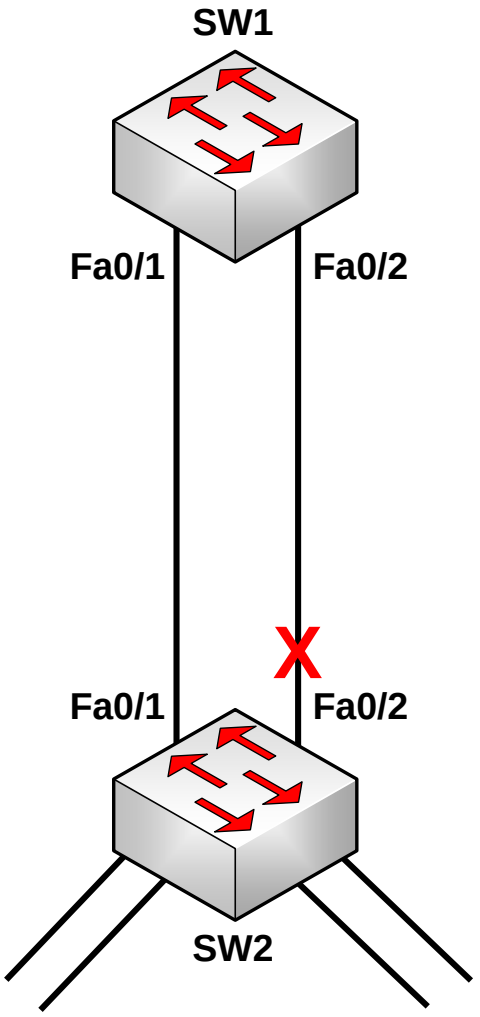
Implementing VLANs in Campus Networks

Configuring Link Aggregation with EtherChannel

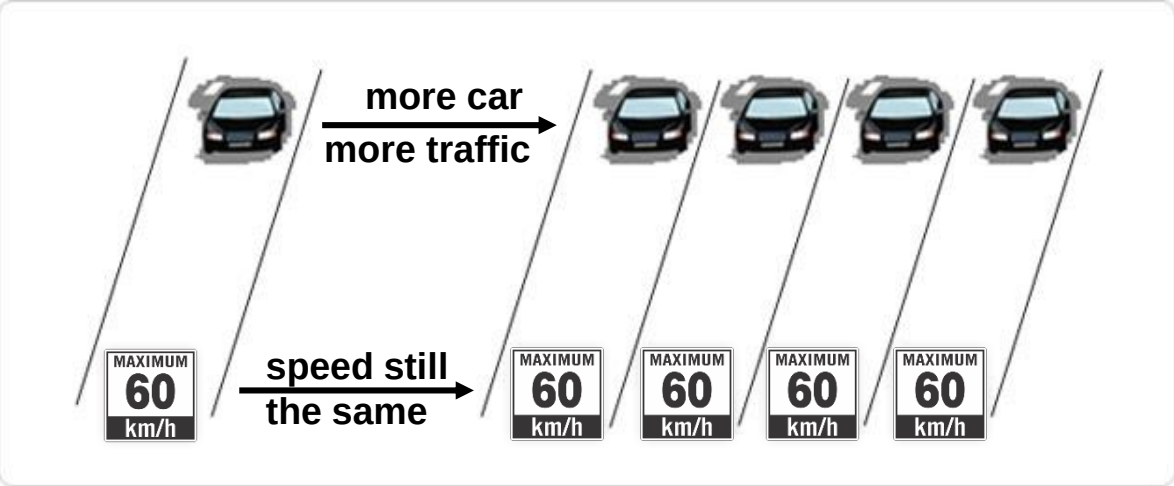
Multiple Links

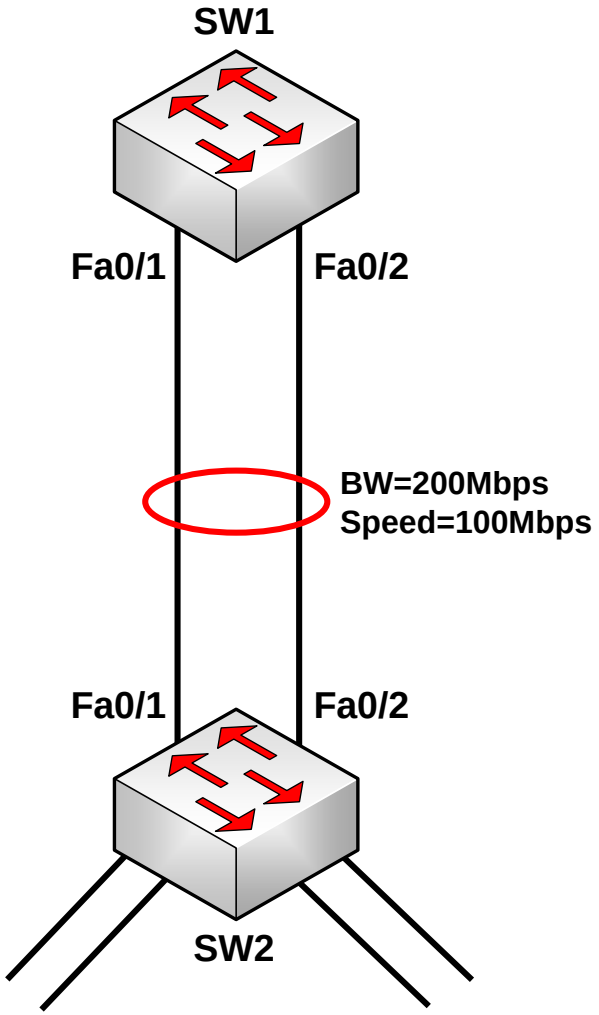
- When multiple links aggregate on a switch, congestion occurs.
- One solution is to increase uplink speed, but cannot scale indefinitely.
- Another solution is to multiply uplinks; loop prevention mechanisms disable some ports.



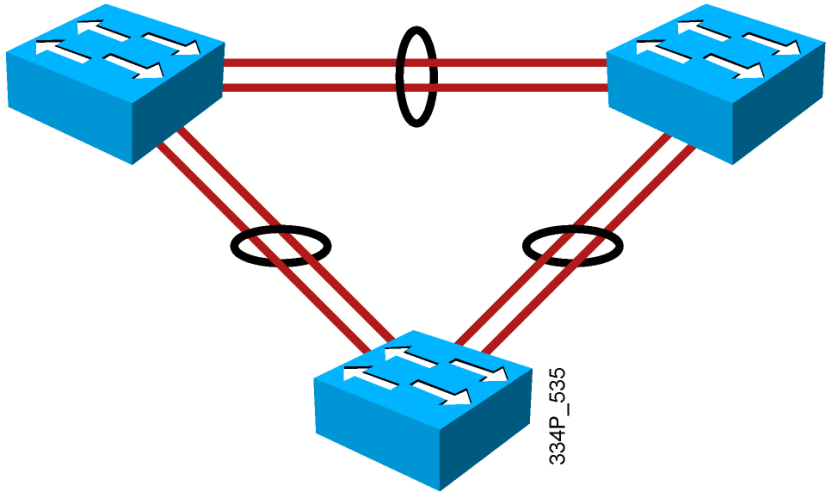
EtherChannel

- Solution to provide more bandwidth
- Logical aggregation of similar links
- Viewed as one logical link
- Provides load balancing and redundancy
- Supported for switch ports (Layer 2) and routed ports (Layer 3)





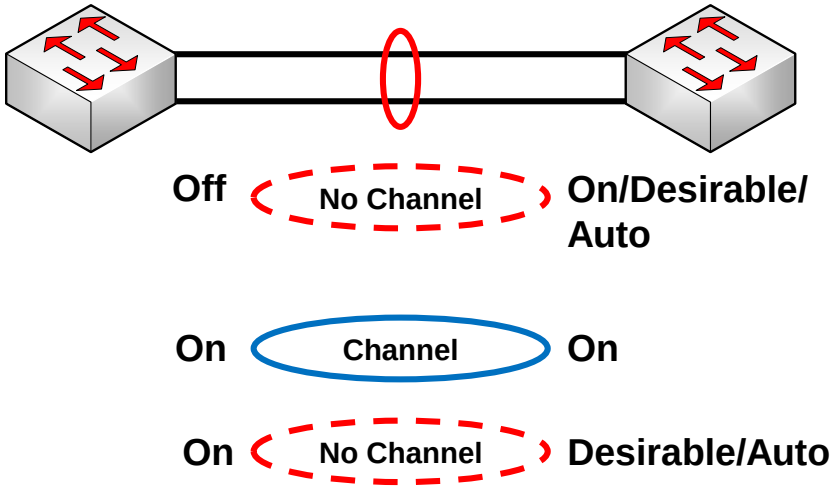
PAgP and LACP



- Protocols to negotiate the EtherChannel link creation and maintenance.
- **PAgP** (**P**ort **Ag**gregation **P**rotocol) is a Cisco proprietary protocol.
- **LACP** (**L**ink **A**ggregation **C**ontrol **P**rotocol) is IEEE 802.3ad standard.
- **Static** EtherChannel configuration without protocol.

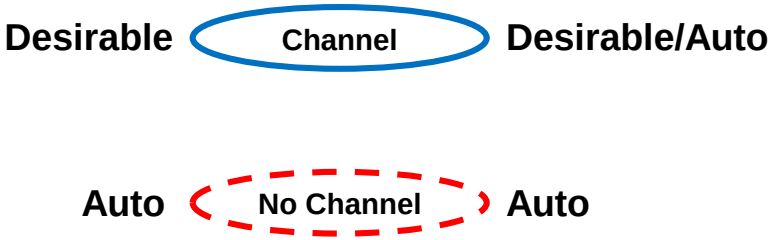
PAgP Modes

- **Off:** EtherChannel not configured on interface
- **On:** channel member without negotiation (no protocol)



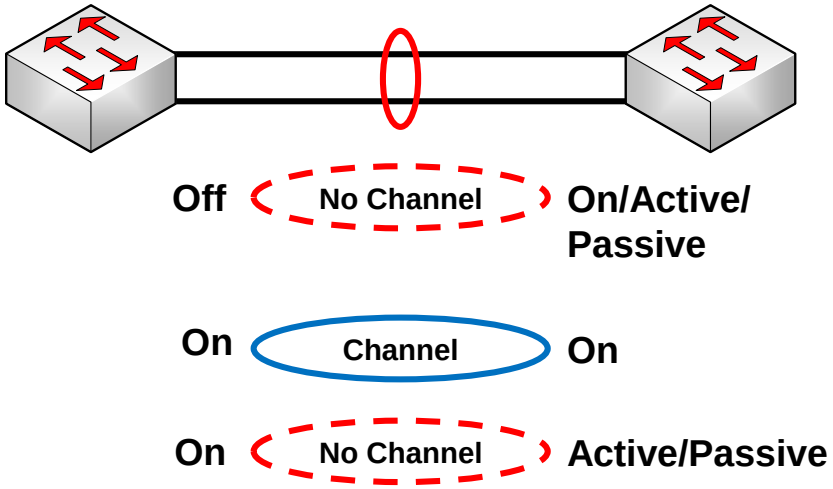
PAgP negotiates EtherChannel formation and maintenance:

- **Desirable:** actively ask if the other side can/will
- **Auto:** passively wait for other side to ask



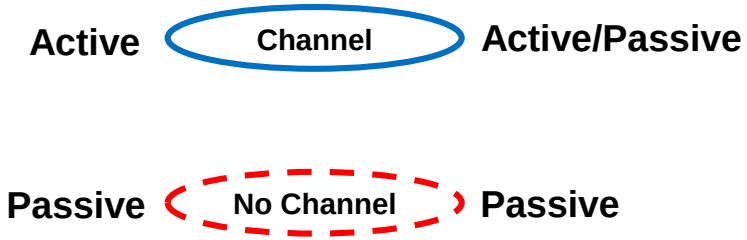
LACP Modes

- **Off:** EtherChannel not configured on interface
- **On:** channel member without negotiation (no protocol)



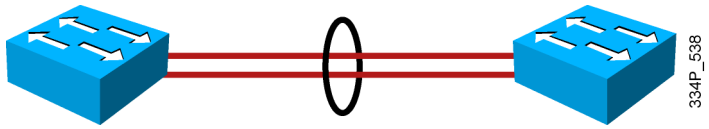
LACP negotiates EtherChannel formation and maintenance :

- **Active:** actively ask if the other side can/will
- **Passive:** passively wait for other side to ask

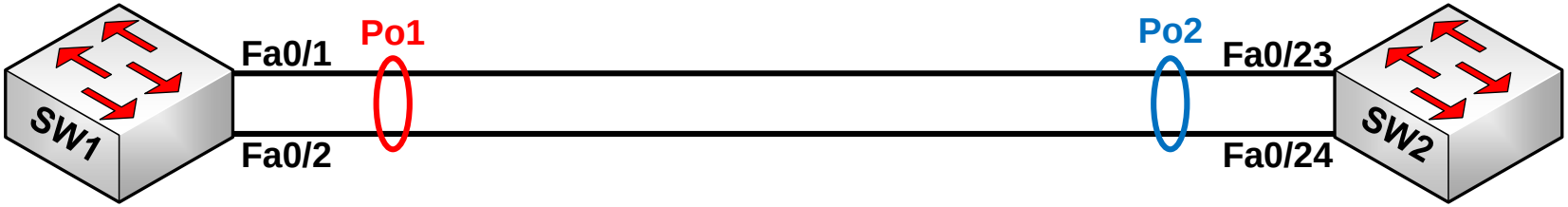


Guidelines for Configuring EtherChannel

- **Port-channel interface configuration changes affect the EtherChannel.**
- **The physical interface configuration changes affect the interface only.**
- **EtherChannel cannot be used if SPAN is a destination port.**
- **All interfaces within an EtherChannel must have same configuration.**
  - Same speed and duplex.
  - Same mode (access or trunk).
  - Same native and allowed VLANs on trunk ports.
  - Same access VLAN on access ports.
  - Configure these parameters on the port-channel interface.



How to Configure Port Channels Using EtherChannel (Static)




```
SW1(config)# interface range fa0/1 , fa0/2
SW1(config-if-range)# channel-group 1 mode on

Creating a port-channel interface Port-channel 1
```

```
SW1(config)# interface Po1
SW1(config-if)# switchport trunk encapsulation dot1q
SW1(config-if)# switchport mode trunk
```

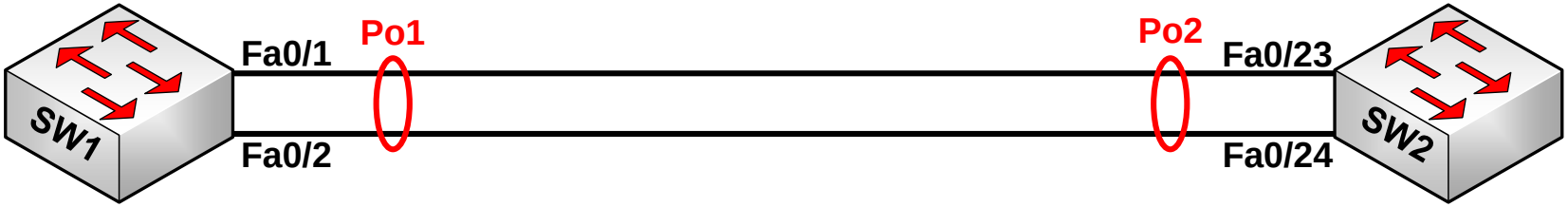
```
SW2(config)# interface range fa0/23 , fa0/24
SW2(config-if-range)# switchport trunk encapsulation dot1q
SW2(config-if-range)# switchport mode trunk
SW2(config-if-range)# channel-group 2 mode on

Creating a port-channel interface Port-channel 2
```

```
SW1# show etherchannel summary
Flags:   D - down              P - bundled in port-channel
         I - stand-alone       s - suspended
         R - Layer3            S - Layer2
         U - in use            f - failed to allocate aggregator

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

How to Configure Port Channels Using EtherChannel (LACP, PAgP)



LACP:

```
SW1(config)# interface range fa0/1 , fa0/2
SW1(config-if-range)# channel-protocol lacp
SW1(config-if-range)# channel-group 1 mode
active
```

```
SW2(config)# interface range fa0/23 , fa0/24
SW2(config-if-range)# channel-protocol lacp
SW2(config-if-range)# channel-group 2 mode
passive
```

PAgP:

```
SW1(config)# interface range fa0/1 , fa0/2
SW1(config-if-range)# channel-protocol pagp
SW1(config-if-range)# channel-group 1 mode
desirable
```

```
SW2(config)# interface range fa0/23 , fa0/24
SW2(config-if-range)# channel-protocol pagp
SW2(config-if-range)# channel-group 2 mode
auto
```

How to Configure Port Channels Using EtherChannel (Summary)

Basic tasks:

- **Identify the ports to use on each switch.**
- **Specify PAgP or LACP protocol (optional).**
- **Configure channel group on interface.**
  - Specify a channel group number.
  - Specify the mode (will set protocol).
    - On (no protocol)
    - Auto/desirable (PAgP)
    - Active/passive (LACP)
- **Configure port-channel interface.**
  - Access or trunk mode and other parameters.
- **Verify connectivity.**

Implementing Stackwise

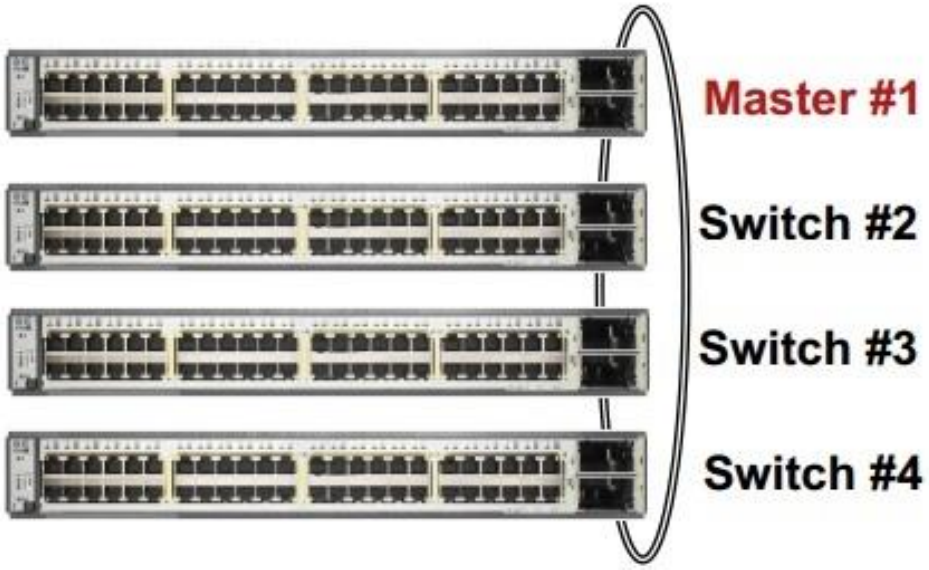
Stackwise Technology

Technology Overview

- Cisco StackWise technology create a unified, logical switching architecture through the linkage of multiple, fixed configuration switches.
- The switches use special stack interconnect cables that create a bidirectional closed-loop path.
- The bidirectional path acts as a switch fabric for all the connected switches

The Master and Subordinate Switches

- Each switch is assigned a number.
- Up to nine separate switches can be joined together.
- Each switch in the stack can be a master or a subordinate (member).
- The master switch is elected and serves as the control center for the stack.



The Master Switch Activities

- **Acts as the primary point of contact for IP functions such as Telnet, pings, command-line interface (CLI), routing information exchange, ACL, QoS,…**
- **Implements multicast and unicast routing tasks.**
- **Downloads the tables and the configurations to each of the subordinate switches and keeps this information current by periodically sending copies or updates to all the subordinate switches in the stack.**
- **When a new master is elected, it reapplies the running configuration from the previous master to help ensure user and network continuity.**

The Sub-ordinate Switch Activities

- **Each individual switch in the stack will perform forwarding based on the information distributed by the master.**
- **Keeps a copy of startup and running config at all times.**
- **Wait to receive copies of the running configuration from the master and begin to start transmitting data upon receipt of the most current information.**

The Master Election

1. **User priority:**
   - 1 to 15, the default value is 1.
   - The highest is the best.
2. **Software priority:**
   - IP Services (IPS) image has the highest priority, followed by IP Base Software Image (IPB).
3. **Default configuration:**
   - If a switch has preexisting configuration information, it will take precedence over switches that have not been configured.
4. **Uptime:**
   - The switch that has been running the longest is selected.
5. **MAC address:**
   - Each switch reports its MAC address to all its neighbors for comparison.
   - The switch with the lowest MAC address is selected.

Stackwise Configuration & Verification

```
Sw(config)# switch 1 priority <priority>
```

```
Sw# show switch
Switch/Stack Mac Address : 0017.5a33.f180
                                                    H/W   Current
         Role   Mac Address     Priority Version  State
------------------------
*1       Master 0017.5a33.f180     15      0        Ready
 2       Member 0016.9dba.9800     14      0        Ready
 3       Member 0024.5038.e200     13      0        Ready
```

```
Sw# show switch stack-ring speed
Stack Ring Speed          : 32G
Stack Ring Configuration: Full
Stack Ring Protocol       : StackWise
```

Stackwise Configuration & Verification (Cont.)

```
Sw# show ip int brief
Interface                  IP-Address      OK? Method Status
Protocol
Vlan1                      192.168.50.2    YES manual up          up
FastEthernet1/0/1          unassigned      YES unset  down        down
FastEthernet1/0/2          unassigned      YES unset  down        down
FastEthernet1/0/3          unassigned      YES unset  down        down
FastEthernet1/0/4          unassigned      YES unset  down        down
FastEthernet1/0/5          unassigned      YES unset  down        down
……..
FastEthernet2/0/1          unassigned      YES unset  up          up
FastEthernet2/0/2          unassigned      YES unset  down        down
FastEthernet2/0/3          unassigned      YES unset  down        down
FastEthernet2/0/4          unassigned      YES unset  down        down
FastEthernet2/0/5          unassigned      YES unset  down        down
```

Stack Technologies

- **Stackwise:**
  - Cisco Catalyst 3750.
  - 32 Gbps.
- **Stackwise plus:**
  - Cisco Catalyst 3750E, 3750X.
  - 64 Gbps.
- **Stackwise 160:**
  - Cisco Catalyst 3650.
  - 160 Gbps.
- **Stackwise 480:**
  - Cisco Catalyst 3850.
  - 480 Gbps.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