

Computer Networks

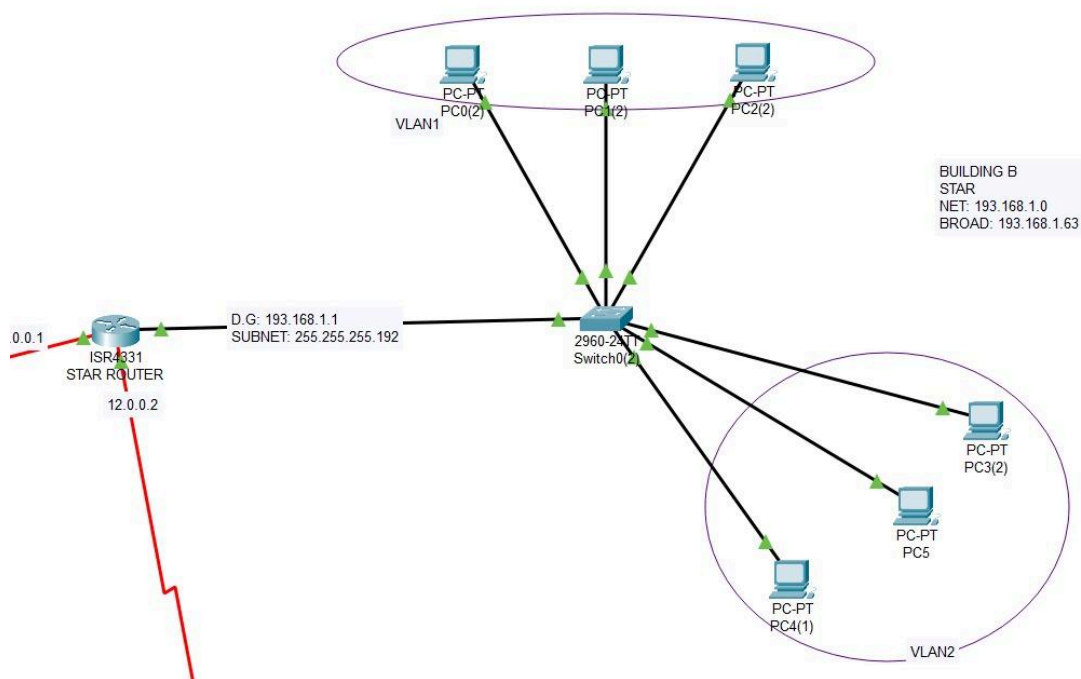
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Topology

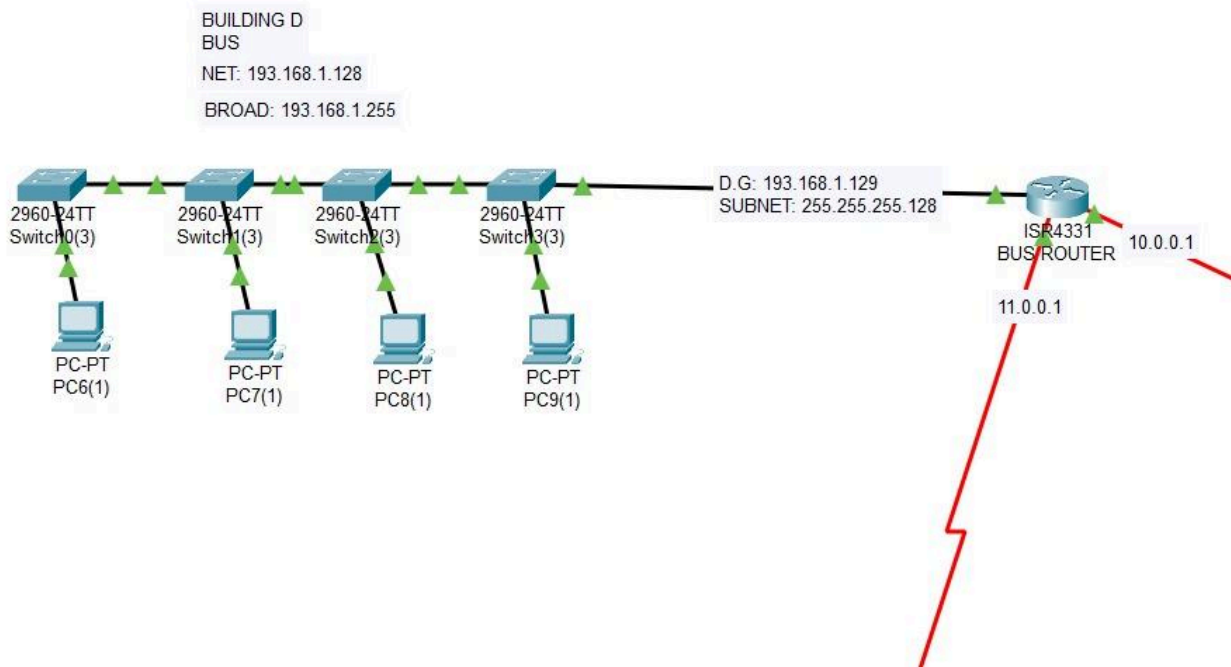
I. Star

A star topology is a network layout where devices are connected to a central hub or switch, facilitating communication among devices via the central node.



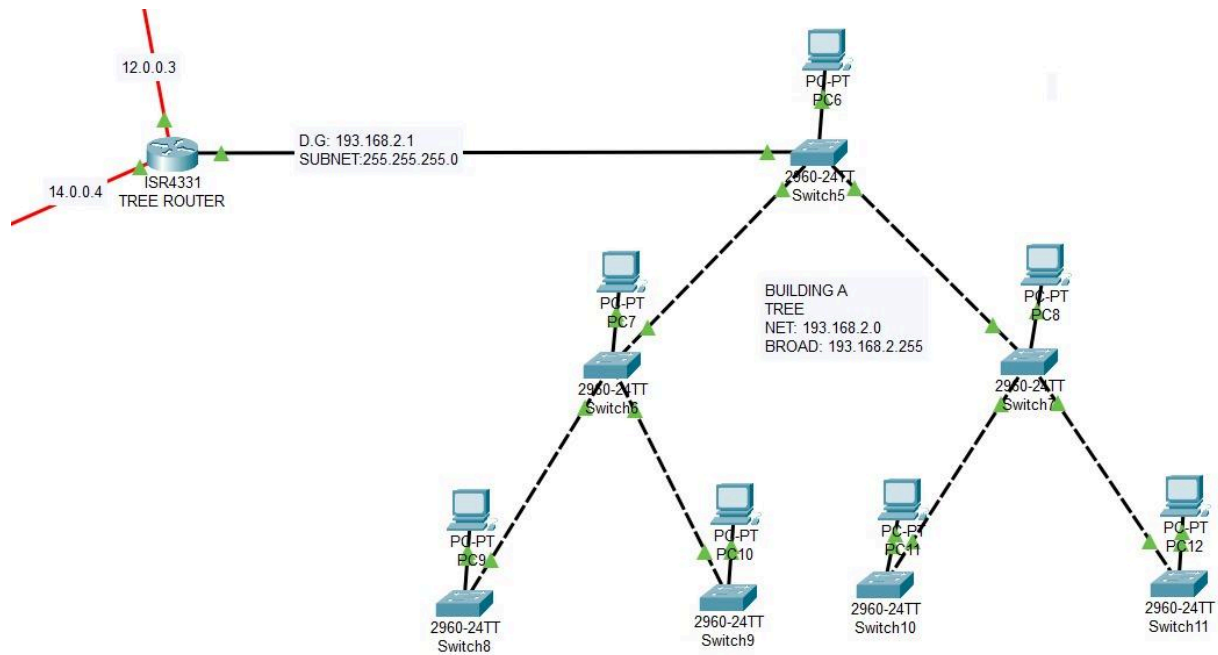
II. Bus

A bus topology is a network configuration where all devices are connected to a single shared communication line, called the bus, allowing data transmission to travel in both directions across the line.



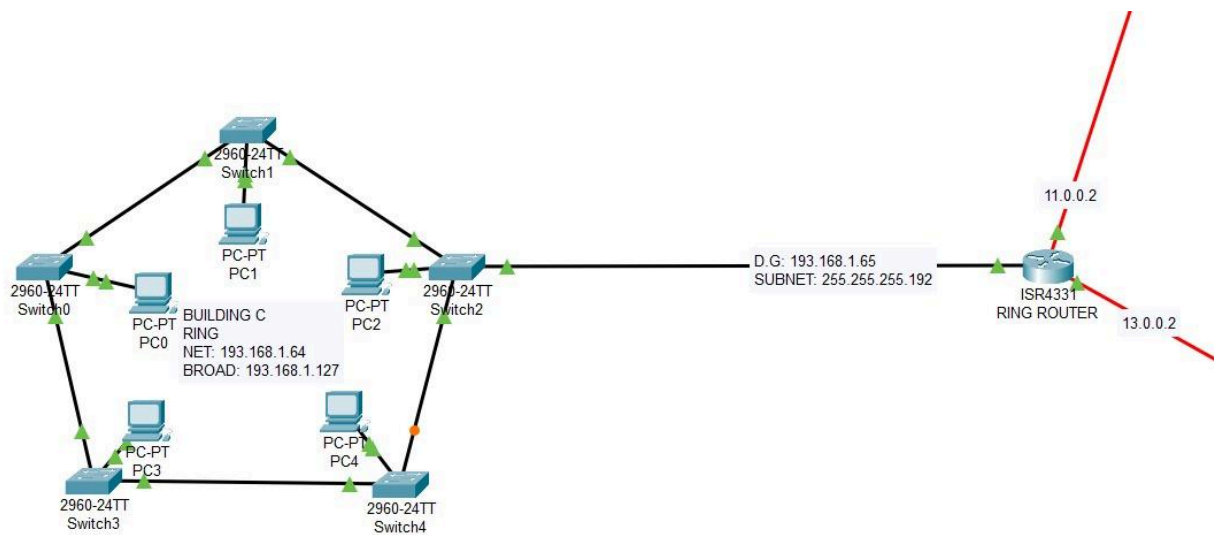
III. Tree

A tree topology is a network structure where devices are arranged in a hierarchical tree-like pattern, with multiple levels of interconnected nodes originating from a single root node, facilitating efficient communication and scalability within the network.



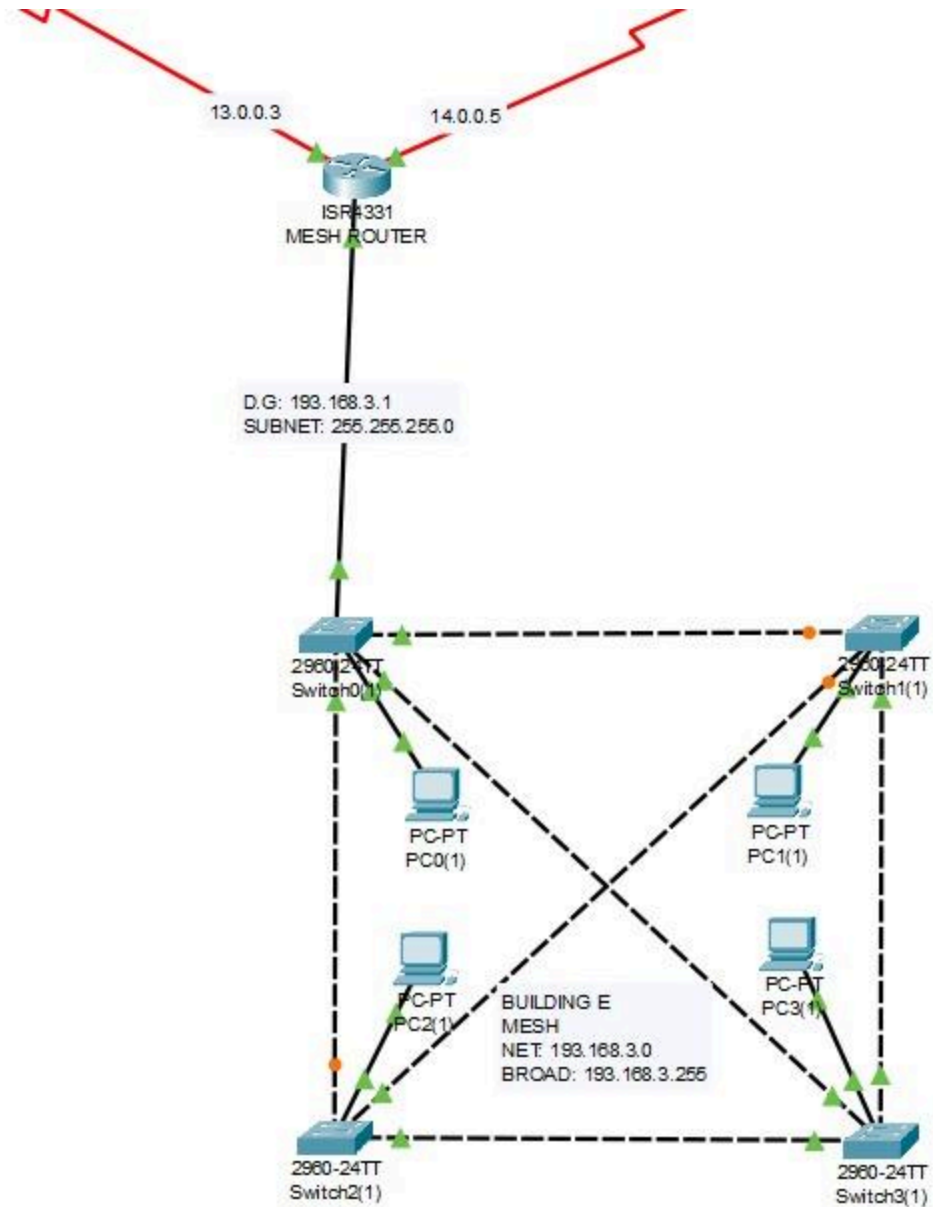
IV. Ring

A ring topology is a network configuration where each device is connected to exactly two other devices, forming a circular arrangement, enabling data to flow in one direction around the loop, providing simplicity and redundancy but vulnerable to a single point of failure.



V. Mesh (extra topology(BONUS))

A mesh topology is a network layout where every device is interconnected with every other device, forming a fully interconnected network, offering high redundancy and fault tolerance but requiring significant cabling and configuration complexity.



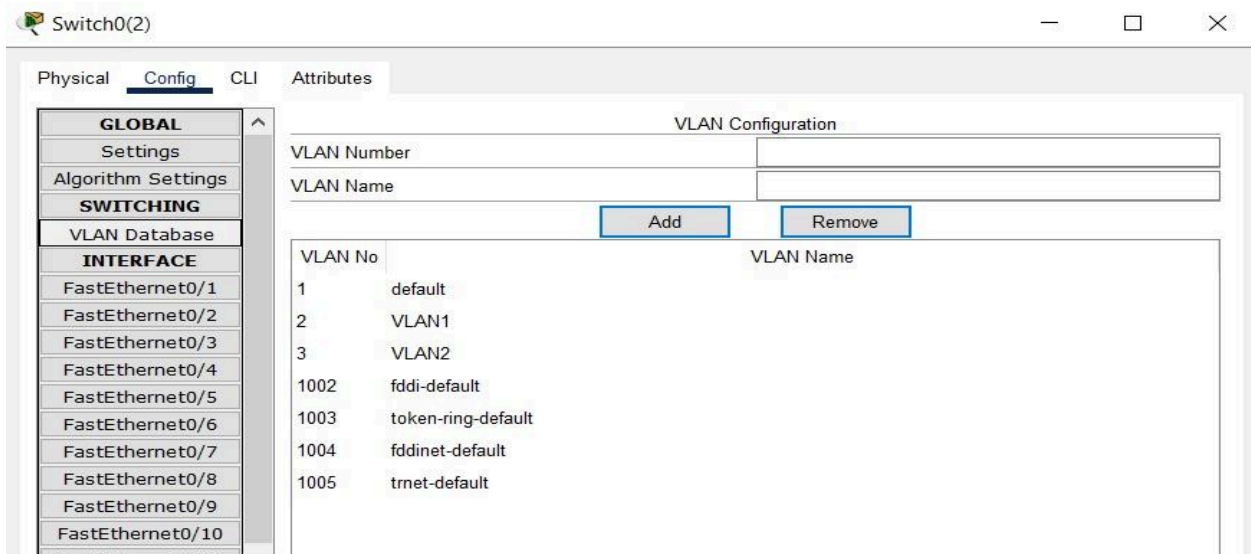
Subnetting

	Building A	Building B	Building C	Building D	Building E
BroadCast IP	193.168.2.255	193.168.1.63	193.168.1.127	193.168.1.255	193.168.3.255
Network IP	193.168.2.0	193.168.1.0	193.168.1.64	193.168.1.128	193.168.3.0
Default Gateway	193.168.2.1	193.168.1.1	193.168.1.65	193.168.1.129	193.168.3.1
1st valid IP	193.168.2.2	193.168.1.2	193.168.1.66	193.168.1.130	193.168.3.2
Last valid IP	193.168.2.254	193.168.1.62	193.168.1.126	193.168.1.254	193.168.3.254
Subnet Mask	255.255.255.0	255.255.255.192	255.255.255.192	255.255.255.128	255.255.255.0

VLAN

A VLAN (Virtual Local Area Network) is a logical subgroup within a physical network that segments network traffic, effectively creating separate, isolated networks on the same physical hardware. This segmentation improves network management, security, and performance by controlling broadcast domains, limiting the scope of traffic, and organizing devices according to function, department, or application requirements.

-We created 2 VLANs and we added the first 3 devices in VLAN 1 and the other 3 devices we added in VLAN 2



-The command that we wrote it in the terminal

```

:
spanning-tree mode pvst
spanning-tree extend system-id
!
interface FastEthernet0/1
  switchport access vlan 2
!
interface FastEthernet0/2
  switchport access vlan 2
!
interface FastEthernet0/3
  switchport access vlan 2
!
interface FastEthernet0/4
  switchport access vlan 3
!
interface FastEthernet0/5
  switchport access vlan 3
!
interface FastEthernet0/6
  switchport access vlan 3
:

```

OSPF

OSPF (Open Shortest Path First) is a widely used routing protocol in IP networks. It is an Interior Gateway Protocol (IGP) designed for use within an Autonomous System (AS) and operates using a link-state routing algorithm.

-The commands of the routing in the bus router

```
!
router ospf 1
 log-adjacency-changes
 network 11.0.0.0 0.255.255.255 area 0
 network 10.0.0.0 0.255.255.255 area 0
 network 193.168.1.128 0.0.0.127 area 1
!
```

And we did the same commands in the other routers

PAT

PAT (Port Address Translation) is networking techniques used to modify network address information in packet headers while in transit across a traffic routing device. These techniques are essential for conserving IP addresses, enhancing security, and enabling private IP networks to connect to the internet.

-The commands that we wrote it in the PAT

```
Router(config)#int g0/0/0
Router(config-if)#ip nat inside
Router(config-if)#exit
```

```
Router(config)#int s0/2/0
Router(config-if)#ip nat outside
Router(config-if)#exit
```

```
Router(config)#int s0/2/1
Router(config-if)#ip nat outside
Router(config-if)#exit
```

```
Router(config)#ip nat inside source list 7 int s0/2/0
Router(config)#access-list 7 permit 193.168.2.0 0.0.0.255
Router(config)#ip nat inside source list 7 int s0/2/1
Router(config)#access-list 7 permit 193.168.2.0 0.0.0.255
```

```
Router#show ip nat translations
```

Pro	Inside global	Inside local	Outside local	Outside global
icmp	12.0.0.3:1	193.168.2.3:1	193.168.1.66:1	193.168.1.66:1
icmp	12.0.0.3:2	193.168.2.3:2	193.168.1.66:2	193.168.1.66:2
icmp	12.0.0.3:3	193.168.2.3:3	193.168.1.66:3	193.168.1.66:3
icmp	12.0.0.3:4	193.168.2.3:4	193.168.1.66:4	193.168.1.66:4

Static NAT(BONUS)

Static NAT (one-to-one NAT) permanently maps a single private IP address to a single public IP address. This fixed mapping allows specific internal devices, like web or email servers, to be accessible from the outside world.

-We did it in the bus router

```
Router#show ip nat translations
Pro  Inside global      Inside local      Outside local      Outside global
---  158.80.1.40          193.168.1.128     ---                ---

Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int g0/0/0
Router(config-if)#ip nat inside
Router(config-if)#exit
Router(config)#int s0/2/0
Router(config-if)#ip nat outside
Router(config-if)#exit
Router(config)#ip nat inside static 193.168.1.128 158.80.1.40
^
% Invalid input detected at '^' marker.

Router(config)#ip nat inside source static 193.168.1.128 158.80.1.40

Router#show ip nat statistics
Total translations: 1 (1 static, 0 dynamic, 0 extended)
Outside Interfaces: Serial0/2/0
Inside Interfaces: GigabitEthernet0/0/0
Hits: 0  Misses: 32
Expired translations: 0
Dynamic mappings:
Router#
```

RIP ROUTING (BONUS)

RIP (Routing Information Protocol) is one of the oldest distance-vector routing protocols used in both local and wide area networks. It is designed to facilitate the exchange of routing information within an autonomous system (AS). RIP uses a simple hop count metric to determine the best path to a destination network.

-the RIP commands

```
router rip
 network 10.0.0.0
 network 11.0.0.0
 network 12.0.0.0
 network 13.0.0.0
 network 14.0.0.0
 network 15.0.0.0
 network 172.125.0.0
 network 193.168.1.0
 network 193.168.2.0
 network 193.168.3.0

```

And we did the same commands in the other routers

STATIC ROUTING (BONUS)

Static routing is a network routing technique in which routes are manually configured and maintained by a network administrator, rather than being dynamically updated by routing protocols. In static routing, specific paths are defined for data packets to follow to reach their destination.

The screenshot displays the BUS ROUTER configuration window, specifically the Static Routes section. The interface includes a sidebar with a tree view of configuration categories: GLOBAL (Settings, Algorithm Settings), ROUTING (Static, RIP), SWITCHING (VLAN Database), and INTERFACE (GigabitEthernet0/0/0, GigabitEthernet0/0/1, GigabitEthernet0/0/2, Serial0/2/0, Serial0/2/1). The main area is titled 'Static Routes' and contains input fields for 'Network', 'Mask', and 'Next Hop', followed by an 'Add' button. Below these fields is a list of configured static routes, each showing the network address and the next hop. The routes are: 193.168.1.0/26 via 10.0.0.2, 193.168.1.64/26 via 11.0.0.2, 193.168.3.0/24 via 11.0.0.2, 15.0.0.0/8 via 10.0.0.2, 12.0.0.0/8 via 10.0.0.2, 193.168.2.0/24 via 10.0.0.2, and 13.0.0.0/8 via 11.0.0.2. A 'Remove' button is located at the bottom right of the list. At the bottom of the window, there is a section for 'Equivalent IOS Commands' showing a terminal session with the following commands: Router>enable, Router#, Router#configure terminal, Enter configuration commands, one per line. End with CNTL/Z., Router (config) #, and Router (config) #. A 'Top' button is located at the bottom left of the window.

BUS ROUTER

Physical Config CLI Attributes

Static Routes

Network

Mask

Next Hop

Add

Network Address

193.168.1.0/26 via 10.0.0.2

193.168.1.64/26 via 11.0.0.2

193.168.3.0/24 via 11.0.0.2

15.0.0.0/8 via 10.0.0.2

12.0.0.0/8 via 10.0.0.2

193.168.2.0/24 via 10.0.0.2

13.0.0.0/8 via 11.0.0.2

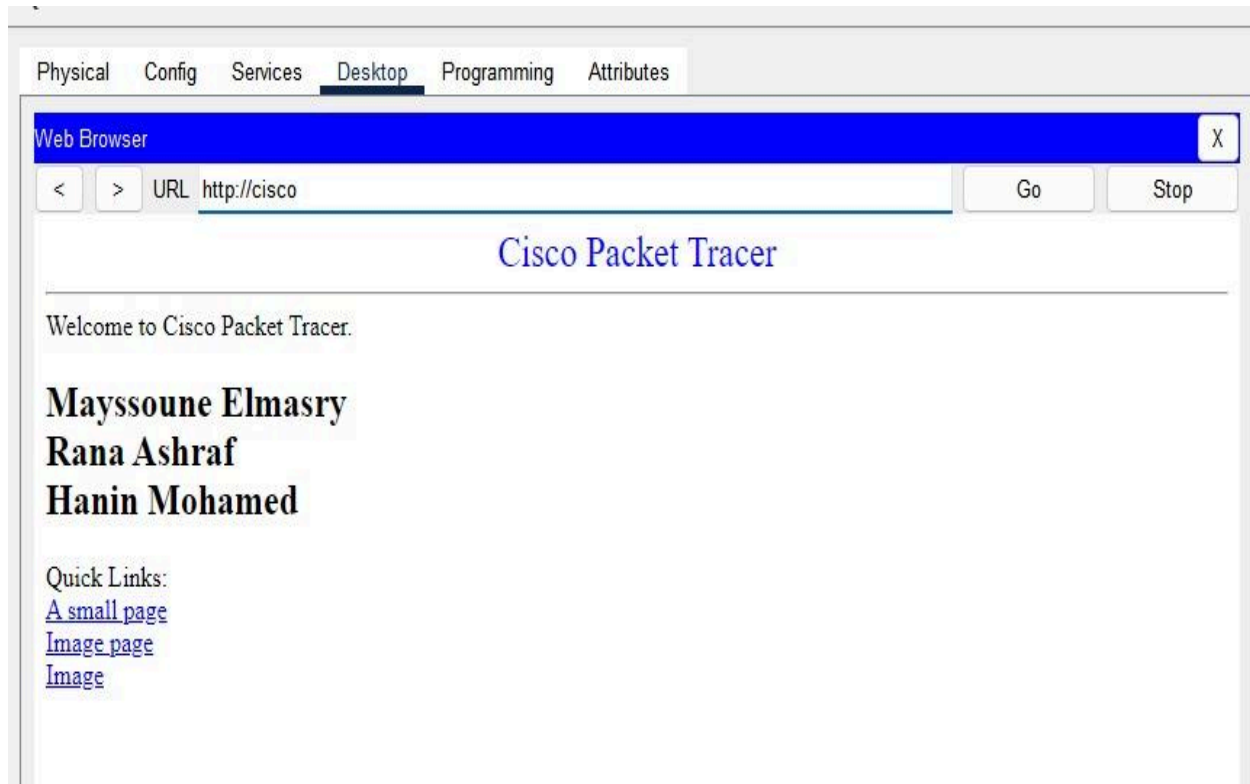
Remove

Equivalent IOS Commands

```
Router>enable
Router#
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router (config) #
Router (config) #
```

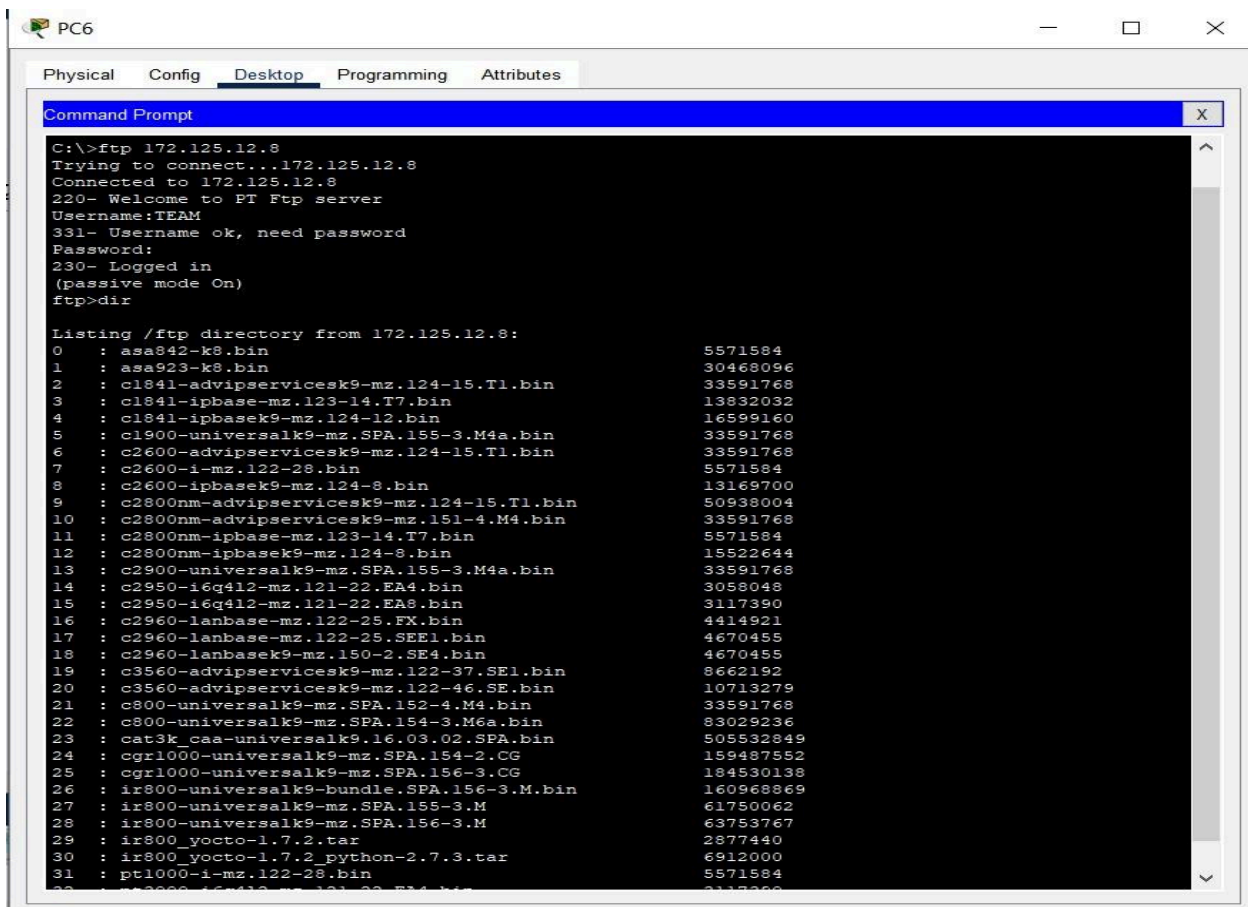
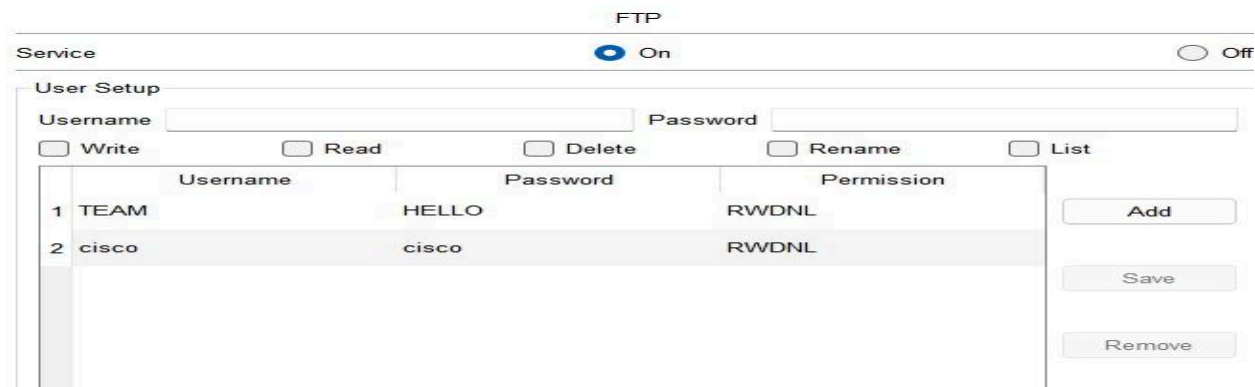
Top

Web Server(BONUS)



FTP(BONUS)

FTP (File Transfer Protocol) is a standard network protocol used for transferring files between a client and a server over a TCP/IP-based network, such as the Internet. FTP is designed to facilitate the transfer of files, allowing users to upload and download files, manage file directories, and perform various file operations remotely.



Router Password(BONUS)

Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#enable password cisco

Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#service password-encryption

```
!
!
enable password 7 0822455D0A16
!
!
```

Router(config)#enable secret ciscopt

```
enable secret 5 $1$mERr$aRM/LRsfigaDSjazpaGkp/
enable password 7 0822455D0A16
!
```

Firewall(BONUS)

A firewall is a network security device or software that monitors and controls incoming and outgoing network traffic based on predetermined security rules. It acts as a barrier between a trusted internal network and untrusted external networks, such as the internet, to prevent unauthorized access and protect the network from various cyber threats.

Firewall

X

Service

☒ On ☐ Off

Interface

FastEthernet0

Inbound Rules

Action

Protocol

Remote IP

Remote Wildcard Mask

Remote Port

Local Port

Save

Remove

Add

	Action	Protocol	Remote IP	Remote Wild Card	Remote Port	Local Port
1	Allow	ICMP	0.0.0.0	255.255.255.255	-	-
2	Deny	TCP	0.0.0.0	255.255.255.255	any	any
3	Deny	IP	0.0.0.0	255.255.255.255	-	-

DNS server(BONUS)

DNS

DNS Service ☒ On ☐ Off

Resource Records

Name Type **A Record** ▼

Address

No.	Name	Type	Detail
0	cisco.com	A Record	172.125.12.9

DHCP server(BONUS)

DHCP

Interface **FastEthernet0** ▼ Service ☒ On ☐ Off

Pool Name

Default Gateway

DNS Server

Start IP Address :

Subnet Mask:

Maximum Number of Users :

TFTP Server:

WLC Address:

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
Bus	193.168.1.1	172.125.12.9	193.168.1.1	255.255.255.0	125	0.0.0.0	0.0.0.0
Ring	193.168.1.65	172.125.12.9	193.168.1.67	255.255.255.0	61	0.0.0.0	0.0.0.0
Tree	193.168.2.1	172.125.12.9	193.168.2.3	255.255.255.0	253	0.0.0.0	0.0.0.0
Star	193.168.1.1	172.125.12.9	193.168.1.3	255.255.255.0	61	0.0.0.0	0.0.0.0
Mesh	193.168.3.1	172.125.12.9	193.168.3.3	255.255.255.0	253	0.0.0.0	0.0.0.0
serverPool	172.125.12.1	172.125.12.2	172.125.12.3	255.255.0.0	253	0.0.0.0	0.0.0.0