Boundary Scan test control in the ATCA standard

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Boundary Scan test control in the ATCA standard

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- Demonstration Board
- Conclusions
Boundary Scan in Modern Systems

- Boundary Scan (BScan) not only used for production interconnect test of boards
- In multiboard systems the test controller and the target devices may be located on different boards
- How to link BScan between controller and target devices?
- Natural solution: BScan control and data must be routed through backplane
Introduction

Multiboard systems

- Backplane board
- Application specific boards
- Shelf Management Board
Related work

- Several commercial solutions exist how to link BScan in a backplane environment
- National Semiconductor: SCAN Bridge
  - Based upon: [D.Bhavsar, ITC´91]
  - Addressing boards and modules by using the instruction scan
- Texas instruments: Addressable Shadow Port (ASP)
  - [L.Whetsel, ITC´92]
  - Added shadow protocol used to access boards and modules
Introduction

Problem definition

- However, some system architectures do not include BScan in the backplane
- The emerging ATCA standard is an example, which will be increasingly deployed
- The purpose of this project is to find a way to manage remote BScan control in ATCA based systems
System Environment

ATCA overview

- Advanced Telecommunications Computing Architecture (ATCA)
- Contain design specifications and requirements in the following areas:
  - Mechanical and Dimensions
  - Power Distribution
  - Thermal Dissipation
  - Interfacing and Interconnections
  - System Management
System Environment

System management (IPMI)

- Intelligent Platform Management Interface (IPMI)
- Exposing HW management functions to OS and Management SW
- Provides interface and communications for:
  - Monitoring and Logging
  - Inventory
  - Recovery Control
- Allows implementation of additional management applications within the IPMI framework
System Environment

System management (IPMI)

SM = Shelf Manager
BMC = Baseboard Management Controller
Management bus (IPMB)

- Intelligent Platform Management Bus (IPMB)
- Based on the two wire serial I²C Bus
  - Data transfers up to: 100 kbit/s
  - Maximum message size: 32 bytes
- All IPMI messaging, including IPMB, uses a request/response protocol
  - All IPMB requests must be answered with an IPMB response
  - Requests and Responses are not automatically paired
Approach

Project goals

- Propose a way to transport BScan data and control using the IPMB
- Propose means how to manage embedded tests in IPMI
- The solution should fit in the ATCA/IPMI context
- Build a demonstration board to validate the proposed solution
New functionality in IPMI
Commands and data format

- Command set to interface and control the onboard tests:
  - Test management commands:
    - LIST, SEND, RECEIVE, DELETE
  - Test execution commands:
    - RUN
  - Test setup commands:
    - LINK, OPTIONS

- Embedded test data format
  - National Semiconductor EVF is an example
  - Based on the Serial Vector Format (SVF)
Approach

Transport of BScan control and data

- IPMB designed to carry short control and status messages
- Extended the IPMB protocol to enable transport of BScan control and data
  - Still follows the rules and requirements set by the standard IPMB protocol
  - The SM unit is the requester (master) and the BMC units are the responders (slaves)
  - Mechanisms for dividing larger test files into smaller IPMB packages and re-assembling of packages back into test files has been specified and implemented
Approach

Transport of BScan control and data

- Transport times of a 77 kB EVF file on IPMB

<table>
<thead>
<tr>
<th>Description</th>
<th>Max. packet size $P_o + P_d$</th>
<th>I²C Speed $S$</th>
<th>Total transport time $T_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard IPMB restrictions</td>
<td>32 B</td>
<td>100 kbit/s</td>
<td>11.7 s</td>
</tr>
<tr>
<td>Increased max packet size</td>
<td>64 B</td>
<td>100 kbit/s</td>
<td>8.44 s</td>
</tr>
<tr>
<td>Fast I²C mode</td>
<td>32 B</td>
<td>400 kbit/s</td>
<td>2.94 s</td>
</tr>
<tr>
<td>I²C High speed mode</td>
<td>32 B</td>
<td>3.4 Mbit/s</td>
<td>0.35 s</td>
</tr>
<tr>
<td>I²C High speed mode and Increased max packet size</td>
<td>64 B</td>
<td>3.4 Mbit/s</td>
<td>0.25 s</td>
</tr>
</tbody>
</table>
Demonstration Board

Demonstration board

Operator Interface

SM

IPMB

BMC

BSC

UUT

Shelf Manager Board

Backplane Board

Application Board
Demonstration Board

Demonstration board

- Operators interface
- SM-unit
- BMC-unit
- UUT
- BScan controller
Conclusions

- Easy to add BScan functionality to the ATCA/IPMI context
- IPMB suitable to carry BScan control and status
- IPMB less suitable to carry large tests due to the limitations of the standard.
- Can be solved using the higher available I²C data transfer speeds and larger IPMB packet sizes