Digital Representation

Everyone knows computers use bits and bytes ... but what are they?

Info Representation

Digitization: representing information by any fixed set of symbols

What number is: 1 1 1 2 2 2 3 3 3

Creating Symbols

Often, there are many things to digitize, but too few symbols available

- The solution is to create more symbols by composing patterns ...
- Three patterns make three symbols: ■ □ □
- Pairing them makes 9 symbols; when they are triples, 27 symbols, and ...

An Encoding

Encode the Latin alphabet

Digitize — encode with symbols

Info in the Physical World

Physical world:

- The most fundamental representation of information is presence/absence of a phenomenon
- matter, light, magnetism, flow, charge, ...

Info in the Logical World

Logical World:

- Information, reasoning, computation are formulated by true/false and logic
  - All men are mortal
  - Aristotle is a man
  - Aristotle is mortal

True and false can be the patterns for encoding information
Connect Physical/Logical

The miracle of IT is that physical and logical worlds can be connected

Pavement Memory

false true false false false true true false true false true false false false

0 1 0 0 0 1 1 0 1 0 1 0 0 0

Bytes

A byte is eight bits treated as a unit
- Adapted by IBM in 1960s
- A standard measure ever since
- Bytes encode the Latin alphabet using ASCII -- the American Standard Code for Information Interchange

0100 0110 0100 1001 0101 0100 0100 1000 0111 0101 0111 0011 0110 1011 0110 1001 0110 0101 0111 0011 0010 0001

Demonstration

Bits

PandA is a binary representation because it uses 2 patterns
- Bit -- it’s a contraction for “binary digit” -- a position in space/time capable of being set and detected in 2 patterns

Sherlock Holmes’s Mystery of Silver Blaze -- a popular example where “absent” gives information … the dog didn’t bark, that is the phenomenon wasn’t detected

ASCII

0100 0110 0100 1001 0101 0100 0100 1000 0111 0101 0111 0011 0110 1011 0110 1001 0110 0101 0111 0011 0010 0001

Encoding Information

Bits and bytes encode the information, but that’s not all
- Tags encode format and some structure in word processors
- Tags encode format and some structure in HTML
- In the Oxford English Dictionary tags encode structure and some formatting
Byte (baIt). Computers. [Arbitrary, prob. influenced by bit and bite] A group of eight consecutive bits operated on as a unit in a computer. 1964 Blauw & Brooks in IBM Systems Jnl. III. 122 An 8-bit unit of information is fundamental to most of the formats of the System/360. A consecutive group of eight bits, such as a byte, is the basic unit of data in many computer systems. These groups are eight-bit bytes, halfwords, words, and double words respectively. 1964 Blauw & Brooks in IBM Systems Jnl. III. 122.

When a byte of data appears from an I/O device, the CPU is seized, dumped, used and restored. 1967 P. A. Stark Digital Computer Programming xix. 351

The normal operations in fixed point are done on four bytes at a time. 1968 Dataweek 24 Jan. 1/1 Tape reading and writing is at from 34,160 to 192,000 bytes per second.