Abstract

High-Level Data Link Control (HDLC) is a bit-oriented code transparent synchronous data link layer protocol developed by the International Organization for Standardization (ISO). HDLC is used to connect one device to another, using what is known as Asynchronous Balanced Mode (ABM). HDLC is based on IBM's Systems Network Architecture (SNA). HDLC is the default encapsulation for serial interfaces on Cisco routers.

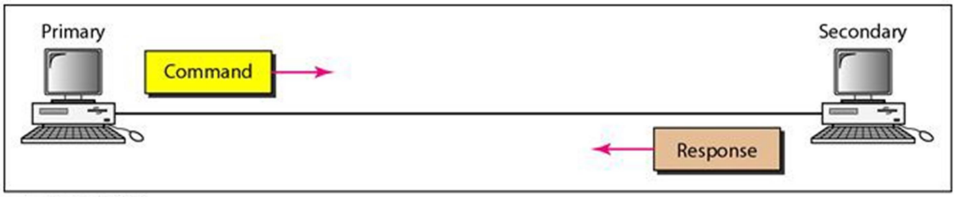
HDLC Protocol is used to send the data in the form of frames; a controller controls the flow of data in the data link layer of the OSI model. HDLC protocol is used to transmit frames in the logic link layer of the Data link Layer. HDLC frame consists of an 8 bit Flag bit as 01111110, followed by control bits, information bits, FCS bits (CRC), address bits and terminates with flag bit. It involves the processing of data before transmission, termed as Zero Stuffing, which is a special feature of HDLC protocol. A FIFO is used to transmit the data in the order of First in First out (FIFO). When complete data is transmitted, FIFO generates an empty signal and the transmission of FCS, control, information and address bits begin. On the receiver side, detection of flag bits marks the beginning of a new frame and zero un stuffing of data is performed. The unstuffed data is stored in variable-length memory.

Introduction

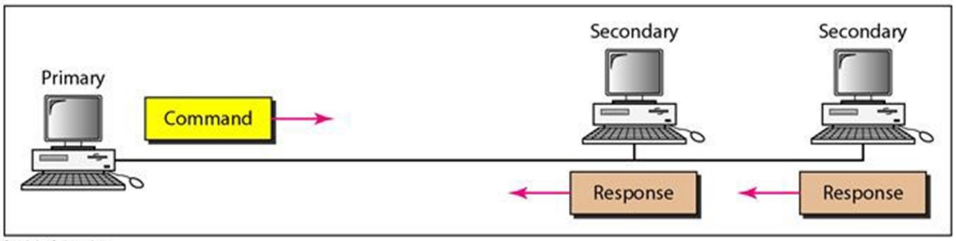
High-level Data Link Control (HDLC) is a group of communication protocols of the data link layer for transmitting data between network points or nodes. Since it is a data link protocol, data is organized into frames. A frame is transmitted via the network to the destination that verifies its successful arrival. It is a bit-oriented protocol that is applicable for both point-to-point and multipoint communications.

Transfer Modes

Normal Response Mode (NRM) −Primary station sends commands and secondary station responds to received commands. It is used for both point-to-point and multipoint communications.



a. Point-to-point



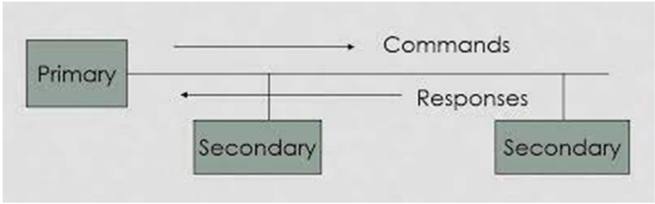
b. Multipoint

NRM Mode

Asynchronous Balanced Mode (ABM) −Both stations can send commands and respond to commands. It is used for only point-to-point communications.

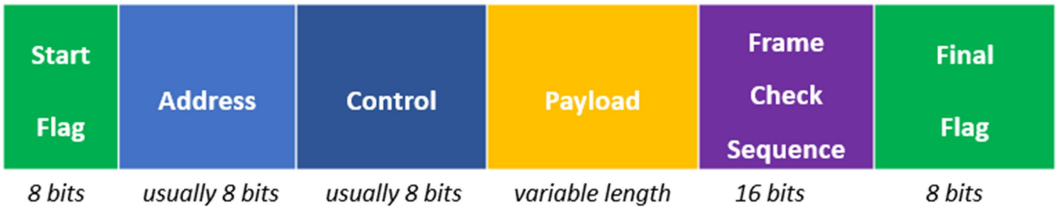
ABM Mode

Asynchronous response mode (ARM) -Primary station may initiate or start a data transfer as well as the secondary station can also start or initiate data transfer without any explicit permission or command from the primary station to transfer data. The primary station still has the responsibility of doing initialization, error correction or recovery, the control flow of data, and logical disconnections.



ARM Mode

HDLC Frame



HDLC Frame

HDLC is a bit-oriented protocol where each frame contains up to six fields. The structure varies according to the type of frame. The fields of an HDLC frame are: −

Flag − It is an 8-bit sequence that marks the beginning and the end of the frame. The bit pattern of the flag is 01111110.

Address − It contains the address of the receiver. If the frame is sent by the primary station, it contains the address (es) of the secondary station(s). If it is sent by the secondary station, it contains the address of the primary station. The address field may be from 1 byte to several bytes.

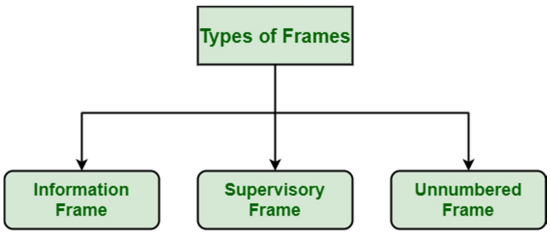
Control − is 1 or 2 bytes containing flow and error control information.

Payload − carries the data from the network layer. Its length may vary from one network to another.

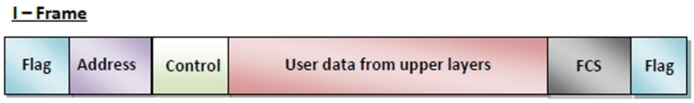
FCS − is a 2 byte or 4 bytes frame check sequence for error detection. The standard code used is CRC (cyclic redundancy code).

Types of HDLC Frames

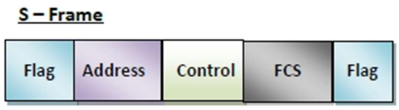
There are three types of HDLC frames. The type of frame is determined by the control field of the frame: −



I-frame − I-frames or Information frames carry user data from the network layer. They also include flow and error control information that is piggybacked on user data. The first bit of the control field of the I-frame is 0.



S-frame − S-frames or Supervisory frames do not contain an information field. They are used for flow and error control when piggybacking is not required. The first two bits of the control field of the S-frame are 10.



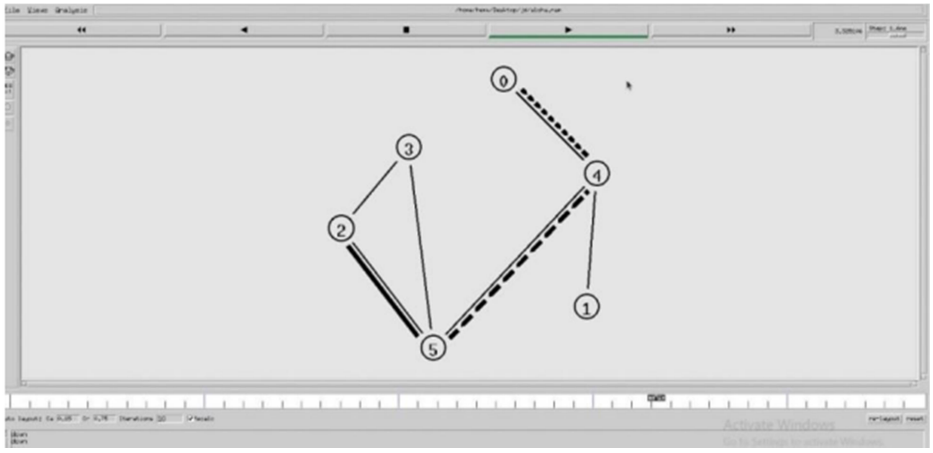
U-frame − U-frames or Un-numbered frames are used for myriad miscellaneous functions, like link management. It may contain an information field if required. The first two bits of the control field of the U-frame are 11.

ALGORITHM

1. Create a simulator object
2. Define different colors for different data flows
3. Open a Nam trace file and define the finish procedure then close the trace file, and execute Nam on the trace file.
4. Create six nodes that form a network numbered from 0 to 5
5. Create duplex links between the nodes
6. Setup UDP Connection between n(0) and n(2)
7. Apply CBR Traffic over UDP
8. Choose distance vector routing protocol as a high-level data link control.
9. Make any one of the links go down to check the working nature of HDLC
10. Schedule events and run the program.

Results and Discussion

Network animator output for HDLC represents the working of HDLC. Initially, the simulator object is created followed by the Nam file and trace file. The six nodes are created and duplex links are established between nodes. User Datagram Protocol (UDP) connection is set between node 0 and node 2, Constant Bit Rate (CBR) traffic is applied over UDP. One of the links is made to go down to check the working nature of HDLC



Representation of HDLC on Network animator window

High-Level Data Link Control (HDLC) basically provides reliable delivery of data frames over a network or communication link. HDLC provides various operations such as framing, data transparency, error detection, and correction, and even flow control. Primary stations simply transmit commands that contain the address of secondary stations. The secondary station then simply transmits responses that contain its own address