CFM CCM Extensions to Support the NSN Microwave 1+1 Hot Standby Protocol

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The Nokia Siemens Networks (NSN) Microwave 1+1 Hot Standby (HSBY) protocol is a link-protection protocol that extends connectivity fault management (CFM) continuity check messages (CCMs) to enable 1:1 link redundancy in microwave devices. NSN Microwave 1+1 HSBY provides link-protection support for both indoor units (IDUs) and outdoor units (ODUs).

This document describes the extensions to the IEEE 802.1ag CFM component in Cisco IOS software that enable the detection and handling of microwave outdoor unit hardware failures.

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 for CFM CCM Extensions to Support the NSN Microwave 1+1 HSBY Protocol" section on page 14.

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

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Restrictions for CFM CCM Extensions to Support the NSN Microwave 1+1 HSBY Protocol

- The CFM CCM Extensions to Support the NSN Microwave 1+1 HSBY Protocol feature is supported only in Cisco IOS Release 15.1(2)S and in Release 15.0(1)MR.
- NSN Hot Standby supports only the ES+, ES20, and 6700 series line cards on the Cisco 7600 series router.
- To enable link-protection on a maintenance endpoint (MEP), the CFM domain and MEP must adhere to the NSN configuration requirements.

Information About CFM CCM Extensions to Support the NSN Microwave 1+1 HSBY Protocol

NSN Microwave 1+1 HSBY and CFM Integration

CFM Continuity Check Messages

CFM CCMs are heartbeat messages exchanged periodically between maintenance association endpoints (MEPs). CCMs allow MEPs to discover each other within a maintenance association, and allow maintenance association intermediate points (MIPs) to discover MEPs. CCMs provide a means for detecting connectivity failures in a maintenance domain. CCMs are transmitted frequently enough so that consecutive messages can be lost without causing the information to time out in any of the receiving MEPs.

For detailed information about CFM, MEPs, MIPs, and maintenance associations, see *Configuring IEEE Standard-Compliant Ethernet CFM in a Service Provider Network*.

Monitoring Devices and Suspending CFM Traffic

The NSN Microwave 1+1 HSBY Protocol has specified a proprietary time-to-live (TLV) field in CCMs for monitoring active and standby ODUs, and a flag to temporarily suspend CCM monitoring. Identified by an Organizational Unique Identifier (OUI) value of 0x000FBB, the TLV is attached to CCMs as an organization-specific TLV.

An IDU or an ODU may need to temporarily halt transmitting traffic, including CCMs, in circumstances such as a software upgrade or a reload. An IDU or ODUs can set the Suspend CC Monitor flag to signal a temporary pause in CFM traffic if a suspension is needed. Using this flag prevents the other two devices from triggering an unnecessary link-protection action. The Suspend CC Monitor time interval field, in conjunction with the flag, indicates the maximum amount of time the two devices must wait before expecting CCMs to resume from the suspended device.

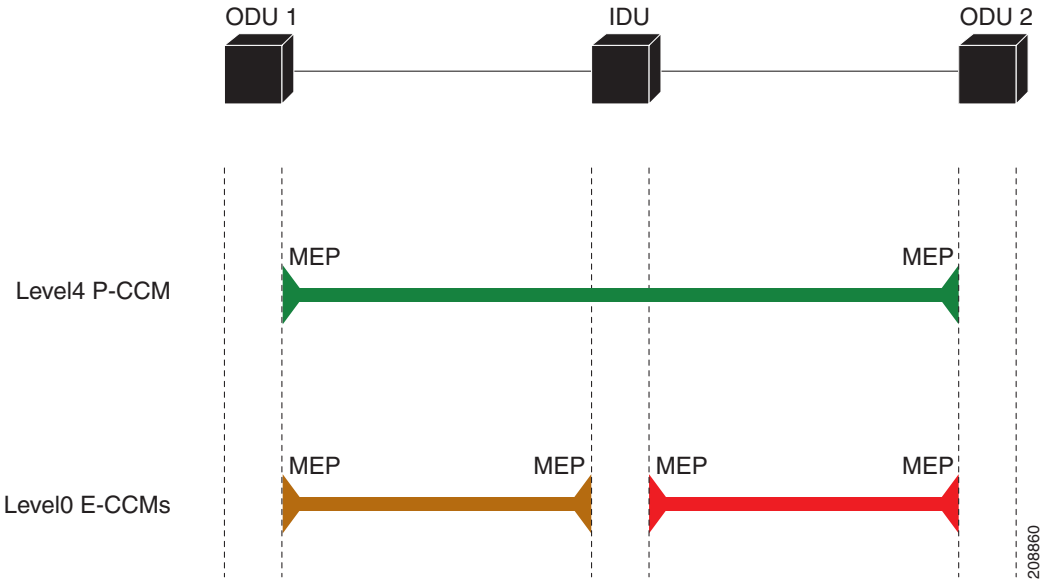
NSN Microwave 1+1 HSBY Protocol Monitoring of Maintenance Associations

The NSN Microwave 1+1 HSBY protocol monitors three maintenance associations. One maintenance association is at Ethernet CFM level 4 and is called the ODU-to-ODU CCM (P-CCM) session, and two maintenance associations are at Ethernet CFM level 0 and are called the IDU-to-ODU CCM (E-CCM) sessions. The IDU is associated with only the two E-CCM sessions and has an outward-facing MEP configured in each session. The IDU is required to pass CFM traffic between the ODUs only in the P-CCM session; no additional monitoring of this maintenance association is needed.

The HSBY configuration shown in Figure 1 supports four separate traffic flows:

- CFM traffic between the IDU and ODU 1.
- CFM traffic between the IDU and ODU 2.
- CFM traffic between ODU 1 and ODU 2. This traffic passes through the IDU.
- Data traffic between the WAN and ODU 1. This traffic passes through the IDU.

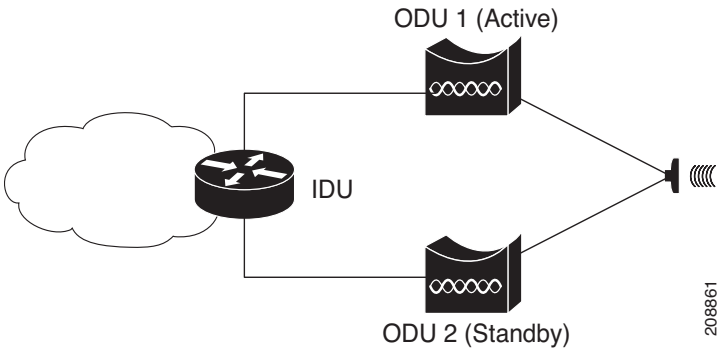
Figure 1 HSBY Protocol and CFM Maintenance Associations



Microwave 1+1 HSBY Configuration

The NSN Microwave 1+1 HSBY link-protection function within the scope of CFM CCM extensions is provided through configuration of a single IDU connected to two ODUs for redundancy. The Cisco IOS device acts as the IDU. At a given time only one ODU is actively handling data traffic, but both the active and standby ODUs are processing and transmitting CFM traffic. The CFM traffic is composed of CCMs with NSN proprietary TLV fields that extend the CCMs' detection of connectivity failures to IDUs and ODUs. Additionally, these extended CCMs passed between the IDU and ODUs are used to indicate which ODU is active and handling the data traffic. If a failure occurs, the standby ODU assumes the role of the active ODU. Figure 2 shows a sample physical topology.

Figure 2 HSBY Link Protection Physical Topology



IDU Configuration Values

The HSBY Protocol specifies that some IDU parameters are configurable and others are fixed values. Table 1 summarizes the permitted values for an IDU using the HSBY Protocol.

Note The same maintenance association (MA) VLAN ID (MA VLAN-ID) can be used for all MAs configured on an IDU.

Table 1 HSBY IDU Configuration Parameters

Parameter	Default Value	Permitted Values
CC Interval	100 milliseconds (ms)	10ms, 100ms, and 1000ms **Note** Release 15.0(1)MR and Cisco IOS Release 15.1(2)S do not support 10-ms CC intervals.
Domain Level	0	Fixed
Domain Name	Null	Fixed
MA VLAN-ID (E-CCM)	None	1–15
MPID	1	Fixed
Short MA Name	None	0–65535
Suspend Interval	160 seconds	80s, 160s, 240s, and 320s

ODU Configuration Values

The HSBY Protocol specifies that some ODU parameters are configurable and others are fixed values. Table 2 summarizes the permitted values for an ODU using the HSBY Protocol.

Note By default, an ODU learns the short MA name when it receives the first E-CCM from an IDU.

Table 2 HSBY ODU Configuration Parameters

Parameter	Default Value	Permitted Values
MA VLAN-ID (E-CCM)	None	16–50
MPID	2	Fixed
Short MA Name	Learned	0–65535

How to Configure CFM CCM Extensions to Support the NSN Microwave 1+1 HSBY Protocol

- Configuring NSN Microwave 1+1 HSBY Protocol and CFM CCM Extensions, page 5 (required)

Configuring NSN Microwave 1+1 HSBY Protocol and CFM CCM Extensions

Perform this task to configure the NSN Microwave 1+1 HSBY Protocol and the CFM CCM extensions to support it.

Summary Steps

1. **enable**
2. **configure terminal**
3. **ethernet cfm global**
4. **link-protection enable**
5. **link-protection group management vlan** *vlan-id*
6. **link-protection group** *group-number* **pccm vlan** *vlan-id*
7. **ethernet cfm domain** *domain-name* **level** *level-id* [**direction outward**]
8. **id** {*mac-address domain-number* | **dns** *dns-name* | **null**}
9. **service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]]
10. **mep mpid** *mpid*
11. **mep mpid** *mpid*
12. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
13. **exit**
14. **exit**

15. **ethernet cfm domain** *domain-name* **level** *level-id* [**direction outward**]
16. **id** {*mac-address domain-number* | **dns** *dns-name* | **null**}
17. **service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]]
18. **mep mpid** *mpid*
19. **mep mpid** *mpid*
20. **continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**]
21. **exit**
22. **exit**
23. **interface** *type slot/port*
24. **switchport mode** {**access** | **dot1q-tunnel** | **dynamic** {**auto** | **desirable**} | **private-vlan** | **trunk**}
25. **spanning-tree portfast** {**disable** | **trunk**}
26. **ethernet cfm mep domain** *domain-name* **mpid** *mpid* {**port** | **vlan** *vlan-id*}
27. **link-protection group** *group-number*
28. **exit**
29. **interface** *type slot/port*
30. **switchport mode** {**access** | **dot1q-tunnel** | **dynamic** {**auto** | **desirable**} | **private-vlan** | **trunk**}
31. **spanning-tree portfast** {**disable** | **trunk**}
32. **ethernet cfm mep domain** *domain-name* **mpid** *mpid* {**port** | **vlan** *vlan-id*}
33. **link-protection group** *group-number*
34. **end**
35. **show ethernet cfm maintenance-points remote detail** (optional)

DETAILED STEPS

	Command	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	**ethernet cfm global** **Example:** `Router(config)# ethernet cfm global`	Enables Ethernet CFM globally.
Step 4	**link-protection enable** **Example:** `Router(config)# link-protection enable`	Enables link protection globally on the router.

	Command	Purpose
Step 5	**link-protection group management vlan** *vlan-id* **Example:** `Router(config)# link-protection group management vlan 51`	Defines the management VLAN used for link protection. • The Cisco 7600 series router supports 12 link-protection groups per router.
Step 6	**link-protection group** *group-number* **pccm vlan** *vlan-id* **Example:** `Router(config)# link-protection group 2 pccm vlan 16`	Specifies an ODU-to-ODU continuity check message (P-CCM) VLAN.
Step 7	**ethernet cfm domain** *domain-name* **level** *level-id* [**direction outward**] **Example:** `Router(config)# ethernet cfm domain eccm1 level 0`	Configures the CFM domain for ODU 1 and enters Ethernet CFM configuration mode.
Step 8	**id** {*mac-address domain-number* | **dns** *dns-name* | **null**} **Example:** `Router(config-ecfm)# id null`	Configures a maintenance domain identifier (MDID).
Step 9	**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]] **Example:** `Router(config-ecfm)# service 1 vlan 14 direction down`	Defines a maintenance association for ODU 1 and enters Ethernet CFM service instance configuration mode.
Step 10	**mep mpid** *mpid* **Example:** `Router(config-ecfm-srv)# mep mpid 1`	Defines the local MEP ID.
Step 11	**mep mpid** *mpid* **Example:** `Router(config-ecfm-srv)# mep mpid 2`	Defines the remote MEP ID.
Step 12	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check interval 100ms`	Enables transmission of continuity check messages (CCMs) within the ODU 1 maintenance association and defines a continuity-check interval.
Step 13	**exit** **Example:** `Router(config-ecfm-srv)# exit`	Exits Ethernet CFM service instance configuration mode.

	Command	Purpose
Step 14	**exit** **Example:** `Router(config-ecfm)# exit`	Exits Ethernet CFM configuration mode.
Step 15	**ethernet cfm domain** *domain-name* **level** *level-id* [**direction outward**] **Example:** `Router(config)# ethernet cfm domain eccm2 level 0`	Configures the CFM domain for ODU 2 and enters CFM configuration mode.
Step 16	**id** {*mac-address domain-number* | **dns** *dns-name* | **null**} **Example:** `Router(config-ecfm)# id null`	Configures a maintenance domain identifier (MDID).
Step 17	**service** {*ma-name* | *ma-num* | **vlan-id** *vlan-id* | **vpn-id** *vpn-id*} [**port** | **vlan** *vlan-id* [**direction down**]] **Example:** `Router(config-ecfm)# service 2 vlan 15 direction down`	Defines a maintenance association for ODU 2 and enters Ethernet CFM service configuration mode.
Step 18	**mep mpid** *mpid* **Example:** `Router(config-ecfm-srv)# mep mpid 1`	Defines the local MEP ID.
Step 19	**mep mpid** *mpid* **Example:** `Router(config-ecfm-srv)# mep mpid 2`	Defines the remote MEP ID.
Step 20	**continuity-check** [**interval** *time* | **loss-threshold** *threshold* | **static rmep**] **Example:** `Router(config-ecfm-srv)# continuity-check interval 100ms`	Enables transmission of CCMs within the ODU 2 maintenance association and defines a continuity-check interval.
Step 21	**exit** **Example:** `Router(config-ecfm-srv)# exit`	Exits Ethernet CFM service instance configuration mode.
Step 22	**exit** **Example:** `Router(config-ecfm)# exit`	Exits Ethernet CFM configuration mode.

	Command	Purpose
Step 23	**interface** *type slot/port* **Example:** `Router(config)# interface gigabitethernet 1/1`	Configures the interface to be connected to ODU 1 and enters interface configuration mode.
Step 24	**switchport mode** {**access** | **dot1q-tunnel** | **dynamic** {**auto** | **desirable**} | **private-vlan** | **trunk**} **Example:** `Router(config-if)# switchport mode trunk`	Sets the switching characteristics of the Layer 2-switched interface.
Step 25	**spanning-tree portfast** {**disable** | **trunk**} **Example:** `Router(config-if)# spanning-tree portfast trunk`	Enables PortFast on the interface when it is in trunk mode.
Step 26	**ethernet cfm mep domain** *domain-name* **mpid** *mpid* {**port** | **vlan** *vlan-id*} **Example:** `Router(config-if)# ethernet cfm mep domain eccm1 mpid 1 vlan 14`	Configures a CFM MEP domain for ODU 1.
Step 27	**link-protection group** *group-number* **Example:** `Router(config-if)# link-protection group 1`	Configures a link-protection group for ODU 2.
Step 28	**exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode.
Step 29	**interface** *type slot/port* **Example:** `Router(config)# interface GigabitEthernet 3/2`	Configures the interface to be connected to ODU 2 and enters interface configuration mode.
Step 30	**switchport mode** {**access** | **dot1q-tunnel** | **dynamic** {**auto** | **desirable**} | **private-vlan** | **trunk**} **Example:** `Router(config-if)# switchport mode trunk`	Sets the switching characteristics of the Layer 2-switched interface.
Step 31	**spanning-tree portfast** {**disable** | **trunk**} **Example:** `Router(config-if)# spanning-tree portfast trunk`	Enables PortFast on the interface when it is in trunk mode.

	Command	Purpose
Step 32	**ethernet cfm mep domain** *domain-name* **mpid** *mpid* {**port** | **vlan** *vlan-id*} **Example:** `Router(config-if)# ethernet cfm mep domain eccm2 mpid 1 vlan 15`	Configures a CFM MEP domain for ODU 2.
Step 33	**link-protection group** *group-number* **Example:** `Router(config-if)# link-protection group 1`	Configures a link-protection group for ODU 2.
Step 34	**end** **Example:** `Router(config-if)# end`	Returns the CLI to privileged EXEC mode.
Step 35	**show ethernet cfm maintenance-points remote detail** **Example:** `Router# show ethernet cfm maintenance-points remote detail`	(Optional) Displays remote maintenance endpoints in the continuity check database.

Configuration Examples for CFM CCM Extensions to Support the NSN Microwave 1+1 HSBY Protocol

Example: CFM Domain and MEP Configuration

This example is a sample CFM domain and MEP configuration that follows the NSN requirements for monitoring ODUs. The **link-protection** command for configuring NSN-specific parameters is included. CFM configuration parameters for an IDU are shown within angle brackets (<>):

```
link-protection suspend-interval <80s, 160s, 240s, 320s>
link-protection management vlan <51-4094>
link-protection pccm vlan <16-50>
!
ethernet cfm ieee
ethernet cfm global
!
ethernet cfm domain <Domain for ODU1> level 0
 id null
 service number <number> vlan <1-15> direction down
 continuity-check
 continuity-check interval <10, 100, 1000ms>
!
ethernet cfm domain <Domain for ODU2> level 0
 id null
 service number <number> vlan <1-15> direction down
```

```
  continuity-check
  continuity-check interval <10, 100, 1000ms>
!
interface GigabitEthernet 0/3
 ethernet cfm mep domain <Domain for ODU1> mpid 1 vlan <1-15>
   link-protection group <group #>
!
interface GigabitEthernet 0/4
 ethernet cfm mep domain <Domain for ODU2> mpid 1 vlan <1-15>
   link-protection group <group #>
!
```

Example: 1+1 HSBY Protocol Configuration

The following example shows a 1+1 HSBY protocol configuration on the Cisco 7600 series router:

```
Router> enable
Router# configure terminal
Router(config)# ethernet cfm global
Router(config)# link-protection enable
Router(config)# link-protection group management vlan 51
Router(config)# link-protection group 2 pccm vlan 16
Router(config)# ethernet cfm domain eccm1 level 0
Router(config-ecfm)# id null
Router(config-ecfm)# service 1 vlan 14 direction down
Router(config-ecfm-srv)# mep mpid 1
Router(config-ecfm-srv)# mep mpid 2
Router(config-ecfm-srv)# continuity-check interval 100ms
Router(config-ecfm-srv)# exit
Router(config-ecfm)# exit
Router(config)# ethernet cfm domain eccm2 level 0
Router(config-ecfm)# id null
Router(config-ecfm)# service 2 vlan 15 direction down
Router(config-ecfm-srv)# mep mpid 1
Router(config-ecfm-srv)# mep mpid 2
Router(config-ecfm-srv)# continuity-check interval 100ms
Router(config-ecfm-srv)# exit
Router(config-ecfm)# exit
Router(config)# interface gigabitethernet 1/1
Router(config-if)# switchport mode trunk
Router(config-if)# spanning-tree portfast trunk
Router(config-if)# ethernet cfm mep domain eccm1 mpid 1 vlan 14
Router(config-if)# link-protection group 1
Router(config-if)# exit
Router(config)# interface GigabitEthernet 3/2
Router(config-if)# switchport mode trunk
Router(config-if)# spanning-tree portfast trunk
Router(config-if)# ethernet cfm mep domain eccm2 mpid 1 vlan 15
Router(config-if)# link-protection group 1
Router(config-if)# end
Router# show ethernet cfm maintenance-points remote detail
```

Additional References

Related Documents

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 Commands List, All Releases*
Carrier Ethernet commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	*Cisco IOS Carrier Ethernet Command Reference*
Configuring IEEE Standard-Compliant Ethernet CFM	*Configuring IEEE Standard-Compliant Ethernet CFM in a Service Provider Network*
Configurations for Carrier Ethernet networks	*Carrier Ethernet Configuration Guide, Cisco IOS Release 15.1S*
Understanding and configuring Microwave 1+1 HSBY on the Cisco MWR 2941 Mobile Wireless Edge Router	"Configuring Ethernet Link Operations, Administration, and Maintenance" chapter of the *Cisco MWR 2941 Mobile Wireless Edge Router Software Configuration Guide, Release 15.0(1)MR*

Standards

Standard	Title
IEEE 802.1ag	*Connectivity Fault Management*

MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
None	—

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 CFM CCM Extensions to Support the NSN Microwave 1+1 HSBY Protocol

Table 3 lists the release history for this feature.

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 Table 3 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 3 Feature Information for CFM CCM Extensions to Support the NSN Microwave 1+1 HSBY Protocol

Feature Name	Releases	Feature Information
CFM Extension for 1+1 Hot-Standby Support	15.1(2)S	The NSN Microwave 1+1 HSBY protocol is a link-protection protocol that extends CFM CCMs to enable 1:1 link redundancy in microwave devices. NSN Microwave 1+1 HSBY provides link-protection support for both IDUs and ODUs. In Cisco IOS Release 15.1(2)S, this feature was introduced on the Cisco 7600 series router. The following command was introduced or modified: **show ethernet cfm maintenance-points remote detail**.