ACPI 2.0 Support for IA-64 Systems

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Learning Objectives

- Differentiate the changes in IA-64 system ACPI support moving from ACPI 1.0 to ACPI 2.0
- Identify the specific ACPI 2.0 enhancements that support or impact IA-64 platforms
- Explain how IA-64 workstation and server configurations are supported using ACPI 2.0 interfaces
- Articulate the time frame for when ACPI 2.0 platform support will be required including the estimated OS support timeline

Agenda

- ACPI Specification Scope and History
- ACPI 2.0 Overview
- ACPI 2.0 support for the IA-64 architecture and platforms
- ACPI 1.0 Support for IA-64 Systems
- ACPI 2.0 System Description Tables
- Migrating IA-64 Systems from ACPI 1.0 to ACPI 2.0
- Platform and OS Support Timeline
- Call to Action

ACPI Specification Scope and History

- ACPI provides uniform cross-platform interfaces enabling robust motherboard device enumeration and configuration along with device and system power management
- ACPI/OS-directed configuration and Power Management (OSPM) replaces existing interfaces:
  - PnP BIOS, APM, MPS, proprietary
- ACPI defines hardware, software, and firmware interfaces
- ACPI 1.0 published in December 1996

Scope and History - continued

- OS implementations to date include Windows* 98 and Windows 2000
- ACPI 1.0 Specification comments to date:
  - Difficult to read
  - Overwhelming to implement (from the OSV perspective)
  - Very mobile and power management focused
- ACPI 2.0 under development for 18 months
- ACPI Component Architecture is paving the way to greater OSV support for ACPI
- IA-64 Systems require ACPI!

ACPI 2.0 Overview

- 64-bit processor / addressing support added
- Processor / device performance states added
- Functional Fixed Hardware concept defined
- Many server related enhancements added
  - Hot-pluggable CPUs, Memory, and GPE Blocks
- Legacy Reduced HW IA-PC support included
- SM Bus CM interfaces rewritten
- General readability/consistency enhancements applied throughout
- ASL examples updated (corrected)

ACPI 2.0 Support for the IA-64 Architecture

- 64 bit addressing enhancements
  - Registers and Memory addresses
- IA-64 Interrupt controller (SAPIC, I/O SAPIC) support added
- System Address Map Interfaces now include EFI GetMemoryMap() Boot Services function
- Platform corrected error interrupt routing specified
- ASL QWORD arithmetic added
  - 64-bit ASL compiler available from tentatively Microsoft* January 1, 2001

ACPI 2.0 Support for IA-64 Platforms

- _PR and _TZ scopes obsoleted
  - Processors and thermal zones now defined under _SB
- Processor Object updated (more device-like)
- Memory Device added
  - Resource Type Specific Flags enhanced - Memory types expanded
- GPE Block Device added
- Module Device added
- New Device Notifications added for
  - Processor, Thermal, and PCI Hot Plug
- Expanded reserved table signatures
  - DBGP, ECDT, ETDT, HMEM, OEMx
  - Data Table operation region support added

Other Configuration Enhancements for Servers

- _FIX (Fixed Hardware)
  - Provides a correlation between the fixed hardware register blocks and the devices in the ACPI namespace that implement them
- _MAT (Multiple APIC Table Entry)
  - Facilitates hot plugging of APICs and SAPICs
- _PXM (Proximity)
  - Provides topology information conveying proximity of processors, memory, and I/O enabling CC-NUMA optimizations
- _HPP (Hot Plug Parameters)
  - Specifies the Cache-line size, Latency timer, SERR enable, and PERR enable values for use during hot inserting a PCI device
- _SEG (Segment)
  - Indicates a bus segment location - a level higher than _BBN
    - Each segment has a potential of 256 PCI Bus Numbers

ACPI 1.0 Support for IA-64 Systems

- ACPI 1.0 System Description Tables for IA-64 (interim tables)
  - 32-bit tables expanded to 64-bits + interrupt controller support
  - Not backward compatible with ACPI 1.0 OS
  - Conveyed to OS from the EFI OS loader
    - Loader finds pointer to RSDP Structure in EFI system table using ACPI 1.0 GUID
    - Pointer conveyed to OS via OS dependent data structure

ACPI 2.0 System Description Tables

- Generic Address Structure (GAS) is a key structure
  - Extends register addressing to 64-bits
  - A Register's address space can be specified
    - Enables Memory-mapped I/O–based registers
  - Can describe both fixed registers and addresses

- New fields added at end of the system description tables to maintain compatibility with ACPI 1.0

ACPI 2.0 Tables - continued

- RSDP Structure extended to allow 64-bit pointer to the new extended RSDT (XSDT)
- Support added for finding the RSDP structure on EFI-enabled systems (IA-64)
  - Loader finds pointer to RSDP Structure in EFI system table using ACPI 2.0 GUID (8868E871-E4F1-11d3-BC22-0080C73C8881)
- XSDT added (extended RSDT)
  - Provides identical functionality to the RSDT but accommodates 64-bit physical addresses
  - XSDT supersedes RSDT – ACPI 2.0 OS will look for XSDT first
  - Allows platform to provide one set of tables to an ACPI 1.0 OS and another set of tables to an ACPI 2.0 OS

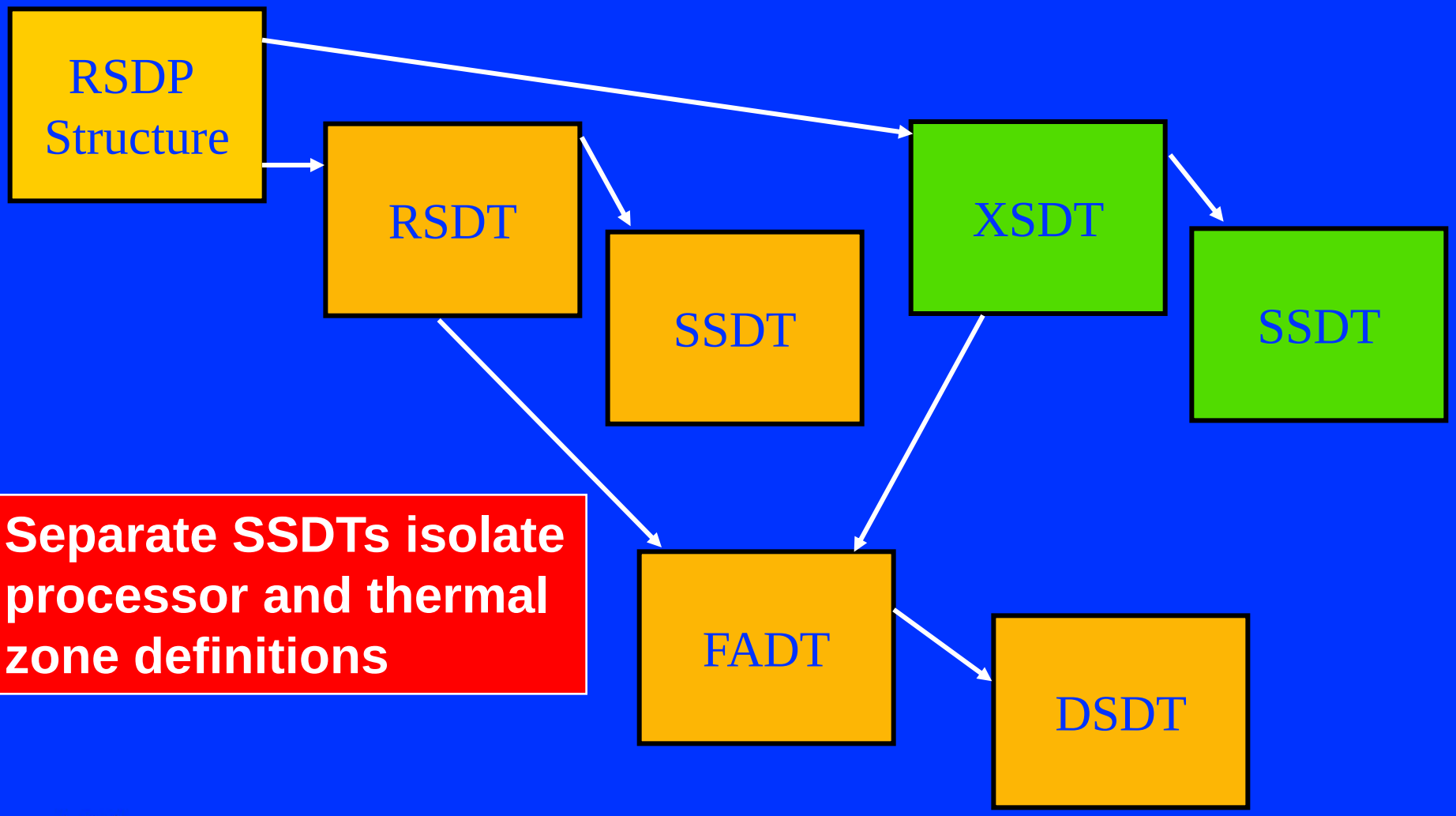
ACPI 2.0 Tables - continued

- **Fixed ACPI Description Table (FADT)**
  - **New fields support IA-64**
    - **FACS (X_FIRMWARE _CTRL)**
    - **DSDT (X_DSDT)**
    - **Fixed register blocks (X_*registerblock*)**
    - **SW_CPU_SLP (fixed feature flags bit 13)**
      - If set, OSPM uses native instruction to place the CPU in a sleeping state during system sleep sequence
- **Firmware ACPI Control Structure (FACS)**
  - **New X_Firmware_Waking_Vector field supports IA-64**
  - **Global lock stays 32 bits!**

ACPI 2.0 Tables - continued

- Multiple APIC Description Table (MADT)
  - New APIC structure entries support IA-64
    - Local APIC address override
    - Local SAPIC
    - I/O SAPIC
    - Platform Interrupt sources
      - Routing for PMI, INIT, and Corrected Platform Error Interrupts

ACPI 1.0 and 2.0 OS use of ACPI 2.0 System Description Tables



Separate SSDTs isolate processor and thermal zone definitions

Migrating IA-64 Systems from ACPI 1.0 to ACPI 2.0

	ACPI 1.0	ACPI 2.0
RSDP Structure Pointer	ACPI GUID	ACPI 2.0 GUID
RSDP	Reserved = 0 RsdtAddress (8 bytes)	Revision = 2 RsdtAddress (4 bytes) Length XsdtAddress Extended Checksum Reserved (3 bytes)
RSDT / XSDT	Reserved (4 bytes) Entry (8 bytes)	ACPI 1.0b RSDT is maintained Use new XSDT – Same as IA-64 RSDT except: Reserved field removed
FADT	ACPI 1.0b FADT Reserved fields added (padding) Other fields removed ADDRESS_SPACE field added Address fields expanded	ACPI 1.0b FADT is extended: Reserved fields now used New fields added (e.g. reset support) New fields (at end) provide extended addressing support using the GAS.
FACS	Firmware Waking Vector (8 bytes) Global Lock (8 bytes)	X_Firmware_Waking_Vector added (at end) Global Lock remains 4 bytes
MADT (APIC/SPIC)	Interrupt Block	ACPI 1.0b MADT extended – new APIC structure entries. Local APIC Address Override Local SAPIC, I/O SAPIC, Platform Interrupt Sources

ACPI 2.0 Release Schedule

- ACPI 2.0 is published!
- Download the spec from the teleport site:

  http://www.teleport.com/~acpi

Platform Support Timeline

- Hardware Design Guide Version 3.0 for Microsoft* Windows 2000 Server
  - Requires ACPI 2.0-defined interfaces for all IA-64 systems
  - Compliance date is July 1, 2001
- DIG64 Release 2.0
  - Update will require ACPI 2.0-defined interfaces (September 29, 2000)
  - Expected compliance – McKinley-based IA-64 platforms

OS Support Timeline

- Microsoft* will have a phased implementation approach to ACPI 2.0 support
  - Implementation of a small subset of interfaces is planned for Win64 and BTS 2001 OS releases
  - General support for ACPI 2.0 is planned for the OS release after the BTS 2001 OS release
  - Ask Microsoft for more information

- Linux support will vary with distributor
  - Contact your Linux distributor for more information
  - See also: http://phobos.fachschaften.tu-muenchen.de/acpi/

OS Support Timeline – cont.

- IBM Monterey
  - Tentatively targeted for the second release of Monterey on IA-64 in 1H2002
- HP-Unix
  - HP platforms and operating systems will support DIG64 guidelines on ACPI 2.0 when they become available
- Novell
  - NetWare 5 - 6 Pack release 1H2001 basic support
  - Modesto IA-64 OS - basic support in initial release
- Sun Solaris
  - Support timeframe not yet determined

What we learned today:

- The changes in IA-64 system ACPI support moving from ACPI 1.0b to ACPI 2.0
- The specific ACPI 2.0 enhancements that support or impact IA-64 platforms
- How IA-64 workstation and server configurations are supported using ACPI 2.0 interfaces
- The time frame for when ACPI 2.0 platform support will be required including an estimated OS support timeline

Call To Action

- Review the ACPI 2.0 specification
  - http://www.teleport.com/~acpi
- Contact us with any implementation questions
  - Use the email reflectors
    - Winpower@hwdev.org (Windows)
    - Acpilist@telelist.com (General)
- Include ACPI 2.0 support in your emerging platforms
  - Ask your BIOS vendor for ACPI 2.0 support
- Become an ACPI 2.0 Adopter
  - http://www.teleport.com/~acpi

ACPI 2.0 Contributors

- **Promoters**
  - Compaq, Intel, Phoenix, Microsoft, Toshiba
- **Contributing Adopters**

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Silicon Motion Inc.
Standard Microsystems Corp.
TouchStone (Unicore) Software
Transmeta Corp.
Unisys Corporation
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