Semester Project Report

Fall 2024

Course Title: Data Communication and Networking
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Enrollment: 01-134231-088
Semester: 4th

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1 Introduction to Cisco Packet Tracer (CLO 1)

What is Cisco Packet Tracer?

Cisco Packet Tracer is a network simulation tool developed by Cisco Systems. It provides a virtual environment to design, configure, and troubleshoot complex network architectures without the need for physical hardware. The tool supports a wide range of network devices and protocols, making it suitable for both beginners and advanced learners.

Why Use Cisco Packet Tracer?

- It provides a cost-effective alternative to physical hardware.
- The platform is user-friendly and allows hands-on experience in network design and troubleshooting.
- It supports various topologies and real-world scenarios, facilitating practical learning.
- It is widely accepted in academia and industry for network simulations.

Advantages:

- Cost-efficient and hardware-independent.
- Supports a wide range of devices and protocols.
- Real-time simulation and troubleshooting.
- Encourages learning through a visual interface.

Disadvantages:

- Limited support for non-Cisco devices.
- Some advanced features of real devices are not available.
- May not fully replicate the behavior of physical hardware in certain cases.

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2 Comparison with Other Networking Simulation Tools (CLO 2)

Cisco Packet Tracer is often compared with other tools like GNS3 and EVE-NG:

Feature	**Cisco Packet Tracer**	**GNS3**	**EVE-NG**
Cost	Free for students	Free/Open-source	Free (Basic)/Paid
Ease of Use	Beginner-friendly	Moderate	Advanced
Device Support	Cisco devices	Multi-vendor	Multi-vendor
Realism	Limited to Cisco	High realism	High realism
Resource Usage	Low	High	High

Table 1: Comparison of Networking Simulation Tools

Cisco Packet Tracer stands out as the best choice for academic purposes due to its simplicity and focus on Cisco networking concepts.

3 Topologies Designed in Cisco Packet Tracer (CLO 3)

Topologies Implemented:

- **Star Topology**
- **Bus Topology**
- **Ring Topology**
- **Mesh Topology**

Explanation of Topologies (CLO 1, CLO 2):

Star Topology

- All devices are connected to a central switch.
- **Advantages**: High performance, easy to manage.
- **Disadvantages**: Single point of failure at the central switch.

Screenshots:

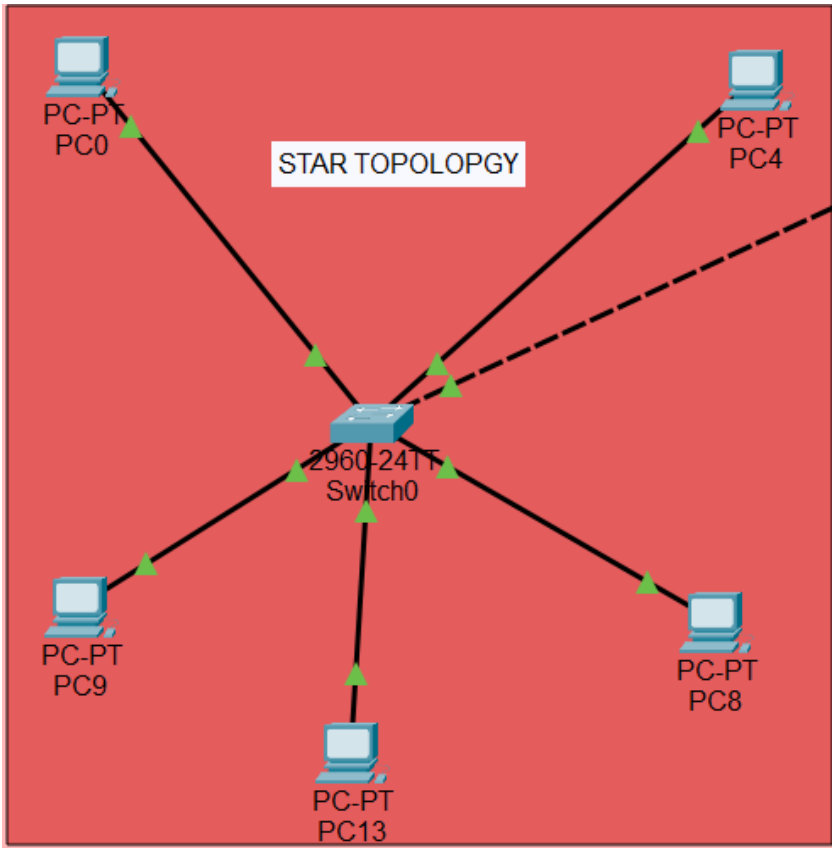

Figure 1: Star Topology in Cisco Packet Tracer

Bus Topology

- Devices are connected in a linear fashion through a shared backbone cable.
- **Advantages**: Cost-effective and easy to set up.
- **Disadvantages**: Collision-prone and difficult to troubleshoot.

Screenshots:

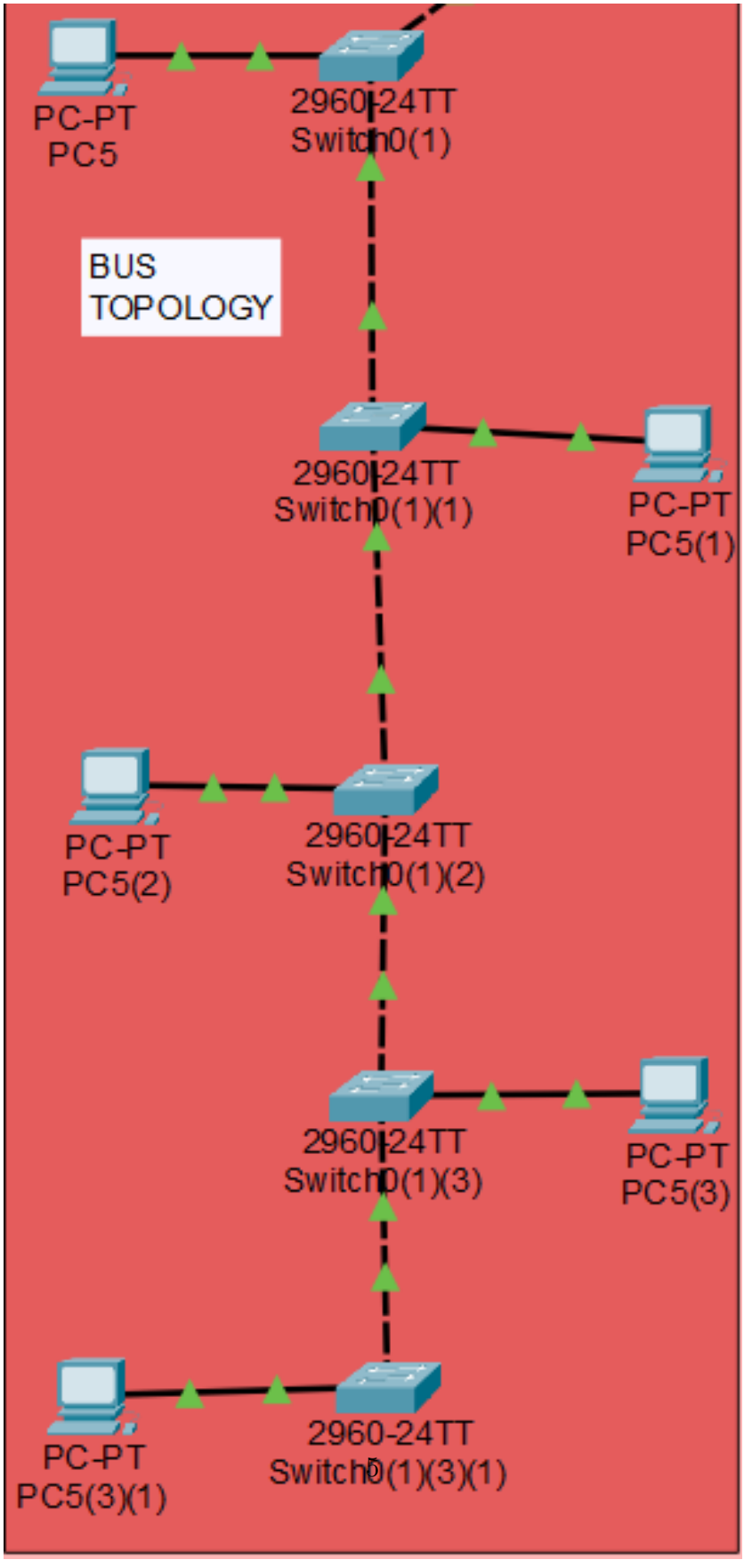
PC-PT
PC5
2960-24TT
Switch0(1)
BUS
TOPOLOGY
2960-24TT
Switch0(1)(1)
PC-PT
PC5(1)
PC-PT
PC5(2)
2960-24TT
Switch0(1)(2)
2960-24TT
Switch0(1)(3)
PC-PT
PC5(3)
PC-PT
PC5(3)(1)
2960-24TT
Switch0(1)(3)(1)

Figure 2: Bus Topology in Cisco Packet Tracer

Ring Topology

- Devices are connected in a closed loop.
- **Advantages**: Predictable data flow.
- **Disadvantages**: Failure in any device disrupts the network.

Screenshots:

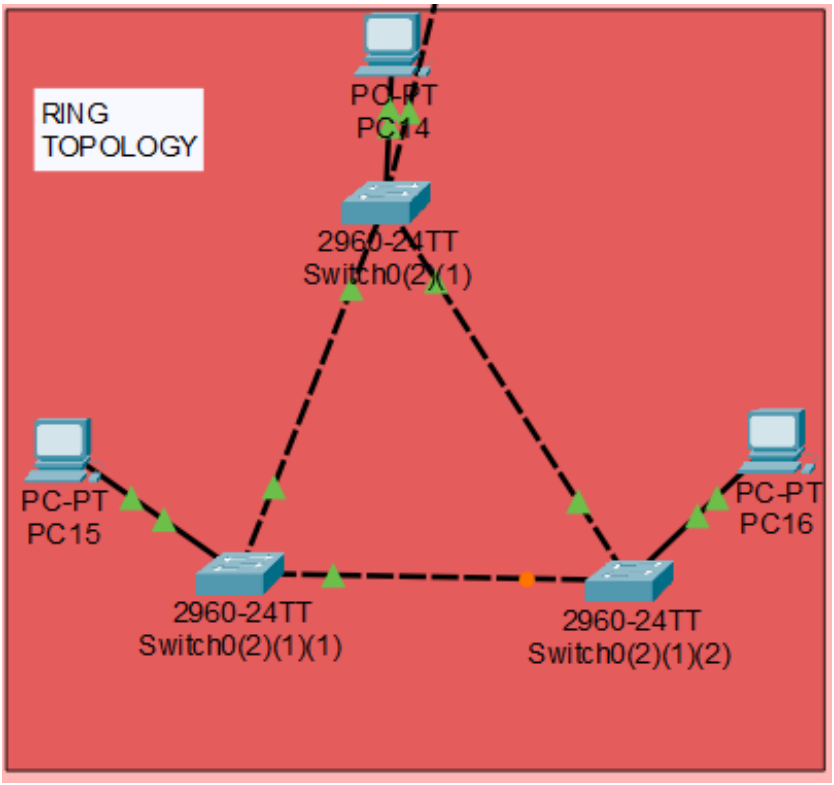

Figure 3: Ring Topology in Cisco Packet Tracer

Mesh Topology

- Every device is connected to every other device.
- **Advantages**: Highly reliable and redundant.
- **Disadvantages**: High cost and complexity.

Screenshots:

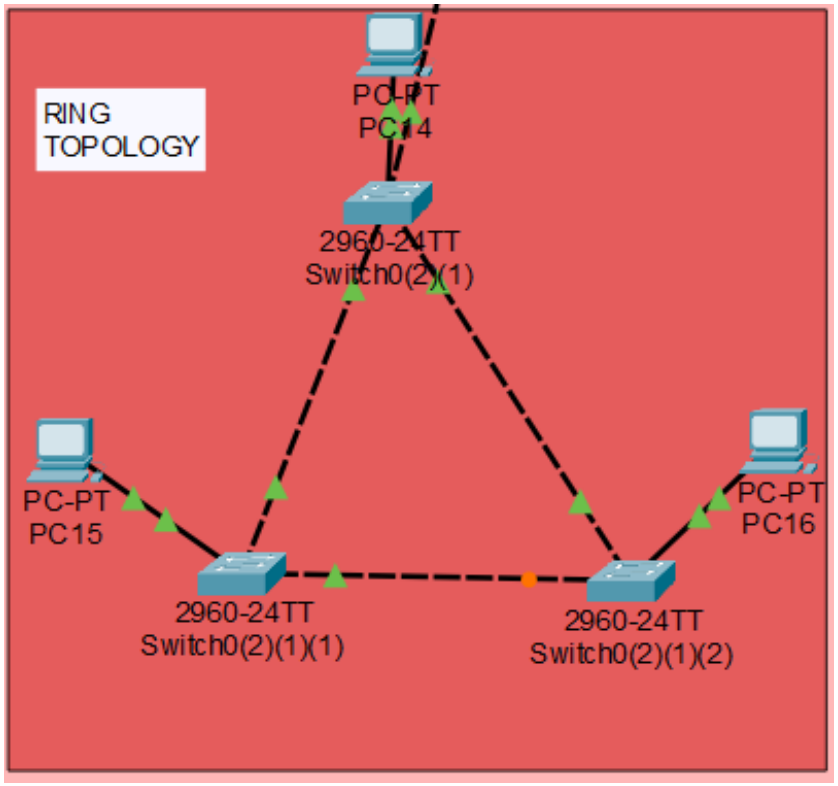

Figure 4: Mesh Topology in Cisco Packet Tracer

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4 Complex Network Design for an Organization (CLO 3)

Network Architecture Description:

The complex network design consists of two routers connected to each other. The following configurations were implemented:

- **Network 1**: 100.0.0.0/24 (DHCP-enabled)
- **Network 2**: 100.100.200.0/24 (Static routing)
- **Intermediate Network**: 100.100.50.0/24 (Between routers)

Key Features:

- A **DHCP server** is deployed under the first router to automatically assign IPs ranging from 100.0.0.3 to 100.0.0.24.

- Static IP configuration is used for devices under the second router, with IPs 100.100.200.2 and 100.100.200.3.
- **Routing Protocols**: Dynamic routing for the DHCP network and static routing for the second network.

Protocols Used:

- **Dynamic Routing Protocol**: Ensures seamless communication within the DHCP-enabled network.
- **Static Routing**: Provides manual configuration for precise control in the second network.

Screenshots:

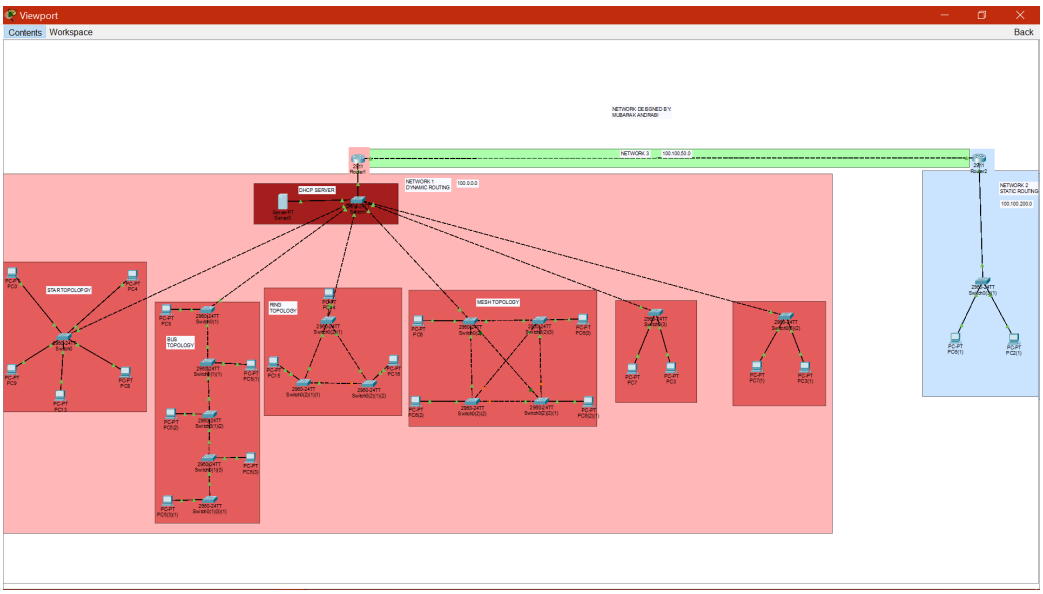

Figure 5: Network Design

```
C:\>ipconfig

FastEthernet0 Connection:(default port)

   Connection-specific DNS Suffix..:
   Link-local IPv6 Address.....: FE80::201:43FF:FEED:7BA0
   IPv6 Address.....: ::
   IPv4 Address.....: 100.0.0.6
   Subnet Mask.....: 255.255.255.0
   Default Gateway.....: ::
                                 100.0.0.1

Bluetooth Connection:

   Connection-specific DNS Suffix..:
   Link-local IPv6 Address.....: ::
   IPv6 Address.....: ::
   IPv4 Address.....: 0.0.0.0
   Subnet Mask.....: 0.0.0.0
   Default Gateway.....: ::
                                 0.0.0.0

C:\>ping 100.100.200.2

Pinging 100.100.200.2 with 32 bytes of data:

Reply from 100.100.200.2: bytes=32 time<1ms TTL=126
Reply from 100.100.200.2: bytes=32 time<1ms TTL=126
Reply from 100.100.200.2: bytes=32 time<1ms TTL=126
Reply from 100.100.200.2: bytes=32 time<1ms TTL=126

Ping statistics for 100.100.200.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Figure 6: Ping Testing from Network-1 DHCP to Network-2 Static

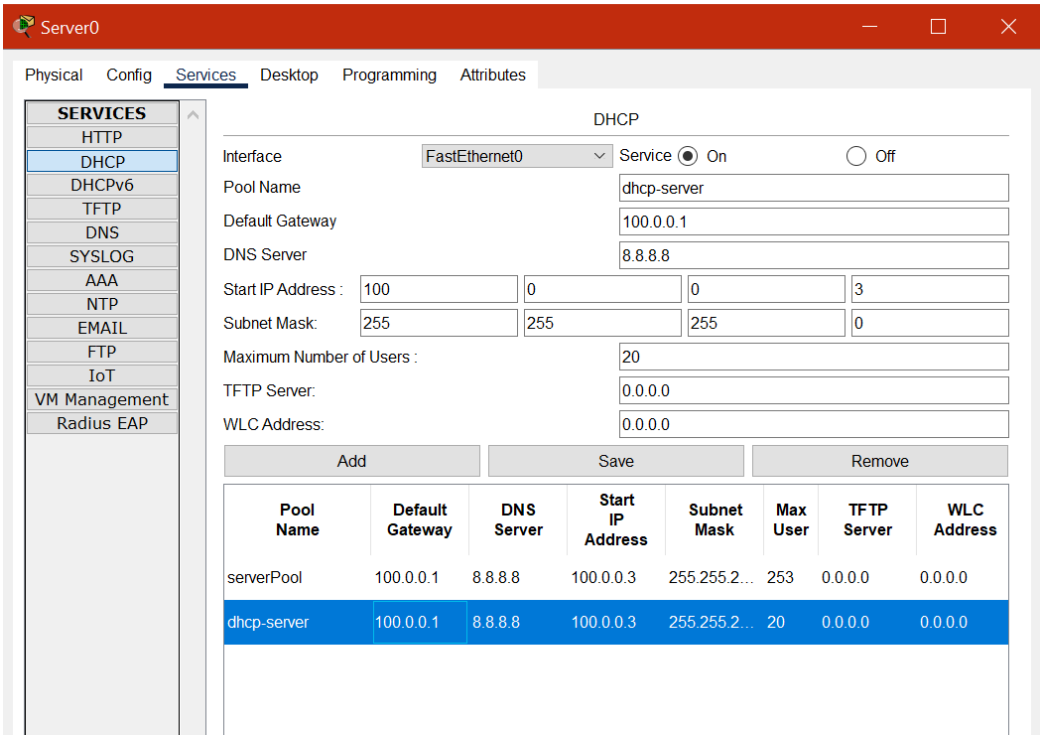

Figure 7: DHCP Server

5 Conclusion

This project demonstrated the creation and simulation of a multi-topology network using Cisco Packet Tracer. The implementation of DHCP and static routing highlights the flexibility and practicality of network design. By integrating multiple topologies (Star, Bus, Ring, Mesh) and a complex organizational architecture, the project serves as a robust learning experience in network design and simulation.