Data Link Layer

The data link layer is the second layer from the bottom in the OSI (Open System Interconnection) network architecture model. It is responsible for the node-to-node delivery of data. Its major role is to ensure error-free transmission of information. DLL is also responsible for encoding, decoding, and organizing the outgoing and incoming data.

This is considered the most complex layer of the OSI model as it hides all the underlying complexities of the hardware from the other above layers. In this article, we will discuss Data Link Layer in Detail along with its functions, and sub-layers.
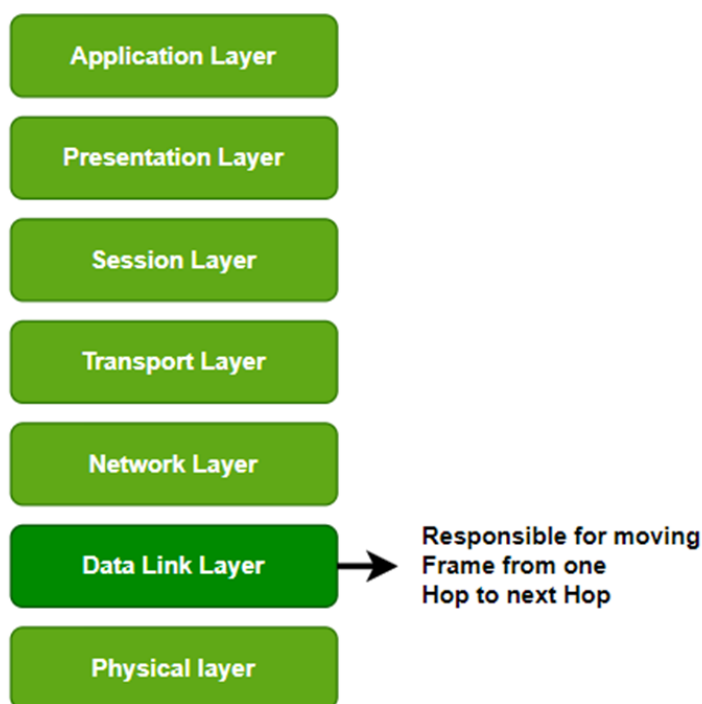
OSI Model: Data Link Layer

Sub-Layers of The Data Link Layer

The data link layer is further divided into two sub-layers, which are as follows:

Logical Link Control (LLC)

This sublayer of the data link layer deals with multiplexing, the flow of data among applications and other services, and LLC is responsible for providing error messages and acknowledgments as well.

Media Access Control (MAC)

MAC sublayer manages the device's interaction, responsible for addressing frames, and also controls physical media access.

The data link layer receives the information in the form of packets from the Network layer, it divides packets into frames and sends those frames bit-by-bit to the underlying physical layer.

Functions of The Data-link Layer

There are various benefits of data link layers s let's look into it.
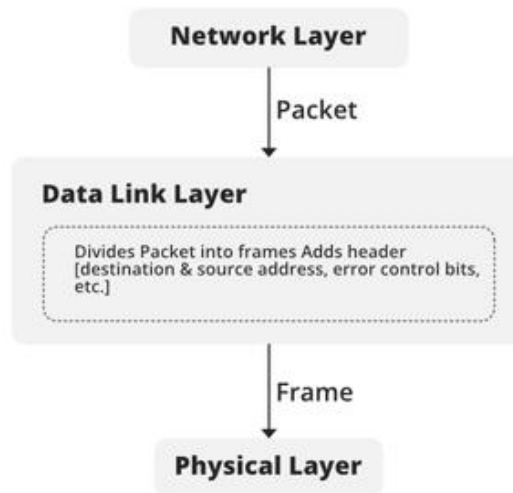
Framing

The packet received from the Network layer is known as a frame in the Data link layer. At the sender's side, DLL receives packets from the Network layer and divides them into small frames, then, sends each frame bit-by-bit to the physical layer. It also attaches some special bits (for error control and addressing) at the header and end of the frame. At the receiver's end, DLL takes bits from the Physical layer organizes them into the frame, and sends them to the Network layer.

Addressing

The data link layer encapsulates the source and destination's MAC address/ physical address in the header of each frame to ensure node-to-node delivery. MAC address is the unique hardware address that is assigned to the device while manufacturing.

Error Control

Data can get corrupted due to various reasons like noise, attenuation, etc. So, it is the responsibility of the data link layer, to detect the error in the transmitted data and correct it using error detection and correction techniques respectively. DLL adds error detection bits into the frame's header, so that receiver can check received data is correct or not. It adds reliability to phyiscal layer by adding mechansims to detect and retransmit damaged or lost frames.

Flow Control

If the receiver's receiving speed is lower than the sender's sending speed, then this can lead to an overflow in the receiver's buffer and some frames may get lost. So, it's the responsibility of DLL to synchronize the sender's and receiver's speeds and establish flow control between them.

Access Control

When multiple devices share the same communication channel there is a high probability of collision, so it's the responsibility of DLL to check which device has control over the channel and CSMA/CD and CSMA/CA can be used to avoid collisions and loss of frames in the channel.

Protocols in Data link layer

There are various protocols in the data link layer, which are as follows:

- Synchronous Data Link Protocol (SDLC)

- High-Level Data Link Protocol (HDLC)

- Serial Line Interface Protocol (SLIP) for encoding

- Point to Point Protocol (PPP)

- Link Access Procedure (LAP)

- Link Control Protocol (LCP)

- Network Control Protocol (NCP)

Conclusion

In conclusion, the Data Link Layer is essential for ensuring that data is transferred reliably and accurately across a network. It handles error detection and correction, manages data frame sequencing, and provides access to the physical network. By organizing data into frames and controlling how devices on the network communicate, the Data Link Layer plays a crucial role in maintaining smooth and efficient network operations.