

Extra slides for understanding  
Packet switching and Circuit  
switching

# Packet switching

- In a packet switched network data is transmitted in blocks, known as packets, typically less than 1KB in length.
- Each packet contains a chunk of data and sufficient information for the packet to navigate to its destination and the original data reconstituted.
- A packet arriving at a switch is queued until it is possible to send it on to the next switch by the appropriate route.
- There are 2 basic mechanisms employed for packet switching: **datagrams** and **virtual circuits**.

# Datagrams

- Each **datagram** is a packet which is treated independently as it traverses the network, each switch in the network must decide where to send that datagram next.
- It is **possible** therefore that two datagrams from the same message may take entirely **different routes** to reach a destination, with the possibility that the order of packets may be changed or than packets may become lost (or terminally delayed) en route.
- Datagram protocols (such as **IP**) must therefore include sufficient information so that order can be re-instated, missing packets detected and that lost packets are eventually terminated.

# Virtual Circuits

- In a **virtual circuit** a **preplanned route** is set **for all packets** constituting a message.
- This is achieved by a **control packet** preceding all the data: each switch makes a decision as to where to send the control, but all subsequent packets follow the control.
- This does **not constitute a dedicated route** (as in a circuit switched network) as the packets will still be queued at each switch and other virtual circuits may use the same equipment.

- The main advantage of the virtual circuit is that each of the switches makes only one route choice per message,
- there is an additional delay in setting up the virtual circuit and the switches must remember the next step of the route for every virtual circuit
- the datagram approach can adapt a route to cope with problems that arise during the transmission of a message
- if messages are generally short or the network unstable, then the datagram approach is better,
- most networks employ some sort of virtual circuit.

# Comparison between circuit switched and packet switched

- The main reason for employing a packet switched network is to :
  - increase carrying capacity.
- Although a packet switched network requires more information to be sent to manage the packets this is generally small enough that a packet switch mechanism will always carry more data than a circuit switch on the same cables.

# Transmission Overhead

- For an individual message on an unloaded network the fastest mechanism will be determined by the amount of overhead in routing the data.
- For a circuit switched network this means the time taken to set up the circuit.
- For a datagram this means the cumulative time for routing each packet.
- for a virtual circuit it will be the sum of the time taken to set up the virtual circuit plus the time taken to identify each packet at each switch

## Packet Size:

- There is an additional delay in a packet switch network caused by the fact that each switch will not start to send on a packet until it has finished receiving it, whereas in a circuit switch there is no such delay.
- Therefore, small packets travel faster than larger packets, although the more packets there are the more work is needed to route them individually (in a datagram approach).

## Circuit setup time:

- Generally the time to initiate a circuit is very similar whether that circuit is physical (circuit switched) or not (packet switched with virtual circuit).
- Thus a packet switched network with virtual circuit will generally be slower than a circuit switched network (although it has a larger capacity).



## Network Load

- In a lightly loaded network a datagram approach may be faster than a circuit switch as each datagram can potentially take a separate route to the destination.
- However, if the number of short alternative routes is small (relative to the number of packets) then the cumulative delay of routing every packet will be greater than the set up of the circuit, so the circuit switched will be faster.
- If there are a large number of packets on each possible route then the datagram approach may be slower than the virtual circuit.