



Introduction to Information Technology

CSC109

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By: Rajiv Raman Parajuli

Data Transmission And Data Networking

Data transmission: transmitting digital or analog data over a communication medium to one or more devices.

At physical level; it involves the hardware that handle individual bits and encode bits in signals. And transmit via medium

Data Transmission Network tropology:

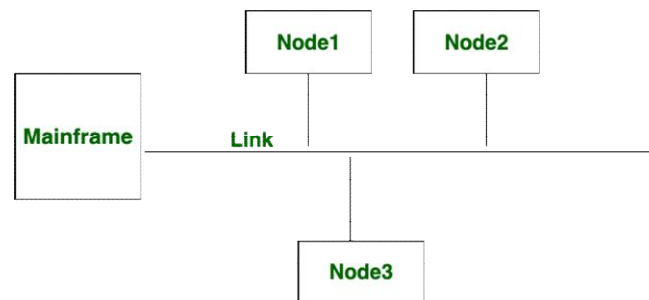
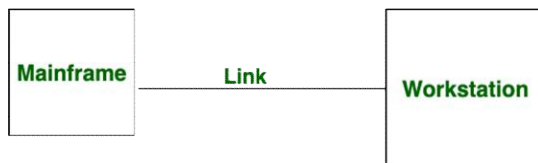
point-to-point, point-to-multipoint, or multipoint-to-multipoint(Mesh)

If a large number of computers need to interact with each other, point to point communication will require direct link between all the computers.

- More expensive
- Not practical

Also, Data doesn't transmit data all the time, which will result in the communication medium will be ideal. (Waste of resources)

Computer Network; it provide convenient interface that handles sending of multiple bytes of data across the network instead of handling data transmission at physical level.



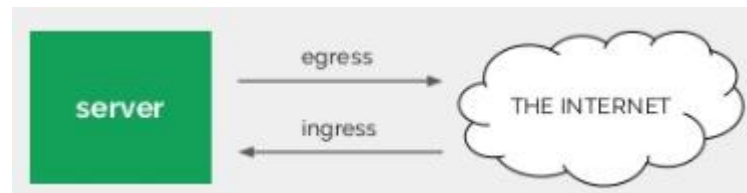
POINT TO POINT COMMUNICATION	MULTIPOINT COMMUNICATION
Point to point communication means the channel is shared between two devices.	Multipoint Communication means the channel is shared among multiple devices or nodes.
In this communication, There is dedicated link between two nodes.	In this communication, link is provided all times for share the connection among nodes.
In this communication, the entire capacity is reserved between these connected two devices.	In this communication, the entire capacity is depend on the quick sharing.
In this communication, there is one transmitter and one receiver.	In this communication, there is one transmitter and many receivers.
In point-to-point connections, the smallest distance is most important to reach the receiver.	In Multi-point connections, the smallest distance is not important to reach the receiver.
Point-to-point communication provides security and privacy because communication channel is not shared.	Multi-point communication does not provides security and privacy because communication channel is shared.

Switching

Switching is the process of transmitting data packets from the source to the destination through a number of intermediate network nodes.

Each node controls or Route/Switches data packets to the next node towards the destination

It allows different users, fair access to the shared communication medium



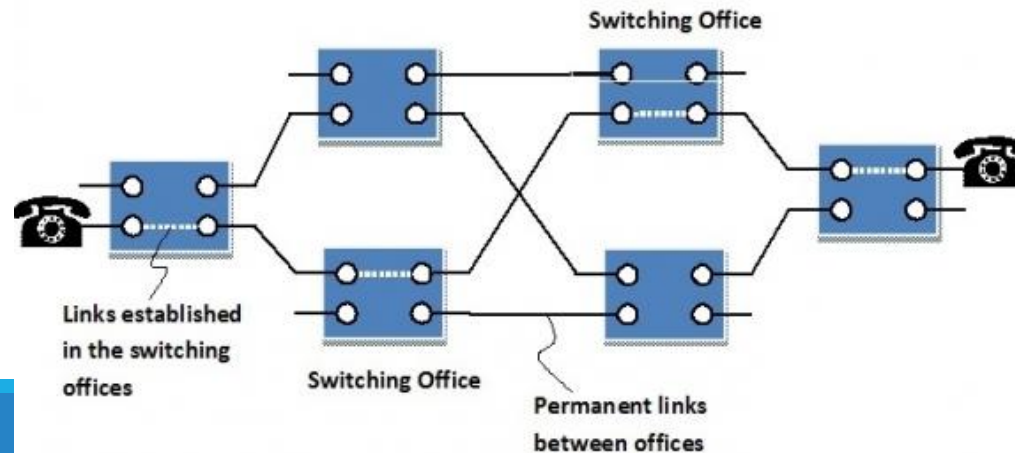
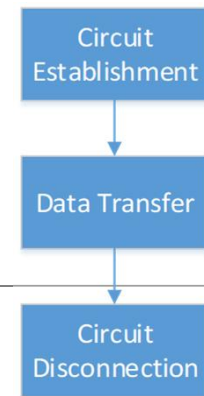
When data comes on a node it is called **ingress**, and when data goes out of a node it is called **egress**.

Switching methods are **connection oriented** switching and **connectionless switching**.

Switching Techniques

Circuit Switching

- Connection Oriented N/W switching technique
- Dedicated route is established between the source and the destination
- Full Channel bandwidth is available for communication during the communication session.
- Commonly used in telephone communication



Advantages	Disadvantages
It is suitable for long continuous transmission, since a continuous transmission route is established, that remains throughout the conversation.	Circuit switching establishes a dedicated connection between the end parties. This dedicated connection cannot be used for transmitting any other data, even if the data load is very low.
The dedicated path ensures a steady data rate of communication.	underutilization of system resources.
No intermediate delays are found once the circuit is established.	As it's the dedicated channel, Cannot be used for other connections
suitable for real time communication of both voice and data transmission	Time required to establish connection may be high.

Switching Techniques

Message Switching

Message switching is a connectionless network switching technique where the entire message is routed from the source node to the destination node, one hop at a time

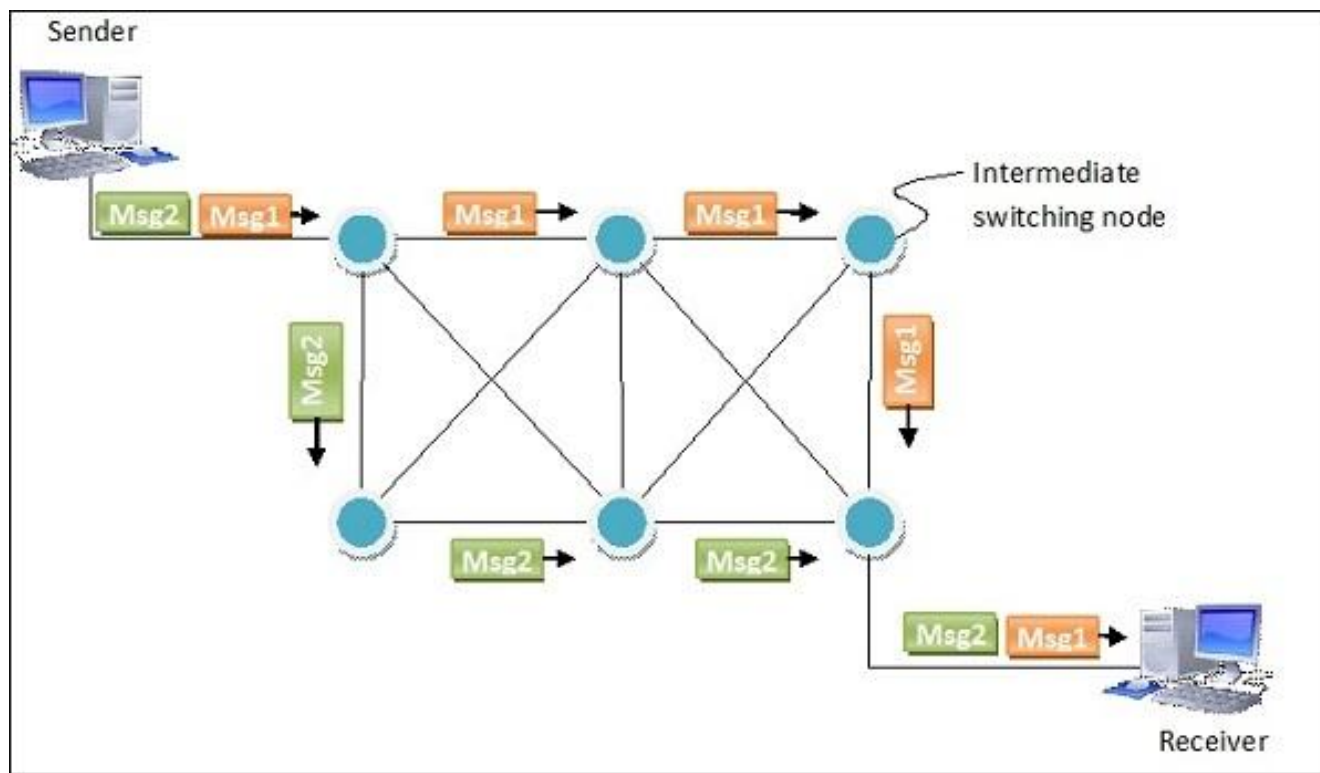
It uses the 'store and forward' mechanism at each intermediate node during switching

Message switching treats each message as an individual unit. Before sending the message, the sender node adds the destination address to the message.

Then delivered to the next intermediate switching node

intermediate node stores the message checks for transmission errors, inspects the destination address and then delivers it to the next node.

If intermediate switching node is busy, it delay the switching until resource is available. **'store and forward'**



Advantages	Disadvantages
Sharing of communication channels ensures better bandwidth utilization	In order to store many messages of unlimited sizes, each intermediate switching node requires large storage capacity.
reduces network congestion due to store and forward method.	Store and forward method introduces delay at each switching node.
Broadcasting messages requires much less bandwidth than circuit switching.	Unsuitable for real time applications, because of delay, store and forward mechanism.
Messages of unlimited sizes can be sent.	
No need to deal with out of order packets or lost packets as in packet switching.	

Switching Techniques

Packet Switching

Connectionless Network Switching Technique

the message is divided and grouped into a number of units called packets

Packets individually routed from the source to the destination.

There is no need to establish a dedicated circuit for communication.

Process

Each packet has two parts: **a header** and **a payload**.

The header contains the addressing information of the packet.

Used by the intermediate routers to direct it towards its destination.

The payload carries the actual data.

Based on header information, Packet is transmitted as soon as it is available in a node

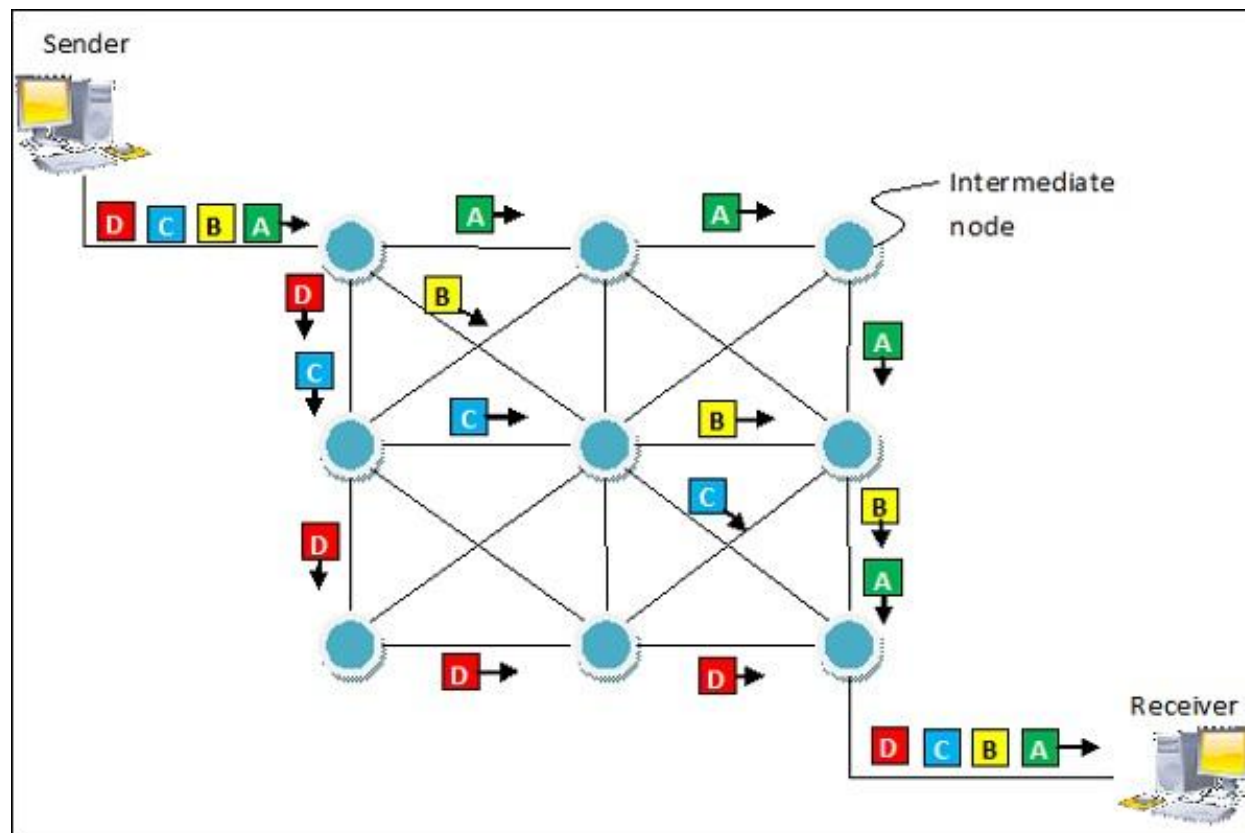
packets of a message are not routed via the same path, they are transmitted as per the path available.

When packets of a message arrive to destination they are not in order.

Destination retrieve the original message by reordering the received packets

A packet is transmitted as soon as it is available in a node, based upon its header information

Packets A,B,C and D follow different routes from sender to receiver.



Advantages	Disadvantages
Delay in delivery of packets is less, since packets are sent as soon as they are available	unsuitable for applications that cannot afford delays in communication like high quality voice calls.
Don't require massive storage, since they don't have to store the entire messages before forwarding them to the next node.	high installation costs.
Data delivery can continue even if some parts of the network faces link failure. Packets can be routed via other paths.	Network problems may introduce errors in packets, delay in delivery of packets or loss of packets. If not properly handled, this may lead to loss of critical information.
use of the same channel by multiple users.	Requires high skilled manpower, complex protocols for delivery.
better bandwidth usage	

Computer Network

It is an interconnection of two or more computers that are able to exchange information.

Connection establish via any data transmission medium or link

Computer Networks can be categorized depending on

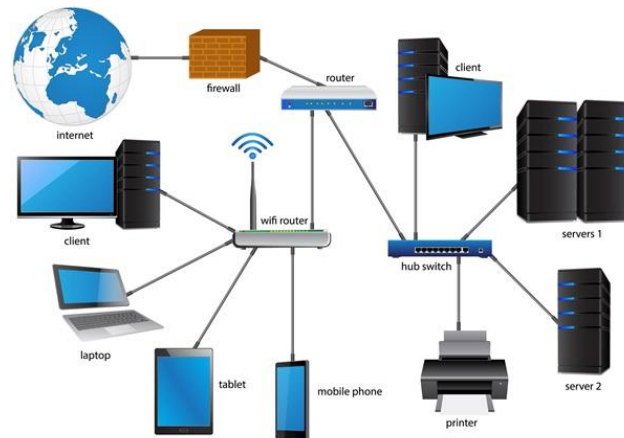
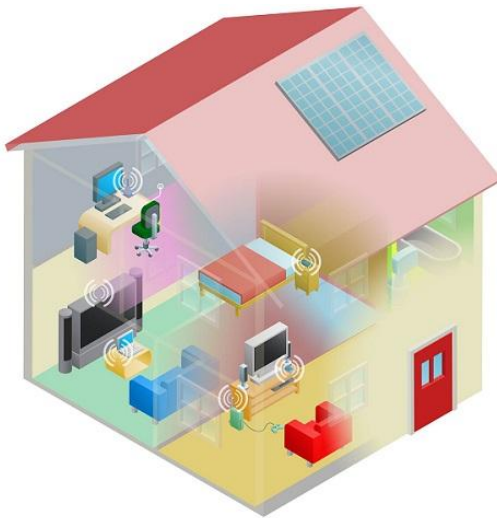
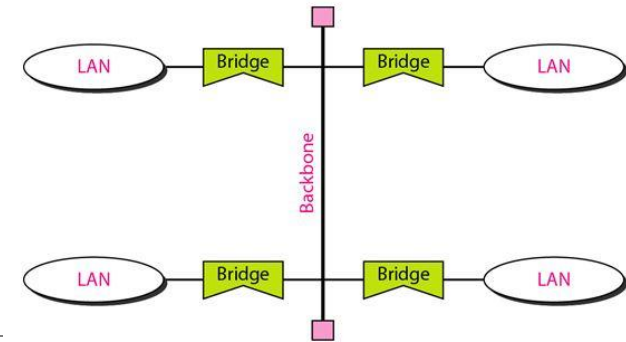
Size of Network; area over which the network is spread

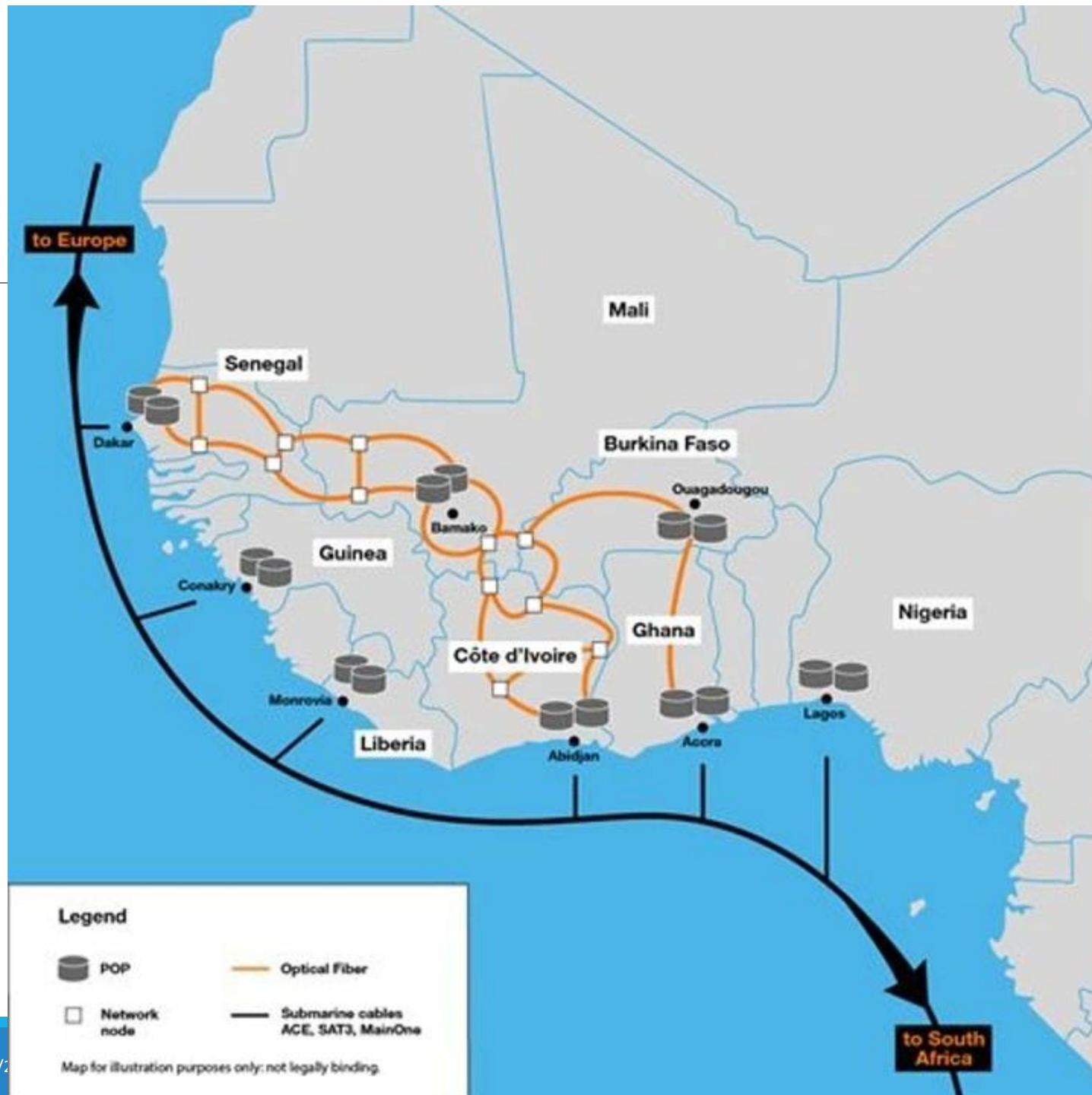
Transmission Technology; transmission media and transmission protocols

Network Tropology; arrangement / shape of network

Types Of Networks

PAN, LAN, BN, MAN, WAN





Local Area Network

widely used for local communication

LAN connects computers in a small area like a room, building, office or a campus spread up to a **few kilometers**

LAN runs at a speed of **10 Mbps to 100 Mbps** and has low delays

A LAN based on WiFi wireless network technology is called Wireless Local Area Network (WLAN)

it is a privately owned networks, with a purpose to share resources and to exchange information

Hardware resources that can be easily shared over the LAN network include printer, fax machines, modems, memory space, etc

Metropolitan Area Network

It is a network spread over a city, college campus or a small region

Typical Example is Cable Television and Local ISP.

MAN is larger than a LAN and typically spread over **several kilometers**.

MAN is also interconnection of several LAN spread over a city.

Objective of MAN is to share hardware and software resources, thereby decreasing infrastructure costs

MAN are connected using coaxial cables or fiber optic cables

Wide Area Network

connects computers over long distances like cities, countries, continents or worldwide

WAN is typically a network of many LANs, MANs and WANs

WAN uses telephone lines, satellite link, and radio link to connect

Internet is a common example of WAN