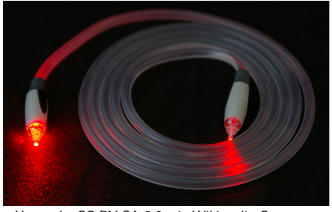
physical media



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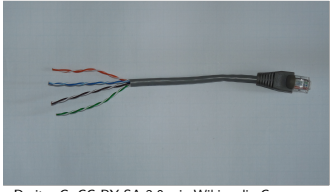

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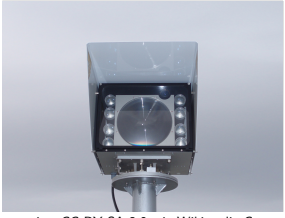

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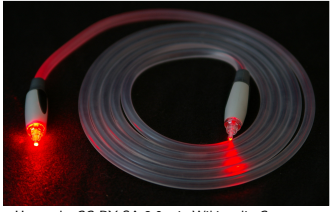
...

physical media

fiber carrying light



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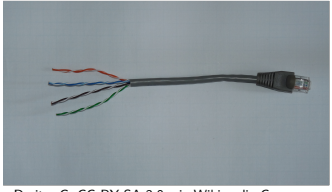
bundle of wires



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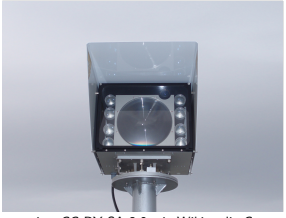
infrared through air



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single wire

FDominec, CC BY-SA 3.0, via Wikimedia Commons

radio

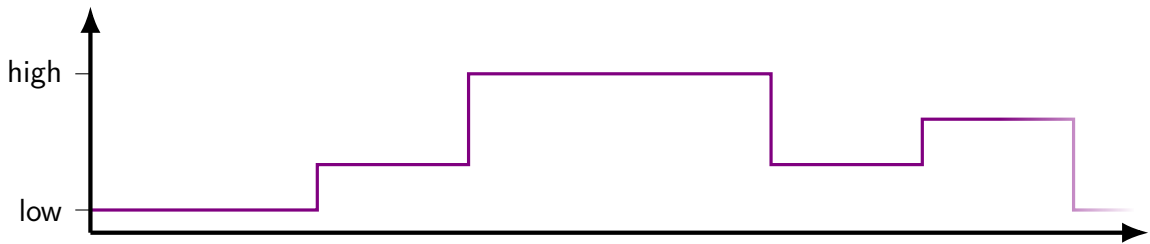
Evan-Amos, via Wikimedia Commons

...

transmitting a signal

can vary...

- voltage
- radio/light intensity
- radio/light frequency
- ...



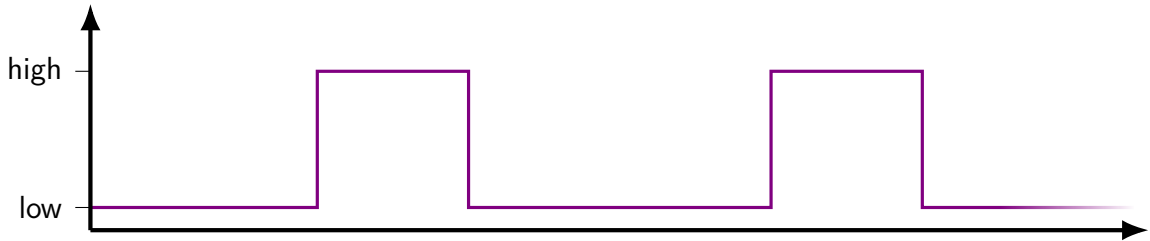
some simplifying assumptions

signal low/high — no in between

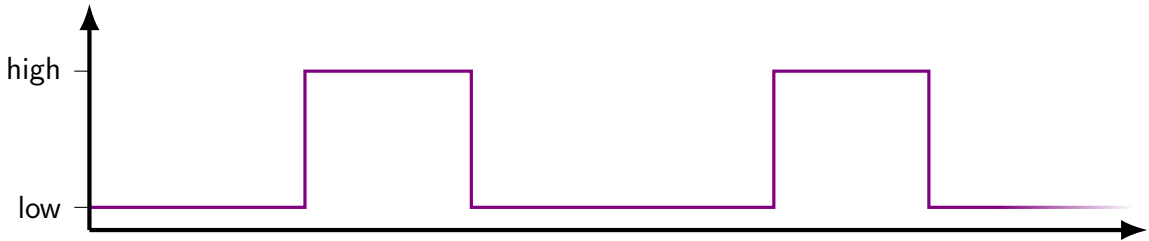
only one 'channel'

won't have multiple wires/antennas/frequencies/etc.
won't modulate different things same time

want to send receive bits (0 or 1)

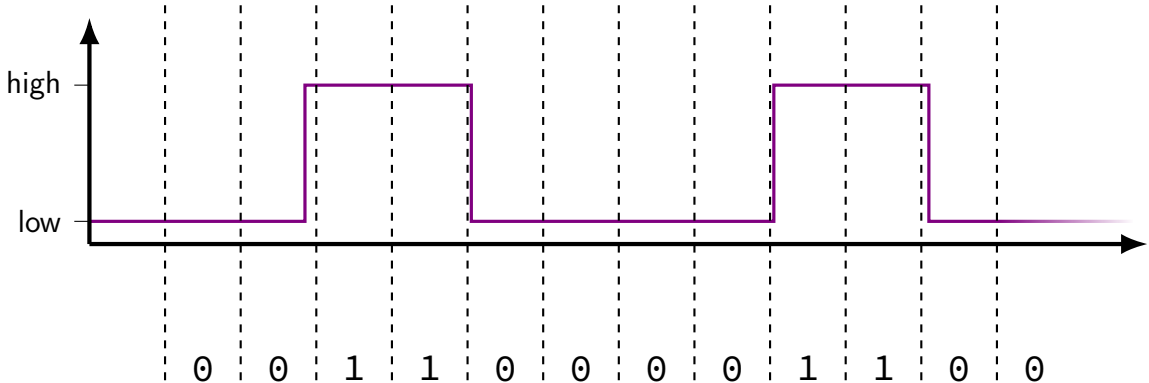


clocking

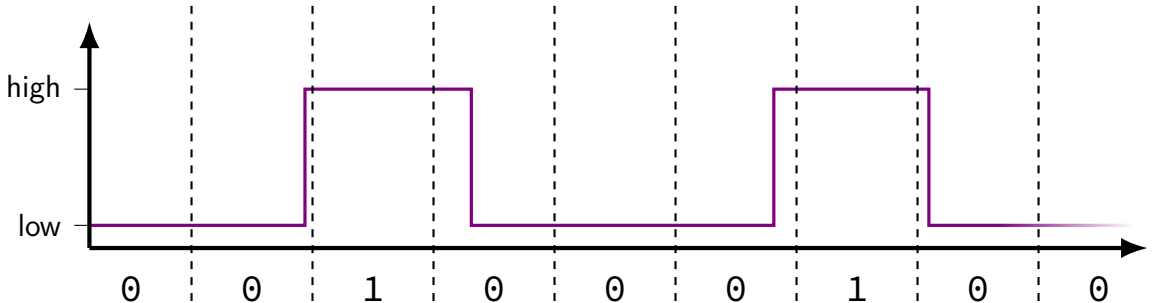


clocking

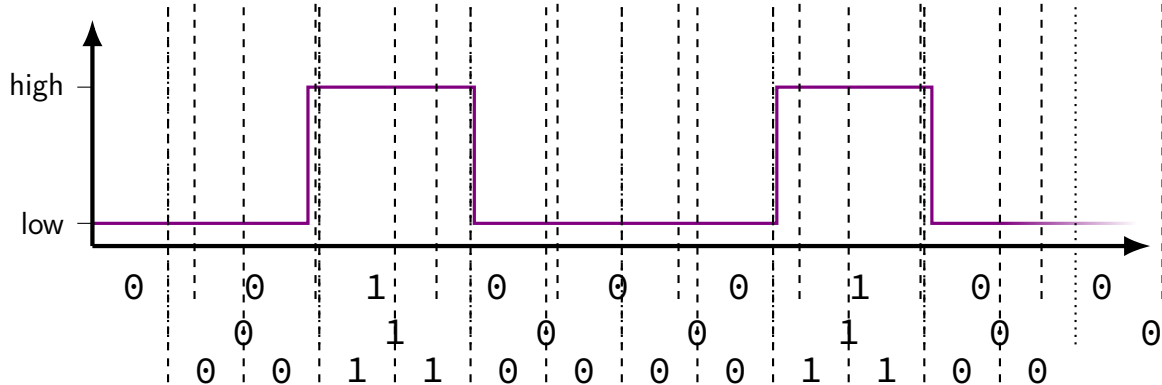
clocking



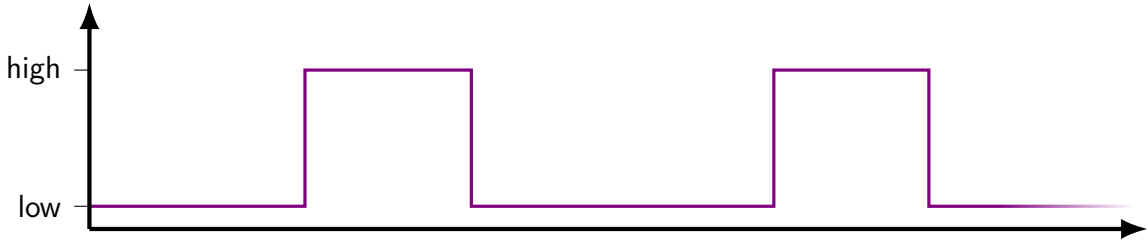
clocking



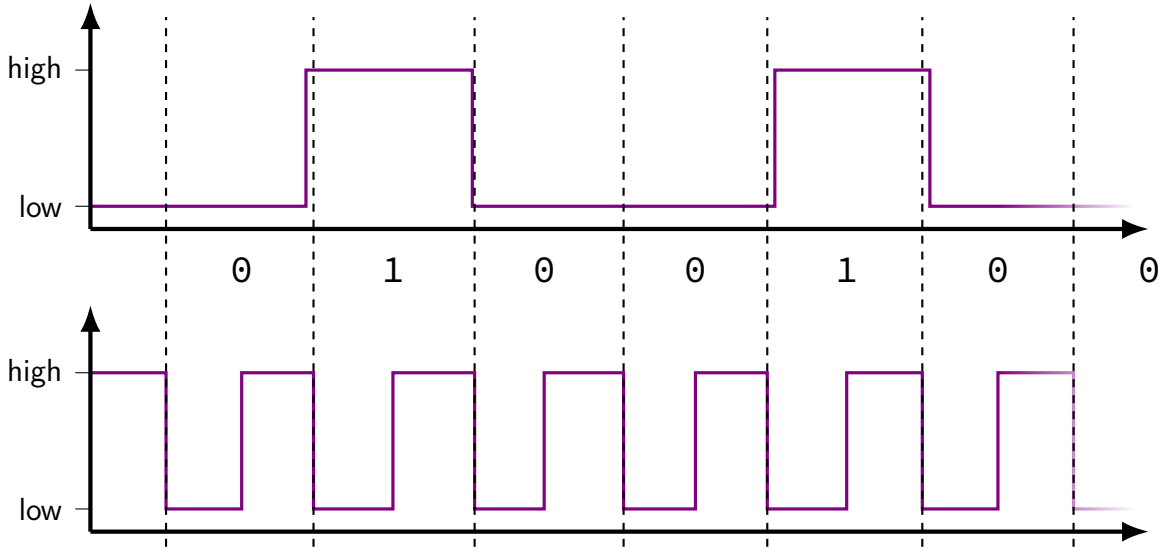
clocking



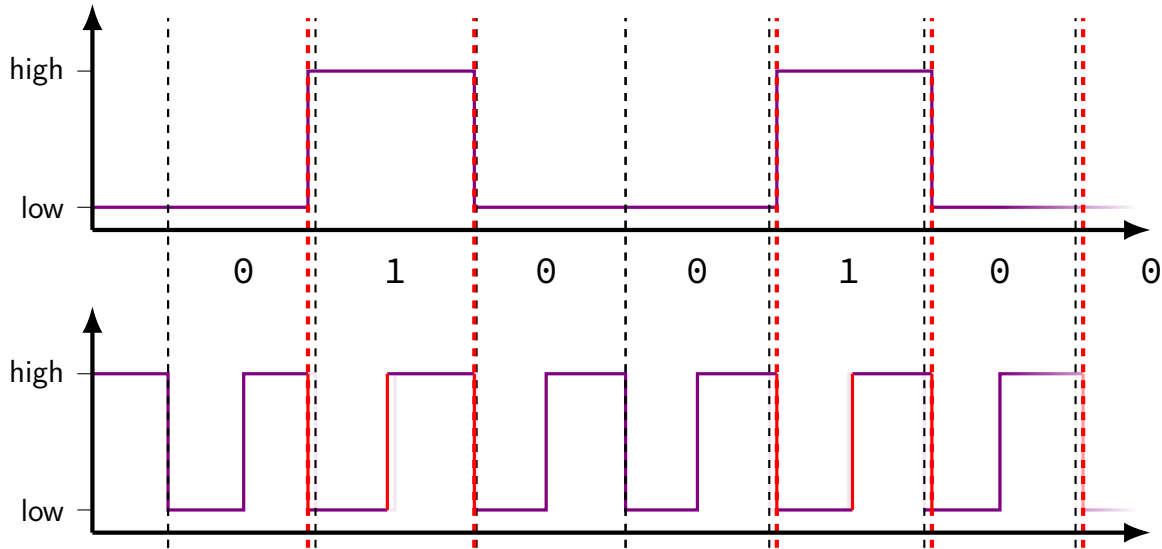
keeping a clock



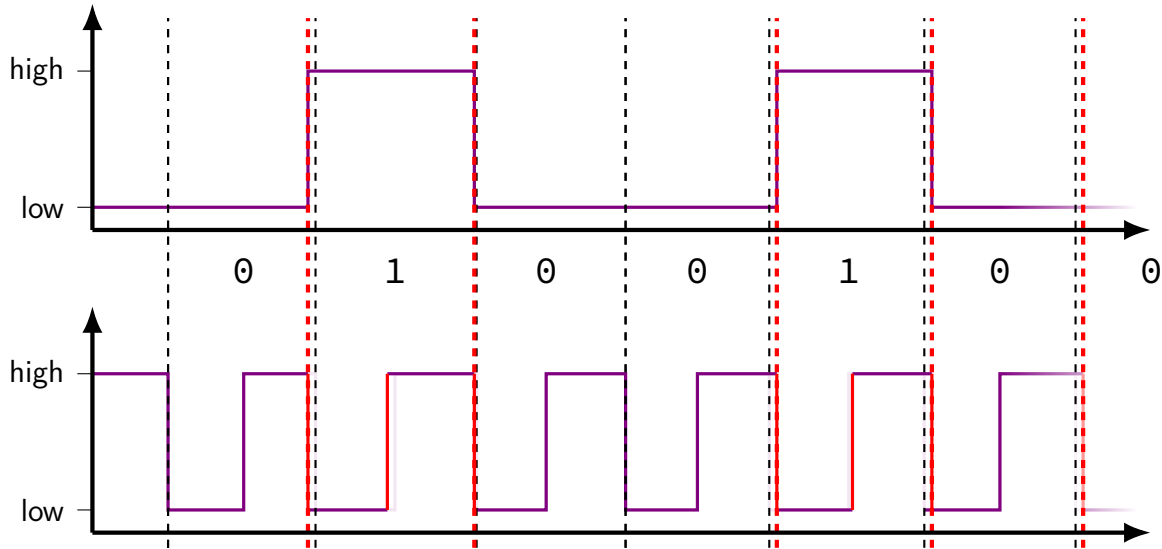
keeping a clock



keeping a clock



keeping a clock



self-synchronizing?

can resynchronize clock by looking for transitions

but doesn't work if lots of consecutive 0s or 1s

also, need to know where low and high point is

important to have transitions to low/high to calibrate this

self-sync and ‘start-message’

one idea: set start-message to have lots of 0/1/0/1/0/1/0/1/etc.

- something 10Mbit Ethernet does

but probably not enough to ensure things stay in sync on big message

Manchester encoding

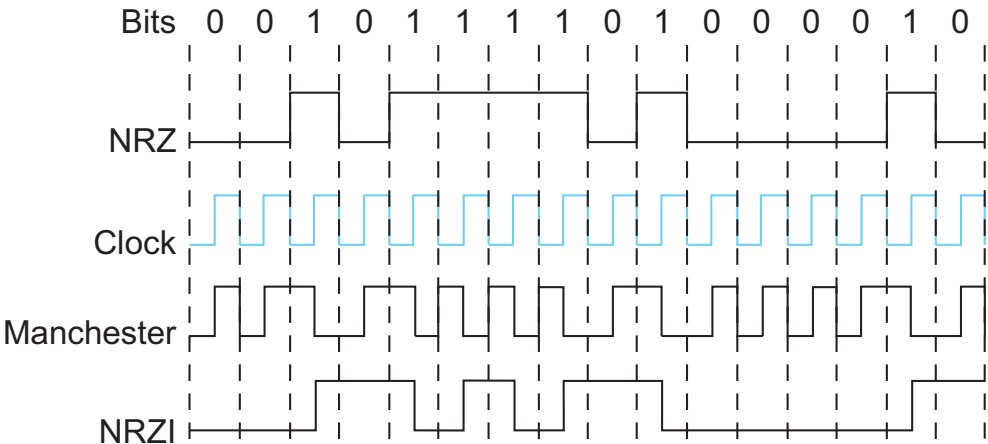


Figure 25 from Section 2.2 of *Computer Networks: A Systems Approach* (6th ed) (Peterson and Davie)

problem with Manchester

fixed the problem of too few transitions

but now most transitions don't send information

means we aren't making good use of wire/etc. capacity

there are more clever compromises

(example: 4B5B encoding)

other better encoding options

vary more than just one thing

- example: pulse amplitude and duration

use more than just low/high

...much more

probably covered in ECE Signals course?

backup slides