

Universal Serial Bus (USB)

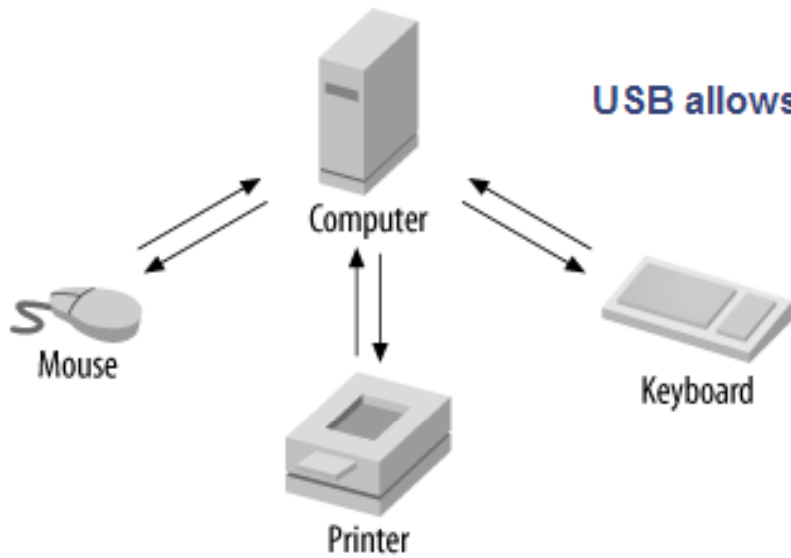
By:

Engr. Joseph Ronald Cañedo

Introduction to USB

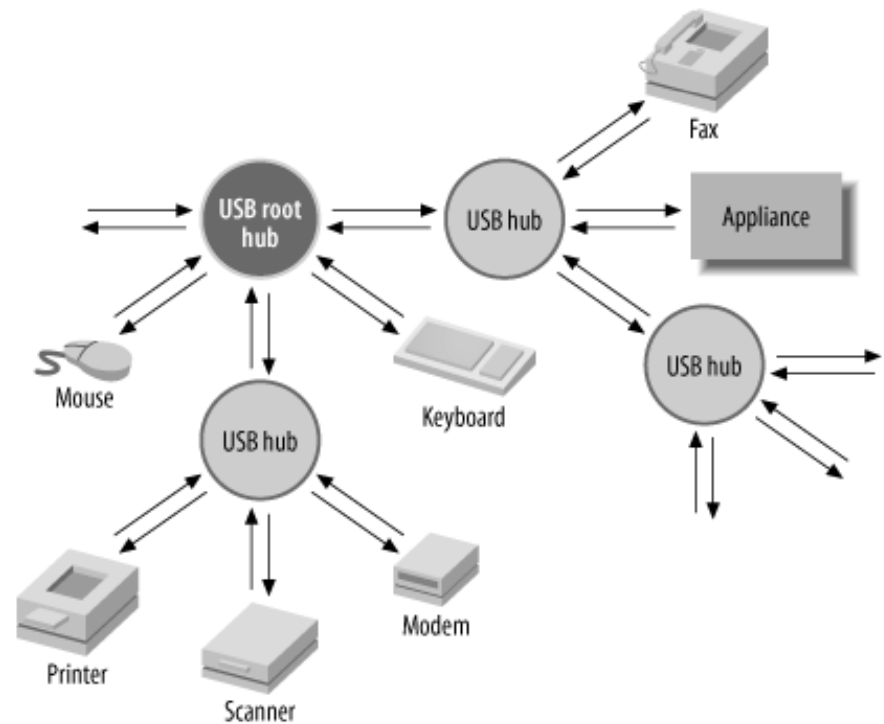
- There are two specifications for USB: USB 1.1 and USB 2.0.
- USB 2.0 is fully compatible with USB 1.1.
- USB supports data rates of 12 Mbps and 1.5 Mbps (for slower peripherals) for USB 1.1, and data rates of 480 Mbps for USB 2.0.
- Data transfers can be either isochronous or asynchronous

Introduction to USB



USB allows a host to connect with a variety of peripherals

USB is expandable using hubs



Introduction to USB

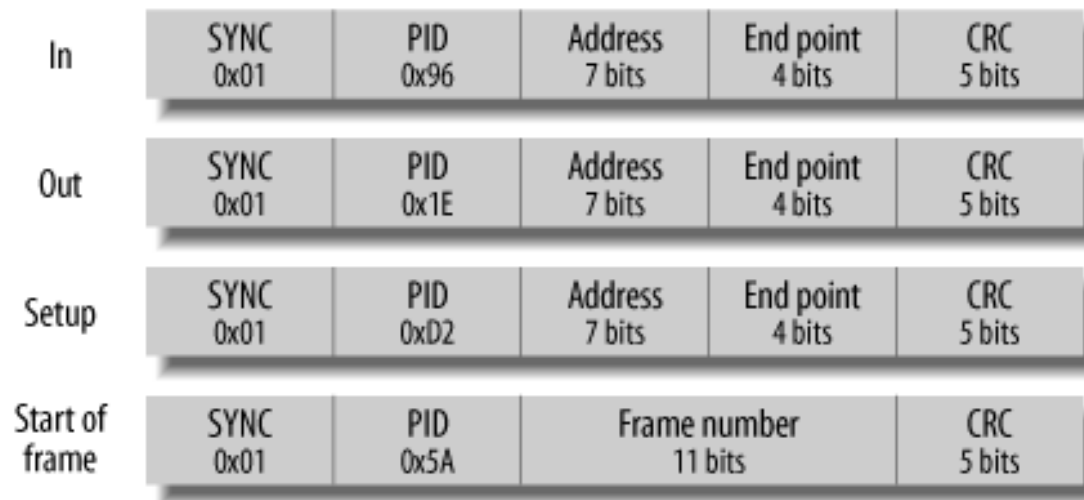
Class	Purpose
Audio	Audio and music devices, sound systems
Chip/smart card interface devices (CCID)	Smart card devices
Common class (CCS)	Generic devices
Communications device	Modems, telephones, and network interfaces
HID	<i>Human Interface Devices (HIDs)</i> such as mice and keyboards
Hub	USB hub
IrDA	Infrared devices
Mass storage	Hard disks, CD-ROMs, DVD-ROMs
Monitor	Computer monitors and display devices
Physical interface devices	Joysticks and other devices (such as motion platforms) that provide physical feedback
POS terminals	Point of Sale (POS) devices such as cash registers and EFTPOS devices
Power	Devices with power control or monitoring (battery backup and recharging, for example)
Printer class	Printers
Imaging class	Scanners and cameras

USB Packets

- There are four types of transfers that can take place over USB.
 - A control transfer is used to configure the bus and devices on the bus, and to return status information.
 - A bulk transfer moves data asynchronously over USB.
 - An isochronous transfer is used for moving time-critical data, such as audio data destined for an output device. Unlike a bulk transfer, which can be bidirectional, an isochronous transfer is uni-directional and does not include a cyclic-redundancy-check (CRC) field.
 - An interrupt transfer is used to retrieve data at regular intervals, ranging from 1 to 255 milliseconds.

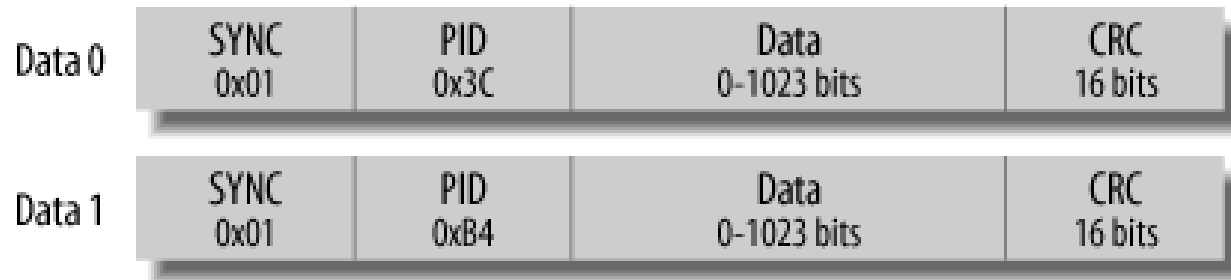
USB Packets

- USB packets can be one of four types:
 - token,
 - data,
 - handshaking, or
 - preamble.

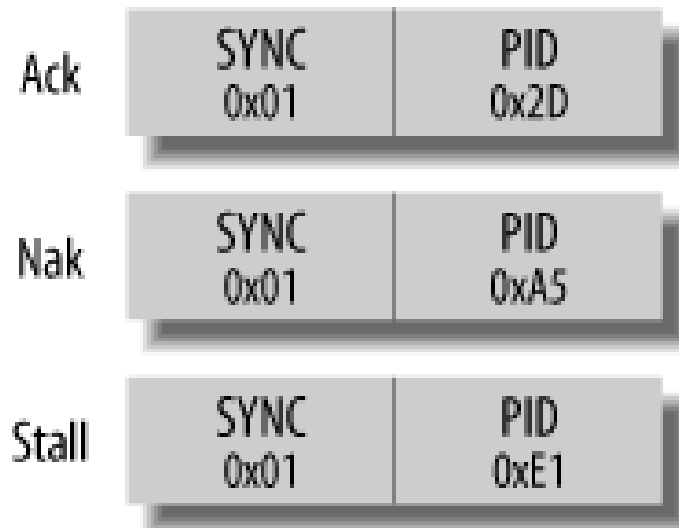


USB token packets

USB Packets



USB data packets



USB handshaking packets

Physical Interface

- USB uses a shielded, four-wire cable to interconnect devices on the network.

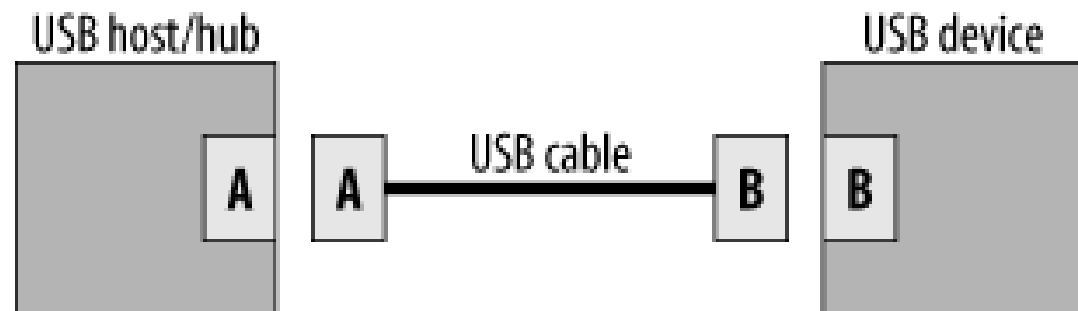
Connector pin	Signal	Purpose	Wire color
1	VBUS	USB device power (+5V)	Red
3	D+	Differential data line	Green
2	D-	Differential data line	White
4	GND	Power and signal ground	Black

Physical Interface

Series A plug and receptacle



Series B plug and receptacle



Implementing a USB Interface

- One possible solution to implementing USB in your embedded system is to use a USB-to-SPI bridge.

