Configuring Flex Links

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Information About Flex Links

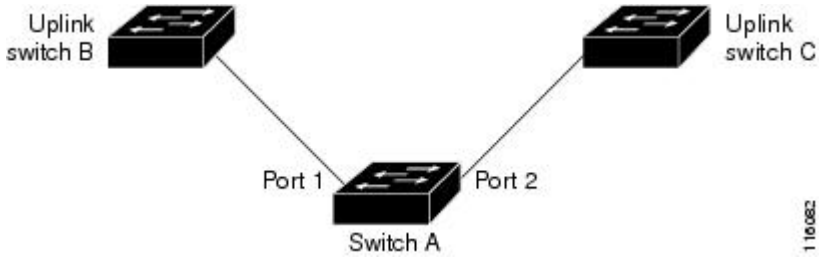
Flex links are a pair of a Layer 2 interfaces (switch ports or port channels) where one interface is configured to act as a backup to the other. The feature provides an alternative solution to the Spanning Tree Protocol (STP). You can disable STP and still retain basic link redundancy. Flex links are 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 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.

In the Flex Links Configuration Example, ports 1 and 2 on switch A are connected to uplink switches B and C. Because they are configured as Flex Links, 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.

Flex Links are supported only on Layer 2 ports and port channels, not on VLANs or on Layer 3 ports.

Figure 1: Flex Links Configuration Example



Preemption

You can optionally configure a preemption mechanism to specify the preferred port for forwarding traffic. 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, then it will begin forwarding after 35 seconds (default preemption delay) 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, a trap notifies the network management stations. If the standby link goes down, a trap notifies the users.

You can configure preemption in the following three modes:

- Forced—The active interface always preempts the backup.
- Bandwidth—The interface with the higher bandwidth always acts as the active interface.
- Off—There is no preemption; the first interface that is up 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 Fast-Convergence

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:

- 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, BPDU Guard, and so forth) on Flex Links ports or the ports to which the links connect.
- 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.
- MVR configuration on Flex Link ports is not supported.

Flex links cannot be configured on the following interface types:

- FEX fabric ports and FEX host ports
- FCoE (vFC) interfaces
- VNTAG (vETH) interfaces
- Interfaces with port security enabled
- Layer 3 interfaces
- SPAN destinations
- Port channel members
- Interfaces configured with Private VLANs
- Interfaces in end node mode
- Fabric path core interfaces (Layer 2 multipath)

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** | **preemption** { **delay** *delay-time* | **mode** [**bandwidth** | **forced** | **off**] }]
5. (Optional) switch(config-if) # **end**
6. (Optional) switch# **show interface** *interface-id* **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. 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** | **preemption** { **delay** *delay-time* | **mode** [**bandwidth** | **forced** | **off**] }]	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 from 1 to 255 and the *port* number is from 1 to 128. • **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. • **preemption**—Configures a preemption scheme for a backup interface pair. • **delay** *delay-time*—Specifies the preemption delay. The *delay-time* range is from 1 to 300 seconds. The default is 35 seconds. • **mode**—Specifies the preemption mode.

	Command or Action	Purpose
		• **bandwidth—**Specifies that the interface with the higher available bandwidth always preempts the backup. • **forced—**Specifies the interface that always preempts the backup. • **off—**Specifies that no preemption occurs from backup to active.
Step 5	switch(config-if) # **end**	(Optional) Return to privileged EXEC mode.
Step 6	switch# **show interface** *interface-id* **switchport backup**	(Optional) Verifies the configuration.
Step 7	switch# **copy running-config startup-config**	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

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 ethernet1/1
switch(config-if)# switchport backup interface ethernet2/1
switch(config-if) # exit
switch(config)# interface po300
Switch(config-if)# switchport backup interface po301
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 1/48** *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** *interface-id* **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 1/48** *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. Configure a preemption mechanism and delay 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 default preemption delay is 35 seconds. **Note** Setting a delay time only works with forced and bandwidth modes.
Step 6	switch(config-if) # **end**	(Optional) Return to privileged EXEC mode.

	Command or Action	Purpose
Step 7	switch# **show interface** *interface-id* **switchport backup**	(Optional) Verifies the configuration.
Step 8	switch# **copy running-config startup-config**	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

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

```
Switch# configure terminal
switch(conf)# interface ethernet0/1
switch(conf-if)#switchport backup interface ethernet0/2 preemption mode forced
switch(conf-if)#switchport backup interface ethernet0/2 preemption delay 50
switch(conf-if)# end

switch# show interface switchport backup detail
Active Interface Backup Interface State
--------------------------------------------------------------------------------
Ethernet0/21 Ethernet0/2 Active Up/Backup Standby
Interface Pair : Gi0/1, Gi0/2
Preemption Mode : forced
Preemption Delay : 50 seconds
Bandwidth : 100000 Kbit (Gi0/1), 100000 Kbit (Gi0/2)
Mac Address Move Update Vlan : auto
```

Verifying Flex Link Configuration

Use the following commands to display flex link configuration information:

Command	Purpose
show interface switchport backup	Displays information about all switch ort Flex Link interfaces.
show interface switchport backup detail	Displays detailed information about all switch ort 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.

Flex Link Configuration Examples

This example shows how to configure a port-channel switchport backup pair with forced preemption. The active interface port-channel10 is the preferred forwarding interface:

```
switch(config)# interface port-channel10
switch(config-if)# switchport backup interface port-channel20 preemption mode forced
switch(config-if)# switchport backup interface port-channel20 preemption delay 35
```

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: po300 and po301. A general query received on po300 makes it an mrouter port and po301 as co-learned.

```
switch(config)# interface po300
Switch(config-if)# switchport backup interface po301
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
```

This example shows po300 and po301 as mrouter ports (po301 is co-learned); it is not added to the hardware table when multicast fast-convergence is disabled.

```
switch# show ip igmp snooping groups vlan 4
Type: S - Static, D - Dynamic, R - Router port

Vlan  Group Address      Ver  Type  Port list
4     */*                -    R     Po300 Po301
   224.1.1.1          v2   D     Eth1/31

switch# show platform fwm info hw-stm | grep 0100.5e01.0101
1.4    0100.5e01.0101   midx 36  1:2849:0 0:0:1:0 1.0.0.0.0.24 (e:0)

switch# show platform fwm info oifl 36
oifl 36 vdc 1 oifl 36: vdc 1 gpinif 0, mcast idx 36(alt:0), oifl_type 2
oifl 36 vdc 1 oifl 36: oifl iods 8,44
oifl 36 vdc 1 oifl 36: max_iod 8192,  ref count 1000  num_oifs 2, seq_num 33
oifl 36 vdc 1 oifl 36: hw pgmd: 1 msg present: 0
oifl 36 vdc 1 oifl 36: l2_bum_ref_cnt 0,  l3_macg_ref_cnt 1000
oifl 36 vdc 1 oifl 36: if_indexs - Po300 Eth1/31
```

This example shows co-learned po301 is added to hardware when multicast fast-convergence is enabled:

```
switch(config)# interface po300
Switch(config-if)# switchport backup interface po301 multicast fast-convergence

switch# show platform fwm info hw-stm | grep 0100.5e01.0101
1.4    0100.5e01.0101   midx 38   1:2849:0 0:0:1:0 1.0.0.0.0.26 (e:0)

switch# show platform fwm info oifl 38
oifl 38 vdc 1 oifl 38: vdc 1 gpinif 0, mcast idx 38(alt:0), oifl_type 2
oifl 38 vdc 1 oifl 38: oifl iods 8-9,44
oifl 38 vdc 1 oifl 38: max_iod 8192,  ref count 1000  num_oifs 3, seq_num 35
oifl 38 vdc 1 oifl 38: hw pgmd: 1 msg present: 0
oifl 38 vdc 1 oifl 38: l2_bum_ref_cnt 0,  l3_macg_ref_cnt 1000
oifl 38 vdc 1 oifl 38: if_indexs - Po300 Po301 Eth1/31
```

This example shows the running configuration of Flex Link:

```
switch# show running-config flexlink

!Command: show running-config flexlink
!Time: Thu Jan  1 03:21:12 2011

version 5.0(3)N2(1)
feature flexlink
```

```
logging level Flexlink 5

interface port-channel500
  switchport backup interface port-channel501 preemption delay 36
  switchport backup interface port-channel501 multicast fast-convergence

interface Ethernet2/2
  switchport backup interface port-channel507 preemption mode forced
```

This example shows details about the Flex Link interface. Forced preemption is about to take place because (scheduled) is displayed.

```
switch# show interface switchport backup detail

Switch Backup Interface Pairs:

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

port-channel300         port-channel301         Active Down/Backup Up
        Preemption Mode  : forced
        Preemption Delay : 35 seconds (default) (scheduled)
        Multicast Fast Convergence  : Off
        Bandwidth : 20000000 Kbit (port-channel300), 10000000 Kbit (port-channel301)
```