LAB #1 :Overview of Networks & Cabling .

Objectives

- *Study of different types of Network cables and Practically implement the cross-wired cable and straight through cable using clamping tool.*
- *Study of following Network Devices in Detail : Repeater, Hub, Switch, Bridge and Router*

(Components): RJ-45 connector, Climping Tool, Twisted pair Cable

Procedure: To do these practical following steps should be done:

1. *Start by stripping off about 2 inches of the plastic jacket off the end of the cable. Be very careful at this point, as to not nick or cut into the wires, which are inside. Doing so could alter the characteristics of your cable, or even worse render is useless. Check the wires, one more time for nicks or cuts. If there are any, just whack the whole end off, and start over.*

2. *Spread the wires apart, but be sure to hold onto the base of the jacket with your other hand. You do not want the wires to become untwisted down inside the jacket. Category 5 cable must only have 1/2 of an inch of 'untwisted' wire at the end; otherwise it will be 'out of spec'. At this point, you obviously have ALOT more than 1/2 of an inch of un-twisted wire.*

3. *You have 2 end jacks, which must be installed on your cable. If you are using a pre-made cable, with one of the ends whacked off, you only have one end to install - the crossed over end. Below are two diagrams, which show how you need to arrange the cables for each type of cable end. Decide at this point which end you are making and examine the associated picture below.*

Diagram shows you how to prepare straight through wired connection

RJ45 Pin # (END 1)	Wire Color	Diagram End #1	RJ45 Pin # (END 2)	Wire Color	Diagram End #2
1	White/Orange		1	White/Green	
2	Orange		2	Green	
3	White/Green		3	White/Orange	
4	Blue		4	White/Brown	
5	White/Blue		5	Brown	
6	Green		6	Orange	
7	White/Brown		7	Blue	
8	Brown		8	White/Blue	

Diagram shows you how to prepare Cross wired connection

RJ45 Pin # (END 1)	Wire Color	Diagram End #1	RJ45 Pin # (END 2)	Wire Color	Diagram End #2
1	White/Orange		1	White/Green	
2	Orange		2	Green	
3	White/Green		3	White/Orange	
4	Blue		4	White/Brown	
5	White/Blue		5	Brown	
6	Green		6	Orange	
7	White/Brown		7	Blue	
8	Brown		8	White/Blue	

<u>NETWORKS DEVICES :</u>

1. Repeater: *Functioning at Physical Layer.A* ***repeater*** *is an electronic device that receives a signal and retransmits it at a higher level and/or higher power, or onto the other side of an obstruction, so that the signal can cover longer distances. Repeater have two ports ,so cannot be use to connect for more than two devices.*

2. **Hub:** *An* ***Ethernet hub***, ***active hub***, ***network hub***, ***repeater hub***, ***hub*** *or* ***concentrator*** *is a device for connecting multiple twisted pair or fiber optic Ethernet devices together and making them act as a single network segment. Hubs work at the physical layer (layer 1) of the OSI model. The device is a form of multiport repeater. Repeater hubs also participate in collision detection, forwarding a jam signal to all ports if it detects a collision.*

3. **Switch:** *A* ***network switch*** *or* ***switching hub*** *is a computer networking device that connects network segments.The term commonly refers to a network bridge that processes and routes data at the data link layer (layer 2) of the OSI model. Switches that additionally process data at the network layer (layer 3 and above) are often referred to as Layer 3 switches or multilayer switches.*

4. **Bridge:** *A* ***network bridge*** *connects multiple network segments at the data link layer (Layer 2) of the OSI model. In Ethernet networks, the term* bridge *formally means a device that behaves according to the IEEE 802.1D standard. A bridge and switch are very much alike; a switch being a bridge with numerous ports.* Switch *or* Layer 2 switch *is often used interchangeably with* bridge*.Bridges can analyze incoming data packets to determine if the bridge is able to send the given packet to another segment of the network.*

5. **Router:** *A* ***router*** *is an electronic device that interconnects two or more computer networks, and selectively interchanges packets of data between them. Each data packet contains address*

information that a router can use to determine if the source and destination are on the same network, or if the data packet must be transferred from one network to another. Where multiple routers are used in a large collection of interconnected networks, the routers exchange information about target system addresses, so that each router can build up a table showing the preferred paths between any two systems on the interconnected networks.

Network Types:

Different types of networks are distinguished based on their size (in terms of the number of machines), their data transfer speed, and their reach. There are usually said to be two categories of networks:

- ***Local Area Network*** *(LAN) : is limited to a specific area, usually an office, and cannot extend beyond the boundaries of a single building. The first LANs were limited to a range (from a central point to the most distant computer) of 185 meters (about 600 feet) and no more than 30 computers. Today's technology allows a larger LAN, but practical administration limitations require dividing it into small, logical areas called workgroups.*

A workgroup is a collection of individuals who share the same files and databases over the LAN.

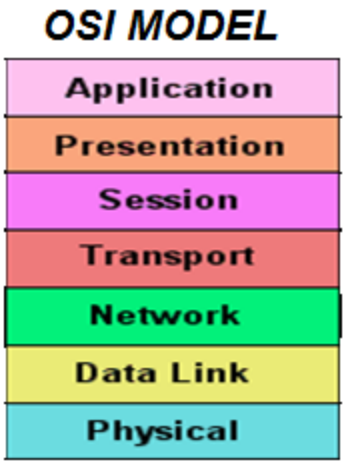
Wide Area Network *(WAN):If you have ever connected to the Internet, you have used the largest WAN on the planet. A WAN is any network that crosses metropolitan, regional, or national boundaries. Most networking professionals define a WAN as any network that uses routers and public network links. The Internet fits both definitions.*

	LAN	WAN
Definition:	LAN (Local Area Network) is a computer network covering a small geographic area, like a home, office, schools, or group of buildings.	WAN (Wide Area Network) is a computer network that covers a broad area or any network whose communications links cross metropolitan, regional, or national boundaries over a long distance.
Speed:	High speed(1000mbps)	Less speed(150mbps)
Data transfer rates:	High data transfer rate.	Lower data transfer rate as compared to LANs.
Example:	Network in an organization.	The Internet.
Components:	Layer 2 devices like switches, bridges. layer1 devices like hubs , repeaters	Layers 3 devices Routers, Switches and Technology specific devices like ATM or Frame-relay Switches.
Data Transmission Error:	Experiences fewer data transmission errors.	Experiences more data transmission errors as compared to LAN.
Ownership:	Typically owned, controlled, and managed by a single person or organization.	WANs (like the Internet) are not owned by any one organization but rather exist under collective distributed ownership and management over long distances.
Set-up costs:	Set-up an extra devices on the network, it is not very expensive.	Networks in remote areas have to be connected, Set-up costs are higher.
Maintenance costs:	Covers a relatively small geographical area, LAN is easier to maintain at relatively low costs.	Maintaining WAN is difficult because of its wider geographical coverage and higher maintenance costs.
Geographical Spread:	Have a small geographical range.	Have a large geographical range generally spreading across boundaries.
Bandwidth:	High bandwidth is available for transmission.	Low bandwidth is available for transmission.

The OSI Model:

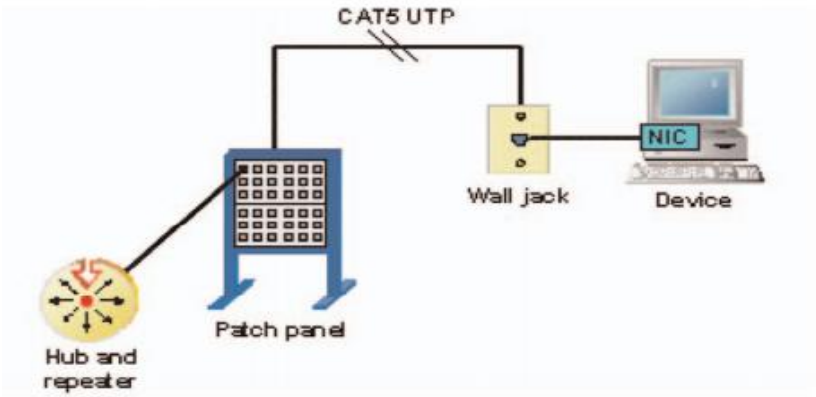
Understanding the Seven Layers of Computer Networks

The Open Systems Interconnection (OSI) model is a reference tool for understanding data communications between any two networked systems. It divides the communications processes into seven layers. Each layer both performs specific functions to support the layers above it and offers services to the layers below it. The three lowest layers focus on passing traffic through the network to an end system. The top four layers come into play in the end system to complete the process.



The main benefits of the OSI model include the following: • Helps users understand the big picture of networking • Helps users understand how hardware and software elements function together • Makes troubleshooting easier by separating networks into manageable pieces • Defines terms that networking professionals can use to compare basic functional relationships on different networks • Helps users understand new technologies as they are developed • Aids in interpreting vendor explanations of product functionality

Layer 1 – The Physical Layer



The physical layer of the OSI model defines connector and interface specifications, as well as the medium (cable) requirements. Electrical, mechanical, functional, and procedural specifications are provided for sending a bit stream on a computer network.

Components of the physical layer include:

• *Cabling system components.*

• *Adapters that connect media to physical interfaces*

• *Connector design and pin assignments*

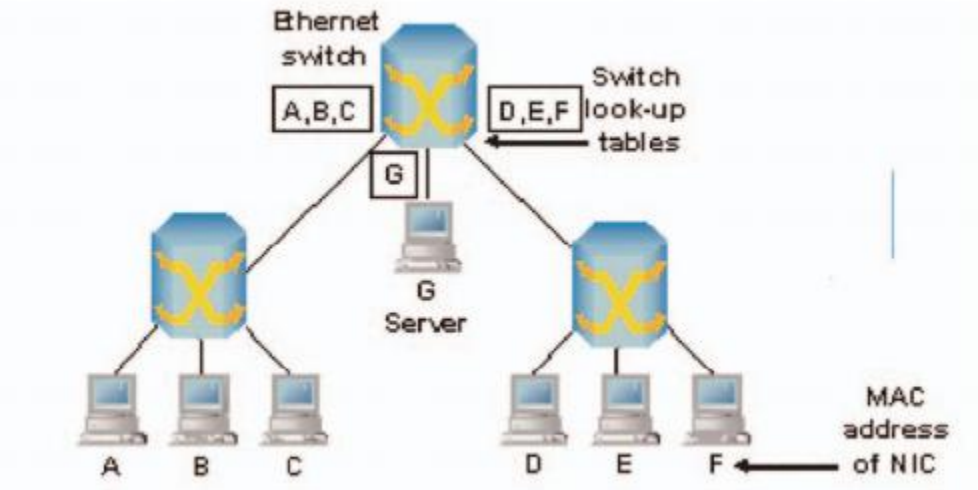
• *Hub, repeater, and patch panel specifications*

• *Wireless system components*

• *Parallel SCSI (Small Computer System Interface)*

• *Network Interface Card (NIC)*

Layer 2 – The Data Link Layer



Layer 2 of the OSI model provides the following functions:

• *Allows a device to access the network to send and receive messages*

• *Offers a physical address so a device's data can be sent on the network*

• *Works with a device's networking software when sending and receiving messages*

• *Provides error-detection capability*

Common networking components that function at layer 2 include:

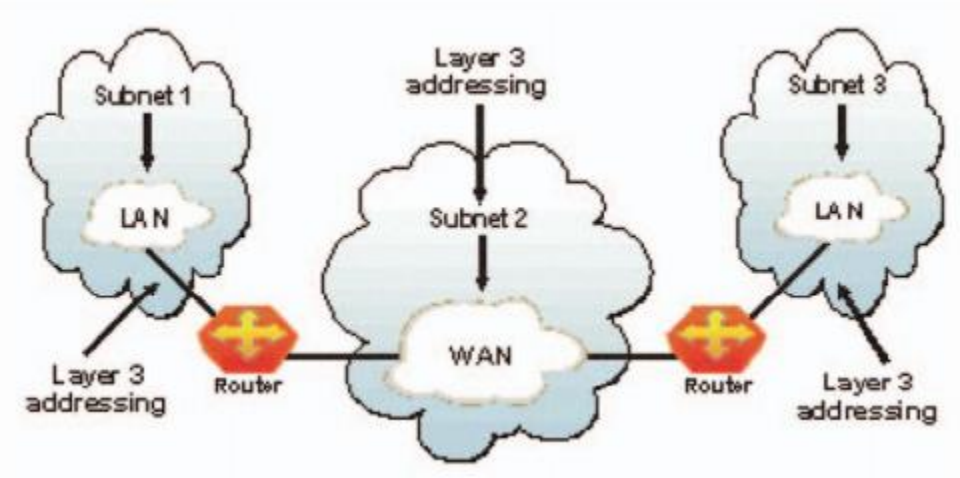
• *Network interface cards*

• *Ethernet and Token Ring switches*

• *Bridges NICs have a layer 2 or MAC address.*

A switch uses this address to filter and forward traffic, helping relieve congestion and collisions on a network segment. Bridges and switches function in a similar fashion; however, bridging is normally a software program on a CPU, while switches use Application-Specific Integrated Circuits (ASICs) to perform the task in dedicated hardware, which is much faster.

Layer 3 – The Network Layer



Layer 3, the network layer of the OSI model, provides an end-to-end logical addressing system so that a packet of data can be routed across several layer 2 networks (Ethernet, Token Ring, Frame Relay, etc.). Note that network layer addresses can also be referred to as logical addresses. Initially, software manufacturers, such as Novell, developed proprietary layer 3 addressing. However, the networking industry has evolved to the point that it requires a common layer 3 addressing system. The Internet Protocol (IP) addresses make networks easier to both set up and connect with one another. The Internet uses IP addressing to provide connectivity to millions of networks around the world. To make it easier to manage the network and control the flow of packets, many organizations separate their network layer addressing into smaller parts known as subnets. Routers use the network or subnet portion of the IP addressing to route traffic between different networks. Each router must be configured specifically for the networks or subnets that will be connected to its interfaces. Routers communicate with one another using routing protocols, such as Routing Information Protocol (RIP) and Open version of Shortest Path First (OSPF), to learn of other networks that are present and to calculate the best way to reach each network based on a variety of criteria (such as the path with the fewest routers). Routers and other networked systems make these routing decisions at the network layer. When passing packets between different networks, it may become necessary to adjust their outbound size to one that is compatible with the layer 2 protocol that is being used. The network layer accomplishes this via a process known as fragmentation. A router's network layer is usually responsible for doing the fragmentation. All reassembly of fragmented packets happens at the network layer of the final destination system.

Layer 4 – The Transport Layer

Layer 4, the transport layer of the OSI model, offers end-to-end communication between end devices through a network. Depending on the application, the transport layer either offers reliable, connection-oriented or connectionless, best-effort communications.

Some of the functions offered by the transport layer include:

• Application identification

• Client-side entity identification

• Confirmation that the entire message arrived intact

• Segmentation of data for network transport

• Control of data flow to prevent memory overruns

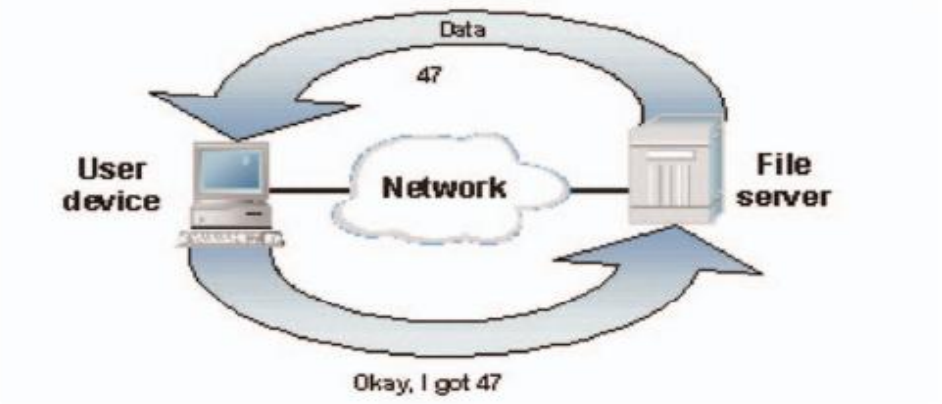
• Establishment and maintenance of both ends of virtual circuits

• Transmission-error detection

• Realignment of segmented data in the correct order on the receiving side

• Multiplexing or sharing of multiple sessions over a single physical link The most common transport layer protocols are the connection-oriented TCP Transmission Control Protocol (TCP) and the connectionless UDP User Datagram Protocol (UDP).

Layer 5 – The Session Layer



Layer 5, the session layer, provides various services, including tracking the number of bytes that each end of the session has acknowledged receiving from the other end of the session. This

session layer allows applications functioning on devices to establish, manage, and terminate a dialog through a network.

Session layer functionality includes:

• Virtual connection between application entities

• Synchronization of data flow

• Creation of dialog units

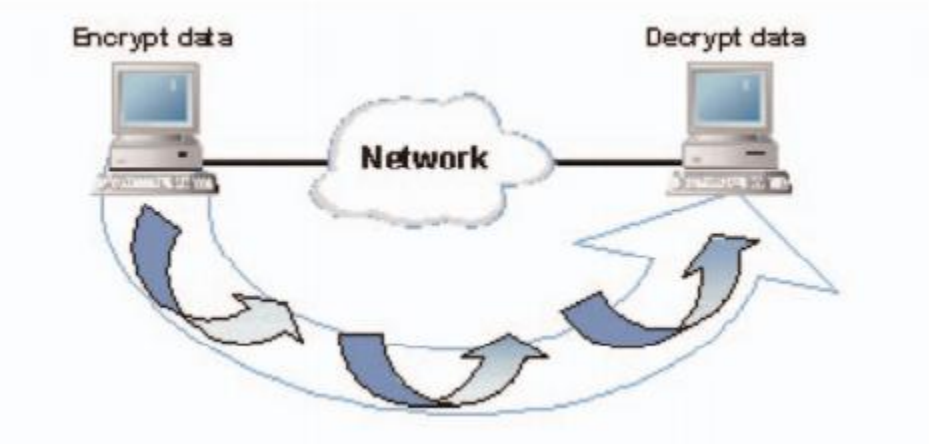
• Connection parameter negotiations

• Partitioning of services into functional groups

• Acknowledgements of data received during a session

• Retransmission of data if it is not received by a device

Layer 6 – The Presentation Layer



Layer 6, the presentation layer, is responsible for how an application formats the data to be sent out onto the network. The presentation layer basically allows an application to read (or understand) the message.

Examples of presentation layer functionality include:

• Encryption and decryption of a message for security

• Compression and expansion of a message so that it travels efficiently

• Graphics formatting • Content translation • System-specific translation

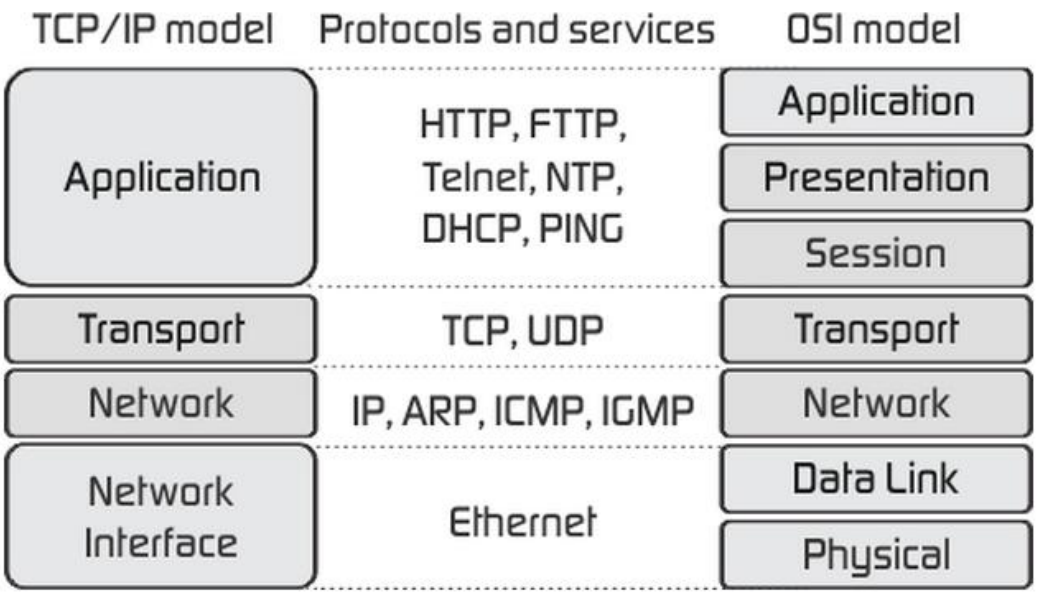
Layer 7 – The Application Layer

Layer 7, the application layer, provides an interface for the end user operating a device connected to a network. This layer is what the user sees, in terms of loading an application (such as Web browser or e-mail); that is, this application layer is the data the user views while using these applications.

Examples of application layer functionality include:

- *Support for file transfers*
- *Ability to print on a network*
- *Electronic mail*
- *Electronic messaging*
- *Browsing the World Wide Web*

TCP/IP Model Overview


TCP/IP model
Protocols and services
OSI model
Application
HTTP, FTTP,
Telnet, NTP,
DHCP, PING
Application
Presentation
Session
Transport
TCP, UDP
Transport
Network
IP, ARP, ICMP, IGMP
Network
Network
Interface
Ethernet
Data Link
Physical