Agenda

- IPMI in modular architecture
- IPMI specification support for modular
- IPMI components for modular systems
- IPMI future directions for modular
- Summary
Introduction

- **Audience:** Architects, Technical Managers, Firmware Leads, and Hardware Designers
  - Involved in architecture, component selection, debug, test, or design of server baseboard and peripheral management subsystems
- **Focus:** IPMI-based platform management for modular system architectures
  - Hardware and Software components

**Early look at new IPMI Extensions**
IPMI
Intelligent Platform Management Interface

• Defines a standardized, abstracted, message-based interface to intelligent platform management hardware

• Defines standardized records for describing platform management devices and their characteristics

Promoters: Intel, Hewlett-Packard, NEC, Dell
Adopters: 140 and growing

http://developer.intel.com/design/servers/ipmi
Updated Errata, ICMB specifications, and Conformance Test Suite

- IPMI v1.5 Conformance Test Suite (ICTS) Prototype 5.02
  Includes IPMI v1.0 and IPMI v1.5 automated conformance tests, IPMI v1.5 CMDTOOL for manual IPMI v1.5 testing, support for PCI* card based IPMB and SMBus testing, and support for IPMI v1.5 new interfaces including LAN, Serial and SMBus. ICTS 5.02 is an update to ICTS 5.01 and adds new tests for IPMI 1.5 commands and includes some bug fixes as well.

* Other names and brands may be claimed as the property of others.
IPMI in modular architecture

Where it fits…

Complements existing management standards
IPMI in modular architecture

Where it fits…

The Modular Computing Data Center

Virtualization

- Dynamic logical partitioning
- Compute, I/O, and storage
- Devices, O.S., and apps

Automation

- Self-optimizing
- Provisioning
- Self-healing
- SW updates
- Auto failover
- Performance optimization
- Auto recovery

SOFTWARE

Manages Complexity

HARDWARE

Delivers Flexibility And Value

Open standards & protocols

Independent scaling

Modularity

Enables Modular Hardware Platform Management

App logic, server, & network

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Spring 2003
IPMI in modular architecture

IPMI v1.5 for Standalone Systems

Baseboard

LAN

MODEM / Serial

Remote Mgmt. Card

ICMB

Bridge Controller

Satellite Mgmt. Controller

Chassis

Mgmt Netwk Ctrlr

Baseboard

Sensor & control circuitry

System Interface

System Bus

IPMI Messages
IPMI in modular architecture

Where it fits…

Remote Management Applications

LAN/Serial ‘out-of-band’ transport for standalone replaced with Backplane Mgmt Interface (BP I/F)

IPMI unifies blade and standalone server management implementations
IPMI in modular architecture

Typical application

Option: IPMI Satellite Controller

- enables mgmt module re-use across different chassis
- enables any node to be assigned as mgmt module
IPMI in modular architecture
Partitioning for protection

- **Problem:** Bus topology enables local mgmt s/w to access other nodes
- **Solution:** firmware internal ‘firewall’
IPMI in modular architecture
Partitioning for protection

Firmware Internal ‘firewall’

- F/W blocks messaging to other nodes on shared bus
- Allows messages between local software and management module
- Local software may also be blocked from SDR or FRU updates that might be used to generate false events
- Firmware updates can only occur from management bus side
- Access rights can only be configured from management bus side

System Interface

BMC

Satellite Controller

BP I/F

Sensors

FRU, SEL, SDR

FLASH

“side-band” port

backplane mgmt. bus

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IPMI in modular architecture

Redundant Backplane Management Busses

System Interface

BMC

Sensors

FRU, SEL, SDR

BP I/F

Management Module

Busses can be treated as a single communication “Channel” under IPMI, or can be separate ‘always active’ channels.
IPMI in modular architecture
Ethernet-based Backplane Mgmt Interface

Embedded switch isolates internal Management VLAN traffic from external Ethernet

System Interface

BMC

Sensors
FRU, SEL, SDR
FLASH

“side-band” port

PCI, PCI-E
Dual eNet I/F

Management Module

LAN Switch

Dual eNet

LAN

= Management VLAN

Sensors
FRU, SEL, SDR
FLASH

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Spring 2003
IPMI for modular systems

Benefits

• Commonality with standalone servers
  – Reduces ‘special knowledge’ for blade management

• Third party hardware components
  – Management controllers
  – Firmware

• Test tools
  – ICTS: IPMI conformance test suite
    – extensible automated testing for IPMI interfaces
    – can be used for development and validation

• Drivers and Software
  – Linux and Windows operating systems
  – Samples available from IPMI web site
  – Management applications from ISVs
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IPMI support for modular

IPMI Messaging

• IPMI Channel Model supports multiple paths to BMC
  – Supports OEM-defined media
    – not limited to present LAN, serial, IPMB
  – Supports multiple media types
    – e.g. LAN for normal connects, serial/IPMB for backup

• Channels can be implemented with redundant physical media
  – Channels are a ‘logical’ concept

• Message-bridging architecture provides framework for ‘firmware firewall’
  – Straightforward parsing to route and filter messages by type
IPMI support for modular
Node/FRU removal and replacement

Sensor support for coordinating Node and FRU removal and replacement:

• **FRU State sensor**
  – reports hot- or warm- swappable FRU status
    – FRU Not Installed
    – FRU Inactive (in standby or ‘hot spare’ state)
    – FRU Activation Requested
    – FRU Activation In Progress
    – FRU Active
    – FRU Deactivation Requested
    – FRU Deactivation In Progress
    – FRU Communication Lost

• **Version Change sensor**
  – Reports changes to FRU and/or firmware-software versions or configuration

• **Button/switch sensor extended for FRU mgmt**
  – “FRU Service” and “FRU Latch” offsets
modular system extensions

Under development

• Management Bus ‘failover’ status
  – ability to report redundancy status of an IPMI Channel

• Provisions for ‘Firmware Firewall’
  – spec updates to allow certain functions to be restricted
    without breaking spec conformance

• Monitoring and control of shared chassis resources: Power, Thermal, Cooling and Slot
  – e.g. support for coordinating chassis FAN speed
  – ‘read only’ access to chassis satellite controller

• Support for node discovery and set up for management
  – e.g. support for reporting ‘node ID’, configuring
    node access rights to backplane, etc.
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Baseboard Management Controllers

- QLogic
- Philips Semiconductor
- National Semiconductor
- Agilent Technologies
- Vitesse Semiconductor
- Winbond
- Hitachi

IPMI components fit your design
components

Blade-focused BMCs

**Qlogic Zircon UL***
- Target applications: 1P/2P Servers
- 32 GPIO (max), 4 Fan tach, 3 PWM
- 128-pin PQFP
- Virtual Storage Interface – supports ‘virtual floppy’
- Universal Serial Interface
  - for serial redirection / headless
- Production: 4Q02

**Qlogic Zircon BL***
- Target applications: server blades, high-end workstations
- 18 GPIO (max), 2 Fan tach, 2 PWM
- 100-pin PQFP
- Virtual Storage Interface
- Universal Serial Interface
- Production: 4Q02

* Other names and brands may be claimed as the property of others.
components
Blade-focused BMCs

• Hitachi H8S/2145* ‘Single-chip’ BMC / Satellite Controller
  – 128KB in-system programmable FLASH and 8KB SRAM on-chip
  – Two master-slave 400KHz I2C ports
  – Supports 3 KCS LPC channels
  – 8 A-D, 2 PWM and 4 fan tach inputs, 3 serial ports, up to 75 GP I/O
  – Full capability ICE debug is available
  – 14x14mm TQFP-100 package
  – Sampling: Now, Production: May

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components

IPMI Software and Tools

IPMI Web Site
- Reference drivers for Itanium® Architecture and IA-32 under Windows* .NET/2000 and Linux
- IPMI Conformance Test Suite
  - Serves as both validation and development tool

ISV Software
E.g. OSA Technologies
- Management Applications for IPMI
  - “Remote Console” applications and IPMI Drivers
- Firmware engineering also available
  - SDKs for popular BMCs
  - Supports IPMI v1.5 and out-of-band access (serial, LAN)

IPMI components improve TTM and reduce design cost

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## IPMI Future Directions

### Technology Transitions

<table>
<thead>
<tr>
<th>Technology</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Q1</td>
<td>Q2</td>
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<tr>
<td>Full BMCs</td>
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<td>Blade BMCs</td>
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<td>Baseline BMCs</td>
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<td>Add-on BMCs</td>
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<td>Integrated BMCs</td>
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<tr>
<td>IPMI</td>
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*Update next IDF*
IPMI Future Directions

IPMI ‘2.0’ Proposals

• Serial redirection over LAN
• Terminal mode extensions (improved ‘CLI’)
• ASF Alignment
  – Common authentication protocols
  – Smoothes ASF to IPMI transition between desktop and sub-entry server systems
• Modular (blade) support
  – blade/chassis relationship, blade power mgmt., etc.
  – AdvancedTCA support (formerly 'CompactPCI')
• IPMI over Web
  – enabling technology for IPMI over Web (may be post 2.0)

IPMI continues to evolve valuable new capabilities
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Summary

• IPMI unifies modular and general-purpose server platform management
• IPMI components and tools save design time and improve TTM
• IPMI provides the foundation for future platform management initiatives and features
Using IPMI Platform Management In Modular Computer Systems
Tom Slaight
Intel Corporation

Questions?

This presentation will be posted March 25th
http://developer.intel.com/idf
Attendee password will be sent three weeks after the conference via email.

Please remember to turn in your session survey form
Acronyms

- 3GIO – Third Generation IO, now named PCIExpress*
- 10GbE – 10 Gigabit Ethernet
- ACPC - Automatic Control of Power Consumption
- aTCA - Advanced Telecom Computing Architecture*
- B2B – Business to Business
- BE – Enterprise Backend (Data Services)
- BIS – Boot Integrity Service [Link](http://www.intel.com/design/security/bis/bis_wks.htm)
- BMC – Baseboard Management controller
- CLR – common language runtime - engine running MSIL
- COO – Cost of Ownership
- cPCI – CompactPCI* (PICMG 2.x)
- DBS – Demand Based Switching
- EFI – Extensible Firmware Interface [Link](http://www.intel.com/technology/efi/main_specification.htm)
- EMCI – Enterprise Modular Computing Initiative
- EPTM - Enterprise Power and Thermal Manager FE – Front End
- FRU – Field Replaceable Unit
- GbE – Gigabit Ethernet
- ICMB - Intelligent Chassis Management Bus
- IPMB - Intelligent Platform Management Bus
- IPMI – Intelligent Platform Management Interface [Link](http://www.intel.com/design/servers/ipmi/index.htm)
- ISA – Instruction Set Architecture
- ISCCI – Internet SCSI (Small Computer System Interface)
- J2EE – Java 2 Enterprise Edition
- JVM – Java Virtual Machine

* Other names and brands may be claimed as the property of others
Acronyms

- L3 – level 3
- MT – Enterprise Mid-Tier (Application Services)
- MP – multiprocessing (4P & above)
- MRTE – Managed Run-Time Environments
- MSIL – Microsoft intermediate language; compiler language of .Net code
- OOB – Out of Band
- PCI - Peripheral Component Interconnect
- PEF - Platform Event Filtering
- PICMG3.x- PCI Industrial Computer Manufacturer’s Group - Follow on to cPCI (PICMG 2.x)
- RCO – Real Cost of Ownership
- SAF - Service Availability Forum
- SAF-HPI - Server Availability Forum - Hardware Platform Interface
- SDR - Sensor Data Record
- SEL - System Event Log
- TCO – total cost of ownership
- TOE – TCP/IP offload engine
- TDP – thermal design point
- UD – Ultra Dense
- U – unit of measure of server height (1U = 1.75 inches)
- 2P – dual processing capable
- 4P – quad processing capable
Collateral

• White paper: Modular Computing: The New Enterprise Computing Model (Egenera/Intel)

• URLs:
  - IPMI Web Site: http://developer.intel.com/design/servers/ipmi
  - Distributed Management Task Force (DMTF): http://www.dmtf.org
  - IBM eLiza* project on X-series: http://www-1.ibm.com/servers/autonomic/
  - Microsoft .NET*: http://www.microsoft.com/net/
  - Giga* analyses: (R.Fichera)
    – Criteria for Selection: Bladed and Modular Servers (July 31, 2002)
    – Future of the Data Center: Modularity and Virtualization (May 8, 2002)
    – Economics of Cable Consolidation: A Major Impact on Server Cost (July 23, 2002)
## Glossary

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>BMC</td>
<td>Baseboard Management Controller.</td>
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<tr>
<td>FRU</td>
<td>Field Replaceable Unit. A field replaceable component such as a board, module, fan, power supply, etc.</td>
</tr>
<tr>
<td>ICMB</td>
<td>Intelligent Chassis Management Bus. The ICMB provides a dedicated management bus that enables delivering IPMI messages and alerts between multiple host and peripheral chassis.</td>
</tr>
<tr>
<td>IPMB</td>
<td>Intelligent Platform Management Bus. Name for the architecture, protocol, and implementation of a special bus that interconnects the baseboard and chassis electronics and provides a communications media for system platform management information.</td>
</tr>
<tr>
<td>IPMI</td>
<td>Intelligent Platform Management Interface. IPMI defines a common, abstracted, and self-descriptive interface for platform management hardware that monitors server characteristics such as temperature, voltage, fans, power supplies, and chassis.</td>
</tr>
<tr>
<td>OOB</td>
<td>Out-of-Band. System platform management access that does not involve going through the OS or other software running on the main processors of the managed system.</td>
</tr>
<tr>
<td>PEF</td>
<td>Platform Event Filtering. A feature in IPMI that enables the BMC to generate a selectable action (e.g. power on/off, reset, send Alert, etc.) when a configurable event occurs on the management system.</td>
</tr>
</tbody>
</table>
Glossary

SAF  Service Availability Forum. Standards body consisting of Telco platform and software vendors that is defining RAS standards including UCMI

SAF-HPI  Server Availability Forum - Hardware Platform Interface. Name for a set of APIs and structures for representing and accessing platform management hardware.

SAF-TE  SCSI Accessed Fault-Tolerant Enclosures. SAF-TE provides a mechanism that enables RAID fault information to be sent to the hot-swap backplane via SCSI.

SDR  Sensor Data Record. SDRs provide the information that tells management software what sensors, events, management controllers, and FRU information is available from a given IPMI implementation.

SEL  System Event Log. A non-volatile storage area and associated interfaces for storing system platform event information for later retrieval.