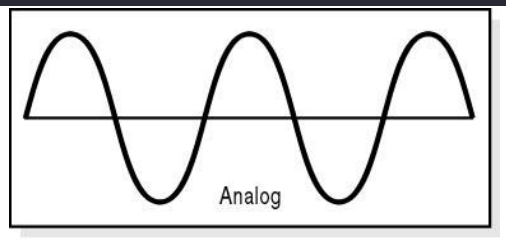
ANALOG VS DIGITAL

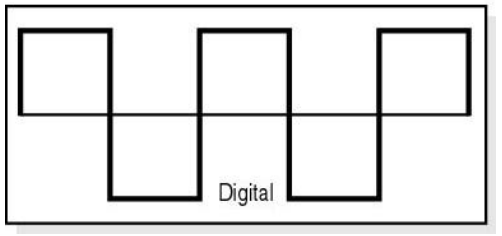
The Basis of all communication

Analog Communication



- Any type of communication that uses physical properties of a media to convey a signal.
  - Example:
    - Vinyl records: Each bump and dent in the disc moves the reading head in a specific way to restitute sound
  - Advantages:
    - The signal is restituted as is, if the reader is calibrated to the writer the signal will be true
    - Very low or even no restitution latency
  - Disadvantages:
    - No possibility of error control
    - Density of recording is limited to the physical properties of the media

Digital Communication



- Uses a universal coding system enabling media independent transmission and reception of data.
  - Binary is the 2-state coding system used for digital communication
  - Digital uses analog features, properties, to convey a state, a binary 0 or 1
  - Advantages:
    - The data is media independent because it sits above analog
    - Data restitution requires assembly of the bits, process which can provide error control
  - Disadvantages:
    - Induces latency due to the decoding/translation process
    - Faults in the analog media can corrupt a whole portion of the message

Digital Coding system

- Binary values (0,1), bits, are grouped by 8 to be read and form an octet/Byte

- Each octet can then be translated to a decimal value that can be translated to a character
  - Known as UTF-8 encoding, is the most popular encoding for WWW since 2007
  - Other encoding types, such as US-ASCII, use a different number of bits (7) to encode characters

  - As long as source and destination agree on the reading / conversion methods, anything can be used

Binary Translation

- To read / convert an octet to decimal you add together the weight of each bit coded to 1

- The position of the bit in the octet defines the weight

Position	1	2	3	4	5	6	7	8
Weight	128	64	32	16	8	4	2	1

  - In an octet the left most bit holds the weight of 128, each following value is half the weight of the previous
  - Example:
    - In the octet 10100011 we will only add together the weights of the 1st,3rd, 7th and 8th bits

Base-2 to Base-10

- Example 10100011:
  - Octets base-2 can be converted to decimal base-10 using the conversion table :

Position	1	2	3	4	5	6	7	8	
Weight	128	64	32	16	8	4	2	1	
Example	1	0	1	0	0	0	1	1	
Result	128	+	32		+		2	+ 1	= 163

Base-2 to Base-16

- Example 10100011:
  - Octets base-2 can be converted to hexadecimal base-16 by grouping the bits by 4 and then translating them :

Position	1	2	3	4	5	6	7	8
Weight	8	4	2	1	8	4	2	1
Example	1	0	1	0	0	0	1	1
Result	8	+	2				2	+ 1
		= 10						= 3

  - Hexadecimal notations use 0-9 and A-F, so our result would be A3