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**Welcome
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EtherChannel**



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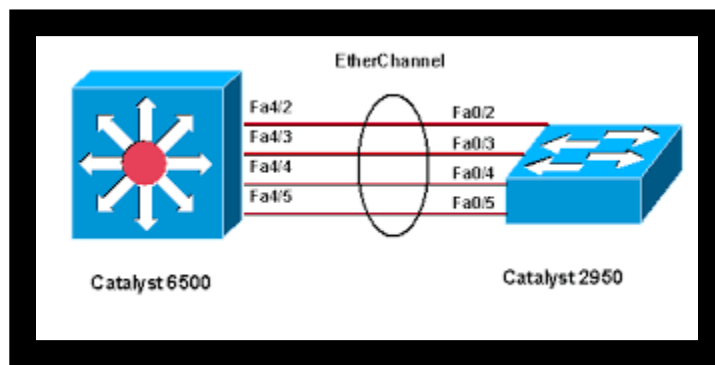
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Ether Channel

- 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.

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).

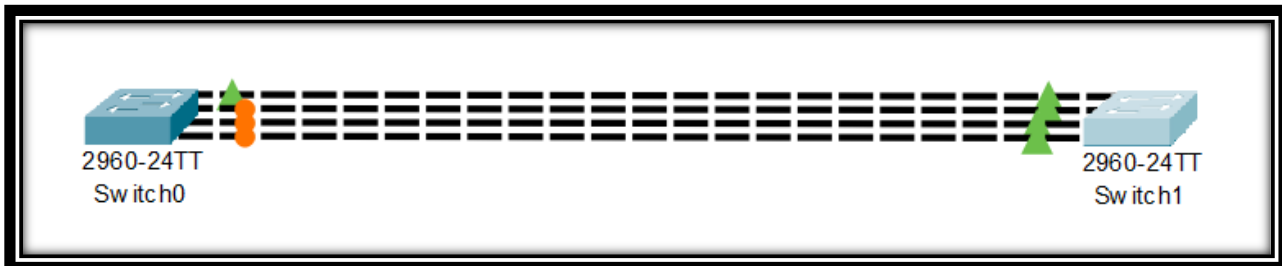
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If we want to configure PAgP there are number of options we can choose for interface configuration as given below.

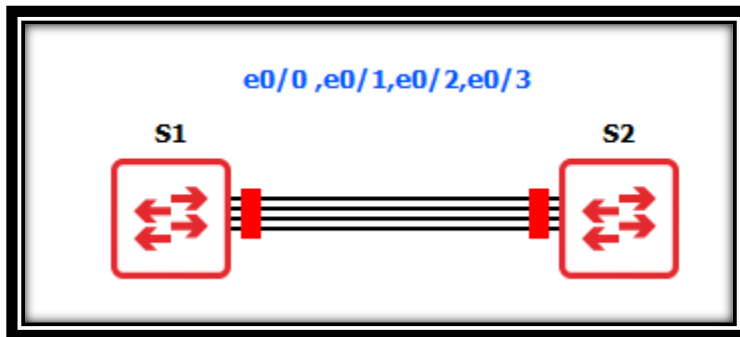


- ON (In this Interface becomes member of the ether channel but does not negotiate).
- Desirable (In this Interface will actively ask the other side to become an ether channel).
- Auto (In this Interface will wait passively for the other side to ask to become an ether channel).
- OFF (no ether channel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

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



Lab Time: PAgP



SW1 PAgP Configuraiton	SW2 PAgP Configuraiton
<pre>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</pre>	<pre>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</pre>

To Check Etherchannel
<pre>sh spanning-tree vlan 1 sh etherchannel summary Sh etherchannel detail Sh etherchannel port-channel</pre>

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```
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
```

```
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)
```

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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 = 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    Gchange = 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
```

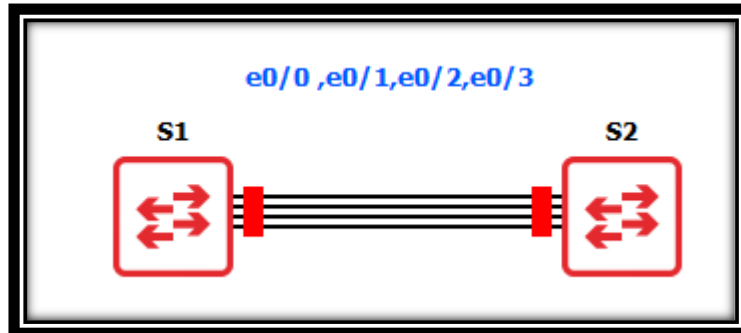
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Lab time: LACP



SW1 lacp Configuraiton	SW2 lacp Configuraiton
<pre>en config t hostname SW1 interface range e0/0-3 switchport trunk encapsulation dot1q switchport mode trunk channel-protocol lacp channel-group 1 mode active</pre>	<pre>en config t hostname SW2 interface range e0/0-3 switchport trunk encapsulation dot1q switchport mode trunk channel-protocol lacp channel-group 1 mode passive</pre>

To Check Etherchannel
<pre>sh spanning-tree vlan 1 sh etherchannel summary Sh etherchannel detail Sh etherchannel port-channel</pre>

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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
```

```
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:
```

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```
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

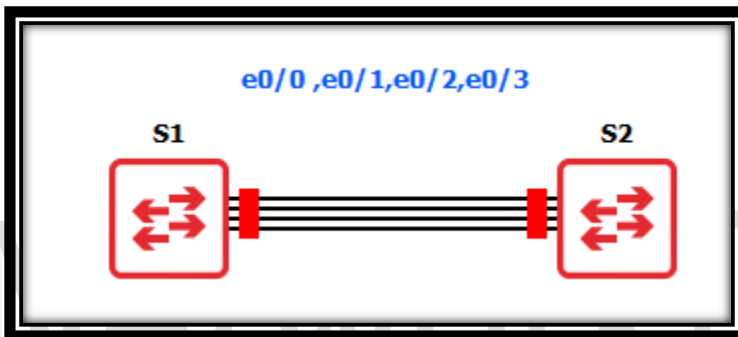
Time since last port bundled:    0d:00h:03m:48s    Et0/2
```



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

To Check Etherchannel
<pre>sh spanning-tree vlan 1 sh etherchannel summary Sh etherchannel detail Sh etherchannel port-channel</pre>

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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

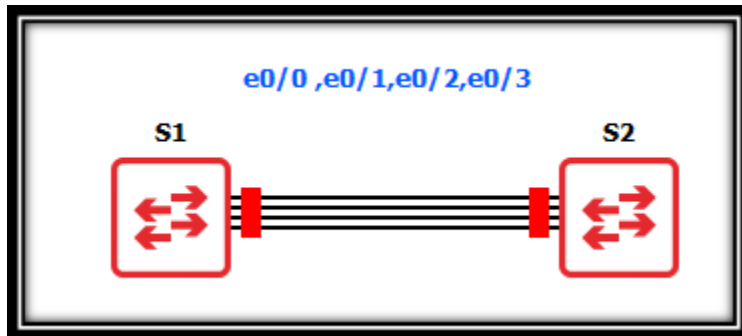
Time since last port bundled:    0d:00h:02m:43s    Et0/3
```



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
<pre> 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 </pre>	<pre> 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 </pre>

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.cc00.0900
           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
```

```
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
```

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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: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
```