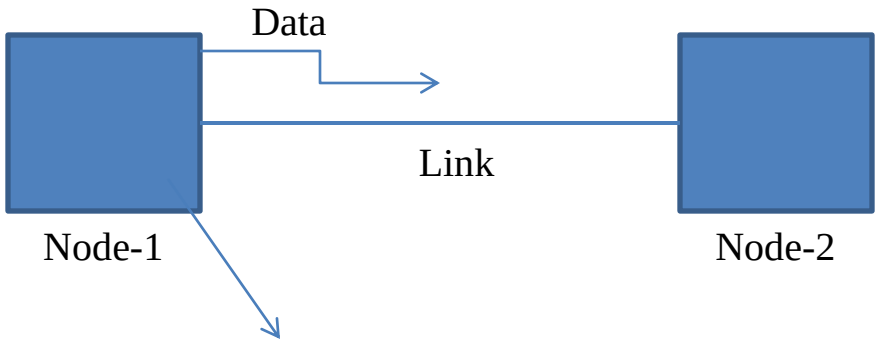
Physical Layer: Components

Kameswari Chebrolu

Physical Layer

- Bit-by-bit delivery



Nodes: Hosts, Routers or Switches
Hosts: General Purpose computers
Routers/Switches: Specialized hardware (for performance reasons)

Components: Outline

- Host Internals
- Link Characteristics
- Types of Links

Inside Computer

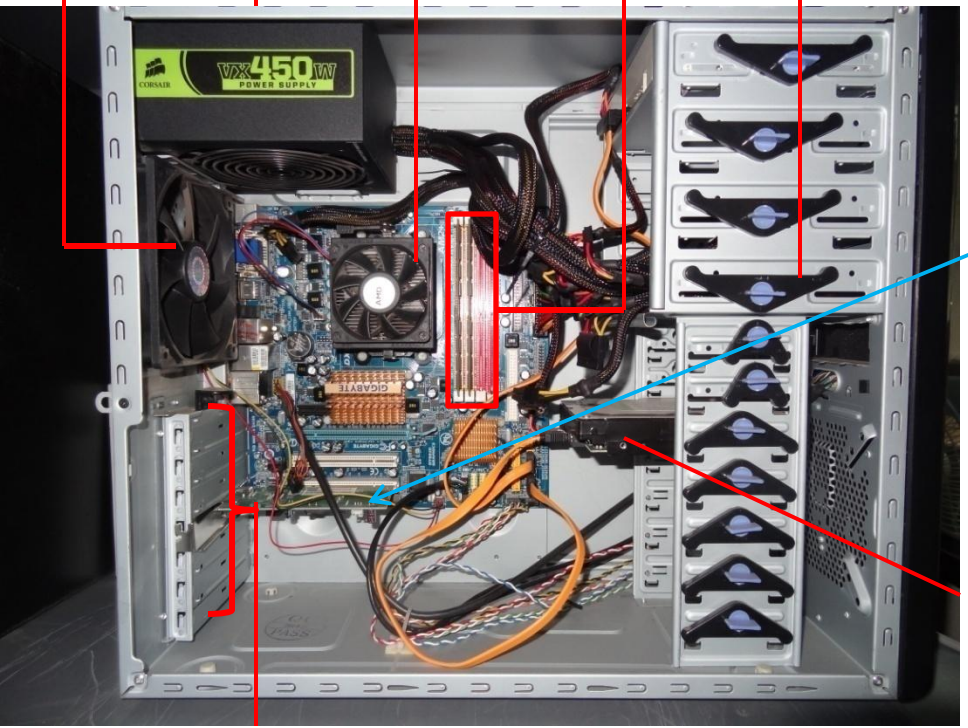
Power Supply

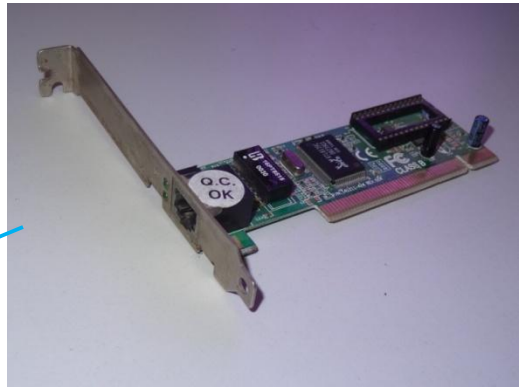
System Fan

Microprocessor Fan and Heat Sink

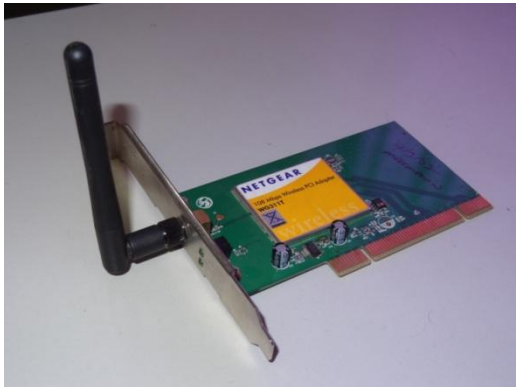
RAM

CD/DVD Drives





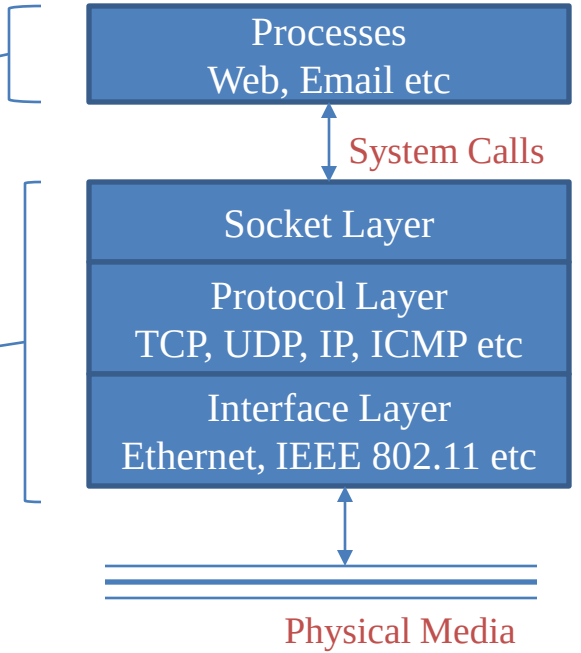
Hard Drive



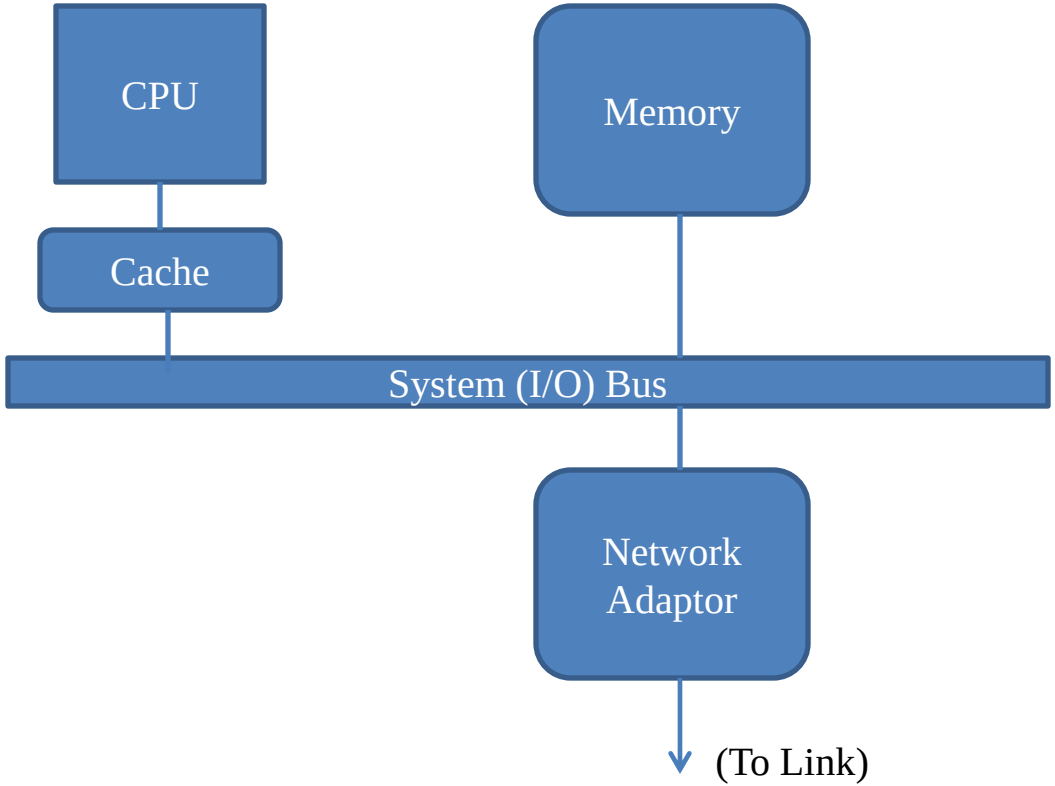
Expansion Slots (network adaptor, graphics card etc)

Network Code Organization

- Most applications implemented as user space processes.
- Protocols are implemented in the system kernel.
  - Socket Layer
  - Protocol Layer
  - Interface Layer



Architecture



Data Transfer

- Digital Data (bits: 1’s and 0’s)
- Direct Memory Access (DMA)
  - Adaptor directly reads/writes host memory
- Programmed I/O (PIO)
  - CPU responsible for moving data between adaptor and memory

Links

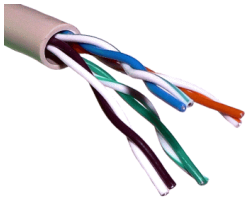
- Examples: Twisted Pair, Co-axial cable, Wireless
- Physical medium that propagates signals (electromagnetic waves)
- Wave: speed, frequency, wavelength

$$c = f * \lambda$$

(c is speed of light in the medium, ranges from $2*10^8$ to $3*10^8$ m/s)

Imperfect Physical Media

- Signal often made up of multiple frequency components
- Attenuation: Loss of energy over distance (expressed in dB/km)
  - Different frequencies experience different amount of loss
  - Often some frequencies are fully cutoff leading to link bandwidth
- Delay Distortion: Different frequencies propagate at different speeds
- Noise: Unwanted energy from other sources
  - Thermal Noise due to random motion of electrons
  - Crosstalk: Interference from adjacent transmissions



End Result: Received Signal is distorted

Decibels

- Ratio between two power quantities expressed in logarithmic scale
  - $10\log_{10}(P1/P2)$
- Example: 3dB/100m attenuation means P2 = P1/2 i.e. power reduced by half after 100m