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|  | Experiment No: |
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| Title | Types of connections, namely LAN, WAN and MAN |

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| Theory (short) | Local Area Network (LAN):  A Local Area Network (LAN) connects computers and devices within a confined geographical space such as a home, school, office building, or closely situated buildings. LANs are known for their high data transfer speeds, typically between 100 Mbps to 10 Gbps, and low latency due to the proximity of the connected devices. They are commonly used for sharing resources like files, printers, and internet access. LANs can be either wired or wireless, with Ethernet and Wi-Fi being the prevalent technologies. They are generally managed by a single organization.    Metropolitan Area Network (MAN):  A Metropolitan Area Network (MAN) spans a broader geographic area than a LAN, covering regions like cities or large campuses. MANs extend connectivity over distances of several to tens of kilometers, connecting multiple LANs within a metropolitan area. This allows for efficient data transfer and communication across different organizational locations or provides high-speed internet access to a city. MANs typically utilize high-capacity backbone connections such as fiber optic cables and technologies like Ethernet, MPLS  (Multiprotocol Label Switching), and DWDM (Dense Wavelength Division Multiplexing).    Wide Area Network (WAN):  A Wide Area Network (WAN) covers a vast geographical area, which can range from a country to the entire globe. WANs connect multiple LANs and MANs, enabling communication and data transfer over long distances. They are vital for organizations with widespread operations, as they support centralized data management, enterprise-wide applications, and internet access. WANs often rely on leased telecommunication lines, satellite links, and undersea cables. Technologies like MPLS, ATM (Asynchronous Transfer Mode), and VPN (Virtual Private Network) are commonly used to manage and |

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|  | secure data traffic over WANs. The internet is the largest example of a WAN, linking millions of networks worldwide.    Comparison and Application:   * LAN is ideal for small, localized environments where highspeed data transfer and low latency are crucial. It is typically inexpensive and easy to set up. * 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. * 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. |

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| Procedure | Setting Up a LAN with 4 Computers and 1 Switch   1. Open Cisco Packet Tracer:    * Launch Cisco Packet Tracer on your computer. 2. Add Devices:    * From the bottom toolbar, select the End Devices section.    * Drag and drop 4 computers (PCs) onto the workspace.    * From the Network Devices section, choose Switches and drag a switch onto the workspace. 3. Connect Devices:    * Select the Connections tool (lightning bolt icon).    * Choose Copper Straight-Through cable. o Connect each   PC to the switch:  Click on a PC, select the FastEthernet0 interface.  Click on the switch, select any available  FastEthernet port (e.g., Fa0/1, Fa0/2, etc.).   * + Repeat this process for all 4 PCs.  1. 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:   PC1: IP: 192.168.1.1, Subnet Mask: 255.255.255.0  PC2: IP: 192.168.1.2, Subnet Mask:  255.255.255.0  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 Co   1. ing Up a LAN with 1 Router, 2 Switches, and 4 mputers 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,  GigabitEthernet0/1.  Each PC to one of the switches (distribute PCs | select |
|  |  |  |  | evenly):   * Click on a PC, select the   FastEthernet0 interface.   * Click on a switch, select an   FastEthernet port. | available |
|  | 3. Assign IP Addresses:  o Click on each PC, go to the Desktop tab, then IP Configuration. | | | | |

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|  | * 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:  o 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  GigabitEthernet0/0. | 2, | select |

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|  | * 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:  o Click on each router, go to the Config tab, and assign IP addresses to the interfaces. |

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|  | o Ensure that the Serial interfaces are enabled.  5. Configure Routing:  o 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 |
| 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. |