USB2 Specification

- Reference: http://www.usb.org/developers/docs/
- Asynchronous Communication
- 4-wire connector
  - 2 wires for power
  - 1 twisted pair for signal
- Hosts and devices

USB2 Connectors

Host connector

Device connector
USB2 Speeds

- Three speeds are supported
  - High speed: 480 Mbps ±0.05% (500 ppm)
  - Full speed: 12 Mbps ±0.25% (2500 ppm)
  - Low speed: 1.5 Mbps ±1.5% (15,000 ppm)

USB2 Data Encoding

- Two levels are used
  - High state is called J
  - Low state is called K
- Idle is represented by a high (J) state
- Packets start with a sync pattern
  - High speed: 15 KJ pairs followed by 2 K's
  - Other speeds: 3 KJ pairs followed by 2 K's
- NRZI:
  - 1 represented by no change in level
  - 0 represented by a change in level
- Bit stuffing used for synchronization
  - a 0 is inserted after 6 consecutive 1's
  - guarantees a transition at least every 7 bit times
USB2 Packets

- Starts with 8-bit PID field including
  - 4-bit packet type
  - 4-bit checksum (one’s complement of packet type)
- Types of packets:
  - Token: contains address information
  - Data
  - Handshake
  - Special
- Addresses are 7 bits
- Data fields up to 1024 bytes
- All fields other than PID are checked with a CRC
  - Data packet CRC generator: $X^{16} + X^{15} + X^2 + 1$