Real Insight from Code to Silicon

SourcePoint® ScanWorks®

System-Level JTAG with ScanWorks Dispatcher

Michael R. Johnson
ScanWorks JTAG Product Manager/Support Manager
November 30, 2023
Agenda

- Guidelines for Board DFT based on Boundary Scan Webinars #1 & # 2
- Guidelines for System-Level JTAG Design Webinar #3
- ScanWorks Dispatcher
- Elements of a ScanWorks Dispatcher Deployment
- ScanWorks Dispatcher Demonstration
- ScanWorks Dispatcher Use Cases
- Summary
<table>
<thead>
<tr>
<th>Why do we test?</th>
<th>TCK and TMS distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test challenges</td>
<td>Pull-up/pull-down on TAP signals</td>
</tr>
<tr>
<td>Boundary Scan overview</td>
<td>Board TRST</td>
</tr>
<tr>
<td>Boundary Scan device selection</td>
<td>Handle troublesome devices / different voltages</td>
</tr>
<tr>
<td>Focus on the Scan Chain design</td>
<td>Connector test</td>
</tr>
<tr>
<td>Accessing to the TAP</td>
<td>Allow defeatable tied-off pins / unused boundary scan pins</td>
</tr>
<tr>
<td>Buffering the TAP</td>
<td>Introduction to testing memory devices/flash programming</td>
</tr>
<tr>
<td>Direct control of the system clock</td>
<td>Bypass watchdog circuits</td>
</tr>
</tbody>
</table>

Covered in **Board Design for Test (DFT) based on Boundary Scan Webinar #1**
Interconnect Testing
- Cluster modeling
- Using Discrete I/O
- Controlling clocks

Memory Interconnect Testing
- Chip Enables
- Flash Programming
- Cell Z/Cell Active Configurations

Testing with FPGAs
- Pros/cons of testing unconfigured and configured

Covered in **Board Design for Test (DFT) based on Boundary Scan Webinar #2**
System-Level JTAG Design – Webinar #3

- Ring Architecture
- Star Architecture
- Multi-TAP Devices
  - SCANSTA112
- Multi-TAP Controllers
- ScanWorks Embedded Diagnostics
- SED for Test
- SED for Built-in Self-Test

Covered in Guidelines for System-Level JTAG Design Webinar #3
System-level JTAG (SJTAG) presumes that concept of applying JTAG to the individual boards of the target system has been embraced and implemented.

System-level creates a test access mechanism that extends the usefulness of JTAG throughout the entire product life-cycle.

System-level JTAG extends JTAG significantly beyond the traditional board-level scope of structural test and device programming.

The potential of SJTAG is illustrated by the Venn Diagram described as the SJTAG Universe.
System-Level JTAG Design – Webinar #3
What Is ScanWorks Dispatcher?

ScanWorks Dispatcher is a flexible, high-speed parallel boundary-scan test and in-system programming application system for high test throughput.

Example Use Cases:
- High volume production test facilities
- Programming multiple boards simultaneously
- High-reliability HALT/HASS testing in environmental chambers
What Can ScanWorks Dispatcher Do?

- Multiply production throughput by testing multiple UUTs in parallel
- UUTs may be identical or completely different
- Manage test results independently for each tester and each individual UUT
- Actions can be controlled individually or as a ScanWorks sequence
- Existing ScanWorks tests can be used with no modifications or special preparations
- Actions downloaded to on-board memory in specific RICs and are applied independently by processors in each RIC
ScanWorks Dispatcher API

- Dispatcher provides an API designed to support custom test applications
- The API is a “.NET” API written in C# and compatible with most commonly used programming languages and with National Instruments LabVIEW and TestStand
- Dispatcher API includes complete documentation and example applications
- Dispatcher does not include an operator user interface, except for an authorization dialog and a hardware configuration dialog
- Dispatcher gives you the flexibility to test multiple UUTs simultaneously and asynchronously from your test executive
ScanWorks Dispatcher

API Object Model

- The ScanWorks Dispatcher API provides access to everything you need for running and evaluating your boundary scan test.
ScanWorks Dispatcher

- Test Runner used to run single ScanWorks actions
- Test Fanatic used to run multiple ScanWorks actions in a sequence
Elements of a ScanWorks Dispatcher Deployment

- ScanWorks and Dispatcher software
- ScanWorks license with Dispatcher and Parallel Access addons
- Two or more Remote Instrumentation Controllers (RIC-1400)
- Test Runner, Test Fantic example application (supplied with Dispatcher), or other API created to apply test
- A previously created ScanWorks project compatible with the RIC-1400 as the controller
ScanWorks Dispatcher Demonstration

ScanWorks 4.11.0
Dispatcher 1.7.7

192.168.0.1
Test Runner
Test Fanatic

ScanLite2 – UUT A
192.168.0.2 – RIC A

ScanLite2 – UUT B
192.168.0.3 – RIC B

ScanLite – UUT C
192.168.0.4 – RIC C
## UUT A & UUT B (Scanite2)

<table>
<thead>
<tr>
<th>Fault Switch</th>
<th>Default Setting</th>
<th>Fault Setting</th>
<th>Fault Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW2</td>
<td>Norm</td>
<td>SA0</td>
<td>2 Drivers, 1 Receiver</td>
</tr>
<tr>
<td>SW3</td>
<td>Norm</td>
<td>SA0</td>
<td>1 Driver, 2 Receivers - Open</td>
</tr>
<tr>
<td>SW4</td>
<td>Norm</td>
<td>SA0</td>
<td>2 Drivers, 2 Receivers – 1 Pin Fail</td>
</tr>
<tr>
<td>SW5</td>
<td>Norm</td>
<td>SA0</td>
<td>TDO/TDI Error</td>
</tr>
<tr>
<td>SW6</td>
<td>Norm</td>
<td>SA1</td>
<td>Flip Flop Error</td>
</tr>
<tr>
<td><strong>SW7</strong></td>
<td>Norm</td>
<td>SA0</td>
<td>Memory – D0</td>
</tr>
<tr>
<td>SW8</td>
<td>Norm</td>
<td>Bridge</td>
<td>Flash Interconnect Fail</td>
</tr>
<tr>
<td>SW9</td>
<td>Norm</td>
<td>SA0</td>
<td>Memory – D1</td>
</tr>
<tr>
<td>SW10</td>
<td>Norm</td>
<td>Bridge</td>
<td>Address Fault</td>
</tr>
<tr>
<td><strong>SW11</strong></td>
<td>Norm</td>
<td>SA0</td>
<td>Short</td>
</tr>
<tr>
<td>SW12</td>
<td>Norm</td>
<td>Open</td>
<td>1 Driver, 1 Receiver</td>
</tr>
</tbody>
</table>

## Data Switch

<table>
<thead>
<tr>
<th>Data Switch</th>
<th>Default Setting</th>
<th>Data Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW1 (1-4)</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3- Bits of Test Stimulus Data for U1 and LED’s</td>
</tr>
</tbody>
</table>

## UUT C (ScanLite)

<table>
<thead>
<tr>
<th>Fault Switch</th>
<th>Default Setting</th>
<th>Fault Setting</th>
<th>Fault Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW1</td>
<td>Norm</td>
<td>SA0</td>
<td>Address Fault</td>
</tr>
<tr>
<td>SW2 (1-4)</td>
<td>Norm</td>
<td>Open</td>
<td>Memory</td>
</tr>
<tr>
<td>SW4</td>
<td>Norm</td>
<td>SA1</td>
<td>2 Drivers, 2 Receivers</td>
</tr>
<tr>
<td>SW5</td>
<td>Norm</td>
<td>SA1</td>
<td>1 Driver, 2 Receivers</td>
</tr>
<tr>
<td>SW6</td>
<td>Norm</td>
<td>SA1</td>
<td>2 Drivers, 1 Receiver</td>
</tr>
<tr>
<td>SW7</td>
<td>Norm</td>
<td>Bridge</td>
<td>Open Fault</td>
</tr>
<tr>
<td>SW8</td>
<td>Norm</td>
<td>SA0</td>
<td>1 Driver, 1 Receiver</td>
</tr>
<tr>
<td>SW9</td>
<td>Norm</td>
<td>Bridge</td>
<td>Flip Flop Fault</td>
</tr>
<tr>
<td><strong>SW11</strong></td>
<td>Norm</td>
<td>Open</td>
<td>TDO/TDI Fault</td>
</tr>
</tbody>
</table>

## Data Switch

<table>
<thead>
<tr>
<th>Data Switch</th>
<th>Default Setting</th>
<th>Data Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW10 (1-4)</td>
<td>Logic O/Norm</td>
<td>Logic 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3-Bits of Test Stimulus Data for U8 and for LEDs</td>
</tr>
</tbody>
</table>

## Clock Switch

<table>
<thead>
<tr>
<th>Clock Switch</th>
<th>Oscillator Disconnected</th>
<th>Oscillator Connected</th>
<th>Data Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW3</td>
<td>On</td>
<td>Off</td>
<td>Clock</td>
</tr>
</tbody>
</table>
ScanWorks Dispatcher Use Cases

- Dispatcher manages the application of ScanWorks test and programming operations for many UUTs simultaneously
- Applications include high-throughput production and environmental test
- If Dispatcher is used with boards and backplanes implementing DFT guidelines and system-level JTAG designs, the test coverage and programming capabilities of ScanWorks Dispatcher expands tremendously
ScanWorks Dispatcher Use Cases

- High volume test and programming
- RIC-1400 per backplane
- Backplane designed with a JTAG system-level architecture (ex. Ring or Multi-TAP device)
- Low volume-high mix test and programming/Mid-mix test and programming
- RIC-1400 per rack or fixture
- Backplane designed with a JTAG system-level architecture (ex. Ring or Multi-TAP device)
ScanWorks Dispatcher is a solution for system-level parallel board test

- Multiply production throughput
- Remote test management
- Parallel test of different UUTs
- Parallel programming
- Remote diagnostics
- Backplane/Rack testing
- High-mix production
- High-volume Production
- Result files in XML
- Extensive .NET API
View the webinar, Guidelines for Board Design for Test (DFT) based on Boundary Scan Webinar #1, https://www.asset-intertech.com/wp-content/uploads/2022/12/Boundary-Scan-Design-for-Test.mp4

View the webinar, Guidelines for Board Design for Test (DFT) based on Boundary Scan Webinar #2, https://www.asset-intertech.com/wp-content/uploads/2023/04/Boundary-Scan-Design-for-Test_Part-2.mp4


Questions and Contact Information

Michael R. Johnson
ScanWorks JTAG Product Manager/Support Manager
7161 Bishop Rd. Ste. 250
Plano, TX. 75024
michael.johnson@asset-intertech.com
https://www.linkedin.com/in/michaelrjohnson1911
www.asset-intertech.com
Real Insight from Code to Silicon