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Data Communication CS601 Lecture No 26

Lecture Prepared By

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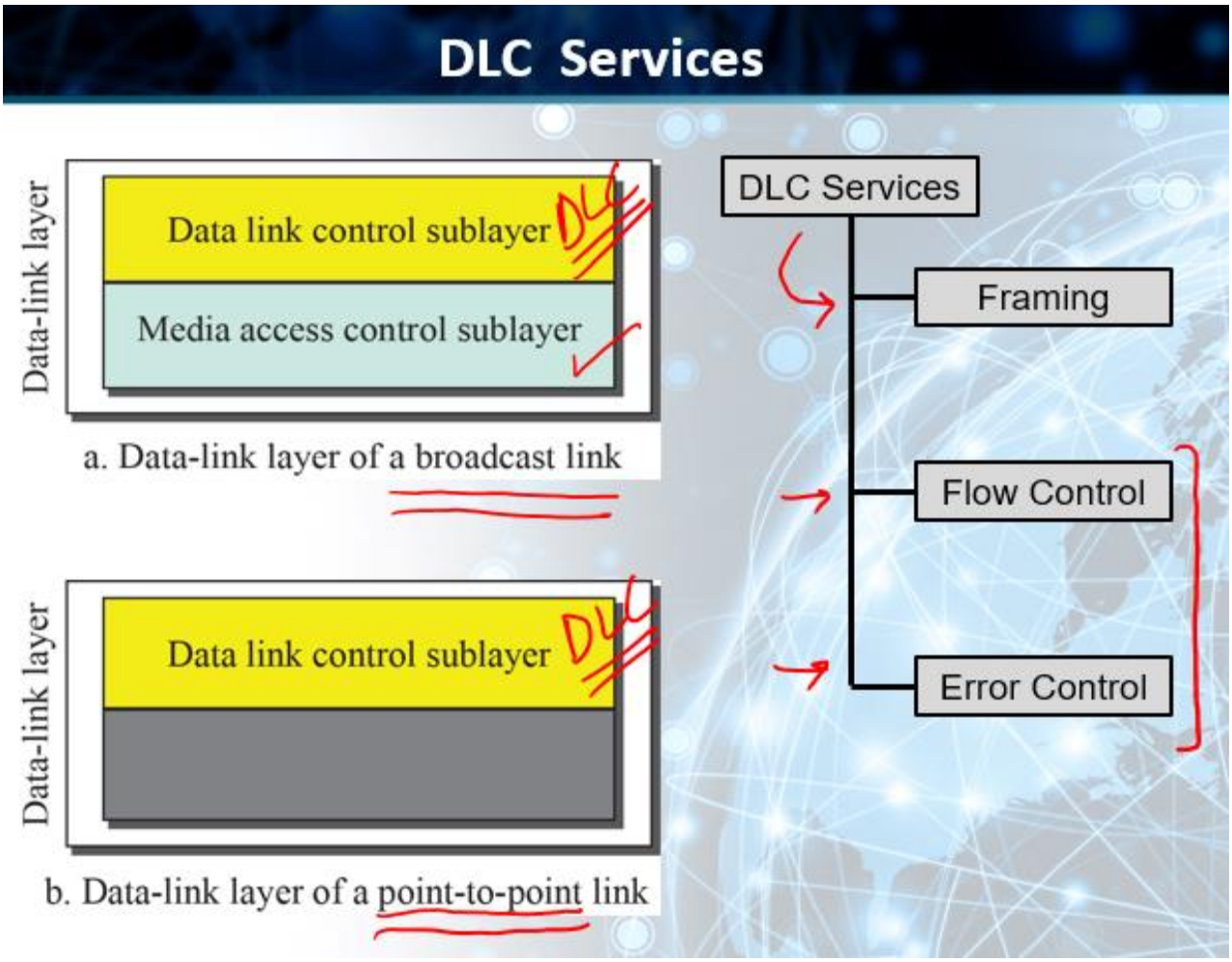
Data Link Control (DLC) Services

- **The data link control (DLC) deals with procedures for communication between two adjacent nodes no matter whether the link is dedicated or broadcast**
- **Data link control functions include framing, flow control and error control**

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Framing

- **Data-Link layer needs to pack bits into frames, so that each frame is distinguishable from another**
- **Our postal system practices a type of framing**
- **Framing separates a message by adding a sender address and a destination address**
- The destination address defines where the packet is to go; the sender address helps the recipient acknowledge the receipt

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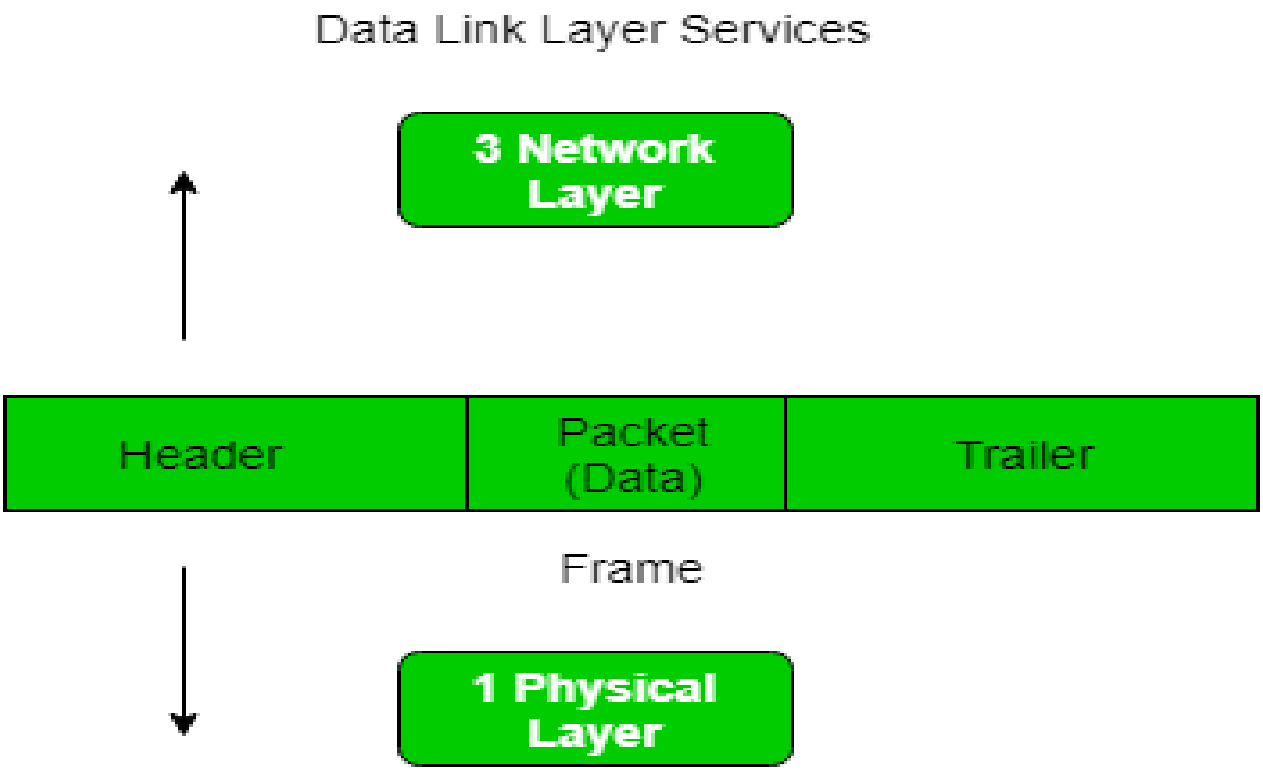
Parts of a Frame

A frame has the following parts −

- Frame Header − It contains the source and the destination addresses of the frame.
- Payload field − It contains the message to be delivered.
- Trailer − It contains the error detection and error correction bits.
- Flag − It marks the beginning and end of the frame.

Delimiter

In computer programming, a delimiter is **a character that identifies the beginning or the end of a character string** (a contiguous sequence of characters). The delimiting character is not part of the character string.



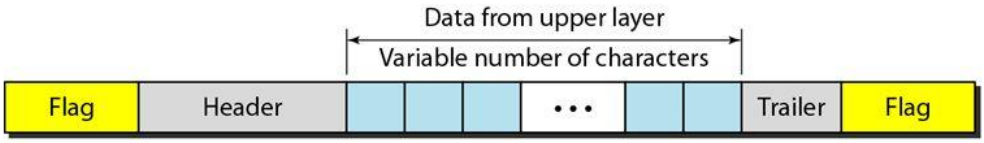
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Framing

- Process of wrapping data with certain info before sending out



- A frame typically consists of
  - Flag: indication for start and end of a frame
  - Header: source/destination addresses, as well as other control information
  - Data from the upper layer
  - Trailer: error detection/correction code

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Why not one BIG Frame?

Data-link layer takes the packets from the Network Layer and encapsulates them into frames. If the frame size becomes too large, then the packet may be divided into small sized frames. Smaller sized frames make flow control and error control more efficient.

Types of Framing

Framing can be of two types, fixed sized framing and variable sized framing.

Fixed-sized Framing

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Here the size of the frame is fixed and so the frame length acts as delimiter of the frame. Consequently, it does not require additional boundary bits to identify the start and end of the frame.

Example − ATM cells.

Variable – Sized Framing

Here, the size of each frame to be transmitted may be different. So additional mechanisms are kept to mark the end of one frame and the beginning of the next frame.

It is used in local area networks.

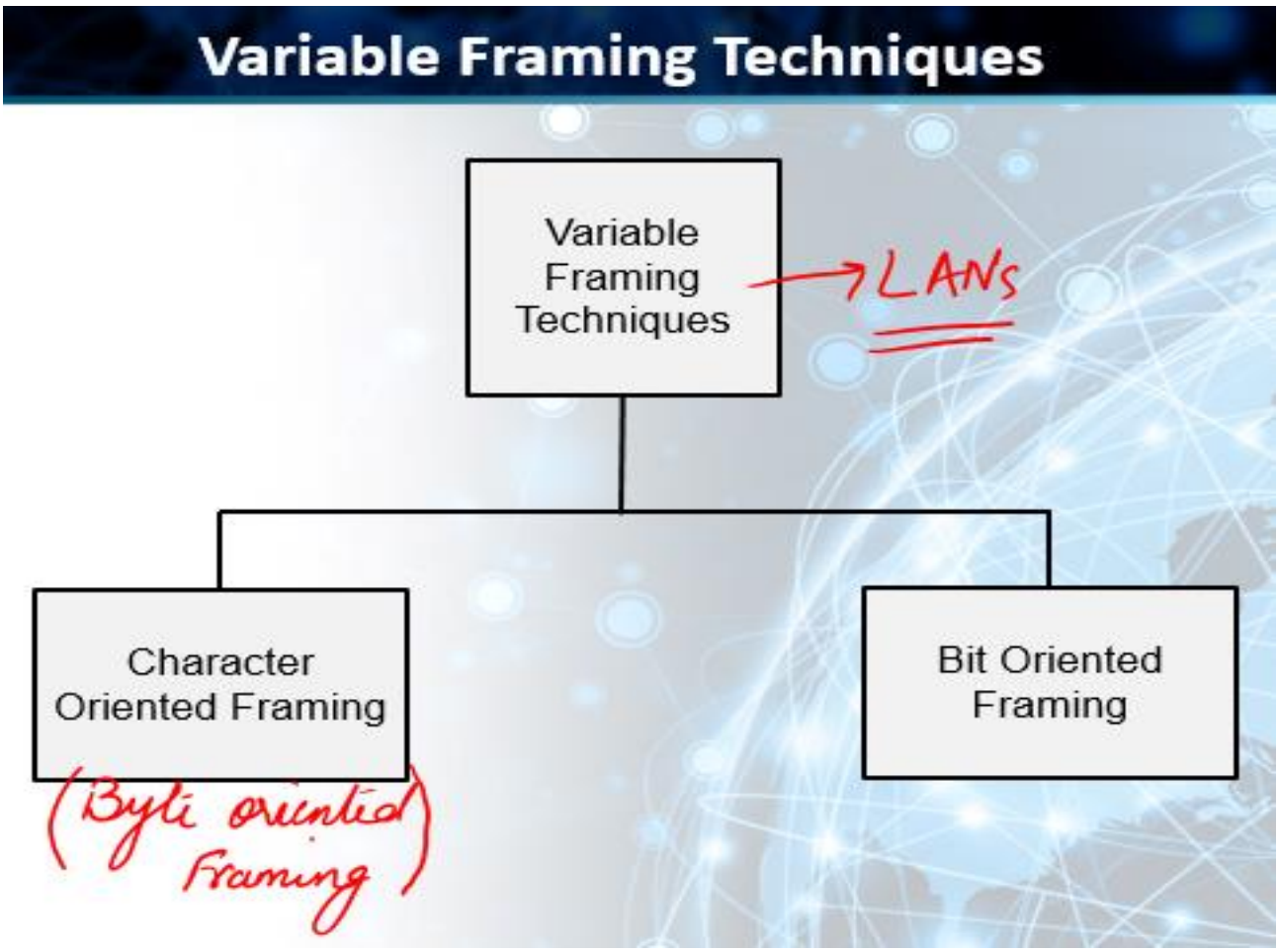
Two ways to define frame delimiters in variable sized framing are −

- **Length Field** − Here, a length field is used that determines the size of the frame. It is used in Ethernet (IEEE 802.3).
- **End Delimiter** − Here, a pattern is used as a delimiter to determine the size of frame. It is used in Token Rings. If the pattern occurs in the message, then two approaches are used to avoid the situation −

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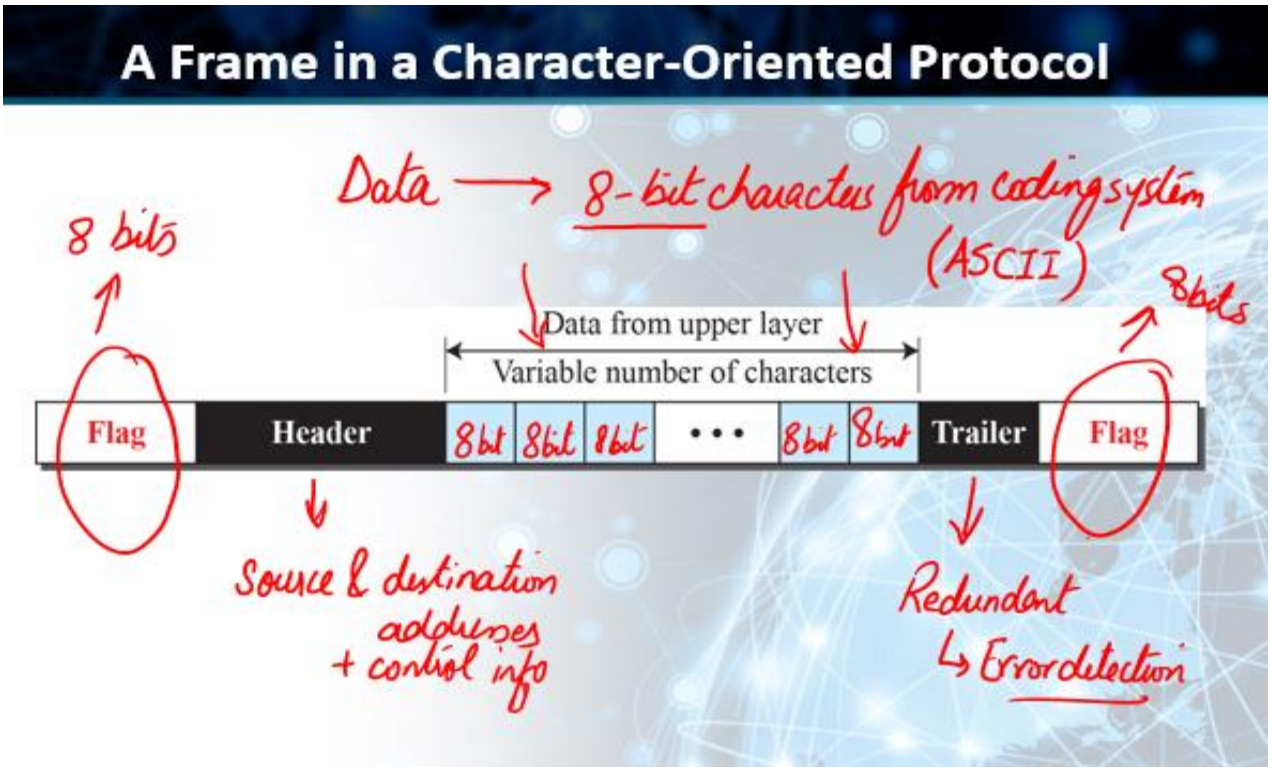
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Connection Oriented Framing

- **Data to be carried are 8-bit characters**

- **Byte – Stuffing** − A byte is stuffed in the message to differentiate from the delimiter. This is also called character-oriented framing.
- **Bit – Stuffing** − A pattern of bits of arbitrary length is stuffed in the message to differentiate from the delimiter. This is also called bit – oriented framing.

Byte Stuffing in Connection-Oriented Framing

- **Connection-oriented Framing used text characters as flags**
- **Nowadays any character used for flag can also be a part of the data**
- **In order to avoid confusing the receiver, we use Byte Stuffing**

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What are escape characters?

An escape sequence contains a backslash (\) symbol followed by one of the escape sequence characters or an octal or hexadecimal number.

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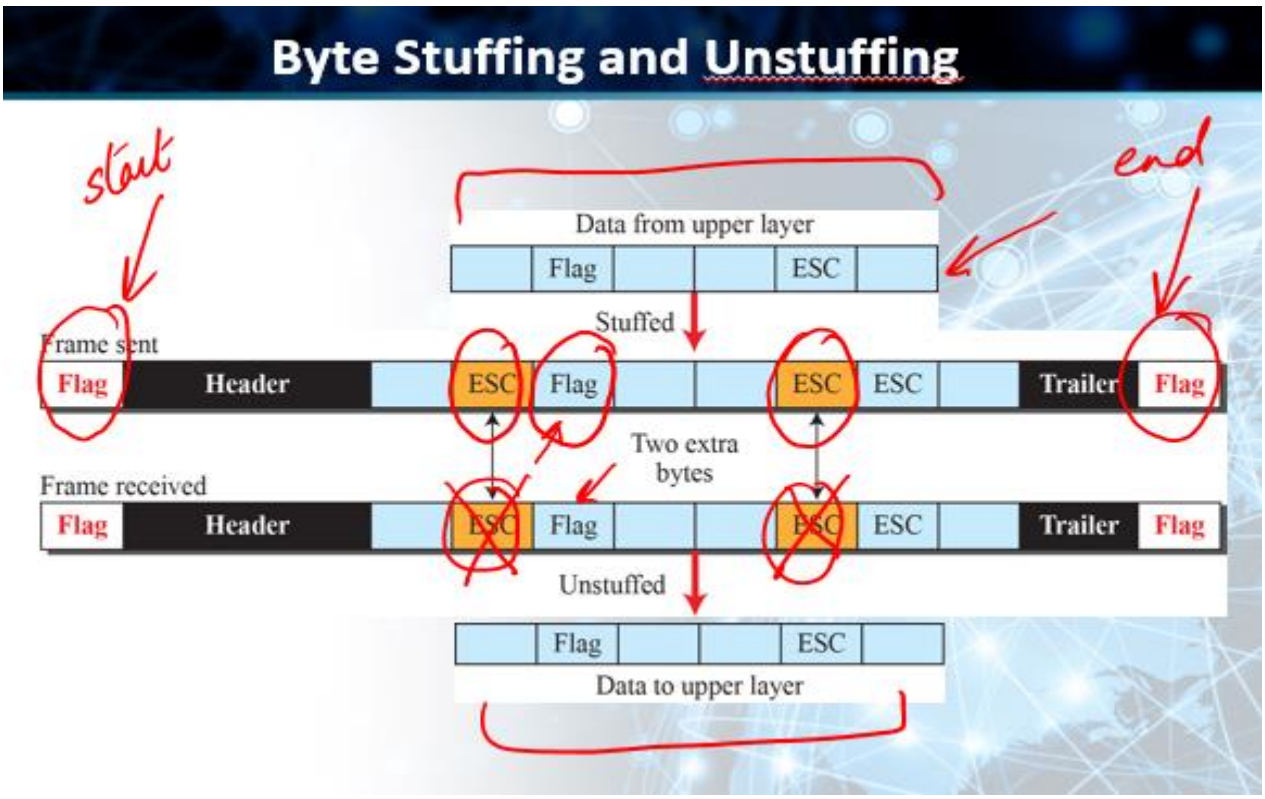
Escape character syntax.

Escape sequence	Character represented
\r	Carriage return
\t	Horizontal tab
\v	Vertical tab
\'	Single quotation mark

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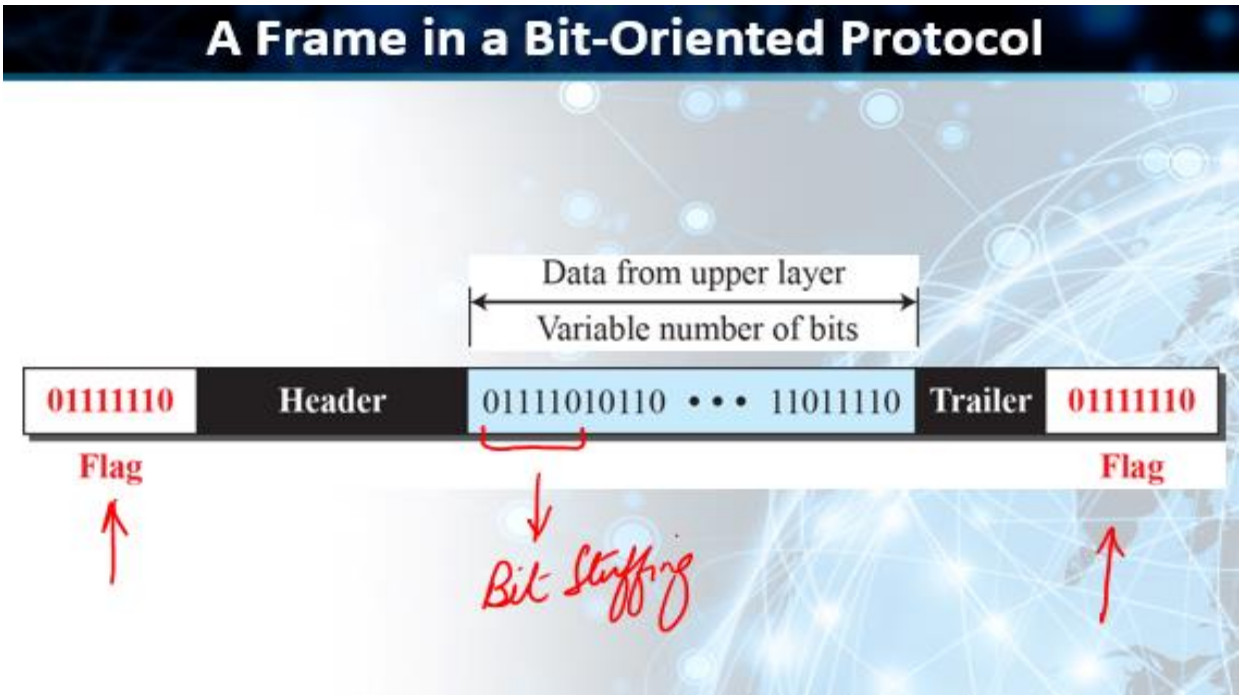
Bit-Oriented Framing

- Data section of frame is a sequence of bits
- We need a delimiter to separate one frame from the other
- A special 8-bit pattern (01111110) to define beginning and end of a frame
- Same issue as Connection-oriented Framing

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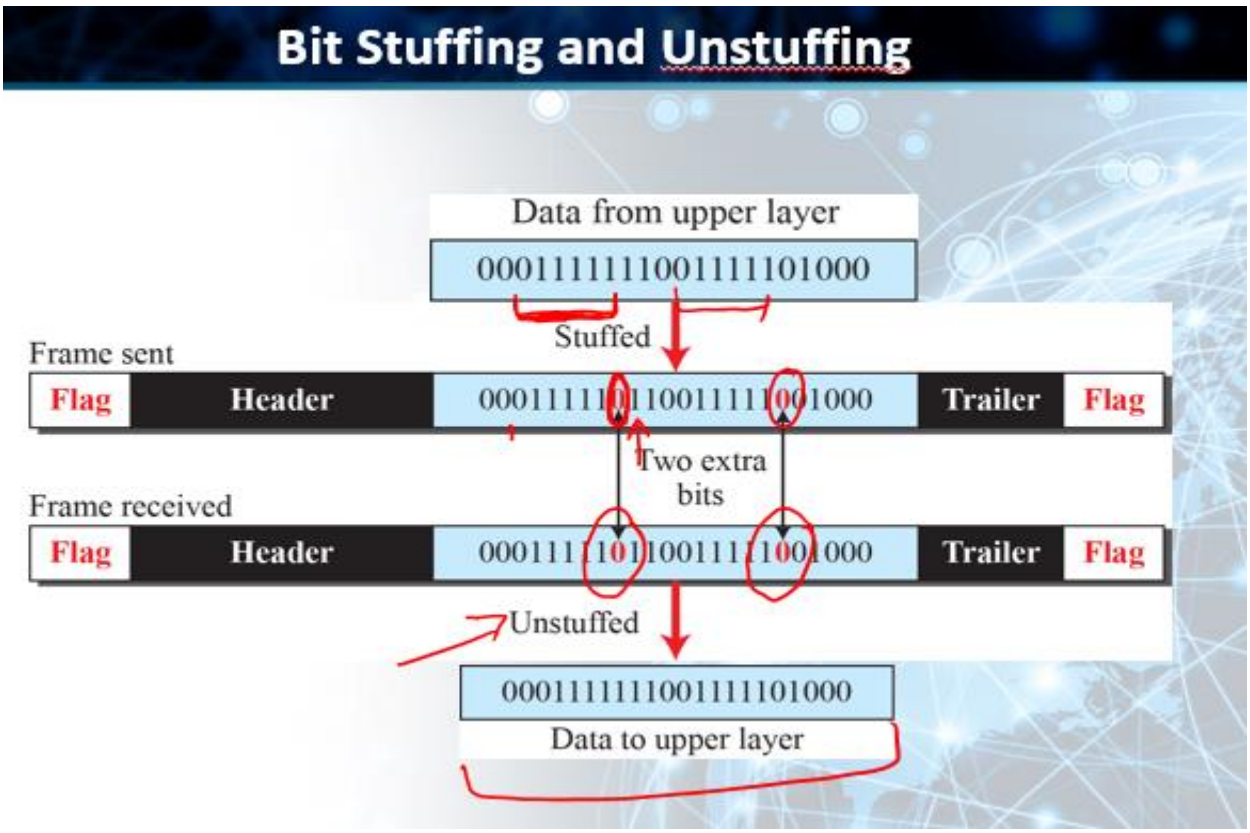
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Flow and Error Control

One of the responsibilities of the data-link control sublayer is flow and error control at the data-link layer

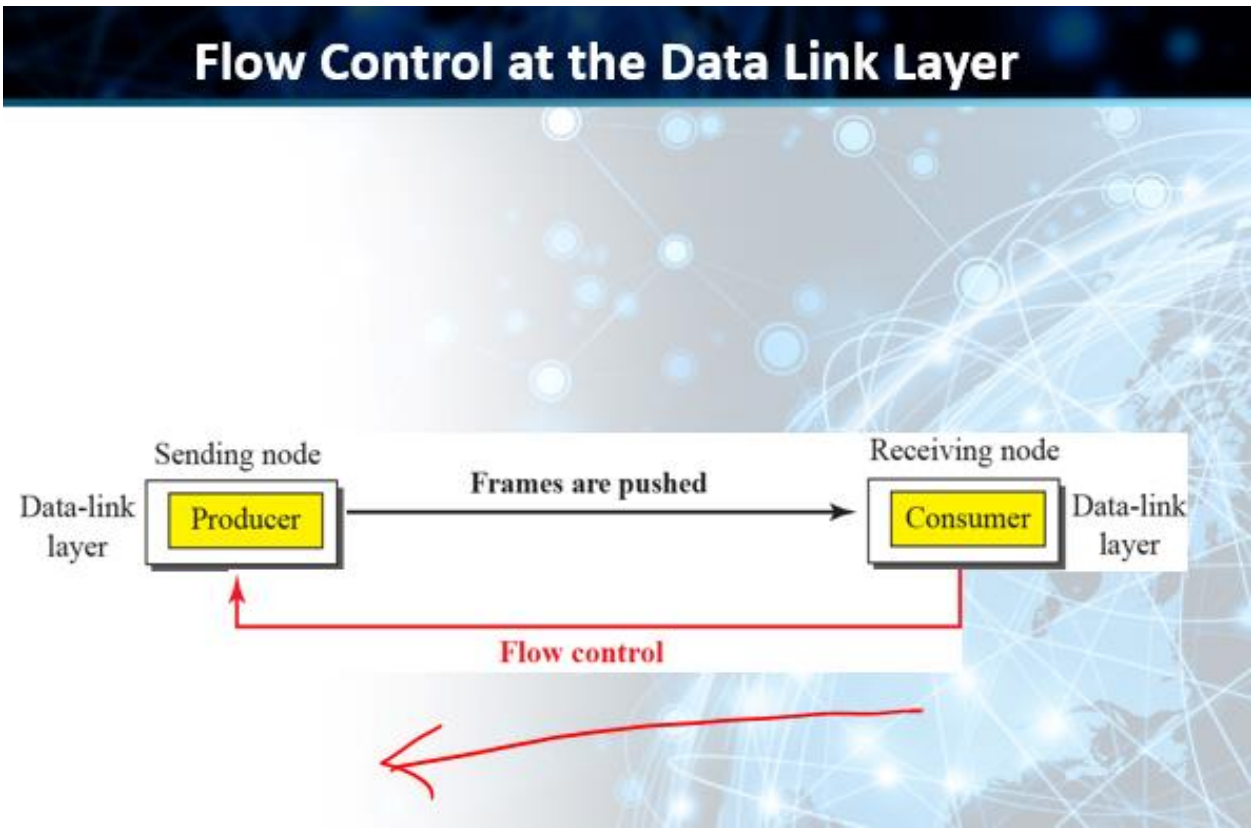
Flow Control

- **Balance between production and consumption rates**
- **If frames are produced faster than they are consumed at the receiving data link layer, the frames will be discarded**
- **Use of buffers; one at sending end and other at receiving end**

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Example

- **Consumers need to communicate with the producers on two occasions:**
  - ✓ **When the buffer is full; &**
  - ✓ **When there are vacancies**
  - ✓ **If the two parties use a buffer with only one slot, the communication can be easier**

Error Control

- Error Control at Data Link layer uses CRC in one of the two ways:
  - ✓ If a frame is corrupted, it is silently discarded and if it is good, it is delivered to network layer

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- ✓ If frame is corrupted, it is silently discarded and if it is good, an acknowledgement is sent to sender

Connectionless and Connection-Oriented

- A DLC protocol can be either connectionless or connection-oriented
- Connectionless: No relationship between the frames
- Connection-Oriented: Frames are numbered and sent in order