G.8032 and CFM Support for Microwave Adaptive Bandwidth

The G.8032 and CFM Support for Microwave Adaptive Bandwidth feature enables the G.8032 Ethernet Protection Ring (ERP) mechanism to be used as a trigger in response to bandwidth degradation occurrences (such as a signal degradation [SD] indicator) on microwave links. Ethernet Connectivity Fault Management (CFM) interacts with the microwave transceiver to continuously check the quality and the bandwidth of the microwave link. When microwave link degradation (based on the configured service level agreement [SLA] in use) is detected, CFM notifies the Embedded Event Manager (EEM), which in turn notifies a mechanism such as, G.8032 ERP. G.8032 ERP ensures that the degraded microwave link is bypassed and no longer used. The degraded microwave link can still be used by one or more of the G.8032 ERP instances. Only the affected G.8032 ERP instances are switched to alternate link.

Prerequisites for G.8032 and CFM Microwave Adaptive Bandwidth Support

- The microwave transceiver in the network topology must support adaptive bandwidth modulation, and the microwave transceiver must support the Ethernet Connectivity Fault Management (CFM) extension for microwave devices as defined by Cisco.
- All devices connected directly to the microwave transceiver must support signal degradation (SD) functions. Devices not connected directly to the microwave transceiver can be standard-compliant nodes or enhanced SD-capable nodes.
- In any homogeneous ring topology, all links must be microwave links and all devices must support microwave SD-based ring protection.
- A ring topology with multiple microwave links can experience a signal degradation condition on one or more of the microwave links. Only one signal degradation condition per ring instance is supported. This support is provided on a first-come, first-serve basis, per ring instance.

About G.8032 and CFM Support for Microwave Adaptive Bandwidth

Microwave Adaptive Bandwidth Feature Functionality

The G.8032 and CFM Support for Microwave Adaptive Bandwidth feature extends the functionality of the G.8032 Ethernet Protection Ring (ERP) mechanism and Ethernet Connectivity Fault Management (CFM).

This feature enables the G.8032 ERP mechanism to be used as a trigger in response to bandwidth degradation occurrences (such as a signal degradation [SD] indicator) on microwave links. Ethernet CFM interacts with the microwave transceiver to continuously check the quality and the bandwidth of the microwave link. When microwave link degradation (based on the configured service level agreement [SLA] in use) is detected, CFM notifies the Embedded Event Manager (EEM), which in turn notifies a mechanism such as, G.8032 ERP. G.8032 ERP ensures that the degraded microwave link is bypassed and no longer used. Depending upon the severity of the signal degradation and the configured threshold, G.8032 protection switching occurs on a per-instance basis.

For more information about Ethernet CFM, see the “Configuring IEEE Standard-Compliant Ethernet CFM in a Service Provider Network” module or the “Configuring Ethernet Connectivity Fault Management in a Service Provider Network” module.

For more information about G.8032 ERP, see the “ITU-T G.8032 Ethernet Ring Protection Switching” module.

Fixed Versus Adaptive Bandwidth Modulation and the Microwave Adaptive Bandwidth Feature

Traditional microwave radios use fixed modulation schemes whereby any degradation in the wave propagation conditions (for example, due to adverse weather conditions such as heavy fog or rain) led to complete loss of the signal and a disruption of traffic. In a fixed modulation scheme, the microwave radio link had a binary state of either “'available” (on) or “unavailable” (off).

More technologically advanced microwave radios use an adaptive modulation scheme. In an adaptive modulation scheme, when the microwave link degrades due to adverse weather conditions, the radio changes its modulation scheme to a more robust scheme. The radio continues to broadcast but with less capacity. As a result, the radio can be in several capacity or bandwidth states, and not just on or off.

In the case of microwave links with adaptive modulation, the control Operation, Administration, and Maintenance (OAM) protocols are unable to make best use of the available bandwidth due of the following OAM characteristics:

- If the protocol used for failure detection is tagged as high-priority traffic, the OAM frames bypass the degraded (congested) microwave links and no protection switching is triggered.

- If the protocol used for failure detection is tagged as low-priority traffic, then momentary congestion over the native Ethernet (that is, the nonmicrowave) links could lead to loss of continuity and spurious protection switching.

Even though the network topology must be provisioned with enough redundant bandwidth to handle a complete failure, in certain situations where the service committed information rate (CIR) is very low, forwarding as

much excess traffic (above the CIR) as possible is important. Therefore, for those situations, treating bandwidth degradation as a complete failure is not desirable.

How to Configure G.8032 and CFM Support for Microwave Adaptive Bandwidth

Creating the Ethernet Microwave Event and Using G.8032 to Specify Appropriate Actions

For more information on how to configure the ethernet ring profile, see LAN Switching Configuration Guide IOS XE Release 3S (Cisco ASR 900 Series).

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **event manager applet** *applet-name*
4. **action** *action-id* **switch ring g8032** *ring-name* **instance** *instance-id*
5. **event ethernet microwave clear-sd** {**interface** *type number*}
6. **action** *action-id* **switch ring g8032 clear** *ring-name* **instance** {*instance-id* | **all**}
7. Repeat steps 4 through 7 for each Ethernet microwave event you want to create. Then proceed to step 9.
8. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**event manager applet** *applet-name* **Example:** `Device(config)# event manager applet mw_ring_sd1`	Registers an applet with the Embedded Event Manager (EEM) and enters applet configuration mode.
Step 4	**action** *action-id* **switch ring g8032** *ring-name* **instance** *instance-id* **Example:**	Specifies the protocol switch action for an instance on a link of a G.8032 Ethernet Protection Ring (ERP).

	Command or Action	Purpose
	`Device(config-applet)# action 1 switch ring g8032 ringA instance 1`	
Step 5	**event ethernet microwave clear-sd** {**interface** *type number*} **Example:** `Device(config-applet)# event ethernet microwave clear-sd interface gigabitethernet0/0/0`	Creates the Ethernet microwave event to be associated with bandwidth SD occurrences. • After the event is created, use the **action switch ring g8032 clear instance** command at step 7 to clear the SD occurrence and bring the ring back to the normal (idle) state.
Step 6	**action** *action-id* **switch ring g8032 clear** *ring-name* **instance** {*instance-id* | **all**} **Example:** `Device(config-applet)# action 1 switch ring g8032 clear ringA instance 1`	Specifies the action of clearing an SD occurrence on a link of a G.8032 Ethernet Protection Ring (ERP) topology.
Step 7	Repeat steps 4 through 7 for each Ethernet microwave event you want to create. Then proceed to step 9. **Example:** –	
Step 8	**exit** **Example:** `Device(config-applet)# exit`	Exits applet configuration mode.

Modifying Ethernet Microwave Event Settings

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type name*
4. **ethernet event microwave hold-off** *seconds*
5. **ethernet event microwave loss-threshold** *number-of-messages*
6. **ethernet event microwave wtr** *seconds*
7. **exit**
8. **show ethernet event microwave status** [**interface** *type number*]
9. **show ethernet event microwave statistics** [**interface** *type number*]
10. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Device> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Device# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type name* **Example:** `Device(config)# interface gigabitethernet0/0/0`	Specifies an interface and enters interface configuration mode.
Step 4	**ethernet event microwave hold-off** *seconds* **Example:** `Device(config-if)# ethernet event microwave hold-off 30`	Specifies the microwave bandwidth degradation hold-off time, in seconds. • This time is used to prevent changes in the state of the network node as a result of signal degradation (SD) occurrences.
Step 5	**ethernet event microwave loss-threshold** *number-of-messages* **Example:** `Device(config-if)# ethernet event microwave loss-threshold 3`	Specifies the number of bandwidth Vendor-Specific Messages (VSM) sent from the microwave transceiver to the Cisco device. Once the link experiences signal degradation, the microwave transceiver sends periodic bandwidth VSM messages to the Cisco device until the bandwidth is fully restored. The interval of these messages is controlled by the microwave transceiver. This configuration specifies the continuous bandwidth VSM messages the Cisco device misses before declaring a signal recovery event.
Step 6	**ethernet event microwave wtr** *seconds* **Example:** `Device(config-if)# ethernet event microwave wtr 45`	Specifies the wait-to-restore (WTR) time, in seconds. • This time is used to prevent changes in the state of the network node as a result of recovery events after an SD occurrence.
Step 7	**exit** **Example:** `Device(config-if)# exit`	Exits interface configuration mode.

	Command or Action	Purpose
Step 8	**show ethernet event microwave status** [**interface** *type number*] **Example:** `Device# show ethernet event microwave status GigabitEthernet 0/0/2`	(Optional) Displays the microwave event status.
Step 9	**show ethernet event microwave statistics** [**interface** *type number*] **Example:** `Device# show ethernet event microwave statistics GigabitEthernet 0/0/2`	(Optional) Displays the microwave event statistics.
Step 10	**end** **Example:** `Device# end`	Returns to user EXEC mode.

Configuration Examples for G.8032 and CFM Support for Microwave Adaptive Bandwidth

Example: Configuring the Ethernet Microwave Event

In this example, two Ethernet microwave events have been created, mw_ring_sdl1 and mw_ring_sd_2:

```
Device> enable
Device> configure terminal
Device(config)# event manager applet mw_ring_sd1
Device(config-applet)# event ethernet microwave sd interface gigabitethernet0/0/0 threshold
 400
Device(config-applet)# action 1 switch ring g8032 ringA instance 1
Device(config-applet)# exit
Device(config)# event manager applet mw_ring_sd2
Device(config-applet)# event ethernet microwave sd interface gigabitethernet0/0/0 threshold
 400
Device(config-applet)# action 1 switch ring g8032 ringA instance 2
Device(config-applet)# exit
```

In this example, a microwave event has been configured that clears all the signal degradation (SD) events, as defined by the **action switch ring g8032 clear instance all** command:

```
Device> enable
Device> configure terminal
Device(config)# event manager applet mw_ring_clear_sd
Device(config-applet)# event ethernet microwave clear-sd interface gigabitethernet0/0/0
Device(config-applet)# action 1 switch ring g8032 clear ringA instance all
Device(config-applet)# exit
```

Example: Verifying the Ethernet Microwave Event Configuration

The following is sample output from the **show ethernet event microwave status** command where GigabitEthernet interface 0/0/2 has been specified. Use the command to confirm that the configuration is performing as intended.

The following is sample output from the **show ethernet event microwave statistics** command where GigabitEthernet interface 0/0/2 has been specified:

Additional References for G.8032 and CFM Support for Microwave Adaptive Bandwidth

Related Documents

Related Topic	Document Title
Ethernet Connectivity Fault Management (CFM)	*Configuring Ethernet Connectivity Fault Management in a Service Provider Network* or *Cofiguring IEEE Standard-Compliant Ethernet CFM in a Service Provider Network"*
G.8032 Ethernet Ring Protection (ERP) administrative information and wiki	*ITU-T G.8032 Ethernet Ring Protection Switching* http://docwiki.cisco.com/wiki/G.8032_Ethernet_Ring_Protection_(ERP)_Administrative_Procedures
Operations, Administration, and Maintenance (OAM)	*Using Ethernet Operations, Administration, and Maintenance*
Carrier Ethernet commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	*Cisco IOS Carrier Ethernet Command Reference*

Related Topic	Document Title
Cisco IOS commands: master list of commands with complete command syntax, command mode, command history, defaults, usage guidelines, and examples	Cisco IOS Master Command List, All Releases

Standards

Standard	Title
ITU-T	*ITU-T Y.1731 OAM Mechanisms for Ethernet-Based Networks*

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for G.8032 and CFM Support for Microwave Adaptive Bandwidth

The following table provides release information about the feature or features described in this module. This table 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.

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

Table 1: Feature Information for G.8032 and CFM Support for Microwave Adaptive Bandwidth

Feature Name	Releases	Feature Information
G.8032 and CFM Support for Microwave Adaptive Bandwidth	15.3(2)S	The G.8032 and CFM Support for Microwave Adaptive Bandwidth feature extends the functionality of the G.8032 Ethernet Protection Ring (ERP) mechanism and Ethernet Connectivity Fault Management (CFM). This feature enables the G.8032 ERP mechanism to be used as a trigger in response to bandwidth degradation occurrences (such as a signal degradation [SD] indicator) on microwave links. Ethernet CFM interacts with the microwave transceiver to continuously check the quality and the bandwidth of the microwave link. When microwave link degradation (based on the configured service level agreement [SLA] in use) is detected, CFM notifies the G.8032 ERP mechanism, which in turn ensures that the degraded microwave link is bypassed and no longer used. The degraded microwave link can still be used by one or more of the G.8032 ERP instances. Only the affected G.8032 ERP instances are switched to alternate link. In Cisco IOS Release 15.3(2)S, support was added for the Cisco ASR 901 series Aggregation Services Router. The following commands were introduced or modified: **action switch ring g8032 clear instance**, **action switch switch ring g8032 instance**, **clear ethernet event microwave data**, **clear ethernet event microwave statistics**, **debug ethernet event microwave**, **ethernet event microwave**, **event ethernet microwave clear-sd**, **event ethernet microwave sd**, **show ethernet event microwave statistics**, and **show ethernet event microwave status**.