



## Understanding Layer 3 EtherChannel Support on the Cisco Integrated Services Router

The purpose of this document is to explain Cisco Integrated Services Router (ISR) specific information regarding Layer 3 EtherChannel support. This document is not going to describe how EtherChannel works in general. The EtherSwitch Service Modules in ISR product family support both Layer 2 and Layer 3 EtherChannel, the implementation is identical to Catalyst 3750 switch therefore it is not covered in this document. Please refer to Catalyst 3750 Configuration Guide for detail information.

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### **Overview**

EtherChannel allows multiple physical Ethernet links to be combined into one logical channel. This allows link redundancy in the event that one or more links in the channel fail as well as load sharing of traffic among the links in the channel.

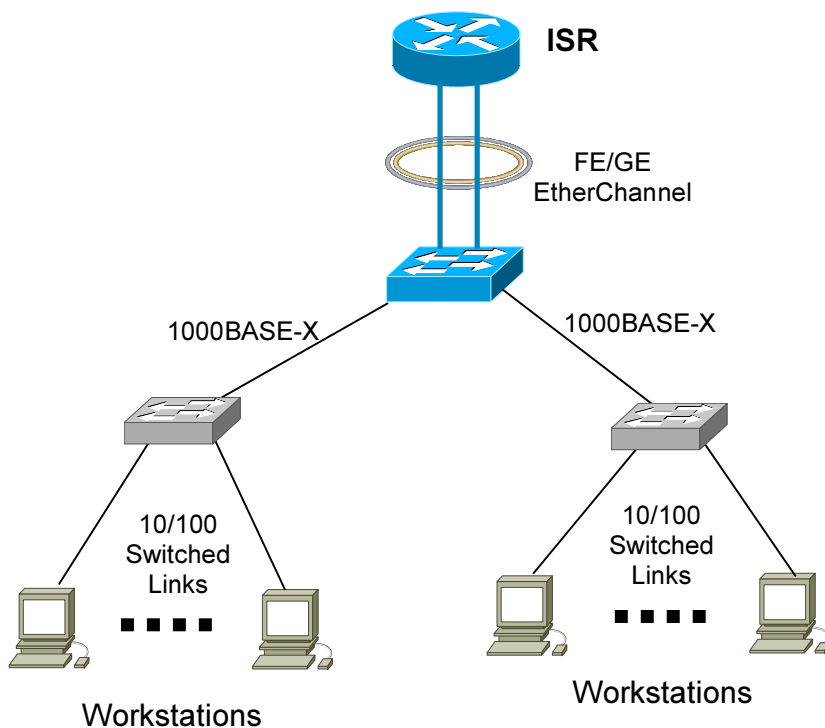
In Cisco IOS Release 12.4(17.6), EtherChannel support is introduced for embedded Fast Ethernet and Gigabit Ethernet interfaces on Cisco 2811, Cisco 2821, Cisco 2851, Cisco 3825 and Cisco 3845. Additionally, the same feature is also supported on the NM-1GE, HWIC-1GE-SFP, HWIC-1FE and HWIC-2FE modules in the earlier IOS release.

This document refers to Fast EtherChannel, Gigabit EtherChannel, port channel and port group with a single term, EtherChannel. The information in the document applies to all of these Layer 3 EtherChannels. Layer 2 EtherChannel can only be formed on a switch product which inherits Layer 2 Switch port characters. Routed port functionality can not be applied on Layer 2 EtherChannel, for example IP address can not be configured on Layer 2 EtherChannel. Layer 2 EtherChannel is not supported on the modules and interfaces mentioned above, thus is not in the scope of this document.

## ***Application***

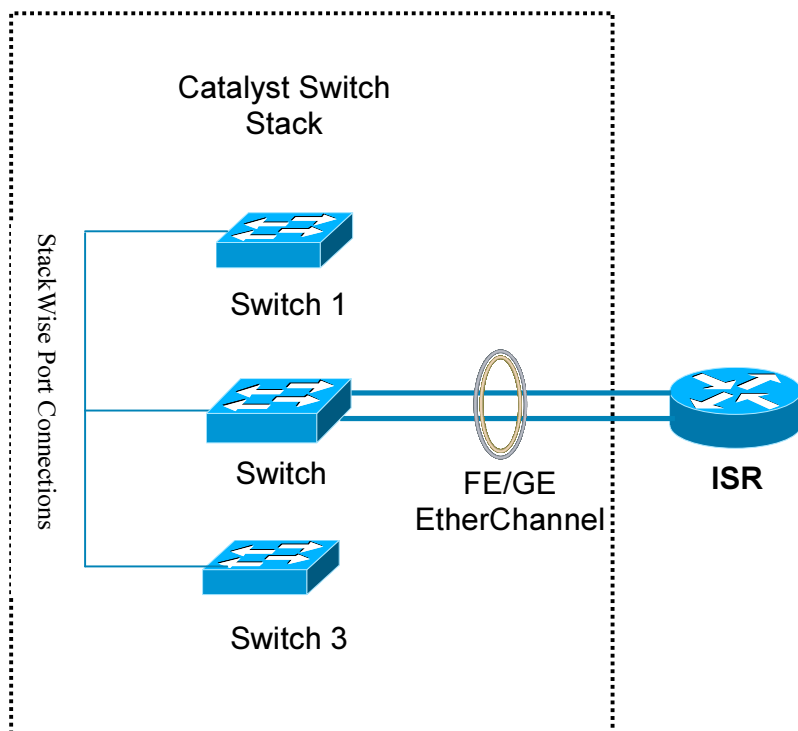
An EtherChannel bundles individual Ethernet links into a single logical link. If a segment within an EtherChannel fails, traffic previously carried over the failed link switches to the remaining segments within the EtherChannel. EtherChannel is to interconnect router, switches or servers with resiliency and load sharing across links. EtherChannel provides automatic recovery for the loss of a link by redistributing the load across the remaining links. If a link fails, EtherChannel redirects traffic from the failed link to the remaining links in the channel without intervention.

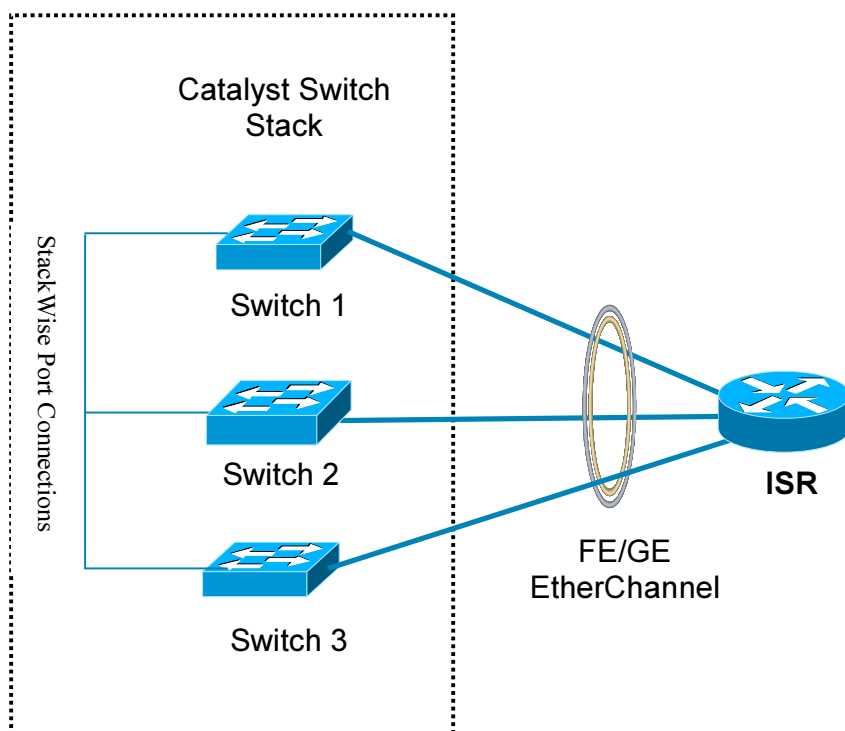
Even though EtherChannel can use multiple Ethernet based links in parallel, aggregated wire-rate on EtherChannel is not guaranteed with ISR platforms. ISR performance is at a premium and is based on what services are enabled on the router. With different services configured on the platform, the performance can range very differently. Hence, using EtherChannel to increase additional bandwidth between ISR and connected devices is not recommended. The main purpose to enable the feature on ISR is to provide redundancy between ISR and another device and it is not to provide scalable bandwidth between them. Figure 1 shows the typical EtherChannel deployment with ISR. For more ISR performance information please refer to the link in the Reference section.

**Figure 1.** Typical EtherChannel Deployment with ISR

Users can create an EtherChannel on ISR to connect to a standalone switch like the topology demonstrated in Figure 1. To further enhance the overall network resilience, EtherChannel can be used on ISR to connect to a single switch in the stack (Figure 2), or on multiple switches in the stack (Figure 3), known as cross-stack EtherChannel.

**Figure 2.** Single switch in the stack EtherChannel Deployment



**Figure 3.** Cross-Stack EtherChannel Deployment

### ***Feature Support and Performance Consideration***

An EtherChannel consists of individual Fast Ethernet or Gigabit Ethernet links bundled into a single logical link. If one port within an EtherChannel fails, traffic previously carried over the failed link switches to the remaining ports within the EtherChannel. When a failure occurs, the EtherChannel feature sends a trap that identifies the router, the EtherChannel, and the failed link. Inbound broadcast and multicast packets on one segment in an EtherChannel are blocked from link at returning on any other segment of the EtherChannel.

Each EtherChannel on ISR can consist of up to four compatibly configured Ethernet ports. However, the maximum aggregate bandwidth per EtherChannel is not guaranteed on ISR. The performance impact by EtherChannel is minimal. In general platform CPU is the performance limiting factor and ISR performance is tied to the configuration of the router. For ISR performance guideline information please refer to the ISR Performance Information link provided in the Reference section.

The maximum number of EtherChannel groups supported on an ISR is two, for all of the supported platforms.

### Understanding Hardware Support

EtherChannel is currently supported on ISR product family Cisco 2811, 2821, 2851, 3825 and 3845.

Table 1 lists all the components and first IOS release for the EtherChannel support.

**Table 1.** EtherChannel Hardware Support

Platforms	Modules/Interface	Layer 3 EtherChannel Support	First IOS Release support for EtherChannel
Cisco 2811/2821/2851/3825/3845	Embedded FE/GE interfaces	YES	12.4(17.6)
Cisco 2811/2821/2851/3825/3845	HWIC-1GE-SFP	YES	12.3(8)T4
Cisco 3825/3845	NM-1GE	YES	12.3(8)T for 2800 and 12.3(11)T for 3800
Cisco 2811/2821/2851/3825/3845	HWIC-1FE	YES	12.4(11) XJ
Cisco 3825/ 3845	HWIC-2FE	YES	12.4(11) XJ
Cisco 1841/2801/2811/2821/2851 /3825/3845	HWIC-4ESW	NO	12.3(8)T for 1800/2800 12.3(11)T for 3800
Cisco 2801/2811/2821/2851 /3825/3845	HWICD-9ESW	NO	12.3(8)T for 2800 12.3(11)T for 3800
Cisco 2811/2821/2851/3800	NM-16ESW	YES	12.3(8)T for 2800 and 12.3(11)T for 3800
Cisco 2851/3800	NMD-36ESW	YES	12.3(8)T for 2800 and 12.3(11)T for 3800
Cisco 2811/2821/2851/3825/3845	NME-16ES-1G-P	YES	12.3(14)T
Cisco 2811/2821/2851/3825/3845	NME-16ES-1G	YES	12.4(2)T
Cisco 2821/2851/3825/3845	NME-X-23ES-1G-P	YES	12.3(14)T
Cisco 2821/2851/3825/3845	NME-X-23ES-1G	YES	12.4(2)T
Cisco 2851/3800	NME-XD-48ES-2S-P, and NME-XD-24ES-1S-P	YES	12.3(14)T

**To bundle physical ports across different types of interface modules into same EtherChannel is not supported.** For example, Gigabit Ethernet interface on HWIC-1GE-SFP and Gigabit Ethernet interface on NM-1GE can not be assigned as members of the same EtherChannel. Each physical port within the same EtherChannel does not have to be located on the same interface module but they must have exact same module type.

You can form an EtherChannel with up to four compatibly configured Ethernet ports, on any supported platform in ISR family. All the physical ports in each EtherChannel must be the same speed and duplex. Ports that are not compatible are suspended, even though they are assigned into the same EtherChannel.

### Understanding EtherChannel Negotiation Protocol Support

EtherChannel can only be set up manually on ISR. Negotiation protocol such as Port Aggregation Protocol (PAgP) and Link Aggregation Control Protocol (LACP) are not supported. Manually configured EtherChannel ports do not exchange EtherChannel protocol packets; hence no EtherChannel negotiation takes place. A manually configured EtherChannel forms only when you enter configure all ports in the EtherChannel compatibly.

- The other end of the EtherChannel must be configured manually; Otherwise, EtherChannel might not come up and packet loss can occur.
- Extreme care should be taken that neither PAgP nor LACP can interoperate with ports configured manually. Hence, the EtherChannel on the peer device needs to be manually configured as well.
- Manually configured EtherChannel ports do not exchange EtherChannel protocol packets. A manually configured EtherChannel forms only when you configure all ports in the EtherChannel compatibly.

### Understanding Load Balancing

An EtherChannel balances the traffic load across the EtherChannel links by reducing part of the binary pattern, formed from the addresses in the frame to a numerical value that selects one of the links in the channel.

EtherChannel load balancing on ISR uses both source and destination IP addresses only. Load balancing based on either source IP address or destination IP address is not supported. Using both source and destination addresses can help result in better load balancing. Load balancing is enabled constantly and can not be disabled, therefore there is not CLI is required for load balancing. The load balancing is only based on both source and destination IP address and the VLAN ID has no influence on the link that a packet takes.

### Understanding VLAN Trunking protocol Support

Only IEEE 802.1Q trunking protocol is supported on ISR EtherChannel but not Inter-Switch Link Protocol (ISL). You can configure Layer 3 EtherChannel connections on ISR with or without IEEE 802.1Q trunking. After the formation of a channel, the configuration of any ports in the channel, as a trunk, applies the configuration to all ports in the channel. Only the identically configured trunk ports can be configured as an EtherChannel.

## EtherChannel Feature Configuration Guidelines and Restrictions

When EtherChannel interfaces are configured improperly, they are disabled automatically to avoid packet drop and other problems. To avoid configuration problems, observe these guidelines and restrictions:

- The commands in this chapter can be used on Cisco2811, 2821, 2851, Cisco3825 and 3845 embedded FE/GE ports and all the supported modules.
- Configure all physical ports in an EtherChannel manually; negotiation protocol PAgP and LACP are not supported.
- Each EtherChannel can consist of up to four compatibly configured physical ports. Configuring more than two EtherChannels per platform is not supported.
- Configure all physical ports in an EtherChannel must operate at the same criteria, such as speed, duplex and trunk mode.
- Each physical port can be a member of one EtherChannel group.
- If you shut down one port in an EtherChannel, it is treated as a link failure and its traffic is transferred to one of the remaining ports in the EtherChannel.
- Assign Layer 3 addresses to the port channel logical interface, not to the physical ports in the channel.
- If trunking is required, make sure IEEE 802.1Q is used. Trunking protocol ISL is not supported.
- After you configure an EtherChannel, the configuration that you apply to the port channel interface affects the EtherChannel. The configuration that you apply to the physical ports affects only the LAN port where you apply the configuration.

## EtherChannel Configuration Example Consideration

EtherChannel configuration on ISR is consistent with EtherChannel configuration on other platforms. As with other platforms, the **interface port-channel** command is used to create and configure an EtherChannel, and the **channel-group** command, in interface configuration mode while configuring a Fast Ethernet or Gigabit Ethernet interface, is used to assign an interface to



an EtherChannel. To remove a port from the EtherChannel group, use the **no channel-group** interface configuration command.

This example shows how to create the logical port channel 1 and assign 20.0.0.1 as its IP address:

```
ISR# configure terminal
ISR(config)# interface port-channel 1
ISR(config-if)# ip address 20.0.0.1 255.255.255.0
ISR(config-if)# end
```

This example shows how to add physical ports into port channel 1:

```
ISR#
ISR#config t
ISR(config)#interface range gigabitEthernet 0/0 - 1
ISR(config-if-range)#channel-group 1
GigabitEthernet0/0 added as member-1 to port-channel1
GigabitEthernet0/1 added as member-2 to port-channel1
ISR(config-if-range)#end
```

This example shows how to verify the configuration of Fast Ethernet port 5/6:

```
interface Port-channel1
 ip address 20.0.0.1 255.255.255.0
 load-interval 30
 hold-queue 150 in
!
interface GigabitEthernet0/0
 no ip address
 load-interval 30
 duplex auto
 speed auto
 channel-group 1
!
interface GigabitEthernet0/1
 no ip address
 load-interval 30
 duplex auto
 speed auto
 channel-group 1
!
```

## Reference

For Cross-Stack EtherChannel information please refer to the link below:

[http://www.cisco.com/en/US/products/hw/switches/ps5023/products\\_configuration\\_example09186a00806cb982.shtml](http://www.cisco.com/en/US/products/hw/switches/ps5023/products_configuration_example09186a00806cb982.shtml)

For EtherChannel Load Balancing details please refer to the link below:

[http://www.cisco.com/en/US/products/ps5855/products\\_data\\_sheet0900aecd80581fe6.html](http://www.cisco.com/en/US/products/ps5855/products_data_sheet0900aecd80581fe6.html)

For ISR performance information please refer to the link below:

<http://www.in.cisco.com/marketing/network/solutions/routing/isr/resources.shtml#performance>

For EtherSwitch Service Module information please refer to links below:

[http://www.cisco.com/en/US/products/ps5855/products\\_data\\_sheet0900aecd8028d15f.html](http://www.cisco.com/en/US/products/ps5855/products_data_sheet0900aecd8028d15f.html)

[http://www.cisco.com/en/US/products/ps5855/products\\_qanda\\_item0900aecd8028d16a.shtml](http://www.cisco.com/en/US/products/ps5855/products_qanda_item0900aecd8028d16a.shtml)

For Catalyst 3750 EtherChannel configuration information please refer to:

<http://www.cisco.com/univercd/cc/td/doc/product/lan/cat3750/12237se/scg/swethchl.htm#wp1376182>



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