Communication Company Network

Done by:

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Agenda

1. Introduction
2. VLANS
3. Inter-VLAN
4. Access point
5. SERVERS
6. Protocols
7. DMZ
8. Security System

➢ Introduction

❑ A simple network design for a small communication company focuses on creating an efficient and secure infrastructure to connect employees, devices, services, etc.

❑An efficient network is essential to facilitate the systematic & cost-efficient transfer of information through messages, files, and resources.

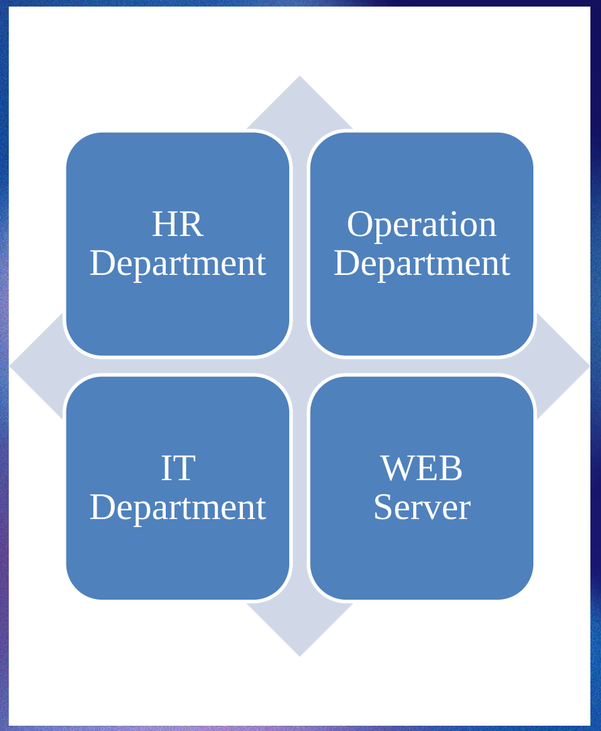
❑The project will provide insight into concepts such as topology design, IP addressing, and how to send information in packet form to the wire networks in different corporate buildings.

❑We created a topology for a company of multi-network sand virtual local area networks (VLANs) , inter-VLAN, OSPF Routing, Servers (DHCP, DNS, SYSLOG, NTP, WEB) , ACL , and Port Security using Cisco packet tracer.

❑Also recommendation for development to avoid potential attacks.

➢ Small Communication Company

Requirements of the project



HR Department
IT Department
Operation Department

PCs
Switch
Printer
Access point
Laptop

Building A

HR Department
IT Department
Operation Department

PCs
Switch
Printer
Access point
Laptop

Building B

WEB Server

Multi-layer Switch

Routers

DMZ

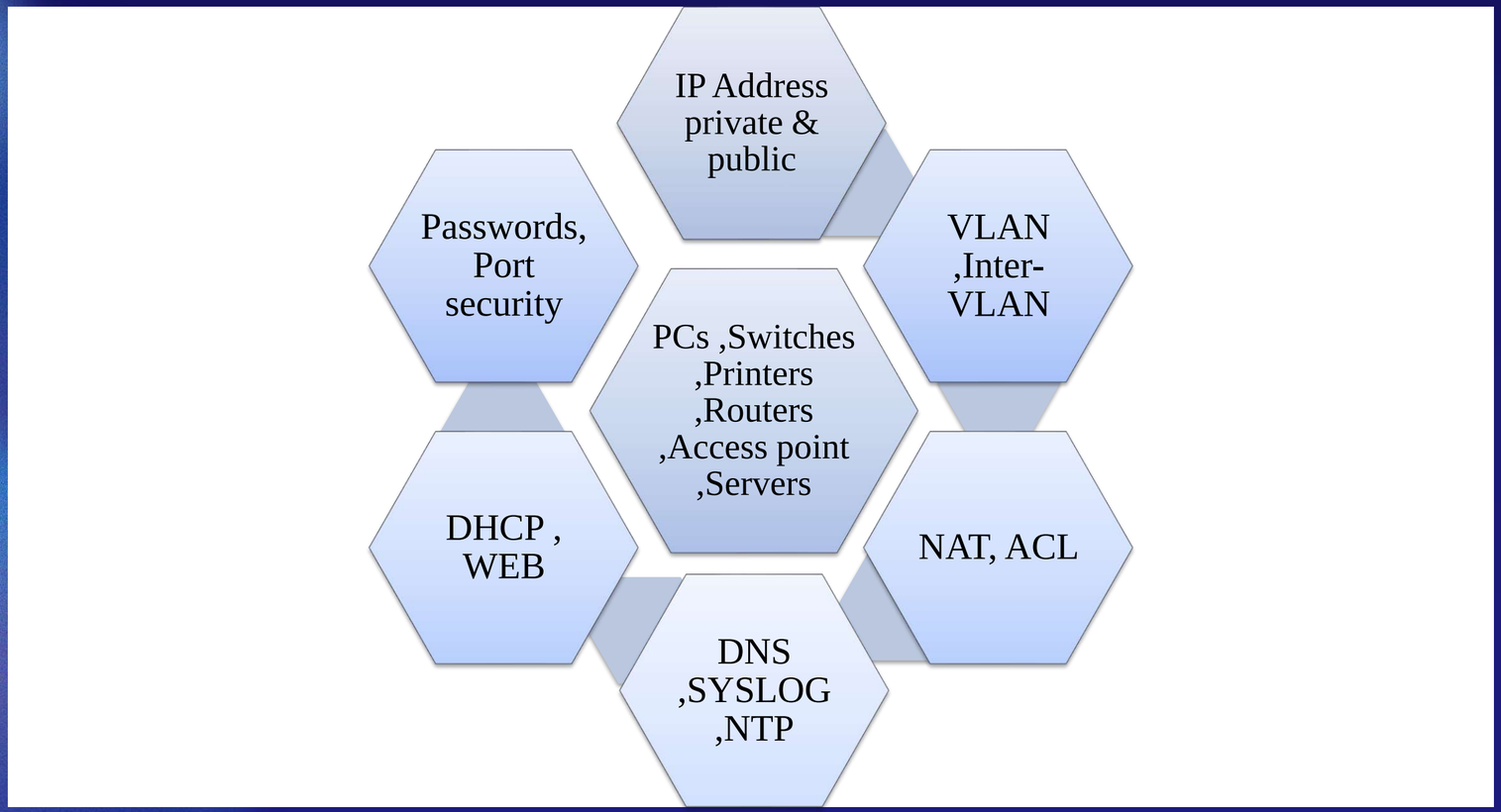
SYSLOG Server
NTP Server
DNS Server
DHCP Server

Data Center

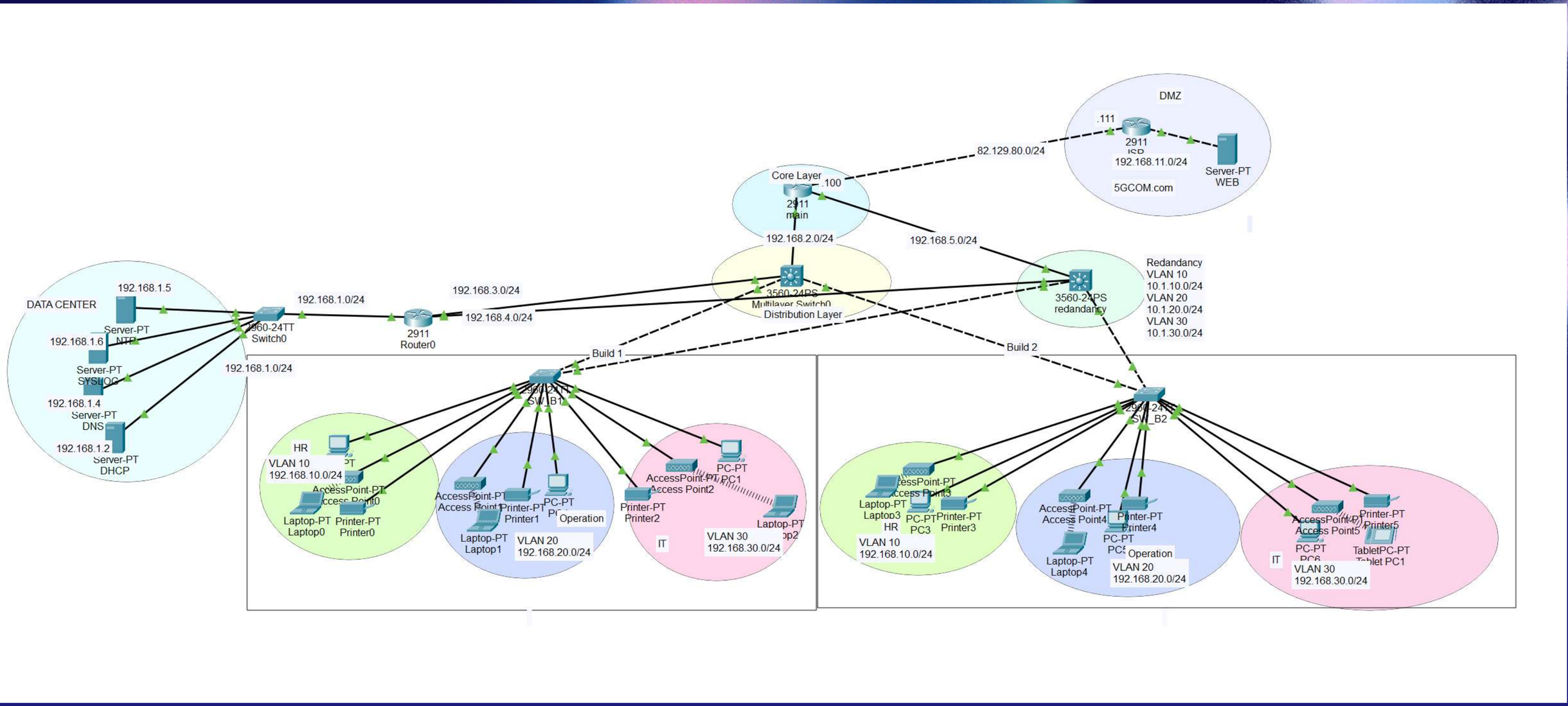
Small Communication Company
Tasks

We have done following tasking

Design Network Topology Devices Configuration IP Address VLAN Configuration Servers Configuration Security

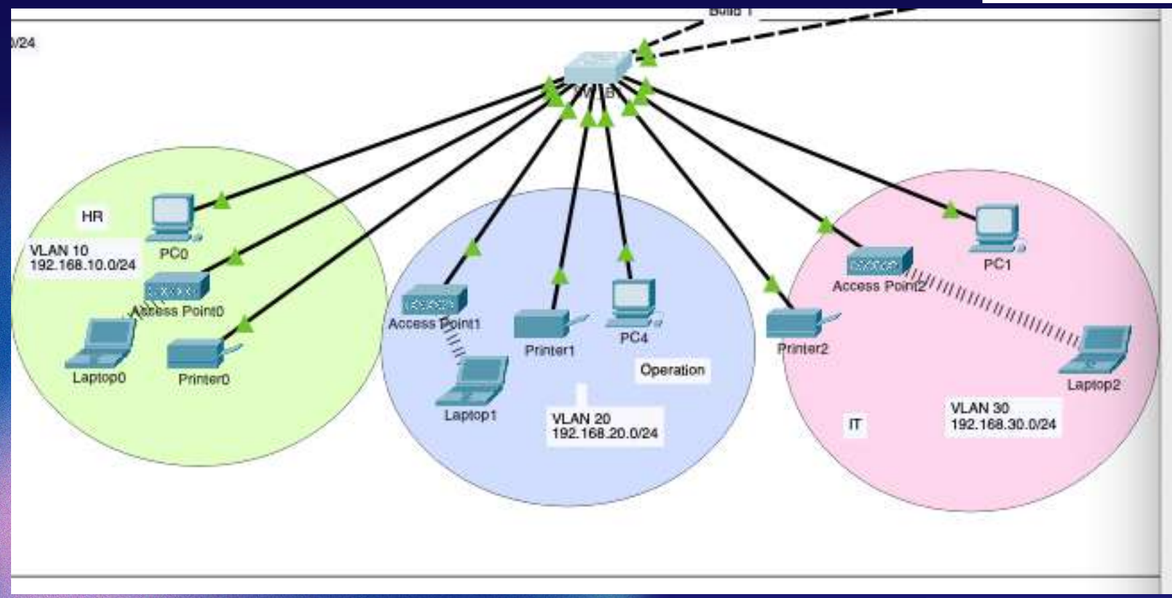


➢ Block Diagram



➢ VLAN Configurations

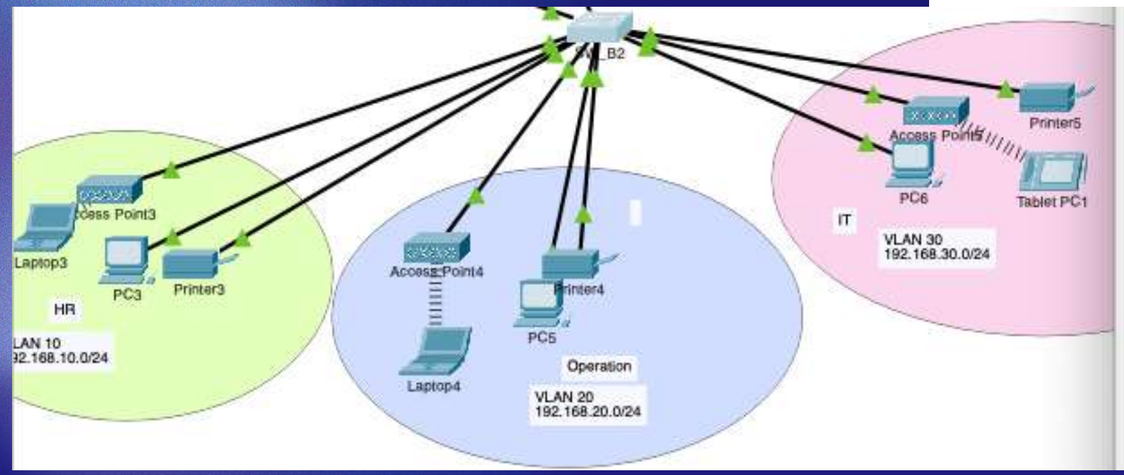
Build A



IOS Command Line Interface

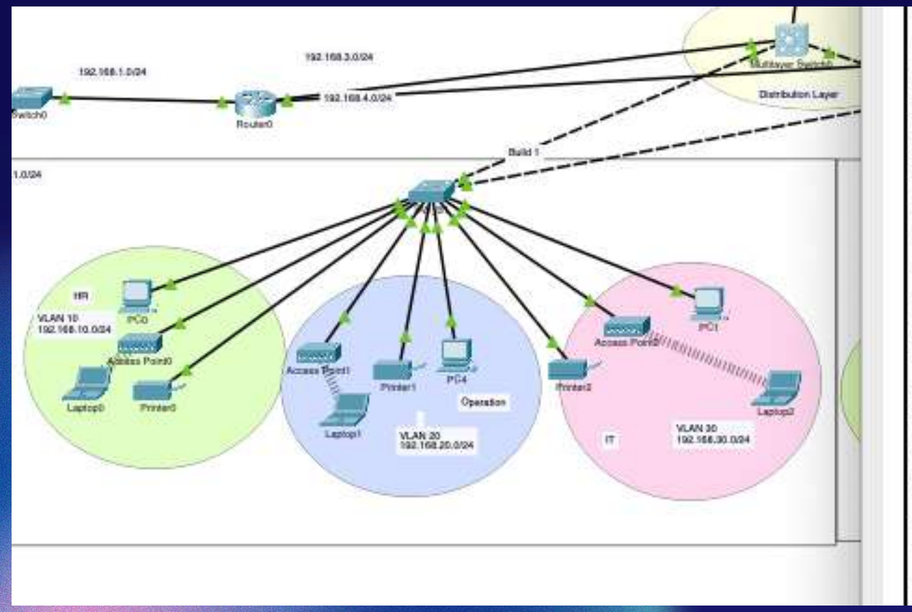
```
Switch#show vlan

VLAN Name                                Status    Ports
---- ----------------------------------- --------- -------------------------------
1    default                             active    Fa0/13, Fa0/14,
Fa0/15, Fa0/16
                                                   Fa0/17, Fa0/18,
Fa0/19, Fa0/20
                                                   Fa0/21, Fa0/22,
Fa0/23, Fa0/24
                                                   Gig0/1, Gig0/2
10   HR                                  active    Fa0/2, Fa0/5,
Fa0/8
20   Operation                           active    Fa0/3, Fa0/6,
Fa0/9
30   IT                                  active    Fa0/4, Fa0/7,
```

Build B



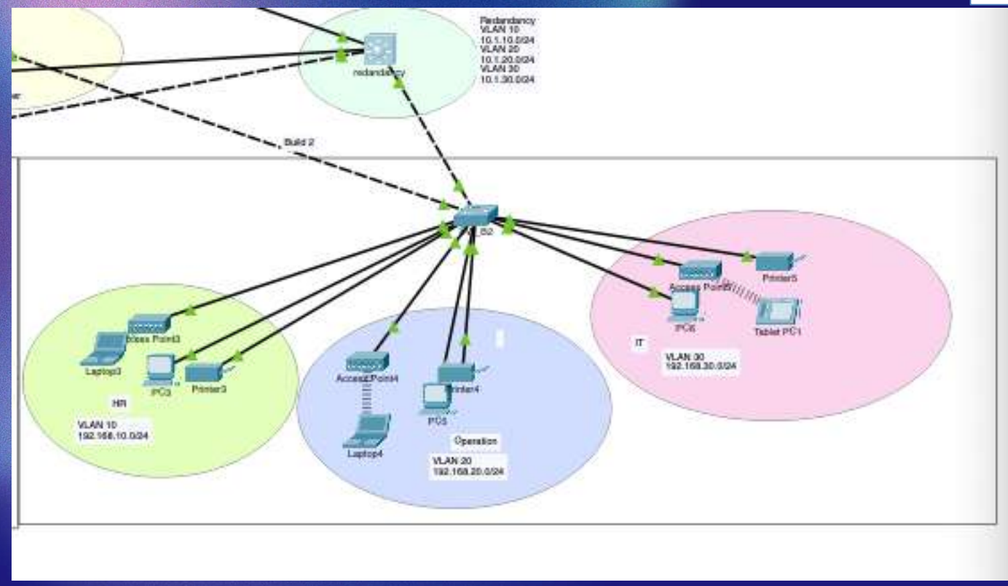

```
Switch#show vlan

VLAN Name                                Status    Ports
---- ----------------------------------- --------- -------------------------------
1    default                             active    Fa0/12, Fa0/13,
Fa0/14, Fa0/15
                                                   Fa0/16, Fa0/17,
Fa0/18, Fa0/19
                                                   Fa0/20, Fa0/21,
Fa0/22, Fa0/23
                                                   Fa0/24, Gig0/1, Gig0/2
10   HR                                  active    Fa0/1, Fa0/2, Fa0/8
20   Operation                           active    Fa0/3, Fa0/6, Fa0/9
30   IT                                  active    Fa0/4, Fa0/7, Fa0/10
```

➢ Inter-VLAN Configuration



Multi-layer Switch 1

```
down
FastEthernet0/22       unassigned      YES unset  down
down
FastEthernet0/23       unassigned      YES unset  down
down
FastEthernet0/24       unassigned      YES unset  down
down
GigabitEthernet0/1     unassigned      YES unset  down
down
GigabitEthernet0/2     unassigned      YES unset  down
down
Vlan1                  unassigned      YES unset  administratively down
down
Vlan10                 192.168.10.1    YES manual up
up
Vlan20                 192.168.20.1    YES manual up
up
Vlan30                 192.168.30.1    YES manual up
up
```



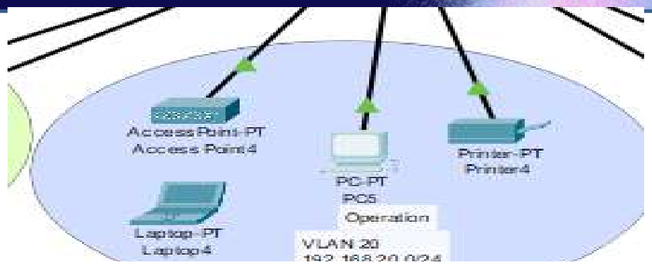
Multi-layer Switch 2

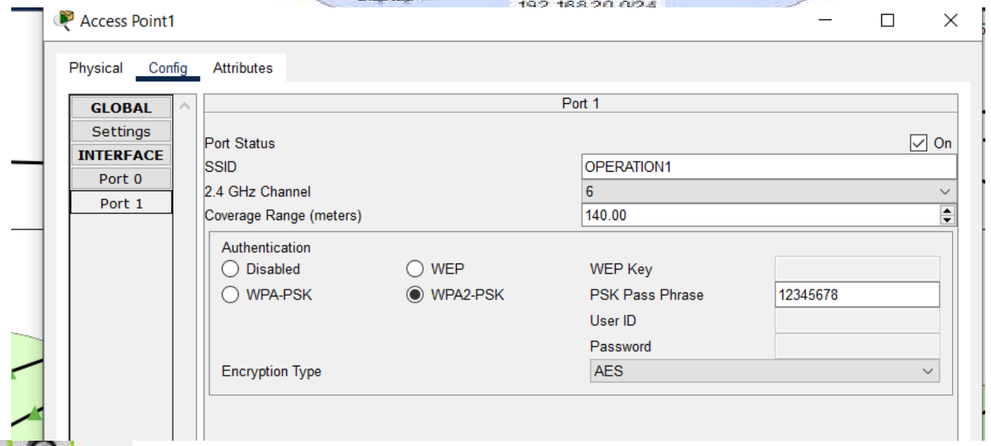
```
down
FastEthernet0/22       unassigned      YES unset  down
down
FastEthernet0/23       unassigned      YES unset  down
down
FastEthernet0/24       unassigned      YES unset  down
down
GigabitEthernet0/1     unassigned      YES unset  down
down
GigabitEthernet0/2     unassigned      YES unset  down
down
Vlan1                  unassigned      YES unset  administratively down
down
Vlan10                 10.1.10.1       YES manual up
up
Vlan20                 10.1.20.1       YES manual up
up
Vlan30                 10.1.30.1       YES manual up
up
```

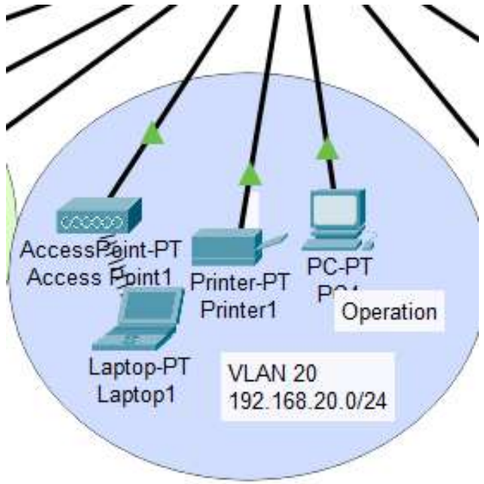
Access Point

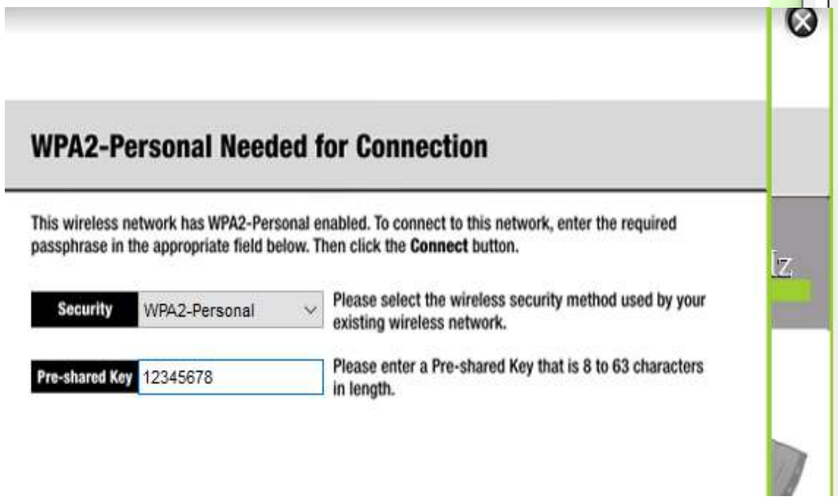
It serves as a central point for providing connectivity between wireless devices (such as smartphones, laptops, and printers) and the wired network.

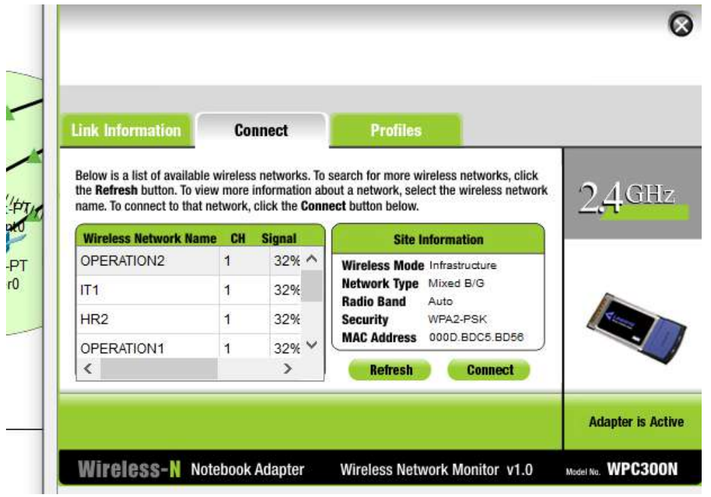
- **Placement:** Ensure proper placement to maximize coverage.
- **Configuration:** Use management tools to set security and access parameters.
- **Testing:** Test the range and signal strength.











Common Uses

- **Home**

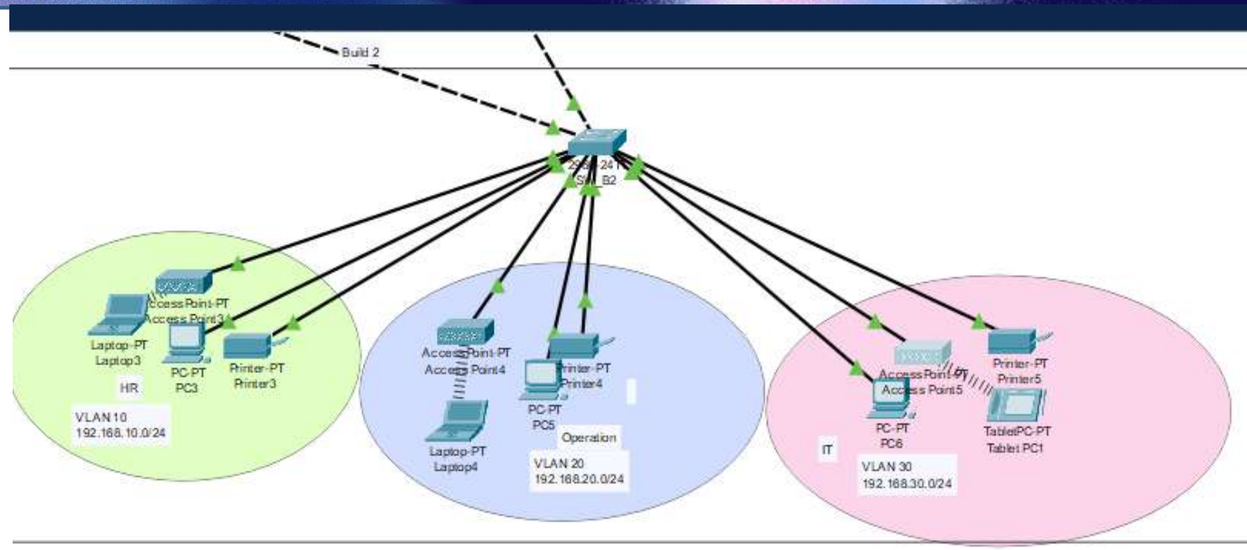
To provide wireless internet access throughout the home.

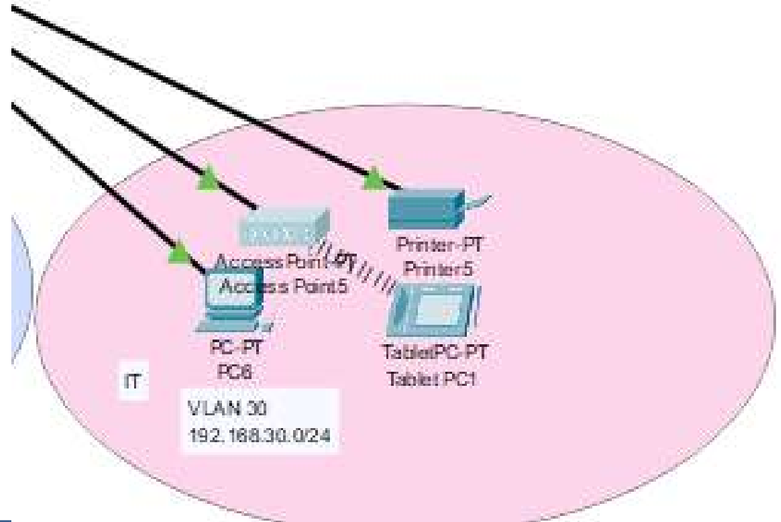
- **Offices**

To facilitate access to the network and shared resources.

- **Public Areas:**

Such as cafes and airports, to provide internet access for visitors.





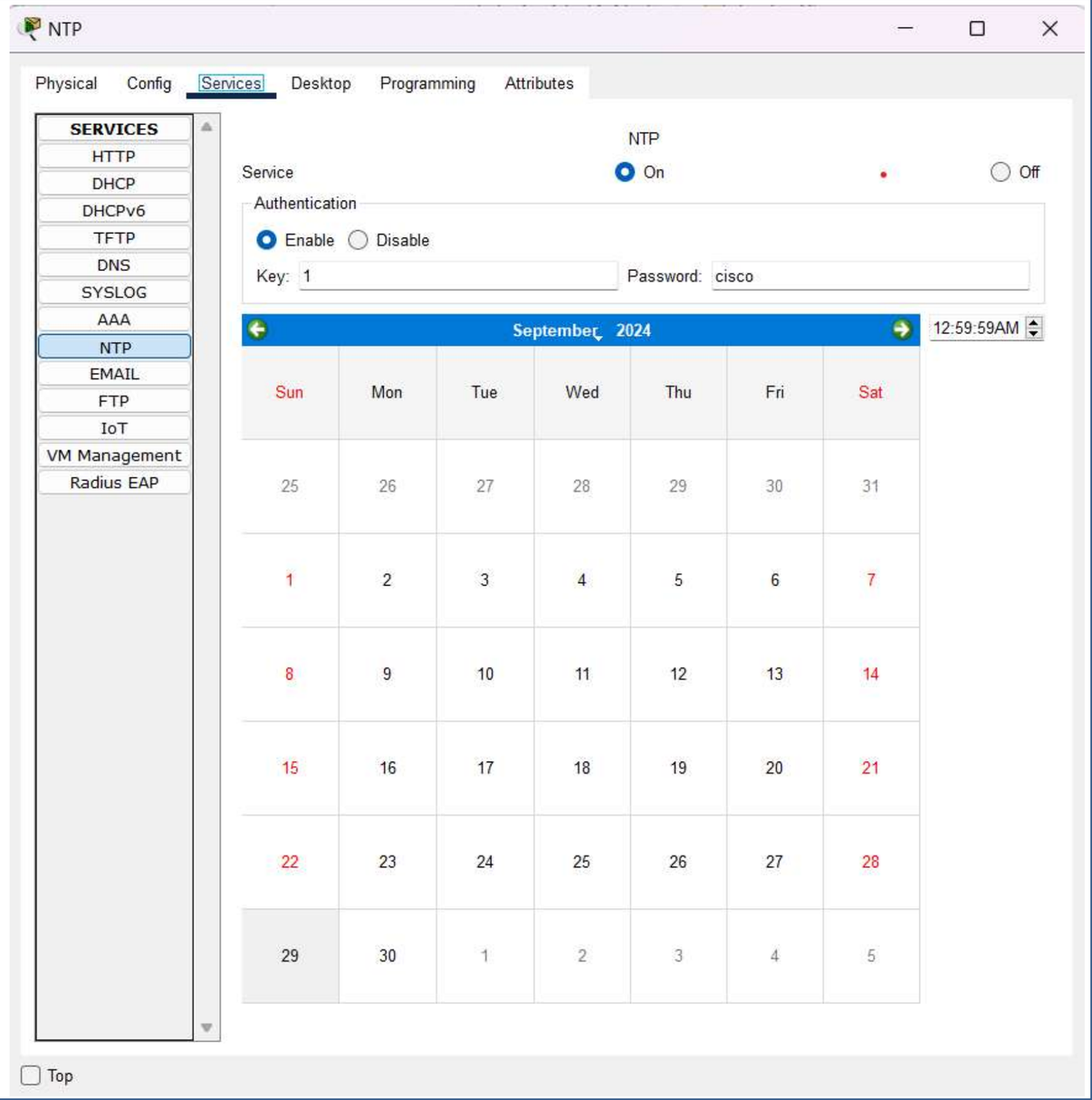
NTP Server

❑ What is NTP:

is a protocol designed to synchronize the clocks of computers or network devices over a network.

❑ Steps to Configure NTP Server:

- ➢ **Click on the server** to open the configuration window.
- ➢ Go to the **"Services" tab**.
- ➢ From the left menu, select **NTP**.
- ➢ **Turn NTP Service ON** (ensure the button is green).
- ➢ Setting date and clock



NTP Status in Main & Multilayer_SW0

Multilayer Switch0

```
Switch# show ntp status
Clock is synchronized, stratum 2, reference is 192.168.1.5
nominal freq is 250.0000 Hz, actual freq is 249.9990 Hz, precision is 2**24
reference time is EA73871E.00000238 (22:9:34.568 UTC Thu Sep 26 2024)
clock offset is 0.00 msec, root delay is 3.00  msec
root dispersion is 10.59 msec, peer dispersion is 0.00 msec.
loopfilter state is 'CTRL' (Normal Controlled Loop), drift is - 0.000001193 s/s system poll
interval is 5, last update was 28 sec ago.
Switch#
```

Main Router

```
Router# show ntp status
%SYS-5-CONFIG_I: Configured from console by console

Clock is synchronized, stratum 2, reference is 192.168.1.5
nominal freq is 250.0000 Hz, actual freq is 249.9990 Hz, precision is 2**24
reference time is EA73862A.0000019F (22:5:30.415 UTC Thu Sep 26 2024)
clock offset is 1.00 msec, root delay is 0.00  msec
root dispersion is 10.30 msec, peer dispersion is 0.00 msec.
loopfilter state is 'CTRL' (Normal Controlled Loop), drift is - 0.000001193 s/s system poll
interval is 4, last update was 2 sec ago.
Router#
```

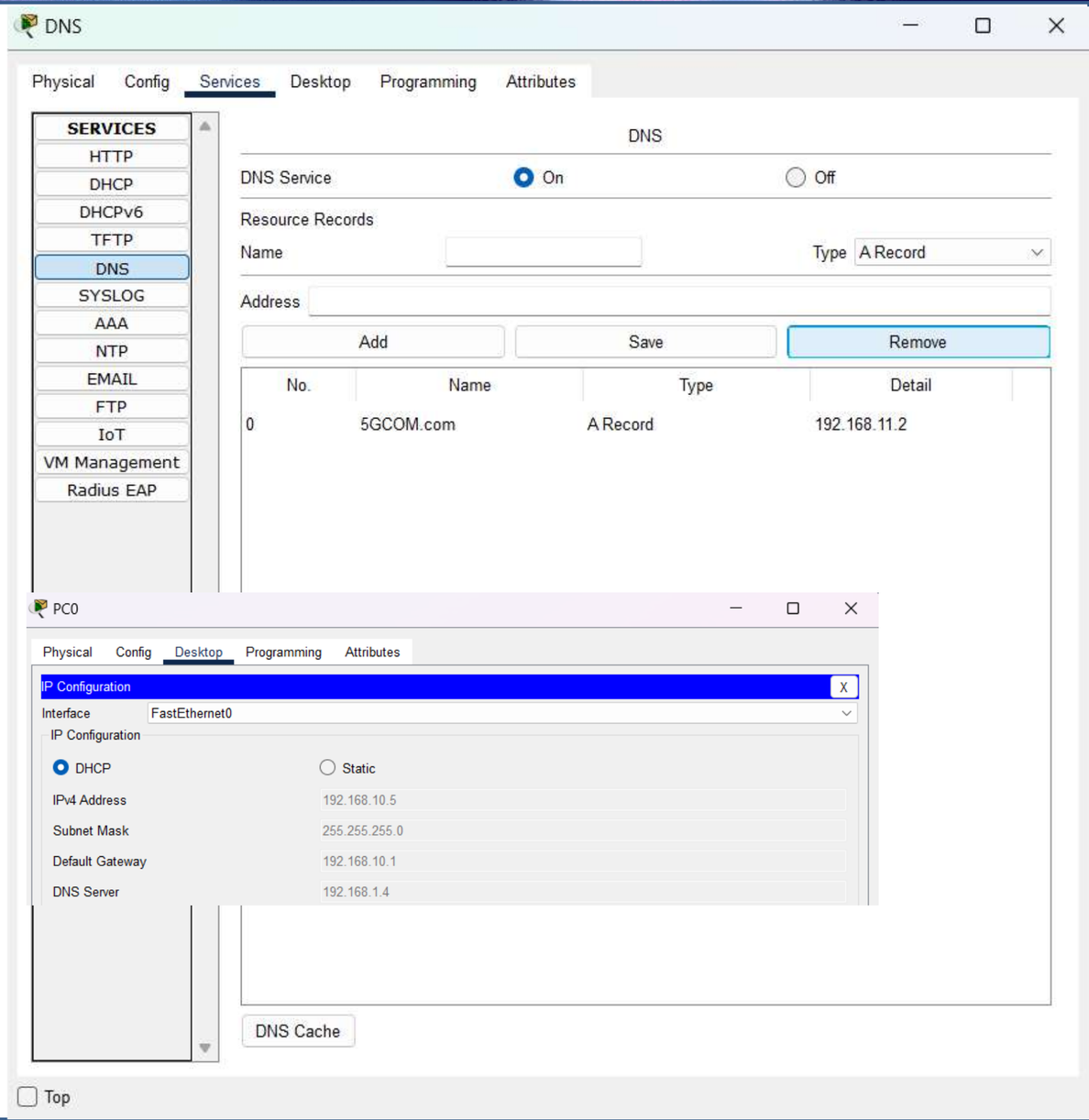
DNS Server

What is DNS?

- DNS (Domain Name System) is like the phonebook of the internet.
- It translates human-readable domain names (e.g., 5GCOM.com) into IP addresses (e.g., 192.168.11.2).

Configration :

- **Click on the server** to open the configuration window.
- Go to **the "Services" tab.**
- From the left menu, select **DNS.**
- **Turn DNS Service ON** (ensure the button is green).
- Under **"Name"**, enter the domain name you want to resolve (5GCOM.com).
- Under **"Address"**, enter the corresponding IP address of the website (e.g., 192.168.11.2 for PC1 or another device that will host the web service).
- Click **Add** to save the record.



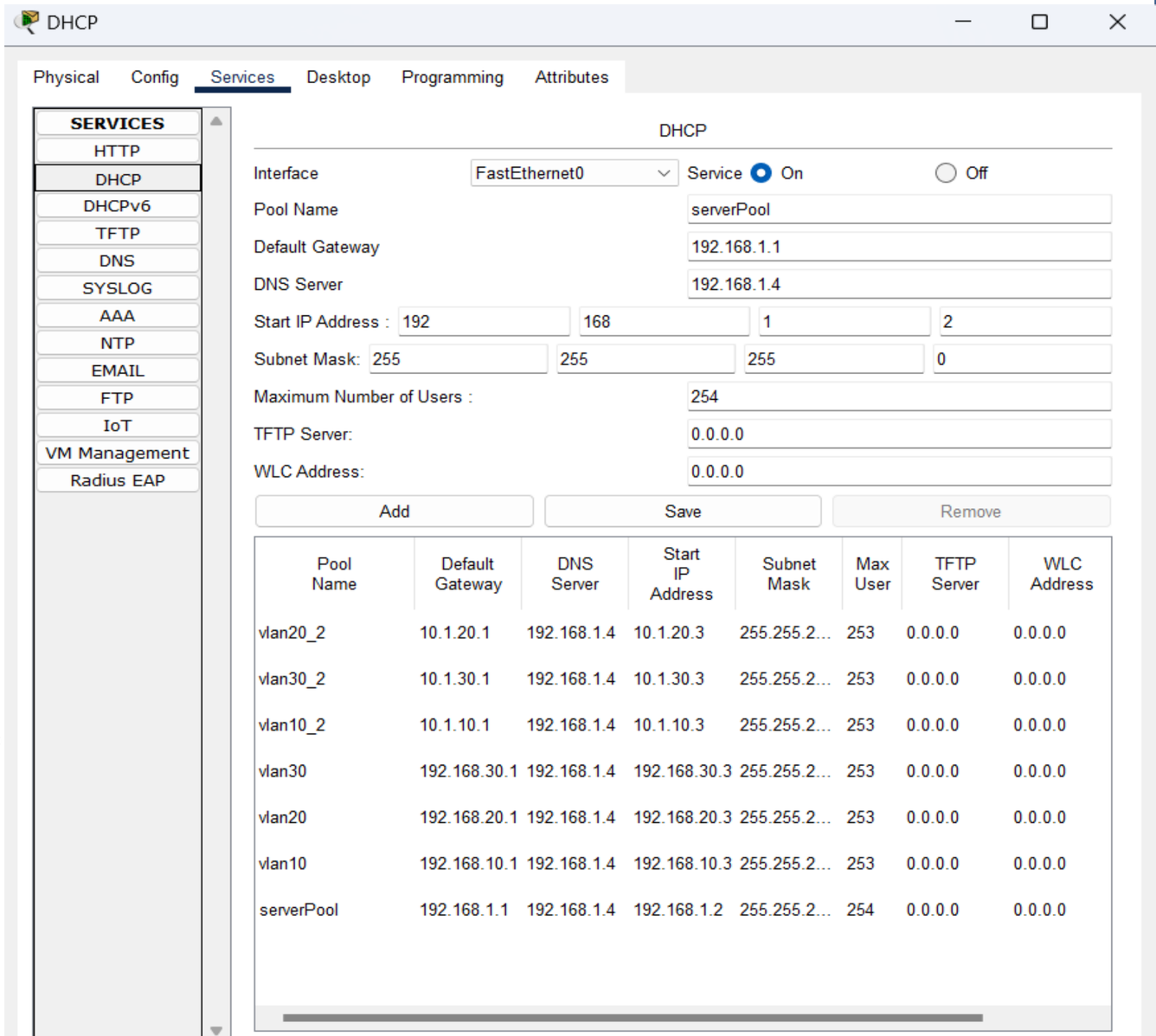
DHCP Server

What is DHCP?

- **DHCP** stands for Dynamic Host Configuration Protocol, a network management protocol used to automatically assign IP addresses and other configuration settings to devices on a network.

Steps to Configure DHCP Server:

- **IP DHCP pool [name]:** Creates a DHCP pool on Cisco devices.
- **Configure Gateway** : Assign default gateway and DNS settings.
- **Configure DNS-Server [DNS IP]**: Specifies DNS server for clients
- **Network [IP/subnet]:** Specifies the range of IP addresses to assign.
- **Click Add** to save
- **Start the DHCP Service**.



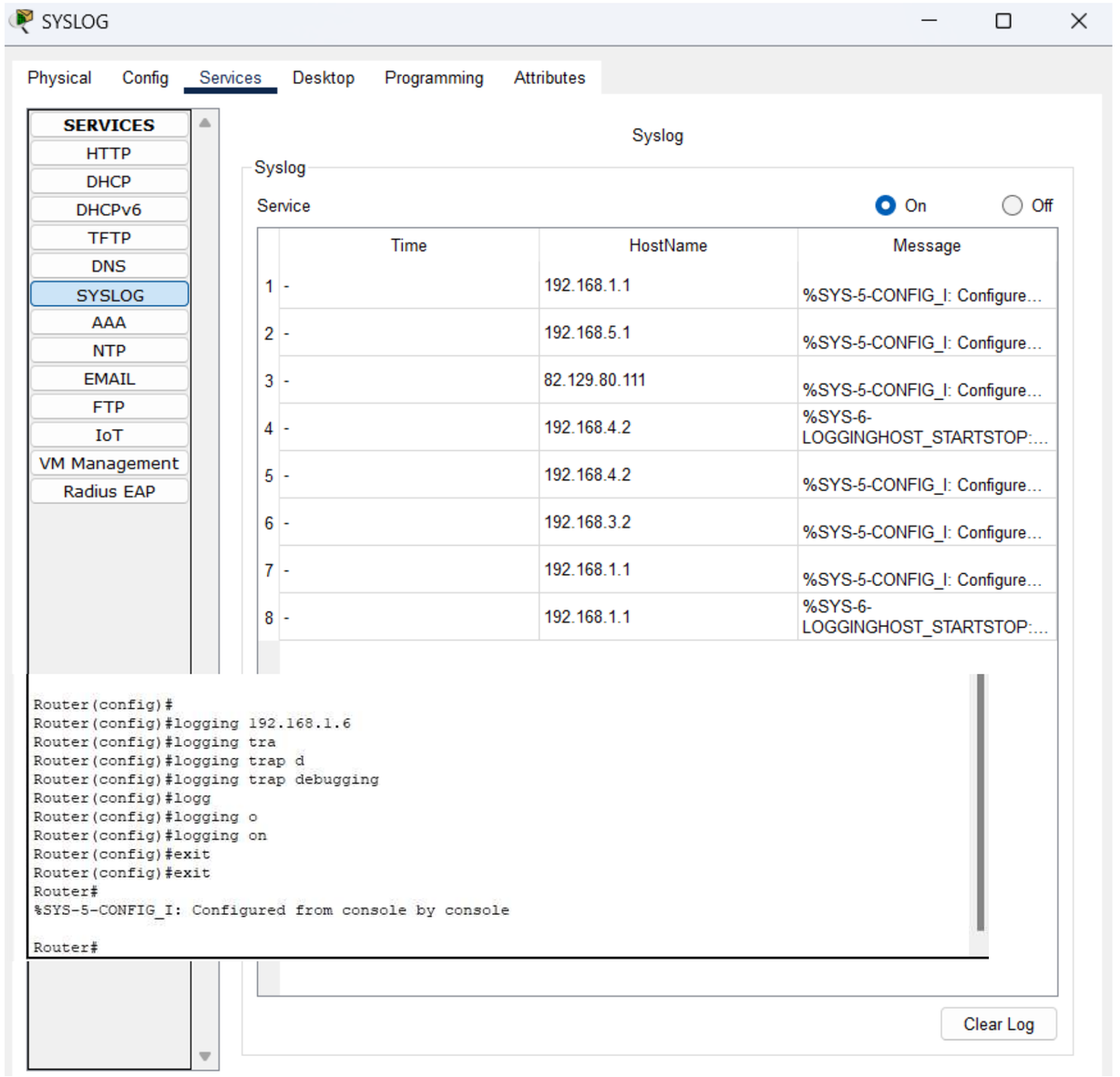
Syslog Server

What is Syslog?

- Syslog (System Logging Protocol) is a standard protocol used to send and receive log messages from various network devices and servers.

Configure the Router :

- **Click on the Router** to open its configuration window.
- Go to the **CLI tab** to access the command-line interface.
- Enter the following commands to configure Syslog logging on the network device:
  - enable
  - configure terminal
    - logging host 192.168.1.6
    - logging trap debugging
    - logging on
    - exit

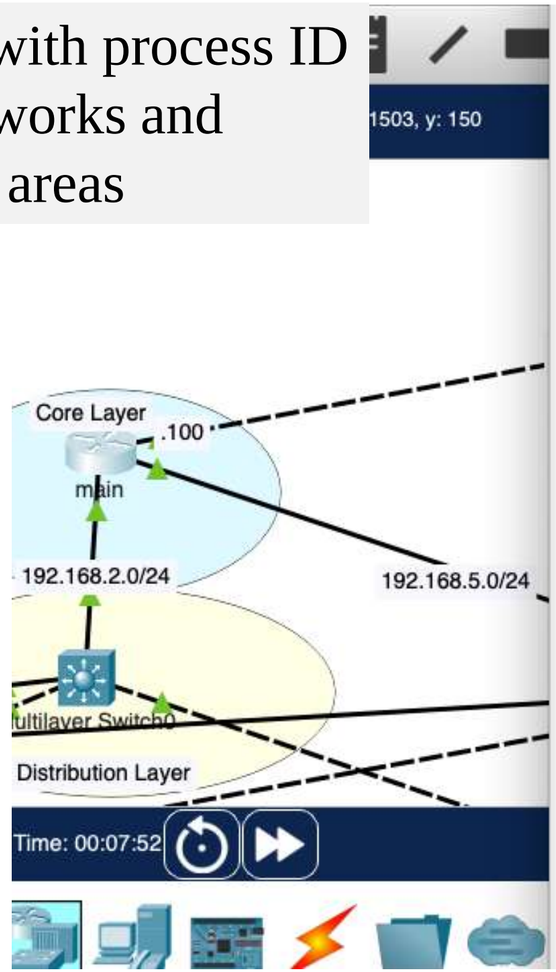


1. OSPF Routing

OSPF Routing protocol

OSPF Configuration

- ❑ Enable OSPF with process ID
- ❑ Define the networks and assign them to areas



Result in main router

Routing table

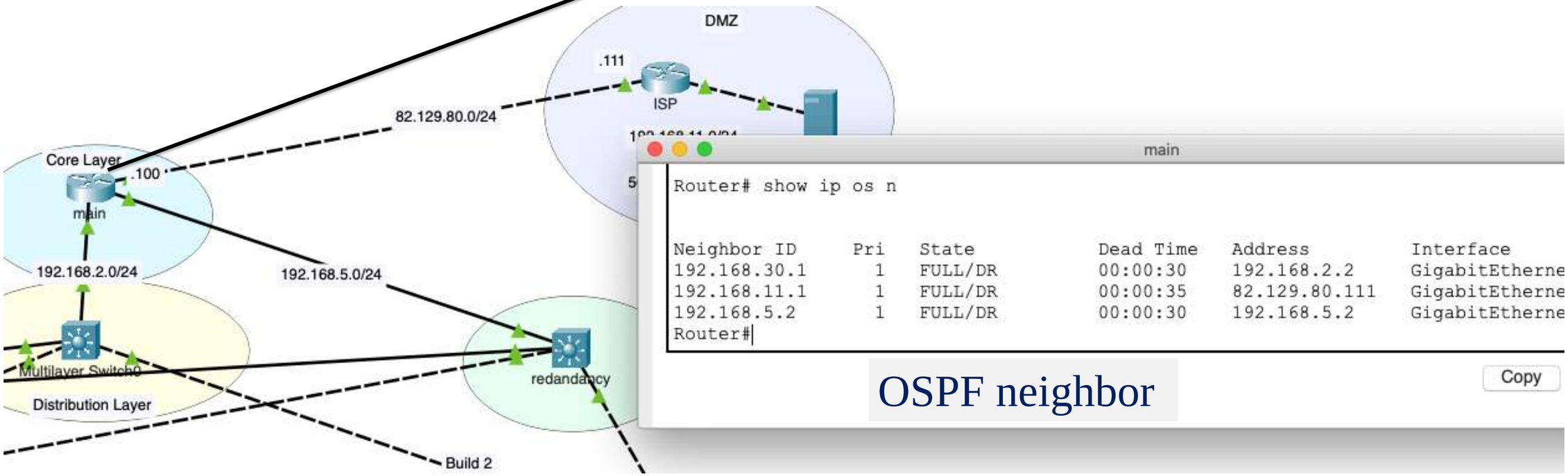
```
     10.0.0.0/24 is subnetted, 3 subnets
O       10.1.10.0/24 [110/2] via 192.168.5.2, 00:4294967262:4294967276,
GigabitEthernet0/2
O       10.1.20.0/24 [110/2] via 192.168.5.2, 00:4294967262:4294967276,
GigabitEthernet0/2
O       10.1.30.0/24 [110/2] via 192.168.5.2, 00:4294967262:4294967276,
GigabitEthernet0/2
     82.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       82.129.80.0/24 is directly connected, GigabitEthernet0/1
L       82.129.80.100/32 is directly connected, GigabitEthernet0/1
O    192.168.1.0/24 [110/3] via 192.168.2.2, 00:4294967262:4294967276,
GigabitEthernet0/0
                    [110/3] via 192.168.5.2, 00:4294967262:4294967276,
GigabitEthernet0/2
     192.168.2.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.2.0/24 is directly connected, GigabitEthernet0/0
L       192.168.2.1/32 is directly connected, GigabitEthernet0/0
O    192.168.3.0/24 [110/2] via 192.168.2.2, 00:4294967262:4294967276,
GigabitEthernet0/0
O    192.168.4.0/24 [110/2] via 192.168.5.2, 00:4294967262:4294967276,
GigabitEthernet0/2
     192.168.5.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.5.0/24 is directly connected, GigabitEthernet0/2
L       192.168.5.1/32 is directly connected, GigabitEthernet0/2
O    192.168.10.0/24 [110/2] via 192.168.2.2, 00:4294967262:4294967276,
GigabitEthernet0/0
O    192.168.11.0/24 [110/2] via 82.129.80.111, 00:4294967262:4294967276,
GigabitEthernet0/1
O    192.168.20.0/24 [110/2] via 192.168.2.2, 00:4294967262:4294967276,
GigabitEthernet0/0
O    192.168.30.0/24 [110/2] via 192.168.2.2, 00:4294967262:4294967276,
GigabitEthernet0/0
```

OSPF Routing

OSPF Routing protocol

OSPF Configuration

Result in main router

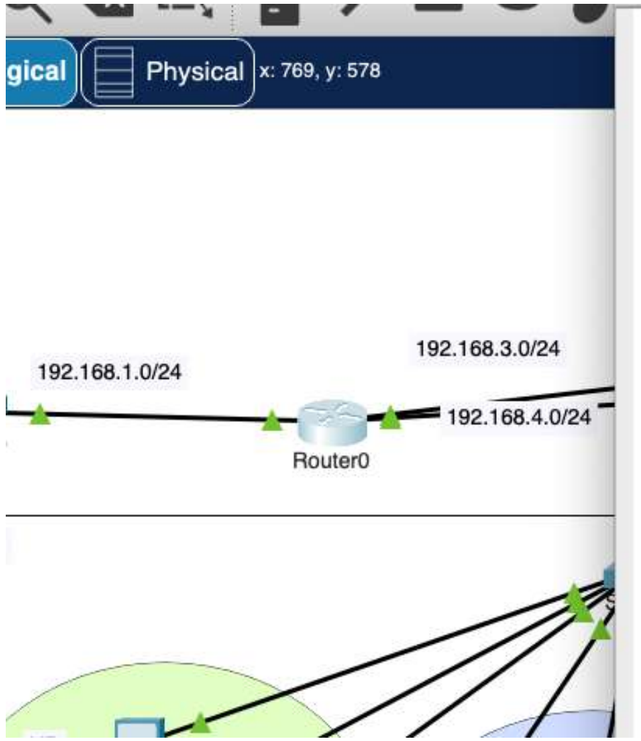


OSPF neighbor

OSPF Routing

OSPF Routing protocol

OSPF Configuration



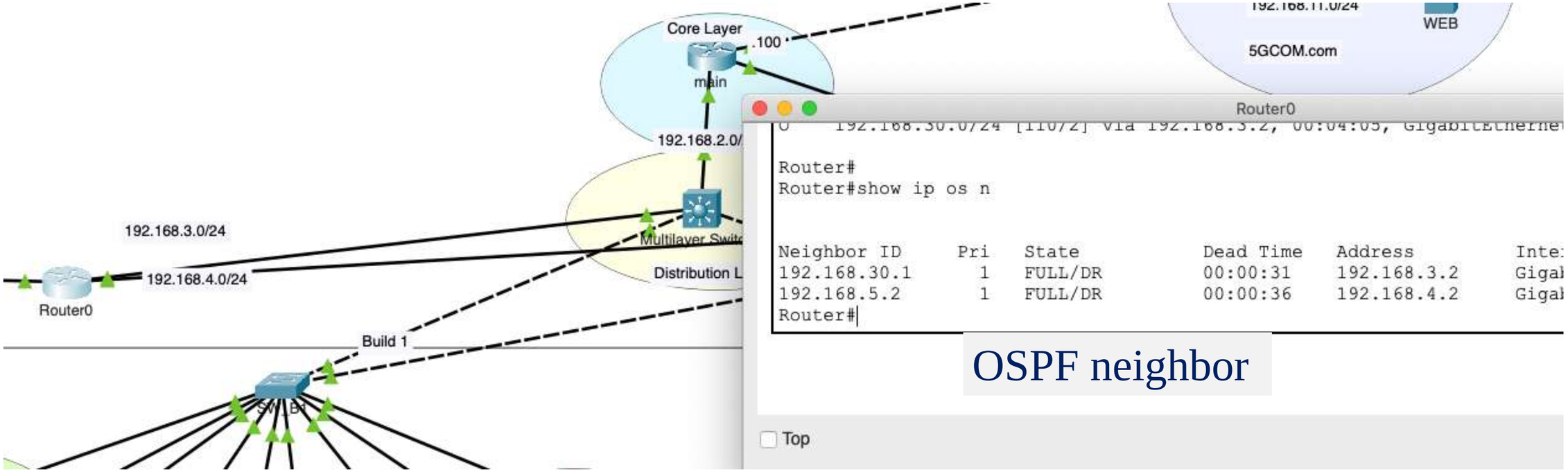
Routing table

```
Gateway of last resort is not set

     10.0.0.0/24 is subnetted, 3 subnets
O       10.1.10.0/24 [110/2] via 192.168.4.2, 00:03:55, GigabitEthernet0/2
O       10.1.20.0/24 [110/2] via 192.168.4.2, 00:03:55, GigabitEthernet0/2
O       10.1.30.0/24 [110/2] via 192.168.4.2, 00:03:55, GigabitEthernet0/2
     82.0.0.0/24 is subnetted, 1 subnets
O       82.129.80.0/24 [110/3] via 192.168.4.2, 00:03:55, GigabitEthernet0/2
                       [110/3] via 192.168.3.2, 00:03:55, GigabitEthernet0/1
     192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/0
L       192.168.1.1/32 is directly connected, GigabitEthernet0/0
O    192.168.2.0/24 [110/2] via 192.168.3.2, 00:03:55, GigabitEthernet0/1
     192.168.3.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.3.0/24 is directly connected, GigabitEthernet0/1
L       192.168.3.1/32 is directly connected, GigabitEthernet0/1
     192.168.4.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.4.0/24 is directly connected, GigabitEthernet0/2
L       192.168.4.1/32 is directly connected, GigabitEthernet0/2
O    192.168.5.0/24 [110/2] via 192.168.4.2, 00:03:55, GigabitEthernet0/2
O    192.168.10.0/24 [110/2] via 192.168.3.2, 00:04:05, GigabitEthernet0/1
O    192.168.11.0/24 [110/4] via 192.168.4.2, 00:03:55, GigabitEthernet0/2
                     [110/4] via 192.168.3.2, 00:03:55, GigabitEthernet0/1
O    192.168.20.0/24 [110/2] via 192.168.3.2, 00:04:05, GigabitEthernet0/1
O    192.168.30.0/24 [110/2] via 192.168.3.2, 00:04:05, GigabitEthernet0/1

Router#
```

OSPF Routing

OSPF Routing protocol

OSPF Configuration

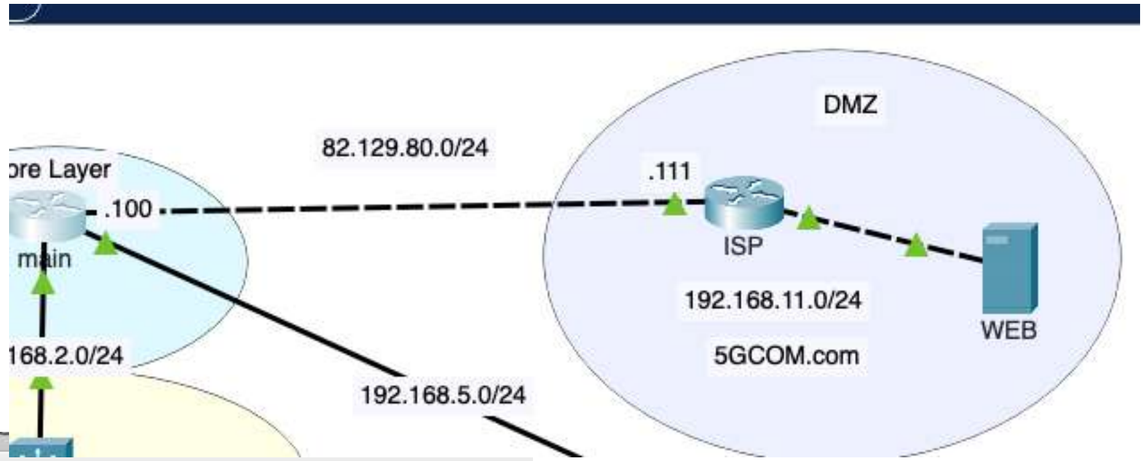


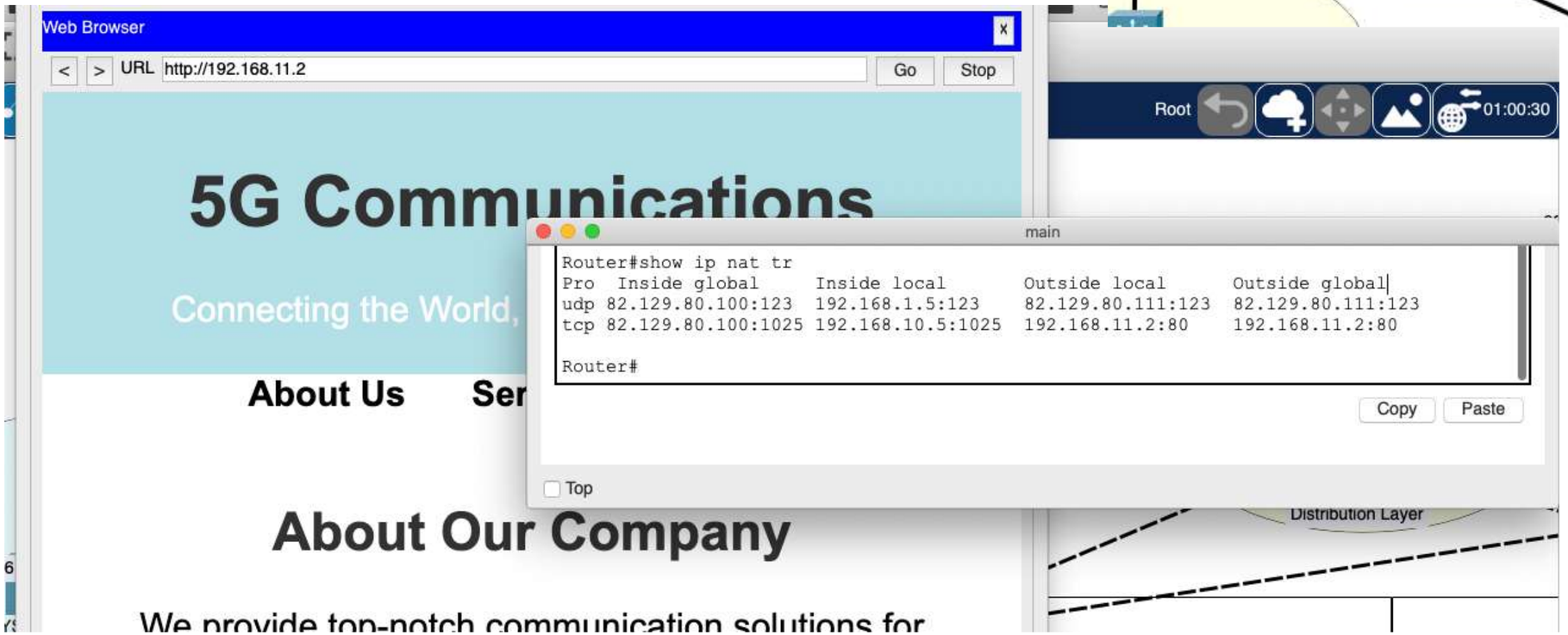
OSPF neighbor

NAT

NAT Protocol

Port Address Translation (PAT)



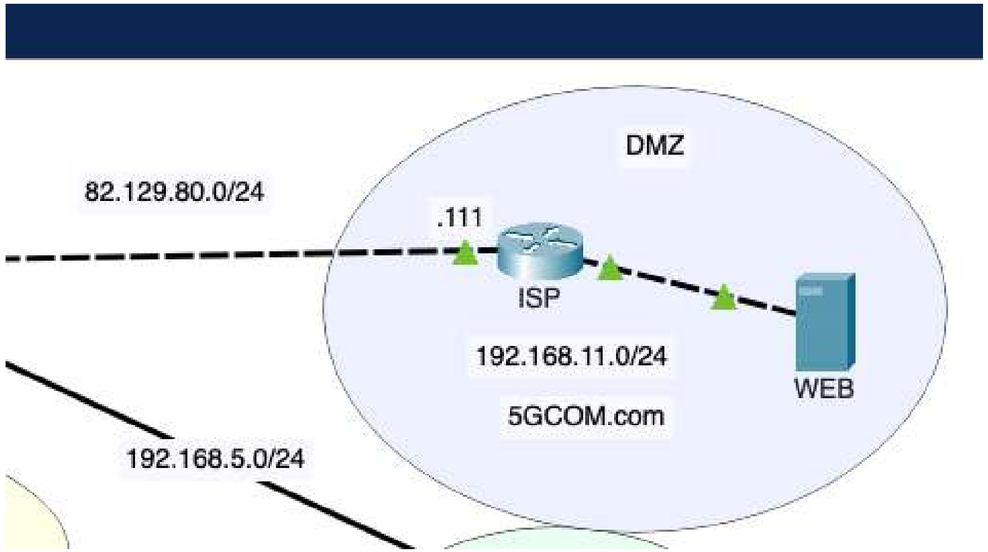


DMZ

A **DMZ (Demilitarized Zone)**

Setup Works in a DMZ

- Web server is assigned a private IP (192.168.11.2) in a dedicated DMZ zone, separated from the internal LAN.
- The server offers public-facing services (HTTP on port 80 in this case), accessible to external users but not directly connected to the internal network.



Router Password Configuration and Network Login

❑ Local Password Authentication

- **Local Password Setup**: configured local password authentication to secure router access. This method involves creating a password directly on the router for users trying to log in through a console and also used the **secret** command, which provides encrypted storage of the password.

❑ Privilege Levels

- Routers have **16 different privilege levels** (0–15), with **level 15** being the highest level, providing full administrative access.

❑ Enable secret

- The **enable secret** is used to move from user EXEC mode (privilege level 1) to privileged EXEC mode (privilege level 15).
- I configured the enable secret to allow authorized users to elevate their privileges after logging in.

```
Current configuration : 1133 bytes
!
version 15.1
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
!
enable secret 5 $1$mERr$gyuIXJhnplcKI.3q1Kd2a/
!
!
!
!
!
!
ip cef
no ipv6 cef
!
!
!
username IT privilege 15 secret 5 $1$mERr$3HhIgMGBA/9qNmgzccuxv0
username user secret 5 $1$mERr$DqFv/bNKU3CFm5jwSLasx/
!
!
license udi pid CISCO2911/K9 sn FTX1524C45G-
!
!
!
!
!
!
!
```

Access Control Lists (ACLs)

- ACLs are used to filter traffic in a network based on specific conditions. There are two main types of ACLs in network security:
  - **Standard ACLs** and **Extended ACLs**.
  - Both serve different purposes and offer different levels of control over the traffic passing through a network device.

- We configured an **Extended IP Access List (ACL)** on the router to enhance network security and manage traffic more efficiently.

```
Router>ena
Router#show acc
Extended IP access list 100
    10 permit tcp any any eq www
    20 deny icmp any any echo
    30 permit ip any any (1877 match(es))
```

Feature	Standard ACL	Extended ACL
Filtering Criteria	Based only on **source IP address**	Based on **source IP, destination IP, protocol, port**
Configuration Range	1–99, 1300–1999	100–199, 2000–2699
Use Case	Basic filtering, less specific control	Detailed traffic filtering with precise control
Placement	Close to **destination**	Close to **source**
Flexibility	Limited, filters by source IP only	Highly flexible, filters by IP, protocol, and port

- **This ACL effectively:**
  - Allows **HTTP web traffic** (TCP port 80).
  - Denies **ICMP ping requests** for security reasons.
  - Permits all other IP traffic to ensure basic network communication.

Port Security

How It Works

1. Limit Devices:

- Example: Only **2 devices** are allowed to connect to a port.

2. Monitor Devices:

- The switch checks the **MAC addresses** of connected devices.

3. Action on Violation:

- If a new (unauthorized) device tries to connect, the switch takes action based on the violation mode (e.g., shutting down the port).

```
Switch>
Switch>ena
Switch#show por
Secure Port MaxSecureAddr CurrentAddr SecurityViolation Security Action
                 (Count)       (Count)         (Count)
---------------------------------------------------------------------
        Fa0/2         1             1                0          Shutdown
        Fa0/3         1             1                0          Shutdown
        Fa0/4         1             0                0          Shutdown
        Fa0/5         1             1                0          Shutdown
        Fa0/6         1             1                0          Shutdown
        Fa0/7         1             1                0          Shutdown
        Fa0/8         1             1                0          Shutdown
        Fa0/9         1             1                0          Shutdown
       Fa0/10         1             0                0          Shutdown
       Fa0/12         1             0                0          Shutdown
---------------------------------------------------------------------
```

```
Switch#show port-security
Secure Port MaxSecureAddr CurrentAddr SecurityViolation Security Action
                 (Count)       (Count)         (Count)
---------------------------------------------------------------------
        Fa0/1         1             1                0          Shutdown
        Fa0/2         1             0                0          Shutdown
        Fa0/3         1             0                0          Shutdown
        Fa0/4         1             0                0          Shutdown
        Fa0/6         1             1                0          Shutdown
        Fa0/7         1             1                0          Shutdown
        Fa0/8         1             1                0          Shutdown
        Fa0/9         1             0                0          Shutdown
       Fa0/10         1             0                0          Shutdown
---------------------------------------------------------------------
Switch#
```