Configuring Flex Links

# Information about Flex Links

Flex Links are a pair of a Layer 2 interfaces (switch ports or port channels) where one interface is configured to act as a backup to the other. The feature provides an alternative solution to the Spanning Tree Protocol (STP). You can disable STP and still retain basic link redundancy. Flex Links are typically configured in service provider or enterprise networks where customers do not want to run STP on the switch. If the switch is running STP, Flex Links are not necessary because STP already provides link-level redundancy or backup.

You can configure Flex Links on one Layer 2 interface (the active link) by assigning another Layer 2 interface as the Flex Links or backup link. The Flex Links interface can be on the same switch. When one of the links is up and forwarding traffic, the other link is in standby mode, ready to begin forwarding traffic if the other link shuts down. At any given time only one of the interfaces is in the linkup state and forwarding traffic. 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. Flex Links are not configured by default and there are no backup interfaces defined. STP is disabled on Flex Link interfaces.

Figure 1: Flex Links Configuration Example
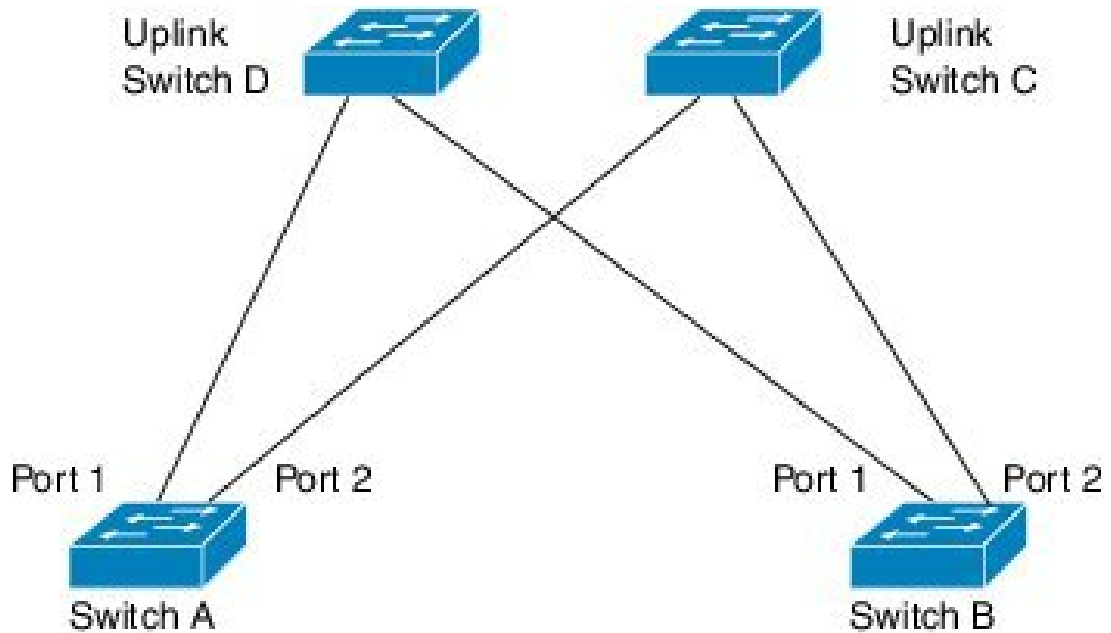
In the Flex Links Configuration Example, Switches A and B are downlink switches. Ports 1 and 2 on switches A and B are connected to uplink switches C and D. Because they are configured as Flex Links, only one of the interfaces is forwarding traffic; the other is in standby mode. The interface that is forwarding traffic is the active interface. If port 1 on switch A is the active interface, it begins forwarding traffic between port 1 and switch D; the link between port 2 (the backup interface) 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.

Flex Links are supported only on Layer 2 ports and port channels, not on VLANs or on Layer 3 ports. It provides link redundancy for switch topologies where other types of redundancies such as STP, VPC and Layer 2 Multi-Path are not required or desired.

Preemption

You can optionally configure a preemption mechanism to specify the active interface. For example, you can configure a Flex Link pair with preemption mode so that when a port comes back up, if it has greater bandwidth than the peer port, it will begin forwarding after 60 seconds and the peer port will be on standby. This is done by entering the preemption mode bandwidth and delay commands.

If a primary (forwarding) link goes down, the network management stations are notified. If the standby link goes down, you are notified.

You can configure preemption in the following three modes:

- Forced-The active interface always preempts the backup interface.

- Bandwidth-The interface with the higher bandwidth always acts as the active interface.

- Off-There is no preemption; the first interface that is working is put in forwarding mode.

You can also configure the preemption delay as a specified amount of time (in seconds) before preempting a working interface for another. This ensures that the counterpart in the upstream switch has transitioned to an STP forwarding state before the switch over.

Multicast

When a Flex Link interface is learned as an mrouter port, the standby (non-forwarding) interface is also co-learned as an mrouter port if the link is up. This co-learning is for internal software state maintenance and has no relevance with respect to IGMP operations or hardware forwarding unless multicast fast-convergence is enabled. With multicast fast-convergence configured, the co-learned mrouter port is immediately added to the hardware. Flex Link supports multicast fast convergence for IPv4 IGMP.

Guidelines and Limitations for Flex Link

Consider the following guidelines and limitations when configuring Flex Links:

- Because the Spanning Tree Protocol is implicitly disabled on Flex Link interfaces, ensure that you do not configure any other redundant paths in the same topology to prevent loops. In addition, configure the corresponding links to upstream switches by using the spanning-tree port type normal command so they do not get blocked by Bridge Assurance.

- Flex Links are designed for uplink interfaces, which are typically configured as trunk ports. As a link backup mechanism, a Flex Link pair must have the same configuration characteristics, including the same switchport mode and list of allowed VLANs. Port-profile makes a convenient tool for syncing up such configurations for the Flex Link pair. Flex Link does not require that the two interfaces have the same configurations. However, long term mismatches in configurations may result in forwarding problems, particularly during failover.

- Flex Links cannot be configured on the following interface types:

  - Layer 3 interfaces

  - SPAN destinations

  - Port channel members

  - Interfaces configured with Private VLANs

  - Interfaces in end node mode

  - Layer 2 multi-path

- You can configure only one Flex Link backup link for any active link and it must be a different interface from the active interface.

- An interface can belong to only one Flex Link pair; it can be a backup link for only one active link.

- Neither of the links can be a port that belongs to an EtherChannel. However, you can configure two port channels (EtherChannel logical interfaces) as Flex Links, and you can configure a port channel and a physical interface as Flex Links, with either the port channel or the physical interface as the active link.

- STP is disabled on Flex Link ports. A Flex Link port does not participate in STP, even if the VLANs present on the port are configured for STP. When STP is not enabled, be sure that there are no loops in the configured topology.

• Do not configure any STP features (for example, PortFast, and BPDU Guard) on Flex Links ports.

• vPC is not supported. Flex Link is used in place of vPC where configuration simplicity is desired and there is no need for active-active redundancy.

Note Flex Link is only supported on Nexus 3500 Series switches. You cannot configure Flex Link on Nexus 3000 or Nexus 3100 Series switches.

Default Settings for Flex Link

Table 1: Flex Link Default Parameter Settings

Parameter	Definition
Multicast Fast-Convergence	Disabled
Preemption mode	Off
Preemption delay	35 seconds

Configuring Flex Links

You can configure a pair of layer 2 interfaces (switch ports or port channels) as Flex Link interfaces, where one interface is configured to act as a backup to the other.

SUMMARY STEPS

1. switch# **configure terminal**
2. switch(config) # **feature flexlink**
3. switch(config) # **interface** {**ethernet** *slot/port* | **port-channel** *channel-no* }
4. switch(config-if) # **switchport backup interface** {**ethernet** *slot/port* | **port-channel** *channel-no*} [**multicast fast-convergence**]
5. (Optional) switch(config-if) # **end**
6. (Optional) switch# **show interface switchport backup**
7. (Optional) switch# **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config) # **feature flexlink**	Enables Flex Link.
Step 3	switch(config) # **interface** {**ethernet** *slot/port*	**port-channel** *channel-no* }	Specifies the Ethernet or port channel interface and enters interface configuration mode.

	Command or Action	Purpose
		The port channel range is 1 to 48.
Step 4	switch(config-if) # **switchport backup interface** {**ethernet** *slot/port* | **port-channel** *channel-no*} [**multicast fast-convergence**]	Specifies a physical layer 2 interface (Ethernet or port channel) as the backup interface in a Flex Link pair. When one link is forwarding traffic the other interface is in standby mode. • **ethernet** *slot/port*—Specifies the backup Ethernet interface. The slot number is 1 and the port number is from 1 to 48. • **port-channel** *port-channel-no*—Specifies the backup port channel interface. The port-channel-no number is from 1 to 4096. • **multicast**—Specifies the multicast parameters. • **fast-convergence**—Configures fast convergence on the backup interface.
Step 5	(Optional) switch(config-if) # **end**	Return to privileged EXEC mode.
Step 6	(Optional) switch# **show interface switchport backup**	Verifies the configuration.
Step 7	(Optional) switch# **copy running-config startup-config**	Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

Example

This example shows how to configure an Ethernet switchport backup pair: Ethernet 1/1 is active interface, Ethernet 1/2 is the backup interface:

```
switch(config)# feature flexlink
switch(config)# interface ethernet 1/1
switch(config-if)# switchport backup interface ethernet 1/2
switch(config-if)# exit
switch(config)# interface port-channel300
switch(config-if)# switchport backup interface port-channel301
switch(config-if)# show ip igmp snooping mrouter
Type: S - Static, D - Dynamic, V - vPC Peer Link,
      I - Internal,C - Co-learned, U - User Configured
Vlan  Router-port    Type      Uptime      Expires
200   Po300          D         13:13:47    00:03:15
200   Po301          DC        13:13:47    00:03:15
```

This example shows how to configure the port channel switchport backup pair with multicast fast convergence:

```
switch(config)# interface port-channel10
switch(config-if)# switchport backup interface port-channel20 multicast fast-convergence
```

This example shows an example of multicast convergence with a pair of Flex Link interfaces: po305 and po306. A general query received on po305 makes it an mrouter port and po306 as co-learned.

```
switch(config)# interface po305
Switch(config-if)# switchport backup interface po306
switch# show ip igmp snooping mrouter
Type: S - Static, D - Dynamic, V - vPC Peer Link, I - Internal, C - Co-learned
Vlan  Router-port  Type      Uptime     Expires
4     Po300        D         00:00:12   00:04:50
4     Po301        DC        00:00:12   00:04:50
```

Configuring Flex Link Preemption

You can configure a preemption scheme for a pair of Flex Links.

Before you begin

Enable the Flex Link feature.

SUMMARY STEPS

1. switch# **configure terminal**
2. switch(config)# **interface ethernet** *slot/port*
3. switch(config-if)# **switchport backup interface ethernet** *slot/port*
4. switch(config-if)# **switchport backup interface ethernet** *slot/port* **preemption mode** [**bandwidth** | **forced** | **off**]
5. switch(config-if)# **switchport backup interface ethernet** *slot/port* **preemption delay** *delay-time*
6. (Optional) switch(config-if)# **end**
7. (Optional) switch# **show interface switchport backup**
8. (Optional) switch# **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **interface ethernet** *slot/port*	Specifies the Ethernet interface and enters interface configuration mode.
		The interface is a physical Layer 2 interface or a port channel (logical interface).
		The slot/port range is from 1 to 48.
Step 3	switch(config-if)# **switchport backup interface ethernet** *slot/port*	Configures a physical Layer 2 interface (or port channel) as part of a Flex Link pair with the interface. When one link is forwarding traffic, the other interface is in standby mode.
Step 4	switch(config-if)# **switchport backup interface ethernet** *slot/port* **preemption mode** [**bandwidth**	**forced**	**off**]	Configures a physical Layer 2 interface (Ethernet or port channel) as part of a flex link pair. When one link is forwarding traffic the other interface is in standby mode.
		• preemption—Configures a preemption scheme for a backup interface pair.
		• mode—Specifies the preemption mode.

	Command or Action	**Purpose**
		Configure a preemption mechanism for a Flex Link interface pair. You can configure the preemption as: • bandwidth—Interface with higher bandwidth always acts as the active interface • forced—Active interface always preempts the backup • off—No preemption happens from active to backup
Step 5	switch(config-if)# **switchport backup interface ethernet** *slot/port* **preemption delay** *delay-time*	Configure the delay time until a port preempts another port. The delay-time range is from 1 to 300 seconds. The default preemption delay is 35 seconds. **Note** Setting a delay time only works with forced and bandwidth modes.
Step 6	(Optional) switch(config-if)# **end**	Return to privileged EXEC mode.
Step 7	(Optional) switch# **show interface switchport backup**	Verifies the configuration.
Step 8	(Optional) switch# **copy running-config startup-config**	Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

Example

This example shows how to sets the preemption mode to forced, sets the delay time to 50, and verifies the configuration:

```
switch(config)# configure terminal
switch(config)# interface ethernet 1/48
switch(config-if)# switchport backup interface ethernet 1/4 preemption mode forced
switch(config-if)# switchport backup interface ethernet 1/4 preemption delay 50
switch(config-if)# end
switch# show interface switchport backup detail


Switch Backup Interface Pairs:

Active Interface        Backup Interface        State
--------------------------------------------------------------------


Ethernet1/48            Ethernet1/4             Active Down/Backup Down
        Preemption Mode  : forced
        Preemption Delay : 50 seconds
        Multicast Fast Convergence  : Off
        Bandwidth : 10000000 Kbit (Ethernet1/48), 10000000 Kbit (Ethernet1/4)
```

Verifying Flex Link Configuration

Use the following commands to display flex link configuration information:

Command	Purpose
show interface switchport backup	Displays information about all switchport Flex Link interfaces.
show interface switchport backup detail	Displays detailed information about all switchport Flex Link interfaces.
show running-config backup **show startup-config backup**	Displays the running or startup configuration for backup interfaces.
show running-config flexlink **show startup-config flexlink**	Displays the running or startup configuration for flex link interfaces.

Example

This example shows information about all switchport Flex Link interfaces:

```
switch# show interface switchport backup


Switch Backup Interface Pairs:

Active Interface          Backup Interface          State
----------------------------------------------------------------------
Ethernet1/1               Ethernet1/2               Active Down/Backup Down
Ethernet1/8               Ethernet1/45              Active Down/Backup Down
Ethernet1/48              Ethernet1/4               Active Down/Backup Down
port-channel10            port-channel20            Active Down/Backup Up
port-channel300           port-channel301           Active Down/Backup Down
```

This example shows details about all switchport Flex Link interfaces:

```
switch# show interface switchport backup detail


Switch Backup Interface Pairs:

Active Interface          Backup Interface          State
----------------------------------------------------------------------
Ethernet1/1               Ethernet1/2               Active Down/Backup Down
        Preemption Mode  : off
        Multicast Fast Convergence  : Off
        Bandwidth : 10000000 Kbit (Ethernet1/1), 10000000 Kbit (Ethernet1/2)

Ethernet1/8               Ethernet1/45              Active Down/Backup Down
        Preemption Mode  : forced
        Preemption Delay : 10 seconds
        Multicast Fast Convergence  : Off
        Bandwidth : 10000000 Kbit (Ethernet1/8), 10000000 Kbit (Ethernet1/45)

Ethernet1/48              Ethernet1/4               Active Down/Backup Down
        Preemption Mode  : forced
        Preemption Delay : 50 seconds
        Multicast Fast Convergence  : Off
        Bandwidth : 10000000 Kbit (Ethernet1/48), 10000000 Kbit (Ethernet1/4)
```

```
port-channel10          port-channel20          Active Down/Backup Up
        Preemption Mode  : forced
        Preemption Delay : 10 seconds
        Multicast Fast Convergence  : Off
        Bandwidth : 100000 Kbit (port-channel10), 10000000 Kbit (port-channel20)

port-channel300         port-channel301         Active Down/Backup Down
        Preemption Mode  : off
        Multicast Fast Convergence  : Off
        Bandwidth : 100000 Kbit (port-channel300), 100000 Kbit (port-channel301)
```

This example shows the running configuration for backup interfaces

```
switch# show running-config backup

!Command: show running-config backup
!Time: Sun Mar  2 03:05:17 2014

version 6.0(2)A3(1)
feature flexlink


interface port-channel10
  switchport backup interface port-channel20 preemption mode forced
  switchport backup interface port-channel20 preemption delay 10

interface port-channel300
  switchport backup interface port-channel301

interface Ethernet1/1
  switchport backup interface Ethernet1/2

interface Ethernet1/8
  switchport backup interface Ethernet1/45 preemption mode forced
  switchport backup interface Ethernet1/45 preemption delay 10

interface Ethernet1/48
  switchport backup interface Ethernet1/4 preemption mode forced
  switchport backup interface Ethernet1/4 preemption delay 50
```

This example shows the startup configuration for backup interfaces

```
switch# show startup-config backup

!Command: show startup-config backup
!Time: Sun Mar  2 03:05:35 2014
!Startup config saved at: Sun Mar  2 02:54:58 2014

version 6.0(2)A3(1)
feature flexlink


interface port-channel10
  switchport backup interface port-channel20 preemption mode forced
  switchport backup interface port-channel20 preemption delay 10

interface Ethernet1/8
  switchport backup interface Ethernet1/45 preemption mode forced
```

```
    switchport backup interface Ethernet1/45 preemption delay 10
```

This example shows the running configuration of Flex Link:

```
switch# show running-config flexlink

!Command: show running-config flexlink
!Time: Sun Mar  2 03:11:49 2014

version 6.0(2)A3(1)
feature flexlink


interface port-channel10
  switchport backup interface port-channel20 preemption mode forced

interface port-channel300
  switchport backup interface port-channel301

interface port-channel305
  switchport backup interface port-channel306

interface Ethernet1/1
  switchport backup interface Ethernet1/2

interface Ethernet1/8
  switchport backup interface Ethernet1/45 preemption mode forced
  switchport backup interface Ethernet1/45 preemption delay 10

interface Ethernet1/48
  switchport backup interface Ethernet1/4 preemption mode forced
  switchport backup interface Ethernet1/4 preemption delay 50
```

This example shows the startup configuration of Flex Link:

```
switch# show startup-config flexlink

!Command: show startup-config flexlink
!Time: Sun Mar  2 03:06:00 2014
!Startup config saved at: Sun Mar  2 02:54:58 2014

version 6.0(2)A3(1)
feature flexlink


interface port-channel10
  switchport backup interface port-channel20 preemption mode forced
  switchport backup interface port-channel20 preemption delay 10

interface Ethernet1/8
  switchport backup interface Ethernet1/45 preemption mode forced
  switchport backup interface Ethernet1/45 preemption delay 10
```