

Data Link Layer

Asynchronous and Synchronous Transmission

ICT 2156

Introduction

- Data **Transmission** to Data **Communication**.
- Synchronization: Communication Task
- For two devices linked by a transmission medium to exchange data, a high degree of **cooperation** is required.

Introduction

- Data are transmitted one bit at a time over the medium.
- The **timing** of these bits must be the same for transmitter and receiver.

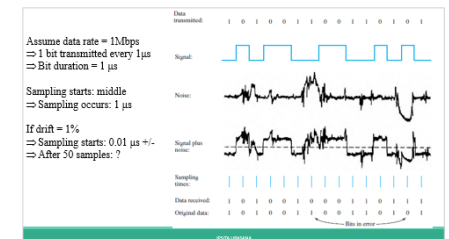
- **Timing:**

Rate

Duration

Spacing

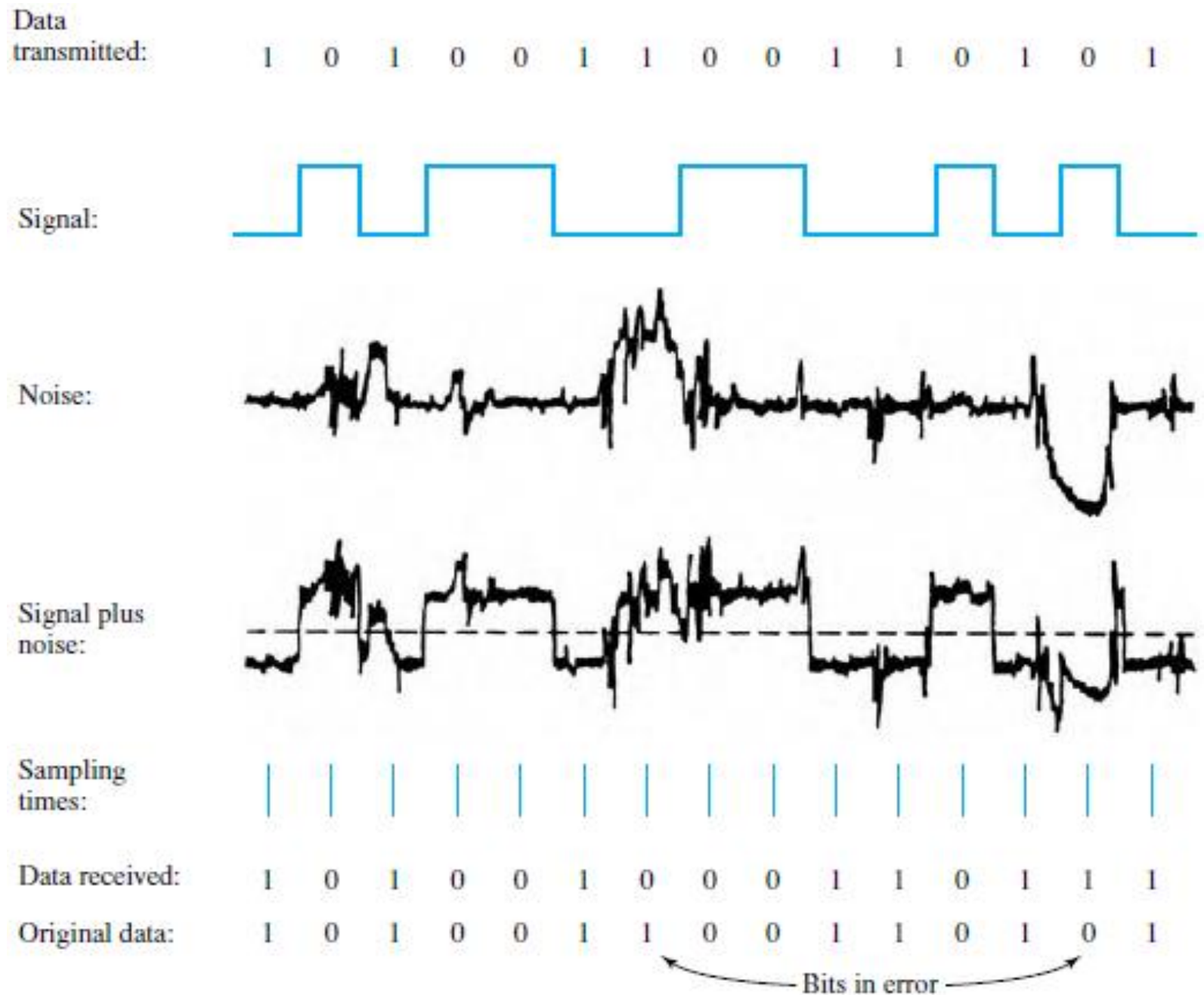
- Techniques for controlling timing:
 - Asynchronous Transmission
 - Synchronous Transmission



Assume data rate = 1Mbps
⇒ 1 bit transmitted every $1\mu\text{s}$
⇒ Bit duration = $1\mu\text{s}$

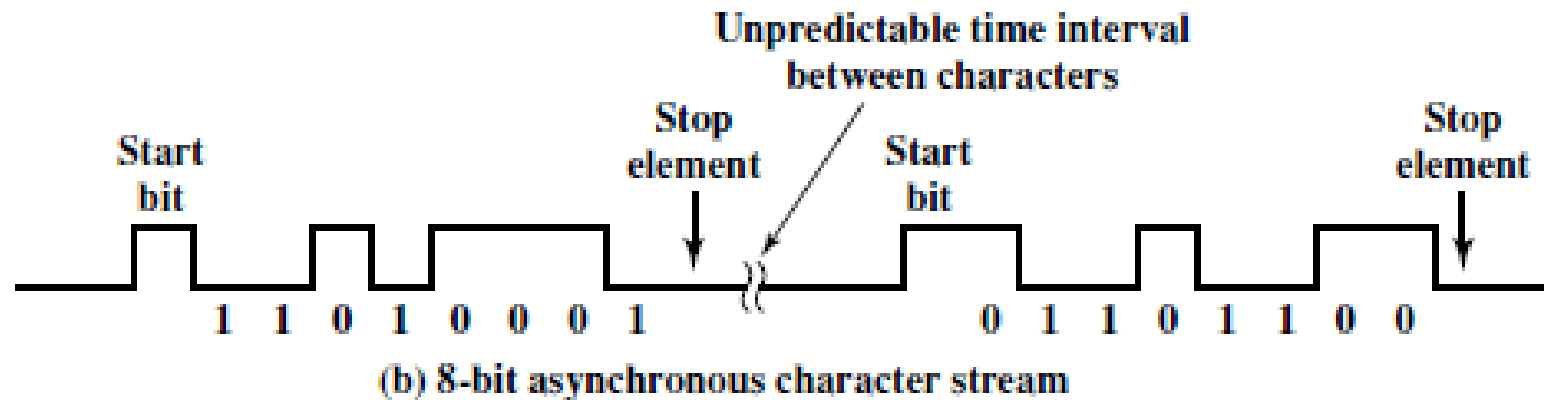
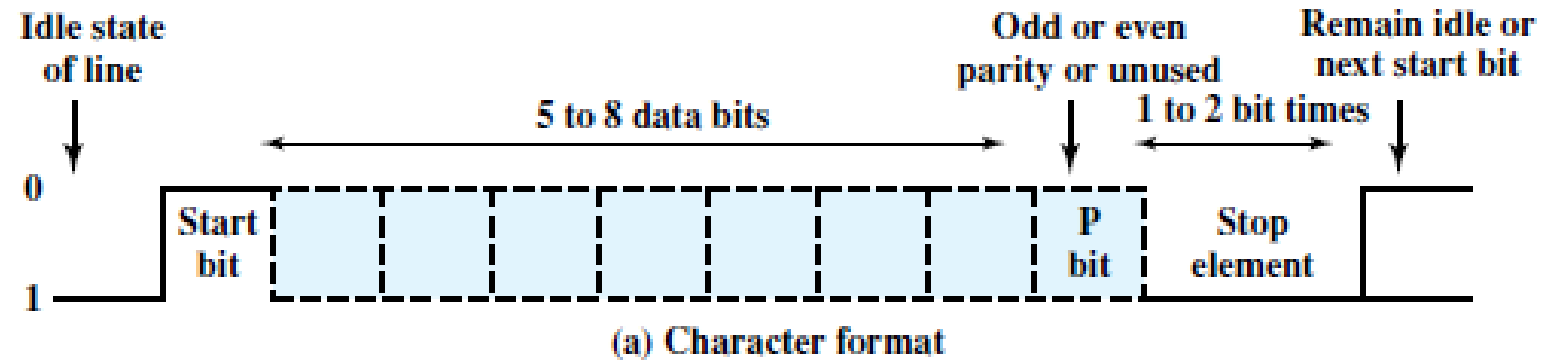
Sampling starts: middle
⇒ Sampling occurs: $1\mu\text{s}$

If drift = 1%
⇒ Sampling starts: $0.01\mu\text{s} \pm$
⇒ After 50 samples: ?



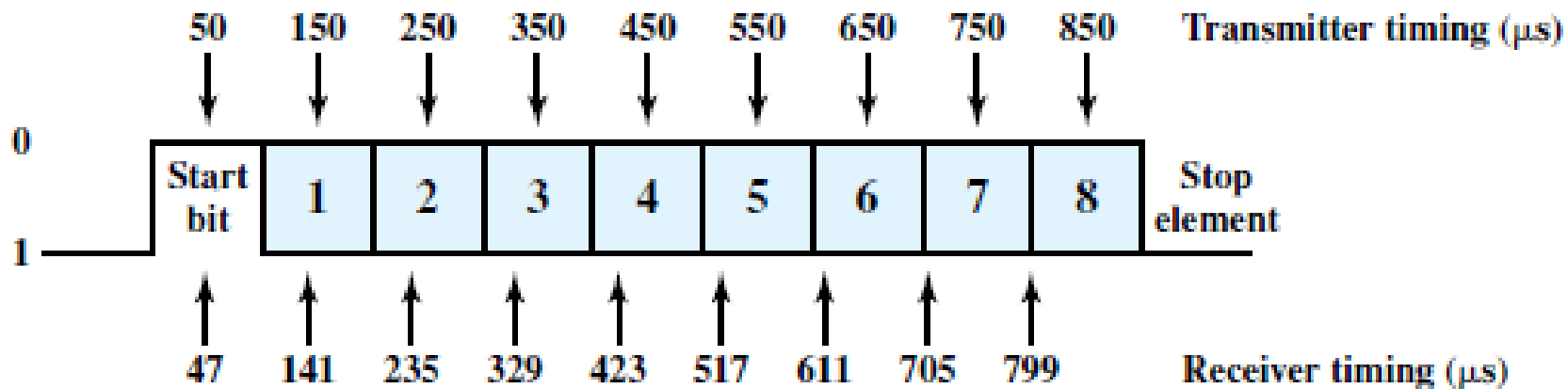
Asynchronous Transmission

- Start bit
- Stop element
- Idle state



Asynchronous Transmission

- Data rate = 10,000 bits per second (10 kbps).
 - Bit Duration = 0.1 millisecond (ms) = 100 microseconds.
 - Assume that the receiver is fast by 6%, or 6 microseconds per bit time.
- => The receiver samples the incoming character every 94 microseconds.



(c) Effect of timing error

Asynchronous Transmission

- Overhead.
- Framing error.
- Advantages and Disadvantages.

Synchronous Transmission

- Block of bits is transmitted in a steady stream without start and stop codes.
Timing Drift?
- Two alternatives:
 - Send a separate clock pulse.
 - Embed the clocking information in the data signal.
- Preamble and Postamble.



Example

One of the more common schemes, HDLC contains 48 bits of control, preamble, and postamble.

⇒ a 1000-character block of data, each frame consists of 48 bits of overhead and $1000 * 8 = 8,000$ bits of data.

⇒ Percentage overhead = $48/8048 * 100\% = 0.6\%$.

Book

- William Stallings, Data and Computer Communications, Pearson Education Inc., Noida, 2017, **Chapter 6 (6.1)**