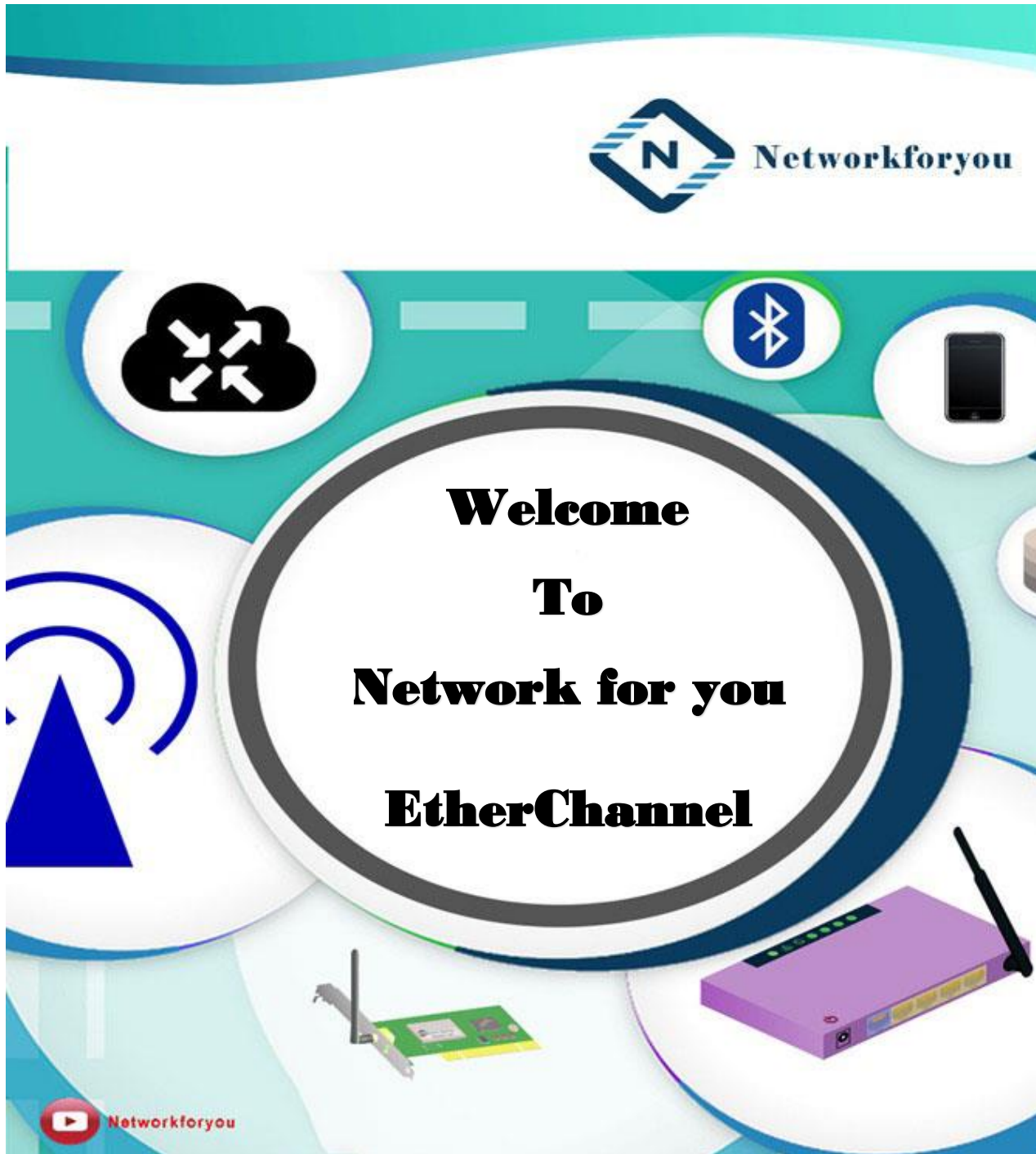




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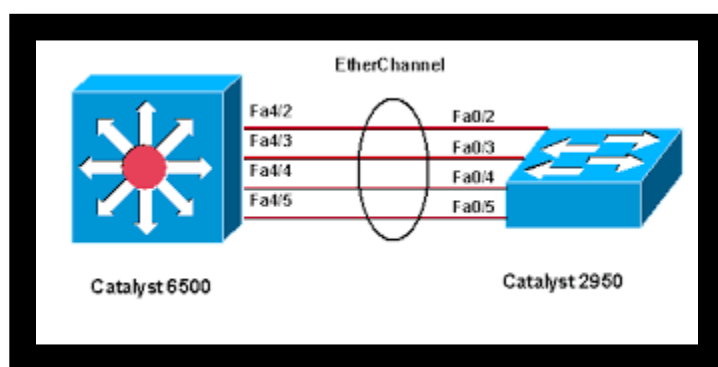
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Ether Channel

- It is also known as Link aggregation.
- Ether channel is a technology which allows us to make multiple physical interfaces into single logical interface. So STP will not block that multiple links etc.
- Ether channel increases bandwidth and provides redundancy by aggregating individual links of switches.
- Ether Channel load balances traffic over all the links in the bundle.
- It can be configured as layer 2 or layer 3.
- Maximum we can do ether channel to 8 Physical interfaces.



Ether Channel can be configured between switches by using two protocols.

1. PAgP (Port Aggregation Protocol) is Cisco Proprietary. (Advertises messages with the multicast MAC address 0100:0CCC:CCCC)
2. LACP (Link Aggregation Protocol) it is standard. (Advertises messages with the multicast MAC address 0180:C200:0002).
3. Manual or Static Mode without protocol.



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If we want to configure ether channel we need to make sure that all ports have the same configuration.

- Duplex has to be the same
- Speed has to be same there.
- Same Native and allowed Vlans
- Same switchport mode (Like access or trunk).

If we want to configure PAGP there are number of options we can choose for interface configuration as given below.



- ON (In this Interface becomes member of the ether channel but does not negotiate).
- Desirable (In this Interface will actively ask the other side to become an ether channel).
- Auto (In this Interface will wait passively for the other side to ask to become an ether channel).
- OFF (no ether channel configured on the interface).

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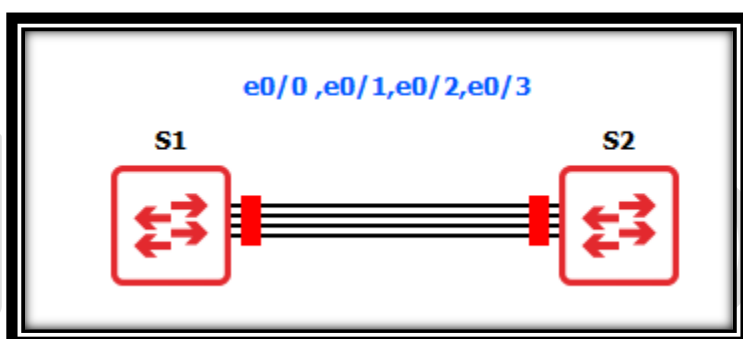
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LACP			PAgP		
	Active	Passive		Desirable	Auto
Active	Yes	Yes	Desirable	Yes	Yes
Passive	Yes	No	Auto	Yes	No

Lab Time: PAgP



SW1 PAgP Configuraiton	SW2 PAgP Configuraiton
en config t hostname SW1 interface range ethernet 0/0-3 switchport trunk encapsulation dot1q switchport mode trunk channel-protocol pagp channel-group 1 mode auto	en config t hostname SW2 interface range ethernet 0/0-3 switchport trunk encapsulation dot1q switchport mode trunk channel-protocol pagp channel-group 1 mode desirable

To Check Etherchannel

```
sh spanning-tree vlan 1  
sh etherchannel summary
```

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Sh etherchannel detail
Sh etherchannel port-channel

```
SW1#sh spanning-tree vlan 1
VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    32769
            Address     aabb.cc00.0100
            This bridge is the root
            Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    32769 (priority 32768 sys-id-ext 1)
            Address     aabb.cc00.0100
            Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time  15 sec

Interface          Role Sts Cost      Prio.Nbr Type
-----
Et1/0              Desg FWD 100       128.5   P2p
Et1/1              Desg FWD 100       128.6   P2p
Et1/2              Desg FWD 100       128.7   P2p
Et1/3              Desg FWD 100       128.8   P2p
Et2/0              Desg FWD 100       128.9   P2p
Et2/1              Desg FWD 100       128.10  P2p
Et2/2              Desg FWD 100       128.11  P2p
Et2/3              Desg FWD 100       128.12  P2p
Et3/0              Desg FWD 100       128.13  P2p
Et3/1              Desg FWD 100       128.14  P2p
Et3/2              Desg FWD 100       128.15  P2p
Et3/3              Desg FWD 100       128.16  P2p
Po1                Desg FWD 41        128.65  P2p
```

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```
SW1#sh 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       N - not in use, no aggregation
       f - failed to allocate aggregator

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

       A - formed by Auto LAG

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

Group  Port-channel  Protocol    Ports
-----+-----+-----+-----
1      Po1(SU)        PAgP        Et0/0(P)  Et0/1(P)  Et0/2(P)
                   Et0/3(P)

SW1#
```

```
SW1#sh etherchannel detail
Channel-group listing:
-----

Group: 1
-----
Group state = L2
Ports: 4    Maxports = 4
Port-channels: 1 Max Port-channels = 1
Protocol:   PAgP
Minimum Links: 0

Ports in the group:
-----
Port: Et0/0
-----

Port state      = Up Mstr In-Bndl
Channel group   = 1          Mode = Automatic-S1    Gcchange = 0
Port-channel    = Po1        GC   = 0x00010001    Pseudo port-channel = Po1
Port index      = 0          Load = 0x00          Protocol = PAgP

Flags: S - Device is sending Slow hello.  C - Device is in Consistent state.
       A - Device is in Auto mode.         P - Device learns on physical port.
       d - PAgP is down.

Timers: H - Hello timer is running.        Q - Quit timer is running.
        S - Switching timer is running.    I - Interface timer is running.
```



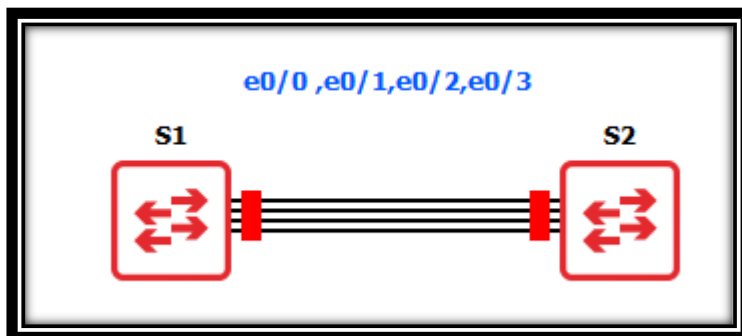
```
SW1#sh etherchannel port-channel
Channel-group listing:
-----
Group: 1
-----
Port-channels in the group:
-----
Port-channel: Po1
-----
Age of the Port-channel   = 0d:00h:02m:55s
Logical slot/port        = 16/0          Number of ports = 4
GC                        = 0x00010001    HotStandBy port = null
Port state                = Port-channel Ag-Inuse
Protocol                  = PAgP
Port security              = Disabled
Load share deferral       = Disabled

Ports in the Port-channel:

Index  Load  Port      EC state      No of bits
-----+---+-----+-----+-----
0      00     Et0/0     Automatic-S1   0
0      00     Et0/1     Automatic-S1   0
0      00     Et0/2     Automatic-S1   0
0      00     Et0/3     Automatic-S1   0

Time since last port bundled:  0d:00h:01m:43s  Et0/0
```

Lab time: LACP



SW1 lACP Configuraiton	SW2 lACP Configuraiton
en config t hostname SW1	en config t hostname SW2

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```
interface range e0/0-3
switchport trunk encapsulation dot1q
switchport mode trunk
channel-protocol lacp
channel-group 1 mode active
```

```
interface range e0/0-3
switchport trunk encapsulation dot1q
switchport mode trunk
channel-protocol lacp
channel-group 1 mode passive
```

To Check Etherchannel

```
sh spanning-tree vlan 1
sh etherchannel summary
Sh etherchannel detail
Sh etherchannel port-channel
```

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```
SW1#sh spanning-tree vlan 1
```

```
VLAN0001
```

```
Spanning tree enabled protocol ieee
```

```
Root ID Priority 32769
```

```
Address aabb.cc00.0300
```

```
This bridge is the root
```

```
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
```

```
Bridge ID Priority 32769 (priority 32768 sys-id-ext 1)
```

```
Address aabb.cc00.0300
```

```
Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
```

```
Aging Time 15 sec
```

Interface	Role	Sts	Cost	Prio.Nbr	Type
Et1/0	Desg	FWD	100	128.5	P2p
Et1/1	Desg	FWD	100	128.6	P2p
Et1/2	Desg	FWD	100	128.7	P2p
Et1/3	Desg	FWD	100	128.8	P2p
Et2/0	Desg	FWD	100	128.9	P2p
Et2/1	Desg	FWD	100	128.10	P2p
Et2/2	Desg	FWD	100	128.11	P2p
Et2/3	Desg	FWD	100	128.12	P2p
Et3/0	Desg	FWD	100	128.13	P2p
Et3/1	Desg	FWD	100	128.14	P2p
Et3/2	Desg	FWD	100	128.15	P2p
Et3/3	Desg	FWD	100	128.16	P2p
Po1	Desg	FWD	41	128.65	P2p



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```
SW1# sh 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       N - not in use, no aggregation
        f - failed to allocate aggregator

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

        A - formed by Auto LAG

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

Group  Port-channel  Protocol    Ports
-----+-----+-----+-----
1      Po1(SU)        LACP        Et0/0(P)   Et0/1(P)   Et0/2(P)
                          Et0/3(P)
```

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```
SW1#Sh etherchannel detail
      Channel-group listing:
      -----
Group: 1
-----
Group state = L2
Ports: 4      Maxports = 4
Port-channels: 1 Max Port-channels = 4
Protocol: LACP
Minimum Links: 0

      Ports in the group:
      -----
Port: Et0/0
-----
Port state      = Up Mstr Assoc In-Bndl
Channel group   = 1          Mode = Active          Gcchange = -
Port-channel    = Po1        GC      = -            Pseudo port-channel = Po1
Port index      = 0          Load = 0x00           Protocol = LACP

Flags:  S - Device is sending Slow LACPDUs   F - Device is sending fast LACPDUs.
        A - Device is in active mode.         P - Device is in passive mode.

Local information:
Port      Flags  State  LACP port  Admin  Oper  Port  Port
Et0/0     SA     bndl   32768      0x1    0x1    0x1    0x3D

Partner's information:
Port      Flags  LACP port  Dev ID      Age  Admin  Oper  Port  Port
Et0/0     SP     32768     aabb.cc80.0400 18s  0x0    0x1    0x1    0x3C

Age of the port in the current state: 0d:00h:02m:36s

Port: Et0/1
-----
Port state      = Up Mstr Assoc In-Bndl
Channel group   = 1          Mode = Active          Gcchange = -
Port-channel    = Po1        GC      = -            Pseudo port-channel = Po1
Port index      = 0          Load = 0x00           Protocol = LACP

Flags:  S - Device is sending Slow LACPDUs   F - Device is sending fast LACPDUs.
        A - Device is in active mode.         P - Device is in passive mode.

Local information:
```



```
SW1#Sh etherchannel port-channel
      Channel-group listing:
-----

Group: 1
-----

      Port-channels in the group:
-----

Port-channel: Po1      (Primary Aggregator)
-----

Age of the Port-channel   = 0d:00h:04m:29s
Logical slot/port        = 16/0              Number of ports = 4
HotStandBy port = null
Port state                = Port-channel Ag-Inuse
Protocol                  = LACP
Port security              = Disabled
Load share deferral       = Disabled

Ports in the Port-channel:

Index   Load   Port      EC state      No of bits
-----+-----+-----+-----+-----
  0      00     Et0/0     Active        0
  0      00     Et0/1     Active        0
  0      00     Et0/2     Active        0
  0      00     Et0/3     Active        0

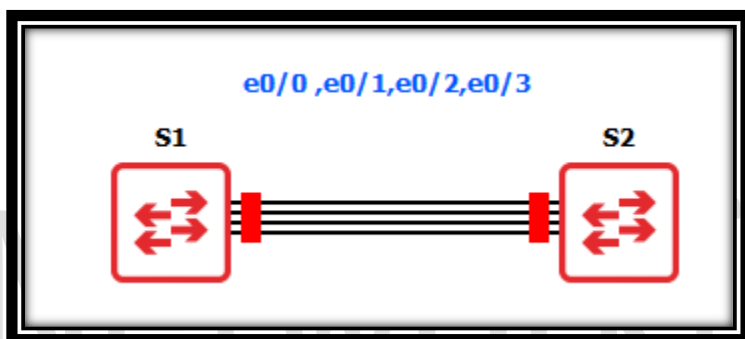
Time since last port bundled:    0d:00h:03m:48s    Et0/2
```



EtherChannel Static (Manual):

- Switchports can be configured to bypass LACP or PAgP Protocols.
- It is simply changing the mode to ON both sides of the switches.
- This mode is used to Configure EtherChannel Manually.
- This mode can be used if device on another end does not support PAgP and LACP.

Lab time: Static (Manual):



SW1 ON Configuraiton	SW2 ON Configuraiton
en config t hostname SW1 interface range e0/0-3 switchport trunk encapsulation dot1q switchport mode trunk channel-group 1 mode on	en config t hostname SW2 interface range e0/0-3 switchport trunk encapsulation dot1q switchport mode trunk channel-group 1 mode on

To Check Etherchannel

```
sh spanning-tree vlan 1  
sh etherchannel summary  
Sh etherchannel detail  
Sh etherchannel port-channel
```

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```
SW2#sh spanning-tree vlan 1
VLAN0001
Spanning tree enabled protocol ieee
Root ID    Priority    32769
           Address    aabb.cc00.0600
           This bridge is the root
           Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec

Bridge ID  Priority    32769 (priority 32768 sys-id-ext 1)
           Address    aabb.cc00.0600
           Hello Time 2 sec Max Age 20 sec Forward Delay 15 sec
           Aging Time 15 sec

Interface Role Sts Cost Prio.Nbr Type
-----
Et1/0     Desg FWD 100 128.5 P2p
Et1/1     Desg FWD 100 128.6 P2p
Et1/2     Desg FWD 100 128.7 P2p
Et1/3     Desg FWD 100 128.8 P2p
Et2/0     Desg FWD 100 128.9 P2p
Et2/1     Desg FWD 100 128.10 P2p
Et2/2     Desg FWD 100 128.11 P2p
Et2/3     Desg FWD 100 128.12 P2p
Et3/0     Desg FWD 100 128.13 P2p
Et3/1     Desg FWD 100 128.14 P2p
Et3/2     Desg FWD 100 128.15 P2p
Et3/3     Desg FWD 100 128.16 P2p
Po1       Desg LIS 41 128.65 P2p
```

```
SW2#sh 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 N - not in use, no aggregation
       f - failed to allocate aggregator

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

       A - formed by Auto LAG

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

Group Port-channel Protocol Ports
-----
1 Po1(SU) - Et0/0(P) Et0/1(P) Et0/2(P)
Et0/3(P)
```



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```
SW2#Sh etherchannel detail
      Channel-group listing:
      -----
Group: 1
-----
Group state = L2
Ports: 4    Maxports = 4
Port-channels: 1 Max Port-channels = 1
Protocol:    -
Minimum Links: 0

      Ports in the group:
      -----
Port: Et0/0
-----
Port state      = Up Mstr In-Bndl
Channel group   = 1          Mode = On          Gcchange = -
Port-channel    = Po1        GC   = -          Pseudo port-channel = Po1
Port index      = 0          Load = 0x00        Protocol = -

Age of the port in the current state: 0d:00h:02m:00s

Port: Et0/1
-----
Port state      = Up Mstr In-Bndl
Channel group   = 1          Mode = On          Gcchange = -
Port-channel    = Po1        GC   = -          Pseudo port-channel = Po1
Port index      = 0          Load = 0x00        Protocol = -

Age of the port in the current state: 0d:00h:02m:00s

Port: Et0/2
-----
```

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```
SW2#Sh etherchannel port-channel
      Channel-group listing:
      -----
Group: 1
-----
      Port-channels in the group:
      -----
Port-channel: Po1
-----
Age of the Port-channel   = 0d:00h:02m:43s
Logical slot/port        = 16/0           Number of ports = 4
GC                        = 0x00000000     HotStandBy port = null
Port state                = Port-channel Ag-Inuse
Protocol                  = -
Port security              = Disabled
Load share deferral       = Disabled

Ports in the Port-channel:

Index   Load   Port      EC state      No of bits
-----+-----+-----+-----+-----
  0      00     Et0/0     On             0
  0      00     Et0/1     On             0
  0      00     Et0/2     On             0
  0      00     Et0/3     On             0

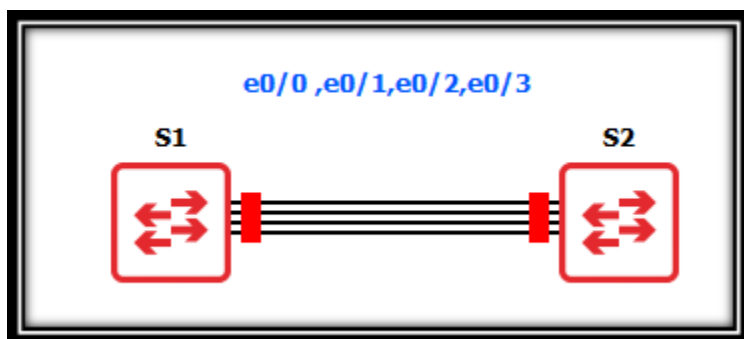
Time since last port bundled:    0d:00h:02m:43s    Et0/3
```



Layer 3 EtherChannel:

- Layer 3 EtherChannel is as a single port configured in routed mode.
- Layer 3 EtherChannel is configured with no switchport.
- Logical interface and no ip address is configured under member interfaces.
- Layer 3 port channel are used for interconnecting routers with layer 3 switches.
- Layer 3 port channel are used for interconnecting routers with routers.

Lab time: Layer 3 EtherChannel:



SW1 Layer 3 Etherchannel Configuraiton	SW2 Layer 3 Etherchannel Configuraiton
en config t hostname SW1 interface range e0/0-3 no switchport no ip address channel-group 1 mode on interface port-channel 1 ip address 192.168.1.1 255.255.255.0 No sh	en config t hostname SW2 interface range e0/0-3 no switchport no ip address channel-group 1 mode on interface port-channel 1 ip address 192.168.1.2 255.255.255.0 no sh

To Check Etherchannel

```
sh spanning-tree vlan 1  
sh etherchannel summary  
Sh etherchannel detail
```

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Sh etherchannel port-channel

```
SW2#sh spanning-tree vlan 1

VLAN0001
  Spanning tree enabled protocol ieee
  Root ID    Priority    32769
            Address     aabb.cc00.0900
            This bridge is the root
            Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec

  Bridge ID  Priority    32769 (priority 32768 sys-id-ext 1)
            Address     aabb.cc00.0900
            Hello Time  2 sec  Max Age 20 sec  Forward Delay 15 sec
            Aging Time  300 sec

Interface                Role Sts Cost      Prio.Nbr Type
-----
Et1/0                    Desg FWD 100      128.33 Shr
Et1/1                    Desg FWD 100      128.34 Shr
Et1/2                    Desg FWD 100      128.35 Shr
Et1/3                    Desg FWD 100      128.36 Shr
Et2/0                    Desg FWD 100      128.65 Shr
Et2/1                    Desg FWD 100      128.66 Shr
Et2/2                    Desg FWD 100      128.67 Shr
Et2/3                    Desg FWD 100      128.68 Shr
Et3/0                    Desg FWD 100      128.97 Shr
Et3/1                    Desg FWD 100      128.98 Shr
Et3/2                    Desg FWD 100      128.99 Shr
Et3/3                    Desg FWD 100      128.100 Shr
```

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```
SW2#sh 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(RU)        -           Et0/0(P)  Et0/1(P)  Et0/2(P)
                        Et0/3(P)
```

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```
SW2#Sh etherchannel detail
      Channel-group listing:
      -----
Group: 1
-----
Group state = L3
Ports: 4    Maxports = 8
Port-channels: 1 Max Port-channels = 1
Protocol:   -
Minimum Links: 0

      Ports in the group:
      -----
Port: Et0/0
-----
Port state      = Up Mstr In-Bndl
Channel group   = 1          Mode = On          Gcchange = -
Port-channel    = Po1        GC   = -          Pseudo port-channel = Po1
Port index      = 0          Load = 0x00       Protocol = -

Age of the port in the current state: 0d:00h:01m:58s

Port: Et0/1
-----
Port state      = Up Mstr In-Bndl
Channel group   = 1          Mode = On          Gcchange = -
Port-channel    = Po1        GC   = -          Pseudo port-channel = Po1
Port index      = 0          Load = 0x00       Protocol = -

Age of the port in the current state: 0d:00h:01m:58s

Port: Et0/2
-----
Port state      = Up Mstr In-Bndl
Channel group   = 1          Mode = On          Gcchange = -
Port-channel    = Po1        GC   = -          Pseudo port-channel = Po1
Port index      = 0          Load = 0x00       Protocol = -

Age of the port in the current state: 0d:00h:01m:58s

Port: Et0/3
-----
Port state      = Up Mstr In-Bndl
```



```
SW2#Sh etherchannel port-channel
      Channel-group listing:
      -----

Group: 1
-----

      Port-channels in the group:
      -----

Port-channel: Po1
-----

Age of the Port-channel    = 0d:00h:02m:51s
Logical slot/port          = 16/1           Number of ports = 4
GC                          = 0x00000000    HotStandBy port = null
Passive port list          = Et0/0 Et0/1 Et0/2 Et0/3
Port state                  = Port-channel L3-Ag Ag-Inuse
Protocol                    = -
Port security               = Disabled

Ports in the Port-channel:

Index   Load   Port      EC state      No of bits
-----+-----+-----+-----+-----
  0      00     Et0/0     On             0
  0      00     Et0/1     On             0
  0      00     Et0/2     On             0
  0      00     Et0/3     On             0

Time since last port bundled:    0d:00h:02m:51s    Et0/3
```



Troubleshooting Ether channel:

- Most of the issues with Ether channels (Link Aggregation) are because of **misconfiguration**.
- Keep in mind that the configuration of all physical interfaces has to match.
- Due to logical all the member interfaces must have the same characteristics.
- If they do not have same characteristics & configuration problems will occur.

The following configuration settings must match on the member interfaces:

Port Type:

- Every port in interface must be consistently configured to be Layer 2 or Layer 3.

Port Mode:

- All Layer 2 port channels must be configured as either access ports or trunk ports.
- All Layer 2 port channels must be the same configuration ports cannot be mixed.

Native VLAN:

- Member interfaces on Layer 2 trunk port channel must be configured same native VLAN.
- Native VLAN can be configured using the command **switchport trunk native vlan vlan-id**.

Allowed VLAN:

- Member interfaces on Layer 2 trunk port channel must be configured same VLANs.
- Same allow VLAN can be configured using command switchport trunk allowed vlan-ids.

Speed:

- All member interfaces or ports in port channel must be the same speed.

Duplex:

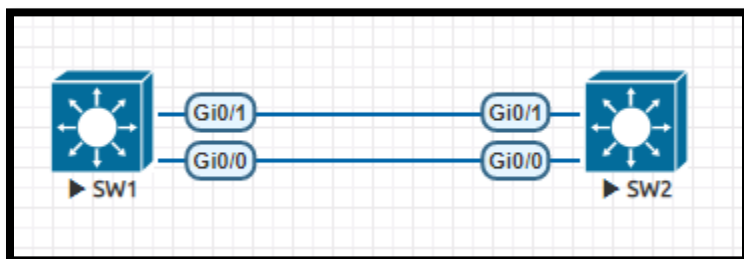
- The duplex must be the same for all member interfaces or ports in Port Channel link.

MTU:

- All Layer 3 member interfaces or ports must have the same MTU configured.
- Interface cannot be added to port channel if MTU does not match the MTU.



Lab Wrong Ether channel Mode:



SW1 configuration:	SW2 configuration:
en config t hostname SW1 interface range g0/0-1 switchport trunk encapsulation dot1q switchport mode trunk channel-protocol pagp channel-group 1 mode auto	en config t hostname SW2 interface range g0/0-1 switchport trunk encapsulation dot1q switchport mode trunk channel-protocol lacp channel-group 1 mode active

```
SW2#  
*Mar 30 08:08:38.999: %EC-5-L3DONTBNL2: Gi0/0 suspended: LACP currently not enabled on the remote port.  
--
```

```
SW1#sh ip int br  
Interface      IP-Address      OK? Method Status      Protocol  
GigabitEthernet0/0  unassigned      YES unset    up          up  
GigabitEthernet0/1  unassigned      YES unset    up          up  
GigabitEthernet0/2  unassigned      YES unset    up          up  
GigabitEthernet0/3  unassigned      YES unset    up          up  
Port-channel1      unassigned      YES unset    down        down
```

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```
SW2#sh ip int br
```

Interface	IP-Address	OK?	Method	Status	Protocol
GigabitEthernet0/0	unassigned	YES	unset	up	down
GigabitEthernet0/1	unassigned	YES	unset	up	down
GigabitEthernet0/2	unassigned	YES	unset	up	up
GigabitEthernet0/3	unassigned	YES	unset	up	up
Port-channel1	unassigned	YES	unset	down	down

```
SW1#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 N - not in use, no aggregation
f - failed to allocate aggregator

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

A - formed by Auto LAG

Number of channel-groups in use: 1

Number of aggregators: 1

Group	Port-channel	Protocol	Ports
-------	--------------	----------	-------

1	Po1 (SD)	PAgP	Gi0/0 (I) Gi0/1 (I)
---	----------	------	---------------------

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```
SW2#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        N - not in use, no aggregation
       f - failed to allocate aggregator

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

       A - formed by Auto LAG

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

Group  Port-channel  Protocol    Ports
-----+-----+-----+-----
1      Po1 (SD)        LACP        Gi0/0(s)   Gi0/1(s)
```

Here we notice that SW1 is running PAGP and SW2 is running LACP so we will have issues. We should have both side same protocol not different. So After reconfiguring SW2 to PAGP it will start working. This is Basic Troubleshooting lab. Same like this you can do by change native VLAN, or by change other parameters etc.