



# Computer Networks

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# Team

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# Roadmap

**Q1**

1. **network topologies**
  - Bus
  - Fully Connected
  - Ring
  - Tree
  - Star
2. **Subnetting**

**Q2**

1. **dynamic routing**
  - OSPF
  - EIGRB
2. **NAT**
  - Static NAT
  - Dynamic NAT
  - PAT NAT

**Q3**

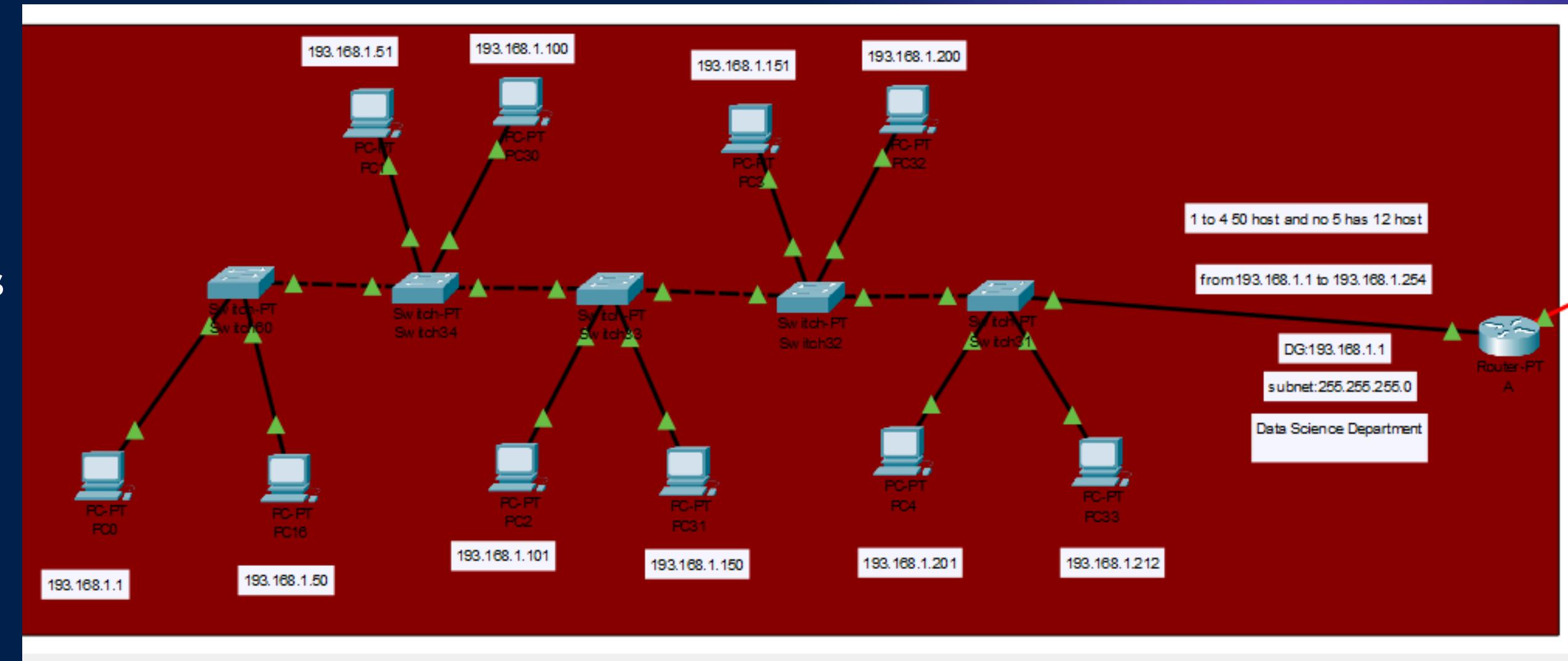
1. **Type of network security**
2. **Additional bonus:**
  - DHCP
  - DNS
  - FTP

# Q1

## Network Topologies

### 1. Bus:

- **The LAN of Computing and Data Science Department contains (212 hosts) represent as BUS topologies with 5 Switch.**
- **In the first 4 switch contain 50 hosts**
- **In the last switch contain 12 host**
- **This LAN full the first IP (193.168.1.0)**

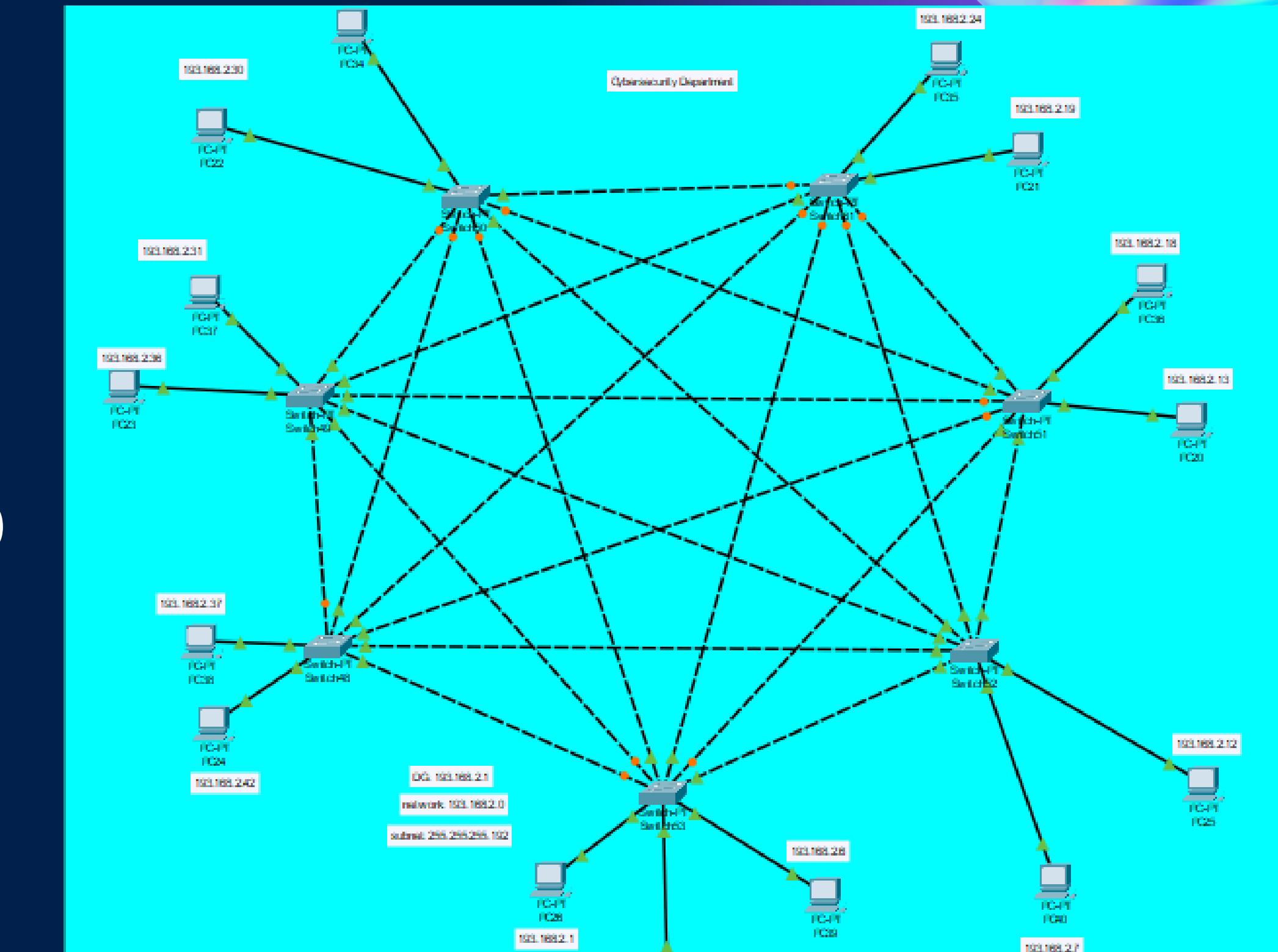


# Q1

## Network Topologies

### 2. Fully Connected:

- The LAN of Cybersecurity Department contains (36 hosts ) represent as Fully Connected topologies with 7 Switch.
- The first 6 switch contain 5 hosts
- The last switch contain 6 host
- This LAN full the Second IP (193.168.2.0) until IP (193.168.2.63)

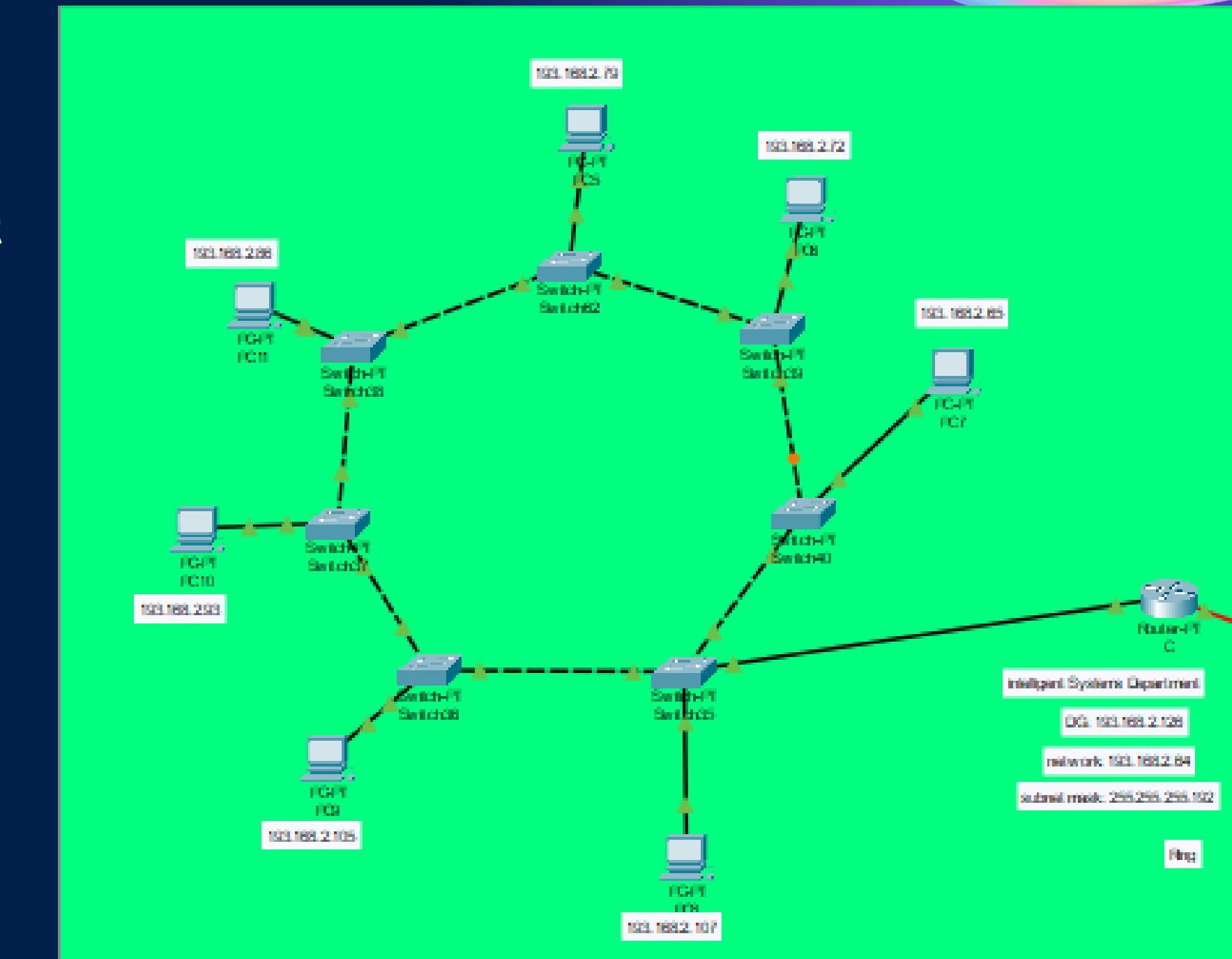


# Q1

## Network Topologies

### 3. Ring:

- **The LAN of Intelligent Systems Department contains (47 hosts ) represent as Ring topologies with 7 Switch.**
- **The first 6 switch contain 7 hosts**
- **The last switch contain 5 host**
- **This LAN full the Second IP from (193.168.2.64) until IP (193.168.2.127)**

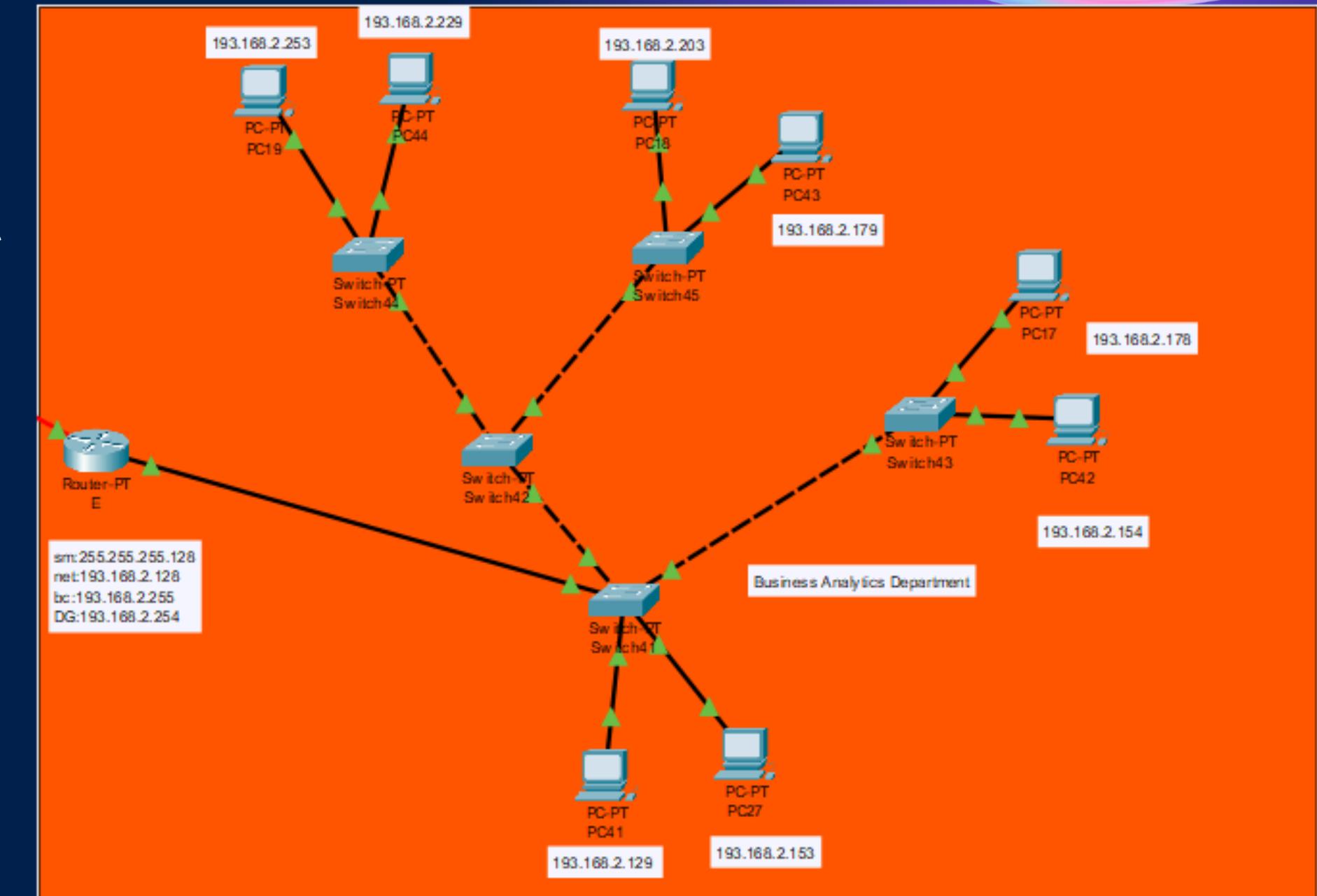


# Q1

# Network Topologies

## 4. Tree:

- **The LAN of Business Analytics Department contains (125 hosts ) represent as Tree topologies with 5 Switch.**
- **The each of 5 switch contain 25 hosts**
- **This LAN full the Second IP from (193.168.2.128) until IP (193.168.2.255)**

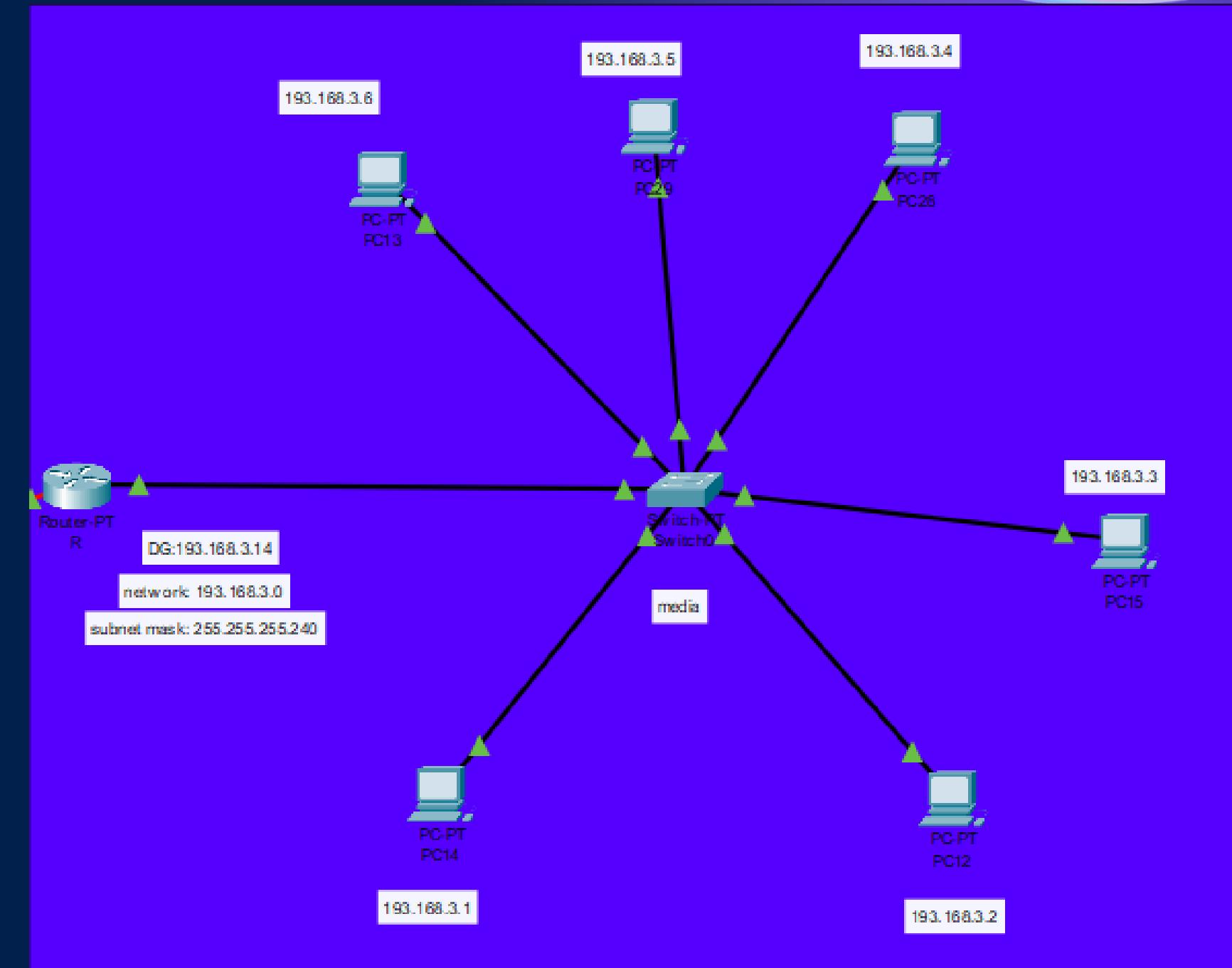


# Q1

## Network Topologies

### 5. Star:

- **The LAN of Media Analytics Department contains (10 hosts ) represent as Star topologies with one Switch only.**
- **The switch contains 10 hosts**
- **This before LAN full the Second IP**
- **This two IP is full with 4 department so, we enter to new IP (193.168.3.0) for this department**
- **This LAN full the Third IP from (193.168.3.0) until IP (193.168.3.15)**



# Q1 1. Subnetting for Computing and Data Science Department (212 Hosts)

Device	First_IP	Last_IP	Subnet mask	Default Gateway	Network IP	Broadcast IP
SWITCH 1	193.168.1.1	193.168.1.50	255.255.255.0	193.168.1.254	193.168.1.0	193.168.1.255
SWITCH 2	193.168.1.51	193.168.1.100	255.255.255.0	193.168.1.254	193.168.1.0	193.168.1.255
SWITCH 3	193.168.1.101	193.168.1.150	255.255.255.0	193.168.1.254	193.168.1.0	193.168.1.255
SWITCH 4	193.168.1.151	193.168.1.200	255.255.255.0	193.168.1.254	193.168.1.0	193.168.1.255
SWITCH 5	193.168.1.201	193.168.1.212	255.255.255.0	193.168.1.254	193.168.1.0	193.168.1.255

# Q1

## 2. Subnetting for Cybersecurity Department (36 Hosts)

Devices	First_IP	Last_IP	Subnet mask	Default Gateway	Network IP	Broadcast IP
SWITCH 1	193.168.2.1	193.168.2.5	255.255.255.192	193.168.2.62	193.168.2.0	193.168.2.63
SWITCH 2	193.168.2.6	193.168.2.10	255.255.255.192	193.168.2.62	193.168.2.0	193.168.2.63
SWITCH 3	193.168.2.11	193.168.2.15	255.255.255.192	193.168.2.62	193.168.2.0	193.168.2.63
SWITCH 4	193.168.2.16	193.168.2.20	255.255.255.192	193.168.2.62	193.168.2.0	193.168.2.63
SWITCH 5	193.168.2.21	193.168.2.25	255.255.255.192	193.168.2.62	193.168.2.0	193.168.2.63
SWITCH 6	193.168.2.26	193.168.2.30	255.255.255.192	193.168.2.62	193.168.2.0	193.168.2.63
SWITCH 7	193.168.2.31	193.168.2.36	255.255.255.192	193.168.2.62	193.168.2.0	193.168.2.63

# Q1

## 3. Subnetting for Intelligent Systems Department (47 Hosts)

Devices	First_IP	Last_IP	Subnet mask	Default Gateway	Network IP	Broadcast IP
SWITCH 1	193.168.2.65	193.168.2.71	255.255.255.192	193.168.2.126	193.168.2.64	193.168.2.127
SWITCH 2	193.168.2.72	193.168.2.78	255.255.255.192	193.168.2.126	193.168.2.64	193.168.2.127
SWITCH 3	193.168.2.79	193.168.2.85	255.255.255.192	193.168.2.126	193.168.2.64	193.168.2.127
SWITCH 4	193.168.2.86	193.168.2.92	255.255.255.192	193.168.2.126	193.168.2.64	193.168.2.127
SWITCH 5	193.168.2.93	193.168.2.99	255.255.255.192	193.168.2.126	193.168.2.64	193.168.2.127
SWITCH 6	193.168.2.100	193.168.2.106	255.255.255.192	193.168.2.126	193.168.2.64	193.168.2.127
SWITCH 7	193.168.2.107	193.168.2.111	255.255.255.192	193.168.2.126	193.168.2.64	193.168.2.127

# Q1

## 4. Subnetting for Business Analytics Department (125 Hosts)

Devices	First_IP	Last_IP	Subnet mask	Default Gateway	Network IP	Broadcast IP
SWITCH 1	193.168.2.129	193.168.2.153	255.255.255.128	193.168.2.254	193.168.2.128	193.168.2.255
SWITCH 2	193.168.2.154	193.168.2.178	255.255.255.128	193.168.2.254	193.168.2.128	193.168.2.255
SWITCH 3	193.168.2.179	193.168.2.203	255.255.255.128	193.168.2.254	193.168.2.128	193.168.2.255
SWITCH 4	193.168.2.204	193.168.2.228	255.255.255.128	193.168.2.254	193.168.2.128	193.168.2.255
SWITCH 5	193.168.2.229	193.168.2.253	255.255.255.128	193.168.2.254	193.168.2.128	193.168.2.255

# Q1

## 5. Subnetting for Media Analytics Department (10 Hosts)

Devices	First_IP	Last_IP	Subnet mask	Default Gateway	Network IP	Broadcast IP
SWITCH 1	193.168.3.1	193.168.3.13	255.255.255.240	193.168.3.14	193.168.3.0	193.168.3.15
PC 14	193.168.3.1		255.255.255.240	193.168.3.14	193.168.3.0	193.168.3.15
PC 12	193.168.3.2		255.255.255.240	193.168.3.14	193.168.3.0	193.168.3.15
PC 15	193.168.3.3		255.255.255.240	193.168.3.14	193.168.3.0	193.168.3.15
PC 28	193.168.3.4		255.255.255.240	193.168.3.14	193.168.3.0	193.168.3.15
PC 29	193.168.3.5		255.255.255.240	193.168.3.14	193.168.3.0	193.168.3.15
PC 13	193.168.3.6		255.255.255.240	193.168.3.14	193.168.3.0	193.168.3.15

# Q1

## 6. Subnetting for Serial for each router

Devices	First_IP	Last_IP	Subnet mask	Network IP
Router A - B	10.0.0.1	10.0.0.2	255.255.255.252	10.0.0.0
Router C - B	10.0.0.5	10.0.0.6	255.255.255.252	10.0.0.4
Router D - B	10.0.0.9	10.0.0.10	255.255.255.252	10.0.0.8
Router E - B	10.0.0.13	10.0.0.14	255.255.255.252	10.0.0.12
Router R - B	10.0.0.17	10.0.0.18	255.255.255.252	10.0.0.16
Router F - B	10.0.0.21	10.0.0.22	255.255.255.252	10.0.0.20
Router N - B	10.0.0.25	10.0.0.26	255.255.255.252	10.0.0.24

# Q2 1. Dynamic routing

- **Routing Protocols:**

- Routing protocols are the rules or algorithms that dictate how routers communicate with each other to direct traffic on a network. They determine the most efficient path for data packets to travel across a complex network of interconnected routers.

- **Open Shortest Path First (OSPF):**

- it is used to find the best and the optimal pathway between the starting point and the destination target router using (its own shortest path first algorithm).
  - The shortest path is calculated with the Dijkstra algorithm.

- **Commands to Configuring OSPF:**

- **(config)# router ospf <process ID>**

- config-router)# network<network ID><wildcard mask>area<area ID>**

- where (Wildcard mask) is : just subtract the subnet mask from the subnet mask  
255.255.255.255.

- command to show the ospf route:

- Router#conf t

- Router(config)#do sh ip route

# OSPF Routing for Computing and Data Science Department

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#do sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

  10.0.0.0/30 is subnetted, 7 subnets
C        10.0.0.0 is directly connected, Serial2/0
O        10.0.0.4 [110/128] via 10.0.0.2, 00:46:39, Serial2/0
O        10.0.0.8 [110/128] via 10.0.0.2, 00:46:39, Serial2/0
O        10.0.0.12 [110/128] via 10.0.0.2, 00:46:39, Serial2/0
O        10.0.0.16 [110/128] via 10.0.0.2, 00:46:39, Serial2/0
O        10.0.0.20 [110/128] via 10.0.0.2, 00:46:39, Serial2/0
O        10.0.0.24 [110/128] via 10.0.0.2, 00:46:39, Serial2/0
O        172.125.0.0/16 [110/129] via 10.0.0.2, 00:46:39, Serial2/0
O        172.126.0.0/16 [110/129] via 10.0.0.2, 00:46:39, Serial2/0
O        174.125.0.0/16 [110/129] via 10.0.0.2, 00:46:39, Serial2/0
O        174.126.0.0/16 [110/129] via 10.0.0.2, 00:46:39, Serial2/0
C        193.168.1.0/24 is directly connected, FastEthernet1/0
        193.168.2.0/24 is variably subnetted, 3 subnets, 2 masks
O          193.168.2.0/26 [110/129] via 10.0.0.2, 00:46:39, Serial2/0
O          193.168.2.64/26 [110/129] via 10.0.0.2, 00:46:39, Serial2/0
O          193.168.2.128/25 [110/129] via 10.0.0.2, 00:46:39, Serial2/0
        193.168.3.0/28 is subnetted, 1 subnets
O          193.168.3.0 [110/129] via 10.0.0.2, 00:46:39, Serial2/0
```

# OSPF Routing for Cybersecurity Department:



```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#do show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

  10.0.0.0/30 is subnetted, 7 subnets
O   10.0.0.0 [110/128] via 10.0.0.10, 00:58:38, Serial2/0
O   10.0.0.4 [110/128] via 10.0.0.10, 00:58:38, Serial2/0
C   10.0.0.8 is directly connected, Serial2/0
O   10.0.0.12 [110/128] via 10.0.0.10, 00:58:38, Serial2/0
O   10.0.0.16 [110/128] via 10.0.0.10, 00:58:38, Serial2/0
O   10.0.0.20 [110/128] via 10.0.0.10, 00:58:38, Serial2/0
O   10.0.0.24 [110/128] via 10.0.0.10, 00:58:38, Serial2/0
O   172.125.0.0/16 [110/129] via 10.0.0.10, 00:58:28, Serial2/0
O   172.126.0.0/16 [110/129] via 10.0.0.10, 00:58:28, Serial2/0
O   174.125.0.0/16 [110/129] via 10.0.0.10, 00:58:28, Serial2/0
O   174.126.0.0/16 [110/129] via 10.0.0.10, 00:58:28, Serial2/0
O   193.168.1.0/24 [110/129] via 10.0.0.10, 00:58:28, Serial2/0
  193.168.2.0/24 is variably subnetted, 3 subnets, 2 masks
C     193.168.2.0/26 is directly connected, FastEthernet0/0
O     193.168.2.64/26 [110/129] via 10.0.0.10, 00:58:28, Serial2/0
O     193.168.2.128/25 [110/129] via 10.0.0.10, 00:58:28, Serial2/0
  193.168.3.0/28 is subnetted, 1 subnets
O     193.168.3.0 [110/129] via 10.0.0.10, 00:58:28, Serial2/0
```

# OSPF Routing for Intelligent Systems

## Department

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#do sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      p - periodic downloaded static route

Gateway of last resort is not set

  10.0.0.0/30 is subnetted, 7 subnets
O   10.0.0.0 [110/128] via 10.0.0.6, 01:06:56, Serial2/0
C   10.0.0.4 is directly connected, Serial2/0
O   10.0.0.8 [110/128] via 10.0.0.6, 01:06:56, Serial2/0
O   10.0.0.12 [110/128] via 10.0.0.6, 01:06:56, Serial2/0
O   10.0.0.16 [110/128] via 10.0.0.6, 01:06:56, Serial2/0
O   10.0.0.20 [110/128] via 10.0.0.6, 01:06:56, Serial2/0
O   10.0.0.24 [110/128] via 10.0.0.6, 01:06:56, Serial2/0
O   172.125.0.0/16 [110/129] via 10.0.0.6, 01:06:46, Serial2/0
O   172.126.0.0/16 [110/129] via 10.0.0.6, 01:06:46, Serial2/0
O   174.125.0.0/16 [110/129] via 10.0.0.6, 01:06:46, Serial2/0
O   174.126.0.0/16 [110/129] via 10.0.0.6, 01:06:46, Serial2/0
O   193.168.1.0/24 [110/129] via 10.0.0.6, 01:06:46, Serial2/0
      193.168.2.0/24 is variably subnetted, 3 subnets, 2 masks
O     193.168.2.0/26 [110/129] via 10.0.0.6, 01:06:56, Serial2/0
C     193.168.2.64/26 is directly connected, FastEthernet0/0
O     193.168.2.128/25 [110/129] via 10.0.0.6, 01:06:56, Serial2/0
      193.168.3.0/28 is subnetted, 1 subnets
O     193.168.3.0 [110/129] via 10.0.0.6, 01:06:56, Serial2/0
```

# OSPF Routing for Business Analytics Department

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#do sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

      10.0.0.0/30 is subnetted, 7 subnets
O        10.0.0.0 [110/128] via 10.0.0.14, 01:09:26, Serial2/0
O        10.0.0.4 [110/128] via 10.0.0.14, 01:09:26, Serial2/0
O        10.0.0.8 [110/128] via 10.0.0.14, 01:09:26, Serial2/0
C        10.0.0.12 is directly connected, Serial2/0
O        10.0.0.16 [110/128] via 10.0.0.14, 01:09:26, Serial2/0
O        10.0.0.20 [110/128] via 10.0.0.14, 01:09:26, Serial2/0
O        10.0.0.24 [110/128] via 10.0.0.14, 01:09:26, Serial2/0
O        172.125.0.0/16 [110/129] via 10.0.0.14, 01:09:26, Serial2/0
O        172.126.0.0/16 [110/129] via 10.0.0.14, 01:09:26, Serial2/0
O        174.125.0.0/16 [110/129] via 10.0.0.14, 01:09:26, Serial2/0
O        174.126.0.0/16 [110/129] via 10.0.0.14, 01:09:26, Serial2/0
O        193.168.1.0/24 [110/129] via 10.0.0.14, 01:09:26, Serial2/0
          193.168.2.0/24 is variably subnetted, 3 subnets, 2 masks
O            193.168.2.0/26 [110/129] via 10.0.0.14, 01:09:26, Serial2/0
O            193.168.2.64/26 [110/129] via 10.0.0.14, 01:09:26, Serial2/0
C            193.168.2.128/25 is directly connected, FastEthernet0/0
          193.168.3.0/28 is subnetted, 1 subnets
O            193.168.3.0 [110/129] via 10.0.0.14, 01:09:26, Serial2/0
```

# OSPF Routing for Media Analytics Department

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#do sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

      10.0.0.0/30 is subnetted, 7 subnets
O        10.0.0.0 [110/128] via 10.0.0.18, 01:11:59, Serial2/0
O        10.0.0.4 [110/128] via 10.0.0.18, 01:11:59, Serial2/0
O        10.0.0.8 [110/128] via 10.0.0.18, 01:11:59, Serial2/0
O        10.0.0.12 [110/128] via 10.0.0.18, 01:11:59, Serial2/0
C        10.0.0.16 is directly connected, Serial2/0
O        10.0.0.20 [110/128] via 10.0.0.18, 01:11:59, Serial2/0
O        10.0.0.24 [110/128] via 10.0.0.18, 01:11:59, Serial2/0
O        172.125.0.0/16 [110/129] via 10.0.0.18, 01:11:49, Serial2/0
O        172.126.0.0/16 [110/129] via 10.0.0.18, 01:11:49, Serial2/0
O        174.125.0.0/16 [110/129] via 10.0.0.18, 01:11:49, Serial2/0
O        174.126.0.0/16 [110/129] via 10.0.0.18, 01:11:49, Serial2/0
O        193.168.1.0/24 [110/129] via 10.0.0.18, 01:11:49, Serial2/0
        193.168.2.0/24 is variably subnetted, 3 subnets, 2 masks
O          193.168.2.0/26 [110/129] via 10.0.0.18, 01:11:49, Serial2/0
O          193.168.2.64/26 [110/129] via 10.0.0.18, 01:11:49, Serial2/0
O          193.168.2.128/25 [110/129] via 10.0.0.18, 01:11:49, Serial2/0
        193.168.3.0/28 is subnetted, 1 subnets
C          193.168.3.0 is directly connected, FastEthernet0/0
```

# OSPF Routing for Router in center B

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#do sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      p - periodic downloaded static route

Gateway of last resort is not set

      10.0.0.0/30 is subnetted, 7 subnets
C        10.0.0.0 is directly connected, Serial6/0
C        10.0.0.4 is directly connected, Serial7/0
C        10.0.0.8 is directly connected, Serial8/0
C        10.0.0.12 is directly connected, Serial9/0
C        10.0.0.16 is directly connected, Serial5/0
C        10.0.0.20 is directly connected, Serial3/0
C        10.0.0.24 is directly connected, Serial2/0
O        172.125.0.0/16 [110/65] via 10.0.0.25, 01:13:15, Serial2/0
O        172.126.0.0/16 [110/65] via 10.0.0.25, 01:13:15, Serial2/0
O        174.125.0.0/16 [110/65] via 10.0.0.21, 01:13:15, Serial3/0
O        174.126.0.0/16 [110/65] via 10.0.0.21, 01:13:15, Serial3/0
O        193.168.1.0/24 [110/65] via 10.0.0.1, 01:13:15, Serial6/0
          193.168.2.0/24 is variably subnetted, 3 subnets, 2 masks
O            193.168.2.0/26 [110/65] via 10.0.0.9, 01:13:15, Serial8/0
O            193.168.2.64/26 [110/65] via 10.0.0.5, 01:13:15, Serial7/0
O            193.168.2.128/25 [110/65] via 10.0.0.13, 01:13:15, Serial9/0
          193.168.3.0/28 is subnetted, 1 subnets
O            193.168.3.0 [110/65] via 10.0.0.17, 01:13:15, Serial5/0
```

# OSPF Routing for General server



```
Router>
Router>EN
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#do sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

  10.0.0.0/30 is subnetted, 7 subnets
O   10.0.0.0 [110/128] via 10.0.0.22, 00:30:04, Serial3/0
O   10.0.0.4 [110/128] via 10.0.0.22, 00:30:04, Serial3/0
O   10.0.0.8 [110/128] via 10.0.0.22, 00:30:04, Serial3/0
O   10.0.0.12 [110/128] via 10.0.0.22, 00:30:04, Serial3/0
O   10.0.0.16 [110/128] via 10.0.0.22, 00:30:04, Serial3/0
C   10.0.0.20 is directly connected, Serial3/0
O   10.0.0.24 [110/128] via 10.0.0.22, 00:30:04, Serial3/0
O   172.125.0.0/16 [110/129] via 10.0.0.22, 00:30:04, Serial3/0
O   172.126.0.0/16 [110/129] via 10.0.0.22, 00:30:04, Serial3/0
C   174.125.0.0/16 is directly connected, FastEthernet0/0
C   174.126.0.0/16 is directly connected, FastEthernet1/0
O   193.168.1.0/24 [110/129] via 10.0.0.22, 00:30:04, Serial3/0
  193.168.2.0/24 is variably subnetted, 3 subnets, 2 masks
O     193.168.2.0/26 [110/129] via 10.0.0.22, 00:30:04, Serial3/0
O     193.168.2.64/26 [110/129] via 10.0.0.22, 00:30:04, Serial3/0
O     193.168.2.128/25 [110/129] via 10.0.0.22, 00:30:04, Serial3/0
  193.168.3.0/28 is subnetted, 1 subnets
O     193.168.3.0 [110/129] via 10.0.0.22, 00:30:04, Serial3/0
```

# OSPF Routing for Special server

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#do sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

      10.0.0.0/30 is subnetted, 7 subnets
O       10.0.0.0 [110/128] via 10.0.0.26, 00:33:22, Serial3/0
O       10.0.0.4 [110/128] via 10.0.0.26, 00:33:22, Serial3/0
O       10.0.0.8 [110/128] via 10.0.0.26, 00:33:22, Serial3/0
O       10.0.0.12 [110/128] via 10.0.0.26, 00:33:22, Serial3/0
O       10.0.0.16 [110/128] via 10.0.0.26, 00:33:22, Serial3/0
O       10.0.0.20 [110/128] via 10.0.0.26, 00:33:22, Serial3/0
C       10.0.0.24 is directly connected, Serial3/0
C       172.125.0.0/16 is directly connected, FastEthernet0/0
C       172.126.0.0/16 is directly connected, FastEthernet1/0
O       174.125.0.0/16 [110/129] via 10.0.0.26, 00:33:22, Serial3/0
O       174.126.0.0/16 [110/129] via 10.0.0.26, 00:33:22, Serial3/0
O       193.168.1.0/24 [110/129] via 10.0.0.26, 00:33:22, Serial3/0
      193.168.2.0/24 is variably subnetted, 3 subnets, 2 masks
O       193.168.2.0/26 [110/129] via 10.0.0.26, 00:33:22, Serial3/0
O       193.168.2.64/26 [110/129] via 10.0.0.26, 00:33:22, Serial3/0
O       193.168.2.128/25 [110/129] via 10.0.0.26, 00:33:22, Serial3/0
      193.168.3.0/28 is subnetted, 1 subnets
O       193.168.3.0 [110/129] via 10.0.0.26, 00:33:22, Serial3/0
```

# Q2

## 1. Dynamic routing

### 2. Eigrp Routing :

**Eigrp protocol (Enhanced Interior Gateway Routing Protocol) is dynamic system designed by ciso**

#### Feature:

**1-Fast Convergence:uses diffusing computations (DUAL - Diffusing Update Algorithm) to calculate the shortest path quickly, leading to faster convergence**

**2-EIGRP uses Diffusing update algorithm to calculate the best path.**

**3-The metrics used are bandwidth, delay, load and reliability**

# EIGRP Routing for Computing and Data Science Department

```
Router(config)#do sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

  10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
D    10.0.0.0/8 is a summary, 00:06:51, Null0
C    10.0.0.0/30 is directly connected, Serial2/0
D    10.0.0.4/30 [90/21024000] via 10.0.0.2, 00:06:51, Serial2/0
D    10.0.0.8/30 [90/21024000] via 10.0.0.2, 00:06:51, Serial2/0
D    10.0.0.12/30 [90/21024000] via 10.0.0.2, 00:06:51, Serial2/0
D    10.0.0.16/30 [90/21024000] via 10.0.0.2, 00:06:51, Serial2/0
D    10.0.0.20/30 [90/21024000] via 10.0.0.2, 00:06:51, Serial2/0
D    10.0.0.24/30 [90/21024000] via 10.0.0.2, 00:06:51, Serial2/0
D    172.125.0.0/16 [90/21026560] via 10.0.0.2, 00:06:51, Serial2/0
D    172.126.0.0/16 [90/21026560] via 10.0.0.2, 00:06:51, Serial2/0
D    174.125.0.0/16 [90/21026560] via 10.0.0.2, 00:06:51, Serial2/0

--More--
```

# EIGRP Routing for Intelligent Systems

## Department

```
Router(config)#do sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
        i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
        * - candidate default, U - per-user static route, o - ODR
        P - periodic downloaded static route

Gateway of last resort is not set

      10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
D    10.0.0.0/8 is a summary, 00:12:20, Null0
D    10.0.0.0/30 [90/21024000] via 10.0.0.6, 00:12:20, Serial2/0
C    10.0.0.4/30 is directly connected, Serial2/0
D    10.0.0.8/30 [90/21024000] via 10.0.0.6, 00:12:20, Serial2/0
D    10.0.0.12/30 [90/21024000] via 10.0.0.6, 00:12:20, Serial2/0
D    10.0.0.16/30 [90/21024000] via 10.0.0.6, 00:12:20, Serial2/0
D    10.0.0.20/30 [90/21024000] via 10.0.0.6, 00:12:20, Serial2/0
D    10.0.0.24/30 [90/21024000] via 10.0.0.6, 00:12:20, Serial2/0
D    172.125.0.0/16 [90/21026560] via 10.0.0.6, 00:12:20, Serial2/0
D    172.126.0.0/16 [90/21026560] via 10.0.0.6, 00:12:20, Serial2/0
D    174.125.0.0/16 [90/21026560] via 10.0.0.6, 00:12:17, Serial2/0
--More-- |
```

# EIGRP Routing for Cybersecurity Department:

```
Router(config)#do sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

      10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
D        10.0.0.0/8 is a summary, 00:01:23, Null0
D        10.0.0.0/30 [90/21024000] via 10.0.0.10, 00:01:23, Serial2/0
D        10.0.0.4/30 [90/21024000] via 10.0.0.10, 00:01:23, Serial2/0
C        10.0.0.8/30 is directly connected, Serial2/0
D        10.0.0.12/30 [90/21024000] via 10.0.0.10, 00:01:23, Serial2/0
D        10.0.0.16/30 [90/21024000] via 10.0.0.10, 00:01:23, Serial2/0
D        10.0.0.20/30 [90/21024000] via 10.0.0.10, 00:01:23, Serial2/0
D        10.0.0.24/30 [90/21024000] via 10.0.0.10, 00:01:23, Serial2/0
D        172.125.0.0/16 [90/21026560] via 10.0.0.10, 00:01:23, Serial2/0
D        172.126.0.0/16 [90/21026560] via 10.0.0.10, 00:01:23, Serial2/0
D        174.125.0.0/16 [90/21026560] via 10.0.0.10, 00:01:23, Serial2/0
```

# EIGRP Routing for Business Analytics Department

```
Router(config)#do sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route
```

Gateway of last resort is not set

```
    10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
D      10.0.0.0/8 is a summary, 00:02:53, Null0
D      10.0.0.0/30 [90/21024000] via 10.0.0.14, 00:02:53, Serial2/0
D      10.0.0.4/30 [90/21024000] via 10.0.0.14, 00:02:53, Serial2/0
D      10.0.0.8/30 [90/21024000] via 10.0.0.14, 00:02:53, Serial2/0
C      10.0.0.12/30 is directly connected, Serial2/0
D      10.0.0.16/30 [90/21024000] via 10.0.0.14, 00:02:53, Serial2/0
D      10.0.0.20/30 [90/21024000] via 10.0.0.14, 00:02:53, Serial2/0
D      10.0.0.24/30 [90/21024000] via 10.0.0.14, 00:02:53, Serial2/0
D      172.125.0.0/16 [90/21026560] via 10.0.0.14, 00:02:53, Serial2/0
D      172.126.0.0/16 [90/21026560] via 10.0.0.14, 00:02:53, Serial2/0
D      174.125.0.0/16 [90/21026560] via 10.0.0.14, 00:02:53, Serial2/0
```

--More--

# EIGRP Routing for Media Analytics Department

```
Router(config)#do sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
        i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
        * - candidate default, U - per-user static route, o - ODR
        P - periodic downloaded static route
```

Gateway of last resort is not set

```
    10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
D      10.0.0.0/8 is a summary, 00:00:08, Null0
D      10.0.0.0/30 [90/21024000] via 10.0.0.18, 00:00:08, Serial2/0
D      10.0.0.4/30 [90/21024000] via 10.0.0.18, 00:00:08, Serial2/0
D      10.0.0.8/30 [90/21024000] via 10.0.0.18, 00:00:08, Serial2/0
D      10.0.0.12/30 [90/21024000] via 10.0.0.18, 00:00:08, Serial2/0
C      10.0.0.16/30 is directly connected, Serial2/0
D      10.0.0.20/30 [90/21024000] via 10.0.0.18, 00:00:08, Serial2/0
D      10.0.0.24/30 [90/21024000] via 10.0.0.18, 00:00:08, Serial2/0
D      172.125.0.0/16 [90/21026560] via 10.0.0.18, 00:00:08, Serial2/0
D      172.126.0.0/16 [90/21026560] via 10.0.0.18, 00:00:08, Serial2/0
D      174.125.0.0/16 [90/21026560] via 10.0.0.18, 00:00:08, Serial2/0
```

# EIGRP Routing for General server

```
Router(config)#do sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
      D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
      N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
      E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
      i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
      * - candidate default, U - per-user static route, o - ODR
      P - periodic downloaded static route

Gateway of last resort is not set

      10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
D        10.0.0.0/8 is a summary, 00:01:29, Null0
D        10.0.0.0/30 [90/21024000] via 10.0.0.22, 00:01:29, Serial3/0
D        10.0.0.4/30 [90/21024000] via 10.0.0.22, 00:01:29, Serial3/0
D        10.0.0.8/30 [90/21024000] via 10.0.0.22, 00:01:29, Serial3/0
D        10.0.0.12/30 [90/21024000] via 10.0.0.22, 00:01:29, Serial3/0
D        10.0.0.16/30 [90/21024000] via 10.0.0.22, 00:01:29, Serial3/0
C        10.0.0.20/30 is directly connected, Serial3/0
D        10.0.0.24/30 [90/21024000] via 10.0.0.22, 00:01:26, Serial3/0
D        172.125.0.0/16 [90/21026560] via 10.0.0.22, 00:01:26, Serial3/0
D        172.126.0.0/16 [90/21026560] via 10.0.0.22, 00:01:25, Serial3/0
C        174.125.0.0/16 is directly connected, FastEthernet0/0
--More-- |
```

# EIGRP Routing for Special server

```
Router(config)#do sh ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
        i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
        * - candidate default, U - per-user static route, o - ODR
        P - periodic downloaded static route
```

```
Gateway of last resort is not set
```

```
    10.0.0.0/8 is variably subnetted, 8 subnets, 2 masks
D      10.0.0.0/8 is a summary, 00:01:02, Null0
D      10.0.0.0/30 [90/21024000] via 10.0.0.26, 00:00:54, Serial3/0
D      10.0.0.4/30 [90/21024000] via 10.0.0.26, 00:00:54, Serial3/0
D      10.0.0.8/30 [90/21024000] via 10.0.0.26, 00:00:54, Serial3/0
D      10.0.0.12/30 [90/21024000] via 10.0.0.26, 00:00:54, Serial3/0
D      10.0.0.16/30 [90/21024000] via 10.0.0.26, 00:00:54, Serial3/0
D      10.0.0.20/30 [90/21024000] via 10.0.0.26, 00:00:54, Serial3/0
C      10.0.0.24/30 is directly connected, Serial3/0
C      172.125.0.0/16 is directly connected, FastEthernet0/0
C      172.126.0.0/16 is directly connected, FastEthernet1/0
D      174.125.0.0/16 [90/21026560] via 10.0.0.26, 00:00:54, Serial3/0
```

```
--More--
```

# Q2

## 2. NAT

### Nating:

**we applying a nating for more security to convert privets IP to public IP by 3 ways**

- **Dynamic**
- **Static**
- **Pat**

**Note:** when applying Nating between devices cant send a packet from the device in a specific topology to another PC, the PC in the second topology cant translate the IP that coming

**Just from pc to router or pc to server**

**Note:** we can apply Nating on the server to solve this we added another device with another network to apply static and Dynamic Nating on router that carry the server

## PAT: we apply the pat on 5 department

### the pat on Business department

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#do sh ip nat trans
Pro Inside global      Inside local      Outside local      Outside global
icmp 10.0.0.13:7       193.168.2.129:7   172.125.12.9:7   172.125.12.9:7
icmp 10.0.0.13:8       193.168.2.129:8   10.0.0.17:8     10.0.0.17:8
```

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#do sh ip nat trans
Pro Inside global      Inside local      Outside local      Outside global
icmp 10.0.0.9:1         193.168.2.6:1    172.125.12.9:1   172.125.12.9:1
icmp 10.0.0.9:2         193.168.2.6:2    172.125.12.9:2   172.125.12.9:2
```

### the pat on general department

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#do sh ip nat trans
Pro Inside global      Inside local      Outside local      Outside global
icmp 10.0.0.1:3          193.168.1.10:3    10.0.0.5:3      10.0.0.5:3
icmp 10.0.0.1:4          193.168.1.10:4    174.125.12.9:4  174.125.12.9:4
tcp 10.0.0.1:1025        193.168.1.10:1025  174.125.12.9:80  174.125.12.9:80
tcp 10.0.0.1:1026        193.168.1.10:1026  174.125.12.9:80  174.125.12.9:80
```

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#do sh ip nat trans
Pro Inside global      Inside local      Outside local      Outside global
icmp 10.0.0.17:1         193.168.3.6:1    10.0.0.13:1    10.0.0.13:1
icmp 10.0.0.17:2         193.168.3.6:2    174.125.12.9:2  174.125.12.9:2
icmp 10.0.0.17:3         193.168.3.6:3    174.125.12.9:3  174.125.12.9:3
icmp 10.0.0.17:4         193.168.3.6:4    174.125.12.9:4  174.125.12.9:4
icmp 10.0.0.17:5         193.168.3.6:5    172.125.12.9:5  172.125.12.9:5
icmp 10.0.0.17:6         193.168.3.6:6    10.0.0.18:6    10.0.0.18:6
```

### the pat on intelligent Systems Department

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#do sh ip nat trans
Pro Inside global      Inside local      Outside local      Outside global
icmp 10.0.0.5:1          193.168.2.107:1   10.0.0.1:1      10.0.0.1:1
icmp 10.0.0.5:2          193.168.2.107:2   174.125.12.9:2  174.125.12.9:2
icmp 10.0.0.5:3          193.168.2.107:3   174.125.12.9:3  174.125.12.9:3
icmp 10.0.0.5:4          193.168.2.107:4   172.125.12.9:4  172.125.12.9:4
```

### the pat on Cyper security department

# Q3

## 1. Access list (Security):

- **Access control lists (ACLs) can be used for two purposes on Cisco devices:**
  - To filter traffic
  - To identify traffic
- Each rule or line in an access-list provides a condition, either permit or deny:
  - a permit statement is used to “allow” traffic, while a deny statement is used to “block” traffic.
- the command of that is :
  - access-list [1-99] [permit | deny] [source address = network IP] [wildcard mask] [log]
- To view all IP access lists configured on the router:
  - Router# show ip access-list
- We apply that to (server 1 | general server ) where it permit for network of general department and deny any other
- and apply that to (server 0 | special server) where it permit for network of special departments only and deny the general department

### general server

```
Router>en
Router#show ip access-list
Standard IP access list 6
  10 permit 174.126.0.0 0.0.255.255
Standard IP access list 66
  10 deny 10.0.0.4 0.0.0.3 (2 match(es))
  20 deny 10.0.0.8 0.0.0.3
  30 deny 10.0.0.12 0.0.0.3
  40 deny 10.0.0.16 0.0.0.3 (3 match(es))
  50 permit any (806 match(es))
```

### special server

```
Router>en
Router#show ip access-list
Standard IP access list 66
  10 deny 10.0.0.0 0.0.0.3
  20 permit any (873 match(es))
```

# Q3

## 2. Additional bonus:

### 1. DHCP:

- Dynamic Host Configuration Protocol (DHCP) is a network protocol used to automate the process of assigning IP addresses and other network configuration parameters to devices on a network.

### • DHCP Server:

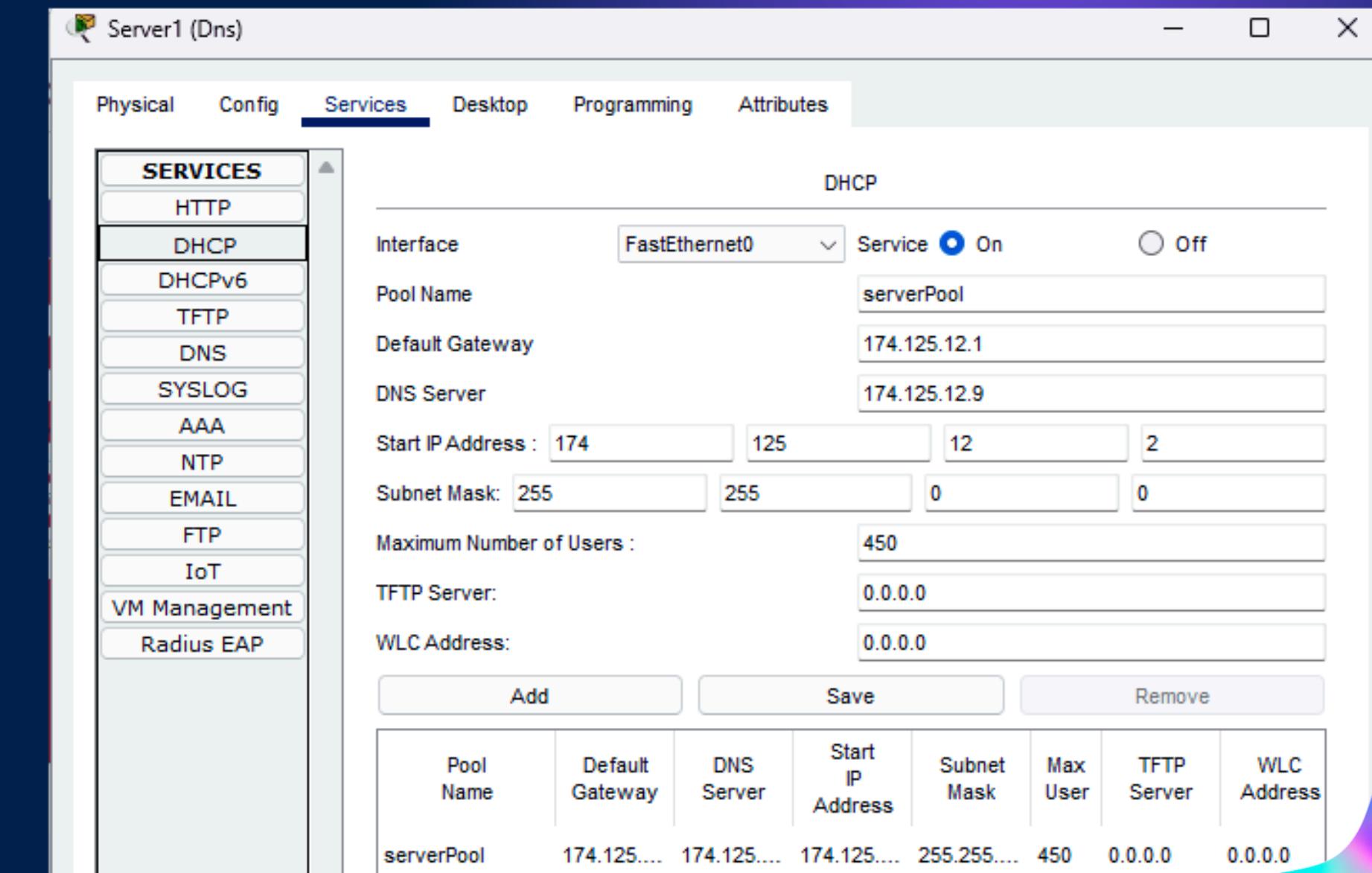
- The DHCP server is a network device responsible for assigning IP addresses and other network configuration parameters to DHCP clients.

### ◦ DHCP Client:

- The DHCP client is any device on the network that requires an IP address and other network configuration parameters. It sends a request to the DHCP server to obtain this information.

- done the DHCP on the router of computer and data science department by :

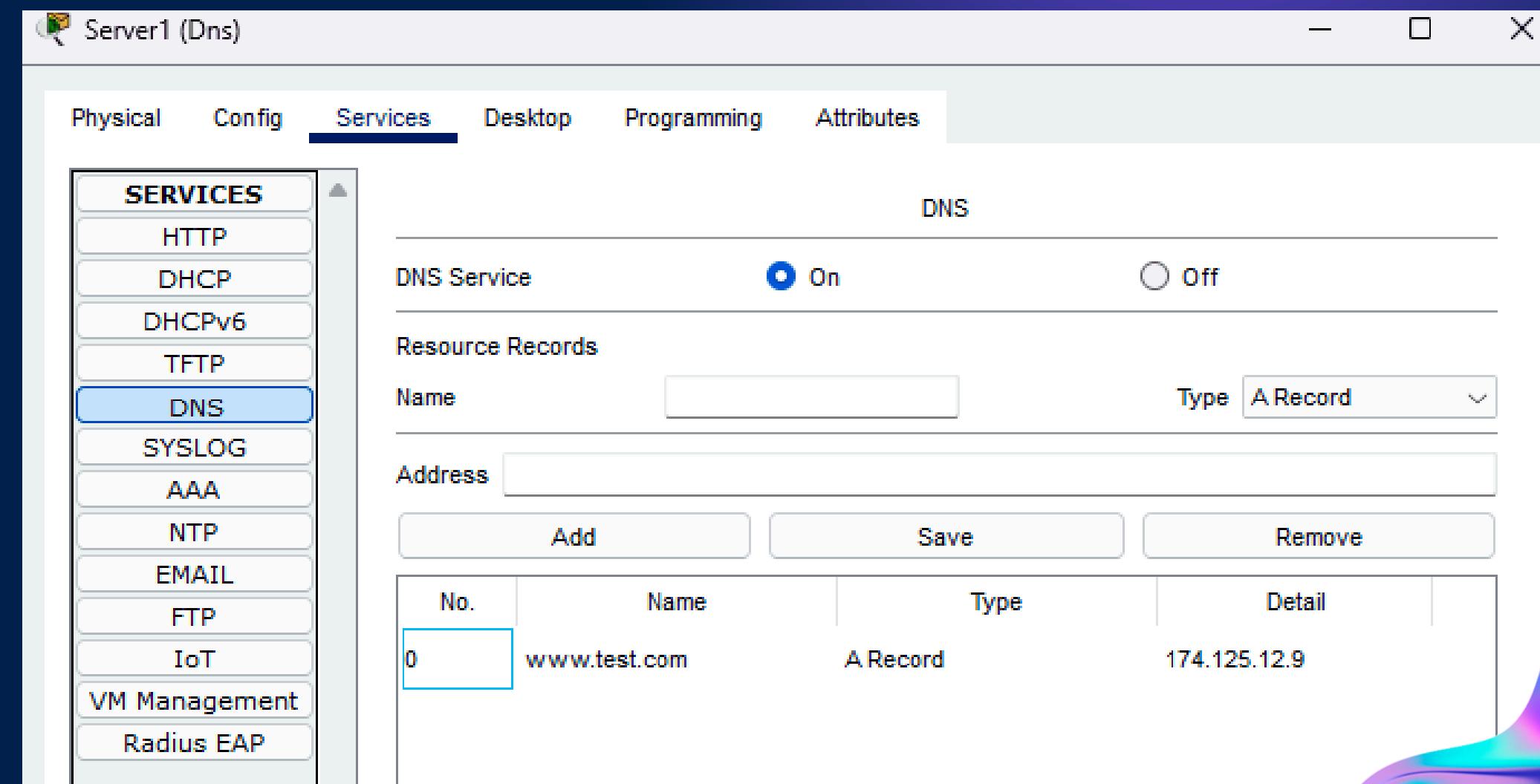
- Router(config)# ip dhcp pool MY\_POOL
- Router(dhcp-config)# network 193.168.1.0 255.255.255.0
- Router(dhcp-config)# default-router 193.168.1.254
- Router (dhcp-config)# dns 174.125.12.9
- but first open the DHCP on the server that in left



# Q3 2. Additional bonus:

## 2. DNS:

- Domain Name System (DNS) server resolves host names into IP addresses.  
Although we can access a network host using its IP address, DNS makes it easier by allowing us use domain names which are easier to remember.
- done the DNS on the Server 1 on the left
  - a. click on services and choose the DNS
  - i. Then click to on this and give to it :
    1. Name: www.test.com
    2. Type: A Record
    3. Address: 174.125.12.9



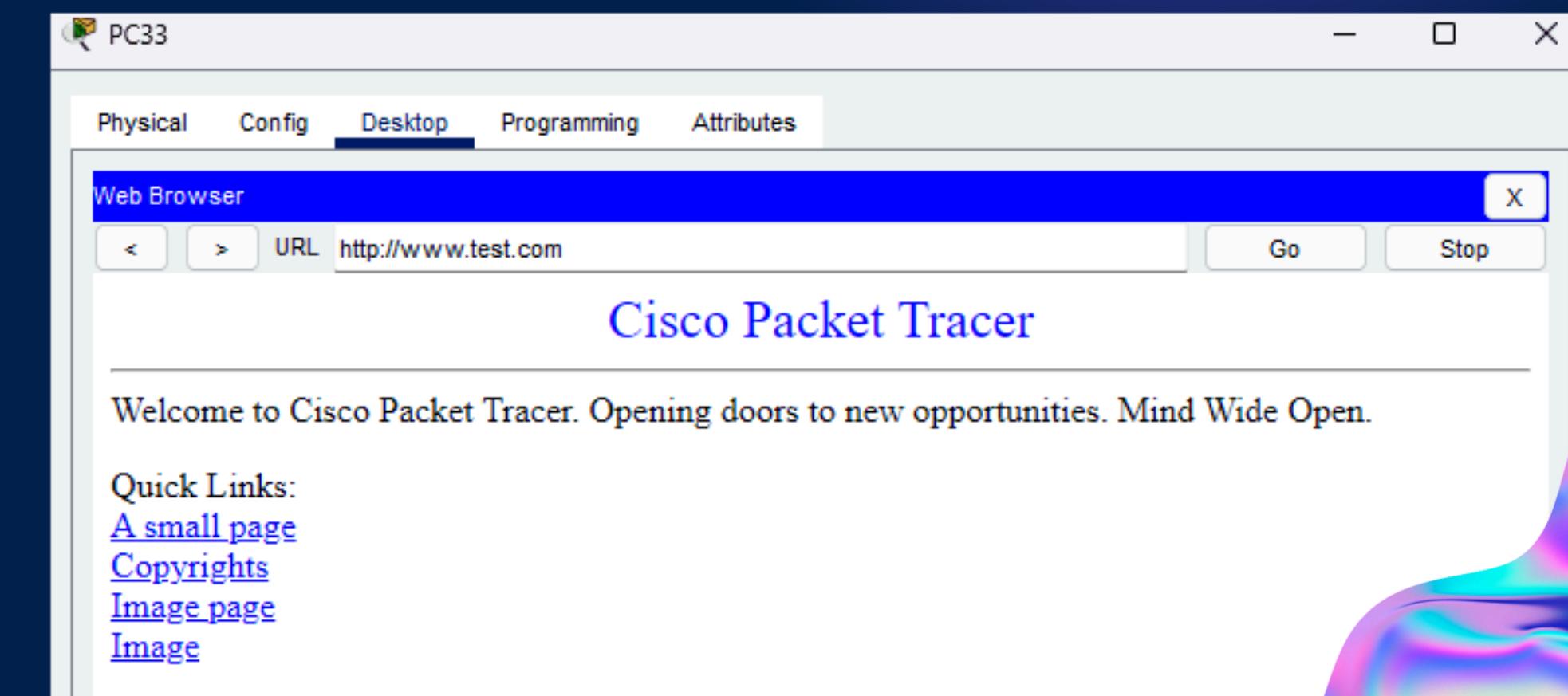
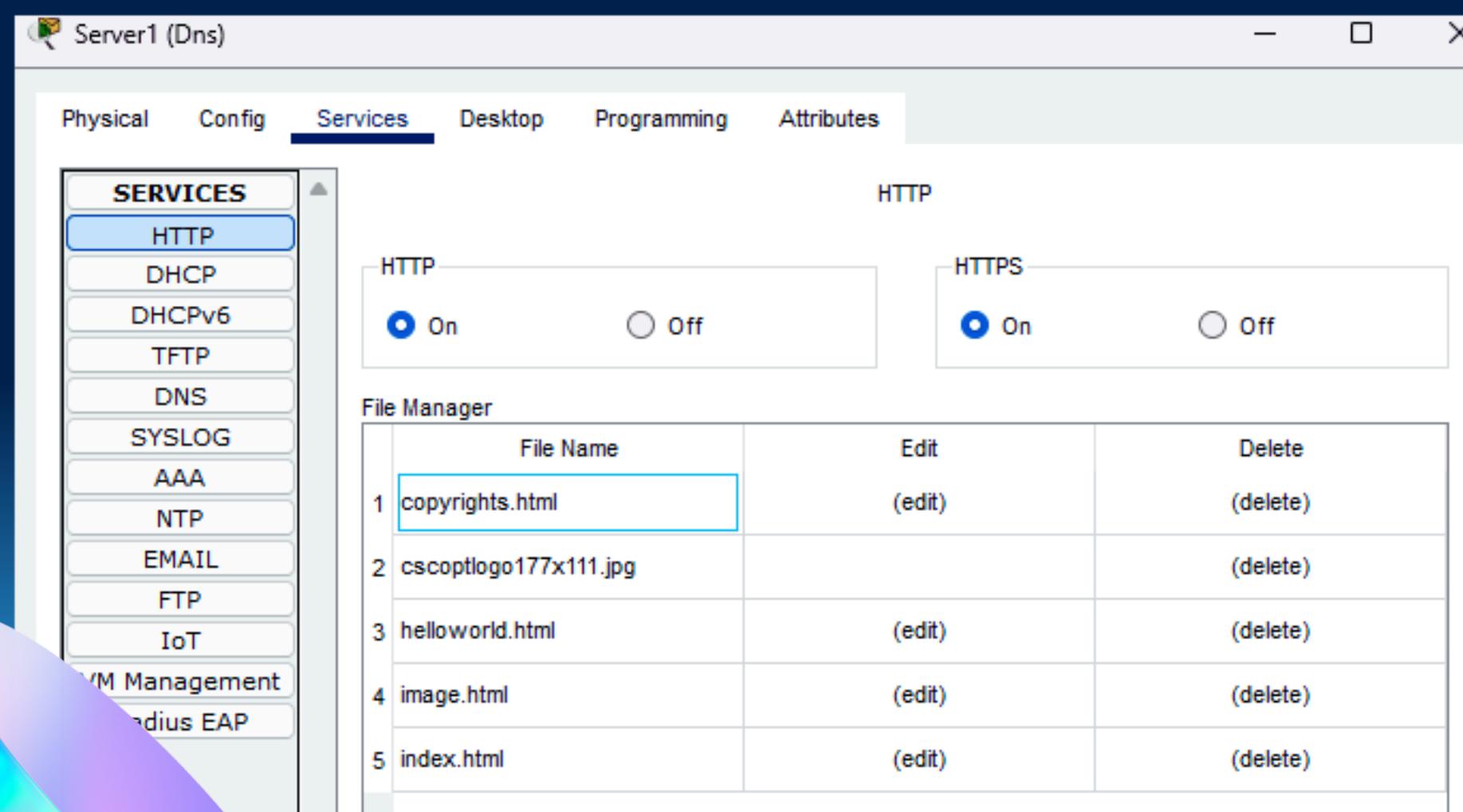
# Q3

## 2. Additional bonus:

### 2. DNS:

- Go to HTTP and make a file in file name
  - In this file you can write whatever you want to showcase in your web page.

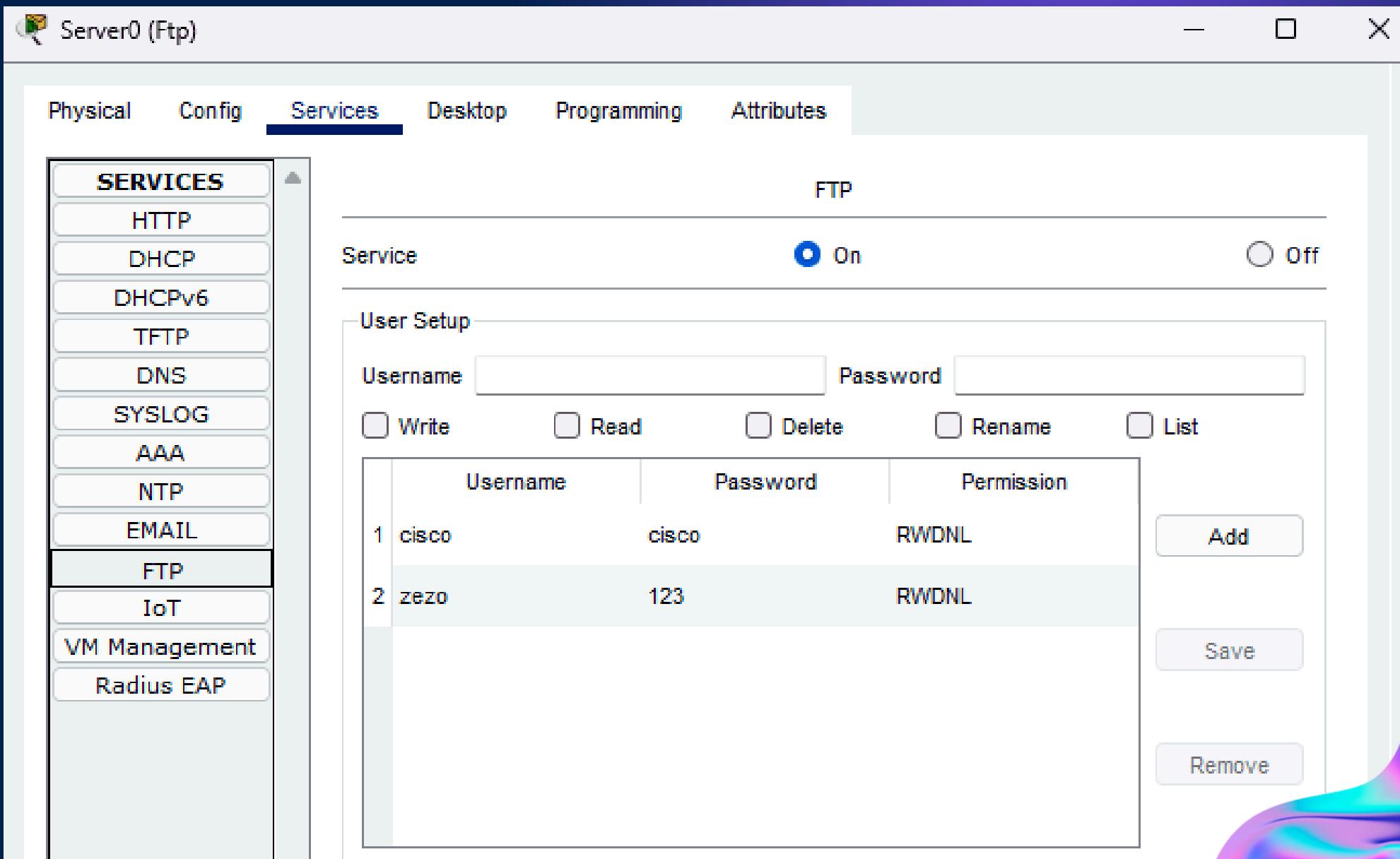
Now you can go to any pc and check your web page by writing your web page name rather then writing IP address.



# Q3 2. Additional bonus:

## 3. FTP:

- File transfer protocol is a standard internet protocol provided by TCP/IP used for transmitting the files from one host to another.
- It is also used for downloading the files to computer from other servers.
- Configuring FTP (Server0)
  - a. Go to services and open FTP Service.
  - b. Go to user setup and create a username and password.
  - c. Select all the permissions (Write, Read, Delete, Rename, List) and add the user.



# Q3

## 2. Additional bonus:

### 3. FTP:

- **Creating a file named ce.txt for writing(uploading) into FTP Server.**
  - **Help.text**
  - **ftp 172.125.12.9**
- **Writing (uploading) the file named Help.text into FTP Server from PC14 using (put Help.text) command and verifying this file transfer using (dir) command.**

```
Command Prompt

C:\>ftp 172.125.12.9
Trying to connect...172.125.12.9
Connected to 172.125.12.9
220- Welcome to PT Ftp server
Username:zezo
331- Username ok, need password
Password:
230- Logged in
      (passive mode On)
ftp>put Help.text

Writing file Help.text to 172.125.12.9:
File transfer in progress...

[Transfer complete - 4 bytes]

4 bytes copied in 0.012 secs (333 bytes/sec)
ftp>dir

Listing /ftp directory from 172.125.12.9:
0   : Help.text
1   : asa842-k8.bin
2   : asa923-k8.bin
3   : c1841-advipsericesk9-mz.124-15.T1.bin
4   : c1841-ipbase-mz.123-14.T7.bin
5   : c1841-ipbasek9-mz.124-12.bin
6   : c1900-universalk9-mz.SPA.155-3.M4a.bin
7   : c2600-advipsericesk9-mz.124-15.T1.bin
8   : c2600-i-mz.122-28.bin
9   : c2600-ipbasek9-mz.124-8.bin
10  : c2800nm-advipsericesk9-mz.124-15.T1.bin
11  : c2800nm-advipsericesk9-mz.151-4.M4.bin
12  : c2800nm-ipbase-mz.123-14.T7.bin
13  : c2800nm-ipbasek9-mz.124-8.bin
14  : c2900-universalk9-mz.SPA.155-3.M4a.bin
```