Data Communications Techniques

- Two types of data transmission:
  - *Serial* - one bit at a time,
  - *Parallel* - more than one bit at a time on several channels Typically 8, 16 or 32 bits.
- This course is primarily concerned with *Serial* data transmission.

Data Communications Techniques

- Data are typically transmitted one bit at a time over a *channel.*
- A high degree of co-operation is required between the communicating devices.
- The timing (rate, duration and spacing) must be identical for both the *Transmitter* and *Receiver:*
  - For example, if a Transmitter device is “clocking-out” bits at 1Mbps (one million bits per sec) then the Receiver device must “clock-in” bits at 1Mbps to ensure successful communications.

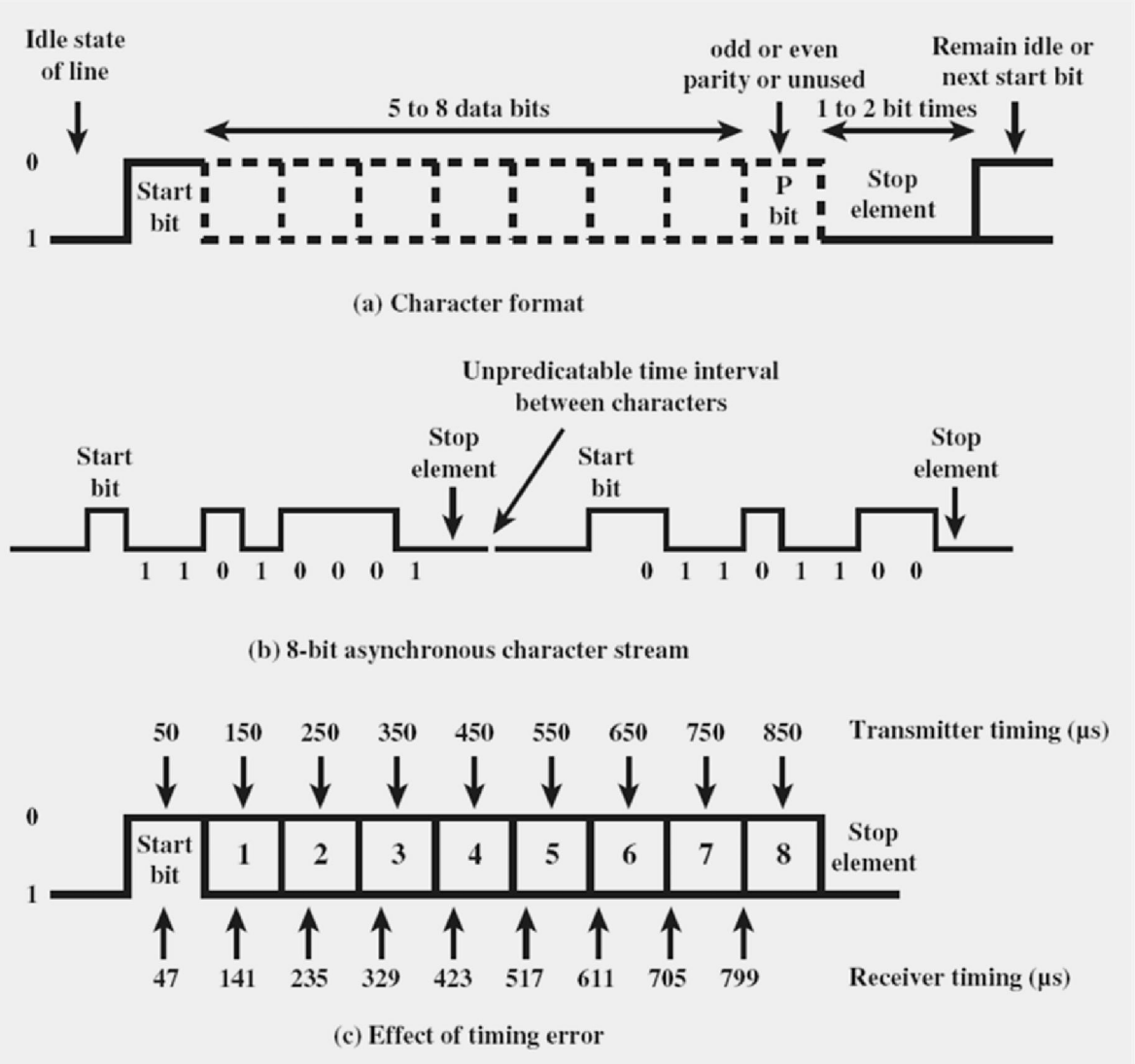
Data Communications Techniques

- To successfully receive the data bits the *Receiver* device must *sample* an incoming bit stream once every ***bit interval***:
  - Consequently it must know the duration of each bit,
  - For a 1Mbps transmission the ***bit interval*** (or ***bit duration)*** is 1 millionth of a second.
- *Timing* is achieved on both sides (i.e. at the Receiver and Transmitter) using an internal electronic clock:
  - To achieve successful communications these clocks must somehow be *synchronised.*

Data Communications Techniques

- Three possibilities for achieving *synchronization*:
  - Use separate clock link – not viable for computer-to-computer communications as its too expensive,
  - Ignore the potential synchronisation problems by sending very short bursts of data. This is called *Asynchronous* transmission,
  - Embed clocking pulses within the data signal. This is called *Synchronous* transmission – this *framing* approach is more commonly used.

Asynchronous transmission and *Timing* problems



Asynchronous transmission

- The *start* and *stop* bits determine where a character starts and ends,
- This function is called *framing,*
- Advantage:
  - Simple and Cheap,
  - Typically used between keyboard and PC.
- Disadvantage. The overhead is typically 20% i.e. 2 framing bits plus 8 data bits.

Synchronous Transmission

- Here the data bits are transmitted in a large block of bits which has a particular structure:
  - This structure is known as a ***frame***.
- The Receiver must be able to identify the start and end of a frame:
  - This is achieved by using a special bit pattern for the ***preamble*** (start of frame) and ***postamble*** (end of frame).
- Additional *control information* is also sent within the frame to provide extra functionality – to be examined later.

Generic Synchronous Frame Structure

- In general frames have a well defined structure which is comprised of a number of distinct fields:
  - A *preamble* field, or *Opening Flag*, at the start of the frame,
  - *A postamble* field or *Closing Flag*, at the end of the frame,
  - *Data* and C*ontrol Information* fields in between.
  - The exact format of the frame depends upon the *data link protocol* being used. Different structures will be examined later.

Opening FLAG	**Control Fields**	**Variable-length Data field**	**Control Fields**	**Closing FLAG**