

USB 3.2 Update Course

Training

Let MindShare Bring The New USB 3.2 Enhancements To You

The USB 3.2 specification carries forward the dual bus topology introduced in the earlier USB 3.x specifications. The dual bus model provides for a legacy USB 2.0 interface coexisting side-by-side with a SuperSpeed interface on the same physical connection. Compliant cables, plugs, and receptacles support both sets of signals. At attachment, peripheral devices connect to a host or external hub port using only one of the interfaces. Attachment is made at the highest performance protocol/speed supported by the two link partners. Hubs connect upstream using both interfaces. If both upstream connections are successful, the hub will be prepared to handle a mix of USB devices attached to its downstream facing ports.

One of the most significant USB 3.2 enhancements is the option for *dual-lane* traffic on the Enhanced SuperSpeed (ESS) interface. Prior to USB 3.2, all generations of USB were based on single-lane serial bus communications. SuperSpeed and SuperSpeedPlus as defined in the USB 3.1 specification is a dual-simplex connection with one differential signal pair for each direction (Tx/Rx). With USB 3.2 dual-lane signaling uses two differential pairs in each direction.

USB 3.2 compliant hosts, hubs, and peripherals, now support four signaling options: single-lane Gen 1 (Gen 1x1), single-lane Gen 2 (Gen 2x1), dual-lane Gen 1 (Gen 1x2), and dual-lane Gen 2 (Gen 2x2). Note that here are still just two speeds: 5 Gb/s Gen 1 and 10 Gb/s Gen 2 but, with Gen 2x2, the peak link bandwidth is now 20 Gb/s. The USB 3.2 transition to dual-lane signaling was vastly simplified by the fact that the USB Type-C (USB-C) port already has two sets of SuperSpeed differential Tx/Rx signals in the receptacles, plugs, and cables. The legacy USB Type-A/Type-B connector and cable environment only has one set of SuperSpeed differential Tx/Rx signals and dual-lane signaling is not supported at either Gen 1 or Gen 2 rates.

If a USB 3.2 link is in single-lane mode (Gen 1x1 or Gen 2x1), protocol rules are much the same as they are for USB 3.1. On the other hand, USB 3.2 dual-lane operation requires byte/block striping across lanes, lane skew considerations, dual-lane link training, changes to link level flow control and error handling, and has other minor and major impacts to normal single-lane SS/SSP protocol rules. The USB 3.2 specification also defines several new requirements for USB 3.2 hubs to accommodate the new upstream and downstream link configurations (Gen 1x2 and Gen 2x2) and required hub support for Precision Time Management (PTM).

In each section of the course, USB 3.2 single-lane protocols (Gen 1x1 and Gen 2x1) are covered first, followed by changes/impacts if the link is operating in dual-lane mode (Gen 1x2 and Gen 2x2).

Who Should Attend?

This course is designed with hardware, software, and validation engineers in mind. The assumption is that attendees have some background in USB 3.0 or USB 3.1 protocol.

Course Length: 1 Day

USB 3.2 Update Course Outline:

- USB 3.2 Basics
 - Background
 - Some Definitions
 - The Dual-Bus Topology
- USB 3.2 The ESS Signal Interface (Receptacles/Plugs/Cables)
 - Type-A/Type-B Single-Lane Interface
 - USB-C Single-Lane Interface
 - USB-C Dual-Lane Interface
- USB 3.2 ESS Protocol Layer
 - End-to-End Protocol: Gen 1x1 and Gen 1x2
 - End-to-End Protocol Differences: Gen 2x1 and Gen 2x2
- USB 3.2 ESS Tx/Rx Link Layer
 - Link Layer: Gen 1x1
 - Link Layer Differences: Gen 1x2
 - Link Layer: Gen 2x1
 - Link Layer Differences: Gen 2x2
- USB 3.2 ESS Tx/Rx Physical Layer
 - Physical Layer: Gen 1x1
 - Physical Layer Differences: Gen 1x2
 - Physical Layer: Gen 2x1
 - Physical Layer Differences: Gen 2x2
- USB 3.2 Link Training
 - SuperSpeed Gen 1x1 Link Training
 - SuperSpeedPlus Gen 1x2 Link Training Differences
 - SuperSpeedPlus Gen 2x1 Link Training
 - SuperSpeedPlus Gen 2x2 Link Training Differences
- USB 3.2 Hubs
 - USB 3.2 Hub Key Features
 - Deferred Transactions
 - SS Hub Architecture
 - SSP Hub Architecture
 - Precision Time Management (PTM)
- Other USB 3.2 Features

Recommended Prerequisites: background in USB 3.0 or USB 3.1 protocol.

Course materials:

Students will be provided with:

1. An electronic (PDF) version of the presentation used in class

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