Link Aggregation Control Protocol (IEEE 802.3ad) Support for Cisco uBR10012 Routers

This document describes the features, benefits and configuration of Link Aggregation Control Protocol (IEEE 802.3ad) technology on the Cisco uBR10012 Routers.

Currently, adding member interface into a port channel is supported only in a static way. The CMTS port channel interface cannot automatically detect the link status over port channel.

The IEEE 802.3ad is the standard to aggregate physical Ethernet interfaces to form a logical Ethernet link using the Link Aggregation Control Protocol (LACP) that provides greater bandwidth, high availability, and auto reconfiguration.

LACP protocol aggregates interfaces by exchanging the Link Aggregation Control Protocol Data Units (LACPDUs) between two network switches or devices. LACP protocol instance runs on every switch and independently performs aggregations based on the local switch information and the exchanged LACPDUs.

A switch may limit the number of interfaces that can be aggregated together due to system limitations. In such a case, an interface may not be allowed to operate as part of an aggregation it is eligible to join the aggregation from the protocol perspective. LACP provides a mechanism to make such links hot-standby for the aggregation such that they can automatically join the aggregation in case one or more operational members fail.

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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LACP Feature Advantages

It increases the redundancy and high availability of the aggregation. If a port fails, traffic continues on the remaining ports.

The below figure shows the software interaction for the LACP services.

Figure 1: Software Interaction Diagram for LACP Services
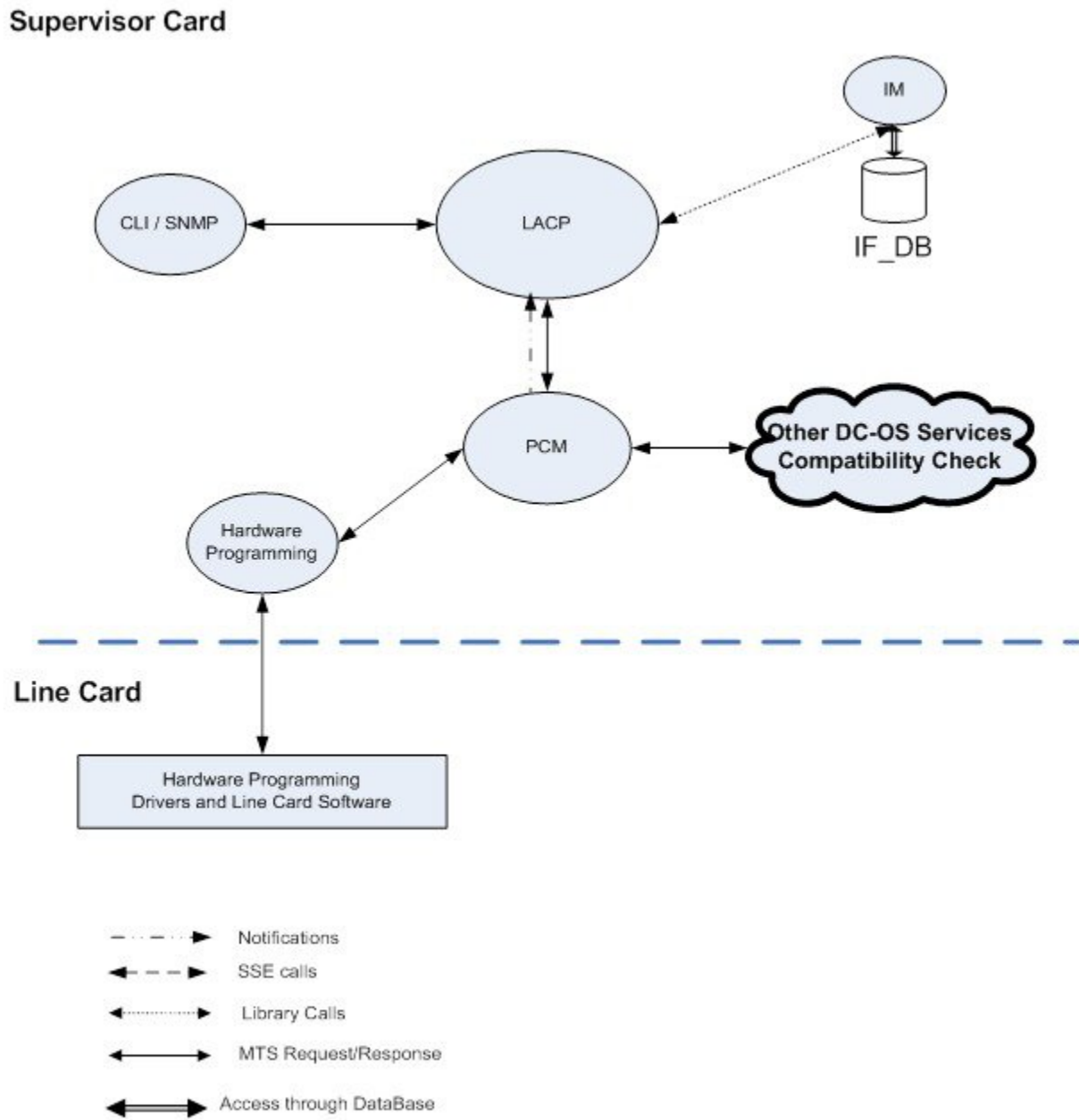
LACP Feature Limitations

The following points list the limitations in enabling the LACP services:

• IOS configuration should be applied seamlessly. If LACP is not running, the VSH and SNMP MIBs are not loaded. You cannot configure the ASCII configuration as the required VHS nodes are not present.

• Channeling mode configuration is maintained by the port channel manager. During the system startup, LACP cannot independently run based on only the configuration present in its binary configuration stored in PSS. If LACP enable or disable is not used, then it requires a special handshake with the Port Channel Manager to know how many ports have LACP configured.

• LACP has some independent global as well as interface level configurations.

• Using enable or disable requires a cleanup of all the existing ports that are using LACP. The current port channel model results in removing these ports from the port channel.

LACP Feature Components

The following are some of the components of LACP services:

• Channel group—It is a group used to aggregate a set of interfaces either explicitly or by using channeling protocols. This group is a container that comprises of all the ports that you have configured. You can add or remove ports from a channel group. In the figure below, Device (CMTS) is configured with channel group 1 with members 1/1-5 and Device (R) is configured with channel group 2 with members 2/1-6.

• Port channel—It is a logical interface representing a set of interfaces that are operationally aggregated into a single logical forwarding interface. The port channel interface aggregation characteristic is determined by the configurational and operational parameters. A port channel interface is always associated with a channel group. Whenever a channel group is created, an associated port channel is also created.

• Suspended link—It is any link that cannot be aggregated due to the misconfiguration of operational or administrative parameters. These links are logically kept down and no data is exchanged till the misconfiguration is resolved.

• Individual link—It is a link that is allowed to participate in aggregation and no other links can be aggregated with this link. Individual links continue to work as a normal 802.3 link. These links are different from the misconfigured links that are kept suspended. Individual links are formed only when channeling protocols run on the port. In the figure below, link between port 1/6 on Device(CMTS) and Device(R) on switch operates as an individual link.

• Hot standby link—It is a link that can be aggregated operationally but is not included in the aggregation due to limitations of the system's aggregation capability. For example, a system can support a maximum of four links in an aggregation but it can allow eight (CMTS currently supports eight member link into one channel group) links to be configured in the channel group. So, any set of four links amongst the configured eight links can be aggregated to form a logical port channel interface within the channel group. The remaining four links become standby links, which can join the port channel interface if one

or more aggregated links fail. In the figure below, link between port fc1/5 on Device(CMTS) and port 2/5 on Device(R) is a standby link for the port channel po1 on Device (CMTS) and po2 on Device(R).

Figure 2: Channel Groups with Multiple Port Channel Interface and Individual Links
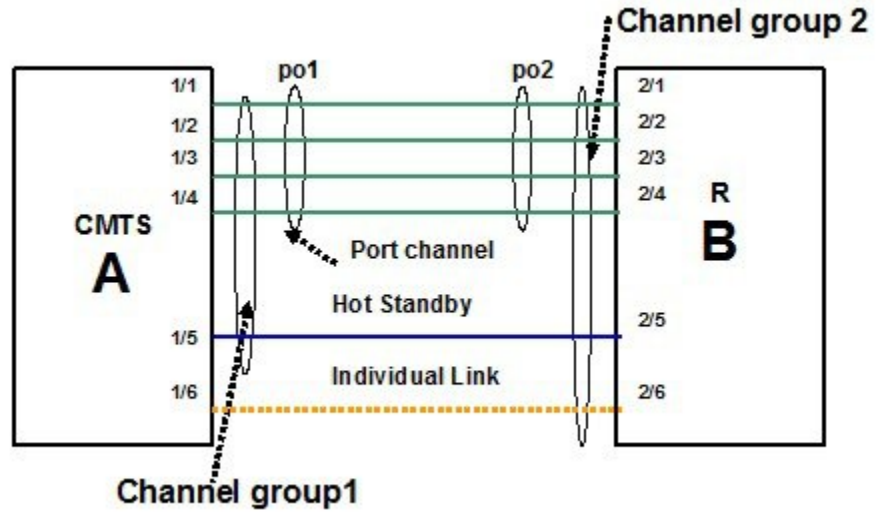
Configuring LACP Service Components

This section contains the following topics:

Configuring a Port Channel Virtual Interface

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.

	Command or Action	Purpose
Step 3	**interface port-channel** *channel-number* **Example:** `Router(config)# interface port-channel 1`	Configures the interface port channel number.

The following example shows how to configure interface port channel number 1:

```
Router(config)# enable
Router(config)# configure terminal
Router(config)# interface port-channel 1
Router(config-if)# exit
```

Configuring LACP Port Priority

You can assign a port priority to each port on a device running LACP. You can specify the port priority by using the **lacp port-priority** command or use the default port priority (32768). The port priority is used to decide which ports should be put in the standby mode when a hardware limitation or the **lacp max-bundle** command configuration prevents all compatible ports from aggregating. Priority is supported only on port channels with LACP-enabled physical interfaces.

Note A high priority number means a low priority.

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	**interface port-channel** *channel-number* **Example:** `Router(config)# interface port-channel 10`	Identifies the interface port channel and enters interface configuration mode.
Step 4	**lacp port-priority** *priority* **Example:** `Router(config-if)# lacp port-priority 23700`	Sets the port priority.

The following example shows how to configure port priority of 23700 for an interface:

```
Router> enable
Router# configure terminal
Router(config)# interface port-channel 10
Router(config-if)# lacp port-priority 23700
```

Configuring LACP System Priority

You can assign a system priority to each device running LACP. You can specify the system priority by using the **lacp system-priority** command or use the default system priority (32768). The system priority is used with the MAC address of the device to form the system ID and is used during negotiation with the other systems. The system priority is supported only on port channels with LACP-enabled physical interfaces.

Note A high priority number means a low priority.

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	**interface port-channel** *channel-number* **Example:** `Router(config)# interface port-channel 10`	Identifies the interface port channel and enters interface configuration mode.
Step 4	**lacp system-priority** *priority* **Example:** `Router(config-if)# lacp system-priority 23700`	Sets the system priority.

The following example shows how to configure system priority of 25500 for a device:

```
Router> enable
Router# configure terminal
Router(config)# interface port-channel 10
Router(config-if)# lacp system-priority 25500
```

Configuring LACP 1:1 Link Redundancy

When you enable LACP 1:1 link redundancy based on the system priority and port priority, the port with the higher system priority chooses one link as the active link and the other link as the standby link. When the active link fails, the standby link is selected as the new active link the port channel going down. When the original active link recovers, it reverts to its active link status. During this switchover, the port channel is also up.

Before You Begin

- Make sure that the port channel protocol type is LACP.

- Make sure that **lacp max-bundle** command is configured on the port channel. The **lacp fast-switchover** command does not affect the **lacp max-bundle** command.

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	**interface port-channel** *channel-number* **Example:** Router(config)# **interface port-channel 1**	Identifies the interface port channel and enters the interface configuration mode.
Step 4	**lacp fast-switchover** **Example:** Router(config-if)# **lacp fast-switchover**	Enables the fast switch over feature for this channel group.

The following example shows how to configure the LACP channel group with 1:1 redundancy:

```
Router(config)# enable
Router(config)# configure terminal
Router(config)# interface port-channel 1
Router(config-if)# lacp fast-switchover
```

Configuring Minimum Active Bundled LACP Ports

When the number of active links falls below the minimum threshold, the port channel shuts down.

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	**interface port-channel** *channel-number* **Example:** `Router(config)# ` **`interface port-channel 2`**	Identifies the interface port channel and enters the interface configuration mode.
Step 4	**lacp min-bundle** *min-bundle-number* **Example:** `Router(config-if)# ` **`lacp min-bundle 5`**	Sets the minimum threshold of active member links allowed in the LACP bundle. The range is from 1 to 8. The default is 1.

The following example shows how to set a minimum threshold of active member links:

```
Router(config)# enable
Router(config)# configure terminal
Router(config)# interface port-channel 2
Router(config-if)# lacp min-bundle 5
```

Configuring Maximum Active Bundled LACP Ports

The value specified in the max-bundle-number argument determines the number of active links that are bundled in the port channel. The remaining links are in hot-standby mode.

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	**interface port-channel** *channel-number* **Example:** Router(config)# **interface port-channel 2**	Identifies the interface port channel and enters the interface configuration mode.
Step 4	**lacp max-bundle** *max-bundle-number* **Example:** Router(config-if)# **lacp max-bundle 3**	Sets the maximum threshold of active member links allowed in the LACP bundle. The range is from 1 to 8. The maximum threshold value must be greater than or equal to the minimum threshold value.

The following example shows how to set a maximum threshold of active member links:

```
Router(config)# enable
Router(config)# configure terminal
Router(config)# interface port-channel 2
Router(config-if)# lacp max-bundle 3
```

Configuring LACP

Before You Begin

- It is recommended to disable the IP address assigned to a physical interface that is part of a channel group.
- You must create a port channel before member links are assigned to it.

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.

	Command or Action	Purpose
Step 3	**interface port-channel** *channel-number* **Example:** `Router(config)# interface port-channel 1`	Identifies the interface port channel.
Step 4	**interface** *type number* **Example:** `Router(config)# interface TenGigabitEthernet 4/1`	Configures a member interface and enters interface configuration mode.
Step 5	**channel-group** *channel-number* **mode {active	passive}** **Example:** `Router(config-if)# channel-group 5 mode active`	Configures the channel group with the LACP.
Step 6	**exit** **Example:** `Router(config-if)# exit`	Returns to privileged EXEC mode.

The following example shows how to configure channel group number 1:

```
Router(config)# enable
Router(config)# configure terminal
Router(config)# interface port-channel 1
Router(config)# interface TenGigabitEthernet 4/1
Router(config-if)# channel-group 1 mode active
Router(config-if)# exit
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases

MIBs

MIB	MIBs Link
• IEEE8023-LAG-MIB • CISCO-IEEE8023-LAG-CAPABILITY	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/support

Feature Information for LACP services

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://tools.cisco.com/ITDIT/CFN/. An account on http://www.cisco.com/ is not required.

Note The below 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.

Table 1: Feature Information for LACP Services

Feature Name	Releases	Feature Information
LACP Services	Cisco IOS 12.2(33)SCJ	This feature was introduced on the Cisco uBR Series Universal Broadband Routers.