



Design and Implement a Network Infrastructure

CPIT 370 Project

By

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[Spring 2023]

A. The network devices (hardware) needed for the project are:

- **4 switches** with 24 ports each, to connect the 14 hosts (computers) in each lab and one port for the router.
- **1 router** with 4 fast Ethernet ports to connect the 4 switches in each port.
- **176 RJ45 connectors** to connect the hosts to the switches through RJ45 sockets and to connect the switches to the router (**lab1**: 28 connectors, **lab2**: 28 connectors, **lab3**: 28 connectors, **lab4**: 28 connectors, and **switches room**: 64 connectors).
- **116 cables wires** 14 wires (one for each host) and 60 wires for the **switch room** in each lab with varying lengths (**lab1**: $50\text{m} * 14 = 700\text{m}$, **lab2**: $45\text{m} * 14 = 630\text{m}$, **lab3**: $40\text{m} * 14 = 560\text{m}$, and **lab4**: $35\text{m} * 14 = 490\text{m}$). Those are the length of the 56 wires **between the socket and the switch room**. The length of **the host-to-sockets** is 3m for each host. and the 4 wires **between the switch and router** will be 1m.
- **56 RJ45 Sockets** to connect the host to the switch through the socket in the wall. Helps to make half of the cables needed short.
- **1 network rack** to hold the switches and the router.

B. The specification and justification for each network device are as follows:

- **Switches:** Four 24-port switches are needed to connect the 14 hosts in each lab and the router. The Cisco Catalyst 2950T-24 switch supports a range of advanced features, such as quality of service (QoS) and VLAN support, which can help to improve network performance and security. For example, QoS can be used to prioritize traffic on the network, ensuring that critical traffic such as voice or video is given priority over less important traffic. VLAN support can be used to segment the network into multiple virtual LANs, which can help to improve security and simplify network management.
- **Router:** One router with 4 fast Ethernet ports is needed to connect the 4 switches in each port. The router should support basic routing functionality and provide security features. The Cisco 2811 router comes with a range of security features, such as access control lists (ACLs) and virtual private network (VPN) support, that can help protect your network from unauthorized access and attacks. NM-2FE2W-V2 piece will be used in this router to provide 4 ports of fast Ethernet.

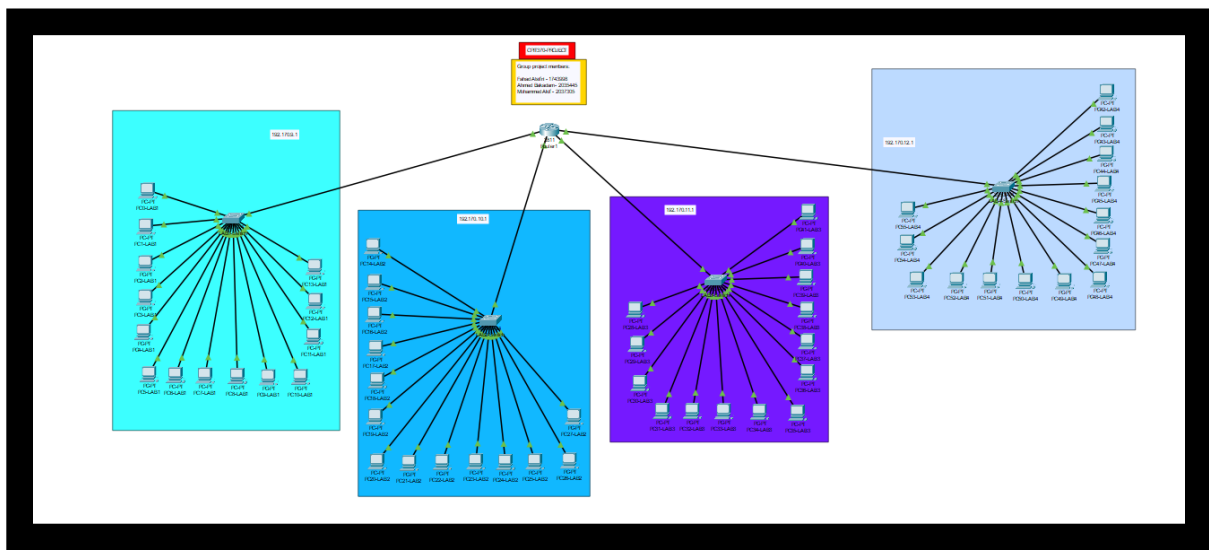
- **RJ45 connectors:** 176 RJ45 connectors are needed to connect the hosts to the socket and the socket to the switches and the switches to the router. The connectors should be reliable and easy to install. CAT6 RJ45 connectors from Amazon Basics are a good option as they are affordable and provide reliable connectivity.
- **Cables:** 116 cable wires are needed to connect the hosts to the switches and the switches to the router. We will need 2 cables for each host. The first cable will be between the host and the RJ45 socket. The second cable will be between the socket and the switch. Also, there are cables between the switch and the router. The cables should be of high quality to ensure reliable data transmission and should be long enough to accommodate the varying distances between the socket and the switches. However, the cable should be short between the host and the socket, and between the switch and the router. The Amazon Basics CAT6 Ethernet patch cables are a good option as they are affordable and provide reliable data transmission.
- **Network rack:** One network rack is needed to hold the switches and the router. The rack should be sturdy and easy to install. The StarTech 9U Wall Mount Network Equipment Rack (RK9WALM) is a good option as it is easy to install and provides ample space for the switches and the router.

C. The selected network devices were chosen based on factors such as scalability, performance, and budget. The switches and routers were selected based on their support for VLANs and basic routing functionality, which will allow for network segmentation and security. RJ45 sockets are available in different categories, such as Category 5 (Cat5), Category 6 (Cat6), and Category 6a (Cat6a), among others. The category of the socket determines the maximum bandwidth and transmission speed that it can support. For example, Cat5 sockets can support up to 100 Mbps, while Cat6a sockets can support up to 10 Gbps. The RJ45 connectors and cables were selected based on their reliability and affordability. The network rack was selected based on its sturdiness and ease of installation.

D. The cost of each network device and equipment was sourced from Ebay.com and Amazon.com stores. The selected vendors offer competitive prices for their products, and the Amazon Basics brand provides cost-effective options for sockets and connectors, cables, and the Network rack. Moreover, eBay provides you with a perfect price for the router and switch.

E. Screenshots of network simulation

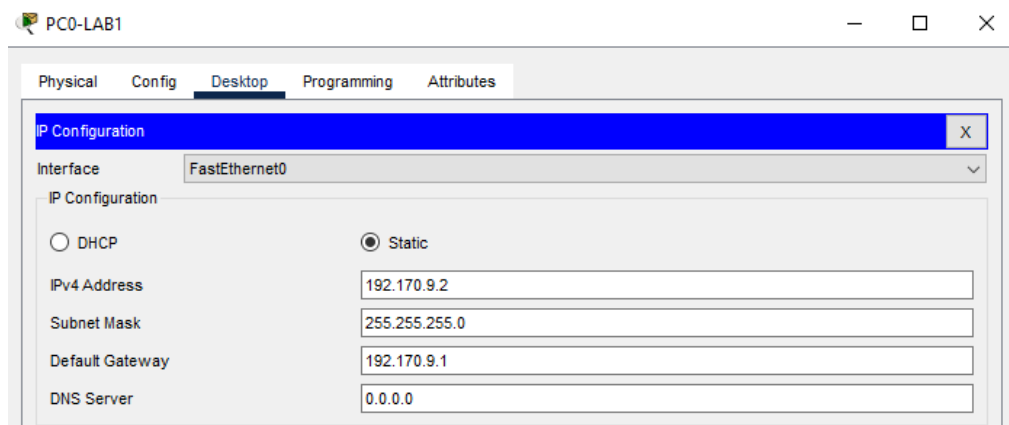
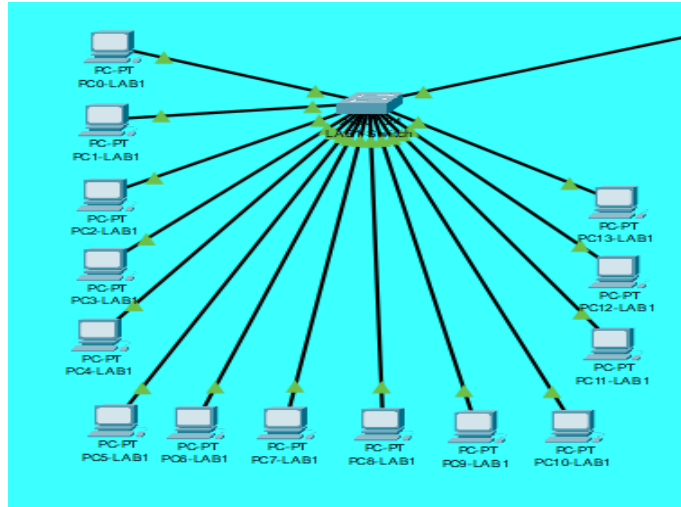
- Network Infrastructure



- Router



- (Lab)



Lab 1 IPv4 and gateway

```
C:\>ping 192.170.9.6

Pinging 192.170.9.6 with 32 bytes of data:

Reply from 192.170.9.6: bytes=32 time<1ms TTL=128
Reply from 192.170.9.6: bytes=32 time<1ms TTL=128
Reply from 192.170.9.6: bytes=32 time<1ms TTL=128
Reply from 192.170.9.6: bytes=32 time<1ms TTL=128

Ping statistics for 192.170.9.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

```
C:\>ping 192.170.10.6

Pinging 192.170.10.6 with 32 bytes of data:

Reply from 192.170.10.6: bytes=32 time<1ms TTL=127
Reply from 192.170.10.6: bytes=32 time=1ms TTL=127
Reply from 192.170.10.6: bytes=32 time=1ms TTL=127
Reply from 192.170.10.6: bytes=32 time=1ms TTL=127

Ping statistics for 192.170.10.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

```
C:\>ping 192.170.11.6

Pinging 192.170.11.6 with 32 bytes of data:

Reply from 192.170.11.6: bytes=32 time<1ms TTL=127
Reply from 192.170.11.6: bytes=32 time<1ms TTL=127
Reply from 192.170.11.6: bytes=32 time<1ms TTL=127
Reply from 192.170.11.6: bytes=32 time=1ms TTL=127

Ping statistics for 192.170.11.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

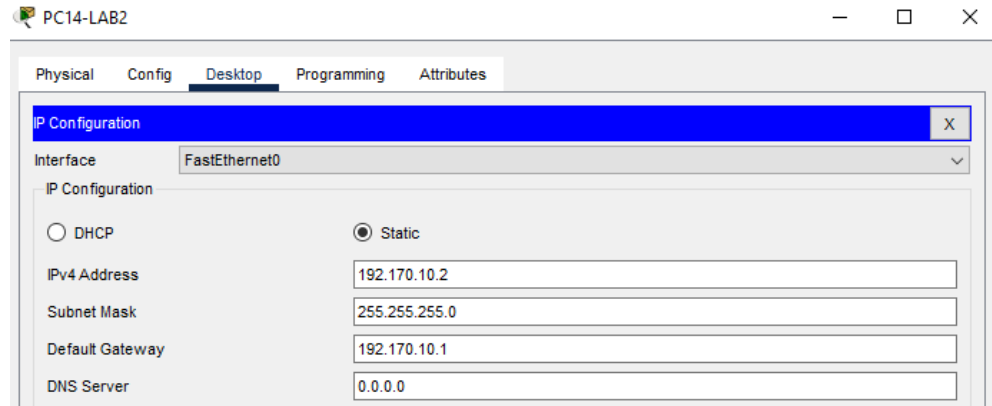
```
C:\>ping 192.170.12.6

Pinging 192.170.12.6 with 32 bytes of data:

Reply from 192.170.12.6: bytes=32 time<1ms TTL=127
Reply from 192.170.12.6: bytes=32 time<1ms TTL=127
Reply from 192.170.12.6: bytes=32 time<1ms TTL=127
Reply from 192.170.12.6: bytes=32 time<1ms TTL=127

Ping statistics for 192.170.12.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Ping picture for lab 1



Lab 2 IPv4 and gateway

```
C:\>ping 192.170.10.6

Pinging 192.170.10.6 with 32 bytes of data:

Reply from 192.170.10.6: bytes=32 time<1ms TTL=128
Reply from 192.170.10.6: bytes=32 time=1ms TTL=128
Reply from 192.170.10.6: bytes=32 time=1ms TTL=128
Reply from 192.170.10.6: bytes=32 time=1ms TTL=128

Ping statistics for 192.170.10.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

```
C:\>ping 192.170.9.6

Pinging 192.170.9.6 with 32 bytes of data:

Reply from 192.170.9.6: bytes=32 time<1ms TTL=127
Reply from 192.170.9.6: bytes=32 time<1ms TTL=127
Reply from 192.170.9.6: bytes=32 time<1ms TTL=127
Reply from 192.170.9.6: bytes=32 time<1ms TTL=127

Ping statistics for 192.170.9.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

```
C:\>ping 192.170.11.6

Pinging 192.170.11.6 with 32 bytes of data:

Reply from 192.170.11.6: bytes=32 time<1ms TTL=127
Reply from 192.170.11.6: bytes=32 time<1ms TTL=127
Reply from 192.170.11.6: bytes=32 time<1ms TTL=127
Reply from 192.170.11.6: bytes=32 time<1ms TTL=127

Ping statistics for 192.170.11.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

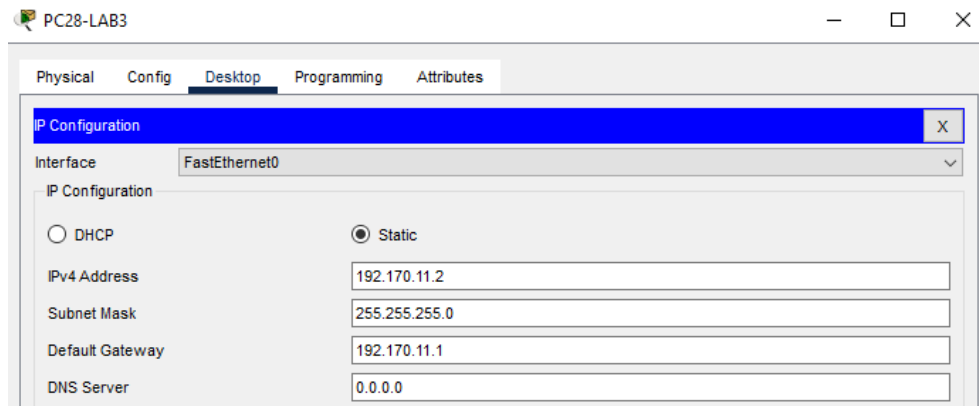
```
C:\>ping 192.170.12.6

Pinging 192.170.12.6 with 32 bytes of data:

Reply from 192.170.12.6: bytes=32 time<1ms TTL=127
Reply from 192.170.12.6: bytes=32 time=10ms TTL=127
Reply from 192.170.12.6: bytes=32 time=10ms TTL=127
Reply from 192.170.12.6: bytes=32 time<1ms TTL=127

Ping statistics for 192.170.12.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 10ms, Average = 5ms
```

Ping picture for lab 2



Lab 3 IPv4 and gateway

```
C:\>ping 192.170.11.6

Pinging 192.170.11.6 with 32 bytes of data:

Reply from 192.170.11.6: bytes=32 time<1ms TTL=128
Reply from 192.170.11.6: bytes=32 time<1ms TTL=128
Reply from 192.170.11.6: bytes=32 time<1ms TTL=128
Reply from 192.170.11.6: bytes=32 time=1ms TTL=128

Ping statistics for 192.170.11.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

```
C:\>ping 192.170.9.6

Pinging 192.170.9.6 with 32 bytes of data:

Reply from 192.170.9.6: bytes=32 time=10ms TTL=127
Reply from 192.170.9.6: bytes=32 time=12ms TTL=127
Reply from 192.170.9.6: bytes=32 time=10ms TTL=127
Reply from 192.170.9.6: bytes=32 time=10ms TTL=127
Reply from 192.170.9.6: bytes=32 time<1ms TTL=127

Ping statistics for 192.170.9.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 12ms, Average = 8ms
```

```
C:\>ping 192.170.10.6

Pinging 192.170.10.6 with 32 bytes of data:

Reply from 192.170.10.6: bytes=32 time=10ms TTL=127
Reply from 192.170.10.6: bytes=32 time<1ms TTL=127
Reply from 192.170.10.6: bytes=32 time<1ms TTL=127
Reply from 192.170.10.6: bytes=32 time=1ms TTL=127

Ping statistics for 192.170.10.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 10ms, Average = 2ms
```

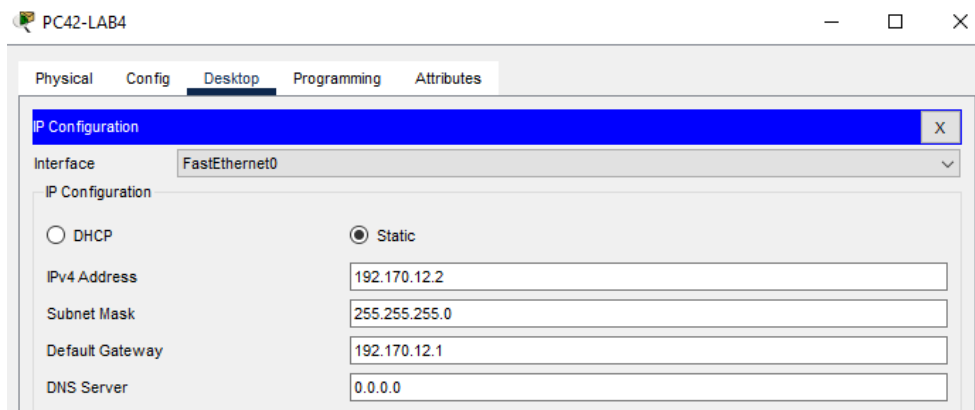
```
C:\>ping 192.170.12.6

Pinging 192.170.12.6 with 32 bytes of data:

Reply from 192.170.12.6: bytes=32 time=1ms TTL=127
Reply from 192.170.12.6: bytes=32 time=48ms TTL=127
Reply from 192.170.12.6: bytes=32 time=2ms TTL=127
Reply from 192.170.12.6: bytes=32 time<1ms TTL=127

Ping statistics for 192.170.12.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 48ms, Average = 12ms
```

Ping picture for lab 3



Lab 4 IPv4 and gateway

```
C:\>ping 192.170.12.6

Pinging 192.170.12.6 with 32 bytes of data:

Reply from 192.170.12.6: bytes=32 time=9ms TTL=128
Reply from 192.170.12.6: bytes=32 time<1ms TTL=128
Reply from 192.170.12.6: bytes=32 time=1ms TTL=128
Reply from 192.170.12.6: bytes=32 time<1ms TTL=128

Ping statistics for 192.170.12.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 9ms, Average = 2ms
```

```
C:\>ping 192.170.12.6

Pinging 192.170.12.6 with 32 bytes of data:

Reply from 192.170.12.6: bytes=32 time=9ms TTL=128
Reply from 192.170.12.6: bytes=32 time<1ms TTL=128
Reply from 192.170.12.6: bytes=32 time=1ms TTL=128
Reply from 192.170.12.6: bytes=32 time<1ms TTL=128

Ping statistics for 192.170.12.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 9ms, Average = 2ms
```

```
C:\>ping 192.170.10.6

Pinging 192.170.10.6 with 32 bytes of data:

Reply from 192.170.10.6: bytes=32 time<1ms TTL=127
Reply from 192.170.10.6: bytes=32 time=12ms TTL=127
Reply from 192.170.10.6: bytes=32 time=10ms TTL=127
Reply from 192.170.10.6: bytes=32 time<1ms TTL=127

Ping statistics for 192.170.10.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 12ms, Average = 5ms
```

```
C:\>ping 192.170.11.6

Pinging 192.170.11.6 with 32 bytes of data:

Reply from 192.170.11.6: bytes=32 time=10ms TTL=127
Reply from 192.170.11.6: bytes=32 time=12ms TTL=127
Reply from 192.170.11.6: bytes=32 time<1ms TTL=127
Reply from 192.170.11.6: bytes=32 time<1ms TTL=127

Ping statistics for 192.170.11.6:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 12ms, Average = 5ms
```

Ping picture for lab 4

F. Cost breakdown:

- **Switches:** 4 x The Cisco Catalyst 2950T-24 switch at SAR 337 each, for a total of SAR 1350 from eBay.
- **Router:** 1 x Cisco 2811 router at SAR 750 and NM-2FE2W-V2 at SAR160 from eBay.
- **RJ45 connectors:** 176 x Amazon Basics CAT6 RJ45 connectors at SAR 0.50 each, for a total of SAR 85.
- **RJ45 Sockets:** 56x Amazon Basics 2-pack RJ45 sockets at SAR 26.25 each, for a total of SAR 735.
- **Cables:** 116 x total length 2380. New York Cables CAT6 Plenum Cable 1000ft (CMP) cost SAR 1200 |From Amazon Basics.
- **Network rack:** 1 x StarTech 9U Wall Mount Network Equipment Rack (RK9WALM) at SAR 299.
- **Total cost:** SAR 4,580.

G. In summary, the selected network devices are the Cisco Catalyst 2950T-24 switch, Cisco 2811 router from eBay Store, CAT6 RJ45 connectors and RJ45-sockets from Amazon Basics, Amazon Basics CAT6 Ethernet patch cables, and StarTech 9U Wall Mount Network Equipment Rack (RK9WALM). These devices were chosen based on their specific purpose in the network infrastructure and their ability to provide reliable connectivity, security, and scalability within the given budget constraints.