Intel Developer Forum
Fall 2001

Implementing IPMI-based Server Management

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Agenda

- Initiative Update & Architecture Review
- IPMI over Serial/Modem
- IPMI over LAN
- Components, Tests, and Tools

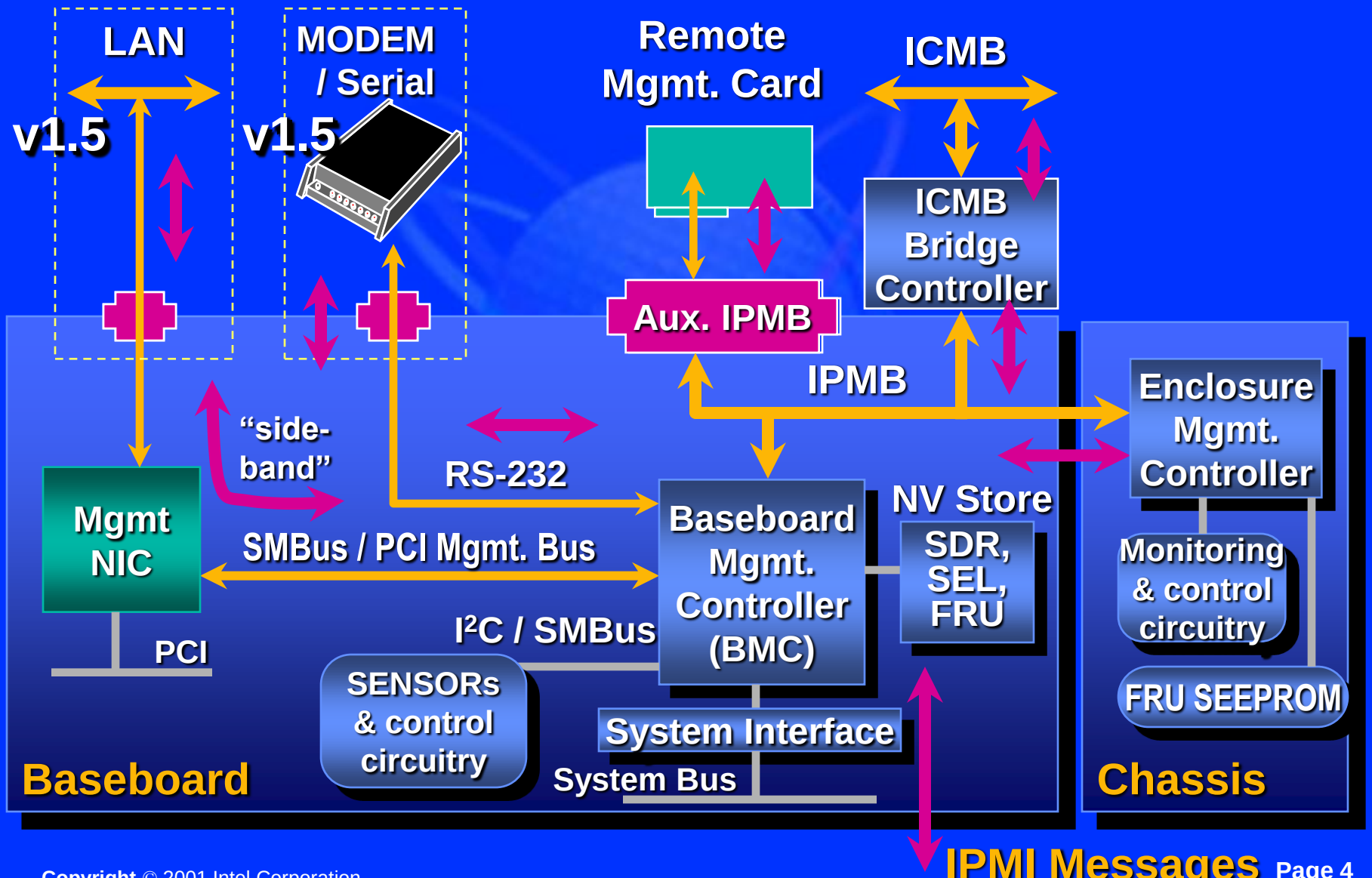
IPMI

Intelligent Platform Management Interface

- Defines common, abstracted, message-based interfaces to intelligent platform management hardware
- Defines common records for describing platform management devices and their characteristics
- Supports OEM differentiation and value added features
- Promoters: Intel, HP, NEC & Dell
- Plus over 87 adopters and growing…

IPMI Enables Cross-Platform Management Software

IPMI v1.5 Architecture

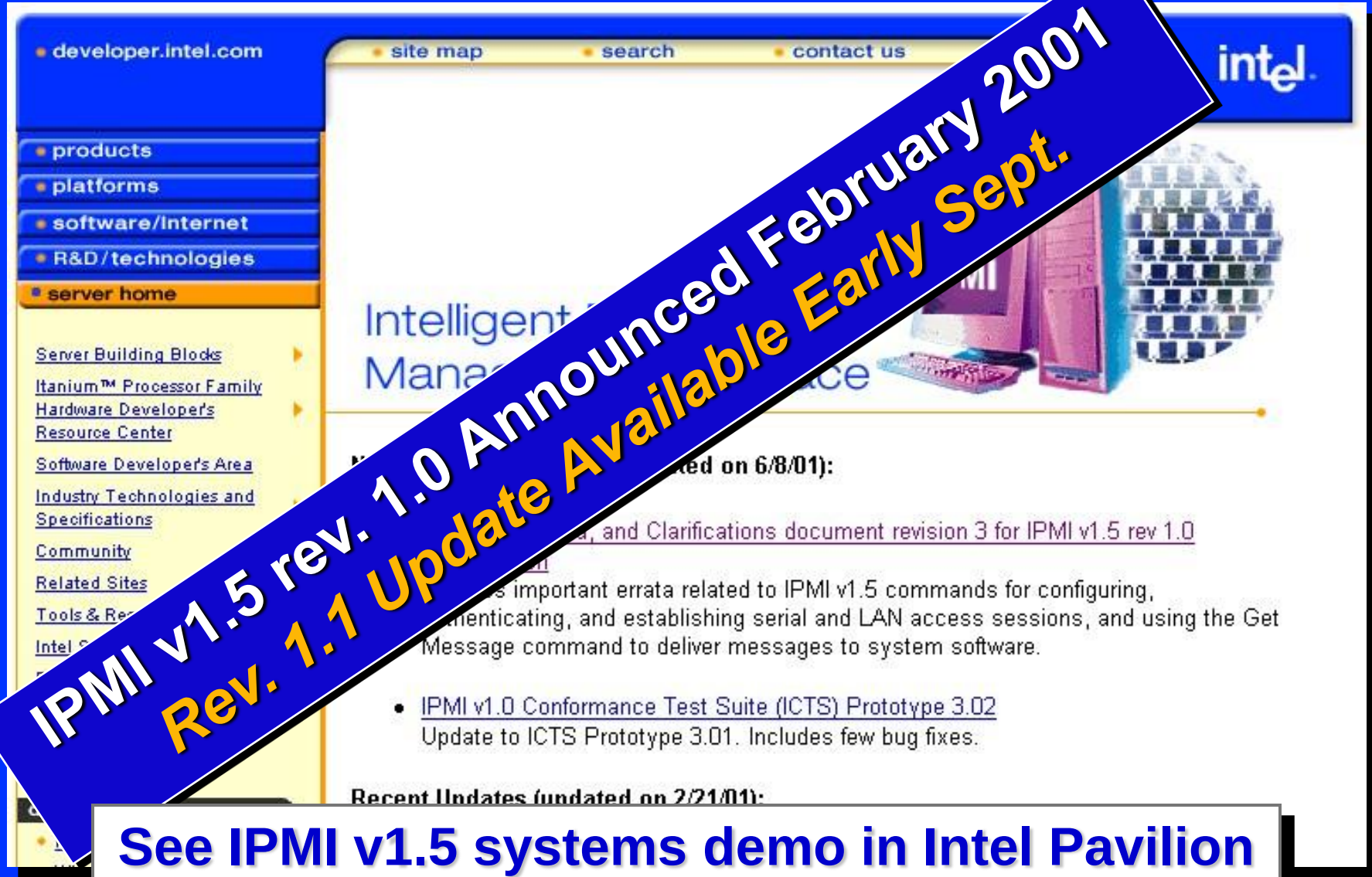


Common Serial/LAN Features

- Common communication commands using IPMI v1.5 “Channels”
- Common Multi-User, Multi-level authentication and access capabilities and commands
  - Callback, User, Operator and Administrator levels
  - Disabled, Pre-boot, Always available, and Shared access modes
- Flexible Alerting
  - Supports multiple alert destinations for ‘call down’ alerting
  - Alerting is enabled/disabled separate from IPMI messaging
- Event-based, automatic alerting & recovery actions
  - Configurable using Platform Event Filtering (PEF)
  - Reset, power off, power cycle, diagnostic interrupt, Alert

IPMI News

Intel Developer Forum



IPMI v1.5 rev. 1.0 Announced February 2001

Rev. 1.1 Update Available Early Sept.

See IPMI v1.5 systems demo in Intel Pavilion

Errata & Clarifications

- Corrections, including errata on:
  - Remote session activation, authentication, and access commands
  - Serial/LAN, Modem, and PEF configuration parameters
- Clarifications on:
  - Operation with Microsoft* 'Whistler' Headless
  - Interactions between serial port sharing and software/BIOS
  - Bridging messages between interfaces and to system software
  - Operation with multiple, teamed NICs

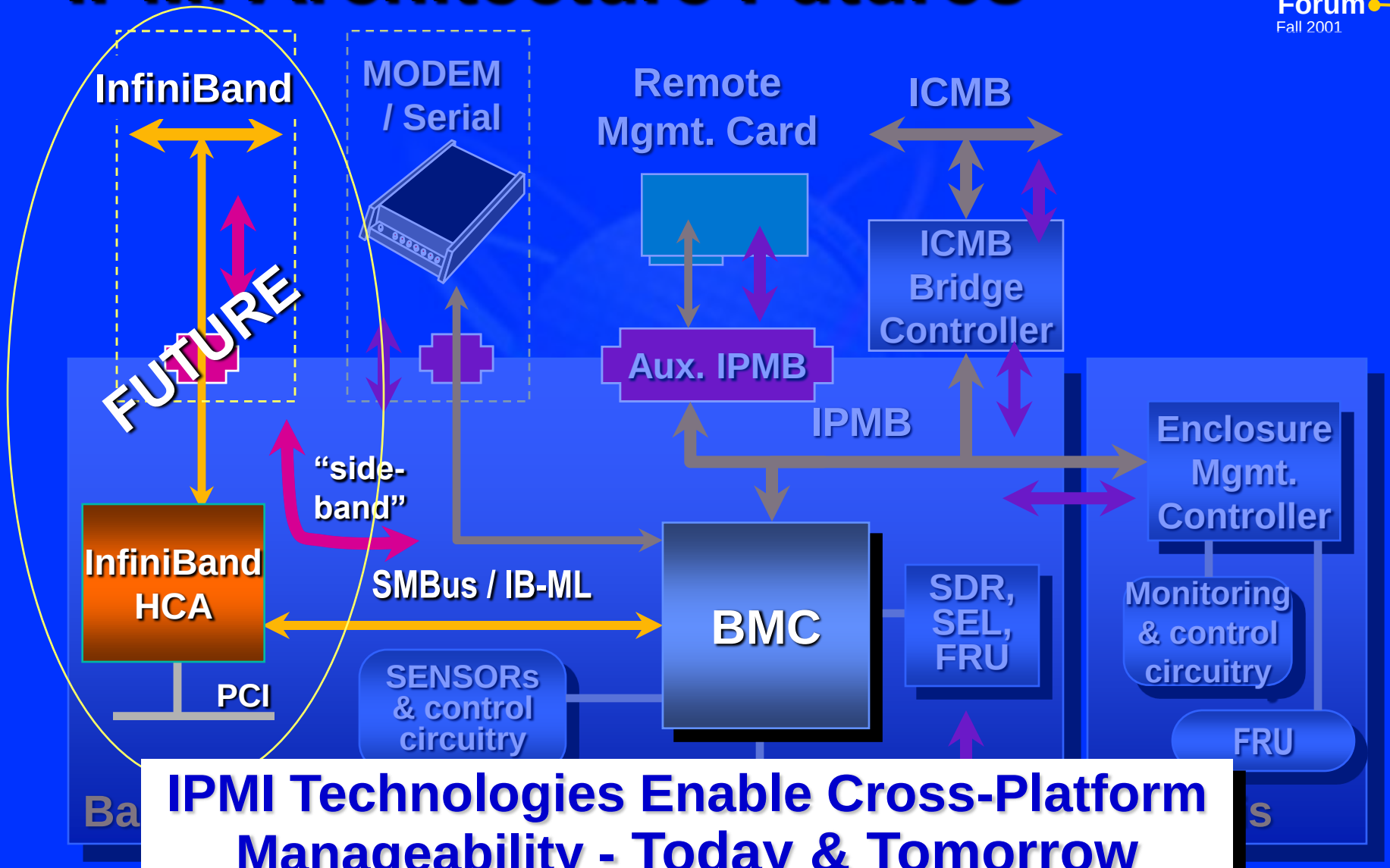
Addenda

- Auxiliary Event Log Support
  - Common commands to report when new entries added to companion logs to SEL
    - E.g. Itanium™ Processor Family machine check architecture (MCA) log
- Inferred Privilege Levels
  - Enable IPMI authentication to be used when communicating with local software

Addenda

- Additional Post Progress Event Codes
  - To match up with DMTF ASF (Alert Standard Format) specification
- External Environment entity
  - Identifies monitoring and events associated with external chassis environment
    - E.g. ambient temperature outside the chassis
- Additional System Restart Causes
  - For 'Get System Restart Cause' command
    - added restart due to: PEF initiated reset, PEF initiated power-cycle, & soft-reset <ctrl, alt, del>

IPMI Architecture Futures



IPMI Technologies Enable Cross-Platform Manageability - Today & Tomorrow

IPMI Web Site

- IPMI Specifications & Errata
  - Adopters get early access
- Presentations
- FAQ & Integration Guide
- Mailing list
- Tests and Tools
- Win32 Reference Driver

developer.intel.com/design/servers/ipmi

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Unique Features & Functions

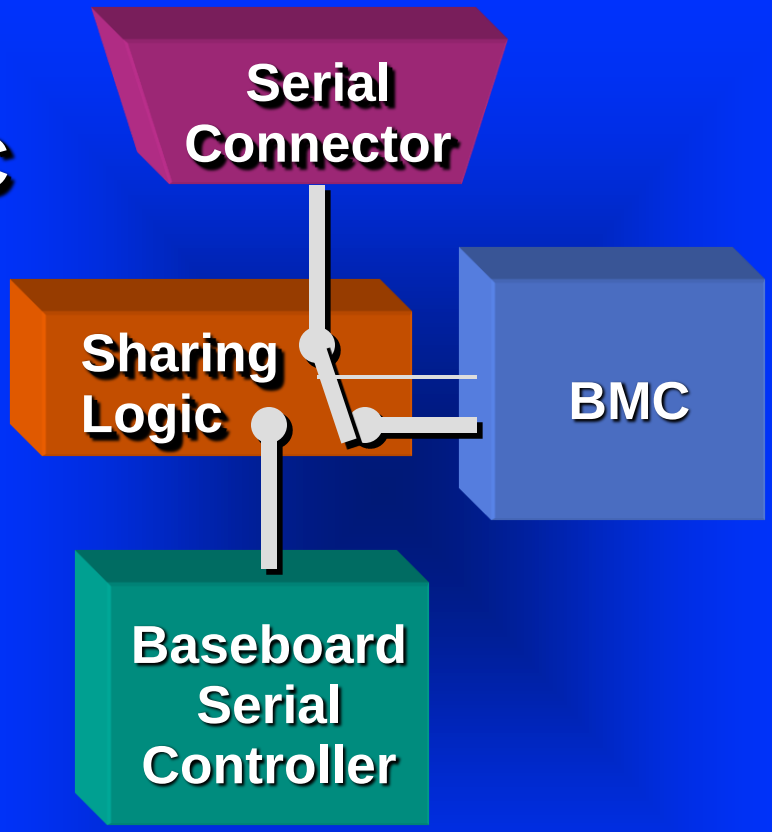
- Supports Direct and Modem Connect modes
- Basic, PPP, and Terminal Mode protocols
  - With protocol auto-detect option
- Callback
  - For Basic or PPP mode
  - PPP Call-back with CBCP option
- Serial Port Sharing
  - Ability to share serial connection between BMC and system serial controller
- Serial Alerting…

Alerting

- Three Types of serial/modem alerts
  - Dial Page
    - BMC sends numeric page by sending ‘touch tone’ dial sequence to Modem
  - TAP Page
    - BMC delivers alphanumeric page by connecting to a TAP 1.8 paging service via Modem
  - PPP Alert
    - BMC logs in to a remote account via PPP and delivers an SNMP Trap to the network

Serial Port Sharing

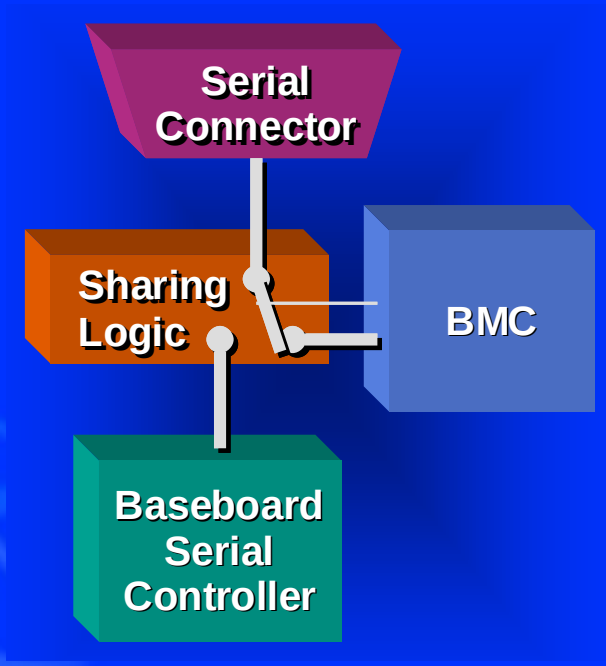
- Enables sharing serial connection between BMC and software/BIOS
  - Designed to work with BIOS console redirection
  - Supports Microsoft* 'Whistler' escape sequences



IPMI Serial/Modem Technology Provides All Phase Manageability

Serial Port Sharing

- Connection to BMC must run on Standby Power
- Must be wired for hardware handshake
  - uses CTS, RTS, DSR, DCD, RI
- BMC needs to be able to 'snoop' traffic to when 'mux' switched to system
- Avoid glitching when switching
  - Preserve handshake line state (e.g. DSR) to system



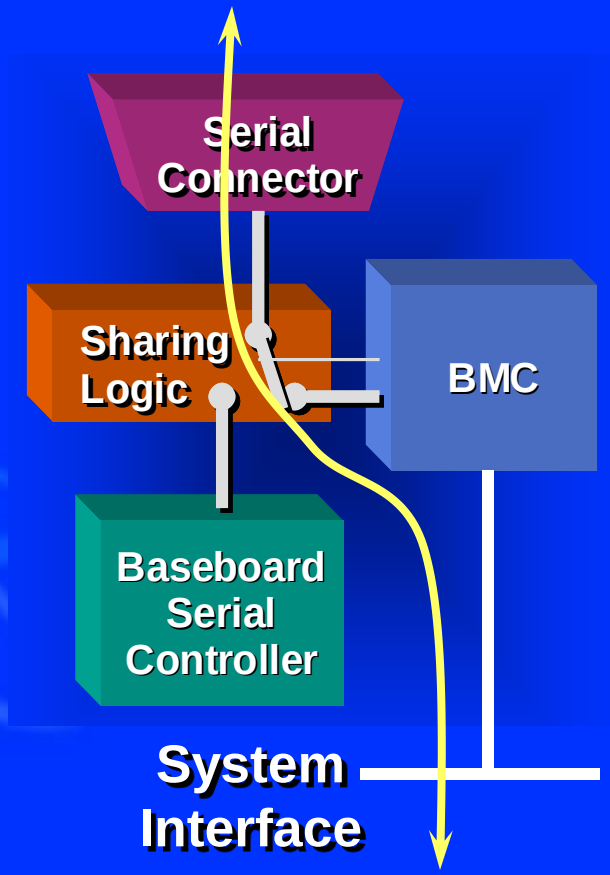
Whistler Headless Support

- Specifies BIOS Console Redirection format
  - Plus reset and 'service processor' escape sequences
- IPMI support for PPP, Basic, & Terminal Modes
  - BMC Snoops for Microsoft Whistler* escape sequences
  - PPP negotiation must be set to mask <ESC> character
- IPMI provides common configuration interface
  - enable/disable switch to "service processor" (BMC) on <ESC>(
  - enable/disable switch to System on <ESC>Q
  - enable/disable system Hard-Reset Sequence <ESC>RrR
- Don't forget 20 second "Escape Timeout"

Refer to Microsoft specs for additional system requirements

Messaging to Local Software

- BMC can be used to deliver messages to system software & vice versa
  - Via *Send Message* and *Get Message* commands
  - OEM Proprietary Messages
    - e.g. “Soft Shutdown Request”
  - Authentication provided via “Inferred Privilege Level”
  - Can communicate with system via any IPMI interface
- Can also use Boot Options parameters as ‘mailbox’



Example Remote Console Interaction

- Console uses *Set System Boot Options* to request next boot is to Diagnostic Partition
- Console uses *Chassis Control* to hard-reset system
- BIOS requests serial connection using *Set Serial/Modem Mux* command
  - Remote console receives BIOS Console redirection traffic
- BIOS acts on and acknowledges Boot Options using *Get* and *Set System Boot Options* commands
- Diagnostic Partition Loads, using special OEM Boot Options & switches connection back to BMC
- Remote Console uses IPMI Messaging to communicate with Diagnostic Partition via BMC

All IPMI control actions are authenticated

Access Mode options

IPMI *messaging* restrictions based on system phase and usage - do not affect Alerting

- **Disabled**
  - Channel unavailable for IPMI Messaging
- **Pre-boot**
  - Channel only available during POST, and when system is powered-down or hard reset. BIOS disables port prior to initiating boot.
- **Always Available**
  - Mgmt. Connection available during all phases of system operation.
  - For serial/modem, port is disabled or hidden from OS use
- **Shared**
  - Management connection available during all phases of system operation, and also available for system use
  - For serial/modem, BMC can 'answer the phone' if OS does not using Modem Ring Time parameter

See new info in rev. 1.1

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Unique Features & Functions

- IPMI Messaging and LAN Alerting via UDP
  - Uses DMTF 'Alerting Standard Format' RMCP Packet
- "Always Available"
  - Operates on standby power
  - Independent of host processors
- Can be used with dedicated or shared "side-band" network interfaces

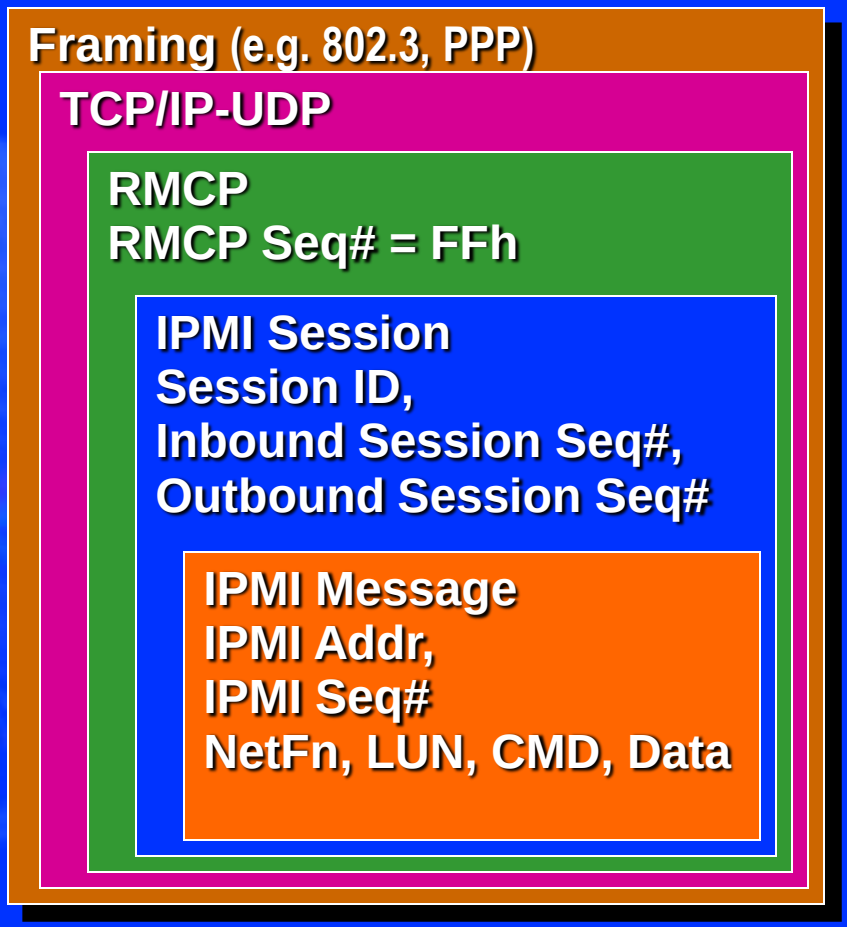
LAN Alerts

- Delivered as SNMP Traps
  - Format follows the Platform Event Trap (PET) Format Specification
  - IPMI supports optional *PET Acknowlege* message and retries
    - Requires 'IPMI Aware' remote console
    - Acknowledge can be configured on a per-destination basis

LAN Format

- Standards based:
  - 802.3 transport
  - UDP
  - DMTF Pre-OS WG RMCP Packet
- Supports multiple sessions on channel
- Supports per message authentication

Works with common network stacks & tools



Activating a Session

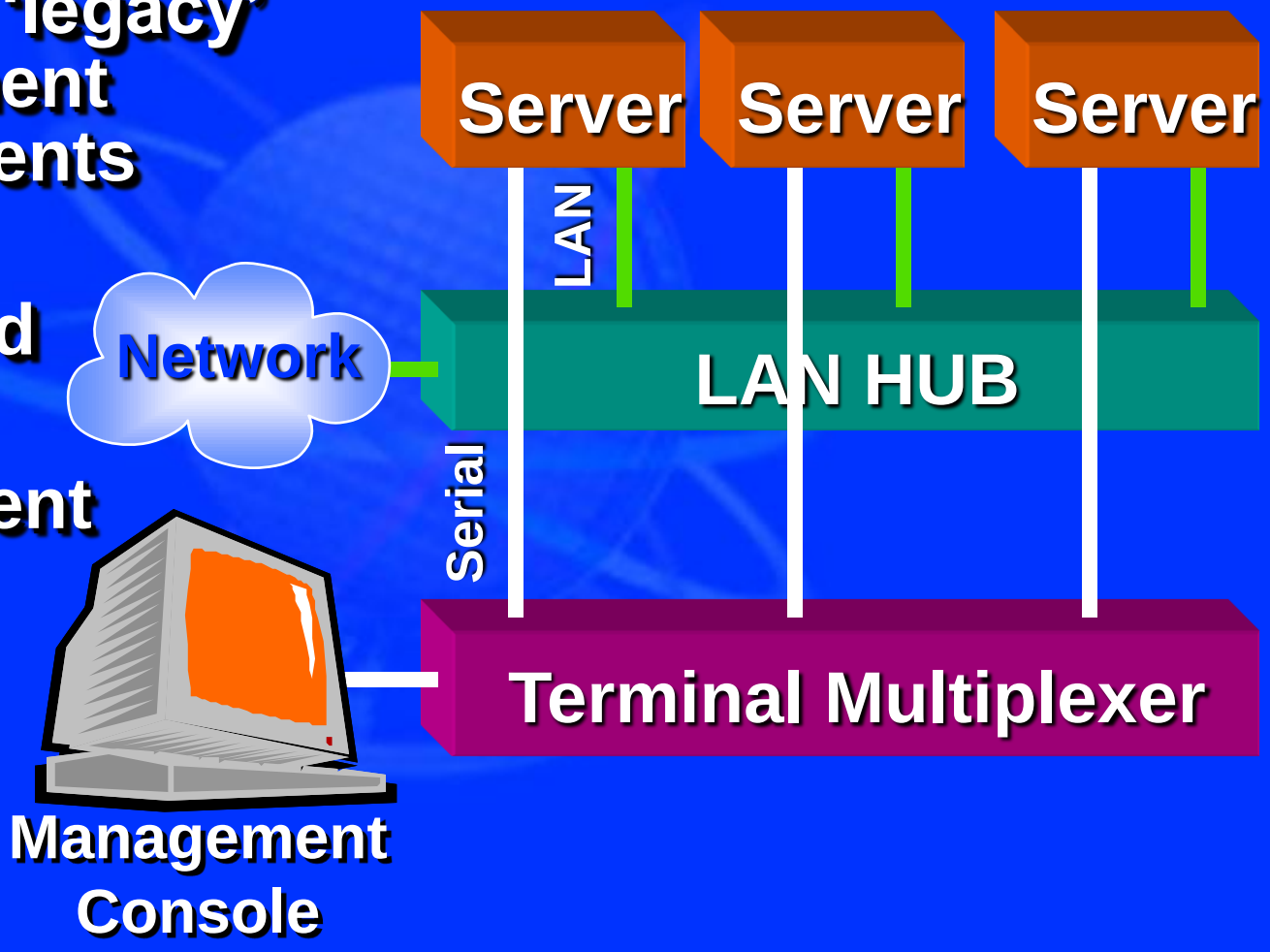
IPMI Challenge/Response

1. Console sends *Get Authentication Capabilities* command to BMC
2. BMC returns supported Authentication Types (e.g. MD5, password)
3. Console sends *Get Session Challenge* command including User Name and requested Authentication Type
4. BMC returns challenge string and temporary Session ID
5. Remote Console uses session info, user password, and challenge to generate signed *Activate Session* command to BMC
6. If signature verifies, session is activated

Same steps regardless of Authentication Type – For LAN *and* Serial/Modem = Software Reuse!

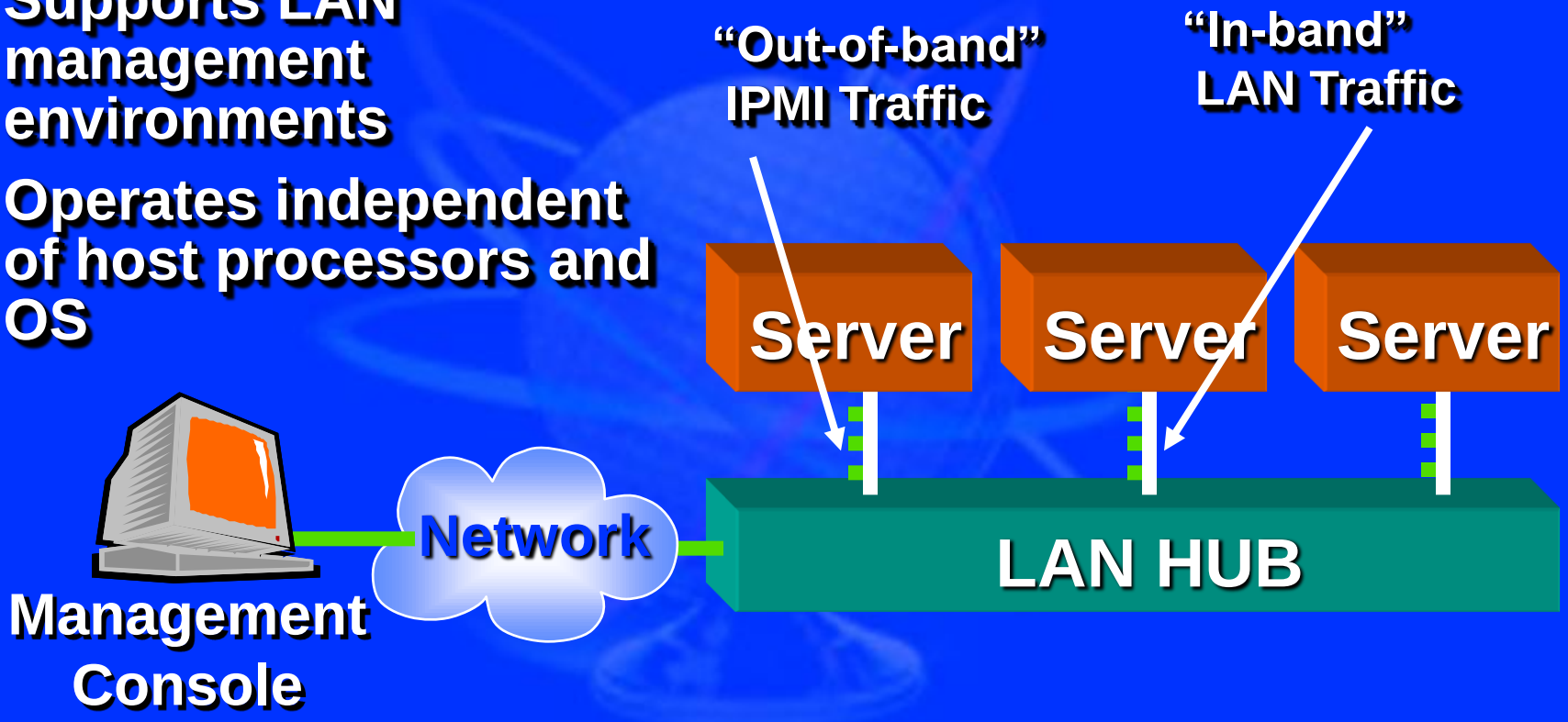
"Rack Management" Topology

- Supports 'legacy' management environments
- Supports partitioned networks
- Independent of LAN health



"Rack Management" Topology

- Supports LAN management environments
- Operates independent of host processors and OS



IPMI LAN Technology Enables "One-wire" Manageability

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Controllers and Components

- Companies creating Baseboard & Peripheral Management Controllers for IPMI
  - Agilent, National Semiconductor, Qlogic Corp., Vitesse Semiconductor, Winbond Electronics Corp.,
    - IPMI firmware and SDKs included in offerings
- New Sensor Components target System Management Applications
  - Many options: Offerings from Philips, Analog Devices, TI, National Semiconductor and others*

IPMI Software & Drivers

- Win32 Reference Driver from IPMI Web Site
- IPMI Driver Support in IBM AIX* and HP/UX*
- Open-Source Asia
  - IPMI-based Instrumentation Software development
- GoAhead Software
  - Developing SW application for IPMI in embedded system applications
- Agilent Technologies
  - IPMI SW available with Remote Management Card
- Intel Server Control
  - Bundled with Intel OEM Server Products

IPMI Adopter Tools

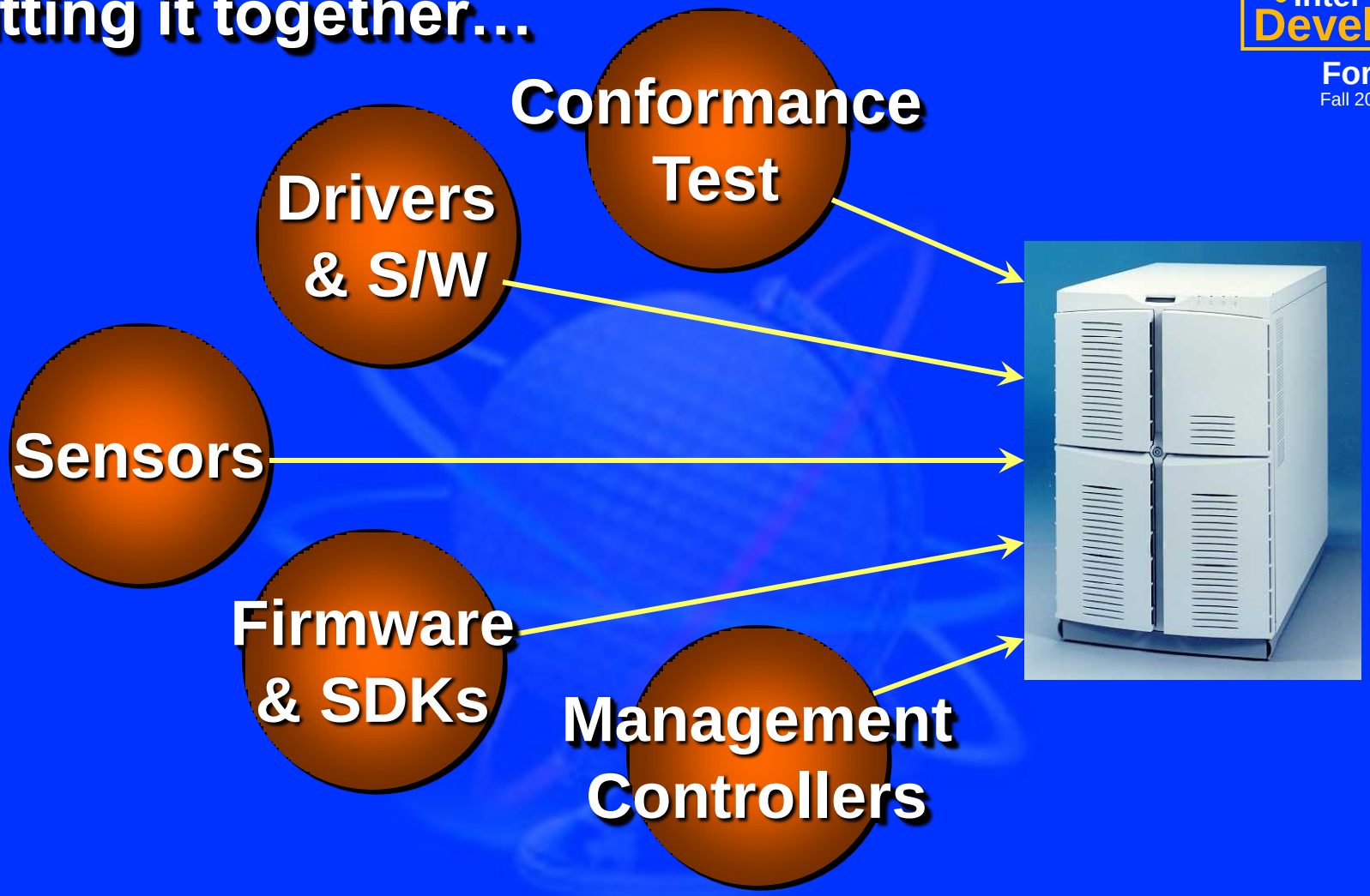
- IPMI v1.0 IPMITOOL
  - Simple DOS Command line tool for entering IPMI messages in 'hex-ascii' format
- IPMI v1.5 CMDTOOL
  - Available ~September '01 Supports manual IPMI v1.5 testing
  - Graphical Utility operates under Windows*
  - Supports:
    - KCS & SMIC System Interface
    - IPMB – Using Calibre ICA90 or PCI90 card*
    - ICMB – Using RS232-to-RS485 Adapter
    - PCI SMBus interface to BMC** using Caliber ICA90/PCI90
    - LAN
    - Serial (basic mode only)

** requires BMC that accepts I^2C timing

IPMI Conformance Test

- v1.0 version available to IPMI Adopters today
  - IPMI v1.5 version available ~Q1 '02
- Performs automated conformance testing
  - System interfaces, Watchdog Timer, BMC Sensors
  - System event log (SEL) & sensor data record (SDR) access
  - Supports IPMB and ICMB Hardware-based testing
- Usable as IPMI development aid
  - Speeds Validation Testing (Days to Minutes)
- User extensible
  - TCL/TK-based

Putting it together…



Components, Tests, and Tools Reduce TTM for IPMI-based Designs

Summary

- IPMI Provides the Foundation for Extensible, Cross-Platform Manageability
- IPMI Serial/Modem Technology Provides All Phase Manageability
- IPMI LAN Technology Enables “One-wire” Manageability
- Tools and Components Reduce TTM for IPMI-based Designs

Call to Action

Implement IPMI “Always Available” Management In Your Next System Design

Organizations / Specifications

- IPMI (Intelligent Platform Management Interface) Specifications
  - http://developer.intel.com/design/servers/ipmi
- Microsoft “Whistler” Headless Server Operation
  - http://www.microsoft.com/hwdev/headless/
- DMTF* Pre-OS Working Group / ASF Specifications
  - http://www.dmtf.org

Contacts on IPMI Offerings

- **Agilent Technologies**
  contact.tm.agilent.com/tmo/datasheets/English/PRMC_ERMC.html, Niki Haines, niki_haines@agilent.com
- **Analog Devices, Inc.**
  www.analog.com/pc & /temp-sensors, Paul Errico - paul.errico@analog.com
- **Intel Corporation, LAN Access Division**, Kevin Cline, ISV/Strategic Mktg Mgr, kevin.cline@intel.com [info on IPMI with Intel LAN controllers]
- **National Semiconductor Corporation**
  www.national.com/appinfo/tempsensors/ & /advancedio, Hezi Friedman, hezi.friedman@nsc.com
- **Open Source Asia**
  http://www.opensourceasia.com, Mark Lee, mark@opensourceasia.com
- **Philips Semiconductors**
  www.philipslogic.com/products/i2c, Joe Kochanski, joseph.kochanski@philips.com
- **Qlogic Corporation**
  www.qlogic.com, Mark Byrne-Quinn, mark.byrne-quinn@qlogic.com
- **Texas Instruments**
  www.ti.com
- **Vitesse Semiconductor Corporation**
  www.vitesse.com, Tom Brokaw,brokaw@vitesse.com
- **Winbond Electronics Corporation**
  www.winbond.com.tw, Chad M.C. Wu, mcwu0@winbond.com.tw

Server Management Controllers, Sensors, and Tools

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Questions?

Please remember to turn in your session survey form.

Acronyms

- BMC – Baseboard Management Controller
- FRU – Field Replaceable Unit
- IPMI – Intelligent Platform Management Interface
- IPMB – Intelligent Platform Management Bus
- ICMB – Intelligent Chassis Management Bus
- SDR – Sensor Data Record
- SEL – System Event Log
- RMCP – Remote Management Control Protocol
- PEF – Platform Event Filtering
- SNMP – Simple Network Management Protocol

IPMI Promoter, Contributor, and Adopter News

- Acer Inc.
- Agilent Technologies GmbH
- Alberta Microelectronics
- American Megatrends Inc.
- Arima Computer Corp.
- ASUSTek Computer, Inc.
- Axil Computer, Inc.
- Blue Wave Systems
- Bull S.A.
- Celestica
- Concurrent Technologies, PLC
- CyberGuard Corporation
- Data General Corporation
- Dell Computer Corporation
- Egenera, Inc.
- ElanVital Corporation
- Ericsson UAB
- Evans & Sutherland
- Eversys Corporation
- Exabyte Corporation
- FORCE Computers GmbH
- Fujitsu, Ltd.
- GoAhead Software, Inc.
- HADCO Corporation
- HCL Infosystems Ltd.
- Hewlett-Packard Company
- Hewlett-Packard GmbH
- Hitachi Ltd.
- Hybricon Corporation
- Ibus/Phoenix Corporation
- InnoMediaLogic, Inc.
- Intel Corporation
- Interphase Corporation
- InterWorks Computer Products
- Inventec Corporation
- Ipex ITG
- JMC Products
- L-3 Communications Corp.
- Lynux Works, Inc.
- Macrolink, Inc
- Magnetek, Inc.
- Micro-Star International
- Mirapoint, Inc.
- Mitsubishi Electric Corp. Info. Systems Engineering Center
- National Semiconductor Corp.
- NEC Corporation
- Nematron Corporation
- Network Appliance, Inc.
- Network Engines, Inc.
- NOCpulse, Inc.
- Olivetti Computers Worldwide
- Open Source Asia
- PEP Modular Computers
- Phoenix Technologies Ltd.
- Pinnacle Data Systems, Inc.
- Praim, Inc.
- Qlogic Corporation
- Radisys Corporation
- Reliance Computer Corporation
- Samsung Electronics Co., Inc.
- Sanera Systems, Inc.
- SBS Technologies (Industrial Computers GmbH)
- Scenix Semiconductor, Inc.
- Siemens AG
- Silicon Graphics, Inc.
- Stratus Computer Systems Ireland Ltd.
- Sun Microsystems
- Super Micro Computer, Inc.
- Symphony Group Intl. Co., Ltd.
- Synergy Microsystems
- Teknor Applicom, Inc.
- T-Netix, Inc.
- Tatung Co.
- Tektronix
- Texas Micro Corporation
- Toshiba Corporation
- Trimm Technologies
- Tyan Computer Corporation
- Universal Scientific Industrial Corp.
- USAR Systems, Inc.
- Vitesse Semiconductor Corp.
- Watrin System Design
- Vividon, Inc.
- Vooha, Inc.
- Winbond Electronics Corp.
- Ziatech Corporation