect code selection within the JPEG library,
* but they don't need to be visible to applications using the library.
* To minimize application namespace pollution, the symbols won't be
* defined unless JPEG_INTERNALS
 has been defined.
*/

#ifdef JPEG_INTERNALS

/* Define this if your compiler implements ">>" on signed values as a logical
* (unsigned) shift; leave it undefined if ">>" is a signed (arithmetic) shift,
* which is the normal and rational definition.
*/
#undef RIGHT_SHIFT_IS_UNSIGNED



#endif /* JPEG_INTERNALS */



/*
```

* The remaining options do not affect the JPEG library proper,
* but only the sample applications cjpeg/djpeg (see cjpeg.c, djpeg.c).
* Other applications can ignore these.
*/

#ifdef JPEG_CJPEG_DJPEG

/* These defines indicate which image (non-JPEG) file formats are allowed. */

#define BMP_SUPPORTED /* BMP image file format */
#define GIF_SUPPORTED /* GIF image file format */
#define PPM_SUPPORTED /* PBMPLUS PPM/PGM image file format */
#undef RLE_SUPPORTED /* Utah RLE image file format */
#define TARGA_SUPPORTED /* Targa image file format */

/* Define this if you want to name both input and output files on the command
* line, rather than using stdout
 and optionally stdin. You MUST do this if
* your system can't cope with binary I/O to stdin/stdout. See comments at
* head of cjpeg.c or djpeg.c.
*/
#undef TWO_FILE_COMMANDLINE

/* Define this if your system needs explicit cleanup of temporary files.
* This is crucial under MS-DOS, where the temporary "files" may be areas
* of extended memory; on most other systems it's not as important.
*/
#undef NEED_SIGNAL_CATCHER

/* By default, we open image files with fopen(...,"rb") or fopen(...,"wb").
* This is necessary on systems that distinguish text files from binary files,
* and is harmless on most systems that don't. If you have one of the rare
* systems that complains about the "b" spec, define this symbol.
*/
#undef DONT_USE_B_MODE

/* Define this if you want percent-done progress reports from cjpeg/djpeg.
*/
#undef PROGRESS_REPORT

#endif /* JPEG_CJPEG_DJPEG */

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jconfig.txt
No license file was found, but licenses were detected in source scan.

/*

* jidctfst.c
*
* Copyright (C) 1994-1998, Thomas G. Lane.
* Modified 2015-2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains a fast, not so accurate integer implementation of the
* inverse DCT (Discrete Cosine Transform). In the IJG code, this routine
* must also perform dequantization of the input coefficients.
*
* A 2-D IDCT can be done by 1-D IDCT on each column followed by 1-D IDCT
* on each row (or vice versa, but it's more convenient to emit a row at
* a time). Direct algorithms are also available, but they are much more
* complex and seem not to be any faster when reduced to code.
*
* This implementation is based on Arai, Agui, and Nakajima's algorithm for
* scaled DCT. Their original paper (Trans. IEICE E-71(11):1095) is in
* Japanese, but the algorithm
 is described in the Pennebaker & Mitchell
* JPEG textbook (see REFERENCES section in file README). The following code
* is based directly on figure 4-8 in P&M.
* While an 8-point DCT cannot be done in less than 11 multiplies, it is
* possible to arrange the computation so that many of the multiplies are
* simple scalings of the final outputs. These multiplies can then be
* folded into the multiplications or divisions by the JPEG quantization
* table entries. The AA&N method leaves only 5 multiplies and 29 adds
* to be done in the DCT itself.
* The primary disadvantage of this method is that with fixed-point math,
* accuracy is lost due to imprecise representation of the scaled
* quantization values. The smaller the quantization table entry, the less
* precise the scaled value, so this implementation does worse with high-
* quality-setting files than with low-quality ones.
*/

Found in path(s):
* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jidctfst.c
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/*
* jdmaster.c
*
* Copyright (C) 1991-1997, Thomas G. Lane.
* Modified 2002-2017 by Guido Vollbeding.
* This file is part of the Independent JPEG Group's software.
* For conditions of distribution and use, see the accompanying README file.
*
* This file contains master control logic for the JPEG decompressor.

* These routines are concerned with selecting the modules to be executed

* and with determining the number of passes and the work to be done in each

* pass.

*/

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jdmaster.c

No license file was found, but licenses were detected in source scan.

/*

* rdbmp.c

*

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* Modified 2009-2017 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains routines to read input images in Microsoft "BMP"

* format (MS Windows 3.x, OS/2 1.x, and OS/2 2.x flavors).

* Currently, only 8-, 24-, and 32-bit images are supported, not 1-bit or

* 4-bit (feeding such low-depth images into JPEG would be silly anyway).

* Also, we don't support RLE-compressed files.

*

* These routines may need modification for non-Unix environments or

* specialized applications. As they stand, they assume input from

* an ordinary stdio stream. They further assume that reading begins

* at the start of the file; start_input may need work if the

* user interface has already read some data (e.g., to determine that

* the file is

 indeed BMP format).

*

* This code contributed by James Arthur Boucher.

*/

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/rdbmp.c

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/*

* wrppm.c

*

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* Modified 2009-2017 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file contains routines to write output images in PPM/PGM format.

* The extended 2-byte-per-sample raw PPM/PGM formats are supported.

* The PBMPLUS library is NOT required to compile this software

* (but it is highly useful as a set of PPM image manipulation programs).

*

* These routines may need modification for non-Unix environments or

* specialized applications. As they stand, they assume output to

* an ordinary stdio stream.

*/

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/wrppm.c

No license file was found, but licenses were detected in source scan.

/*

* jpeglib.h

*

* Copyright (C) 1991-1998, Thomas G. Lane.

* Modified 2002-2017 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* This file defines the application interface for the JPEG library.

* Most applications using the library need only include this file,

* and perhaps jerror.h if they want to know the exact error codes.

*/

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/jpeglib.h

No license file was found, but licenses were detected in source scan.

/*

* wrgif.c

*

* Copyright (C) 1991-1997, Thomas G. Lane.

* Modified 2015-2017 by Guido Vollbeding.

* This file is part of the Independent JPEG Group's software.

* For conditions of distribution and use, see the accompanying README file.

*

* ***

* NOTE: to avoid entanglements with Unisys' patent on LZW compression,   *

* this code has been modified to output "uncompressed GIF" files.   *

* There is no trace of the LZW algorithm in this file.   *

* ***

*

* These routines may need modification for non-Unix environments or

* specialized applications. As they stand, they assume output to

* an ordinary stdio stream.

```
*/
/*
* This code is loosely based on ppmtogif from the PBMPLUS
 distribution
* of Feb. 1991.  That file contains the following copyright notice:
*    Based on GIFENCODE by David Rowley <mgardi@watdscu.waterloo.edu>.
*    Lempel-Ziv compression based on "compress" by Spencer W. Thomas et al.
*    Copyright (C) 1989 by Jef Poskanzer.
*    Permission to use, copy, modify, and distribute this software and its
*    documentation for any purpose and without fee is hereby granted, provided
*    that the above copyright notice appear in all copies and that both that
*    copyright notice and this permission notice appear in supporting
*    documentation.  This software is provided "as is" without express or
*    implied warranty.
*
* We are also required to state that
*    "The Graphics Interchange Format(c) is the Copyright property of
*    CompuServe Incorporated. GIF(sm) is a Service Mark property of
*    CompuServe Incorporated."
*/
```

Found in path(s):

* /opt/cola/permits/1104792432_1607505170.95/0/jpeg-9c-tar-gz/jpeg-9c/wrgif.c

1.36 conntrack-tools 1.0.1

1.36.1 Available under license :

```
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The of the start-stop-daemon

* A rewrite
 of the original Debian's start-stop-daemon Perl script
* in C (faster - it is executed many times during system startup).
*
* Written by Marek Michalkiewicz <marekm@i17linuxb.ists.pwr.wroc.pl>,
* public domain.

1.44 sysv-init 2.88

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The of the start-stop-daemon

* A rewrite
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1.45 linux-kernel 3.18.31

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 Video4Linux interface and 2.1.x kernel adaptation

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Ragnar Hojland Espinosa <ragnar@macula.net>
 ConferenceTV card

+ many more (please mail me if you are missing in this list and would
    like to be mentioned)
/* nicstar.c v0.22 Jawaid Bazyar (bazyar@hypermall.com)
* nicstar.c, M. Welsh (matt.welsh@cl.cam.ac.uk)
*
* Hacked October, 1997 by Jawaid Bazyar, Interlink Advertising Services Inc.

```
*  http://www.hypermall.com/
* 10/1/97 - commented out CFG_PHYIE bit - we don't care when the PHY
* interrupts us (except possibly for removal/insertion of the cable?)
* 10/4/97 - began heavy inline documentation of the code. Corrected typos
* and spelling mistakes.
* 10/5/97 - added code to handle PHY interrupts, disable PHY on
* loss of link, and correctly re-enable PHY when link is
* re-established. (put back CFG_PHYIE)
*
*  Modified to work with the IDT7721 nicstar -- AAL5 (tested) only.
*
* R. D. Rechenmacher <ron@fnal.gov>, Aug. 6, 1997
*
* Linux driver for the IDT77201 NICStAR PCI ATM controller.
* PHY component is expected to be 155 Mbps S/UNI-Lite or IDT 77155;
* see init_nicstar() for PHY initialization to change this. This driver
* expects the Linux ATM stack to support scatter-gather
 lists
* (skb->atm.iovcnt != 0) for Rx skb's passed to vcc->push.
*
* Implementing minimal-copy of received data:
*   IDT always receives data into a small buffer, then large buffers
*     as needed. This means that data must always be copied to create
*     the linear buffer needed by most non-ATM protocol stacks (e.g. IP)
*     Fix is simple: make large buffers large enough to hold entire
*     SDU, and leave <small_buffer_data> bytes empty at the start. Then
*     copy small buffer contents to head of large buffer.
*   Trick is to avoid fragmenting Linux, due to need for a lot of large
*     buffers. This is done by 2 things:
*       1) skb->destructor / skb->atm.recycle_buffer
*           combined, allow nicstar_free_rx_skb to be called to
*           recycle large data buffers
*       2) skb_clone of received buffers
*   See nicstar_free_rx_skb and linearize_buffer for implementation
*     details.
*
*
*
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 *
 * M. Welsh, 6 July 1996
 *
 *
 */
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*
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 "Source code" for a work means the preferred form of the work for
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These requirements apply to the modified work as a whole. If
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medium customarily used for software interchange.

 If distribution of object code is made by offering access to copy
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 However, linking a "work that uses the Library" with the Library
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Section 6 states terms for distribution of such executables.

 When a "work that uses the Library" uses material from a header file
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Whether this is true is especially significant if the work can be
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threshold for this to be true is not precisely defined by law.

 If such an object file uses only numerical parameters, data
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Any executables containing that work also fall under Section 6,
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 b) Accompany the work
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which the executable runs, unless that component itself accompanies
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 for merging the nxt2002 and nxt2004 modules into a
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you if you distribute copies of the library or if you modify it.

 For example, if you distribute copies of the library,
 whether gratis
or for a fee, you must give the recipients all the rights that we gave
you. You must make sure that they, too, receive or can get the source

code. If you link other code with the library, you must provide
complete object files to the recipients, so that they can relink them
with the library after making changes to the library and recompiling
it. And you must show them these terms so they know their rights.

 We protect your rights with a two-step method: (1) we copyright the
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 To protect each distributor, we want to make it very clear that
there is no warranty for the free library. Also, if the library is
modified by someone else and passed on, the recipients should know
that what they have is not the original version, so that the original
author's reputation will not be affected by problems that might be
introduced by others.

 Finally, software
 patents pose a constant threat to the existence of
any free program. We wish to make sure that a company cannot
effectively restrict the users of a free program by obtaining a
restrictive license from a patent holder. Therefore, we insist that
any patent license obtained for a version of the library must be
consistent with the full freedom of use specified in this license.

 Most GNU software, including some libraries, is covered by the
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General Public License, applies to certain designated libraries, and
is quite different from the ordinary General Public License. We use
this license for certain libraries in order to permit linking those
libraries into non-free programs.

 When a program is linked with a library, whether statically or using
a shared library, the combination of the two is legally speaking a
combined work, a derivative of the original library. The ordinary
General Public License therefore permits
 such linking only if the
entire combination fits its criteria of freedom. The Lesser General
Public License permits more lax criteria for linking other code with
the library.

 We call this license the "Lesser" General Public License because it
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are the reason we use the ordinary General Public License for many
libraries. However, the Lesser license provides advantages in certain
special circumstances.

For example, on rare occasions, there may be a special need to
encourage the widest possible use of a certain library, so that it becomes
a de-facto standard. To achieve this, non-free programs must be
allowed to use the library. A more frequent case is that a free
library does the same job as widely used non-free libraries. In this
case, there is little to gain by limiting
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software only, so we use the Lesser General Public License.

 In other cases, permission to use a particular library in non-free
programs enables a greater number of people to use a large body of
free software. For example, permission to use the GNU C Library in
non-free programs enables many more people to use the whole GNU
operating system, as well as its variant, the GNU/Linux operating
system.

 Although the Lesser General Public License is Less protective of the
users' freedom, it does ensure that the user of a program that is
linked with the Library has the freedom and the wherewithal to run
that program using a modified version of the Library.

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modification follow. Pay close attention to the difference between a
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former contains code derived from the library, whereas the latter must
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 A "library" means a collection of software functions and/or data
prepared so as to be conveniently linked with application programs
(which use some of those functions and data) to form executables.

 The "Library", below, refers to any such software library or work
which has been distributed under these terms. A "work based on the
Library" means either the Library or any derivative work under
copyright law: that is to say, a work containing the Library or a
portion of it, either verbatim or with modifications and/or translated
straightforwardly into

another language. (Hereinafter, translation is
included without limitation in the term "modification".)

 "Source code" for a work means the preferred form of the work for
making modifications to it. For a library, complete source code means
all the source code for all modules it contains, plus any associated
interface definition files, plus the scripts used to control compilation
and installation of the library.

 Activities other than copying, distribution and modification are not
covered by this License; they are outside its scope. The act of
running a program using the Library is not restricted, and output from
such a program is covered only if its contents constitute a work based
on the Library (independent of the use of the Library in a tool for
writing it). Whether that is true depends on what the Library does
and what the program that uses the Library does.

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 You may charge a fee for the physical act of transferring a copy,
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 2. You may modify your copy or copies of the Library or any portion
of it, thus forming a work based on the Library, and copy and
distribute such modifications or work under the terms of Section 1
above, provided that you also meet all of these conditions:

  a) The modified work must itself be a software library.

  b) You must cause the files modified to carry prominent notices
   stating that you changed the files and the date of any change.

  c) You must cause the whole of the work to be licensed at no
   charge to all third parties under the
 terms of this License.

  d) If a facility in the modified Library refers to a function or a
   table of data to be supplied by an application program that uses
   the facility, other than as an argument passed when the facility
   is invoked, then you must make a good faith effort to ensure that,

in the event an application does not supply such function or
table, the facility still operates, and performs whatever part of
its purpose remains meaningful.

(For example, a function in a library to compute square roots has
a purpose that is entirely well-defined independent of the
application. Therefore, Subsection 2d requires that any
application-supplied function or table used by this function must
be optional: if the application does not supply it, the square
root function must still compute square roots.)

These requirements apply to the modified work as a whole. If
identifiable sections of that work are not derived from the Library,
and can be
 reasonably considered independent and separate works in
themselves, then this License, and its terms, do not apply to those
sections when you distribute them as separate works. But when you
distribute the same sections as part of a whole which is a work based
on the Library, the distribution of the whole must be on the terms of
this License, whose permissions for other licensees extend to the
entire whole, and thus to each and every part regardless of who wrote
it.

Thus, it is not the intent of this section to claim rights or contest
your rights to work written entirely by you; rather, the intent is to
exercise the right to control the distribution of derivative or
collective works based on the Library.

In addition, mere aggregation of another work not based on the Library
with the Library (or with a work based on the Library) on a volume of
a storage or distribution medium does not bring the other work under
the scope of this License.

 3. You may opt to apply the terms of the ordinary
 GNU General Public
License instead of this License to a given copy of the Library. To do
this, you must alter all the notices that refer to this License, so
that they refer to the ordinary GNU General Public License, version 2,
instead of to this License. (If a newer version than version 2 of the
ordinary GNU General Public License has appeared, then you can specify
that version instead if you wish.) Do not make any other change in
these notices.

 Once this change is made in a given copy, it is irreversible for
that copy, so the ordinary GNU General Public License applies to all
subsequent copies and derivative works made from that copy.

 This option is useful when you wish to copy part of the code of

the Library into a program that is not a library.

 4. You may copy and distribute the Library (or a portion or
derivative of it, under Section 2) in object code or executable form
under the terms of Sections 1 and 2 above provided that you accompany
it with the complete corresponding
 machine-readable source code, which
must be distributed under the terms of Sections 1 and 2 above on a
medium customarily used for software interchange.

 If distribution of object code is made by offering access to copy
from a designated place, then offering equivalent access to copy the
source code from the same place satisfies the requirement to
distribute the source code, even though third parties are not
compelled to copy the source along with the object code.

 5. A program that contains no derivative of any portion of the
Library, but is designed to work with the Library by being compiled or
linked with it, is called a "work that uses the Library". Such a
work, in isolation, is not a derivative work of the Library, and
therefore falls outside the scope of this License.

 However, linking a "work that uses the Library" with the Library
creates an executable that is a derivative of the Library (because it
contains portions of the Library), rather than a "work that
 uses the
library". The executable is therefore covered by this License.
Section 6 states terms for distribution of such executables.

 When a "work that uses the Library" uses material from a header file
that is part of the Library, the object code for the work may be a
derivative work of the Library even though the source code is not.
Whether this is true is especially significant if the work can be
linked without the Library, or if the work is itself a library. The
threshold for this to be true is not precisely defined by law.

 If such an object file uses only numerical parameters, data
structure layouts and accessors, and small macros and small inline
functions (ten lines or less in length), then the use of the object
file is unrestricted, regardless of whether it is legally a derivative
work. (Executables containing this object code plus portions of the
Library will still fall under Section 6.)

 Otherwise, if the work is a derivative of the Library, you may
distribute the
 object code for the work under the terms of Section 6.
Any executables containing that work also fall under Section 6,
whether or not they are linked directly with the Library itself.

6. As an exception to the Sections above, you may also combine or
link a "work that uses the Library" with the Library to produce a
work containing portions of the Library, and distribute that work
under terms of your choice, provided that the terms permit
modification of the work for the customer's own use and reverse
engineering for debugging such modifications.

 You must give prominent notice with each copy of the work that the
Library is used in it and that the Library and its use are covered by
this License. You must supply a copy of this License. If the work
during execution displays copyright notices, you must include the
copyright notice for the Library among them, as well as a reference
directing the user to the copy of this License. Also, you must do one
of these things:

  a) Accompany
 the work with the complete corresponding
   machine-readable source code for the Library including whatever
   changes were used in the work (which must be distributed under
   Sections 1 and 2 above); and, if the work is an executable linked
   with the Library, with the complete machine-readable "work that
   uses the Library", as object code and/or source code, so that the
   user can modify the Library and then relink to produce a modified
   executable containing the modified Library. (It is understood
   that the user who changes the contents of definitions files in the
   Library will not necessarily be able to recompile the application
   to use the modified definitions.)

  b) Use a suitable shared library mechanism for linking with the
   Library. A suitable mechanism is one that (1) uses at run time a
   copy of the library already present on the user's computer system,
   rather than copying library functions into the executable, and (2)
   will operate
 properly with a modified version of the library, if
   the user installs one, as long as the modified version is
   interface-compatible with the version that the work was made with.

  c) Accompany the work with a written offer, valid for at
   least three years, to give the same user the materials
   specified in Subsection 6a, above, for a charge no more
   than the cost of performing this distribution.

  d) If distribution of the work is made by offering access to copy
   from a designated place, offer equivalent access to copy the above
   specified materials from the same place.

  e) Verify that the user has already received a copy of these

materials or that you have already sent this user a copy.

 For an executable, the required form of the "work that uses the
Library" must include any data and utility programs needed for
reproducing the executable from it. However, as a special exception,
the materials to be distributed need not include anything that is
normally
 distributed (in either source or binary form) with the major
components (compiler, kernel, and so on) of the operating system on
which the executable runs, unless that component itself accompanies
the executable.

 It may happen that this requirement contradicts the license
restrictions of other proprietary libraries that do not normally
accompany the operating system. Such a contradiction means you cannot
use both them and the Library together in an executable that you
distribute.

 7. You may place library facilities that are a work based on the
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  facilities. This must be distributed under the terms of the
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  b) Give prominent notice with the combined library of the fact
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Ty Coon, President of Vice

That's all there is to it!

1.47 libcap 2.24

1.47.1 Available under license :

No license file was found, but licenses were detected in source scan.

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Found in path(s):
* /opt/cola/permits/1821587989_1697224323.9834158/0/mer-packages-libcap-2-24-0-g9905edb-1-tar-gz/mer-packages-libcap-9905edb/rpm/libcap.spec

1.48 lzo 2.09

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  stating that you changed the files and the date of any change.

  b) You must cause
 any work that you distribute or publish, that in
  whole or in part contains or is derived from the Program or any
  part thereof, to be licensed as a whole at no charge to all third
  parties under the terms of this License.

  c) If the modified program normally reads commands interactively
  when run, you must cause it, when started running for such
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  announcement including an appropriate copyright notice and a
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  License. (Exception: if the Program itself is interactive but
  does not normally print such an announcement, your work based on
  the Program is not required to print an announcement.)

These requirements apply to the modified work as a whole. If
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 are not derived from the Program,
and can be reasonably considered independent and separate works in

themselves, then this License, and its terms, do not apply to those
sections when you distribute them as separate works. But when you
distribute the same sections as part of a whole which is a work based
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entire whole, and thus to each and every part regardless of who wrote it.

Thus, it is not the intent of this section to claim rights or contest
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In addition, mere aggregation of another work not based on the Program
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Sections 1 and 2 above provided that you also do one of the following:

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  1 and 2 above on a medium customarily used for software interchange; or,

  b) Accompany it with a written offer, valid for at least three
  years, to give any third party, for a charge no more than your
  cost of physically performing source distribution, a complete
  machine-readable copy of the corresponding source code, to be
  distributed under the terms of Sections 1 and 2 above on a medium
  customarily used for software interchange; or,

  c) Accompany it with the information you received as to the offer
  to distribute corresponding source code. (This alternative is
  allowed only for noncommercial distribution
 and only if you
  received the program in object code or executable form with such
  an offer, in accord with Subsection b above.)

The source code for a work means the preferred form of the work for
making modifications to it. For an executable work, complete source
code means all the source code for all modules it contains, plus any
associated interface definition files, plus the scripts used to
control compilation and installation of the executable. However, as a
special exception, the source code distributed need not include
anything that is normally distributed (in either source or binary
form) with the major components (compiler, kernel, and so on) of the
operating system on which the executable runs, unless that component

itself accompanies the executable.

If distribution of executable or object code is made by offering
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   its purpose remains meaningful.

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* OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF
* SUCH DAMAGE.
*
* @(#)tftp.h 8.1 (Berkeley) 6/2/93
*/
```

Found in path(s):
* /opt/cola/permits/1826454257_1697752738.11816/0/iputils-s20101006-tar-gz/iputils-s20101006/tftp.h
No license file was found, but licenses were detected in source scan.

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For more details see the file COPYING in the source

Found in path(s):
* /opt/cola/permits/1826454257_1697752738.11816/0/iputils-s20101006-tar-gz/iputils-s20101006/doc/clockdiff.sgml
* /opt/cola/permits/1826454257_1697752738.11816/0/iputils-s20101006-tar-gz/iputils-s20101006/doc/tracepath.sgml
* /opt/cola/permits/1826454257_1697752738.11816/0/iputils-s20101006-tar-gz/iputils-s20101006/doc/arping.sgml
* /opt/cola/permits/1826454257_1697752738.11816/0/iputils-s20101006-tar-gz/iputils-s20101006/doc/rarpd.sgml
* /opt/cola/permits/1826454257_1697752738.11816/0/iputils-s20101006-tar-gz/iputils-s20101006/doc/traceroute6.sgml
* /opt/cola/permits/1826454257_1697752738.11816/0/iputils-s20101006-tar-gz/iputils-s20101006/doc/pg3.sgml
No license file was found, but licenses were detected in source scan.

=head1 NAME

docbook2man-spec - convert DocBook RefEntries to Unix manpages

=head1 SYNOPSIS

The SGMLSpm package from CPAN. This contains the sgmlspl script which
is used to grok this file. Use it like this:

nsgmls some-docbook-document.sgml | sgmlspl docbook2man-spec.pl

=head1 DESCRIPTION

This is a sgmlspl spec file that produces Unix-style
manpages from RefEntry markup.

See the accompanying RefEntry man page for 'plain new' documentation. :)

=head1 LIMITATIONS

Trying docbook2man on non-DocBook or non-conformant SGML results in
undefined behavior. :-)

This program is a slow, dodgy Perl script.

This program does not come close to supporting all the possible markup
in DocBook, and will produce wrong output in some cases with supported
markup.

=head1 TODO

Add new element handling and fix existing handling. Be robust.
Produce cleanest, readable man output as possible (unlike some
other converters). Follow
 Linux man(7) convention.
If this results in added logic in this script,
that's okay. The code should still be reasonably organized.

Make it faster. If Perl sucks port it to another language.

=head1 COPYRIGHT

Copyright (C) 1998-1999 Steve Cheng <steve@ggi-project.org>

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under the terms of the GNU General Public License as published by the Free
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version.

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this program; see the file COPYING. If not, please write to the Free
Software Foundation, 675 Mass Ave, Cambridge, MA 02139, USA.

=cut

$Id: docbook2man-spec.pl,v 1.1 2000/07/21 20:22:30 rosalia Exp $

use SGMLS;   # Use the SGMLS package.
use SGMLS::Output; # Use stack-based output.
use SGMLS::Refs;

##
SGMLSPL script produced automatically by
 the script sgmlspl.pl
#
Document Type: any, but processes only RefEntries
Edited by: me :)
##

$write_manpages = 0;
$blank_xrefs = 0;

sgml('start', sub {
 push_output('nul');
 $raw_cdata = 1;   # Makes it a bit faster.

 # Links file
 open(LINKSFILE, ">manpage.links");

 $Refs = new SGMLS::Refs("manpage.refs");
});
sgml('end', sub {
 close(LINKSFILE);
 if($blank_xrefs) {
 print STDERR "Warning: output contains unresolved XRefs\n";
 }
});

##
#
Output helpers
#
##

```perl
# Our own version of sgml() and output() to allow simple string output
# to play well with roff's stupid whitespace rules.

sub man_sgml
{
 if(ref($_[1]) eq 'CODE') {
  return &sgml;
 }

 my $s = $_[1];

 $s =~ s/\\/\\\\/g;
 $s =~ s/'/\\'/g;

 # \n at the beginning means start at beginning of line
 if($s
 =~ s/^\n//) {
  $sub = 'sub { output "\n" unless $newline_last++; ';
  if($s eq '') {
   sgml($_[0], eval('sub { output "\n" unless $newline_last++; }'));
  } elsif($s =~ /\n$/) {
   sgml($_[0], eval("sub { output \"\\n\" unless \$newline_last++; output '$s'; }"));
  } else {
   sgml($_[0], eval("sub { output \"\\n\" unless \$newline_last; output '$s'; \$newline_last = 0; }"));
  }
 } else {
  if($s =~ /\n$/) {
   sgml($_[0], eval("sub { output '$s'; \$newline_last = 1; }"));
  } else {
   sgml($_[0], eval("sub { output '$s'; \$newline_last = 0; }"));
  }
 }
}

sub man_output
{
 $_ = shift;
 if(s/^\n//) {
  output "\n" unless $newline_last++;
 }
 return if $_ eq '';

 output $_;

 if(@_) {
  output @_;
  $newline_last = (pop(@_) =~ /\n$/);
```

```perl
  } else {
   $newline_last = ($_ =~ /\n$/)
  }
 }

# Fold lines into one, quote some characters
sub fold_string
{
 $_ = shift;

 s/\\/\\\\/g;
 s/"/\\\&"/g;

 # Change tabs to spaces
 tr/\t\n/  /;

 # Trim whitespace from beginning and end.
 s/^ +//;
 s/
 +$//;

 return $_;
}

sub save_cdata()
{
 $raw_cdata++;
 push_output('string');
}

sub bold_on()
{
 # If the last font is also bold, don't change anything.
 # Basically this is to just get more readable man output.
 if($fontstack[$#fontstack] ne 'bold') {
  if(!$raw_cdata) {
   output '\fB';
   $newline_last = 0;
  }
 }
 push(@fontstack, 'bold');
}

sub italic_on()
{
 # If the last font is also italic, don't change anything.
 if($fontstack[$#fontstack] ne 'italic') {
  if(!$raw_cdata) {
```

```perl
   output '\fI';
   $newline_last = 0;
  }
 }
 push(@fontstack, 'italic');
}

sub font_off()
{
 my $thisfont = pop(@fontstack);
 my $lastfont = $fontstack[$#fontstack];

 # Only output font change if it is different
 if($thisfont ne $lastfont) {
  if($raw_cdata)   { return; }
  elsif($lastfont eq 'bold')  { output '\fB'; }
  elsif($lastfont eq 'italic') { output '\fI'; }
  else    { output '\fR'; }

  $newline_last = 0;
 }
}




###############################################################################
#
#
 Manpage management
#
###############################################################################

sgml('<REFENTRY>', sub {
 # This will be overwritten at end of REFMETA, when we know the name of the page.
 pop_output();

 $write_manpages = 1;  # Currently writing manpage.

 $nocollapse_whitespace = 0; # Current whitespace collapse counter.
 $newline_last = 1;  # At beginning of line?
  # Just a bit of warning, you will see this variable manipulated
  # manually a lot.  It makes the code harder to follow but it
  # saves you from having to worry about collapsing at the end of
  # parse, stopping at verbatims, etc.
 $raw_cdata = 0;                # Instructs certain output functions to
```

```
    # leave CDATA alone, so we can assign
    # it to a string and process it, etc.
@fontstack = ();  # Fonts being activated.

$manpage_title = '';  # Needed for indexing.
$manpage_sect = '';
@manpage_names = ();

$manpage_misc = '';

$list_nestlevel = 0;  # Indent certain nested
content.
});
sgml('</REFENTRY>', sub {
if(!$newline_last) {
 output "\n";
 }

$write_manpages = 0;
$raw_cdata = 1;
push_output('nul');
});

sgml('</REFMETA>', sub {
push_output('file', "$manpage_title.$manpage_sect");

output <<_END_BANNER;
.\\" This manpage has been automatically generated by docbook2man
.\\" from a DocBook document.  This tool can be found at:
.\\" <http://shell.ipoline.com/~elmert/comp/docbook2X/>
.\\" Please send any bug reports, improvements, comments, patches,
.\\" etc. to Steve Cheng <steve\@ggi-project.org>.
_END_BANNER

my $manpage_date = `date "+%d %B %Y"`;

output '.TH "';

# If the title is not mixed-case, convention says to
# uppercase the whole title.  (The canonical title is
# lowercase.)
if($manpage_title =~ /[A-Z]/) {
 output fold_string($manpage_title);
} else {
 output uc(fold_string($manpage_title));
}

output '" "', fold_string($manpage_sect),
```

```
      '" "', fold_string(`date "+%d %B %Y"`),
      '" "', $manpage_misc,
      '" "',
     $manpage_manual,
      "\"\n";

     $newline_last = 1;

     # References to this RefEntry.
     my $id = $_[0]->parent->attribute('ID')->value;
     if($id ne '') {
      # The 'package name' part of the section should
      # not be used when citing it.
      my ($sectnum) = ($manpage_sect =~ /([0-9]*)/);

      if($_[0]->parent->attribute('XREFLABEL')->value eq '') {
       $Refs->put("refentry:$id", "$manpage_title($sectnum)");
      } else {
       $Refs->put("refentry:$id",
        $_[0]->parent->attribute('XREFLABEL')->value .
        "($sectnum)");
      }
     }
    });

    sgml('<REFENTRYTITLE>', sub {
     if($_[0]->in('REFMETA')) {
      save_cdata();
     } else {
      # Manpage citations are in bold.
      bold_on();
     }
    });
    sgml('</REFENTRYTITLE>', sub {
     if($_[0]->in('REFMETA')) {
      $raw_cdata--;
      $manpage_title = pop_output();
     }
     else { font_off(); }
    });

    sgml('<MANVOLNUM>', sub {
     if($_[0]->in('REFMETA')) {
      save_cdata();
     } else {
      # Manpage citations use ().
      output '(';
     }
```

```
});
sgml('</MANVOLNUM>', sub {
 if($_[0]->in('REFMETA')) {
  $raw_cdata--;
  $manpage_sect
 = pop_output();
 }
 else { output ')' }
});


sgml('<REFMISCINFO>', \&save_cdata);
sgml('</REFMISCINFO>', sub {
 $raw_cdata--;
 $manpage_misc = fold_string(pop_output());
});



# NAME section
man_sgml('<REFNAMEDIV>', "\n.SH NAME\n");

sgml('<REFNAME>', \&save_cdata);
sgml('</REFNAME>', sub {
 $raw_cdata--;
 push(@manpage_names, pop_output());
});

sgml('<REFPURPOSE>', \&save_cdata);
sgml('</REFPURPOSE>', sub {
 $raw_cdata--;
 my $manpage_purpose = fold_string(pop_output());

 for(my $i = 0; $i < $#manpage_names; $i++) {
  output fold_string($manpage_names[$i]), ', ';
 }

 output fold_string($manpage_names[$#manpage_names]);
 output " \\- $manpage_purpose\n";

 $newline_last = 1;

 foreach(@manpage_names) {
  # Don't link to itself
  if($_ ne $manpage_title) {
   print LINKSFILE "$manpage_title.$manpage_sect $_.$manpage_sect\n";
  }
 }
});
```

```perl
man_sgml('<REFCLASS>', "\n.sp\n");

#RefDescriptor




##########################################################################
#
#
 SYNOPSIS section and synopses
#
##########################################################################

man_sgml('<REFSYNOPSISDIV>', "\n.SH SYNOPSIS\n");
man_sgml('</REFSYNOPSISDIV>', "\n");

## FIXME! Must be made into block elements!!
#sgml('<FUNCSYNOPSIS>', \&bold_on);
#sgml('</FUNCSYNOPSIS>', \&font_off);
#sgml('<CMDSYNOPSIS>', \&bold_on);
#sgml('</CMDSYNOPSIS>', \&font_off);

man_sgml('<FUNCSYNOPSIS>', sub {
 man_output("\n.sp\n");
 bold_on();
});
man_sgml('</FUNCSYNOPSIS>', sub {
 font_off();
 man_output("\n");
});

man_sgml('<CMDSYNOPSIS>', "\n\n");
man_sgml('</CMDSYNOPSIS>', "\n\n");

man_sgml('<FUNCPROTOTYPE>', "\n.sp\n");

# Arguments to functions.  This is C convention.
man_sgml('<PARAMDEF>', '(');
man_sgml('</PARAMDEF>', ');\n");
man_sgml('<VOID>', "(void);\n");



sub arg_start
{
 # my $choice = $_[0]->attribute('CHOICE')->value;
```

```perl
# The content model for CmdSynopsis doesn't include #PCDATA,
# so we won't see any of the whitespace in the source file,
#
so we have to add it after each component.
output ' ';

    if($_[0]->attribute('CHOICE')->value =~ /opt/i) {
    output '[ ';
    }
    bold_on();
}
sub arg_end
{
    font_off();
    if($_[0]->attribute('REP')->value =~ /^Repeat/i) {
    italic_on();
    output ' ...';
    font_off();
    }
    if($_[0]->attribute('CHOICE')->value =~ /opt/i) {
    output '] ';
    }
}

sgml('<ARG>', \&arg_start);
sgml('</ARG>', \&arg_end);
sgml('<GROUP>', \&arg_start);
sgml('</GROUP>', \&arg_end);

sgml('<OPTION>', \&bold_on);
sgml('</OPTION>', \&font_off);

# FIXME: This is one _blank_ line.
man_sgml('<SBR>', "\n\n");


#############################################################################
#
# General sections
#
#############################################################################

# The name of the section is handled by TITLE.  This just sets
# up the roff markup.
man_sgml('<REFSECT1>', "\n.SH ");
man_sgml('<REFSECT2>', "\n.SS ");
man_sgml('<REFSECT3>', "\n.SS ");
```

```
#############################################################################
#
#
 Titles, metadata.
#
#############################################################################

sgml('<TITLE>', sub {
 if($_[0]->in('REFERENCE') or $_[0]->in('BOOK')) {
  $write_manpages = 1;
 }
 save_cdata();
});
sgml('</TITLE>', sub {
 my $title = fold_string(pop_output());
 $raw_cdata--;

 if($_[0]->in('REFERENCE') or $_[0]->in('BOOK')) {
  # We use TITLE of enclosing Reference or Book as manual name
  $manpage_manual = $title;
  $write_manpages = 0;
 }
 elsif(exists $_[0]->parent->ext->{'title'}) {
  # By far the easiest case.  Just fold the string as
  # above, and then set the parent element's variable.
  $_[0]->parent->ext->{'title'} = $title;
 }
 else {
  # If the parent element's handlers are lazy,
  # output the folded string for them :)
  # We assume they want uppercase and a newline.
  output "", uc($title), "\"\n";
  $newline_last = 1;
 }
});

sgml('<ATTRIBUTION>', sub { push_output('string') });
sgml('</ATTRIBUTION>', sub { $_[0]->parent->ext->{'attribution'}
 = pop_output(); });


# IGNORE.
sgml('<DOCINFO>', sub { push_output('nul'); });
sgml('</DOCINFO>', sub { pop_output(); });
sgml('<REFSECT1INFO>', sub { push_output('nul'); });
sgml('</REFSECT1INFO>', sub { pop_output(); });
```

```perl
sgml('<REFSECT2INFO>', sub { push_output('nul'); });
sgml('</REFSECT2INFO>', sub { pop_output(); });
sgml('<REFSECT3INFO>', sub { push_output('nul'); });
sgml('</REFSECT3INFO>', sub { pop_output(); });


sgml('<INDEXTERM>', sub { push_output('nul'); });
sgml('</INDEXTERM>', sub { pop_output(); });



##########################################################################
#
# Set bold on enclosed content
#
##########################################################################

sgml('<APPLICATION>', \&bold_on); sgml('</APPLICATION>', \&font_off);

sgml('<CLASSNAME>', \&bold_on);  sgml('</CLASSNAME>', \&font_off);
sgml('<STRUCTNANE>', \&bold_on); sgml('</STRUCTNAME>', \&font_off);
sgml('<STRUCTFIELD>', \&bold_on); sgml('</STRUCTFIELD>', \&font_off);
sgml('<SYMBOL>',
 \&bold_on);  sgml('</SYMBOL>', \&font_off);
sgml('<TYPE>', \&bold_on);  sgml('</TYPE>', \&font_off);

sgml('<ENVAR>', \&bold_on); sgml('</ENVAR>', \&font_off);

sgml('<FUNCTION>', \&bold_on); sgml('</FUNCTION>', \&font_off);

sgml('<EMPHASIS>', \&bold_on); sgml('</EMPHASIS>', \&font_off);

sgml('<ERRORNAME>', \&bold_on); sgml('</ERRORNAME>', \&font_off);
# ERRORTYPE

sgml('<COMMAND>', \&bold_on); sgml('</COMMAND>', \&font_off);

sgml('<GUIBUTTON>', \&bold_on); sgml('</GUIBUTTON>', \&font_off);
sgml('<GUIICON>', \&bold_on); sgml('</GUIICON>', \&font_off);
# GUILABEL
# GUIMENU
# GUIMENUITEM
# GUISUBMENU
# MENUCHOICE
# MOUSEBUTTON

sgml('<ACCEL>', \&bold_on); sgml('</ACCEL>', \&font_off);
sgml('<KEYCAP>', \&bold_on); sgml('</KEYCAP>', \&font_off);
sgml('<KEYSYM>', \&bold_on); sgml('</KEYSYM>', \&font_off);
# KEYCODE
```

```
# KEYCOMBO
# SHORTCUT

sgml('<USERINPUT>', \&bold_on); sgml('</USERINPUT>', \&font_off);

sgml('<INTERFACEDEFINITION>', \&bold_on);
sgml('</INTERFACEDEFINITION>', \&font_off);

#
 May need to look at the CLASS
sgml('<SYSTEMITEM>', \&bold_on);
sgml('</SYSTEMITEM>', \&font_off);




#########################################################################
#
# Set italic on enclosed content
#
#########################################################################

sgml('<FIRSTTERM>', \&italic_on); sgml('</FIRSTTERM>', \&font_off);

sgml('<FILENAME>', \&italic_on); sgml('</FILENAME>', \&font_off);
sgml('<PARAMETER>', \&italic_on); sgml('</PARAMETER>', \&font_off);
sgml('<PROPERTY>', \&italic_on); sgml('</PROPERTY>', \&font_off);

sgml('<REPLACEABLE>', sub {
 italic_on();
 if($_[0]->in('TOKEN')) {
  # When tokenizing, follow more 'intuitive' convention
  output "<";
 }
});
sgml('</REPLACEABLE>', sub {
 if($_[0]->in('TOKEN')) {
  output ">";
 }
 font_off();
});

sgml('<CITETITLE>', \&italic_on); sgml('</CITETITLE>', \&font_off);
sgml('<FOREIGNPHRASE>', \&italic_on); sgml('</FOREIGNPHRASE>', \&font_off);

sgml('<LINEANNOTATION>', \&italic_on); sgml('</LINEANNOTATION>',
```

```
    \&font_off);




##########################################################################
#
# Other 'inline' elements
#
##########################################################################

man_sgml('<EMAIL>', '<');
man_sgml('</EMAIL>', '>');
man_sgml('<OPTIONAL>', '[');
man_sgml('</OPTIONAL>', ']');

man_sgml('</TRADEMARK>', "\\u\\s-2TM\\s+2\\d");

man_sgml('<COMMENT>', "[Comment: ");
man_sgml('</COMMENT>', "]");

man_sgml('<QUOTE>', "``");
man_sgml('</QUOTE>', "''");

#man_sgml('<LITERAL>', "'");
#man_sgml('</LITERAL>', "'");

# No special presentation:

# AUTHOR
# AUTHORINITIALS

# ABBREV
# ACTION
# ACRONYM
# ALT
# CITATION
# PHRASE
# QUOTE
# WORDASWORD

# COMPUTEROUTPUT
# MARKUP
# PROMPT
# RETURNVALUE
# SGMLTAG
```

```
# TOKEN

# DATABASE
# HARDWARE
# INTERFACE
# MEDIALABEL

# There doesn't seem to be a good way to represent LITERAL in -man




#############################################################################
#
# Paragraph and paragraph-like elements
#
#############################################################################

sub
 para_start {
 output "\n" unless $newline_last++;

 # In lists, etc., don't start paragraph with .PP since
 # the indentation will be gone.

 if($_[0]->parent->ext->{'nobreak'}==1) {
  # Usually this is the FIRST element of
  # a hanging tag, so we MUST not do a full
  # paragraph break.
  $_[0]->parent->ext->{'nobreak'} = 2;
 } elsif($_[0]->parent->ext->{'nobreak'}==2) {
  # Usually these are the NEXT elements of
  # a hanging tag.  If we break using a blank
  # line, we're okay.
  output "\n";
 } else {
  # Normal case. (For indented blocks too, at least
  # -man isn't so braindead in this area.)
  output ".PP\n";
 }
}
# Actually applies to a few other block elements as well
sub para_end {
 output "\n" unless $newline_last++;
}

sgml('<PARA>', \&para_start);
sgml('</PARA>', \&para_end);
sgml('<SIMPARA>', \&para_start);
```

```
sgml('</SIMPARA>', \&para_end);


# Nothing special, except maybe FIXME set nobreak.
sgml('<INFORMALEXAMPLE>',
 \&para_start);
sgml('</INFORMALEXAMPLE>', \&para_end);




##########################################################################
#
# Blocks using SS sections
#
##########################################################################

# FIXME: We need to consider the effects of SS
# in a hanging tag :(

# Complete with the optional-title dilemma (again).
sgml('<ABSTRACT>', sub {
 $_[0]->ext->{'title'} = 'ABSTRACT';
 output "\n" unless $newline_last++;
 push_output('string');
});
sgml('</ABSTRACT>', sub {
 my $content = pop_output();

 # As ABSTRACT is never on the same level as RefSect1,
 # this leaves us with only .SS in terms of -man macros.
 output ".SS \"", uc($_[0]->ext->{'title'}), "\"\n";

 output $content;
 output "\n" unless $newline_last++;
});

# Ah, I needed a break.  Example always has a title.
man_sgml('<EXAMPLE>', "\n.SS ");
sgml('</EXAMPLE>', \&para_end);

# Same with sidebar.
man_sgml('<SIDEBAR>', "\n.SS ");
sgml('</SIDEBAR>', \&para_end);

# NO title.
man_sgml('<HIGHLIGHTS>',
```

```
            "\n.SS HIGHLIGHTS\n");
sgml('</HIGHLIGHTS>', \&para_end);




######################################################################
#
# Indented 'Block' elements
#
######################################################################

sub indent_block_start
{
 output "\n" unless $newline_last++;
 output ".sp\n.RS\n";
}
sub indent_block_end
{
 output "\n" unless $newline_last++;
 output ".RE\n";
}

# This element is almost like an admonition (below),
# only the default title is blank :)

sgml('<BLOCKQUOTE>', sub {
 $_[0]->ext->{'title'} = '';
 output "\n" unless $newline_last++;
 push_output('string');
});
sgml('</BLOCKQUOTE>', sub {
 my $content = pop_output();

 indent_block_start();

 if($_[0]->ext->{'title'}) {
 output ".B \"", $_[0]->ext->{'title'}, ":\"\n";
 }

 output $content;

 if($_[0]->ext->{'attribution'}) {
 output "\n" unless $newline_last++;
 # One place where roff's space-sensitivity makes sense :)
 output "\n            -- ";
 output
```

Open Source Used In EM74x1 Modem FW Version 01.14.03.00, 01.14.20.00, and 01.14.22.00
EM7431_01.14.22.00_Based_FW 833

```perl
    $_[0]->ext->{'attribution'} . "\n";
 }

 indent_block_end();
});

# Set off admonitions from the rest of the text by indenting.
# FIXME: Need to check if this works inside paragraphs, not enclosing them.
sub admonition_end {
 my $content = pop_output();

 indent_block_start();

 # When the admonition is only one paragraph,
 # it looks nicer if the title was inline.
 my $num_para;
 while ($content =~ /^\.PP/gm) { $num_para++ }
 if($num_para==1) {
  $content =~ s/^\.PP\n//;
 }

 output ".B \"" . $_[0]->ext->{'title'} . ":\"\n";
 output $content;

 indent_block_end();
}

sgml('<NOTE>', sub {
 # We can't see right now whether or not there is a TITLE
 # element, so we have to save the output now and add it back
 # at the end of this admonition.
 $_[0]->ext->{'title'} = 'Note';

 # Although admonition_end's indent_block_start will do this,
 # we need to synchronize the output _now_
 output "\n" unless $newline_last++;

 push_output('string');
});
sgml('</NOTE>', \&admonition_end);

#
 Same as above.
sgml('<WARNING>', sub {
 $_[0]->ext->{'title'} = 'Warning';
 output "\n" unless $newline_last++;
 push_output('string');
});
```

```
sgml('</WARNING>', \&admonition_end);

sgml('<TIP>', sub {
 $_[0]->ext->{'title'} = 'Tip';
 output "\n" unless $newline_last++;
 push_output('string');
});
sgml('</TIP>', \&admonition_end);
sgml('<CAUTION>', sub {
 $_[0]->ext->{'title'} = 'Caution';
 output "\n" unless $newline_last++;
 push_output('string');
});
sgml('</CAUTION>', \&admonition_end);

sgml('<IMPORTANT>', sub {
 $_[0]->ext->{'title'} = 'Important';
 output "\n" unless $newline_last++;
 push_output('string');
});
sgml('</IMPORTANT>', \&admonition_end);




############################################################################
#
# Verbatim displays.
#
############################################################################

sub verbatim_start {
 output "\n" unless $newline_last++;

 if($_[0]->parent->ext->{'nobreak'}==1) {
 # Usually this is the FIRST element of
 #
 a hanging tag, so we MUST not do a full
 # paragraph break.
 $_[0]->parent->ext->{'nobreak'} = 2;
```

```perl
 } else {
  output "\n";
 }

 output(".nf\n") unless $nocollapse_whitespace++;
}

sub verbatim_end {
 output "\n" unless $newline_last++;
 output(".fi\n") unless --$nocollapse_whitespace;
}

sgml('<PROGRAMLISTING>', \&verbatim_start);
sgml('</PROGRAMLISTING>', \&verbatim_end);

sgml('<SCREEN>', \&verbatim_start);
sgml('</SCREEN>', \&verbatim_end);

sgml('<LITERALLAYOUT>', \&verbatim_start);
sgml('</LITERALLAYOUT>', \&verbatim_end);

#sgml('<SYNOPSIS>', sub {
# if($_[0]->attribute('FORMAT')->value =~ /linespecific/i) {
#  &verbatim_start;
# } else {
#  roffcmd("");
# }
#});
#
#sgml('</SYNOPSIS>', sub {
# if($_[0]->attribute('FORMAT')->value =~ /linespecific/i) {
#  &verbatim_end;
# }
# else {
#  roffcmd("");# not sure about this.
# }
#});
sgml('<SYNOPSIS>', \&verbatim_start);
sgml('</SYNOPSIS>', \&verbatim_end);
```

```
##############################################################################
#
#
 Lists
#
##############################################################################

# Indent nested lists.
sub indent_list_start {
 if($list_nestlevel++) {
  output "\n" unless $newline_last++;
  output ".RS\n";
 }
}
sub indent_list_end {
 if(--$list_nestlevel) {
  output "\n" unless $newline_last++;
  output ".RE\n";
 }
}

sgml('<VARIABLELIST>', \&indent_list_start);
sgml('</VARIABLELIST>', \&indent_list_end);
sgml('<ITEMIZEDLIST>', \&indent_list_start);
sgml('</ITEMIZEDLIST>', \&indent_list_end);
sgml('<ORDEREDLIST>', sub {
 indent_list_start();
 $_[0]->ext->{'count'} = 1;
});
sgml('</ORDEREDLIST>', \&indent_list_end);

# Output content on one line, bolded.
sgml('<TERM>', sub {
 output "\n" unless $newline_last++;
 output ".TP\n";
 bold_on();
 push_output('string');
});
sgml('</TERM>', sub {
 my $term = pop_output();
 $term =~ tr/\n/ /;
 output $term;
 font_off();
 output "\n";
 $newline_last = 1;
});

sgml('<LISTITEM>', sub {
```

```perl
 # A bulleted list.
 if($_[0]->in('ITEMIZEDLIST'))
 {
  output "\n" unless $newline_last++;
  output ".TP 0.2i\n\\(bu\n";
 }


 # Need numbers.
 # Assume Arabic numeration for now.
 elsif($_[0]->in('ORDEREDLIST')) {
  output "\n" unless $newline_last++;
  output ".TP ", $_[0]->parent->ext->{'count'}++, ". \n";
 }

 $_[0]->ext->{'nobreak'} = 1;
});


sgml('<SIMPLELIST>', sub {
 $_[0]->ext->{'first_member'} = 1;
});


sgml('<MEMBER>', sub {
 my $parent = $_[0]->parent;

 if($parent->attribute('TYPE')->value =~ /Inline/i) {
  if($parent->ext->{'first_member'}) {
   # If this is the first member don't put any commas
   $parent->ext->{'first_member'} = 0;
  } else {
   output ", ";
  }
 } elsif($parent->attribute('TYPE')->value =~ /Vert/i) {
  output "\n" unless $newline_last++;
  output "\n";
 }
});




#########################################################################
#
# Stuff we don't know how to handle (yet)
#
#########################################################################

# Address blocks:
```

```
# Credit stuff:
#
 ACKNO
# ADDRESS
# AFFILIATION
# ARTPAGENUMS
# ATTRIBUTION
# AUTHORBLURB
# AUTHORGROUP
# OTHERCREDIT
# HONORIFIC

# Areas:
# AREA
# AREASET
# AREASPEC




############################################################################
#
# Linkage, cross references
#
############################################################################

# Print the URL
sgml('</ULINK>', sub {
# output ' <URL:', $_[0]->attribute('URL')->value, '>';
 $newline_last = 0;
});

# If cross reference target is a RefEntry,
# output CiteRefEntry-style references.
sgml('<XREF>', sub {
 my $id = $_[0]->attribute('LINKEND')->value;
 my $manref = $Refs->get("refentry:$id");

 if($manref) {
 my ($title, $sect) = ($manref =~ /(.*)(\(.*\))/);
 bold_on();
 output $title;
 font_off();
 output $sect;
 } else {
 $blank_xrefs++ if $write_manpages;
```

```
 output "[XRef to $id]";
 }

 $newline_last = 0;
});


# Anchor




##############################################################################
#
# Other handlers
#
##############################################################################

man_sgml('|[lt
   ]|', '<');
man_sgml('|[gt   ]|', '>');
man_sgml('|[amp   ]|', '&');


#
# Default handlers (uncomment these if needed).  Right now, these are set
# up to gag on any unrecognised elements, sdata, processing-instructions,
# or entities.
#
# sgml('start_element',sub { die "Unknown element: " . $_[0]->name; });
# sgml('end_element','');

# This is for weeding out and escaping certain characters.
# This looks like it's inefficient since it's done on every line, but
# in reality, SGMLSpm and sgmlspl parsing ESIS takes _much_ longer.

sgml('cdata', sub
{
 if(!$write_manpages) { return; }
 elsif($raw_cdata) { output $_[0]; return; }

 # Escape backslashes
 $_[0] =~ s/\/\\\\/g;

 # In non-'pre'-type elements:
 if(!$nocollapse_whitespace) {
  # Change tabs to spaces
  $_[0] =~ tr/\t/ /;

  # Do not allow indents at beginning of line
```

```perl
  # groff chokes on that.
  if($newline_last) {
   $_[0] =~ s/^ +//;

    # If the
 line is all blank, don't do anything.
   if($_[0] eq '') { return; }

    $_[0] =~ s/^\./\\\&\./;

    # Argh... roff doesn't like ' either...
   $_[0] =~ s/^\'/\\\&\'/;
  }
 }

 $newline_last = 0;

 output $_[0];
});


# When in whitespace-collapsing mode, we disallow consecutive newlines.

sgml('re', sub
{
 if($nocollapse_whitespace || !$newline_last) {
  output "\n";
 }

 $newline_last = 1;
});

sgml('sdata',sub { die "Unknown SDATA: " . $_[0]; });
sgml('pi',sub { die "Unknown processing instruction: " . $_[0]; });
sgml('entity',sub { die "Unknown external entity: " . $_[0]->name; });
sgml('start_subdoc',sub { die "Unknown subdoc entity: " . $_[0]->name; });
sgml('end_subdoc','');
sgml('conforming','');

1;
```

Found in path(s):
* /opt/cola/permits/1826454257_1697752738.11816/0/iputils-s20101006-tar-gz/iputils-
s20101006/doc/docbook2man-spec.pl
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*/
/*
* P I N G . C
*
 * Using the InterNet Control Message Protocol (ICMP) "ECHO" facility,
* measure round-trip-delays and packet loss across network paths.
*
* Author -
* Mike Muuss
* U. S. Army Ballistic Research Laboratory
* December, 1983
*
* Status -
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* Bugs -

* More statistics could always be gathered.
* This program has to run SUID to ROOT to access the ICMP socket.
*/

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* /opt/cola/permits/1826454257_1697752738.11816/0/iputils-s20101006-tar-gz/iputils-s20101006/ping.c
* /opt/cola/permits/1826454257_1697752738.11816/0/iputils-s20101006-tar-gz/iputils-s20101006/ping6.c
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```
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 *
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 *                             Uppsala University, Sweden
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 *
 *
 *
 */
```

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*
 /opt/cola/permits/1826454257_1697752738.11816/0/iputils-s20101006-tar-gz/iputils-s20101006/tftpsubs.c
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*
* Authors: Alexey Kuznetsov, <kuznet@ms2.inr.ac.ru>
*/

Found in path(s):
* /opt/cola/permits/1826454257_1697752738.11816/0/iputils-s20101006-tar-gz/iputils-s20101006/arping.c

1.54 tinyproxy 1.8.3

1.54.1 Available under license :

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1.55 wpa-supplicant 2.5-devel

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Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-
gz/wpa_supplicant/doc/docbook/wpa_priv.sgml
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-
gz/wpa_supplicant/doc/docbook/wpa_gui.sgml
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-
gz/wpa_supplicant/doc/docbook/wpa_supplicant.sgml
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-
gz/wpa_supplicant/doc/docbook/wpa_cli.sgml
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-
gz/wpa_supplicant/doc/docbook/wpa_passphrase.sgml
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-
gz/wpa_supplicant/doc/docbook/eapol_test.sgml
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-
gz/wpa_supplicant/doc/docbook/wpa_background.sgml
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/*
* wpa_supplicant - Temporary BSSID blacklist
* Copyright (c) 2003-2007, Jouni Malinen <j@w1.fi>
*
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*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/blacklist.c
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/blacklist.h
No license file was found, but licenses were detected in source scan.

ChangeLog for wpa_supplicant

2016-10-02 - v2.6
 * fixed WNM Sleep Mode processing when PMF is not enabled
   [http://w1.fi/security/2015-6/] (CVE-2015-5310)
 * fixed EAP-pwd last fragment validation
   [http://w1.fi/security/2015-7/] (CVE-2015-5315)
 * fixed EAP-pwd unexpected Confirm message processing
   [http://w1.fi/security/2015-8/] (CVE-2015-5316)
 * fixed WPS configuration update vulnerability with malformed passphrase
   [http://w1.fi/security/2016-1/] (CVE-2016-4476)
 * fixed configuration update vulnerability with malformed parameters set
   over the local control interface
   [http://w1.fi/security/2016-1/] (CVE-2016-4477)
 * fixed TK configuration to the driver in EAPOL-Key 3/4 retry case
 * extended channel switch support for P2P GO
 * started to throttle control interface event message bursts to avoid
   issues with monitor sockets running out of buffer space
 * mesh mode fixes/improvements
   - generate
proper AID for peer
   - enable WMM by default
   - add VHT support
   - fix PMKID derivation
   - improve robustness on various exchanges
   - fix peer link counting in reconnect case
   - improve mesh joining behavior
   - allow DTIM period to be configured
   - allow HT to be disabled (disable_ht=1)
   - add MESH_PEER_ADD and MESH_PEER_REMOVE commands
   - add support for PMKSA caching
   - add minimal support for SAE group negotiation
   - allow pairwise/group cipher to be configured in the network profile
   - use ieee80211w profile parameter to enable/disable PMF and derive
     a separate TX IGTK if PMF is enabled instead of using MGTK

incorrectly
- fix AEK and MTK derivation
- remove GTKdata and IGTKdata from Mesh Peering Confirm/Close
- note: these changes are not fully backwards compatible for secure
  (RSN) mesh network
* fixed PMKID derivation with SAE
* added support for requesting and fetching arbitrary ANQP-elements
  without internal support in wpa_supplicant
for the specific element
  (anqp[265]=<hexdump> in "BSS <BSSID>" command output)
* P2P
- filter control characters in group client device names to be
  consistent with other P2P peer cases
- support VHT 80+80 MHz and 160 MHz
- indicate group completion in P2P Client role after data association
  instead of already after the WPS provisioning step
- improve group-join operation to use SSID, if known, to filter BSS
  entries
- added optional ssid=<hexdump> argument to P2P_CONNECT for join case
- added P2P_GROUP_MEMBER command to fetch client interface address
* P2PS
- fix follow-on PD Response behavior
- fix PD Response generation for unknown peer
- fix persistent group reporting
- add channel policy to PD Request
- add group SSID to the P2PS-PROV-DONE event
- allow "P2P_CONNECT <addr> p2ps" to be used without specifying the
  default PIN
* BoringSSL
- support for OCSP stapling
- support building of h20-osu-client
* D-Bus

- add ExpectDisconnect()
- add global config parameters as properties
- add SaveConfig()
- add VendorElemAdd(), VendorElemGet(), VendorElemRem()
* fixed Suite B 192-bit AKM to use proper PMK length
  (note: this makes old releases incompatible with the fixed behavior)
* improved PMF behavior for cases where the AP and STA has different
  configuration by not trying to connect in some corner cases where the
  connection cannot succeed
* added option to reopen debug log (e.g., to rotate the file) upon
  receipt of SIGHUP signal
* EAP-pwd: added support for Brainpool Elliptic Curves
  (with OpenSSL 1.0.2 and newer)
* fixed EAPOL reauthentication after FT protocol run
* fixed FTIE generation for 4-way handshake after FT protocol run

* extended INTERFACE_ADD command to allow certain type (sta/ap)
  interface to be created
* fixed and improved various FST operations
* added 80+80 MHz and 160 MHz VHT support for IBSS/mesh
* fixed SIGNAL_POLL in IBSS and mesh cases
*
added an option to abort an ongoing scan (used to speed up connection
  and can also be done with the new ABORT_SCAN command)
* TLS client
  - do not verify CA certificates when ca_cert is not specified
  - support validating server certificate hash
  - support SHA384 and SHA512 hashes
  - add signature_algorithms extension into ClientHello
  - support TLS v1.2 signature algorithm with SHA384 and SHA512
  - support server certificate probing
  - allow specific TLS versions to be disabled with phase2 parameter
  - support extKeyUsage
  - support PKCS #5 v2.0 PBES2
  - support PKCS #5 with PKCS #12 style key decryption
  - minimal support for PKCS #12
  - support OCSP stapling (including ocsp_multi)
* OpenSSL
  - support OpenSSL 1.1 API changes
  - drop support for OpenSSL 0.9.8
  - drop support for OpenSSL 1.0.0
* added support for multiple schedule scan plans (sched_scan_plans)
* added support for external server certificate chain validation
  (tls_ext_cert_check=1
in the network profile phase1 parameter)
* made phase2 parser more strict about correct use of auth=<val> and
  autheap=<val> values
* improved GAS offchannel operations with comeback request
* added SIGNAL_MONITOR command to request signal strength monitoring
  events
* added command for retrieving HS 2.0 icons with in-memory storage
  (REQ_HS20_ICON, GET_HS20_ICON, DEL_HS20_ICON commands and
  RX-HS20-ICON event)
* enabled ACS support for AP mode operations with wpa_supplicant
* EAP-PEAP: fixed interoperability issue with Windows 2012r2 server
  ("Invalid Compound_MAC in cryptobinding TLV")
* EAP-TTLS: fixed success after fragmented final Phase 2 message
* VHT: added interoperability workaround for 80+80 and 160 MHz channels
* WNM: workaround for broken AP operating class behavior
* added kqueue(2) support for eloop (CONFIG_ELOOP_KQUEUE)
* nl80211:
  - add support for full station state operations
  - do not add NL80211_ATTR_SMPS_MODE attribute if HT is disabled

- add NL80211_ATTR_PREV_BSSID with Connect command
  - fix IEEE 802.1X/WEP EAP reauthentication and rekeying to use
    unencrypted EAPOL frames
* added initial MBO support; number of extensions to WNM BSS Transition
  Management
* added support for PBSS/PCP and P2P on 60 GHz
* Interworking: add credential realm to EAP-TLS identity
* fixed EAPOL-Key Request Secure bit to be 1 if PTK is set
* HS 2.0: add support for configuring frame filters
* added POLL_STA command to check connectivity in AP mode
* added initial functionality for location related operations
* started to ignore pmf=1/2 parameter for non-RSN networks
* added wps_disabled=1 network profile parameter to allow AP mode to
  be started without enabling WPS
* wpa_cli: added action script support for AP-ENABLED and AP-DISABLED
  events
* improved Public Action frame addressing
  - add gas_address3 configuration parameter to control Address 3
    behavior
* number of small fixes

2015-09-27 - v2.5
*
fixed P2P validation of SSID element length before copying it
  [http://w1.fi/security/2015-1/] (CVE-2015-1863)
* fixed WPS UPnP vulnerability with HTTP chunked transfer encoding
  [http://w1.fi/security/2015-2/] (CVE-2015-4141)
* fixed WMM Action frame parser (AP mode)
  [http://w1.fi/security/2015-3/] (CVE-2015-4142)
* fixed EAP-pwd peer missing payload length validation
  [http://w1.fi/security/2015-4/]
  (CVE-2015-4143, CVE-2015-4144, CVE-2015-4145, CVE-2015-4146)
* fixed validation of WPS and P2P NFC NDEF record payload length
  [http://w1.fi/security/2015-5/]
* nl80211:
  - added VHT configuration for IBSS
  - fixed vendor command handling to check OUI properly
  - allow driver-based roaming to change ESS
* added AVG_BEACON_RSSI to SIGNAL_POLL output
* wpa_cli: added tab completion for number of commands
* removed unmaintained and not yet completed SChannel/CryptoAPI support
* modified Extended Capabilities element use in Probe Request frames to
  include all
cases if any of the values are non-zero
* added support for dynamically creating/removing a virtual interface
  with interface_add/interface_remove
* added support for hashed password (NtHash) in EAP-pwd peer
* added support for memory-only PSK/passphrase (mem_only_psk=1 and

CTRL-REQ/RSP-PSK_PASSPHRASE)
* P2P
  - optimize scan frequencies list when re-joining a persistent group
  - fixed number of sequences with nl80211 P2P Device interface
  - added operating class 125 for P2P use cases (this allows 5 GHz
    channels 161 and 169 to be used if they are enabled in the current
    regulatory domain)
  - number of fixes to P2PS functionality
  - do not allow 40 MHz co-ex PRI/SEC switch to force MCC
  - extended support for preferred channel listing
* D-Bus:
  - fixed WPS property of fi.w1.wpa_supplicant1.BSS interface
  - fixed PresenceRequest to use group interface
  - added new signals: FindStopped, WPS pbc-overlap,
    GroupFormationFailure, WPS timeout, InvitationReceived

  - added new methods: WPS Cancel, P2P Cancel, Reconnect, RemoveClient
  - added manufacturer info
* added EAP-EKE peer support for deriving Session-Id
* added wps_priority configuration parameter to set the default priority
  for all network profiles added by WPS
* added support to request a scan with specific SSIDs with the SCAN
  command (optional "ssid <hexdump>" arguments)
* removed support for WEP40/WEP104 as a group cipher with WPA/WPA2
* fixed SAE group selection in an error case
* modified SAE routines to be more robust and PWE generation to be
  stronger against timing attacks
* added support for Brainpool Elliptic Curves with SAE
* added support for CCMP-256 and GCMP-256 as group ciphers with FT
* fixed BSS selection based on estimated throughput
* added option to disable TLSv1.0 with OpenSSL
  (phase1="tls_disable_tlsv1_0=1")
* added Fast Session Transfer (FST) module
* fixed OpenSSL PKCS#12 extra certificate handling
* fixed key derivation for
Suite B 192-bit AKM (this breaks
  compatibility with the earlier version)
* added RSN IE to Mesh Peering Open/Confirm frames
* number of small fixes

2015-03-15 - v2.4
* allow OpenSSL cipher configuration to be set for internal EAP server
  (openssl_ciphers parameter)
* fixed number of small issues based on hwsim test case failures and
  static analyzer reports
* P2P:
  - add new=<0/1> flag to P2P-DEVICE-FOUND events
  - add passive channels in invitation response from P2P Client

- enable nl80211 P2P_DEVICE support by default
- fix regresssion in disallow_freq preventing search on social
  channels
- fix regressions in P2P SD query processing
- try to re-invite with social operating channel if no common channels
  in invitation
- allow cross connection on parent interface (this fixes number of
  use cases with nl80211)
- add support for P2P services (P2PS)
- add p2p_go_ctwindow configuration parameter to allow GO CTWindow to
  be configured
*
increase postponing of EAPOL-Start by one second with AP/GO that
  supports WPS 2.0 (this makes it less likely to trigger extra roundtrip
  of identity frames)
* add support for PMKSA caching with SAE
* add support for control mesh BSS (IEEE 802.11s) operations
* fixed number of issues with D-Bus P2P commands
* fixed regression in ap_scan=2 special case for WPS
* fixed macsec_validate configuration
* add a workaround for incorrectly behaving APs that try to use
  EAPOL-Key descriptor version 3 when the station supports PMF even if
  PMF is not enabled on the AP
* allow TLS v1.1 and v1.2 to be negotiated by default; previous behavior
  of disabling these can be configured to work around issues with broken
  servers with phase1="tls_disable_tlsv1_1=1 tls_disable_tlsv1_2=1"
* add support for Suite B (128-bit and 192-bit level) key management and
  cipher suites
* add WMM-AC support (WMM_AC_ADDTS/WMM_AC_DELTS)
* improved BSS Transition Management processing
* add support
for neighbor report
* add support for link measurement
* fixed expiration of BSS entry with all-zeros BSSID
* add optional LAST_ID=x argument to LIST_NETWORK to allow all
  configured networks to be listed even with huge number of network
  profiles
* add support for EAP Re-Authentication Protocol (ERP)
* fixed EAP-IKEv2 fragmentation reassembly
* improved PKCS#11 configuration for OpenSSL
* set stdout to be line-buffered
* add TDLS channel switch configuration
* add support for MAC address randomization in scans with nl80211
* enable HT for IBSS if supported by the driver
* add BSSID black and white lists (bssid_blacklist, bssid_whitelist)
* add support for domain_suffix_match with GnuTLS
* add OCSP stapling client support with GnuTLS
* include peer certificate in EAP events even without a separate probe

operation; old behavior can be restored with cert_in_cb=0
* add peer ceritficate alt subject name to EAP events
  (CTRL-EVENT-EAP-PEER-ALT)
* add domain_match
network profile parameter (similar to
  domain_suffix_match, but full match is required)
* enable AP/GO mode HT Tx STBC automatically based on driver support
* add ANQP-QUERY-DONE event to provide information on ANQP parsing
  status
* allow passive scanning to be forced with passive_scan=1
* add a workaround for Linux packet socket behavior when interface is in
  bridge
* increase 5 GHz band preference in BSS selection (estimate SNR, if info
  not available from driver; estimate maximum throughput based on common
  HT/VHT/specific TX rate support)
* add INTERWORKING_ADD_NETWORK ctrl_iface command; this can be used to
  implement Interworking network selection behavior in upper layers
  software components
* add optional reassoc_same_bss_optim=1 (disabled by default)
  optimization to avoid unnecessary Authentication frame exchange
* extend TDLS frame padding workaround to cover all packets
* allow wpa_supplicant to recover nl80211 functionality if the cfg80211
  module
gets removed and reloaded without restarting wpa_supplicant
* allow hostapd DFS implementation to be used in wpa_supplicant AP mode

2014-10-09 - v2.3
 * fixed number of minor issues identified in static analyzer warnings
 * fixed wfd_dev_info to be more careful and not read beyond the buffer
   when parsing invalid information for P2P-DEVICE-FOUND
 * extended P2P and GAS query operations to support drivers that have
   maximum remain-on-channel time below 1000 ms (500 ms is the current
   minimum supported value)
 * added p2p_search_delay parameter to make the default p2p_find delay
   configurable
 * improved P2P operating channel selection for various multi-channel
   concurrency cases
 * fixed some TDLS failure cases to clean up driver state
 * fixed dynamic interface addition cases with nl80211 to avoid adding
   ifindex values to incorrect interface to skip foreign interface events
   properly
 * added TDLS workaround for some APs that may add extra data to the
   end of a short
 frame
 * fixed EAP-AKA' message parser with multiple AT_KDF attributes
 * added configuration option (p2p_passphrase_len) to allow longer
   passphrases to be generated for P2P groups
 * fixed IBSS channel configuration in some corner cases

* improved HT/VHT/QoS parameter setup for TDLS
* modified D-Bus interface for P2P peers/groups
* started to use constant time comparison for various password and hash
  values to reduce possibility of any externally measurable timing
  differences
* extended explicit clearing of freed memory and expired keys to avoid
  keeping private data in memory longer than necessary
* added optional scan_id parameter to the SCAN command to allow manual
  scan requests for active scans for specific configured SSIDs
* fixed CTRL-EVENT-REGDOM-CHANGE event init parameter value
* added option to set Hotspot 2.0 Rel 2 update_identifier in network
  configuration to support external configuration
* modified Android PNO functionality to send Probe Request
frames only
  for hidden SSIDs (based on scan_ssid=1)
* added generic mechanism for adding vendor elements into frames at
  runtime (VENDOR_ELEM_ADD, VENDOR_ELEM_GET, VENDOR_ELEM_REMOVE)
* added fields to show unrecognized vendor elements in P2P_PEER
* removed EAP-TTLS/MSCHAPv2 interoperability workaround so that
  MS-CHAP2-Success is required to be present regardless of
  eap_workaround configuration
* modified EAP fast session resumption to allow results to be used only
  with the same network block that generated them
* extended freq_list configuration to apply for sched_scan as well as
  normal scan
* modified WPS to merge mixed-WPA/WPA2 credentials from a single session
* fixed nl80211/RTM_DELLINK processing when a P2P GO interface is
  removed from a bridge
* fixed number of small P2P issues to make negotiations more robust in
  corner cases
* added experimental support for using temporary, random local MAC
  address (mac_addr and preassoc_mac_addr parameters);
this is disabled
  by default (i.e., previous behavior of using permanent address is
  maintained if configuration is not changed)
* added D-Bus interface for setting/clearing WFD IEs
* fixed TDLS AID configuration for VHT
* modified -m<conf> configuration file to be used only for the P2P
  non-netdev management device and do not load this for the default
  station interface or load the station interface configuration for
  the P2P management interface
* fixed external MAC address changes while wpa_supplicant is running
* started to enable HT (if supported by the driver) for IBSS
* fixed wpa_cli action script execution to use more robust mechanism
  (CVE-2014-3686)

2014-06-04 - v2.2
  * added DFS indicator to get_capability freq

* added/fixed nl80211 functionality
  - BSSID/frequency hint for driver-based BSS selection
  - fix tearing down WDS STA interfaces
  - support vendor specific driver command
    (VENDOR <vendor id> <sub command id> [<hex formatted data>])

 - GO interface teardown optimization
  - allow beacon interval to be configured for IBSS
  - add SHA256-based AKM suites to CONNECT/ASSOCIATE commands
* removed unused NFC_RX_HANDOVER_REQ and NFC_RX_HANDOVER_SEL control
  interface commands (the more generic NFC_REPORT_HANDOVER is now used)
* fixed MSCHAP UTF-8 to UCS-2 conversion for three-byte encoding;
  this fixes password with include UTF-8 characters that use
  three-byte encoding EAP methods that use NtPasswordHash
* fixed couple of sequences where radio work items could get stuck,
  e.g., when rfkill blocking happens during scanning or when
  scan-for-auth workaround is used
* P2P enhancements/fixes
  - enable enable U-APSD on GO automatically if the driver indicates
    support for this
  - fixed some service discovery cases with broadcast queries not being
    sent to all stations
  - fixed Probe Request frame triggering invitation to trigger only a
    single invitation instance even if multiple Probe Request
frames are
    received
  - fixed a potential NULL pointer dereference crash when processing an
    invalid Invitation Request frame
  - add optional configuration file for the P2P_DEVICE parameters
  - optimize scan for GO during persistent group invocation
  - fix possible segmentation fault when PBC overlap is detected while
    using a separate P2P group interface
  - improve GO Negotiation robustness by allowing GO Negotiation
    Confirmation to be retransmitted
  - do use freed memory on device found event when P2P NFC
* added phase1 network parameter options for disabling TLS v1.1 and v1.2
  to allow workarounds with misbehaving AAA servers
  (tls_disable_tlsv1_1=1 and tls_disable_tlsv1_2=1)
* added support for OCSP stapling to validate AAA server certificate
  during TLS exchange
* Interworking/Hotspot 2.0 enhancements
  - prefer the last added network in Interworking connection to make the
    behavior more consistent with likely user expectation
  -
roaming partner configuration (roaming_partner within a cred block)
  - support Hotspot 2.0 Release 2
    * "hs20_anqp_get <BSSID> 8" to request OSU Providers list
    * "hs20_icon_request <BSSID> <icon filename>" to request icon files

---

* "fetch_osu" and "cancel_osu_fetch" to start/stop full OSU provider
    search (all suitable APs in scan results)
  * OSEN network for online signup connection
  * min_{dl,ul}_bandwidth_{home,roaming} cred parameters
  * max_bss_load cred parameter
  * req_conn_capab cred parameter
  * sp_priority cred parameter
  * ocsp cred parameter
  * slow down automatic connection attempts on EAP failure to meet
    required behavior (no more than 10 retries within a 10-minute
    interval)
  * sample implementation of online signup client (both SPP and
    OMA-DM protocols) (hs20/client/*)
 - fixed GAS indication for additional comeback delay with status
   code 95
 - extend ANQP_GET to accept Hotspot 2.0 subtypes

   ANQP_GET <addr> <info id>[,<info id>]...
    [,hs20:<subtype>][...,hs20:<subtype>]
 - add control interface events CRED-ADDED <id>,
   CRED-MODIFIED <id> <field>, CRED-REMOVED <id>
 - add "GET_CRED <id> <field>" command
 - enable FT for the connection automatically if the AP advertises
   support for this
 - fix a case where auto_interworking=1 could end up stopping scanning
* fixed TDLS interoperability issues with supported operating class in
  some deployed stations
* internal TLS implementation enhancements/fixes
  - add SHA256-based cipher suites
  - add DHE-RSA cipher suites
  - fix X.509 validation of PKCS#1 signature to check for extra data
* fixed PTK derivation for CCMP-256 and GCMP-256
* added "reattach" command for fast reassociate-back-to-same-BSS
* allow PMF to be enabled for AP mode operation with the ieee80211w
  parameter
* added "get_capability tdls" command
* added option to set config blobs through control interface with
  "SET blob <name>
<hexdump>"
* D-Bus interface extensions/fixes
  - make p2p_no_group_iface configurable
  - declare ServiceDiscoveryRequest method properly
  - export peer's device address as a property
  - make reassociate command behave like the control interface one,
    i.e., to allow connection from disconnected state
* added optional "freq=<channel ranges>" parameter to SET pno
* added optional "freq=<channel ranges>" parameter to SELECT_NETWORK
* fixed OBSS scan result processing for 20/40 MHz co-ex report

* remove WPS 1.0 only support, i.e., WSC 2.0 support is now enabled
  whenever CONFIG_WPS=y is set
* fixed regression in parsing of WNM Sleep Mode exit key data
* fixed potential segmentation fault and memory leaks in WNM neighbor
  report processing
* EAP-pwd fixes
  - fragmentation of PWD-Confirm-Resp
  - fix memory leak when fragmentation is used
  - fix possible segmentation fault on EAP method deinit if an invalid
    group is negotiated
* added MACsec/IEEE Std 802.1X-2010
PAE implementation (currently
  available only with the macsec_qca driver wrapper)
* fixed EAP-SIM counter-too-small message
* added 'dup_network <id_s> <id_d> <name>' command; this can be used to
  clone the psk field without having toextract it from wpa_supplicant
* fixed GSM authentication on USIM
* added support for usin epoll in eloop (CONFIG_ELOOP_EPOLL=y)
* fixed some concurrent virtual interface cases with dedicated P2P
  management interface to not catch events from removed interface (this
  could result in the management interface getting disabled)
* fixed a memory leak in SAE random number generation
* fixed off-by-one bounds checking in printf_encode()
  - this could result in some control interface ATTACH command cases
    terminating wpa_supplicant
* fixed EAPOL-Key exchange when GCMP is used with SHA256-based AKM
* various bug fixes

2014-02-04 - v2.1
* added support for simultaneous authentication of equals (SAE) for
  stronger password-based
authentication with WPA2-Personal
* improved P2P negotiation and group formation robustness
  - avoid unnecessary Dialog Token value changes during retries
  - avoid more concurrent scanning cases during full group formation
    sequence
  - do not use potentially obsolete scan result data from driver
    cache for peer discovery/updates
  - avoid undesired re-starting of GO negotiation based on Probe
    Request frames
  - increase GO Negotiation and Invitation timeouts to address busy
    environments and peers that take long time to react to messages,
    e.g., due to power saving
  - P2P Device interface type
* improved P2P channel selection (use more peer information and allow
  more local options)
* added support for optional per-device PSK assignment by P2P GO
  (wpa_cli p2p_set per_sta_psk <0/1>)

* added P2P_REMOVE_CLIENT for removing a client from P2P groups

  (including persistent groups); this can be used to securely remove

  a client from a group if per-device

PSKs are used

* added more configuration flexibility for allowed P2P GO/client

  channels (p2p_no_go_freq list and p2p_add_cli_chan=0/1)

* added nl80211 functionality

  - VHT configuration for nl80211

  - MFP (IEEE 802.11w) information for nl80211 command API

  - support split wiphy dump

  - FT (IEEE 802.11r) with driver-based SME

  - use advertised number of supported concurrent channels

  - QoS Mapping configuration

* improved TDLS negotiation robustness

* added more TDLS peer parameters to be configured to the driver

* optimized connection time by allowing recently received scan results

  to be used instead of having to run through a new scan

* fixed ctrl_iface BSS command iteration with RANGE argument and no

  exact matches; also fixed argument parsing for some cases with

  multiple arguments

* added 'SCAN TYPE=ONLY' ctrl_iface command to request manual scan

  without executing roaming/network re-selection on scan results

* added Session-Id derivation for

EAP peer methods

* added fully automated regression testing with mac80211_hwsim

* changed configuration parser to reject invalid integer values

* allow AP/Enrollee to be specified with BSSID instead of UUID for

  WPS ER operations

* disable network block temporarily on repeated connection failures

* changed the default driver interface from wext to nl80211 if both are

  included in the build

* remove duplicate networks if WPS provisioning is run multiple times

* remove duplicate networks when Interworking network selection uses the

  same network

* added global freq_list configuration to allow scan frequencies to be

  limited for all cases instead of just for a specific network block

* added support for BSS Transition Management

* added option to use "IFNAME=<ifname> " prefix to use the global

  control interface connection to perform per-interface commands;

  similarly, allow global control interface to be used as a monitor

  interface to receive events from all interfaces

*

fixed OKC-based PMKSA cache entry clearing

* fixed TKIP group key configuration with FT

* added support for using OCSP stapling to validate server certificate

  (ocsp=1 as optional and ocsp=2 as mandatory)

* added EAP-EKE peer

* added peer restart detection for IBSS RSN

---

* added domain_suffix_match (and domain_suffix_match2 for Phase 2
  EAP-TLS) to specify additional constraint for the server certificate
  domain name
* added support for external SIM/USIM processing in EAP-SIM, EAP-AKA,
  and EAP-AKA' (CTRL-REQ-SIM and CTRL-RSP-SIM commands over control
  interface)
* added global bgscan configuration option as a default for all network
  blocks that do not specify their own bgscan parameters
* added D-Bus methods for TDLS
* added more control to scan requests
  - "SCAN freq=<freq list>" can be used to specify which channels are
    scanned (comma-separated frequency ranges in MHz)
  - "SCAN passive=1" can be used to request a passive scan (no Probe
    Request
frames are sent)
  - "SCAN use_id" can be used to request a scan id to be returned and
    included in event messages related to this specific scan operation
  - "SCAN only_new=1" can be used to request the driver/cfg80211 to
    report only BSS entries that have been updated during this scan
    round
  - these optional arguments to the SCAN command can be combined with
    each other
* modified behavior on externally triggered scans
  - avoid concurrent operations requiring full control of the radio when
    an externally triggered scan is detected
  - do not use results for internal roaming decision
* added a new cred block parameter 'temporary' to allow credential
  blocks to be stored separately even if wpa_supplicant configuration
  file is used to maintain other network information
* added "radio work" framework to schedule exclusive radio operations
  for off-channel functionality
  - reduce issues with concurrent operations that try to control which
    channel
is used
  - allow external programs to request exclusive radio control in a way
    that avoids conflicts with wpa_supplicant
* added support for using Protected Dual of Public Action frames for
  GAS/ANQP exchanges when associated with PMF
* added support for WPS+NFC updates and P2P+NFC
  - improved protocol for WPS
  - P2P group formation/join based on NFC connection handover
  - new IPv4 address assignment for P2P groups (ip_addr_* configuration
    parameters on the GO) to replace DHCP
  - option to fetch and report alternative carrier records for external
    NFC operations
* various bug fixes

2013-01-12 - v2.0

* removed Qt3-based wpa_gui (obsoleted by wpa_qui-qt4)
* removed unmaintained driver wrappers broadcom, iphone, osx, ralink,
  hostap, madwifi (hostap and madwifi remain available for hostapd;
  their wpa_supplicant functionality is obsoleted by wext)
* improved debug logging (human readable event names, interface name
  included in more entries)
*
changed AP mode behavior to enable WPS only for open and
  WPA/WPA2-Personal configuration
* improved P2P concurrency operations
  - better coordination of concurrent scan and P2P search operations
  - avoid concurrent remain-on-channel operation requests by canceling
    previous operations prior to starting a new one
  - reject operations that would require multi-channel concurrency if
    the driver does not support it
  - add parameter to select whether STA or P2P connection is preferred
    if the driver cannot support both at the same time
  - allow driver to indicate channel changes
  - added optional delay=<search delay in milliseconds> parameter for
    p2p_find to avoid taking all radio resources
  - use 500 ms p2p_find search delay by default during concurrent
    operations
  - allow all channels in GO Negotiation if the driver supports
    multi-channel concurrency
* added number of small changes to make it easier for static analyzers
  to understand the
implementation
* fixed number of small bugs (see git logs for more details)
* nl80211: number of updates to use new cfg80211/nl80211 functionality
  - replace monitor interface with nl80211 commands for AP mode
  - additional information for driver-based AP SME
  - STA entry authorization in RSN IBSS
* EAP-pwd:
  - fixed KDF for group 21 and zero-padding
  - added support for fragmentation
  - increased maximum number of hunting-and-pecking iterations
* avoid excessive Probe Response retries for broadcast Probe Request
  frames (only with drivers using wpa_supplicant AP mode SME/MLME)
* added "GET country" ctrl_iface command
* do not save an invalid network block in wpa_supplicant.conf to avoid
  problems reading the file on next start
* send STA connected/disconnected ctrl_iface events to both the P2P
  group and parent interfaces
* added preliminary support for using TLS v1.2 (CONFIG_TLSV12=y)
* added "SET pno <1/0>" ctrl_iface command to start/stop preferred
  network
offload with sched_scan driver command
* merged in number of changes from Android repository for P2P, nl80211,

and build parameters
* changed P2P GO mode configuration to use driver capabilities to
  automatically enable HT operations when supported
* added "wpa_cli status wps" command to fetch WPA2-Personal passhrase
  for WPS use cases in AP mode
* EAP-AKA: keep pseudonym identity across EAP exchanges to match EAP-SIM
  behavior
* improved reassociation behavior in cases where association is rejected
  or when an AP disconnects us to handle common load balancing
  mechanisms
  - try to avoid extra scans when the needed information is available
* added optional "join" argument for p2p_prov_disc ctrl_iface command
* added group ifname to P2P-PROV-DISC-* events
* added P2P Device Address to AP-STA-DISCONNECTED event and use
  p2p_dev_addr parameter name with AP-STA-CONNECTED
* added workarounds for WPS PBC overlap detection for some P2P use cases
  where deployed
stations work incorrectly
* optimize WPS connection speed by disconnecting prior to WPS scan and
  by using single channel scans when AP channel is known
* PCSC and SIM/USIM improvements:
  - accept 0x67 (Wrong length) as a response to READ RECORD to fix
    issues with some USIM cards
  - try to read MNC length from SIM/USIM
  - build realm according to 3GPP TS 23.003 with identity from the SIM
  - allow T1 protocol to be enabled
* added more WPS and P2P information available through D-Bus
* improve P2P negotiation robustness
  - extra waits to get ACK frames through
  - longer timeouts for cases where deployed devices have been
    identified have issues meeting the specification requirements
  - more retries for some P2P frames
  - handle race conditions in GO Negotiation start by both devices
  - ignore unexpected GO Negotiation Response frame
* added support for libnl 3.2 and newer
* added P2P persistent group info to P2P_PEER data
* maintain a list of P2P Clients
for persistent group on GO
* AP: increased initial group key handshake retransmit timeout to 500 ms
* added optional dev_id parameter for p2p_find
* added P2P-FIND-STOPPED ctrl_iface event
* fixed issues in WPA/RSN element validation when roaming with ap_scan=1
  and driver-based BSS selection
* do not expire P2P peer entries while connected with the peer in a
  group
* fixed WSC element inclusion in cases where P2P is disabled
* AP: added a WPS workaround for mixed mode AP Settings with Windows 7
* EAP-SIM: fixed AT_COUNTER_TOO_SMALL use

* EAP-SIM/AKA: append realm to pseudonym identity
* EAP-SIM/AKA: store pseudonym identity in network configuration to
  allow it to persist over multiple EAP sessions and wpa_supplicant
  restarts
* EAP-AKA': updated to RFC 5448 (username prefixes changed); note: this
  breaks interoperability with older versions
* added support for WFA Hotspot 2.0
  - GAS/ANQP to fetch network information
  - credential configuration and automatic
network selections based on
    credential match with ANQP information
* limited PMKSA cache entries to be used only with the network context
  that was used to create them
* improved PMKSA cache expiration to avoid unnecessary disconnections
* adjusted bgscan_simple fast-scan backoff to avoid too frequent
  background scans
* removed ctrl_iface event on P2P PD Response in join-group case
* added option to fetch BSS table entry based on P2P Device Address
  ("BSS p2p_dev_addr=<P2P Device Address>")
* added BSS entry age to ctrl_iface BSS command output
* added optional MASK=0xH option for ctrl_iface BSS command to select
  which fields are included in the response
* added optional RANGE=ALL|N1-N2 option for ctrl_iface BSS command to
  fetch information about several BSSes in one call
* simplified licensing terms by selecting the BSD license as the only
  alternative
* added "P2P_SET disallow_freq <freq list>" ctrl_iface command to
  disable channels from P2P use
*
added p2p_pref_chan configuration parameter to allow preferred P2P
  channels to be specified
* added support for advertising immediate availability of a WPS
  credential for P2P use cases
* optimized scan operations for P2P use cases (use single channel scan
  for a specific SSID when possible)
* EAP-TTLS: fixed peer challenge generation for MSCHAPv2
* SME: do not use reassociation after explicit disconnection request
  (local or a notification from an AP)
* added support for sending debug info to Linux tracing (-T on command
  line)
* added support for using Deauthentication reason code 3 as an
  indication of P2P group termination
* added wps_vendor_ext_m1 configuration parameter to allow vendor
  specific attributes to be added to WPS M1
* started using separate TLS library context for tunneled TLS
  (EAP-PEAP/TLS, EAP-TTLS/TLS, EAP-FAST/TLS) to support different CA
  certificate configuration between Phase 1 and Phase 2
* added optional "auto" parameter for

p2p_connect to request automatic

  GO Negotiation vs. join-a-group selection

* added disabled_scan_offload parameter to disable automatic scan

  offloading (sched_scan)

* added optional persistent=<network id> parameter for p2p_connect to

  allow forcing of a specific SSID/passphrase for GO Negotiation

* added support for OBSS scan requests and 20/40 BSS coexistence reports

* reject PD Request for unknown group

* removed scripts and notes related to Windows binary releases (which

  have not been used starting from 1.x)

* added initial support for WNM operations

  - Keep-alive based on BSS max idle period

  - WNM-Sleep Mode

  - minimal BSS Transition Management processing

* added autoscan module to control scanning behavior while not connected

  - autoscan_periodic and autoscan_exponential modules

* added new WPS NFC ctrl_iface mechanism

  - added initial support NFC connection handover

  - removed obsoleted WPS_OOB command (including support for deprecated

    UFD config_method)

*

added optional framework for external password storage ("ext:<name>")

* wpa_cli: added optional support for controlling wpa_supplicant

  remotely over UDP (CONFIG_CTRL_IFACE=udp-remote) for testing purposes

* wpa_cli: extended tab completion to more commands

* changed SSID output to use printf-escaped strings instead of masking

  of non-ASCII characters

  - SSID can now be configured in the same format: ssid=P"abc\x00test"

* removed default ACM=1 from AC_VO and AC_VI

* added optional "ht40" argument for P2P ctrl_iface commands to allow

  40 MHz channels to be requested on the 5 GHz band

* added optional parameters for p2p_invite command to specify channel

  when reinvoking a persistent group as the GO

* improved FIPS mode builds with OpenSSL

  - "make fips" with CONFIG_FIPS=y to build wpa_supplicant with the

    OpenSSL FIPS object module

  - replace low level OpenSSL AES API calls to use EVP

  - use OpenSSL keying material exporter when possible

  - do

not export TLS keys in FIPS mode

  - remove MD5 from CONFIG_FIPS=y builds

  - use OpenSSL function for PKBDF2 passphrase-to-PSK

  - use OpenSSL HMAC implementation

  - mix RAND_bytes() output into random_get_bytes() to force OpenSSL

    DRBG to be used in FIPS mode

  - use OpenSSL CMAC implementation

* added mechanism to disable TLS Session Ticket extension

  - a workaround for servers that do not support TLS extensions that

was enabled by default in recent OpenSSL versions
   - tls_disable_session_ticket=1
   - automatically disable TLS Session Ticket extension by default when
     using EAP-TLS/PEAP/TTLS (i.e., only use it with EAP-FAST)
* changed VENDOR-TEST EAP method to use proper private enterprise number
   (this will not interoperate with older versions)
* disable network block temporarily on authentication failures
* improved WPS AP selection during WPS PIN iteration
* added support for configuring GCMP cipher for IEEE 802.11ad
* added support for Wi-Fi Display

extensions
   - WFD_SUBELEMENT_SET ctrl_iface command to configure WFD subelements
   - SET wifi_display <0/1> to disable/enable WFD support
   - WFD service discovery
   - an external program is needed to manage the audio/video streaming
     and codecs
* optimized scan result use for network selection
   - use the internal BSS table instead of raw scan results
   - allow unnecessary scans to be skipped if fresh information is
     available (e.g., after GAS/ANQP round for Interworking)
* added support for 256-bit AES with internal TLS implementation
* allow peer to propose channel in P2P invitation process for a
   persistent group
* added disallow_aps parameter to allow BSSIDs/SSIDs to be disallowed
   from network selection
* re-enable the networks disabled during WPS operations
* allow P2P functionality to be disabled per interface (p2p_disabled=1)
* added secondary device types into P2P_PEER output
* added an option to disable use of a separate P2P group interface

(p2p_no_group_iface=1)
* fixed P2P Bonjour SD to match entries with both compressed and not
   compressed domain name format and support multiple Bonjour PTR matches
   for the same key
* use deauthentication instead of disassociation for all disconnection
   operations; this removes the now unused disassociate() wpa_driver_ops
   callback
* optimized PSK generation on P2P GO by caching results to avoid
   multiple PBKDF2 operations
* added okc=1 global configuration parameter to allow OKC to be enabled
   by default for all network blocks
* added a workaround for WPS PBC session overlap detection to avoid
   interop issues with deployed station implementations that do not
   remove active PBC indication from Probe Request frames properly
* added basic support for 60 GHz band
* extend EAPOL frames processing workaround for roaming cases
   (postpone processing of unexpected EAPOL frame until association
   event to handle reordered events)

2012-05-10 - v1.0
 * bsd: Add support
for setting HT values in IFM_MMASK.
 * Delay STA entry removal until Deauth/Disassoc TX status in AP mode.
   This allows the driver to use PS buffering of Deauthentication and
   Disassociation frames when the STA is in power save sleep. Only
   available with drivers that provide TX status events for Deauth/
   Disassoc frames (nl80211).
 * Drop oldest unknown BSS table entries first. This makes it less
   likely to hit connection issues in environments with huge number
   of visible APs.
 * Add systemd support.
 * Add support for setting the syslog facility from the config file
   at build time.
 * atheros: Add support for IEEE 802.11w configuration.
 * AP mode: Allow enable HT20 if driver supports it, by setting the
   config parameter ieee80211n.
 * Allow AP mode to disconnect STAs based on low ACK condition (when
   the data connection is not working properly, e.g., due to the STA
   going outside the range of the AP). Disabled by default, enable by
   config option disassoc_low_ack.
 *
nl80211:
   - Support GTK rekey offload.
   - Support PMKSA candidate events. This adds support for RSN
     pre-authentication with nl80211 interface and drivers that handle
     roaming internally.
 * dbus:
   - Add a DBus signal for EAP SM requests, emitted on the Interface
     object.
   - Export max scan ssids supported by the driver as MaxScanSSID.
   - Add signal Certification for information about server certification.
   - Add BSSExpireAge and BSSExpireCount interface properties and
     support set/get, which allows for setting BSS cache expiration age
     and expiration scan count.
   - Add ConfigFile to AddInterface properties.
   - Add Interface.Country property and support to get/set the value.
   - Add DBus property CurrentAuthMode.
   - P2P DBus API added.
   - Emit property changed events (for property BSSs) when adding/
     removing BSSs.
   - Treat " in SSIDs of Interface.Scan as a request for broadcast
     scan, instead of ignoring it.
   - Add DBus getter/setter
for FastReauth.
   - Raise PropertiesChanged on org.freedesktop.DBus.Properties.
 * wpa_cli:

- Send AP-STA-DISCONNECTED event when an AP disconnects a station
  due to inactivity.
- Make second argument to set command optional. This can be used to
  indicate a zero length value.
- Add signal_poll command.
- Add bss_expire_age and bss_expire_count commands to set/get BSS
  cache expiration age and expiration scan count.
- Add ability to set scan interval (the time in seconds wpa_s waits
  before requesting a new scan after failing to find a suitable
  network in scan results) using scan_interval command.
- Add event CTRL-EVENT-ASSOC-REJECT for association rejected.
- Add command get version, that returns wpa_supplicant version string.
- Add command sta_autoconnect for disabling automatic reconnection
  on receiving disconnection event.
- Setting bssid parameter to an empty string "" or any can now be
  used to clear the bssid_set

flag in a network block, i.e., to remove
  bssid filtering.
- Add tdls_testing command to add a special testing feature for
  changing TDLS behavior. Build param CONFIG_TDLS_TESTING must be
  enabled as well.
- For interworking, add wpa_cli commands interworking_select,
  interworking_connect, anqp_get, fetch_anqp, and stop_fetch_anqp.
- Many P2P commands were added. See README-P2P.
- Many WPS/WPS ER commands - see WPS/WPS ER sections for details.
- Allow set command to change global config parameters.
- Add log_level command, which can be used to display the current
  debugging level and to change the log level during run time.
- Add note command, which can be used to insert notes to the debug
  log.
- Add internal line edit implementation. CONFIG_WPA_CLI_EDIT=y
  can now be used to build wpa_cli with internal implementation of
  line editing and history support. This can be used as a replacement
  for CONFIG_READLINE=y.
* AP mode:
Add max_num_sta config option, which can be used to limit
  the number of stations allowed to connect to the AP.
* Add WPA_IGNORE_CONFIG_ERRORS build option to continue in case of bad
  config file.
* wext: Increase scan timeout from 5 to 10 seconds.
* Add blacklist command, allowing an external program to
  manage the BSS blacklist and display its current contents.
* WPS:
- Add wpa_cli wps_pin get command for generating random PINs. This can
  be used in a UI to generate a PIN without starting WPS (or P2P)
  operation.
- Set RF bands based on driver capabilities, instead of hardcoding
  them.

- Add mechanism for indicating non-standard WPS errors.
- Add CONFIG_WPS_REG_DISABLE_OPEN=y option to disable open networks
  by default.
- Add wps_ap_pin cli command for wpa_supplicant AP mode.
- Add wps_check_pin cli command for processing PIN from user input.
  UIs can use this command to process a PIN entered by a user and to
  validate the checksum
digit (if present).
- Cancel WPS operation on PBC session overlap detection.
- New wps_cancel command in wpa_cli will cancel a pending WPS
  operation.
- wpa_cli action: Add WPS_EVENT_SUCCESS and WPS_EVENT_FAIL handlers.
- Trigger WPS config update on Manufacturer, Model Name, Model
  Number, and Serial Number changes.
- Fragment size is now configurable for EAP-WSC peer. Use
  wpa_cli set wps_fragment_size <val>.
- Disable AP PIN after 10 consecutive failures. Slow down attacks on
  failures up to 10.
- Allow AP to start in Enrollee mode without AP PIN for probing, to
  be compatible with Windows 7.
- Add Config Error into WPS-FAIL events to provide more info to the
  user on how to resolve the issue.
- Label and Display config methods are not allowed to be enabled
  at the same time, since it is unclear which PIN to use if both
  methods are advertised.
- When controlling multiple interfaces:
  - apply WPS commands to all interfaces
configured to use WPS
  - apply WPS config changes to all interfaces that use WPS
  - when an attack is detected on any interface, disable AP PIN on
    all interfaces
* WPS ER:
- Add special AP Setup Locked mode to allow read only ER.
  ap_setup_locked=2 can now be used to enable a special mode where
  WPS ER can learn the current AP settings, but cannot change them.
- Show SetSelectedRegistrar events as ctrl_iface events
- Add wps_er_set_config to enroll a network based on a local
  network configuration block instead of having to (re-)learn the
  current AP settings with wps_er_learn.
- Allow AP filtering based on IP address, add ctrl_iface event for
  learned AP settings, add wps_er_config command to configure an AP.
* WPS 2.0: Add support for WPS 2.0 (CONFIG_WPS2)
- Add build option CONFIG_WPS_EXTENSIBILITY_TESTING to enable tool
  for testing protocol extensibility.
- Add build option CONFIG_WPS_STRICT to allow disabling of
WPS
  workarounds.
- Add support for AuthorizedMACs attribute.

* TDLS:
 - Propogate TDLS related nl80211 capability flags from kernel and
   add them as driver capability flags. If the driver doesn't support
   capabilities, assume TDLS is supported internally. When TDLS is
   explicitly not supported, disable all user facing TDLS operations.
 - Allow TDLS to be disabled at runtime (mostly for testing).
   Use set tdls_disabled.
 - Honor AP TDLS settings that prohibit/allow TDLS.
 - Add a special testing feature for changing TDLS behavior. Use
   CONFIG_TDLS_TESTING build param to enable. Configure at runtime
   with tdls_testing cli command.
 - Add support for TDLS 802.11z.
* wlantest: Add a tool wlantest for IEEE802.11 protocol testing.
  wlantest can be used to capture frames from a monitor interface
  for realtime capturing or from pcap files for offline analysis.
* Interworking: Support added for 802.11u. Enable in .config with
  CONFIG_INTERWORKING.
See wpa_supplicant.conf for config parameters
  for interworking. wpa_cli commands added to support this are
  interworking_select, interworking_connect, anqp_get, fetch_anqp,
  and stop_fetch_anqp.
* Android: Add build and runtime support for Android wpa_supplicant.
* bgscan learn: Add new bgscan that learns BSS information based on
  previous scans, and uses that information to dynamically generate
  the list of channels for background scans.
* Add a new debug message level for excessive information. Use
  -ddd to enable.
* TLS: Add support for tls_disable_time_checks=1 in client mode.
* Internal TLS:
 - Add support for TLS v1.1 (RFC 4346). Enable with build parameter
   CONFIG_TLSV11.
 - Add domainComponent parser for X.509 names.
* Linux: Add RFKill support by adding an interface state "disabled".
* Reorder some IEs to get closer to IEEE 802.11 standard. Move
  WMM into end of Beacon, Probe Resp and (Re)Assoc Resp frames.
  Move HT IEs to be later in (Re)Assoc
Resp.
* Solaris: Add support for wired 802.1X client.
* Wi-Fi Direct support. See README-P2P for more information.
* Many bugfixes.

2010-04-18 - v0.7.2
 * nl80211: fixed number of issues with roaming
 * avoid unnecessary roaming if multiple APs with similar signal
   strength are present in scan results
 * add TLS client events and server probing to ease design of
   automatic detection of EAP parameters
 * add option for server certificate matching (SHA256 hash of the

certificate) instead of trusted CA certificate configuration
* bsd: Cleaned up driver wrapper and added various low-level
  configuration options
* wpa_gui-qt4: do not show too frequent WPS AP available events as
  tray messages
* TNC: fixed issues with fragmentation
* EAP-TNC: add Flags field into fragment acknowledgement (needed to
  interoperate with other implementations; may potentially breaks
  compatibility with older wpa_supplicant/hostapd versions)
* wpa_cli: added option for using a separate
process to receive event
  messages to reduce latency in showing these
  (CFLAGS += -DCONFIG_WPA_CLI_FORK=y in .config to enable this)
* maximum BSS table size can now be configured (bss_max_count)
* BSSes to be included in the BSS table can be filtered based on
  configured SSIDs to save memory (filter_ssids)
* fix number of issues with IEEE 802.11r/FT; this version is not
  backwards compatible with old versions
* nl80211: add support for IEEE 802.11r/FT protocol (both over-the-air
  and over-the-DS)
* add freq_list network configuration parameter to allow the AP
  selection to filter out entries based on the operating channel
* add signal strength change events for bgscan; this allows more
  dynamic changes to background scanning interval based on changes in
  the signal strength with the current AP; this improves roaming within
  ESS quite a bit, e.g., with bgscan="simple:30:-45:300" in the network
  configuration block to request background scans less frequently
when
  signal strength remains good and to automatically trigger background
  scans whenever signal strength drops noticeably
  (this is currently only available with nl80211)
* add BSSID and reason code (if available) to disconnect event messages
* wpa_gui-qt4: more complete support for translating the GUI with
  linguist and add German translation
* fix DH padding with internal crypto code (mainly, for WPS)
* do not trigger initial scan automatically anymore if there are no
  enabled networks

2010-01-16 - v0.7.1
 * cleaned up driver wrapper API (struct wpa_driver_ops); the new API
   is not fully backwards compatible, so out-of-tree driver wrappers
   will need modifications
 * cleaned up various module interfaces
 * merge hostapd and wpa_supplicant developers' documentation into a
   single document
 * nl80211: use explicit deauthentication to clear cfg80211 state to
   avoid issues when roaming between APs
 * dbus: major design changes in the new D-Bus API

(fi.w1.wpa_supplicant1)
*

nl80211: added support for IBSS networks
* added internal debugging mechanism with backtrace support and memory
  allocation/freeing validation, etc. tests (CONFIG_WPA_TRACE=y)
* added WPS ER unsubscription command to more cleanly unregister from
  receiving UPnP events when ER is terminated
* cleaned up AP mode operations to avoid need for virtual driver_ops
  wrapper
* added BSS table to maintain more complete scan result information
  over multiple scans (that may include only partial results)
* wpa_gui-qt4: update Peers dialog information more dynamically while
  the dialog is kept open
* fixed PKCS#12 use with OpenSSL 1.0.0
* driver_wext: Added cfg80211-specific optimization to avoid some
  unnecessary scans and to speed up association

2009-11-21 - v0.7.0
 * increased wpa_cli ping interval to 5 seconds and made this
   configurable with a new command line options (-G<seconds>)
 * fixed scan buffer processing with WEXT to handle up to 65535
   byte result
buffer (previously, limited to 32768 bytes)
 * allow multiple driver wrappers to be specified on command line
   (e.g., -Dnl80211,wext); the first one that is able to initialize the
   interface will be used
 * added support for multiple SSIDs per scan request to optimize
   scan_ssid=1 operations in ap_scan=1 mode (i.e., search for hidden
   SSIDs); this requires driver support and can currently be used only
   with nl80211
 * added support for WPS USBA out-of-band mechanism with USB Flash
   Drives (UFD) (CONFIG_WPS_UFD=y)
 * driver_ndis: add PAE group address to the multicast address list to
   fix wired IEEE 802.1X authentication
 * fixed IEEE 802.11r key derivation function to match with the standard
   (note: this breaks interoperability with previous version) [Bug 303]
 * added better support for drivers that allow separate authentication
   and association commands (e.g., mac80211-based Linux drivers with
   nl80211; SME in wpa_supplicant); this allows over-the-air FT protocol

 to be used (IEEE 802.11r)
 * fixed SHA-256 based key derivation function to match with the
   standard when using CCMP (for IEEE 802.11r and IEEE 802.11w)
   (note: this breaks interoperability with previous version) [Bug 307]
 * use shared driver wrapper files with hostapd
 * added AP mode functionality (CONFIG_AP=y) with mode=2 in the network
   block; this can be used for open and WPA2-Personal networks
   (optionally, with WPS); this links in parts of hostapd functionality

into wpa_supplicant
* wpa_gui-qt4: added new Peers dialog to show information about peers
  (other devices, including APs and stations, etc. in the neighborhood)
* added support for WPS External Registrar functionality (configure APs
  and enroll new devices); can be used with wpa_gui-qt4 Peers dialog
  and wpa_cli commands wps_er_start, wps_er_stop, wps_er_pin,
  wps_er_pbc, wps_er_learn
  (this can also be used with a new 'none' driver wrapper if no
  wireless device or IEEE 802.1X on wired is
needed)
* driver_nl80211: multiple updates to provide support for new Linux
  nl80211/mac80211 functionality
* updated management frame protection to use IEEE Std 802.11w-2009
* fixed number of small WPS issues and added workarounds to
  interoperate with common deployed broken implementations
* added support for NFC out-of-band mechanism with WPS
* driver_ndis: fixed wired IEEE 802.1X authentication with PAE group
  address frames
* added preliminary support for IEEE 802.11r RIC processing
* added support for specifying subset of enabled frequencies to scan
  (scan_freq option in the network configuration block); this can speed
  up scanning process considerably if it is known that only a small
  subset of channels is actually used in the network (this is currently
  supported only with -Dnl80211)
* added a workaround for race condition between receiving the
  association event and the following EAPOL-Key
* added background scan and roaming infrastructure to allow

  network-specific optimizations to be used to improve roaming within
  an ESS (same SSID)
* added new DBus interface (fi.w1.wpa_supplicant1)

2009-01-06 - v0.6.7
 * added support for Wi-Fi Protected Setup (WPS)
  (wpa_supplicant can now be configured to act as a WPS Enrollee to
  enroll credentials for a network using PIN and PBC methods; in
  addition, wpa_supplicant can act as a wireless WPS Registrar to
  configure an AP); WPS support can be enabled by adding CONFIG_WPS=y
  into .config and setting the runtime configuration variables in
  wpa_supplicant.conf (see WPS section in the example configuration
  file); new wpa_cli commands wps_pin, wps_pbc, and wps_reg are used to
  manage WPS negotiation; see README-WPS for more details
* added support for EAP-AKA' (draft-arkko-eap-aka-kdf)
* added support for using driver_test over UDP socket
* fixed PEAPv0 Cryptobinding interoperability issue with Windows Server
  2008 NPS; optional cryptobinding is now enabled (again) by
default
* fixed PSK editing in wpa_gui

* changed EAP-GPSK to use the IANA assigned EAP method type 51
* added a Windows installer that includes WinPcap and all the needed
  DLLs; in addition, it set up the registry automatically so that user
  will only need start wpa_gui to get prompted to start the wpasvc
  servide and add a new interface if needed through wpa_gui dialog
* updated management frame protection to use IEEE 802.11w/D7.0

2008-11-23 - v0.6.6
* added Milenage SIM/USIM emulator for EAP-SIM/EAP-AKA
  (can be used to simulate test SIM/USIM card with a known private key;
  enable with CONFIG_SIM_SIMULATOR=y/CONFIG_USIM_SIMULATOR=y in .config
  and password="Ki:OPc"/password="Ki:OPc:SQN" in network configuration)
* added a new network configuration option, wpa_ptk_rekey, that can be
  used to enforce frequent PTK rekeying, e.g., to mitigate some attacks
  against TKIP deficiencies
* added an optional mitigation mechanism for certain attacks against
  TKIP by delaying
Michael MIC error reports by a random amount of time
  between 0 and 60 seconds; this can be enabled with a build option
  CONFIG_DELAYED_MIC_ERROR_REPORT=y in .config
* fixed EAP-AKA to use RES Length field in AT_RES as length in bits,
  not bytes
* updated OpenSSL code for EAP-FAST to use an updated version of the
  session ticket overriding API that was included into the upstream
  OpenSSL 0.9.9 tree on 2008-11-15 (no additional OpenSSL patch is
  needed with that version anymore)
* updated userspace MLME instructions to match with the current Linux
  mac80211 implementation; please also note that this can only be used
  with driver_nl80211.c (the old code from driver_wext.c was removed)
* added support (Linux only) for RoboSwitch chipsets (often found in
  consumer grade routers); driver interface 'roboswitch'
* fixed canceling of PMKSA caching when using drivers that generate
  RSN IE and refuse to drop PMKIDs that wpa_supplicant does not know
  about

2008-11-01
- v0.6.5
* added support for SHA-256 as X.509 certificate digest when using the
  internal X.509/TLSv1 implementation
* updated management frame protection to use IEEE 802.11w/D6.0
* added support for using SHA256-based stronger key derivation for WPA2
  (IEEE 802.11w)
* fixed FT (IEEE 802.11r) authentication after a failed association to
  use correct FTIE
* added support for configuring Phase 2 (inner/tunneled) authentication
  method with wpa_gui-qt4

2008-08-10 - v0.6.4

* added support for EAP Sequences in EAP-FAST Phase 2
* added support for using TNC with EAP-FAST
* added driver_ps3 for the PS3 Linux wireless driver
* added support for optional cryptobinding with PEAPv0
* fixed the OpenSSL patches (0.9.8g and 0.9.9) for EAP-FAST to
  allow fallback to full handshake if server rejects PAC-Opaque
* added fragmentation support for EAP-TNC
* added support for parsing PKCS #8 formatted private keys into the
  internal TLS implementation (both PKCS #1 RSA key and
PKCS #8
  encapsulated RSA key can now be used)
* added option of using faster, but larger, routines in the internal
  LibTomMath (for internal TLS implementation) to speed up DH and RSA
  calculations (CONFIG_INTERNAL_LIBTOMMATH_FAST=y)
* fixed race condition between disassociation event and group key
  handshake to avoid getting stuck in incorrect state [Bug 261]
* fixed opportunistic key caching (proactive_key_caching)

2008-02-22 - v0.6.3
 * removed 'nai' and 'eappsk' network configuration variables that were
   previously used for configuring user identity and key for EAP-PSK,
   EAP-PAX, EAP-SAKE, and EAP-GPSK. 'identity' field is now used as the
   replacement for 'nai' (if old configuration used a separate
   'identity' value, that would now be configured as
   'anonymous_identity'). 'password' field is now used as the
   replacement for 'eappsk' (it can also be set using hexstring to
   present random binary data)
* removed '-w' command line parameter (wait for interface
to be added,
   if needed); cleaner way of handling this functionality is to use an
   external mechanism (e.g., hotplug scripts) that start wpa_supplicant
   when an interface is added
* updated FT support to use the latest draft, IEEE 802.11r/D9.0
* added ctrl_iface monitor event (CTRL-EVENT-SCAN-RESULTS) for
   indicating when new scan results become available
* added new ctrl_iface command, BSS, to allow scan results to be
   fetched without hitting the message size limits (this command
   can be used to iterate through the scan results one BSS at the time)
* fixed EAP-SIM not to include AT_NONCE_MT and AT_SELECTED_VERSION
   attributes in EAP-SIM Start/Response when using fast reauthentication
* fixed EAPOL not to end up in infinite loop when processing dynamic
   WEP keys with IEEE 802.1X
* fixed problems in getting NDIS events from WMI on Windows 2000

2008-01-01 - v0.6.2
 * added support for Makefile builds to include debug-log-to-a-file
   functionality (CONFIG_DEBUG_FILE=y

and -f<path> on command line)
* fixed EAP-SIM and EAP-AKA message parser to validate attribute
  lengths properly to avoid potential crash caused by invalid messages
* added data structure for storing allocated buffers (struct wpabuf);
  this does not affect wpa_supplicant usage, but many of the APIs
  changed and various interfaces (e.g., EAP) is not compatible with old
  versions
* added support for protecting EAP-AKA/Identity messages with
  AT_CHECKCODE (optional feature in RFC 4187)
* added support for protected result indication with AT_RESULT_IND for
  EAP-SIM and EAP-AKA (phase1="result_ind=1")
* added driver_wext workaround for race condition between scanning and
  association with drivers that take very long time to scan all
  channels (e.g., madwifi with dual-band cards); wpa_supplicant is now
  using a longer hardcoded timeout for the scan if the driver supports
  notifications for scan completion (SIOCGIWSCAN event); this helps,
  e.g., in cases where
wpa_supplicant and madwifi driver ended up in
  loop where the driver did not even try to associate
* stop EAPOL timer tick when no timers are in use in order to reduce
  power consumption (no need to wake up the process once per second)
  [Bug 237]
* added support for privilege separation (run only minimal part of
  wpa_supplicant functionality as root and rest as unprivileged,
  non-root process); see 'Privilege separation' in README for details;
  this is disabled by default and can be enabled with CONFIG_PRIVSEP=y
  in .config
* changed scan results data structure to include all information
  elements to make it easier to support new IEs; old get_scan_result()
  driver_ops is still supported for backwards compatibility (results
  are converted internally to the new format), but all drivers should
  start using the new get_scan_results2() to make them more likely to
  work with new features
* Qt4 version of wpa_gui (wpa_gui-qt4 subdirectory) is now native Qt4
  application,
i.e., it does not require Qt3Support anymore; Windows
  binary of wpa_gui.exe is now from this directory and only requires
  QtCore4.dll and QtGui4.dll libraries
* updated Windows binary build to use Qt 4.3.3 and made Qt DLLs
  available as a separate package to make wpa_gui installation easier:
  http://w1.fi/wpa_supplicant/qt4/wpa_gui-qt433-windows-dll.zip
* added support for EAP-IKEv2 (draft-tschofenig-eap-ikev2-15.txt);
  only shared key/password authentication is supported in this version

2007-11-24 - v0.6.1
* added support for configuring password as NtPasswordHash
  (16-byte MD4 hash of password) in hash:<32 hex digits> format
* added support for fallback from abbreviated TLS handshake to

full handshake when using EAP-FAST (e.g., due to an expired
PAC-Opaque)
* updated EAP Generalized Pre-Shared Key (EAP-GPSK) to use the latest
draft (draft-ietf-emu-eap-gpsk-07.txt)
* added support for drivers that take care of RSN 4-way handshake
internally
(WPA_DRIVER_FLAGS_4WAY_HANDSHAKE in get_capa flags and
WPA_ALG_PMK in set_key)
* added an experimental port for Mac OS X (CONFIG_DRIVER_OSX=y in
.config); this version supports only ap_scan=2 mode and allow the
driver to take care of the 4-way handshake
* fixed a buffer overflow in parsing TSF from scan results when using
driver_wext.c with a driver that includes the TSF (e.g., iwl4965)
[Bug 232]
* updated FT support to use the latest draft, IEEE 802.11r/D8.0
* fixed an integer overflow issue in the ASN.1 parser used by the
(experimental) internal TLS implementation to avoid a potential
buffer read overflow
* fixed a race condition with -W option (wait for a control interface
monitor before starting) that could have caused the first messages to
be lost
* added support for processing TNCC-TNCS-Messages to report
recommendation (allow/none/isolate) when using TNC [Bug 243]

2007-05-28 - v0.6.0
* added network configuration parameter 'frequency' for setting

initial channel for IBSS (adhoc) networks
* added experimental IEEE 802.11r/D6.0 support
* updated EAP-SAKE to RFC 4763 and the IANA-allocated EAP type 48
* updated EAP-PSK to use the IANA-allocated EAP type 47
* fixed EAP-PAX key derivation
* fixed EAP-PSK bit ordering of the Flags field
* fixed EAP-PEAP/TTLS/FAST to use the correct EAP identifier in
tunnelled identity request (previously, the identifier from the outer
method was used, not the tunnelled identifier which could be
different)
* added support for fragmentation of outer TLS packets during Phase 2
of EAP-PEAP/TTLS/FAST
* fixed EAP-TTLS AVP parser processing for too short AVP lengths
* added support for EAP-FAST authentication with inner methods that
generate MSK (e.g., EAP-MSCHAPv2 that was previously only supported
for PAC provisioning)
* added support for authenticated EAP-FAST provisioning
* added support for configuring maximum number of EAP-FAST PACs to
store in a PAC list (fast_max_pac_list_len=<max>
in phase1 string)
* added support for storing EAP-FAST PACs in binary format

(fast_pac_format=binary in phase1 string)
* fixed dbus ctrl_iface to validate message interface before
  dispatching to avoid a possible segfault [Bug 190]
* fixed PeerKey key derivation to use the correct PRF label
* updated Windows binary build to link against OpenSSL 0.9.8d and
  added support for EAP-FAST
* updated EAP Generalized Pre-Shared Key (EAP-GPSK) to use the latest
  draft (draft-ietf-emu-eap-gpsk-04.txt)
* fixed EAP-AKA Notification processing to allow Notification to be
  processed after AKA Challenge response has been sent
* updated to use IEEE 802.11w/D2.0 for management frame protection
  (still experimental)
* fixed EAP-TTLS implementation not to crash on use of freed memory
  if TLS library initialization fails
* added support for EAP-TNC (Trusted Network Connect)
  (this version implements the EAP-TNC method and EAP-TTLS changes
  needed to run two
methods in sequence (IF-T) and the IF-IMC and
  IF-TNCCS interfaces from TNCC)

2006-11-24 - v0.5.6
 * added experimental, integrated TLSv1 client implementation with the
   needed X.509/ASN.1/RSA/bignum processing (this can be enabled by
   setting CONFIG_TLS=internal and CONFIG_INTERNAL_LIBTOMMATH=y in
   .config); this can be useful, e.g., if the target system does not
   have a suitable TLS library and a minimal code size is required
   (total size of this internal TLS/crypto code is bit under 50 kB on
   x86 and the crypto code is shared by rest of the supplicant so some
   of it was already required; TLSv1/X.509/ASN.1/RSA added about 25 kB)
 * removed STAKey handshake since PeerKey handshake has replaced it in
   IEEE 802.11ma and there are no known deployments of STAKey
 * updated EAP Generalized Pre-Shared Key (EAP-GPSK) to use the latest
   draft (draft-ietf-emu-eap-gpsk-01.txt)
 * added preliminary implementation of IEEE 802.11w/D1.0 (management
   frame protection)
   (Note:
this requires driver support to work properly.)
   (Note2: IEEE 802.11w is an unapproved draft and subject to change.)
 * fixed Windows named pipes ctrl_iface to not stop listening for
   commands if client program opens a named pipe and closes it
   immediately without sending a command
 * fixed USIM PIN status determination for the case that PIN is not
   needed (this allows EAP-AKA to be used with USIM cards that do not
   use PIN)
 * added support for reading 3G USIM AID from EF_DIR to allow EAP-AKA to
   be used with cards that do not support file selection based on
   partial AID
 * added support for matching the subjectAltName of the authentication

server certificate against multiple name components (e.g.,
altsubject_match="DNS:server.example.com;DNS:server2.example.com")
* fixed EAP-SIM/AKA key derivation for re-authentication case (only
affects IEEE 802.1X with dynamic WEP keys)
* changed ctrl_iface network configuration 'get' operations to not
return password/key
material; if these fields are requested, "*"
will be returned if the password/key is set, but the value of the
parameter is not exposed

2006-08-27 - v0.5.5
* added support for building Windows version with UNICODE defined
(wide-char functions)
* driver_ndis: fixed static WEP configuration to avoid race condition
issues with some NDIS drivers between association and setting WEP
keys
* driver_ndis: added validation for IELength value in scan results to
avoid crashes when using buggy NDIS drivers [Bug 165]
* fixed Release|Win32 target in the Visual Studio project files
(previously, only Debug|Win32 target was set properly)
* changed control interface API call wpa_ctrl_pending() to allow it to
return -1 on error (e.g., connection lost); control interface clients
will need to make sure that they verify that the value is indeed >0
when determining whether there are pending messages
* added an alternative control interface backend for Windows targets:

 Named Pipe (CONFIG_CTRL_IFACE=named_pipe); this is now the default
control interface mechanism for Windows builds (previously, UDP to
localhost was used)
* changed ctrl_interface configuration for UNIX domain sockets:
 - deprecated ctrl_interface_group variable (it may be removed in
   future versions)
 - allow both directory and group be configured with ctrl_interface
   in following format: DIR=/var/run/wpa_supplicant GROUP=wheel
 - ctrl_interface=/var/run/wpa_supplicant is still supported for the
   case when group is not changed
* added support for controlling more than one interface per process in
Windows version
* added a workaround for a case where the AP is using unknown address
(e.g., MAC address of the wired interface) as the source address for
EAPOL-Key frames; previously, that source address was used as the
destination for EAPOL-Key frames and in key derivation; now, BSSID is
used even if the source address does not match with it

 (this resolves an interoperability issue with Thomson SpeedTouch 580)
* added a workaround for UDP-based control interface (which was used in
Windows builds before this release) to prevent packets with forged
addresses from being accepted as local control requests

* removed ndis_events.cpp and possibility of using external
  ndis_events.exe; C version (ndis_events.c) is fully functional and
  there is no desire to maintain two separate versions of this
  implementation
* ndis_events: Changed NDIS event notification design to use WMI to
  learn the adapter description through Win32_PnPEntity class; this
  should fix some cases where the adapter name was not recognized
  correctly (e.g., with some USB WLAN adapters, e.g., Ralink RT2500
  USB) [Bug 113]
* fixed selection of the first network in ap_scan=2 mode; previously,
  wpa_supplicant could get stuck in SCANNING state when only the first
  network for enabled (e.g., after 'wpa_cli select_network 0')
* winsvc: added
support for configuring ctrl_interface parameters in
  registry (ctrl_interface string value in
  HKLM\SOFTWARE\wpa_supplicant\interfaces\0000 key); this new value is
  required to enable control interface (previously, this was hardcoded
  to be enabled)
* allow wpa_gui subdirectory to be built with both Qt3 and Qt4
* converted wpa_gui-qt4 subdirectory to use Qt4 specific project format

2006-06-20 - v0.5.4
* fixed build with CONFIG_STAKEY=y [Bug 143]
* added support for doing MLME (IEEE 802.11 management frame
  processing) in wpa_supplicant when using Devicescape IEEE 802.11
  stack (wireless-dev.git tree)
* added a new network block configuration option, fragment_size, to
  configure the maximum EAP fragment size
* driver_ndis: Disable WZC automatically for the selected interface to
  avoid conflicts with two programs trying to control the radio; WZC
  will be re-enabled (if it was enabled originally) when wpa_supplicant
  is terminated
* added an experimental TLSv1
client implementation
  (CONFIG_TLS=internal) that can be used instead of an external TLS
  library, e.g., to reduce total size requirement on systems that do
  not include any TLS library by default (this is not yet complete;
  basic functionality is there, but certificate validation is not yet
  included)
* added PeerKey handshake implementation for IEEE 802.11e
  direct link setup (DLS) to replace STAKey handshake
* fixed WPA PSK update through ctrl_iface for the case where the old
  PSK was derived from an ASCII passphrase and the new PSK is set as
  a raw PSK (hex string)
* added new configuration option for identifying which network block
  was used (id_str in wpa_supplicant.conf; included on
  WPA_EVENT_CONNECT monitor event and as WPA_ID_STR environmental
  variable in wpa_cli action scripts; in addition WPA_ID variable is

set to the current unique identifier that wpa_supplicant assigned
automatically for the network and that can be used with
GET_NETWORK/SET_NETWORK
ctrl_iface commands)
* wpa_cli action script is now called only when the connect/disconnect
  status changes or when associating with a different network
* fixed configuration parser not to remove CCMP from group cipher list
  if WPA-None (adhoc) is used (pairwise=NONE in that case)
* fixed integrated NDIS events processing not to hang the process due
  to a missed change in eloop_win.c API in v0.5.3 [Bug 155]
* added support for EAP Generalized Pre-Shared Key (EAP-GPSK,
  draft-clancy-emu-eap-shared-secret-00.txt)
* added Microsoft Visual Studio 2005 solution and project files for
  build wpa_supplicant for Windows (see vs2005 subdirectory)
* eloop_win: fixed unregistration of Windows events
* l2_packet_winpcap: fixed a deadlock in deinitializing l2_packet
  at the end of RSN pre-authentication and added unregistration of
  a Windows event to avoid getting eloop_win stuck with an invalid
  handle
* driver_ndis: added support for selecting AP based on BSSID
*
added new environmental variable for wpa_cli action scripts:
  WPA_CTRL_DIR is the current control interface directory
* driver_ndis: added support for using NDISUIO instead of WinPcap for
  OID set/query operations (CONFIG_USE_NDISUIO=y in .config); with new
  l2_packet_ndis (CONFIG_L2_PACKET=ndis), this can be used to build
  wpa_supplicant without requiring WinPcap; note that using NDISUIO
  requires that WZC is disabled (net stop wzcsvc) since NDISUIO allows
  only one application to open the device
* changed NDIS driver naming to only include device GUID, e.g.,
  {7EE3EFE5-C165-472F-986D-F6FBEDFE8C8D}, instead of including WinPcap
  specific \Device\NPF_ prefix before the GUID; the prefix is still
  allowed for backwards compatibility, but it is not required anymore
  when specifying the interface
* driver_ndis: re-initialize driver interface is the adapter is removed
  and re-inserted [Bug 159]
* driver_madwifi: fixed TKIP and CCMP sequence number configuration
on
  big endian hosts [Bug 146]

2006-04-27 - v0.5.3
* fixed EAP-GTC response to include correct user identity when run as
  phase 2 method of EAP-FAST (i.e., EAP-FAST did not work in v0.5.2)
* driver_ndis: Fixed encryption mode configuration for unencrypted
  networks (some NDIS drivers ignored this, but others, e.g., Broadcom,
  refused to associate with open networks) [Bug 106]
* driver_ndis: use BSSID OID polling to detect when IBSS network is
  formed even when ndis_events code is included since some NDIS drivers

do not generate media connect events in IBSS mode
* config_winreg: allow global ctrl_interface parameter to be configured
  in Windows registry
* config_winreg: added support for saving configuration data into
  Windows registry
* added support for controlling network device operational state
  (dormant/up) for Linux 2.6.17 to improve DHCP processing (see
  http://www.flamewarmaster.de/software/dhcpclient/ for a DHCP client
  that can use this information)
*
driver_wext: added support for WE-21 change to SSID configuration
* driver_wext: fixed privacy configuration for static WEP keys mode
  [Bug 140]
* added an optional driver_ops callback for MLME-SETPROTECTION.request
  primitive
* added support for EAP-SAKE (no EAP method number allocated yet, so
  this is using the same experimental type 255 as EAP-PSK)
* added support for dynamically loading EAP methods (.so files) instead
  of requiring them to be statically linked in; this is disabled by
  default (see CONFIG_DYNAMIC_EAP_METHODS in defconfig for information
  on how to use this)

2006-03-19 - v0.5.2
* do not try to use USIM APDUs when initializing PC/SC for SIM card
  access for a network that has not enabled EAP-AKA
* fixed EAP phase 2 Nak for EAP-{PEAP,TTLS,FAST} (this was broken in
  v0.5.1 due to the new support for expanded EAP types)
* added support for generating EAP Expanded Nak
* try to fetch scan results once before requesting new scan when
  starting
up in ap_scan=1 mode (this can speed up initial association
  a lot with, e.g., madwifi-ng driver)
* added support for receiving EAPOL frames from a Linux bridge
  interface (-bbr0 on command line)
* fixed EAPOL re-authentication for sessions that used PMKSA caching
* changed EAP method registration to use a dynamic list of methods
  instead of a static list generated at build time
* fixed PMKSA cache deinitialization not to use freed memory when
  removing PMKSA entries
* fixed a memory leak in EAP-TTLS re-authentication
* reject WPA/WPA2 message 3/4 if it does not include any valid
  WPA/RSN IE
* driver_wext: added fallback to use SIOCSIWENCODE for setting auth_alg
  if the driver does not support SIOCSIWAUTH

2006-01-29 - v0.5.1
* driver_test: added better support for multiple APs and STAs by using
  a directory with sockets that include MAC address for each device in

the name (driver_param=test_dir=/tmp/test)
* added support for EAP expanded type (vendor specific
EAP methods)
* added AP_SCAN command into ctrl_iface so that ap_scan configuration
  option can be changed if needed
* wpa_cli/wpa_gui: skip non-socket files in control directory when
  using UNIX domain sockets; this avoids selecting an incorrect
  interface (e.g., a PID file could be in this directory, even though
  use of this directory for something else than socket files is not
  recommended)
* fixed TLS library deinitialization after RSN pre-authentication not
  to disable TLS library for normal authentication
* driver_wext: Remove null-termination from SSID length if the driver
  used it; some Linux drivers do this and they were causing problems in
  wpa_supplicant not finding matching configuration block. This change
  would break a case where the SSID actually ends in '\0', but that is
  not likely to happen in real use.
* fixed PMKSA cache processing not to trigger deauthentication if the
  current PMKSA cache entry is replaced with a valid new entry
*
fixed PC/SC initialization for ap_scan != 1 modes (this fixes
  EAP-SIM and EAP-AKA with real SIM/USIM card when using ap_scan=0 or
  ap_scan=2)

2005-12-18 - v0.5.0 (beginning of 0.5.x development releases)
 * added experimental STAKey handshake implementation for IEEE 802.11e
   direct link setup (DLS); note: this is disabled by default in both
   build and runtime configuration (can be enabled with CONFIG_STAKEY=y
   and stakey=1)
* fixed EAP-SIM and EAP-AKA pseudonym and fast re-authentication to
   decrypt AT_ENCR_DATA attributes correctly
* fixed EAP-AKA to allow resynchronization within the same session
* made code closer to ANSI C89 standard to make it easier to port to
   other C libraries and compilers
* started moving operating system or C library specific functions into
   wrapper functions defined in os.h and implemented in os_*.c to make
   code more portable
* wpa_supplicant can now be built with Microsoft Visual C++
   (e.g., with the freely available Toolkit 2003
version or Visual
   C++ 2005 Express Edition and Platform SDK); see nmake.mak for an
   example makefile for nmake
* added support for using Windows registry for command line parameters
   (CONFIG_MAIN=main_winsvc) and configuration data
   (CONFIG_BACKEND=winreg); see win_example.reg for an example registry
   contents; this version can be run both as a Windows service and as a
   normal application; 'wpasvc.exe app' to start as applicant,
   'wpasvc.exe reg <full path to wpasvc.exe>' to register a service,

'net start wpasvc' to start the service, 'wpasvc.exe unreg' to

unregister a service

* made it possible to link ndis_events.exe functionality into

wpa_supplicant.exe by defining CONFIG_NDIS_EVENTS_INTEGRATED

* added better support for multiple control interface backends

(CONFIG_CTRL_IFACE option); currently, 'unix' and 'udp' are supported

* fixed PC/SC code to use correct length for GSM AUTH command buffer

and to not use pioRecvPci with SCardTransmit() calls;

these were not

causing visible problems with pcsc-lite, but Windows Winscard.dll

refused the previously used parameters; this fixes EAP-SIM and

EAP-AKA authentication using SIM/USIM card under Windows

* added new event loop implementation for Windows using

WaitForMultipleObject() instead of select() in order to allow waiting

for non-socket objects; this can be selected with

CONFIG_ELOOP=eloop_win in .config

* added support for selecting l2_packet implementation in .config

(CONFIG_L2_PACKET; following options are available now: linux, pcap,

winpcap, freebsd, none)

* added new l2_packet implementation for WinPcap

(CONFIG_L2_PACKET=winpcap) that uses a separate receive thread to

reduce latency in EAPOL receive processing from about 100 ms to about

3 ms

* added support for EAP-FAST key derivation using other ciphers than

RC4-128-SHA for authentication and AES128-SHA for provisioning

* added support for configuring CA certificate as DER file and as

a

configuration blob

* fixed private key configuration as configuration blob and added

support for using PKCS#12 as a blob

* tls_gnutls: added support for using PKCS#12 files; added support for

session resumption

* added support for loading trusted CA certificates from Windows

certificate store: ca_cert="cert_store://<name>", where <name> is

likely CA (Intermediate CA certificates) or ROOT (root certificates)

* added C version of ndis_events.cpp and made it possible to build this

with MinGW so that CONFIG_NDIS_EVENTS_INTEGRATED can be used more

easily on cross-compilation builds

* added wpasvc.exe into Windows binary release; this is an alternative

version of wpa_supplicant.exe with configuration backend using

Windows registry and with the entry point designed to run as a

Windows service

* integrated ndis_events.exe functionality into wpa_supplicant.exe and

wpasvc.exe and removed this additional tool from the Windows binary

release since it is

not needed anymore

* load winscard.dll functions dynamically when building with MinGW

since MinGW does not yet include winscard library

2005-11-20 - v0.4.7 (beginning of 0.4.x stable releases)
 * l2_packet_pcap: fixed wired IEEE 802.1X authentication with libpcap
   and WinPcap to receive frames sent to PAE group address
 * disable EAP state machine when IEEE 802.1X authentication is not used
   in order to get rid of bogus "EAP failed" messages
 * fixed OpenSSL error reporting to go through all pending errors to
   avoid confusing reports of old errors being reported at later point
   during handshake
 * fixed configuration file updating to not write empty variables
   (e.g., proto or key_mgmt) that the file parser would not accept
 * fixed ADD_NETWORK ctrl_iface command to use the same default values
   for variables as empty network definitions read from config file
   would get
 * fixed EAP state machine to not discard EAP-Failure messages in many
   cases (e.g., during TLS handshake)
 *
fixed a infinite loop in private key reading if the configured file
   cannot be parsed successfully
 * driver_madwifi: added support for madwifi-ng
 * wpa_gui: do not display password/PSK field contents
 * wpa_gui: added CA certificate configuration
 * driver_ndis: fixed scan request in ap_scan=2 mode not to change SSID
 * driver_ndis: include Beacon IEs in AssocInfo in order to notice if
   the new AP is using different WPA/RSN IE
 * use longer timeout for IEEE 802.11 association to avoid problems with
   drivers that may take more than five second to associate

2005-10-27 - v0.4.6
 * allow fallback to WPA, if mixed WPA+WPA2 networks have mismatch in
   RSN IE, but WPA IE would match with wpa_supplicant configuration
 * added support for named configuration blobs in order to avoid having
   to use file system for external files (e.g., certificates);
   variables can be set to "blob://<blob name>" instead of file path to
   use a named blob; supported fields: pac_file, client_cert,

   private_key
 * fixed RSN pre-authentication (it was broken in the clean up of WPA
   state machine interface in v0.4.5)
 * driver_madwifi: set IEEE80211_KEY_GROUP flag for group keys to make
   sure the driver configures broadcast decryption correctly
 * added ca_path (and ca_path2) configuration variables that can be used
   to configure OpenSSL CA path, e.g., /etc/ssl/certs, for using the
   system-wide trusted CA list
 * added support for starting wpa_supplicant without a configuration
   file (-C argument must be used to set ctrl_interface parameter for
   this case; in addition, -p argument can be used to provide
   driver_param; these new arguments can also be used with a

configuration to override the values from the configuration)
* added global control interface that can be optionally used for adding
  and removing network interfaces dynamically (-g command line argument
  for both wpa_supplicant and wpa_cli) without having to restart
  wpa_supplicant process
*
wpa_gui:
  - try to save configuration whenever something is modified
  - added WEP key configuration
  - added possibility to edit the current network configuration
* driver_ndis: fixed driver polling not to increase frequency on each
  received EAPOL frame due to incorrectly cancelled timeout
* added simple configuration file examples (in examples subdirectory)
* fixed driver_wext.c to filter wireless events based on ifindex to
  avoid interfaces receiving events from other interfaces
* delay sending initial EAPOL-Start couple of seconds to speed up
  authentication for the most common case of Authenticator starting
  EAP authentication immediately after association

2005-09-25 - v0.4.5
 * added a workaround for clearing keys with ndiswrapper to allow
   roaming from WPA enabled AP to plaintext one
 * added docbook documentation (doc/docbook) that can be used to
   generate, e.g., man pages
 * l2_packet_linux: use socket type SOCK_DGRAM instead of SOCK_RAW for
   PF_PACKET
in order to prepare for network devices that do not use
   Ethernet headers (e.g., network stack with native IEEE 802.11 frames)
 * use receipt of EAPOL-Key frame as a lower layer success indication
   for EAP state machine to allow recovery from dropped EAP-Success
   frame
 * cleaned up internal EAPOL frame processing by not including link
   layer (Ethernet) header during WPA and EAPOL/EAP processing; this
   header is added only when transmitted the frame; this makes it easier
   to use wpa_supplicant on link layers that use different header than
   Ethernet
 * updated EAP-PSK to use draft 9 by default since this can now be
   tested with hostapd; removed support for draft 3, including
   server_nai configuration option from network blocks
 * driver_wired: add PAE address to the multicast address list in order
   to be able to receive EAPOL frames with drivers that do not include
   these multicast addresses by default
 * driver_wext: add support for WE-19
 * added support for
multiple configuration backends (CONFIG_BACKEND
   option); currently, only 'file' is supported (i.e., the format used
   in wpa_supplicant.conf)
 * added support for updating configuration ('wpa_cli save_config');

this is disabled by default and can be enabled with global
update_config=1 variable in wpa_supplicant.conf; this allows wpa_cli
and wpa_gui to store the configuration changes in a permanent store
* added GET_NETWORK ctrl_iface command
(e.g., 'wpa_cli get_network 0 ssid')

2005-08-21 - v0.4.4
 * replaced OpenSSL patch for EAP-FAST support
   (openssl-tls-extensions.patch) with a more generic and correct
   patch (the new patch is not compatible with the previous one, so the
   OpenSSL library will need to be patched with the new patch in order
   to be able to build wpa_supplicant with EAP-FAST support)
 * added support for using Windows certificate store (through CryptoAPI)
   for client certificate and private key operations (EAP-TLS)
   (see wpa_supplicant.conf
for more information on how to configure
   this with private_key)
 * ported wpa_gui to Windows
 * added Qt4 version of wpa_gui (wpa_gui-qt4 directory); this can be
   built with the open source version of the Qt4 for Windows
 * allow non-WPA modes (e.g., IEEE 802.1X with dynamic WEP) to be used
   with drivers that do not support WPA
 * ndis_events: fixed Windows 2000 support
 * added support for enabling/disabling networks from the list of all
   configured networks ('wpa_cli enable_network <network id>' and
   'wpa_cli disable_network <network id>')
 * added support for adding and removing network from the current
   configuration ('wpa_cli add_network' and 'wpa_cli remove_network
   <network id>'); added networks are disabled by default and they can
   be enabled with enable_network command once the configuration is done
   for the new network; note: configuration file is not yet updated, so
   these new networks are lost when wpa_supplicant is restarted
 * added support for setting
network configuration parameters through
   the control interface, for example:
   wpa_cli set_network 0 ssid "\"my network\""
 * fixed parsing of strings that include both " and # within double
   quoted area (e.g., "start"#end")
 * added EAP workaround for PEAP session resumption: allow outer,
   i.e., not tunneled, EAP-Success to terminate session since; this can
   be disabled with eap_workaround=0
   (this was allowed for PEAPv1 before, but now it is also allowed for
   PEAPv0 since at least one RADIUS authentication server seems to be
   doing this for PEAPv0, too)
 * wpa_gui: added preliminary support for adding new networks to the
   wpa_supplicant configuration (double click on the scan results to
   open network configuration)

2005-06-26 - v0.4.3
 * removed interface for external EAPOL/EAP supplicant (e.g.,
   Xsupplicant), (CONFIG_XSUPPLICANT_IFACE) since it is not required
   anymore and is unlikely to be used by anyone
 * driver_ndis: fixed WinPcap 3.0 support
 * fixed
 build with CONFIG_DNET_PCAP=y on Linux
 * l2_packet: moved different implementations into separate files
   (l2_packet_*.c)

2005-06-12 - v0.4.2
 * driver_ipw: updated driver structures to match with ipw2200-1.0.4
   (note: ipw2100-1.1.0 is likely to require an update to work with
   this)
 * added support for using ap_scan=2 mode with multiple network blocks;
   wpa_supplicant will go through the networks one by one until the
   driver reports a successful association; this uses the same order for
   networks as scan_ssid=1 scans, i.e., the priority field is ignored
   and the network block order in the file is used instead
 * fixed a potential issue in RSN pre-authentication ending up using
   freed memory if pre-authentication times out
 * added support for matching alternative subject name extensions of the
   authentication server certificate; new configuration variables
   altsubject_match and altsubject_match2
 * driver_ndis: added support for IEEE 802.1X authentication with
 wired
   NDIS drivers
 * added support for querying private key password (EAP-TLS) through the
   control interface (wpa_cli/wpa_gui) if one is not included in the
   configuration file
 * driver_broadcom: fixed couple of memory leaks in scan result
   processing
 * EAP-PAX is now registered as EAP type 46
 * fixed EAP-PAX MAC calculation
 * fixed EAP-PAX CK and ICK key derivation
 * added support for using password with EAP-PAX (as an alternative to
   entering key with eappsk); SHA-1 hash of the password will be used as
   the key in this case
 * added support for arbitrary driver interface parameters through the
   configuration file with a new driver_param field; this adds a new
   driver_ops function set_param()
 * added possibility to override l2_packet module with driver interface
   API (new send_eapol handler); this can be used to implement driver
   specific TX/RX functions for EAPOL frames
 * fixed ctrl_interface_group processing for the case where gid is
   entered as a number,
 not group name
 * driver_test: added support for testing hostapd with wpa_supplicant

by using test driver interface without any kernel drivers or network
cards

2005-05-22 - v0.4.1
* driver_madwifi: fixed WPA/WPA2 mode configuration to allow EAPOL
  packets to be encrypted; this was apparently broken by the changed
  ioctl order in v0.4.0
* driver_madwifi: added preliminary support for compiling against 'BSD'
  branch of madwifi CVS tree
* added support for EAP-MSCHAPv2 password retries within the same EAP
  authentication session
* added support for password changes with EAP-MSCHAPv2 (used when the
  password has expired)
* added support for reading additional certificates from PKCS#12 files
  and adding them to the certificate chain
* fixed association with IEEE 802.1X (no WPA) when dynamic WEP keys
  were used
* fixed a possible double free in EAP-TTLS fast-reauthentication when
  identity or password is entered through control interface
* display EAP Notification
messages to user through control interface
  with "CTRL-EVENT-EAP-NOTIFICATION" prefix
* added GUI version of wpa_cli, wpa_gui; this is not build
  automatically with 'make'; use 'make wpa_gui' to build (this requires
  Qt development tools)
* added 'disconnect' command to control interface for setting
  wpa_supplicant in state where it will not associate before
  'reassociate' command has been used
* added support for selecting a network from the list of all configured
  networks ('wpa_cli select_network <network id>'; this disabled all
  other networks; to re-enable, 'wpa_cli select_network any')
* added support for getting scan results through control interface
* added EAP workaround for PEAPv1 session resumption: allow outer,
  i.e., not tunneled, EAP-Success to terminate session since; this can
  be disabled with eap_workaround=0

2005-04-25 - v0.4.0 (beginning of 0.4.x development releases)
* added a new build time option, CONFIG_NO_STDOUT_DEBUG, that can
be
  used to reduce the size of the wpa_supplicant considerably if
  debugging code is not needed
* fixed EAPOL-Key validation to drop packets with invalid Key Data
  Length; such frames could have crashed wpa_supplicant due to buffer
  overflow
* added support for wired authentication (IEEE 802.1X on wired
  Ethernet); driver interface 'wired'
* obsoleted set_wpa() handler in the driver interface API (it can be
  replaced by moving enable/disable functionality into init()/deinit())

(calls to set_wpa() are still present for backwards compatibility,
  but they may be removed in the future)
* driver_madwifi: fixed association in plaintext mode
* modified the EAP workaround that accepts EAP-Success with incorrect
  Identifier to be even less strict about verification in order to
  interoperate with some authentication servers
* added support for sending TLS alerts
* added support for 'any' SSID wildcard; if ssid is not configured or
  is set to an empty string, any SSID
will be accepted for non-WPA AP
* added support for asking PIN (for SIM) from frontends (e.g.,
  wpa_cli); if a PIN is needed, but not included in the configuration
  file, a control interface request is sent and EAP processing is
  delayed until the PIN is available
* added support for using external devices (e.g., a smartcard) for
  private key operations in EAP-TLS (CONFIG_SMARTCARD=y in .config);
  new wpa_supplicant.conf variables:
  - global: opensc_engine_path, pkcs11_engine_path, pkcs11_module_path
  - network: engine, engine_id, key_id
* added experimental support for EAP-PAX
* added monitor mode for wpa_cli (-a<path to a program to run>) that
  allows external commands (e.g., shell scripts) to be run based on
  wpa_supplicant events, e.g., when authentication has been completed
  and data connection is ready; other related wpa_cli arguments:
  -B (run in background), -P (write PID file); wpa_supplicant has a new
  command line argument (-W) that can be used
to make it wait until a
  control interface command is received in order to avoid missing
  events
* added support for opportunistic WPA2 PMKSA key caching (disabled by
  default, can be enabled with proactive_key_caching=1)
* fixed RSN IE in 4-Way Handshake message 2/4 for the case where
  Authenticator rejects PMKSA caching attempt and the driver is not
  using assoc_info events
* added -P<pid file> argument for wpa_supplicant to write the current
  process id into a file

2005-02-12 - v0.3.7 (beginning of 0.3.x stable releases)
* added new phase1 option parameter, include_tls_length=1, to force
  wpa_supplicant to add TLS Message Length field to all TLS messages
  even if the packet is not fragmented; this may be needed with some
  authentication servers
* fixed WPA/RSN IE verification in message 3 of 4-Way Handshake when
  using drivers that take care of AP selection (e.g., when using
  ap_scan=2)
* fixed reprocessing of pending request after ctrl_iface requests for

identity/password/otp
* fixed ctrl_iface requests for identity/password/otp in Phase 2 of
  EAP-PEAP and EAP-TTLS
* all drivers using driver_wext: set interface up and select Managed
  mode when starting wpa_supplicant; set interface down when exiting
* renamed driver_ipw2100.c to driver_ipw.c since it now supports both
  ipw2100 and ipw2200; please note that this also changed the
  configuration variable in .config to CONFIG_DRIVER_IPW

2005-01-24 - v0.3.6
* fixed a busy loop introduced in v0.3.5 for scan result processing
  when no matching AP is found

2005-01-23 - v0.3.5
* added a workaround for an interoperability issue with a Cisco AP
  when using WPA2-PSK
* fixed non-WPA IEEE 802.1X to use the same authentication timeout as
  WPA with IEEE 802.1X (i.e., timeout 10 -> 70 sec to allow
  retransmission of dropped frames)
* fixed issues with 64-bit CPUs and SHA1 cleanup in previous version
  (e.g., segfault when processing EAPOL-Key frames)
* fixed EAP workaround
and fast reauthentication configuration for
  RSN pre-authentication; previously these were disabled and
  pre-authentication would fail if the used authentication server
  requires EAP workarounds
* added support for blacklisting APs that fail or timeout
  authentication in ap_scan=1 mode so that all APs are tried in cases
  where the ones with strongest signal level are failing authentication
* fixed CA certificate loading after a failed EAP-TLS/PEAP/TTLS
  authentication attempt
* allow EAP-PEAP/TTLS fast reauthentication only if Phase 2 succeeded
  in the previous authentication (previously, only Phase 1 success was
  verified)

2005-01-09 - v0.3.4
* added preliminary support for IBSS (ad-hoc) mode configuration
  (mode=1 in network block); this included a new key_mgmt mode
  WPA-NONE, i.e., TKIP or CCMP with a fixed key (based on psk) and no
  key management; see wpa_supplicant.conf for more details and an
  example on how to configure this (note: this is currently
implemented
  only for driver_hostapd.c, but the changes should be trivial to add
  in associate() handler for other drivers, too (assuming the driver
  supports WPA-None)
* added preliminary port for native Windows (i.e., no cygwin) using
  mingw

2005-01-02 - v0.3.3
 * added optional support for GNU Readline and History Libraries for
   wpa_cli (CONFIG_READLINE)
 * cleaned up EAP state machine <-> method interface and number of
   small problems with error case processing not terminating on
   EAP-Failure but waiting for timeout
 * added couple of workarounds for interoperability issues with a
   Cisco AP when using WPA2
 * added support for EAP-FAST (draft-cam-winget-eap-fast-00.txt);
   Note: This requires a patch for openssl to add support for TLS
   extensions and number of workarounds for operations without
   certificates. Proof of concept type of experimental patch is
   included in openssl-tls-extensions.patch.

2004-12-19 - v0.3.2
 * fixed private key loading for cases
 where passphrase is not set
 * fixed Windows/cygwin L2 packet handler freeing; previous version
   could cause a segfault when RSN pre-authentication was completed
 * added support for PMKSA caching with drivers that generate RSN IEs
   (e.g., NDIS); currently, this is only implemented in driver_ndis.c,
   but similar code can be easily added to driver_ndiswrapper.c once
   ndiswrapper gets full support for RSN PMKSA caching
 * improved recovery from PMKID mismatches by requesting full EAP
   authentication in case of failed PMKSA caching attempt
 * driver_ndis: added support for NDIS NdisMIncidateStatus() events
   (this requires that ndis_events is ran while wpa_supplicant is
   running)
 * driver_ndis: use ADD_WEP/REMOVE_WEP when configuring WEP keys
 * added support for driver interfaces to replace the interface name
   based on driver/OS specific mapping, e.g., in case of driver_ndis,
   this allows the beginning of the adapter description to be used as
   the interface name
 *
 added support for CR+LF (Windows-style) line ends in configuration
   file
 * driver_ndis: enable radio before starting scanning, disable radio
   when exiting
 * modified association event handler to set portEnabled = FALSE before
   clearing port Valid in order to reset EAP state machine and avoid
   problems with new authentication getting ignored because of state
   machines ending up in AUTHENTICATED/SUCCESS state based on old
   information
 * added support for driver events to add PMKID candidates in order to
   allow drivers to give priority to most likely roaming candidates
 * driver_hostap: moved PrivacyInvoked configuration to associate()
   function so that this will not be set for plaintext connections
 * added KEY_MGMT_802_1X_NO_WPA as a new key_mgmt type so that driver

interface can distinguish plaintext and IEEE 802.1X (no WPA)
authentication
* fixed static WEP key configuration to use broadcast/default type for
all keys (previously, the default TX key was
configured as pairwise/
unicast key)
* driver_ndis: added legacy WPA capability detection for non-WPA2
drivers
* added support for setting static WEP keys for IEEE 802.1X without
dynamic WEP keying (eapol_flags=0)

2004-12-12 - v0.3.1
* added support for reading PKCS#12 (PFX) files (as a replacement for
PEM/DER) to get certificate and private key (CONFIG_PKCS12)
* fixed compilation with CONFIG_PCSC=y
* added new ap_scan mode, ap_scan=2, for drivers that take care of
association, but need to be configured with security policy and SSID,
e.g., ndiswrapper and NDIS driver; this mode should allow such
drivers to work with hidden SSIDs and optimized roaming; when
ap_scan=2 is used, only the first network block in the configuration
file is used and this configuration should have explicit security
policy (i.e., only one option in the lists) for key_mgmt, pairwise,
group, proto variables
* added experimental port of wpa_supplicant for Windows
- driver_ndis.c
driver interface (NDIS OIDs)
- currently, this requires cygwin and WinPcap
- small utility, win_if_list, can be used to get interface name
* control interface can now be removed at build time; add
CONFIG_CTRL_IFACE=y to .config to maintain old functionality
* optional Xsupplicant interface can now be removed at build time;
(CONFIG_XSUPPLICANT_IFACE=y in .config to bring it back)
* added auth_alg to driver interface associate() parameters to make it
easier for drivers to configure authentication algorithm as part of
the association

2004-12-05 - v0.3.0 (beginning of 0.3.x development releases)
* driver_broadcom: added new driver interface for Broadcom wl.o driver
(a generic driver for Broadcom IEEE 802.11a/g cards)
* wpa_cli: fixed parsing of -p <path> command line argument
* PEAPv1: fixed tunneled EAP-Success reply handling to reply with TLS
ACK, not tunneled EAP-Success (of which only the first byte was
actually send due to a bug in previous code);
this seems to
interoperate with most RADIUS servers that implements PEAPv1
* PEAPv1: added support for terminating PEAP authentication on tunneled
EAP-Success message; this can be configured by adding
peap_outer_success=0 on phase1 parameters in wpa_supplicant.conf

(some RADIUS servers require this whereas others require a tunneled
  reply

* PEAPv1: changed phase1 option peaplabel to use default to 0, i.e., to
  the old label for key derivation; previously, the default was 1,
  but it looks like most existing PEAPv1 implementations use the old
  label which is thus more suitable default option

* added support for EAP-PSK (draft-bersani-eap-psk-03.txt)

* fixed parsing of wep_tx_keyidx

* added support for configuring list of allowed Phase 2 EAP types
  (for both EAP-PEAP and EAP-TTLS) instead of only one type

* added support for configuring IEEE 802.11 authentication algorithm
  (auth_alg; mainly for using Shared Key authentication with static
  WEP keys)

* added
support for EAP-AKA (with UMTS SIM)

* fixed couple of errors in PCSC handling that could have caused
  random-looking errors for EAP-SIM

* added support for EAP-SIM pseudonyms and fast re-authentication

* added support for EAP-TLS/PEAP/TTLS fast re-authentication (TLS
  session resumption)

* added support for EAP-SIM with two challanges
  (phase1="sim_min_num_chal=3" can be used to require three challenges)

* added support for configuring DH/DSA parameters for an ephemeral DH
  key exchange (EAP-TLS/PEAP/TTLS) using new configuration parameters
  dh_file and dh_file2 (phase 2); this adds support for using DSA keys
  and optional DH key exchange to achieve forward secracy with RSA keys

* added support for matching subject of the authentication server
  certificate with a substring when using EAP-TLS/PEAP/TTLS; new
  configuration variables subject_match and subject_match2

* changed SSID configuration in driver_wext.c (used by many driver
  interfaces) to use ssid_len+1
as the length for SSID since some Linux
  drivers expect this

* fixed couple of unaligned reads in scan result parsing to fix WPA
  connection on some platforms (e.g., ARM)

* added driver interface for Intel ipw2100 driver

* added support for LEAP with WPA

* added support for larger scan results report (old limit was 4 kB of
  data, i.e., about 35 or so APs) when using Linux wireless extensions
  v17 or newer

* fixed a bug in PMKSA cache processing: skip sending of EAPOL-Start
  only if there is a PMKSA cache entry for the current AP

* fixed error handling for case where reading of scan results fails:
  must schedule a new scan or wpa_supplicant will remain waiting
  forever

* changed debug output to remove shared password/key material by
  default; all key information can be included with -K command line
  argument to match the previous behavior

* added support for timestamping debug log messages (disabled by
  default, can be enabled with -t command line argument)
*
set pairwise/group cipher suite for non-WPA IEEE 802.1X to WEP-104
  if keys are not configured to be used; this fixes IEEE 802.1X mode
  with drivers that use this information to configure whether Privacy
  bit can be in Beacon frames (e.g., ndiswrapper)
* avoid clearing driver keys if no keys have been configured since last
  key clear request; this seems to improve reliability of group key
  handshake for ndiswrapper & NDIS driver which seems to be suffering
  of some kind of timing issue when the keys are cleared again after
  association
* changed driver interface API:
  - WPA_SUPPLICANT_DRIVER_VERSION define can be used to determine which
    version is being used (now, this is set to 2; previously, it was
    not defined)
  - pass pointer to private data structure to all calls
  - the new API is not backwards compatible; all in-tree driver
    interfaces has been converted to the new API
* added support for controlling multiple interfaces (radios) per
  wpa_supplicant
process; each interface needs to be listed on the
  command line (-c, -i, -D arguments) with -N as a separator
  (-cwpa1.conf -iwlan0 -Dhostap -N -cwpa2.conf -iath0 -Dmadwifi)
* added a workaround for EAP servers that incorrectly use same Id for
  sequential EAP packets
* changed libpcap/libdnet configuration to use .config variable,
  CONFIG_DNET_PCAP, instead of requiring Makefile modification
* improved downgrade attack detection in IE verification of msg 3/4:
  verify both WPA and RSN IEs, if present, not only the selected one;
  reject the AP if an RSN IE is found in msg 3/4, but not in Beacon or
  Probe Response frame, and RSN is enabled in wpa_supplicant
  configuration
* fixed WPA msg 3/4 processing to allow Key Data field contain other
  IEs than just one WPA IE
* added support for FreeBSD and driver interface for the BSD net80211
  layer (CONFIG_DRIVER_BSD=y in .config); please note that some of the
  required kernel mods have not yet been committed
*
made EAP workarounds configurable; enabled by default, can be
  disabled with network block option eap_workaround=0

2004-07-17 - v0.2.4 (beginning of 0.2.x stable releases)
* resolved couple of interoperability issues with EAP-PEAPv1 and
  Phase 2 (inner EAP) fragment reassembly
* driver_madwifi: fixed WEP key configuration for IEEE 802.1X when the
  AP is using non-zero key index for the unicast key and key index zero
  for the broadcast key

* driver_hostap: fixed IEEE 802.1X WEP key updates and
  re-authentication by allowing unencrypted EAPOL frames when not using
  WPA
* added a new driver interface, 'wext', which uses only standard,
  driver independent functionality in Linux wireless extensions;
  currently, this can be used only for non-WPA IEEE 802.1X mode, but
  eventually, this is to be extended to support full WPA/WPA2 once
  Linux wireless extensions get support for this
* added support for mode in which the driver is responsible for AP
  scanning and
selection; this is disabled by default and can be
  enabled with global ap_scan=0 variable in wpa_supplicant.conf;
  this mode can be used, e.g., with generic 'wext' driver interface to
  use wpa_supplicant as IEEE 802.1X Supplicant with any Linux driver
  supporting wireless extensions.
* driver_madwifi: fixed WPA2 configuration and scan_ssid=1 (e.g.,
  operation with an AP that does not include SSID in the Beacon frames)
* added support for new EAP authentication methods:
  EAP-TTLS/EAP-OTP, EAP-PEAPv0/OTP, EAP-PEAPv1/OTP, EAP-OTP
* added support for asking one-time-passwords from frontends (e.g.,
  wpa_cli); this 'otp' command works otherwise like 'password' command,
  but the password is used only once and the frontend will be asked for
  a new password whenever a request from authenticator requires a
  password; this can be used with both EAP-OTP and EAP-GTC
* changed wpa_cli to automatically re-establish connection so that it
  does not need to be re-started when
wpa_supplicant is terminated and
  started again
* improved user data (identity/password/otp) requests through
  frontends: process pending EAPOL packets after getting new
  information so that full authentication does not need to be
  restarted; in addition, send pending requests again whenever a new
  frontend is attached
* changed control frontends to use a new directory for socket files to
  make it easier for wpa_cli to automatically select between interfaces
  and to provide access control for the control interface;
  wpa_supplicant.conf: ctrl_interface is now a path
  (/var/run/wpa_supplicant is the recommended path) and
  ctrl_interface_group can be used to select which group gets access to
  the control interface;
  wpa_cli: by default, try to connect to the first interface available
  in /var/run/wpa_supplicant; this path can be overriden with -p option
  and an interface can be selected with -i option (i.e., in most common
  cases, wpa_cli does not need to get
any arguments)
* added support for LEAP
* added driver interface for Linux ndiswrapper
* added priority option for network blocks in the configuration file;

this allows networks to be grouped based on priority (the scan
results are searched for matches with network blocks in this order)

2004-06-20 - v0.2.3
 * sort scan results to improve AP selection
 * fixed control interface socket removal for some error cases
 * improved scan requesting and authentication timeout
 * small improvements/bug fixes for EAP-MSCHAPv2, EAP-PEAP, and
   TLS processing
 * PEAP version can now be forced with phase1="peapver=<ver>"
   (mostly for testing; by default, the highest version supported by
   both the Supplicant and Authentication Server is selected
   automatically)
 * added support for madwifi driver (Atheros ar521x)
 * added a workaround for cases where AP sets Install Tx/Rx bit for
   WPA Group Key messages when pairwise keys are used (without this,
   the Group Key would be used for
Tx and the AP would drop frames
   from the station)
 * added GSM SIM/USIM interface for GSM authentication algorithm for
   EAP-SIM; this requires pcsc-lite
 * added support for ATMEL AT76C5XXx driver
 * fixed IEEE 802.1X WEP key derivation in the case where Authenticator
   does not include key data in the EAPOL-Key frame (i.e., part of
   EAP keying material is used as data encryption key)
 * added support for using plaintext and static WEP networks
   (key_mgmt=NONE)

2004-05-31 - v0.2.2
 * added support for new EAP authentication methods:
   EAP-TTLS/EAP-MD5-Challenge
   EAP-TTLS/EAP-GTC
   EAP-TTLS/EAP-MSCHAPv2
   EAP-TTLS/EAP-TLS
   EAP-TTLS/MSCHAPv2
   EAP-TTLS/MSCHAP
   EAP-TTLS/PAP
   EAP-TTLS/CHAP
   EAP-PEAP/TLS
   EAP-PEAP/GTC
   EAP-PEAP/MD5-Challenge
   EAP-GTC
   EAP-SIM (not yet complete; needs GSM/SIM authentication interface)
 * added support for anonymous identity (to be used when identity is
   sent in plaintext; real identity will be used within TLS protected

tunnel (e.g., with EAP-TTLS)
 * added event messages from wpa_supplicant to frontends, e.g., wpa_cli

* added support for requesting identity and password information using
  control interface; in other words, the password for EAP-PEAP or
  EAP-TTLS does not need to be included in the configuration file since
  a frontand (e.g., wpa_cli) can ask it from the user
* improved RSN pre-authentication to use a candidate list and process
  all candidates from each scan; not only one per scan
* fixed RSN IE and WPA IE capabilities field parsing
* ignore Tx bit in GTK IE when Pairwise keys are used
* avoid making new scan requests during IEEE 802.1X negotiation
* use openssl/libcrypto for MD5 and SHA-1 when compiling wpa_supplicant
  with TLS support (this replaces the included implementation with
  library code to save about 8 kB since the library code is needed
  anyway for TLS)
* fixed WPA-PSK only mode when compiled without IEEE 802.1X support
  (i.e., without CONFIG_IEEE8021X_EAPOL=y
in .config)

2004-05-06 - v0.2.1
 * added support for internal IEEE 802.1X (actually, IEEE 802.1aa/D6.1)
   Supplicant
   - EAPOL state machines for Supplicant [IEEE 802.1aa/D6.1]
   - EAP peer state machine [draft-ietf-eap-statemachine-02.pdf]
   - EAP-MD5 (cannot be used with WPA-RADIUS)
     [draft-ietf-eap-rfc2284bis-09.txt]
   - EAP-TLS [RFC 2716]
   - EAP-MSCHAPv2 (currently used only with EAP-PEAP)
   - EAP-PEAP/MSCHAPv2 [draft-josefsson-pppext-eap-tls-eap-07.txt]
     [draft-kamath-pppext-eap-mschapv2-00.txt]
     (PEAP version 0, 1, and parts of 2; only 0 and 1 are enabled by
     default; tested with FreeRADIUS, Microsoft IAS, and Funk Odyssey)
   - new configuration file options: eap, identity, password, ca_cert,
     client_cert, privatekey, private_key_passwd
   - Xsupplicant is not required anymore, but it can be used by
     disabling the internal IEEE 802.1X Supplicant with -e command line
     option
   - this code is not included in the default build; Makefile
need to
     be edited for this (uncomment lines for selected functionality)
   - EAP-TLS and EAP-PEAP require openssl libraries
 * use module prefix in debug messages (WPA, EAP, EAP-TLS, ..)
 * added support for non-WPA IEEE 802.1X mode with dynamic WEP keys
   (i.e., complete IEEE 802.1X/EAP authentication and use IEEE 802.1X
    EAPOL-Key frames instead of WPA key handshakes)
 * added support for IEEE 802.11i/RSN (WPA2)
   - improved PTK Key Handshake
   - PMKSA caching, pre-authentication
 * fixed wpa_supplicant to ignore possible extra data after WPA
   EAPOL-Key packets (this fixes 'Invalid EAPOL-Key MIC when using

TPTK' error from message 3 of 4-Way Handshake in case the AP

includes extra data after the EAPOL-Key)

 * added interface for external programs (frontends) to control

wpa_supplicant

  - CLI example (wpa_cli) with interactive mode and command line

   mode

  - replaced SIGUSR1 status/statistics with the new control interface

 * made some feature compile time

configurable

  - .config file for make

  - driver interfaces (hostap, hermes, ..)

  - EAPOL/EAP functions

2004-02-15 - v0.2.0

 * Initial version of wpa_supplicant

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/ChangeLog

No license file was found, but licenses were detected in source scan.

/*

* Interworking (IEEE 802.11u)

* Copyright (c) 2011-2013, Qualcomm Atheros, Inc.

* Copyright (c) 2011-2014, Jouni Malinen <j@w1.fi>

*

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* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/interworking.c

No license file was found, but licenses were detected in source scan.

/*

* BSS table

* Copyright (c) 2009-2015, Jouni Malinen <j@w1.fi>

*

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* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/bss.c

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/bss.h

No license file was found, but licenses were detected in source scan.

/*

* wpa_gui - SignalBar class

* Copyright (c) 2011, Kel Modderman <kel@otaku42.de>

*

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* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-qt4/signalbar.h

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-qt4/signalbar.cpp

No license file was found, but licenses were detected in source scan.

/*

* WPA Supplicant - Basic AP mode support routines

* Copyright (c) 2003-2009, Jouni Malinen <j@w1.fi>

* Copyright (c) 2009, Atheros Communications

*

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* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/ap.h

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/ap.c

No license file was found, but licenses were detected in source scan.

/*

* WPA Supplicant / WinMain() function for Windows-based applications

* Copyright (c) 2006, Jouni Malinen <j@w1.fi>

*

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* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/main_winmain.c

No license file was found, but licenses were detected in source scan.

/*

* Copyright (c) 2011-2013, Qualcomm Atheros, Inc.

*

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* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/hs20_supplicant.h

No license file was found, but licenses were detected in source scan.

```
/*
* libwpa_test - Test program for libwpa_client.* library linking
* Copyright (c) 2015, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/
```

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/libwpa_test.c
No license file was found, but licenses were detected in source scan.

```
/*
* wpa_supplicant - IBSS RSN
* Copyright (c) 2009, Jouni Malinen <j@w1.fi>
*
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* See README for more details.
*/
```

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/ibss_rsn.h
No license file was found, but licenses were detected in source scan.

```
/*
* wpa_supplicant - DPP
* Copyright (c) 2017, Qualcomm Atheros, Inc.
* Copyright (c) 2018, The Linux Foundation
*
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* See README for more details.
*/
```

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/dpp_supplicant.c
No license file was found, but licenses were detected in source scan.

```
/*
* WPA Supplicant - auto scan periodic module
* Copyright (c) 2012, Intel Corporation. All rights reserved.
*
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* See README for more details.
*/
```

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/autoscan_periodic.c
No license file was found, but licenses were detected in source scan.

/*
* wpa_supplicant - Wi-Fi Display
* Copyright (c) 2011, Atheros Communications, Inc.
* Copyright (c) 2011-2012, Qualcomm Atheros, Inc.
*
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* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wifi_display.h
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wifi_display.c
No license file was found, but licenses were detected in source scan.

/*
* WPA Supplicant - Glue code to setup EAPOL and RSN modules
* Copyright (c) 2003-2008, Jouni Malinen <j@w1.fi>
*
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* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpas_glue.h
No license file was found, but licenses were detected in source scan.

/*
* WPA Supplicant - background scan and roaming interface
* Copyright (c) 2009-2010, Jouni Malinen <j@w1.fi>
*
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* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/bgscan.h
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/bgscan.c
No license file was found, but licenses were detected in source scan.

/*
* WPA Supplicant / UNIX domain socket -based control interface
* Copyright (c) 2004-2005, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.

```
* See README for more details.
*/
```

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/ctrl_iface.h
No license file was found, but licenses were detected in source scan.

```
/*
* WPA Supplicant / dbus-based control interface (WPS)
* Copyright (c) 2006, Dan Williams <dcbw@redhat.com> and Red Hat, Inc.
*
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* See README for more details.
*/
```

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-
gz/wpa_supplicant/dbus/dbus_old_handlers_wps.c
No license file was found, but licenses were detected in source scan.

```
/*
* WPA Supplicant / Control interface (shared code for all backends)
* Copyright (c) 2004-2015, Jouni Malinen <j@w1.fi>
*
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* See README for more details.
*/
```

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/ctrl_iface.c
No license file was found, but licenses were detected in source scan.

```
/*
* WPA Supplicant / main() function for UNIX like OSes and MinGW
* Copyright (c) 2003-2013, Jouni Malinen <j@w1.fi>
*
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* See README for more details.
*/
```

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/main.c
No license file was found, but licenses were detected in source scan.

```
/*
* WPA Supplicant - ASCII passphrase to WPA PSK tool
* Copyright (c) 2003-2005, Jouni Malinen <j@w1.fi>
*
```

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* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_passphrase.c
No license file was found, but licenses were detected in source scan.

/*
* WPA Supplicant - auto scan
* Copyright (c) 2012, Intel Corporation. All rights reserved.
*
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*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/autoscan.h
No license file was found, but licenses were detected in source scan.

/*
* wpa_gui - Peers class
* Copyright (c) 2009-2010, Atheros Communications
*
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* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-qt4/peers.h
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-qt4/peers.cpp
No license file was found, but licenses were detected in source scan.

/*
* wpa_gui - Application startup
* Copyright (c) 2005-2006, Jouni Malinen <j@w1.fi>
*
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* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-qt4/main.cpp
No license file was found, but licenses were detected in source scan.

```
/*
* WPA Supplicant / Configuration file structures
* Copyright (c) 2003-2012, Jouni Malinen <j@w1.fi>
*
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* See README for more details.
*/
```

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/config.h
No license file was found, but licenses were detected in source scan.

```
/*
* WPA Supplicant - background scan and roaming module: learn
* Copyright (c) 2009-2010, Jouni Malinen <j@w1.fi>
*
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* See README for more details.
*/
```

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/bgscan_learn.c
No license file was found, but licenses were detected in source scan.

```
/*
* WPA Supplicant / Configuration backend: Windows registry
* Copyright (c) 2003-2008, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*
* This file implements a configuration backend for Windows registry. All the
* configuration information is stored in the registry and the format for
* network configuration fields is same as described in the sample
* configuration file, wpa_supplicant.conf.
*
* Configuration data is in
* \a HKEY_LOCAL_MACHINE\\SOFTWARE\\%wpa_supplicant\\configs
* key. Each configuration profile has its own key under this. In terms of text
* files, each profile would map to a separate text file with possibly multiple
* networks. Under each profile, there is a networks key that lists all
* networks as a subkey. Each network has set of values in the same way as
* network block in the configuration file.
 In addition, blobs subkey has
* possible blobs as values.
*
* Example network configuration block:
* \verbatim
```

HKEY_LOCAL_MACHINE\SOFTWARE\wpa_supplicant\configs\test\networks\0000
  ssid="example"
  key_mgmt=WPA-PSK
\endverbatim
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/config_winreg.c
No license file was found, but licenses were detected in source scan.

/*
* wpa_gui - EventHistory class
* Copyright (c) 2005-2006, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-qt4/eventhistory.h
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-qt4/eventhistory.cpp
No license file was found, but licenses were detected in source scan.

Example wpa_supplicant build time configuration
#
This file lists the configuration options that are used when building the
wpa_supplicant binary. All lines starting with # are ignored. Configuration
option lines must be commented out complete, if they are not to be included,
i.e., just setting VARIABLE=n is not disabling that variable.
#
This file is included in Makefile, so variables like CFLAGS and LIBS can also
be modified from here. In most cases, these lines should use += in order not
to override previous values of the variables.

Uncomment following two lines and fix the paths if you have installed OpenSSL
or GnuTLS in non-default location
#CFLAGS += -I/usr/local/openssl/include
#LIBS += -L/usr/local/openssl/lib

Some Red Hat versions seem to include kerberos header files from OpenSSL, but
the kerberos files are not in the default include path. Following line can be
used to fix build
 issues on such systems (krb5.h not found).
#CFLAGS += -I/usr/include/kerberos

# Driver interface for generic Linux wireless extensions
# Note: WEXT is deprecated in the current Linux kernel version and no new
# functionality is added to it. nl80211-based interface is the new
# replacement for WEXT and its use allows wpa_supplicant to properly control
# the driver to improve existing functionality like roaming and to support new
# functionality.
CONFIG_DRIVER_WEXT=y

# Driver interface for Linux drivers using the nl80211 kernel interface
CONFIG_DRIVER_NL80211=y

QCA vendor extensions to nl80211
#CONFIG_DRIVER_NL80211_QCA=y

driver_nl80211.c requires libnl. If you are compiling it yourself
you may need to point hostapd to your version of libnl.
#
#CFLAGS += -I$<path to libnl include files>
#LIBS += -L$<path to libnl library files>

Use libnl v2.0 (or 3.0) libraries.
#CONFIG_LIBNL20=y

Use libnl 3.2 libraries (if this is selected, CONFIG_LIBNL20 is ignored)
#CONFIG_LIBNL32=y

#
 Driver interface for FreeBSD net80211 layer (e.g., Atheros driver)
#CONFIG_DRIVER_BSD=y
#CFLAGS += -I/usr/local/include
#LIBS += -L/usr/local/lib
#LIBS_p += -L/usr/local/lib
#LIBS_c += -L/usr/local/lib

Driver interface for Windows NDIS
#CONFIG_DRIVER_NDIS=y
#CFLAGS += -I/usr/include/w32api/ddk
#LIBS += -L/usr/local/lib
For native build using mingw
#CONFIG_NATIVE_WINDOWS=y
Additional directories for cross-compilation on Linux host for mingw target
#CFLAGS += -I/opt/mingw/mingw32/include/ddk
#LIBS += -L/opt/mingw/mingw32/lib
#CC=mingw32-gcc
By default, driver_ndis uses WinPcap for low-level operations. This can be
replaced with the following option which replaces WinPcap calls with NDISUIO.
However, this requires that WZC is disabled (net stop wzcsvc) before starting

```
# wpa_supplicant.
# CONFIG_USE_NDISUIO=y

# Driver interface for wired Ethernet drivers
CONFIG_DRIVER_WIRED=y

# Driver interface for MACsec capable Qualcomm Atheros drivers
#CONFIG_DRIVER_MACSEC_QCA=y

# Driver
 interface for Linux MACsec drivers
#CONFIG_DRIVER_MACSEC_LINUX=y

# Driver interface for the Broadcom RoboSwitch family
#CONFIG_DRIVER_ROBOSWITCH=y

# Driver interface for no driver (e.g., WPS ER only)
#CONFIG_DRIVER_NONE=y

# Solaris libraries
#LIBS += -lsocket -ldlpi -lnsl
#LIBS_c += -lsocket

# Enable IEEE 802.1X Supplicant (automatically included if any EAP method or
# MACsec is included)
CONFIG_IEEE8021X_EAPOL=y

# EAP-MD5
CONFIG_EAP_MD5=y

# EAP-MSCHAPv2
CONFIG_EAP_MSCHAPV2=y

# EAP-TLS
CONFIG_EAP_TLS=y

# EAL-PEAP
CONFIG_EAP_PEAP=y

# EAP-TTLS
CONFIG_EAP_TTLS=y

# EAP-FAST
# Note: If OpenSSL is used as the TLS library, OpenSSL 1.0 or newer is needed
# for EAP-FAST support. Older OpenSSL releases would need to be patched, e.g.,
# with openssl-0.9.8x-tls-extensions.patch, to add the needed functions.
#CONFIG_EAP_FAST=y
```

```
# EAP-GTC
CONFIG_EAP_GTC=y

# EAP-OTP
CONFIG_EAP_OTP=y

# EAP-SIM (enable CONFIG_PCSC, if EAP-SIM is used)
#CONFIG_EAP_SIM=y

# EAP-PSK (experimental; this is
 _not_ needed for WPA-PSK)
#CONFIG_EAP_PSK=y

# EAP-pwd (secure authentication using only a password)
#CONFIG_EAP_PWD=y

# EAP-PAX
#CONFIG_EAP_PAX=y

# LEAP
CONFIG_EAP_LEAP=y

# EAP-AKA (enable CONFIG_PCSC, if EAP-AKA is used)
#CONFIG_EAP_AKA=y

# EAP-AKA' (enable CONFIG_PCSC, if EAP-AKA' is used).
# This requires CONFIG_EAP_AKA to be enabled, too.
#CONFIG_EAP_AKA_PRIME=y

# Enable USIM simulator (Milenage) for EAP-AKA
#CONFIG_USIM_SIMULATOR=y

# EAP-SAKE
#CONFIG_EAP_SAKE=y

# EAP-GPSK
#CONFIG_EAP_GPSK=y
# Include support for optional SHA256 cipher suite in EAP-GPSK
#CONFIG_EAP_GPSK_SHA256=y

# EAP-TNC and related Trusted Network Connect support (experimental)
#CONFIG_EAP_TNC=y

# Wi-Fi Protected Setup (WPS)
#CONFIG_WPS=y
# Enable WPS external registrar functionality
#CONFIG_WPS_ER=y
# Disable credentials for an open network by default when acting as a WPS
```

registrar.
#CONFIG_WPS_REG_DISABLE_OPEN=y
Enable WPS support with NFC config method
#CONFIG_WPS_NFC=y

EAP-IKEv2
#CONFIG_EAP_IKEV2=y

#
 EAP-EKE
#CONFIG_EAP_EKE=y

MACsec
#CONFIG_MACSEC=y

# PKCS#12 (PFX) support (used to read private key and certificate file from
# a file that usually has extension .p12 or .pfx)
CONFIG_PKCS12=y

# Smartcard support (i.e., private key on a smartcard), e.g., with openssl
# engine.
CONFIG_SMARTCARD=y

PC/SC interface for smartcards (USIM, GSM SIM)
Enable this if EAP-SIM or EAP-AKA is included
#CONFIG_PCSC=y

Support HT overrides (disable HT/HT40, mask MCS rates, etc.)
#CONFIG_HT_OVERRIDES=y

Support VHT overrides (disable VHT, mask MCS rates, etc.)
#CONFIG_VHT_OVERRIDES=y

Development testing
#CONFIG_EAPOL_TEST=y

Select control interface backend for external programs, e.g, wpa_cli:
unix = UNIX domain sockets (default for Linux/*BSD)
udp = UDP sockets using localhost (127.0.0.1)
udp6 = UDP IPv6 sockets using localhost (::1)
named_pipe = Windows Named Pipe (default for Windows)
udp-remote = UDP sockets with remote access (only for tests systems/purpose)
#
 udp6-remote = UDP IPv6 sockets with remote access (only for tests purpose)
# y = use default (backwards compatibility)
# If this option is commented out, control interface is not included in the
# build.
CONFIG_CTRL_IFACE=y

Include support for GNU Readline and History Libraries in wpa_cli.
When building a wpa_cli binary for distribution, please note that these
libraries are licensed under GPL and as such, BSD license may not apply for
the resulting binary.
#CONFIG_READLINE=y

Include internal line edit mode in wpa_cli. This can be used as a replacement
for GNU Readline to provide limited command line editing and history support.
#CONFIG_WPA_CLI_EDIT=y

Remove debugging code that is printing out debug message to stdout.
This can be used to reduce the size of the wpa_supplicant considerably
if debugging code is not needed. The size reduction can be around 35%
(e.g., 90 kB).
#CONFIG_NO_STDOUT_DEBUG=y

Remove WPA support, e.g., for wired-only IEEE 802.1X supplicant,
 to save
35-50 kB in code size.
#CONFIG_NO_WPA=y

Remove IEEE 802.11i/WPA-Personal ASCII passphrase support
This option can be used to reduce code size by removing support for
converting ASCII passphrases into PSK. If this functionality is removed, the
PSK can only be configured as the 64-octet hexstring (e.g., from
wpa_passphrase). This saves about 0.5 kB in code size.
#CONFIG_NO_WPA_PASSPHRASE=y

Disable scan result processing (ap_mode=1) to save code size by about 1 kB.
This can be used if ap_scan=1 mode is never enabled.
#CONFIG_NO_SCAN_PROCESSING=y

# Select configuration backend:
# file = text file (e.g., wpa_supplicant.conf; note: the configuration file
# path is given on command line, not here; this option is just used to
# select the backend that allows configuration files to be used)
# winreg = Windows registry (see win_example.reg for an example)
CONFIG_BACKEND=file

Remove configuration write functionality (i.e., to allow the configuration
file to be updated
 based on runtime configuration changes). The runtime
configuration can still be changed, the changes are just not going to be
persistent over restarts. This option can be used to reduce code size by
about 3.5 kB.
#CONFIG_NO_CONFIG_WRITE=y

```
# Remove support for configuration blobs to reduce code size by about 1.5 kB.
#CONFIG_NO_CONFIG_BLOBS=y

# Select program entry point implementation:
# main = UNIX/POSIX like main() function (default)
# main_winsvc = Windows service (read parameters from registry)
# main_none = Very basic example (development use only)
#CONFIG_MAIN=main

# Select wrapper for operating system and C library specific functions
# unix = UNIX/POSIX like systems (default)
# win32 = Windows systems
# none = Empty template
#CONFIG_OS=unix

# Select event loop implementation
# eloop = select() loop (default)
# eloop_win = Windows events and WaitForMultipleObject() loop
#CONFIG_ELOOP=eloop

# Should we use poll instead of select? Select is used by default.
#CONFIG_ELOOP_POLL=y

#
 Should we use epoll instead of select? Select is used by default.
#CONFIG_ELOOP_EPOLL=y

# Should we use kqueue instead of select? Select is used by default.
#CONFIG_ELOOP_KQUEUE=y

# Select layer 2 packet implementation
# linux = Linux packet socket (default)
# pcap = libpcap/libdnet/WinPcap
# freebsd = FreeBSD libpcap
# winpcap = WinPcap with receive thread
# ndis = Windows NDISUIO (note: requires CONFIG_USE_NDISUIO=y)
# none = Empty template
#CONFIG_L2_PACKET=linux

# Disable Linux packet socket workaround applicable for station interface
# in a bridge for EAPOL frames. This should be uncommented only if the kernel
# is known to not have the regression issue in packet socket behavior with
# bridge interfaces (commit 'bridge: respect RFC2863 operational state')').
#CONFIG_NO_LINUX_PACKET_SOCKET_WAR=y

# IEEE 802.11w (management frame protection), also known as PMF
# Driver support is also needed for IEEE 802.11w.
#CONFIG_IEEE80211W=y
```

Select TLS implementation
openssl
 = OpenSSL (default)
gnutls = GnuTLS
internal = Internal TLSv1 implementation (experimental)
linux = Linux kernel AF_ALG and internal TLSv1 implementation (experimental)
none = Empty template
#CONFIG_TLS=openssl

TLS-based EAP methods require at least TLS v1.0. Newer version of TLS (v1.1)
can be enabled to get a stronger construction of messages when block ciphers
are used. It should be noted that some existing TLS v1.0 -based
implementation may not be compatible with TLS v1.1 message (ClientHello is
sent prior to negotiating which version will be used)
#CONFIG_TLSV11=y

TLS-based EAP methods require at least TLS v1.0. Newer version of TLS (v1.2)
can be enabled to enable use of stronger crypto algorithms. It should be
noted that some existing TLS v1.0 -based implementation may not be compatible
with TLS v1.2 message (ClientHello is sent prior to negotiating which version
will be used)
#CONFIG_TLSV12=y

Select which ciphers to use by default with OpenSSL
 if the user does not
specify them.
#CONFIG_TLS_DEFAULT_CIPHERS="DEFAULT:!EXP:!LOW"

If CONFIG_TLS=internal is used, additional library and include paths are
needed for LibTomMath. Alternatively, an integrated, minimal version of
LibTomMath can be used. See beginning of libtommath.c for details on benefits
and drawbacks of this option.
#CONFIG_INTERNAL_LIBTOMMATH=y
#ifndef CONFIG_INTERNAL_LIBTOMMATH
#LTM_PATH=/usr/src/libtommath-0.39
#CFLAGS += -I$(LTM_PATH)
#LIBS += -L$(LTM_PATH)
#LIBS_p += -L$(LTM_PATH)
#endif
At the cost of about 4 kB of additional binary size, the internal LibTomMath
can be configured to include faster routines for exptmod, sqr, and div to
speed up DH and RSA calculation considerably
#CONFIG_INTERNAL_LIBTOMMATH_FAST=y

Include NDIS event processing through WMI into wpa_supplicant/wpasvc.
This is only for Windows builds and requires WMI-related header files and
WbemUuid.Lib from Platform SDK even when building with MinGW.

```
#CONFIG_NDIS_EVENTS_INTEGRATED=y
#PLATFORMSDKLIB="/opt/Program
 Files/Microsoft Platform SDK/Lib"


# Add support for old DBus control interface
# (fi.epitest.hostap.WPASupplicant)
#CONFIG_CTRL_IFACE_DBUS=y


# Add support for new DBus control interface
# (fi.w1.hostap.wpa_supplicant1)
#CONFIG_CTRL_IFACE_DBUS_NEW=y


# Add introspection support for new DBus control interface
#CONFIG_CTRL_IFACE_DBUS_INTRO=y


# Add support for loading EAP methods dynamically as shared libraries.
# When this option is enabled, each EAP method can be either included
# statically (CONFIG_EAP_<method>=y) or dynamically (CONFIG_EAP_<method>=dyn).
# Dynamic EAP methods are build as shared objects (eap_*.so) and they need to
# be loaded in the beginning of the wpa_supplicant configuration file
# (see load_dynamic_eap parameter in the example file) before being used in
# the network blocks.
#
# Note that some shared parts of EAP methods are included in the main program
# and in order to be able to use dynamic EAP methods using these parts,
 the
# main program must have been build with the EAP method enabled (=y or =dyn).
# This means that EAP-TLS/PEAP/TTLS/FAST cannot be added as dynamic libraries
# unless at least one of them was included in the main build to force inclusion
# of the shared code. Similarly, at least one of EAP-SIM/AKA must be included
# in the main build to be able to load these methods dynamically.
#
# Please also note that using dynamic libraries will increase the total binary
# size. Thus, it may not be the best option for targets that have limited
# amount of memory/flash.
#CONFIG_DYNAMIC_EAP_METHODS=y


# IEEE Std 802.11r-2008 (Fast BSS Transition) for station mode
#CONFIG_IEEE80211R=y


# Add support for writing debug log to a file (/tmp/wpa_supplicant-log-#.txt)
#CONFIG_DEBUG_FILE=y


# Send debug messages to syslog instead of stdout
#CONFIG_DEBUG_SYSLOG=y
# Set syslog facility for debug messages
#CONFIG_DEBUG_SYSLOG_FACILITY=LOG_DAEMON
```

Add support for sending all debug messages (regardless of debug
 verbosity)
to the Linux kernel tracing facility. This helps debug the entire stack by
making it easy to record everything happening from the driver up into the
same file, e.g., using trace-cmd.
#CONFIG_DEBUG_LINUX_TRACING=y

Add support for writing debug log to Android logcat instead of standard
output
#CONFIG_ANDROID_LOG=y

Enable privilege separation (see README 'Privilege separation' for details)
#CONFIG_PRIVSEP=y

Enable mitigation against certain attacks against TKIP by delaying Michael
MIC error reports by a random amount of time between 0 and 60 seconds
#CONFIG_DELAYED_MIC_ERROR_REPORT=y

Enable tracing code for developer debugging
This tracks use of memory allocations and other registrations and reports
incorrect use with a backtrace of call (or allocation) location.
#CONFIG_WPA_TRACE=y
For BSD, uncomment these.
#LIBS += -lexecinfo
#LIBS_p += -lexecinfo
#LIBS_c += -lexecinfo

Use libbfd to get more details for developer debugging
This enables use
 of libbfd to get more detailed symbols for the backtraces
generated by CONFIG_WPA_TRACE=y.
#CONFIG_WPA_TRACE_BFD=y
For BSD, uncomment these.
#LIBS += -lbfd -liberty -lz
#LIBS_p += -lbfd -liberty -lz
#LIBS_c += -lbfd -liberty -lz

wpa_supplicant depends on strong random number generation being available
from the operating system. os_get_random() function is used to fetch random
data when needed, e.g., for key generation. On Linux and BSD systems, this
works by reading /dev/urandom. It should be noted that the OS entropy pool
needs to be properly initialized before wpa_supplicant is started. This is
important especially on embedded devices that do not have a hardware random
number generator and may by default start up with minimal entropy available
for random number generation.
#
As a safety net, wpa_supplicant is by default trying to internally collect
additional entropy for generating random data to mix in with the data fetched

from the OS. This by itself is
 not considered to be very strong, but it may
help in cases where the system pool is not initialized properly. However, it
is very strongly recommended that the system pool is initialized with enough
entropy either by using hardware assisted random number generator or by
storing state over device reboots.
#
wpa_supplicant can be configured to maintain its own entropy store over
restarts to enhance random number generation. This is not perfect, but it is
much more secure than using the same sequence of random numbers after every
reboot. This can be enabled with -e<entropy file> command line option. The
specified file needs to be readable and writable by wpa_supplicant.
#
If the os_get_random() is known to provide strong random data (e.g., on
Linux/BSD, the board in question is known to have reliable source of random
data from /dev/urandom), the internal wpa_supplicant random pool can be
disabled. This will save some in binary size and CPU use. However, this
should
 only be considered for builds that are known to be used on devices
that meet the requirements described above.
#CONFIG_NO_RANDOM_POOL=y

IEEE 802.11n (High Throughput) support (mainly for AP mode)
#CONFIG_IEEE80211N=y

IEEE 802.11ac (Very High Throughput) support (mainly for AP mode)
(depends on CONFIG_IEEE80211N)
#CONFIG_IEEE80211AC=y

Wireless Network Management (IEEE Std 802.11v-2011)
Note: This is experimental and not complete implementation.
#CONFIG_WNM=y

Interworking (IEEE 802.11u)
This can be used to enable functionality to improve interworking with
external networks (GAS/ANQP to learn more about the networks and network
selection based on available credentials).
#CONFIG_INTERWORKING=y

Hotspot 2.0
#CONFIG_HS20=y

Enable interface matching in wpa_supplicant
#CONFIG_MATCH_IFACE=y

Disable roaming in wpa_supplicant
#CONFIG_NO_ROAMING=y

AP mode operations with wpa_supplicant
This can be used for controlling AP mode operations with wpa_supplicant.
 It
should be noted that this is mainly aimed at simple cases like
WPA2-Personal while more complex configurations like WPA2-Enterprise with an
external RADIUS server can be supported with hostapd.
#CONFIG_AP=y

P2P (Wi-Fi Direct)
This can be used to enable P2P support in wpa_supplicant. See README-P2P for
more information on P2P operations.
#CONFIG_P2P=y

Enable TDLS support
#CONFIG_TDLS=y

Wi-Fi Direct
This can be used to enable Wi-Fi Direct extensions for P2P using an external
program to control the additional information exchanges in the messages.
#CONFIG_WIFI_DISPLAY=y

Autoscan
This can be used to enable automatic scan support in wpa_supplicant.
See wpa_supplicant.conf for more information on autoscan usage.
#
Enabling directly a module will enable autoscan support.
For exponential module:
#CONFIG_AUTOSCAN_EXPONENTIAL=y
For periodic module:
#CONFIG_AUTOSCAN_PERIODIC=y

Password (and passphrase, etc.) backend for external storage
These optional
 mechanisms can be used to add support for storing passwords
and other secrets in external (to wpa_supplicant) location. This allows, for
example, operating system specific key storage to be used
#
External password backend for testing purposes (developer use)
#CONFIG_EXT_PASSWORD_TEST=y

Enable Fast Session Transfer (FST)
#CONFIG_FST=y

Enable CLI commands for FST testing
#CONFIG_FST_TEST=y

OS X builds. This is only for building eapol_test.
#CONFIG_OSX=y

Automatic Channel Selection
This will allow wpa_supplicant to pick the channel automatically when channel
is set to "0".
#
TODO: Extend parser to be able to parse "channel=acs_survey" as an alternative
to "channel=0". This would enable us to eventually add other ACS algorithms in
similar way.
#
Automatic selection is currently only done through initialization, later on
we hope to do background checks to keep us moving to more ideal channels as
time goes by. ACS is currently only supported through the nl80211
 driver and
your driver must have survey dump capability that is filled by the driver
during scanning.
#
TODO: In analogy to hostapd be able to customize the ACS survey algorithm with
a newly to create wpa_supplicant.conf variable acs_num_scans.
#
Supported ACS drivers:
* ath9k
* ath5k
* ath10k
#
For more details refer to:
http://wireless.kernel.org/en/users/Documentation/acs
#CONFIG_ACS=y

Support Multi Band Operation
#CONFIG_MBO=y

Fast Initial Link Setup (FILS) (IEEE 802.11ai)
Note: This is an experimental and not yet complete implementation. This
should not be enabled for production use.
#CONFIG_FILS=y
FILS shared key authentication with PFS
#CONFIG_FILS_SK_PFS=y

Support RSN on IBSS networks
This is needed to be able to use mode=1 network profile with proto=RSN and
key_mgmt=WPA-PSK (i.e., full key management instead of WPA-None).
#CONFIG_IBSS_RSN=y

External PMKSA cache control
This can be used to enable control interface commands that
 allow the current
PMKSA cache entries to be fetched and new entries to be added.
#CONFIG_PMKSA_CACHE_EXTERNAL=y

Mesh Networking (IEEE 802.11s)
#CONFIG_MESH=y

Background scanning modules
These can be used to request wpa_supplicant to perform background scanning
operations for roaming within an ESS (same SSID). See the bgscan parameter in
the wpa_supplicant.conf file for more details.
Periodic background scans based on signal strength
#CONFIG_BGSCAN_SIMPLE=y
Learn channels used by the network and try to avoid bgscans on other
channels (experimental)
#CONFIG_BGSCAN_LEARN=y

Opportunistic Wireless Encryption (OWE)
Experimental implementation of draft-harkins-owe-07.txt
#CONFIG_OWE=y

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/defconfig
No license file was found, but licenses were detected in source scan.

/*
* wpa_supplicant - D-Bus introspection
* Copyright (c) 2006, Dan Williams <dcbw@redhat.com> and Red Hat, Inc.
* Copyright (c) 2009, Witold Sowa <witold.sowa@gmail.com>
* Copyright (c) 2010, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/dbus/dbus_new_introspect.c
No license file was found, but licenses were detected in source scan.

/*
* WPA Supplicant / dbus-based control interface
* Copyright (c) 2006, Dan Williams <dcbw@redhat.com> and Red Hat, Inc.
* Copyright (c) 2009-2010, Witold Sowa <witold.sowa@gmail.com>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-

gz/wpa_supplicant/dbus/dbus_new_handlers.h

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/dbus/dbus_new.h

No license file was found, but licenses were detected in source scan.

```
/*
 * wpa_supplicant module tests
 * Copyright (c) 2014, Jouni Malinen <j@w1.fi>
 *
 * This software may be distributed under the terms of the BSD license.
 * See README for more details.
 */
```

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpas_module_tests.c

No license file was found, but licenses were detected in source scan.

```
/*
 * WPA Supplicant / dbus-based control interface (P2P)
 * Copyright (c) 2011-2012, Intel Corporation
 *
 * This software may be distributed under the terms of the BSD license.
 * See README for more details.
 */
```

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/dbus/dbus_new_handlers_p2p.c

No license file was found, but licenses were detected in source scan.

```
/*
 * EAP method registration
 * Copyright (c) 2004-2009, Jouni Malinen <j@w1.fi>
 *
 * This software may be distributed under the terms of the BSD license.
 * See README for more details.
 */
```

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/eap_register.c

No license file was found, but licenses were detected in source scan.

```
/*
 * wpa_supplicant - P2P service discovery
 * Copyright (c) 2009-2010, Atheros Communications
 * Copyright (c) 2010-2014, Jouni Malinen <j@w1.fi>
 *
 * This software may be distributed under the terms of the BSD license.
```

* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-

gz/wpa_supplicant/p2p_supplicant_sd.c

No license file was found, but licenses were detected in source scan.

/*

* WPA Supplicant - background scan and roaming module: simple

* Copyright (c) 2009-2010, Jouni Malinen <j@w1.fi>

*

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* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/bgscan_simple.c

No license file was found, but licenses were detected in source scan.

/*

* wpa_gui - WpaMsg class for storing event messages

* Copyright (c) 2005-2006, Jouni Malinen <j@w1.fi>

*

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* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-

qt4/wpamsg.h

No license file was found, but licenses were detected in source scan.

/*

* wpa_supplicant D-Bus control interface - internal definitions

* Copyright (c) 2006, Dan Williams <dcbw@redhat.com> and Red Hat, Inc.

* Copyright (c) 2009, Witold Sowa <witold.sowa@gmail.com>

* Copyright (c) 2009, Jouni Malinen <j@w1.fi>

*

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*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-

gz/wpa_supplicant/dbus/dbus_common_i.h

No license file was found, but licenses were detected in source scan.

/*
* wpa_gui - NetworkConfig class
* Copyright (c) 2005-2006, Jouni Malinen <j@w1.fi>
*
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* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-
qt4/networkconfig.h
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-
qt4/networkconfig.cpp
No license file was found, but licenses were detected in source scan.

/*
* wpa_supplicant - WNM
* Copyright (c) 2011-2013, Qualcomm Atheros, Inc.
*
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* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wnm_sta.c
No license file was found, but licenses were detected in source scan.

/*
* win_if_list - Display network interfaces with description (for Windows)
* Copyright (c) 2004-2006, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*
* This small tool is for the Windows build to provide an easy way of fetching
* a list of available network interfaces.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/win_if_list.c
No license file was found, but licenses were detected in source scan.

/*
* wpa_gui - AddInterface class
* Copyright (c) 2008, Jouni Malinen <j@w1.fi>
*
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* See README for more details.

*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-qt4/addinterface.h
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-qt4/addinterface.cpp
No license file was found, but licenses were detected in source scan.

/*
* WPA Supplicant - Driver event processing
* Copyright (c) 2003-2017, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/events.c
No license file was found, but licenses were detected in source scan.

/*
* wpa_supplicant - Off-channel Action frame TX/RX
* Copyright (c) 2009-2010, Atheros Communications
* Copyright (c) 2011, Qualcomm Atheros
*
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* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/offchannel.c
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/offchannel.h
No license file was found, but licenses were detected in source scan.

/*
* wpa_supplicant - DPP
* Copyright (c) 2017, Qualcomm Atheros, Inc.
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/dpp_supplicant.h
No license file was found, but licenses were detected in source scan.

/*

* wpa_gui - UserDataRequest class
* Copyright (c) 2005-2006, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-qt4/userdatarequest.cpp
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-qt4/userdatarequest.h
No license file was found, but licenses were detected in source scan.

WPA Supplicant
==============

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Features

Supported WPA/IEEE 802.11i features:
-
 WPA-PSK ("WPA-Personal")
- WPA with EAP (e.g., with RADIUS authentication server) ("WPA-Enterprise")
 Following authentication methods are supported with an integrate IEEE 802.1X
 Supplicant:
 * EAP-TLS
 * EAP-PEAP/MSCHAPv2 (both PEAPv0 and PEAPv1)
 * EAP-PEAP/TLS (both PEAPv0 and PEAPv1)
 * EAP-PEAP/GTC (both PEAPv0 and PEAPv1)
 * EAP-PEAP/OTP (both PEAPv0 and PEAPv1)
 * EAP-PEAP/MD5-Challenge (both PEAPv0 and PEAPv1)
 * EAP-TTLS/EAP-MD5-Challenge
 * EAP-TTLS/EAP-GTC
 * EAP-TTLS/EAP-OTP
 * EAP-TTLS/EAP-MSCHAPv2
 * EAP-TTLS/EAP-TLS
 * EAP-TTLS/MSCHAPv2
 * EAP-TTLS/MSCHAP
 * EAP-TTLS/PAP
 * EAP-TTLS/CHAP
 * EAP-SIM
 * EAP-AKA
 * EAP-AKA'
 * EAP-PSK
 * EAP-PAX
 * EAP-SAKE
 * EAP-IKEv2
 * EAP-GPSK

* EAP-pwd
    * LEAP (note: requires special support from the driver for IEEE 802.11
      authentication)
   (following methods are supported, but since they do not generate keying
    material, they cannot be used with WPA or IEEE 802.1X WEP keying)
    * EAP-MD5-Challenge
     * EAP-MSCHAPv2
    * EAP-GTC
    * EAP-OTP
   - key management for CCMP, TKIP, WEP104, WEP40
   - RSN/WPA2 (IEEE 802.11i)
    * pre-authentication
    * PMKSA caching

   Supported TLS/crypto libraries:
   - OpenSSL (default)
   - GnuTLS

   Internal TLS/crypto implementation (optional):
   - can be used in place of an external TLS/crypto library
   - TLSv1
   - X.509 certificate processing
   - PKCS #1
   - ASN.1
   - RSA
   - bignum
   - minimal size (ca. 50 kB binary, parts of which are already needed for WPA;
    TLSv1/X.509/ASN.1/RSA/bignum parts are about 25 kB on x86)

   Requirements

   Current hardware/software requirements:
   - Linux kernel 2.4.x or 2.6.x with Linux Wireless Extensions v15 or newer
   - FreeBSD 6-CURRENT
   - NetBSD-current
   - Microsoft Windows with WinPcap (at least WinXP, may work with other versions)
   - drivers:
    Linux drivers that support cfg80211/nl80211. Even though there are
    number of driver specific interface included in wpa_supplicant, please
    note that Linux drivers are moving to use generic
    wireless configuration
    interface driver_nl80211 (-Dnl80211 on wpa_supplicant command line)
    should be the default option to start with before falling back to driver
    specific interface.

    Linux drivers that support WPA/WPA2 configuration with the generic

Linux wireless extensions (WE-18 or newer). Obsoleted by nl80211.

In theory, any driver that supports Linux wireless extensions can be used with IEEE 802.1X (i.e., not WPA) when using ap_scan=0 option in configuration file.

Wired Ethernet drivers (with ap_scan=0)

BSD net80211 layer (e.g., Atheros driver)
At the moment, this is for FreeBSD 6-CURRENT branch and NetBSD-current.

Windows NDIS
The current Windows port requires WinPcap (http://winpcap.polito.it/).
See README-Windows.txt for more information.

wpa_supplicant was designed to be portable for different drivers and operating systems. Hopefully, support for more wlan cards and OSes will be added in the future. See developer's documentation (http://hostap.epitest.fi/wpa_supplicant/devel/)
 for more information about the design of wpa_supplicant and porting to other drivers. One main goal is to add full WPA/WPA2 support to Linux wireless extensions to allow new drivers to be supported without having to implement new driver-specific interface code in wpa_supplicant.

Optional libraries for layer2 packet processing:
- libpcap (tested with 0.7.2, most relatively recent versions assumed to work,
 this is likely to be available with most distributions,
 http://tcpdump.org/)
- libdnet (tested with v1.4, most versions assumed to work,
 http://libdnet.sourceforge.net/)

These libraries are _not_ used in the default Linux build. Instead, internal Linux specific implementation is used. libpcap/libdnet are more portable and they can be used by adding CONFIG_L2_PACKET=pcap into .config. They may also be selected automatically for other operating systems. In case of Windows builds, WinPcap is used by default (CONFIG_L2_PACKET=winpcap).

Optional libraries for EAP-TLS,
 EAP-PEAP, and EAP-TTLS:
- OpenSSL (tested with 1.0.1 and 1.0.2 versions; assumed to
 work with most relatively recent versions; this is likely to be
 available with most distributions, http://www.openssl.org/)
- GnuTLS
- internal TLSv1 implementation

One of these libraries is needed when EAP-TLS, EAP-PEAP, EAP-TTLS, or
EAP-FAST support is enabled. WPA-PSK mode does not require this or EAPOL/EAP
implementation. A configuration file, .config, for compilation is
needed to enable IEEE 802.1X/EAPOL and EAP methods. Note that EAP-MD5,
EAP-GTC, EAP-OTP, and EAP-MSCHAPV2 cannot be used alone with WPA, so
they should only be enabled if testing the EAPOL/EAP state
machines. However, there can be used as inner authentication
algorithms with EAP-PEAP and EAP-TTLS.

See Building and installing section below for more detailed
information about the wpa_supplicant build time configuration.

WPA

The original security mechanism of IEEE 802.11 standard was not
designed to be strong and
 has proven to be insufficient for most
networks that require some kind of security. Task group I (Security)
of IEEE 802.11 working group (http://www.ieee802.org/11/) has worked
to address the flaws of the base standard and has in practice
completed its work in May 2004. The IEEE 802.11i amendment to the IEEE
802.11 standard was approved in June 2004 and published in July 2004.

Wi-Fi Alliance (http://www.wi-fi.org/) used a draft version of the
IEEE 802.11i work (draft 3.0) to define a subset of the security
enhancements that can be implemented with existing wlan hardware. This
is called Wi-Fi Protected Access<TM> (WPA). This has now become a
mandatory component of interoperability testing and certification done
by Wi-Fi Alliance. Wi-Fi provides information about WPA at its web
site (http://www.wi-fi.org/OpenSection/protected_access.asp).

IEEE 802.11 standard defined wired equivalent privacy (WEP) algorithm
for protecting wireless networks. WEP uses RC4 with 40-bit keys,
24-bit initialization
 vector (IV), and CRC32 to protect against packet
forgery. All these choices have proven to be insufficient: key space is
too small against current attacks, RC4 key scheduling is insufficient
(beginning of the pseudorandom stream should be skipped), IV space is
too small and IV reuse makes attacks easier, there is no replay
protection, and non-keyed authentication does not protect against bit
flipping packet data.

WPA is an intermediate solution for the security issues. It uses
Temporal Key Integrity Protocol (TKIP) to replace WEP. TKIP is a
compromise on strong security and possibility to use existing

hardware. It still uses RC4 for the encryption like WEP, but with
per-packet RC4 keys. In addition, it implements replay protection,
keyed packet authentication mechanism (Michael MIC).

Keys can be managed using two different mechanisms. WPA can either use
an external authentication server (e.g., RADIUS) and EAP just like
IEEE 802.1X is using or pre-shared keys without need for
 additional
servers. Wi-Fi calls these "WPA-Enterprise" and "WPA-Personal",
respectively. Both mechanisms will generate a master session key for
the Authenticator (AP) and Supplicant (client station).

WPA implements a new key handshake (4-Way Handshake and Group Key
Handshake) for generating and exchanging data encryption keys between
the Authenticator and Supplicant. This handshake is also used to
verify that both Authenticator and Supplicant know the master session
key. These handshakes are identical regardless of the selected key
management mechanism (only the method for generating master session
key changes).

IEEE 802.11i / WPA2

The design for parts of IEEE 802.11i that were not included in WPA has
finished (May 2004) and this amendment to IEEE 802.11 was approved in
June 2004. Wi-Fi Alliance is using the final IEEE 802.11i as a new
version of WPA called WPA2. This includes, e.g., support for more
robust encryption algorithm (CCMP: AES in Counter mode with CBC-MAC)
to
 replace TKIP and optimizations for handoff (reduced number of
messages in initial key handshake, pre-authentication, and PMKSA caching).

wpa_supplicant
----

wpa_supplicant is an implementation of the WPA Supplicant component,
i.e., the part that runs in the client stations. It implements WPA key
negotiation with a WPA Authenticator and EAP authentication with
Authentication Server. In addition, it controls the roaming and IEEE
802.11 authentication/association of the wlan driver.

wpa_supplicant is designed to be a "daemon" program that runs in the
background and acts as the backend component controlling the wireless
connection. wpa_supplicant supports separate frontend programs and an

example text-based frontend, wpa_cli, is included with wpa_supplicant.

Following steps are used when associating with an AP using WPA:

- wpa_supplicant requests the kernel driver to scan neighboring BSSes
- wpa_supplicant selects a BSS based on its configuration
- wpa_supplicant
 requests the kernel driver to associate with the chosen
 BSS
- If WPA-EAP: integrated IEEE 802.1X Supplicant completes EAP
 authentication with the authentication server (proxied by the
 Authenticator in the AP)
- If WPA-EAP: master key is received from the IEEE 802.1X Supplicant
- If WPA-PSK: wpa_supplicant uses PSK as the master session key
- wpa_supplicant completes WPA 4-Way Handshake and Group Key Handshake
 with the Authenticator (AP)
- wpa_supplicant configures encryption keys for unicast and broadcast
- normal data packets can be transmitted and received

Building and installing

In order to be able to build wpa_supplicant, you will first need to
select which parts of it will be included. This is done by creating a
build time configuration file, .config, in the wpa_supplicant root
directory. Configuration options are text lines using following
format: CONFIG_<option>=y. Lines starting with # are considered
comments and are ignored. See defconfig
 file for an example configuration
and a list of available options and additional notes.

The build time configuration can be used to select only the needed
features and limit the binary size and requirements for external
libraries. The main configuration parts are the selection of which
driver interfaces (e.g., nl80211, wext, ..) and which authentication
methods (e.g., EAP-TLS, EAP-PEAP, ..) are included.

Following build time configuration options are used to control IEEE
802.1X/EAPOL and EAP state machines and all EAP methods. Including
TLS, PEAP, or TTLS will require linking wpa_supplicant with OpenSSL
library for TLS implementation. Alternatively, GnuTLS or the internal
TLSv1 implementation can be used for TLS functionality.

CONFIG_IEEE8021X_EAPOL=y
CONFIG_EAP_MD5=y
CONFIG_EAP_MSCHAPV2=y

CONFIG_EAP_TLS=y
CONFIG_EAP_PEAP=y
CONFIG_EAP_TTLS=y
CONFIG_EAP_GTC=y
CONFIG_EAP_OTP=y
CONFIG_EAP_SIM=y
CONFIG_EAP_AKA=y
CONFIG_EAP_AKA_PRIME=y
CONFIG_EAP_PSK=y
CONFIG_EAP_SAKE=y
CONFIG_EAP_GPSK=y
CONFIG_EAP_PAX=y
CONFIG_EAP_LEAP=y
CONFIG_EAP_IKEV2=y
CONFIG_EAP_PWD=y

Following
 option can be used to include GSM SIM/USIM interface for GSM/UMTS
authentication algorithm (for EAP-SIM/EAP-AKA/EAP-AKA'). This requires pcsc-lite
(http://www.linuxnet.com/) for smart card access.

CONFIG_PCSC=y

Following options can be added to .config to select which driver
interfaces are included.

CONFIG_DRIVER_NL80211=y
CONFIG_DRIVER_WEXT=y
CONFIG_DRIVER_BSD=y
CONFIG_DRIVER_NDIS=y

Following example includes some more features and driver interfaces that
are included in the wpa_supplicant package:

CONFIG_DRIVER_NL80211=y
CONFIG_DRIVER_WEXT=y
CONFIG_DRIVER_BSD=y
CONFIG_DRIVER_NDIS=y
CONFIG_IEEE8021X_EAPOL=y
CONFIG_EAP_MD5=y
CONFIG_EAP_MSCHAPV2=y
CONFIG_EAP_TLS=y
CONFIG_EAP_PEAP=y
CONFIG_EAP_TTLS=y
CONFIG_EAP_GTC=y
CONFIG_EAP_OTP=y
CONFIG_EAP_SIM=y
CONFIG_EAP_AKA=y

CONFIG_EAP_PSK=y
CONFIG_EAP_SAKE=y
CONFIG_EAP_GPSK=y
CONFIG_EAP_PAX=y
CONFIG_EAP_LEAP=y
CONFIG_EAP_IKEV2=y
CONFIG_PCSC=y

EAP-PEAP and EAP-TTLS
 will automatically include configured EAP
methods (MD5, OTP, GTC, MSCHAPV2) for inner authentication selection.

After you have created a configuration file, you can build
wpa_supplicant and wpa_cli with 'make' command. You may then install
the binaries to a suitable system directory, e.g., /usr/local/bin.

Example commands:

build wpa_supplicant and wpa_cli
make
install binaries (this may need root privileges)
cp wpa_cli wpa_supplicant /usr/local/bin

You will need to make a configuration file, e.g.,
/etc/wpa_supplicant.conf, with network configuration for the networks
you are going to use. Configuration file section below includes
explanation fo the configuration file format and includes various
examples. Once the configuration is ready, you can test whether the
configuration work by first running wpa_supplicant with following
command to start it on foreground with debugging enabled:

wpa_supplicant -iwlan0 -c/etc/wpa_supplicant.conf -d

Assuming everything goes fine, you
 can start using following command
to start wpa_supplicant on background without debugging:

wpa_supplicant -iwlan0 -c/etc/wpa_supplicant.conf -B

Please note that if you included more than one driver interface in the
build time configuration (.config), you may need to specify which
interface to use by including -D<driver name> option on the command
line. See following section for more details on command line options
for wpa_supplicant.

Command line options
----

usage:
 wpa_supplicant [-BddfhKLqqtuvW] [-P<pid file>] [-g<global ctrl>] \
    [-G<group>] \
    -i<ifname> -c<config file> [-C<ctrl>] [-D<driver>] [-p<driver_param>] \
    [-b<br_ifname> [-MN -i<ifname> -c<conf> [-C<ctrl>] [-D<driver>] \
    [-p<driver_param>] [-b<br_ifname>] [-m<P2P Device config file>] ...

options:
 -b = optional bridge interface name
 -B = run daemon in the background
 -c = Configuration file
 -C = ctrl_interface parameter (only used if -c is not)
 -i = interface
 name
 -d = increase debugging verbosity (-dd even more)
 -D = driver name (can be multiple drivers: nl80211,wext)
 -f = Log output to default log location (normally /tmp)
 -g = global ctrl_interface
 -G = global ctrl_interface group
 -K = include keys (passwords, etc.) in debug output
 -t = include timestamp in debug messages
 -h = show this help text
 -L = show license (BSD)
 -p = driver parameters
 -P = PID file
 -q = decrease debugging verbosity (-qq even less)
 -u = enable DBus control interface
 -v = show version
 -W = wait for a control interface monitor before starting
 -M = start describing matching interface
 -N = start describing new interface
 -m = Configuration file for the P2P Device

drivers:
 nl80211 = Linux nl80211/cfg80211
 wext = Linux wireless extensions (generic)
 wired = wpa_supplicant wired Ethernet driver
 roboswitch = wpa_supplicant Broadcom switch driver
 bsd = BSD 802.11 support (Atheros, etc.)
 ndis = Windows NDIS driver

In most common
 cases, wpa_supplicant is started with

wpa_supplicant -B -c/etc/wpa_supplicant.conf -iwlan0

This makes the process fork into background.

The easiest way to debug problems, and to get debug log for bug
reports, is to start wpa_supplicant on foreground with debugging
enabled:

wpa_supplicant -c/etc/wpa_supplicant.conf -iwlan0 -d

If the specific driver wrapper is not known beforehand, it is possible
to specify multiple comma separated driver wrappers on the command
line. wpa_supplicant will use the first driver wrapper that is able to
initialize the interface.

wpa_supplicant -Dnl80211,wext -c/etc/wpa_supplicant.conf -iwlan0

wpa_supplicant can control multiple interfaces (radios) either by
running one process for each interface separately or by running just
one process and list of options at command line. Each interface is
separated with -N argument. As an example, following command would
start wpa_supplicant for two interfaces:

wpa_supplicant \
 -c wpa1.conf -i wlan0 -D nl80211 -N
 \
 -c wpa2.conf -i wlan1 -D wext

If the interfaces on which wpa_supplicant is to run are not known or do
not exist, wpa_supplicant can match an interface when it arrives. Each
matched interface is separated with -M argument and the -i argument now
allows for pattern matching.

As an example, the following command would start wpa_supplicant for a
specific wired interface called lan0, any interface starting with wlan
and lastly any other interface. Each match has its own configuration
file, and for the wired interface a specific driver has also been given.

wpa_supplicant \
 -M -c wpa_wired.conf -ilan0 -D wired \
 -M -c wpa1.conf -iwlan* \
 -M -c wpa2.conf

If the interface is added in a Linux bridge (e.g., br0), the bridge
interface needs to be configured to wpa_supplicant in addition to the

main interface:

wpa_supplicant -cw.conf -Dnl80211 -iwlan0 -bbr0

Configuration file
----

wpa_supplicant is configured using a text file that lists all accepted
networks and security
 policies, including pre-shared keys. See
example configuration file, wpa_supplicant.conf, for detailed
information about the configuration format and supported fields.

Changes to configuration file can be reloaded be sending SIGHUP signal
to wpa_supplicant ('killall -HUP wpa_supplicant'). Similarly,
reloading can be triggered with 'wpa_cli reconfigure' command.

Configuration file can include one or more network blocks, e.g., one
for each used SSID. wpa_supplicant will automatically select the best
network based on the order of network blocks in the configuration
file, network security level (WPA/WPA2 is preferred), and signal
strength.

Example configuration files for some common configurations:

1) WPA-Personal (PSK) as home network and WPA-Enterprise with EAP-TLS as work
 network

# allow frontend (e.g., wpa_cli) to be used by all users in 'wheel' group
ctrl_interface=/var/run/wpa_supplicant
ctrl_interface_group=wheel
#
# home network; allow all valid ciphers
network={
 ssid="home"
 scan_ssid=1
 key_mgmt=WPA-PSK
 psk="very
 secret passphrase"
}
#
# work network; use EAP-TLS with WPA; allow only CCMP and TKIP ciphers
network={
 ssid="work"
 scan_ssid=1
 key_mgmt=WPA-EAP
 pairwise=CCMP TKIP

```
 group=CCMP TKIP
 eap=TLS
 identity="user@example.com"
 ca_cert="/etc/cert/ca.pem"
 client_cert="/etc/cert/user.pem"
 private_key="/etc/cert/user.prv"
 private_key_passwd="password"
}
```

2) WPA-RADIUS/EAP-PEAP/MSCHAPv2 with RADIUS servers that use old peaplabel
 (e.g., Funk Odyssey and SBR, Meetinghouse Aegis, Interlink RAD-Series)

```
ctrl_interface=/var/run/wpa_supplicant
ctrl_interface_group=wheel
network={
 ssid="example"
 scan_ssid=1
 key_mgmt=WPA-EAP
 eap=PEAP
 identity="user@example.com"
 password="foobar"
 ca_cert="/etc/cert/ca.pem"
 phase1="peaplabel=0"
 phase2="auth=MSCHAPV2"
}
```

3) EAP-TTLS/EAP-MD5-Challenge configuration with anonymous identity for the
 unencrypted use. Real identity is sent only within an encrypted TLS tunnel.

```
ctrl_interface=/var/run/wpa_supplicant
ctrl_interface_group=wheel
network={
 ssid="example"
 scan_ssid=1
 key_mgmt=WPA-EAP
 eap=TTLS
 identity="user@example.com"
 anonymous_identity="anonymous@example.com"
 password="foobar"
 ca_cert="/etc/cert/ca.pem"
 phase2="auth=MD5"
}
```

4)

IEEE 802.1X (i.e., no WPA) with dynamic WEP keys (require both unicast and
broadcast); use EAP-TLS for authentication

```
ctrl_interface=/var/run/wpa_supplicant
ctrl_interface_group=wheel
network={
 ssid="1x-test"
 scan_ssid=1
 key_mgmt=IEEE8021X
 eap=TLS
 identity="user@example.com"
 ca_cert="/etc/cert/ca.pem"
 client_cert="/etc/cert/user.pem"
 private_key="/etc/cert/user.prv"
 private_key_passwd="password"
 eapol_flags=3
}
```

5) Catch all example that allows more or less all configuration modes. The
configuration options are used based on what security policy is used in the
selected SSID. This is mostly for testing and is not recommended for normal
use.

```
ctrl_interface=/var/run/wpa_supplicant
ctrl_interface_group=wheel
network={
 ssid="example"
 scan_ssid=1
 key_mgmt=WPA-EAP
 WPA-PSK IEEE8021X NONE
 pairwise=CCMP TKIP
 group=CCMP TKIP WEP104 WEP40
 psk="very secret passphrase"
 eap=TTLS PEAP TLS
 identity="user@example.com"
 password="foobar"
 ca_cert="/etc/cert/ca.pem"
 client_cert="/etc/cert/user.pem"
 private_key="/etc/cert/user.prv"
 private_key_passwd="password"
 phase1="peaplabel=0"
 ca_cert2="/etc/cert/ca2.pem"
 client_cert2="/etc/cer/user.pem"
 private_key2="/etc/cer/user.prv"
 private_key2_passwd="password"
}
```

6) Authentication for wired Ethernet. This can be used with 'wired' or
  'roboswitch' interface (-Dwired or -Droboswitch on command line).

```
ctrl_interface=/var/run/wpa_supplicant
ctrl_interface_group=wheel
ap_scan=0
network={
 key_mgmt=IEEE8021X
 eap=MD5
 identity="user"
 password="password"
 eapol_flags=0
}
```

Certificates

Some EAP authentication methods require use of certificates. EAP-TLS
uses both server side and client certificates whereas EAP-PEAP and
EAP-TTLS only require the
 server side certificate. When client
certificate is used, a matching private key file has to also be
included in configuration. If the private key uses a passphrase, this
has to be configured in wpa_supplicant.conf ("private_key_passwd").

wpa_supplicant supports X.509 certificates in PEM and DER
formats. User certificate and private key can be included in the same
file.

If the user certificate and private key is received in PKCS#12/PFX
format, they need to be converted to suitable PEM/DER format for
wpa_supplicant. This can be done, e.g., with following commands:

```
# convert client certificate and private key to PEM format
openssl pkcs12 -in example.pfx -out user.pem -clcerts
# convert CA certificate (if included in PFX file) to PEM format
openssl pkcs12 -in example.pfx -out ca.pem -cacerts -nokeys
```

wpa_cli
----

wpa_cli is a text-based frontend program for interacting with
wpa_supplicant. It is used to query current status, change

configuration, trigger events, and request interactive
 user input.

wpa_cli can show the current authentication status, selected security
mode, dot11 and dot1x MIBs, etc. In addition, it can configure some
variables like EAPOL state machine parameters and trigger events like
reassociation and IEEE 802.1X logoff/logon. wpa_cli provides a user
interface to request authentication information, like username and
password, if these are not included in the configuration. This can be
used to implement, e.g., one-time-passwords or generic token card
authentication where the authentication is based on a
challenge-response that uses an external device for generating the
response.

The control interface of wpa_supplicant can be configured to allow
non-root user access (ctrl_interface_group in the configuration
file). This makes it possible to run wpa_cli with a normal user
account.

wpa_cli supports two modes: interactive and command line. Both modes
share the same command set and the main difference is in interactive
mode providing access to
 unsolicited messages (event messages,
username/password requests).

Interactive mode is started when wpa_cli is executed without including
the command as a command line parameter. Commands are then entered on
the wpa_cli prompt. In command line mode, the same commands are
entered as command line arguments for wpa_cli.

Interactive authentication parameters request

When wpa_supplicant need authentication parameters, like username and
password, which are not present in the configuration file, it sends a
request message to all attached frontend programs, e.g., wpa_cli in
interactive mode. wpa_cli shows these requests with
"CTRL-REQ-<type>-<id>:<text>" prefix. <type> is IDENTITY, PASSWORD, or
OTP (one-time-password). <id> is a unique identifier for the current
network. <text> is description of the request. In case of OTP request,
it includes the challenge from the authentication server.

The reply to these requests can be given with 'identity', 'password',
and 'otp' commands. <id> needs
 to be copied from the the matching
request. 'password' and 'otp' commands can be used regardless of
whether the request was for PASSWORD or OTP. The main difference
between these two commands is that values given with 'password' are

remembered as long as wpa_supplicant is running whereas values given with 'otp' are used only once and then forgotten, i.e., wpa_supplicant will ask frontend for a new value for every use. This can be used to implement one-time-password lists and generic token card -based authentication.

Example request for password and a matching reply:

CTRL-REQ-PASSWORD-1:Password needed for SSID foobar
> password 1 mysecretpassword

Example request for generic token card challenge-response:

CTRL-REQ-OTP-2:Challenge 1235663 needed for SSID foobar
> otp 2 9876

wpa_cli commands

 status = get current WPA/EAPOL/EAP status
 mib = get MIB variables (dot1x, dot11)
 help = show this usage help
 interface [ifname] = show interfaces/select interface
 level <debug level>
 = change debug level
 license = show full wpa_cli license
 logoff = IEEE 802.1X EAPOL state machine logoff
 logon = IEEE 802.1X EAPOL state machine logon
 set = set variables (shows list of variables when run without arguments)
 pmksa = show PMKSA cache
 reassociate = force reassociation
 reconfigure = force wpa_supplicant to re-read its configuration file
 preauthenticate <BSSID> = force preauthentication
 identity <network id> <identity> = configure identity for an SSID
 password <network id> <password> = configure password for an SSID
 pin <network id> <pin> = configure pin for an SSID
 otp <network id> <password> = configure one-time-password for an SSID
 passphrase <network id> <passphrase> = configure private key passphrase
   for an SSID
 bssid <network id> <BSSID> = set preferred BSSID for an SSID
 list_networks = list configured networks
 select_network <network id> = select a network (disable others)
 enable_network <network id> = enable a network
 disable_network
 <network id> = disable a network
 add_network = add a network
 remove_network <network id> = remove a network
 set_network <network id> <variable> <value> = set network variables (shows

list of variables when run without arguments)
get_network <network id> <variable> = get network variables
save_config = save the current configuration
disconnect = disconnect and wait for reassociate command before connecting
scan = request new BSS scan
scan_results = get latest scan results
get_capability <eap/pairwise/group/key_mgmt/proto/auth_alg> = get capabilies
terminate = terminate wpa_supplicant
quit = exit wpa_cli

wpa_cli command line options

wpa_cli [-p<path to ctrl sockets>] [-i<ifname>] [-hvB] [-a<action file>] \
     [-P<pid file>] [-g<global ctrl>] [command..]
-h = help (show this usage text)
-v = shown version information
-a = run in daemon mode executing the action file based on events from
     wpa_supplicant
-B = run a daemon in the background
 default path: /var/run/wpa_supplicant
default interface: first interface found in socket path

Using wpa_cli to run external program on connect/disconnect
----

wpa_cli can used to run external programs whenever wpa_supplicant
connects or disconnects from a network. This can be used, e.g., to
update network configuration and/or trigget DHCP client to update IP
addresses, etc.

One wpa_cli process in "action" mode needs to be started for each
interface. For example, the following command starts wpa_cli for the
default interface (-i can be used to select the interface in case of
more than one interface being used at the same time):

wpa_cli -a/sbin/wpa_action.sh -B

The action file (-a option, /sbin/wpa_action.sh in this example) will
be executed whenever wpa_supplicant completes authentication (connect
event) or detects disconnection). The action script will be called
with two command line arguments: interface name and event
 (CONNECTED
or DISCONNECTED). If the action script needs to get more information
about the current network, it can use 'wpa_cli status' to query
wpa_supplicant for more information.

Following example can be used as a simple template for an action
script:

```sh
#!/bin/sh

IFNAME=$1
CMD=$2

if [ "$CMD" = "CONNECTED" ]; then
    SSID=`wpa_cli -i$IFNAME status | grep ^ssid= | cut -f2- -d=`
    # configure network, signal DHCP client, etc.
fi

if [ "$CMD" = "DISCONNECTED" ]; then
    # remove network configuration, if needed
    SSID=
fi
```

Integrating with pcmcia-cs/cardmgr scripts
----

wpa_supplicant needs to be running when using a wireless network with
WPA. It can be started either from system startup scripts or from
pcmcia-cs/cardmgr scripts (when using PC Cards). WPA handshake must be
completed before data frames can be exchanged, so wpa_supplicant
should be started before DHCP client.

For example, following small changes to pcmcia-cs scripts can
 be used
to enable WPA support:

Add MODE="Managed" and WPA="y" to the network scheme in
/etc/pcmcia/wireless.opts.

Add the following block to the end of 'start' action handler in
/etc/pcmcia/wireless:

```sh
  if [ "$WPA" = "y" -a -x /usr/local/bin/wpa_supplicant ]; then
 /usr/local/bin/wpa_supplicant -B -c/etc/wpa_supplicant.conf \
  -i$DEVICE
   fi
```

Add the following block to the end of 'stop' action handler (may need
to be separated from other actions) in /etc/pcmcia/wireless:

```sh
  if [ "$WPA" = "y" -a -x /usr/local/bin/wpa_supplicant ]; then
```

```
 killall wpa_supplicant
  fi
```

This will make cardmgr start wpa_supplicant when the card is plugged in.

Dynamic interface add and operation without configuration files
----

wpa_supplicant can be started without any configuration files or network interfaces. When used in this way, a global (i.e., per wpa_supplicant process) control interface is used to add and remove network interfaces.
 Each network interface can then be configured through a per-network interface control interface. For example, following commands show how to start wpa_supplicant without any network interfaces and then add a network interface and configure a network (SSID):

```
# Start wpa_supplicant in the background
wpa_supplicant -g/var/run/wpa_supplicant-global -B

# Add a new interface (wlan0, no configuration file, driver=nl80211, and
# enable control interface)
wpa_cli -g/var/run/wpa_supplicant-global interface_add wlan0 \
 "" nl80211 /var/run/wpa_supplicant

# Configure a network using the newly added network interface:
wpa_cli -iwlan0 add_network
wpa_cli -iwlan0 set_network 0 ssid '"test"'
wpa_cli -iwlan0 set_network 0 key_mgmt WPA-PSK
wpa_cli -iwlan0 set_network 0 psk '"12345678"'
wpa_cli -iwlan0 set_network 0 pairwise TKIP
wpa_cli -iwlan0 set_network 0 group TKIP
wpa_cli -iwlan0 set_network 0 proto WPA
wpa_cli -iwlan0 enable_network 0

# At this point, the new network interface should start
 trying to associate
# with the WPA-PSK network using SSID test.

# Remove network interface
wpa_cli -g/var/run/wpa_supplicant-global interface_remove wlan0
```

Privilege separation

To minimize the size of code that needs to be run with root privileges
(e.g., to control wireless interface operation), wpa_supplicant
supports optional privilege separation. If enabled, this separates the
privileged operations into a separate process (wpa_priv) while leaving
rest of the code (e.g., EAP authentication and WPA handshakes) into an
unprivileged process (wpa_supplicant) that can be run as non-root
user. Privilege separation restricts the effects of potential software
errors by containing the majority of the code in an unprivileged
process to avoid full system compromise.

Privilege separation is not enabled by default and it can be enabled
by adding CONFIG_PRIVSEP=y to the build configuration (.config). When
enabled, the privileged operations (driver wrapper and l2_packet) are
linked
 into a separate daemon program, wpa_priv. The unprivileged
program, wpa_supplicant, will be built with a special driver/l2_packet
wrappers that communicate with the privileged wpa_priv process to
perform the needed operations. wpa_priv can control what privileged
are allowed.

wpa_priv needs to be run with network admin privileges (usually, root
user). It opens a UNIX domain socket for each interface that is
included on the command line; any other interface will be off limits
for wpa_supplicant in this kind of configuration. After this,
wpa_supplicant can be run as a non-root user (e.g., all standard users
on a laptop or as a special non-privileged user account created just
for this purpose to limit access to user files even further).

Example configuration:
- create user group for users that are allowed to use wpa_supplicant
 ('wpapriv' in this example) and assign users that should be able to
 use wpa_supplicant into that group
- create /var/run/wpa_priv directory for UNIX
 domain sockets and control
 user access by setting it accessible only for the wpapriv group:
 mkdir /var/run/wpa_priv
 chown root:wpapriv /var/run/wpa_priv
 chmod 0750 /var/run/wpa_priv
- start wpa_priv as root (e.g., from system startup scripts) with the
 enabled interfaces configured on the command line:
 wpa_priv -B -P /var/run/wpa_priv.pid nl80211:wlan0
- run wpa_supplicant as non-root with a user that is in wpapriv group:
 wpa_supplicant -i ath0 -c wpa_supplicant.conf

wpa_priv does not use the network interface before wpa_supplicant is

started, so it is fine to include network interfaces that are not
available at the time wpa_priv is started. As an alternative, wpa_priv
can be started when an interface is added (hotplug/udev/etc. scripts).
wpa_priv can control multiple interface with one process, but it is
also possible to run multiple wpa_priv processes at the same time, if
desired.

It should be noted that the interface used between wpa_supplicant and
wpa_priv does not
 include all the capabilities of the wpa_supplicant
driver interface and at times, this interface lacks update especially
for recent addition. Consequently, use of wpa_priv does come with the
price of somewhat reduced available functionality. The next section
describing how wpa_supplicant can be used with reduced privileges
without having to handle the complexity of separate wpa_priv. While that
approve does not provide separation for network admin capabilities, it
does allow other root privileges to be dropped without the drawbacks of
the wpa_priv process.

Linux capabilities instead of privileged process
----

wpa_supplicant performs operations that need special permissions, e.g.,
to control the network connection. Traditionally this has been achieved
by running wpa_supplicant as a privileged process with effective user id
0 (root). Linux capabilities can be used to provide restricted set of
capabilities to match the functions needed by wpa_supplicant.
 The
minimum set of capabilities needed for the operations is CAP_NET_ADMIN
and CAP_NET_RAW.

setcap(8) can be used to set file capabilities. For example:

sudo setcap cap_net_raw,cap_net_admin+ep wpa_supplicant

Please note that this would give anyone being able to run that
wpa_supplicant binary access to the additional capabilities. This can
further be limited by file owner/group and mode bits. For example:

sudo chown wpas wpa_supplicant
sudo chmod 0100 wpa_supplicant

This combination of setcap, chown, and chmod commands would allow wpas
user to execute wpa_supplicant with additional network admin/raw
capabilities.

Common way style of creating a control interface socket in

/var/run/wpa_supplicant could not be done by this user, but this
directory could be created before starting the wpa_supplicant and set to
suitable mode to allow wpa_supplicant to create sockets
there. Alternatively, other directory or abstract socket namespace could
be used for the control interface.

External
 requests for radio control

External programs can request wpa_supplicant to not start offchannel
operations during other tasks that may need exclusive control of the
radio. The RADIO_WORK control interface command can be used for this.

"RADIO_WORK add <name> [freq=<MHz>] [timeout=<seconds>]" command can be
used to reserve a slot for radio access. If freq is specified, other
radio work items on the same channel may be completed in
parallel. Otherwise, all other radio work items are blocked during
execution. Timeout is set to 10 seconds by default to avoid blocking
wpa_supplicant operations for excessive time. If a longer (or shorter)
safety timeout is needed, that can be specified with the optional
timeout parameter. This command returns an identifier for the radio work
item.

Once the radio work item has been started, "EXT-RADIO-WORK-START <id>"
event message is indicated that the external processing can start. Once
the operation has been
 completed, "RADIO_WORK done <id>" is used to
indicate that to wpa_supplicant. This allows other radio works to be
performed. If this command is forgotten (e.g., due to the external
program terminating), wpa_supplicant will time out the radio work item
and send "EXT-RADIO-WORK-TIMEOUT <id>" event to indicate that this has
happened. "RADIO_WORK done <id>" can also be used to cancel items that
have not yet been started.

For example, in wpa_cli interactive mode:

> radio_work add test
1
<3>EXT-RADIO-WORK-START 1
> radio_work show
ext:test@wlan0:0:1:2.487797
> radio_work done 1
OK
> radio_work show

> radio_work done 3

OK

> radio_work show

ext:test freq=2412 timeout=30@wlan0:2412:1:28.583483

<3>EXT-RADIO-WORK-TIMEOUT 2

> radio_work add test2 freq=2412 timeout=60

5

<3>EXT-RADIO-WORK-START 5

> radio_work add test3

6

> radio_work add test4

7

> radio_work show

ext:test2 freq=2412 timeout=60@wlan0:2412:1:9.751844

ext:test3@wlan0:0:0:5.071812

ext:test4@wlan0:0:0:3.143870

> radio_work done

 6

OK

> radio_work show

ext:test2 freq=2412 timeout=60@wlan0:2412:1:16.287869

ext:test4@wlan0:0:0:9.679895

> radio_work done 5

OK

<3>EXT-RADIO-WORK-START 7

<3>EXT-RADIO-WORK-TIMEOUT 7

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/README

No license file was found, but licenses were detected in source scan.

/*

* IEEE 802.1X-2010 KaY Interface

* Copyright (c) 2013-2014, Qualcomm Atheros, Inc.

*

* This software may be distributed under the terms of the BSD license.

* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpas_kay.c

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpas_kay.h

No license file was found, but licenses were detected in source scan.

/*

* wpa_supplicant - P2P

* Copyright (c) 2009-2010, Atheros Communications

* Copyright (c) 2010-2014, Jouni Malinen <j@w1.fi>

*

* This software may be distributed under the terms of the BSD license.

* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/p2p_supplicant.c

No license file was found, but licenses were detected in source scan.

/*

* WPA Supplicant / UDP socket -based control interface

* Copyright (c) 2004-2016, Jouni Malinen <j@w1.fi>

*

* This software may be distributed under the terms of the BSD license.

* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/ctrl_iface_udp.c

No license file was found, but licenses were detected in source scan.

/*

* wpa_gui - StringQuery class

* Copyright (c) 2009, Atheros Communications

*

* This software may be distributed under the terms of the BSD license.

* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-qt4/stringquery.h

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-qt4/stringquery.cpp

No license file was found, but licenses were detected in source scan.

/*

* wpa_supplicant - P2P

* Copyright (c) 2009-2010, Atheros Communications

*

* This software may be distributed under the terms of the BSD license.

* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/p2p_supplicant.h

No license file was found, but licenses were detected in source scan.

```
/*
 * wpa_supplicant - Internal driver interface wrappers
 * Copyright (c) 2003-2015, Jouni Malinen <j@w1.fi>
 *
 * This software may be distributed under the terms of the BSD license.
 * See README for more details.
 */
```

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/driver_i.h
No license file was found, but licenses were detected in source scan.

```
/*
 * Interworking (IEEE 802.11u)
 * Copyright (c) 2011-2012, Qualcomm Atheros
 *
 * This software may be distributed under the terms of the BSD license.
 * See README for more details.
 */
```

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/interworking.h
No license file was found, but licenses were detected in source scan.

```
/*
 * nfc_pw_token - Tool for building NFC password tokens for WPS
 * Copyright (c) 2012, Jouni Malinen <j@w1.fi>
 *
 * This software may be distributed under the terms of the BSD license.
 * See README for more details.
 */
```

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/nfc_pw_token.c
No license file was found, but licenses were detected in source scan.

```
/*
 * WPA Supplicant - auto scan exponential module
 * Copyright (c) 2012, Intel Corporation. All rights reserved.
 *
 * This software may be distributed under the terms of the BSD license.
 * See README for more details.
 */
```

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-

gz/wpa_supplicant/autoscan_exponential.c

No license file was found, but licenses were detected in source scan.

/*
* WPA Supplicant / privileged helper program
* Copyright (c) 2007-2009, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_priv.c

No license file was found, but licenses were detected in source scan.

/*
* Copyright (c) 2009, Atheros Communications, Inc.
* Copyright (c) 2011-2013, Qualcomm Atheros, Inc.
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/hs20_supplicant.c

No license file was found, but licenses were detected in source scan.

/*
* wpa_supplicant D-Bus control interface - common definitions
* Copyright (c) 2006, Dan Williams <dcbw@redhat.com> and Red Hat, Inc.
* Copyright (c) 2009, Witold Sowa <witold.sowa@gmail.com>
* Copyright (c) 2009, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-
gz/wpa_supplicant/dbus/dbus_common.h

No license file was found, but licenses were detected in source scan.

/*
* wpa_supplicant - MBO
*
* Copyright(c) 2015 Intel Deutschland GmbH
* Contact Information:
* Intel Linux Wireless <ilw@linux.intel.com>

* Intel Corporation, 5200 N.E. Elam Young Parkway, Hillsboro, OR 97124-6497
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/mbo.c
No license file was found, but licenses were detected in source scan.

/*
* WPA Supplicant - Mesh RSN routines
* Copyright (c) 2013-2014, cozybit, Inc. All rights reserved.
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/mesh_rsn.h
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/mesh_rsn.c
No license file was found, but licenses were detected in source scan.

/*
* WPA Supplicant - test code
* Copyright (c) 2003-2013, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*
* IEEE 802.1X Supplicant test code (to be used in place of wpa_supplicant.c.
* Not used in production version.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/eapol_test.c
No license file was found, but licenses were detected in source scan.

/*
* WPA Supplicant - auto scan
* Copyright (c) 2012, Intel Corporation. All rights reserved.
* Copyright 2015 Intel Deutschland GmbH
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/autoscan.c

No license file was found, but licenses were detected in source scan.

```
/*
* wpa_supplicant - Radio Measurements
* Copyright (c) 2003-2016, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/
```

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/rrm.c

No license file was found, but licenses were detected in source scan.

```
/*
* WPA Supplicant / main() function for Win32 service
* Copyright (c) 2003-2006, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*
* The root of wpa_supplicant configuration in registry is
* HKEY_LOCAL_MACHINE\\SOFTWARE\\%wpa_supplicant. This level includes global
* parameters and a 'interfaces' subkey with all the interface configuration
* (adapter to confname mapping). Each such mapping is a subkey that has
* 'adapter' and 'config' values.
*
* This program can be run either as a normal command line application, e.g.,
* for debugging, with 'wpasvc.exe app' or as a Windows service. Service need
* to be registered with 'wpasvc.exe reg <full path to wpasvc.exe>'. After
* this, it can be started like any other Windows service (e.g., 'net start
* wpasvc') or it can be configured to start automatically through the Services
*  tool in administrative tasks. The service can be unregistered with
* 'wpasvc.exe unreg'.
*/
```

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/main_winsvc.c

No license file was found, but licenses were detected in source scan.

```
/*
* wpa_supplicant - SME
* Copyright (c) 2009-2014, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/
```

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/sme.c

No license file was found, but licenses were detected in source scan.

/*

* wpa_supplicant / WPS integration

* Copyright (c) 2008-2014, Jouni Malinen <j@w1.fi>

*

* This software may be distributed under the terms of the BSD license.

* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wps_supplicant.c

No license file was found, but licenses were detected in source scan.

/*

* wpa_supplicant - Event notifications

* Copyright (c) 2009-2010, Jouni Malinen <j@w1.fi>

*

* This software may be distributed under the terms of the BSD license.

* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/notify.h

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/notify.c

No license file was found, but licenses were detected in source scan.

/*

* WPA Supplicant - Basic mesh mode routines

* Copyright (c) 2013-2014, cozybit, Inc. All rights reserved.

*

* This software may be distributed under the terms of the BSD license.

* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/mesh.c

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/mesh.h

No license file was found, but licenses were detected in source scan.

/*

* wpa_gui - ScanResultsItem class

* Copyright (c) 2015, Adrian Nowicki <adinowicki@gmail.com>

*

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* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-qt4/scanresultsitem.cpp

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-qt4/scanresultsitem.h

No license file was found, but licenses were detected in source scan.

/*

* WPA Supplicant / Network configuration structures

* Copyright (c) 2003-2013, Jouni Malinen <j@w1.fi>

*

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* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/config_ssid.h

No license file was found, but licenses were detected in source scan.

/*

* Generic advertisement service (GAS) query

* Copyright (c) 2009, Atheros Communications

* Copyright (c) 2011, Qualcomm Atheros

*

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* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/gas_query.h

No license file was found, but licenses were detected in source scan.

/*

* WPA Supplicant

* Copyright (c) 2003-2017, Jouni Malinen <j@w1.fi>

*

* This software may be distributed under the terms of the BSD license.

* See README for more details.

*

* This file implements functions for registering and unregistering

* %wpa_supplicant interfaces. In addition, this file contains number of

* functions for managing network connections.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_supplicant.c

No license file was found, but licenses were detected in source scan.

```
/*
* WPA Supplicant - command line interface for wpa_supplicant daemon
* Copyright (c) 2004-2017, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/
```

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_cli.c

No license file was found, but licenses were detected in source scan.

```
/*
* WPA Supplicant / dbus-based control interface (WPS)
* Copyright (c) 2006, Dan Williams <dcbw@redhat.com> and Red Hat, Inc.
* Copyright (c) 2009, Witold Sowa <witold.sowa@gmail.com>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/
```

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/dbus/dbus_new_handlers_wps.c

No license file was found, but licenses were detected in source scan.

```
/*
* WPA Supplicant / Configuration backend: empty starting point
* Copyright (c) 2003-2005, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*
* This file implements dummy example of a configuration backend. None of the
* functions are actually implemented so this can be used as a simple
* compilation test or a starting point for a new configuration backend.
*/
```

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/config_none.c

No license file was found, but licenses were detected in source scan.

```
/*
* binder interface for wpa_supplicant daemon
* Copyright (c) 2004-2016, Jouni Malinen <j@w1.fi>
```

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/binder/binder.cpp

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/binder/binder_manager.h

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/binder/binder_manager.cpp

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/binder/binder_i.h

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/binder/iface.cpp

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/binder/iface.h

*

 /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/binder/binder_constants.cpp

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/binder/binder.h

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/binder/binder_constants.h

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/binder/supplicant.cpp

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/binder/supplicant.h

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/binder/fi/w1/wpa_supplicant/ISupplicantCallbacks.aidl

No license file was found, but licenses were detected in source scan.

Example wpa_supplicant build time configuration

#

This file lists the configuration options that are used when building the

wpa_supplicant binary. All lines starting with # are ignored. Configuration

option lines must be commented out complete, if they are not to be included,

i.e., just setting VARIABLE=n is not disabling that variable.

#

This file is included in Makefile, so variables like CFLAGS and LIBS can also

be modified from here. In most cases, these lines should use += in order not

to override previous values of the variables.

Uncomment following two lines and fix the paths if you have installed OpenSSL

or GnuTLS in non-default location

#CFLAGS += -I/usr/local/openssl/include

#LIBS += -L/usr/local/openssl/lib

Some Red Hat versions seem to include kerberos header files from OpenSSL, but

the kerberos files are not in the default include path. Following line can be

used to fix build

issues on such systems (krb5.h not found).
#CFLAGS += -I/usr/include/kerberos

Driver interface for generic Linux wireless extensions
Note: WEXT is deprecated in the current Linux kernel version and no new
functionality is added to it. nl80211-based interface is the new
replacement for WEXT and its use allows wpa_supplicant to properly control
the driver to improve existing functionality like roaming and to support new
functionality.
#CONFIG_DRIVER_WEXT=y

Driver interface for Linux drivers using the nl80211 kernel interface
#CONFIG_DRIVER_NL80211=y
CONFIG_LIBNL20=y

# QCA vendor extensions to nl80211
CONFIG_DRIVER_NL80211_QCA=y

Driver interface for FreeBSD net80211 layer (e.g., Atheros driver)
#CONFIG_DRIVER_BSD=y
#CFLAGS += -I/usr/local/include
#LIBS += -L/usr/local/lib
#LIBS_p += -L/usr/local/lib
#LIBS_c += -L/usr/local/lib

Driver interface for Windows NDIS
#CONFIG_DRIVER_NDIS=y
#CFLAGS += -I/usr/include/w32api/ddk
#LIBS += -L/usr/local/lib
For native build using
 mingw
#CONFIG_NATIVE_WINDOWS=y
Additional directories for cross-compilation on Linux host for mingw target
#CFLAGS += -I/opt/mingw/mingw32/include/ddk
#LIBS += -L/opt/mingw/mingw32/lib
#CC=mingw32-gcc
By default, driver_ndis uses WinPcap for low-level operations. This can be
replaced with the following option which replaces WinPcap calls with NDISUIO.
However, this requires that WZC is disabled (net stop wzcsvc) before starting
wpa_supplicant.
CONFIG_USE_NDISUIO=y

Driver interface for wired Ethernet drivers
#CONFIG_DRIVER_WIRED=y

Driver interface for the Broadcom RoboSwitch family
#CONFIG_DRIVER_ROBOSWITCH=y

```
# Driver interface for no driver (e.g., WPS ER only)
#CONFIG_DRIVER_NONE=y

# Solaris libraries
#LIBS += -lsocket -ldlpi -lnsl
#LIBS_c += -lsocket

# Enable IEEE 802.1X Supplicant (automatically included if any EAP method is
# included)
CONFIG_IEEE8021X_EAPOL=y

# EAP-MD5
CONFIG_EAP_MD5=y

# EAP-MSCHAPv2
CONFIG_EAP_MSCHAPV2=y

# EAP-TLS
CONFIG_EAP_TLS=y

# EAL-PEAP
CONFIG_EAP_PEAP=y

#
 EAP-TTLS
CONFIG_EAP_TTLS=y

# EAP-FAST
# Note: If OpenSSL is used as the TLS library, OpenSSL 1.0 or newer is needed
# for EAP-FAST support. Older OpenSSL releases would need to be patched, e.g.,
# with openssl-0.9.8x-tls-extensions.patch, to add the needed functions.
#CONFIG_EAP_FAST=y

# EAP-GTC
CONFIG_EAP_GTC=y

# EAP-OTP
CONFIG_EAP_OTP=y

# EAP-SIM (enable CONFIG_PCSC, if EAP-SIM is used)
CONFIG_EAP_SIM=y

# EAP-PSK (experimental; this is _not_ needed for WPA-PSK)
#CONFIG_EAP_PSK=y

# EAP-pwd (secure authentication using only a password)
CONFIG_EAP_PWD=y
```

```
# EAP-PAX
#CONFIG_EAP_PAX=y

# LEAP
CONFIG_EAP_LEAP=y

# EAP-AKA (enable CONFIG_PCSC, if EAP-AKA is used)
CONFIG_EAP_AKA=y

# EAP-AKA' (enable CONFIG_PCSC, if EAP-AKA' is used).
# This requires CONFIG_EAP_AKA to be enabled, too.
CONFIG_EAP_AKA_PRIME=y

# Enable USIM simulator (Milenage) for EAP-AKA
#CONFIG_USIM_SIMULATOR=y

# EAP-SAKE
#CONFIG_EAP_SAKE=y

# EAP-GPSK
#CONFIG_EAP_GPSK=y
# Include support for
 optional SHA256 cipher suite in EAP-GPSK
#CONFIG_EAP_GPSK_SHA256=y

# EAP-TNC and related Trusted Network Connect support (experimental)
#CONFIG_EAP_TNC=y

# Wi-Fi Protected Setup (WPS)
CONFIG_WPS=y
# Enable WPS external registrar functionality
CONFIG_WPS_ER=y
# Disable credentials for an open network by default when acting as a WPS
# registrar.
#CONFIG_WPS_REG_DISABLE_OPEN=y
# Enable WPS support with NFC config method
CONFIG_WPS_NFC=y

# EAP-IKEv2
#CONFIG_EAP_IKEV2=y

# EAP-EKE
#CONFIG_EAP_EKE=y

# PKCS#12 (PFX) support (used to read private key and certificate file from
# a file that usually has extension .p12 or .pfx)
CONFIG_PKCS12=y
```

# Smartcard support (i.e., private key on a smartcard), e.g., with openssl
# engine.
CONFIG_SMARTCARD=y

PC/SC interface for smartcards (USIM, GSM SIM)
Enable this if EAP-SIM or EAP-AKA is included
#CONFIG_PCSC=y

Support HT overrides (disable HT/HT40, mask MCS rates, etc.)
#CONFIG_HT_OVERRIDES=y

Support VHT overrides (disable VHT, mask MCS
 rates, etc.)
#CONFIG_VHT_OVERRIDES=y

Development testing
#CONFIG_EAPOL_TEST=y

# Select control interface backend for external programs, e.g, wpa_cli:
# unix = UNIX domain sockets (default for Linux/*BSD)
# udp = UDP sockets using localhost (127.0.0.1)
# udp6 = UDP IPv6 sockets using localhost (::1)
# named_pipe = Windows Named Pipe (default for Windows)
# udp-remote = UDP sockets with remote access (only for tests systems/purpose)
# udp6-remote = UDP IPv6 sockets with remote access (only for tests purpose)
# y = use default (backwards compatibility)
# If this option is commented out, control interface is not included in the
# build.
CONFIG_CTRL_IFACE=y

Include support for GNU Readline and History Libraries in wpa_cli.
When building a wpa_cli binary for distribution, please note that these
libraries are licensed under GPL and as such, BSD license may not apply for
the resulting binary.
#CONFIG_READLINE=y

Include internal line edit mode in wpa_cli. This can be used as a
 replacement
# for GNU Readline to provide limited command line editing and history support.
CONFIG_WPA_CLI_EDIT=y

Remove debugging code that is printing out debug message to stdout.
This can be used to reduce the size of the wpa_supplicant considerably
if debugging code is not needed. The size reduction can be around 35%
(e.g., 90 kB).
#CONFIG_NO_STDOUT_DEBUG=y

Remove WPA support, e.g., for wired-only IEEE 802.1X supplicant, to save

35-50 kB in code size.
#CONFIG_NO_WPA=y

Remove IEEE 802.11i/WPA-Personal ASCII passphrase support
This option can be used to reduce code size by removing support for
converting ASCII passphrases into PSK. If this functionality is removed, the
PSK can only be configured as the 64-octet hexstring (e.g., from
wpa_passphrase). This saves about 0.5 kB in code size.
#CONFIG_NO_WPA_PASSPHRASE=y

Disable scan result processing (ap_mode=1) to save code size by about 1 kB.
This can be used if ap_scan=1 mode is never enabled.
#CONFIG_NO_SCAN_PROCESSING=y

#
 Select configuration backend:
# file = text file (e.g., wpa_supplicant.conf; note: the configuration file
# path is given on command line, not here; this option is just used to
# select the backend that allows configuration files to be used)
# winreg = Windows registry (see win_example.reg for an example)
CONFIG_BACKEND=file

Remove configuration write functionality (i.e., to allow the configuration
file to be updated based on runtime configuration changes). The runtime
configuration can still be changed, the changes are just not going to be
persistent over restarts. This option can be used to reduce code size by
about 3.5 kB.
#CONFIG_NO_CONFIG_WRITE=y

Remove support for configuration blobs to reduce code size by about 1.5 kB.
#CONFIG_NO_CONFIG_BLOBS=y

Select program entry point implementation:
main = UNIX/POSIX like main() function (default)
main_winsvc = Windows service (read parameters from registry)
main_none = Very basic example (development
 use only)
#CONFIG_MAIN=main

# Select wrapper for operating system and C library specific functions
# unix = UNIX/POSIX like systems (default)
# win32 = Windows systems
# none = Empty template
CONFIG_OS=unix

Select event loop implementation
eloop = select() loop (default)
eloop_win = Windows events and WaitForMultipleObject() loop

CONFIG_ELOOP=eloop

Should we use poll instead of select? Select is used by default.
#CONFIG_ELOOP_POLL=y

Should we use epoll instead of select? Select is used by default.
#CONFIG_ELOOP_EPOLL=y

Should we use kqueue instead of select? Select is used by default.
#CONFIG_ELOOP_KQUEUE=y

# Select layer 2 packet implementation
# linux = Linux packet socket (default)
# pcap = libpcap/libdnet/WinPcap
# freebsd = FreeBSD libpcap
# winpcap = WinPcap with receive thread
# ndis = Windows NDISUIO (note: requires CONFIG_USE_NDISUIO=y)
# none = Empty template
CONFIG_L2_PACKET=linux

Disable Linux packet socket workaround applicable for station interface
#
 in a bridge for EAPOL frames. This should be uncommented only if the kernel
is known to not have the regression issue in packet socket behavior with
bridge interfaces (commit 'bridge: respect RFC2863 operational state')').
#CONFIG_NO_LINUX_PACKET_SOCKET_WAR=y

# IEEE 802.11w (management frame protection), also known as PMF
# Driver support is also needed for IEEE 802.11w.
CONFIG_IEEE80211W=y

Select TLS implementation
openssl = OpenSSL (default)
gnutls = GnuTLS
internal = Internal TLSv1 implementation (experimental)
none = Empty template
#CONFIG_TLS=openssl

TLS-based EAP methods require at least TLS v1.0. Newer version of TLS (v1.1)
can be enabled to get a stronger construction of messages when block ciphers
are used. It should be noted that some existing TLS v1.0 -based
implementation may not be compatible with TLS v1.1 message (ClientHello is
sent prior to negotiating which version will be used)
#CONFIG_TLSV11=y

TLS-based EAP methods require at least TLS
 v1.0. Newer version of TLS (v1.2)
can be enabled to enable use of stronger crypto algorithms. It should be

noted that some existing TLS v1.0 -based implementation may not be compatible
with TLS v1.2 message (ClientHello is sent prior to negotiating which version
will be used)
#CONFIG_TLSV12=y

Select which ciphers to use by default with OpenSSL if the user does not
specify them.
#CONFIG_TLS_DEFAULT_CIPHERS="DEFAULT:!EXP:!LOW"

If CONFIG_TLS=internal is used, additional library and include paths are
needed for LibTomMath. Alternatively, an integrated, minimal version of
LibTomMath can be used. See beginning of libtommath.c for details on benefits
and drawbacks of this option.
#CONFIG_INTERNAL_LIBTOMMATH=y
#ifndef CONFIG_INTERNAL_LIBTOMMATH
#LTM_PATH=/usr/src/libtommath-0.39
#CFLAGS += -I$(LTM_PATH)
#LIBS += -L$(LTM_PATH)
#LIBS_p += -L$(LTM_PATH)
#endif
At the cost of about 4 kB of additional binary size, the internal LibTomMath
can be configured to include faster
 routines for exptmod, sqr, and div to
speed up DH and RSA calculation considerably
#CONFIG_INTERNAL_LIBTOMMATH_FAST=y

Include NDIS event processing through WMI into wpa_supplicant/wpasvc.
This is only for Windows builds and requires WMI-related header files and
WbemUuid.Lib from Platform SDK even when building with MinGW.
#CONFIG_NDIS_EVENTS_INTEGRATED=y
#PLATFORMSDKLIB="/opt/Program Files/Microsoft Platform SDK/Lib"

Add support for old DBus control interface
(fi.epitest.hostap.WPASupplicant)
#CONFIG_CTRL_IFACE_DBUS=y

Add support for new DBus control interface
(fi.w1.hostap.wpa_supplicant1)
#CONFIG_CTRL_IFACE_DBUS_NEW=y

Add introspection support for new DBus control interface
#CONFIG_CTRL_IFACE_DBUS_INTRO=y

Add support for Binder control interface
Only applicable for Android platforms.
#CONFIG_CTRL_IFACE_BINDER=y

Add support for loading EAP methods dynamically as shared libraries.

When this option is enabled, each EAP method can be either included
statically
 (CONFIG_EAP_<method>=y) or dynamically (CONFIG_EAP_<method>=dyn).
Dynamic EAP methods are build as shared objects (eap_*.so) and they need to
be loaded in the beginning of the wpa_supplicant configuration file
(see load_dynamic_eap parameter in the example file) before being used in
the network blocks.
#
Note that some shared parts of EAP methods are included in the main program
and in order to be able to use dynamic EAP methods using these parts, the
main program must have been build with the EAP method enabled (=y or =dyn).
This means that EAP-TLS/PEAP/TTLS/FAST cannot be added as dynamic libraries
unless at least one of them was included in the main build to force inclusion
of the shared code. Similarly, at least one of EAP-SIM/AKA must be included
in the main build to be able to load these methods dynamically.
#
Please also note that using dynamic libraries will increase the total binary
size. Thus, it may not be the best option for targets that have
 limited
amount of memory/flash.
#CONFIG_DYNAMIC_EAP_METHODS=y

# IEEE Std 802.11r-2008 (Fast BSS Transition) for station mode
CONFIG_IEEE80211R=y

Add support for writing debug log to a file (/tmp/wpa_supplicant-log-#.txt)
#CONFIG_DEBUG_FILE=y

Send debug messages to syslog instead of stdout
#CONFIG_DEBUG_SYSLOG=y
Set syslog facility for debug messages
#CONFIG_DEBUG_SYSLOG_FACILITY=LOG_DAEMON

Add support for sending all debug messages (regardless of debug verbosity)
to the Linux kernel tracing facility. This helps debug the entire stack by
making it easy to record everything happening from the driver up into the
same file, e.g., using trace-cmd.
#CONFIG_DEBUG_LINUX_TRACING=y

# Add support for writing debug log to Android logcat instead of standard
# output
CONFIG_ANDROID_LOG=y

Enable privilege separation (see README 'Privilege separation' for details)
#CONFIG_PRIVSEP=y

Enable mitigation against certain attacks against TKIP by delaying Michael
MIC error reports

by a random amount of time between 0 and 60 seconds

#CONFIG_DELAYED_MIC_ERROR_REPORT=y

Enable tracing code for developer debugging

This tracks use of memory allocations and other registrations and reports

incorrect use with a backtrace of call (or allocation) location.

#CONFIG_WPA_TRACE=y

For BSD, uncomment these.

#LIBS += -lexecinfo

#LIBS_p += -lexecinfo

#LIBS_c += -lexecinfo

Use libbfd to get more details for developer debugging

This enables use of libbfd to get more detailed symbols for the backtraces

generated by CONFIG_WPA_TRACE=y.

#CONFIG_WPA_TRACE_BFD=y

For BSD, uncomment these.

#LIBS += -lbfd -liberty -lz

#LIBS_p += -lbfd -liberty -lz

#LIBS_c += -lbfd -liberty -lz

wpa_supplicant depends on strong random number generation being available

from the operating system. os_get_random() function is used to fetch random

data when needed, e.g., for key generation. On Linux and BSD systems, this

works by reading /dev/urandom. It should be noted that the OS

 entropy pool

needs to be properly initialized before wpa_supplicant is started. This is

important especially on embedded devices that do not have a hardware random

number generator and may by default start up with minimal entropy available

for random number generation.

#

As a safety net, wpa_supplicant is by default trying to internally collect

additional entropy for generating random data to mix in with the data fetched

from the OS. This by itself is not considered to be very strong, but it may

help in cases where the system pool is not initialized properly. However, it

is very strongly recommended that the system pool is initialized with enough

entropy either by using hardware assisted random number generator or by

storing state over device reboots.

#

wpa_supplicant can be configured to maintain its own entropy store over

restarts to enhance random number generation. This is not perfect, but it is

much more secure than using the same sequence of random numbers

 after every

reboot. This can be enabled with -e<entropy file> command line option. The

specified file needs to be readable and writable by wpa_supplicant.

#

If the os_get_random() is known to provide strong random data (e.g., on

Linux/BSD, the board in question is known to have reliable source of random

data from /dev/urandom), the internal wpa_supplicant random pool can be
disabled. This will save some in binary size and CPU use. However, this
should only be considered for builds that are known to be used on devices
that meet the requirements described above.

# Wpa_supplicant's random pool is not necessary on Android. Randomness is
# already provided by the entropymixer service which ensures sufficient
# entropy is maintained across reboots. Commit b410eb1913 'Initialize
# /dev/urandom earlier in boot' seeds /dev/urandom with that entropy before
# either wpa_supplicant or hostapd are run.
CONFIG_NO_RANDOM_POOL=y

IEEE 802.11n (High Throughput) support (mainly for
 AP mode)
CONFIG_IEEE80211N=y

IEEE 802.11ac (Very High Throughput) support (mainly for AP mode)
(depends on CONFIG_IEEE80211N)
#CONFIG_IEEE80211AC=y

# Wireless Network Management (IEEE Std 802.11v-2011)
# Note: This is experimental and not complete implementation.
CONFIG_WNM=y

# Interworking (IEEE 802.11u)
# This can be used to enable functionality to improve interworking with
# external networks (GAS/ANQP to learn more about the networks and network
# selection based on available credentials).
CONFIG_INTERWORKING=y

# Hotspot 2.0
CONFIG_HS20=y

Enable interface matching in wpa_supplicant
#CONFIG_MATCH_IFACE=y

# Disable roaming in wpa_supplicant
CONFIG_NO_ROAMING=y

# AP mode operations with wpa_supplicant
# This can be used for controlling AP mode operations with wpa_supplicant. It
# should be noted that this is mainly aimed at simple cases like
# WPA2-Personal while more complex configurations like WPA2-Enterprise with an
# external RADIUS server can be supported with hostapd.
CONFIG_AP=y

#

P2P (Wi-Fi Direct)
# This can be used to enable P2P support in wpa_supplicant. See README-P2P for
# more information on P2P operations.
CONFIG_P2P=y

# Enable TDLS support
CONFIG_TDLS=y

# Wi-Fi Direct
# This can be used to enable Wi-Fi Direct extensions for P2P using an external
# program to control the additional information exchanges in the messages.
CONFIG_WIFI_DISPLAY=y

Autoscan
This can be used to enable automatic scan support in wpa_supplicant.
See wpa_supplicant.conf for more information on autoscan usage.
#
Enabling directly a module will enable autoscan support.
For exponential module:
#CONFIG_AUTOSCAN_EXPONENTIAL=y
For periodic module:
#CONFIG_AUTOSCAN_PERIODIC=y

Password (and passphrase, etc.) backend for external storage
These optional mechanisms can be used to add support for storing passwords
and other secrets in external (to wpa_supplicant) location. This allows, for
example, operating system specific key storage to be used
#
#
 External password backend for testing purposes (developer use)
#CONFIG_EXT_PASSWORD_TEST=y

Enable Fast Session Transfer (FST)
#CONFIG_FST=y

Support Multi Band Operation
#CONFIG_MBO=y

Fast Initial Link Setup (FILS) (IEEE 802.11ai)
Note: This is an experimental and not yet complete implementation. This
should not be enabled for production use.
#CONFIG_FILS=y

Support RSN on IBSS networks
This is needed to be able to use mode=1 network profile with proto=RSN and
key_mgmt=WPA-PSK (i.e., full key management instead of WPA-None).
#CONFIG_IBSS_RSN=y

External PMKSA cache control
This can be used to enable control interface commands that allow the current
PMKSA cache entries to be fetched and new entries to be added.
#CONFIG_PMKSA_CACHE_EXTERNAL=y

Mesh Networking (IEEE 802.11s)
#CONFIG_MESH=y

Background scanning modules
These can be used to request wpa_supplicant to perform background scanning
operations for roaming within an ESS (same SSID). See the bgscan
 parameter in
the wpa_supplicant.conf file for more details.
Periodic background scans based on signal strength
#CONFIG_BGSCAN_SIMPLE=y
Learn channels used by the network and try to avoid bgscans on other
channels (experimental)
#CONFIG_BGSCAN_LEARN=y

Opportunistic Wireless Encryption (OWE)
Experimental implementation of draft-harkins-owe-07.txt
#CONFIG_OWE=y

include $(wildcard $(LOCAL_PATH)/android_config_*.inc)

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/android.config
No license file was found, but licenses were detected in source scan.

/*
* WPA Supplicant / Configuration parser and common functions
* Copyright (c) 2003-2015, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/config.c
No license file was found, but licenses were detected in source scan.

/*
* WPA Supplicant / Example program entrypoint
* Copyright (c) 2003-2005, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/main_none.c

No license file was found, but licenses were detected in source scan.

/*

* Wi-Fi Multimedia Admission Control (WMM-AC)

* Copyright(c) 2014, Intel Mobile Communication GmbH.

* Copyright(c) 2014, Intel Corporation. All rights reserved.

*

* This software may be distributed under the terms of the BSD license.

* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wmm_ac.c

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wmm_ac.h

No license file was found, but licenses were detected in source scan.

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Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/Android.mk

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_supplicant_conf.sh

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/examples/dpp-qrcode.py

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/eapol_test.py

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/examples/p2p-nfc.py

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_supplicant_conf.mk

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/examples/wps-nfc.py

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/utils/log2pcap.py

No license file was found, but licenses were detected in source scan.

/*

* WPA Supplicant - Basic mesh peer management

* Copyright (c) 2013-2014, cozybit, Inc. All rights reserved.

*

* This software may be distributed under the terms of the BSD license.

* See README for more details.

*/

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/mesh_mpm.h

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/mesh_mpm.c

No license file was found, but licenses were detected in source scan.

```
/*
* wpa_supplicant - SME
* Copyright (c) 2009-2010, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/
```

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/sme.h
No license file was found, but licenses were detected in source scan.

```
/*
* WPA Supplicant / dbus-based control interface
* Copyright (c) 2006, Dan Williams <dcbw@redhat.com> and Red Hat, Inc.
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/
```

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-
gz/wpa_supplicant/dbus/dbus_dict_helpers.c
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/dbus/dbus_old.h
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-
gz/wpa_supplicant/dbus/dbus_old_handlers.c
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/dbus/dbus_old.c
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-
gz/wpa_supplicant/dbus/dbus_old_handlers.h
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-
gz/wpa_supplicant/dbus/dbus_dict_helpers.h
No license file was found, but licenses were detected in source scan.

```
/*
* wpa_gui - ScanResults class
* Copyright (c) 2005-2006, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/
```

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-
qt4/scanresults.h
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-
qt4/scanresults.cpp

No license file was found, but licenses were detected in source scan.

/*
* WPA Supplicant / dbus-based control interface
* Copyright (c) 2006, Dan Williams <dcbw@redhat.com> and Red Hat, Inc.
* Copyright (c) 2009-2010, Witold Sowa <witold.sowa@gmail.com>
* Copyright (c) 2009, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/dbus/dbus_new.c
No license file was found, but licenses were detected in source scan.

/*
* wpa_supplicant D-Bus control interface - common functionality
* Copyright (c) 2006, Dan Williams <dcbw@redhat.com> and Red Hat, Inc.
* Copyright (c) 2009, Witold Sowa <witold.sowa@gmail.com>
* Copyright (c) 2009, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-
gz/wpa_supplicant/dbus/dbus_common.c
No license file was found, but licenses were detected in source scan.

/*
* WPA Supplicant / Configuration backend: text file
* Copyright (c) 2003-2012, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*
* This file implements a configuration backend for text files. All the
* configuration information is stored in a text file that uses a format
* described in the sample configuration file, wpa_supplicant.conf.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/config_file.c
No license file was found, but licenses were detected in source scan.

/*

* IEEE 802.11v WNM related functions and structures
* Copyright (c) 2011-2012, Qualcomm Atheros, Inc.
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wnm_sta.h
No license file was found, but licenses were detected in source scan.

/*
* wpa_supplicant - Internal definitions
* Copyright (c) 2003-2014, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_supplicant_i.h
No license file was found, but licenses were detected in source scan.

/*
* wpa_supplicant / WPS integration
* Copyright (c) 2008-2012, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wps_supplicant.h
No license file was found, but licenses were detected in source scan.

/*
* WPA Supplicant / dbus-based control interface for p2p
* Copyright (c) 2011-2012, Intel Corporation
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/dbus/dbus_new_handlers_p2p.h

No license file was found, but licenses were detected in source scan.

/*
* WPA Supplicant / dbus-based control interface
* Copyright (c) 2006, Dan Williams <dcbw@redhat.com> and Red Hat, Inc.
* Copyright (c) 2009, Witold Sowa <witold.sowa@gmail.com>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-
gz/wpa_supplicant/dbus/dbus_new_helpers.c
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-
gz/wpa_supplicant/dbus/dbus_new_helpers.h
No license file was found, but licenses were detected in source scan.

/*
* Operating classes
* Copyright(c) 2015 Intel Deutschland GmbH
* Contact Information:
* Intel Linux Wireless <ilw@linux.intel.com>
* Intel Corporation, 5200 N.E. Elam Young Parkway, Hillsboro, OR 97124-6497
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/op_classes.c
No license file was found, but licenses were detected in source scan.

/*
* wpa_gui - WpaGui class
* Copyright (c) 2005-2011, Jouni Malinen <j@w1.fi>
*
* This software may be distributed under the terms of the BSD license.
* See README for more details.
*/

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-
qt4/wpagui.cpp
No license file was found, but licenses were detected in source scan.

wpa_supplicant for Windows
==========================

wpa_supplicant has support for being used as a WPA/WPA2/IEEE 802.1X
Supplicant on Windows. The current port requires that WinPcap
(http://winpcap.polito.it/) is installed for accessing packets and the
driver interface. Both release versions 3.0 and 3.1 are supported.

The current port is still somewhat experimental. It has been tested
mainly on Windows XP (SP2) with limited set of NDIS drivers. In
addition, the current version has been reported to work with Windows
2000.

All security modes have been verified to work (at least complete
authentication and successfully ping a wired host):
- plaintext
- static WEP / open system authentication
- static WEP / shared key authentication
- IEEE
 802.1X with dynamic WEP keys
- WPA-PSK, TKIP, CCMP, TKIP+CCMP
- WPA-EAP, TKIP, CCMP, TKIP+CCMP
- WPA2-PSK, TKIP, CCMP, TKIP+CCMP
- WPA2-EAP, TKIP, CCMP, TKIP+CCMP

Building wpa_supplicant with mingw

The default build setup for wpa_supplicant is to use MinGW and
cross-compiling from Linux to MinGW/Windows. It should also be
possible to build this under Windows using the MinGW tools, but that
is not tested nor supported and is likely to require some changes to
the Makefile unless cygwin is used.

Building wpa_supplicant with MSVC
----

wpa_supplicant can be built with Microsoft Visual C++ compiler. This
has been tested with Microsoft Visual C++ Toolkit 2003 and Visual
Studio 2005 using the included nmake.mak as a Makefile for nmake. IDE
can also be used by creating a project that includes the files and

defines mentioned in nmake.mak. Example VS2005 solution and project files are included in vs2005 subdirectory. This can
 be used as a
starting point for building the programs with VS2005 IDE. Visual Studio 2008 Express Edition is also able to use these project files.

WinPcap development package is needed for the build and this can be downloaded from http://www.winpcap.org/install/bin/WpdPack_4_0_2.zip. The default nmake.mak expects this to be unpacked into C:\dev\WpdPack so that Include and Lib directories are in this directory. The files can be stored elsewhere as long as the WINPCAPDIR in nmake.mak is updated to match with the selected directory. In case a project file in the IDE is used, these Include and Lib directories need to be added to project properties as additional include/library directories.

OpenSSL source package can be downloaded from http://www.openssl.org/source/openssl-0.9.8i.tar.gz and built and installed following instructions in INSTALL.W32. Note that if EAP-FAST support will be included in the wpa_supplicant, OpenSSL needs to be patched to# support it openssl-0.9.8i-tls-extensions.patch.
 The example
nmake.mak file expects OpenSSL to be installed into C:\dev\openssl, but this directory can be modified by changing OPENSSLDIR variable in nmake.mak.

If you do not need EAP-FAST support, you may also be able to use Win32 binary installation package of OpenSSL from http://www.slproweb.com/products/Win32OpenSSL.html instead of building the library yourself. In this case, you will need to copy Include and Lib directories in suitable directory, e.g., C:\dev\openssl for the default nmake.mak. Copy {Win32OpenSSLRoot}\include into C:\dev\openssl\include and make C:\dev\openssl\lib subdirectory with files from {Win32OpenSSLRoot}\VC (i.e., libeay*.lib and ssleay*.lib). This will end up using dynamically linked OpenSSL (i.e., .dll files are needed) for it. Alternative, you can copy files from {Win32OpenSSLRoot}\VC\static to create a static build (no OpenSSL .dll files needed).

Building wpa_supplicant for cygwin
----

wpa_supplicant can be built
 for cygwin by installing the needed
development packages for cygwin. This includes things like compiler, make, openssl development package, etc. In addition, developer's pack for WinPcap (WPdpack.zip) from http://winpcap.polito.it/install/default.htm is needed.

.config file should enable only one driver interface,
CONFIG_DRIVER_NDIS. In addition, include directories may need to be
added to match the system. An example configuration is available in
defconfig. The library and include files for WinPcap will either need
to be installed in compiler/linker default directories or their
location will need to be adding to .config when building
wpa_supplicant.

Othen than this, the build should be more or less identical to Linux
version, i.e., just run make after having created .config file. An
additional tool, win_if_list.exe, can be built by running "make
win_if_list".

Building wpa_gui
----

wpa_gui uses Qt application framework from Trolltech. It can be built
with the open source
 version of Qt4 and MinGW. Following commands can
be used to build the binary in the Qt 4 Command Prompt:

go to the root directory of wpa_supplicant source code
cd wpa_gui-qt4
qmake -o Makefile wpa_gui.pro
make
the wpa_gui.exe binary is created into 'release' subdirectory

Using wpa_supplicant for Windows
----

wpa_supplicant, wpa_cli, and wpa_gui behave more or less identically to
Linux version, so instructions in README and example wpa_supplicant.conf
should be applicable for most parts. In addition, there is another
version of wpa_supplicant, wpasvc.exe, which can be used as a Windows
service and which reads its configuration from registry instead of
text file.

When using access points in "hidden SSID" mode, ap_scan=2 mode need to
be used (see wpa_supplicant.conf for more information).

Windows NDIS/WinPcap uses quite long interface names, so some care
will be needed when starting wpa_supplicant. Alternatively, the
adapter description can be used
 as the interface name which may be
easier since it is usually in more human-readable

format. win_if_list.exe can be used to find out the proper interface
name.

Example steps in starting up wpa_supplicant:

win_if_list.exe
ifname: \Device\NPF_GenericNdisWanAdapter
description: Generic NdisWan adapter

ifname: \Device\NPF_{769E012B-FD17-4935-A5E3-8090C38E25D2}
description: Atheros Wireless Network Adapter (Microsoft's Packet Scheduler)

ifname: \Device\NPF_{732546E7-E26C-48E3-9871-7537B020A211}
description: Intel 8255x-based Integrated Fast Ethernet (Microsoft's Packet Scheduler)

Since the example configuration used Atheros WLAN card, the middle one
is the correct interface in this case. The interface name for -i
command line option is the full string following "ifname:" (the
"\Device\NPF_" prefix can be removed). In other words, wpa_supplicant
would be started with the following command:

wpa_supplicant.exe -i'{769E012B-FD17-4935-A5E3-8090C38E25D2}' -c wpa_supplicant.conf -d

-d
 optional enables some more debugging (use -dd for even more, if
needed). It can be left out if debugging information is not needed.

With the alternative mechanism for selecting the interface, this
command has identical results in this case:

wpa_supplicant.exe -iAtheros -c wpa_supplicant.conf -d

Simple configuration example for WPA-PSK:

#ap_scan=2
ctrl_interface=
network={
 ssid="test"
 key_mgmt=WPA-PSK
 proto=WPA
 pairwise=TKIP
 psk="secret passphrase"
}

(remove '#' from the comment out ap_scan line to enable mode in which
wpa_supplicant tries to associate with the SSID without doing

scanning; this allows APs with hidden SSIDs to be used)

wpa_cli.exe and wpa_gui.exe can be used to interact with the
wpa_supplicant.exe program in the same way as with Linux. Note that
ctrl_interface is using UNIX domain sockets when built for cygwin, but
the native build for Windows uses named pipes and the contents of the
ctrl_interface configuration item is used to control access to the
interface.
 Anyway, this variable has to be included in the configuration
to enable the control interface.

Example SDDL string formats:

(local admins group has permission, but nobody else):

ctrl_interface=SDDL=D:(A;;GA;;;BA)

("A" == "access allowed", "GA" == GENERIC_ALL == all permissions, and
"BA" == "builtin administrators" == the local admins. The empty fields
are for flags and object GUIDs, none of which should be required in this
case.)

(local admins and the local "power users" group have permissions,
but nobody else):

ctrl_interface=SDDL=D:(A;;GA;;;BA)(A;;GA;;;PU)

(One ACCESS_ALLOWED ACE for GENERIC_ALL for builtin administrators, and
one ACCESS_ALLOWED ACE for GENERIC_ALL for power users.)

(close to wide open, but you have to be a valid user on
the machine):

ctrl_interface=SDDL=D:(A;;GA;;;AU)

(One ACCESS_ALLOWED ACE for GENERIC_ALL for the "authenticated users"
group.)

This one would allow absolutely everyone (including anonymous
users) -- this is *not* recommended, since
 named pipes can be attached
to from anywhere on the network (i.e. there's no "this machine only"
like there is with 127.0.0.1 sockets):

ctrl_interface=SDDL=D:(A;;GA;;;BU)(A;;GA;;;AN)

(BU == "builtin users", "AN" == "anonymous")

See also [1] for the format of ACEs, and [2] for the possible strings
that can be used for principal names.

[1]
http://msdn.microsoft.com/library/default.asp?url=/library/en-us/secauthz/security/ace_strings.asp
[2]
http://msdn.microsoft.com/library/default.asp?url=/library/en-us/secauthz/security/sid_strings.asp

Starting wpa_supplicant as a Windows service (wpasvc.exe)
----

wpa_supplicant can be started as a Windows service by using wpasvc.exe
program that is alternative build of wpa_supplicant.exe. Most of the
core functionality of wpasvc.exe is identical to wpa_supplicant.exe,
but it is using Windows registry for configuration information instead
of a text file and command line parameters. In addition,
 it can be
registered as a service that can be started automatically or manually
like any other Windows service.

The root of wpa_supplicant configuration in registry is
HKEY_LOCAL_MACHINE\SOFTWARE\wpa_supplicant. This level includes global
parameters and a 'interfaces' subkey with all the interface configuration
(adapter to confname mapping). Each such mapping is a subkey that has
'adapter', 'config', and 'ctrl_interface' values.

This program can be run either as a normal command line application,
e.g., for debugging, with 'wpasvc.exe app' or as a Windows service.
Service need to be registered with 'wpasvc.exe reg <full path to
wpasvc.exe>'. Alternatively, 'wpasvc.exe reg' can be used to register
the service with the current location of wpasvc.exe. After this, wpasvc
can be started like any other Windows service (e.g., 'net start wpasvc')
or it can be configured to start automatically through the Services tool
in administrative tasks. The service can be unregistered with
'wpasvc.exe
 unreg'.

If the service is set to start during system bootup to make the
network connection available before any user has logged in, there may
be a long (half a minute or so) delay in starting up wpa_supplicant
due to WinPcap needing a driver called "Network Monitor Driver" which
is started by default on demand.

To speed up wpa_supplicant start during system bootup, "Network
Monitor Driver" can be configured to be started sooner by setting its

startup type to System instead of the default Demand. To do this, open
up Device Manager, select Show Hidden Devices, expand the "Non
Plug-and-Play devices" branch, double click "Network Monitor Driver",
go to the Driver tab, and change the Demand setting to System instead.

Configuration data is in HKEY_LOCAL_MACHINE\SOFTWARE\wpa_supplicant\configs
key. Each configuration profile has its own key under this. In terms of text
files, each profile would map to a separate text file with possibly multiple
networks. Under each profile, there is a
 networks key that lists all
networks as a subkey. Each network has set of values in the same way as
network block in the configuration file. In addition, blobs subkey has
possible blobs as values.

HKEY_LOCAL_MACHINE\SOFTWARE\wpa_supplicant\configs\test\networks\0000
 ssid="example"
 key_mgmt=WPA-PSK

See win_example.reg for an example on how to setup wpasvc.exe
parameters in registry. It can also be imported to registry as a
starting point for the configuration.

Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/README-
Windows.txt
No license file was found, but licenses were detected in source scan.

/*
* WPA Supplicant / dbus-based control interface
* Copyright (c) 2006, Dan Williams <dcbw@redhat.com> and Red Hat, Inc.
* Copyright (c) 2009-2010, Witold Sowa <witold.sowa@gmail.com>
* Copyright (c) 2009-2015, Jouni Malinen <j@w1.fi>
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* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-
gz/wpa_supplicant/dbus/dbus_new_handlers.c
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/*
* WPA Supplicant - binder interface for wpa_supplicant daemon
* Copyright (c) 2004-2016, Jouni Malinen <j@w1.fi>
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* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-

gz/wpa_supplicant/binder/fi/w1/wpa_supplicant/ISupplicant.aidl

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* WPA Supplicant / UNIX domain socket -based control interface

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* binder interface for wpa_supplicant daemon

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*/

package fi.w1.wpa_supplicant;

/**

* Interface exposed by wpa_supplicant for each network interface it controls.

*/

interface IIface {

}

Found in path(s):

* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-

gz/wpa_supplicant/binder/fi/w1/wpa_supplicant/IIface.aidl

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/*

* WPA Supplicant / Windows Named Pipe -based control interface

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* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-
gz/wpa_supplicant/ctrl_iface_named_pipe.c
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* Generic advertisement service (GAS) query
* Copyright (c) 2009, Atheros Communications
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* WPA Supplicant - Scanning
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Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/scan.h
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/scan.c
No license file was found, but licenses were detected in source scan.

/*
* WPA Supplicant - Glue code to setup EAPOL and RSN modules
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Found in path(s):
* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpas_glue.c
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* wpa_gui - WpaGui class

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/*

* WPA Supplicant - test code for pre-authentication

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*

* IEEE 802.1X Supplicant test code (to be used in place of wpa_supplicant.c.

* Not used in production version.

*/

Found in path(s):

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/*

* wpa_supplicant - IBSS RSN

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wpa_gui icon files

To convert the svg icons to other formats, make sure inkscape and imagemagick
are installed and use `make' to create various sized png and xpm icons.

wpa_gui.svg

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ap.svg
------

mystica_Wireless_Router.svg

http://openclipart.org/media/files/mystica/8390
Wireless Router
by: mystica
last change: April 20, 2008 10:32 pm (File added)
date: April 20, 2008 10:31 pm
license: PD

laptop.svg
----

metalmarious_Laptop.svg

http://openclipart.org/media/files/metalmarious/4056
Laptop
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group.svg
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http://www.openclipart.org/detail/25428
http://www.openclipart.org/people/Anonymous/Anonymous_Network.svg
Uploader:
    Anonymous
Drawn by:
    Andrew Fitzsimon / Anonymous
Created:
    2009-04-29 04:07:37
Description:
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invitation.svg

----

http://www.openclipart.org/detail/974

http://www.openclipart.org/people/jean_victor_balin/jean_victor_balin_unknown_green.svg

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  2006-10-27 02:12:13

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* /opt/cola/permits/1832084929_1698262264.028356/0/wpa-supplicant-1-tar-gz/wpa_supplicant/wpa_gui-qt4/icons/README

1.56 openssl 1.0.1k

1.56.1 Available under license :

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University of Cambridge Computing Service,
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PCRE JUST-IN-TIME COMPILATION SUPPORT

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1.63 tinydtls 0.4.0

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/**
* rijndael-alg-fst.c
*
* @version 3.0 (December 2000)
*
* Optimised ANSI C code for the Rijndael cipher (now AES)
*
* @author Vincent Rijmen <vincent.rijmen@esat.kuleuven.ac.be>
* @author Antoon Bosselaers <antoon.bosselaers@esat.kuleuven.ac.be>
* @author Paulo Barreto <paulo.barreto@terra.com.br>
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/**
* rijndael-alg-fst.h
*
* @version 3.0 (December 2000)
*
* Optimised ANSI C code for the Rijndael cipher (now AES)
*
* @author Vincent Rijmen <vincent.rijmen@esat.kuleuven.ac.be>
* @author Antoon Bosselaers <antoon.bosselaers@esat.kuleuven.ac.be>
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* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/hmac.h
* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/ccm.h
* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/global.h
* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/dtls.c
* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/ccm.c
* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/crypto.h
* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/crypto.c
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* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/doc/html/dtls-server_8c_source.html
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/* dtls -- a very basic DTLS implementation
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* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/state.h

* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/peer.c
* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/dtls_time.c
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* $ Id: list.h,v 1.5 2010/09/13 13:31:00 adamdunkels Exp $
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VERSION:

This is version 1.0 RELEASE

While this is my "release" version, due to lack of additional
official test vectors against which to verify this implementation's
correctness, beware that there may be implementation bugs. Also,
it has not yet been tested on very many other architectures,
big-endian machines in particular.

LICENSE:

This implementation is released freely under an open-source BSD
license which appears at the top of each source code file.

WHAT IT IS:

The files sha2.h and sha2.c implement the SHA-256, SHA-384, and SHA-512
hash algorithms as described in the PDF document found at the following
web address:

 http://csrc.nist.gov/cryptval/shs/sha256-384-512.pdf

The interface is similar to the interface to SHA-1 found in the OpenSSL
library.

The file sha2prog.c is a simple program that accepts input from either
STDIN or reads one or more files specified on the command line, and then
generates
 the specified hash (either SHA-256, SHA-384, SHA-512, or any
combination thereof, including all three at once).

LIMITATIONS:

This implementation has several limitations:

* Input data is only accepted in octet-length increments. No sub-byte
 data is handled. The NIST document describes how to handle sub-byte

input data, but for ease of implementation this version will only
accept message data in multiples of bytes.
* This implementation utilizes 64-bit integer data types. If your
system and compiler does not have a 64-bit integer data type, this
implementation will not work.
* Because of the use of 64-bit operations, many 32-bit architectures
that do have 64-bit data types but do operations most efficiently
on 32-bit words, this implementation may be slower than an
implementation designed to use only 32-bit words (emulating the
64-bit operations).
* On platforms with 128-bit integer data types, the SHA-384 and SHA-512
bit counters used by this implementation
might be better off using
the 128-bit type instead of simulating it with two 64-bit integers.
* This implementation was written in C in hopes of portability and for
the fun of it during my spare time. It is probably not the most
efficient or fastest C implementation. I welcome suggestions,
however, that suggest ways to speed things up without breaking
portability. I also welcome suggestions to improve portability.
* As mentioned above, this code has NOT been thoroughly tested.
This is perhaps the most severe limitation.

BEFORE YOU COMPILE (OPTIONS):

Each of the options described below may either be defined in the sha2.h
header file (or in the sha2.c file in some cases), or on the command
line at compile time if your compiler supports such things. For
example:

 #define SHA2_USE_INTTYPES_H
 #define SHA2_UNROLL_TRANSFORM

Or:

 cc -c -DSHA2_UNROLL_TRANSFORM sha2.c
 cc -c -DBYTE_ORDER=4321 -DBIG_ENDIAN=4321 sha2.c

Here are the available options.
  Read on below for a description of
each one:

 SHA2_USE_INTTYPES_H
 SHA2_USE_MEMSET_MEMCPY/SHA2_USE_BZERO_BCOPY
 SHA2_UNROLL_TRANSFORM
 BYTE_ORDER (LITTLE_ENDIAN/BIG_ENDIAN)

* SHA2_USE_INTTYPES_H option:

By default, this code uses u_intXX_t data types for 8 bit, 32 bit, and 64 bit unsigned integer type definitions. Most BSD systems define these, as does Linux. However, some (like Compaq's Tru64 Unix) may instead use uintXX_t data types as defined by recent ANSI C standards and as included in the inttypes.h header file. Those wanting to use inttypes.h need to define this either in sha.h or at compile time.

On those systems where NEITHER definitions are available, you will need to edit both sha2.h and sha2.c and define things by hand in the appropriate sections.

* BYTE_ORDER definitions:
This code assumes that BYTE_ORDER will be defined by the system during compile to either equal LITTLE_ENDIAN or BIG_ENDIAN. If your system does not define these, you may need to define them
 by hand in the sha.c
file according to the byte ordering conventions of your system.

* SHA2_USE_MEMSET_MEMCPY or SHA2_USE_BZERO_BCOPY
The code in sha2.c can use either memset()/memcpy() for memory block operations, or bzero()/mcopy(). If you define neither of these, the code will default to memset()/memcpy(). You can define either at the command line or in sha2.h or in sha2.c.

* SHA2_UNROLL_TRANSFORM
By defining this either on the command line or in sha2.h or sha2.c, the code will use macros to partially "unroll" the SHA transform function. This usually generates bigger executables. It CAN (but not necessarily WILL) generate faster code when you tell your compiler to optimize things. For example, on the FreeBSD and Linux x86 systems I tested things on (using gcc), when I optimized with just -O2 and unrolled the transform, the hash transform was faster by 15-30%. On these same systems, if I did NO optimization, the unrolled transform was SLOWER, much slower (I'm guessing because
 the code was breaking
the cache, but I'm not sure). Your mileage may vary.

PORTABILITY:

The code in sha2.c and sha2.h is intended to be portable. It may require that you do a few #definitions in the .h file. I've successfully compiled and tested the sha2.c and sha2.h code on Apple's OS X (on a PPC), FreeBSD 4.1.1 on Intel, Linux on Intel, FreeBSD on the Alpha, and even under Windows98SE using Metrowerks C. The utility/example programs (sha2prog.c, sha2test.c, and sha2speed.c) will very likely have more trouble in portability since they do I/O.

To get sha2.c/sha2.h working under Windows, I had to define
SHA2_USE_INTTYPES_H, BYTE_ORDER, LITTLE_ENDIAN, and had to comment
out the include of <sys/types.h> in sha2.h. With a bit more work
I got the test program to run and verified that all the test
cases passed.

SUGGESTIONS/BUG FIXES:

If you make changes to get it working on other architectures, if you fix
any bugs, or if you make changes that improve this implementation's
efficiency
 that would be relatively portable and you're willing to release
your changes under the same license, please send them to me for possible
inclusion in future versions.

If you know where I can find some additional test vectors, please let me
know.

CHANGE HISTORY:

0.8 to 0.9 - Fixed spelling errors, changed to u_intXX_t type usage,
   removed names from prototypes, added prototypes to sha2.c,
   and a few things I can't recall.

0.9 to 0.9.5 - Add a new define in sha2.c that permits one to compile
   it to either use memcpy()/memset() or bcopy()/bzero()
   for memory block copying and zeroing. Added support
   for unrolled SHA-256/384/512 transform loops. Just
   compile with SHA2_UNROLL_TRANSFORM to enable. It takes
   longer to compile, but I hope it is a bit faster. I
   need to do some test to see whether or not it is. Oh,
   in sha2.c, you either need to define SHA2_USE_BZERO_BCOPY
   or SHA2_USE_MEMSET_MEMCPY to choose which way you want
   to compile. *Whew*
  It's amazing how quickly something
   simple starts to grow more complex even in the span of
   just a few hours. I didn't really intend to do this much.
0.9.5 to 0.9.6 - Added a test program (sha2test) which tests against several
            known test vectors. WARNING: Some of the test output
            hashes are NOT from NIST's documentation and are the
            output of this implementation and so may be incorrect.
0.9.6 to 0.9.7 - Fixed a bug that could cause invalid output in certain
   cases and added an assumed scenario where zero-length
   data is hashed. Also changed the rotation macros to use
   a temporary variable as this reduces the number of operations.
   When data is fed in blocks of the right length, copying of

data is reduced in this version. Added SHAYXZ_Data()

functions for ease of hashing a set of data. Added another

file sha2speed.c for doing speed testing. Added another test

vector with a larger data size

(16KB). Fixed u_intXX_t and

uintXX_t handling by adding a define for SHA2_USE_INTTYPES_H

as well as made a few other minor changes to get rid of

warnings when compiling on Compaq's Tru64 Unix.

0.9.7 to 0.9.8 - The bug fix in 0.9.7 was incomplete and in some cases made

things worse. I believe that 0.9.8 fixes the bug completely

so that output is correct. I cannot verify this, however,

because of the lack of test vectors against which to do such

verification. All versions correctly matched the very few

NIST-provided vectors, but unfortunately the bug only

appeared in longer message data sets.

0.9.8 to 0.9.9 - Fixed some really bad typos and mistakes on my part that

only affected big-endian systems. I didn't have direct

access for testing before this version. Thanks to

Lucas Marshall for giving me access to his

OS X system.

0.9.9 to 1.0.0b1 Added a few more test samples and made a few changes to

make things easier compiling on several other platforms.

Also I experimented with alternate macro definitions

in the SHA2_UNROLL_TRANSFORM version (see sha2.slower.c)

and eliminated the T1 temporary variable (the compiler

would of course still use internal temporary storage

during expression evaluation, but I'd hoped the compiler

would be more efficient), but unfortunately under FreeBSD

4.1.1-STABLE on an x86 platform, the change slowed things

down.

1.0.0b1 to 1.0 RELEASE Fixed an off-by-one implementation bug that affected

SHA-256 when hashed data length $L = 55 + 64 * X$ where X is

either zero or a positive integer, and another (basically

the same bug) bug in SHA-384 and SHA-512 that

showed up when

hashed data lengths $L = 111 + 128 * X$. Thanks to Rogier

van de Pol for sending me test data that revealed the bug.

The fix was very simple (just two tiny changes). Also,

I finally put the files into RCS so future changes will be

easier to manage. The sha2prog.c file was rewritten to

be more useful to me, and I got rid of the old C testing

program and now use a perl script with a subdirectory full

of test data. It's a more flexible test system.

LATEST VERSION:

The latest version and documentation (if any ;) should always be available

on the web at:

http://www.aarongifford.com/computers/sha.html

CONTACT ME:

I can be reached via email at:

Aaron Gifford <m e @ a a r o n g i f f o r d . c o m>

Please don't send support questions. I don't have the time to answer and
they'll probably be ignored. Bug fixes, or patches that add something
 useful
will be gratefully accepted, however.

If you use this implementation, I would enjoy getting a brief email message
letting me know who you are and what use to which it is being put. There
is no requirement to do so. I just think it would be fun.

EXAMPLES:

Here's an example of compiling and using the sha2 program (in this example
I build it using the unrolled transform version with -O2 optimizations),
and then running the perl testing script:

 cc -O2 -DSHA2_UNROLL_TRANSFORM -Wall -o sha2 sha2prog.c sha2.c
 % ./sha2test.pl

 [most of the perl script output deleted for brevity]

 ===== RESULTS (18 VECTOR DATA FILES HASHED) =====

 HASH TYPE   NO. OF TESTS   PASSED FAILED
 ---------   ------------   ------ ------
 SHA-256   18   18   0
 SHA-384   18   18   0
 SHA-512   18   18   0

 TOTAL: 54   54
 0

 NO ERRORS! ALL TESTS WERE SUCCESSFUL!

 ALL TEST VECTORS PASSED!

That's all folks! Have fun!

Aaron out.

Found in path(s):
* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/sha2/README
No license file was found, but licenses were detected in source scan.

/*
* FILE: sha2speed.c
* AUTHOR: Aaron D. Gifford - http://www.aarongifford.com/
*
* Copyright (c) 2000-2001, Aaron D. Gifford
* All rights reserved.
*
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* LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY
* OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF
* SUCH DAMAGE.
*
* $Id: sha2speed.c,v 1.1 2001/11/08 00:02:23 adg Exp adg $
*/

Found in path(s):
* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/sha2/sha2speed.c
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/* alert.h -- DTLS alert protocol
*

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* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/alert.h
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*/

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* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/tests/ccm-testdata.c
* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/numeric.h
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* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-
0.4.0/doc/html/crypto_8h_source.html
* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-
0.4.0/doc/html/debug_8c_source.html
*
 /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-
0.4.0/doc/html/dtls_8c_source.html
* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-
0.4.0/doc/html/global_8h_source.html
* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-
0.4.0/doc/html/state_8h_source.html
* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-
0.4.0/doc/html/peer_8h_source.html
* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-
0.4.0/doc/html/dtls_8h_source.html
* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-
0.4.0/doc/html/numeric_8h_source.html
* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-
0.4.0/doc/html/peer_8c_source.html
* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-
0.4.0/doc/html/alert_8h_source.html
* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-
0.4.0/doc/html/dtls__time_8h_source.html
*
 /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-
0.4.0/doc/html/crypto_8c_source.html

* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/doc/html/hmac_8c_source.html

* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/doc/html/ccm_8h_source.html

* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/doc/html/ccm_8c_source.html

* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/doc/html/dtls__time_8c_source.html

* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/doc/html/hmac_8h_source.html

* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/doc/html/debug_8h_source.html

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```
#                              -*- Autoconf -*-
# Process this file with autoconf to produce a configure script.
#
# Copyright (C) 2011--2012 Olaf Bergmann <bergmann@tzi.org>
#
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# ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN
# CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE
# SOFTWARE.

AC_PREREQ([2.65])
AC_INIT([tinydtls], [0.4.0])
AC_CONFIG_SRCDIR([dtls.c])
dnl AC_CONFIG_HEADERS([config.h])

# First check for Contiki build to quit configure before any other test
AC_ARG_WITH(contiki,
 [AS_HELP_STRING([--with-contiki],[build libtinydtls for the Contiki OS])],
```

```
 [cp -p Makefile.contiki Makefile
 cp -p config.h.contiki config.h
 AC_MSG_NOTICE([Contiki build prepared])
 exit 0],
[])

# Checks for programs.
AC_PROG_MAKE_SET
AC_PROG_CC
AC_PROG_RANLIB
AC_PATH_PROG(DOXYGEN, doxygen, [:])
AC_PATH_PROG(ETAGS, etags, [/bin/false])

AC_C_BIGENDIAN

# Checks for libraries.
AC_SEARCH_LIBS([gethostbyname], [nsl])
AC_SEARCH_LIBS([socket], [socket])
dnl AC_CHECK_LIB([dl],
 [dlopen])

AC_ARG_WITH(debug,
 [AS_HELP_STRING([--without-debug],[disable all debug output and assertions])],
 [CPPFLAGS="${CPPFLAGS} -DNDEBUG"],
 [])

CPPFLAGS="${CPPFLAGS} -DDTLSv12 -DWITH_SHA256"
OPT_OBJS="${OPT_OBJS} sha2/sha2.o"

AC_SUBST(OPT_OBJS)

# Checks for header files.
AC_CHECK_HEADERS([assert.h arpa/inet.h fcntl.h inttypes.h netdb.h netinet/in.h stddef.h stdint.h stdlib.h string.h
strings.h sys/param.h sys/socket.h sys/time.h time.h unistd.h])

# Checks for typedefs, structures, and compiler characteristics.
AC_C_INLINE
AC_TYPE_SIZE_T
dnl AC_TYPE_UINT8_T
dnl AC_TYPE_UINT16_T
dnl AC_TYPE_UINT32_T
dnl AC_TYPE_UINT64_T

AC_CHECK_MEMBER([struct sockaddr_in6.sin6_len],
 [AC_DEFINE(HAVE_SOCKADDR_IN6_SIN6_LEN, [1],
        [Define to 1 if struct sockaddr_in6 has a member sin6_len.])], [],
 [#include <netinet/in.h>])
```

Checks for library functions.
AC_FUNC_MALLOC
AC_CHECK_FUNCS([memset select socket strdup strerror strnlen fls])

AC_CONFIG_HEADERS([config.h])

AC_CONFIG_FILES([Makefile
          doc/Makefile
          doc/Doxyfile
          tests/Makefile
    sha2/Makefile
    aes/Makefile])
AC_OUTPUT

Found in path(s):
* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/configure.in
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* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-
0.4.0/doc/html/utlist_8h_source.html
*
 /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-
0.4.0/doc/html/uthash_8h_source.html
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/* dtls -- a very basic DTLS implementation
 *
 * Copyright (C) 2011--2013 Olaf Bergmann <bergmann@tzi.org>
 *
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 * obtaining a copy of this software and associated documentation
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 * modify, merge, publish, distribute, sublicense, and/or sell copies
 * of the Software, and to permit persons to whom the Software is
 * furnished to do so, subject to the following conditions:

```
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* BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN
* ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN
* CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE
* SOFTWARE.
*/
/**
* @mainpage
*
* @author Olaf Bergmann, TZI Uni Bremen
*
* This library provides a very simple datagram server with DTLS
* support. It is designed to support session multiplexing in
* single-threaded applications and thus targets specifically on
* embedded systems.
*
* @section license License
*
* This software is under the <a
* href="http://www.opensource.org/licenses/mit-license.php">MIT License</a>.
*
* @subsection uthash UTHash
*
* This library uses <a href="http://uthash.sourceforge.net/">uthash</a> to manage
* its peers (not used for Contiki). @b uthash uses the <b>BSD revised license</b>, see
* <a href="http://uthash.sourceforge.net/license.html">http://uthash.sourceforge.net/license.html</a>.
*
 * @subsection sha256 Aaron D. Gifford's SHA256 Implementation
*
* tinyDTLS provides HMAC-SHA256 with BSD-licensed code from Aaron D. Gifford,
* see <a href="http://www.aarongifford.com/">www.aarongifford.com</a>.
*
* @subsection aes Rijndael Implementation From OpenBSD
*
* The AES implementation is taken from rijndael.{c,h} contained in the crypto
* sub-system of the OpenBSD operating system. It is copyright by Vincent Rijmen, *
* Antoon Bosselaers and Paulo Barreto. See <a
* href="http://www.openbsd.org/cgi-bin/cvsweb/src/sys/crypto/rijndael.c">rijndael.c</a>
* for License info.
*
```

* @section download Getting the Files
*
* You can get the sources either from the <a
* href="http://sourceforge.net/projects/tinydtls/files">downloads section or
* through git from the <a
* href="http://sourceforge.net/projects/tinydtls/develop">project develop page.
*
* @section config Configuration
*
* Use @c configure to set up everything for a successful build. For
 Contiki, use the
* option @c --with-contiki.
*
* @section build Building
*
* After configuration, just type
* @code
make
* @endcode
* optionally followed by
* @code
make install
* @endcode
* The Contiki version is integrated with the Contiki build system, hence you do not
* need to invoke @c make explicitely. Just add @c tinydtls to the variable @c APPS
* in your @c Makefile.
*
* @addtogroup dtls_usage DTLS Usage
*
* @section dtls_server_example DTLS Server Example
*
* This section shows how to use the DTLS library functions to setup a
* simple secure UDP echo server. The application is responsible for the
* entire network communication and thus will look like a usual UDP
* server with socket creation and binding and a typical select-loop as
* shown below. The minimum configuration required for DTLS is the
* creation of the dtls_context_t using dtls_new_context(), and a callback
* for sending data. Received packets are read by the application and
* passed to
 dtls_handle_message() as shown in @ref dtls_read_cb.
* For any useful communication to happen, read and write call backs
* and a key management function should be registered as well.
*
* @code
dtls_context_t *the_context = NULL;
int fd, result;

static dtls_handler_t cb = {

```
   .write = send_to_peer,
   .read  = read_from_peer,
   .event = NULL,
   .get_key = get_key
 };

 fd = socket(...);
 if (fd < 0 || bind(fd, ...) < 0)
   exit(-1);

 the_context = dtls_new_context(&fd);
 dtls_set_handler(the_context, &cb);

 while (1) {
   ...initialize fd_set rfds and timeout ...
   result = select(fd+1, &rfds, NULL, 0, NULL);

   if (FD_ISSET(fd, &rfds))
     dtls_handle_read(the_context);
 }

 dtls_free_context(the_context);
 * @endcode
 *
 * @subsection dtls_read_cb The Read Callback
 *
 * The DTLS library expects received raw data to be passed to
 * dtls_handle_message(). The application is responsible for
 * filling a session_t structure with the address data of the
 * remote
 peer as illustrated by the following example:
 *
 * @code
 int dtls_handle_read(struct dtls_context_t *ctx) {
  int *fd;
  session_t session;
  static uint8 buf[DTLS_MAX_BUF];
  int len;

  fd = dtls_get_app_data(ctx);

  assert(fd);

  session.size = sizeof(session.addr);
  len = recvfrom(*fd, buf, sizeof(buf), 0, &session.addr.sa, &session.size);

  return len < 0 ? len : dtls_handle_message(ctx, &session, buf, len);
 }
```

* @endcode
*
* Once a new DTLS session was established and DTLS ApplicationData has been
* received, the DTLS server invokes the read callback with the MAC-verified
* cleartext data as its argument. A read callback for a simple echo server
* could look like this:
* @code
int read_from_peer(struct dtls_context_t *ctx, session_t *session, uint8 *data, size_t len) {
 return dtls_write(ctx, session, data, len);
}
* @endcode
*
* @subsection dtls_send_cb The Send Callback
*
* The callback function send_to_peer() is called whenever data must be
*
 sent over the network. Here, the sendto() system call is used to
* transmit data within the given session. The socket descriptor required
* by sendto() has been registered as application data when the DTLS context
* was created with dtls_new_context().
* Note that it is on the application to buffer the data when it cannot be
* sent at the time this callback is invoked. The following example thus
* is incomplete as it would have to deal with EAGAIN somehow.
* @code
int send_to_peer(struct dtls_context_t *ctx, session_t *session, uint8 *data, size_t len) {
 int fd = *(int *)dtls_get_app_data(ctx);
 return sendto(fd, data, len, MSG_DONTWAIT, &session->addr.sa, session->size);
}
* @endcode
*
* @subsection dtls_get_key The Key Storage
*
* When a new DTLS session is created, the library must ask the application
* for keying material. To do so, it invokes the registered call-back function
* get_key() with the current context and session information as parameter.
* When the function
 is called with the @p id parameter set, the result must
* point to a dtls_key_t structure for the given identity. When @p id is
* @c NULL, the function must pick a suitable identity and return a pointer to
* the corresponding dtls_key_t structure. The following example shows a
* simple key storage for a pre-shared key for @c Client_identity:
*
* @code
int get_key(struct dtls_context_t *ctx,
 const session_t *session,
 const unsigned char *id, size_t id_len,
 const dtls_key_t **result) {

```
static const dtls_key_t psk = {
  .type = DTLS_KEY_PSK,
  .key.psk.id = (unsigned char *)"my identity",
  .key.psk.id_length = 11,
  .key.psk.key = (unsigned char *)"secret",
  .key.psk.key_length = 6
};
```

 *result = &psk;
 return 0;
 }
* @endcode
*
* @subsection dtls_events The Event Notifier
*
* Applications that want to be notified whenever the status of a DTLS session
* has changed can register an event handling function with the field @c event
* in the
 dtls_handler_t structure (see \ref dtls_server_example). The call-back
* function is called for alert messages and internal state changes. For alert
* messages, the argument @p level will be set to a value greate than zero, and
* @p code will indicate the notification code. For internal events, @p level
* is @c 0, and @p code a value greater than @c 255.
*
* Currently, the only defined internal event is @c DTLS_EVENT_CONNECTED. It
* indicates successful establishment of a new DTLS channel.
*
* @code
int handle_event(struct dtls_context_t *ctx, session_t *session,
          dtls_alert_level_t level, unsigned short code) {
 ... do something with event ...
 return 0;
 }
* @endcode
*
* @section dtls_client_example DTLS Client Example
*
* A DTLS client is constructed like a server but needs to actively setup
* a new session by calling dtls_connect() at some point. As this function
* usually returns before the new DTLS channel is established, the application
* must
 register an event handler and wait for @c DTLS_EVENT_CONNECT before
* it can send data over the DTLS channel.
*
*/

Found in path(s):
* /opt/cola/permits/1846797585_1700034770.4897707/0/tinydtls-0-4-0-tar-gz/tinydtls-0.4.0/dtls.h

1.64 sg3-utils 1.48

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