cādence®

SpeedBridge Adapter for USB 3.0 Devices

Rapid system-level verification deployment

The Cadence® SpeedBridge® Adapter for USB 3.0 Devices is a pre-validated system-level emulation solution that allows a USB 3.0 device emulated in a Cadence Palladium® XP series system to interface with a standard PC. It enables rapid deployment of high-performance system-level emulation and makes it possible to co-verify hardware and software with applications running on an OS using the standard USB 3.0 software stack, dramatically improving verification productivity. It provides the highest performance USB 3.0 solution for emulation, leveraging an independent data channel to the emulator per USB 3.0 port.

Pre-Validated, Off-the-Shelf Emulation Solution

USB 3.0 has become the world standard in connecting peripherals and mobile devices to PCs. An off-the-shelf emulation solution for USB 3.0 designs, the SpeedBridge Adapter for USB 3.0 Devices offers fast bring-up times, a fast path to a sophisticated verification platform, and an easy connection to modern desktop and server-class PC systems running a variety of standard operating systems (OSs).

The SpeedBridge Adapter for USB 3.0 Devices uses an industry-standard Extensible Host Controller Interface core (xHCI) found in modern desktop PC and server systems. The xHCI runs at emulation frequencies and communicates with the desktop PC across a standard PCI bus. The adapter enumerates as a standard USB 3.0 xHCI host controller to the operating system and, therefore, does not require custom drivers. The USB 3.0 device under verification can be connected to the xHCI controller in the SpeedBridge Adapter, and will be enumerated by the system OS through the adapter. USB 3.0 device drivers

Figure 1: Cadence's SpeedBridge Adapter for USB 3.0 Devices enables high-performance emulation system verification

can be installed on the system and the system OS will then have full access to the USB 3.0 device using standard software APIs and across the standard USB 3.0 PIPE interface.

Using a standard digital PIPE interface that would normally connect to a USB 3.0 PHY transceiver, you can connect the SpeedBridge Adapter for USB 3.0 Devices to the device under test compiled for the Cadence Palladium XP series system verification computing platform. The SpeedBridge Adapter provides the necessary virtualization of the USB 3.0 transceivers so that a USB 3.0 device design mapped into a Palladium XP platform will connect and configure in a normal

manner as if a real transceiver were being used. The adapter connects directly to a Palladium XP system through standard emulation cables. The SpeedBridge Adapter transparently buffers the speed difference between the design mapped into the Palladium XP platform and the PC system: this means that the design and the PC system are both unaware of the speed differences and can use standard USB protocols to communicate.

With the extremely high speed of emulation available through the Palladium XP series platform, the USB 3.0 design can be co-verified in an environment that includes the

USB 3.0 device hardware design, the embedded device firmware, the low-level device driver, and the device application software running on top of the standard OS USB host software stack. See Figure 1 for a depiction.

The USB 3.0 system environment includes a complex interaction of different layers of software and hardware, and the SpeedBridge Adapter allows you to debug and verify at many different nodes in the environment. For example, the inclusion of the entire USB 3.0 software stack in the environment means that software engineers can install kernel-level OS software debuggers, along with third-party software packet analysis software to debug issues in the device drivers. The application software engineers can be running standard software debuggers to debug their application software. Firmware engineers can run low-level GDB debuggers on the firmware running in the mapped design in the Palladium XP series system.

In addition to the extensive software debugging that is enabled by the SpeedBridge Adapter, Cadence also provides tools to capture hardware-level PIPE streams of data that can be loaded into industry-standard third-party protocol analyzer software. This allows detailed protocol analysis of huge streams of packets flowing upstream and downstream between the Palladium XP series platform and the PC system. Once issues have been identified in the large, complex streams of data, it is then straightforward to use the extensive, full-vision design debug capabilities of the Palladium XP series system.

Benefits

High-end verification performance

- Offers highest verification performance over all other methods without abstracting out critical portions of a real system

- Offers high-end verification performance that does not scale down the verification performance when used with multiple ports or multiple interconnect technologies, unlike virtualized setups that compromise speed by sharing a single connection channel for each additional port

- Provides the fastest overall system-level verification performance when running a complete top-to-bottom real system environment

Offers rapid verification deployment

- Provides a pre-validated emulation interface fully compatible with the Palladium XP series

- Enables rapid creation of system-level environments using the same hardware and software that the real silicon will use

Enables verification IP reuse

- Built around standards-compliant interfaces, it can be reused between projects

- Eliminates re-implementation of custom per project verification environments

- Improves productivity by getting the design running quickly without weeks or months of specialized test environment creation: the PC system is the test environment

- Allows use of standard third-party protocol analysis software

Ensures quality

- Tested and verified by Cadence against independent verification IPs and other user designs

- The xHCI core is built on top of mature SpeedBridge technology that has been deployed in many emulation environments over many years; this includes PCI™ and USB 2.0 products

- Cadence-provided solution lets you verify your design quickly and efficiently

Reduces system risk

- Performs PIPE interface testing at the physical level

- Runs full system enumeration connected to a real PC chipset running a real OS with a full USB software stack
  - Does not abstract away low system-level connection issues that arise with real chipsets
  - Does not abstract away the real enumeration sequence of different OSs

- Directed random testing is a vital and necessary part of modern system verification, but it is not sufficient: the SpeedBridge Adapter runs the entire system-level suite, just as the design silicon will have to do when it is deployed

- Allows interaction with multiple system-level interconnects such as PCIe® and Ethernet, all in the same verification environment and without impacting performance

Features

- Remotely configurable using embedded network connected SpeedBridge Configuration Module (SCM) (included with each adapter)

- Supports standard SuperSpeed PIPE interface as described in: PHY Interface for PCI Express® and USB 3.0 Architectures Version 3.0

- Standard 32-bit/16-bit PIPE Interface

- Connects to emulator using a 200-pin to LFH cable

- The PIPE interface presented to the compiled design looks like a standard USB 3.0 PHY

- The SpeedBridge models a virtual back-to-back SuperSpeed PHY connection to the host controller in the SpeedBridge Adapter

- The host controller has a xHCI USB 3.0 register set

- Supports standard Microsoft Windows 8 USB 3.0 driver stack for xHCI

- Supports other OSs, including Linux RHEL and Ubuntu

- Supports CONTROL, BULK and INTERRUPT endpoint transactions

- Supports standard transaction packets (tp), data packets (dp), and link management packets (LMP)

- Supports standard LTSSM link training

- Full support for all USB 3.0 power modes: U0, U1, U2, U3

Cadence Services and Support

- Cadence application engineers can answer your technical questions by telephone, email, or Internet—they can also provide technical assistance and custom training

- Cadence certified instructors teach more than 70 courses and bring their real-world experience into the classroom

- More than 25 Internet Learning Series (iLS) online courses allow you the flexibility of training at your own computer via the Internet

- Cadence Online Support gives you 24x7 online access to a knowledgebase of the latest solutions, technical documentation, software downloads, and more

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