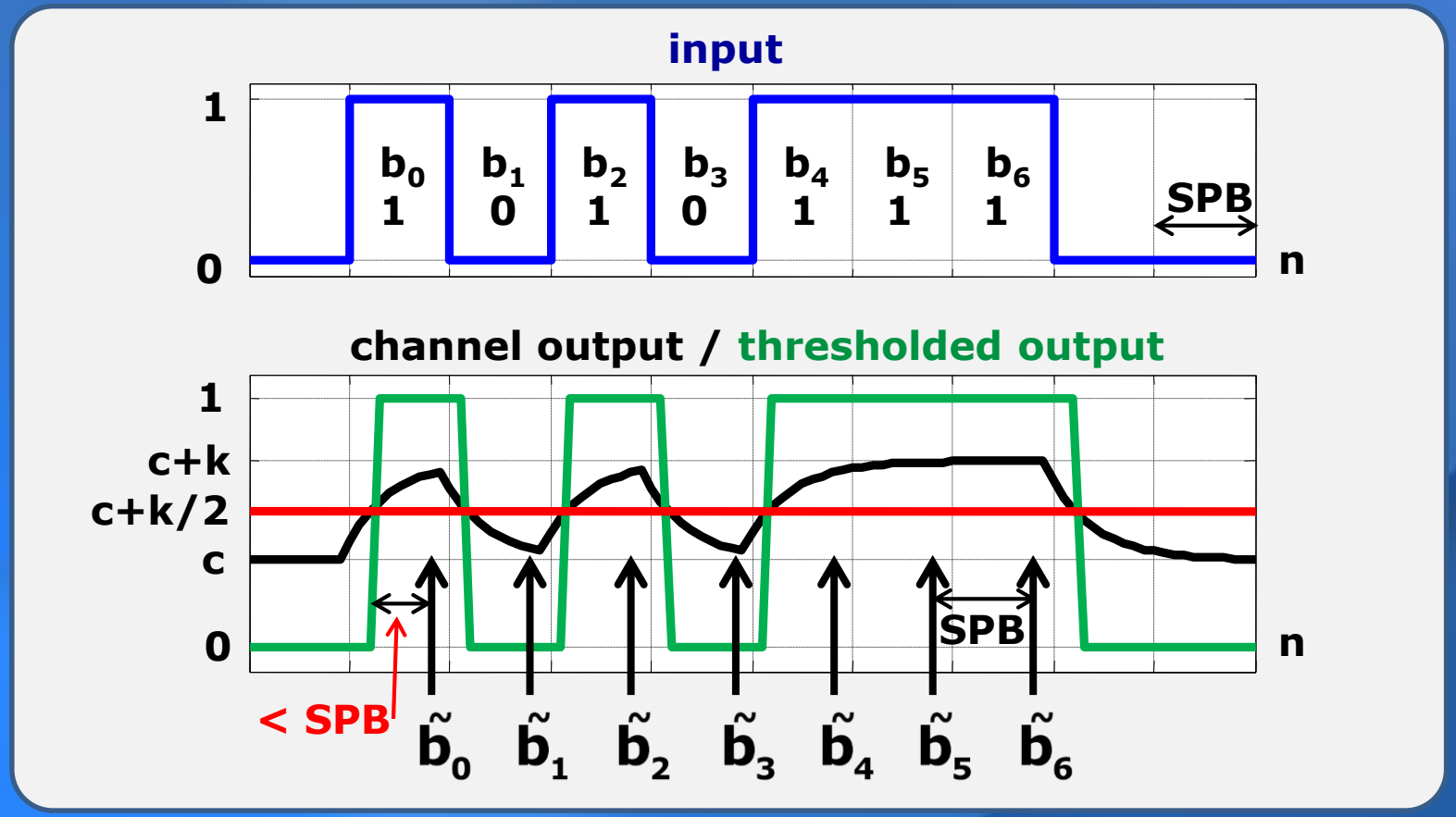
Asynchronous Serial Communication

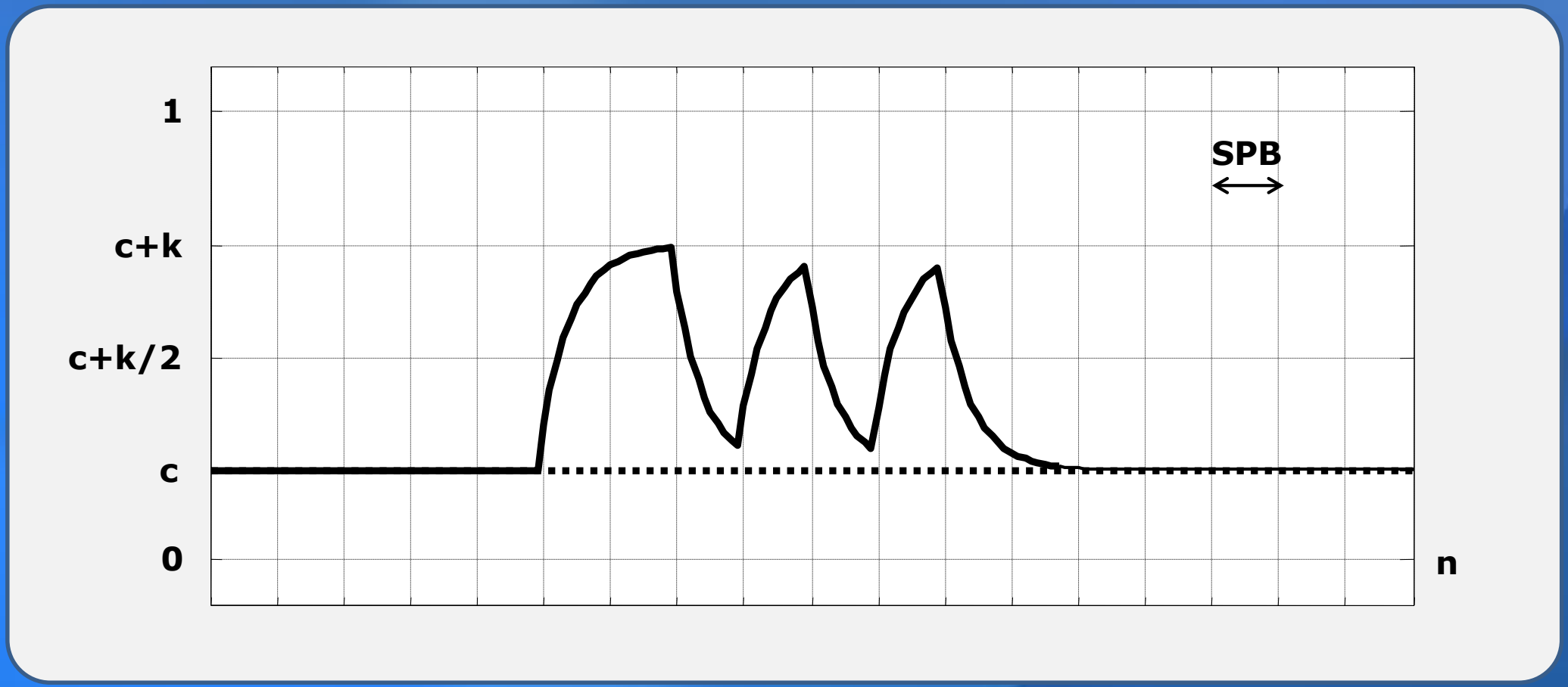
Sub-Sampling

- Every bit is sent using many (SPB) samples.
- To recover one bit, we sub-sample b(n) once every SPB samples.
  - SUB-SAMPLE = take only a SUBset of the SAMPLES
- We must also determine when to start sub-sampling



Problem

- Suppose the transmitter only sends information occasionally. If we receive the following waveform over an asynchronous channel, what was the input bit sequence?

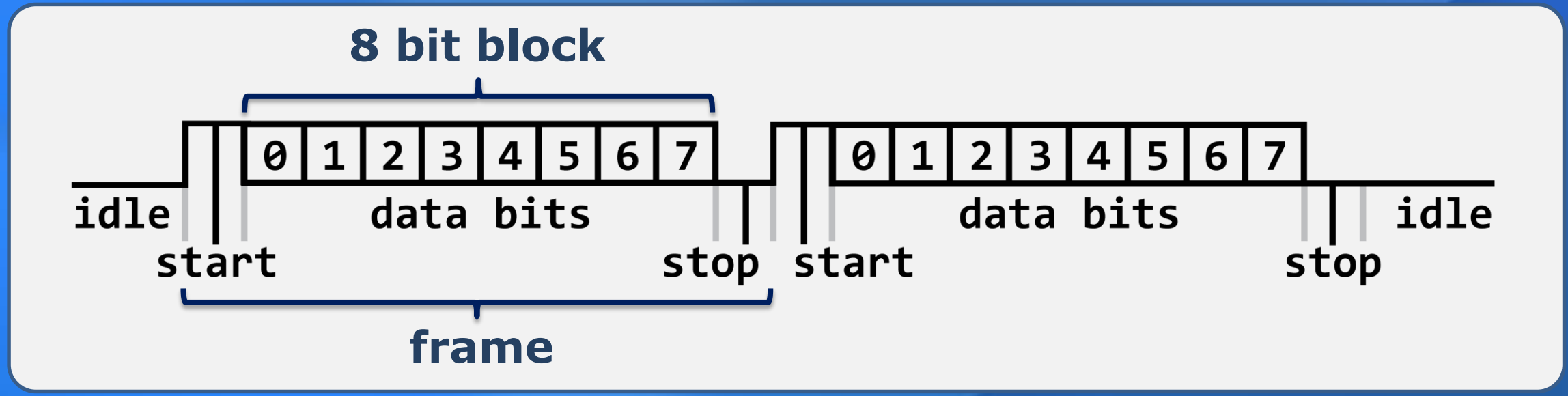


Asynchronous Communication

- In many communication systems, the transmitter and receiver are not synchronized (aligned in time)
  - syn = same, chron = time
- The receiver does not know when then transmitter will transmit data.
- This type of communication is known as an asynchronous (not synchronous) link.
- In this type of link, the receiver needs a signal from the transmitter indicating when it starts to transmit data
  Question: How do we do this as humans?

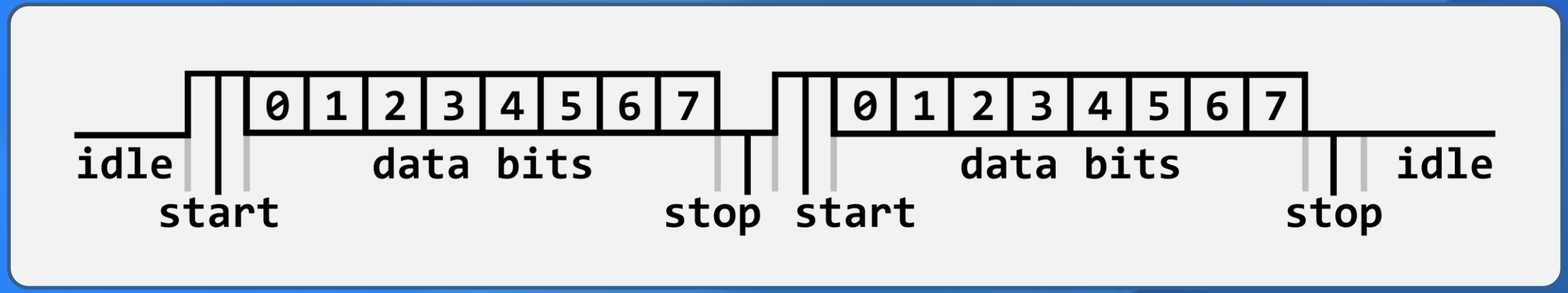
Framing

- In an asynchronous communication,
  - data bits are first grouped into blocks
  - the blocks are then "framed," i.e., surrounded by extra bits
- Framing bits
  - Start bit – indicates the start of a data transmission
  - Stop bits – allow for time between transmission
- The data block plus framing bits is called a frame.



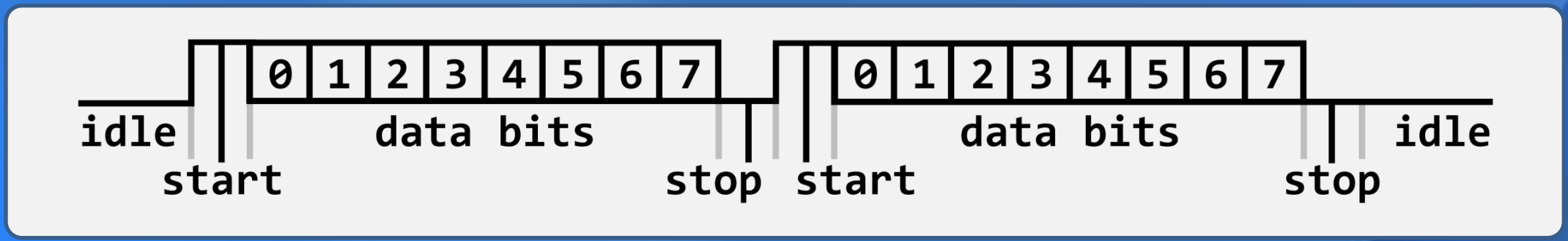
Start Bits

- In order for the receiver to know the start of a transmitted bit sequence, we add a start bit before the bit sequence.
- The start bit is chosen to be either 0 or 1, depending upon the normal received output of the idle channel (when there is no transmission).
- In our channel, the output is normally low (0), so we choose the start bit to be 1.



Data Block

- For the receiver to know how long to listen, the transmitter and receiver must agree upon how many bits will follow the start bit. We will refer to these bits as a **character** or **data block**.
- In RS232 serial transmission used in PCs, there are usually 8 data bits following the start bit.



- In lab, we use blocks of 160 bytes = 1280 bits.
- If the transmitter has
  - too few bits: add zeros to the end (padding)
  - too many bits: split the bits to multiple blocks

Stop Bits

- In some cases, we add one or more stop bits to the end of each frame to allow time for the receiver to process the frame.
- The stop bits are chosen so that the received signal is the same as when the channel is idle so that the new start bit can be detected.
- Using more stop bits provides more time between data blocks
  - Advantage: the receiver has more time to process the frame
  - Disadvantage: reduces the rate we can send information