



ශ්‍රී ලංකා විවෘත විශ්වවිද්‍යාලය  
இலங்கை திறந்த பல்கலைக்கழகம்  
The Open University of Sri Lanka

# EEX3373

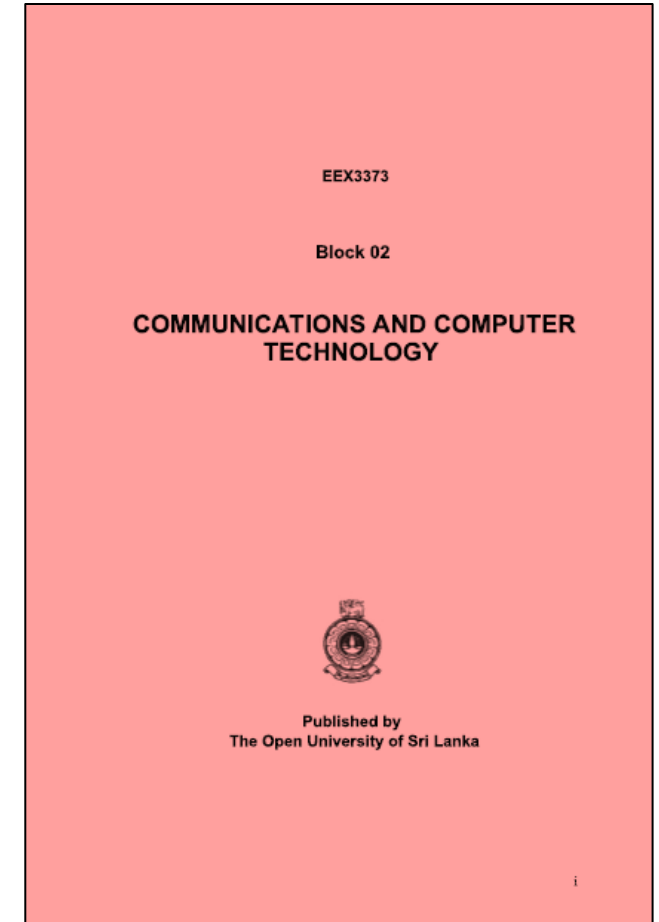
# Communication and Computer Technology

## Day School 03

Center for IT Educational Services (CITES)  
Faculty of Engineering Technology  
Open University of Sri Lanka

# CONTENT

- Session 09: Introduction to Networking
- Session 10: Connecting Devices and Network Topologies
- Session 11: Internet
- Networking Practical



## Session 09: Introduction to Networking

## Session 10: Connecting Devices and Network Topologies

## Session 11: Internet

- Concept of Computer Networking
- OSI Reference Model

- Introduction
- Connecting Devices
- Network Types
- Transmission Media
- Local Area Network
- Wide Area Network

- Introduction
- Internet Administration
- Domain Names and Addressing
- TCP/IP (Transmission Control Protocol/Internet Protocol)
- Addressing with TCP/IP
- Accessing the Internet
- Email
- Telnet
- FTP
- WWW
- HTML (Hyper Text Markup language)
- Web Authoring Tools
- Security Concerns



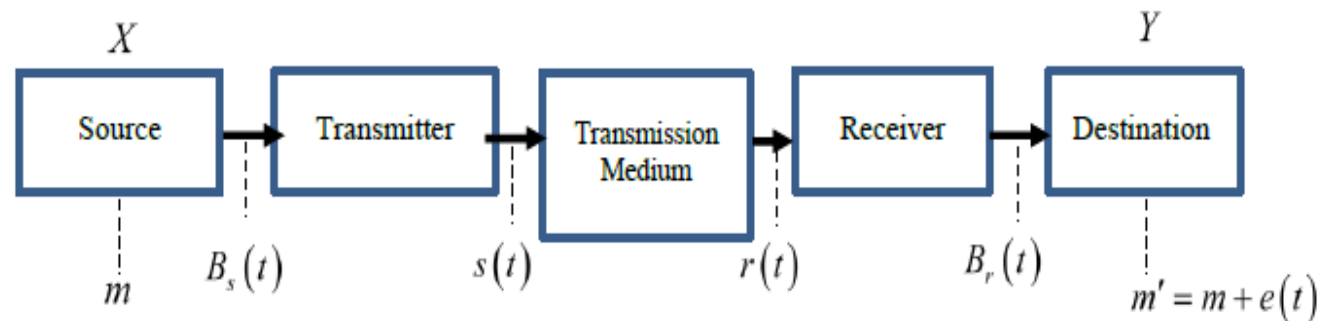
# INTRODUCTION TO NETWORKING

## Concept of Computer Networking

A **Computer Network** is a system in which multiple computers are connected to each other to share information and resources.

- Share resources from one computer to another.
- Create, Store and Access files from computer(s) connected over a network.
- Connect and use peripherals across network.

**Data communication** is the process of transferring digital data in a reliable and efficient manner.



Data Communication Model



# INTRODUCTION TO NETWORKING

## Concept of Computer Networking cntd.

Based on the **Geographical Area**, computer networks can be categorized as;

- LAN(Local Area Network)
- PAN(Personal Area Network)
- MAN(Metropolitan Area Network)
- WAN(Wide Area Network)

Based on **Transmission Media**, computer networks can be categorized as;

- Guided Media Network
- Unguided Media Network

Based on **Functionality**, computer networks can be categorized as;

- Client-Server Network
- Peer-to-Peer Network

Based on **Line Configuration**, computer networks can be categorized as;

- Point-to-Point
- Multipoint

Based on **Ownership**, computer networks can be categorized as;

- Private Network
- Public Network

Based on **Topology**, computer networks can be categorized as;

- Bus Topology
- Ring Topology
- Tree Topology
- Star Topology
- Mesh Topology
- Hybrid Topology



# INTRODUCTION TO NETWORKING cntd.

## Related Terminologies to the OSI Reference Model

- Protocol
- Peer entities
- Interface
- Flow Control
- Error Control
- Routing



# INTRODUCTION TO NETWORKING cntd.

## OSI Reference Model

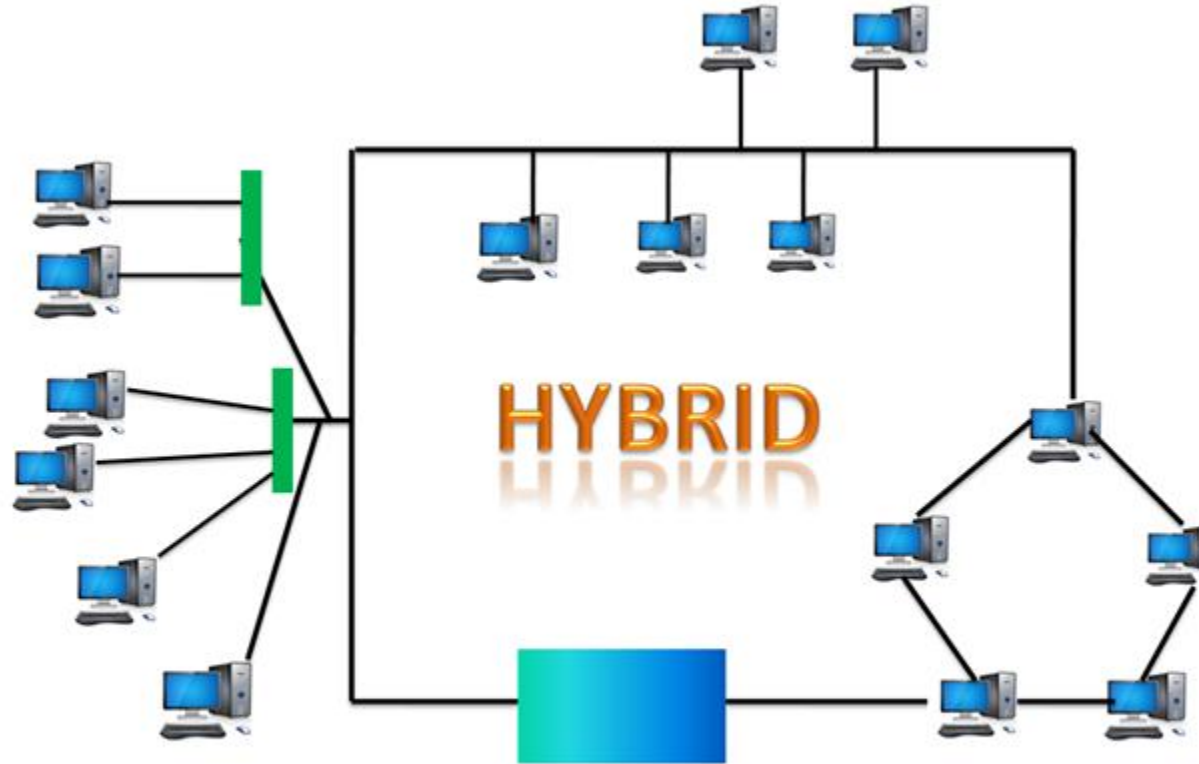
**Open System Interconnection(OSI)** is a reference model consists of seven layers that describes how information from one computer moves another computer.

OSI Model	TCP/IP Model
Application Layer	Application layer
Presentation Layer	
Session Layer	
Transport Layer	Transport Layer
Network Layer	Internet Layer
Data link layer	Link Layer
Physical layer	

- Each layer performs a related subset of functions required for communication
- Each layer provides services to the next higher layer while depending on the next lower layer to perform more primitive functions
- Communication is achieved by having corresponding (peer) entities in the same layer in two different systems communicate via a protocol
- Each protocol entity sends data down to the next lower layer to get the data across to its peer entity
- Each entity communicates with entities in the layers above it and below it, across an interface



# CONNECTING DEVICES AND NETWORK TOPOLOGIES





# CONNECTING DEVICES AND NETWORK TOPOLOGIES cntd.

## Connecting Devices

**Network Interface Card(NIC)** is a hardware component used to connect a computer with another computer onto a network.

**Bridges** are connection devices between networks that operate in the data link layer of the OSI model.

**Switches** send incoming data packets (frames) to a specific port over a network.

A **Modem** stands for Modulator/Demodulator is a hardware device that allows the computer to connect to the internet over the existing telephone line.

**Hub** in computer network is used for connecting multiple computers or segments of a LAN. Normally, it is used for broadcasting in Peer to Peer small Home Network.

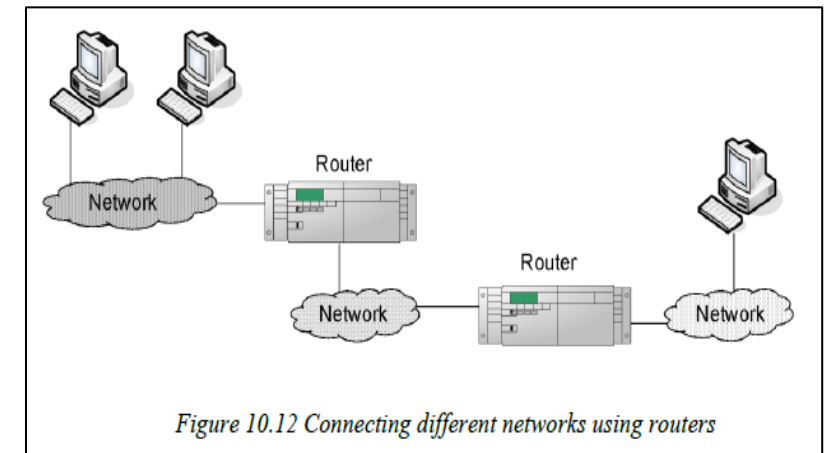
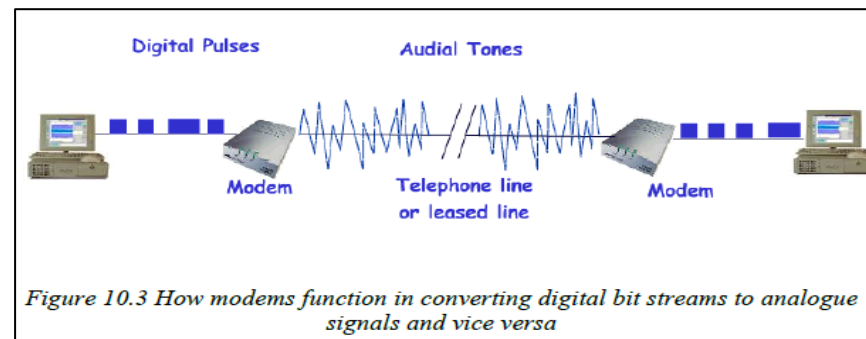
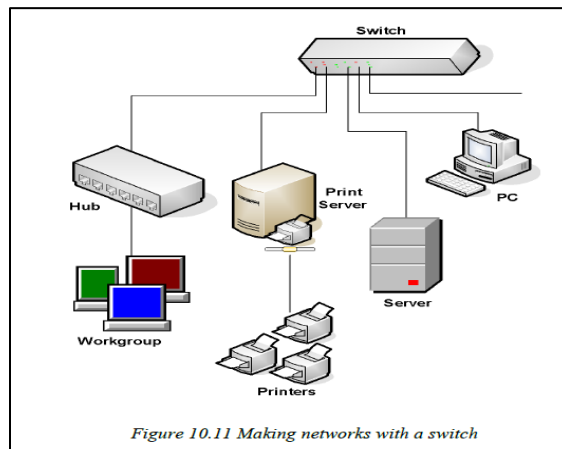
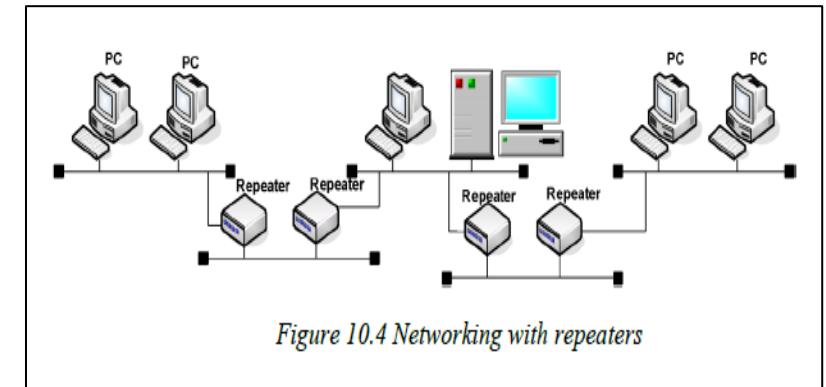
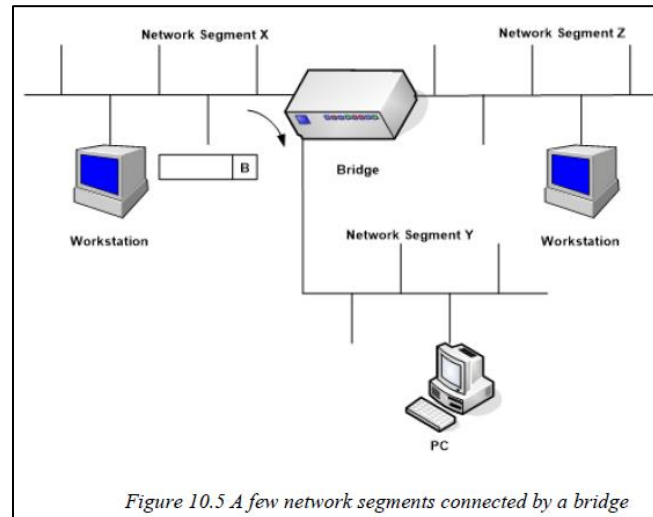
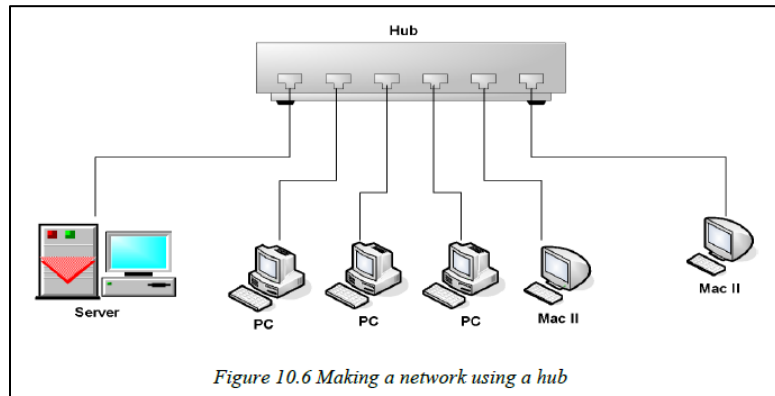
**Repeaters** take the signal they receive from the network devices and regenerate it to keep it intact during its transmission through the physical environment.

**Routers** are used to connect both similar and dissimilar LANs. Router operates on the network layer of OSI model using the physical layer, data link layer and network layer to provide connectivity, addressing and switching.



# CONNECTING DEVICES AND NETWORK TOPOLOGIES cntd.

## Connecting Devices cntd.



# CONNECTING DEVICES AND NETWORK TOPOLOGIES cntd.

## Network Types

**Local Area Network(LAN)** is a group of computers connected to each other in a small area such as building, office.

- LAN is used for connecting two or more personal computers through a communication medium such as twisted pair, coaxial cable, etc.
- It is less costly as it is built with inexpensive hardware such as hubs, network adapters, and ethernet cables.
- The data is transferred at an extremely faster rate in Local Area Network.
- Local Area Network provides higher security.

**Wide Area Network(WAN)** is a network that extends over a large geographical area such as states or countries.

- A Wide Area Network is quite bigger network than the LAN.
- A Wide Area Network is not limited to a single location, but it spans over a large geographical area through a telephone line, fibre optic cable or satellite links.
- The internet is one of the biggest WAN in the world.
- A Wide Area Network is widely used in the field of Business, government, and education.



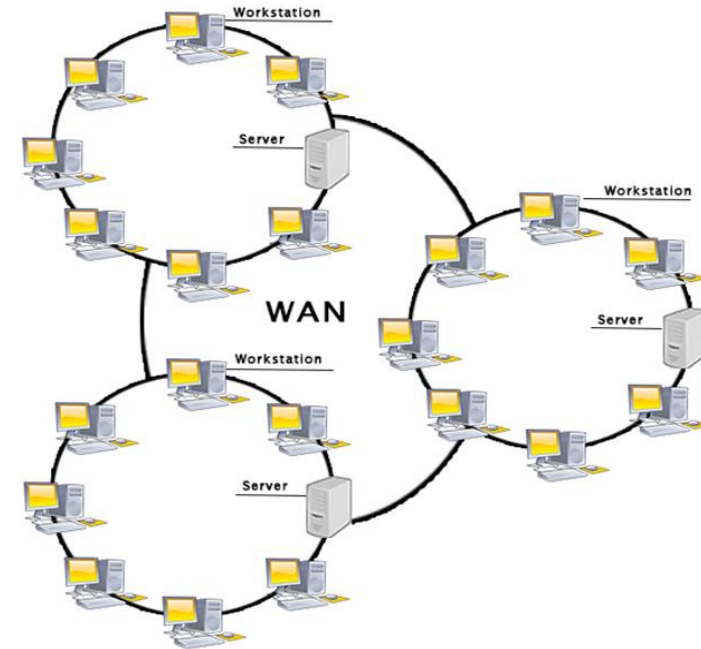
# CONNECTING DEVICES AND NETWORK TOPOLOGIES cntd.

## Network Types cntd.

### Local Area Network(LAN)

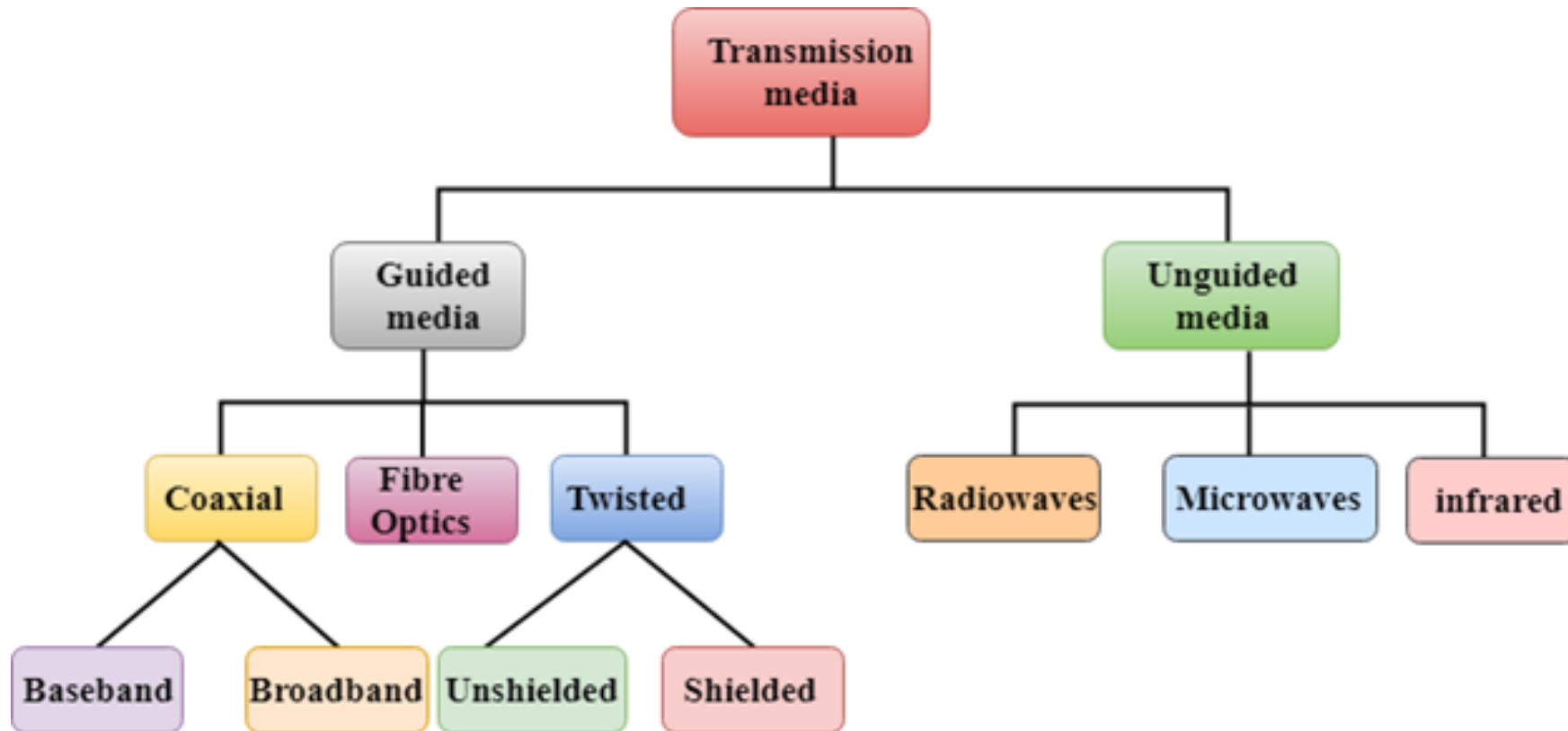


### Wide Area Network(WAN)



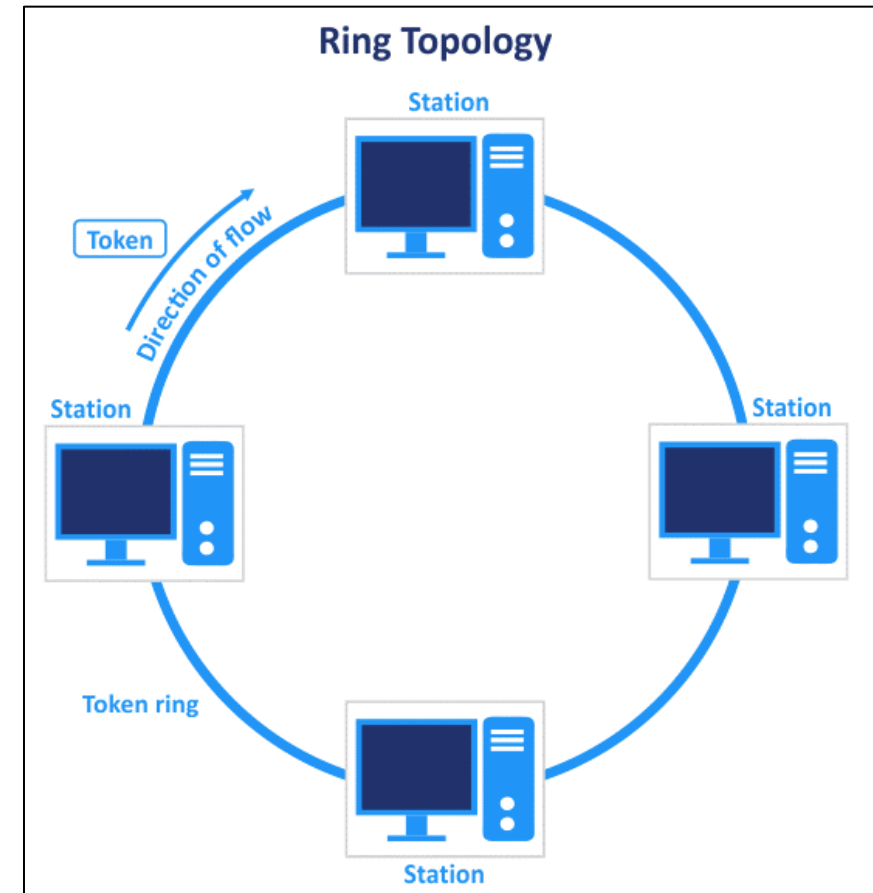
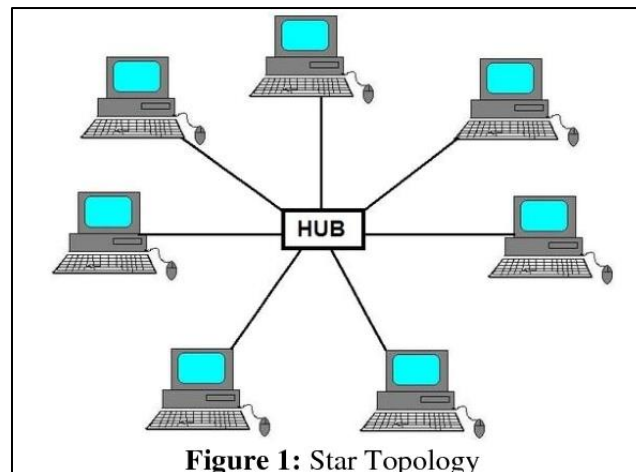
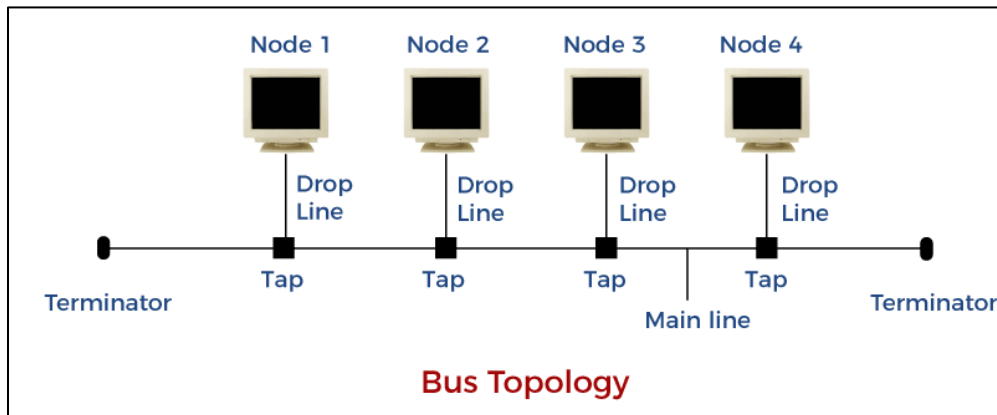
# CONNECTING DEVICES AND NETWORK TOPOLOGIES cntd.

## Transmission Media



# CONNECTING DEVICES AND NETWORK TOPOLOGIES cntd.

## LAN Technology cntd.



# CONNECTING DEVICES AND NETWORK TOPOLOGIES cntd.

## LAN Technology

**Bus Topology** is designed in such a way that all the stations are connected through a single cable known as a backbone cable.

- Each node is either connected to the backbone cable by drop cable or directly connected to the backbone cable.
- When a node wants to send a message over the network, it puts a message over the network. All the stations available in the network will receive the message whether it has been addressed or not.
- The bus topology is mainly used in 802.3 (ethernet) and 802.4 standard networks.
- The configuration of a bus topology is quite simpler as compared to other topologies.
- The backbone cable is considered as a "single lane" through which the message is broadcast to all the stations.
- The most common access method of the bus topologies is CSMA (Carrier Sense Multiple Access).



# CONNECTING DEVICES AND NETWORK TOPOLOGIES cntd.

## LAN Technology

**Ring Topology** is like a bus topology, but with connected ends.

- The node that receives the message from the previous computer will retransmit to the next node.
- The data flows in one direction, i.e., it is unidirectional.
- The data flows in a single loop continuously known as an endless loop.
- It has no terminated ends, i.e., each node is connected to other node and having no termination point.
- The data in a ring topology flow in a clockwise direction.
- The most common access method of the ring topology is token passing.
- Token passing: It is a network access method in which token is passed from one node to another node.
- Token: It is a frame that circulates around the network.





# CONNECTING DEVICES AND NETWORK TOPOLOGIES cntd.

## LAN Technology

**Star Topology** is an arrangement of the network in which every node is connected to the central hub, switch or a central computer.

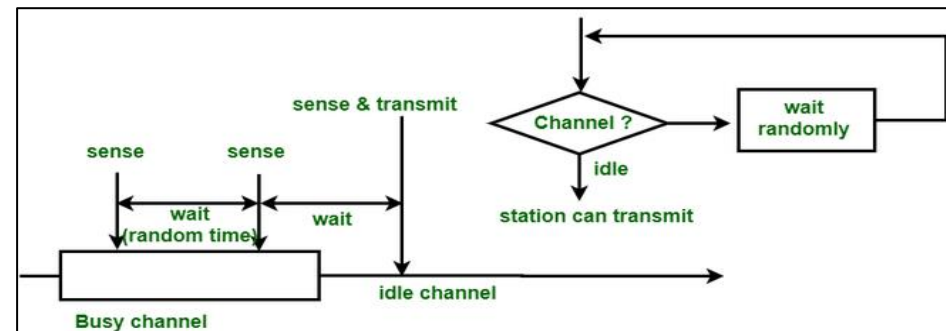
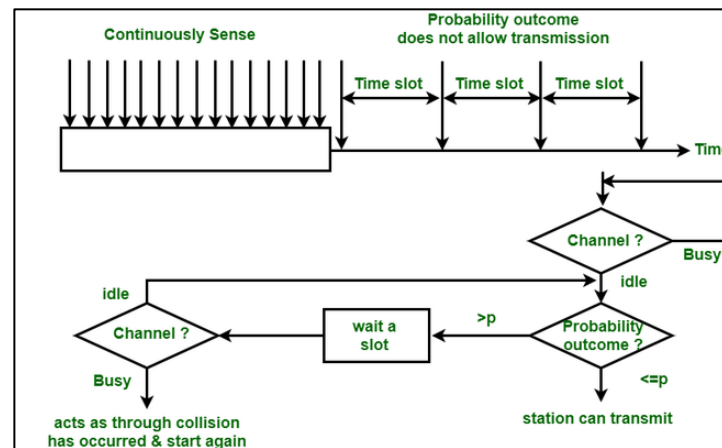
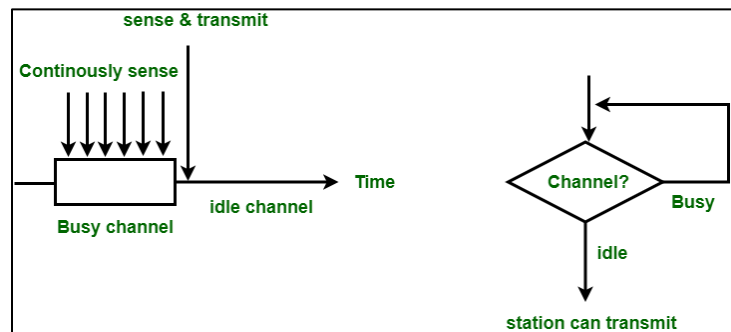
- The central computer is known as a server, and the peripheral devices attached to the server are known as clients.
- Coaxial cable or RJ-45 cables are used to connect the computers.
- Hubs or Switches are mainly used as connection devices in a physical star topology.
- Star topology is the most popular topology in network implementation.



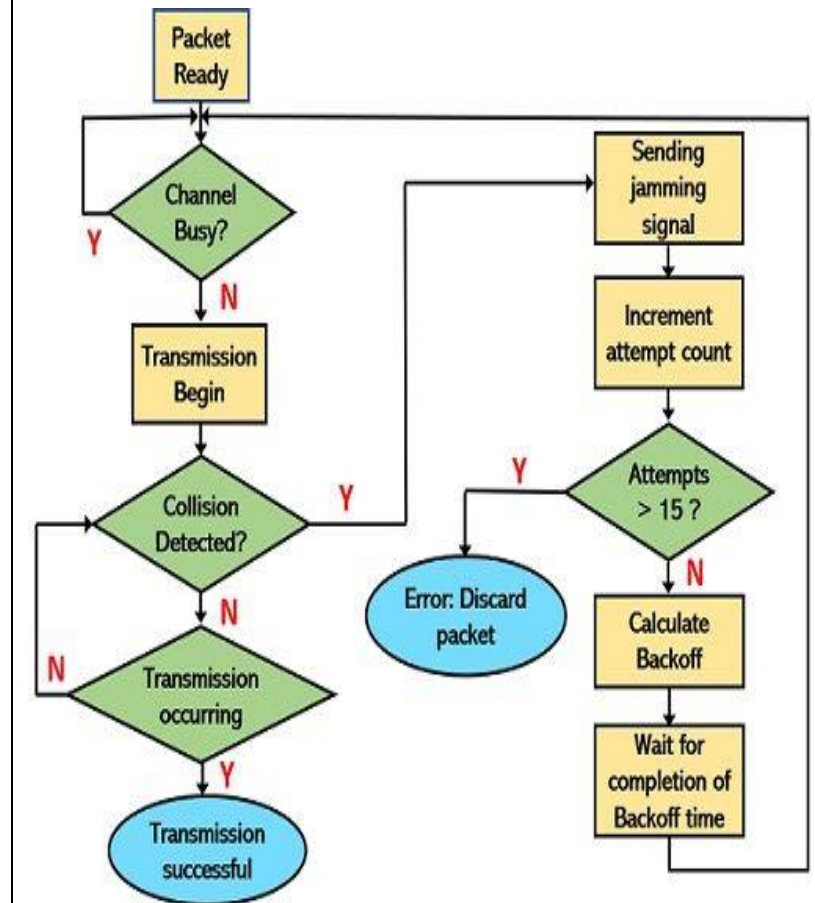
# CONNECTING DEVICES AND NETWORK TOPOLOGIES cntd.

## LAN Technology cntd.

### Career Sense Multiple Access(CSMA) / 1-persistent, non-persistent, p-persistent



### CSMA/CD

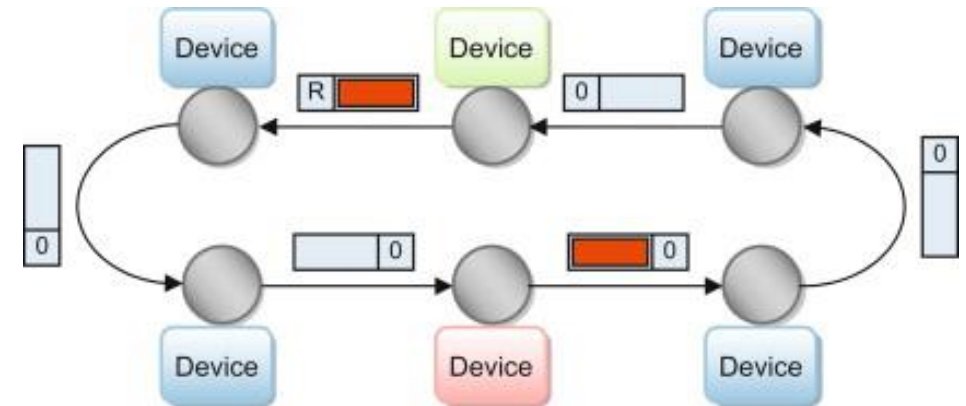


# CONNECTING DEVICES AND NETWORK TOPOLOGIES cntd.

## LAN Technology cntd.

### Token Ring

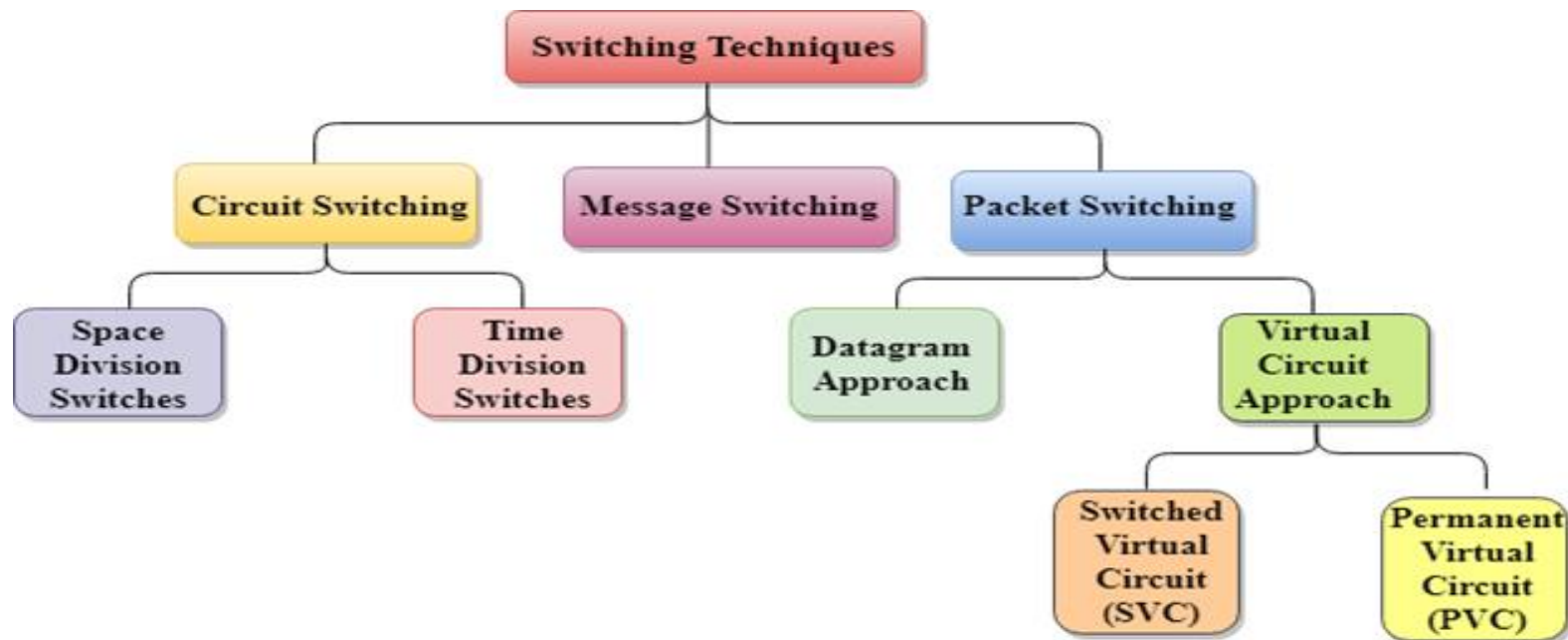
- When a node wants to transmit
  - Wait for free token
  - Remove token from ring (replace with busy token)
  - Transmit message
  - When transmitting finished, replace free token on ring
  - Nodes must buffer 1 bit of data so that a free token can be changed to a busy token



# CONNECTING DEVICES AND NETWORK TOPOLOGIES cntd.

## Wide Area Network

In large networks, there can be multiple paths from sender to receiver. The **switching technique** will decide the best route for data transmission. Switching technique is used to connect the systems for making one-to-one communication.



- Circuit Switching
- Packet Switching





# INTERNET



# INTERNET cntd.

## Internet Administration

- **IAB** - Internet Architecture Board (formerly Internet Activities Board) oversees standards and development of the internet. IETF and IRTF are the two primary task forces of IAB.
- **IETF** Internet Engineering Task Force - working groups in IETF have primary responsibility for the technical activities of the Internet, including writing specifications and protocols.
- **IRTF** Internet Research Task Force – Works on long term research projects.
- **ISOC** Internet Society – promote the use of the Internet for communication and collaboration. It provides a forum for the discussion of issues related to the administration and evolution of Internet.
- **IANA** Internet Assigned Numbers Authority - a group in the Internet community that managed IP address space, and all TCP/IP-related numbers historically. IANA and IP addressing, both have undergone many changes since their formulation.



# INTERNET cntd.

## Domain Names and Addressing

Any computer connected to the Internet can be a **Host**. A host computer provides information for other people to access and retrieve.

**Hostname** is the name assigned to the computer on which you install software.

**Domain Name** is a hierarchical naming system to identify the domain a host belongs.

**Server** - means a program implementing a service (e.g. the Apache WWW server) as well as the host on which the service runs.

**Gateway Address** is the IP address of the router that connects an internal network to another external network.

**Domain Name Server (DNS)** converts the fully-qualified domain names into IP addresses.

**IP Address** – Ipv4 address is a 32 bit number separated into 4, 8-bit. IPv4 address is given in dotted decimal notation e.g. 192.248.72.3. IPv6 address is 128 bit in length and has a colon hexadecimal notation e.g.

2000:0db8:85a3:0000:0000:8a2e:0370:7334

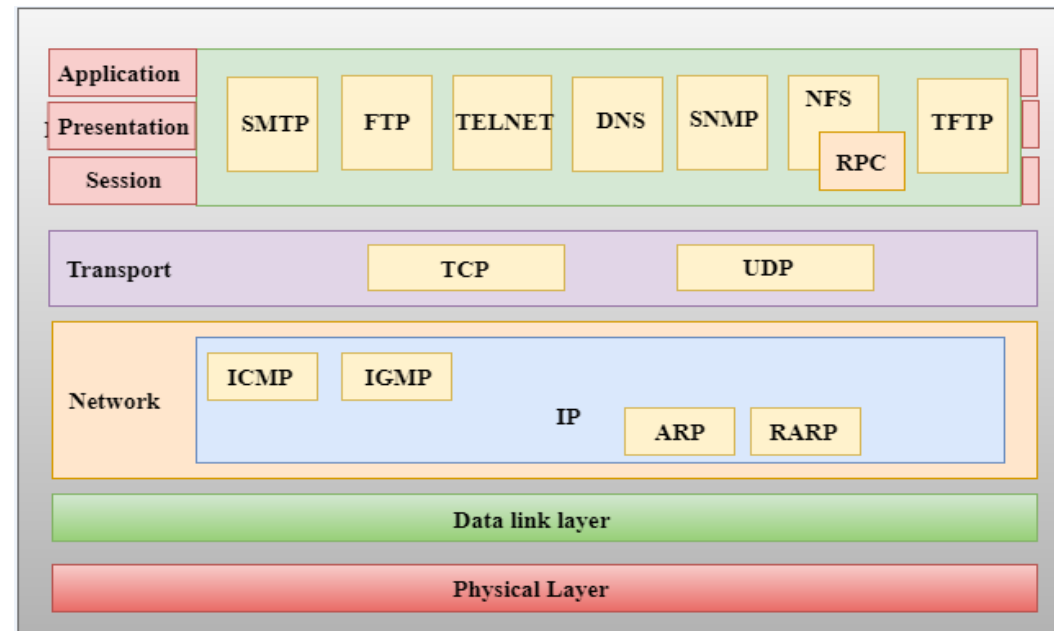
**ARP (Address Resolution Protocol)** is used to find out the physical address of a network node (node could be a computer, a printer etc.) when the IP address is known.



# INTERNET cntd.

## TCP/IP (Transmission Control Protocol/Internet Protocol)

**TCP/IP** model was developed prior to the OSI model and consists of five layers. In the TCP/IP model, services, protocols, and interfaces are not properly separated. It is protocol dependent. This model is highly used.





# INTERNET cntd.

## Addressing with TCP/IP(IPV4)

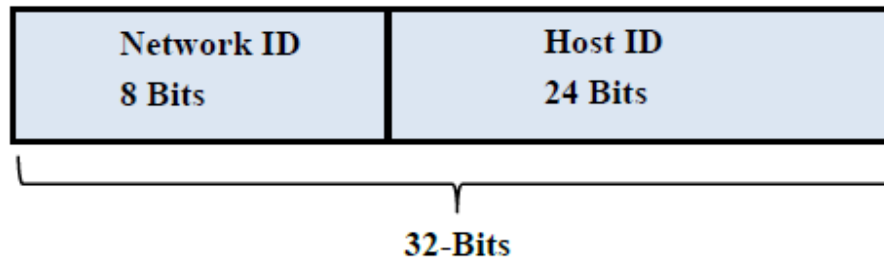


Table 11.1 Subnet mask, number of networks and hosts available for different IP classes.

IP Address Class	Decimal Range	No. networks available $2^x-2$	No. of hosts available $2^y-2$	Subnet Mask
Class A	1 to 126	126	16777214	255.0.0.0
Class B	128 to 191	16382	65534	255.255.0.0
Class C	192 to 223	2097150	254	255.255.255.0
Class D	224 to 239	Reserved for multi-casting		
Class E	240 to 255	Reserved for research/experimental		

Let us take **192.248.72.3**

In binary form this IP address would translate to:

192 ----- 11000000

248 ----- 11100100

72 ----- 01010000

3 ----- 00000011

So the IP address in binary form would be;

**11000000.1100100.01010000.00000011**

**Formula to calculate number of hosts;**

Number of usable Hosts =  $2^x - 2$

;  $x$  is the number of host bits in ip address

**We remove network address and broadcast address to get the number of usable ip addresses.**

Table 11.2 Subnet masks are derived for class A

Subnet Mask(decimal)	Subnet Mask(binary)	No. of Subnets
192	11000000	2
224	11100000	6
240	11110000	14
248	11111000	30
252	11111100	62
254	11111110	126
255	11111111	254



# INTERNET cntd.

## Addressing with TCP/IP cntd.

**CIDR (Classless Inter-Domain Routing)**, there are no address classes in CIDR, the size of the network ID cannot be seen from the address alone. In CIDR, the length of the network ID is indicated by placing it following a slash after the address. This is called **CIDR notation** or **slash notation**.

**192.248.112.3/22** means this **network has 22 bits** for the network ID and **10 bits for the host ID**.

### Workout problem:

ABC company has 6 branches across different districts. Number of particular hosts are as follows (within brackets); Colombo (356), Kandy (256), Gampaha (128), Kalutara (255), Galle (127), Jaffna (65). In addition to that, they have planned to initiate new 2 branches for Kegalle and Anuradhapura. In Kegalle the planned hosts count is  $253 \pm 5$  and for Anuradhapura  $129 \pm 10$ . Ip address of the main IP block is 162.120.135.100/20. **Clearly show the all steps.**

1. Find network address of the main IP block.
2. What is the maximum number of hosts can accommodate without moving to subnetting?
3. In general, what is the need of subnetting?
4. Subnet the given network for existing branches.
5. Subnet the given network for proposed branches.

State your assumptions. Provide the network address, subnet mask, starting host address and the broadcast address of each subnet allocated to a particular branch.

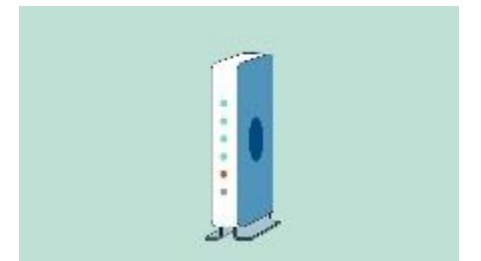
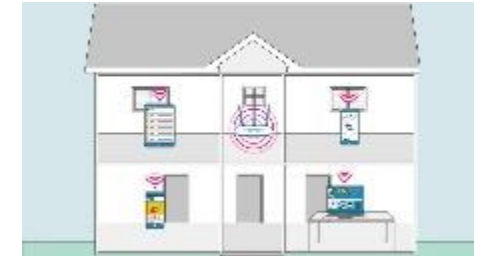
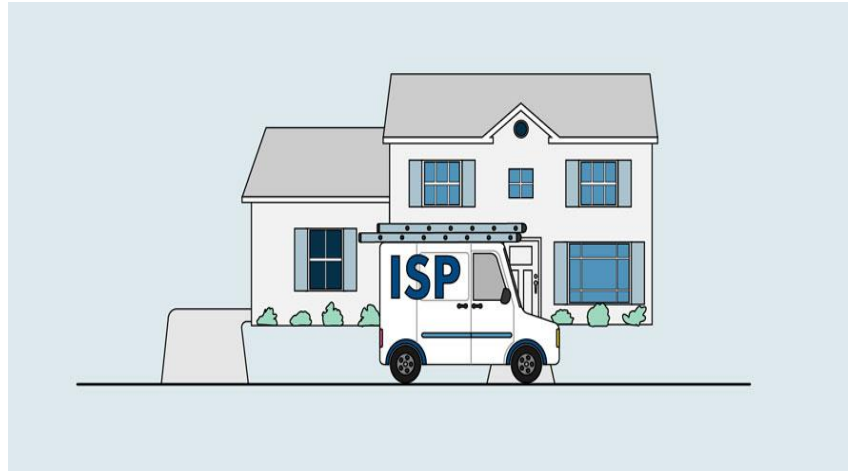


# INTERNET cntd.

## Accessing the Internet

### Types of Internet service

- Dial-up
- DSL
- Cable
- Satellite
- 3G and 4G/5G



# INTERNET cntd.

## Accessing the Internet

### Internet service provider (ISP)

**An ISP is a company that provides individuals and organizations access to the internet and other related services.**

Ex:

Most ISPs offer several tiers of service with different Internet speeds, usually measured in Mbps (short for megabits per second). If you mainly want to use the Internet for email and social networking, a slower connection (around 2 to 5 Mbps) might be all you need. However, if you want to download music or stream videos, you'll want a faster connection (at least 5 Mbps or higher).

You'll also want to consider the cost of the service, including installation charges and monthly fees. Generally speaking, the faster the connection, the more expensive it will be per month.



# INTERNET cntd.

## Accessing the Internet

**Hardware** needed for accessing the internet;

### **Modem:**

The primary piece of hardware you need is a **modem**. Dial-up access uses a telephone modem, DSL service uses a DSL modem, cable access uses a cable modem, and satellite service uses a satellite adapter.

### **Router:**

This is a hardware device that allows you to connect several computers and other devices to a single Internet connection, which is known as a home network.

(Some routers are wireless, which allows you to create a home wireless network, commonly known as a Wi-Fi network. You don't necessarily need to buy a router, many modems include a built-in router)



# INTERNET cntd.

## Email

### Format of a typical email message

- Envelop contains delivery information
- Header contains information about the message
- Body is the message itself
- Attachment is extra information, a file or picture that is separate from the body of the mail

Header consists of following fields,

- From: (mean the sender)
- To: (mean the receiver)
- Subject: (what is this email is about or topic of the message)
- CC: (carbon copies, who else other than given in 'To' filed get a copy)
- BCC: (Blind carbon copies, others cannot see that a copy has gone to somebody if that mailbox is given in BCC)



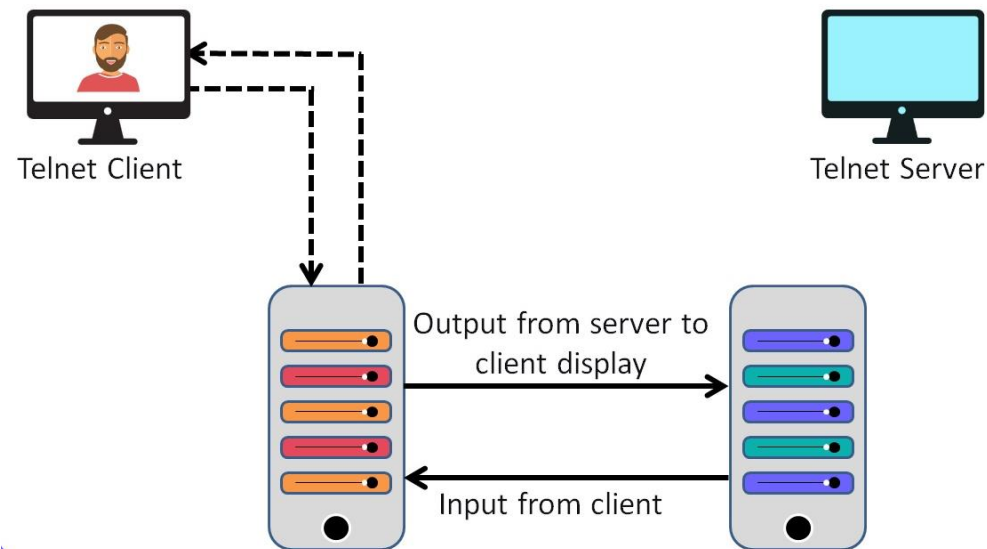
# INTERNET cntd.

## Telnet

Incidentally, the name **telnet** comes from **Teletype Network**.

Telnet is a part of TCP/IP protocol that lets you log on to another computer and use it.

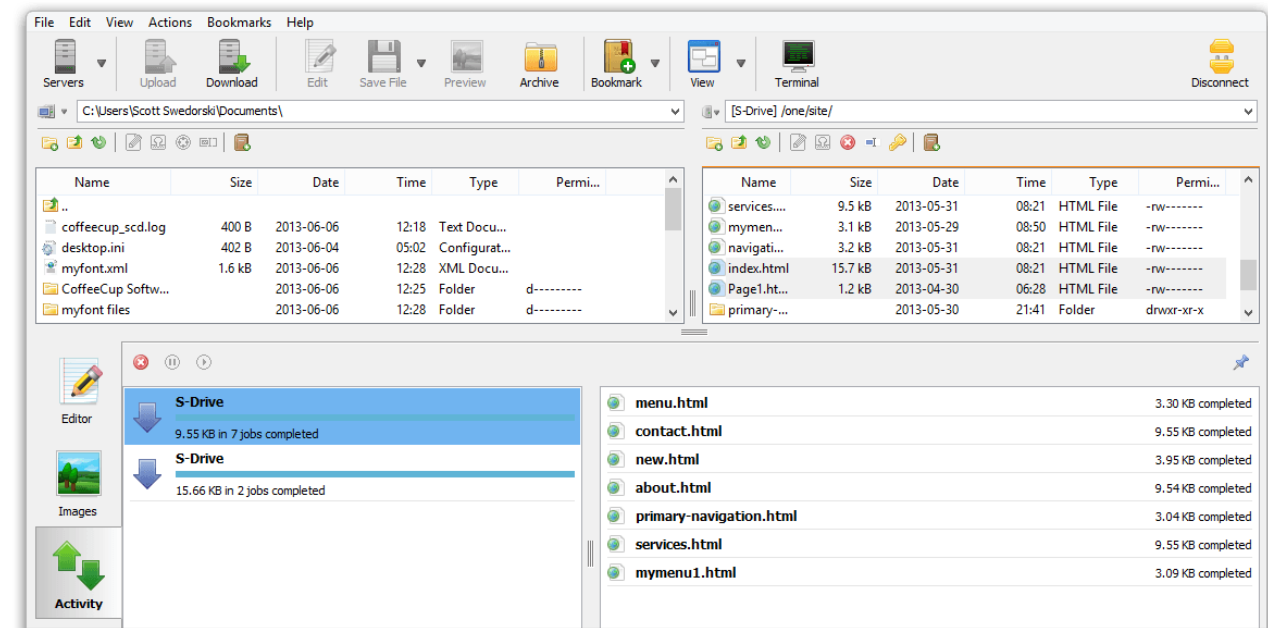
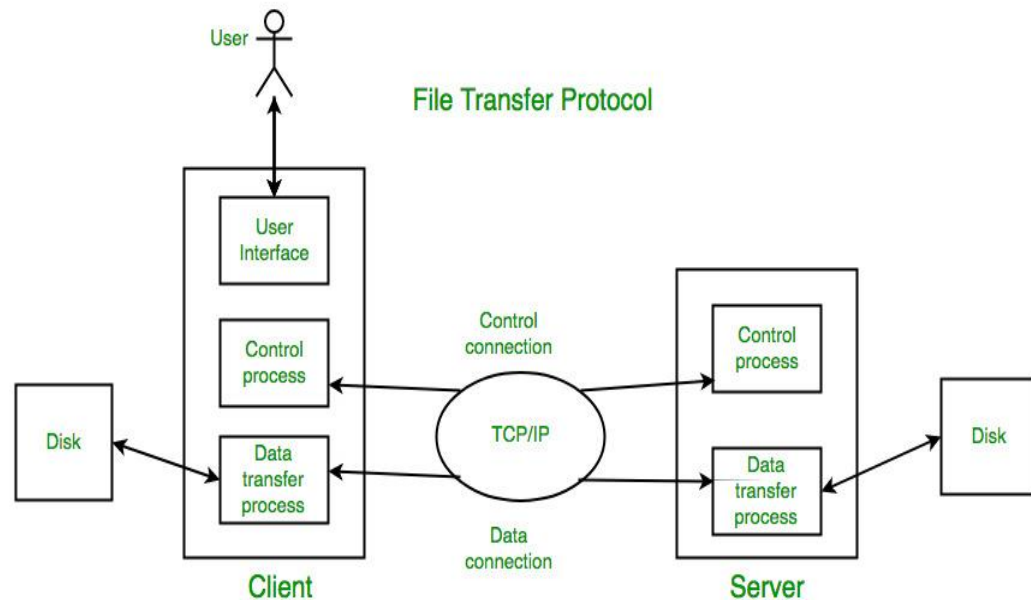
**One disadvantage** of Telnet is that when you Telnet to another computer, you have to use the menus that are set up on that system can be unfamiliar and have to learn by trial and error.



# INTERNET cntd.

## FTP

FTP Stands for **File Transfer Protocol**. FTP allows you to access remote computers and retrieve files from these computers.



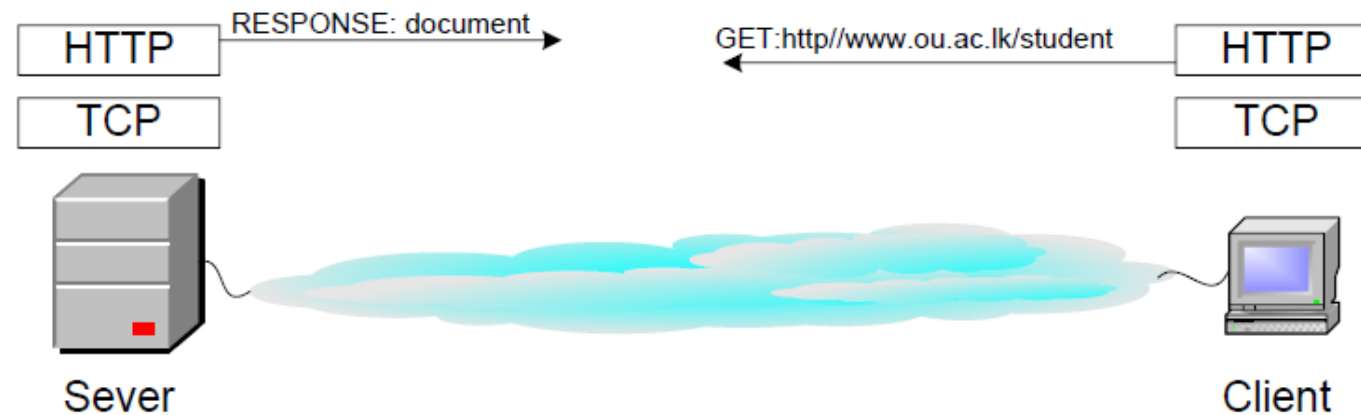


# INTERNET cntd.

## WWW

**URL (Universal Resource Locator)** is a addresses for the location of any Internet resource. URL addresses are case sensitive. URL points to the location where the information you need is held.  
e.g. <http://www.ou.ac.lk>

**HTTP** - Hyper Text Transport Protocol is the protocol to transfer information over the World Wide Web. It is a request/response protocol between clients and servers.



# INTERNET cntd.

## HTML (Hyper Text Markup language)

HTML is a markup language for creation of web pages. HTML provides syntax to describe the structure of a webpage. It denotes text-based information in a document using tags to show headings, paragraphs, lists, etc. It has syntax to include interactive forms, embedded images, and other objects with HTML. HTML can also describe, the appearance and semantics of a document, and can include embedded scripting language code which can affect the behavior of web browsers.

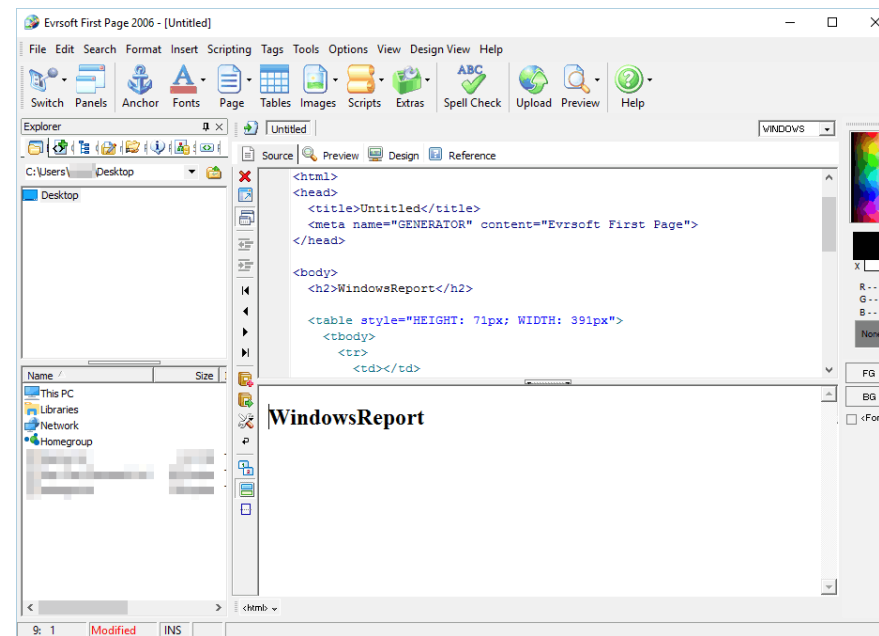
Tag	Description
<html> .. </html>	Declares the web page to be written in HTML
<head> .. </head>	Delimits the pages head
<title> .. </title>	Define the title. It is not displayed on the page.
<body>.. </body>	Delimits the page's body
<h1> .. </h1>	Delimits a level n heading
<b> .. </b>	Set .. in boldface
<p>	Starts a paragraph
<hr>	Insert a horizontal rule
<img src = “..”>	Displays an image here
<a href= “..”> .. </a>	Defines a hyperlink



# INTERNET cntd.

## Web Authoring Tools

Web authoring tool is a **software that helps you create web pages**. Web authoring uses the **WYSIWYG(What You See Is What You Get) interface**, meaning that web pages can be created visually similar to a desktop publishing program. This is an easier way to create web pages **for a less experienced designer**.



# INTERNET cntd.

## Security Concerns

Now that you understand what the internet is and the functions and the concepts regarding the internet and the web services, it is important to have an understanding the security concerns related to **privacy, integrity, confidentiality** and **non-repudiation**.



# Q & A



# THANK YOU



ශ්‍රී ලංකා විවෘත විශ්වවිද්‍යාලය  
இலங்கை திறந்த பல்கலைக்கழகம்  
The Open University of Sri Lanka

PO Box 21, Nawala, Nugegoda, Sri Lanka  
Phone: +94 11 288 1000  
<https://ou.ac.lk>