Intel® UEFI Development Kit 2010 and Intel® Boot Loader Development Kit: Foundations for Advanced Embedded Development

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EFIS004

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Agenda

- Intel® UEFI Development Kit 2010 Key Features
- Embedded Device Boot Loader
- Intel® Boot Loader Development Kit Key Features
- Summary

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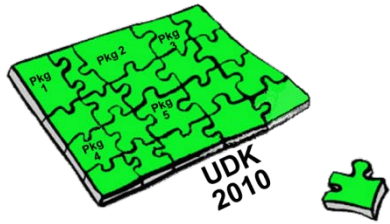
- Intel® UEFI Development Kit 2010 Key Features
- Embedded Device Challenges
- Intel® Boot Loader Development Kit Key Features
- Summary

Intel® UDK2010 Enables a Common Firmware Development Foundation Across the Compute Continuum

Spotlight on Select Intel® UDK2010 Features

- UEFI Specification Support
- Packaging
- Multiple compilers and OS development environment support
- Platform Configuration Database
- Well defined and Optimized Libraries
- Source Level Debugger
- Security
- IP6 Networking

UEFI Specification Support



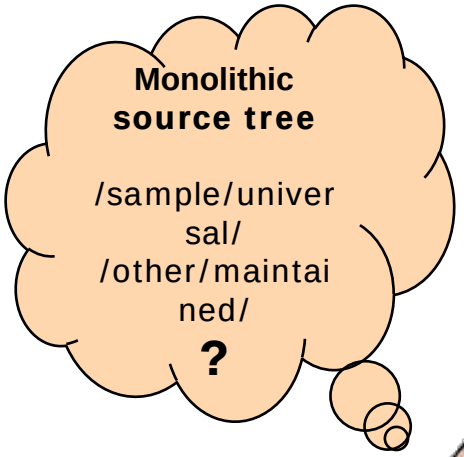
- Intel® UDK2010 Native support:
  - UDK2010 includes support for UEFI 2.2, UEFI 2.3, PI 1.1, and PI 1.2 (as well as all previous UEFI, EFI, and PI Specifications)
    - Shell 2.0 specification support in separate shell package
  - Pre-UDK contained definitions for UEFI 2.0, UEFI 2.1, PI 1.0 and Framework 0.9x Specifications; focused on UEFI 2.1 and PI 1.0 (PEI Core, DXE Core, PEIMs, DXE Drivers, UEFI Drivers, and libraries)

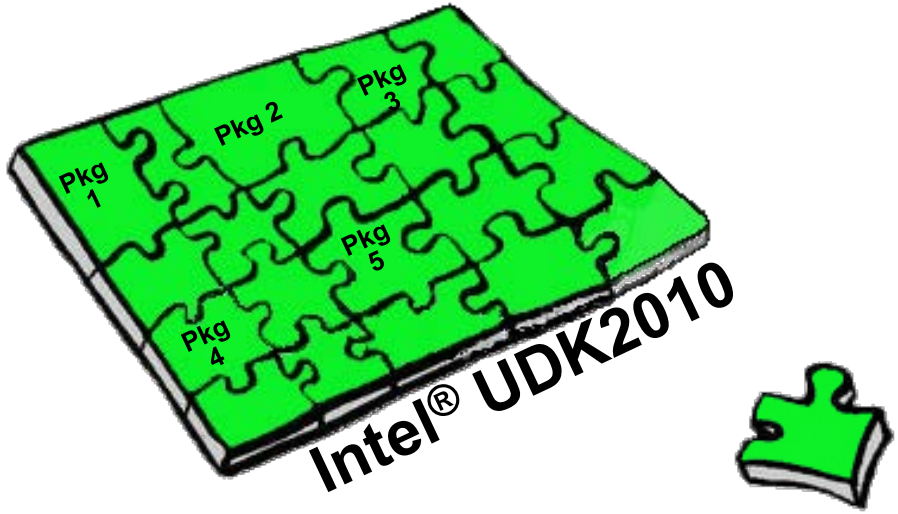
Security / Networking - UEFI 2.3
- IPV6/IPSec – next gen internet IP address allocation and security
- User Authentication & Driver Signing
- iSCSI & VLAN

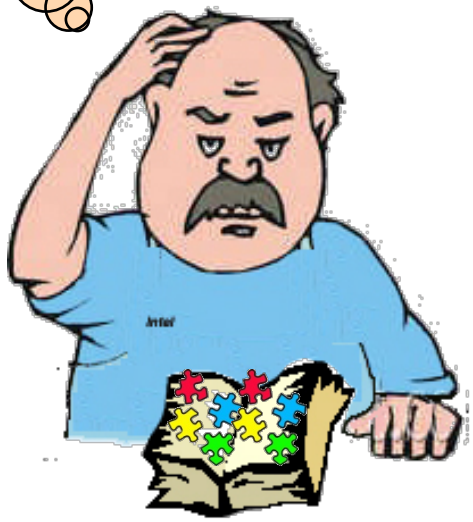
Human Infrastructure Interface (HII) – UEFI 2.1

Advanced Standard-based Capabilities

Packaging: Enabling Fast Delivery of Advanced Capabilities to Market







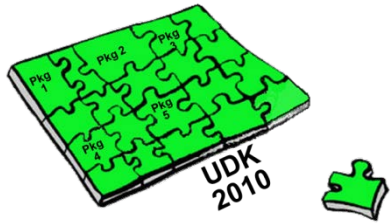
Firmware Developer

Example of Package-based deployment

- **Package 1** Industry standard modules and drivers
- **Package 2** Chipset PEIM's and DXE drivers
- **Package 3** System board code
- **Package 4** OEM Value-add

Intel® UDK2010 enables all the pieces to fit together and work!

Multiple Compilers and OS Development Environment Support Improvement over EDK

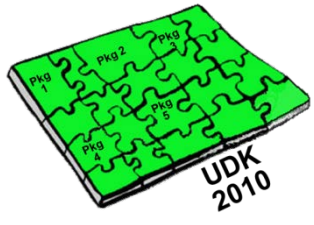


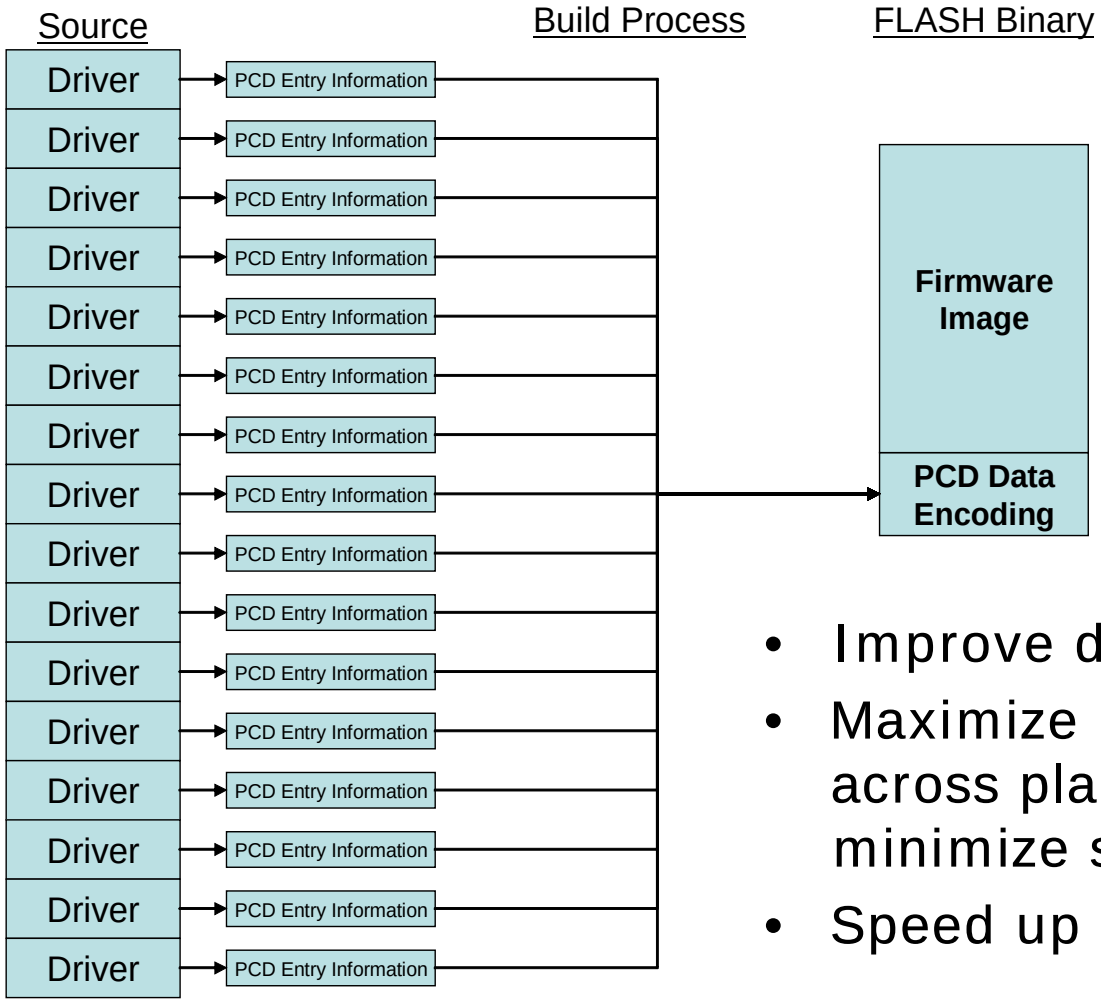
	EDK	UDK 2010
Development OS	Windows* XP	Windows XP, Windows 64, Vista32, Vista64, Linux*, OS/X*
Compiler/Linker	Visual Studio 2003, 2005, WinDDK	Visual Studio 2003, 2005, 2008*, WinDDK*, Intel® C++Compiler, GCC
Build	nmake	nmake, gmake
Build Tools	C	POSIX C, Python*

Improved Features and Support

GCC GNU Compiler Collection for C++
POSIX C Portable Operating System Interface for Unix

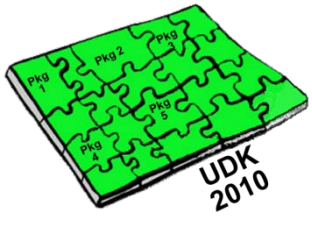
Platform Configuration Database

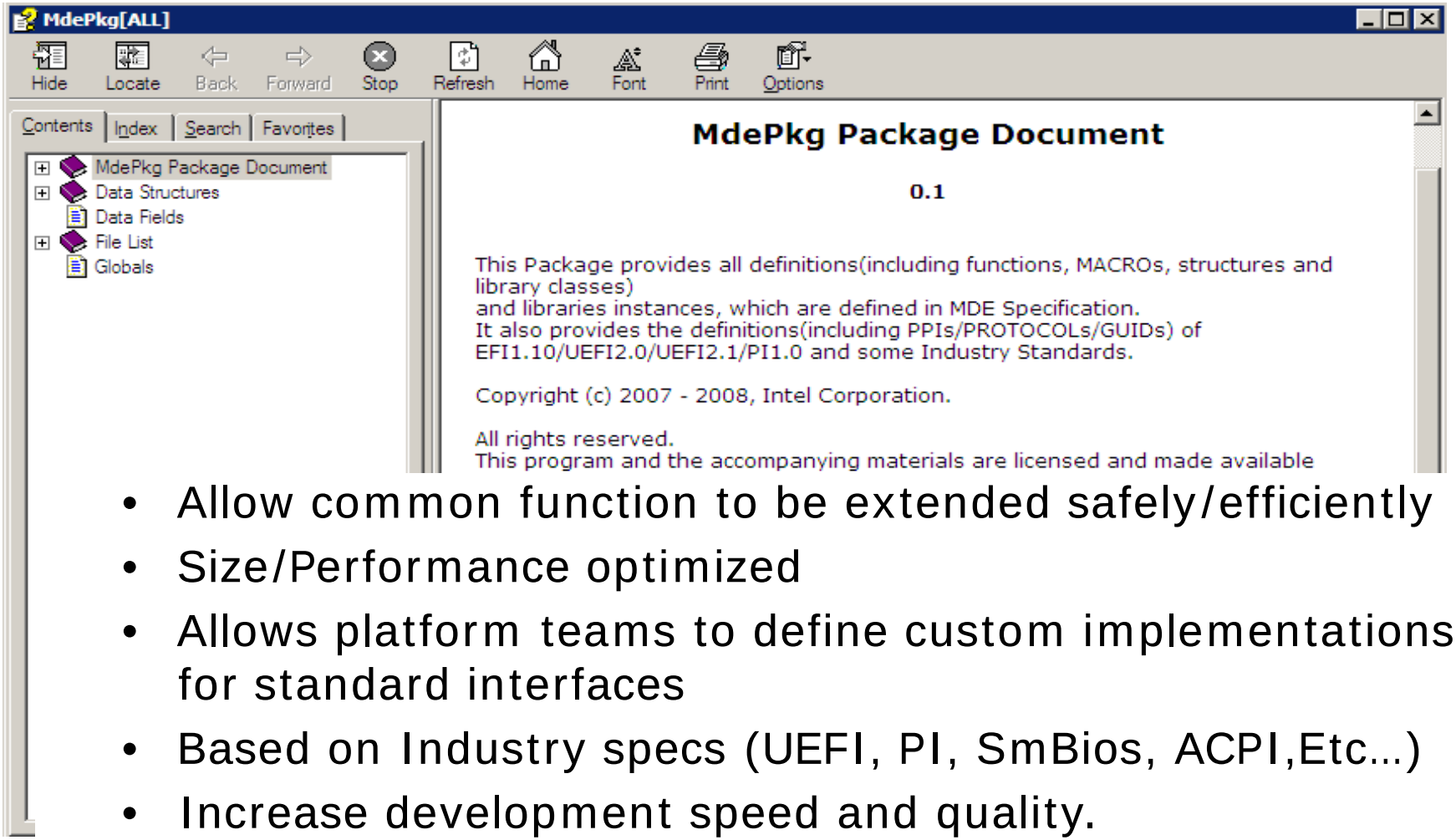




- Improve developer efficiency
- Maximize modules reuse across platforms and minimize source code editing
- Speed up development

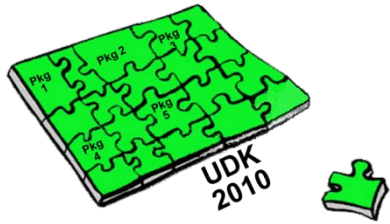
Optimized Libraries





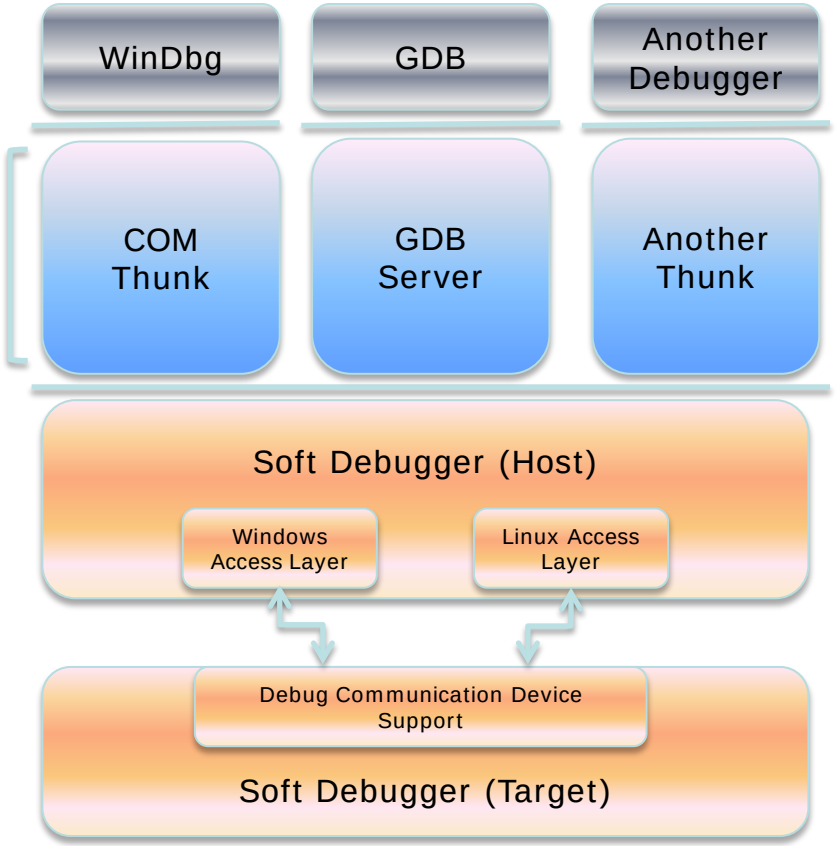
- Allow common function to be extended safely/efficiently
- Size/Performance optimized
- Allows platform teams to define custom implementations for standard interfaces
- Based on Industry specs (UEFI, PI, SmBios, ACPI,Etc…)
- Increase development speed and quality.

Source Level Debugger



The Intel® UDK2010 contains a Source Debugger Package:

- Interface and use like the standard Windows* WinDBG* tool
  - Low learning Curve
  - Robust operation
  - Support from early pre-boot phase
- Integrated directly into the Pre-boot image of the platform
- Uses Serial or USB port for communications to host platform



Intel® UDK2010 Available on tianocore.org

tianocore.org

Intel® UDK2010
Open Source
UEFI Development Kit

Develop. Contribute. Advance.

http://www.tianocore.Sourceforge.net

Agenda

- Intel® UEFI Development Kit 2010 Key Features
- **Embedded Device Boot Loader**
- Intel® Boot Loader Development Kit Key Features
- Summary

Embedded Growth Today and Future

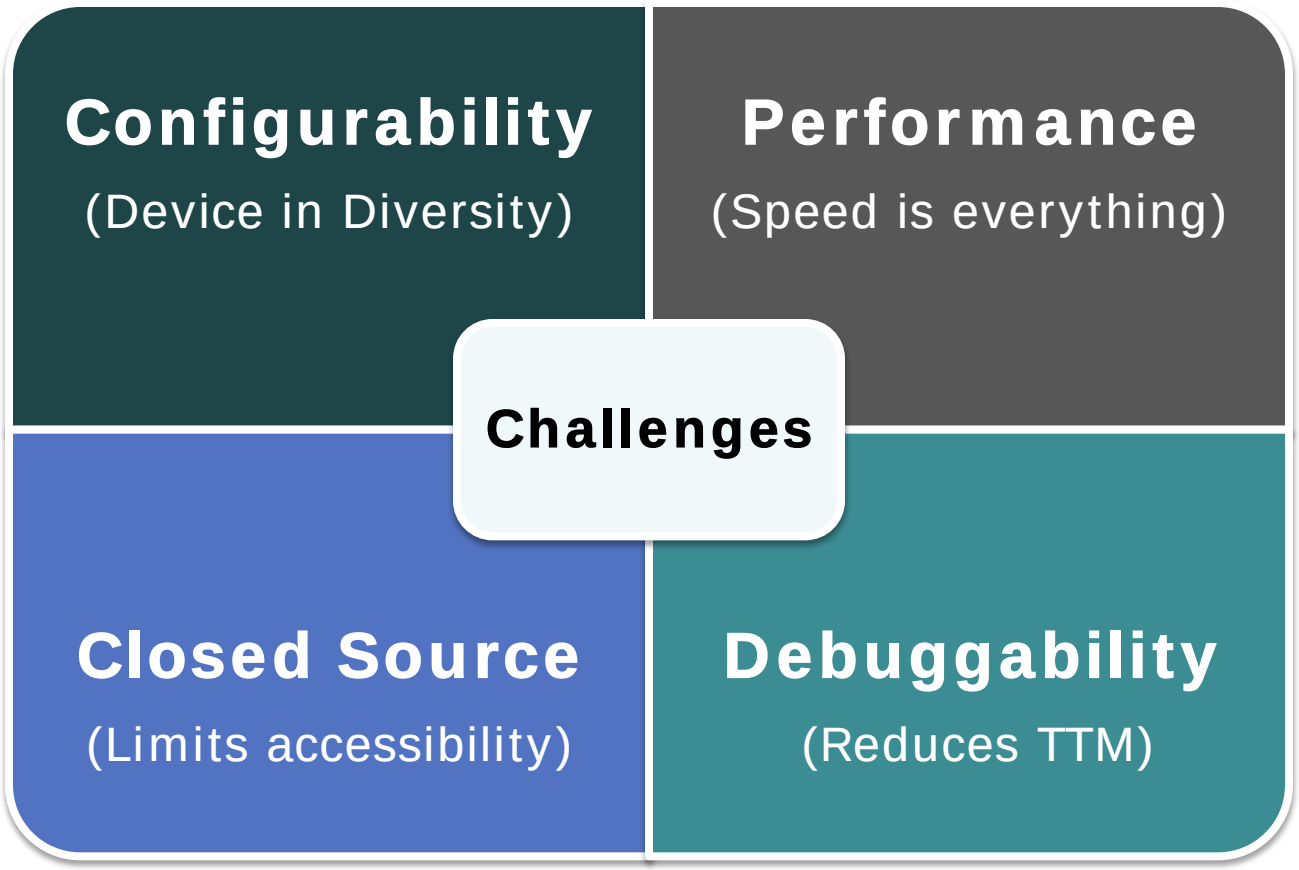
Embedded market is growing rapidly in diversity

Traditional BIOS vs. Embedded Boot Loader

BIOS Dynamically configures per Broad PC industry standards	Boot Loader Statically configures for a specific application
• Standard OS compatibility • Feature richness • Open to many use cases • Multiple boot paths • Extra services and support • For a price	• Custom OS & applications • Basic IA initialization • Quick and small • Single use case • Limited boot options • No frills • Royalty free • No hand-holding

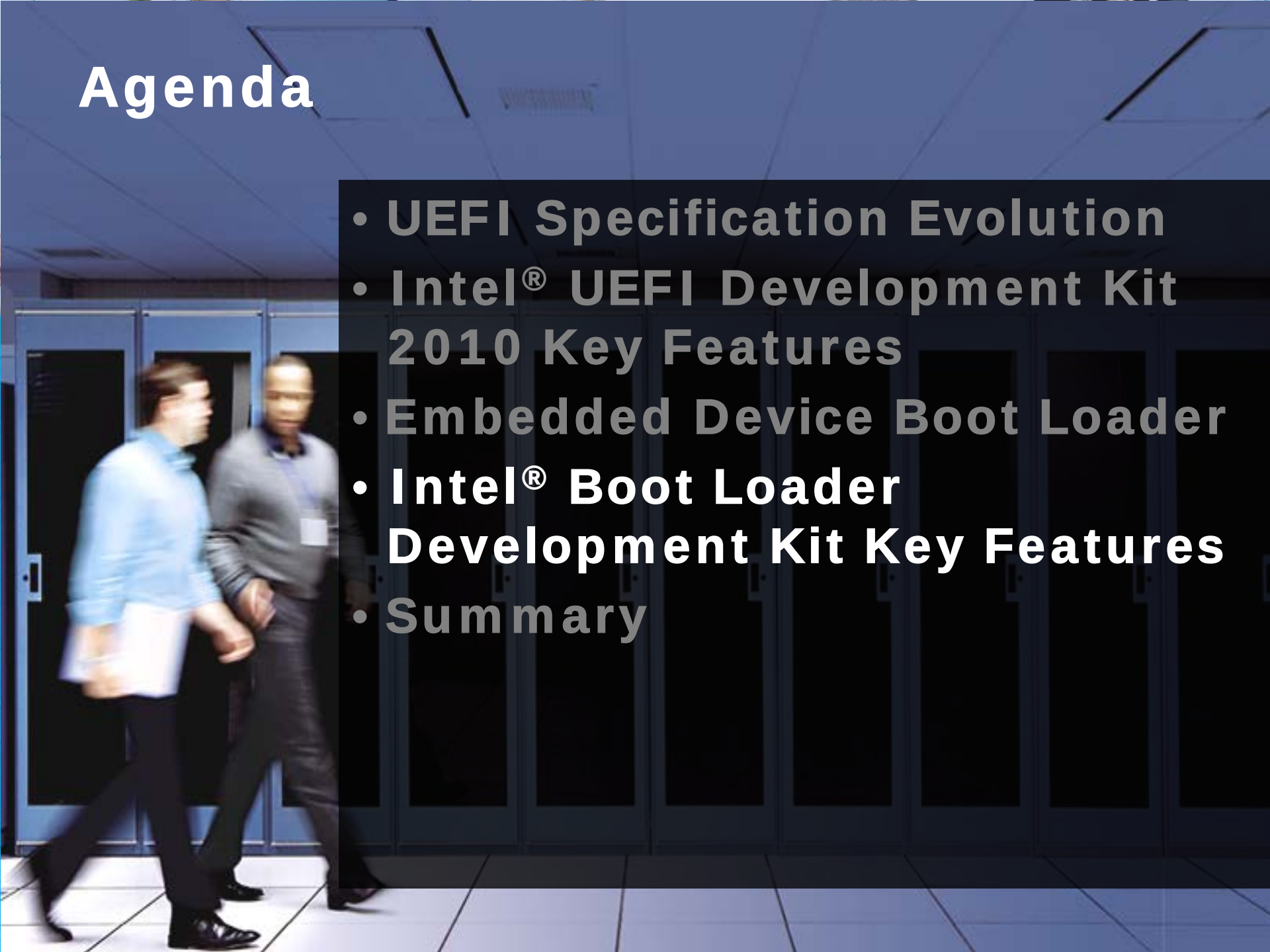
Intel® BLDK is designed for Embedded Boot Loader

Embedded Device Boot loader Challenges



Intel® UDK2010 can address these challenges

Agenda



- UEFI Specification Evolution
- Intel® UEFI Development Kit 2010 Key Features
- Embedded Device Boot Loader
- **Intel® Boot Loader Development Kit Key Features**
- Summary

Intel® Boot Loader Development Kit

Documentation & Sample Reference Code

- Comprehensive instructional documents enable Self-Sufficiency and effective, scalable support

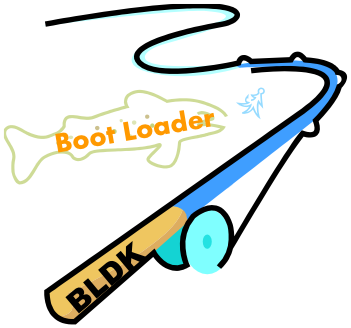
CRB Example Image & Firmware Code

- Example Intel CRB Image & BOM provides baseline from which customers can modify their system firmware image

Software Tools and GUI Interface

- GUI Module Selection & Build Tool allows custom image creation without direct code changes
- IDE facilitates Easy Navigation and Modification of the Code

Intel BLDK provides the mechanism for customers to develop their own boot loader solutions



Intel BLDK is on http://goto.intel.com/bldk

Intel® BLDK Key Features

Industry Standard Compliant
- UEFI 2.0, UEFI 2.1, UEFI 2.2, UEFI 2.3 and PI 1.0, PI 1.1, PI 1.2
- ACPI 3.0

Customer Binary Configuration
- Feature selection and binary patchable without direct code change

Multiple Tools Chains Support
- MSFT (VS2003, VS2005, VS2008, WinDDK), GNU (GCC), INTEL (ICC)

Multiple Boot Device
- Boot from ATA, SSD, CF, SD, USB, FWH, SPI, iSCSI, PXE

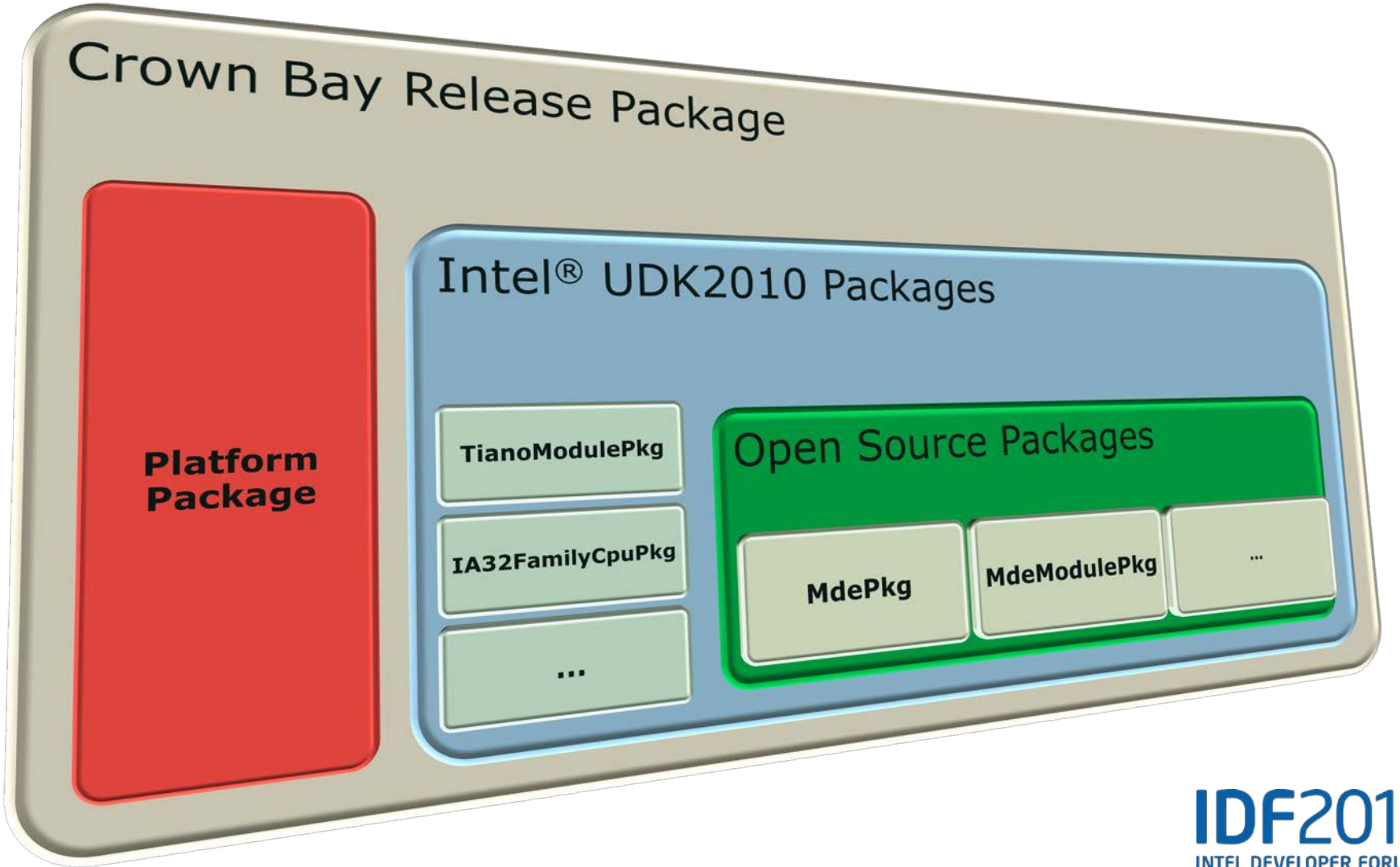
Source Level Debug
- UDK Debugger Tool provide pure soft debug solution

Extensible Foundation
- Pre-OS Security, Rich Networking, Manageability, etc.

Royalty-free Source Code
- Majority of source available via tiano.org

Intel® UDK2010 is the best choice of firmware code

Intel® Atom™ Processor E6xx Series with Intel® Platform Controller Hub EG20T Platform (Codename Crown Bay) – Based on Intel® UDK2010



Intel® UEFI Development Kit 2010 (Intel® UDK2010)

Address Challenge – Configurability

- Configurability is a key feature in embedded
  - Ability to customize behavior and optimize for the target environment involves what might be some changes to the normal desktop PC behavior model.
  - Is there a UI to launch?

Interactive Boot

No pre-boot interaction

  - What type of hardware are we required to initialize prior to launching the payload?

The embedded space has some unique policy decisions

Address Challenge - Performance

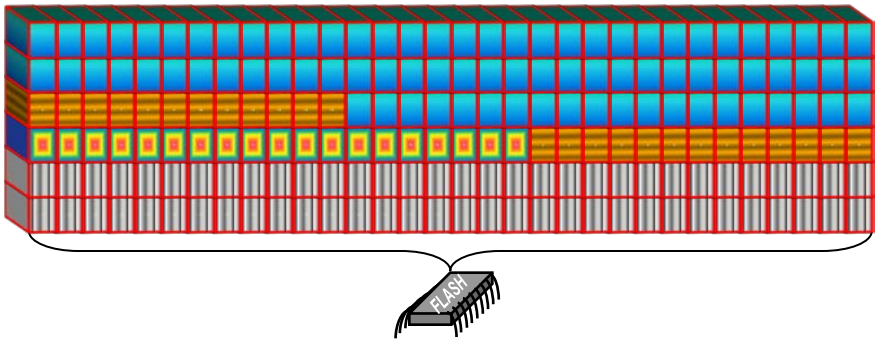
- Boot Target Hardware Choice
  - Boot device spin-up/down time affects performance
  - Use of an SSD boot device in lieu of rotating media can save seconds in the boot time

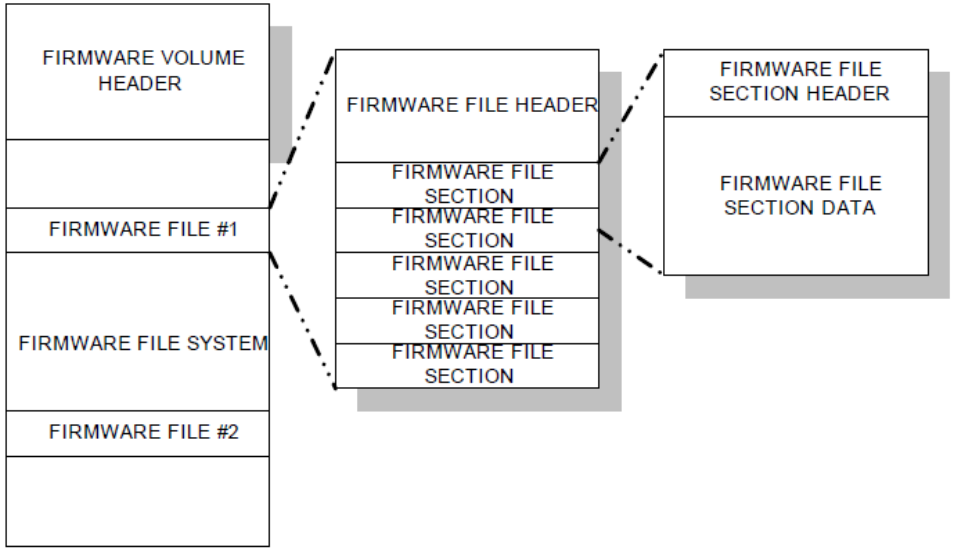
Values	DRAM	SSD (34nm)	EIDE
Read Latency	~30 ns	65 µs	8.5 ms
Read BW (MB/s)	1800	250	120
Write Latency	~30 ns	85 µs	10 ms
Write BW (MB/s)	1800	70	120
Spin-up/down time	N/A	N/A	1-2s++

The shorter boot device legacy, the faster boot time

Address Challenge – Performance (Cont)

- FLASH Organization
  - Flash layout affects performance
  - Organize FLASH layout so that you only search firmware volumes which contain items of interest for that configuration





Core Firmware Components (e.g. SEC/PEI Core/DXE Core)

Firmware Data (e.g. Drivers for certain configurations)

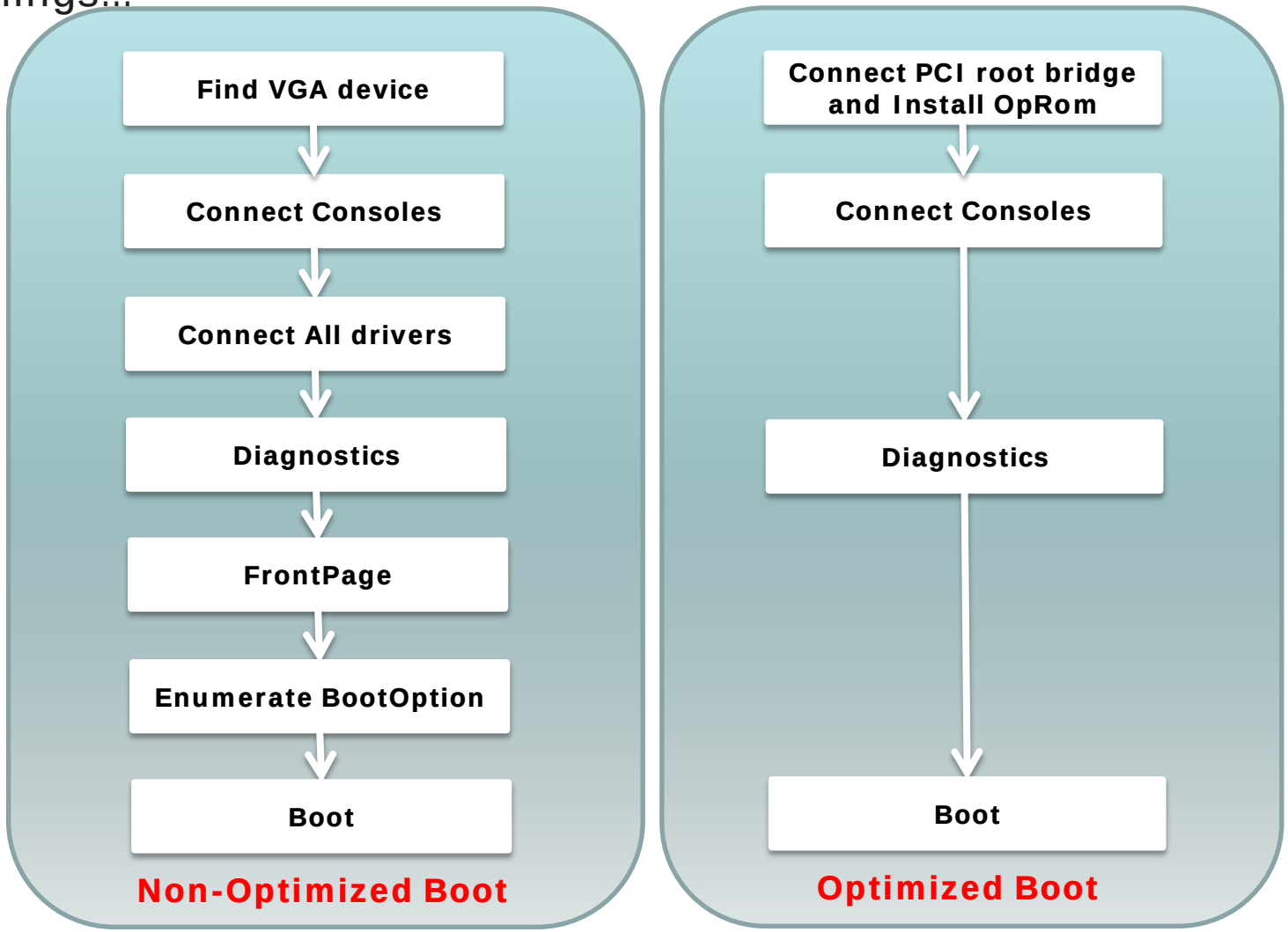
Alternate Firmware Data (e.g. Drivers for other configurations)

Free Space

The more organized layout, the faster boot time

Address Challenge – Performance (Cont)

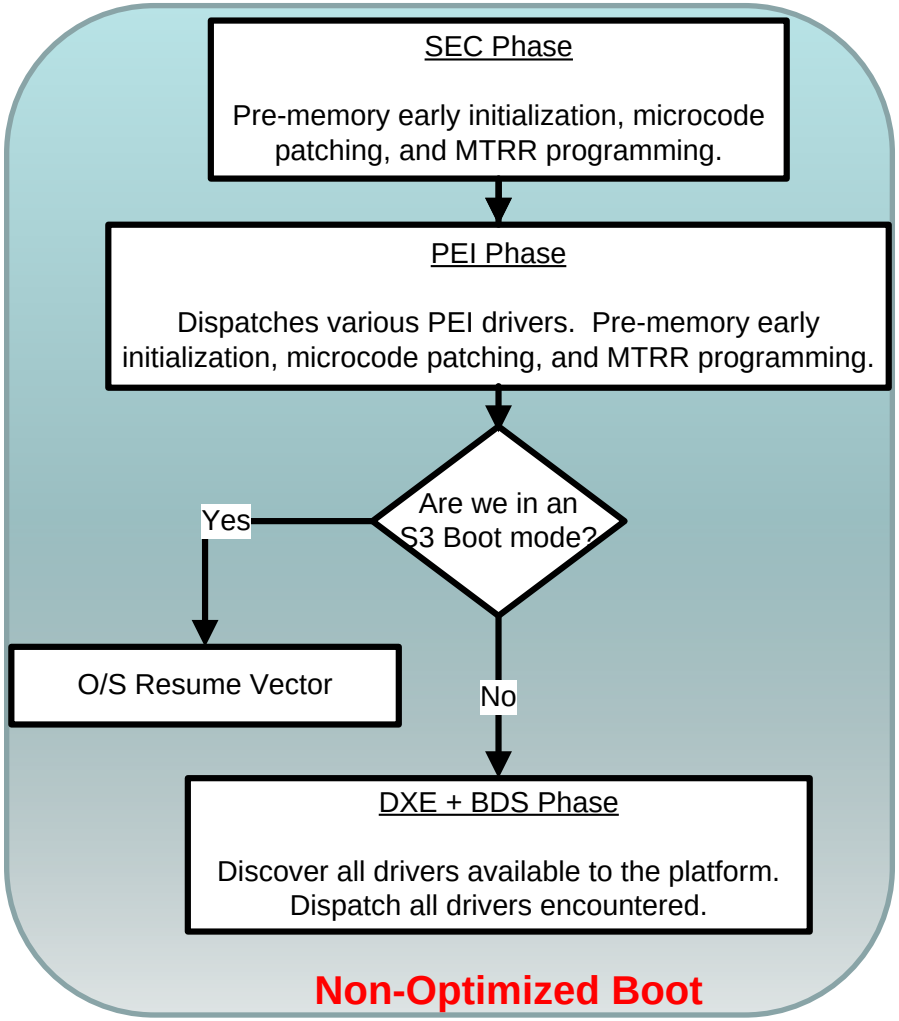
- Note that depending on platform needs, we may very well do different things…

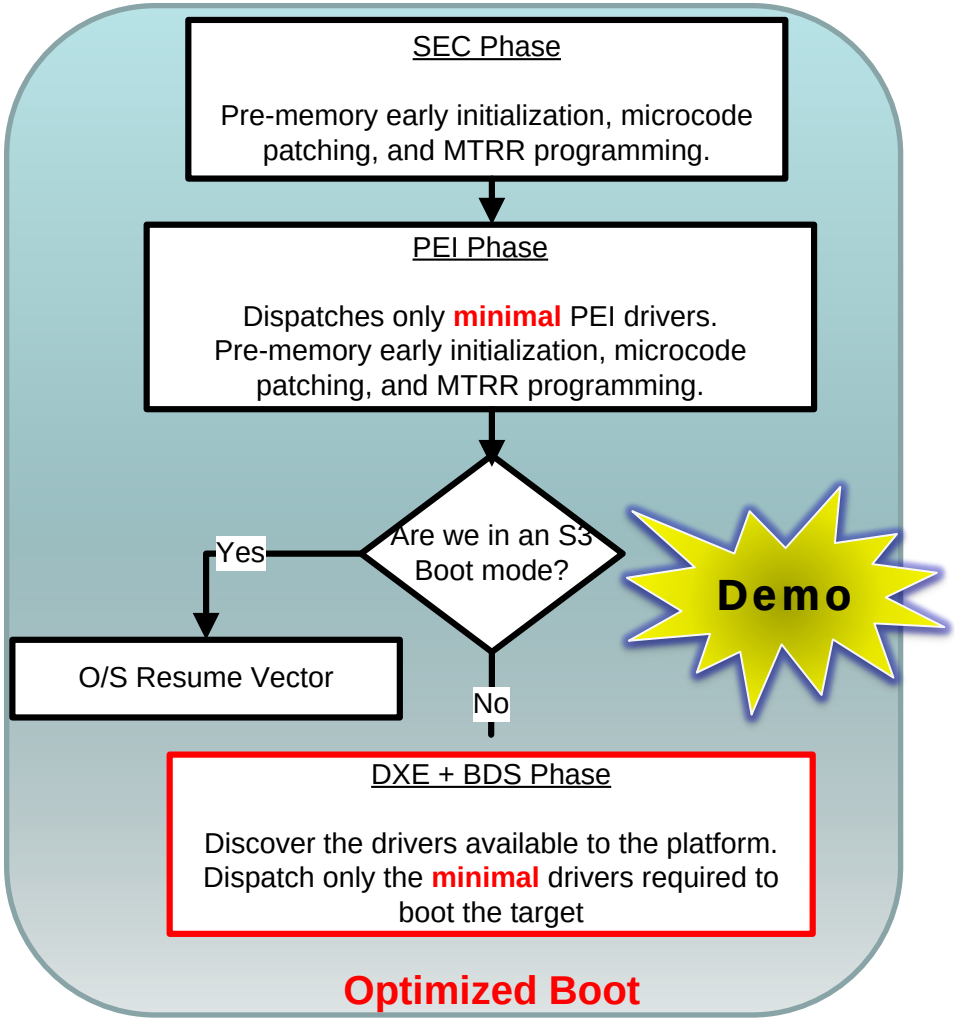


The more customized boot sequence, the faster boot time

Address Challenge – Performance (Cont)

- Performance Optimization doesn't mean we lose UEFI compatibility



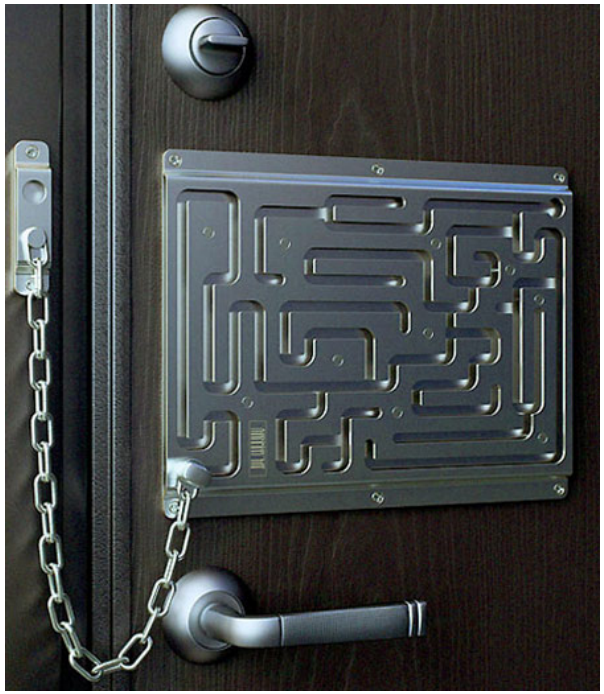


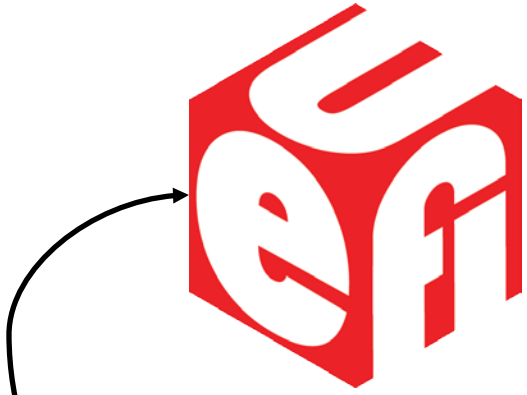
More details in a whitepaper located at: http://edc.intel.com/Link.aspx?id=4603

Optimize without losing UEFI compatibility

Address Challenge – Closed Source

- Limited access to certain source material
  - Traditionally, closed source code and distribution restrictions in a Boot Loader has made distribution to a wide audience a challenge.





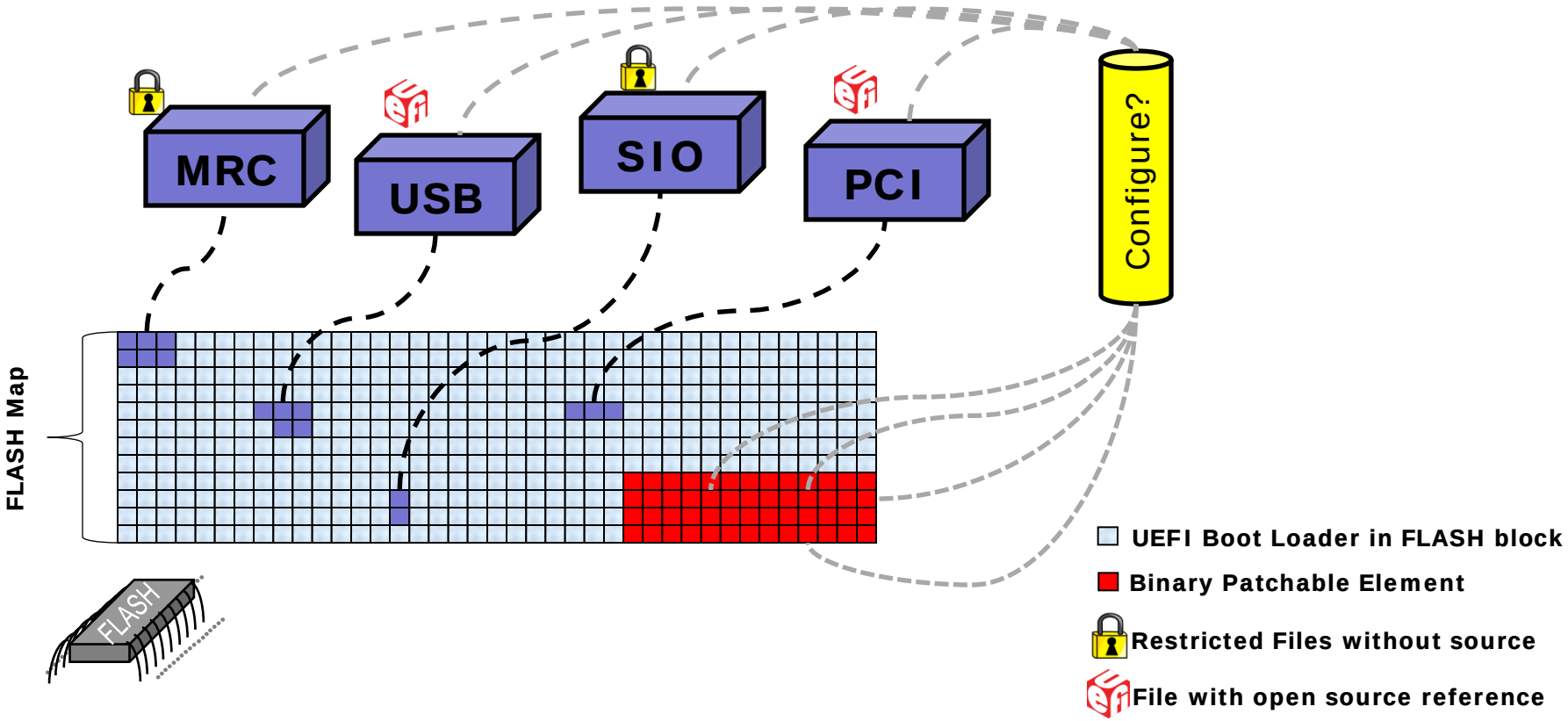
www.tianocore.org forwards user to a Source Forge repository.

Relatively small portion remains With source & distribution restrictions

UEFI introduces a large amount of open source

Address Challenge– Closed Source (Cont)

- By extending the configurability of binary components, we can enable much broader usage.



Binary image manipulation removes source restriction hurdles so a large variety of clients can use solution

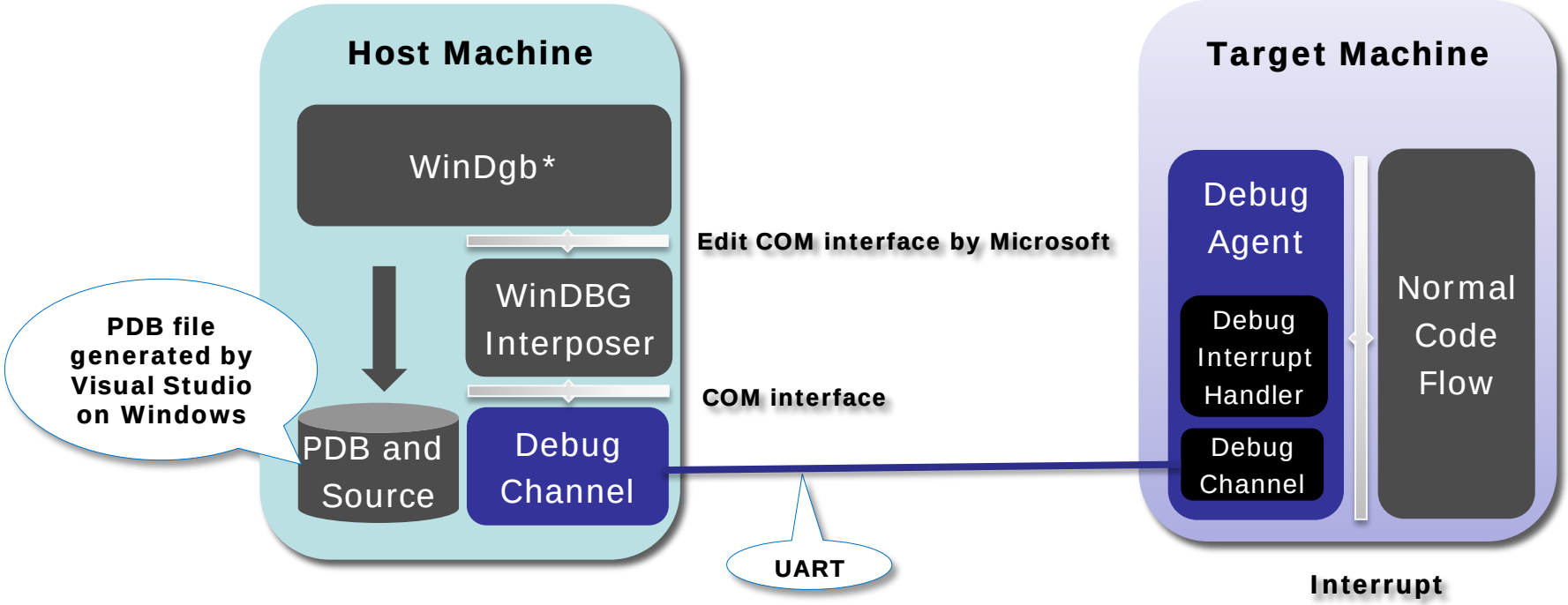
Address Challenge – Debuggability

- Software-only debugger solution
  - New Intel® UEFI Development Kit Debugger Tool available
  - Provides ability to debug target without need for exposed JTAG
    - Leverage various debug ports (e.g. USB, Serial)
  - Supports WinDbg* as a front-end
  - Few differences between this solution and a high-end HW-based debugger
    - To break into target, SEC startup code must have established a stack.
      - Typically a few dozen instructions from the reset vector.
      - This is also true of first few dozen instructions in SMI entry.
    - Some Processor mode transitions are difficult to debug.

UEFI-based open source debugger solutions available

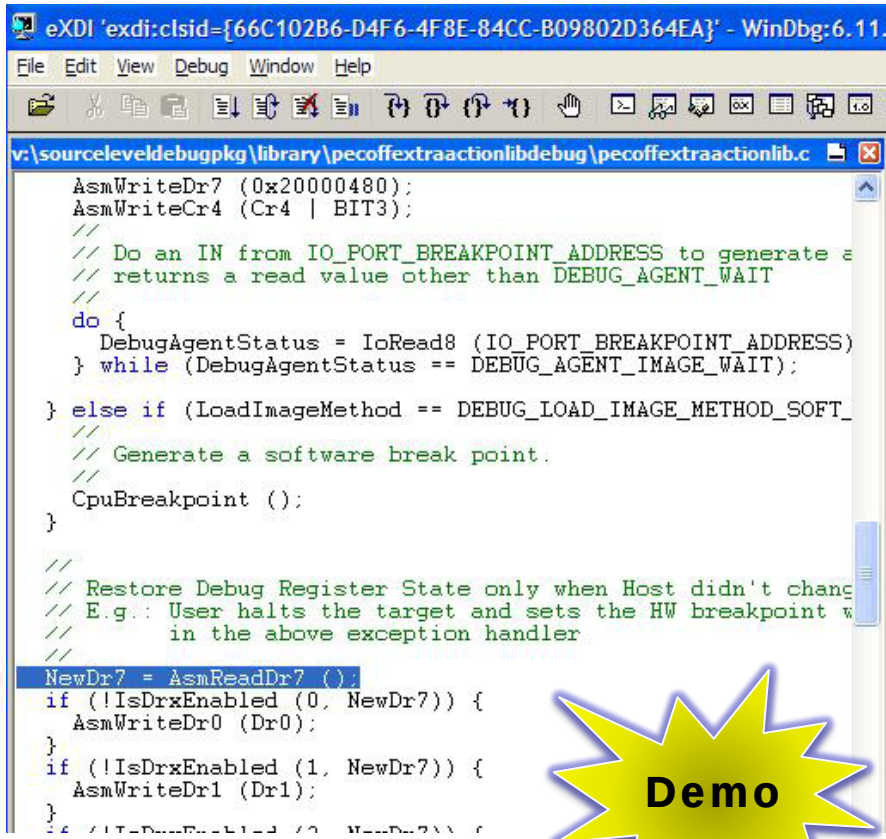
Address Challenge – Debuggability (Cont)

- Intel® UEFI Development Debugger Tool Architecture



Address Challenge – Debuggability (Cont)

- WinDBG* should stop the TARGET at late SEC phase, and loaded the symbols for SecCore. WinDbg will show the source code similar to the example shown
- Bottom window allows commands to be entered
  - .reboot
  - Smmentrybreak=1 or 0
  - g - Go
  - B[C|D|E][<bps>] - clear/disable/enable breakpoint(s)
  - Q - quit
  - ? – Command list



Summary

- Intel® UEFI Development Kit 2010 (Intel® UDK2010) meets newest Industry Standard and provide a well suited development base
- Intel® Boot Loader Development Kit (Intel® BLDK) offers a solution to develop Intel® Atom™ Processor based embedded design rapidly.
- Intel UDK2010 is the best choice of firmware to help Intel BLDK to address embedded design challenges.

Additional resources on UEFI:

- Other UEFI Sessions – Next slide
- More web based info:
  - Specifications sites www.uefi.org, www.intel.com/technology/efi
  - EDK II Open Source Implementation: www.tianocore.org

- Technical book from Intel Press: "Beyond BIOS: Implementing the Unified Extensible Firmware Interface with Intel's Framework" www.intel.com/intelpress

EFI Track Sessions

Session ID	Title	Day/ Time	Room
✓ EFIS001	Microsoft* Windows* Platform Evolution and UEFI	Tuesday 11:10	306A
✓ EFIS002	UEFI Development and Innovations for System-On-Chip (SoC)	Tuesday 14:05	306A
✓ EFIS003	UEFI and Transparent Computing Technology	Tuesday 15:10	306A
✓ EFIS004	Intel® UEFI Development Kit 2010 and Intel® Boot Loader Development Kit: Foundations for Advanced Embedded Development	Tuesday 16:10	306A
SPCQ001	Hot Topic Q&A: Intel® Boot Loader Development Kit (Intel® BLDK)	Tuesday 17:00	306A
EFIS005	Security and Networking Advancements Today's UEFI and Intel® UEFI Development Kit 2010 (Intel® UDK2010)	Wednesday 11:10	306A

✓ = DONE

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Q&A

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