

E1-E2 (CFA) CONCEPT OF PACKET SWITCHING

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INTRODUCTION



- Packet-switched and circuit-switched networks use two different technologies for sending messages and data from one point to another.
- Each have their advantages and disadvantages too.
- There is another technology almost not in use called the Message switched network best known by the descriptive term store and forward.



- Circuit switching was designed in 1878 in order to send telephone calls down a dedicated channel. This channel remained open and in use throughout the whole call and could not be used by any other data or phone calls.
- There are three phases in circuit switching:

Establish Transfer Disconnect



- The telephone message is sent in one go, it is not broken up. The message arrives in the same order that it was originally sent.
- In modern circuit-switched networks, electronic signals pass through several switches before a connection is established.
- During a call, no other network traffic can use those switches.
- The resources remain dedicated to the circuit during the entire data transfer and the entire message follows the same path.



- Circuit switching can be analogue or digital
- With the expanded use of the Internet for voice and video, analysts predict a gradual shift away from circuitswitched networks.
- A circuit-switched network is excellent for data that needs a constant link from end-to-end. For example realtime video.



- Circuit Switching
 - ✤Advantages:
 - ✤Circuit is dedicated to the call no interference,
 - no sharing
 - Guaranteed the full bandwidth for the duration of
 - the call
 - Guaranteed Quality of Service



Disadvantages:

- Inefficient the equipment may be unused for a lot of the call, if no data is being sent, the dedicated line still remains open
- Takes a relatively long time to set up the circuit
- During a crisis or disaster, the network may
 - become unstable or unavailable.
- It was primarily developed for voice traffic rather than data traffic.



CIRCUIT SWITCHING(ILLUSTRATION)





CIRCUIT SWITCHING(ILLUSTRATION)



(a) Circuit switching

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- In packet-based networks, the message gets broken into small data packets. These packet travel around the network seeking out the most efficient route to travel as circuits become available. This does not necessarily mean that they seek out the shortest route.
- Each packet may go a different route from the others.
- Each packet is sent with a 'header address'. This tells it where its final destination is, so it knows where to go.



- The header address also describes the sequence for reassembly at the destination computer so that the packets are put back into the correct order.
- One packet also contains details of how many packets should be arriving so that the recipient computer knows if one packet has failed to turn up.
- If a packet fails to arrive, the recipient computer sends a message back to the computer which originally sent the data, asking for the missing packet to be resent.



- *Advantages:
 - *Security
 - Bandwidth used to full potential
 - Devices of different speeds can communicate
 - Not affected by line failure (re diverts signal)
 - Availability do not have to wait for a direct connection to become available
 - During a crisis or disaster, when the public telephone network might stop working, e-mails and texts can still be sent via packet switching



Disadvantages

Under heavy use there can be a delay

- Data packets can get lost or become corrupted
- Protocols are needed for a reliable transfer
- Not so good for some types data streams e.g real-
- time video streams can lose frames due to the way packets arrive out of sequence.



✤ SWITCHING TECHNIQUE

- Station breaks long message into packets
- Packets sent one at a time to the network
- Packets are handled in two way
 - Datagram
 - Virtual circuit

DATAGRAM PACKET SWITCHING



- In datagram approach each packet is treated independently with no reference to packets that have gone before. No connection is set up.
- Packets can take any practical route
- Packets may arrive out of order
- Packets may go missing
- Up to receiver to re-order packets and recover from missing packets
- More processing time per packet per node
- Robust in the face of link or node failures.

DATAGRAM PACKET SWITCHING







- The approach seems to be feasible, but we have not considered a very important aspect, updation of routing tables. If a new node is added to the sub-network, all the routing tables at various nodes need to be updated.
- In heavy traffic conditions, datagram movement across the sub-network can stop altogether.
- The main implementation of Datagram Switching network is the Internet which uses the IP network protocol.



- In the Virtual Circuit approach a pre-planned route is established before any packets are sent.
- There is a call set up before the exchange of data (handshake).
- All packets follow the same route and therefore arrive in sequence.
- Each packet contains a virtual circuit identifier instead of destination address
- More set up time
- No routing decisions required for each packet Less routing or processing time



- Susceptible to data loss in the face of link or node failure
- Clear request to drop circuit
- Not a dedicated path
- The most common forms of Virtual Circuit networks are X.25 and Frame Relay, which are commonly used for public data networks (PDN)

VIRTUAL CIRCUIT PACKET SWITCHING







Source-to-destination data transfer





- Virtual circuits can be either permanent, called Permanent virtual Circuits (PVC), or temporary, called Switched Virtual Circuits (SVCs).
- A Permanent Virtual Circuit (PVC) is a virtual circuit that is permanently available to the user.
- ✤ A PVC is defined in advance by a network manager.
- If permanent, an outgoing VCI is given to the source, and an incoming VCI is given to the destination.
- The source always uses this OG VCI to send frames to this particular destination.



- The destination knows that the frame is coming from that particular source if the frame carries the corresponding incoming VCI.
- Once a communication session is complete, the virtual circuit is disabled.

VIRTUAL CIRCUIT PACKET SWITCHING



Permanent Virtual Circuit (PVC) Operation





- ✤ A PVC has several drawbacks:
- Always connected, so always paying
- Connection is between two parties only. If
 you need a connection to another point, you
 need another PVC.



- Switched Virtual Circuit SVC
- A switched virtual circuit is an automatically and temporarily created logical path with aid of some switch control for a communication session.
- Once a communication session is complete, the virtual circuit is disabled.



SVC setup request

1 - Setup frame sent from A to Switch I.

Note how the Outgoing VCI is not yet known.



VIRTUAL CIRCUIT PACKET SWITCHING



SVC setup acknowledgment

As the acknowledgment frame goes back, the VCI number is placed into the Outgoing VCI entry in each table.





The major limitations of Packet switching is that it is unsuitable for real time applications such as Voice telephony, Video Conference etc. However in modern 'Voice over IP' protocols and with use of ATM, the inherent limitations of packet switching e.g. variable delays, packet loss etc are possible to eliminate and guaranteed Quality of Service can be offered.

COMPARISION



ltern	Circuit-switched	Packet-switched
Dedicated "copper" path	Yes	No
Bandwidth available	Fixed	Dynamic
Potentially wasted bandwidth	Yes	No
Store-and-forward transmission	No	Yes
Each packet follows the same route	Yes	No
Call setup	Required	Not needed
When can congestion occur	At setup time	On every packet
Charging	Per minute	Per packet

CIRCUIT SWITCH VS VIRTUAL CIRCUIT SWITCH



- Path versus route: A circuit-switched connection creates a physical path by setting the switches. A virtual-circuit connection creates a route between two points. This means each switch creates an entry in its routing table for the duration of the session.
- Dedicated versus sharing: In a circuit-switched connection, the links that make a path are dedicated; they cannot be used by other connections. In a virtual circuit connection, the links the make a route can be shared by other connections

PATH VRS ROUTE





b. Virtual circuit connection

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MESSAGE SWITCHING



- Message switching is best known by store and forward technology.
- A node (usually a special computer with a number of disks) receives a message, stores it until the appropriate route is free, them sends it along.
- Store and forward is considered a switching technique because there is no direct link between the sender and receiver of a transmission.

MESSAGE SWITCHING



- A message is delivered to the node alone one path then rerouted along another to its destination.
- It is secondary storage

 (disk) dependent, while in
 packet switching it is (RAM)
 dependent





