

Configuring Flexlink+

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Restrictions for FlexLink+

- FlexLink+ is not supported in a Cisco StackWise Virtual solution.
- FlexLink+ is supported only on Layer 2 trunk ports and port channels and is not supported on interfaces configured on Layer 3 ports and on VLANs.



Note FlexLink+ is not supported on port channels configured with access mode.

Information about FlexLink+

The following sections provide information about FlexLink+

FlexLink+ Overview

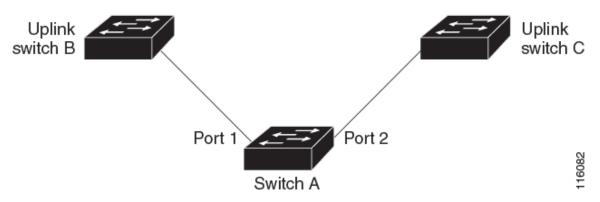
The FlexLink+ feature enables the user to configure a pair of a Layer 2 interfaces (trunk ports or port channels) where one interface is configured to act as a backup to the other. FlexLink+ provides an alternative solution to the Spanning Tree Protocol (STP) when you require simple link redundancy between two network nodes. STP is a complete solution that provides link redundancy and prevents loops in the network. If you need fast link redundancy between two nodes in the network, it is simpler and quicker to use FlexLink+. Flexlinks are typically configured in service provider or enterprise networks where customers do not want to run STP on the device. If the device is running STP, Flexlinks are not necessary because STP already provides link-level redundancy or backup.

In FlexLink+, when one of the links is up and forwarding traffic, the other link is in standby mode, ready to begin forwarding traffic if the active link shuts down. If the primary link shuts down, the standby link starts forwarding traffic. When the active link comes back up, it goes into standby mode and does not forward traffic.

FlexLink+ Configuration

In the following figure, ports 1 and 2 on switch A are connected to uplink switches B and C. Because they are configured with FlexLink+, only one of the interfaces is forwarding traffic; the other is in standby mode. If port 1 is the active link, it begins forwarding traffic between port 1 and switch B; the link between port 2 (the backup link) and switch C is not forwarding traffic. If port 1 goes down, port 2 comes up and starts forwarding traffic to switch C. When port 1 comes back up, it goes into standby mode and does not forward traffic; port 2 continues forwarding traffic.





If STP is configured on the uplink switch interfaces that connect to the FlexLink+ ports (Switch B and Switch C in this case), we recommend running the **spanning-tree portfast trunk** command on such uplink switch interfaces, for faster convergence.

Flexlink+ includes an optimization for improved multicast traffic convergence. The optimization uses Layer 2 multicast snooping mechanisms and requires that the uplink switches connected to the Flexlink+ configured ports have the same Layer 2 multicast snooping feature that is enabled.



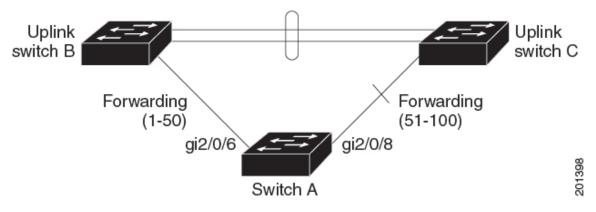
Note

For IPv4 multicast IGMP snooping is on by default. If IGMP snooping needs to be disabled on the uplink switches it must also be disabled on the Flexlink+ host switch. Otherwise IGMP reports may be looped around the active and standby Flexlink+ ports leading to excessively high CPU utilization.

VLAN Load Balancing and FlexLink+

VLAN load-balancing allows you to configure a FlexLink+ pair so that both ports simultaneously forward the traffic for some mutually exclusive VLANs. For example, if FlexLink+ ports are configured for 1-100 VLANs, the traffic of the first 50 VLANs is forwarded on one port and the rest on the other port. If one of the ports fails, the other active port forwards all the traffic. When the failed port comes back up, it resumes forwarding traffic in the preferred VLANs. This way, apart from providing redundancy, this FlexLink+ pair is used for load balancing. FlexLink+ VLAN load-balancing doesn't impose any restrictions on uplink switches.

Figure 2: VLAN Load Balancing in FlexLink+ Topology



When you configure VLAN load balancing, you must also configure triggers in one of two ways:

- Manually trigger VLAN load balancing at any time by entering the **rep preempt segment** privileged EXEC command on the switch that has the primary edge port.
- Configure a preempt delay time by entering the **rep preempt delay** interface configuration command. After a link failure and recovery, VLAN load balancing begins after the configured preemption time period elapses. The delay timer restarts if another port fails before the time has elapsed.

Note When VLAN load balancing is configured, it does not start working until triggered by either manual intervention or a link failure and recovery.

When VLAN load balancing is triggered, the primary edge port sends out a message to alert all interfaces in the segment about the preemption. When the secondary port receives the message, it is reflected into the network to notify the alternate port to block the set of VLANs specified in the message and to notify the primary edge port to block the remaining VLANs.

You can also configure a particular port in the segment to block all VLANs. Only the primary edge port initiates VLAN load balancing, which is not possible if the segment is not terminated by an edge port on each end. The primary edge port determines the local VLAN load balancing configuration.

Reconfigure the primary edge port to reconfigure load balancing. When you change the load balancing configuration, the primary edge port again waits for the rep preempt segment command or for the configured preempt delay period after a port failure and recovery before executing the new configuration. If you change an edge port to a regular segment port, the existing VLAN load balancing status does not change. Configuring a new edge port might cause a new topology configuration.

When VLAN load balancing is enabled, the default is manual preemption with the delay timer disabled. If VLAN load balancing is not configured, the default after manual preemption is to block all VLANs at the primary edge port.

When a primary link fails, FlexLink+ transmits dummy multicast packets over the new active interface. The dummy multicast packet format is:

- Destination: 01:00:0c:cd:cd:cd
- Source: MAC address of the hosts or ports on the newly active Flex Link port.

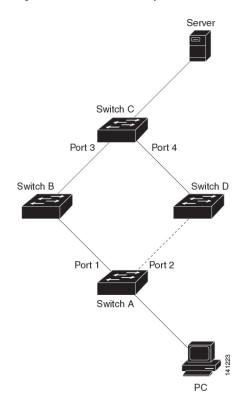


Figure 3: Transmission of Dummy Multicast Packets in FlexLink+ Topology

In the above figure, Ports 1 and 2 on switch A are connected to switches B and D through a Flex Link pair. Port 1 is forwarding traffic, and port 2 is in the blocking state. Traffic from the PC to the server is forwarded from port 1 to port 3. The MAC address of the PC has been learned on port 3 of switch C. Traffic from the server to the PC is forwarded from port 3 to port 1.

If port 1 shuts down, port 2 starts forwarding traffic. If there is no traffic from the PC to the server after failover to port 2, switch C does not learn the MAC address of the PC on port 4, and because of that, switch C keeps forwarding traffic from the server to the PC out of port 3. There is traffic loss from the server to the PC because port 1 is down. To alleviate this problem, the feature sends out a dummy multicast packet with the source MAC address of the PC over port 2. Switch C learns the PC MAC address on port 4 and starts forwarding traffic from the server to the PC out of port 4. One dummy multicast packet is sent out for every MAC address.



Note

• Local administrative shut down or a link that starts forwarding again due to preemption is not considered a link failure. In those cases, the feature flushes the dynamic hosts and and does not move them.

• Static MAC addresses that are configured on a Flex Link port are restored when it starts forwarding again.

How to configure Flexlink+

The following sections provide information on how to configure Flexlink+.

Configuring the Active Port for FlexLink+

To configure the active port for FlexLink+, follow this procedure:

Procedure

	Command or Action	Purpose
Step 1	enable	Enables privileged EXEC mode. Enter your
	Example:	password if prompted.
	Device> enable	
Step 2	configure terminal	Enters global configuration mode.
	Example:	
	Device# configure terminal	
Step 3	interface interface-id	Specifies the interface, and enters interface
	Example:	configuration mode.
	Device# interface Port-channel2	
Step 4	switchport trunk allowed vlan vlan-list	Configures the allowed VLANs for an interface.
	Example:	
	Device(config-if)# switchport trunk allowed vlan 20-23,40,41	
Step 5	switchport mode trunk	Configures the interface as a Layer 2 trunk.
	Example:	
	Device(config-if)# switchport mode trunk	
Step 6	rep segment segment-id edge no-neighbor primary	Specifies that the port is the primary edge po where you can configure the active port of FlexLink+. A segment has only one primary
	Example:	
· ·	Device(config-if)# rep segment 1023 edge	edge port.

Configuring the Standby Port for FlexLink+

To configure the standby port for FlexLink+, follow this procedure:

Procedure

	Command or Action	Purpose
Step 1	enable	Enables privileged EXEC mode.
	Example:	Enter your password if prompted.

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	Command or Action	Purpose	
	Device> enable		
Step 2	configure terminal	Enters global configuration mode.	
	Example:		
	Device# configure terminal		
Step 3	interface interface-id	Specifies the interface, and enters interface	
	Example:	configuration mode.	
	Device# interface Port-channel7		
Step 4	switchport trunk allowed vlan vlan-list	Configures the allowed VLANs for an interfac	
	Example:		
	Device(config-if)# switchport trunk allowed vlan 20-23,40,41		
Step 5	switchport mode trunk	Configures the interface as a Layer 2 trunk.	
	Example:		
	Device(config-if) # switchport mode trunk		
Step 6	rep segment segment-id edge no-neighbor	Specifies the segment edge as one with no	
	preferred	external REP neighbor. Specifies that the port is the standby port for FlexLink+.	
	<pre>Example: Device(config-if)# rep segment 1023 edge no-neighbor preferred</pre>		
		• Configuring a port as preferred does not guarantee that it becomes the alternate port; it merely gives the port a slight edge over equal contenders. The alternate port is usually a previously failed port.	

Configuring VLAN Load Balancing on FlexLink+

To configure VLAN load balancing, perform this procedure:

	Command or Action	Purpose	
Step 1	enable	Enables privileged EXEC mode. Enter your	
	Example:	password if prompted.	
	Device> enable		
Step 2	configure terminal	Enters global configuration mode.	
	Example:		
	Device# configure terminal		
Step 3	interface interface-id	Specifies the interface, and enters interface	
	Example:	configuration mode. The interface can be a physical Layer 2 interface or a port channel	
	Device(config)# interface gigabitethernet2/0/8	(logical interface).	
Step 4	switchport mode trunk	Configures the interface as a Layer 2 trunk.	
	Example:		
	Device(config-if)# switchport mode trunk		
Step 5	rep segment <i>segment-id</i> edge no-neighbor primary	Specifies that the port is the primary edge port.	
	Example:		
	Device(config-if)# rep segment 300 edge no-neighbor primary		
Step 6	rep block port port-number vlan vlan-range	Forwarding traffic for VLANs 1-50 is blocked	
	Example:	on the standby port. Forwarding of traffic VLANs 51-100 is blocked on the active p	
	Device(config-if)# rep block port 2 vlan 1-50		
Step 7	exit	Exits the Interface configuration mode.	
	Example:		
	Device(config-if) exit		
Step 8	interface interface-id	Specifies the interface, and enters interface	
	Example:	configuration mode. The interface can be a physical Layer 2 interface or a port channel	
	Device(config)# interface gigabitethernet2/0/6	(logical interface).	

Procedure

	Command or Action	Purpose
Step 9	switchport mode trunk	Configures the interface as a Layer 2 trunk.
	Example:	
	Device(config-if) # switchport mode trunk	
Step 10	<pre>rep segment segment-id edge no-neighbor Example: Device(config-if)# rep segment 300 edge no-neighbor</pre>	Specifies the segment edge as one with no external REP neighbor. Specifies that the port is the standby port for Flexlink+.
Step 11	end Example:	Exits to privileged EXEC mode.
	Device(config-if)# end	

Configuring Propagation of FlexLink+ Topology Change Messages

When the FlexLink+ protocol is deployed as part of a larger domain, you can configure the propagation of FlexLink+ topology change messages to the next tier devices. To configure the propagation of FlexLink+ topology change messages, perform this procedure.

Procedure

	Command or Action	Purpose
Step 1	enable Example:	Enables privileged EXEC mode. Enter your password if prompted.
	Device> enable	
Step 2	configure terminal	Enters global configuration mode.
	Example:	
	Device# configure terminal	
Step 3	interface interface-id Example:	Specifies the interface, and enters interface configuration mode. The interface can be a physical Layer 2 interface or a port channel
	<pre>Device(config) # interface gigabitethernet2/0/8</pre>	(logical interface).
Step 4	switchport mode trunk	Configures the interface as a Layer 2 trunk.
	Example:	
	Device(config-if) # switchport mode trunk	
Step 5	rep segment segment-id edge no-neighbor primary	Specifies the port as the primary edge port.

	Command or Action	Purpose
	Example:	
	Device(config-if)# rep segment 300 edge no-neighbor primary	
Step 6	rep stcn stp	Propagates FlexLink+ topology change
	Example:	messages to the next tier devices.
	Device(config-if)# rep stcn stp	
Step 7	rep block port port-number vlan vlan-range	Forwarding traffic for VLANs 1-50 is blocked
	Example:	on the standby port. Forwarding of traffic for VLANs 51-100 is blocked on the active port.
	Device(config-if)# rep block port 2 vlan 1-50	
Step 8	exit	Exits the Interface configuration mode.
	Example:	
	Device(config-if) exit	
Step 9	switchport mode trunk	Configures the interface as a Layer 2 trunk.
	Example:	
	Device (config-if) # switchport mode trunk	
Step 10	interface interface-id	Specifies the interface, and enters interface
	Example:	configuration mode. The interface can be a physical Layer 2 interface or a port channel
	Device(config)# interface gigabitethernet2/0/6	(logical interface).
Step 11	rep segment segment-id edge no-neighbor	Specifies the segment edge as one with no
	Example:	external REP neighbor. Specifies that the port is the standby port for FlexLink+.
	Device(config-if)# rep segment 300 edge no-neighbor	
Step 12	rep stcn stp	Propagates FlexLink+ topology change
	Example:	messages to the next tier devices.
	Device(config-if)# rep stcn stp	
Step 13	end	Exits to privileged EXEC mode.
	Example:	
	Device(config-if)# end	

Configuring Preempt Time Delay

To configure a preempt time dealy for VLAN load balancing, perform this procedure:

Procedure

	Command or Action	Purpose
Step 1	enable Example:	Enables privileged EXEC mode. Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	<pre>interface interface-id Example: Device(config)# interface gigabitethernet2/0/8</pre>	Specifies the interface, and enters interface configuration mode. The interface can be a physical Layer 2 interface or a port channel (logical interface).
Step 4	<pre>switchport mode trunk Example: Device(config-if)# switchport mode trunk</pre>	Configures the interface as a Layer 2 trunk.
Step 5	rep preempt delay seconds Example: Device(config-if)# rep preempt delay 30	Configures a preempt time delay. Automatically triggers VLAN load balancing after a link failure and recovery. The time delay range is between15 to 300 seconds. The default is manual preemption with no time delay. Note Enter this command only on the REP primary edge port.

Configuring Manual Preemption for VLAN Load Balancing

If you do not enter a preemption time delay, the default is to manually trigger VLAN load balancing on the segment. Ensure that all other segment configurations are complete before manually preempting VLAN load balancing. When you enter the **rep preempt delay segment** command, a confirmation message appears before the command is executed because preemption can cause network disruption.

Procedure

	Command or Action	Purpose
Step 1	enable Example:	Enables privileged EXEC mode. Enter your password if prompted.
	Device> enable	
Step 2	rep preempt segment segment-id Example: Device# rep preempt segment 300	Manually triggers VLAN load balancing on the segment. The range for segment id is from 1 to 1024.
Step 3	<pre>show rep topology segment segment-id Example: Device# show rep topology segment 300</pre>	Displays REP topology information for the segment.

Configuration Examples for FlexLink+

The following sections provide examples for configuring FlexLink+.

Example: Configuring the Active Port for FlexLink+

This example shows how to configure the active port for FlexLink+.

```
Device# interface Port-channel2
Device(config-if)# switchport trunk allowed vlan 20-23,40,41
Device(config-if)# switchport mode trunk
Device(config-f)# rep segment 1023 edge no-neighbor primary
```

Example: Configuring the Standby Port for FlexLink+

This example shows how to configure the standby port for FlexLink+.

```
Device# interface Port-channel7
Device(config-if)# switchport trunk allowed vlan 20-23,40,41
Device(config-if)# switchport mode trunk
Device(config-f)# rep segment 1023 edge no-neighbor preferred
```

Example: Configuring VLAN Load Balancing for FlexLink+

The following example shows VLAN load balancing configured on a FlexLink+ interface. VLANs 1-50 are blocked on the active port and VLANs 51-100 are blocked on the standby port.

```
Device(config) # interface gigabitethernet2/0/8
Device(config-if) # switchport mode trunk
Device(config-if) # rep segment 300 edge no-neighbor primary
Device(config-if) # rep block port 2 vlan 1-50
Device(confif-if) # exit
Device(config) # interface gigabitethernet2/0/6
Device(config-if) # switchport mode trunk
```

```
Device(config-if) # rep segment 300 edge no-neighbor
Device(config-if) # end
```

Example: Configuring Propogation of FlexLink+ Topology Change Messages

The following example shows how to configure the propogation of FlexLink+ topology change messages to the next tier devices.

```
Device(config)# interface gigabitethernet2/0/8
Device(config-if)# switchport mode trunk
Device(config-if)# rep segment 300 edge no-neighbor primary
Device(config-if)# rep stcn stp
Device(config-if)# rep block port 2 vlan 1-50
Device(confif-if)# exit
Device(config-if)# switchport mode trunk
Device(config-if)# switchport mode trunk
Device(config-if)# rep segment 300 edge no-neighbor
Device(config-if)# rep stcn stp
Device(config-if)# rep stcn stp
```

Feature History for FlexLink+

This table provides release and related information for features explained in this module.

These features are available on all releases subsequent to the one they were introduced in, unless noted otherwise.

Release	Feature	Feature Information
Cisco IOS XE Gibraltar 16.12.1	FlexLink+	The FlexLink+ feature enables the user to configure a pair of a Layer 2 interfaces (trunk ports or port channels) where one interface is configured to act as a backup to the other interface.
Cisco IOS XE Amsterdam 17.2.1	VLAN Load Balancing for FlexLink+ Preemption for VLAN Load Balancing FlexLink+ Dummy Multicast Packets	 VLAN load balancing feature was introduced on FlexLink+. VLAN load-balancing allows you to configure a FlexLink+ pair so that both ports can simultaneously forward the traffic for some mutually exclusive VLANs. You can trigger VLAN load balancing either by manually triggering it or by configuring a preempt delay. When a primary link fails, FlexLink+ transmits dummy multicast packets over the new active interface. These packets help learn the source MAC address.

Use Cisco Feature Navigator to find information about platform and software image support. To access Cisco Feature Navigator, go to http://www.cisco.com/go/cfn.