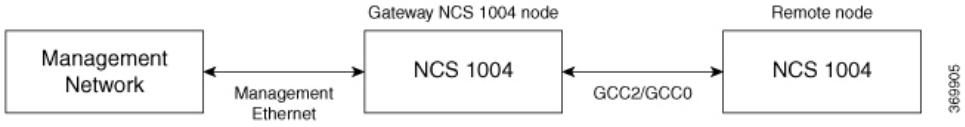
Understanding Remote Node Management Using GCC

The remote node management feature allows you to remotely manage NCS 1004 nodes over the General Communication Channel (GCC) interface. The remote nodes that are not connected to the management network over the Ethernet interface can be managed over the GCC interface. This feature supports remote management of up to eight nodes in hub topology and up to two nodes in linear topology.

Figure 1: Remote Node Management in Linear Topology



The remote nodes can be dynamically discovered over the GCC interface using OSPF. The connectivity to the management network can be achieved using OSPF and static routes.

Note The GCC2 and GCC0 interfaces are supported in NCS 1004. The GCC0 interface is supported on the Coherent DSP controller whereas the GCC2 interface is supported on the ODU controller.

Note The GCC0 and GCC2 interfaces are supported in Muxponder and Muxponder slice modes. Only the GCC0 interface is supported in the Regeneration (Regen) mode.

Remote Node Management on OTN-XP Card

Table 1: Feature History

Feature Name	Release Information	Feature Description
GCC Support for OTN-XP Card	Cisco IOS XR Release 7.3.2	The node supports a maximum of 48 GCC (GCC0 and GCC1) channels for each OTN-XP card.

From R7.2.1 onwards, the OTN-XP card provides OTU interface that supports communication channels between adjacent network elements or nodes using GCC bytes in the OTN header. Remote node management is supported over the GCC interface.

From R7.2.1 onwards, the node supports GCC0 on the corresponding OTU2, OTU2e, and OTU4 interfaces. The node (Cisco FPGA) supports a maximum of 22 GCC channels for each card.

Note The GCC0 and GCC1 interfaces are supported on OTN-XP card and GCC2 interface is not supported.

From R7.3.1 onwards, the node supports GCC0 on the corresponding OTU2, OTU2e, OTU4, and Coherent DSP interfaces, and GCC1 on OTN ODU controller (ODU2, ODU2E, ODU4, and ODUCn).

From R7.3.2 onwards, the node (Cisco FPGA) supports a maximum of 48 GCC (GCC0 and GCC1) channels for each card.

Limitations

- gRPC is not supported over the GCC interface. Therefore, Open Config and streaming telemetry are not supported over the GCC interface.
- Only the Tx and Rx packet count information are available in GCC statistics.
- The devices can be remotely managed over the GCC interface only when they are connected to the management network through GCC. Therefore, initial provisioning and bringing up of the GCC interface must be performed either through the console or management Ethernet interface.
- The following headless or high availability events at the intermediate nodes may affect remote node management of subsequent nodes:
  - Reload of the route processor
  - Reload of IOS XR
  - Restart of the driver process
- IP fragmentation is not supported on GCC interface for the SCP protocol. As a workaround, you can apply any of the following configurations to limit the maximum packet size below the fragmentation limit (1454 bytes):
  - Use the **tcp mss** <*maximum segment size*> command (for example, **tcp mss** *1200*) in the global configuration mode. The maximum segment limit is applied to all interfaces.
  - Use the **ipv4 mtu** <*MTU size*> command in the interface configuration mode. The MTU size is applied only to the specified interface.

Supported Protocols

The following protocols are supported over the GCC interface.

- PING
- SSH
- TELNET
- SCP
- TFTP
- FTP
- SFTP
- HTTP
- HTTPS
- OSPF

Enable the GCC Interface

Enable the GCC Interface on 1.2T Card

To enable the GCC2 interface for the 1.2T line card, use the following commands:

```
configure
controller odu4 R/S/I/P/L
gcc2
commit
exit
```

To enable the GCC0 interface for the 1.2T line card, use the following commands:

```
configure
controller CoherentDSP R/S/I/P
gcc0
commit
exit
```

Enable the GCC Interface on OTN-XP Card

To enable the GCC0 interface for the OTN-XP card, use the following commands:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller {otu2 | otu2e | otu4} R/S/I/P/L
RP/0/RP0/CPU0:ios(config-otu)#gcc0
RP/0/RP0/CPU0:ios(config-otu)#commit
RP/0/RP0/CPU0:ios(config-otu)#exit
```

The following example displays how to enable the GCC0 interface for the OTN-XP card on OTU2 controller.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller otu2 0/0/0/4/1
RP/0/RP0/CPU0:ios(config-otu2)#gcc0
RP/0/RP0/CPU0:ios(config-otu2)#commit
RP/0/RP0/CPU0:ios(config-otu2)#exit
```

To enable the GCC1 interface for the OTN-XP card, use the following commands:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller {odu2 | odu2e | odu4 | oducn} R/S/I/P/L
RP/0/RP0/CPU0:ios(config-odu)#gcc1
RP/0/RP0/CPU0:ios(config-odu)#commit
RP/0/RP0/CPU0:ios(config-odu)#exit
```

The following example displays how to enable the GCC1 interface for the OTN-XP card on ODU2 controller.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#controller odu2 0/0/0/4/1
RP/0/RP0/CPU0:ios(config-odu2)#gcc1
RP/0/RP0/CPU0:ios(config-odu2)#commit
RP/0/RP0/CPU0:ios(config-odu2)#exit
```

Configure the GCC Interface

Configure the GCC Interface on 1.2T Card

To configure the GCC2 interface using the static IP address for the 1.2T card, use the following commands:

configure

interface gcc2 *R/S/I/P/L*

ipv4 address *ipv4-address*

commit

exit

To configure the GCC0 interface using the static IP address for the 1.2T card, use the following commands:

configure

interface gcc0 *R/S/I/P*

ipv4 address *ipv4-address*

commit

exit

Configure the GCC Interface on OTN-XP Card

To configure the GCC0 interface on OTN-XP card, use the following commands:

configure

interface gcc0 *R/S/I/P*

ipv4 address *ipv4-address net-mask*

commit

exit

To configure the GCC1 interface on OTN-XP card, use the following commands:

configure

interface gcc1 *R/S/I/P*

ipv4 address *ipv4-address net-mask*

commit

exit

Examples

The following sample displays how to configure the GCC2 interface using the static IP address on 1.2T card:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#interface gcc2 0/1/0/0/1
RP/0/RP0/CPU0:ios(config-if)#ipv4 address 198.51.100.244 255.255.255.0
RP/0/RP0/CPU0:ios(config-if)#commit
RP/0/RP0/CPU0:ios(config-if)#exit
RP/0/RP0/CPU0:ios(config)#exit
RP/0/RP0/CPU0:ios#show run interface gcc2 0/1/0/0/1
interface GCC20/1/0/0/1
 ipv4 address 10.1.1.1 255.255.255.0
!
```

The following sample displays how to configure the GCC2 interface using the loopback IP address on 1.2T card.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:R2(config)#interface gcc2 0/1/0/0/1
RP/0/RP0/CPU0:R2(config-if)#ipv4 unnumbered loopback 0
RP/0/RP0/CPU0:ios(config-if)#exit
RP/0/RP0/CPU0:ios(config)#exit
```

The following sample checks the status of GCC2 interface.

```
RP/0/RP0/CPU0:ios#show ipv4 interface brief
Wed Sep 22 17:10:04.190 IST

Interface                      IP-Address         Status          Protocol Vrf-Name
GCC20/0/0/0/1                  198.51.100.234        Up              Up       default
GCC20/3/0/1/3                  198.51.100.244        Up              Up       default
Loopback0                      198.51.100.224        Up              Up       default
```

The following sample displays how to configure the GCC0 interface using the static IP address on 1.2T or OTN-XP card.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#interface gcc0 0/1/0/0
P/0/RP0/CPU0:ios(config-if)#ipv4 address 198.51.100.244 255.255.255.0
RP/0/RP0/CPU0:ios(config-if)#commit
RP/0/RP0/CPU0:ios(config-if)#exit
RP/0/RP0/CPU0:ios(config)#exit
```

```
RP/0/RP0/CPU0:ios#show run interface gcc0 0/1/0/0
interface GCC00/1/0/0
 ipv4 address 198.51.100.244 255.255.255.0
!
```

The following sample displays how to configure the GCC0 interface using the loopback IP address on 1.2T or OTN-XP card.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:R2(config)#interface gcc0 0/1/0/0
RP/0/RP0/CPU0:R2(config-if)#ipv4 unnumbered loopback 0
RP/0/RP0/CPU0:ios(config-if)#exit
RP/0/RP0/CPU0:ios(config)#exit
```

Configure Static Routes Over the GCC Interface

To configure the static routes over the GCC interface, use the following commands:

configure

router static address-family ipv4 unicast 0.0.0.0/0 *default-gateway*

exit

Examples

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#router static address-family ipv4 unicast 0.0.0.0/0 10.105.57.1
RP/0/RP0/CPU0:ios(config)#exit
```

Configure OSPF Routes Over the GCC Interface

To configure OSPF routes over the GCC interface, use the following commands:

configure

router ospf *process-id*

router-id *ip-address*

area *area-id*

interface *type R/S/I/P/L*

exit

Examples

The following is a sample to configure OSPF routes over the GCC interface.

Gateway Node:

```
configure
router ospf 1
router-id 192.0.2.89
```

```
 area 0

  interface Loopback0

  !

  interface MgmtEth0/RP0/CPU0/1

  !

  interface GCC20/0/0/0/1

  !

  interface GCC20/0/0/0/2
```

Remote Node:

```
configure
router ospf 1
router-id 192.0.2.92
redistribute connected

 area 0

  interface Loopback0

  !

  interface GCC20/0/0/0/1

  !

  interface GCC20/0/0/0/2
```

iBGP Support Using GCC

The Internal BGP (iBGP) support over GCC allows external devices to exchange BGP routes through management interfaces of NCS1004 system. The NCS 1004 device advertises local networks through BGP and manages these networks using path learnt through BGP. With the iBGP route information, the NCS 1004 devices establish iBGP sessions over GCC to exchange BGP routes.

You can configure VPN routing and forwarding (VRF) on the GCC management interfaces (port 0 and port 1) of the NCS 1004 device. The VRF enables traffic isolation between the management ports (port 0 and port 1).

The GCC2 and GCC0 interfaces are supported in NCS 1004 for 1.2 T line card.

Restrictions for iBGP Support Using GCC

- IP fragmentation is not supported on the GCC interface.
- The BGP configuration over Open Config (OC) is not supported.

Note The limitations of Remote Node Management Using GCC are applicable for iBGP Support Using GCC. For more information, see Limitations.

Enabling the GCC Interface

To enable the GCC2 interface, use the following commands:

```
configure
controller odu4 R/S/I/P/L
gcc2
commit
exit
```

To enable the GCC0 interface, use the following commands:

```
configure
controller CoherentDSP R/S/I/P
gcc0
commit
exit
```

Configuring the Management Interface

To configure the management Ethernet interface with VRF, use the following commands:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios#interface MgmtEth0/RP0/CPU0/1
RP/0/RP0/CPU0:ios(config-if)#vrf transport-vrf
RP/0/RP0/CPU0:ios(config-if)#ipv4 address ipv4-address
RP/0/RP0/CPU0:ios(config-if)#commit
RP/0/RP0/CPU0:ios(config-if)#exit
```

The following example displays how to configure the management Ethernet interface with VRF.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios#interface MgmtEth0/RP0/CPU0/1
RP/0/RP0/CPU0:ios(config-if)#vrf transport-vrf
RP/0/RP0/CPU0:ios(config-if)#ipv4 address 192.0.2.1 255.255.255.255
RP/0/RP0/CPU0:ios(config-if)#commit
RP/0/RP0/CPU0:ios(config-if)#exit
```

Configuring the Loopback Interface

To configure the loopback interface 0 with VRF, use the following commands:

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios#interface Loopback0
RP/0/RP0/CPU0:ios(config-if)#vrf transport-vrf
RP/0/RP0/CPU0:ios(config-if)#ipv4 address ipv4-address
RP/0/RP0/CPU0:ios(config-if)#commit
RP/0/RP0/CPU0:ios(config-if)#exit
```

The following example displays how to configure the loopback interface 0 with VRF.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios#interface Loopback0
RP/0/RP0/CPU0:ios(config-if)#vrf transport-vrf
RP/0/RP0/CPU0:ios(config-if)#ipv4 address 192.0.2.1 255.255.255.255
RP/0/RP0/CPU0:ios(config-if)#commit
RP/0/RP0/CPU0:ios(config-if)#exit
```

Configuring the GCC interface

To configure the GCC2 interface with VRF and static IP address, use the following commands:

configure

interface gcc2 *R/S/I/P/L*

vrf transport-vrf

ipv4 address *ipv4-address*

commit

exit

To configure the GCC0 interface with VRF and static IP address, use the following commands:

configure

interface gcc0 *R/S/I/P*

vrf transport-vrf

ipv4 address *ipv4-address*

commit

exit

Examples

The following sample displays how to configure the GCC2 interface with VRF and static IP address.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#interface gcc2 0/1/0/0/1
RP/0/RP0/CPU0:ios(config-if)#vrf transport-vrf
P/0/RP0/CPU0:ios(config-if)#ipv4 address 198.51.100.5 255.255.255.0
RP/0/RP0/CPU0:ios(config-if)#commit
RP/0/RP0/CPU0:ios(config-if)#exit
RP/0/RP0/CPU0:ios(config)#exit
```

The following sample displays how to configure the GCC2 interface using loopback IP address.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:R2(config)#interface gcc2 0/1/0/0/1
RP/0/RP0/CPU0:R2(config-if)#ipv4 unnumbered loopback 0
RP/0/RP0/CPU0:ios(config-if)#exit
RP/0/RP0/CPU0:ios(config)#exit
```

The following sample displays how to configure the GCC0 interface with VRF and static IP address.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:ios(config)#interface gcc0 0/1/0/0
RP/0/RP0/CPU0:ios(config-if)#vrf transport-vrf
P/0/RP0/CPU0:ios(config-if)#ipv4 address 198.51.100.2 255.255.255.0
RP/0/RP0/CPU0:ios(config-if)#commit
RP/0/RP0/CPU0:ios(config-if)#exit
RP/0/RP0/CPU0:ios(config)#exit
```

The following sample displays how to configure the GCC0 interface using the loopback IP address.

```
RP/0/RP0/CPU0:ios#configure
RP/0/RP0/CPU0:R2(config)#interface gcc0 0/1/0/0
RP/0/RP0/CPU0:R2(config-if)#ipv4 unnumbered loopback 0
RP/0/RP0/CPU0:ios(config-if)#exit
RP/0/RP0/CPU0:ios(config)#exit
```

Verifying iBGP Support Using GCC

To verify BGP support using GCC configuration, use the following **show** commands:

```
RP/0/RP0/CPU0:ios#show bgp vrf transport-vrf neighbors brief
Neighbor        Spk    AS Description                          Up/Down  NBRState
198.51.100.0     0     200                                   00:51:49 Established
198.51.100.1       0    100                                    00:50:32 Established
```

```
RP/0/RP0/CPU0:ios#show bgp vrf transport-vrf
BGP VRF transport-vrf, state: Active
BGP Route Distinguisher: 192.0.2.7:0
VRF ID: 0x60000002
BGP router identifier 192.0.2.7, local AS number 100
Non-stop routing is enabled
BGP table state: Active
Table ID: 0xe0000002   RD version: 51
BGP main routing table version 51
BGP NSR Initial initsync version 11 (Reached)
BGP NSR/ISSU Sync-Group versions 0/0

Status codes: s suppressed, d damped, h history, * valid, > best
              i - internal, r RIB-failure, S stale, N Nexthop-discard
Origin codes: i - IGP, e - EGP, ? - incomplete
   Network            Next Hop            Metric LocPrf Weight Path
Route Distinguisher: 192.0.2.7:0 (default for vrf transport-vrf)

*> 209.165.201.30/27        198.51.100.0             0         0 200 i
*> 209.165.201.28/27        0.0.0.0                  0         32768 i
*> 209.165.201.26/27        0    100      0 i
*> 209.165.201.24/27       198.51.100.2              0    100      0 300 i
```

```
RP/0/RP0/CPU0:ios#show bgp vrf transport-vrf
BGP VRF transport-vrf, state: Active
BGP Route Distinguisher: 203.0.113.10:0
VRF ID: 0x60000002
BGP router identifier 203.0.113.10, local AS number 100
Non-stop routing is enabled
BGP table state: Active
Table ID: 0xe0000002   RD version: 51
BGP main routing table version 51
BGP NSR Initial initsync version 11 (Reached)
```

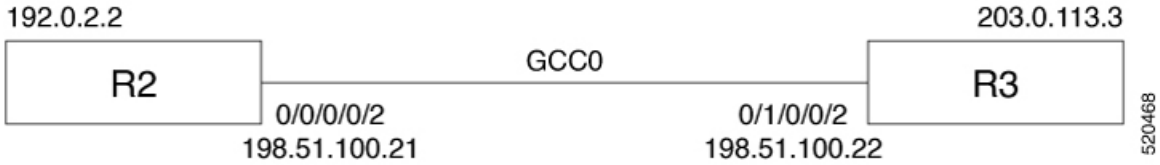
```
BGP NSR/ISSU Sync-Group versions 0/0

Status codes: s suppressed, d damped, h history, * valid, > best
              i - internal, r RIB-failure, S stale, N Nexthop-discard
Origin codes: i - IGP, e - EGP, ? - incomplete
   Network            Next Hop            Metric LocPrf Weight Path
Route Distinguisher: 203.0.113.10:0 (default for vrf transport-vrf)

*> 209.165.201.30/27        198.51.100.0             0             0 200 i
*> 209.165.201.28/27        0.0.0.0                  0             32768 i
*>i209.165.201.26/27        198.51.100.12              0    100      0 i
*>i209.165.201.24/27       198.51.100.24              0    100      0 300 i
```

Use Case - iBGP Support Using GCC Configuration

Consider two NCS 1004 devices R2 and R3 connected through GCC0 interfaces.



R2 is connected through GCC0 0/0/0/0 interface with IP address of 198.51.100.21 and R3 is connected through GCC0 0/1/0/0 with IP address of 198.51.100.22. The R2 and R3 devices are connected to external devices through management interfaces.

Table 2:

Configuration on R2	Configuration on R3

Global Configuration on R2
 	
`hw-module location 0/0`
` mxponder`
`  trunk-rate 600G`
`  client-rate 100GE`
 	
`vrf transport-vrf`
` address-family ipv4 unicast`
	Global Configuration on R3
	
	`hw-module location 0/0`
	` mxponder`
	`  trunk-rate 600G`
	`  client-rate 100GE`
	
	`vrf transport-vrf`
	` address-family ipv4 unicast`

Configuration on R2	Configuration on R3

Interface Configuration on R2
 	
`interface Loopback0`
` vrf transport-vrf`
` ipv4 address 192.0.2.2 255.255.255.255`
 	
`interface MgmtEth0/RP0/CPU0/1`
` vrf transport-vrf`
` ipv4 address 198.51.100.25 255.255.255.0`
 	
`controller ODU40/0/0/0/2`
` gcc2`
 	
`interface GCC20/0/0/0/2`
` vrf transport-vrf`
` ipv4 address 198.51.100.21 255.255.255.0`
	Interface Configuration on R3
	
	`interface Loopback0`
	` vrf transport-vrf`
	` ipv4 address 203.0.113.3 255.255.255.255`
	
	`interface MgmtEth0/RP0/CPU0/1`
	` vrf transport-vrf`
	` ipv4 address 198.51.100.32 255.255.255.0`
	
	`controller ODU40/1/0/0/2`
	` gcc2`
	
	`interface GCC20/1/0/0/2`
	` vrf transport-vrf`
	` ipv4 address 198.51.100.22 255.255.255.0`

Route-policy Configuration on R2
 	
`route-policy PASS-ALL`
`  pass`
`end-policy`
	Router Policy Configuration on R3
	
	`route-policy PASS-ALL`
	`  pass`
	`end-policy`

Static Route Configuration on R2
 	
`router static`
` address-family ipv4 unicast`
`  0.0.0.0/0 198.51.100.28`
` !`
` vrf transport-vrf`
`  address-family ipv4 unicast`
`   198.51.100.0/24 198.51.100.22`
	Static Route Configuration on R3
	
	`router static`
	` address-family ipv4 unicast`
	`  0.0.0.0/0 198.51.100.28`
	
	` vrf transport-vrf`
	`  address-family ipv4 unicast`
	`   198.51.100.0/24 198.51.100.21`

BGP Configurationon R2
 	
`router bgp 100`
` bgp router-id 192.0.2.123`
` address-family vpnv4 unicast`
` !`
` vrf transport-vrf`
`  rd auto`
`  address-family ipv4 unicast`
`   network 203.0.113.1/32`
`  !`
`  neighbor 198.51.100.22`
`   remote-as 100`
`   address-family ipv4 unicast`
`    route-policy PASS-ALL in`
`    route-policy PASS-ALL out`
`    next-hop-self`
`   !`
	BGP Configuration on R3
	
	`router bgp 100`
	` bgp router-id 192.0.2.124`
	` address-family vpnv4 unicast`
	` !`
	` vrf transport-vrf`
	`  rd auto`
	`  address-family ipv4 unicast`
	`   network 203.0.113.3/32`
	`  !`
	`  neighbor 198.51.100.21`
	`   remote-as 100`
	`   address-family ipv4 unicast`
	`    route-policy PASS-ALL in`
	`    route-policy PASS-ALL out`
	`    next-hop-self`
	`   !`

Configuration on R2	Configuration on R3

BGP Verification on R2
 	
`RP/0/RP0/CPU0:ios#show bgp sessions`
`Mon Jul 20 14:47:30.378 UTC`
 	
`Neighbor VRF Spk`
`AS InQ OutQ NBRState NSRState`
`198.51.100.22 transport-vrf 0`
`100 0 0 Established None`
	BGP Verification on R3
	
	`RP/0/RP0/CPU0:regen#show bgp sessions`
	`Tue Jul 21 02:50:14.134 UTC`
	
	`Neighbor VRF Spk`
	`AS InQ OutQ NBRState NSRState`
	`198.51.100.21 transport-vrf 0`
	`100 0 0 Established None`