Signals

Last updated 10/3/24

These slides introduce signals

Signals

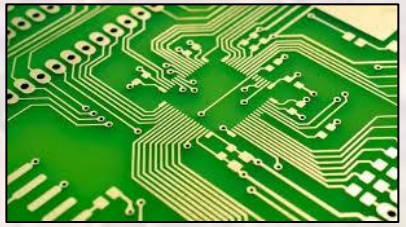
- Signal
  - Information transported or conveyed using an agreed upon medium
    - Visual

    - Audio

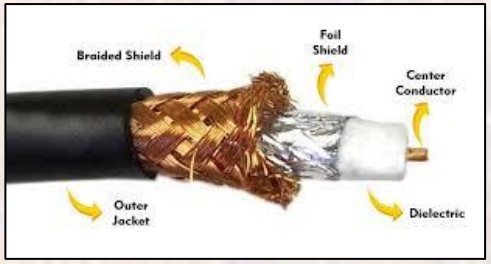
    - Tactile

Signals

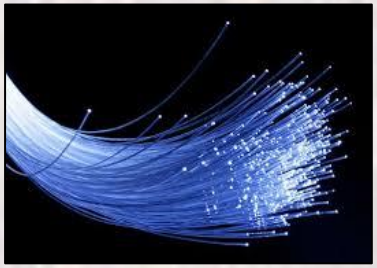
- Electronic Signal - Medium
  - Wires
    - Individual wires
    - Ribbon cables
    - Traces on a PC Board or an Integrated Circuit



  - Coaxial cables



  - Fiber Optics



  - Radio
    - AM/FM/BT/WiFi/RADAR/GPS/…

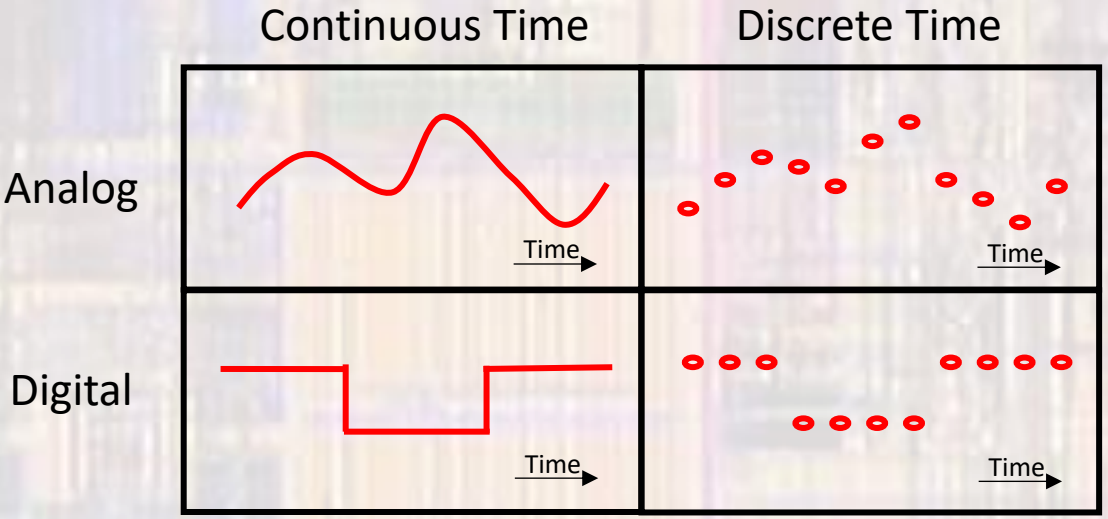
Signals

- Electronic Signal - Carrier
  - The most common signal carriers in wired systems are voltage and current
  - Voltage
    - Electric potential - potential energy of a charge in an electric field
    - Measured in volts (V)
  - Current
    - Flow of electric charge
    - Measured in amps (A)

If the carrier signals are DC
– we use capital V, A
If the carrier signals are AC or Transient
– we use small v, a

Signals

- Electronic Signal - Format
  - Electronic signals can be broken into one of 4 categories



infinite amplitude precision

discrete amplitude precision – N values (Typically, N = 2)

defined for all points in time

defined for specific points in time

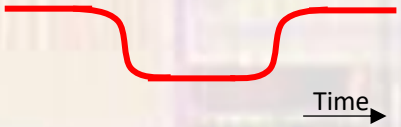
- DC signals are a special case of continuous time signals
  - They have values for all points in time – they just don't change

Signals

- Digital Signals – CPE 1500
  - In CPE 1500 we will be working with Continuous Time – Digital Signals

  - Ideal Signal
    - 2 values
    - No transition time

  - Actual Signal
    - Analog values
    - Finite transition times

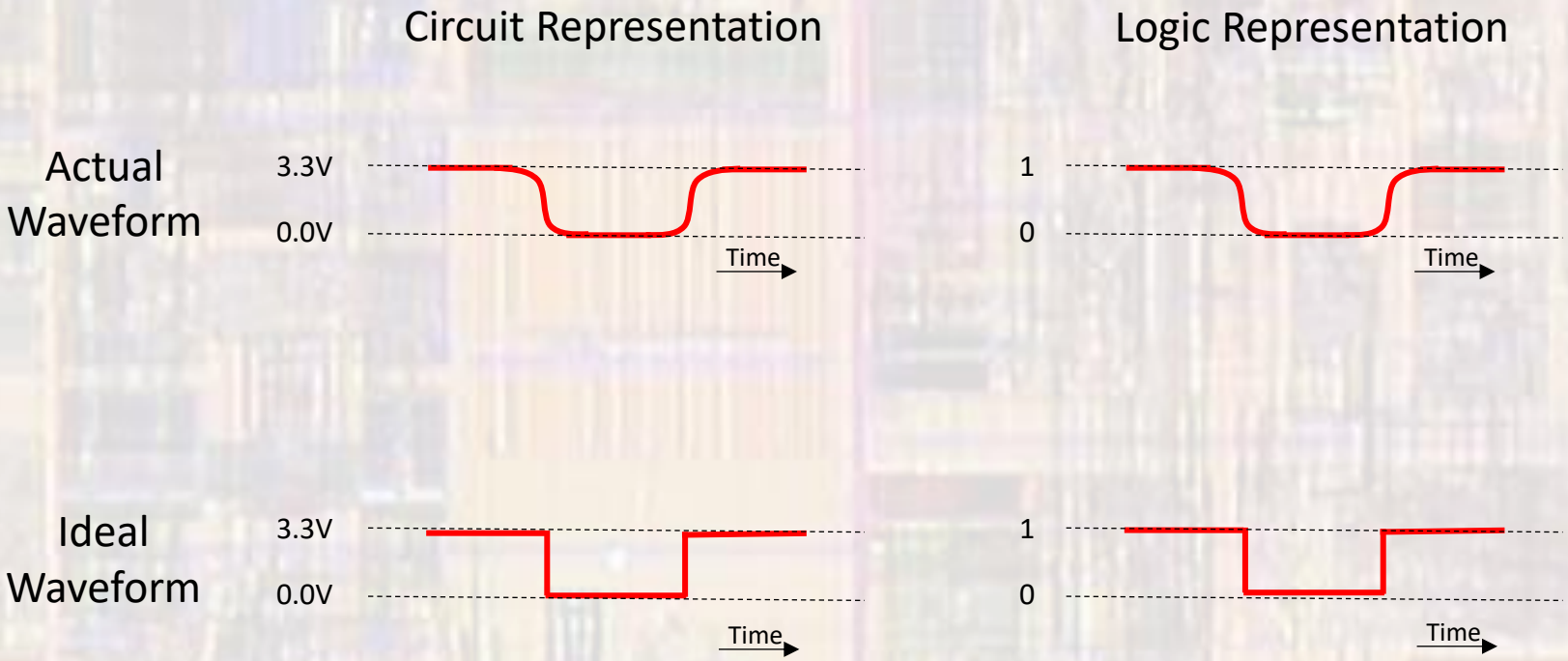


In most cases we will treat our digital signals as a hybrid of these two views

2 values
with
finite transition times

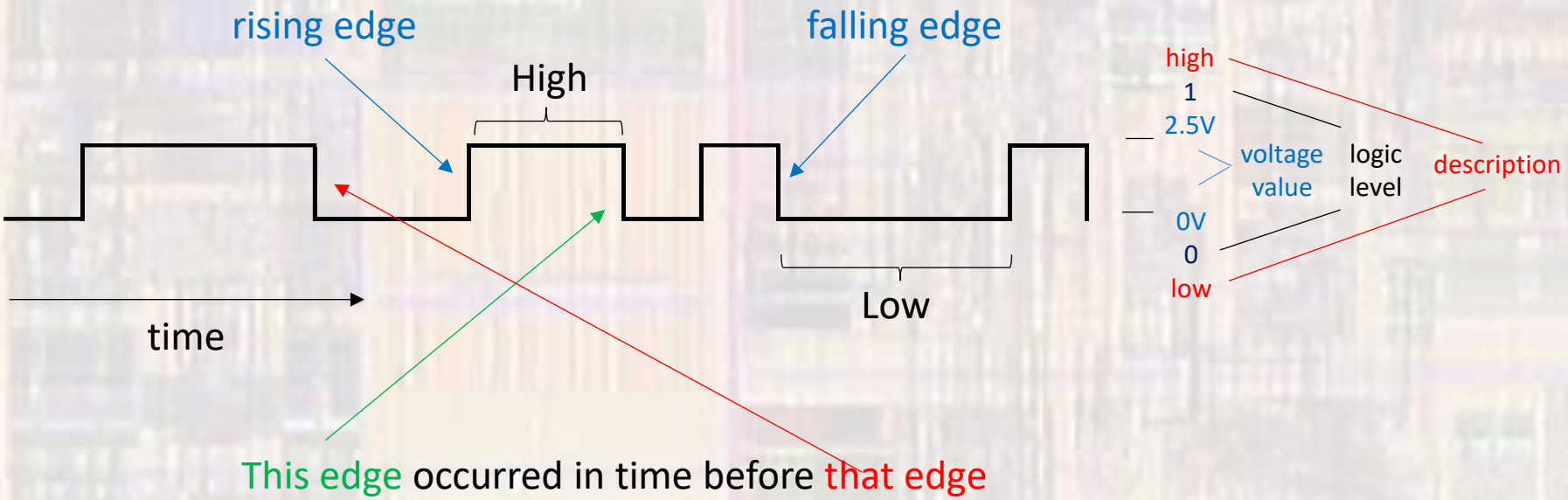
Signals

- Signal Abstraction
  - There are multiple representations of the same signal



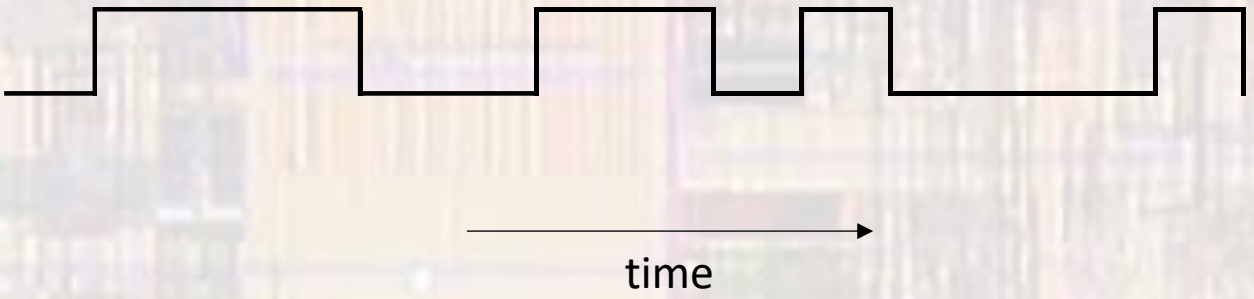
Signals

- Signal Terms



Signals

- Aperiodic Signals
  - No fixed repetition
  - e.g. Intermittent transitions



Signals

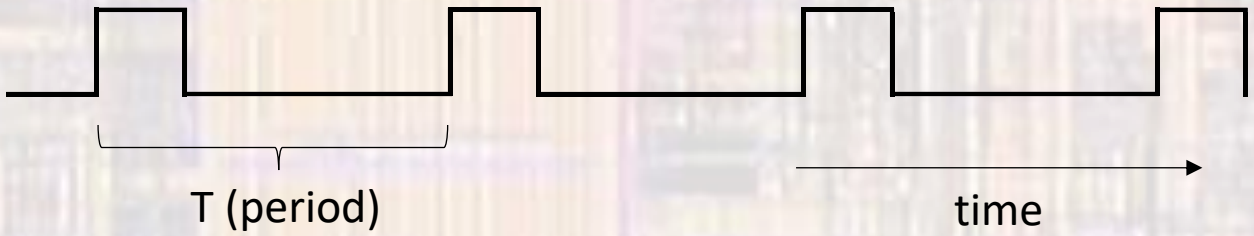
- Periodic Signals
  - Fixed repetition cycle
  - Frequency = 1/Period

F (frequency) = 1/T

50MHz ←→ 20ns

Signals

- Periodic Signals
  - Fixed repetition cycle
  - Duty Cycle = ($Time_{High}$ / Period) %



Duty Cycle = ($Time_{High}$ / T) %

High = 10ns, Low = 40ns → 25% Duty Cycle

