Configuring Dense Wavelength Division Multiplexing Controllers

This module describes the configuration of dense wavelength division multiplexing (DWDM) controllers.

DWDM is an optical technology that is used to increase bandwidth over existing fiber-optic backbones. DWDM can be configured on supported 10-Gigabit Ethernet (GE) line cards. After you configure the DWDM controller, you can configure an associated 10-Gigabit Ethernet interface.

Feature History for Configuring DWDM Controller Interfaces

Release	Modification
Release 3.9.0	This feature was introduced on the Cisco ASR 9000 Series Router on the following cards: • Cisco 8-Port 10 Gigabit Ethernet Line Card (A9K-8T-L and -E) • Cisco 2-port 10 Gigabit Ethernet + 20-port Gigabit Ethernet Combination Line Card (A9K-2T20GE-L)
Release 3.9.1	Support for the following cards was added: • Cisco 8-Port 10 Gigabit Ethernet Line Card (A9K-8T-B) • Cisco 2-port 10 Gigabit Ethernet + 20-port Gigabit Ethernet Combination Line Card (A9K-2T20GE-B and -E)
Release 4.0.0	Support for IPoDWDM Proactive Protection was added on these cards: • Cisco 8-Port 10 Gigabit Ethernet Line Card (A9K-8T-L, -B, and -E) • Cisco 2-port 10 Gigabit Ethernet + 20-port Gigabit Ethernet Combination Line Card (A9K-2T20GE-L, -B, and -E)
Release 4.2.1	Support for IPoDWDM Proactive Protection was added on these Module Port Adaptors: • A9K-MPA-4x10GE • A9K-MPA-2X10GE

Release 4.2.3	Support for IPoDWDM Proactive Protection was added on these Module Port Adaptors: • A9K-MPA-2X40GE • A9K-MPA-1X40GE

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Release 4.2.3	Support for IPoDWDM Proactive Protection was added on these Module Port Adaptors: • A9K-MPA-2X40GE • A9K-MPA-1X40GE

Prerequisites for Configuring DWDM Controller Interfaces

You must be in a user group associated with a task group that includes the proper task IDs. The command reference guides include the task IDs required for each command. If you suspect user group assignment is preventing you from using a command, contact your AAA administrator for assistance.

Before configuring a DWDM controller, be sure that you have installed one of these cards that support DWDM:

- Cisco 8-Port 10 Gigabit Ethernet Line Card
- Cisco 2-port 10 Gigabit Ethernet + 20-port Gigabit Ethernet Combination Line Card

Information About the DWDM Controllers

DWDM support in Cisco IOS XR software is based on the Optical Transport Network (OTN) protocol that is specified in ITU-T G.709. This standard combines the benefits of SONET/SDH technology with the multiwavelength networks of DWDM. It also provides for forward error correction (FEC) that can allow a reduction in network costs by reducing the number of regenerators used.

Note Configuring two ends of an OTN link with different FEC modes is not supported. Even if different FEC modes are configured, the FEC mismatch alarm will not be raised. Interface may experience continuous port flap in addition to continuous bit interleaved parity (BIP) errors at both OTN and LAN level.

To enable multiservice transport, OTN uses the concept of a wrapped overhead (OH). To illustrate this structure:

- Optical channel payload unit (OPU) OH information is added to the information payload to form the OPU. The OPU OH includes information to support the adaptation of client signals.
- Optical channel data unit (ODU) OH is added to the OPU to create the ODU. The ODU OH includes information for maintenance and operational functions to support optical channels.
- Optical channel transport unit (OTU) OH together with the FEC is added to form the OTU. The OTU OH includes information for operational functions to support the transport by way of one or more optical channel connections.

- Optical channel (OCh) OH is added to form the OCh. The OCh provides the OTN management functionality and contains four subparts: the OPU, ODU, OTU, and frame alignment signal (FAS). See figure below.

Figure 1: OTN Optical Channel Structure

CFP2 DCO Optics Version Compatibility

There are two hardware versions of the CFP2 DCO optics (A0 and B0). The following table shows hardware version compatibility.

You can identify the version using **show inventory** command and looking at the **version ID** (VID):

V01 = A0

V02 = B0

Table 1: Hardware Version Compatibility

FEC Mode	CFP2 DCO Versions	Supported
15sdfec	A0 -> A0 / B0 -> B0	Yes
	A0 -> B0 / B0 -> A0	Yes
15sdfecde	A0 -> A0 / B0 -> B0	Yes
	A0 -> B0 / B0 -> A0	Yes
Staircase FEC	A0 -> A0 / B0 -> B0	Yes
	A0 -> B0 / B0 -> A0	No
	B0 -> A9K-400G-DWDM-TR	Yes
	A0 -> A9K-400G-DWDM-TR	No

Note

- A9K-400G-DWDM-TR (2x100G (CFP2) + 20x10GE (SFP+) Combination IPoDWDM) supports 100G ACO optics (ONS-CFP2-WDM).
- A9K-MPA-2X100GE (2x100G CFP2) supports CFP2 DCO, but only at 100G.
- CFP2 DCO A0 version optics do not support 100G, 7% Staircase FEC mode as per the required standard and therefore is non-compatible with CFP2 DCO B0 version and A9K-400G-DWDM-TR (2x100G (CFP2) + 20x10GE (SFP+) Combination IPoDWDM) ACO Optics.

Information about IPoDWDM

Cisco IOS XR software includes the IP over Dense Wavelength Division Multiplexing (IPoDWDM) feature.

IPoDWDM is supported on these hardware devices:

- Cisco 8-Port 10 Gigabit Ethernet Line Card
- Cisco 2-port 10 Gigabit Ethernet + 20-port Gigabit Ethernet Combination Line Card

Note The **ONS-C2-WDM-DE-1HL** Line Card supports only the OTN mode. To make **ONS-C2-WDM-DE-1HL** work in the OTN mode, use the following configuration:

```
Set port to OTN mode
(config)#controller dwdm 0/2/0/0
(config-dwdm)#g709 enable
(config-dwdm)#admin-state in-service
(config-dwdm)#commit
```

IPoDWDM currently provides these software features:

- Proactive Maintenance

Proactive Maintenance

Proactive maintenance automatically triggers Forward Error Correction-Fast Re-Route (FEC-FRR). Proactive maintenance requires coordinated maintenance between Layer 0 (L0) and Layer 3 (L3). L0 is the DWDM optical layer. FEC-FRR is an L3 protection mechanism. FEC-FRR detects failures before they happen and corrects errors introduced during transmission or that are due to a degrading signal.

Shared Risk Link Group (SRLG)

System administrators can configure the following IPoDWDM features:

- Optical Layer DWDM port, see Configuring the Optical Layer DWDM Ports.
- Administrative state of DWDM optical ports, see Configuring the Administrative State of DWDM Optical Ports.
- FEC-FRR trigger threshold, window size, revert threshold, and revert window size, see Configuring Proactive FE-FRR Triggering.

FEC-FRR Triggering

FEC-FRR can be configure to be triggered by the following alarms:

- ais – Alarm Indication Signal (AIS)
- bdi – Backward Defect Indication (BDI)
- *bdiO – Backward Defect Indication - Overhead (BDI-O)
- *bdiP – Backward Defect Indication - Payload (BDI-P)

- *deg – Degraded (DEG)
- lck – Locked (LCK)
- lof – Loss of Frame (LOF)
- lom – Loss of Multi Frame
- los – Loss of Signal (LOS)
- *losO – Loss of Signal - Overhead (LOS-O)
- *losP – Loss of Signal - Payload (LOS-P)
- oci – Open Connection Indication (OCI)
- plm – Payload Mismatch (PLM)
- *ssf – Server Signal Failure (SSF)
- *ssfO – Server Signal Failure - Overhead (SSF-O)
- *ssfP – Server Signal Failure - Payload (SSF-P)
- tim – Trace Identifier Mismatch (TIM)

Signal Logging

DWDM statistic data, such as EC, UC and alarms, are collected and stored in the log file on the DWDM line card.

How to Configure DWDM Controllers

The DWDM controllers are configured in the physical layer control element of the Cisco IOS XR software configuration space. This configuration is done using the **controller dwdm** command, and is described in the following task:

Note All interface configuration tasks for Gigabit Ethernet interfaces still must be performed in interface configuration mode.

Configuring the Optical Parameters

This task describes how to configure the receive power threshold and the wavelength parameters for the DWDM controller. You should verify that the optical parameters are configured correctly for your DWDM installation and if necessary, perform this task.

Before you begin

The **rx-los-threshold**, **wavelength** and **transmit-power** commands can be used only when the controller is in the shutdown state. Use the **shutdown** command.

Restrictions

The transmit power level and receive LOS threshold are configurable only on the Cisco Cisco 1-Port OC-768c/STM-256c DWDM PLIM.

SUMMARY STEPS

1. **configure**
2. **controller dwdm** *interface-path-id*
3. **admin-state {maintenance | out-of-service}**
4. **commit**
5. **rx-los-threshold** *power-level*
6. **wavelength** *frequency-grid channel-number*
7. **transmit-power** *power-level*
8. **end** or **commit**
9. **admin-state in-service**
10. **show controllers dwdm** *interface-path-id* **[optics | wavelength-map]**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RP0/CPU0:Router# configure`	Enters global configuration mode.
Step 2	**controller dwdm** *interface-path-id* **Example:** `RP/0/RP0/CPU0:Router(config)# controller dwdm 0/1/0/0`	Specifies the DWDM controller name in the notation *rack/slot/module/port* and enters DWDM configuration mode.
Step 3	**admin-state {maintenance | out-of-service}** **Example:** `RP/0/RP0/CPU0:Router(config-dwdm)# admin-state maintenance`	Specifies the DWDM interface administrative state. You must put the controller in **maintenance** or **out-of-service** state before you can use the DWDM configuration commands.
Step 4	**commit** **Example:** `RP/0/RP0/CPU0:Router(config-dwdm)# commit`	Saves configuration changes. This performs the shutdown from the previous step. When the controller has been shut down, you can proceed with the configuration.
Step 5	**rx-los-threshold** *power-level* **Example:** `RP/0/RP0/CPU0:Router(config-dwdm)# rx-los-threshold -10`	Configures the transponder receive power threshold. Values are in units of 0.1 dBm and can range from -350 to 50. This corresponds to a range of -35 dBm to 5 dBm.

	Command or Action	Purpose
Step 6	**wavelength** *frequency-grid channel-number* **Example:** `RP/0/RP0/CPU0:Router(config-dwdm)# wavelength 50GHz-Grid 1`	Configures the channel number corresponding to the first wavelength. Values can range from 1 to 185, but not all channels are supported on all PLIMs. Use the **show controller dwdm** command with the **wavelength-map** keyword to determine which channels and wavelengths are supported on a specific controller. **Note** • There is no cross-checking to determine if the chosen wavelength is being used on another port on the same PLIM or on another PLIM in the system.
Step 7	**transmit-power** *power-level* **Example:** `RP/0/RP0/CPU0:Router(config-dwdm)# transmit-power 10`	Configures the transponder transmit power. Values are in units of 0.1 dBm and can range from -190 to +10. This corresponds to a range of -19 dBm to +1 dBm.

Step 8	**end** or **commit**
	Example:
	`RP/0/RP0/CPU0:Router(config-dwdm)# end`
	or
	`RP/0/RP0/CPU0:Router(config-dwdm)# commit`
		Saves configuration changes.
		• When you issue the **end** command, the system prompts you to commit changes:
		`Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:`
		• Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
		• Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
		• Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
		• Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Step 9	**admin-state in-service** **Example:** `RP/0/RP0/CPU0:Router(config-dwdm)# admin-state in-service`	Places the DWDM port in In Service (IS) state, to support all normal operation.

	Command or Action	Purpose
Step 10	**show controllers dwdm** *interface-path-id* **[optics | wavelength-map]** **Example:** `RP/0/RP0/CPU0:Router# show controller dwdm 0/1/0/0 optics`	Displays the output power level, input power level, wavelength, and laser bias current monitoring information.

Troubleshooting Tips

You will get an error message if you try to commit configuration changes to the controller when it is in the up state. You must use the **admin-states maintenance** or **admin-states out-of-service** command before you can use the DWDM configuration commands.

Configuring G.709 Parameters

Before you begin

The , and **g709 fec** commands can be used only when the controller is in the shutdown state. Use the **admin-state** command.

SUMMARY STEPS

1. **configure**
2. **controller dwdm** *interface-path-id*
3. **admin-state maintenance** or **admin-state out-of-service**
4. **commit**
5. **g709 disable**
6. **loopback {internal | line}**
7. **g709 fec** {**disable** | **standard**}
8. **g709** {**odu** | **otu**} **report** *alarm* **disable**
9. **g709 otu overhead tti** {**expected** | **sent**} {**ascii** | **hex**} *tti-string*
10. **end** or **commit**
11. **admin-state in-service**
12. **show controllers dwdm** *interface-path-id* **g709**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:Router# configure`	Enters global configuration mode.

	Command or Action	Purpose
Step 2	**controller dwdm** *interface-path-id* **Example:** `RP/0/RSP0/CPU0:Router(config)# controller dwdm 0/1/0/0`	Specifies the DWDM controller name in the notation *rack/slot/module/port* and enters DWDM configuration mode.
Step 3	**admin-state maintenance** or **admin-state out-of-service** **Example:** `RP/0/RSP0/CPU0:Router(config-dwdm)# admin-state out-of-service`	Disables the DWDM controller. You must disable the controller before you can use the DWDM configuration commands.
Step 4	**commit** **Example:** `RP/0/RSP0/CPU0:Router(config-dwdm)# commit`	Saves configuration changes. This performs the shutdown from the previous step. When the controller has been shut down, you can proceed with the configuration.
Step 5	**g709 disable** **Example:** `RP/0/RP0/CPU0:Router(config-dwdm)# g709 disable`	(Optional) Disables the G.709 wrapper. The wrapper is enabled by default. **Note** • The **g709 disable** command is available on the Cisco 4-Port 10-Gigabit Ethernet DWDM PLIM only.
Step 6	**loopback {internal | line}** **Example:** `RP/0/RSP0/CPU0:Router(config-dwdm)# loopback internal`	(Optional) Configures the DWDM controller for loopback mode.
Step 7	**g709 fec** {**disable** | **standard**} **Example:** `RP/0/RSP0/CPU0:Router(config-dwdm)# g709 fec disable`	(Optional) Configures the forward error correction mode (FEC) for the DWDM controller. By default, enhanced FEC is enabled.
Step 8	**g709** {**odu** | **otu**} **report** *alarm* **disable** **Example:** `RP/0/RSP0/CPU0:Router(config-dwdm)# g709 odu bdi disable`	(Optional) Disables the logging of selected optical channel data unit (ODU) alarms or optical channel transport unit (OTU) alarms to the console for a DWDM controller. By default, all alarms are logged to the console.
Step 9	**g709 otu overhead tti** {**expected** | **sent**} {**ascii** | **hex**} *tti-string* **Example:** `RP/0/RSP0/CPU0:Router(config-dwdm)# g709 otu overhead tti expected ascii test OTU 5678`	Configures a transmit or expected Trail Trace Identifier (TTI) that is displayed in the **show controller dwdm** command.

	Command or Action	Purpose

Step 10	**end** or **commit**
	Example:
	`RP/0/RSP0/CPU0:Router(config-dwdm)# end`
	or
	`RP/0/RSP0/CPU0:Router(config-dwdm)# commit`
		Saves configuration changes.
		• When you issue the **end** command, the system prompts you to commit changes:
		`Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:`
		• Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
		• Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
		• Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
		• Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Step 11	**admin-state in-service** **Example:** `RP/0/RSP0/CPU0:Router(config-dwdm)# admin-state in-service`	Places the DWDM port in In Service (IS) state, to support all normal operation.
Step 12	**show controllers dwdm** *interface-path-id* **g709** **Example:** `RP/0/RSP0/CPU0:Router# show controller dwdm 0/1/0/0 optics`	Displays the G.709 Optical Transport Network (OTN) protocol alarms and counters for Bit Errors, along with the FEC statistics and threshold-based alerts.

What to do next

All interface configuration tasks for the POS or Gigabit Ethernet interfaces still must be performed in interface configuration mode. Refer to the corresponding modules in this book for more information.

This task describes how to customize the alarm display and the thresholds for alerts and forward error correction (FEC). You need to use this task only if the default values are not correct for your installation.

How to Perform Performance Monitoring on DWDM Controllers

Performance monitoring parameters are used to gather, store, set thresholds for, and report performance data for early detection of problems. Thresholds are used to set error levels for each performance monitoring parameter. During the accumulation cycle, if the current value of a performance monitoring parameter reaches

or exceeds its corresponding threshold value, a threshold crossing alert (TCA) can be generated. The TCAs provide early detection of performance degradation.

Performance monitoring statistics are accumulated on a 15-minute basis, synchronized to the start of each quarter-hour. They are also accumulated on a daily basis starting at midnight. Historical counts are maintained for thirty-three 15-minute intervals and two daily intervals.

Performance monitoring is described in the following task:

Configuring DWDM Controller Performance Monitoring

This task describes how to configure performance monitoring on DWDM controllers and how to display the performance parameters.

SUMMARY STEPS

1. **configure**
2. **controller dwdm** *interface-path-id*
3. **pm** {**15-min** | **24-hour**} **fec threshold** {**ec-bits** | **uc-words**} *threshold*
4. **pm** {**15-min** | **24-hour**} **optics threshold** {**lbc** | **opr** | **opt**} {**max** | **min**} *threshold*
5. **pm** {**15-min** | **24-hour**} **otn threshold** *otn-parameter threshold*
6. **pm** {**15-min** | **24-hour**} **fec report** {**ec-bits** | **uc-words**} **enable**
7. **pm** {**15-min** | **24-hour**} **optics report** {**lbc** | **opr** | **opt**} {**max-tca** | **min-tca**} **enable**
8. **pm** {**15-min** | **24-hour**} **otn report** *otn-parameter* **enable**
9. **end** or **commit**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:Router# configure`	Enters global configuration mode.
Step 2	**controller dwdm** *interface-path-id* **Example:** `RP/0/RSP0/CPU0:Router(config)# controller dwdm 0/1/0/0`	Specifies the DWDM controller name in the notation *rack/slot/module/port* and enters DWDM configuration mode.
Step 3	**pm** {**15-min**	**24-hour**} **fec threshold** {**ec-bits**	**uc-words**} *threshold* **Example:** `RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min fec threshold ec-bits 49000000`	Configures a performance monitoring threshold for specific parameters on the FEC layer.

	Command or Action	Purpose
	`RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min fec threshold uc-words xxxxxx`	

Step 4	**pm** {**15-min** | **24-hour**} **optics threshold** {**lbc** | **opr** | **opt**} {**max** | **min**} *threshold*
	Example:
	`RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min optics threshold opt max xxx`
	`RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min optics threshold lbc min xxx`
		Configures a performance monitoring threshold for specific parameters on the optics layer.

Step 5	**pm** {**15-min** | **24-hour**} **otn threshold** *otn-parameter threshold*
	Example:
	`RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min otn threshold bbe-pm-ne xxx`
	`RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min otn threshold es-sm-fe xxx`
		Configures a performance monitoring threshold for specific parameters on the optical transport network (OTN) layer. OTN parameters can be as follows:
		• **bbe-pm-fe**—Far-end path monitoring background block errors (BBE-PM)
		• **bbe-pm-ne**—Near-end path monitoring background block errors (BBE-PM)
		• **bbe-sm-fe**—Far-end section monitoring background block errors (BBE-SM)
		• **bbe-sm-ne**—Near-end section monitoring background block errors (BBE-SM)
		• **bber-pm-fe**—Far-end path monitoring background block errors ratio (BBER-PM)
		• **bber-pm-ne**—Near-end path monitoring background block errors ratio (BBER-PM)
		• **bber-sm-fe**—Far-end section monitoring background block errors ratio (BBER-SM)
		• **bber-sm-ne**—Near-end section monitoring background block errors ratio (BBER-SM)
		• **es-pm-fe**—Far-end path monitoring errored seconds (ES-PM)
		• **es-pm-ne**—Near-end path monitoring errored seconds (ES-PM)
		• **es-sm-fe**—Far-end section monitoring errored seconds (ES-SM)
		• **es-sm-ne**—Near-end section monitoring errored seconds (ES-SM)
		• **esr-pm-fe**—Far-end path monitoring errored seconds ratio (ESR-PM)

	Command or Action	Purpose
		• **esr-pm-ne**—Near-end path monitoring errored seconds ratio (ESR-PM) • **esr-sm-fe**—Far-end section monitoring errored seconds ratio (ESR-SM) • **esr-sm-ne**—Near-end section monitoring errored seconds ratio (ESR-SM) • **fc-pm-fe**—Far-end path monitoring failure counts (FC-PM) • **fc-pm-ne**—Near-end path monitoring failure counts (FC-PM) • **fc-sm-fe**—Far-end section monitoring failure counts (FC-SM) • **fc-sm-ne**—Near-end section monitoring failure counts (FC-SM) • **ses-pm-fe**—Far-end path monitoring severely errored seconds (SES-PM) • **ses-pm-ne**—Near-end path monitoring severely errored seconds (SES-PM) • **ses-sm-fe**—Far-end section monitoring severely errored seconds (SES-SM) • **ses-sm-ne**—Near-end section monitoring severely errored seconds (SES-SM) • **sesr-pm-fe**—Far-end path monitoring severely errored seconds ratio (SESR-PM) • **sesr-pm-ne**—Near-end path monitoring severely errored seconds ratio (SESR-PM) • **sesr-sm-fe**—Far-end section monitoring severely errored seconds ratio (SESR-SM) • **sesr-sm-ne**—Near-end section monitoring severely errored seconds ratio (SESR-SM) • **uas-pm-fe**—Far-end path monitoring unavailable seconds (UAS-PM) • **uas-pm-ne**—Near-end path monitoring unavailable seconds (UAS-PM) • **uas-sm-fe**—Far-end section monitoring unavailable seconds (UAS-SM) • **uas-sm-ne**—Near-end section monitoring unavailable seconds (UAS-SM)

	Command or Action	Purpose

Step 6	**pm** {**15-min** | **24-hour**} **fec report** {**ec-bits** | **uc-words**} **enable**
	Example:
	`RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min fec report ec-bits enable`
	`RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min fec report uc-words enable`
		Configures threshold crossing alert (TCA) generation for specific parameters on the FEC layer.

Step 7	**pm** {**15-min** | **24-hour**} **optics report** {**lbc** | **opr** | **opt**} {**max-tca** | **min-tca**} **enable**
	Example:
	`RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min optics report opt enable`
	`RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min optics report lbc enable`
		Configures TCA generation for specific parameters on the optics layer.

Step 8	**pm** {**15-min** | **24-hour**} **otn report** *otn-parameter* **enable**
	Example:
	`RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min otn report bbe-pm-ne enable`
	`RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min otn report es-sm-fe enable`
		Configures TCA generation for specific parameters on the optical transport network (OTN) layer. OTN parameters are shown in Step 5.

Step 9	**end** or **commit**
	Example:
	`RP/0/RSP0/CPU0:Router(config-dwdm)# end`
	or
	`RP/0/RSP0/CPU0:Router(config-dwdm)# commit`
		Saves configuration changes.
		• When you issue the **end** command, the system prompts you to commit changes:
		`Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:`
		• Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
		• Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
		• Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
		• Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Configuring IPoDWDM

This section provides the following configuration procedures:

Configuring the Optical Layer DWDM Ports

Use this procedure to configure the Optical Layer DWDM ports.

SUMMARY STEPS

1. **configure**
2. **controller dwdm** *interface-path-id*
3. **network srlg** *value1 value2 value3*
4. **network port id** *id-number*
5. **network connection id** *id-number*
6. **end** or **commit**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:Router# config`	Enters global configuration mode.
Step 2	**controller dwdm** *interface-path-id* **Example:** `RP/0/RSP0/CPU0:Router(config)# controller dwdm 0/1/0/1`	Specifies the DWDM controller and enters DWDM controller mode.
Step 3	**network srlg** *value1 value2 value3* **Example:** `RP/0//CPU0:Router(config-dwdm)# network srlg value1 value2 value3`	Configures the Shared Risk Link Group (SRLG).
Step 4	**network port id** *id-number* **Example:** `RP/0/RSP0/CPU0:Router(config-dwdm)# network port id 1/0/1/1`	Assigns an identifier number to a port for the Multi Service Transport Protocol (MSTP).

	Command or Action	Purpose
Step 5	**network connection id** *id-number* **Example:** `RP/0/RSP0/CPU0:Router(config-dwdm)# network connection id 1/1/1/1`	Configures a connection identifier for the Multi Service Transport Protocol (MSTP).

Step 6	**end** or **commit**
	Example:
	`RP/0/RSP0/CPU0:Router(config-dwdm)# end`
	or
	`RP/0/RSP0/CPU0:Router(config-dwdm)# commit`
		Saves configuration changes.
		• When you issue the **end** command, the system prompts you to commit changes:
		`Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:`
		• Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode.
		• Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes.
		• Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes.
		• Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Configuring the Administrative State of DWDM Optical Ports

Use this procedure to configure the administrative state and optionally set the maintenance embargo flag.

SUMMARY STEPS

1. **configure**
2. **controller dwdm** *interface-path-id*
3. **admin-state** {**in-service** | **maintenance** | **out-of-service**}
4. **exit**
5. **interface pos** *interface-path-id*
6. or
7. **interface tengige** *interface-path-id*
8. **maintenance disable**
9. **end** or **commit**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:Router# config`	Enters global configuration mode.
Step 2	**controller dwdm** *interface-path-id* **Example:** `RP/0/RSP0/CPU0:Routerconfig)# controller dwdm 0/1/0/1`	Specifies the DWDM controller and enters DWDM controller mode.
Step 3	**admin-state** {**in-service** | **maintenance** | **out-of-service**} **Example:** `RP/0/RSP0/CPU0:Router(config-dwdm)# admin-state maintenance`	Specifies the transport administration state.
Step 4	**exit** **Example:** `RP/0/RSP0/CPU0:Router(config-dwdm)# exit`	Exits to the previous mode.
Step 5	**interface pos** *interface-path-id*	
Step 6	or	

Step 7	**interface tengige** *interface-path-id*
	Example:
	`RP/0/RSP0/CPU0:Router(config)# interface pos 1/0/1/1`
	`or`
	`RP/0/RSP0/CPU0:Router(config)# interface tengige 1/0/1/1`
		Specifies the interface and enters interface configuration mode.

Step 8	**maintenance disable** **Example:** `RP/0/RSP0/CPU0:Router(config-if)# maintenance disable`	Provisions the maintenance embargo flag, which prevents maintenance activities from being performed on an interface.
Step 9	**end** or **commit** **Example:** `RP/0/RSP0/CPU0:Router(config-dwdm)# end`	Saves configuration changes. • When you issue the **end** command, the system prompts you to commit changes:

	Command or Action	Purpose
	or `RP/0/RSP0/CPU0:Router(config-dwdm)# commit`	`Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:` • Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode. • Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes. • Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes. • Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Configuring Proactive FEC-FRR Triggering

Use this procedure to configure automatic triggering of Forward Error Correction-Fast Re-Route (FEC-FRR).

SUMMARY STEPS

1. **configure**
2. **controller dwdm** *interface-path-id*
3. **proactive**
4. **logging signal** *file-name*
5. **proactive trigger threshold** *x-coefficient y-power*
6. **proactive trigger window** *window*
7. **proactive revert threshold** *x-coefficient y-power*
8. **proactive revert window** *window*
9. **end** or **commit**

DETAILED STEPS

Procedure

	Command or Action	Purpose
Step 1	**configure** **Example:** `RP/0/RSP0/CPU0:Router# config`	Enters global configuration mode.

	Command or Action	Purpose
Step 2	**controller dwdm** *interface-path-id* **Example:** `RP/0/RSP0/CPU0:Router(config)# controller dwdm 0/1/0/1`	Specifies the DWDM controller and enters DWDM controller mode.
Step 3	**proactive** **Example:** `RP/0/RSP0/CPU0:Router(config-dwdm)# proactive enable`	Enables automatic triggering of FEC-FRR.
Step 4	**logging signal** *file-name* **Example:** `RP/0/RSP0/CPU0:Router(config-dwdm)# logging signal LogFile1`	Enables10 millisecond proactive monitoring of FEC-FRR.
Step 5	**proactive trigger threshold** *x-coefficient y-power* **Example:** `RP/0/RSP0/CPU0:Routerconfig-dwdm)# proactive trigger threshold 1 9`	Configures the trigger threshold of FEC-FRR in the form of *x*E-*y*.
Step 6	**proactive trigger window** *window* **Example:** `RP/0/RSP0/CPU0:Router(config-dwdm)# proactive trigger window 10000`	Configures the trigger window (in milliseconds) in which FRR may be triggered.
Step 7	**proactive revert threshold** *x-coefficient y-power* **Example:** `RP/0/RSP0/CPU0:Router(config-dwdm)# proactive revert threshold 1 9`	Configures the revert threshold (in the form of *x*E-*y*) to trigger reverting from the FEC-FRR route back to the original route.
Step 8	**proactive revert window** *window* **Example:** `RP/0/RSP0/CPU0:Router(config-dwdm)# proactive revert window 600000`	Configures the revert window in which reverting from the FEC-FRR route back to the original route is triggered.
Step 9	**end** or **commit** **Example:** `RP/0/RSP0/CPU0:Router(config-dwdm)# end` or	Saves configuration changes. • When you issue the **end** command, the system prompts you to commit changes: `Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:`

	Command or Action	Purpose
	`RP/0/RSP0/CPU0:Router(config-dwdm)# commit`	• Entering **yes** saves configuration changes to the running configuration file, exits the configuration session, and returns the router to EXEC mode. • Entering **no** exits the configuration session and returns the router to EXEC mode without committing the configuration changes. • Entering **cancel** leaves the router in the current configuration session without exiting or committing the configuration changes. • Use the **commit** command to save the configuration changes to the running configuration file and remain within the configuration session.

Configuration Examples

This section includes these examples:

Turning On the Laser: Example

Note This is a required configuration. The DWDM cards will not operate without this configuration.

This example shows how to turn on the laser and place a DWDM port in In Service (IS) state:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:Router(config)# controller dwdm 0/1/0/1
RP/0/RP0/CPU0:Router(config-dwdm)# admin-state in-service
RP/0/RP0/CPU0:Router(config-dwdm)# commit
```

Turning Off the Laser: Example

This example shows how to turn off the laser, stop all traffic and place a DWDM port in Out of Service (OOS) state:

```
RP/0/RP0/CPU0:router# configure
RP/0/RP0/CPU0:Router(config)# controller dwdm 0/1/0/1
RP/0/RP0/CPU0:Router(config-dwdm)# admin-state out-of-service
RP/0/RP0/CPU0:Router(config-dwdm)# commit
```

DWDM Controller Configuration: Examples

This example shows how to customize the alarm display and the thresholds for alerts and forward error correction (FEC):

```
RP/0/RSP0/CPU0:Router# configure
RP/0/RSP0/CPU0:Router(config)# controller dwdm 0/1/0/0
RP/0/RSP0/CPU0:Router(config-dwdm)# maintenance out-of-service
RP/0/RSP0/CPU0:Router(config-dwdm)# commit
RP/0/RSP0/CPU0:Router(config-dwdm)# g709 disable
RP/0/RSP0/CPU0:Router(config-dwdm)# loopback internal
RP/0/RSP0/CPU0:Router(config-dwdm)# g709 fec standard
RP/0/RSP0/CPU0:Router(config-dwdm)# g709 odu bdi disable
RP/0/RSP0/CPU0:Router(config-dwdm)# maintenance in-service
RP/0/RSP0/CPU0:Router(config-dwdm)# commit
```

DWDM Performance Monitoring: Examples

This example shows how to configure performance monitoring for the optics parameters and how to display the configuration and current statistics:

```
RP/0/RSP0/CPU0:Router# configure
RP/0/RSP0/CPU0:Router(config)# controller dwdm 0/2/0/0

RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min optics threshold opt max 2000000
RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min optics threshold opt min 200
RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min optics threshold lbc max 3000000
RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min optics threshold lbc min 300
RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min optics threshold opr max 4000000
RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min optics threshold opr min 400
RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min optics report opt max-tca enable
RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min optics report opt min-tca enable
RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min optics report opr max-tca enable
RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min optics report opr min-tca enable
RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min optics report lbc max-tca enable
RP/0/RSP0/CPU0:Router(config-dwdm)# pm 15-min optics report lbc min-tca enable
RP/0/RSP0/CPU0:Router(config-dwdm)# exit
RP/0/RSP0/CPU0:Router(config)# exit

Uncommitted changes found, commit them before exiting(yes/no/cancel)? [cancel]:y

LC/0/2/CPU0:Jul 12 04:10:47.252 : plim_4p_10ge_dwdm[194]: %L1-PMENGINE-4-TCA : Port DWDM
0/2/0/0 reports OPTICS TX-PWR-MIN(NE) PM TCA with current value 0, threshold 200 in current
 15-min interval window
LC/0/2/CPU0:Jul 12 04:10:47.255 : plim_4p_10ge_dwdm[194]: %L1-PMENGINE-4-TCA : Port DWDM
0/2/0/0 reports OPTICS RX-PWR-MIN(NE) PM TCA with current value 68, threshold 400 in current
 15-min interval window
RP/0/RP1/CPU0:Jul 12 04:09:05.443 : config[65678]: %MGBL-CONFIG-6-DB_COMMIT : Configuration
 committed by user 'lab'. Use 'show configuration commit changes 1000000001' to view the
changes.
RP/0/RP1/CPU0:Jul 12 04:09:05.604 : config[65678]: %MGBL-SYS-5-CONFIG_I : Configured from
console by lab

RP/0/RSP0/CPU0:Router# show controllers dwdm 0/2/0/0 pm interval 15-min optics 0

Optics in the current interval [ 4:15:00 - 04:26:02 Wed Jul 12 2006]
             MIN     AVG     MAX  Threshold  TCA  Threshold  TCA
                                  (min)  (enable) (max)  (enable)
LBC[mA ] :  3605    4948    6453    300        YES     3000000   YES
OPT[uW]  :  2593    2593    2593    200        YES     2000000   YES
OPR[uW]  :  69      69      70      400        YES     4000000   YES
```

IPoDWDM Configuration: Examples

This section includes the following examples:

Optical Layer DWDM Port Configuration: Examples

This example shows how to configure Optical Layer DWDM ports.

```
RP/0/RSP0/CPU0:Router# configure
RP/0/RSP0/CPU0:Router(config)# controller dwdm 0/1/0/1
RP/0/RP0/CPU0:Router(config-dwdm)# network srlg value1 value2 value3
RP/0/RSP0/CPU0:Router(config-dwdm)# network port id 1/0/1/1
RP/0/RSP0/CPU0:Router(config-dwdm)# network connection id 1/1/1/1
```

Administrative State of DWDM Optical Ports Configuration: Examples

The following examples show how to configure the administrative state and optionally set the maintenance embargo flag:

For TenGigabit Interface

```
RP/0/RSP0/CPU0:Router# configure
RP/0/RSP0/CPU0:Router(config)# controller dwdm 0/1/0/1
RP/0/RSP0/CPU0:Router(config-dwdm)# admin-state in-service
RP/0/RSP0/CPU0:Router(config-dwdm)# exit
RP/0/RSP0/CPU0:Router(config)# interface tengige 1/0/1/1
RP/0/RSP0/CPU0:Router(config-if)# maintenance disable
RP/0/RSP0/CPU0:Router(config-if)# commit
```

Proactive FEC-FRR Triggering Configuration: Examples

This example shows how to configure automatic triggering of Forward Error Correction-Fast Re-Route (FEC-FRR):

```
RP/0/RSP0/CPU0:Router# configure
RP/0/RSP0/CPU0:Router(config)# controller dwdm 0/1/0/1
RP/0/RSP0/CPU0:Router(config-dwdm)#proactive
RP/0/RSP0/CPU0:Router(config-dwdm)# logging signal LogFile1
RP/0/RSP0/CPU0:Router(config-dwdm)# proactive trigger threshold 1 9
RP/0/RSP0/CPU0:Router(config-dwdm)# proactive trigger window 10000
RP/0/RSP0/CPU0:Router(config-dwdm)# proactive revert threshold 1 9
RP/0/RSP0/CPU0:Router(config-dwdm)# proactive revert window 600000
```