Module 10

Frame Relay and ATM

Version 1 ECE , IIT Kharagpur

10.0 INTRODUCTION

Multimedia is basically a heterogeneous service which is characterized by different traffic types and variable bandwidths. Specifically Video bandwidth has a grey scale i.e. it is not uniquely defined and largely varying. Thus while providing Multimedia service the focus should be on

Combining different Bit rates

For combining different bit rate streams conventional TDM and FDM would be inapplicable whereas hierarchical TDM (inefficient and complex demultiplexing) and CDMA (with different spreading rates) may be used. The only way out is to use Statistical Multiplexing.

Accommodating varying bit rate services

We can have same type of data at different bit rates as varying bit rate requirements may be specified as 64X, to specify video at 128 Mbps or 256 Mbps. This varying bit rate data inherently uses packet switching, so the multiplexing technique used is Statistical Multiplexing. So for Multimedia all type of data should be packetised.

Providing sufficiently high basic transmission rate.

The packetization followed should have a sufficiently high basic transmission rate so that it can cater to all kinds of bandwidth requirements. Actual speed of transmission should be at least higher than the highest data rate to be used.

There are two different but related techniques for achieving these objectives—**Frame Relay** and **Asynchronous Transfer Mode (ATM)**

ATM is a multiplexing and switching technique for combining all types of multimedia services Frame relay uses a basic transmission rate of 1.544 Mbps or 44.736 Mbps while ATM provides a basic transmission rate of 155Mbps (Europe)/ 51Mbps (North America) which is sufficiently high to cater to all kind of

Lesson

33

Frame Relay

OBJECTIVE

General

The lesson will discuss the frame relay technique

Specific

The focus areas of this lesson are:

1. Introduction to frame relay
2. Frame relay frame structure

10.1.1 INTRODUCTION

Frame relay is a virtual circuit wide area network that was developed to respond to demands for a new type of WAN in the late 1980s and early 1990s. Prior to Frame relay organizations used X.25. X.25 has problems of low data rate, high amount of flow and error control; which is not necessary in networks using a reliable transmission medium. Some organizations moved over to privately developed LANs using T1 or T3 lines, but this proved to be a costly alternative. Finally Frame relay was developed as an absolute bare-bones connection-oriented service to move bits from A to B at reasonable speed and low cost. Its existence is due to the changes in technology over the past many years. Previously telephone lines were slow, analog and unreliable computers were also slow and expensive. As a result complex protocols were required to mask errors. The situation has changed radically. Leased lines are now fast and digital, and computers are fast and inexpensive. This suggests the use of simple protocols. Frame relay works in this situation.

Frame relay has the following properties:

1. Frame relay operates at a higher speed (1.544 Mbps and recently 44.736 Mbps). This means that it can easily be used instead of a mesh of T1 or T3 lines.
2. Frame relay operates in just the physical and data link layers. Thus it can be easily used in backbone networks that already have a network layer protocol such as the internet.
3. Frame relay allows bursty data
4. Frame relay allows a frame size of 9000 bytes, which can accommodate all local area network frame sizes.
5. Frame relay is less expensive than other traditional WANs.
6. Frame relay has error detection at the data link layer only. It does not have any flow control or retransmission policy, if a frame is damaged; it is silently dropped.

10.1.2 ARCHITECTURE

Frame relay provides permanent virtual circuits and switched virtual circuits. Figure below shows an example of a Frame Relay network connected to the Internet. A virtual circuit in a Frame Relay is identified by a number called a data link connection identifier (DLCI). The frame relay network consists of switches each of which has a table to route frames. The table matches an incoming port-DLCI combination with an out going-DLCI combination.

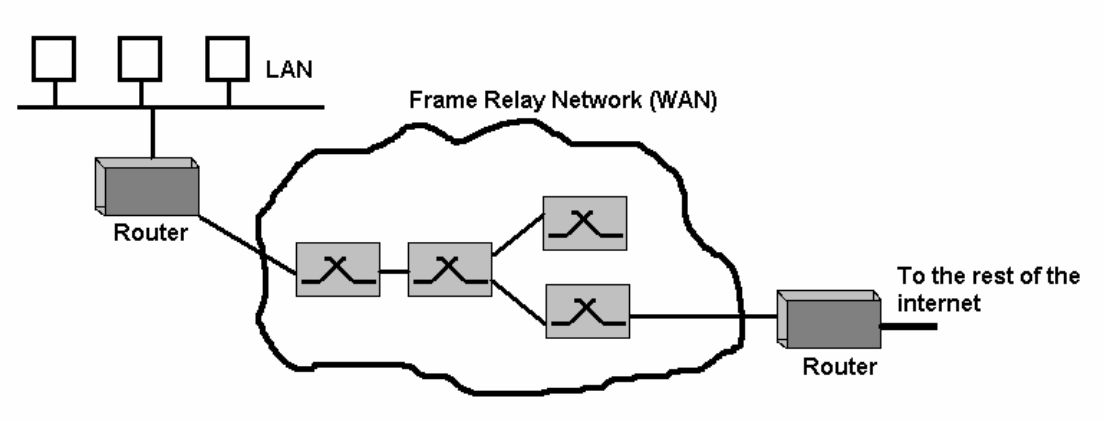

Figure 1 Frame Relay

10.1.3 FRAME RELAY LAYERS

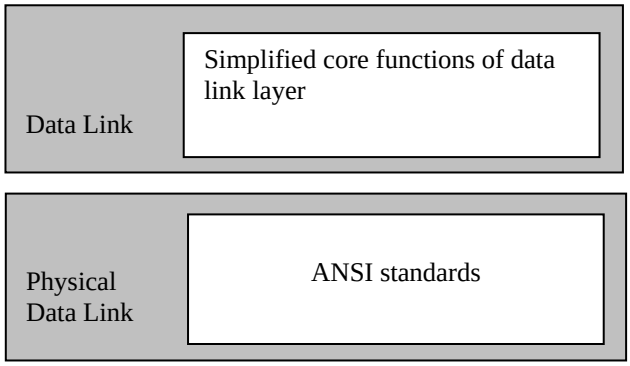

Figure 2 Frame relay layers

Physical Layer

No specific protocol is defined for the physical layer in frame relay. Instead it is left to the implementation to use whatever is available.

Data Link Layer

Frame relay employs a simplified version of HDLC here, without the complex flow and error control. The Frame Relay frame format is shown

below. It is similar to the HDLC frame, but the control field is missing. The address field defines the DLCI as well as some bits used to control congestion and traffic.

The fields of the Frame relay frame are

Flag	Address	Information	FCS	Flag

Figure 3 Frame relay frame structure

The fields of the address field are

DLCI (6)	C/R (1)	EA(1)	DLCI (4)	FECN(1)	BECN(1)	DE(1)	EA(1)

Figure 4 Frame relay address

Address (DLCI) field. 6 bits from the first byte and 4 bits from the second byte of the address field make up the 10 bit DLCI.

Command/Response (C/R).

The C/R bit is provided to allow the upper layers to identify a frame as either a command or response frame. It is not used by the Frame Relay protocol.

Extended Address (EA)

This bit indicates whether the current byte is the final byte of the address. An EA of 0 means that another address is to follow. EA of 1 means that the current byte is the final one.

Forward explicit congestion notification (FECN)

This bit can be set by any switch to indicate that traffic is congested in the direction that the frame is traveling. This bit informs the destination that congestion has occurred.

Backward explicit congestion notification (BECN)

This bit can be set by any switch to indicate that traffic is congested in the direction opposite to the one in which the frame is traveling. This bit informs the sender that congestion has occurred.

Discard eligibility (DE)

The DE bit indicates the priority level of the frame. In emergency situations, switches may have to discard frames to relieve the bottlenecks. The network may discard a frame whose DE bit is set. This bit may be set either by the sender of the frames or by any switch in the network.

Extended Addresses

The Frame relay address may be extended from the original 2-byte address to a 3- or 4- byte address. The EA field defines the number of bytes. In the 3- and 4- byte address formats the bit before the last bit is set to 0.

FRAD

To handle frames arriving from other protocols Frame Relay uses a device called a **Frame Relay assembler/ disassembler (FRAD).** FRAD can be implemented as a separate device or as a part of a switch

VOFR

Frame Relay networks offer an option called **Voice over Frame Relay** that sends voice through the network. Voice is digitized using PCM, compressed and sent as data frames over the network. The quality of voice is not as good as voice over a circuit-switched network.

LMI

Local Management Information (LMI) is a protocol added recently to the Frame Relay protocol to provide management functions. LMI can provide

- A keep-alive mechanism to check if data are flowing.
- A multicast mechanism to allow a local end system to send data to more than one remote end system
- A mechanism to allow an end system to check the status of a switch.

☞ *Frame relay also provides congestion control and Quality of service*

Frame relay provides a minimal service, primarily a way to determine the start and end of each frame, and detection of transmission errors. If a bad frame is received, the frame relay service simply discards it. It is up to the user to discover that a frame is missing and take the necessary action to recover. Unlike the X.25, frame relay does not provide acknowledgements or normal flow control. It does have a bit in the header. However which one end of a connection can set to indicate to the other end that problems exist. The use of this bit is up to the users.

Objective Questions

33.01

Subjective Questions

33.11

Level 2 Questions

33.21

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