| Experiment No: 3 | |
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| **PRN** | 22070126125 |
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| **Title** | Types of connections, namely LAN, WAN and MAN |
| **Theory (short)** | • **Local Area Network (LAN):**<br>A Local Area Network (LAN) is a network that connects computers and devices within a limited geographical area, such as a home, school, office building, or closely positioned group of buildings. LANs are characterized by high data transfer rates, typically ranging from 100 Mbps to 10 Gbps, and low latency due to the proximity of networked devices. They are often used for sharing resources such as files, printers, and internet connections. Ethernet and Wi-Fi are common technologies used in LANs. LANs are usually managed by a single organization and can be either wired or wireless.<br><br>• **Metropolitan Area Network (MAN):**<br>A Metropolitan Area Network (MAN) covers a larger geographic area than a LAN, such as a city or a large campus. MANs are designed to extend connectivity over distances typically ranging from several kilometers to tens of kilometers. They are used to connect multiple LANs within a metropolitan area, enabling efficient data transfer and communication between different locations of an organization, or to provide high-speed internet access to a city. MANs often use high-capacity backbone connections, like fiber optic cables, to ensure robust performance and can employ technologies like Ethernet, MPLS (Multiprotocol Label Switching), and DWDM (Dense Wavelength Division Multiplexing).<br><br>• **Wide Area Network (WAN):**<br>A Wide Area Network (WAN) spans a vast geographical area, often a country or even the entire globe. WANs connect multiple LANs and MANs, facilitating communication and data transfer across long distances. They are essential for organizations with distributed operations, allowing for centralized data management, enterprise-wide applications, and internet access. WANs typically use leased telecommunication lines, satellite links, and undersea cables to ensure connectivity. Technologies such as MPLS, ATM (Asynchronous Transfer Mode), and VPN (Virtual Private Network) are commonly |

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| | employed to manage and secure data traffic over WANs. The internet itself is the largest example of a WAN, interconnecting millions of networks worldwide.<br>**Comparison and Application:**<br>• **LAN** is ideal for small, localized environments where high-speed data transfer and low latency are crucial. It is typically inexpensive and easy to set up.<br>• **MAN** serves larger areas than a LAN, suitable for cities or large campuses, providing connectivity over intermediate distances with higher costs and complexity compared to LAN.<br>• **WAN** is essential for connecting dispersed networks over extensive geographical areas, suitable for multinational organizations. It involves higher costs and more complex infrastructure and management compared to LANs and MANs. |

| Procedure | **Setting Up a LAN with 4 Computers and 1 Switch**<br>1. **Open Cisco Packet Tracer:**<br>o Launch Cisco Packet Tracer on your computer.<br>2. **Add Devices:**<br>o From the bottom toolbar, select the **End Devices** section.<br>o Drag and drop 4 computers (PCs) onto the workspace.<br>o From the **Network Devices** section, choose **Switches** and drag a switch onto the workspace.<br>3. **Connect Devices:**<br>o Select the **Connections** tool (lightning bolt icon).<br>o Choose **Copper Straight-Through** cable.<br>o Connect each PC to the switch:<br>▪ Click on a PC, select the **FastEthernet0** interface.<br>▪ Click on the switch, select any available **FastEthernet** port (e.g., Fa0/1, Fa0/2, etc.).<br>o Repeat this process for all 4 PCs.<br>4. **Assign IP Addresses:**<br>o Click on each PC, go to the **Desktop** tab, then **IP Configuration**.<br>o Assign IP addresses and subnet masks to each PC. Example:<br>▪ PC1: IP: 192.168.1.1, Subnet Mask: 255.255.255.0<br>▪ PC2: IP: 192.168.1.2, Subnet Mask: 255.255.255.0<br>▪ PC3: IP: 192.168.1.3, Subnet Mask: 255.255.255.0 |
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- PC4: IP: 192.168.1.4, Subnet Mask: 255.255.255.0

**Setting Up a LAN with 1 Router, 2 Switches, and 4 Computers**

1. **Add Devices:**
    - From the **End Devices** section, drag and drop 4 computers onto the workspace.
    - From the **Network Devices** section, drag and drop 1 router and 2 switches onto the workspace.
2. **Connect Devices:**
    - Select the **Connections** tool.
    - Use **Copper Straight-Through** cable to connect:
        - Router to Switch 1:
            - Click on the router, select **GigabitEthernet0/0**.
            - Click on Switch 1, select **GigabitEthernet0/1**.
        - Router to Switch 2:
            - Click on the router, select **GigabitEthernet0/1**.
            - Click on Switch 2, select **GigabitEthernet0/1**.
        - Each PC to one of the switches (distribute PCs evenly):
            - Click on a PC, select the **FastEthernet0** interface.
            - Click on a switch, select an available **FastEthernet** port.
3. **Assign IP Addresses:**
    - Click on each PC, go to the **Desktop** tab, then **IP Configuration**.

- Assign IP addresses and subnet masks to each PC. Example:
  - PCs on Switch 1: 192.168.1.x
  - PCs on Switch 2: 192.168.2.x
- Set the router's interfaces IP addresses accordingly. Example:
  - GigabitEthernet0/0: 192.168.1.1, Subnet Mask: 255.255.255.0
  - GigabitEthernet0/1: 192.168.2.1, Subnet Mask: 255.255.255.0

4. **Configure Router Interfaces:**
   - Click on the router, go to the **Config** tab, and assign IP addresses to the interfaces.

**Setting Up a WAN with 2 Routers, 2 Switches, and 4 Computers**

1. **Add Devices:**
   - From the **End Devices** section, drag and drop 4 computers onto the workspace.
   - From the **Network Devices** section, drag and drop 2 routers and 2 switches onto the workspace.
2. **Connect Devices:**
   - Select the **Connections** tool.
   - Use **Copper Straight-Through** cable to connect:
     - Router 1 to Switch 1:
       - Click on Router 1, select **GigabitEthernet0/0**.
       - Click on Switch 1, select **GigabitEthernet0/1**.
     - Router 2 to Switch 2:
       - Click on Router 2, select **GigabitEthernet0/0**.

- Click on Switch 2, select **GigabitEthernet0/1**.
- Each PC to one of the switches (distribute PCs evenly):
  - Click on a PC, select the **FastEthernet0** interface.
  - Click on a switch, select an available **FastEthernet** port.

- Use **Serial DCE** cable to connect:
  - Router 1 to Router 2:
    - Click on Router 1, select **Serial0/0/0**.
    - Click on Router 2, select **Serial0/0/0**.

3. **Assign IP Addresses:**
   - Click on each PC, go to the **Desktop** tab, then **IP Configuration**.
   - Assign IP addresses and subnet masks to each PC. Example:
     - PCs on Switch 1: 192.168.1.x
     - PCs on Switch 2: 192.168.2.x
   - Set the routers' interfaces IP addresses accordingly. Example:
     - Router 1 GigabitEthernet0/0: 192.168.1.1, Subnet Mask: 255.255.255.0
     - Router 2 GigabitEthernet0/0: 192.168.2.1, Subnet Mask: 255.255.255.0
     - Router 1 Serial0/0/0: 10.1.1.1, Subnet Mask: 255.255.255.252
     - Router 2 Serial0/0/0: 10.1.1.2, Subnet Mask: 255.255.255.252
4. **Configure Router Interfaces:**
   - Click on each router, go to the **Config** tab, and assign IP addresses to the interfaces.

- Ensure that the Serial interfaces are enabled.

5. **Configure Routing:**
   - On Router 1 and Router 2, configure static routing or use a dynamic routing protocol like RIP, OSPF, or EIGRP to enable communication between different subnets.

**Verifying the Network**

1. **Test Connectivity:**
   - Use the **Command Prompt** on each PC to ping other devices on the network to ensure connectivity.
   - Example: Open **Command Prompt** on PC1, type ping 192.168.1.2 to ping another PC on the same LAN, and ping 192.168.2.2 to ping a PC on a different LAN through the WAN.
2. **Troubleshooting:**
   - Check cable connections, IP configurations, and router settings if there is no connectivity.
   - Ensure all interfaces are up and correctly configured.

**Output Screenshots**

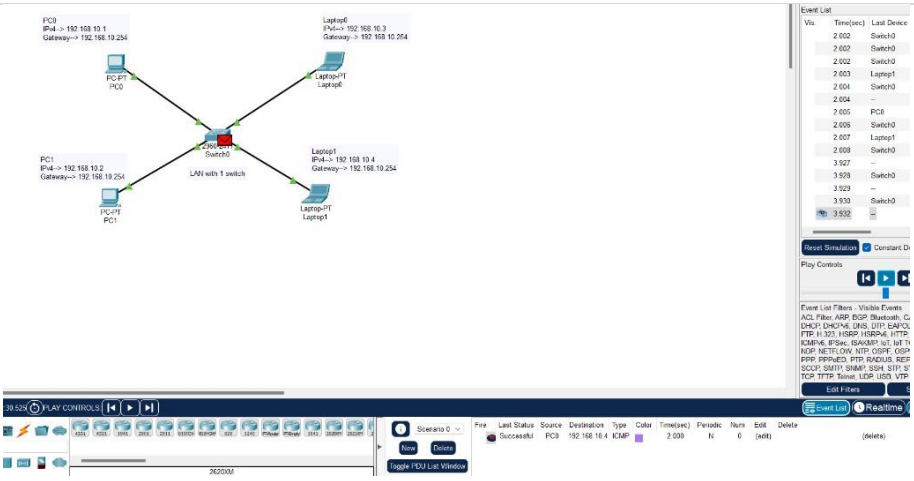


Fig 1- LAN with 1 switch

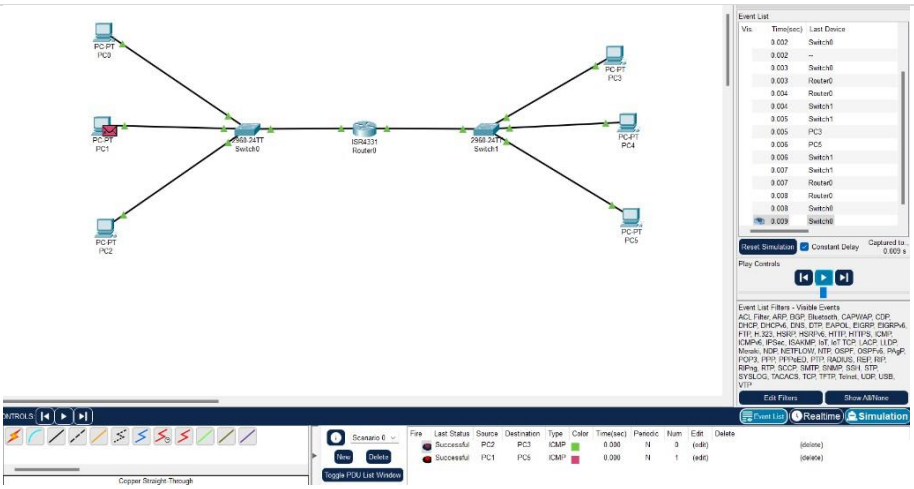

Fig 2- LAN with 2 switches 1 router

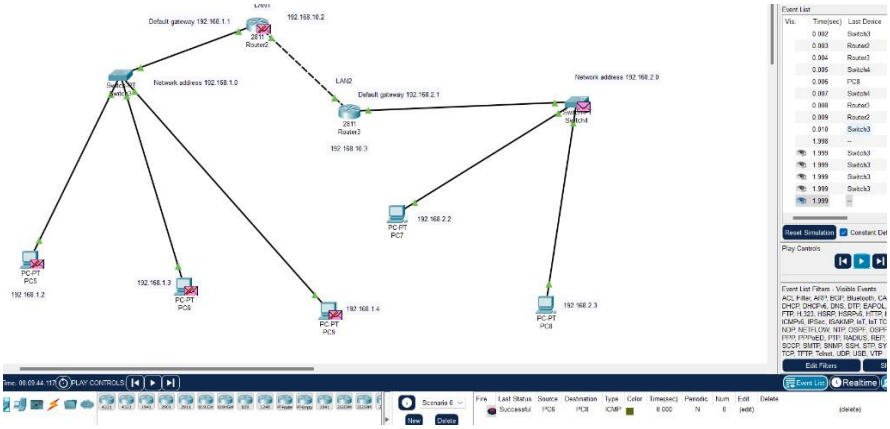

Fig 3- Simple WAN

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| **Observation** | In all these types of connections, we expect a failure in connections. It's quite possible due to wrong IP addresses or subnet mask not being equal. We also note that we can add as many pc's as we want as long as they are connected to fast ethernet ports in the switch. |
| **Self-assessment Q&A** | NA |
| **Conclusion** | Through these exercises, we gain a deeper appreciation of network topologies, device roles, and the critical nature of addressing and routing in maintaining network functionality. These practical skills are essential for network administrators and IT professionals tasked with designing, implementing, and managing network infrastructures in real-world scenarios. |