Unit- Seven

DATA LINK CONTROL AND PROTOCOL

❖ Framing

❖ Flow Control: Stop - & - Wait, Sliding Window, Error Control: Automatic Repeat

❖ Request (ARQ), Stop-and Wait ARQ, Sliding Window (ARQ)

❖ HDLC protocol

❖ Point-to-Point protocol

Compiled by: Er. Ganesh Datt Joshi, Lecturer at NAST

DATA LINK CONTROL AND PROTOCOL
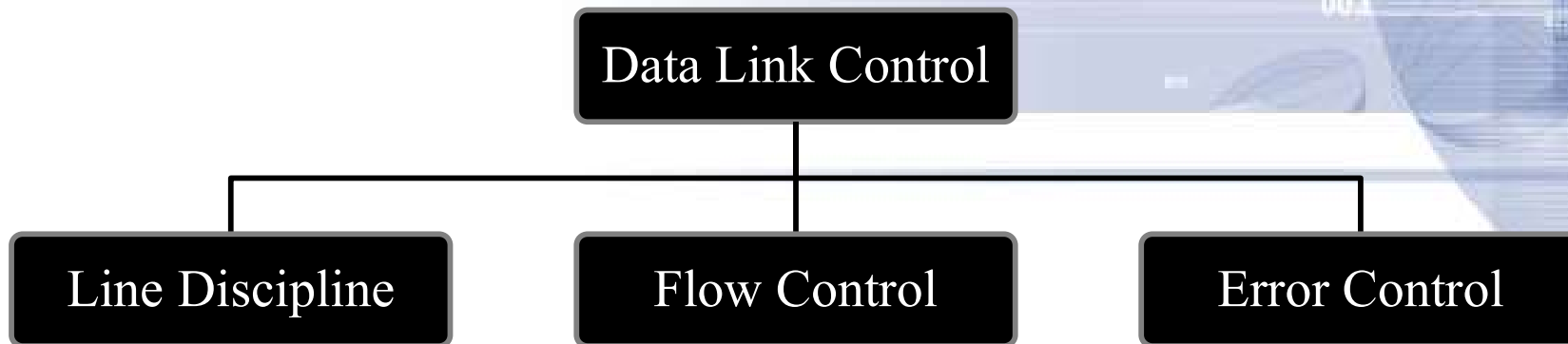
The main responsibility of data link layer is:

➢ Line Discipline
➢ Flow Control
➢ Error control

Software implemented protocols, that provides smooth & reliable transmission between modes.

DATA LINK CONTROL AND PROTOCOL

Data Link Control

Data link control is the service provided by the data link layer to provide reliable data, transfer over the physical medium.

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                    Data Link Control
                           |
        ------------------------------------------
        |                  |                     |
  Line Discipline     Flow Control          Error Control
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Line Discipline: It determines which device can send, & when it can send the data. It can achieve in two ways;

- **ENQ/ACK**

It stands for Enquiry/Acknowledgement is used when there is no wrong receiver available on the line and having a dedicated path between two devices so that the device capable of receiving the transmission is the intended one.

It coordinates which devices will start the transmission and whether the rest is ready or not.

Line Discipline:

- **Poll/Select**

The poll/select method of line discipline works with those topologies where one device is designated as a primary station of other devices as secondary stations.

❖ Framing

It deals with how to organize the bits that are carried by the physical layer. Frame can be of fixed or variable size.

Flow Control

❖ **Flow Control**

It is a set of procedures that tells the sender how much data it can transmit before it must wait for an acknowledgement from the receiver.

Any receiving device has a limited speed at which it can process incoming data and a limited amount of memory in which to store the incoming data. Thus, the flow of data must not be allowed to overwhelm the receiver.

Flow Control

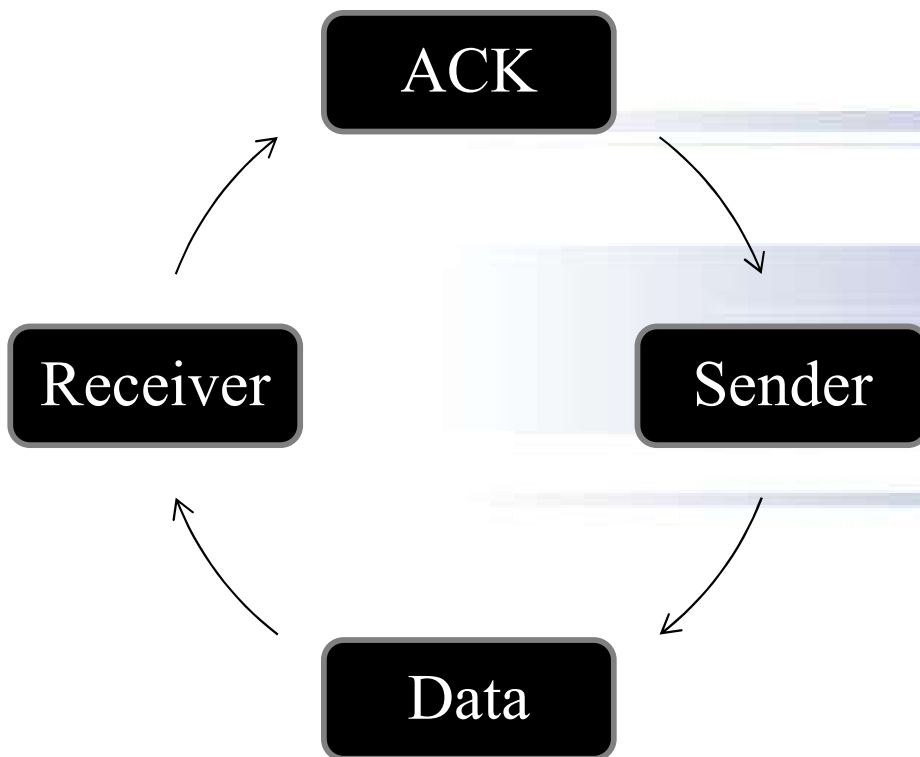The protocol used for flow control are:

a. Stop & Wait Flow Control

It is simple protocol used for flow control. In this protocol the sender sends one frame, stop until it receives confirmation from the receiver and then sends next frame. Here, for data frames the communication is unidirectional but auxiliary ACK frame travels from other direction.
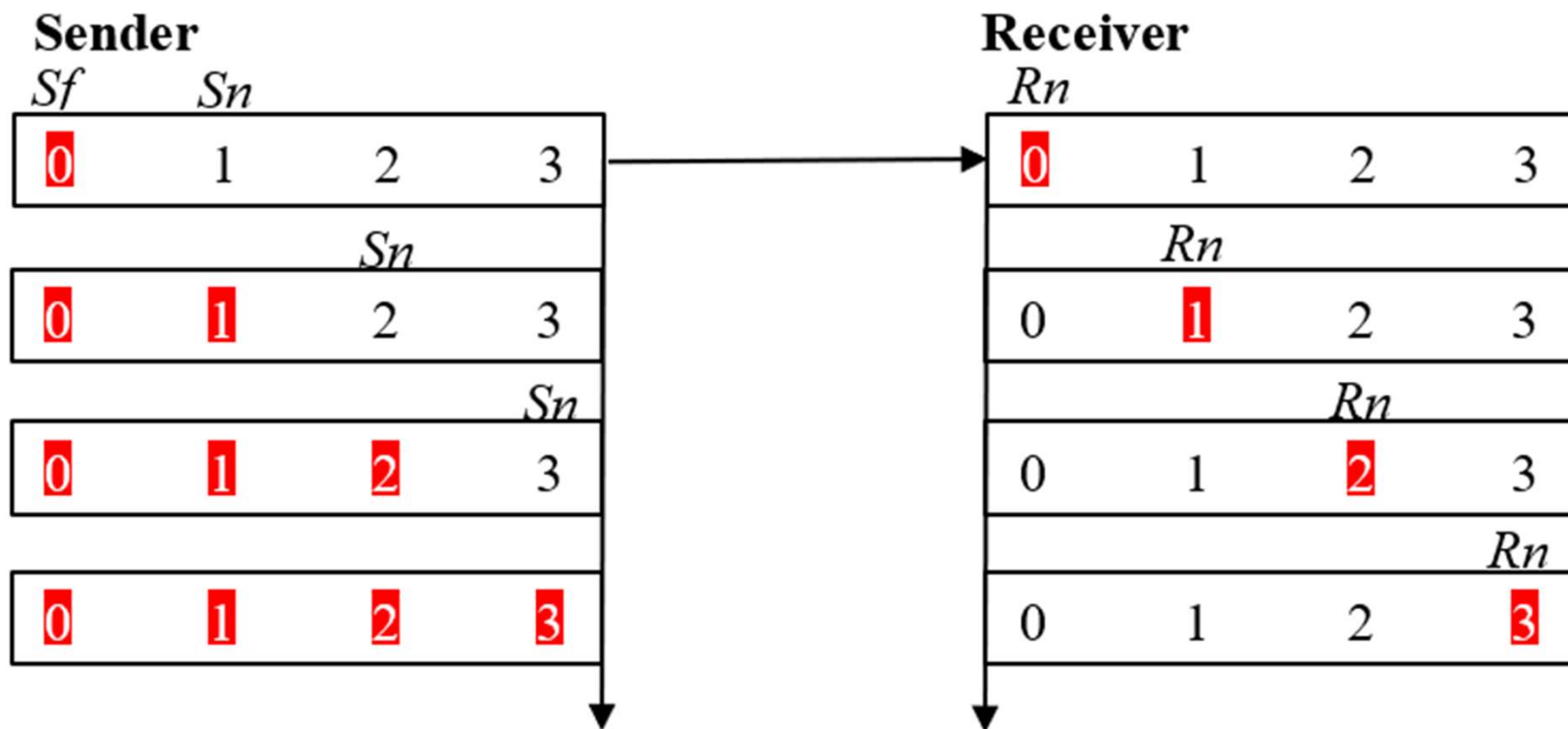
a. Stop & Wait Flow Control

b. Sliding Window

This protocol allows multiple frames to be in transit. Receiver sends ACK with sequence no. of anticipated frame. Sender maintains list of sequence no. it can send and receiver maintains list of sequence no. it can receive.

Flow Control

b. Sliding Window

b. Sliding Window

Where,

Sf :Send First

Sn: Send Next

Rn: Receive Next

Piggbackin is a feature for bidirectional flow control using sliding window protocol. If two stations exchange data, each needs to maintain two windows, one for transmit & one for receive and each side needs to send the data and ACK to the other.

Error Control

Error control is both error detection and error correction. If any frame is lost or damaged in transmission, then error control protocol allows the receiver to inform and retransmits those frames.

In the transmission of sequence of frames, there is possibility of two types of error.

➤ Lost Frame: A frame that fails to arrive at the other side.

➤ Damaged Frame: A recognizable frame does arrive but some of the bits are in error.

Error Control

The source retransmits such frame collectively, these mechanisms are all referred to automatic repeat request (ARQ). ARQ turn on unreliable data link error control protocol.

Error Control

a. Stop & Wait ARQ

It is based on stop & wait flow control techniques. The source transmits a single frame and then must wait an acknowledgement (ACK). Here, two sorts of errors could occur.
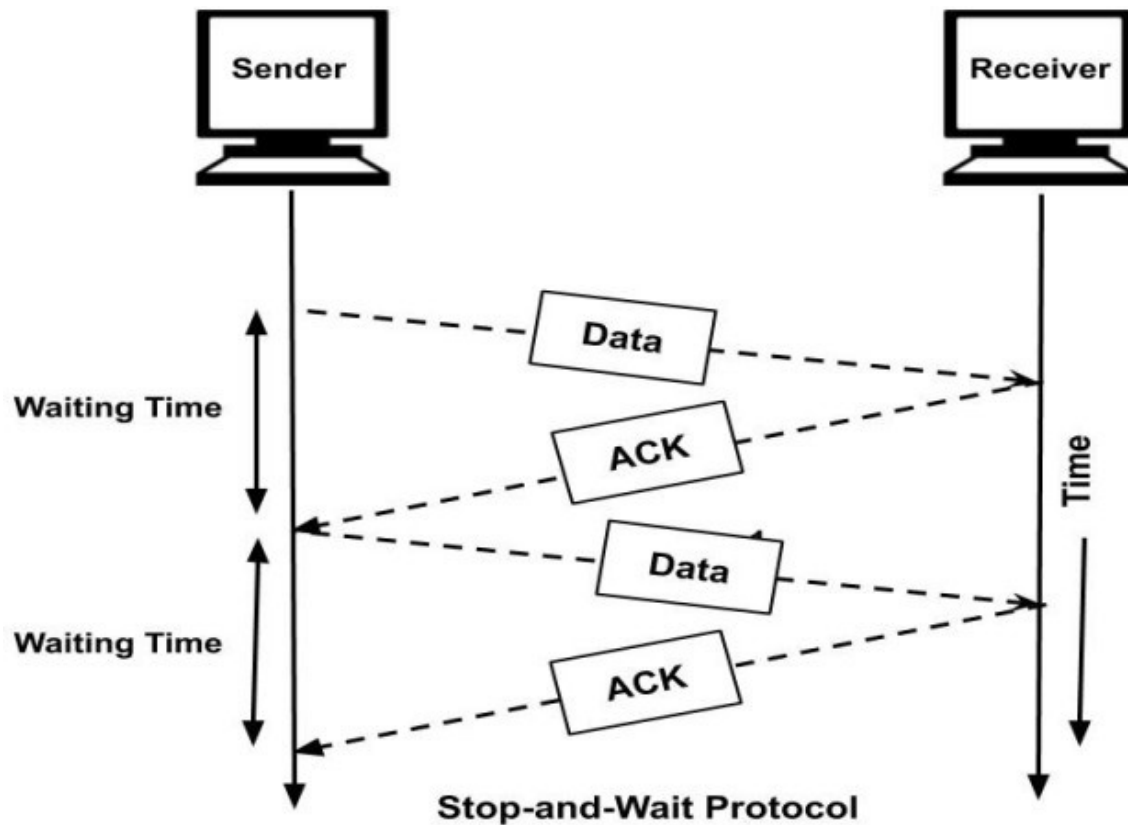
➢ The frame that arrives at the destination could be damaged or lost. Hence, to account this possibility the source station is equipped with a timer.

After the frame is transmitted, the source station waits for an acknowledgement. If no ACK is received by the source when time expires the frame is sent again

a. Stop & Wait ARQ

➤ The acknowledgement of the frame is damaged or lost.

Stop-and-Wait Protocol

b. Sliding Window (ARQ)

It is a technique for sending multiple frames at a time. It controls the data packets between two device where reliable and gradual delivery of data frames is needed. It is also used in transmission control protocol (TCP).

In this technique, each frame has sent from the sequence number. The sequence number are used to find the missing data in receiver end. The purpose of sliding window techniques is to avoid duplicate data, so, it uses the sequence number.

b. Sliding Window (ARQ)

Types:

➢ **Go-Back-N ARQ**

This form of error control is based on sliding window flow control. In Go-Back-N ARQ, a station may send a sequentially numbered series of frames. The number of unacknowledged frames outstanding is determined by window size using the sliding window flow control technique.

➤ Go-Back-N ARQ

While no error occurs, the destination will be acknowledged RR (Receive Ready) incoming frame as usual. If the destination detects an error in a frame, it sends negative ACK i.e. REJ (Reject) for that frame until rejected frame is not received correctly it does not receive other frames.

So, the transmitter that rejected frame as well as other frames. The receiver receives first rejected frame again and then other frames.
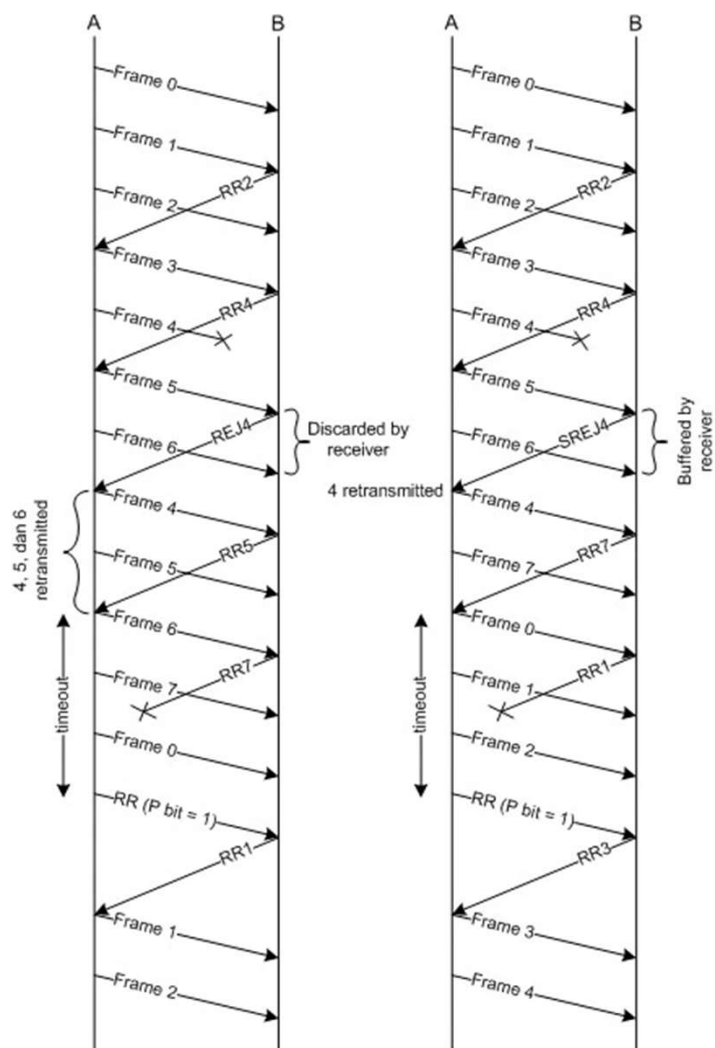
b. Sliding Window (ARQ)

Types:

➢ **Selective Repeat ARQ**

It is like Go-Back-N ARQ. It is also based on sliding window flow control. Here, if the destinations station detects in frame, it sends a negative ACK for that frame.

The destination station will discard that frames and retransmit only that frame rather than it Go-Back-N ARQ, along with that error frame and succeeding frames.

Error Control

➢ Selective Repeat ARQ

HDLC Protocol

HDLC stands for High Level Data Link control. It is a bit oriented synchronous data link layer protocol. Originally developed by the International Organization for standardization (ISO). It is commonly used in Telecommunication to control the transmission of data between two points.

HDLC operates by framing data packets and adding control information to them before transmission over a communication channel. It ensures reliable and error free transmission of data by using mechanism for error detection and flow control.

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Point-to-point Protocol

It is widely used data link protocol used to establish a direct connection between two nodes. It is commonly utilized in establishing connections between a computer and an internet service provider (ISP) over a dialup connection or dedicated line. PPP operate at the data link layer of OSI model and serves as a mean to encapsulate different network layer protocols, like IP allowing them to be transmitted over a PPP link.

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Point-to-point Protocol

Key features:

- ➢ Authentication
- ➢ Error Detection
- ➢ Multilink Support
- ➢ Link Quality Monitoring

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