

USB model

Wednesday, February 23, 2022 3:45 AM

Shared serial Bus

- Half Duplex
- Master Host, slave Devices
- one serial link.
- Data formatted in packets, header to ID
- Protocol takes care of bit error handling and correction.

Intelligent Host

- requires smart H/W & S/W
- schedules Traffic on bus
- implements sharing on bus based on need of each device.

ONLY ONE in a SYSTEM

Lightweight Devices

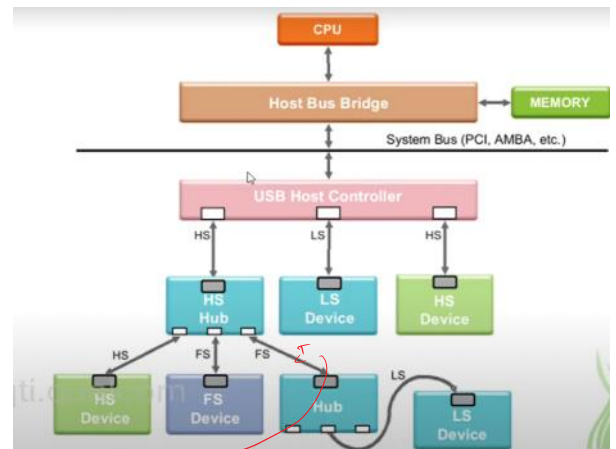
- only respond to request from Host
- low gate count (~7500 gates)
- small firmware.

Hub

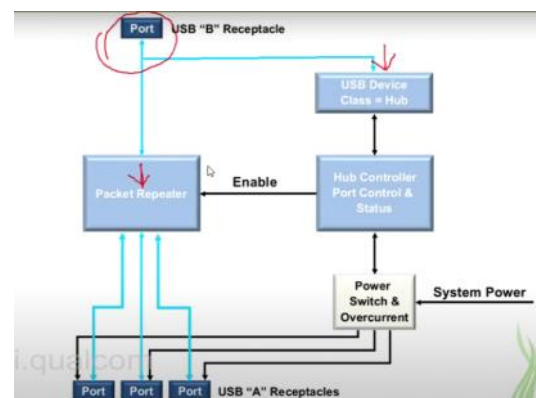
- managed by Host
- invisible for devices
- extending # of devices for Host (system)

Hubs

- special class of USB device.
- allows Host to broadcast packets downstream and [1] device to respond upstream.
- Isolates lower speed segments from Higher speed.
- Provide control to: Power on/off, reset/enable, suspend/resume, disable port on basis.
- Detects attach/detach, overcurrent events and some device problems
- Host polls each hub periodically to get status.



SW manages Bandwidth when there are multiple HS, FS and LS devices.
 I: HS hub buffers and slows down for FS & LS device



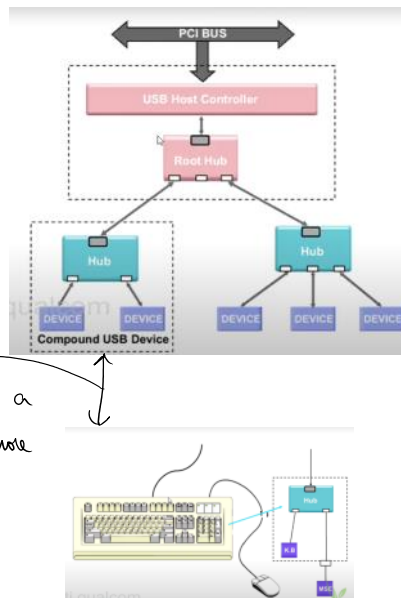
Root Hub

- usually Registers (memory mapped)
- SW can talk to it find device connection.
- Turn off power to port

External Hub-

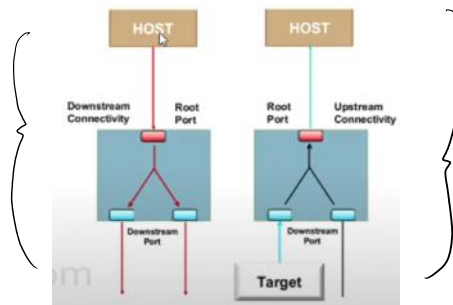
Hub

Compound USB device.
It is a device which has a hub inside to support more downstream devices



Hub Repeater

Host broadcast to devices via Hub



Host to receive data from single device (upstream connectivity)

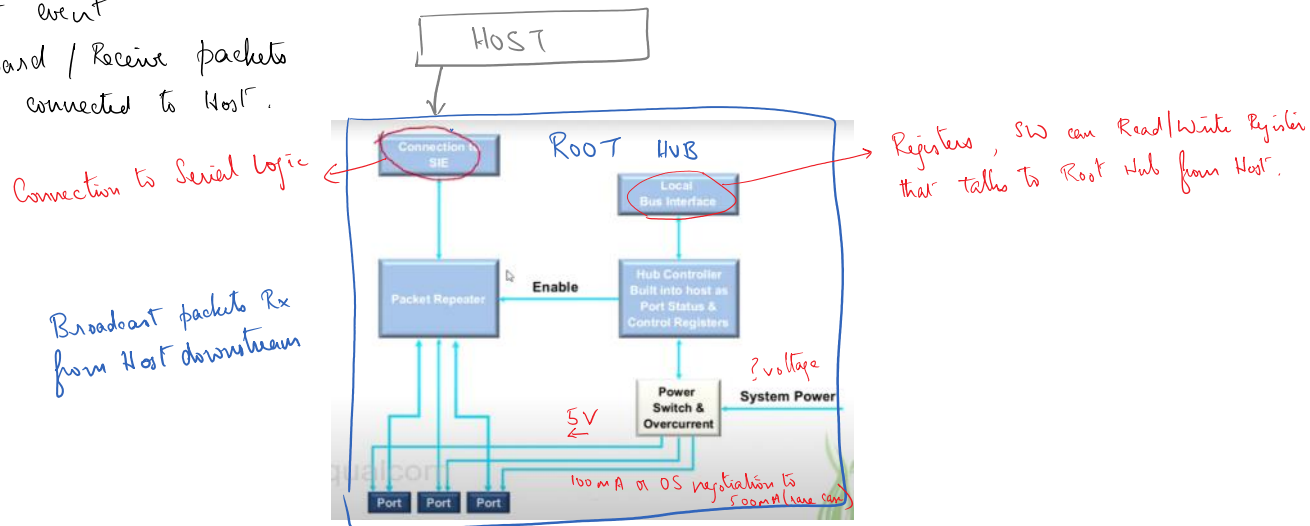
Host Controller / Root hub Roles.

IMP

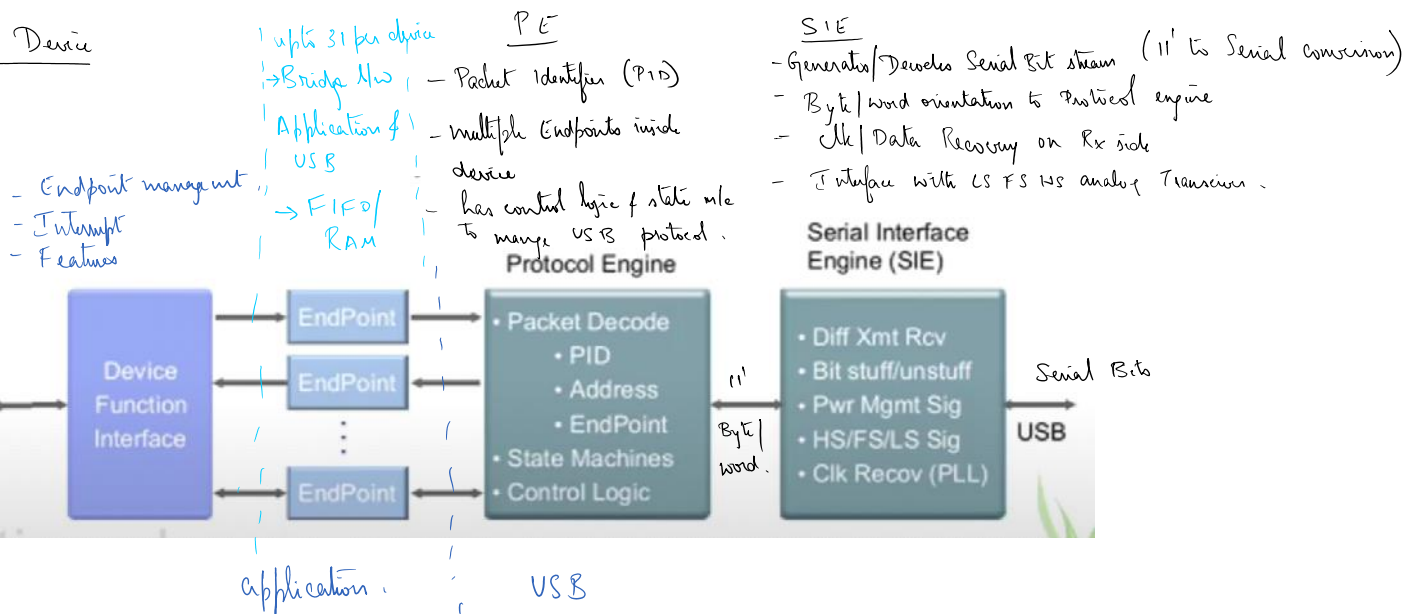
- 1) fetches and execute linked-list of transfer descriptors in memory.
 - Transfer descriptors move packets to specific device mentioned and then retrieve data
 - Direct Memory Access of data b/w target USB device and memory buffer specified within Transfer descriptors.
- 2) Host HW records errors and updates status.
 - stored in registers and Transfer descriptors.
 - issue interrupt to USB system software
- 3) Root Hub provides Expansion ports
 - detect event
 - Forward / Receive packets

HOST

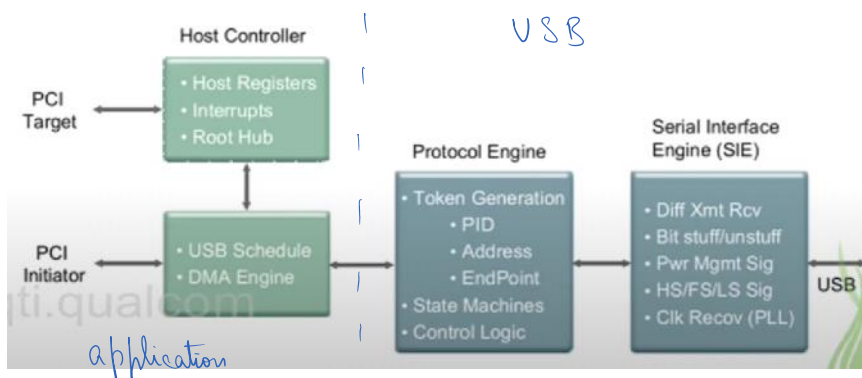
- 5)
- detect event
 - Forward / Receive packets
 - ports connected to Host.



USB Device



USB Host



SIE
similar to USB device

Protocol Engine
Similar to USB device PE but here it initiates transactions.

USB scheduler has algorithm to schedule USB Transaction.

USB description

all USB devices have hierarchy of descriptors which describe host information such as

- what the device is, who makes, versions supported, how many ways it can be configured, # of endpoints (types)

USB On The Go OTG

- wanted USB peer to peer but USB protocol doesn't allow. Then OTG was created.

