Microsoft* Windows* 8 Firmware Developments and Intel® Platforms

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Tony Mangefeste, Senior Program Manager, Microsoft
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Agenda

• UEFI 2.3.1c Specification Update and Intel Support
• Microsoft* Windows* 8 & UEFI
• Features for Modern PC Experiences
• Platform Recommendations
• Summary and Call to Action

The PDF for this Session presentation is available from our Technical Session Catalog at the end of the day at:

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URL is on top of Session Agenda Pages in Pocket Guide
• UEFI 2.3.1c Specification Update and Intel Support
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UEFI 2.3.1c Specification Update and Intel Support

• State of the Industry
• What’s New?
  – UEFI 2.3.1c
  – Platform Initialization (PI)1.2.1
  – Intel® UDK2010.SR1.UP1

• Useful Development Tools
  – Intel UEFI Community
  – Web-based UEFI Training
  – Driver Writer’s Guide
  – UEFI Driver Wizard
  – Intel® UDK Debugger Tool
State of the Industry
State of the Industry

• UEFI is at a tipping point...
  – Logo requirement for Microsoft* Windows* 8
  – Supported by major Linux* distributions

• Still room for improvement in UEFI
  – Developer education, improving the number of peripherals with UEFI Drivers
  – User education, based on common mistakes in coverage on topics like UEFI Secure Boot
What’s New?
UEFI 2.3.1c
Intel® UDK2010.SR1.UP1
What’s New?

• UEFI 2.3.1c
  – Update to the UEFI 2.3.1 Specification
  – Adds important firmware considerations
  – Addresses numerous ECRs

• UEFI Self Certification Test (SCT)
  – Updates for the UEFI 2.3.1c Specification
  – Soon to be released http://uefi.org

• Intel® UDK2010.SR1.UP1
  – Incorporates items deferred from Intel UDK2010.SR1
  – Posted to tianocore.org on June 25th
  – Updates to EDK II specs (v1.22 Errata B)
  – Available at http://tianocore.org
What’s New in UEFI 2.3.1c?

• Add: OS Indications Variable
  - OS/FW feature & capability communication
  - End-users can request to enter BIOS setup menu after next reboot from the OS

• Add: Retain factory default keys in Setup Mode
  - Related to UEFI Secure Boot for Open Source OS or “OS agnostic” end-user configurations

• Remove: Runtime driver requirement for UNDI
  - Allows Network UNDI drivers in EFI Byte Code (EBC)

• Other Engineering Change Requests (ECR) in MANTIS
  - See the Specification for Details
Useful Development Tools

- Intel UEFI Community
- Web-based UEFI Training
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Intel UEFI Community

http://intel.com/udk

Welcome to Intel UEFI Community Resource Center
Your gateway for developing UEFI firmware, drivers, and applications for use on Intel® architecture platforms.

Learn more about UEFI »

Learn.
Training courses and Intel® Developer Forum presentation library »

Communicate.
Forum for discussions with Intel engineers and other developers »

Share.
Upload and download files for sharing with the community »

Develop.
Intel UEFI technology, software and tools, specs, and docs »

Find solutions.
Get conforming devices, BIOS, and drivers from participating vendors »

Launched June 2012
Intel UEFI Community

http://intel.com/udk

Example content from the ‘Develop’ page...

Pointers to content from Intel, TianoCore.org, uefi.org, OS vendor websites and more
UEFI Self-paced Web-based Training

- UEFI and Platform Initialization Specification Training
  - From Power on through PEI, DXE, BDS and Booting the OS
  - 6 lessons with key point questions
Driver Writer’s Guide for UEFI 2.3.1

- Expanded to cover UEFI 2.3.1 topics
- Designed as a developer reference
  - Organized & indexed by driver function
  - Not a “cover to cover read”
- See ‘Enabling Resources for UEFI Driver Developers Using EDK II’ at tianocore.org
UEFI Driver Wizard

- Menu-based GUI to simplify UEFI Driver development
  - Uses EDK II or “IHV” subset of UDK2010
  - Wizard-based template generation
- Open source project contributed to tianocore.org by Intel SSG
  - Python* interface, designed for extensibility
  - Intel encourages contribution by developers
- Download Link: UEFI Driver Wizard (MSI) on Sourceforge.net
Intel® UDK Debugger Tool

- Source level debugger for UEFI firmware & drivers
  - Debug the boot phases – SEC, PEI, DXE, BDS, SMM
  - Set breakpoints, step into, and step over routines
  - View and edit local & global variables, and general purpose registers
- Low-cost alternative to a hardware ITP/JTAG debug

http://intel.com/udk

Many Tools and Resources are Available for UEFI Developers ...
Agenda

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Why UEFI?

- User Experience value prop from day one: Fast Boot, OEM Certification, smooth transitions, etc.
- Secure Boot
- eDrive support for BitLocker
- SOC support
- WDS Multicast
- Boot Next support
- Seamless Boot
- Network unlock support for BitLocker
- Support for > 2.2 TB system disks
Windows* 8 Certification – UEFI

• Requirements:
  – All Windows* 8 Client systems must ship in native UEFI mode
    ▪ Class 2 – CSM Disabled
    ▪ Class 3
    ▪ Secure Boot\(^1\)
    ▪ New graphics requirements
    ▪ POST time maximums
    ▪ OEM Certification display guidance

• If implemented:
  – BitLocker network key protector\(^1\)
  – BitLocker Encrypted Hard Drive (eDrive) support\(^1\)

\(^1\)New with UEFI 2.3.1
Windows* 8 Boot Flow

- Windows 8 installs UEFI OS Loader if UEFI is detected
- Many PCs today boot through CSM path
- For compatibility the CSM boot path available

*Windows 8 with UEFI is preferred*
# Windows* Deployment Paths

<table>
<thead>
<tr>
<th>Original OS</th>
<th>Upgrade to Windows* 8 UEFI Native(^2) Mode</th>
<th>Clean Install Windows 8 UEFI Native(^2) Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windows XP</td>
<td>No support</td>
<td>No Support</td>
</tr>
<tr>
<td>(BIOS Only)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windows Vista/7 (BIOS mode)</td>
<td>No support</td>
<td>No Support</td>
</tr>
<tr>
<td>Windows Vista/7 (UEFI mode)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Windows 8</td>
<td>No support</td>
<td>No support</td>
</tr>
<tr>
<td>(BIOS mode)(^1)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) Windows 8 supports install in BIOS mode systems (Legacy), but not feature parity between UEFI and BIOS systems

\(^2\) UEFI Native Mode – UEFI BIOS without CSM
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Windows* 8 Certification Requirements – UEFI Boot

Boot Performance Requirements

- Windows* 8 aims to support fast boot, on SSD systems
  - POST: <2s (without TPM; SSD) **requirement**
  - Boot to OS: <4s **best practice, varies by apps**
  - Device Init: <2s **best practice, varies by drivers**

- New WHQL Requirements for hardware design
  - TPM: <300ms init
  - Applies mostly to PCs with integrated displays (laptops, tablets, notebooks)
  - Read the Windows 8 System Certification Requirements for more details
Trusted Boot Architecture

1. Secure Boot prevents running an unknown OS loader
2. The kernel launches Early Launch Anti-Malware (ELAM) drivers first and they enforce policy for 3rd party drivers and apps
3. Measurements of the system start state were recorded in the TPM during boot
4. To prove a client is healthy the anti-malware software can quote TPM measurements to a remote verifier
Trusted Boot: Improving Malware Resistance

- **Secure Boot**: Firmware policy prevents launch of an untrusted OS by verifying the publisher of the OS Loader.

- **Anti-Malware Starts First**: Reduce the likelihood of a compromised operating system through early launch of approved AM software during the boot process.

- **Measured Boot**: Remotely determine if the operating system has been compromised by malware during the boot process via a comprehensive chain of measurements recorded during the boot process and stored in a Trusted Platform Module (TPM).
Secure Boot

Existing Boot Processes

<table>
<thead>
<tr>
<th>BIOS</th>
<th>Any OS Loader Code</th>
<th>OS Start</th>
</tr>
</thead>
</table>

- The BIOS starts any OS loader, even malware
- Now firmware enforces policy, only starting trusted OS loaders
- OS loader enforces signature verification of later components

Secure Boot in Windows 8

<table>
<thead>
<tr>
<th>Native UEFI 2.3.1</th>
<th>Verified OS Loader Only</th>
<th>OS Start</th>
</tr>
</thead>
</table>

- UEFI will only launch a verified OS loader – such as in Windows 8
- Malware cannot switch the boot loader
Secure Boot & Windows* 8

• Challenges
  – Growing class of pervasive malware that targets the boot path
  – Should Windows* be compromised by this type of attack, often the only plausible method to fix the problem is to reinstall the operating system

• Windows 8 Solution
  – Secure boot and remediation hardens the boot process against malware from the moment of power on through the initialization of anti-malware software
  – All firmware and software in the boot process must be signed by a trusted CA

• Required for all Windows 8 x64 client and SOC systems
A Seamless Boot Experience

...the modern PC experience

- Consistent requests for consumer electronics-like experience

- Current boot process is:
  - Disjointed, inconsistent
  - Displays varying levels of fidelity
  - When errors occur, displays scary text without actionable information
  - Making boot faster doesn’t resolve the problem
Seamless to the Desktop

...sleek and seamless

- Two visual experiences, seamless transition between them
- Clean up the look and feel of POST—proposed enhancements:
  - Render clean, high-resolution branding elements on black background
  - Remove “Text Mode” items / displays
  - Standardize input methods (e.g., F12 is always boot options across all systems)
- Fix / remove graphics mode switches
  - Several mode switches today—goal to reduce down to one when high-res driver is initialized
  - Systems should post with highest supported native display resolution
Pre-OS Firmware Setup

...Adding Firmware boot options to Boot Menu & how to access it

• F8 No longer available at Boot

• Windows Key preferred method for accessing PC Firmware settings

• Alternative method found in PC Settings to Reboot the system into settings
  − Tailored for environments without keyboard
  − Very fast POST times

• Preferred Key: Windows Key
Introduction to eDrives

What is an eDrive?
• A regular HDD that comes with hardware offload to accelerate crypto processing

How is it different from SEDs?
• **Self-Encrypting Drive**
  – TCG standards
• **Encrypted Drive**
  – TCG OPAL + IEEE 1667

Why should the ecosystem care?
• Initial hardware-based encryption is near line
• Faster than software-based during standard operation
• Removes initial and on-going performance hit caused by software-based encryption be it BitLocker or other 3rd party
• Standardize in-box support can enable broad adoption
Agenda

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Windows* 8 Platform Recommendations

• Improve platform security by ensuring that all assets are trusted on the platform
• Leverage UEFI drivers instead of option ROMs
• Design for adequate flash storage to store keys, certificates
• Consider impact of improved security
• Validate firmware components prior to execution
• Warn the customer if platform is not secure
Agenda

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Summary

• All Windows* 8 Client systems must ship in native UEFI mode

• Microsoft will continue to invest in UEFI

• Windows 8 & UEFI are foundation of the modern computing experience
Microsoft Call to Action

- Assess your UEFI readiness
  - Are you ready?
  - Are your processes ready?
  - Are your customers ready?
- Invest in platform firmware
  - Current investment, future potential
- Review Windows* 8 Certification Documentation
- Review //BUILD 2011 Presentations on hardware, UEFI and security
- Participate in UEFI plugfests
  - Bring your hardware, plug it in, test
- Join the UEFI Forum!
  - Contribute to the success of UEFI
Get More Information

• For more information on the Unified EFI Forum and UEFI Specifications, visit http://www uefi org

• UEFI Forum Learning Center http://www uefi org/learning_center/

• Intel UEFI Community - http://intel com/udk

• Use the TianoCore edk2-devel mailing list for support from other UEFI developers

• Go see UEFI Booth #946 in the showcase
## Other UEFI Sessions @ IDF

<table>
<thead>
<tr>
<th>Session</th>
<th>Title</th>
<th>RM</th>
<th>Day</th>
<th>Date</th>
<th>Time</th>
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<tr>
<td>EFIS001</td>
<td>Developing UEFI Support for Linux*</td>
<td>2008</td>
<td>Tue</td>
<td>11-Sep</td>
<td>10:30</td>
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<tr>
<td>EFIS002</td>
<td>Using Wind River Simics* Virtual Platforms to Accelerate Firmware Development</td>
<td>2008</td>
<td>Tue</td>
<td>11-Sep</td>
<td>12:45</td>
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<td>EFIS003</td>
<td>Intel and McAfee: Hardening and Harnessing the Secure Platform</td>
<td>2008</td>
<td>Tue</td>
<td>11-Sep</td>
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<td>EFIS004</td>
<td>Microsoft* Windows* 8 Firmware Developments and Intel® Platforms</td>
<td>2008</td>
<td>Wed</td>
<td>12-Sep</td>
<td>10:30</td>
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<tr>
<td>SECS004</td>
<td>Security Innovations in Intel® Platforms and Microsoft* Windows* 8</td>
<td>2008</td>
<td>Wed</td>
<td>12-Sep</td>
<td>2:00</td>
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<td>EFIC001</td>
<td>Poster: Intel® UEFI Development Kit Debugger Tool</td>
<td>Poster</td>
<td>Thur</td>
<td>13-Sep</td>
<td>11:15</td>
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<tr>
<td>EFIC002</td>
<td>Poster: UEFI Driver Development Tools</td>
<td>Poster</td>
<td>Thur</td>
<td>13-Sep</td>
<td>11:15</td>
</tr>
</tbody>
</table>

☑️ = DONE
USB Thumb Drive Contents

- **Driver Development**
  - Driver Writer’s Guide for UEFI 2.3.1 (PDF)
  - UEFI Drivers Wizard Install (MSI)
  - UDK2010.SR1.UP1.IHV (ZIP)

- **UEFI Summer Summit – 8 (PDF)**

- **EDK II Specs – Build specifications V 1.22 B (PDF)**

- **The Intel Technology Journal V15 #1 (PDF)**

- **Security – Signing UEFI Images (PDF)**

- **UDK2010.SR1.UP1 Release – (ZIP)**

- **UEFI and EDK II Training - (Self-paced Web)**

**Resources**
- [http://intel.com/go/idfsessionSF](http://intel.com/go/idfsessionSF)
- [http://intel.com/udk](http://intel.com/udk)
- [http://uefi.org](http://uefi.org)
- [http://tianocore.org](http://tianocore.org)
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Q&A
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Rev. 5/4/12
Backup
What’s New in UEFI 2.3.1c?

• Address Engineering Change Requests (ECR) in MANTIS
  – 831 PXE Boot CSA Type definition cleanup
  – 874 Provide a mechanism for providing keys in setup mode
  – 882 Indications Variable - OS/FW feature & capability communication
  – 907 iSCSI Device Path error
  – 909 Update to return codes for AllocatePool / AllocatePages
  – 912 UEFI 2.3.1 Type
  – 913 Enum definition does not match what our current compilers implement
  – 914 Error Descriptor Reset Flag clarification
  – 915 For x64, Change Floating Point Default Configuration to Double-Extended Precision
  – 917 UNDI drive does not need to be initialized as runtime driver
  – 921 Length of IPv6 Device Path is incorrect

See the spec for details!