M-CMTS DEPI Control Plane

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The Downstream External PHY Interface (DEPI) control plane feature is based upon Layer Two Tunneling Protocol-Version 3 (L2TPv3) signaling. Downstream External PHY Interface is a communication protocol between the Modular Cable Modem Termination System (M-CMTS) core and the Edge Quadrature Amplitude Modulation (EQAM). It is an IP tunnel between the MAC (M-CMTS Core) and PHY (EQAM) in an M-CMTS system, which contains both a data path for Data-Over-Cable Service Interface Specifications (DOCSIS) frames and a control path for setting up, maintaining, and tearing down data sessions.

The DEPI Latency Measurement (DLM) packet is a special type of data packet used for measuring the network latency between the M-CMTS core and the EQAM. There are two types of DLM packets, ingress DLM packet and egress DLM packet. The ingress DLM measures the latency between the M-CMTS core and the ingress point in the EQAM, and the egress DLM measures the latency between the M-CMTS core and the egress point of the EQAM. The DEPI Control Plane is supported with a direct connection between the SPA and the EQAM, or between the Cisco uBR-MC3GX60V line card and the EQAM.

The Converged Interconnect Network (CIN) is the standard term used for the network between the M-CMTS and the Radio Frequency Gateway (RFGW). This network can be a direct connection or a Layer 2 or Layer 3 network. Since the CIN is a private network, a Virtual Routing and Forwarding (VRF) instance ensures that only valid traffic is routed to it by removing the IP Address of the interface from the global routing table (and from the interface).

Note Layer 3 CIN support is limited to the case where the primary GigE link of the M-CMTS DEPI port is connected directly to the EQAM and the secondary link is connected through a Layer 3 router. The Layer 3 router between the M-CMTS and the EQAM must support modifying the MAC addresses on its Layer 3 interface.

VRF for DEPI session is used only on the M-CMTS router. It is recommended to configure VRF for the GigE interfaces, to ensure that the CIN routes are isolated from the default routing table of the CMTS router. When connecting two SPAs to a Layer 2 CIN, the GigE interfaces for these SPAs need to be configured with different VRFs.

PortFast mode-enabled switches have to be used when Gigabit Ethernet link redundancy is configured for the Gigabit Ethernet (GigE) interfaces. For more information on the switches that support PortFast mode, see

http://www.cisco.com/en/US/tech/tk389/tk621/technologies_tech_note09186a008009482f.shtml.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to http://tools.cisco.com/ITDIT/CFN/. An account on http://www.cisco.com/ is not required.

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Prerequisites for M-CMTS DEPI Control Plane

The following are the prerequisites for the M-CMTS DEPI Control Plane feature:

- Support of bidirectional communication using the GigE ports on the Cisco Wideband SPA or Cisco uBR-MC3GX60V line card.
- Support DLM (Ingress).
- Support of EQAM configuration from the M-CMTS router (with EQAM in learn mode). The learn feature is supported only on Cisco RFGW-10.
- Provide connectivity verification, and link failure detection.
- Support Management Information Base (MIB).

The table below shows the hardware compatibility prerequisites for this feature.

Note The hardware components introduced in a given Cisco IOS Release are supported in all subsequent releases unless otherwise specified.

Table 1: Cable Hardware Compatibility Matrix for M-CMTS DEPI Control Plane

Platform	Processor Engine	Cable Interface Cards
Cisco uBR10012 Universal Broadband Router	Cisco IOS Release 12.2(33)SCC and later releases • PRE2 • PRE4 Cisco IOS Release 12.2(33)SCH and later releases • PRE5	Cisco IOS Release 12.2(33)SCC and later releases • Cisco Wideband SPA Cisco IOS Release 12.2(33)SCE and later releases • Cisco uBR-MC3GX60V[1]

[1] Cisco uBR-MC3GX60V cable interface line card is not compatible with PRE2.

Restrictions for M-CMTS DEPI Control Plane

- Supports only DOCSIS MPEG-TS (DMPT) mode.
- Modular QoS CLI (MQC) or access control lists (ACL) related features are *not* supported on the DEPI interface.
- The IP address of the DEPI interface must be configured manually. It *cannot* be assigned by the DHCP server.
- VLAN subinterfaces are *not* supported only on the following:
  - Cisco uBR-MC3GX60V line card
  - Cisco Wideband SPA
- Secondary IP address are *not* supported on the DEPI interface.
- Mixed DEPI configuration of manual DEPI and remote DEPI is *not* permitted on the same Cisco uBR-MC3GX60V line card or the Cisco Wideband SPA.
- Configuring or removing an IP address on the controller is *not* permitted when the DEPI interface with an IP address exists in manual DEPI configuration.
- Configuring an IP address on the controller is not permitted in remote DEPI configuration.
- In the DEPI configuration involving L2TP class or tunnel, the direct removal of L2TP class or tunnel is not supported. You need to remove the usage of the L2TP class or tunnel first from the DEPI configuration and then remove the L2TP class or tunnel.

Information About M-CMTS DEPI Control Plane

To configure the M-CMTS DEPI Control Plane feature, you should understand the following concepts:

Benefits of M-CMTS DEPI Control Plane

- The DEPI control plane provides the capability to detect failures in a multi-hop network between the M-CMTS router and EQAM.
- The Cisco RFGW-10 (EQAM) learns the configuration from the M-CMTS router via the DEPI control plane.
- The DEPI control plane facilitates an automatic and accurate method to determine delay via the DLM.
- The DEPI control plane allows interoperability.

DEPI Control Connections

The DEPI control plane configuration is possible only with the following devices that have GigE ports:

- Cisco Wideband SPA—Cisco IOS Release 12.2(33)SCC and later releases
- Cisco uBR-MC3GX60 line card—Cisco IOS Release 12.2(33)SCE and later releases

Configuring a DEPI tunnel on a SPA or Cisco uBR-MC3GX60 line card downstream channel will establish a DEPI control connection (if it does not exist). The M-CMTS router (not the EQAM) initiates the control session connection. At least one DEPI control connection must exist for each SPA or Cisco uBR-MC3GX60 line card that has RF channels configured, to establish a DEPI session with an EQAM. There can be multiple control connections from one SPA or Cisco uBR-MC3GX60 line card to one or more EQAMs. When a DEPI control connection is disconnected, all the associated DEPI data sessions will be disconnected.

When the primary link on the SPA or Cisco uBR-MC3GX60 line card toggles more than five times within 30 seconds, and the secondary link is up, the secondary link is selected for traffic. The link switches back to the primary link during the next primary link transition after 30 seconds or when the secondary link fails. To get the primary link (port 0) or secondary link (port 1) status, use the **show controller gigabitethernet** command.

DEPI Data Sessions

For both primary and non-primary downstream channels, the DEPI data session is established when the DEPI control connection is active. The Transport Stream Identifier (TSID) must be configured on both the M-CMTS router and EQAM, as it is used to bind the logical wideband channel to a physical QAM of the EQAM. Only the M-CMTS router initiates the DEPI data session creation, not the EQAM.

DEPI SSO

The Cisco RFGW-10 supervisor redundancy and the route processor (RP) redundancy on the Cisco uBR10012 router in stateful switchover (SSO) mode support both DEPI manual mode and DEPI protocol mode (control plane DEPI). Minimal disruption might occur in manual DEPI in the case of RP redundancy on the Cisco uBR10012 router. The control plane and data sessions are reestablished after the RP switchover in control plane DEPI while the data plane non-stop forwarding continues to send DEPI data traffic to the EQAM.

With supervisor redundancy, the supervisor switchover does not affect the statically configured DEPI connections in DEPI manual mode. Hence, the switchover interruption to DEPI data traffic is in subseconds. In DEPI protocol mode, the DEPI control plane is SSO-unaware as the underlying IOS L2TPv3 protocol is SSO-unaware. Neither the L2TPv3 protocol state nor the DEPI state is check pointed from the active Supervisor to the standby Supervisor. During Supervisor switchover, the DEPI control plane and data plane are recovered as follows with minimal service outage time:

- DEPI control plane and data plane re-establishment: At Supervisor switchover, the newly active Supervisor card re-establishes the DEPI control connections and data sessions with its M-CMTS peer. The IDs of re-established sessions fall into the same DEPI session ID range as before.
- DEPI data plane non-stop forwarding: While the newly active Supervisor is re-establishing the DEPI connections and data sessions, the Cisco RFGW-10 receives and processes DEPI data traffic that the M-CMTS router continues to forward through the existing data sessions. This non-stop forwarding function minimizes the service outage time for a couple of seconds. The existing data sessions are removed after the new sessions are established.

For more information on Supervisor Redundancy, see 1:1 Supervisor Card Redundancy feature guide.

N+1 DEPI Redundancy

The N+1 DEPI redundancy feature enables the M-CMTS router to protect downstream data path in the event of the Cisco uBR-MC3GX60V line card failure or switchover, using a secondary DEPI session configured on the protect line card. Beginning with Cisco IOS Release 12.2(33)SCE1, the N+1 redundancy feature including DEPI redundancy is supported on the Cisco uBR-MC3GX60V cable interface line card.

This feature allows you to configure a secondary DEPI session on the protect card using the **protect-tunnel** command in DEPI tunnel configuration mode. In this mode, the protect line card has a fully operational secondary DEPI control connection and sessions for the QAM channels on the working line card. The primary DEPI control connection and session is established on the GigE ports on the working line card. These primary and secondary DEPI sessions are paired using the common TSID, which uniquely identifies the target QAM channel.

The N+1 DEPI redundancy feature is supported only on the Cisco uBR-MC3GX60 line card. This feature is not supported on the Cisco Wideband SPA.

The N+1 DEPI redundancy feature requires an EQAM that supports data path redundancy based on CableLabs Downstream External PHY Interface Specification (CM-SP-DEPI-I08-100611).

The Cisco uBR-MC3GX60V line card supports up to six DEPI tunnels per GigE port and a separate DEPI session per downstream channel. Each DEPI session is associated with only one DEPI tunnel and multiple DEPI sessions can be associated with a single DEPI tunnel.

In N+1 DEPI redundancy, the protect line card initiates DEPI control sessions on each QAM channel at bootup. When the M-CMTS router detects a line card failure, the protect line card enables all the sessions that were backing up the sessions of the failed line card.

The network connectivity must be set up to ensure that the Cisco RF Gateway is reachable through the protect Cisco uBR-MC3GX60V line card.

DEPI CIN Failover

The **depi cin-failover** command is introduced to enable CIN failure triggered line card switchover when DEPI control plane is used and N+1 is configured.

When the CPU utilization is high, DEPI CIN failover may get rejected. Starting Cisco IOS Release 12.2(33)SCF4 and later releases, **cpu-thresold** values can be configured using the **depi cin-faiover cpu-threshold** command. For more information, see Cisco IOS CMTS Cable Command Reference.

Downstream Failure Detection

The control plane DEPI detects the downstream device or connection failure on the Cisco uBR-MC3GX60V line card using the "hello" keepalive packets. It triggers the line card switchover if the protect line card DEPI sessions are the superset of the working line card. You can configure the interval used to exchange the "hello" keepalive packets in a Layer 2 control channel using the **hello** command in L2TP class configuration mode.

GigE Port-level Redundancy

The Cisco uBR-MC3GX60V line card also supports GigE port-level redundancy. The port-level redundancy is configured by default on the Cisco Wideband SPA and Cisco uBR-MC3GX60V line card. You do not have to manually configure port-level redundancy on the M-CMTS router.

Difference Between Manual DEPI and Control Plane DEPI Configuration

The manual DEPI configuration also supports N+1 DEPI redundancy and port-level redundancy on the Cisco uBR-MC3GX60V line card.

The following are the differences between the manual DEPI and control plane DEPI configuration:

- In manual DEPI configuration, you do not have to configure the protect tunnel. The working card configuration is automatically applied to the protect card through IPC messages. In DEPI control plane redundancy, you must configure the protect tunnel on both the M-CMTS router and the EQAM.
- For manual DEPI configuration, the GigE ports on the Cisco uBR-MC3GX60V line card must be in active-passive mode.
- The DEPI connection between the M-CMTS router and the EQAM is static in manual DEPI configuration. Whereas, the data sessions are established dynamically in the DEPI control plane configuration.

DEPI EQAM Statistics

The DEPI EQAM statistics feature enables EQAM to send QAM channel statistics to the M-CMTS router for all data sessions in every DEPI tunnel. Support for this feature was introduced in Cisco IOS Release 12.2(33)SCE. The DEPI EQAM statistics feature is configured by default on the M-CMTS router. To disable this configuration use the **no** form of the **depi eqam-stats** command in global configuration mode.

Note Cisco RF Gateway 10 sends EQAM statistics to the M-CMTS router. No other EQAM supports the EQAM statistics feature.

To verify EQAM statistics, use the **show depi session** command with the **verbose** keyword in privileged EXEC mode.

How to Configure M-CMTS DEPI Control Plane

For a quick tour on how to configure DEPI on the Cisco M-CMTS router and the EQAM device, view the following videos available on Cisco.com:

- Configuring the Downstream External PHY Interface Feature on the Cisco M-CMTS and EQAM Device [Part 1 of 2]
- Configuring the Downstream External PHY Interface Feature on the Cisco M-CMTS and EQAM Device [Part 2 of 2]

This section contains the following procedures:

Configuring DEPI Control Plane on the M-CMTS Router

This section describes how to configure DEPI control plane on the M-CMTS router.

Note The DEPI control plane configuration steps for the Cisco Wideband SPA and Cisco uBR-MC3GX60 line card are the same. Step 17, on page 9 is applicable only for the Cisco Wideband SPA and is not required for Cisco uBR-MC3GX60 line card.

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**l2tp-class l2tp-class-name** **Example:** `Router(config)# l2tp-class class1`	Creates an L2TP class template. The template must be configured but the optional settings are not mandatory. **Note** If all the control channels have the same parameters then a separate template must be created for the M-CMTS.
Step 4	**hello** *seconds* **Example:** `Router(config-l2tp-class)# hello 5`	(Optional) Configures the interval used to exchange the “hello” keepalive packets in a Layer 2 control channel. • *seconds*—Number of seconds that a router at one end of a Layer 2 control channel waits between sending the “hello” keepalive packets to its peer router. The valid range is from 0 to 1000 seconds. The default value is 60 seconds.

	Command or Action	Purpose
		Note If you want the DEPI tunnel to be less sensitive to network disturbances, increase the interval for the "hello" keepalive packets. We recommend that you specify 5 seconds on the M-CMTS router.
Step 5	**retransmit retries** *max-retransmissions* **Example:** `Router(config-l2tp-class)# retransmit retries 5`	(Optional) Configures the retransmission retry settings of the control packets. • *max-retransmissions*—Number of retransmission cycles that occur before determining that the peer provider edge (PE) router does not respond. The valid range is from 5 to 1000. The default value is 15. Specify a smaller value for faster failure detection. **Note** We recommend that you specify 5 on the M-CMTS router.
Step 6	**retransmit timeout** {**max** | **min**} *retransmit-timeout* **Example:** `Router(config-l2tp-class)# retransmit timeout max 1`	Specifies maximum and minimum retransmission intervals (in seconds) for resending the control packets. • {**max** | **min**} *retransmit-timeout*—The valid range is from 1 to 8. The default maximum interval is 8; the default minimum interval is 1. **Note** We recommend that you specify 1 second on the M-CMTS router.
Step 7	**exit** **Example:** `Router(config-l2tp-class)# exit`	Exits the L2TP class configuration mode.
Step 8	**depi-class** *depi-class-name* **Example:** `Router(config)# depi-class SPA0`	Creates a DEPI class template.
Step 9	**exit** **Example:** `Router(config-depi-class)# exit`	Exits the DEPI class configuration mode.
Step 10	**depi-tunnel** *working-depi-tunnel-name* **Example:** `Router(config)# depi-tunnel SPA0`	Creates a DEPI tunnel template.
Step 11	**l2tp-class** *l2tp-class-name* **Example:** `Router(config-depi-tunnel)# l2tp-class class1`	Specifies the L2TP control channel parameters to be inherited.
Step 12	**depi-class** *depi-class-name* **Example:** `Router(config-depi-tunnel)# depi-class SPA0`	Specifies the DEPI control channel parameters to be inherited.

	Command or Action	Purpose
Step 13	**dest-ip** *dest-ip-address* **Example:** `Router(config-depi-tunnel)# dest-ip 192.0.2.103`	Specifies the destination IP address of the termination point for the DEPI tunnel. When configuring on the M-CMTS router, destination IP address is the IP address of the EQAM. When configuring on the EQAM, this is the IP address of the M-CMTS router.
Step 14	**tos** *value* **Example:** `Router(config-depi-tunnel)# tos 100`	(Optional) Sets the value of the ToS byte for IP packets in the L2TPv3 data session. The valid range is from 0 to 255. The default value is 0.
Step 15	**exit** **Example:** `Router(config-depi-tunnel)# exit`	Exits the data session configuration mode.
Step 16	**controller modular-cable** {*slot*/*bay*/*port* | *slot*/*subslot*/*controller*} **Example:** `Router(config)# controller modular-cable 1/0/0`	Specifies the modular cable controller interface for the SPA or the line card. • *slot*—SPA interface processor (SIP) or the line card slot. Slots 1 and 3 are used for SIPs. The valid range is from 5 to 8 for the line card slot. • *bay*—The bay in a SIP where a SPA is located. Valid values are 0 (upper bay) and 1 (lower bay). • *port*—Specifies the interface number on the SPA. • *subslot*—Cable interface line card subslot. Valid values are 0 and 1. • *controller*—Controller index for the modular cable. The valid range is from 0 to 2.
Step 17	**modular-host subslot** *slot/subslot* **Example:** `Router(config-controller)# modular-host subslot 6/0`	Specifies the modular host line card that is used for DOCSIS 3.0 downstream or downstream channel bonding operations.
Step 18	**rf-channel** *rf-port* **cable downstream channel-id** *channel-id* **Example:** `Router(config-controller)# rf-channel 0 cable downstream channel-id 24`	Assigns a downstream channel ID to an RF channel. • *rf-port*—RF channel physical port on the SPA or the line card. Valid values for the RF port depend on the configuration of the annex modulation. • *channel-id*—Unique channel ID. The valid range is from 1 to 255.
Step 19	**rf-channel** *rf-port* **frequency** [*freq* | **none**] [**annex** {**A** | B} **modulation** {**64** | **256**} [**interleave-depth** {**8** | **12** | **16** | **32** | **64** | **128**}]]	Configures the frequency of an RF channel in modular cable controller configuration mode. • *rf-port*—RF channel physical port on the SPA or the line card. Valid values for the RF port depend on the configuration of the annex modulation.

	Command or Action	Purpose
	Example: `Router(config-controller)# rf-channel 0 freq 555000000 annex B mod 64qam inter 32`	• *freq*—Center frequency of the RF channel. The valid range for each RF channel is different based on the Annex type. • **none**—Removes the specified frequency if the RF channel is shut down. This can be configured on the modular cable controller of the N+1 protect line card as no frequency is required to be configured on that controller. • **annex** {**A** | **B**}—Indicates the MPEG framing format for each RF channel. ◦ **A**—Annex A. Indicates that the downstream is compatible with the European MPEG framing format specified in ITU-TJ.83 Annex A. ◦ **B**—Annex B. Indicates that the downstream is compatible with the North American MPEG framing format specified in ITU-TJ.83 Annex B. • **modulation** {**64** | **256**}—Indicates the modulation rate (64 or 256 QAM) for each RF channel. • **interleave-depth**—Indicates the downstream interleave depth. For annex A, the interleave value is 12. For annex B, valid values are 8, 16, 32, 64, and 128.
Step 20	**rf-channel** *rf-channel* **depi-tunnel** *depi-tunnel-name* **tsid** *id* **Example:** `Router(config-controller)# rf-channel 0 depi-tunnel SPA0 tsid 100`	Binds the DEPI tunnel, which inherits the configuration of the specified L2TP class and DEPI class, to an RF channel under a modular controller. • *rf-channel*—RF channel physical port on the SPA or the line card. • *depi-tunnel-name*—Name of the DEPI tunnel. • **tsid** *id*—Specifies the Transport Stream Identifier (TSID) value on the QAM subinterface. The TSID is used to associate the logical RF channel of the SPA or the line card to a physical QAM on RF Gateway 10.
Step 21	**rf-channel** *rf-port* **rf-power** *power-level* **Example:** `Router(config-controller)# rf-channel 0 rf-power 46`	Configures the RF power of an RF channel on the SPA or the line card. • *rf-port*—RF channel physical port on the SPA or the line card. Valid values for the RF port depend on the configuration of the annex modulation. • *power-level*—Desired RF output power level in dBmV. The valid range is dependent on the cable interface. The format is XY.Z. By default, .Z is added as .0.
Step 22	**no rf-channel** *rf-port* **rf-shutdown**	Enables the RF channel.

	Command or Action	Purpose
	Example: `Router(config-controller)# no rf-channel 0 rf-shutdown`	• *rf-port*—RF channel physical port on the SPA or the line card. Valid values for the RF port depend on the configuration of the annex modulation.
Step 23	**exit** **Example:** `Router(config-controller)# exit`	Exits the controller configuration mode.
Step 24	**interface gigabitethernet** *slot/subslot/port* **Example:** `Router(config)# interface gigabitethernet 1/0/0`	Specifies the location of the Gigabit Ethernet interface on the M-CMTS router. • *slot*—SPA interface processor (SIP) or the line card slot. Slots 1 and 3 are used for SIPs. The valid range is from 5 to 8 for the line card slot. • *subslot*—Specifies the secondary slot of the SIP where the SPA is installed or the c*able interface line card subslot. Valid values are 0 and 1*. • *port*—Specifies the interface number.
Step 25	**ip-address** *ip-address mask-ip-address* **Example:** `Router(config-if)# ip-address 192.0.2.155 255.255.255.0`	Sets the IP address for the SPA or the line card field-programmable gate array (FPGA). This address is used as the source IP address for packets that the router transmits to the EQAM device.
Step 26	**negotiation** {**forced** | **auto**} **Example:** `Router(config-if)# negotiation auto`	Enables negotiation on the SPA or the line card interface.
Step 27	**end** **Example:** `Router(config-if)# end`	Returns to privileged EXEC mode.

Configuring DEPI Control Plane on Cisco RFGW-10

This section describes how to configure DEPI control plane on Cisco RFGW-10 in learn mode. Learn mode is the recommended mode of operation if you use Cisco RFGW-10 with the Cisco uBR10012 router.

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**l2tp-class** *l2tp-class-name* **Example:** `Router(config)# l2tp-class class1`	Creates an L2TP class template. The template must be configured but the optional settings are not mandatory. **Note** If all the control channels have the same parameters then one template must be created for the Cisco RFGW-10.
Step 4	**hello** *seconds* **Example:** `Router(config-l2tp-class)# hello 15`	(Optional) Configures the interval used to exchange the "hello" keepalive packets in a Layer 2 control channel. • *seconds*—Number of seconds that a router at one end of a Layer 2 control channel waits between sending the "hello" keepalive packets to its peer router. The valid range is from 0 to 1000 seconds. The default value is 60 seconds. **Note** The "hello" value on the Cisco RFGW-10 can be different from what is configured on the M-CMTS router. We recommend that you specify 15 seconds on the Cisco RFGW-10. A value of less than 10 seconds might subject the system to session flaps and may trigger line card switchover, if the M-CMTS router experiences loss of network connectivity.
Step 5	**retransmit retries** *max-retransmissions* **Example:** `Router(config-l2tp-class)# retransmit retries 5`	(Optional) Configures the retransmission retry settings of the control packets. • *max-retransmissions*—Number of retransmission cycles that occur before determining that the peer provider edge (PE) router does not respond. The valid range is from 5 to 1000. The default value is 15. Specify a smaller value for faster failure detection. **Note** We recommend that you specify 5 on the Cisco RFGW-10.
Step 6	**retransmit timeout** [**max** | **min**] *retransmit-timeout* **Example:** `Router(config-l2tp-class)# retransmit timeout max 1`	Specifies maximum and minimum retransmission intervals (in seconds) for resending the control packets. • {**max** | **min**} *retransmit-timeout*—The valid range is from 1 to 8. The default maximum interval is 8; the default minimum interval is 1. **Note** We recommend that you specify 1 second on the Cisco RFGW-10.

	Command or Action	Purpose
Step 7	**exit** **Example:** `Router(config-l2tp-class)# exit`	Exits the L2TP class configuration mode.
Step 8	**depi-class** *depi-class-name* **Example:** `Router(config)# depi-class SPA0`	Creates a DEPI class template.
Step 9	**exit** **Example:** `Router(config-depi-class)# exit`	Exits the DEPI class configuration mode.
Step 10	**depi-tunnel** *working-depi-tunnel-name* **Example:** `Router(config)# depi-tunnel SPA0`	Creates a DEPI tunnel template.
Step 11	**l2tp-class** *l2tp-class-name* **Example:** `Router(config-depi-tunnel)# l2tp-class class1`	Specifies the L2TP control channel parameters to be inherited.
Step 12	**depi-class** *depi-class-name* **Example:** `Router(config-depi-tunnel)# depi-class SPA0`	Specifies the DEPI control channel parameters to be inherited.
Step 13	**dest-ip** *dest-ip-address* **Example:** `Router(config-depi-tunnel)# dest-ip 192.0.2.155`	Specifies the destination IP address of the M-CMTS Gigabit Ethernet port.
Step 14	**exit** **Example:** `Router(config-depi-tunnel)# exit`	Exits the DEPI configuration mode.
Step 15	**interface** {**qam** | **qam-red**} *slot/port*[*.channel*] **Example:** `Router(config)# interface qam 6/4.1`	Specifies a QAM interface or redundancy-configured (QAM-red) interface. • *slot*—The QAM or QAM-red slot for the line card on Cisco RF Gateway 10. If line card redundancy is configured on the QAM, the interface is QAM-red. The valid range is from 3 to 12. • *port*—Interface number on the line card. The valid range is from 1 to 12. • *.channel*—(Optional) Specifies the channel on the port. The valid range is from 1 to 4.

	Command or Action	Purpose
Step 16	**cable mode** {**depi** | **video**} {**local** | **remote**} [**learn**] **Example:** `Router(config-subif)# cable mode depi remote learn`	Sets the mode of the QAM channel. • **depi—**Specifies the DEPI mode of the QAM channel. • **video—**Specifies the video mode of the QAM channel. • **local—**Specifies that the QAM channel is manually configured. • **remote—**Specifies that the QAM channel is remotely configured. • **learn—**(Optional) Specifies that the QAM channel is in "learn" mode and the Cisco RFGW-10 can learn the channel configuration from the M-CMTS router. All QAM channels on a single port must be in "learn" mode for this configuration to work. **Note** When the QAM is in "learn" mode, there is no need to configure all the QAM channel parameters. Step 17, on page 14 to Step 24, on page 15 should not be executed as the parameters in these steps cannot be changed when the Cisco RFGW-10 is in "learn" mode.
Step 17	**cable downstream stacking** *stacking* **Example:** `Router(config)# cable downstream stacking 4`	Configures the stacking level. Stacking level can be 1, 2, or, 4. • QAM channel 1 is enabled on the specified RF port for stacking level 1. • QAM channels 1, and 2 are enabled on the specified RF port for stacking level 2. • QAM channels 1, 2, 3, and 4 are enabled on the specified RF port for stacking level 4.
Step 18	**no cable downstream rf-shutdown** **Example:** `Router(config-if)# no cable downstream rf-shutdown`	Enables the integrated upconverter.
Step 19	**cable downstream annex** {**A** | **B**} **Example:** `Router(config-if)# cable downstream Annex A`	Configures the MPEG framing format for a downstream port. • **annex** {**A** | **B**}**—**Indicates the MPEG framing format for each RF channel. ◦ **A—**Annex A. Indicates that the downstream is compatible with the European MPEG framing format specified in ITU-TJ.83 Annex A. ◦ **B—**Annex B. Indicates that the downstream is compatible with the North American MPEG framing format specified in ITU-TJ.83 Annex B. The default is Annex B for all Cisco cable interface line cards.

	Command or Action	Purpose
Step 20	**cable downstream frequency** *frequency* **Example:** `Router(config-if)# cable downstream frequency 520000000`	Configures the downstream center frequency for the cable interface line card. • *frequency*—QAM channel frequency in Hz.
Step 21	**cable downstream interleave-level** {**1** | **2**} **Example:** `Router(config-subif)# cable downstream interleave-level 1`	Configures the interleave level. The default interleave level is 2. **Note** This command is for Annex B only.
Step 22	**cable downstream interleave-depth** *depth* **Example:** `Router(config-subif)# cable downstream interleave-depth 5`	Configures the interleave depth. **Note** This command is for Annex B only. As you can configure various combinations of the I/J values for Annex B, the input for this command is the fee-code that is derived from the I/J values. The default I/J values are 32/4.
Step 23	**cable downstream modulation** {**64qam** | **256qam**} **Example:** `Router(config-subif)# cable downstream modulation 256qam`	Configures the modulation format for a downstream port on a cable interface line card. If you change the modulation format, the interface is shut down and all the cable modems are disconnected. The default modulation is set to 64 QAM on all cable interface cards.
Step 24	**cable downstream rf-power** *power* **Example:** `Router(config-subif)# cable downstream rf-power 50`	Configures the RF power output level on an integrated upconverter. • *power*—RF power value in tenth of a dBmV. To reset the RF output power level to its default value, use the no form of this command.
Step 25	**cable downstream tsid** *id* **Example:** `Router(config-subif)# cable downstream tsid 100`	Configures the Transport Stream Identifier value on the QAM subinterface. The valid range is from 0 to 65535.
Step 26	**depi depi-tunnel** *working-depi-tunnel-name* **Example:** `Router(config-subif)# depi depi-tunnel working1`	Binds the DEPI tunnel to the QAM.
Step 27	**exit** **Example:** `Router(config-subif)# exit`	Exits the subinterface configuration mode. The Cisco RFGW-10 is now ready to accept incoming control connection requests from the M-CMTS router but cannot initiate a control connection with the router.

	Command or Action	Purpose
Step 28	**interface gigabitethernet** *slot/port* **Example:** `Router(config)# interface gigabitethernet 6/13`	Specifies the Gigabit Ethernet interface.
Step 29	**no switchport** **Example:** `Router(config-if)# no switchport`	Disables switching mode.
Step 30	**ip-address** *ip-address mask-ip-address* **Example:** `Router(config-if)# ip-address 192.0.2.103 255.255.255.0`	Sets the IP address for the SPA or the line card field-programmable gate array (FPGA). This address is used as the source IP address of Cisco RFGW-10.
Step 31	**end** **Example:** `Router(config-if)# end`	Returns to privileged EXEC mode.

Examples

The following is an example for configuring DEPI on Cisco RFGW-10, which is in **learn** mode.

```
Router> enable
Router# configure terminal
Router(config)# l2tp-class class1
Router(config-l2tp-class)# hello 15
Router(config-l2tp-class)# retransmit retries 5
Router(config-l2tp-class)# retransmit timeout max 1
Router(config-l2tp-class)# exit
Router(config)# depi-class 0
Router(config-depi-class)# exit
Router(config)# depi-tunnel 0
Router(config-depi-tunnel)# l2tp-class class1
Router(config-depi-tunnel)# depi-class 0
Router(config-depi-tunnel)# dest-ip 192.0.2.155
Router(config-depi-tunnel)# exit
Router(config)# interface qam 6/4.1
Router(config-subif)# cable mode depi remote learn
Router(config-subif)# cable downstream tsid 100
Router(config-subif)# depi depi-tunnel working1
Router(config-subif)# exit
Router(config)# interface gigabitethernet 6/13
Router(config-if)# no switchport
Router(config-if)# ip-address 192.0.2.103 255.255.255.0
Router(config-if)# end
```

The following is an example for configuring DEPI on Cisco RFGW-10, which is not in “learn” mode.

```
Router> enable
Router# configure terminal
Router(config)# l2tp-class class1
Router(config-l2tp-class)# exit
Router(config)# depi-class 0
```

```
Router(config-depi-class)# exit
Router(config)# depi-tunnel 0
Router(config-depi-tunnel)# l2tp-class class1
Router(config-depi-tunnel)# depi-class 0
Router(config-depi-tunnel)# dest-ip 192.0.2.155
Router(config-depi-tunnel)# exit
Router(config)# interface qam 6/4.1
Router(config-subif)# cable mode depi remote learn
Router(config-subif)# cable downstream stacking 4
Router(config-subif)# no cable downstream rf-shutdown
Router(config-subif)# cable downstream Annex B
Router(config-subif)# cable downstream frequency 520000000
Router(config-subif)# cable downstream tsid 100
Router(config-subif)# cable downstream interleave-level 2
Router(config-subif)# cable downstream interleave-depth 5
Router(config-subif)# cable downstream modulation 256qam
Router(config-subif)# cable downstream rf-power 50
Router(config-subif)# depi depi-tunnel 0
Router(config-subif)# end
```

Configuring N+1 DEPI Redundancy on the M-CMTS Router and Cisco RFGW-10

This configuration is optional. This section describes how to configure N+1 DEPI redundancy on the M-CMTS router and Cisco RFGW-10.

Note The N+1 DEPI redundancy feature is supported only on the Cisco uBR-MC3GX60V line card. This feature is not supported on the Cisco Wideband SPA.

The procedure is the same for configuring N+1 DEPI redundancy on the M-CMTS router and Cisco RFGW-10. You must configure N+1 DEPI redundancy on the M-CMTS router before configuring it on the Cisco RFGW-10.

The working tunnel and the protect tunnel are configured using the same **depi-tunnel** command. The protect tunnel inherits L2TP class and DEPI class parameters from the working tunnel. When you configure the protect tunnel and specify the destination IP address for the protect tunnel, the protect tunnel inherits the QAM channel parameters specified for the working tunnel.

Before You Begin

- You must configure N+1 line card redundancy for the Cisco uBR-MC3GX60V line card before configuring N+1 DEPI redundancy.
- The tunnel names for the working and protect tunnels must be distinct and the protect tunnel must be associated with the corresponding working tunnel.
- The working tunnel must be configured on the M-CMTS router before configuring the protect tunnel.

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**depi-tunnel** *protect-depi-tunnel-name* **Example:** `Router(config)# depi-tunnel protect1`	Specifies a protect tunnel name and enters DEPI tunnel configuration mode.
Step 4	**dest-ip** *dest-ip-address* **Example:** `Router(config-depi-tunnel)# dest-ip 192.0.2.103`	Specifies the destination IP address of the termination point for the protect tunnel. **Note** When configuring on the M-CMTS router, destination IP address is the IP address of the EQAM. When configuring on the EQAM, this is the IP address of the M-CMTS router.
Step 5	**exit** **Example:** `Router(config-depi-tunnel)# exit`	Exits the DEPI tunnel configuration mode.
Step 6	**depi-tunnel** *working-depi-tunnel-name* **Example:** `Router(config)# depi-tunnel working1`	Specifies a working tunnel name that is already configured with QAM channel parameters, and enters DEPI tunnel configuration mode.
Step 7	**protect-tunnel** *protect-depi-tunnel-name* **Example:** `Router(config-depi-tunnel)# protect-tunnel protect1`	Associates the protect tunnel to the corresponding working tunnel. **Note** Use the same protect tunnel that you created using the **depi-tunnel** command to associate the protect tunnel to the corresponding working tunnel.
Step 8	**end** **Example:** `Router(config-depi-tunnel)# end`	Exits DEPI tunnel configuration mode and returns to privileged EXEC mode.

Configuring DLM on the M-CMTS Router

This section describes how to configure DLM on the M-CMTS router.

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable**	Enables privileged EXEC mode.

	Command or Action	Purpose
	Example: `Router> enable`	• Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**controller modular-cable** {*slot*/*bay*/*port* | *slot*/*subslot*/*controller*} **Example:** `Router(config)# controller modular-cable 1/0/0`	Specifies the modular cable controller interface for the SPA or the line card. • *slot*—SPA interface processor (SIP) or the line card slot. Slots 1 and 3 are used for SIPs. The valid range is from 5 to 8 for the line card slot. • *bay*—The bay in a SIP where a SPA is located. Valid values are 0 (upper bay) and 1 (lower bay). • *port*—Specifies the interface number on the SPA. • *subslot*—Cable interface line card subslot. Valid values are 0 and 1. • *controller*—Controller index for the modular cable. The valid range is from 0 to 2.
Step 4	**rf-channel** *rf-port* **network-delay** {*delay* | **auto**} [**sampling-rate** *rate*] **Example:** `Router(config-controller)# rf-channel rf6 network-delay auto sampling-rate 1`	Configures the network delay for an RF channel. • *rf-port*—RF channel physical port on the SPA or the line card. Valid values for the RF port depend on the configuration of the annex modulation. • *delay*—The Converged Interconnect Network (CIN) delay. The default value is 550 usec. The permitted range is from 0 to 3000 usec. • **auto**—Determines the delay through DLM packets automatically. • **sampling-rate** *rate*—(Optional) Specifies how often the DLM is sent. This option is available only when the network delay value is set as auto. The permitted range is from 1 to 500 sec. The default value is 10 sec.
Step 5	**end** **Example:** `Router(config-controller)# end`	Returns to privileged EXEC mode.

Disabling a DEPI Data Session on the M-CMTS Router

This configuration is optional. This section describes how to disable a DEPI data session on the M-CMTS router.

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**controller modular-cable** {*slot*/*bay*/*port* | *slot*/*subslot*/*controller*} **Example:** `Router(config)# controller modular-cable 1/0/0`	Specifies the modular cable controller interface for the SPA or the line card. • *slot*—SPA interface processor (SIP) or the line card slot. Slots 1 and 3 are used for SIPs. The valid range is from 5 to 8 for the line card slot. • *bay*—The bay in a SIP where a SPA is located. Valid values are 0 (upper bay) and 1 (lower bay). • *port*—Specifies the interface number on the SPA. • *subslot*—Cable interface line card subslot. Valid values are 0 and 1. • *controller*—Controller index for the modular cable. The valid range is from 0 to 2.
Step 4	**no rf-channel** *rf-channel* **depi-tunnel** *depi-tunnel-name* [**tsid** *id*] **Example:** `Router(config-controller)# rf-channel 0 depi-tunnel SPA0 tsid 100`	Removes the specified DEPI data session under the modular controller. • *rf-channel*—RF channel physical port on the SPA or the line card. • *depi-tunnel-name*—Name of the DEPI tunnel. • **tsid** *id*—(Optional) Specifies the TSID value on the QAM subinterface. The TSID is used to associate the logical RF channel of the SPA or the line card to a physical QAM on Cisco RFGW-10.
Step 5	**end** **Example:** `Router(config-controller)# end`	Returns to Privileged EXEC mode.

Configuration Examples for M-CMTS DEPI Control Plane

This section provides the following configuration examples:

Example: DEPI Control Plane Configuration on the M-CMTS Router

The following example shows how to configure DEPI control plane on the M-CMTS:

```
Router# show running-config
.
.
.
l2tp-class rf6
!
depi-class rf6
mode mpt
!
depi-tunnel rf6
tos 128
dest-ip 192.0.2.103
l2tp-class rf6
depi-class rf6
!
controller Modular-Cable 1/0/0
ip-address 192.0.2.155
modular-host subslot 6/0
rf-channel 6 cable downstream channel-id 7
rf-channel 6 frequency 717000000 annex B modulation 64qam interleave 64
rf-channel 6 depi-tunnel rf6 tsid 6
rf-channel 6 rf-power 46
rf-channel 6 network-delay auto sampling-rate 1
no rf-channel 6 rf-shutdown
.
.
.
```

Example: DEPI Control Plane Configuration on Cisco RFGW-10

The following example shows how to configure DEPI control plane on Cisco RFGW-10:

```
Router# show running-config
.
.
.
l2tp-class rf6
!
depi-class rf6
!
depi-tunnel rf6
dest-ip 192.0.2.155
l2tp-class rf6
depi-class rf6
!
.
.
.
interface Qam6/4
no ip address
!
interface Qam6/4.1
cable mode depi remote learn
cable downstream tsid 6
depi depi-tunnel rf6
snmp trap link-status
!
```

Example: N+1 DEPI Redundancy Configuration on the M-CMTS Router

The following example shows how to configure N+1 DEPI redundancy on the Cisco CMTS router:

```
Router# show running-config
.
.
.
l2tp-class rf6
!
depi-class rf6
mode mpt
!
depi-tunnel rf6
tos 128
dest-ip 192.0.2.103
l2tp-class rf6
depi-class rf6
protect-tunnel test1_protect
!
depi-tunnel test1_protect
 dest-ip 24.30.14.103
controller Modular-Cable 8/0/0
ip-address 192.0.2.155
modular-host subslot 6/0
rf-channel 6 cable downstream channel-id 7
rf-channel 6 frequency 717000000 annex B modulation 64qam interleave 64
rf-channel 6 depi-tunnel rf6 tsid 6
rf-channel 6 rf-power 46
rf-channel 6 network-delay auto sampling-rate 1
no rf-channel 6 rf-shutdown
.
.
.
```

Example: GigabitEthernet Interface Configuration on the M-CMTS Router

The following example shows the GigabitEthernet configuration on the M-CMTS:

```
Router# show running-config interface gigabitEthernet 1/0/0
.
.
.
interface GigabitEthernet1/0/0
ip address 192.0.2.155 255.255.255.0
negotiation auto
.
.
.
```

Example: GigabitEthernet Interface Configuration on Cisco RFGW-10

The following example shows the GigabitEthernet configuration on RFGW-10:

```
Router# show running-config interface gigabitEthernet 6/13
.
.
.
interface GigabitEthernet6/13
no switchport
ip address 192.0.2.103 255.255.255.0
```

.
.
.

Verifying M-CMTS DEPI Control Plane

This section explains how to verify DEPI control plane configuration on the M-CMTS router, and it contains the following topics:

Verifying DEPI Tunnel Information

To verify a DEPI tunnel information, use the **show depi tunnel** command in privileged EXEC mode.

Note This command works on both the M-CMTS router and the Cisco RFGW-10.

The following is a sample output of the **show depi tunnel** command for all the active control connections:

```
Router# show depi tunnel
LocTunID   RemTunID   Remote Name   State  Remote Address  Sessn L2TP Class/
                                                           Count VPDN Group
1834727012 3849925733 RFGW-10       est    192.0.2.155       1     rf6
```

The following is a sample output of the **show depi tunnel** command for a specific active control connection identified using the depi-tunnel-name:

```
Router# show depi tunnel 1834727012 verbose
Tunnel id 1834727012 is up, remote id is 3849925733, 1 active sessions
  Locally initiated tunnel
  Tunnel state is established, time since change 04:10:38
  Remote tunnel name is RFGW-10
    Internet Address 192.0.2.155, port 0
  Local tunnel name is myankows_ubr10k
    Internet Address 192.0.2.103, port 0
  L2TP class for tunnel is rf6
  Counters, taking last clear into account:
    0 packets sent, 0 received
    0 bytes sent, 0 received
    Last clearing of counters never
  Counters, ignoring last clear:
    0 packets sent, 0 received
    0 bytes sent, 0 received
  Control Ns 255, Nr 254
  Local RWS 1024 (default), Remote RWS 8192
  Control channel Congestion Control is enabled
    Congestion Window size, Cwnd 256
    Slow Start threshold, Ssthresh 8192
    Mode of operation is Slow Start
  Retransmission time 1, max 1 seconds
  Unsent queuesize 0, max 0
  Resend queuesize 0, max 2
  Total resends 0, ZLB ACKs sent 252
  Total peer authentication failures 0
  Current no session pak queue check 0 of 5
  Retransmit time distribution: 0 0 0 0 0 0 0 0 0
  Control message authentication is disabled
```

Note The counters in the **show depi tunnel verbose** command output are not supported.

The following is a sample output of the **show depi tunnel** command that shows DEPI tunnel endpoints in Cisco IOS Release 12.2(33)SCE and later releases. The **endpoints** keyword is supported only on the M-CMTS router.

```
Router# show depi tunnel endpoints
DEPI Tunnel               Modular Controller   State  Remote Address Sessn
                                                                     Count
depi_working_tunnel_8_0_4 Mod8/0/2             est    1.30.84.100     24
depi_protect_tunnel_5_1_0 Mod8/0/0:5/1/0       est    1.30.50.100     24
depi_protect_tunnel_5_1_4 Mod8/0/2:5/1/2       est    1.30.54.100     24
depi_working_tunnel_8_0_0 Mod8/0/0             est    1.30.3.100      24
```

Verifying DEPI Session Information

To verify a DEPI session, use the **show depi session** command in privileged EXEC mode.

Note This command works on both the M-CMTS router and the Cisco RFGW-10.

The following is a sample output of the **show depi session** command for all the established DEPI data sessions:

```
Router# show depi session
LocID      RemID      TunID      Username, Intf/      State  Last Chg Uniq ID
                                 Vcid, Circuit
1252018468 1252055513 1834727012 6,                   est    04:06:10 1
```

The following is a sample output of the **show depi session** command for a specific established DEPI data session identified using the *session-id*:

```
Router# show depi session 1252018468 verbose
Session id 1252018468 is up, tunnel id 1834727012
  Remote session id is 1252055513, remote tunnel id 3849925733
  Locally initiated session
Qam Channel Parameters
  Group Tsid is 0
  Frequency is 717000000
  Modulation is 64qam
  Annex is B
  Interleaver Depth I=32 J=4
  Power is 0
  Qam channel status is 0
  Unique ID is 1
Call serial number is 326100007
Remote tunnel name is RFGW-10
  Internet address is 192.0.2.155
Local tunnel name is myankows_ubr10k
  Internet address is 192.0.2.103
IP protocol 115
  Session is L2TP signaled
  Session state is established, time since change 04:06:24
    0 Packets sent, 0 received
    0 Bytes sent, 0 received
  Last clearing of counters never
  Counters, ignoring last clear:
    0 Packets sent, 0 received
    0 Bytes sent, 0 received
    Receive packets dropped:
      out-of-order:             0
      total:                    0
    Send packets dropped:
      exceeded session MTU:     0
      total:                    0
```

```
  DF bit on, ToS reflect enabled, ToS value 0, TTL value 255
  UDP checksums are disabled
  Session PMTU enabled, path MTU is 1492 bytes
  No session cookie information available
  FS cached header information:
    encap size = 28 bytes
    45000014 00004000 FF73706F 01030467
    0103049B 4AA0D9D9 00000000
  Sequencing is on
    Ns 0, Nr 0, 0 out of order packets received
    Packets switched/dropped by secondary path: Tx 0, Rx 0
  Conditional debugging is disabled
```

Beginning with Cisco IOS Release 12.2(33)SCE, you can verify DEPI EQAM statistics (this feature is enabled by default), using the **show depi session** command with the **verbose** keyword as shown in the following example:

```
Router# show depi session 1252018468 verbose
Session id 1252018468 is up, tunnel id 1834727012
  Remote session id is 1252055513, remote tunnel id 3849925733
  Locally initiated session
Qam Channel Parameters
  Group Tsid is 0
  Frequency is 717000000
  Modulation is 64qam
  Annex is B
  Interleaver Depth I=32 J=4
  Power is 0
  Qam channel status is 0
  Unique ID is 1
.
.
.
Sequencing is on
    Ns 0, Nr 0, 0 out of order packets received
    Packets switched/dropped by secondary path: Tx 0, Rx 0
.
.
.
Peer Session Details
Peer Session ID : 1073808091
Peer Qam ID : Qam3/12.2
Peer Qam State : ACTIVE
Peer Qam Type : Secondary
Peer Qam Statistics
Total Pkts : 35177
Total Octets : 6613276
Total Discards : 0
Total Errors : 0
Total In Pkt Rate : 0
Bad Sequence Num : 0
Total In DLM Pkts : 0
Conditional debugging is disabled
```

Note The counters in the **show depi session verbose** command output are not supported.

The following is a sample output of the **show depi session** command for all the configured DEPI data sessions:

```
Router# show depi session configured
Session Name           State    Reason                      Time
Modular-Cable1/0/0:0   IDLE     Power mismatch              Jun 10 09:59:07
```

The following is a sample output of the **show depi session** command that shows DEPI session endpoints in Cisco IOS Release 12.2(33)SCE and later releases. The **endpoints** keyword is supported only on the M-CMTS router.

```
Router# show depi session endpoints
DEPI Tunnel                RF Channel              EQAM rf-port Tsid  State  Type
depi_working_tunnel_8_0_0 Mod8/0/0:0              Qam3/7.1     371   est    P
depi_protect_tunnel_5_1_0 Mod8/0/0:5/1/0:0        Qam3/7.1     371   est    S
non_cisco_eqam_tunnel     Mod8/0/0:6              -            11012 est    P
```

Verifying DLM Configuration Information

To verify the DLM configuration information, use the **show interface modular-cable dlm** command in privileged EXEC mode.

The following example shows sample output of the **show interface modular-cable** *slot/bay/port:interface_number* **dlm** command:

```
Router# show interface modular-cable 1/0/0:6 dlm
DEPI Latency Measurements for Modular-Cable1/0/0:6
Current CIN Delay: 146 usecs
Current DLM: 4566
Average DLM (last 10): 1514
Max DLM: 5115
Min DLM: 913
Ingress DLM
#           SysUpTime           Delay (Ticks)
x-----------x-------------------x------------
0           831149              949
1           831159              1168
2           831170              4566
3           831076              1005
4           831087              983
5           831097              1185
6           831108              1139
7           831118              1144
8           831128              2013
9           831139              996
```

Note The M-CMTS sends either ingress or egress DLM requests based on the EQAM capabilities that EQAM reports during DEPI data session establishment.

Additional References

The following sections provide references related to the M-CMTS DEPI Control Plane feature.

Related Documents

Related Topic	Document Title
Cisco Wideband SPA	*Cisco uBR10012 Universal Broadband Router SIP and SPA Software Configuration Guide* http://www.cisco.com/en/US/docs/interfaces_modules/shared_port_adapters/configuration/ubr10012/b_10k_sip_spa_scg.html
Cisco uBR-MC3GX60V	*Configuring the Cisco uBR-MC3GX60V Cable Interface Line Card* http://www.cisco.com/en/US/products/hw/cable/ps2209/products_installation_and_configuration_guides_list.html
Command Reference	*Cisco IOS CMTS Cable Command Reference* http://www.cisco.com/en/US/docs/ios/cable/command/reference/cbl_book.html

Standards and RFCs

Standard	Title
CM-SP-DEPI-I08-100611	Data-Over-Cable Service Interface Specification, Modular Headend Architecture, Downstream External PHY Interface Specification
RFC 3931	Layer Two Tunneling Protocol - Version 3 (L2TPv3)

MIBs

MIB	MIBs Link
• DOCS-IF-M-CMTS-MIB • DOCS-DRF-MIB	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for M-CMTS DEPI Control Plane

Use Cisco Feature Navigator to find information about platform support and software image support. Cisco Feature Navigator enables you to determine which software images support a specific software release, feature set, or platform. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn. An account on Cisco.com is not required.

Note The table below lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Table 2: Feature Information for M-CMTS DEPI Control Plane

Feature Name	Releases	Feature Information
M-CMTS DEPI Control Plane	12.2(33)SCC	This feature was introduced in Cisco IOS Release 12.2(33)SCC. The following commands were introduced or modified: • **depi-class** • **depi-tunnel** • **dest-ip** • **rf-channel depi-tunnel** • **rf-channel rf-power** • **rf-channel rf-shutdown** • **show depi** • **show depi session** • **show depi tunnel**
Ingress DLM	12.2(33)SCC	This feature was introduced in Cisco IOS Release 12.2(33)SCC. The following commands were introduced or modified: • **show interface Modular-Cable dlm** • **rf-channel network-delay**
N+1 DEPI Redundancy	12.2(33)SCE	Cisco IOS Release 12.2(33)SCE introduces support for the N+1 redundancy for DEPI control plane feature to protect against the Cisco uBR-MC3GX60V line card failure or switchover. The following commands were introduced or modified: • **protect-tunnel** • **show depi session** • **show depi tunnel**

Feature Name	Releases	Feature Information
DEPI EQAM Statistics	12.2(33)SCE	The DEPI EQAM statistics feature enables the EQAM to send RF channel statistics to the M-CMTS router. The following command was introduced: • **depi eqam-stats**
DEPI CIN Failover	12.2(33)SCF4	The DEPI CPU threshold values can be configured. The following command was modified: **depi cin-failover cpu-threshold**