DATA LINK LAYER

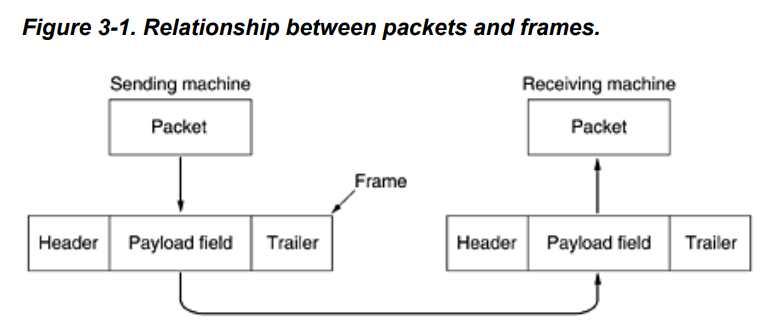
Frames

The **f**unctions of the data link layer are:-

1. Providing a service interface for the network layer.
2. Dealing with the transmission errors.
3. Regulating the flow of data so that the slow receivers are not swamped by the fast senders.

To accomplish these goals, the data link layer , takes the packets from the network layer and encapsulates them into frames . A frame contains

* Header
* Payload field for holding the packet
* Frame trailer.



The principle service is providing data from the network layer of the source machine to the network layer on the destination machine see the figure.

Data

Network Layer

Network Layer

Destination Machine

Source Machine

The services provided by this layer;

1. Unacknowledged connectionless service
2. Acknowledged connectionless service
3. Acknowledged connection-oriented service

Unacknowledged connectionless service(UDP):

* It doesn’t establishes a logical connection.
* The source machine sends independent frames to the destination machine without needing the frames to acknowledge them.
* Even if the frame is lost, no attempt is made to recover it, that is why it is used in real time traffic, such as voice where getting late data would be better than having a bad data.
* A good implementation of it would be LAN cables

Acknowledged connectionless service(WIFI):

* The only difference is that it in it, the acknowledgment is sent back to the user.
* An example is an unreliable wireless network and a reliable fibre network(where the packets loss are minimal)
* As in the example of WIFI, the sender knows whether the frame has arrived. If it hasn’t arrived within a specified time interval, then an attempt can be made to send it again.

Acknowledged connection-oriented service(TCP):

* Here first a logical connection is established between the end users.
* Each frame sent over the connection is numbered and the data link layer makes sure that each frame is indeed received *exactly once*.
* It also makes sure that the packets are received in the right order.
* It is unlike the connectionless service where the unacknowledged packets are sent several times and that results to them being received several times.

**2) ERROR CONTROL**

The problem arrives while the transmission of the frames from source to destination , in a proper order. When the machine is independently outputting the frames without making sure whether they are arriving at the destination or not, this isn’t a problem for the unacknowledged connection oriented service, but it is not fine when we have a reliable connection oriented service.

The usual way to ensure a reliable delivery of frame is to provide the sender with some feedback about what is happening at the other side of the line. This can be done by-:

* Making the receiver sending back special control frames that bear positive and negative acknowledgements with them.
* If a positive acknowledgment has been received to the sender, that means that the frames have arrived safely.
* Else it means that something has gone wrong in the frame transmission.

Another possibility is that a frame can vanish forever in case of a hardware malfunctioning, in such case the receiver can’t react at all.

This possibility is dealt by introducing timers:

* When the sender transmits a frame, it generally starts a timer.
* It is set to expire for the interval long enough till it arrives at the destination, be processed there and then the acknowledgment propagates back to the user.
* Normally the frame is received correctly and the acknowledgement is received before the time and hence the timer is cancelled.

But if the frame and the acknowledgment is lost:

* The timer will go off, which will alert the sender that the frame needs to be retransmitted again, in that case the frame will be sent back again.

Another possibility is when the frames are transmitted multiples time to the destination, then that causes problem. This is solved by associating a serial number to each frame.