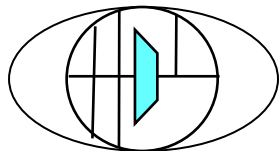


Integrating Nexus 5001™ and 1149.7™ with OCP-IP Debug

Neal Stollon

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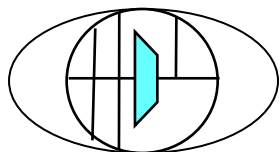
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OCP General Features

- **OCP supports range of sophisticated bus interface capabilities ... which translates into a lot of analysis complexity**
 - **64-bit read and write data busses**
 - **32-bit multiple mode addresses**
 - **Multiple Outstanding transactions**
 - **Multiple Command and Response types**
 - **Multiple User defined signals**
 - **Single or Bursted Reads and Writes**
 - **Single Request Multiple Data**
 - **Multiple synchronous core to bus ratios**
 - **Data Ordering and reordering using tags**
- **System debug needed to get a full picture**
 - **Processor debug is needed to get best out of the core**
 - **Bus visibility is needed to optimize complex interactions**



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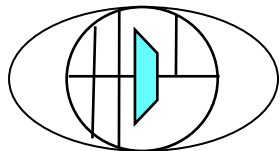
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Drive Ongoing Needs for OCP System Debug

- **Merging debug operations for multiple cores and fabrics**
- **Control/data transfer via a single JTAG TAP or TRACE PORT**
- **Global control signals for multi-core cross triggering and synchronous actions (go, halt and breaks)**
- **Multi-core trace (cores and buses) with timestamps**
- **Probe Hardware and tool API's to support multi-core trace**
- **Handle multiple instantiations of source level debuggers**
- **Customization to measure activity on buses, caches, execution of cores, co-processors, interrupts, peripheral device events, . . .**



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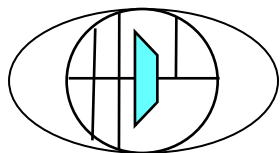
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Nexus addresses these Needs

- **Multi-processor interface - Packet based standard architecture with Implicit multi-core support**
- **Support for JTAG and/or parallel port interfaces**
 - **Low pin count and high function trace options**
- **Independent Input and Output debug ports**
- **Trace packets include timestamp fields**
- **Supported by most leading Debug tools vendors**
 - **Proven debug & calibration interface**
- **Packet-based protocol supports multiple source level debuggers**
- **Standard interface and protocol allows simpler and better integrated customized instruments.**



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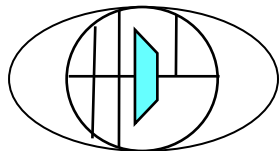
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IEEE 5001 Nexus Introduction

- Real Time Debug Instrumentation Architecture and methodology standard
 - IEEE Standard ISTO program – 20+ member companies
 - CPU/SoC architecture agnostic standard (25+ different architectures to date)
 - Default standard use in US Automotive electronics
 - Aligned with other standards bodies - 1149.1, 1149.7, Power.org, OCP-IP
 - Support from range of vendors in the tools community
 - Nexus Specification is freely available - www.nexus5001.org
 - Nexus 5001-2009 specs include support for 1149.7 interfaces
- Nexus provides a Instrumentation toolbox for to address OCP Debug
 - Debug oriented packet messaging (TCODES) and application registers
 - 4 levels of increasing debug functionality
 - Embedded run control, Breakpoints , Instruction/data trace
 - Memory and Register configuration and system analysis access
 - Defines Multiple Trace and Debug Access Methods and interfaces
 - JTAG & Parallel– Aux. Read (Trace) / Write (Configuration) Ports
 - High speed Serdes and 1149.7 interfaces - 2009 standard



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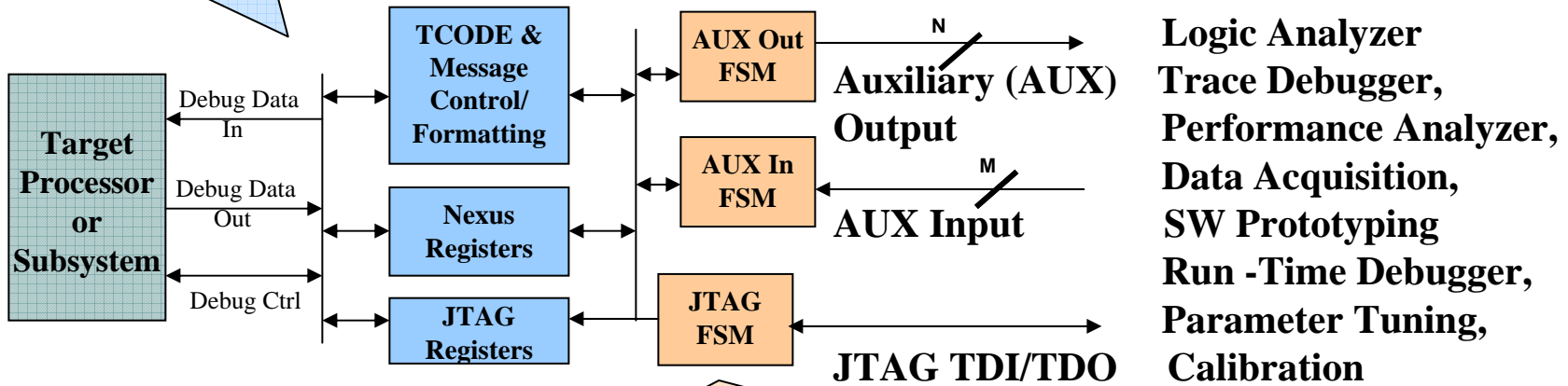
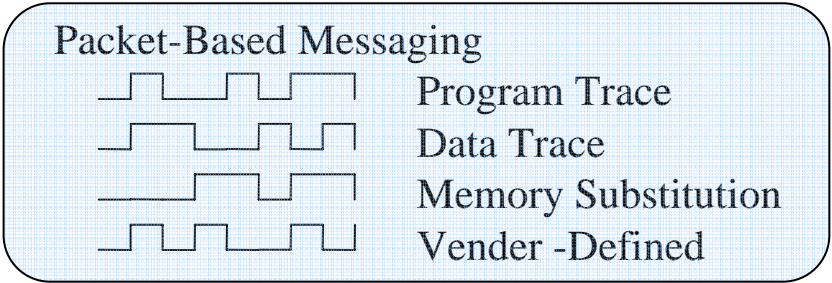
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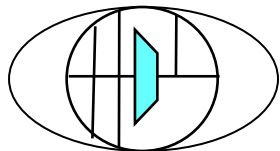
5001 Nexus Debug Environment

Processor Independent signaling
Multiple on-chip processor/core support



IEEE 1149 - 2 or 4 wire Protocol and/or packet based Messaging

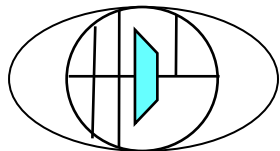
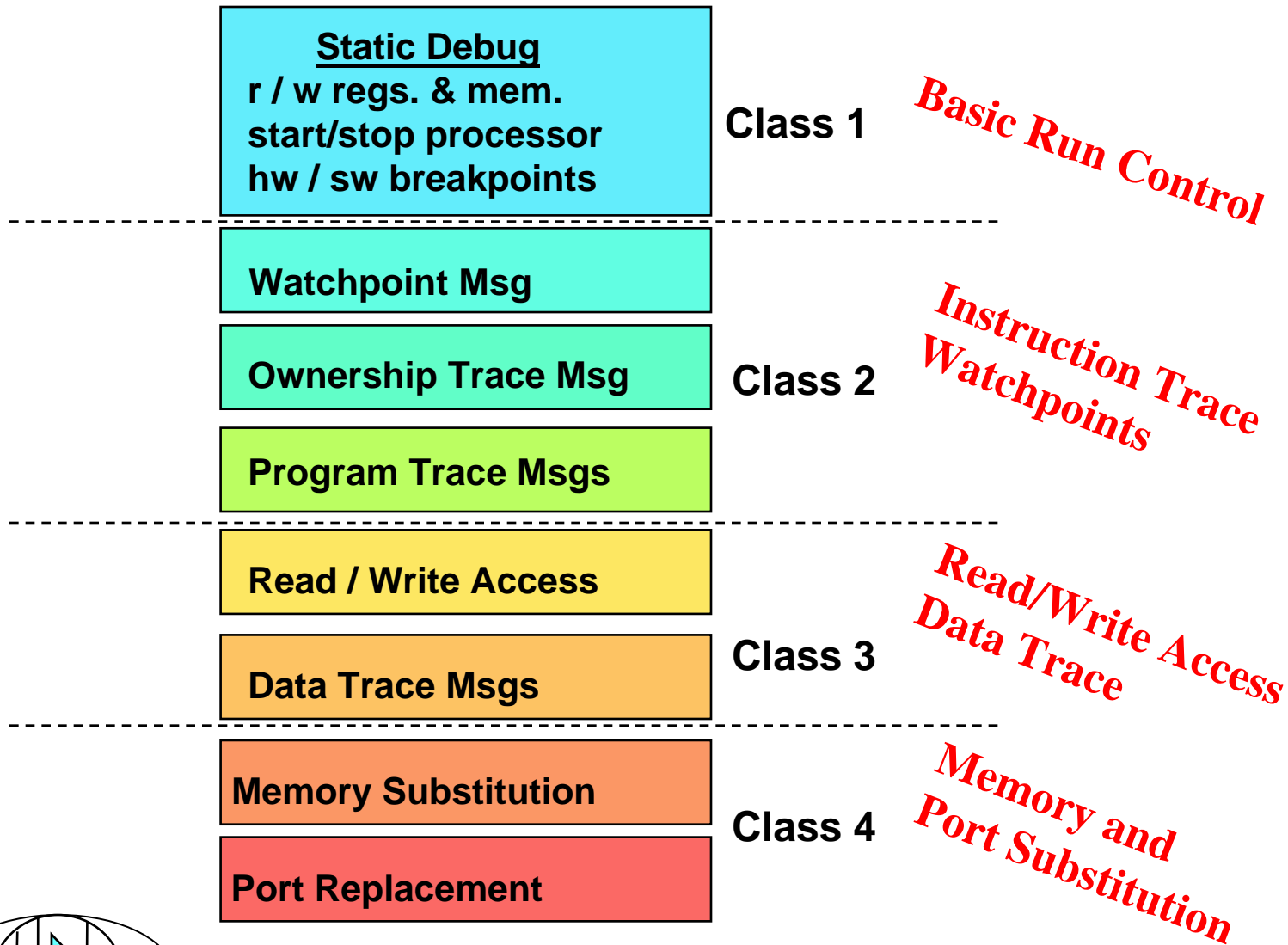
- Low bandwidth Control and Status using 1149.7
- High Performance Read/Write Access to internal resources using Aux ports



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Nexus supports Range of Features



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[Download the IEEE 5001 spec
at www.nexus5001.org](http://www.nexus5001.org)

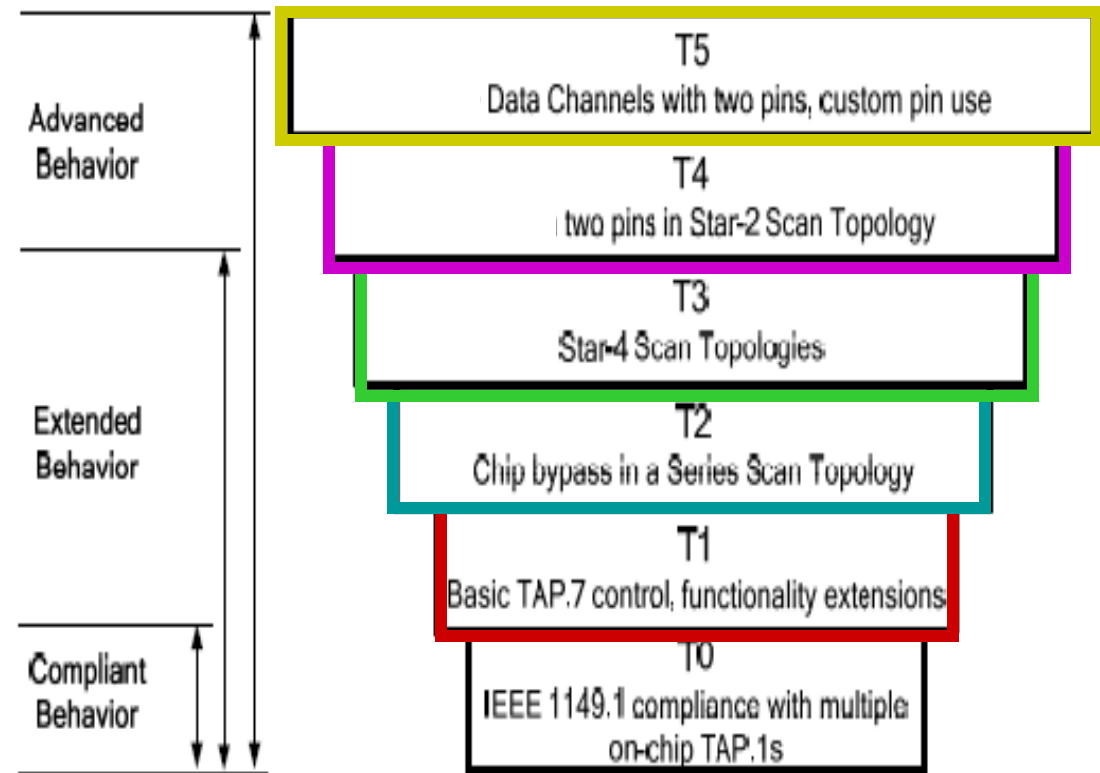
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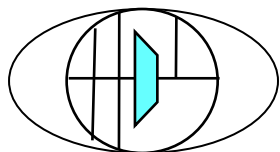
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Nexus integrates IEEE 1149.7 for Next Generation JTAG

- Custom instrument integration interfaces
- 2 wire JTAG interface
- Parallel or Serial data connection
- Improved speed of debug operations
- Streamlined JTAG Function control
- Full 1149.1 emulation



**Increasing layers of functional enhancements
Based on compliance with 1149.1 operations**



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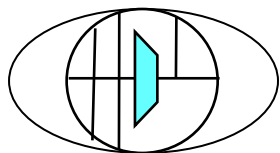
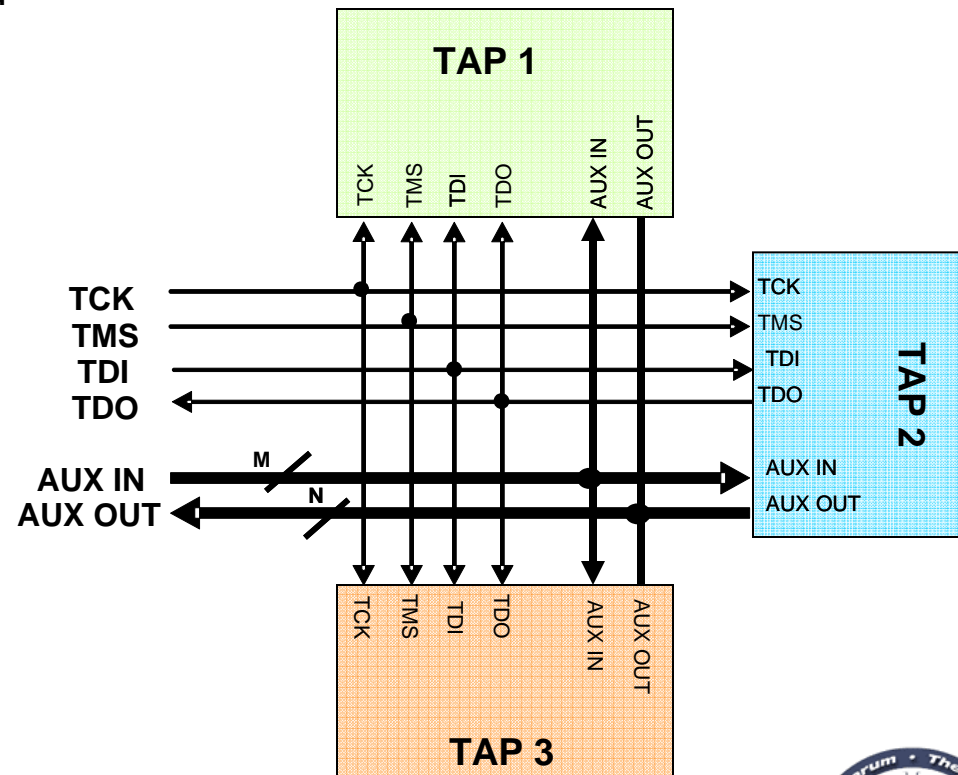


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IEEE 1149.7 JTAG & 5001 Nexus

- Specification release in 2010
- Nexus debug over 2 wire interface
- Nexus Aux In and Out ports extend 1149.7 bandwidth for trace, calibration, mem access, ...
- 1149.7 Star configurations allow direct control/data connection for Nexus ports in different devices
 - **Compatible with AUX ports**
- Native Multi-Processor/SoC debug support using TCODE IDs
- Nexus operation is compatible with 1149.7 (T0-T5) classes
 - Nexus protocol sits on top of 1149.7 signaling,
 - Customized capability using 1149.7 T5 CDX/BDX functions

1149.7 + AUX Port
Star-4 Configuration



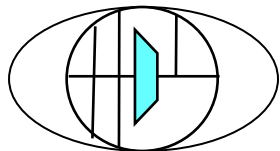
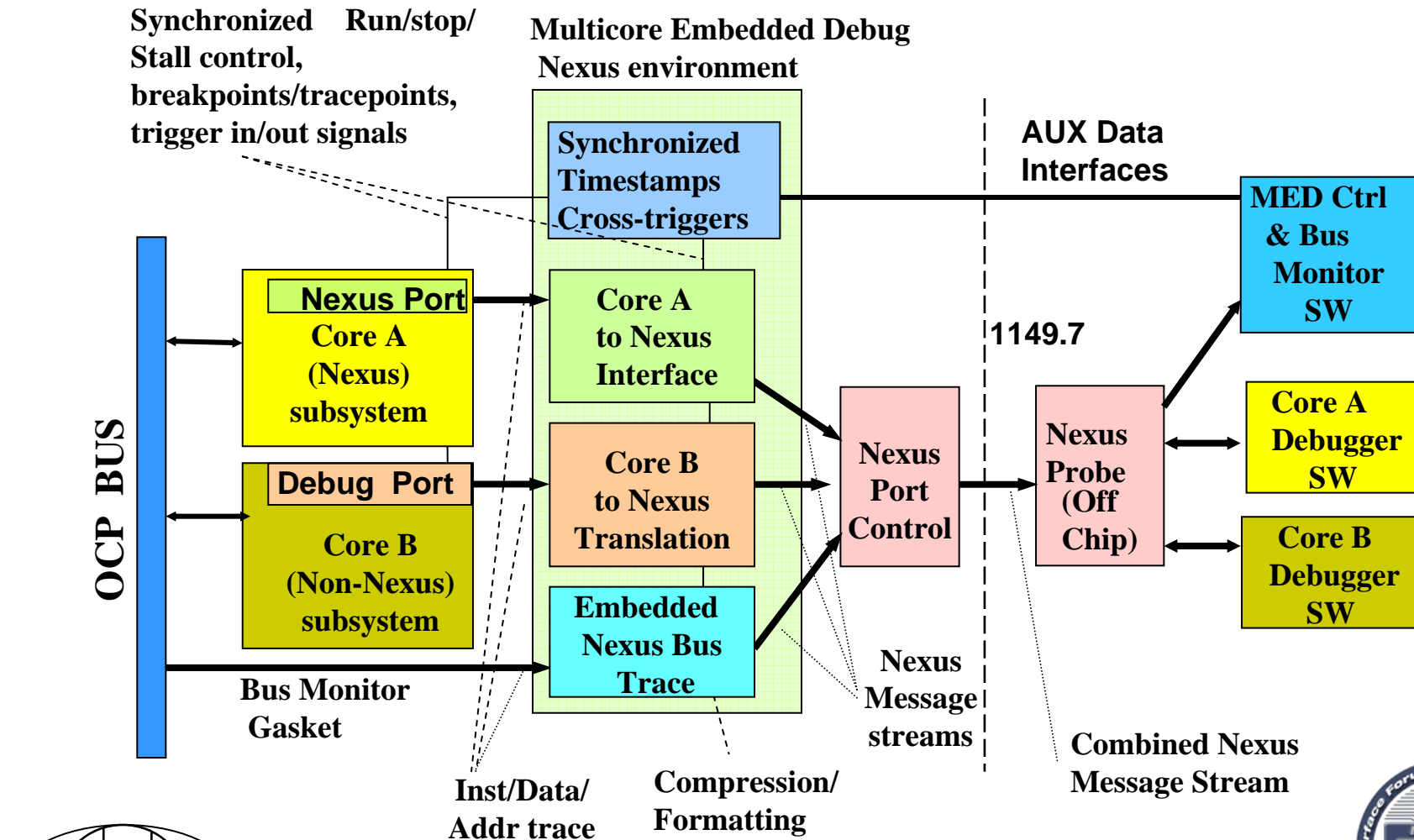
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Nexus Multi-Trace Example



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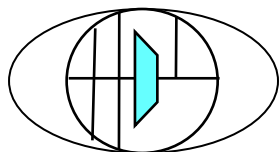


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Example Nexus Message Packet

Program Trace - Indirect Branch Message			Direction: from target
Minimum Packet Size (bits)	Packet Name	Packet Type	Description
0	TSTAMP	Vendor-variable	Number of cycles message was held in the buffer or the full timestamp value. For targets that do not implement timestamping (or use pins for timestamping), this field may be omitted. Refer to 4.11.2 - Timestamping via AUX .
1	U-ADDR	Variable	The unique portion of the branch target address for a taken indirect branch or exception.
1	I-CNT	Variable	Number of instruction units executed since the last taken branch.
0	B-TYPE	Vendor-fixed	Branch type. For targets that do not need to differentiate branch types, this packet can be omitted (see Table 5-8).
0	SRC	Vendor-fixed	Client that is source of message. For targets with only a single client, this packet can be omitted.
6	TCODE	Fixed	Value = 4 (Defines message type)

- Standard Messages defined AND custom message types are supported using different TCODES



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ISTO Nexus 5001™ Forum

Mission Statement:

To define and support global, open, embedded processor and system development interface standards for range of applications.

Key Nexus Applications

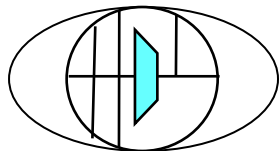
- Real Time Debugging
- Hardware in the Loop
- Program Tuning
- Logic Analysis
- Run Control
- Prototyping
- RTOS Support

With Development Tool Standard Focus

Low Level API

Mechanical Interconnect

Silicon



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[Join at www.nexus5001.org](http://www.nexus5001.org)

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5001 Nexus Benefits

MPU Vendors

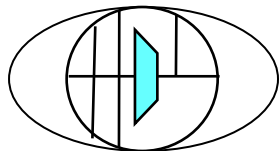
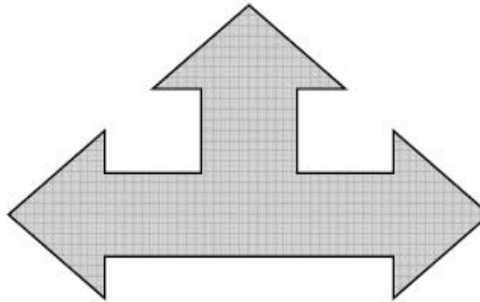
- Simplifies tools support
- Customer understanding of tools strategy
- Design re-use reduces time & cost
- Leverage best in-class tools
- Easier, faster check-out of tools on new architectures
- Ability to add features in standard method
- Same MCU in development & production
- Trace without the bus (pin overhead)

Users

- Learning cycles – tools and architecture(s)
- Quicker time to market
- Development tool reuse
- Proven capabilities - multiple architectures
- Single small foot print interface
- Non-stop debugging, triggering & trace

Tool Vendors

- Reduced development cost
- Rapid migration to new architectures
- Standard functions
- Opportunity to differentiate tools
- Opportunity to address customer requirements
- High performance – lower cost tools



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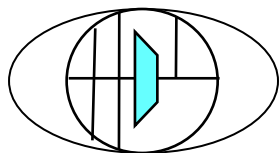
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HDL Dynamics provides IP and integration support for Nexus application

- Customization and application of Nexus to systems**
- Integration with OCP based processor and bus subsystems**
- Development and Integration of 1149.1 interfaces**

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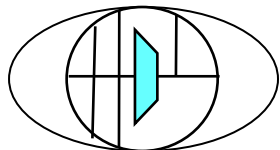
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REFERENCE - Nexus Members

Nexus Membership - 2009



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