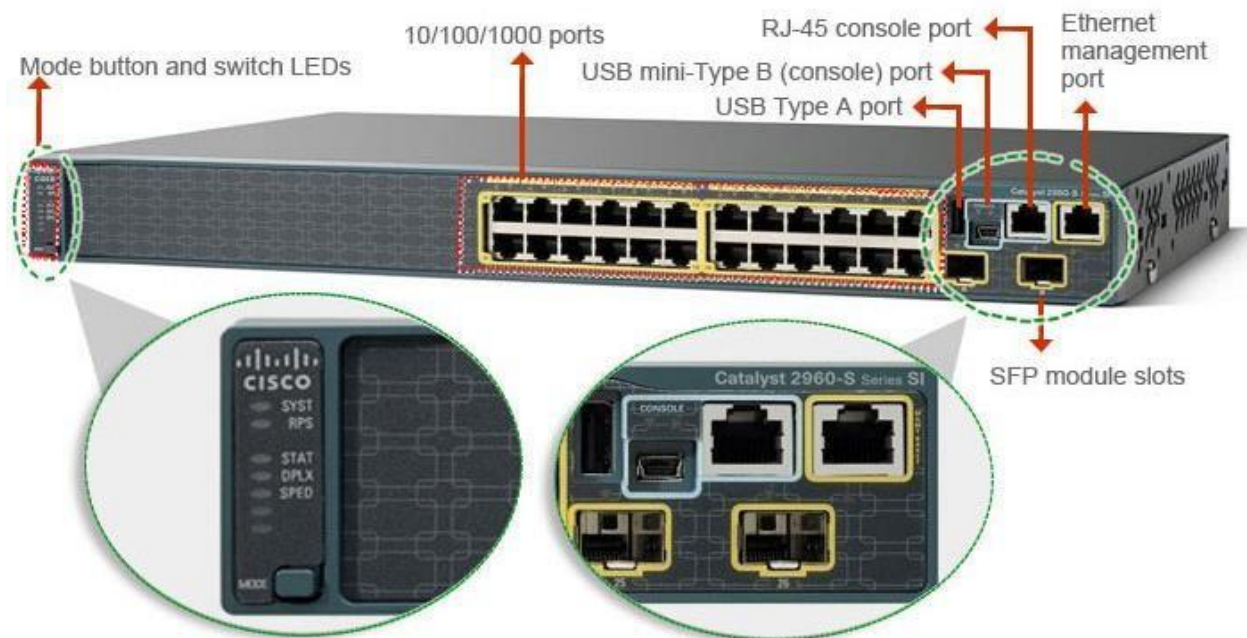


Cisco Switch:

- o Switch is a device, which is used to connect multiple computers inside LAN.
- o Switches are used to connect multiple devices on the same network.
- o Switches which operate at Data Link Layer of OSI model called Layer 2 Switches.
- o Switches which operate at Network Layer 3 called Layer 3 or multilayer switches.
- o Basic Function of a Cisco Network Switch is to forward Layer 2 packets.
- o Switch forward Ethernet Frames from source device to destination device.
- o Switches are a key component of many business networks now a day.
- o Switches connect multiple PCs, laptops, Printers, APs, Phones, Servers etc.
- o Switches allow to send and receive information in the Computer Network.
- o Switches access-shared resources in a smooth, efficient, highly secure manner.
- o Cisco Layer 2 or Layer 3 switches can be managed both locally and remotely.
- o Cisco IOS is proprietary Operating System that Cisco routers & switches run on.



Cisco Operating Systems:

IOS (Internetwork Operating System):

- o Cisco IOS (Originally Internetwork Operating System) is a family of software.
- o IOS is an Operating System used on Cisco devices, such as routers and switches.
- o Multitasking OS that implements and controls logic and functions of a Cisco device.
- o Cisco IOS runs as a single image and all processes share the same memory space.
- o To configure a Cisco device running IOS, the Command-Line Interface (CLI) is used.
- o CLI comes with predefined number of commands to configure routing & switching.
- o The CLI is usually accessed from local or remote Computer running Telnet or SSH.
- o The IOS is usually stored as a system image within a router or switch flash memory.
- o Not all Cisco products routers or switches run IOS (Internetwork Operating System).

```
sw1#show version
```

```
Cisco IOS Software Linux Software (I86BI_LINUXL2-ADVIPSERVICESK9-M), Version 15.2(
DEPLOYMENT DEVELOPMENT BUILD, synced to FLO_DS_GS7_POSTCOLLAPSE_TEAM_TRACK_DS_GS_PI5
Technical Support: http://www.cisco.com/techsupport
Copyright (c) 1986-2015 by Cisco Systems, Inc.
Compiled wed 04-Nov-15 02:31 by mmen
```

NX-OS (Nexus Operating System)

- o The Cisco NX-OS Software is a Data Center-Class OS (Operating System).
- o NX-OS is a network operating system for the Nexus-series Ethernet switches.
- o NX-OS is for Fabric Channel storage area network switches made by Cisco Systems.
- o Originally named SAN-OS where the SAN acronym stood for Storage Area Network.
- o NX-OS doesn't share a single memory space and it support symmetric multiprocessing.
- o The Command-Line Interface of Nexus Operating System is similar to that of Cisco IOS.
- o Nexus feature offers capability to partition Nexus switch into multiple logical switches.
- o Other Operating System are CatOS, Cisco IOS XR, Cisco IOS-XE and Cisco IOS-SX etc.

```
switch# show version
```

```
Cisco Nexus Operating System (NX-OS) Software
TAC support: http://www.cisco.com/tac
```

```
Router#show ver
```

```
Cisco IOS XE Software, Version 16.07.01
Cisco IOS Software [Fuji], Virtual XE Software
```

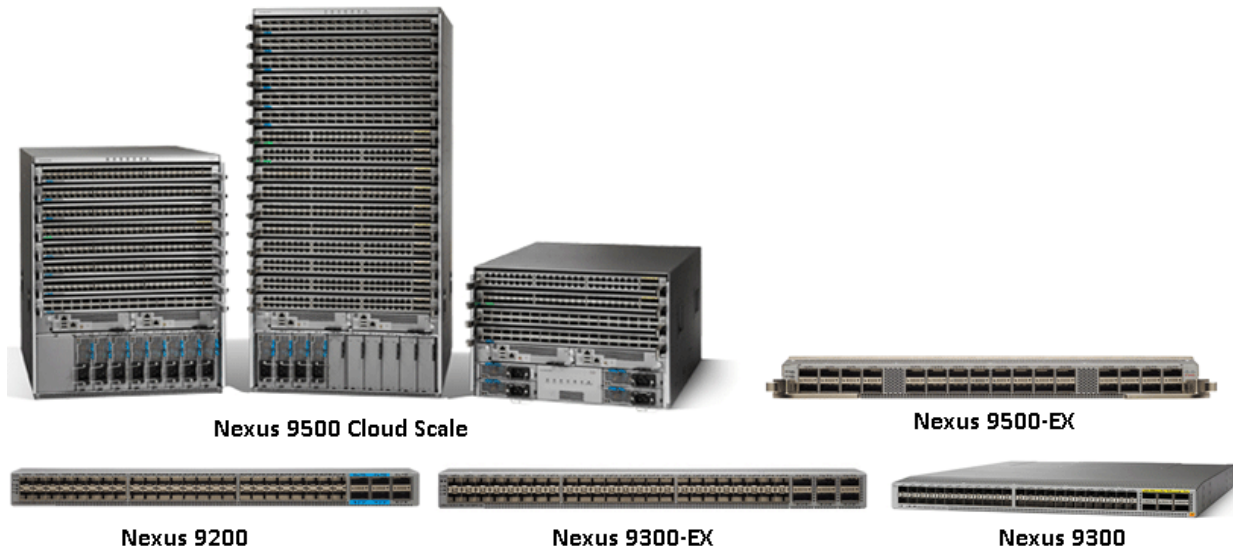
Catalyst Switch:

- o Catalyst was a company which produced switches & which was bought by Cisco.
- o Cisco sold that series of switches by company named catalyst as catalyst switches.
- o Catalyst switches are switches belonging to that old series of Cisco switches.
- o for example, Catalyst 2960 series, Catalyst 4500 series, Catalyst 6500 series etc.
- o For Catalyst switches, CatOS (Catalyst Operating System) and IOS are available.
- o Catalyst switches are mainly designed for distribution & core layers in the network.



Nexus Switches:

- o Nexus switches have a different architecture different then Catalyst Switches.
- o The Operating System of Nexus Switches is not IOS anymore, it is NX-OS.
- o All switches in Nexus range run the modular NX-OS firmware & operating system.
- o Cisco Nexus switches are mainly used for DC (Data Centers) in many organization.
- o Catalyst Switches uses IOS Operating System where Nexus Switches use NX-OS.



Modular Switches:

- o These switches let you add expansion modules into the switches as needed.
- o Modular Switches giving you the flexibility if your network needs change.
- o These types of switches offer more flexibility in their configuration.
- o Such as expansion modules for additional interfaces, power supplies, or cooling fans.
- o Cisco Catalyst 9400 & Catalyst 6500 and 6800 are good examples of modular switches.



Fixed Switch:

- o These switches are switches with fixed number of ports & are typically not expandable.
- o Fixed Configuration Switches are types of switches are fixed in their configuration.
- o Cannot add features or options to switch beyond those that originally came with switch.
- o The particular model you purchase determines the features and options available.
- o Cisco Catalyst 2000, 9300, 9500 and the Cisco 110-550X series are good examples.



Standalone Switch:

- o Standalone switches need to be configured and managed individually.
- o Standalone switches troubleshooting needs to be handled on individual basis.



Stackable Switch:

- o Switch stacking technology make stack of physical switches act like one switch.
- o The stacking cables together make a ring between the switches.
- o The switches connect in series, with the last switch connecting again to the first.
- o Switch stacking, STP, CDP & VTP run on one switch, not multiple switches.
- o Switch Stacking is one logical switch the port density is increase very much.
- o Switch stacking is a feature of certain Cisco access layer switches.
- o Stackable switches logically become one switch.
- o The stacked switches effectively operate as a single larger switch.



Layer 2 Switch:

- o Terms Layers 2 & 3 are adopted from the Open System Interconnect (OSI) model.
- o The Layer 2 provides direct data transfer between two devices within a LAN.
- o Layer 2 switch functions by keeping a table of media access control (MAC) addresses.
- o Switching operates at the Layer 2 of the OSI Reference Model.
- o Uses MAC addresses to facilitate communication within devices from same network.
- o Layer 2 Network devices can only communicate within the same network.
- o Send packet to destination on the basis of MAC address, work with MAC address only.
- o Switching at Layer 2 is quite fast as they do not look at the Layer 3 portion.
- o Devices in the same layer 2 segment do not need routing to reach local peers.

Layer 3 or Multilayer Switch:

- o Operate on Layer 3 (Network Layer) of OSI model.
- o Layer 3 switch also called Multilayer Switch as well.
- o Can perform functioning of both 2 Layer and 3-Layer switch.
- o Perform the routing of data packets using IP addresses.
- o Layer 3 switches are the fast routers for Layer 3 forwarding in hardware.
- o Layer 3 handles packet routing by logical addressing and subnet control.
- o Layer 3, checks the source and destination IP addresses of every packet.
- o Functions of Layer 3 switch combine some of a Layer 2 switch and some of a router.
- o The main difference between Layer 2 and Layer 3 is the routing function.
- o A Layer 3 or Multilayer switch can do all the job that a Layer 2 switch does.



Layer 2 Switch

- 1-Switch within VLANs
- 2-Filter traffic based on Layer 2



Multilayer Switch

- 1-Switch within VLANs
- 2-Route between VLANs
- 3-Filter traffic based on layer2 or 3

Unmanaged Switch:

- o Unmanaged network switch is designed simply plug them in and they work.
- o Unmanaged Switch allows Ethernet devices to communicate with one another.
- o They are shipped with fixed configuration & do not allow changes to configuration.
- o Unmanaged Network switch require no configuration and management.
- o Unmanaged network switches are typically for basic connectivity.
- o Often used in home networks, desk, in a lab, or in a conference room etc.
- o **Key difference between Managed & Unmanaged Switches is the ability to configure.**

Managed Switch:

- o Managed Network switches give greater security and more features.
- o Managed Switches provide all the features of an Unmanaged Switch.
- o Managed Switches provide the ability to configure, manage & monitor LAN.
- o Provide more control over LAN traffic & offers advanced features to control traffic.
- o Provide flexibility because you can configure them to custom-fit your network.
- o With greater control, protect the network & improve the quality of service.



No=Unmanaged Switches

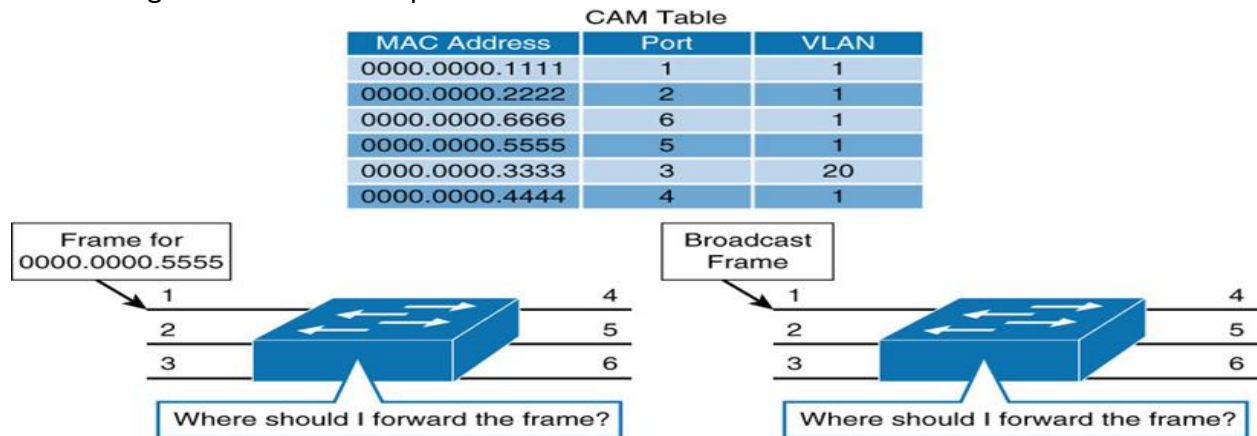


Yes=Managed Switches



How Switches Work:

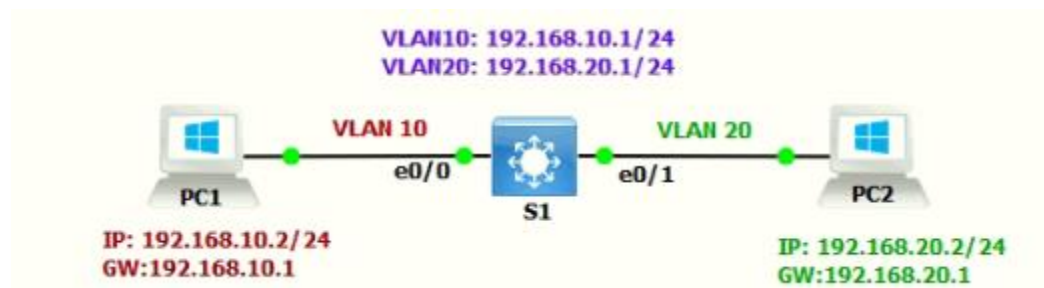
- o Each network card has a unique identifier called Media Access Control address.
- o This address is used in LANs for communication between devices on same network.
- o Devices that want to communicate need to know each other MAC address.
- o Use process called ARP to find out the MAC address of another device in LAN.
- o When the hardware address (MAC Address) of the destination host is known.
- o Sending host has all the required information to communicate with the remote host.



Switch Virtual Interface (SVI):

- o Switch Virtual Interface is a logical interface on Layer 2 or Layer 3 switches.
- o Switch Virtual Interface is normally found on Layer 2 and Layer 3 switches.
- o SVI cannot be activated unless VLAN is created & at least 1 physical port is associated.
- o Switch Virtual Interface (SVI) is used in Layer 2 switch only for management purpose.
- o The Switch Virtual Interface on Layer 2 switches are used for management and testing.
- o Any layer 2 switch can only have one SVI, to have more you will need a Layer 3 switch.
- o Layer 3 Switches use the SVI for Inter-VLAN communication without need of Router.
- o SVI for Layer 3 or Multilayer switch provides both management & routing services.

Interface vlan 10	Interface vlan 20
Ip address 192.168.10.1 255.255.255.0	Ip address 192.168.20.1 255.255.255.0
No shutdown	No shutdown



Switch Memory:

ROM (Read-Only Memory):

- o ROM stand for Read Only Memory also called Permanent Memory.
- o ROM used to store Bootstrap Programs, Mini IOS & Diagnostic Applications.
- o Bootstrap program is loaded when the device first powers on.
- o it is used to find IOS image & manage the process of loading the IOS into RAM.

RAM (Random Access Memory):

- o RAM stand for Random Access Memory also called Volatile Memory.
- o Routing table, ARP Cache, Running Configuration File & IOS loaded in RAM.
- o This type of memory loses its content when the device loses power.

NVRAM (Nonvolatile RAM):

- o NVRAM stand for Non Volatile Random Access Memory.
- o NVRAM is Permanent Memory used to store startup configuration file.
- o This type of memory retains its content even after the device loses power.

Flash Memory:

- o Flash Memory is also Permanent Memory like NVRAM.
- o Flash Memory stored Cisco Operating System IOS in compress format.
- o Flash Memory also store IOS software images and other files.
- o This type of memory retains its content even after the device loses power.
- o Flash Memory normal size are 32MB, 64MB, 128 MB, 256 MB & 512 MB.
- o Flash Memory can be upgraded as per environment requirements.



Switch#show version

Cisco IOS Software, vios_l2 Software (vios_l2-ADVENTERPRISEK9-M), Version 15.2(4.0.55)E, TEST

ROM: Bootstrap program is IOSv

Switch uptime is 9 minutes

System returned to ROM by reload

System image file is "flash0:/vios_l2-adventerprisek9-m"

Last reload reason: Unknown reason

Cisco IOSv () processor (revision 1.0) with 574721K/209920K bytes of memory.

Processor board ID 9L7J9UWJD11

16 Gigabit Ethernet interfaces

DRAM configuration is 72 bits wide with parity disabled.

256K bytes of non-volatile configuration memory.

2097152K bytes of ATA System CompactFlash 0 (Read/Write)

Configuration register is 0x0

Version 15.2(4.0.55)E, TEST

System Image Version

System Uptime

Image Location Flash

Cause of Restart

RAM

Interfaces Type

NVRAM

Flash Memory

Auto-MDIX Feature:

- o Certain cable types straight through or crossover required when connecting devices.
- o Automatic Medium Dependent Interface Crossover feature eliminates this problem.
- o When auto-MDIX is enabled, the interface automatically detects & configures connection.
- o When using auto-MDIX on an interface, the interface speed and duplex must be set to auto.

SW(config)# interface f0/0	SW(config-if)# speed auto
SW(config-if)# duplex auto	SW(config-if)# mdix auto

Basic Switch Hardening:

Configuring Console Authentication	
SW(config)# line console 0	SW(config)# username admin password cisco
SW(config-line)# password cisco	SW(config)# line console 0
SW(config-line)# login	SW(config-line)# login local

Configuring Enable Mode Password	
SW(config)# enable password 123	SW(config)# enable secret cisco

Configuring Telnet Authentication	
SW(config)# line vty 0 4	SW(config)# username admin password cisco
SW(config-line)# password cisco	SW(config)# line vty 0 4
SW(config-line)# login	SW(config-line)# login local

Configuring SSH Authentication	
SW(config)# username ali password 123	SW(config)# line vty 0 4
SW(config)# ip domain-name ksa.com	SW(config-line)# transport input ssh
SW(config)# crypto key generate RSA	SW(config-line)# login local

Password Encryption	
SW(config)# service password-encryption	
SW(config)# enable password cisco	SW(config)# no service password-encryption

Configure IP Address & Default Gateway on Switch	
SW(config)# interface vlan 1 SW(config-if)# ip address 192.168.1.100 255.255.255.0 SW(config-if)# no shutdown	Switch(config)# ip default-gateway 192.168.1.1