

USB Type-C Interconnect and Power Delivery

Let MindShare Bring “USB Type-C Interconnect and Power Delivery” to Life for You

This introductory course is primarily concerned with topics described in two documents: *USB Type-C Cable and Connector Specification* and the *USB Power Delivery Specification*. The USB Type-C connectors address several limitations of traditional USB Type A and Type B connectors related to size, mechanical reliability, and the need to maintain proper cable and plug orientation. Type-C connector and cables have no required orientation and support USB 2.0, USB 3.1, as well as sideband signals for communications, audio, HDMI, or other purposes. In addition, Type-C brings a new set of power delivery capabilities as defined in *USB Power Delivery Specification*, including negotiated switching of upstream/downstream port roles and the device responsible for sourcing VBUS power.

Who Should Attend?

This one-day course is designed with hardware, software, and validation engineers in mind. Major features of Type-C connections and USB power delivery are summarized.

Course Length: 1 Day

Course Outline:

Part 1: USB Type-C Interconnect

- Evolution of USB Cables, Speed and Power
 - New USB Type-C cables and Receptacles
 - Smaller, Thinner, Lighter Receptacles, Plugs & Cables
 - Higher Speeds: USB 3.1 Gen 1 (5Gb/s) and Gen 2 (10Gb/s)
 - Power Distribution—Ranging from 5V@100 mA (5W) to 20V@5A (100W)
- Introduction to USB Type-C Interconnects
 - USB Type-C Receptacle
 - USB Full-Featured Type-C Plug
 - Flexible Cable and Plug Orientation
- USB Type-C Receptacles, Plugs and Cables
 - USB Full-Featured Type-C cable and Type-C plugs at both ends, for USB 3.1 and full-featured applications
 - USB 2.0 Type-C cable with a USB 2.0 Type-C plug at both ends for USB 2.0 applications
 - Captive cable with either a USB Full-Featured Type-C plug or USB 2.0 Type-C plug at one end
 - USB Type-C to USB Legacy Cables/Adaptor (7 Cables/2 Adapters)
- Summary of Type-C Functional Characteristics
 - Signal Group Summary
 - Special Considerations For USB 3.x Hubs Supporting Type-C
 - No Implementation or Forwarding of Alternate Modes or Accessory Mode Traffic
 - No SBU Signal Support (on any port)
 - Must Implement an UFP with Charging Capability (Can Source VBUS)
 - No Dual Role Port Support on Hub DFP
 - Chargers
- Functional Extensions
 - Billboard
 - Alternate Modes
 - Audio Adapter Accessory Mode

Part 2: USB Power Delivery (PD)

- Overview
 - Provides For Port Negotiation of Voltage/Current and Power Direction
 - USB Power Delivery Devices
 - PD Source/Sink Definitions
 - Services Provided By Cable PD Electronics
 - Default USB Power Delivery Used Initially
- Power Delivery Profiles
 - Defined for VBUS Source
 - Standardizes Number of Valid Voltage/Current Ranges
 - The Five Defined PD Profiles
- PD Layered Communications Stack Overview
 - System Policy Manager
 - Device Policy Manager
 - Policy Engine
 - Protocol Layer
 - Physical Layer
- Discovery of Power Delivery Capabilities
 - For the PD Cable
 - For the Facing Port
- Power Delivery Contract Overview
 - Explicit Contracts
 - Implicit Contracts
- Power Delivery (PD) Messages
 - Needed for Port-to-Cable Plug Communications
 - Needed for Port-to-Port Communications
 - SOP Communications Model
 - Signaled Using VBUS BFSK or CC (Communication Channel Wire)
 - VBUS BFSK and CC Signaling Basics
 - PD Control Messages
 - PD Data Messages
- Establishing An Explicit Power Delivery Contract
 - General Downstream Facing Port (DFP) and Upstream Facing Port (UFP) Behavior
 - The Sequence of Events
 - At Attachment
 - Detecting Cable capabilities
 - Establishing Power Delivery (PD) Connection
 - Negotiating a Contract
- While The Explicit Power Delivery Contract Is In Effect
 - Messages and Responses Exchanged
 - Power Role Swap
 - Ping
 - Errors, Reset, Other Special Cases
- USB Interface Required To Manage Power Delivery
 - Allows System to Fetch Power Delivery Capabilities and Dynamic Status Information
 - System-level Coordination of USB Power Delivery
 - A Number of new *PDUSB* Descriptors and Requests needed for PD-capable Peripheral Devices and Hubs
 - Two Special Hub Class Requests enable Host to Request PD Port to Send/Receive a Vendor Device Message (VDM) using SOP Signaling

Recommended Prerequisites: Background in USB 3.1 protocol is required.

Course materials:

Students will be provided with:

1. An electronic (PDF) version of the presentation used in class
2. An eBook (PDF) copy of MindShare's **USB 3.0 Technology** book by Don Anderson and Jay Trodden