

**Course: Computer Networks - 00207N**

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**Tool: CISCO Packet Tracer**

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**Designing and Simulating ANU Campus Network**

**Network Topology and Configuration Report**

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## **1. Introduction**

This report details the configuration and topology of a network with four distinct LANs and a data center. The network is designed to efficiently manage traffic and provide reliable connectivity across different buildings.

## **2. Network Overview**

The network consists of four main LAN types: STAR, Ring/Token, BUS, and TREE, each connected through a central router. The data center is integrated to support centralized services. The overview of the LANs is as follows:

- STAR-LAN (A): 1 Switch, 4 PCs, and 1 Router.
- Ring/Token LAN (B): 5 Switches, 4 PCs, and 1 Router.
- BUS-LAN (C): 6 Switches, 6 PCs, and 1 Router.
- TREE-LAN (D): 7 Switches, 12 PCs, and 1 Router.

## **3. LAN Configuration**

### **-> STAR-LAN (A)**

- Switch: SWITCH 1.1 (Cisco 2960)
- PCs: PC1.1 to PC1.4
- Router: Router 1
- Connection Port: GigabitEthernet 0/0/0

### **-> Ring/Token LAN (B)**

- Switches: SWITCH 2.1 to SWITCH 2.5 (Cisco 2960)
- PCs: PC2.1 to PC2.4
- Router: Router 2
- Connection Port: GigabitEthernet 0/0/0

#### -> **BUS-LAN (C)**

- Switches: SWITCH 3.1 to SWITCH 3.6 (Cisco 2960)
- PCs: PC3.1 to PC3.6
- Router: Router 3
- Connection Port: GigabitEthernet 0/0/0

#### -> **TREE-LAN (D)**

- Switches: SWITCH 4.1 to SWITCH 4.7 (Cisco 2960)
- PCs: PC4.1 to PC4.12
- Router: Router 4
- Connection Port: GigabitEthernet 0/0/0

### **4. Subnetting Details**

#### -> Building A (Tree-LAN)

- Network IP: 193.158.1.0
- First Valid IP: 193.158.1.1
- Default Gateway: 193.158.1.1
- Subnet Mask: 255.255.255.0 (/24)
- IPs Range: 193.158.1.1 - 193.158.1.254
- Broadcast IP: 193.158.1.255

**-> Building B (Ring/Token-LAN)**

- Network IP: 193.158.2.192
- First Valid IP: 193.158.2.193
- Default Gateway: 193.158.2.193
- Subnet Mask: 255.255.255.192 (/26)
- IPs Range: 193.158.2.193 - 193.158.2.254
- Broadcast IP: 193.158.2.255

**-> Building C (BUS-LAN)**

- Network IP: 193.158.2.128
- First Valid IP: 193.158.2.129
- Default Gateway: 193.158.2.129
- Subnet Mask: 255.255.255.192 (/26)
- IPs Range: 193.158.2.129 - 193.158.2.190
- Broadcast IP: 193.158.2.191

**-> Building D (STAR-LAN)**

- Network IP: 193.158.2.0
- First Valid IP: 193.158.2.1
- Default Gateway: 193.158.2.1
- Subnet Mask: 255.255.255.128 (/25)
- IPs Range: 193.158.2.1 - 193.158.2.126
- Broadcast IP: 193.158.2.127

**-> Data Center Building**

- Network IP: 172.125.12.8
- First Valid IP: 172.125.12.9 (Server)

- Default Gateway: 172.125.12.10 (Router Interface)
- Subnet Mask: 255.255.255.248 (/29)
- Broadcast IP: 172.125.12.15

## **5. Router Configuration**

Each router is configured with specific IP addresses on their GigabitEthernet interfaces to ensure connectivity and routing across the network.

### **-> Router-1**

- IPv4 Address: 193.158.1.1
- Subnet Mask: 255.255.255.0

### **-> Router-2**

- IPv4 Address: 193.158.2.193
- Subnet Mask: 255.255.255.192

### **-> Router-3**

- IPv4 Address: 193.158.2.129
- Subnet Mask: 255.255.255.192

### **-> Router-4**

- IPv4 Address: 193.158.2.1
- Subnet Mask: 255.255.255.128

### **-> Router-5**

- IPv4 Address: 172.125.12.10
- Subnet Mask: 255.255.255.248

## 6. Routing Protocols

### -> OSPF Configuration

Routers are configured with OSPF to enable dynamic routing. The OSPF areas and network statements are set to ensure correct routing information exchange.

Router 1:

```
router ospf 1
network 193.158.1.0 0.0.0.255 area 0
network 10.0.0.0 0.255.255.255 area 0
network 14.0.0.0 0.255.255.255 area 0
```

Router 2:

```
router ospf 1
network 193.158.2.192 0.0.0.63 area 0
network 10.0.0.0 0.255.255.255 area 0
network 11.0.0.0 0.255.255.255 area 0
```

Router 3:

```
router ospf 1
network 193.158.2.128 0.0.0.63 area 0
network 11.0.0.0 0.255.255.255 area 0
network 12.0.0.0 0.255.255.255 area 0
```

Router 4:

```
router ospf 1
network 193.158.2.0 0.0.0.127 area 0
network 12.0.0.0 0.255.255.255 area 0
network 13.0.0.0 0.255.255.255 area 0
```

Router 5:

```
router ospf 1
network 172.125.12.8 0.0.0.7 area 0
network 13.0.0.0 0.255.255.255 area 0
network 14.0.0.0 0.255.255.255 area 0
```

### -> RIP Configuration

RIP is used to ensure compatibility with simpler network segments and legacy systems.

Router 1:

```
router rip
version 2
network 193.158.1.0
network 10.0.0.0
network 14.0.0.0
```



Router 2:

```
router rip
version 2
network 193.158.2.192
network 10.0.0.0
network 11.0.0.0
```

Router 3:

```
router rip
version 2
network 193.158.2.128
network 11.0.0.0
network 12.0.0.0
```

Router 4:

```
router rip
version 2
network 193.158.2.0
network 12.0.0.0
network 13.0.0.0
```

Router 5:

```
router rip
version 2
network 172.125.12.8
network 13.0.0.0
network 14.0.0.0
```

## 7. Firewall Configuration

Firewalls are configured on each router to control and secure the traffic entering each network segment.

### -> Router-1 Firewall Configuration:

```
interface GigabitEthernet 0/0/0
ip access-group 101 in
access-list 101 permit icmp any any
access-list 101 permit tcp any any eq 80
access-list 101 permit tcp any any eq 443
access-list 101 deny ip any 193.158.1.4 0.0.0.255
access-list 101 permit ip any any
```

### -> Router-2 Firewall Configuration:

```
interface GigabitEthernet 0/0/0
```

```
ip access-group 102 in
access-list 102 permit icmp any any
access-list 102 permit tcp any any eq 80
access-list 102 permit tcp any any eq 443
access-list 102 deny ip any 193.158.2.195 0.0.0.63
access-list 102 deny ip any 193.158.2.196 0.0.0.63
access-list 102 permit ip any any
```

### **-> Router-3 Firewall Configuration:**

```
interface GigabitEthernet 0/0/0
ip access-group 103 in
access-list 103 permit icmp any any
access-list 103 permit tcp any any eq 80
access-list 103 permit tcp any any eq 443
access-list 103 deny ip any 193.158.2.196 0.0.0.63
access-list 103 deny ip any 193.158.2.132 0.0.0.63
access-list 103 permit ip any any
```

### **-> Router-4 Firewall Configuration:**

```
interface GigabitEthernet 0/0/0
ip access-group 104 in
access-list 104 permit icmp any any
access-list 104 permit tcp any any eq 80
access-list 104 permit tcp any any eq 443
access-list 104 deny ip any 193.158.2.0 0.0.0.127
access-list 104 permit ip any any
```

Router-5 does not have firewall configuration due to specific network requirements.

## 8. DHCP Configuration

DHCP is configured on Router-4 to dynamically assign IP addresses to the devices in the TREE-LAN.

-> **DHCP Configuration:**

```
ip dhcp excluded-address 193.158.1.1
ip dhcp pool TREE-LAN
network 193.158.1.0 255.255.255.0
default-router 193.158.1.1
dns-server 8.8.8.8
```

## 9. NAT Configuration

-> **Static NAT:**

Static NAT maps a single private IP to a single public IP for secure communication.

-> **Dynamic NAT:**

Dynamic NAT allows multiple private IP addresses to be mapped to a pool of public IP addresses.

-> **PAT (Port Address Translation):**

PAT allows multiple devices on a LAN to be mapped to a single public IP address but with a different port number.

### -> PAT Configuration on Router-5:

```
interface GigabitEthernet 0/0
ip address 172.125.12.10 255.255.255.248
ip nat inside
exit
interface serial0/2/0
ip nat outside
exit
interface serial0/2/1
ip nat outside
exit
access-list 1 permit 172.125.12.8 0.0.0.7
ip nat inside source list 1 interface serial0/2/0 overload
ip nat inside source list 1 interface serial0/2/1 overload
```

## **10. Conclusion**

This report outlines the comprehensive configuration of a network consisting of multiple LANs and a data center. The detailed configuration ensures optimal performance, security, and reliability. The use of OSPF and RIP routing protocols, combined with firewall and NAT configurations, enhances the network's efficiency and security. This setup is scalable and can be adapted to future network expansion and technological advancements.