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Simulating a Boundary Scan Device

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- Boundary scan as defined by IEEE 1149.1 is used in a variety of components to assist in printed circuit board test and software installation.
- The eightolives' Workspaces Desktop tool has various features to allow you to simulate these devices in an external simulator using VHDL models or in the tool's Waveform Viewer tool.
- You can run a simulation demo that demonstrates these concepts.

eightolives.com The Simulation Approach

- Boundary scan involves a serial protocol that allows external test equipment to capture and observe device inputs, control device outputs and interact with the device for operations such as programming the device with software.
- Vendors provide Boundary Scan Description Language (BSDL) files for their parts. These files contain the information necessary to describe how to interact with the Boundary Scan logic.
- The eightolives' Design Tool creates a structural model of the device based on the BSDL file. The tool also provides simulatable models of the parts used in that structure.

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Boundary Scan Model for Simulation



The Design Tool creates the simulatable structure when you open a vendor's BSDL file for the part.

You can save the structured design in VHDL for use in third-party simulators. Copyright © 2013 William Kaupinis All Rights Reserved

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You can get Workspaces Desktop from the eightolives web site at http://www.eightolives.com

- Workspaces Desktop provides a tool suite that helps you in digital design.
- The Design Tool lets you input, create and manipulate VHDL designs.
- Other tools support Javascript scripting, simulation, inventory, requirements, process, encryption and test.
- The tool deals with files of type .vhd, .sdf, .edf, .vcd, .bsdl, .js

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eightolives.com You can run this demonstration

- From the Workspaces Desktop's Bookmark tool:
 - Open the Resources folder, then the Examples sub-folder
 - Double click the entry: "Demo Simulating a Boundary Scan Device"
- The demo script will open the Design Tool, load a BSDL file for a T.I. Sn74lvth18502a transceiver, load simulatable models from eightolives' Sim_Library, load Javascript ScriptableArchitectures for a few components, invoke the Waveform Viewer tool, and load a VCD file containing stimulus waveforms for simulation.
- To run the simulation in the Waveform Viewer:
 - Click the "+" button (Adds the stimulus waveforms to the sim queue)
 - Click the ">>" button to run the sim

When you run the demo, you see:

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Home • - × 📅 Bookmarks Waveform Viewer sn74lvth18502a rd' 🛛 r 🛛 🖂 File 🗂 Design Tool File Edit View Tools Simulate Preferences Help 2 File View Report Preferences Help JF ↑ 0 fs 0 н L. z л **N**4 2 us 1 × DesignSpace Element: TOP.sn74lvth18502a ⇒ Waveform Signal Value 1 URI: 🔶 🧰 Libraries ۲ NC << R http://www.eightolives.com/dd 🔶 🕨 New Project TDO Ζ This model is PRIMITIVE true TDI 0 Elements × ÷, Current Architecture: Bounda TMS sn74lvth18502a << +тск 0 Generics Available architectures: TRST < » Ports Default BYPASS 0 **9** Architectures BoundaryScanDevice > IDCODE > *** Default U IR -- Components of sn74lvth18 1 >> CLOCKDR BoundaryScanDevice BC 7 **0**36 ٠ Δ SHIFTDR lo Components BC 1 @12 UPDATEDR ×c 4 Signals sn74lvth18502a internal CLOCKIR 0 Sim 🖕 🕨 Instances SCAN CONTROL sn74lvth18 Scri ⇒ SHIFTIR 0 Logic Expressions INSTRUCTION DECODER sn74 UPDATEIR well one shot startup @1 ⊢ 🧰 BC 1 ISR 00000001 sim StateString CAPTURE IR + a1 <mark>≻ 🗀</mark> вс 7 CELL IN U. Win 🚞 one shot startup Cursor 1: 13793090 fs Cursor 2: 0 ns Delta: 13793090 fs TOP.U2. StateString = CAPTURE IR • 🦳 Command Processor http://www.eightolives.com/docs... 🖬 🔟 🔟 🦳 Command Processor http://www.eightolives.com/docs... 🖬 🗹 🛛 Command Processor http://w File Ops Templates Preferences Help File Ops Templates Preferences Help File Ops Templates Prefere Try executing http://www.eightolives.com/docs/Workspaces/DesignTool/Demo Try executing http://www.eightolives.com/docs/Workspaces/DesignTool/De 💧 Try executing http://www.eightolives /bs demo/SCAN CONTROL sn74lvth18502a_architecture.js mo/bs demo/boundaryscandemo.js /bs_demo/INSTRUCTION_DECODER_s runscript http://www.eightolives.com/docs/Workspaces/DesignTool/Demo/bs runscript http://www.eightolives.com/docs/Workspaces/DesignTool/Demo/b runscript http://www.eightolives.com demo/SCAN CONTROL sn74lvth18502a architecture.js s demo/boundaryscandemo.js demo/INSTRUCTION DECODER sn74 dt - the design tool dt - the design tool K 🐸 Layers - Bi Toolbox 🔝 Kwrite 💲 📄 libreoffi 🤶 🎲 com.eight 💋 eightolive 000 😕 Workspa 🔁 bs_demo 🛢 Java - Wo *[Untitle 🛅 bin : bash Copyright © 2013 William Kaupinis All Rights Reserved

eightolives.com What's Inside

- Upon reading the BSDL file, the Design Tool created the sn74lvth18502a Element (entity) and added a BoundaryScanDevice architecture
- The architecture consists of BC_1 and BC_7 scan cells, a SCAN_CONTROL Element, an INSTRUCTION_DECODER Element, a one_shot_startup Element for initial reset and an internal version of the part that would model its normal functionality.

eightolives.com Getting VHDL Models

- For third-party VHDL simulation, you can retrieve models for BC_1, BC_7, one_shot_startup and SCAN_CONTROL from the eightolives Boundary Scan Library
- The INSTRUCTION_DECODER is created by right-clicking the sn74lvth18502a Element and selecting Test > Testbench > Make Instruction Decoder VHDL
- The top level VHDL is created by right-clicking the sn74lvth18502a Element and selecting Make New > VHDL
- The sn74lvth18502a_internal model, which represents the normal functionality of the part, would need to be separately created by you.

eightolives.com For Waveform Viewer Simulation

- Simulatable models can be retrieved from the eightolives Simulation Library
- The INSTRUCTION_DECODER is created by right-clicking the sn74lvth18502a Element and selecting Test > Testbench > Make Instruction Decoder Architecture Javascript
 - The INSTRUCTION_DECODER Element's option Import > Architecture is used to load the Javascript file as a ScriptableArchitecture which allows edits and reloading while using the same WaveformViewer.

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- Check the tutorials at
 http://www.eightolives.com/tutorials.htm
 - Workspaces Desktop Tool Overview
 - Scripting (Using Javascript and the CommandProcessor)
 - Modeling Hardware in Java (using the com.eightolives.Hardware package to represent digital designs)
 - Simulating Javascript Models (writing ScriptableArchitectures)
- Read the Workspaces Desktop Users Manual

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