

# Cisco Catalyst 4500 E-Series High-Availability Uplinks

## Introduction

This white paper describes how to use the Gigabit Ethernet and 10 Gigabit Ethernet uplinks on Cisco® Catalyst® 4500 E-Series redundant chassis (4507R+E, 4507R-E, 4510R+E, and 4510R-E) with different supervisor engines. It addresses only the uplink ports on the supervisor engines. Additional uplinks can also reside on the line cards, but this paper does not cover this scenario.

## Cisco Catalyst 4500 Supervisor Engine 6-E Uplinks

The new Supervisor Engine 6-E introduced with the Cisco Catalyst 4500 E-Series includes two 10 Gigabit Ethernet uplinks using X2 optics. Twin gigabit converter modules provide 2 Gigabit Ethernet (Small Form-Factor Pluggable [SFP]) uplinks per X2 optic slot, allowing flexibility for up to 4 Gigabit Ethernet uplinks. The Cisco Catalyst 4500 E-Series is designed such that the uplink ports on both the active and backup supervisors are active and forwarding traffic at the same time. This capability is enabled starting with Cisco IOS® Software Release 12.2(40)SG. Figure 1 shows the Supervisor Engine 6-E.

**Figure 1.** Supervisor Engine 6-E

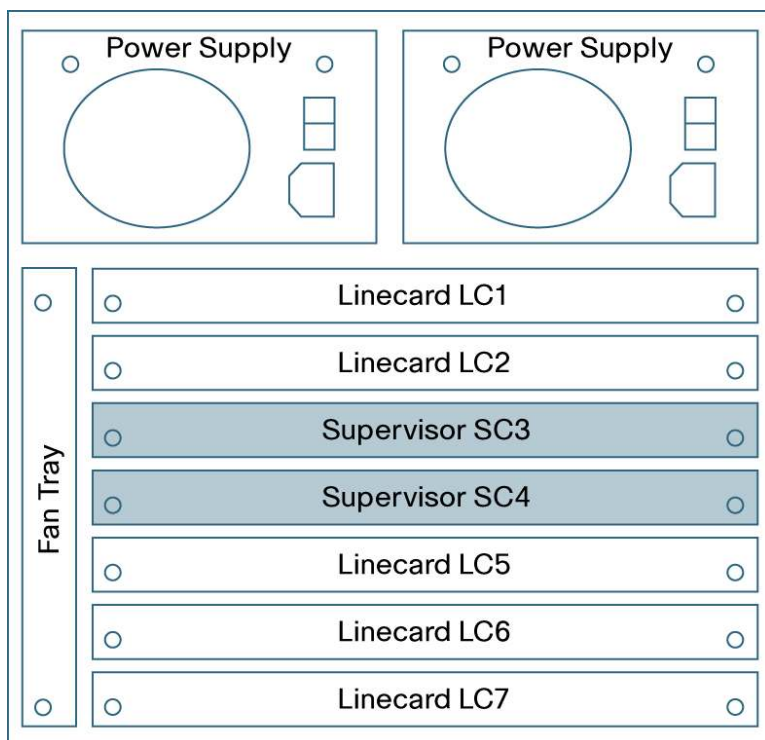


The uplinks on the Supervisor Engine 6-E can operate in one of two modes: redundant and nonredundant. The Cisco Catalyst 4507R+E, 4507R-E, 4510R+E, and 4510R-E model chassis support redundant mode operation (1 + 1 supervisor engine redundancy) using dual Supervisor Engine 6-E engines. In redundant mode operation, the primary supervisor engine is active and is responsible for normal system operation. The other supervisor engine serves as a secondary standby and monitors the operation of the primary supervisor engine. In nonredundant mode, the Cisco Catalyst 4503-E and 4506-E model chassis use a single Supervisor Engine 6-E.

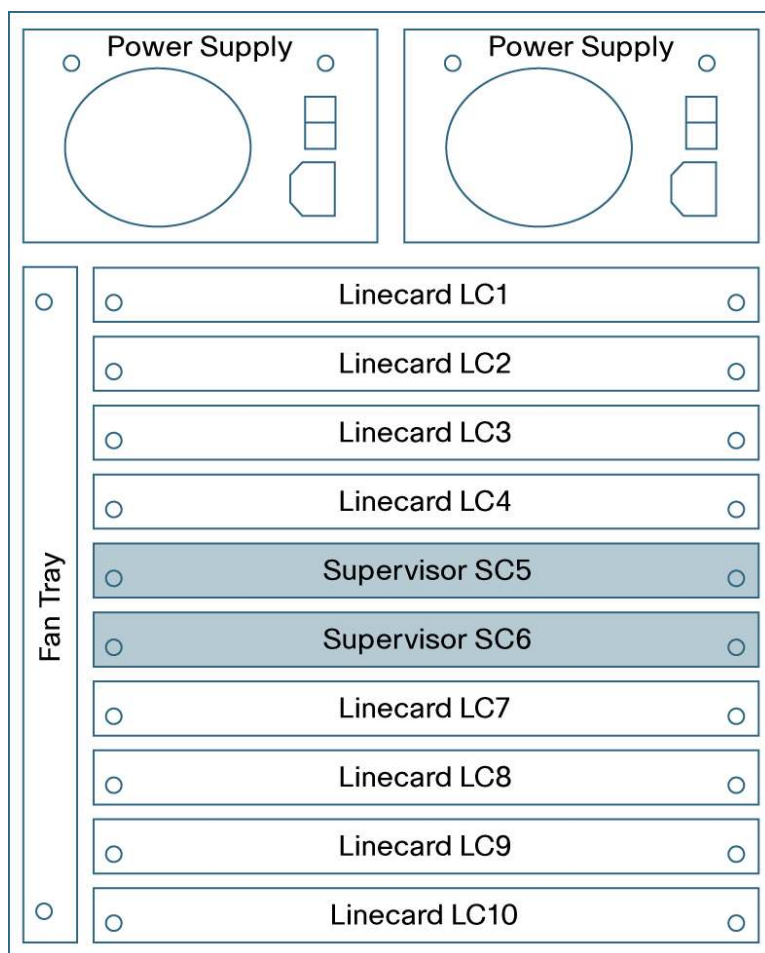
The uplinks on the Supervisor Engine 6-E have three options in redundant mode operation. The first option is referred to as 1 + 1 redundancy. In this configuration, only one 10 Gigabit Ethernet uplink port on each of the two supervisor engines carries traffic, and each port forwards traffic at line rate. The second option is referred to as 2 + 2 redundancy; in this configuration, both 10 Gigabit Ethernet uplink ports on each of the two supervisor engines are forwarding traffic and the uplinks are 2:1 oversubscribed. The third option is referred to as 4 + 4 redundancy. In this configuration, twin gigabit converter modules are used and all four Gigabit Ethernet uplink ports on each of the two supervisor engines carry traffic simultaneously at wire rate.

## Cisco Catalyst 4507R+E, 4507R-E, 4510R+E, and 4510R-E Model Chassis Design

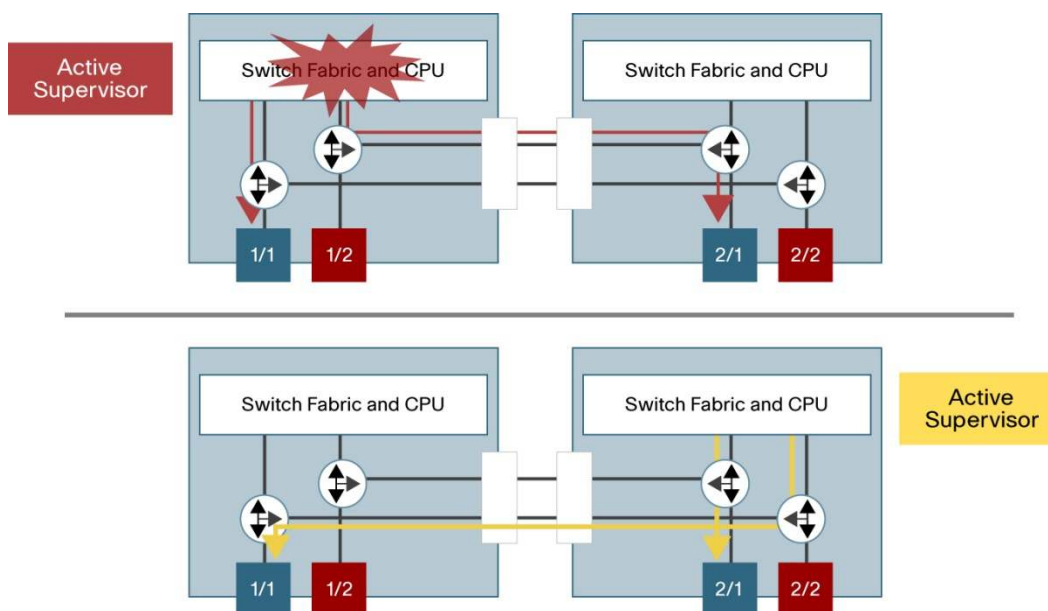
The Cisco Catalyst 4500 E-Series supports four redundant chassis: Cisco Catalyst 4507R+E, 4507R-E, 4510R+E, and 4510R-E model chassis. The 4507R+E and 4507R-E models have seven slots that include two supervisor slots located in slots 3 and 4, and five line-card slots located in slots 1, 2, 5, 6, and 7. Figure 2 shows a schematic of the Cisco Catalyst 4507R+E and 4507R-E chassis.

**Figure 2.** Cisco Catalyst 4507R+E and 4507R-E Chassis

The Cisco Catalyst 4510R+E and 4510R-E chassis have 10 slots, including 2 supervisor engine slots located in slots 5 and 6 and 8 line-card slots located in slots 1, 2, 3, 4, 7, 8, 9, and 10. Figure 3 shows a schematic of the Cisco Catalyst 4510R+E and 4510R-E chassis.

**Figure 3.** Cisco Catalyst 4510R+E and 4510R-E Chassis

The Cisco Catalyst 4507R+E, 4507R-E, 4510R+E, and 4510R-E model chassis contain a redundant 10 Gigabit Ethernet backplane trace to keep the redundant wire-speed 10 Gigabit Ethernet connection active between both supervisors. A single Supervisor Engine 6-E delivers two nonblocking 10 Gigabit Ethernet uplinks. In a redundant configuration, the active supervisor engine controls all of the 10 Gigabit Ethernet uplink ports, including ports on itself and the other standby supervisor engine. Hence, two wire-speed 10 Gigabit Ethernet uplinks are in operation at all times, even if the active supervisor engine fails. Figure 4 illustrates this behavior.

**Figure 4.** Uplink Behavior with Supervisor Engine Redundancy

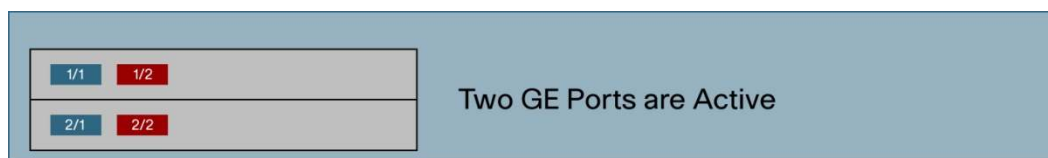
Consider the example of a Cisco Catalyst 4507R+E or 4507R-E chassis with two Supervisor Engine 6-E engines located in slots 3 and 4. First assume the active supervisor engine is in slot 3 and the standby supervisor engine is in slot 4. The active supervisor engine in slot 3 controls uplink port 10 Gigabit Ethernet 1/1 on itself and uplink port 10 Gigabit Ethernet 2/1 on the standby supervisor engine in slot 4 through the hardware backplane trace. If the active supervisor engine in slot 3 goes down, the standby supervisor engine in slot 4 becomes active, and this supervisor engine controls the uplink port 10 Gigabit Ethernet 2/1 on itself and the uplink port 10 Gigabit Ethernet 1/1 on the supervisor engine in slot 3 through the hardware backplane trace. Unique to the Cisco Catalyst 4500, this hardware design eliminates the need for changing the configuration on the uplinks if the active supervisor engine fails.

The next sections cover supervisor engine redundancy for the different supervisor engines on the Cisco Catalyst 4507R+E, 4507R-E, 4510R+E, and 4510R-E model chassis. The Cisco Catalyst 4507R+E and 4507R-E chassis support Supervisor Engine II+, IV, V, II+10GE, V-10GE, and 6-E engines. The Cisco Catalyst 4510R+E and 4510R-E chassis support Supervisor Engine V, V-10GE, and 6-E engines. Uplink redundancy for the classic supervisor engines is supported as of Cisco IOS Software Release 12.2(25)SG. Uplink redundancy for the Supervisor Engine 6-E is supported starting with Cisco IOS Software Release 12.2(40)SG.

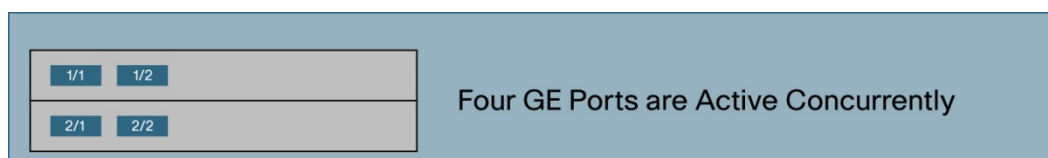
### Cisco Catalyst 4507R+E and 4507R-E Supervisor Engine Redundancy

This section covers supervisor engine redundancy for the classic supervisor engines that are supported on the Cisco Catalyst 4507R+E and 4507R-E chassis.

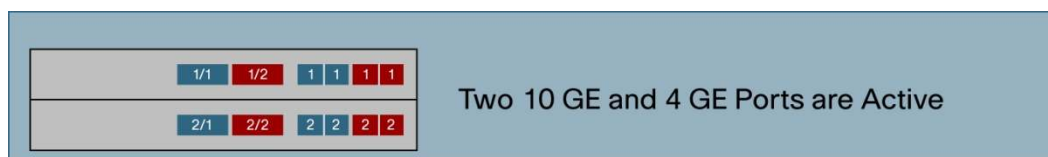
For Supervisor Engine II+ and IV engines, two Gigabit Ethernet uplink ports are active: gig1/1 on slot 3 and gig2/1 on slot 4. Figure 5 depicts this setup.

**Figure 5.** Figure 5 Supervisor Engine II+ and IV Engines

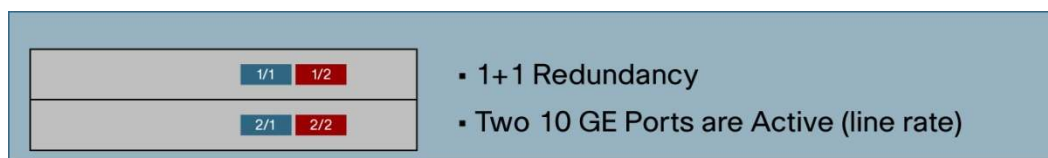
For Supervisor V, four Gigabit Ethernet uplink ports are active concurrently: gig1/1 and gig1/2 on slot 3, and gig2/1 and gig2/2 on slot 4. Figure 6 depicts this setup.

**Figure 6.** Supervisor Engine V

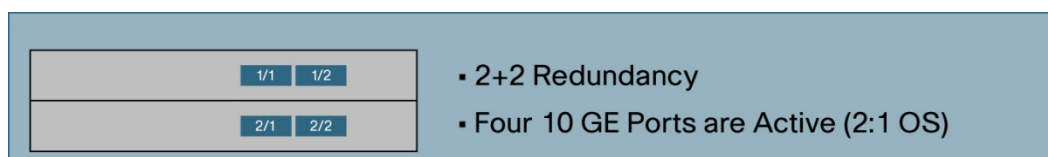
For Supervisor Engine II+10GE and V-10GE engines, two 10 Gigabit Ethernet and four Gigabit Ethernet uplink ports are active: tengig1/1, gig1/3, and gig1/4 on slot 3; and tengig2/1, gig2/3, and gig2/4 on slot 4. Figure 7 shows this setup.

**Figure 7.** Supervisor Engine II+10GE and V-10GE Engines

For Supervisor 6-E, the uplinks in redundant mode operation have three options. The first option is referred to as 1 + 1 redundancy; in this configuration, two 10 Gigabit Ethernet uplink ports are active at line rate: tengig1/1 on slot 3 and tengig2/1 on slot 4. Figure 8 shows this setup.

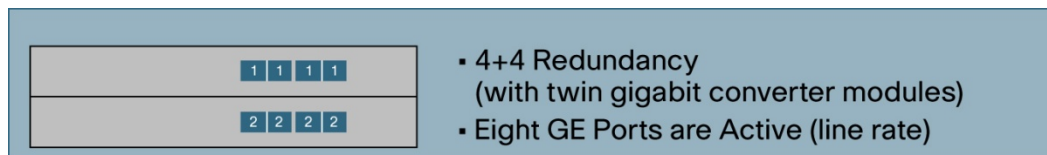
**Figure 8.** Supervisor Engine 6-E

The second option is referred to as 2 + 2 redundancy; in this configuration, four 10 Gigabit Ethernet uplink ports are active at 2:1 oversubscription: tengig1/1 and tengig1/2 on slot 3, and tengig2/1 and tengig2/2 on slot 4. Figure 9 shows this setup.

**Figure 9.** Supervisor Engine 6-E

The third option is referred to as 4 + 4 redundancy; in this configuration, twin gigabit converter modules are used and 8 Gigabit Ethernet uplink ports are active at line rate: gig1/3, gig1/4, gig1/5, and gig1/6 on slot 3; and gig2/3, gig2/4, gig2/5, and gig2/6 on slot 4. Figure 10 depicts this setup.

**Figure 10.** Supervisor Engine 6-E

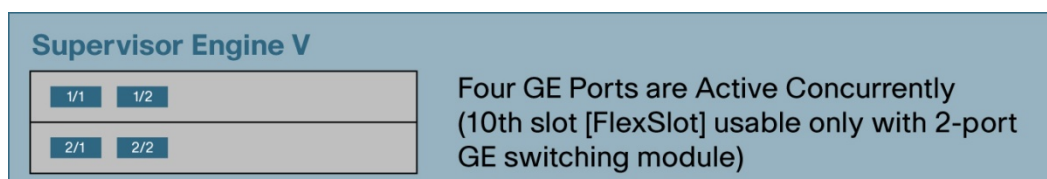


### Cisco Catalyst 4510R+E and 4510R-E Supervisor Engine Redundancy

This section covers supervisor engine redundancy for the classic supervisor engines that are supported on the Cisco Catalyst 4510R+E and 4510R-E chassis.

For Supervisor Engine V, four Gigabit Ethernet uplink ports are active concurrently: gig1/1 and gig1/2 on slot 5, and gig2/1 and gig2/2 on slot 6. Note that slot 10 (FlexSlot) is usable only with the 2-port Gigabit Ethernet switching module (WS-X4302-GB). Figure 11 shows this setup.

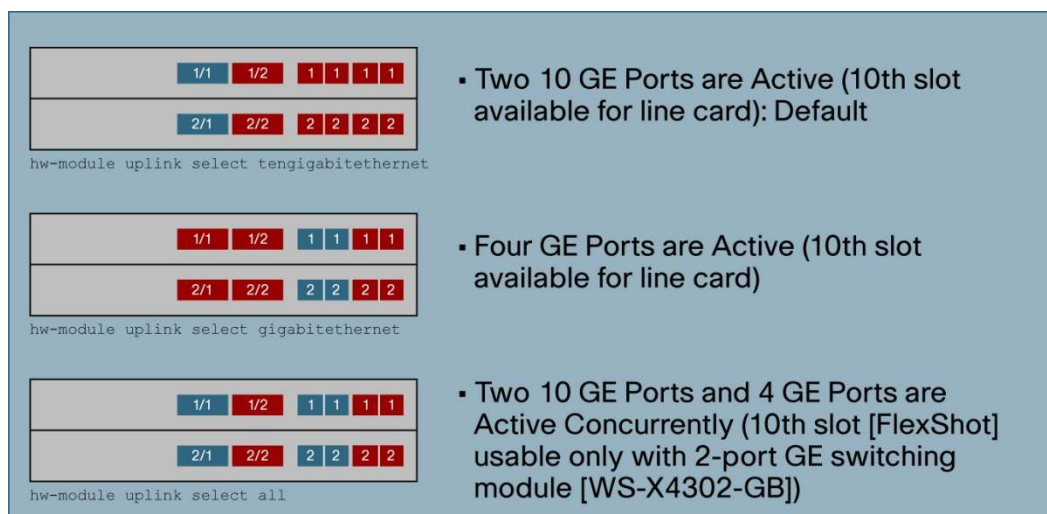
**Figure 11.** Supervisor Engine V



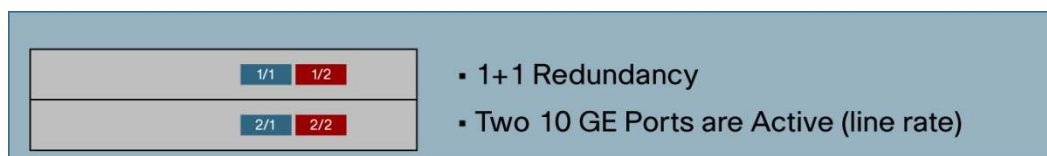
For Supervisor Engine V-10GE, there are three selectable modes using the hw-module uplink select command. These modes allow 10 Gigabit Ethernet uplinks only (the default mode), Gigabit Ethernet uplinks only, or both 10 Gigabit Ethernet and Gigabit Ethernet uplinks.

For 10 Gigabit Ethernet uplinks mode, two 10 Gigabit Ethernet uplink ports are active: tengig1/1 on slot 5 and tengig2/1 on slot 6. In this mode, slot 10 is available for any line card. For Gigabit Ethernet uplinks mode, four Gigabit Ethernet uplink ports are active: gig1/3 and gig1/4 on slot 5, and gig2/3 and gig2/4 on slot 6. In this mode, slot 10 is available for any line card. For both 10 Gigabit Ethernet and Gigabit Ethernet uplinks mode, two 10 Gigabit Ethernet uplink ports and four Gigabit Ethernet uplink ports are active: tengig1/1, gig1/3, and gig1/4 on slot 5; and tengig2/1, gig2/3, and gig2/4 on slot 6. In this mode, slot 10 (FlexSlot) is usable only with the 2-port Gigabit Ethernet switching module (WS-X4302-GB).

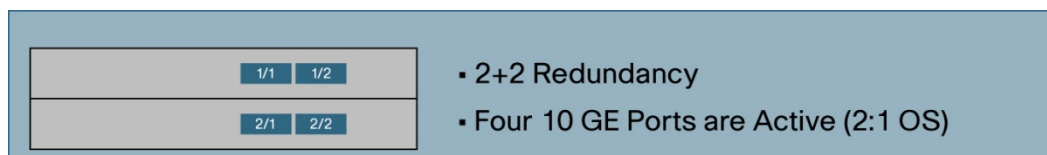
Figure 12 shows the three selectable modes with the associated hw-module uplink select command.

**Figure 12.** Supervisor Engine V-10GE (3 selectable modes with hw-module uplink select Command)

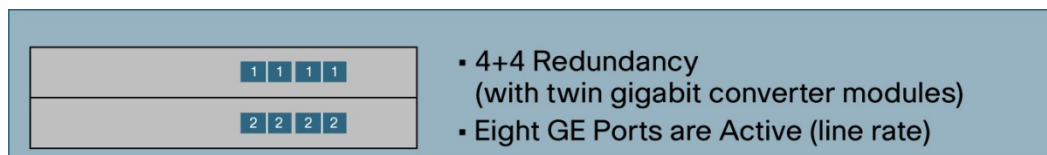
For Supervisor Engine 6-E, the uplinks in redundant mode operation have three options. The first option is referred to as 1 + 1 redundancy; in this configuration, two 10 Gigabit Ethernet uplink ports are active at line rate: tengig1/1 on slot 5 and tengig2/1 on slot 6. Figure 13 shows this setup.

**Figure 13.** Supervisor Engine 6-E

The second option is referred to as 2 + 2 redundancy; in this configuration, four 10 Gigabit Ethernet uplink ports are active at 2:1 oversubscription: tengig1/1 and tengig1/2 on slot 5, and tengig2/1 and tengig2/2 on slot 6. Figure 14 depicts this setup.

**Figure 14.** Supervisor Engine 6-E

The third option is referred to as 4 + 4 redundancy; in this configuration, twin gigabit converter modules are used and 8 Gigabit Ethernet uplink ports are active at line rate: gig1/3, gig1/4, gig1/5, and gig1/6 on slot 5; and gig2/3, gig2/4, gig2/5, and gig2/6 on slot 6. Figure 15 shows this setup.

**Figure 15.** Supervisor Engine 6-E

## Summary

High availability on the Cisco Catalyst 4500 E-Series redundant chassis (4507R+E, 4507R-E, 4510R+E, and 4510R-E) allows support of active 10 Gigabit Ethernet and Gigabit Ethernet uplink ports all the time using backplane traces. Uplink connectivity is not affected, even if the active supervisor engine fails.



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