

CS423: Lecture 5, Finish Clock Recovery and Transmission Media

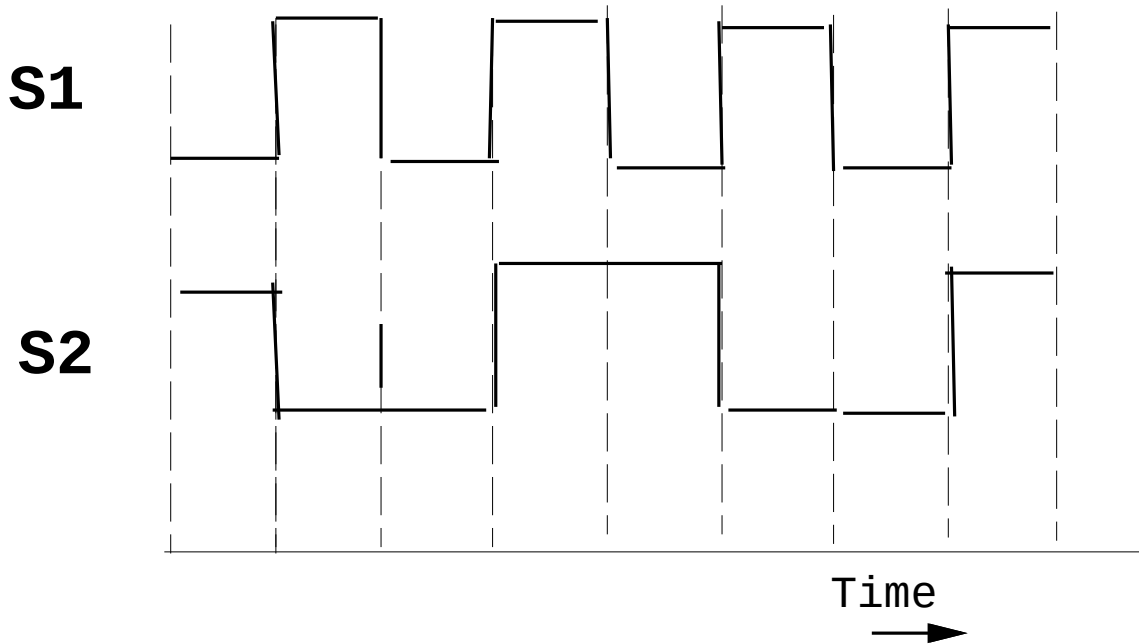
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Why Synchronous Transmission

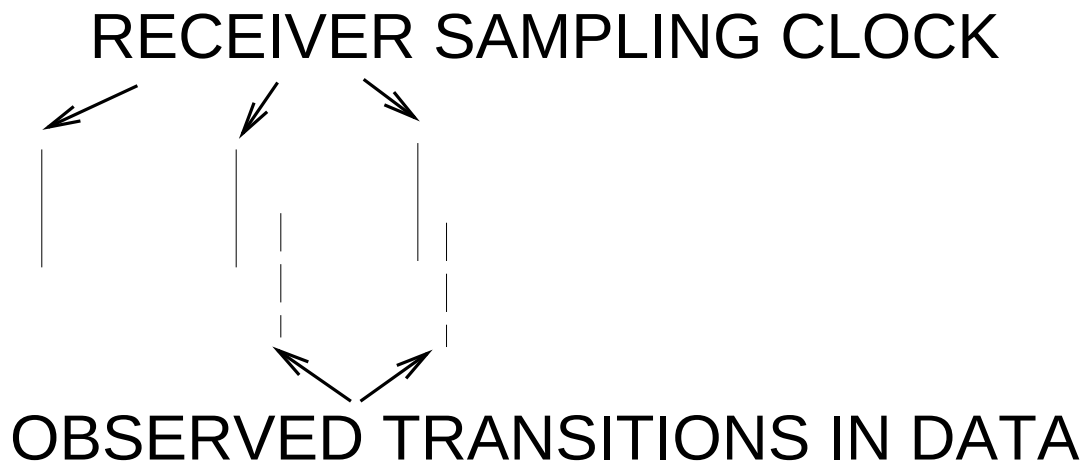
- For Clock Recovery, receiver must know when to start its receive clock (phase). Then can sample the line at periodic intervals at the same rate as sender clock with some help from transitions in data.
- In asynchronous, receiver gets locked in phase when the voltage goes from low to high (start bit). Need to have fairly large idle time between characters for receiver to get locked in phase for each character; slows transmission and limits it to low rates.
- Two overheads to start bits: extra bit but also extra time needed for reliable detection. (Starting up receiver clock is expensive)
- In synchronous, we put a large number of start bits at the start of a large number of data bits. This allows the startup overhead to be amortized.

Getting locked in phase



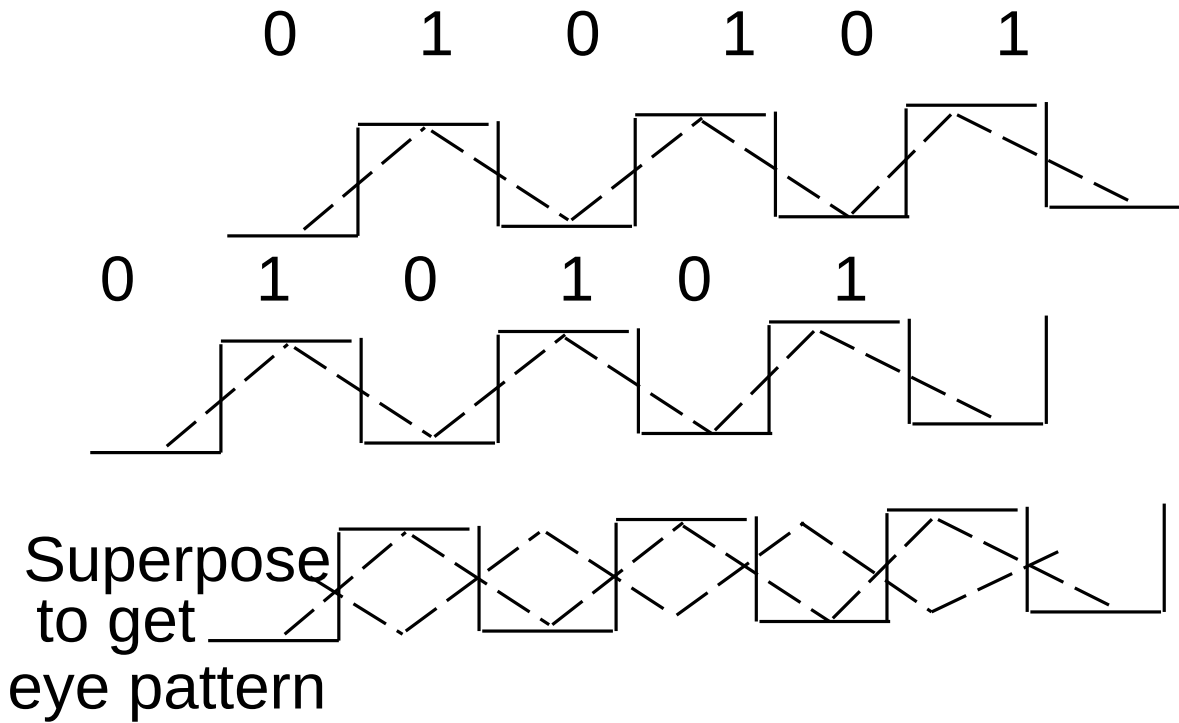
- In asynchronous you get in phase by a single 0 to 1 transition. Not very reliable in the presence of noise.
- In Manchester, you get in phase by sending a preamble or group of start bits of the form 010101 in which the only transitions are at mid bit; easy to recognize and get locked in phase.

Phase Locked Loops



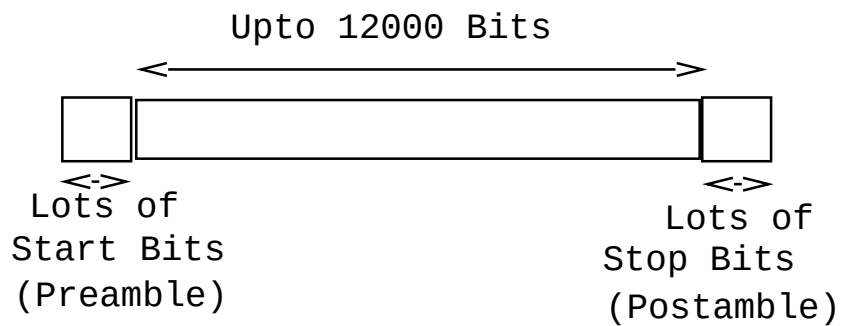
- Once you lock in at the start of a data unit, you can rely on accuracy of receiver clock frequency (as in asynchronous). Can't do that if data unit is large (as in synchronous).
- Could try resetting receiver clock on every observed transition. Susceptible to noise. Better to use more gradual adjustment.
- Phase Locked Loops measure phase difference and speed up or slow down receiver clock to reduce phase difference. Commonly used.

Eye Patterns

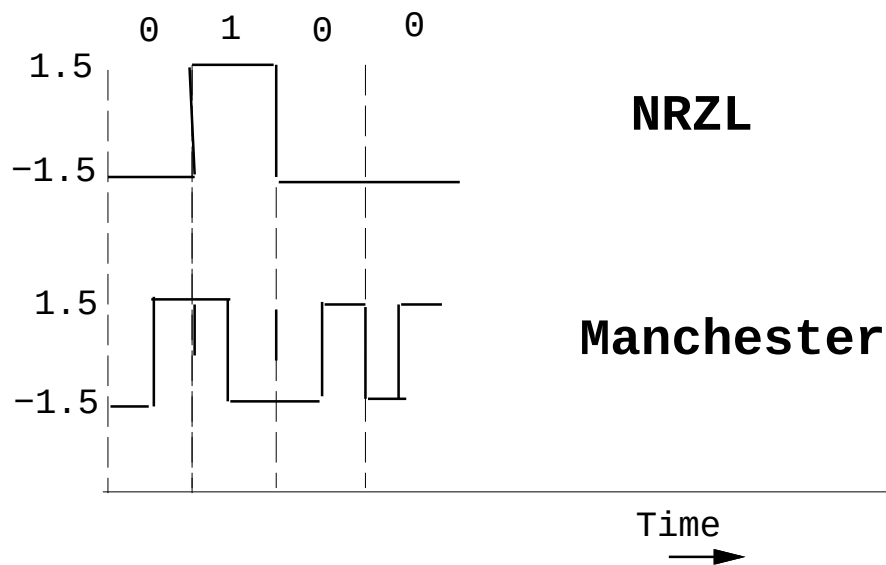


- In a perfect system, we will have a well-defined eye. Should sample at center of eye. Nice visual test of line quality.

"SYNCHRONOUS" TRANSMISSION



same as asynchronous except larger frame sizes . It requires better clock tolerance and more sophisticated coding.



Evaluation Criteria

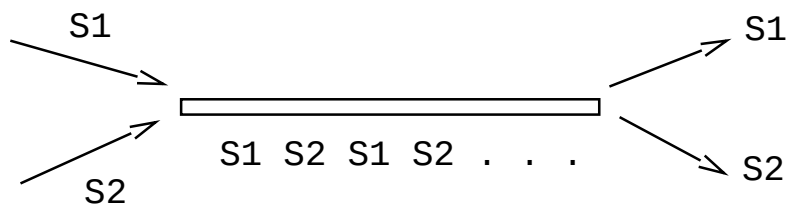
Coding Efficiency(Real Bits/Coded Bits)

Signal to Noise Ratio

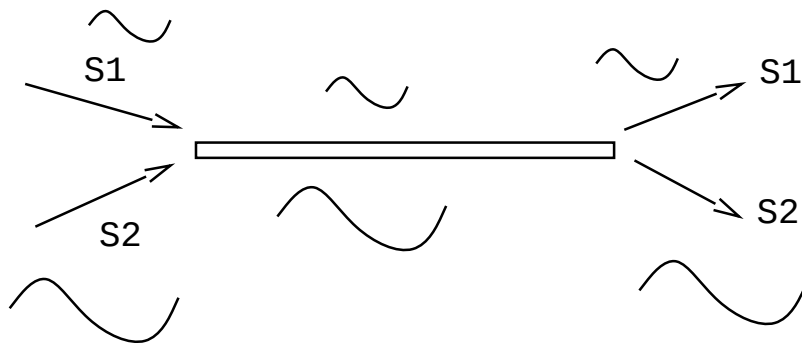
DC Balance

Implementation Complexity

MULTIPLEXING (SHARING)

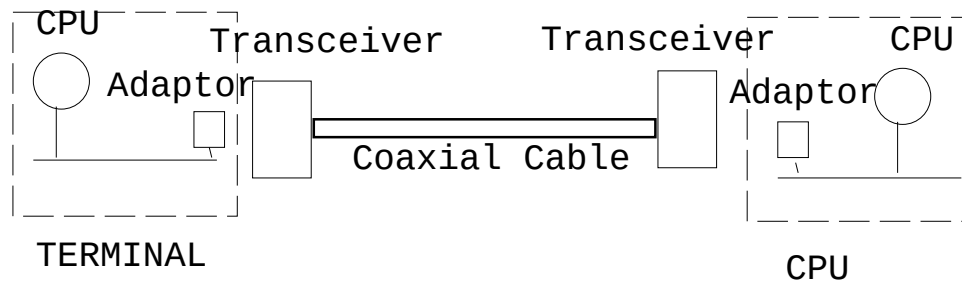


TIME DIVISION MULTIPLEXING (TDM)



FREQUENCY DIVISION MULTIPLEXING (FDM)

BASEBAND CABLE (e.g. ETHERNET)

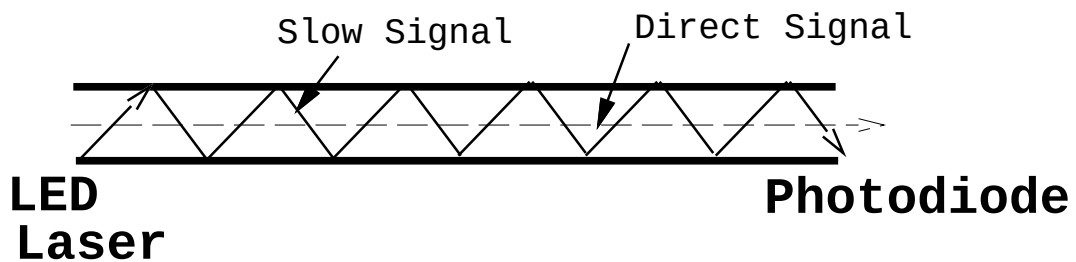


High bandwidth (10-100 MHz)

Hard to tap, expensive to Install

Small Distance (1 - 3 km without repeaters)

FIBRE OPTICS



Huge Bandwidth (10 Million Mhz!)

Almost Impossible to Tap

Point-to-point

Secure

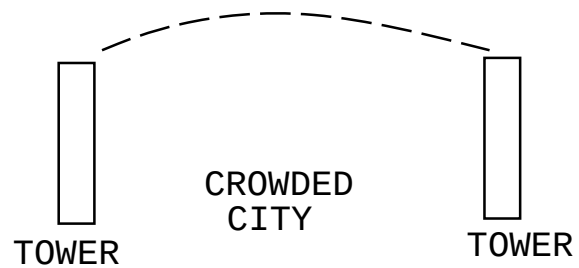
Excellent Electrical Isolation

Thin and Easy to Install

Optics still expensive

Unidirectional

MICROWAVE



Avoids Right of Way

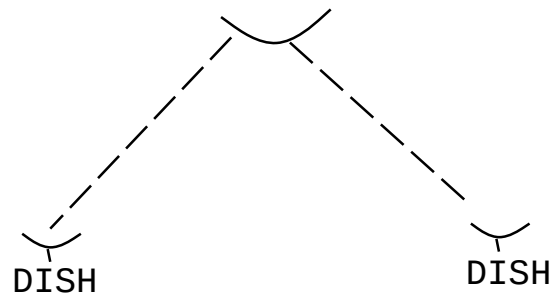
May be cheaper than installing cable

Reasonable Bandwidth

Has problems with Rain

Upto 100 km distance

SATELLITE



Avoids Right of Way

Good Bandwidth (500 Mhz)

World Wide

Large Latency

Antenna Cost

READING ASSIGNMENT: Section 2.2