Using the Latest EFI Development Kit (EDK II) for UEFI Advanced Development and Innovation

Penny Gao - Senior Software Engineer, Intel
Ping Ping Han - Senior Software Engineer, IBM
Dong Wei - Distinguished Technologist, HP

EFIS001
Agenda

• UEFI Technical Specifications updates
• Using UEFI as an enabling foundation for platform innovation
• EFI Developer Kit II (EDK II) Overview
• Industry leaders discussing how UEFI is helping them innovate and differentiate their products using EDK II
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Standard Firmware Interfaces

- **UEFI**: Unified Extensible Firmware Interface
  - a new model for the interface between the OS and platform firmware

- **PI**: Platform Initialization
  - Standardization: key to interoperability across implementations
  - Modular components like silicon drivers (e.g. PCI) and value-add drivers (security)
  - Preferred way to build UEFI

**UEFI is Architected for Dynamic Modularity**
Latest UEFI Specifications

- Platform Initialization (PI) 1.2 Spec
- Packaging 1.0 Spec
- UEFI 2.3 Spec
- Self Certification Tests (SCT) for UEFI 2.1 Spec
- Shell 2.0 Spec

Advancements in firmware technologies continue to evolve. Join the UEFI forum [www.UEFI.org](http://www.UEFI.org)
UEFI Specification Timeline

http://uefi.org

Specifications

- UEFI 2.0
- UEFI 2.1
- UEFI 2.2
- UEFI 2.3

- PI 1.0
- PI 1.1
- PI 1.2

- SCT UEFI 2.0
- SCT UEFI 2.1

Implementation

- EDK 1.01: UEFI 2.0
- EDK 1.04: UEFI 2.1
- EDK 1.05: UEFI 2.1+

- SCT PI 1.0
- PI 1.0
- PI 1.0
- PI 1.0

Open Source

- EDK II: UEFI 2.1+
- EDK II: UEFI 2.3+

All products, dates, and programs are based on current expectations and subject to change without notice.
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Utilize UEFI Full Potential

**Limited Benefits:**
- OEMs/ODMs internal Development Optimization & Code Modularity

**Full Benefits:**
- UEFI Innovation
- Performance
- Extensibility
- Advanced Usability

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<table>
<thead>
<tr>
<th>Legacy BIOS</th>
<th>UEFI CSM(^1) only</th>
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<tbody>
<tr>
<td>Class 0</td>
<td>Class 1</td>
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<table>
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<tr>
<th>UEFI Switch - CSM &amp; UEFI I/F</th>
<th>UEFI Pure I/F</th>
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<tr>
<td>Class 2</td>
<td>Class 3</td>
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1 Compatibility Support Module – Legacy BIOS interface on top of UEFI

Build UEFI Class 2/3 UEFI Systems!
UEFI Enabling Platform Innovation
Modern Firmware for Modern IT

Easier to configure and deploy
- Richer configuration (allows for more adapters)
- Graphic User Interface in Pre-boot environment
- Remote upgrade capability of specific firmware components
- Solves out-of-the-box configuration & provisioning issues

Makes Computers more manageable
- Creates a common infrastructure for managing all machines
- Enable secure automated management – lower risks of “Rogue” servers or clients on the network

Network Scalable and Secure Firmware
- Enhanced networking APIs in the pre-boot network stack
  - Richer network authentication (log-on)
  - UEFI Certificate Authority for interoperable trust

Breaks through BIOS barriers
- Free from architectural limitation - scales technology across all platforms (Server, Desktop, Mobile, and Handheld)
- Access to disk range beyond 2TB – utilization of resources
  - Option Rom Decongestion
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Package Philosophy

- As standards evolve there is a need to target your development on the set of standards you care about.
- Solution: break the EDK II up into “packages” and enable customers to make their own packages.
- Only package together what is needed.
Libraries - UEFI /PI Execution Phases

- Pre Verifier
- CPU Init
- Chipset Init
- Board Init
- Device, Bus, or Service Driver
- EFI Driver Dispatcher
- Intrinsic Services
- Boot Manager
- OS-Absent App
- Transient OS Environment
- Transient OS Boot Loader
- OS-Present App
- Final OS Boot Loader
- Final OS Environment
- ?

Security (SEC)
Pre EFI Initialization (PEI)
Driver Execution Environment (DXE)
Boot Dev Select (BDS)
Transient System Load (TSL)
Run Time (RT)
After Life (AL)

Power on → [ . . . Platform initialization . . . ] → [ . . . . OS boot . . . . ] → Shutdown

Same lib classes exist across multiple phases
Platform Configuration Database

Knobs to fine tune your firmware

• PCD entries are used for module “parameterization”.
• Benefits:
  – Reduce the need to edit source code
  – No searching for “magic” #define statements
  – Maximize module reuse across platforms
  – APIs for access to PCD entries
• PCDs can store platform information
  – Vital Product Data (VPD)
  – Serial Number, etc...
  – Setup options

Maximizes the re-use of modules
Minimize Source code editing
EDK II Benefits Package Distribution

- UEFI Packaging 1.0 Specification

**Distribution Package File**
(ZIP, .dist)

**Distribution Description File**
(XML, .pkg)

**Distribution Content File**
(ZIP, .content)

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**EDK II Implementation of UEFI makes everything just WORK!!!**
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IBM EDKII Era: EDKII Innovation on System x Servers

Ping Ping Han

Senior Software Engineer

China System & Technology Lab, IBM
Agenda

- IBM’s Role in uEFI
- IBM EDK Based System x Servers
- Embracing EDKII
  - What value EDKII adds to development effort
  - What value EDKII adds to the customer & OEM
- IBM Value Add in EDKII
- IBM eX5 Launch on EDKII Based Products
IBM’s Role in UEFI

- One of 11 uEFI forum promoters

- uEFI in System x Servers
  - Global Development (4+ time zones)
    - Raleigh
    - Austin
    - Kirkland
    - Shanghai/Taipei
  - 2007 kick off
  - 2009 ship the first product based on EDK
  - 2010 ship EDKII based System x servers
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EDK Based System x Servers

- Comprehensive transition of the System x portfolio to UEFI based firmware
- UEFI 2.1 PI 1.0 specification compliant

Blade
- HS22
- HS22V

Rack-mount
- x3650 M3
- x3550 M3
- X3250 M3

Tower
- x3500 M3
- x3400 M3
- x3200 M3

Large-scale
- dx360 M3
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EDKII benefits to development effort

**Package resource**
- Package can come from different providers, such as TianoCore, IHV etc

**Integration effort**
- Reduce integration effort with package based release
  - Dramatically lower integration time for Intel code drops (Intel code is mostly touchless in EDKII)

**Developer efficiency**
- Improve developer efficiency
  - Much better build time
  - Better/more complete code documentation
  - Strong/Explicit package structure to support isolation and clean Core/Platform model
  - New features such as PCD, Library class speed up the development
EDKII benefits to customers & OEMs

More standardized, more features and consistent look & Feel
- EDKII core code more strictly follows the UEFI and PI standards.
- New features will be more likely to be integrated to the EDKII products such as IPv6 etc
- More consistent look & feel and operation since more code is shared

Easy for OEM vendor to re-configuration
- OEM vendor can configure the OEM firmware according to their requirement
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IBM Value Add in EDKII

Key features beyond the basic requirements of uEFI firmware

**Seamlessly support legacy environment**
- IBM Surepath CSM (Legacy x86 BIOS support for legacy OS support)
- Touchless CSM invocation - auto detection of boot option (UEFI/legacy)
IBM Value Add in EDKII

Key features beyond the basic requirements of uEFI firmware

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**Standardized Pre-boot Security**
- TPM & Core Root of Trust for Measurement support (CRTM)
- Secure Update methods
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- Memory Predictive Fault Analysis Alerts
- DIMM Isolation
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- **Green Energy: Active Energy Manager (AEM)**
  - Power metering, power capping, power saving
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Out-of-band configuration and update capabilities
- Configure and update uEFI firmware via out-of-band tools such as ASU, iFlash etc
# IBM Value Add in EDKII

**Key features beyond the basic requirements of uEFI firmware**

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<td><strong>Multi-node support</strong></td>
<td>- Intel® Xeon® 7500, memory etc</td>
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Maximize Memory
Minimize Cost
Simplify Deployment

The broadest portfolio of systems optimized for your most demanding workloads

The fifth generation technologies of IBM Enterprise X-Architecture
eX5 Systems represent a broad portfolio including racks & blades

**BladeCenter HX5** Extends the value of Enterprise X-Architecture to BladeCenter

**System x3850 X5** Enhances the current generation with more capability than ever

**System x3690 X5** A new design offering best density for enterprise computing
MAX5: Maximizes memory capacity above x86 limit

MAX5 for eX5 racks and blades enables more, larger, faster databases and virtualization workloads

MAX5 enables up to 192 DIMMs or 3 TB of system memory
EDK II Transition
On HP Integrity Servers

Dong Wei – HP Distinguished Technologist
April 14, 2010
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Nearly all G100 Energy Companies

Efficient Automotive Manufacturing
75% G100 Automobile Manufacturers

More Efficient Manufacturing
75% G100 Electronic Manufacturing Companies

Better Healthcare Delivery
75% G100 Health Care Companies

Delivering New Telecom Services
Nearly all G100 Telecom Providers

More than 80 of top Global 100 companies running Itanium®

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- Intel® 7500 Scalable Memory Buffer and DDR3
- Intel® 7500 Chipset

Intel® Itanium® 9300
Intel® Xeon® 7500

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The Mission Critical Backbone of a Converged Infrastructure

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HP Integrity Servers based on Intel’s Itanium® 9300-series Processors

Delivers:

• Greater virtualization flexibility
• Simplicity through standardization
• Greener IT
• No compromise on RAS
• Dynamic scalability

Three significantly different platforms
• Rack-mount servers
• BladeSystems
• Superdome

Processor and chipsets
• Intel® Itanium® 9300-series processors
• Intel® E7500 Scalable Memory Buffer
• Intel® E7500 IOH, and ICH10
• HP-designed chipset for scalability
Transition to EDK II

• Integrity servers leading the way in HP in the transition

• All three platforms transitioned to EDK II
  • Have a single source tree
  • Benefited from the superior package-oriented architecture
    – Ability for reuse and single module/solution owners. Once a bug is fixed, every platform sees the benefit.

• The EDK Compatibility Package works very well
  – Reuses existing silicon modules
  – Build the UEFI shell
Lessons Learned

• Challenges
  • The continuous reference source tree updates from Intel
    - To keep up, we had to perform multiple large-scale source tree merges once every 2-3 months on average
    - Opportunities for improvements
  • A shared environment
    - some of this can be reduced by using the EDK II package solution to create platform specific modules when needed.
Summary

• UEFI is an industry standard with advanced firmware services enabling a stable platform foundation for richer OS Capabilities
• Industry leaders are using UEFI’s rich environment and delivering innovative solutions
• Utilize UEFI full potential – use the EDK II Implementation
• Make use of the rich UEFI community resources
Additional resources on UEFI:

• Other UEFI Sessions – Next slide
• More web based info:
  – EDK II Open Source Implementation: www.tianocore.org
• UEFI Plugfest Event at Intel in Dupont Washington, June 22-25, 2010 www.uefi.org or email: laurie.jarlstrom@intel.com
IDF 2010 UEFI Spring Sessions
April 14

<table>
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<tr>
<th>EFI#</th>
<th>Company</th>
<th>Description</th>
<th>Time</th>
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<tr>
<td>S001</td>
<td>Intel, IBM, HP</td>
<td>Using the Latest EFI Development Kit (EDK II) for UEFI Advanced Development and Innovation</td>
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<td>302AB</td>
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<td>S002</td>
<td>Intel, HP, Byosoft</td>
<td>Notebook Advancements for Unified Extensible Firmware Interface (UEFI) for Pre-boot Productivity</td>
<td>13:00</td>
<td>302AB</td>
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<td>Intel, Byosoft</td>
<td>Unified Extensible Firmware Interface (UEFI): Best Platform Security Practices</td>
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<td>Intel, Microsoft, Insyde</td>
<td>UEFI Fast Boot for Microsoft* Windows* 7: Fast Boot Without Compromising your BIOS</td>
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<td>Intel, Inspur, Insyde</td>
<td>UEFI Firmware Solutions for Enterprise Servers: A Case Study in 8-way Processor Support</td>
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DONE
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