Data link layer Standard Document – Joel & Syazwan

DLL:	Header [1]	Control [2]	Addressing [2]	Length [1]	NET Packet (or part of) [1-23]	Checksum [2]	Footer [1]

Table 1. Frame field structure

Table 1 shows the frame field structure of the Data Link Layer. A frame is encapsulated by its header and footer bytes. Within the header and footer are the 2-byte control field, 2-byte addressing field, 1-byte length field, up to 23 bytes of the NET Packet payload per frame, and the 2-byte Checksum.

Header & Footer

The header and the footer will be used as byte delimiter to indicate the start and end of the frame. The header and the footer byte used in the frame will be binary 01111110. To prevent framing errors from occurring if the byte pattern occurs in the payload, bit stuffing is used on transmission such that after five 1's occurs in the payload, a 0 is added. On the receiving end, after 5 consecutive 1's is detected, the following 0 is removed to de-stuff the data.

Control

Acknowledgment bits [0-7]	Sequence bits [8-15]

Table 2. Control field bytes allocation

Table 2 shows how the control bytes will be allocated. The sliding window protocol will be used to implement flow control, including selective repeat with a window size of 8 and a buffer size of 4 at a time. This protocol will also be used for retransmission of erroneous or missing frames using packet numbers and negative acknowledgements. The first byte (bit 0-7) represents acknowledgements (ACK) or negative acknowledgements (NAK). This field will be set to 0x00 if not acknowledging (or is sending). The second byte of the control field represents the sequence number attached to the frame used for the sliding window protocol.

Addressing

MAC Source Address [0-7]	Source Address [8-15]

Table 3. Addressing field bytes allocation

Table 3 shows the addressing field byte allocation. The first byte of the addressing field will be a hard-coded source MAC address of the sending device. The second holds the MAC address of the next hop. The next hop address required is provided by NET layer through an ARP table.

Length

Length field holds the number of frames representing one network packet (will be 1 if the network packet is less than 23 bytes or does not require splitting).

Net packet payload

The NET Packet is retrieved from network layer. It has a minimum of 1 byte and a maximum of 23 bytes. If a network packet is larger than 23 bytes, the payload will be split into multiple DLL frames and will be reassembled at the receiver. Before the splitting is done, the payload will be bit stuffed at any occurrence of the header and footer delimiter byte.

Checksum

The checksum will be generated by a 16-bit CRC generator. The generator used will be $x^{16}+x^{12}+x^5+1$ (0b10001000000100001). If erroneous frame is detected, the receiver will send a request for retransmission using NAK. If no error is detected, the receiver will send an ACK.

CSMA

As for collision detection, CSMA p-persistent protocol will be used. When the channel is detected to be idle, the transmitting device will transmit the data with the probability of *p*. The choice of *p* must provide the best balance between collision prevention and latency. If the channel remains idle in the subsequent time slot, the process repeats itself. However, if the channel is found to be busy, the transmitting device waits for a random back-off time, before starting again.

Interfaces

- getMACAddress - provides the MAC address of the current device.
- fromNETLayer - obtain NET Packet from NET layer.
- fromDLL - NET layer call function from DLL.
- fromPHYLayer - get messages from PHY layer.
- toPHYLayer - send messages to the PHY layer to transmit it.