Remote Device Bay Architecture

Mu Afzal
Sanjay Agarwal
New Product Development
Texas Instruments Incorporated

Device Bay

THE BIG QUESTION

Do you want to add/remove/upgrade a computer peripheral as simple as changing a video cassette in your VCR?

Do you or What?

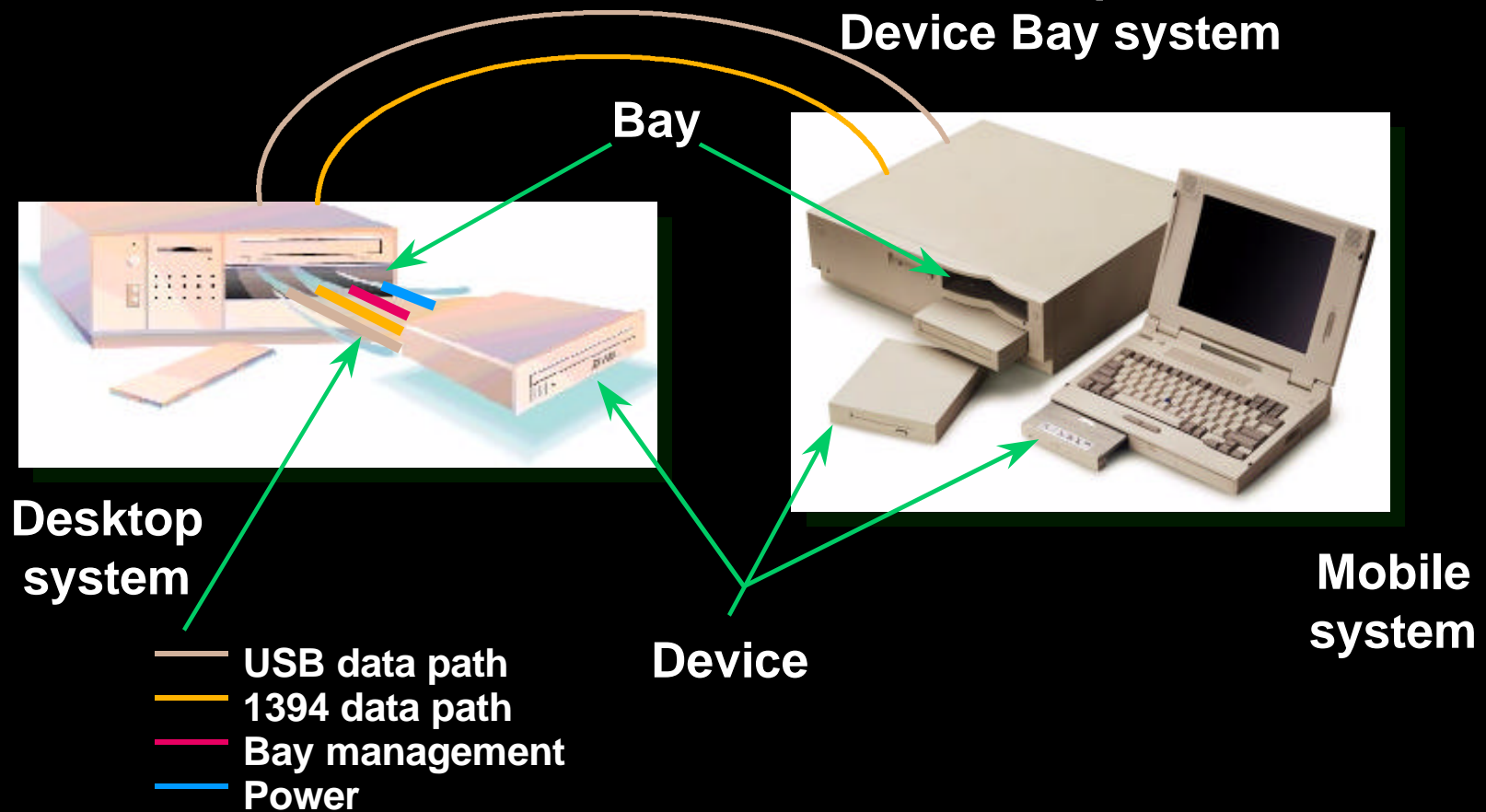# *Device Bay*
Agenda

- Concept
- Overview
- Buses
  - Power Buses
  - Data Buses (USB, 1394)
- DBC Implementation
  - ACPI
  - USB
- Software Pieces
- The Big Picture
- Conclusion

Device Bay
Concept

Remote/Expansion
Device Bay system

Bay

Desktop
system

Device

Mobile
system

— USB data path
— 1394 data path
— Bay management
— Power

Device Bay
Overview

- Open Industry Specification jointly developed by Compaq, Intel, and Microsoft

- Complete Architecture for adding and upgrading PC peripherals without opening the chassis

- Applies to all classes of computers including desktop, mobile, home, and Server machines

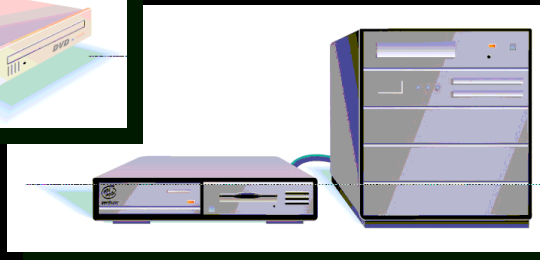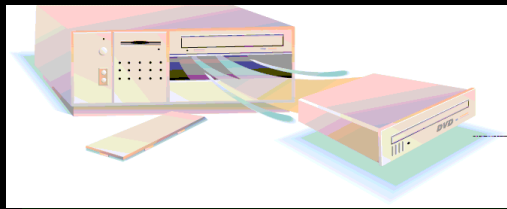- Device Bay is complementary to and coexists with USB & 1394 connectors

Device Bay
Overview

- Explicitly focused at but not limited to:
  - Storage Devices
    - HDD, Tape Backup, High-Density Floppy Disk Drives, CD-ROM, DVD
  - Communications and Connectivity
    - Modems, ISDN Adapters, LAN Cards, Cable IF
  - Security
    - Smart Card Reader, Encryption/Decryption Devices
- Memory and CPU are not supported

Device Bay
Overview

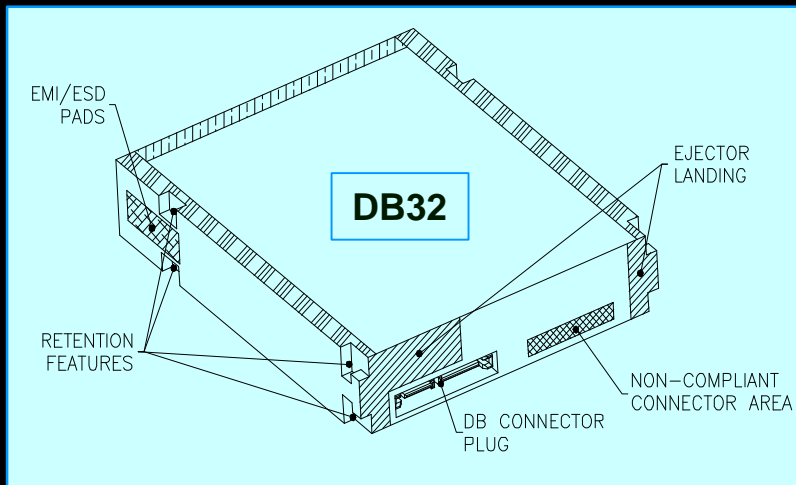- Specifies form factors, mechanicals, bus interfaces and OS behavior for device insertion and removal
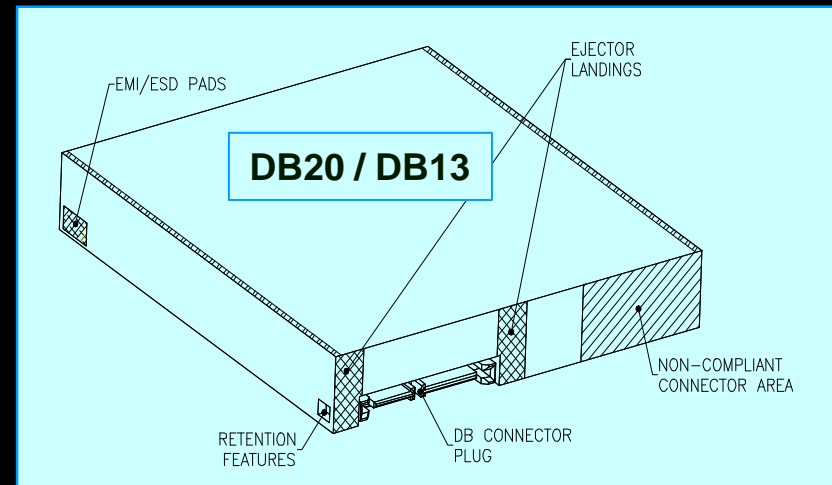
Key enablers:
- IEEE 1394
- USB

Device Bay
Form-Factors

Desktop

Mobile

DB32

EMI/ESD PADS

EJECTOR LANDING

RETENTION FEATURES

DB CONNECTOR PLUG

NON-COMPLIANT CONNECTOR AREA

DB20 / DB13

EMI/ESD PADS

EJECTOR LANDINGS

RETENTION FEATURES

DB CONNECTOR PLUG

NON-COMPLIANT CONNECTOR AREA

Device	Size (H x W x D)	Weight	Power
DB32	32.00 x 146.00 x 178.00	3.08 lb.	25 Watts
DB20	20.00 x 130.00 x 141.50	1.10 lb.	4 Watts
DB13	13.00 x 130.00 x 141.50	0.77 lb.	4 Watts

Device Bay
Connector

- Forty (40) Pin Blind Mate Connector
- Live Insertion & Removal by means of Staggered Mating Contact Pin Lengths
- High Durability (minimum of 2,500 cycles)

Signal Segment

Power Segment

Device Bay Overview

- Vid power: 1.5W at 3.3V
- Vop power:
  - DB32 - 30W, 12V, 5V & 3.3V
  - DB20 and DB13 - 4W, 5V, 3.3V
- Two (2) serial buses (1394 & USB)
- Mandatory Buses
  - Host: USB, 1394 (400 Mbit ports) and POWER Buses Vid, Vop
  - Device: Either USB, 1394 or both & at least Vid and Vop

- **Vid - Identification Voltage (3.3V)**

  - Powers the 1394 PHY and/or USB IF Logic

    - Used during Device Enumeration by the Host

  - If V(id) is Not Present then devices can not:

    - Pull any Power off any operating voltage

    - Respond to any 1394 or USB commands

  - Vid must be switched on a per bay basis by the Device Bay Controller

Device Bay
Vop Power Buses

- ## V(op) - Operating Voltages

  - ◆ V(12) (DB32 Form Factor Only)

  - ◆ V(5)

  - ◆ V(3.3)

  - ◆ Responsibility of the DEVICE to provide over-current and surge protection

Device Bay
USB

- Medium bandwidth bus (1.5 - 12 Mbps)
- Device Bay bay requirements
  - One USB port per bay
- Device Bay device requirements
  - Provide power requirement registers
  - Unique serial number
  - If Vop is used, it must be switched with configuration complete command

Device Bay
1394

- IEEE 1394 and future extensions:
    - High bandwidth bus - 100 - 3200 Mbps
- High performance peripheral bandwidth
- Plug & Play features
- Extensions of 1394 standard for different applications (Working groups)
    - Host Controllers
    - AV Applications (e.g., Digital Cameras)
    - Other industrial

- Device Bay bay requirements:
  - One (1) 1394 port per bay
  - Must support 400Mbps minimum
- Device Bay device requirements:
  - Devices can use 100 - 400Mbps
    - Highest rate - Minimize BW requirements
  - Provide power requirements register
  - If Vop is used, it must be switched with start/stop unit command

Device Bay

DBC Implementations

- For suggested implementation, refer the section six (6) of Device Bay spec.

- DBC manages all bays
  - Maintains bay status
  - Detects device insertion/removal
  - Enables Vid (enumeration power to the device)
  - Detects user removal requests via optional bay mounted push buttons

Device Bay

DBC Implementations

- Minimum Requirements:
  - Power control
  - Insertion/Removal events
  - Software-controlled interlock mechanism
  - 1394 PHY & USB port mapping
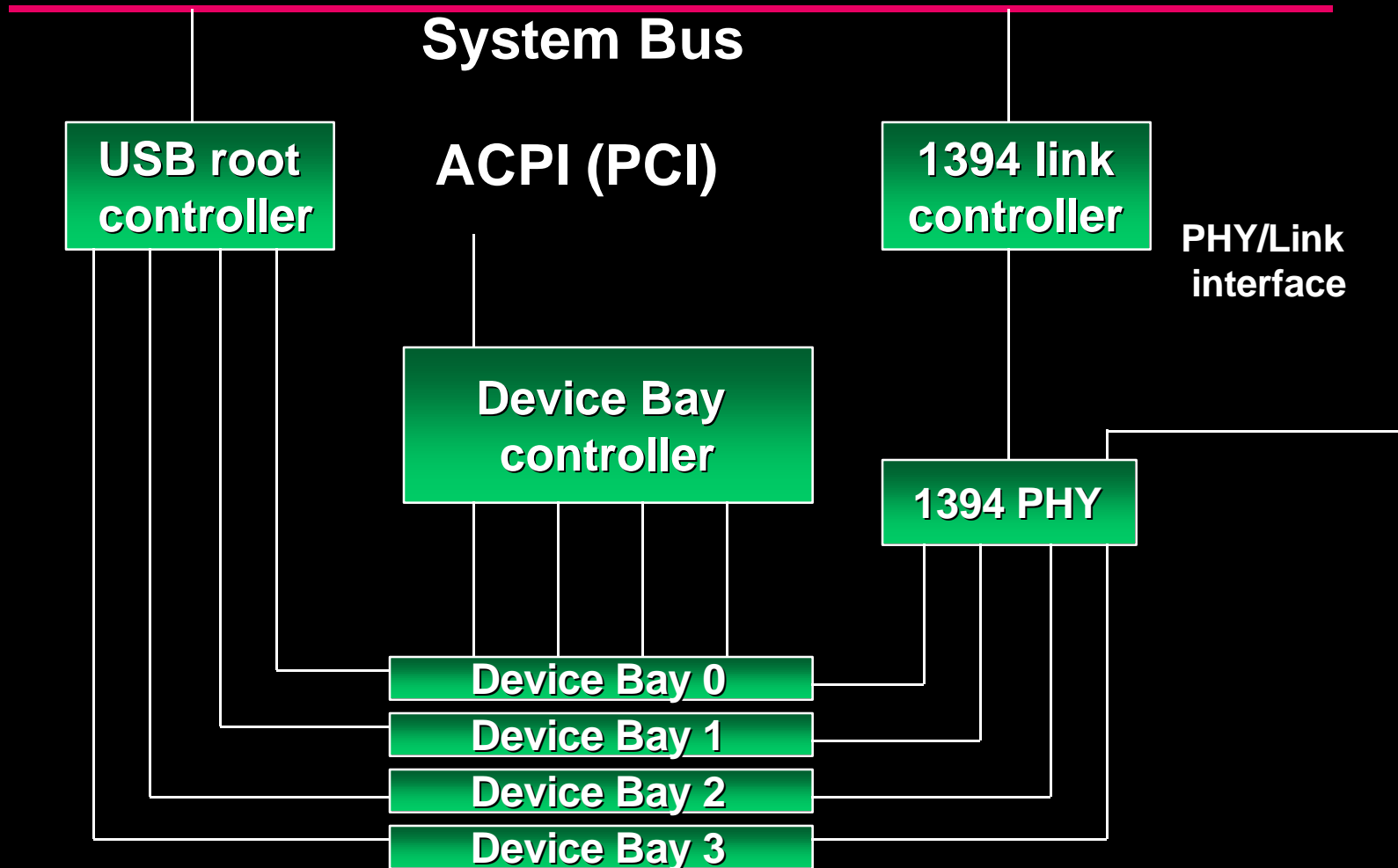- Two (2) possible implementations
  - ACPI
  - USB

Device Bay

ACPI Based DBC Implementation

- ACPI name space and control methods describe the DBC implementation

- Can reside on a bus like PCI, I^{2}C, SMBus

- No physical connection between DBC and PHY

- DBC data structures implemented as a register set

Device Bay
ACPI Based DBC Implementation

System Bus

USB root controller

ACPI (PCI)

1394 link controller

PHY/Link interface

Device Bay controller

1394 PHY

Device Bay 0

Device Bay 1

Device Bay 2

Device Bay 3

Device Bay

USB Based DBC Implementation

- DBC implemented as a USB function

- Connected to the USB hub

  - ◆ Can be integrated into the hub as an embedded function

- Self-powered or bus-powered USB device

- Communicates with system via USB control and interrupt endpoints (pipes)

- DBC descriptors accessed using USB DBC class-specific requests

Device Bay

USB Based DBC Implementation

- DBC descriptors contain info about
  - ◆ Bay control
  - ◆ Bay status
  - ◆ DBC capabilities
- Must have simple Link controller to communicate with a 1394 PHY
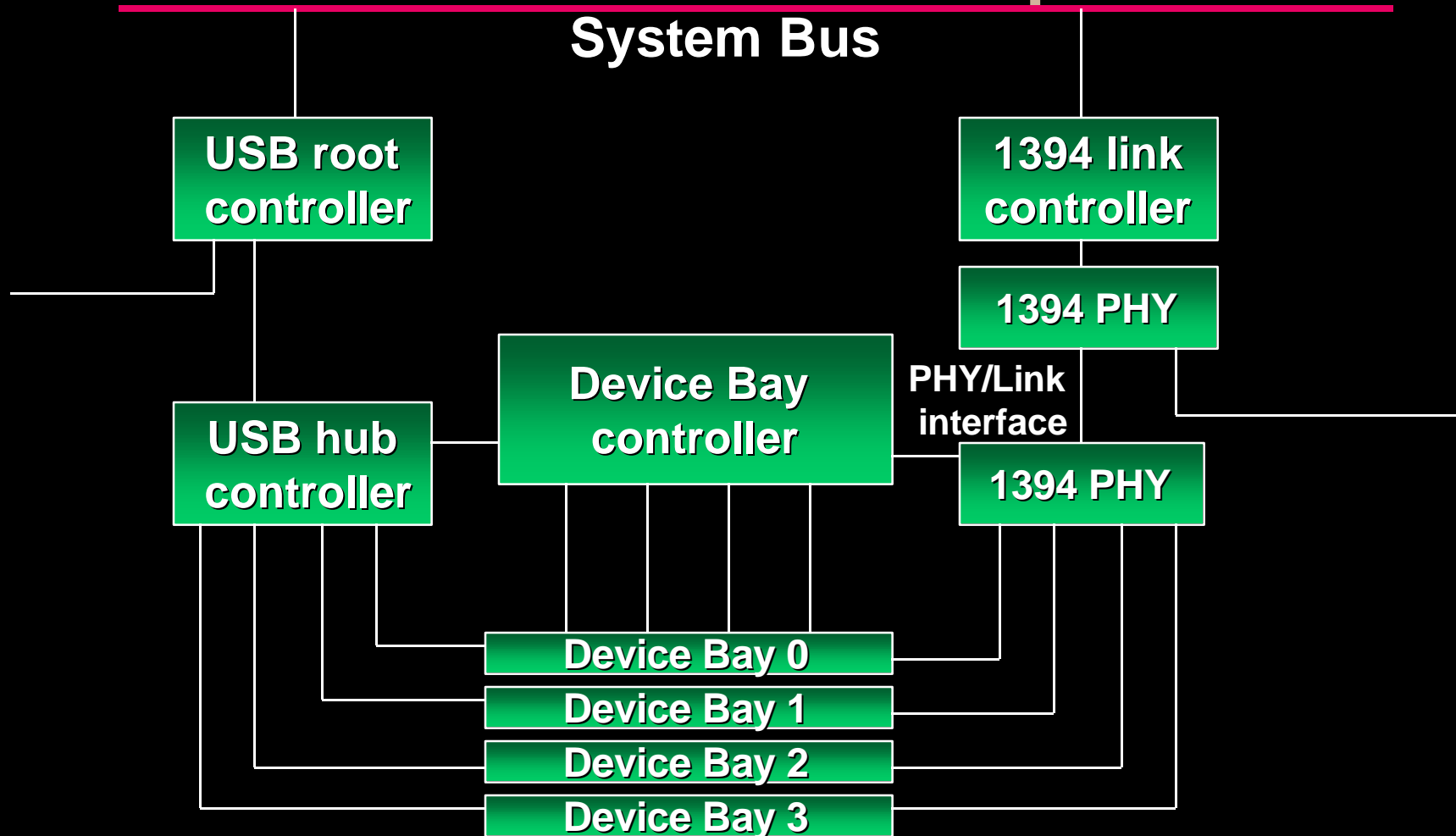- Walk-up ports can be connected to the same USB hub or 1394 PHY that is connected to the bays

Device Bay
DBC Link Controller

- Supports a 400Mbps PHY/Link Interface

- Asynchronous transaction capable

- Isochronous Resource Manager (IRM), Cycle Master, and Bus Manager capability not required

- Minimal CSR and Configuration ROM space

  - General ROM format required

Device Bay

USB Based DBC Implementation

System Bus

USB root controller

1394 link controller

1394 PHY

Device Bay controller

PHY/Link interface

USB hub controller

1394 PHY

Device Bay 0

Device Bay 1

Device Bay 2

Device Bay 3

Device Bay
The Software Pieces

- Universal Serial Bus Driver (USBD)
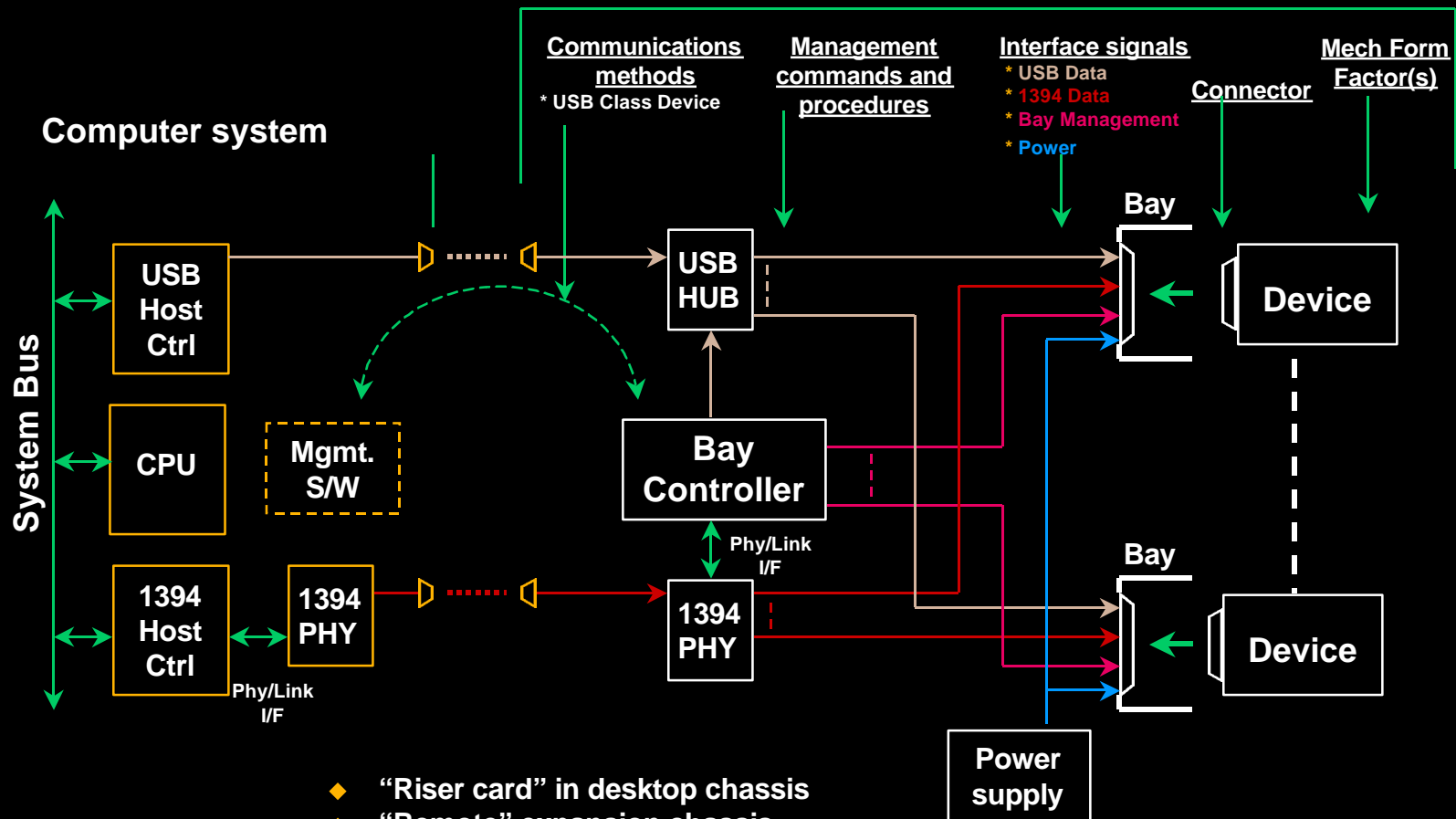- USB OHCI/UHCI port driver
- 1394 bus driver
- 1394 OHCI port driver
- DBC driver

- DBC must verify several things before turning on Vid, after an insertion event:
  - Verify the Bay is enabled to take devices
  - Verify there is 1.5W in the power budget
  - Wait for the device to settle down and become fully latched on the connector before enabling power

Device Bay

USB Based DBC System

Device Bay standard

Communications methods
* USB Class Device

Management commands and procedures

Interface signals
* USB Data
* 1394 Data
* Bay Management
* Power

Connector

Mech Form Factor(s)

Computer system

System Bus

USB Host Ctrl

CPU

Mgmt. S/W

1394 Host Ctrl

1394 PHY

Phy/Link I/F

USB HUB

Bay Controller

1394 PHY

Phy/Link I/F

Bay

Device

Bay

Device

Power supply

- "Riser card" in desktop chassis
- "Remote" expansion chassis
- Monitor with Device Bay capability
- "Docking Station" for mobile platforms

Device Bay
TI's Remote DBC

- Remote DBC as a USB function

- Six (6) port USB Hub

- 1394a compliant PHY/Link interface

- General purpose micro-controller

- Two wire serial bus master/slave interface

- Supports four (4) bays with bay status indicator LEDs

- Security lock status

- Programmable solenoid control

Device Bay
Contact Info.

- TI's DBC Contact: Cecelia Smith

  - email : cecelia@ti.com

- Mu Afzal : mafzal@ti.com

- Spec is at www.device-bay.org

- Private questions: devicebay@acmenet.com

- Public: Send "subscribe device_bay" to majordomo@europa.com

- USB DBC Spec. white paper on www.microsoft.com/hwdev

Device Bay

QUESTIONS AND ANSWERS