Data and Signal

By

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Data

- ✓ Entity that conveys meaning based on previously fixed set of mutual agreements between S and R
- ✓ S and R may be agreed upon ASCII format (7 Bits)

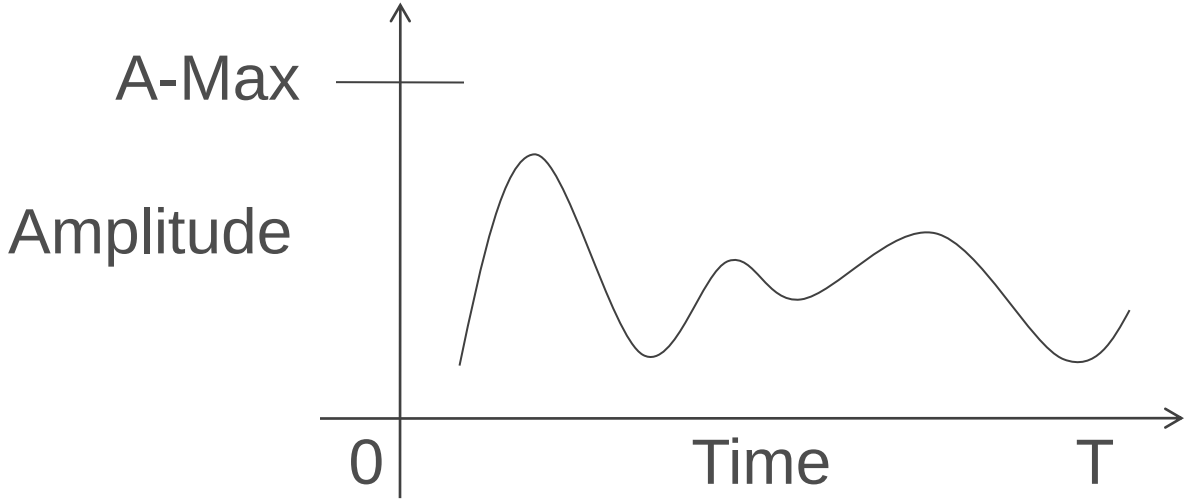
  Ex: 100 0001 – A

Data

- ✓ Transmitted from S to R
- ✓ Must be interpreted at R
- ✓ Can be Analog or Digital

Analog Data

- ✓ Have Continuous values over Time (Infinite)



- ✓ Amplitude takes any value within 0 to A-Max wrt Time

Analog Data

- ✓ Example: Voice and Video

- ✓ Voice:
  - ✓ Mouth – Vibrates – Audio – Ear – Hear
  - ✓ 0 – 3500 Hz (20 Hz – 2000 KHz)
- ✓ Video:
  - ✓ Raster Scan – 500 lines – 475 lines Visible
  - ✓ Interleaved – 237.5
  - ✓ Refresh rate 30 times
  - ✓ Bandwidth – 4 MHz Except Voice and Color

Analog Data

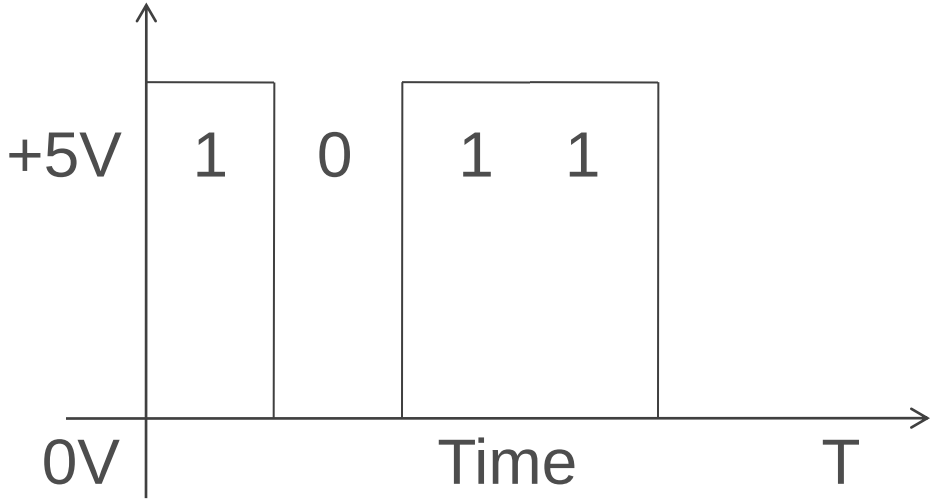
- ✓ All Physical parameters are Analog in Nature
- ✓ Temperature, Pressure, Light Intensity
- ✓ How do we understand values of Physical parameters?
- ✓ Transducer: Converts Temperature to Electrical Signal
- ✓ Electrical Signal is also Analog data

Digital Data

- ✓ Have Discrete values over Time (Finite)
- ✓ Ex: Text, Character
- ✓ Data Stored in Memory and CD have Two Discrete Values: 0 and 1
- ✓ Press A @ Keyboard, 100 0001 will be Sent to PC

Digital Data

- ✓ Mostly Two Voltage Levels



- ✓ Amplitude takes Either 0V or +5V within Time

Signals

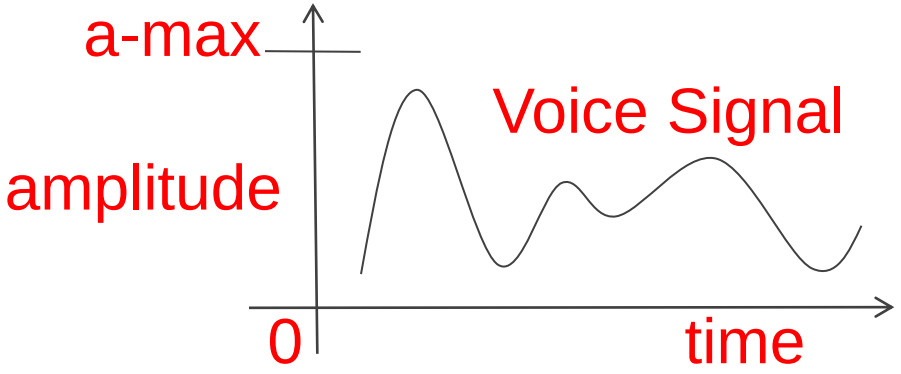
- ✓ Data Can not be Transmitted directly to Media
- ✓ Convert Data to Signal before Transmitting to Media
- ✓ Signal:

  Electric, Electronic, Optical, Electromagnetic Representation of Data

- ✓ Transmitted over Media, Can be Analog or Digital

Analog Signals

- ✓ Continuous Values over a Time
- ✓ Microphone:



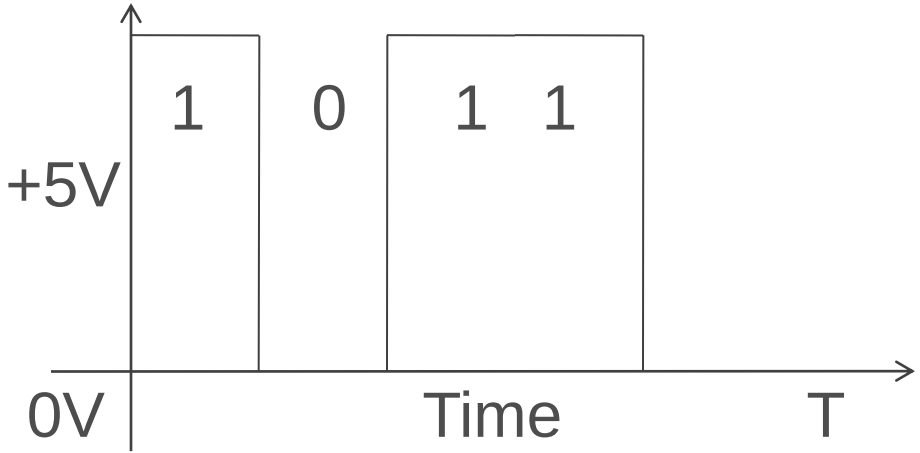
Transducer

Converts Voice Data to Voice(Electrical) Signals

Pair of Wires Transmits Voice Signals

Digital Signal

- ✓ Limited number of Defined Values Mostly Two Voltage Levels 0 and 1



- ✓ Amplitude takes Either 0V or +5V within Time

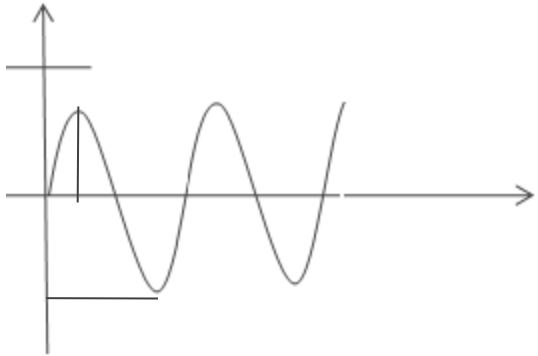
Classification of Analog Signals

- ✓ Simple and Composite
- ✓ Simple Analog Signal: Sine Wave
- ✓ Composite Analog Signal: Mixture of Simple Analog

Simple Analog Signals

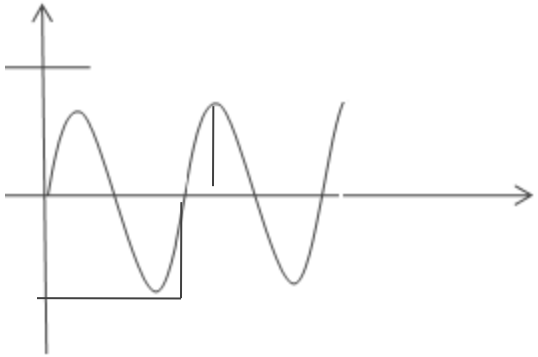
- ✓ Sine Wave is Periodic in nature $s(t) = A \sin(2 \pi f t + \varphi)$
- ✓ Periodic Signal is characterized by 3 Parameters

  Amplitude, Frequency and Phase
- ✓ Pattern is repeated after a Time period



Amplitude, Frequency and Phase

- ✓ Amplitude: Strength of the Signal – Volts
- ✓ Frequency: No. of Cycles/ Second (1 / T) – Hz
- ✓ Phase: @ 0, Relative Position of two Signals in time – Degrees



Amplitude, Frequency and Phase

- ✓ Amplitude: Volts

  V, mV = 10^{-3} V, KV = 10^{3} V

- ✓ Frequency: Hertz

  Hz, KHz = 10^{3} Hz, MHz = 10^{6} Hz, GHz = 10^{9} Hz, THz = 10^{12} Hz

- ✓ Time: Seconds

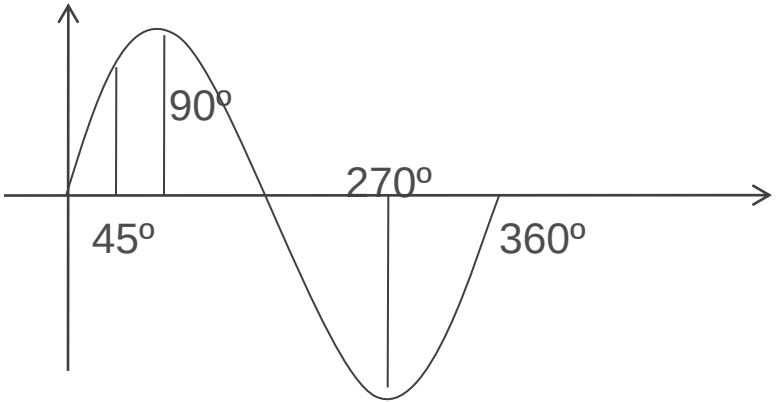
  s, ms = 10^{-3} s, µs = 10^{-6} s, ns = 10^{-9} s, ps = 10^{-12} s

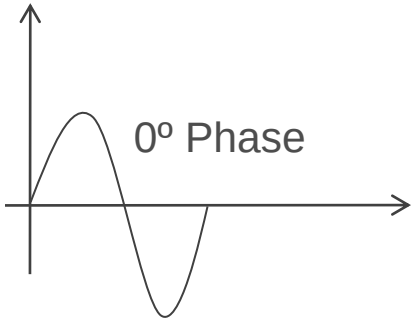
Amplitude, Frequency and Phase

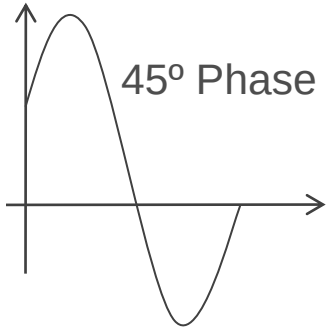
- ✓ Phase: Degrees/ Radian

$360^o = 2\pi$

$45^o = (2\pi/ 360^o)*45^o$ Radian







References

- ✓ Book: Data communication and Networking
  Fourth edition
  By : BEHROUZ A FOROUZAN

- ✓ various relevant websites

Thank You