



SRM

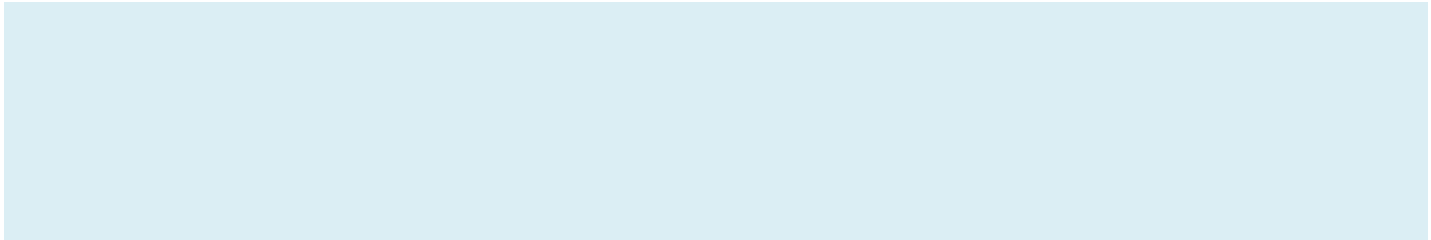
Institute of Science and Technology

21CSC302J-COMPUTER NETWORKS

Unit- I



Introduction to Networks

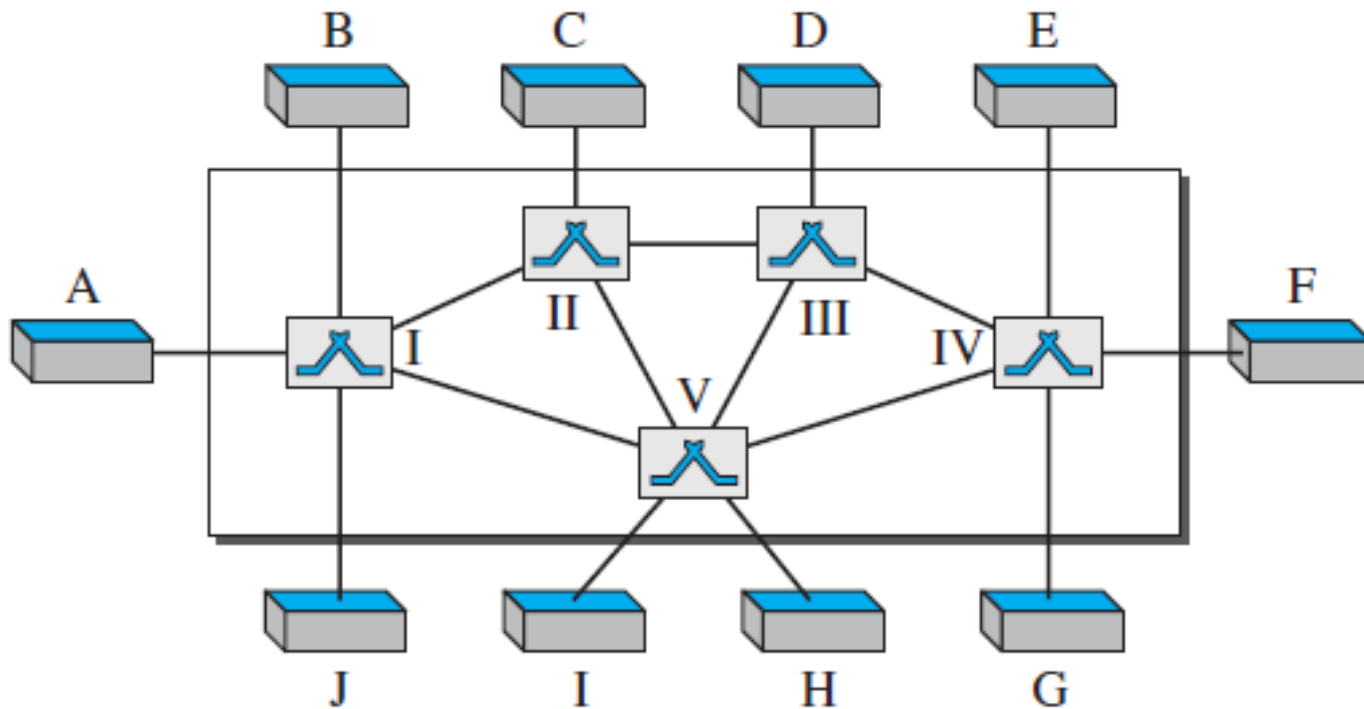


Switching

- A network is a set of connected devices.
- Whenever we have multiple devices, we have the problem of ***“how to connect them to make one-to-one communication possible”***
- Solution
 - ***To make a point-to-point connection between each pair of devices (a mesh topology) or between a central device and every other device (a star topology).***
- These methods, are impractical and wasteful when applied to very large networks.

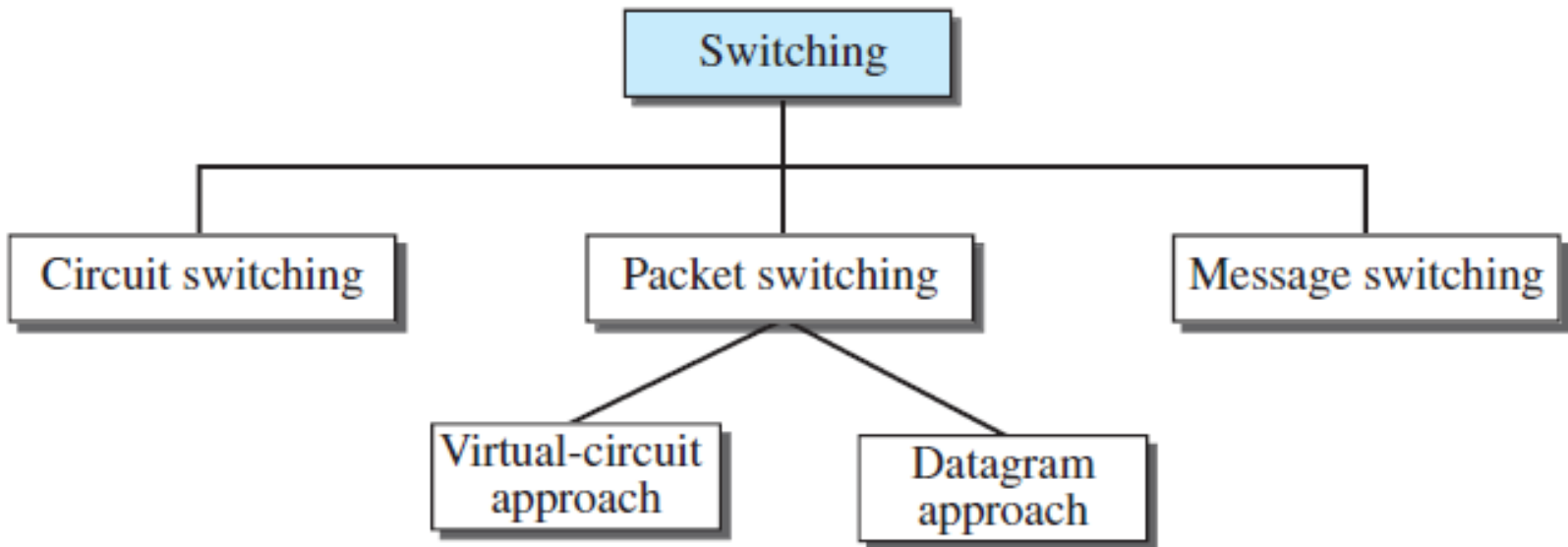
- The number and length of the links require too much infrastructure to be cost-efficient,
- The majority of those links would be idle most of the time.
- Other topologies employing multipoint connections, such as a bus, are ruled out because
 - *the distances between devices and*
 - *the total number of devices increase beyond the capacities of the media and equipment.*

- A better solution is *switching*.
- A switched network
 - *consists of a series of interlinked nodes, called switches.*
 - *Switches are devices*
 - *capable of creating temporary connections between two or more devices linked to the switch.*
 - *some of these nodes are connected to the end systems.*
 - *Others are used only for routing.*



Switched network

- Three methods of switching
 - *Circuit switching,*
 - *Packet switching, and*
 - *Message switching.*

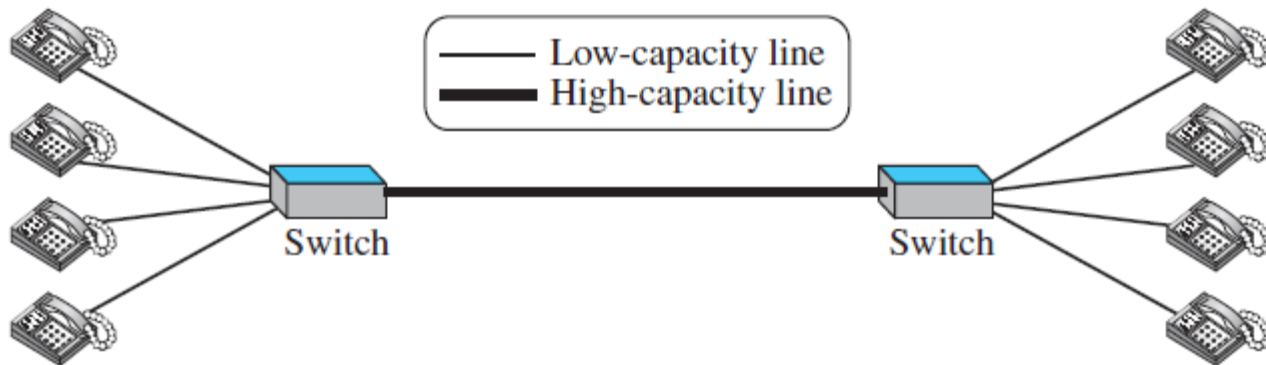


- ***Switching at Physical Layer - circuit switching***
- ***Switching at Data Link Layer – Packet Switching***
- ***Switching at Network Layer – Packet Switching***
- ***Switching at Application Layer – Message Switching***

- An internet *is a switched network* in which a switch connects at least two links together.
- A switch *needs to forward data from a network to another network when required.*
- The two most common types of switched networks are
 - *Circuit-switched and Packet-switched networks.*

Circuit-Switched Network

- a dedicated connection, called a circuit, *is always available between the two end systems;*
- the switch can only make it active or inactive.
- Figure shows a very simple switched network that connects four telephones to each end.



Circuit-Switched Network

- Consists of a set of switches connected by physical links.
- A connection between two stations is a dedicated path made of one or more links.
- each connection uses only one dedicated channel on each link.
- Each link is normally divided into n channels by using FDM or TDM,

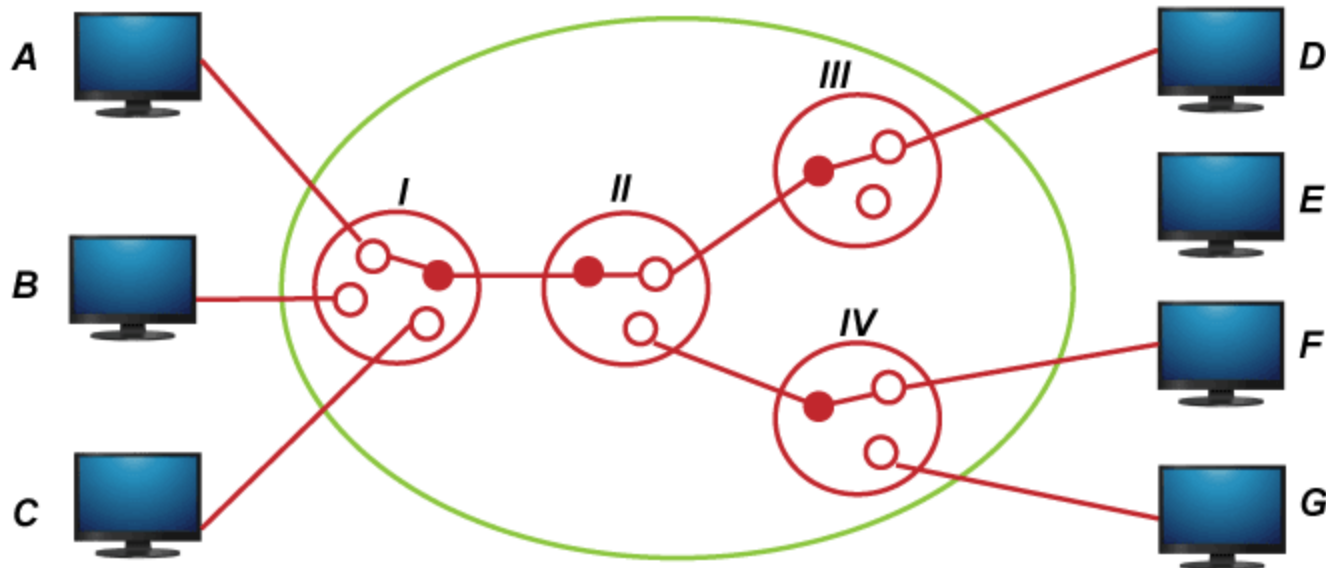
Circuit-Switched Network

A circuit-switched network is made of a set of switches connected by physical links, in which each link is divided into n channels.

In circuit switching, the resources need to be reserved during the setup phase; the resources remain dedicated for the entire duration of data transfer until the teardown phase.

Circuit-Switched Network

- *One of the simplest data communication methods*
- *A dedicated path is established* between the sending and receiving device.
- Physical links connect via a set of switches.



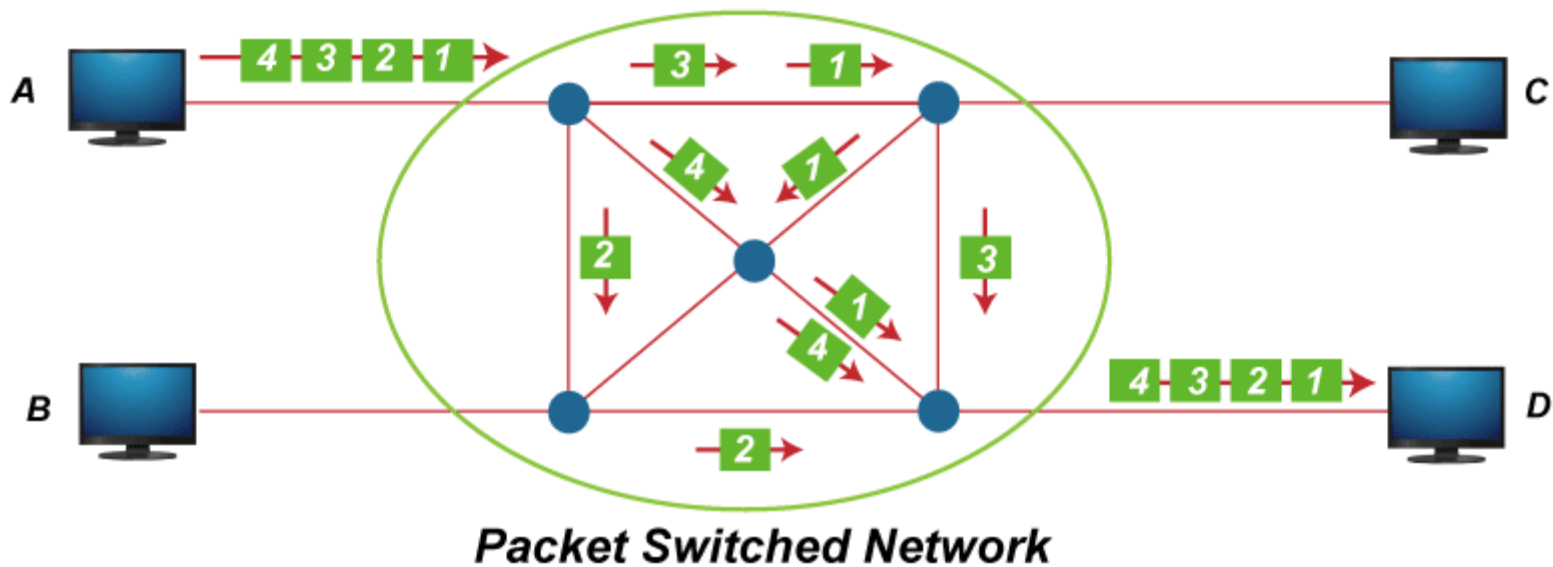
Circuit Switched Network

Packet-Switched Network

In a packet-switched network, there is no resource reservation; resources are allocated on demand.

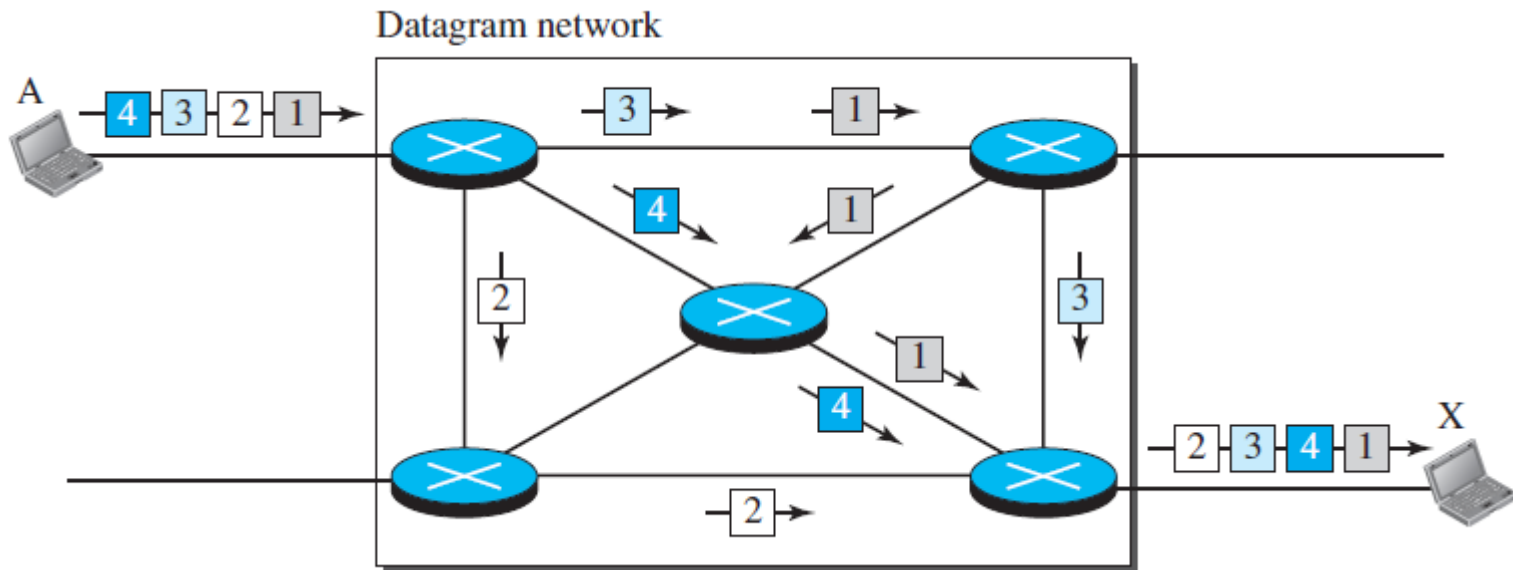
Packet-Switched Network

- *Message is divided into packets.*
- Each packet contains a header which *includes the source address, destination address, and control information.*



Datagram Networks

- Each packet is *treated independently*
- Packets are referred to as *datagrams*.
- normally done at the network layer.



A datagram network with four switches (routers)

Datagram Networks

- all four packets (or datagrams) belong to the same message, but may travel different paths to reach their destination.
- The links may be involved in carrying packets from other sources
 - *do not have the necessary bandwidth available to carry all the packets from A to X.*
- This approach can cause the datagrams of a transmission to arrive at their destination out of order with different delays between the packets.

Datagram Networks

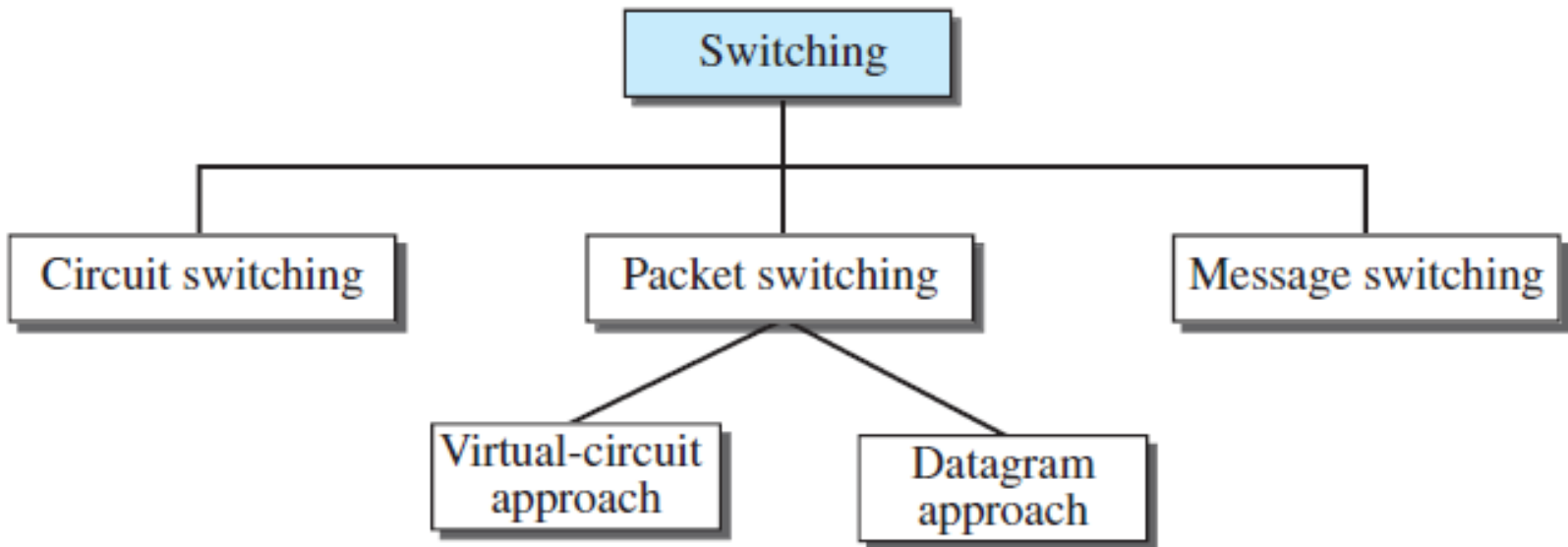
- Packets may also be lost or dropped - *a lack of resources.*
- Responsibility of an upper-layer protocol *to reorder the datagrams or lost datagrams* before passing them on to the application.
- The datagram networks are sometimes referred to as *connectionless networks.*
- Connectionless
 - *The switch (packet switch) does not keep information about the connection state.*

Datagram Networks

- **no setup or teardown phases.**
- Each packet is treated the same by a switch regardless of its source or destination.

A switch in a datagram network uses a routing table that is based on the destination address.

- Three methods of switching
 - *Circuit switching,*
 - *Packet switching, and*
 - *Message switching.*



Virtual-Circuit Networks

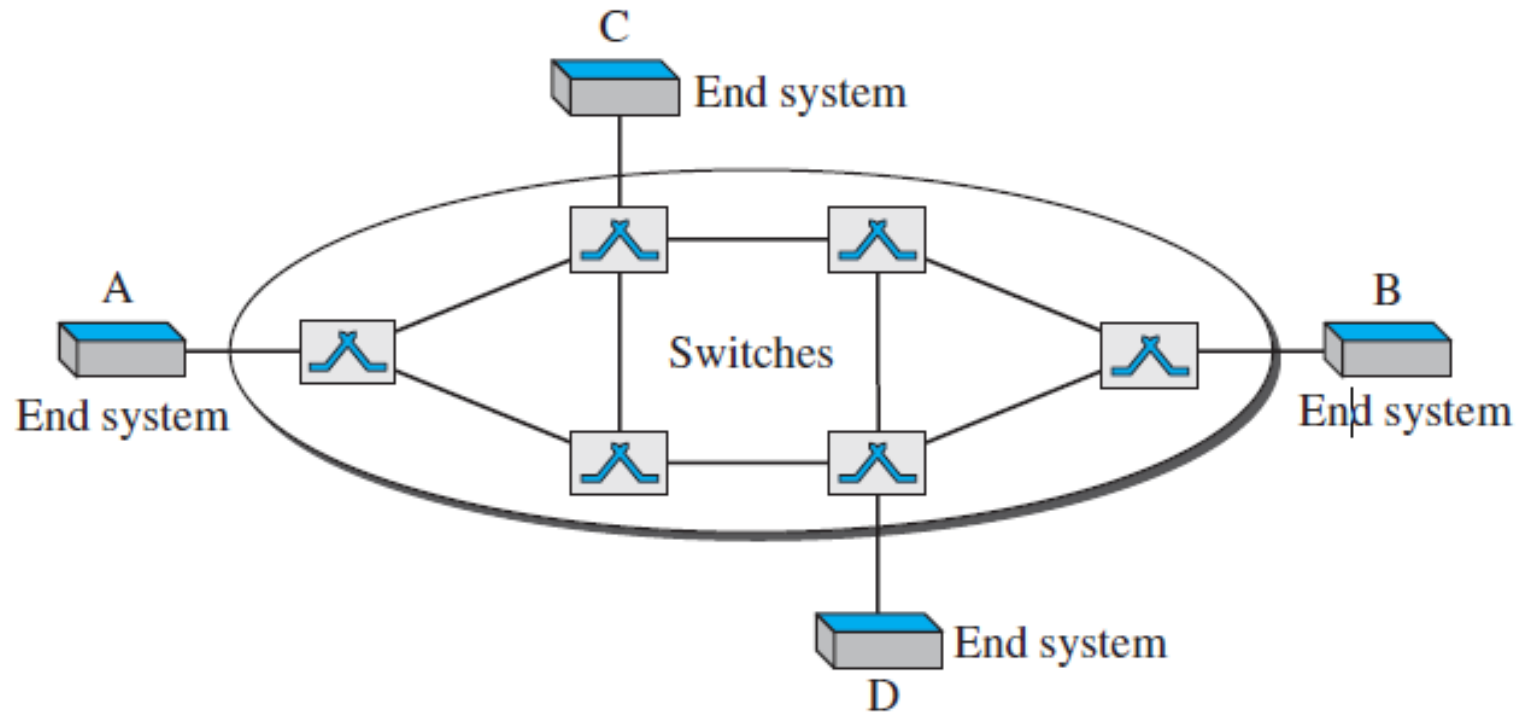
- A cross between *a circuit-switched network and a datagram network.*
- It has some characteristics of both.
 - *There are setup and teardown phases in addition to the data transfer phase.*
 - *Resources can be allocated during the setup phase, or on demand.*



Virtual-Circuit Networks

- It has some characteristics of both.
 - *Data are packetized and each packet carries an address in the header. The address in the header has local jurisdiction (it defines what the next switch should be and the channel on which the packet is being carried), not end-to-end jurisdiction. The reader may ask how the intermediate switches know where to send the packet if there is no final destination address carried by a packet.*
 - *As in a circuit-switched network, all packets follow the same path established during the connection.*
 - *A virtual-circuit network is normally implemented in the data-link layer, while a circuit-switched network is implemented in the physical layer and a datagram network in the network layer. But this may change in the future.*

Virtual-Circuit Networks





Virtual-Circuit Networks

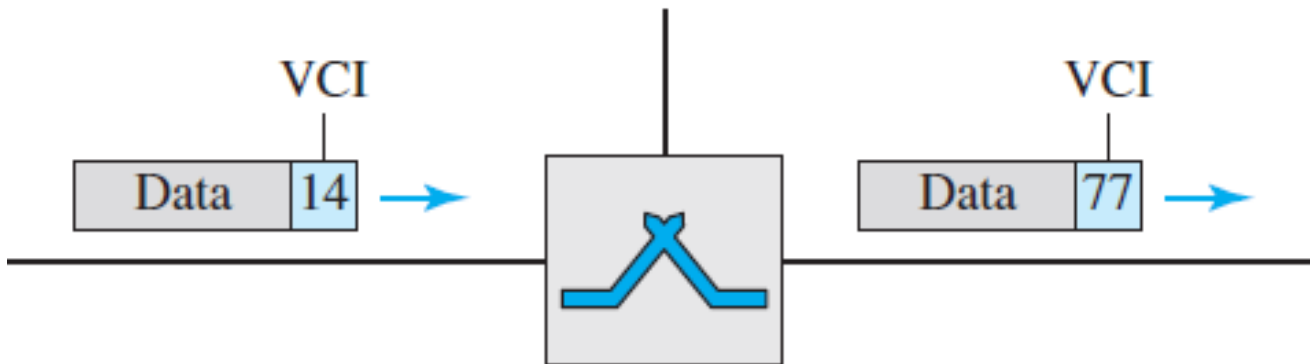
- In a virtual-circuit network, **two types of addressing are involved**
 - *global and local (virtual-circuit identifier).*

Virtual Circuit Identifier

- The identifier is actually *used for data transfer* is called the virtual-circuit identifier (VCI) or the label.
- A VCI, is a small number that has only switch scope;
- it is used by a frame between two switches.
- When a frame arrives at a switch, it has a VCI;
- when it leaves, it has a different VCI.

Virtual Circuit Identifier

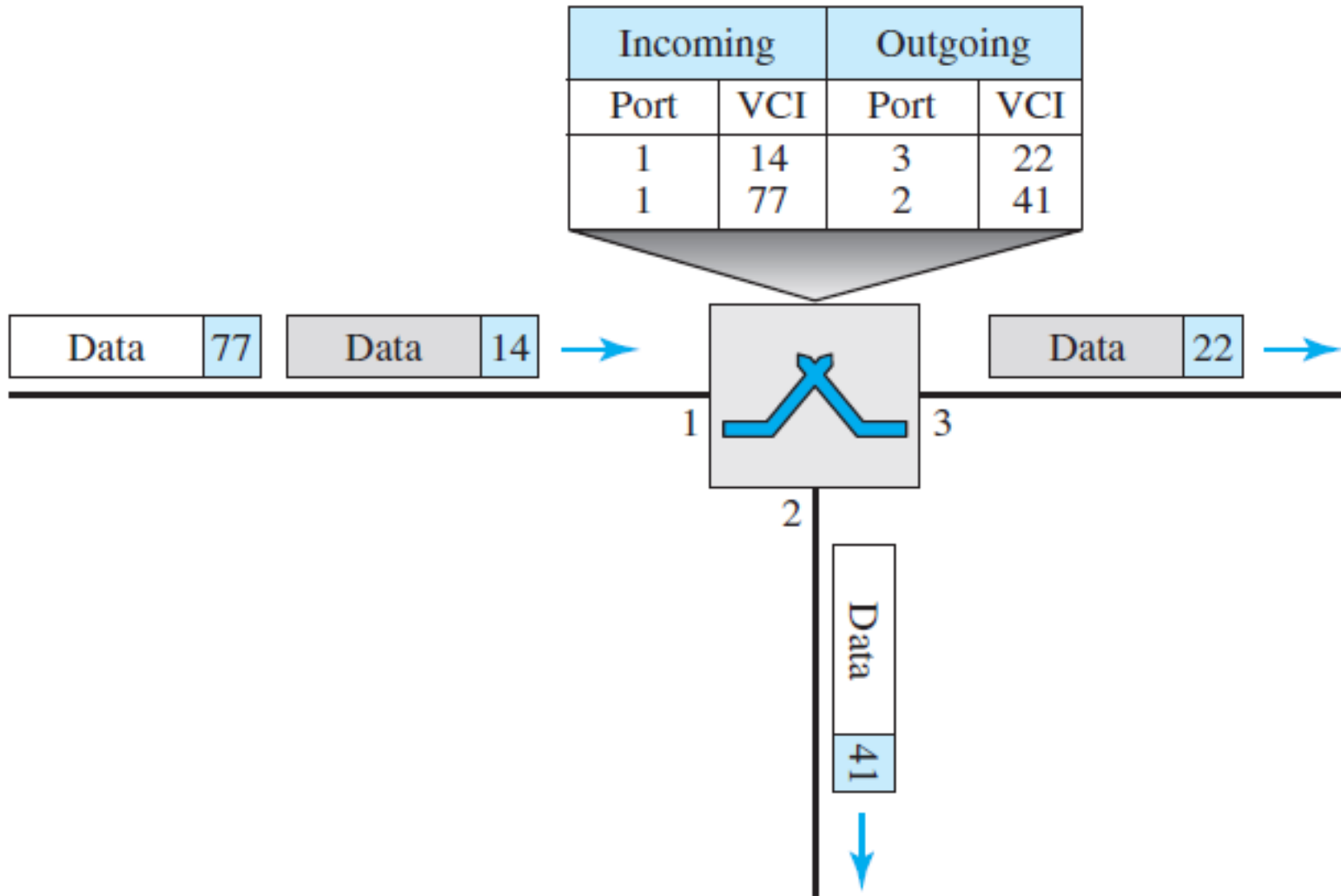
- Figure shows how the VCI in a data frame changes from one switch to another.
- VCI does not need to be a large number since each switch can use its own unique set of VCIs.



Data-Transfer Phase

- To transfer a frame from a source to its destination, *all switches need to have a table entry for this virtual circuit.*
- The table has four columns.
- This means that the switch holds four pieces of information for each virtual circuit that is already set up.

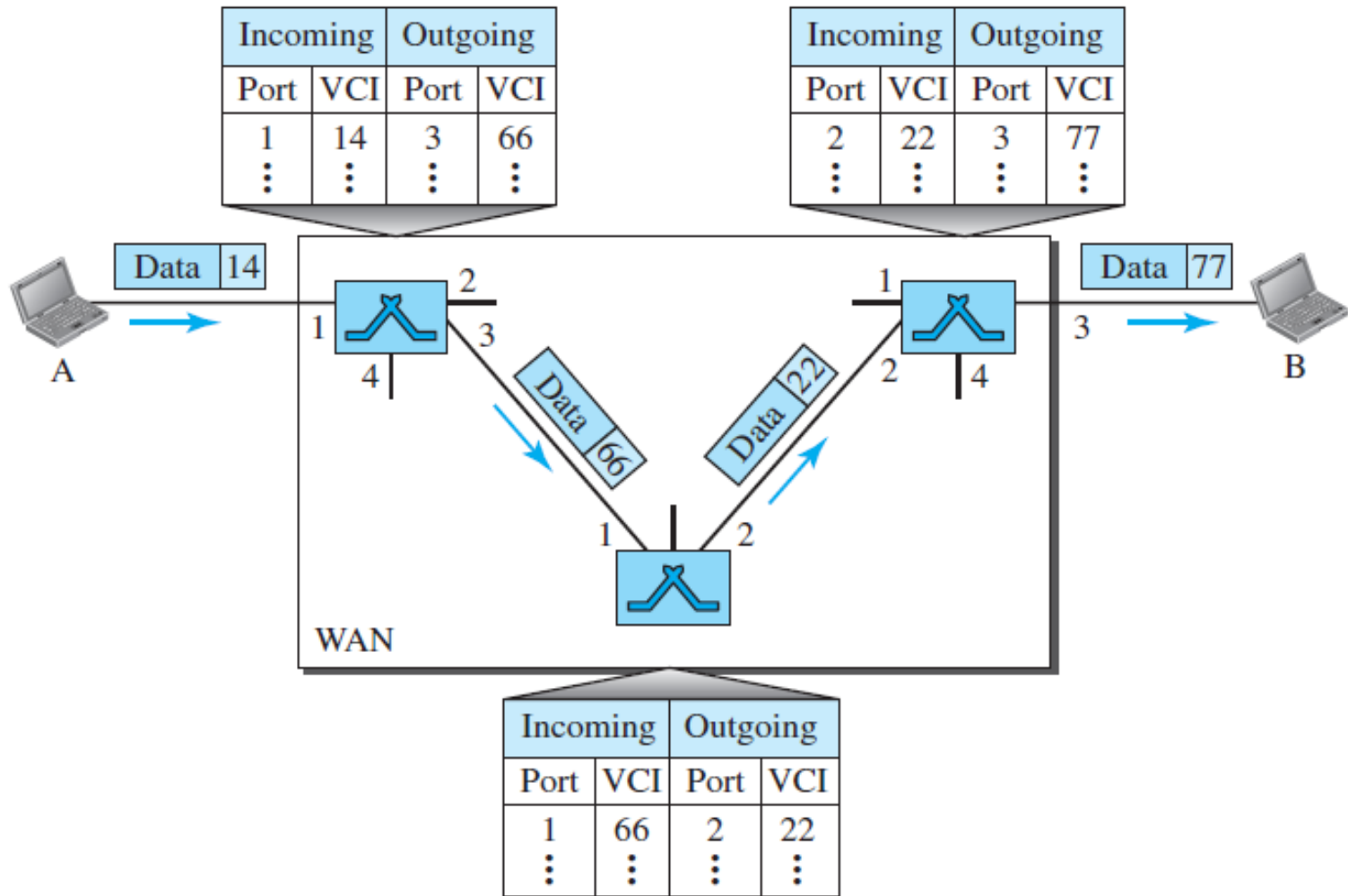
Data-Transfer Phase



Data-Transfer Phase

- Figure shows a frame arriving at port 1 with a VCI of 14.
- When the frame arrives, the switch looks in its table to find port 1 and a VCI of 14.
- When it is found, the switch knows to change the VCI to 22 and send out the frame from port 3.
- Figure 8.13 shows how a frame from source A reaches destination B and how its VCI changes during the trip.
- Each switch changes the VCI and routes the frame.

Data-Transfer Phase



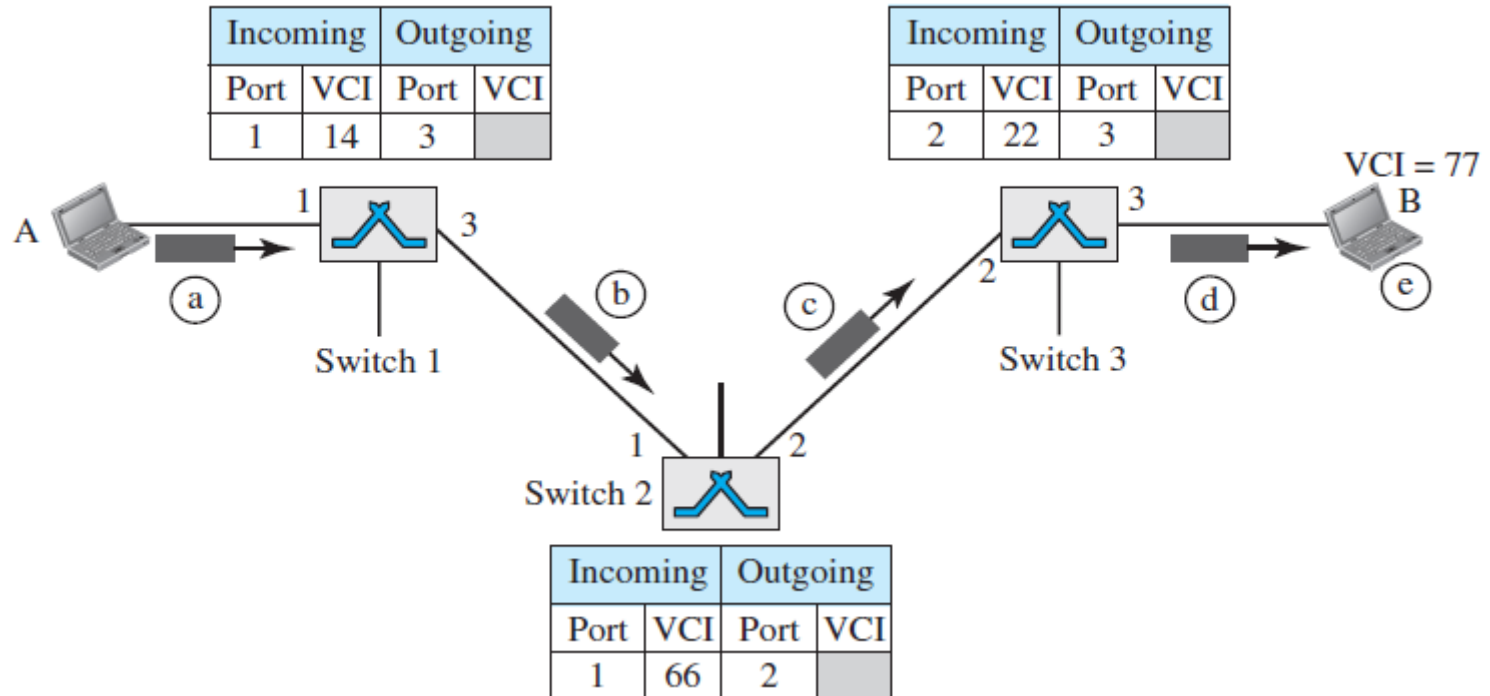
Data-Transfer Phase

- The data-transfer phase is active until the source sends all its frames to the destination.
- The procedure at the switch is the same for each frame of a message.
- The process creates a virtual circuit, not a real circuit, between the source and destination.

Setup Phase

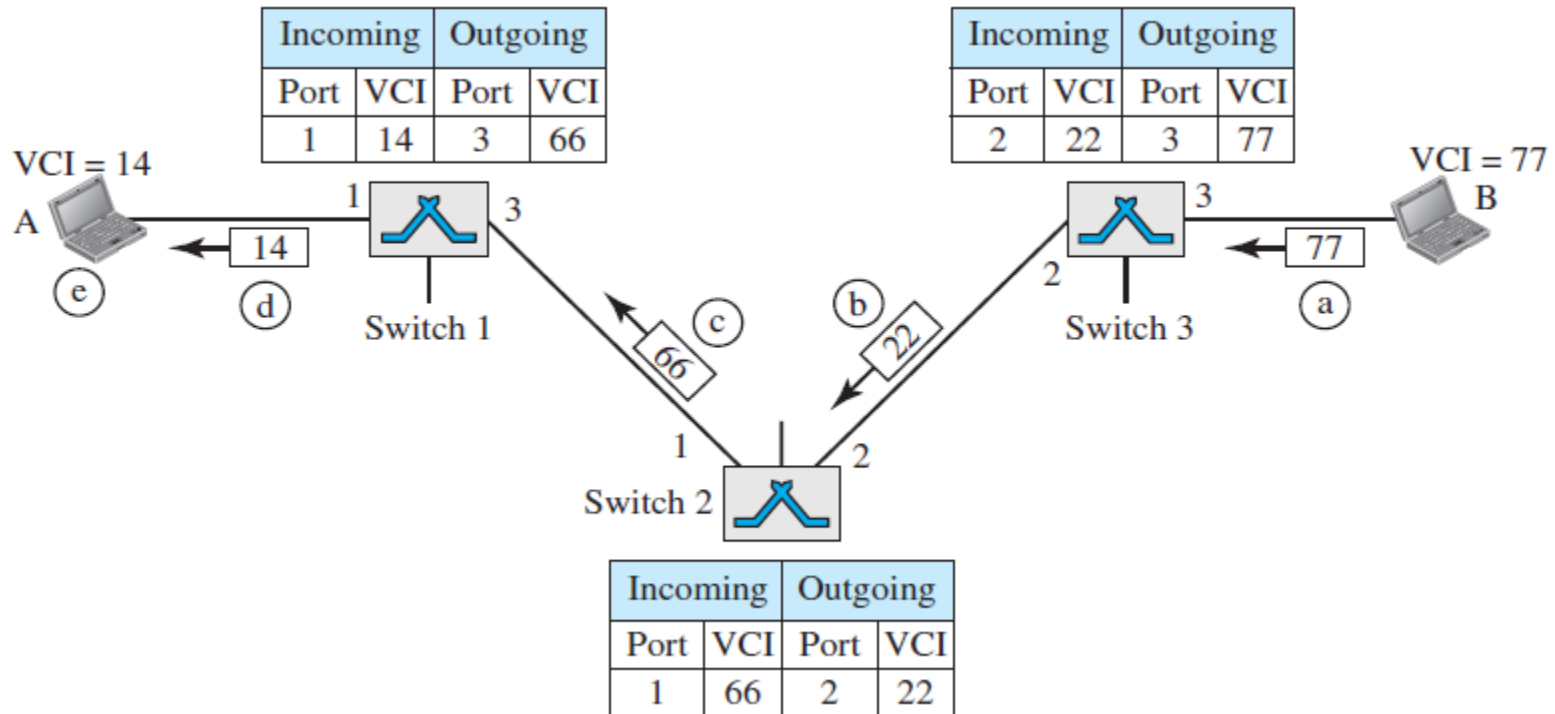
- In the setup phase, a switch creates an entry for a virtual circuit.
- For example, suppose source A needs to create a virtual circuit to B.
- Two steps are required:
 - ***the setup request and the acknowledgment.***

Data-Transfer Phase



Setup request in a virtual-circuit network

Data-Transfer Phase



Setup acknowledgment in a virtual-circuit network

Circuit switching Network	Packet switching Network
a dedicated path is created between two points by setting the switches.	no dedicated path is created between two points. Only the virtual circuit exists.
In circuit switching there is no concept of store and forward transmission.	In virtual packet switched network, each node may store incoming packets and forward them after use.
The links make a path are dedicated and cannot be used for other connections.	In the virtual circuit network, links that make a route can be dedicated with other connections.
bandwidth is fixed because it is reserved in advance.	In the virtual circuit network, require bandwidth is dynamic because it can be released as it is needed.
The route followed by packets is always the same.	The route followed by packets is may or may not be different.
call setup is required.	call setup is not required.
Congestion can occur at set up time.	Congestion can occur on every packet

Circuit switching Network	Packet switching Network
bandwidth is fixed, unused bandwidth on an allocated circuit is wasted.	Other packets from an unrelated source may utilize unused bandwidth
users are charged based on time and the basis of distance	users are charged based on time and number of bytes carried & not based on distance.
Telephone network for bidirectional, real time transfer of voice signal.	Internet for datagram and reliable stream service between computers.
implemented at the physical layer.	implemented at the data link and a network layer.
highly reliable.	low reliability, subject to congestion.
no overhead bits after call setup.	Overhead bits in each packet.
Circuit switching using two technologies Time Division Switching Space Division Switching	Packet Switching using two technologies Datagram circuit approach Virtual circuit Approach
initial cost is low.	high installation costs.

Circuit switching Network	Packet switching Network
Requires simple protocols for delivery.	Requires complex protocols for delivery.
Hierarchical numbering plan scheme is used.	Hierarchical address space is used.
information type is Analog voice or PCM digital voices.	information type is binary information.
Circuit multiplexing is used.	Packet multiplexing shared media access network in used.
In circuit switching, route selecting during set up.	In packet switching, each packet is routed independently.

Thank You