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**Welcome
To
Network for you
CISCO Switch**



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CISCO Switch:

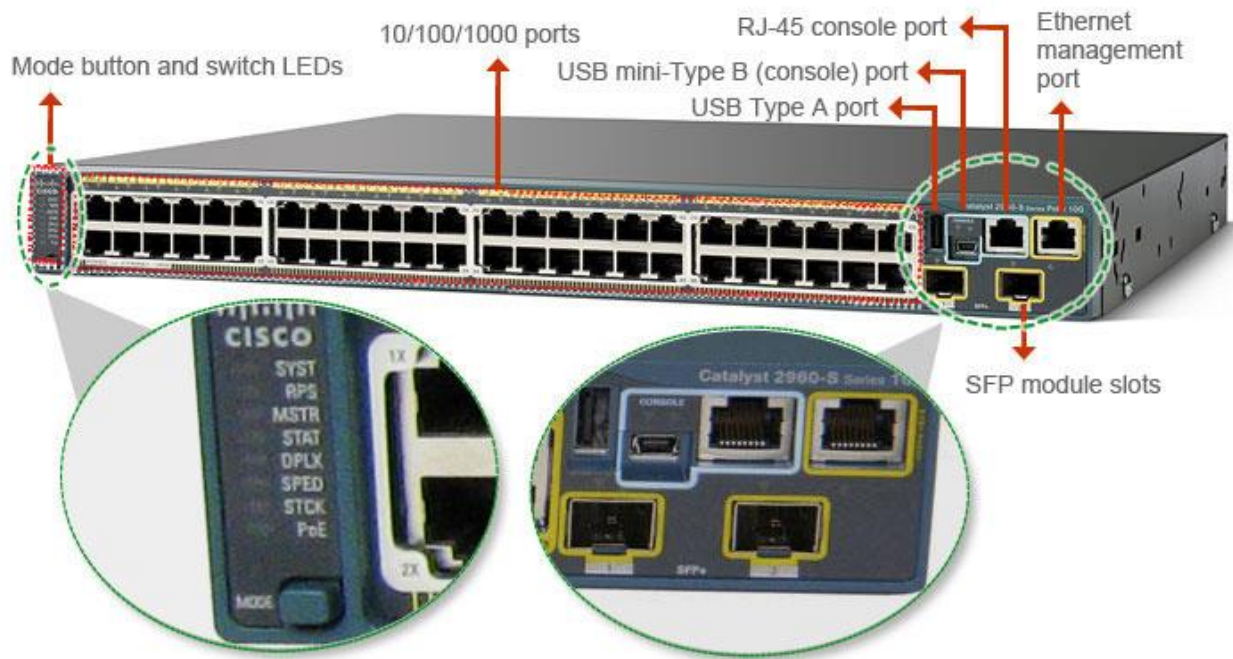
- Switch is a device used to connect multiple systems in LAN.
- Switch is a device used to connect same network where are Router is a device used to connect two or more different Network.
- We have type of Switch that is Manageable and Unmanageable Switch.
- In Manageable Switch we can assign IP address and Create Vlan we can do operation and it have Console port.
- Un Manageable Switch In this type of switch we cannot assign IP address and it is not having Console Port. In our Syllabus we are going to discuss Manageable switches.
- We have two type of switch that is Layer 2 and Layer 3.
- Switches which operate at Network Layer 3 called Layer 3 or Multilayer Switches.
- Switches which operate at Data Link Layer of OSI Model it is called Layer 2 Switches.
- Basic Function of CISCO Switch is to forward Layer 2 packets.
- Switch Forwards Ethernet Frames from Sources device to destination device.
- As we know without switch we cannot connect multiple devices so we can say switch is very important device in networking to connect multiple devices in a network.
- As we know we can Managed switch locally or remotely? If you want to connect to Switch Remotely then we will use SSH or Telnet to connect switch via remotely.
- CISCO IOS is proprietary Operating System that CISCO routers and switches run on it.



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CISCO Operating Systems:

IOS (Internetwork Operating System):

- IOS is an Operating System used on CISCO Devices, such as router and switches.
- CISCO IOS is a family of Software.
- To Configure a CISCO device running IOS, the Command-Line Interface (CLI) is used.
- The CLI is usually accessed from local or remote device running Telnet or SSH.
- The CLI comes with predefined number of commands to configure routing and switching.
- The IOS is usually stored as a system image within a router or switch flash memory.

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Switch#sh ver

Cisco IOS Software, C2960 Software (C2960-LANBASE-M), Version 12.2(25)FX, RELEASE SOFTWARE (fc1)

Copyright (c) 1986-2005 by Cisco Systems, Inc.

Compiled Wed 12-Oct-05 22:05 by pt_team

ROM: C2960 Boot Loader (C2960-HBOOT-M) Version 12.2(25r)FX, RELEASE SOFTWARE (fc4)

System returned to ROM by power-on

Cisco WS-C2960-24TT (RC32300) processor (revision C0) with 21039K bytes of memory.

24 FastEthernet/IEEE 802.3 interface(s)

2 Gigabit Ethernet/IEEE 802.3 interface(s)

63488K bytes of flash-simulated non-volatile configuration memory.

Base ethernet MAC Address : 0040.0BAB.38B1

Motherboard assembly number : 73-9832-06

Power supply part number : 341-0097-02

Motherboard serial number : FOC103248MJ

Power supply serial number : DCA102133JA

Model revision number : B0

Motherboard revision number : C0

Model number : WS-C2960-24TT

NX-OS (Nexus Operating System):

- CISCO Nexus Series switches are modular and Fixed Port network switches designed for the data Center.
- All Switches in the Nexus range run the modular NX-OS firmware/Operating system.
- NX-OS has some high availability features compared to the well-known Cisco IOS.
- CISCO NX-OS Software is a Data Center- Class OS.
- NX-OS is a network operating system for the Nexus –series Ethernet Switches.

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- The Command-Line Interface of Nexus Operating System is similar to that of CISCO IOS.

Switch# Sh Ver

CISCO Nexus Operating System (NX-OS) Software

Cisco Nexus 7000 Series Switches



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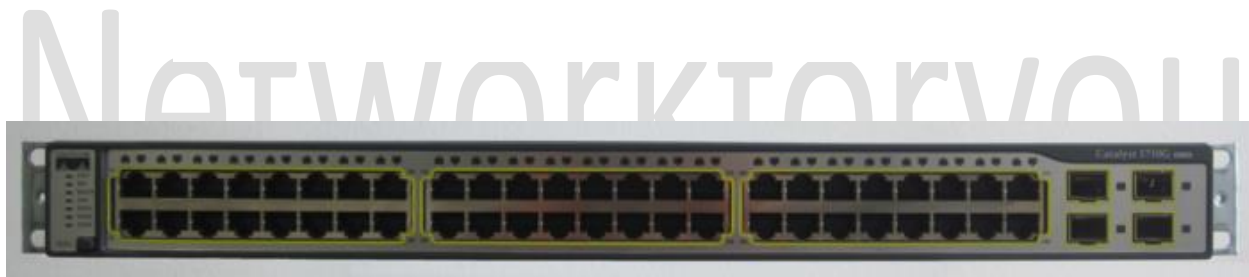
Catalyst Switch:

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

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Modular Switches:

- These Switches support to add card that expansion modules into the switches as needed.
- In this switches we can add more modules as per our requirements.
- This type of switches offers more flexibility in their configuration.
- Such as expansion modules for additional interfaces, power supplies or cooling fans.
- Cisco Catalyst 9400, Catalyst 6500 and 6800 are good examples of modular switches.

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Fixed Switch:

- Fixed Switches are switches with fixed number of ports.
- Fixed Configuration Switches are types of switches are fixed in their configuration.
- Cannot add features or options to switch beyond those that originally came with switch.



Standalone Switch:

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

Layer 2 Switch:

- The terms Layers 2 and 3 adopted from OSI Model.
- The layer 2 provides direct data transfer between two devices within a LAN.
- Layer 2 switch functions by keeping a table of MAC addresses (Media Access Control).
- Uses MAC addresses to facilitate communication within the same network.
- It sends packets to the destination on the basis of MAC addresses and works within that MAC address only.
- Switching at layer 2 is quite fast as they do not look at the layer 3 portion.

Layer 3/ Multilayer Switch:

- It operates on Layer 3 (i.e. Network Layer) of OSI Model.
- Layer 3 switch also called Multilayer Switch.
- Can perform functionality of both Layer 2 and Layer 3 switch.
- Perform the routing of data packets using IP addresses.
- Functions of Layer 3 switch combine some of a Layer 2 Switch and some of a Router.
- The main difference between layer 2 and layer 3 is the routing function.
- A layer 3 or Multilayer switch can do all the jobs that a layer 2 switch does not.

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2960-24TT
Switch0



3650-24PS
Multilayer Switch0

Let see How Switches Work:

- Each network card has a unique identifier called **Media Access Control Address**.
- This address is used in LANs for Communication between devices on same network.
- Devices that want to communicate need to know each **other MAC address**.
- **Use process called ARP to find out the MAC address of another device in LAN.**
- Switches work base on **MAC address or Hardware address or Physical address**
- MAC (Media Access Control address used for layer 2 Datalink layer communication.
- MAC has two parts, **OUI (Organization Unique Identifier)** and Serial Number.
- MAC address is total **48 Bits, 24 Bits for OUI and 24 Bits for Company Serial Number.**
- MAC address also called **Hardware, Physical, Fixed and Brun address**
- Switch manage and use MAC address table to forward traffic from one interface to another.
- MAC address table is combination of VLAN ID, MAC address, Address Type and Port number.
- MAC address table is of two type Dynamic address and Static address table.
- Dynamic MAC address table is a table where Switch learns dynamically.
- Dynamic MAC address is that the switch learns and After it age time flash out if they are not communicating.
- Static MAC address is the address that manually we can assign. And for Static MAC address there is no age time and it will not remove when we restart our device.
- If switch received frame and destination MAC address is not there then it flooded to all ports.
- When the destination replies then switch adds that source MAC address to the table.
- CISCO Switches default aging time is **300 seconds or five mints**, we can be modifying.
- Aging timer is used to remove inactive Media Access Control addresses from the table.
- Aging time help to remove inactive MAC address from the MAC table.

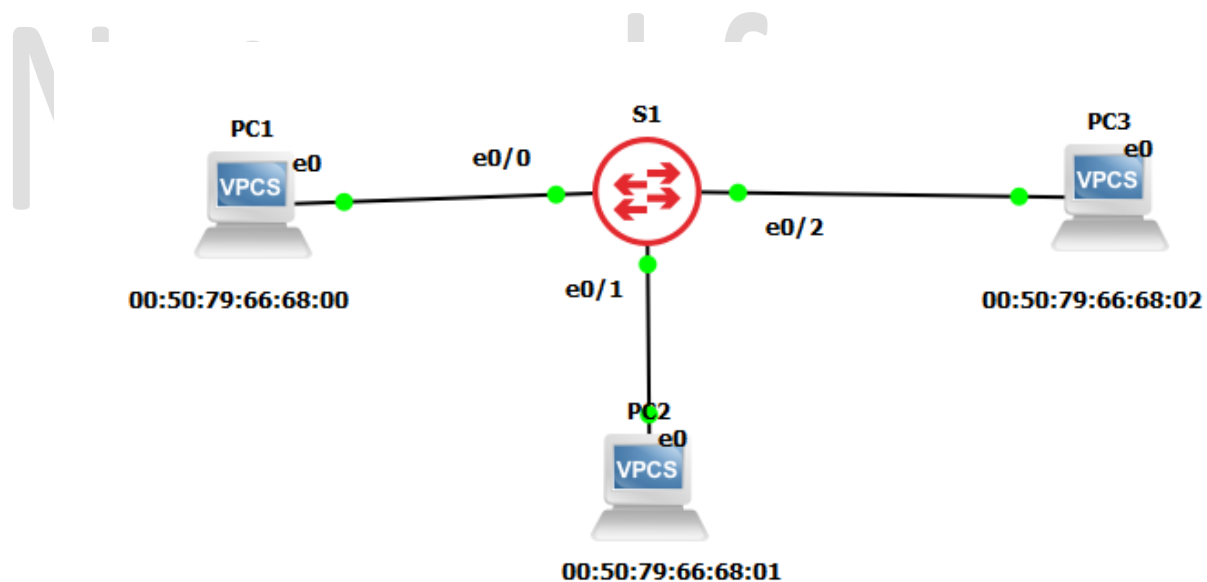
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Command	Description
Show mac address-table aging-time	It will display Aging time for mac address entry
Show mac address-table count	It will display the number of entire currently in mac address table and capacity etc.
Mac address-table static mac-address vlan vlan-id interface	To configure static Mac address on stitch.



- Command to Check and Clear Mac address Table
- Sh mac address-table --- To check Mac address table.
- Clear mac address-table ---- To clear Mac address table

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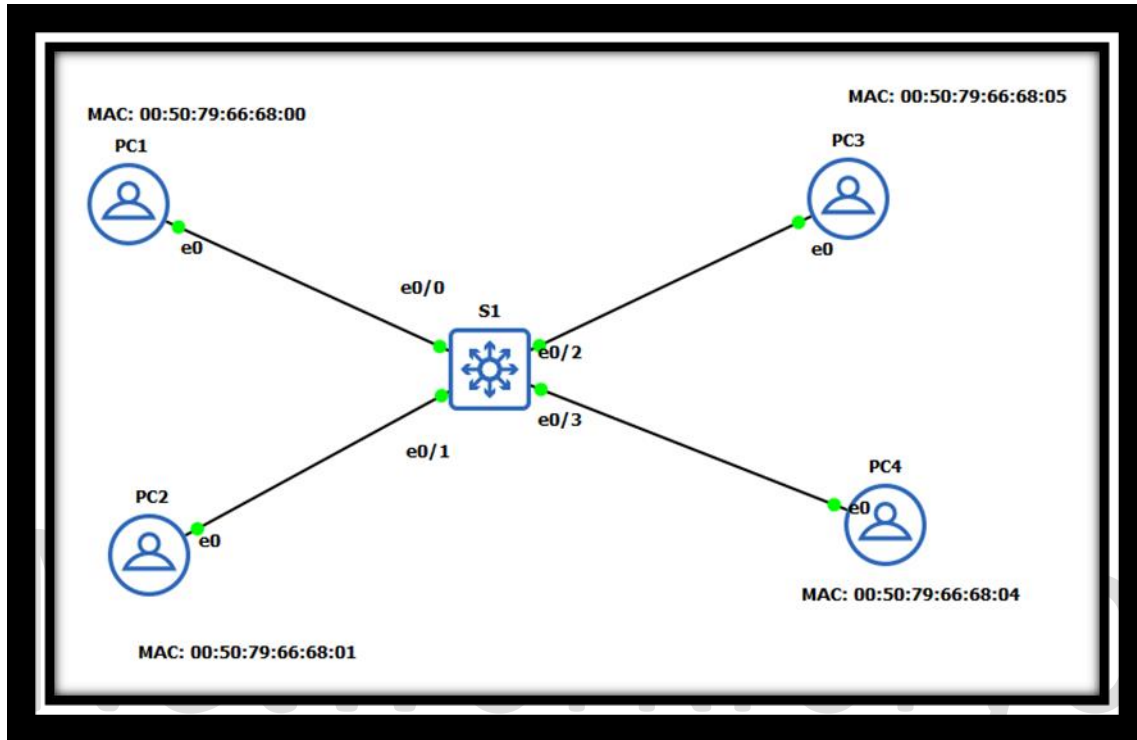


- After 5 Min if no pc is communicating to other pc then it will erase MAC address from Mac Table.

```
S1#sh mac address-table
      Mac Address Table
-----
Vlan    Mac Address      Type    Ports
----    -
S1#
S1#
S1#
S1#sh mac address-table
      Mac Address Table
-----
Vlan    Mac Address      Type    Ports
----    -
   1    0050.7966.6800   DYNAMIC Et0/0
   1    0050.7966.6801   DYNAMIC Et0/1
   1    0050.7966.6802   DYNAMIC Et0/2
Total Mac Addresses for this criterion: 3
S1#
```



Lab for MAC:



Device Configuration PCs and Switch

```
PC1> ip 192.168.1.1/24
PC1> save

PC1> sh ip
NAME      : PC1[1]
IP/MASK   : 192.168.1.1/24
GATEWAY   : 0.0.0.0
DNS       :
MAC       : 00:50:79:66:68:00
LPORT    : 10010
RHOST:PORT : 127.0.0.1:10011
MTU      : 1500
PC2> ip 192.168.1.2/24
```

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```
PC2> sh ip
```

```
NAME      : PC2[1]
IP/MASK   : 192.168.1.2/24
GATEWAY   : 0.0.0.0
DNS       :
MAC       : 00:50:79:66:68:01
LPORT     : 10004
RHOST:PORT : 127.0.0.1:10005
MTU:      : 1500
```

```
PC3> ip 192.168.1.3/24
```

```
PC3> sh ip
```

```
NAME      : PC3[1]
IP/MASK   : 192.168.1.3/24
GATEWAY   : 0.0.0.0
DNS       :
MAC       : 00:50:79:66:68:05
LPORT     : 10008
RHOST:PORT : 127.0.0.1:10009
MTU:      : 1500
```

```
PC4> ip 192.168.1.4/24
```

```
PC4> sh ip
```

```
NAME      : PC4[1]
IP/MASK   : 192.168.1.4/24
GATEWAY   : 0.0.0.0
DNS       :
MAC       : 00:50:79:66:68:04
LPORT     : 10006
RHOST:PORT : 127.0.0.1:10007
MTU:      : 1500
```

```
S1#sh mac address-table dynamic
```

```
Mac Address Table
```

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```
Vlan  Mac Address  Type  Ports
-----
1  0050.7966.6800  DYNAMIC  Et0/0
1  0050.7966.6801  DYNAMIC  Et0/1
1  0050.7966.6804  DYNAMIC  Et0/3
1  0050.7966.6805  DYNAMIC  Et0/2
```

Total Mac Addresses for this criterion: 4

```
S1(config)#mac address-table static aaaa.aaaa.1111 vlan 1 interface e1/0
```

```
S1#sh mac address-table static
Mac Address Table
```

```
Vlan  Mac Address  Type  Ports
-----
1  aaaa.aaaa.1111  STATIC  Et1/0
```

Total Mac Addresses for this criterion: 1

NetworkforYou



Switch Memory:

ROM (Read-Only Memory):

- ROM Stand for Read Only Memory also called Permanent Memory.
- ROM used to store Bootstrap Programs, Mini IOS and Diagnostic Applications.
- Bootstrap program is loaded when the device first powers ON.
- It is used to find IOS Image and Manage the process of loading the IOS into RAM.

RAM (Random Access Memory):

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

NVRAM (Nonvolatile RAM):

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

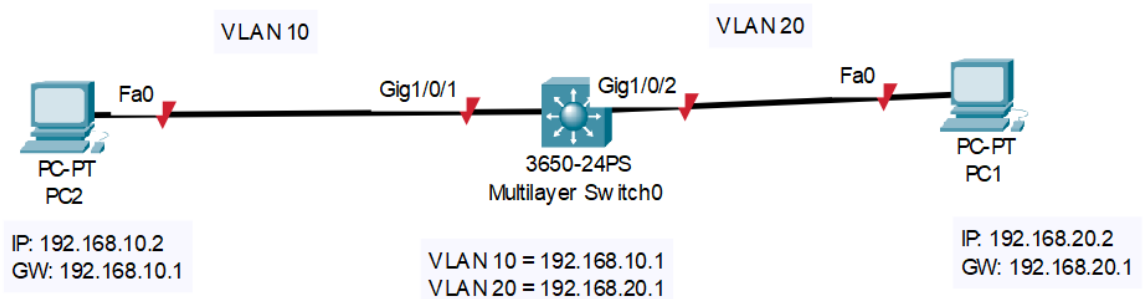
Flash Memory:

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



Switch Virtual Interface (SVI):

- Switch Virtual Interface is a logical Interface on Layer 2 or Layer 3 switches.
- Switch Virtual Interface is normally found on both Layer 2 and 3 Switches.
- SVI cannot be activated unless VLAN is created and at least 1 physical port is associated.
- Switch Virtual Interface (SVI) is used in Layer 2 switch only for management and testing.
- Layer 3 Switch use the SVI for Inter-VLAN communication without need of Router.
- SVI for Layer 3 or Multilayer switch provides both management and routing services.



SVI Configuration in Switch

```
En
Config t
Ip routing
Int vlan 10
Ip add 192.168.10.1 255.255.255.0
No sh
Int vlan 20
Ip add 192.168.20.1 255.255.255.0
No sh
Int g1/0/1
Switchport mode access
Switchport access vlan 10
Int g1/0/2
Switchport mode access
Switchport access vlan 20
```

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Ip routing command is use to enable routing in Layer 3 switch. By default layer 3 switch disable Routing.

Device Management:

- Traffic that network administrator uses to configure network devices is called device Managements.
- Management plane provides the ability to manage network infrastructure devices.
- Management plane traffic is usually consisting of protocol traffic like Telnet, SNMP or SSH.
- First step toward management is to set username and password.

Console Port:

- Console port is used to connect a computer directly to a router or switch.
- Every Cisco Router, Firewall or a Switch has a console port.
- Console port also know as the management port.
- It manages the router or switch since there is no display device for a router or switch.
- Console port must be used to initially to install routers.
- Console port can be used to log into a router directly without network connection.
- Console require a terminal emulator application like putty to connect to router.
- Console port connect to router when a router cannot be accessed over the network.
- Console port is can be used to log into a router directly without network connection.





Virtual Terminal Line (VTY):

- VTY stand for Virtual Terminal Lines or Virtual Teletype.
- We are access network device virtually so we will use Virtual Terminal line.
- VTY is a Command Line Interface (CLI) created in a router
- VTY is just way to access Router or switch CLI Remotely.
- VTY are logical connections from the network to the switch or routers.

Telnet:

- Telnet is a network protocol that provides a command - line interface to communicate with a device remotely.
- In simple words we can say Telnet is use to access device remotely from different location.
- Telnet is an application layer protocol which is use to remotely access network devices.
- Telnet is work on Protocol TCP & Port # 23.
- First, we need to configure Telnet in network device then we can do Telnet from different place

Router Telnet configuration:

Config t
Enable password 12345
Line vty 0 4 ----- if we want to allow 5 people to access device remotely then we will use vty 0 4
i.e. Qty 5

Password cisco
Login

Or

Other Method

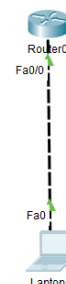
Config t
Username abc password abc

Enable password 12345
Line vty 0 4 ----- if we want to allow 5 people to access device remotely then we will use vty 0 4
i.e. Qty 5

Password cisco
Login local

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SSH: SSH (Secure Shell):

- SSH (Secure Shell) is a secure method for remote access as it includes authentication and encryption. To do this, it uses an RSA public/private key pair.
- It works on Port number 22
- Very Secure Protocol
- SSH are two versions SSH Version 1 and SSH Version 2.
- Communication between server and client is encrypted in both SSH Version.
- SSH Version 2 is more Secure than SSH Version 1.
-

How to Configure SSH on CISCO IOS:

En

Config t

Hostname R1

Ip domain-name NetworkforYou

Now we can generate the RSA Keypair:

Crypto key generate rsa

Then it will ask

The name for the keys will be: Branch2.NetworkforYou

Choose the size of the key modulus in the range of 360 to 2048 for your General Purpose Keys. Choosing a key modulus greater than 512 may take a few minutes.

How many bits in the modulus [512]:

So we will choose let me choose 2048

Then we get

How many bits in the modulus [512]: 2048

% Generating 2048 bit RSA keys, keys will be non-exportable...[OK]

Then it will enable SSH

*Mar 1 5:21:55.540: %SSH-5-ENABLED: SSH 1.99 has been enabled

By default version 1 is enable . Now I am enabling to ssh version 2

Then we will type ip ssh version 2

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```
line vty 0 4
transport input ssh
login local
username admin password admin
```

How to access ssh:

Type
Ssh -l username IP
Password

Different between Telnet and SSH:

- Telnet and SSH protocols have the same purpose and both of them used to communicate to a remote device.
- Telnet is not secure because all the data would be sent in clear text including the passwords without authentication and encryption.
- where SSH is a Secure Protocol because it encrypts the data using authentication.

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INITIAL CONFIGURATION OF A SWITCH

- Connect one end of console cable to console port of switch and other end of cable to your PC com port and then open Putty software and power on the switch.

To Assign Telnet Password	To Assign Console Password
SW>en SW# config t SW(config)# line vty 0 4 SW(config-line) # password <password> SW(config-line) # login	SW>en SW# config t SW(config-line)# line con 0 SW(config-line) # password <password> SW(config-line) # login

To Assign Telnet Password for Users	To Assign Console Password for user
SW>en SW# config t SW(config)# username admin password admin SW(config)# line vty 0 4 SW(config-line) # password <password> SW(config-line) # login local	SW>en SW# config t SW(config)# username admin password admin SW(config-line)# line con 0 SW(config-line) # password <password> SW(config-line) # login local

To Assign Enable Password	To Assign IP to a Switch (SVI)
SW>en SW# config t SW(config)#enable secret < password> SW(config)#enable password < password>	SW>en SW# config t SW(config)# Interface Vlan 1 SW(config-if)# ip address <ip> <Subnet mask> SW(config-if)# no shutdown

To Assign Default Gateway to Switch	To Check Mac address table
SW>en SW# config t SW(config)# ip default-gateway 192.168.1.1	SW>en SW# sh mac-address-table

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