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Beyond DOS: UEFI Modern Pre-boot Application Development Environment

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EFIS003

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Agenda

- Pre-Boot Application Opportunities
- Basic UEFI Application Programming
- UEFI Applications for Manufacturing
- UEFI Applications for Graphics

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What Is Pre-OS Apps Opportunity?

- **The pre-OS environment offers unique opportunities for application development**
  - **hardware configuration, first user visibility**

- **UEFI offers a stable, standard, secure environment**
  - **Anti-virus**
  - **Recovery**
  - **Diagnostics**
  - **Disk imaging**

How Can We Make It Easier?

What is the UEFI Shell?

The UEFI Shell is a standardized programming environment and command-line interface that sits on top of UEFI 2.1+ firmware.

Scalable → Embeddable. Use only as much as you need, with profiles and support levels.

Scriptable → Familiar scripting interface. Automates repetitive tasks.

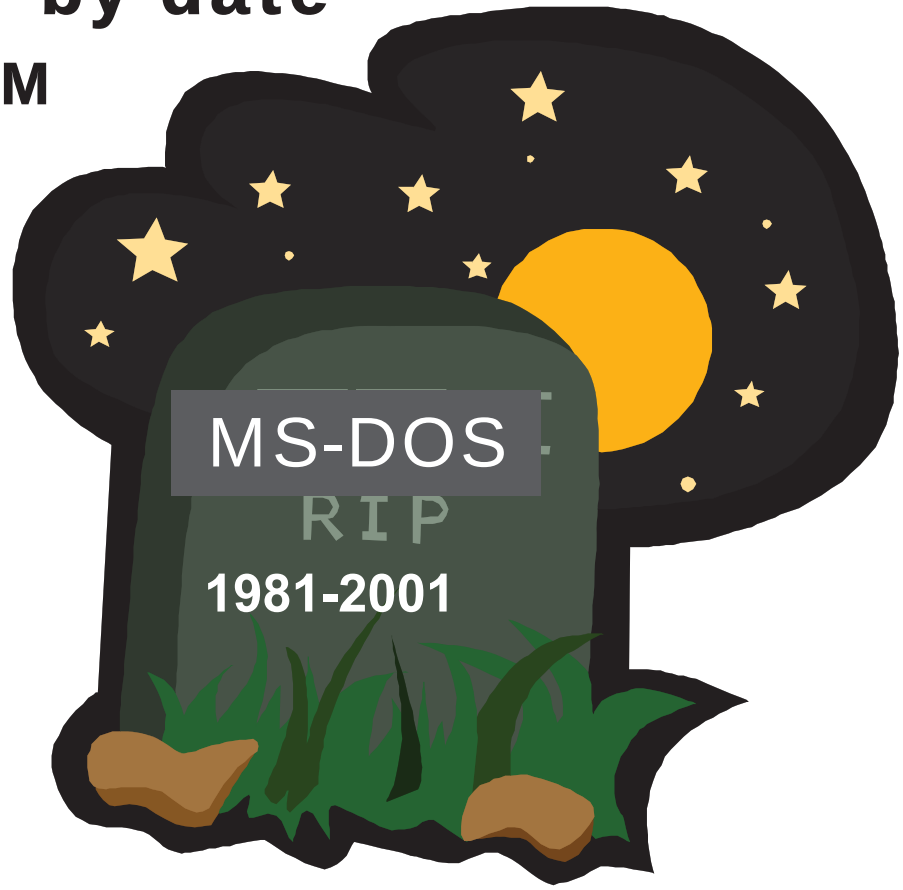
Standardized → Works on all UEFI Shell 2.0-compliant platforms. APIs and cmd. Line parameters.

The UEFI Shell 2.0

- Currently Spec. At 2.0
- Versions available now from tianocore.org or your BIOS vendor
- Described in the book: *Harnessing The UEFI Shell* (Intel Press)

Why Not DOS*?

- DOS – Well beyond its sell-by date
  - Barely supports >1MiB of RAM
  - Many devices not supported
  - Relies on the CSM in UEFI
    - Which is going away
  - Not supported & no updates
  - No up-to-date networking
    - How support IPv6?



The UEFI Shell is Scalable

- **Standard Shell Support Levels describe core capabilities**
- **Detect using environment variable**

Support Level	Description	Size Delta
0	Shell API, No Scripting	+82 KB
1	Scripting	+16 KB
2	File I/O	+43 KB
3	Console Input/Output	+12 KB

UEFI Shell Profiles

- **Standard Shell Profiles describe mix-and-match add-on capabilities**
  - **Detectable using environment variable**
  - **No dependencies between profiles**
  - **You can create your own profiles**

Profile Name	Description	Size Delta
Debug1	Debug commands.	(+144KB)
Network1	Network management commands.	(+24KB)
Driver1	Driver management commands.	(+68KB
Install1	Driver/application installation aid commands.	(+12KB)

The UEFI Shell is Scriptable

- Scripts use the file extension .NSH
  - startup.nsh automatically run when shell starts
- Similar to Windows* & DOS Command-Prompt batch files
- Extensions for:
  - Diskless Operation
    - i.e., Output Redirect to Environment Variable
  - Parsing files

The UEFI Shell is Standardized

- **UEFI Advantages = UEFI Shell Advantages**
  - **Flat memory model**
  - **Robust, extensible architecture**
  - **File system, Network, Keyboard, Mouse**
- **UEFI Works = UEFI Shell Works**
  - **No additional requirements to run**
- **Write Once/Run Anywhere For Pre-OS**
  - **With standard API/commands = applications from different ISVs work on any platform (Ex: UEFI SCT)**

Example #1: Script Detects Shell Capabilities

```
# check that Shell supports level 3 commands.
if %shellsupport% ult 3
  echo Must support UEFI Shell, Level 3
endif

# check that Shell supports Debug1 profile.
if profile(Debug1)
  echo UEFI Shell supports Debug1 profile
endif
```

Example #2: Script Parses Standardized Output

```
# parse out file data from ‘ls’
ls –sfo | parse FileInfo 2
ls –sfo | parse FileInfo 4
```

Option –sfo Standard Format Option

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Example #3: Hello, World

HelloWorld.c

```
#include <stdio.h>

int
main (
  IN int argc,
  IN char *argv[]
  )
{
  printf("Hello World\n");
  return 0;
}
```

Shell Prompt

```
2.0 F12:\> helloworld
Hello World
2.0 F12:\> cls 3
```

```
2.0 F12:\> helloworld
Hello World
```

Porting MS-DOS* to UEFI Shell 2.0

- Simplest way to create a new UEFI application is to port over an existing UEFI application!
- Example: Phoenix ACPI Disassembler (AD.EXE)
  - Disassemble ACPI tables from files or system memory
  - 15K lines of C (no assembly)
  - Works under MS-DOS (using a DOS Extender DOS4GW) and Windows command-line
  - Compiled under Watcom C/C++ and Visual C++ 6.0
  - Uses standard C library functions supported under both compilers

What Did It Take?

Porting AD to UEFI Shell

- **Goals For Move To The UEFI Shell 2.0**
  - **Build 32-bit or 64-bit**
  - **Remove dependencies on DOS4GW**
  - **Update ACPI Table discovery mechanism to use UEFI**
  - **No missing features**
- **Steps for Porting**
  1. **Create new INF file (AD.INF) for build description**
     - **Include paths set to C library build path**
  2. **Remove DOS4GW-related code**
  3. **Update ACPI Table discovery to use EFI System Configuration Table**
  4. **Rebuild!**

Issues Found During Porting

- **64-bit portability issues**
  - `sizeof(int) != sizeof(void*)`
- **Better error checking by the compiler**
  - Dead code, uninitialized variables
  - Fixed the bugs I didn't know I had
- **Used ISO C/C++ Library Functions**
  - Microsoft* C/C++ Library uses ISO C++ Names
  - UDK C Library uses ANSI C95 Names
  - Changed to Compliant Names
    - i.e from _open to open

Issues Found During Porting (2)

- **Used Microsoft*-specific Functions/Headers**
  - `_splitpath, _makepath`
  - `io.h/process.h/malloc.h`
  - **Created Equivalent Functions**

1 Day Effort To Move To UEFI Shell

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UEFI Shell and Manufacturing

- **Many manufacturing tasks are simplified by:**
  - ***Getting*** **the latest tools / resources from the network**
  - ***Using*** **the latest tools / resources from the UEFI Shell**
  - **Let's combine the best of both worlds by…**
- **Launching the UEFI Shell remotely**
  - **From Windows* 2008 Server or other configured OS**
  - **Without impact to standard remote booting**
  - **With only minimal changes on server side**
  - **Without mounting a remote file system**

Remote Boot Overview

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Power On

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Issue DHCP Request

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DHCP Reply

Intel® Desktop Board
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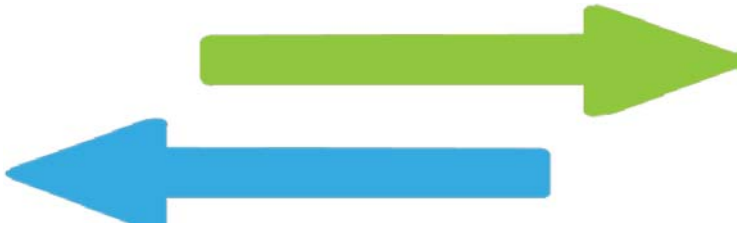
Boot Server Download Request

Intel® Desktop Board
DQ57TML



Boot Loader

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Verify and Boot

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Booting The Shell Remotely

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Load File Request

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Server Sends Replacement Boot Loader

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Load File Request

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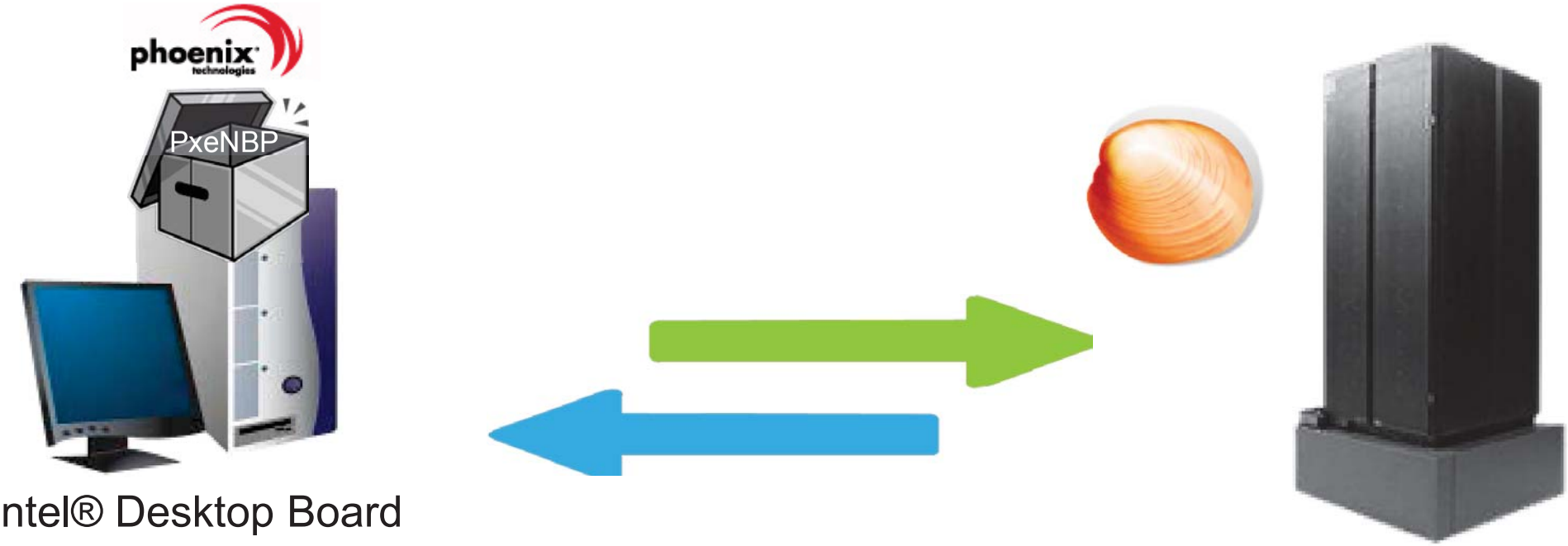
Send UEFI Shell



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DQ57TML

Run UEFI Shell

Intel® Desktop Board
DQ57TML

Demo: Remote Booting UEFI Applications & Shell Scripts

- Demo #1: Remote boot to UEFI Shell
- Demo #2: Remote boot to UEFI Shell Script
- Demo #3: Remote boot to UEFI Shell application

UEFI Manufacturing Summary

- Initialize the machine using the UEFI Shell
- Initialize the machine using server resources
- Launch the UEFI Shell from the server
- Use UEFI Shell scripts for the tasks

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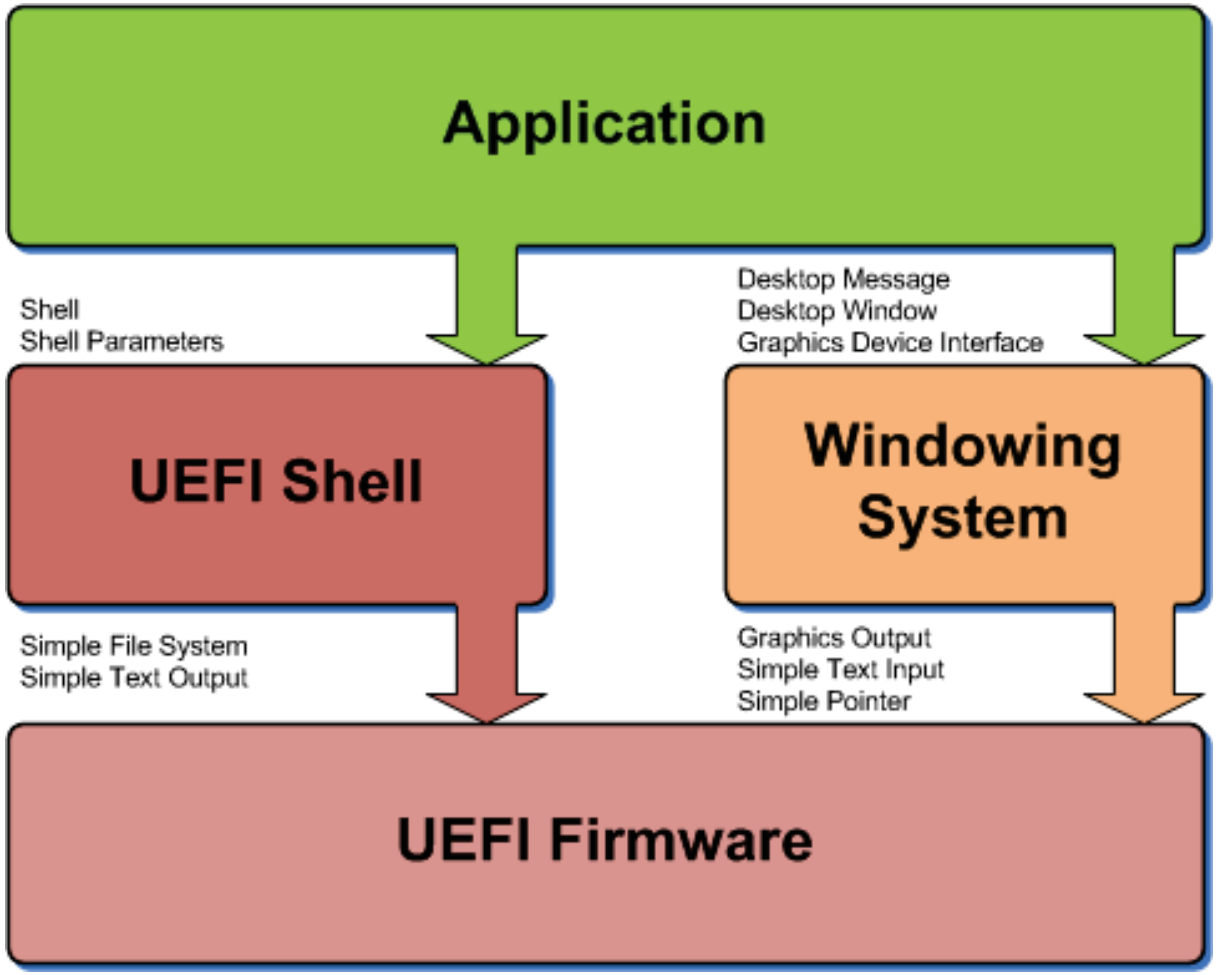
UEFI Graphics Applications

- Users expect their pre-boot experience to resemble their OS-present experience.
  - Fonts, mouse, graphics, windows.



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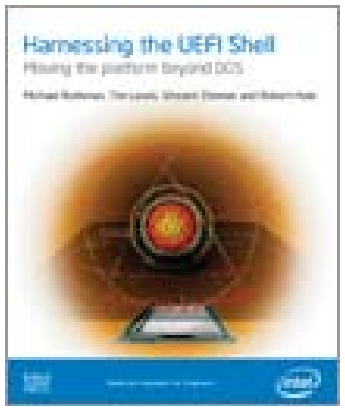
Summary

- The UEFI Shell is a standard, scripted, scalable command-line environment that works on any UEFI 2.1+ capable machine
- With the C Standard Library, porting over DOS applications is easy
- The UEFI Shell simplifies manufacturing using remote boot and scripting
- The UEFI Shell supports graphics application development.

Next Steps

- **Go create UEFI applications!**
- **Get the Intel® DQ57TML or Intel® DQ57TM Desktop Board from. www.tunnelmountain.com**
  - **Recommended reference platform.**
- **Get the UEFI Shell Book!**
  - ***Harnessing the UEFI Shell*, Intel Press.**
    www.intel.com/intelpress



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Tunnel Mountain Intel DQTM57 UEFI 2.3.1 platform

Intel® UDK 2010 Compatible, supports UEFI 2.3.1

Pre-assembled systems available at HDNW, visit

http://www.Tunnelmountain.net

tomk@hdnw.com, (425) 943-5515 ext 42234. Use product name "Tunnel Mountain" when ordering

Comes with class 2 CSM and UEFI enabled firmware
Download site has Class 3 UEFI only firmware(nocsm)

Comes with serial port for debug
Can be ordered with optional ITP connector and socketed SPI flash - AC-SPEC4480

Visit http://developer.intel.com/technology/efi/uefi-ihv.htm for the latest information and other IHVs collateral

Fall 2011 UEFI Plugfest – Taipei, Oct 24-27

Visit www.UEFI.org for Event Info & Registration

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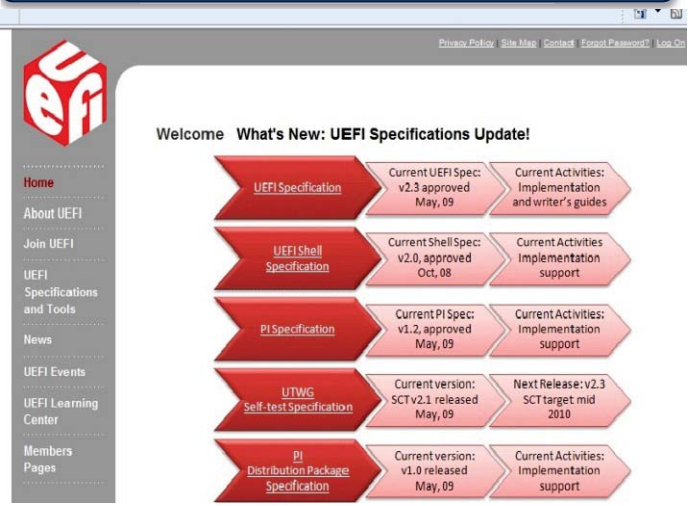
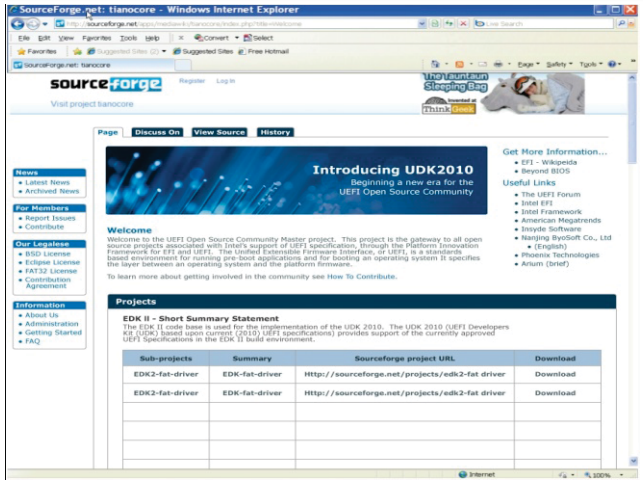
UEFI Industry Resources

UEFI Forum



www.uefi.org

UEFI Open Source



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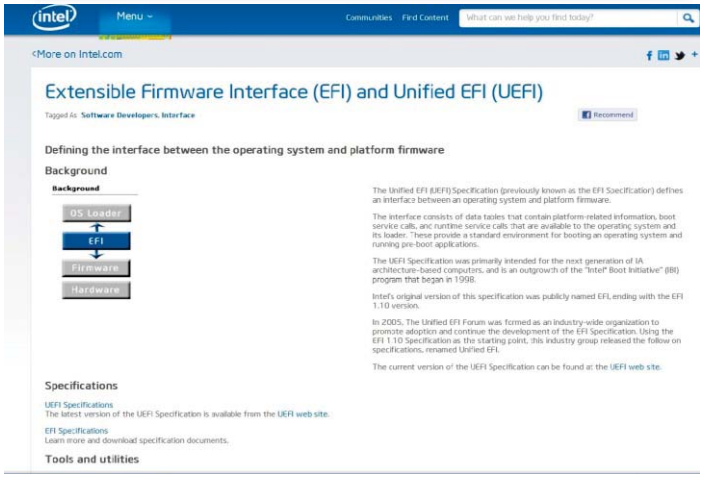
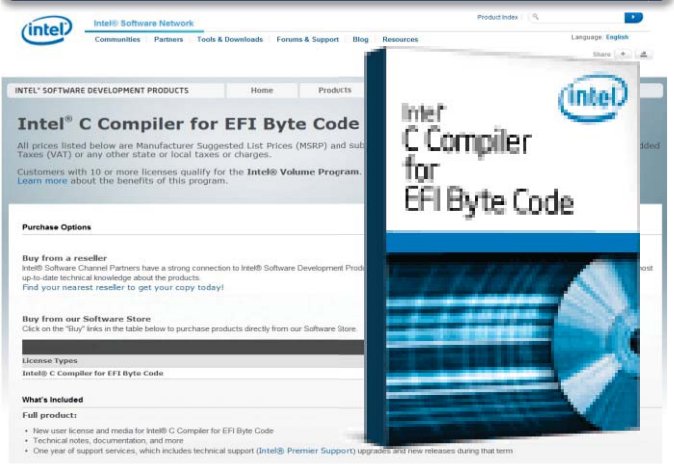
Intel UEFI Resources



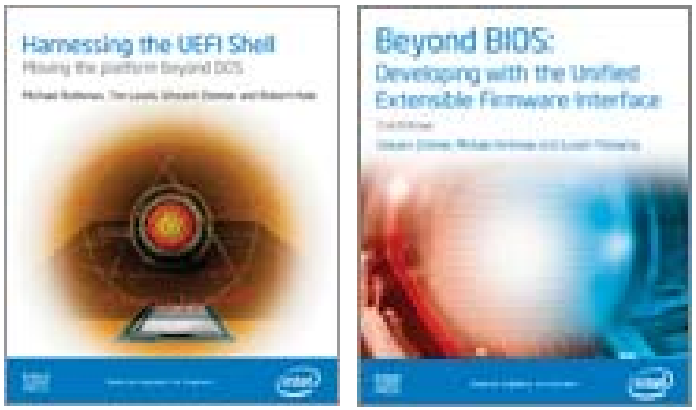
www.intel.com/technology/efi/index.htm

Intel EBC Compiler



http://software.intel.com/en-us/articles/intel-c-compiler-for-efi-byte-code-purchase/

UEFI Books



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UEFI Sessions Moscone SF IDF 2011

Session ID	Title	Company	Day / Time	Rm
✓ EFIS001	UEFI Security and Networking Advancements	Intel & Insyde SW	Tue 1:05 - 2:00	2009
✓ EFIS002	UEFI Innovations for Platform Security	Intel & AMI	Tue 2:10 - 3:00	2009
✓ EFIS003	Beyond DOS: UEFI Modern Pre-boot Application Development Environment	Intel & Phoenix Tech. LTD	Tue 3:20 - 4:10	2009
EFIS004	Designing for Next Generation Best-In-Class Platform Responsiveness	Intel	Tue 4:25 - 5:15	2009
EFIQ001	Hot Topic Q&A: UEFI in the Industry	All Speakers	Tue 5:25 - 6:00	2009
EFIS005	Microsoft* Windows* Platform Evolution and UEFI Requirements	Intel & Microsoft	Thu 1:05 - 1:55	2005
SPCQ003	Hot Topic Q&A: Intel & Microsoft - Windows* 8	Intel & Microsoft	Thu 2:05 - 2:55	2005

✓ = DONE

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Q&A

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