FRAME RELAY

Frame Relay Concept

- high-performance WAN protocol
- operates at the physical and data link layers
- Originally designed for use across ISDN interfaces
- An example of packet-switched technology
- described as a streamlined version of X.25

Compare Frame Relay vs. X.25

- Frame Relay is a Layer 2 protocol suite, X.25 provides services at Layer 3
- Frame Relay offers higher performance and greater transmission efficiency than X.25

Frame Relay Devices

- Data terminal equipment (DTE)
  - terminating equipment for a specific network
  - typically are located on the premises of a customer
  - Examples: terminals, personal computers, routers, and bridges

Frame Relay Devices

- Data circuit-terminating equipment (DCE)
  - carrier-owned internetworking devices
  - to provide clocking and switching services in a network
  - actually transmit data through the WAN

Frame Relay Devices

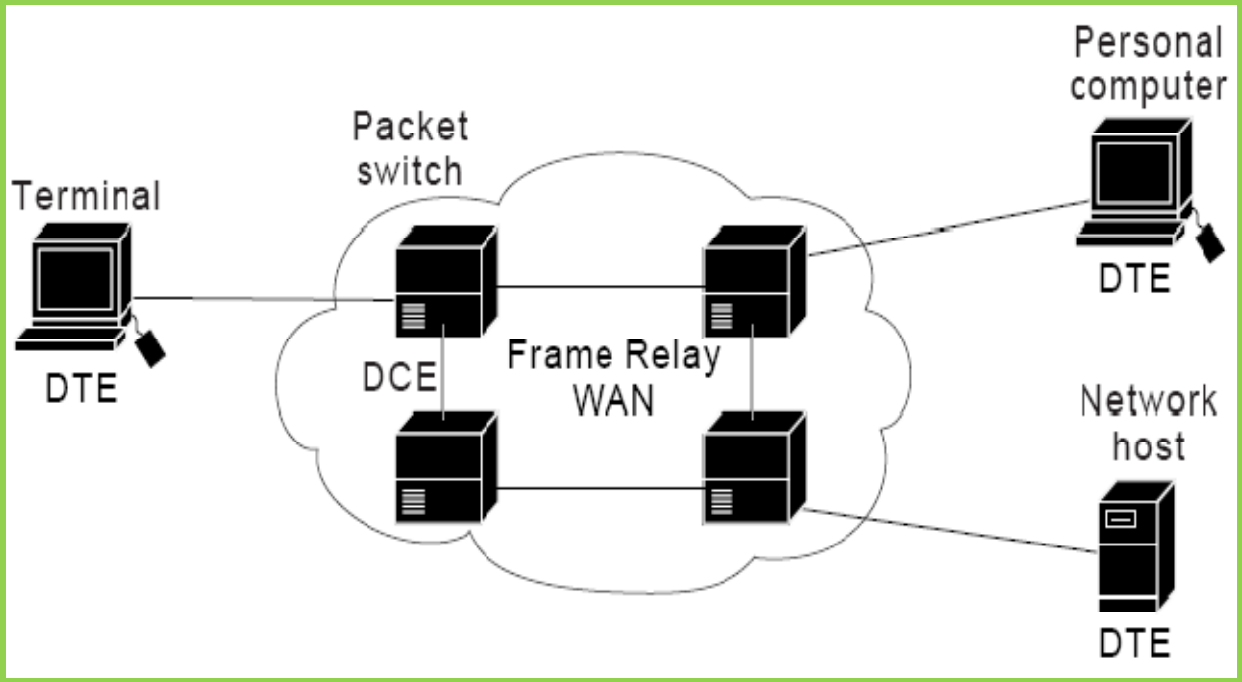

Figure 1 Frame Relay Devices

Frame Relay Virtual Circuits

- provides connection-oriented data link layer communication
- a logical connection between two data terminal equipment across a Frame Relay packet-switched network
- provide a bi-directional communications path from one DTE device to another

Frame Relay Virtual Circuits

- Switched virtual circuits (SVCs)
  - temporary connections requires sporadic data transfer between DTE devices across the Frame Relay network
    - *Call Setup*
    - *Data Transfer*
    - *Idle*
    - *Call Termination*

Frame Relay Virtual Circuits

- Permanent Virtual Circuits (PVCs)
  - used for frequent and consistent data transfers between DTE devices across the Frame Relay network
    - *Data Transfer*
    - *Idle*

Congestion Control Mechanism

- Forward-explicit congestion notification (FECN)
- Backward-explicit congestion notification (BECN)

Forward-explicit congestion notification (FECN)

- initiated when a DTE device sends Frame Relay frames into the network
- When the frames reach the destination DTE device, the frame experienced congestion in the path from source to destination
- flow-control may be initiated, or the indication may be ignored

Backward-explicit congestion notification (BECN)

- DCE devices set the value of the BECN bit to 1 in frames traveling in the opposite direction, informs the receiving DTE device that a particular path through the network is congested
- flow-control may be initiated, or the indication may be ignored

Frame Relay Discard Eligibility (DE)

- (DE) bit is used to indicate that a frame has lower importance than other frames
- When the network becomes congested, DCE devices will discard frames with the DE bit

Frame Relay Error Checking

- common error-checking mechanism known as the *cyclic redundancy check* (CRC)
- CRC compares two calculated values to determine whether errors occurred during the transmission

Frame Relay Network Implementation

- consists of a number of DTE devices connected to remote ports on multiplexer equipment via traditional point-to-point services

Frame Relay Network Implementation

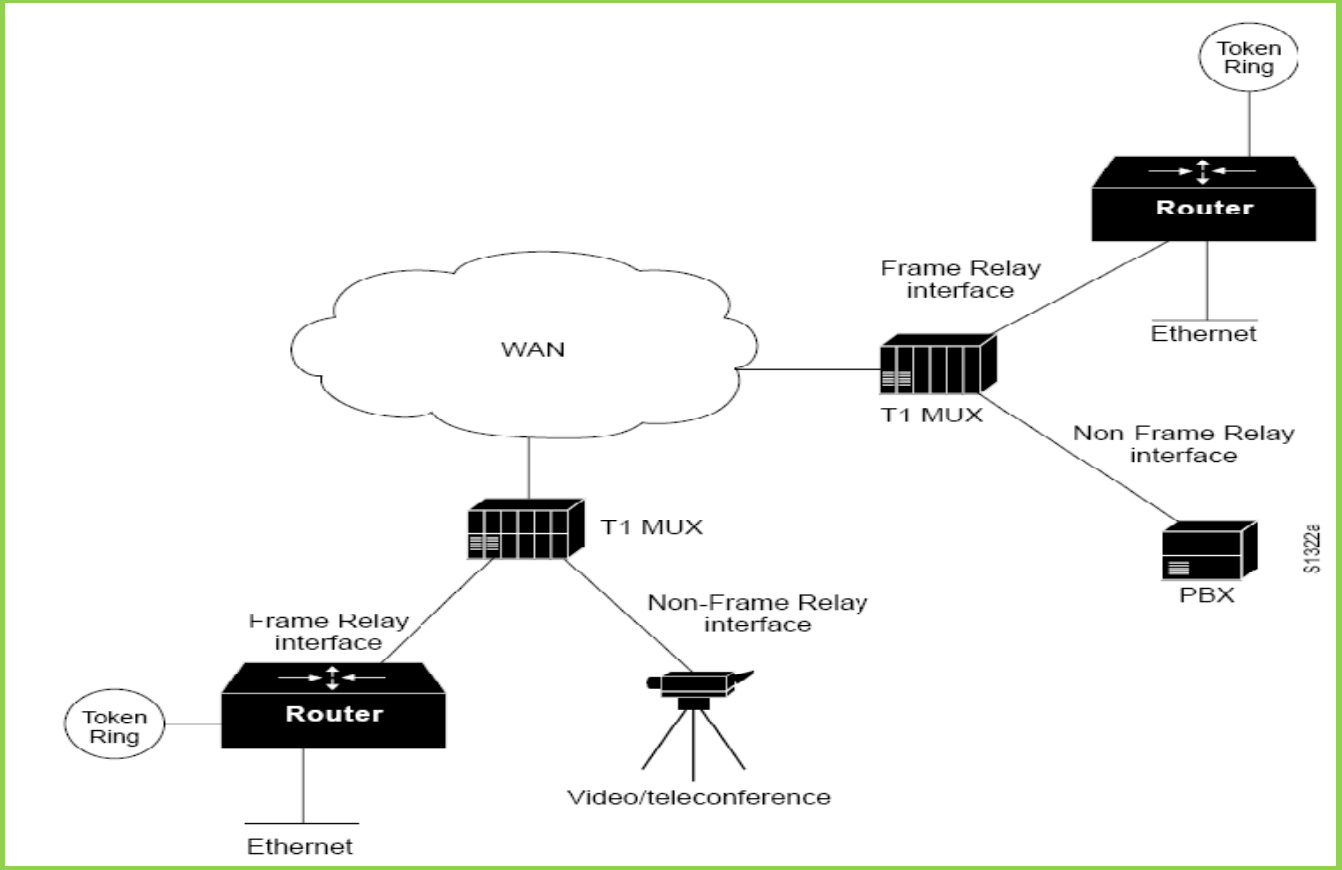

Figure 2 A simple Frame Relay network connects various devices to different services over a WAN.

Public Carrier-Provided Networks

- Frame Relay switching equipment is located in the central offices of a telecommunications carrier
- The DCE equipment also is owned by the telecommunications provider
- The majority of today's Frame Relay networks are public carrier-provided networks

Private Enterprise Networks

- the administration and maintenance of the network are the responsibilities of the enterprise
- All the equipment, including the switching equipment, is owned by the customer

Frame Relay Frames

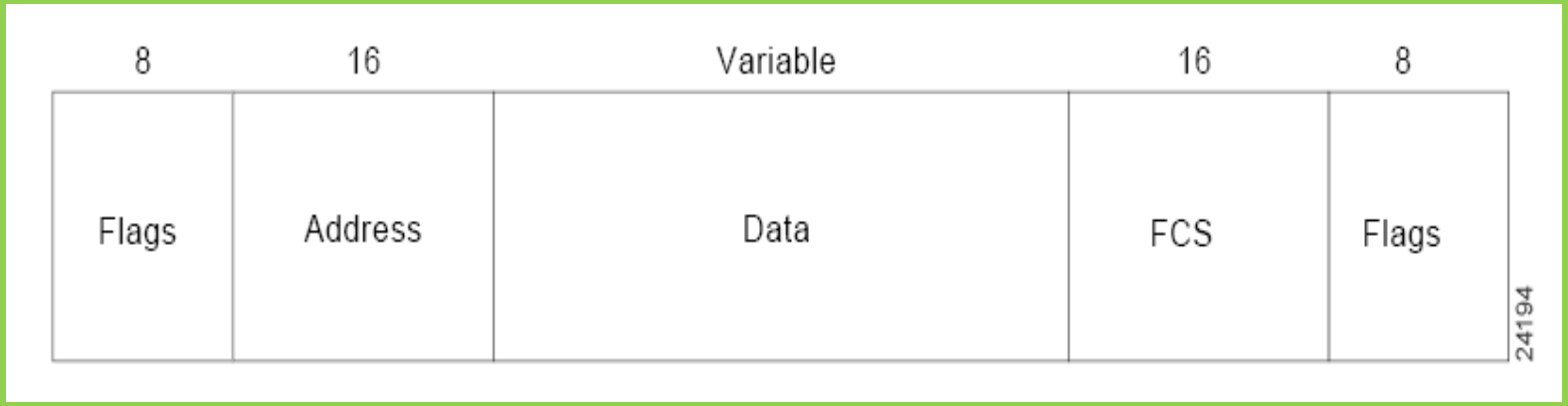

Figure 3 Frame Relay Frame

Frame Relay Frames

- Flags indicate the beginning and end of the frame
- Three primary components make up the Frame Relay frame
  - the header and address area
  - the user-data portion
  - the frame-check sequence (FCS)

Frame Relay Frames

- The address area (2 bytes)
  - 10 bits represents the actual circuit identifier
  - 6 bits of fields related to congestion management

Frame Relay Frame Formats

- Standard Frame Relay Frame
- LMI Frame Format

Standard Frame Relay Frame

- *Flags*
  - Delimits the beginning and end of the frame
  - The value of this field is always the same (7E or 01111110)

Standard Frame Relay Frame

- *Address* – contains the following information
  - DLCI: The 10-bit DLCI is the essence of the Frame Relay header, values have local significance only, devices at opposite ends can use different DLCI values for the same virtual connection

Standard Frame Relay Frame

- *Address*
  - Extended Address (EA): used to indicate whether the byte in which the EA value is 1 is the last addressing field, the eighth bit of each byte of the Address field is used to indicate the EA

Standard Frame Relay Frame

- *Address*
  - Congestion Control: consists of the three bits; FECN, BECN, and DE bits

Standard Frame Relay Frame

- *Data* – Contains encapsulated upper-layer data
  - serves to transport the higher-layer protocol packet (PDU) through a Frame Relay network

Standard Frame Relay Frame

- *Frame Check Sequence*
  - Ensures the integrity of transmitted data

LMI Frame Format

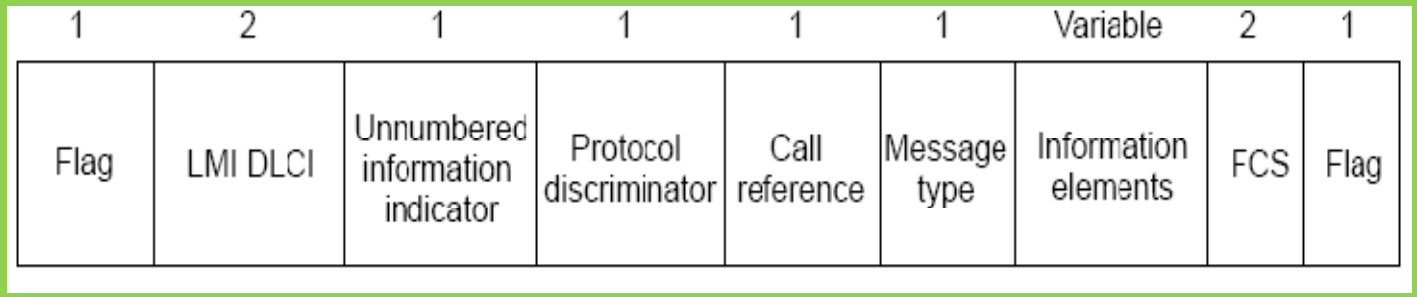

Fig : Nine fields comprise the Frame Relay that conforms to the LMI format