1 Bits and Bytes

Main Points

- Bits and Bytes
- Kilo, Mega, Giga, Tera
- Memory, Packets and Bit Manipulation

1.1 Bits, Bytes, Integers etc

- All data in computers is held as a sequence of ones and zeros.
- A number is represented as the base 2 number held in some pre-ordained fixed number of bits
- Almost all other data is represented as various sets of numbers.
- A byte is 8 bits sequenced together - what is the maximum number?
- Integers (in Java and most other languages nowadays) are 32 bits long - what is the maximum number?

1.2 Prefices

- In communications we talk often about throughput in bits/second, or moving files of some particular size. We use magnitude prefices for convenience

  kilo $1000\times$

  mega $1000000\times$

  giga $10^9\times$

  tera $10^{12}\times$

- There is often confusion as to whether a kilobyte is 1000 or 1024 bytes. When dealing with processor architectures, its generally 1024. When dealing with communications, its generally 1000. State assumptions if it is not obvious from context.

1.3 Memory and Packets

- A computer stores data as bits in memory.
- When it wants to send this data to another computer, it copies the bits into the memory of the communications device.
- The communications device sends the bits through the network to the other machine (we'll cover the details of this in the coming week).

- The other machine's communication device places the bits into memory which the other machine can access.
- The tricky bits come in ensuring that both machines interpret the bits correctly.

1.4 Bit Manipulation

- Not only must the data be sent, but accompnying information allowing the computers to interpret the context of the data.
- Communications software must be able to pick out arbitrary bits from an opaque bit sequence and interpret their meaning.
- We do this using bitwise operations - *and, or, exclusive or, negation.*