

E T H E R C H A N N E L

With EtherChannel, STP forwards or blocks an entire group of up to 8 equal-speed parallel links between two switches. When up, the individual interfaces load-balance, increasing bandwidth, instead of all but one being blocked by STP. EtherChannel, PortChannel, and Channel-group are synonyms. Spanning-tree show commands display EtherChannels as Po1, etc.

Configuration—For each participating interface,

```
S1(config)# interface range fa0/1 -4
S1(config-if-range)# channel-group 1 mode on
Creating a port-channel interface Port-channel 1
```

Status

```
S1# show etherchannel summary
Flags: D - down          P - bundled in port-channel
       I - stand-alone  s - suspended
       H - Hot-standby (LACP only)
       R - Layer3       S - Layer2
       U - in use       f - failed to allocate aggregator

       M - not in use, minimum links not met
       u - unsuitable for bundling
       w - waiting to be aggregated
       d - default port
```

```
Number of channel-groups in use: 1
Number of aggregators:          1
```

Group	Port-channel	Protocol	Ports
1	Po1(SU)	-	Fa0/1(P) Fa0/2(P) Fa0/3(P) Fa0/4(P)

Tells interfaces participating (after a mammoth legend). A (P) beside an interface says that the interface has passed all the checks to be included in the channel.

```
S2# show spanning-tree vlan 1
```

```
VLAN0001
Spanning tree enabled protocol ieee
Root ID    Priority    32769
           Address    000c.85ca.e280
           Cost        8
           Port        65 (Port-channel1)
           Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

Bridge ID   Priority    32769 (priority 32768 sys-id-ext 1)
           Address    000d.29a1.8680
           Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
           Aging Time  300
```

Interface	Role	Sts	Cost	Prio.Nbr	Type
Po1	Root	FWD	8	128.65	P2p

Notice the port cost of 8 (4x100 Mbps) is between 19 (100Mbps) and 4 (1 Gbps).

EtherChannel can eliminate the need for STP convergence when individual links within the group go down. As long as one link within the EtherChannel stays up, the combined interface stays up and STP remains unaware.

The entire interface can be configured by using the name "port-channel #" or po# for short.

```
S2# show interfaces port-channel 1
Port-channell is up, line protocol is up (connected)
  Hardware is EtherChannel, address is 000d.29a1.8681 (bia 000d.29a1.8681)
  MTU 1500 bytes, BW 400000 Kbit, DLY 100 usec,
    (Lots omitted)
S2(config)# interf po1
S2(config-if)# shutdown
```

D Y N A M I C E T H E R C H A N N E L S

Negotiation to form a channel is handled by one of two different protocols and caused by using one of four keywords instead of "on" for the mode. Like trunking, both standards require that one end of the link "actively desire" to form a channel. Unlike trunking, the "on" keyword prevents an interface from negotiating and will prevent the formation of a channel with any dynamic interface. In that way, it's like port speed / duplex.

- PAgP (Port Aggregation Protocol)—Cisco. Keywords: Desirable, Auto.
- LACP (Link Aggregation Control Protocol)—IEEE 802.3ad. Keywords: Active, Passive

Combinations that Form an EtherChannel

PAgP	AUTO	DESIRABLE	ON	LACP	PASSIVE	ACTIVE	ON
AUTO		•		PASSIVE		•	
DESIRABLE	•	•		ACTIVE	•	•	
ON			•	ON			•

I N T E R F A C E S E T T I N G S M U S T M A T C H

If an interface is set to dynamically become part of an EtherChannel and inconsistent settings prevent its participation, the link protocol will be down (up/down) and the status will be "suspended" (instead of connected/notconnect/disabled). The link won't be usable, even individually, until the problem is resolved. That's fine; STP would have killed it anyway because a single link would have a higher cost than the rest of the channel-group combination.

SETTING	WITHIN SWITCH MUST MATCH	OPPOSITE ENDS MUST MATCH
Speed	•	•
Duplex	•	•
Access / Trunk	•	•
DTP (Dynamic Trunking Protocol) Settings		
Access VLAN (if access)	•	•
Trunk Native VLAN (if trunk)	•	•
Trunk Allowed VLANs (if trunk)	•	•
STP Interface Settings	•	
The Channel-Group Number of the EtherChannel	•	

VERIFICATION

```
S1# show etherchannel 1 port-channel
      Port-channels in the group:
      -----

Port-channel: Po1
-----
Age of the Port-channel   = 0d:02h:05m:50s
Logical slot/port        = 1/0           Number of ports = 3
GC                       = 0x00010001   HotStandBy port = null
Port state               = Port-channel Ag-Inuse
Protocol                 = PAgP
Port security            = Disabled

Ports in the Port-channel:
Index  Load  Port      EC state      No of bits
-----+-----+-----+-----+-----
  0     00   Fa0/1     Desirable-S1   0
  0     00   Fa0/2     Desirable-S1   0
  0     00   Fa0/3     Desirable-S1   0

Time since last port bundled:  0d:00h:30m:29s   Fa0/2
Time since last port Un-bundled: 0d:00h:30m:30s   Fa0/2
```

TROUBLESHOOTING

For example, a port channel that couldn't form even though the underlying links are fine:

```
Switch# show etherchannel summary
...
Po1 (SD)          Fa0/14 (I)  Fa0/15 (I)
                  For the Port-Channel Group (Po1 on left):
                    S means the port channel is Layer 2
                    D means it's down
                  For the individual interfaces (on right):
                    I means that the individual interfaces are working independently, so they're OK.
                    P means successfully bundled in the port-channel

Switch# show interfaces status
...
fa 0/14          connected
fa 0/15          connected
Po1              notconnect
```

Err-Disabled Ports—To clear, fix the problem, then do a shut / no shut on the EtherChannel. That'll automatically cascade down to the individual ports.

- Maybe True—If misconfig is between switches, port channel doesn't form but individual interfaces continue to function. BUT if the misconfig is within switch between interfaces, the
- individual interfaces will get err-disabled.

Some ways to break an EtherChannel for a test question:

- Using "on" at one end and negotiation on the other
- Mixing PAgP and LACP negotiation at opposite ends
- Setting both sides passive or both "auto" (at least one end of the link needs to "actively" desire participation)
- Mixing incompatible interface settings—see the table at the bottom of page 2

M A C A D D R E S S T A B L E

Incoming frames on an interface that's participating in an EtherChannel cause their source MAC to be learned as belonging to that port channel, not the underlying interface.

Outgoing frames will use the table to choose a port channel to forward the frame out, then the switch will choose a working interface within the channel to physically carry the frame. This is important because the channel will stay up even if all but one of its interfaces are down.

Load-Balancing Preferences—Specifically, the choice of which interface to use will be based on the load-balancing preferences of the port-channel. By default, Cisco bases the choice on the low-order bits of the source MAC. This keeps frames from the same source to the same destination on the same interface while using the right-hand side of the MAC address randomly spreads *different* sources across the available interfaces.