Workflow for ROADM Split Nodes, Release 10.x.x

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The ROADM Node Split feature allows the configuration of the ROADM node to have separate Network Elements for each of the line sides leading to the complete separation of different ROADM degrees.

Overview

The ROADM node split feature enables per-degree separation of a multi-degree ROADM node into multiple multi-shelf nodes. The feature allows the ROADM node to have separate Network Elements(NEs) for each of the line sides leading to the complete separation of different ROADM degrees. This helps to prevent losing the whole NE manageability in the case of failure.

This feature provides the following benefits:

- Resiliency against a single side or node controller failure.

- Ability to upgrade the node software one degree at a time, thereby enabling improved planned maintenance. Upgrades can be performed on the low priority nodes (with less traffic) first to ensure that the upgrade is successful before attempting to upgrade the high priority nodes.

The following diagram shows a directional A/D multi-degree ROADM node configuration. In this scenario if Site 1 has node failure, the traffic between Site 4 - Site 1, Site 3 -Site 1, and Site 2 - Site 1 are impacted.

Figure 1: A?D Multi-degree ROADM Configuration
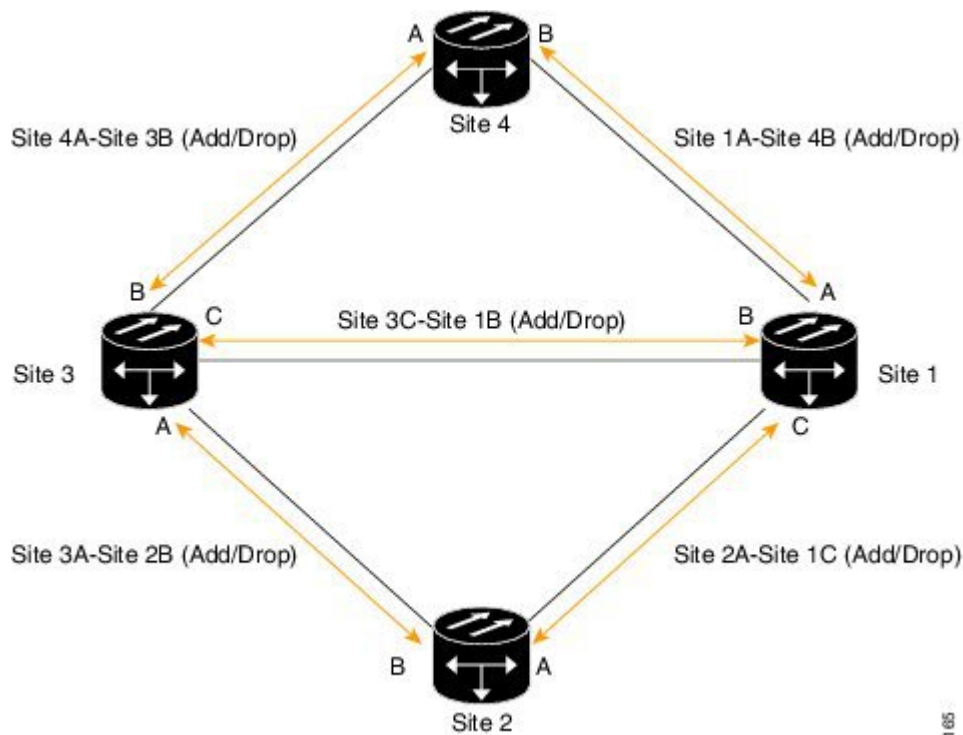
The following diagram shows a split ROADM configuration after Site 1 is split. In case there is node failure at Site 1_C, traffic between Site 2 - Site 1_C goes down but traffic between Site 4 -Site 1_A and Site 3 - Site 1_B remain unaffected.

Figure 2: Split ROADM Configuration
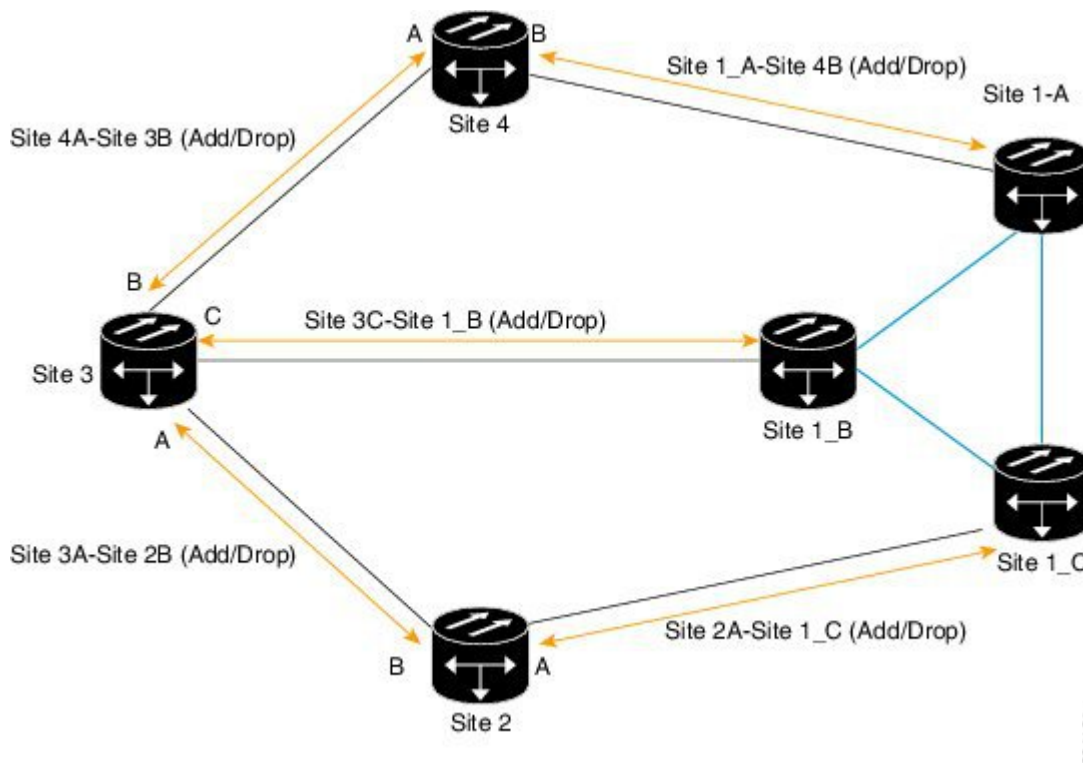
In a 4-degree ROADM node, the four sides are split into four NEs and in an 8-degree ROADM node, the eight sides are split into eight NEs. To manage these nodes, virtual passive devices are used. The virtual passive devices are connected using virtual PPCs that can be configured in CTC. It is possible to migrate legacy ROADM configurations to split ROADM configurations using CTC - CTP collaboration.

Supported Packages

The ROADM split node feature is supported in the following software packages:

- NCS Fixed Grid package
- Cisco ONS 15454 DWDM full package

Supported Configurations

The ROADM split node feature supports the following configurations:

- A 40 or 80 channel two-degree ROADM node with direct interconnection between the 80-WXC-C cards.
- A 40 channel two-degree ROADM node with direct interconnection between the 40-SMR1-C cards.

- A directional colored A/D multi-degree ROADM configuration with PP-MESH-4 or PP-MESH-8 mesh patch panel trays and 80-WXC-C cards.

> ✎
>
> **Note** The 80-WXC-C cards are configured in the BIDI mode.

Prerequisites and Restrictions

The following are the prerequisites and restrictions for configuring the split ROADM node.

Prerequisites for Configuring the Split ROADM Node

- The CTP layout reports and XML files must be generated for both pre and post-split networks.

- All the hardware requirements listed in the CTP post-split site BoM must be available.

- Complete the NTP-G103 Backing Up the Database procedure.

Restrictions for Configuring the Split ROADM Node

- When the security mode is enabled on a node and PPCs are provisioned, the node cannot be split due to connectivity issues.

- Network-level alarm correlation is not supported in split nodes.

- If the side is connected through a PPC link prior to the node split, perform the following steps:
  - Delete all the circuits that pass through the PPC side.

  - Delete the PPC.

    > ✎
    >
    > **Note** If the circuit type is OCHNC, the PPC can be deleted without deleting the OCHNC circuit. For OCHCC circuits, delete the circuit first before deleting the PPC using the procedure, DLP-G347 Deleting Optical Channel Client Connections.

  - Perform the node split procedure.

  - Provision the PPC again after the node split operation is complete.

  - Re-provision the circuits.

Prerequisites for Reverting to the Pre-split ROADM Configuration

- Nodes must be in the post-split state.

- The post-split and pre-split node layout must be the same.

- Each post-split side must reside in separate shelves.

- The pre-split database back up must be available.

- The R10.5.2 software must be installed on the network .

Migration of Legacy ROADM Nodes to Split ROADM Nodes

During the node split operation, traffic passing through the side that is undergoing split is impacted. Traffic restores after the split operation is completed for that side.

ROADM Node Split Configuration Flowchart

This flowchart focuses on specific sets of configuration instructions based on your decisions. But these instructions, and in particular the sequence of tasks described here, are recommended.
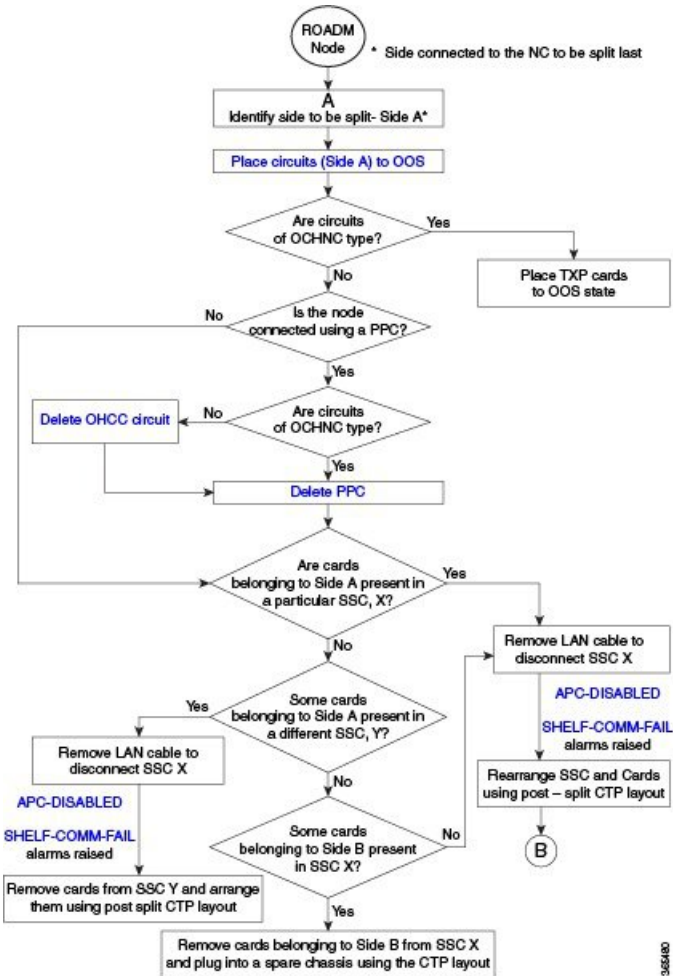
1 Circuits to OOS
2 Delete OCHCC Circuits
3 Delete PPC

Figure 3: ROADM Node Split Configuration FLowchart - 1


```
                    ROADM
                    Node      * Side connected to the NC to be split last
                      │
                      A
        ┌─────────────────────────────┐
        │ Identify side to be split- Side A* │
        └─────────────────────────────┘
                      │
        ┌─────────────────────────────┐
        │ Place circuits (Side A) to OOS │
        └─────────────────────────────┘
                      │
                 ╱ Are circuits ╲   Yes
                ╱ of OCHNC type? ╲──────────┐
                ╲               ╱            │
                 ╲             ╱             ▼
                      │ No        ┌──────────────────┐
                      │           │ Place TXP cards  │
                      │           │ to OOS state     │
                      │           └──────────────────┘
          No    ╱ Is the node ╲
        ┌──────╱ connected using a PPC? ╲
        │      ╲               ╱
        │       ╲             ╱
        │            │ Yes
        │       ╱ Are circuits ╲   No
        │  ┌───╱ of OCHNC type? ╲──────┐
        │  │   ╲               ╱       │
        │  │    ╲             ╱        │
        │  ▼         │ Yes             │
  ┌─────────────┐    │                 │
  │ Delete OHCC │    │                 │
  │ circuit     │────┘                 │
  └─────────────┘                      │
        │       ┌──────────┐           │
        │       │ Delete PPC │◄─────────┘
        │       └──────────┘
        │            │
        │   ╱ Are cards ╲  Yes
        └──╱ belonging to Side A present in ╲──────┐
           ╲ a particular SSC, X? ╱                │
            ╲                    ╱                 ▼
                 │ No              ┌────────────────────┐
                                   │ Remove LAN cable to │
                                   │ disconnect SSC X    │
                                   └────────────────────┘
    Yes  ╱ Some cards ╲                    APC-DISABLED
  ┌─────╱ belonging to Side A present in ╲
  │     ╲ a different SSC, Y? ╱           SHELF-COMM-FAIL
  │      ╲                   ╱               alarms raised
  ▼           │ No              ┌────────────────────┐
┌──────────────┐                │ Rearrange SSC and Cards │
│ Remove LAN cable to │         │ using post – split CTP layout │
│ disconnect SSC X │            └────────────────────┘
└──────────────┘                         │
  APC-DISABLED     ╱ Some cards ╲   No    ▼
                  ╱ belonging to Side B present ╲────► ( B )
  SHELF-COMM-FAIL ╲ in SSC X? ╱
     alarms raised ╲         ╱
┌────────────────────┐  │ Yes
│ Remove cards from SSC Y and arrange │
│ them using post split CTP layout │
└────────────────────┘
       ┌──────────────────────────────┐
       │ Remove cards belonging to Side B from SSC X │
       │ and plug into a spare chassis using the CTP layout │
       └──────────────────────────────┘
```
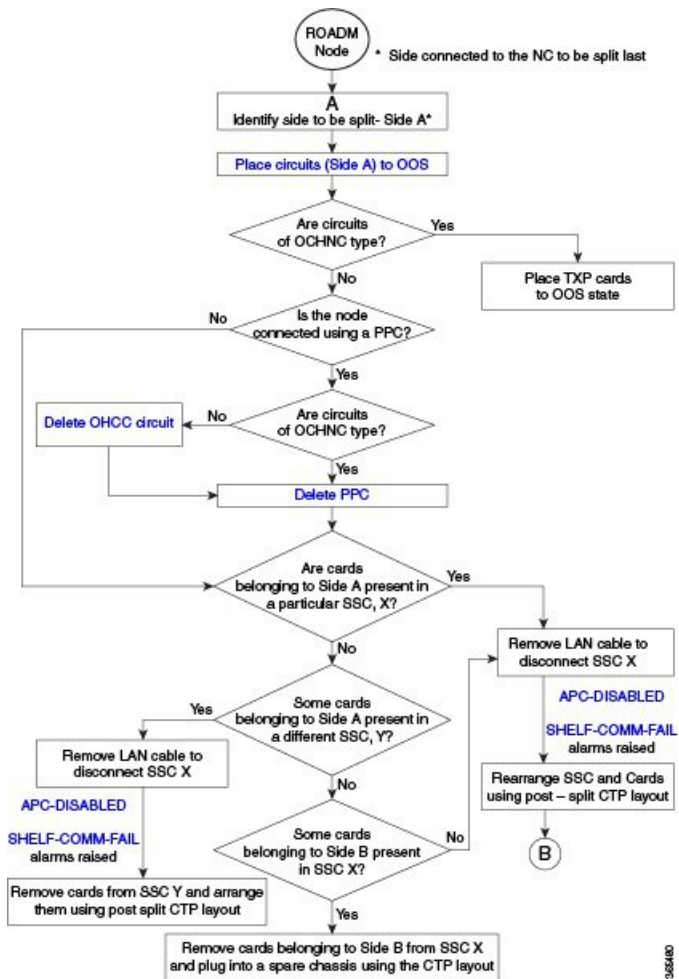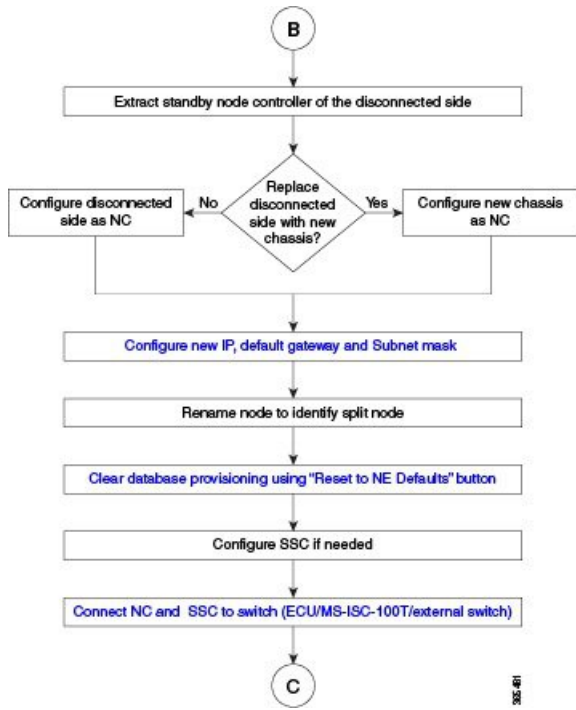
345480

6

Figure 4: ROADM Node Split Configuration FLowchart - 2

Flowchart:

B →

Extract standby node controller of the disconnected side →

Replace disconnected side with new chassis?
- No → Configure disconnected side as NC
- Yes → Configure new chassis as NC

→ Configure new IP, default gateway and Subnet mask →

Rename node to identify split node →

Clear database provisioning using "Reset to NE Defaults" button →

Configure SSC if needed →

Connect NC and SSC to switch (ECU/MS-ISC-100T/external switch) →

C

Figure 5: ROADM Node Split Configuration FLowchart - 3
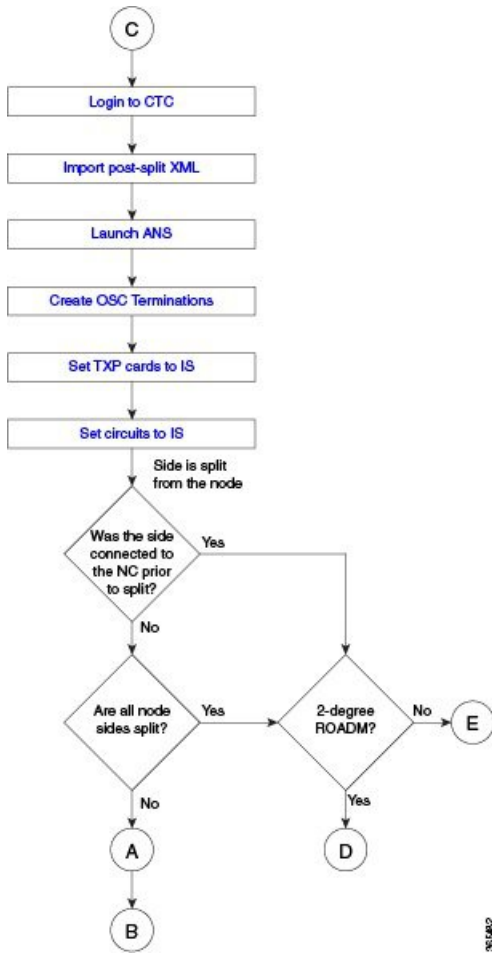
Figure 6: ROADM Node Split Configuration FLowchart - 4
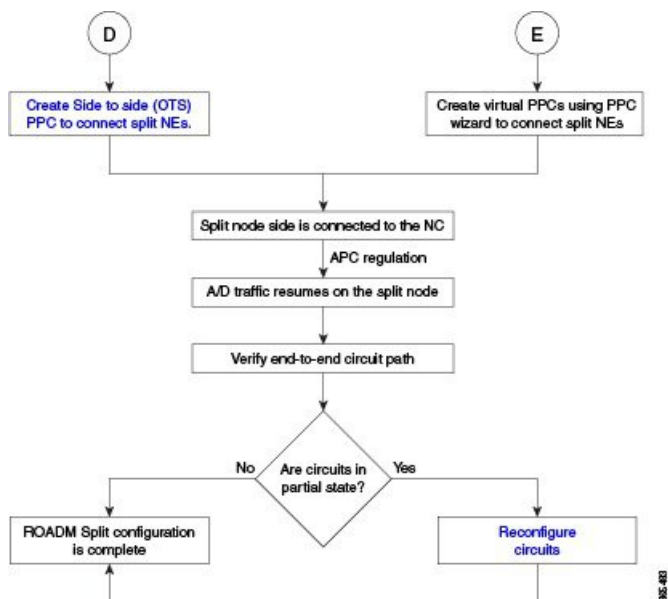
Workflow for the Split ROADM Configuration

To migrate a legacy ROADM node to a split ROADM configuration, perform the following tasks:

Task	Detailed Steps
Task 1 : Identify node side.	Identify the node side to be split. For example, Side A. **Note** The side connected to the node controller must be the last one to be split. This allows to quickly revert to the non-split node configuration when issues are encountered during the split.
Task 2: Place the add/drop and passthrough circuits in the OOS state.	Place the OCHNC, OCHCC, or OCHTRAIL circuits on Side A in the OOS,DSBLD (ANSI) or Locked,disabled (ETSI) state using the Edit Circuit dialog box. If the circuit type is OCHNC, you must place the TXP cards in the OOS-MA,DSBLD (ANSI) or Locked,disabled (ETSI) service state.

Task	Detailed Steps
Task 3:Separate the subtending shelf.	1. If all the cards belonging to Side A are present in the subtending shelf X, disconnect X by performing the following steps: • In the CTC parent view, right-click the subtending shelf you want to disconnect and choose **Delete Shelf**. • Remove the cross-over (CAT 5) LAN cable from the RJ-45 front panel port of the TCC2/TCC2P/TCC3 card in Slot 7 of the ONS 15454 or from the MSM port that corresponds to TNC/TNCE/TSC/TSCE card in Slot 1 of the ONS 15454 M6 . • Remove the cross-over (CAT 5) LAN cable from the RJ-45 front panel port of the TCC2/TCC2P/TCC3 card in Slot 11 of the ONS 15454 or from the MSM port that corresponds to TNC/TNCE/TSC/TSCE card in Slot 8 of the ONS 15454 M6 . **Note** The APC-DISABLED and SHELF-COMM-FAIL alarms are raised when the LAN cable is removed from the subtending shelf. The alarms clear after the split node procedure is complete. 2. If some of the cards belonging to Side A are present in the subtending shelf Y, perform the following steps: • Disconnect X by performing Step 1. • Remove cards from Y and rearrange them using post-split CTP layout report. 3. If some of the cards belonging to Side B are present in the subtending shelf X, remove the cards and install them in a spare shelf (Z) using the following steps: • Delete any OSC or GCC terminations. • Disconnect any cables. • Use the latches/ejectors to pull the card forward and away from shelf X. • Use the latches/ejectors to firmly slide the card along the slot guide rails until the card plugs into the receptacle at the back of the slot in shelf Z. • Verify that the card is inserted correctly. Simultaneously close the latches/ejectors on the card.

Task	Detailed Steps
Task 4:Configure the disconnected side as the node controller.	• Remove the standby TNC/TNCE/TSC/TSCE (in M6) or the TCC2/TCC2P/TCC3 (in M12) node controller card. • To reconfigure the node as the node controller, you must use the LCD panel : • Repeatedly press the Status button until Shelf Status appears. • Repeatedly press the Port button until Controller Status=MS Config appears. • Press Status again and press Port to set multishelf mode to MS=N (for single-shelf) or MS=Y (for multi-shelf). • Press Status again and press Port until ID is set to ID=1. • Press Status again and press Port to set VLAN=N(for single-shelf) or VLAN=Y (for multi-shelf). • Press Status to choose Done. • Repeatedly press Status until "Save and Reboot?" appears, and then press Slot to choose Apply. This reboots the shelf. A "Saving changes; TCC may reboot" message appears on the LCD. **Note** Before you change the MSM ID of the node controller, clear the previous database provisioning by using "Reset to NE Defaults" button located in the node view > Provisioning > General >Reset to NE Defaults tab. • Reinsert the standby TNC/TNCE/TSC/TSCE (in M6) or the TCC2/TCC2P/TCC3 (in M12) node controller card. • Complete DLP-G57 Set the IP Address, Default Router, and Network Mask Using the LCD to configure the new IP address, default gateway and subnet mask. • Rename the node to identify the split node. • Clear the database provisioning by using "Reset to NE Defaults" button located in the node view > Provisioning > General >Reset to NE Defaults tab.
Task 5 (Optional): Configure subtending shelves.	Configure new or existing subtending shelves for the split node using the LCD. The parameters used are [MS=Y: Shelf ID= N: VLAN=Y]; where N varies from 2 to 50. **Note** Use the CTP post-split layout report for this configuration.
Task 6: Connect the node controller and the subtending shelves to the ethernet switch.	Connect the node controller and the subtending shelves to the ethernet switch [ECU (M6), MS-ISC-100T or Catalyst 3650 (M12),] using the procedure, NTP-G309 Connect the ONS 15454 M6 and the ONS 15454 in a Mixed Multishelf Configuration.
Task 7: Import the post-split XML file in CTC.	Login to CTC and import the post-split XML file using the procedure, NTP-G143 Import the Cisco Transport Planner NE Update Configuration File. Apply all the configurations.
Task 8: Install the DWDM cards.	Install the DWDM cards based on the post-split CTP shelf layout report using the procedures, NTP-G30 Installing the DWDM Cards and NTP-G179 Installing the Transponder and Muxponder Cards .

Task	Detailed Steps
Task 9: Launch ANS.	Launch ANS using the procedure, NTP-G37 Running Automatic Node Setup.
Task 10: Create OSC terminations.	Create OSC terminations using the procedure, NTP-G38 Provisioning OSC Terminations.
Task 11:Set TXP cards in service.	Set TXP cards in service.
Task 12: Set circuits in service.	Set circuits that were placed in OOS,DSBLD (ANSI) or Locked,disabled (ETSI) in Task 2 back to service using the Edit Circuit dialog box.
Task 13: Create provisional patchcords (PPCs) between the post-split nodes.	• For two-degree ROADM nodes, create Side to side (OTS) PPCs between express TX and EAD ports using the procedure, NTP-G184 Creating a Provisionable Patchcord. **Note** Optical sides and internal patchcords must be provisioned before creating the PPCs. • For ROADM nodes with more than two degrees, create virtual PPCs using the Tools > Links > Create PPCs option from the tool bar.
Wait for 10 minutes for APC to complete any power regulations. Add/drop traffic resumes on the split node.	
Task 14: Complete split procedure for associated sides.	For pass-through traffic to resume, all the associated sides must be split. Repeat tasks 1 through 14 for all sides that need to be split.
Task 15: Clear the database provisioning on the NC.	Clear the database provisioning on the NC by using "Reset to NE Defaults" button located in the node view > Provisioning > General >Reset to NE Defaults tab.
Task 16: Verify end-to end circuit connectivity	To verify end-to end connectivity of the circuits, use the Show detailed map option in CTC.
Task 17: Reconfigure circuits in PARTIAL state.	• Ensure all the split sides are discovered in CTC. • Select the PARTIAL circuits that are either originating or terminating on the split side and then click **Edit**. • Check the "'Show Detailed Map" checkbox and verify the circuit end-to-end path. • Click Close. • Go to CTC Tools > Circuits > Reconfigure Circuits menu to reconfigure the selected circuits. • Repeat the above steps for the remaining partial circuits.
The split ROADM configuration is complete.	

In R10.5.2, it is possible to create a split ROADM configuration where the side to be split can be replaced with a different chassis. In the example below, Side A is replaced with a new chassis, A'.

Task	Detailed Steps
Task 1 : Identify node side.	Identify the node side to be split. For example, Side A. **Note** The side connected to the node controller must be the last one to be split. This allows to quickly revert to the non-split node configuration when issues are encountered during the split.
Task 2: Place the add/drop and passthrough circuits in the OOS state.	Place the OCHNC, OCHCC, or OCHTRAIL circuits on Side A in the OOS,DSBLD (ANSI) or Locked,disabled (ETSI) state using the Edit Circuit dialog box. If the circuit type is OCHNC, you must place the TXP cards in the OOS-MA,DSBLD (ANSI) or Locked,disabled (ETSI) service state.
Task 3:Separate the subtending shelf.	**1.** If all the cards belonging to Side A are present in the subtending shelf X, disconnect X by performing the following steps: • In the CTC parent view, right-click the subtending shelf you want to disconnect and choose **Delete Shelf**. • Remove the cross-over (CAT 5) LAN cable from the RJ-45 front panel port of the TCC2/TCC2P/TCC3 card in Slot 7 of the ONS 15454 or from the MSM port that corresponds to TNC/TNCE/TSC/TSCE/TNCS/TNCS-O card in Slot 1 of the ONS 15454 M6 . • Remove the cross-over (CAT 5) LAN cable from the RJ-45 front panel port of the TCC2/TCC2P/TCC3 card in Slot 11 of the ONS 15454 or from the MSM port that corresponds to TNC/TNCE/TSC/TSCE/TNCS/TNCS-O card in Slot 8 of the ONS 15454 M6 . **Note** The APC-DISABLED and SHELF-COMM-FAIL alarms are raised when the LAN cable is removed from the subtending shelf. The alarms clear after the split node procedure is complete. **2.** If some of the cards belonging to Side A are present in the subtending shelf Y, perform the following steps: • Disconnect X by performing Step 1. • Remove cards from Y and rearrange them using post-split CTP layout report. **3.** If some of the cards belonging to Side B are present in the subtending shelf X, remove the cards and install them in a spare shelf (Z) using the following steps: • Delete any OSC or GCC terminations. • Disconnect any cables. • Use the latches/ejectors to pull the card forward and away from shelf X. • Use the latches/ejectors to firmly slide the card along the slot guide rails until the card plugs into the receptacle at the back of the slot in shelf Z. • Verify that the card is inserted correctly. Simultaneously close the latches/ejectors on the card.

Task	Detailed Steps
Task 4:Configure the new chassis A' as the node controller. **Note** Chassis A' can be a ONS 15454, ONS 15454 M6, or a NCS 2015 chassis.	• Complete DLP-G57 Set the IP Address, Default Router, and Network Mask Using the LCD to configure the new IP address, default gateway and subnet mask. • Rename the node to identify the split node. • Clear the database provisioning by using "Reset to NE Defaults" button located in the node view > Provisioning > General >Reset to NE Defaults tab.
Task 5 (Optional): Configure subtending shelves.	Configure new or existing subtending shelves for the split node using the LCD. The parameters used are [MS=Y: Shelf ID= N: VLAN=Y]; where N varies from 2 to 50. **Note** Use the CTP post-split layout report for this configuration.
Task 6: Connect the node controller and the subtending shelves to the ethernet switch.	Connect the node controller and the subtending shelves to the ethernet switch [ECU (M6), MS-ISC-100T or Catalyst 3650 (M12),] using the procedure, NTP-G309 Connect the ONS 15454 M6 and the ONS 15454 in a Mixed Multishelf Configuration.
Task 7: Move the cards from Side A to chassis A'	Move all the cards from Side A to the new chassis A'. Ensure all the cards are in active or standby mode.
Task 8: Import the post-split XML file in CTC.	Login to CTC and import the post-split XML file using the following steps: • In CTC node view (single-shelf mode) or multishelf view, click the **Provisioning** > **WDM-ANS** > **Node Setup** tabs. • In the field under Select XML file, type the path to the Cisco Transport Planner node setup file containing the parameters for the network where your node resides, or click Browse and navigate to the file on your computer. Click the file, then click **Open**. The file will have an XML extension. • Click **Browse** and navigate to the log file on your computer or a network server where you want the node setup results recorded. • Select the split site labeled with the side name: Side A • Apply all the configurations except for the "Circuits" option and complete the import process. • Select the XML file again and select the split site labeled Side A. • Check only the Circuits checkbox and click **Apply**. • Install the DWDM cards based on the post-split CTP shelf layout report using the procedures, NTP-G30 Installing the DWDM Cards and NTP-G179 Installing the Transponder and Muxponder Cards . • Launch ANS using the procedure, NTP-G37 Running Automatic Node Setup.
Task 9: Create OSC terminations.	Create OSC terminations using the procedure, NTP-G38 Provisioning OSC Terminations.
Task 10: Set TXP cards in service.	Set TXP cards in service.
Task 11: Set circuits in service.	Set circuits that were placed in OOS,DSBLD (ANSI) or Locked,disabled (ETSI) in Task 2 back to service using the Edit Circuit dialog box.

Task	Detailed Steps
Task 12: Create provisional patchcords (PPCs) between the post-split nodes.	• For two-degree ROADM nodes, create Side to side (OTS) PPCs between express TX and EAD ports using the procedure, NTP-G184 Creating a Provisionable Patchcord. **Note** Optical sides and internal patchcords must be provisioned before creating the PPCs. • For ROADM nodes with more than two degrees, create virtual PPCs using the Tools > Links > Create PPCs option from the tool bar.
Wait for 15 minutes for APC to complete any power regulations. Add/drop traffic resumes on the split node.	
Task 13: Complete split procedure for associated sides.	For pass-through traffic to resume, all the associated sides must be split. Repeat tasks 1 through 12 for all sides that need to be split.
Task 14: Clear the database provisioning on the NC.	Clear the database provisioning on the NC by using "Reset to NE Defaults" button located in the node view > Provisioning > General >Reset to NE Defaults tab.
Task 15: Verify end-to end circuit connectivity	To verify end-to end connectivity of the circuits, use the Show detailed map option in CTC.
Task 16: Reconfigure circuits in PARTIAL state.	• Ensure all the split sides are discovered in CTC. • Select the PARTIAL circuits that are either originating or terminating on the split side and then click **Edit**. • Check the "'Show Detailed Map" checkbox and verify the circuit end-to-end path. • Click Close. • Go to CTC Tools > Circuits > Reconfigure Circuits menu to reconfigure the selected circuits. • Repeat the above steps for the remaining partial circuits.
The split ROADM configuration is complete.	

Reverting a Split ROADM Configuration to a Pre-split Configuration

To revert to pre-split configuration, perform the following steps:

Task	Detailed Steps

Task 1 : Prepare the nodes that are currently existing as separate NEs so that they can be subtended to the mastershelf.	1. Disconnect the branch nodes that belong to other degrees from the network and multishelf switches.
	
	2. Configure the master shelf of these branch nodes as subtending shelves as seen in the pre-split node.
	
	   a. Clear the database provisioning by using "Reset to NE Defaults" button located in the node view > Provisioning > General >Reset to NE Defaults tab.
	
	   b. Configure these branch nodes as subtending shelves using the LCD. The subtending shelf ID must be the same value that was used in the pre-split configuration. The parameters used are [MS=Y: Shelf ID= N: VLAN=Y]; where N varies from 2 to 50.
	
	3. If there are subtending shelves to these branch nodes, change their shelf ID to the value seen in the pre-split node.

Task 2: Restore the database on the node that was the master shelf prior to the split.	Restore the database using the procedure NTP-G104 Restoring the Database.
Task 3: Connect the node controller and the subtending shelves to the ethernet switch.	Connect the node controller and the subtending shelves to the ethernet switch [ECU (M6 or NCS 2015), MS-ISC-100T or Catalyst 3650 (M12),] using the procedure, NTP-G309 Connect the ONS 15454 M6 and the ONS 15454 in a Mixed Multishelf Configuration.
The revert procedure is complete.	

To revert a post-split configuration with chassis replacement, perform the following steps:

Task	Detailed Steps
Task 1: Revert the chassis A' to Side A	To revert A' to Side A, perform the following steps : • Clear the database provisioning on Side A by using "Reset to NE Defaults" button located in the node view > Provisioning > General >Reset to NE Defaults tab. • Configure the Side A as a subtending shelf.

Task	Detailed Steps

Task 2 : Prepare the nodes that are currently existing as separate NEs so that they can be subtended to the mastershelf.	1. Disconnect the branch nodes that belong to other degrees from the network and multishelf switches.
	
	2. Configure the master shelf of these branch nodes as subtending shelves as seen in the pre-split node.
	
	   a. Clear the database provisioning by using "Reset to NE Defaults" button located in the node view > Provisioning > General >Reset to NE Defaults tab.
	
	   b. Configure these branch nodes as subtending shelves using the LCD. The subtending shelf ID must be the same value that was used in the pre-split configuration. The parameters used are [MS=Y: Shelf ID= N: VLAN=Y]; where N varies from 2 to 50.
	
	3. If there are subtending shelves to these branch nodes, change their shelf ID to the value seen in the pre-split node.
	
	4. Clear the database provisioning by using "Reset to NE Defaults" button located in the node view > Provisioning > General >Reset to NE Defaults tab.
	
	5. Move DWDM cards from chassis A' to Side A.

Task 2: Restore the database on the node that was the master shelf prior to the split.	Restore the database using the procedure NTP-G104 Restoring the Database.
Task 3: Connect the node controller and the subtending shelves to the ethernet switch.	Connect the node controller and the subtending shelves to the ethernet switch [ECU (M6 or NCS 2015), MS-ISC-100T or Catalyst 3650 (M12),] using the procedure, NTP-G309 Connect the ONS 15454 M6 and the ONS 15454 in a Mixed Multishelf Configuration.
The revert procedure is complete.	