CSE3151

COMPUTER NETWORKS

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SWITCHING

- Switching is the practice of directing a signal or data element toward a particular hardware destination.
- Two types:
  - Circuit switching
  - Packet Switching

SWITCHING

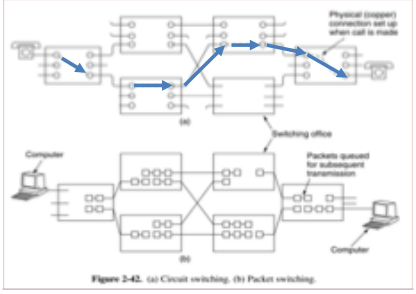


Figure 2-42. (a) Circuit switching. (b) Packet switching.

SWITCHING

- SWITCHING COMPARISON
  - Circuit switching vs Packet Switching

X.25 Protocol

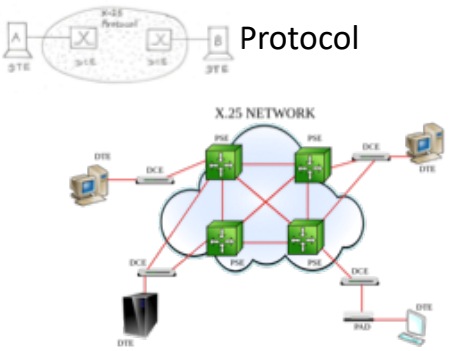
- … 1970s by **ITU-T**
  - ITU Telecommunication Standardization Sector (ITU-T)
  - ITU: International Telecommunication Union (ITU)

- PLP: Packet Layer Protocol
- LAP-B: Link Access Protocol - Balanced

X.25 Protocol

- X.25 network devices fall into three general categories:
  1. Data Terminal Equipment (DTE),
  2. Data Circuit-terminating Equipment (DCE),
  3. Packet-switching Exchange (PSE)
     - PAD- Packet Assembler/ Dissembler.

Protocol



7 of 23

DTE

- Data terminal equipment devices are end systems that communicate across the X.25 network.
- They are usually
  - Terminals,
  - personal computers, or network hosts,
  - and are located on the premises of individual subscribers.

8 of 23

DCE

- DCE devices are communications devices, such as Modems and packet switches, that provide the interface between DTE devices and a PSE, and are generally located in the carrier's facilities.
- PSEs are switches that compose the bulk of the carrier's network.
- They transfer data from one DTE device to another through the X.25 PSN.

9 of 23

PSE

- PSEs are switches that compose the bulk of the carrier's network.
- They transfer data from one DTE device to another through the X.25 PSN

10 of 23

Packet Assembler/Disassembler (PAD)

- The packet assembler/disassembler (PAD) is a device commonly found in X.25 networks.
- The PAD is located between a DTE device and a DCE device, and
- it performs three primary functions:
  - Buffering (storing data until a device is ready to process it),
  - Packet assembly,
  - Packet disassembly.

11 of 23

X.25 Protocol

- X.25 protocol specifies 3 layers:

Network	PACKET LAYER
Data Link	FRAME LAYER
Physical	PHYSICAL LAYER

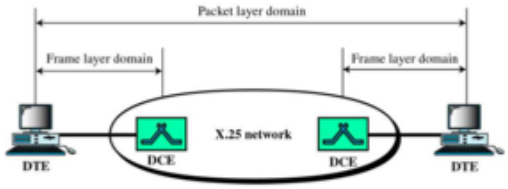
12 of 23

X.25 Protocol

- Communication in this layer involves 3 phases:
  - Link Set Up
  - Data and Control transfer
  - Link disconnect
- These phases use different frames such as:
  - U-Frames — U-frame is used to set up and disconnect the connection between DTE and DCE
  - I-Frames — I-frames are used to encapsulate PLP packets from the upper layer..
  - S-Frames — S-frame is used for error control and flow control

13 of 23

X.25 Protocol



14 of 23

virtual circuits in X.25

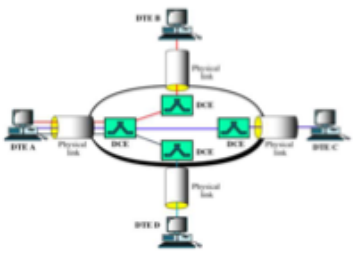
- Two types of virtual circuit exists in x.25
  - Switched virtual circuits (SVCs)
  - Permanent virtual circuit (PVCs)

15 of 23

SVC & PVC

- **Switched virtual circuits (SVCs)** are temporary connections used for irregular data transfers. They require that two DTE devices establish, maintain, and terminate a session each time the devices need to communicate.
- **Permanent virtual circuits (PVCs)**are permanently established connections used for frequent and consistent data transfers. PVCs do not require that sessions be established and terminated.
- Therefore, DTEs can begin transferring data whenever necessary because the session is always active

16 of 23



In X.25, SVCs and PVCs both are used.

17 of 23

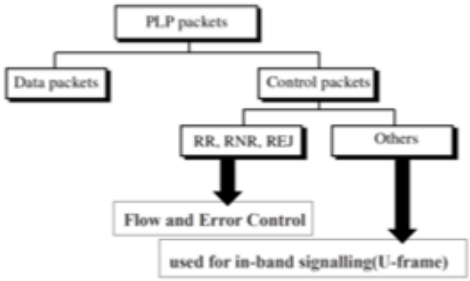
X.25 Protocol

The following 5 events occur :

- link is set up between local DTE & DCE node and also between the remote DTE and DCE.
- VC is established between local and remote DTE.
- Data is transferred between two DTEs.
- VC is released
- Link is disconnected

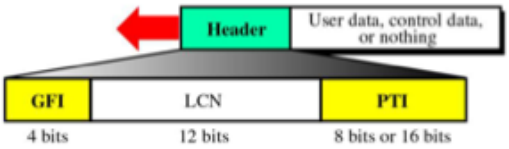
18 of 23

X.25 Protocol



19 of 23

PLP Packet



- GFI or General Format Identifier is a 4 bit field.
- LCN- Logical Channel Number
- PTI or Packet Type Identifier defines the type of packet, viz. data packet or control packet.

20 of 23

PLP Packet

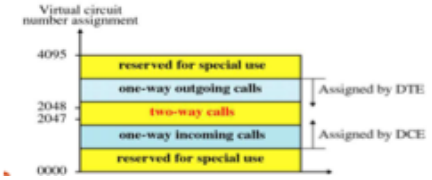
- GFI or General Format Identifier is a 4 bit field.
  - The first bit (Q bit, Qualifier) defined source of control information.
    - 0 for PLP and 1 for upper layer protocol.
  - The D bit(Delivery) defines which device should acknowledge the packet 0 for local DCE, 1 for remote DTE.
  - The last two bits indicate size of sequence number fields.
- LCN- Logical Channel Number
  - 12 bit

21 of 23

PLP Packet

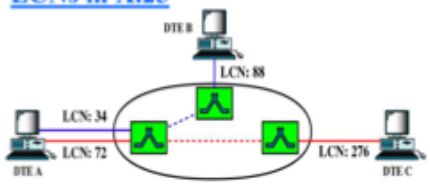
Virtual Channel ID Numbers

- up to 4096 (2^{12}) multiplexed channels between each DTE and DCE
- the calling and called hosts use different numbers



22 of 23

LCNs in X.25



➢Logical Channel Number identifies the VC at different sections of the network.

➢A pair of LCN is defined when a VC is established between two DTE's

23 of 23