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**Intel® Platforms**

<table>
<thead>
<tr>
<th>Business Desktop</th>
<th>Agenda:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Built-in Manageability</td>
<td>• It is an imperfect world</td>
</tr>
<tr>
<td>• Proactive Security</td>
<td>• Building the foundation in 2006</td>
</tr>
<tr>
<td>• Energy Efficient Performance</td>
<td>• The 2007 “Weybridge” Platform</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Digital Home</th>
<th>Solving the problems with Intel vPro™ technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Performance</td>
<td>• Conclusions</td>
</tr>
<tr>
<td>• Energy Efficient</td>
<td></td>
</tr>
<tr>
<td>• Connectivity</td>
<td></td>
</tr>
<tr>
<td>• Ease of Use</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mobility</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Performance</td>
<td></td>
</tr>
<tr>
<td>• Battery Life</td>
<td>• Effective Virtualization</td>
</tr>
<tr>
<td>• Uncompromised Connectivity</td>
<td>• Optimized Power &amp; Thermals</td>
</tr>
<tr>
<td>• Innovative Form Factor</td>
<td>• Reliable Data Intensive Computing</td>
</tr>
</tbody>
</table>

**Energy Efficient Performance**
Today’s Challenges

• Managing and Securing modern business clients is more challenging than ever
  – Zero day malicious exploits create scenarios that patching alone can’t resolve
  – Layered security improves platform protection capabilities
  – Optimized platform architecture removes bottlenecks, but also introduces complexity
  – Damaged software or hardware can impair the ability to remotely repair a client

• Client PCs are not manageable when they need it most, i.e. HW or SW problem or turned “off”.
  1. Desk-side visits & manual processes drive disproportionate share of IT costs
     – Intel IT: ~10-15% of help desk calls require desk-side visit, but drive ~50% of help desk costs
  2. Security threats increasing, time to respond decreasing but protections vulnerable to attack or user tampering
     – Time to exploit = 3 days; Time to vendor patch = 42 days

No single technology solves all of these problems!!
Intel’s Platform Solution

• Utilize a set of technologies that work together to:
  – Enable innovative solutions to solve these problems
  – Create a new framework for a rich layered security architecture
Evolving Intel® vPro™ in 2007 – “Weybridge”

- Intel Core™ 2 Duo
- Wolfdale CPU Support
- Windows Vista* Premium Logo
- eSATA*, Expanded USB*, Intel® Rapid Recovery Technology
- Reduced Chipset & Platform Power
- Low Power
- Intel® Active Management Technology 3.0
- Bearlake Family Chipsets
- Intel Trusted Execution Technology™
- Enhanced Virtualization (VTd)

2007 Weybridge Platform

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

Note: Certain features may be available only on particular SKUs
Intel® Virtualization Technology

Traditional Virtualization

Virtual Machine 1
- User OS 1
- App
- App

Virtual Machine 2
- User OS 2
- App
- App

Virtual Machine 3
- User OS 3
- App
- App

“Heavyweight” Virtual Machine Monitor

Hardware Platform

Full OS Partitions
- Full OS capability
- Multiple applications
- Full HW suite available
- Generally virtualized devices
- Maximum features and capability

Virtual Appliance Model

Virtual Appliance
- User Environment
- App
- App
- Embedded OS
- User OS

Lightweight VMM

Hardware Platform

Virtual Appliance Partitions
- Generally headless
- Fixed/specific function
- Low OS profile
- Minimal management cost
- Minimal platform resource utilization
- Minimal true/virtual HW mapped
- OS state/power independent

Make Virtualization Applicable to Mainstream
VT-d Direct I/O Overview

Virtual Machines

Assigned IO Devices

Virtual Machine Monitor (VMM)

Phys Mem

Software remapping for CPU based memory access

Bearlake Family Chipsets

(VT-d – a chipset technology)

(VT-x – a CPU technology)
VT-d : DMA based Protection and Remapping for Virtual Appliances

- VT-d enables
  - Flexible memory management by VMM
  - Un-modified device drivers to run in both partitions
  - Contain DMA errors across partitions
  - Allows enforcement of independent security policies for each partition
Intel Trusted Execution Technology™
Introduced on Weybridge for Increased Security

• Codename LT extends Intel® VT capabilities of partitions and isolation to increase security using
  – Measured launch and a chain of trust to generate a secure partition
  – Trusted Platform Module (TPM) for Secure Storage of measurements and Signed reporting
Intel® Active Management Technology
Overview

- Provides Built-in Manageability and Proactive Security for networked computing resources
- Enables maintenance and repair of systems using out-of-band (OOB) management capabilities even if the system is powered off or the OS is down
- Helps secure networks by:
  - Proactively blocking incoming threats
  - Reactively containing the spread of threats
  - Ensuring critical software agents are present
  - Keeping installed software versions up to date
  - Enabling popular third-party management consoles and security applications in use today

1 Intel® Active Management Technology requires the platform to have an Intel® AMT-enabled chipset, network hardware and software, connection with a power source, and a network connection.
• **Discover**
  - Enhanced non-volatile memory storage
  - Out of Band access

• **Heal**
  - Provisioning & remote control
  - Hardware Diagnostics

• **Protect – System Defense: Filtering features**
  - Capability to allow, disallow, rate-limit packets based on 5-tuple IP Protocol Filter
  - Filters programmed by remote console
  - Filtering in hardware for LAN
  - Agent Presence

**Intel® AMT 06 Architecture Overview**
**Intel® Active Management Technology**

**Major Intel® AMT Components**

OOB Communication, Management Engine, Nonvolatile Memory

**Operating System**

- SW Diagnostics/Agents/Applications

**Network Driver**

**Management Engine Driver**

**Management Engine**

**ME Services**

**SOAP**

- TCP/IP
- TLS Confidentiality
- HTTP Authorization

**FLASH**

- BIOS
- NV Memory
  - Intel AMT Firmware
  - Intel AMT Private
  - Intel AMT Public

**LAN Controller**

- OOB Comms Filter

**PHY**

**System Defense**

**BIOS**
**Intel® Active Management Technology Usage Cases**

<table>
<thead>
<tr>
<th>Usage Case</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remote Asset Inventory</td>
</tr>
<tr>
<td>Hardware and Software Inventory</td>
</tr>
<tr>
<td>Remote Diagnostics and Repair</td>
</tr>
<tr>
<td>Encrypted, Remote Power-on and Update</td>
</tr>
<tr>
<td>Agent Presence Checking</td>
</tr>
<tr>
<td>Hardware-based Isolation and Recovery</td>
</tr>
</tbody>
</table>
Intel® AMT Core Attributes

Advantage over S/W Solutions

• **OS and HDD-Independent**
  - Runs outside the context of the OS
  - Works the same way regardless of the installed OS
  - Immune from OS configuration issues

• **Highly-Available OOB Remote Management**
  - Provides remote management capabilities in all system power and health states
  - Runs on auxiliary and battery power (mobile)
  - Wired and wireless network support (2007)

• **Tamper-Resistance**
  - Intel® AMT agent bound to the PC and configured by IT
  - Resistant to end-user modify/disable
  - Network and Host I/F Security
## Intel AMT Capabilities

### Advantage over H/W (WoL & ASF) Solutions

<table>
<thead>
<tr>
<th>Capabilities</th>
<th>WoL</th>
<th>ASF 2.0</th>
<th>Intel® AMT</th>
</tr>
</thead>
<tbody>
<tr>
<td>OOB Mgt (Any OS/power state)</td>
<td>Booting Only</td>
<td>Boot/reboot and alerts</td>
<td>Boot/reboot, alerts, event log, and remote control, redirection</td>
</tr>
<tr>
<td>Remote Control</td>
<td>Remote Boot Only</td>
<td>Remote Boot/Reboot w/ boot options</td>
<td>Remote boot/reboot w/ boot options, Serial Over LAN, IDE redirection</td>
</tr>
<tr>
<td>Event Alerting</td>
<td>No</td>
<td>Yes (1 Client, no filtering)</td>
<td>Yes (Broadcast to 16 clients, filter only desired events)</td>
</tr>
<tr>
<td>3rd Party Non-Volatile Storage</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Event Logging</td>
<td>No</td>
<td>No</td>
<td>Yes, including filters</td>
</tr>
<tr>
<td>Remote Reboot</td>
<td>No</td>
<td>Yes (PXE)</td>
<td>Yes (PXE or IDE-Redirect)</td>
</tr>
<tr>
<td>Asset Information</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Remote BIOS Update</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Secure Communications</td>
<td>No</td>
<td>Simple authentication - no encryption</td>
<td>SSL 3.1/TLS encryption, HTTP Digest/Negotiate authentication</td>
</tr>
<tr>
<td>Connection Protocol</td>
<td>None</td>
<td>RMCP</td>
<td>SOAP/HTTP (web browser access)</td>
</tr>
<tr>
<td>Layer 4 Stack</td>
<td>Registered packet</td>
<td>UDP</td>
<td>TCP (preferred routing protocol)</td>
</tr>
<tr>
<td>Firmware Updates Utility</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>System Defense / Agent Presence</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>System Defense /NOC Filters</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Conclusion

• Solving yesterday’s problems with enhancements to yesterday’s solutions is not sufficient to address the challenges of tomorrow

• We are well underway to redefining the PC
  – Radical new hardware that enables distinct technologies that work together being launched in 2006 and 2007
  – New class of solutions that solve problems in new ways are starting to emerge
  – Barriers to innovation are being cleared for ISVs
  – This is just the beginning – new innovations to come for the 2008 platform and beyond – stay tuned...
Intel® Virtualization Technology Mode Transitions

• VM entry (VMLAUNCH/VMRESUME)
  – Transition VMM ➔ Guest
  – Enters VMX non-root operation
  – Loads Guest state and Exit criteria from VMCS

• VM exit (VMEXIT)
  – Transition Guest ➔ VMM
  – Enters VMX root operation
  – Saves Guest state in VMCS
  – Loads VMM state from VMCS
  – May be triggered by many causes
    – E.g. Accessing CPU MSRs
Intel® Virtualization Technology Operation with VMCS

VMX Non-root Operation

VMX Root Operation

VMEXIT

IA-32 Operation

VMLAUNCH

VMRESUME