IDF2011
INTEL DEVELOPER FORUM

UEFI Innovations for Platform Security

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EFIS002

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Agenda

- Introduction
  - Necessity of Secure Flash Update
  - NIST Background
- Secure Flash Update Concepts
  - Overview of Secure Flash Implementation
  - Demo of ASFU
- Security and Platform Policy
  - Overview of UEFI Platform Policy
  - Platform Policy Demonstration
- Summary and Call to Action

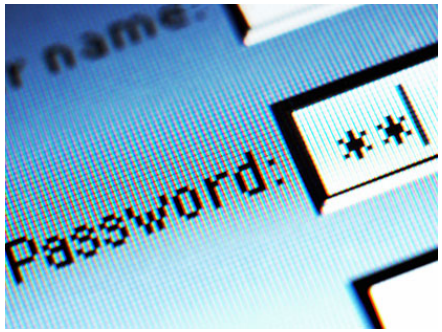
The PDF for this Session presentation is available from our Technical Session Catalog at the end of the day at: http://intel.com/go/idfsessions

The URL is also in the Session Agenda Pages of the Pocket Guide

Introduction

Basic Introduction…

- Platform security is a broad topic…
  - Many technologies work together for platform security.
  - Includes TPM, TXT, secure boot, and secure flash update
- Security Should…
  - Prove the machine has booted in a trusted state
  - Protect the system against attacks
  - Provide a means for user authentication
- From a usability standpoint security can be defined as: “Something you know, something you have, or something you are…”



Securing the Software Stack

- **UEFI 2.3.1 security enhancements specifically address the "secure boot" issue**
  - ***See Session EFIS001 for more details…***
- **Securing the firmware itself further strengthens the UEFI Secure Boot concept**
  - ***How is the firmware update protected?***
  - ***How is the firmware put into "admin mode"?***
- **NIST has created *BIOS Protection Guidelines***
  - **Secure flash update requirements (PDF)**
  - **Maintain firmware core root of trust**
- **UEFI 2.3.1 contains the framework to develop secure flash update on Intel silicon**

NIST
National Institute of Standards and Technology
U.S. Department of Commerce

NIST Implementation Requirements

The NIST BIOS Protection Guidelines break down to three basic requirements…

1. **The BIOS must be protected**
2. **BIOS updates must be signed**
3. **BIOS protection cannot be bypassed**

Achieving Secure Flash Update

- Intel chipsets already contain mechanisms to implement physical protection of the flash part
  - Features vary depending on chipset
  - Contact Intel for more details

- System firmware can leverage UEFI 2.3.1 concepts to implement image verification and non-bypassability for secure updates

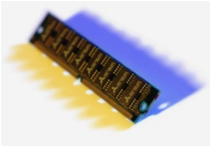
UEFI 2.3.1 provides the security framework to implement secure flash update on Intel silicon

Secure Flash Update Concepts

Secure Flash Update Methods

- **Implemented using capsules defined by UEFI spec**

- ***Capsule ("Capsule-in-Memory")***



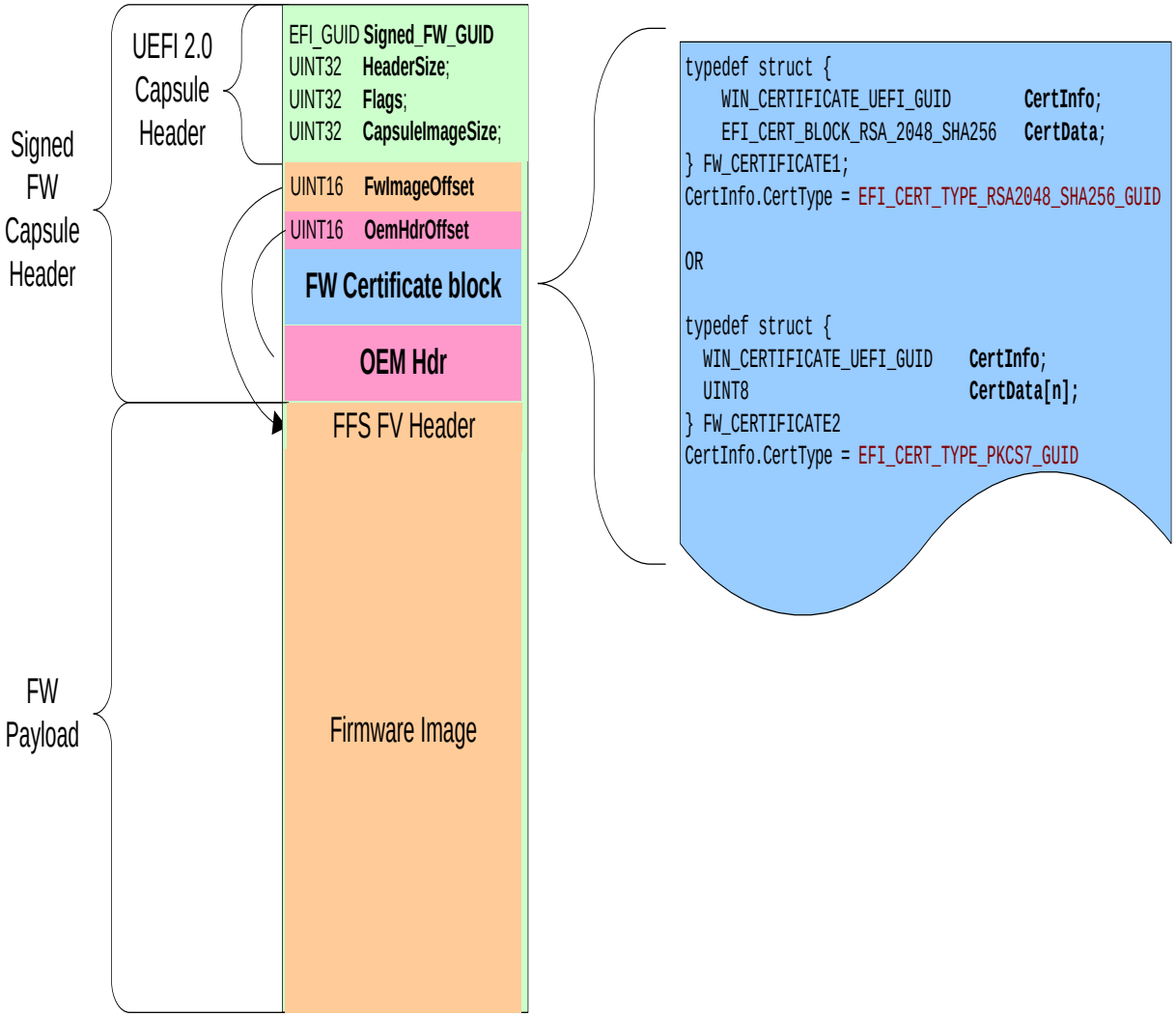
  - **Capsule is put in memory by an application in the OS**
  - **Mailbox event is set to inform BIOS of pending update**
  - **System reboots, verifies the image and update is preformed securely by the BIOS**

- ***Recovery ("Capsule-on-Disk")***

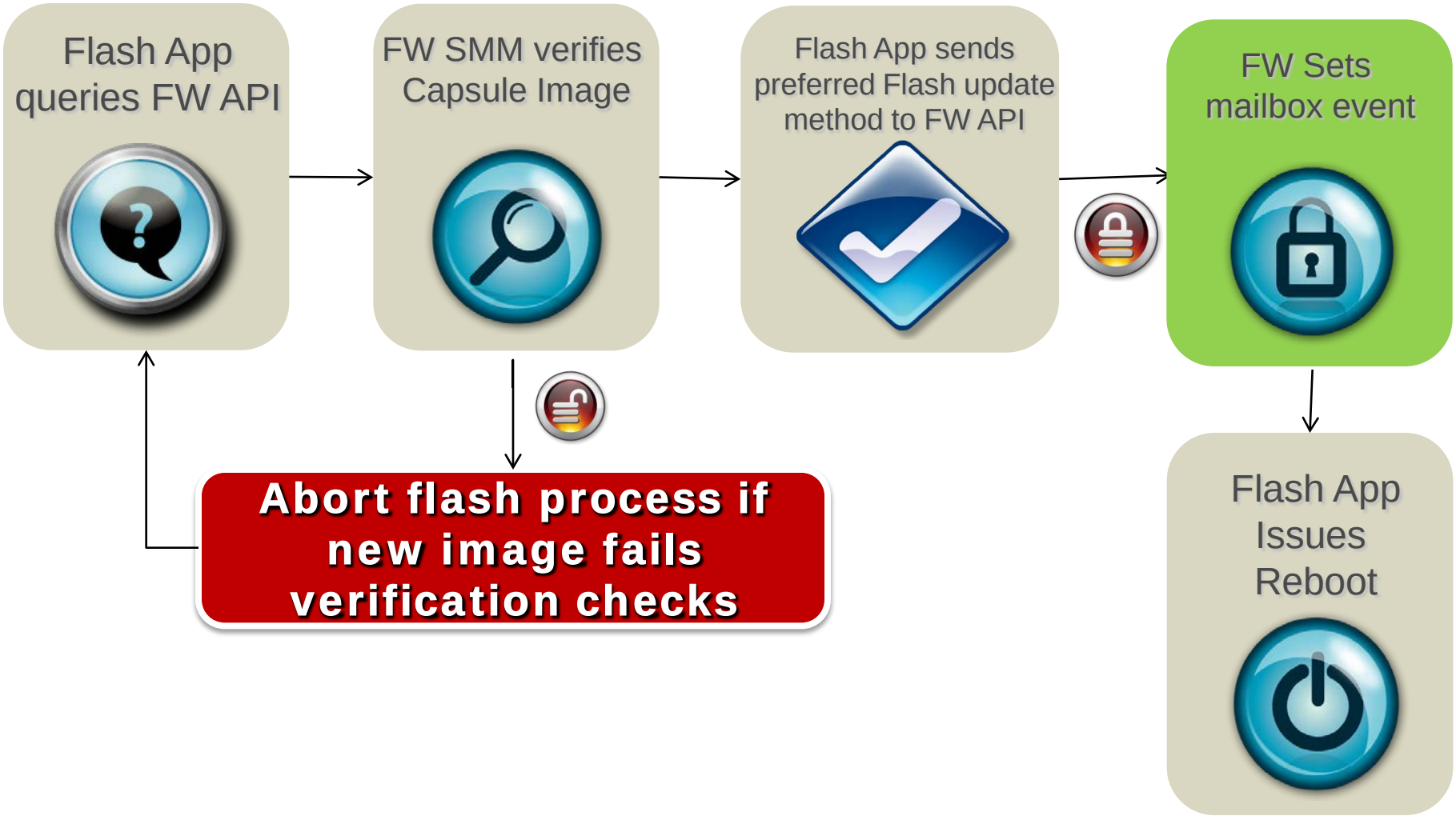
  - **Capsule is stored on a predefined disk and is loaded to memory during BIOS booting**
  - **Mailbox event is set to inform BIOS of pending update**
  - **System reboots, verifies the image and update is preformed securely by the BIOS**

Signed FW Capsule

- **Image is a combination of the firmware payload with the firmware certificate**
- **OEM Header and UEFI-defined Capsule Structure**



Secure Flash Update Process



American Megatrends

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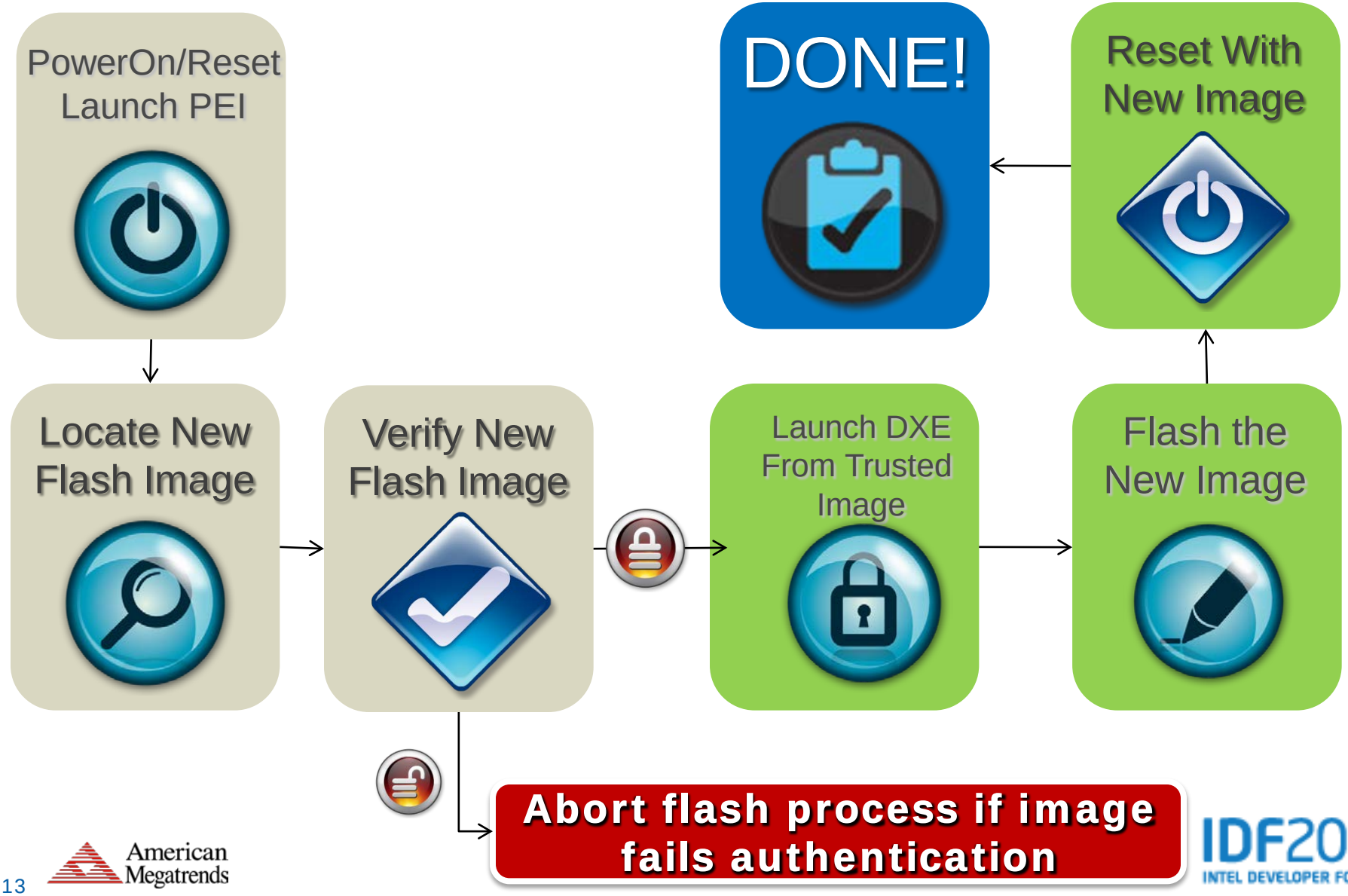
Secure Flash Update Process



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Secure Flash Update Methodology

- Use UEFI Firmware Capsule method as the preferred image delivery mechanism
- Use digital signatures to authenticate the image as defined by UEFI 2.3.1
  - Industry approved Digital signature protocols
  - EMSA PKCS v1.15, RSA PSS signature schemas
  - 2048 bit RSA Key, SHA256 hash (NIST requirement)
- Use chipset features to prevent unauthorized updates to the flash part
  - Chipset dependent: check Intel specs for details

Secure flash update is an integral part of maintaining system security

Secure Flash Update Demonstration

- **The following will be demonstrated:**
  - **The capsule update method using AMI ASFU (AMI Secure Flash Update) Utility**
  - **A modified binary will be used to simulate a malicious BIOS update**
    - **A binary modified after signing will have an invalid signature**

Security and Platform Policy

Platform Policy Background

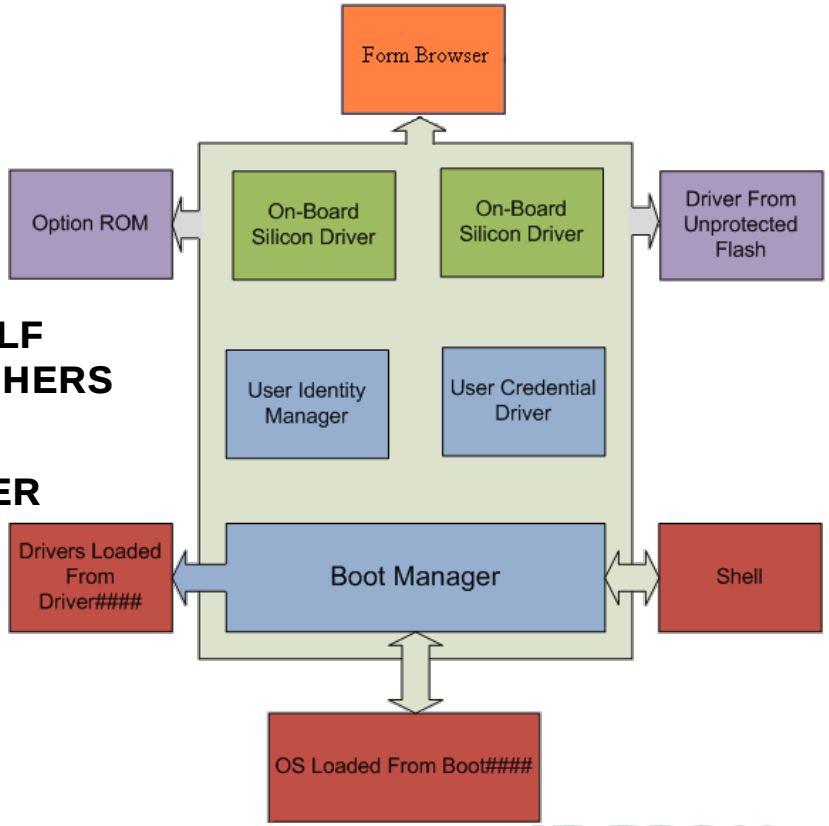
- Currently BIOS user authentication is used to check credentials to enable booting or choosing what type of information to display in setup
- Creating a UEFI credential provider allows to extend the usage of devices like fingerprint scanners to the preboot space
- Drivers and UEFI applications can be limited in usage and/or functionality to certain authorized users

User Credentials Management

- Chapter 31 of the UEFI specification provides a standard method of user authentication and the defines following components:
  - User Identity Management Driver: Manages the process of determining the users identity
  - User Enrollment Manager: Application that enrolls new users
  - Deferred Image Load: Manages if drivers can be loaded by a user
  - Credential Provider Drivers: Manage authenticating a class of credentials
- There are different classes of credential providers listed in the specification. Examples are:
  - EFI_USER_CREDENTIAL_CLASS_PASSWORD
  - EFI_USER_CREDENTIAL_CLASS_SMART_CARD
  - EFI_USER_CREDENTIAL_CLASS_FINGERPRINT

User Management Drivers

- User identity managers, user credential drivers, and on-board drivers are located in the flash and are trusted
- User identity managers handle the users information and a user's associated capabilities
  - Ability to modify setup options
    - EFI_USER_INFO_ACCESS_SETUP
  - Execution of selected drivers
    - EFI_DEFERRED_IMAGE_LOAD
  - User Enrollment privileges
    - EFI_USER_INFO_ACCESS_ENROLL_SELF
    - EFI_USER_INFO_ACCESS_ENROLL_OTHERS
  - Control available boot order
    - EFI_USER_INFO_ACCESS_BOOT_ORDER



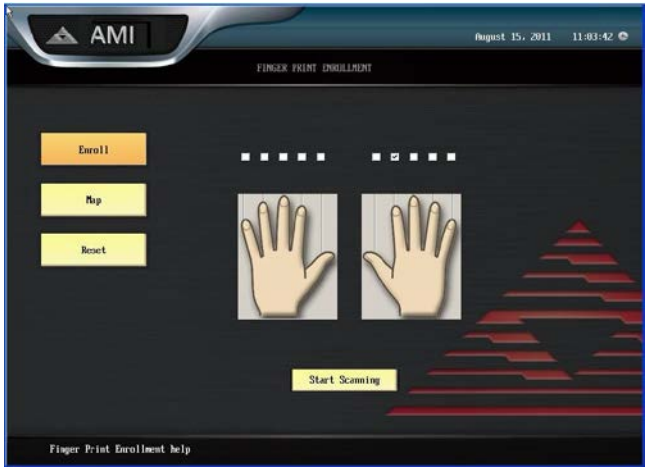
Platform Policy Implementations

- **BIOS user authentication can also be paired with operating systems to allow for a seamless single sign on**
- **Using UEFI provided abstractions for network, the user can also be authenticated with a corporate sever**

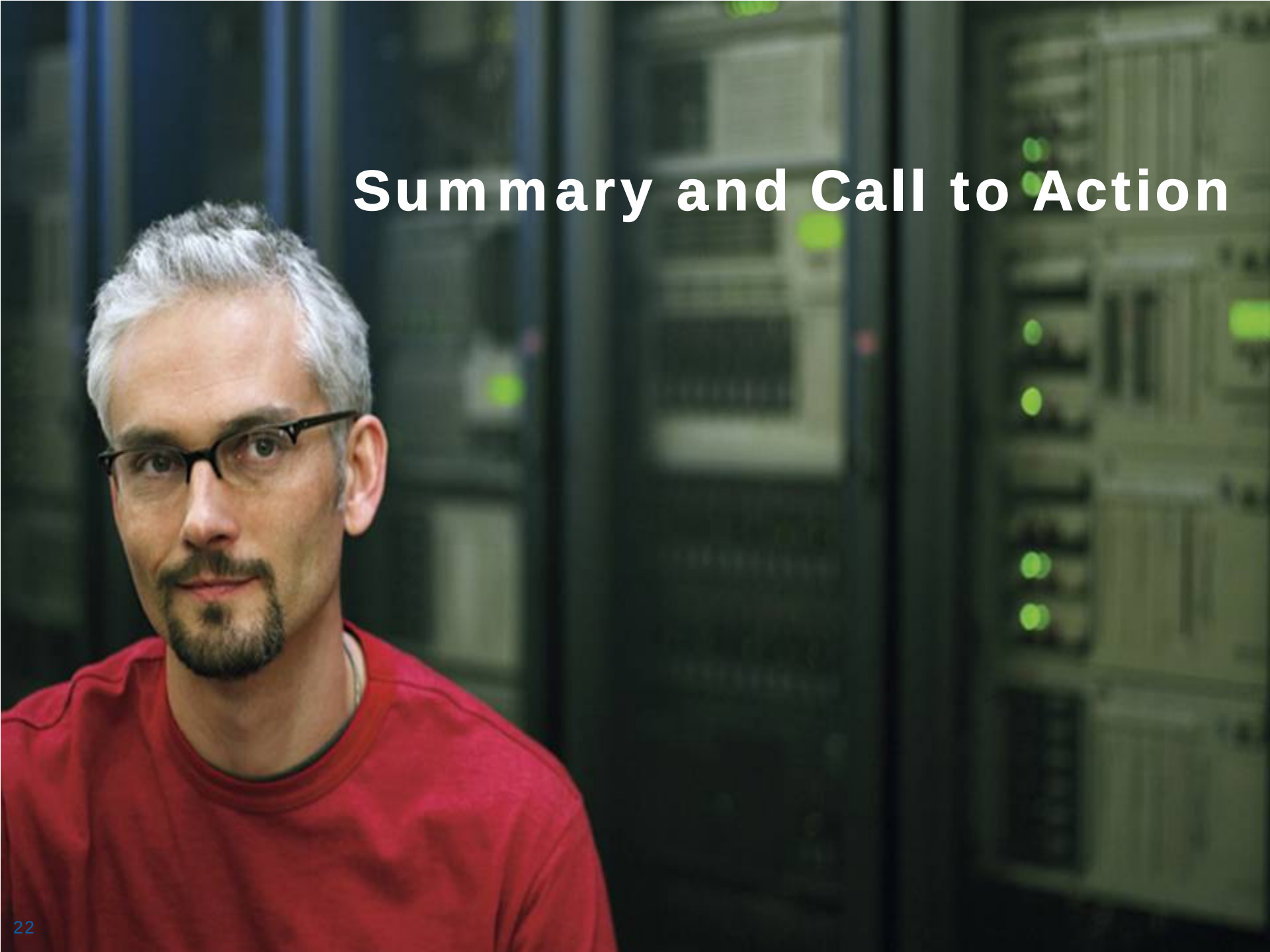
New authentication sources can be integrated by following the protocol definitions in the UEFI specification

Fingerprint Reader Demonstration

- Through fingerprint authentication the user can alter the boot flow with previously enrolled fingers.
- Depending on the finger swiped the system will take one of the following actions:
  - Not allow any action (the user is not verified)
  - Fingerprint enrollment
  - Boot to setup
  - Boot to windows



Summary and Call to Action



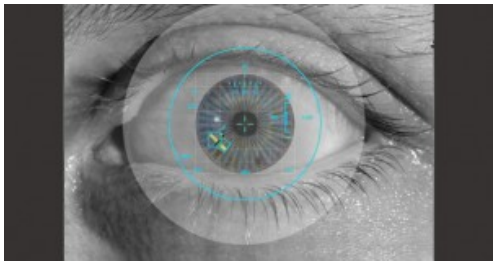
Summary

- UEFI 2.3.1 provides the security framework to implement secure flash update on Intel silicon
- Secure flash update is an integral part of maintaining system security
- New authentication sources can be integrated by following the protocol definitions in the UEFI specification

Call to Action

- **Review NIST BIOS protection guidelines**
  - **NIST Special Publication 800-147**
- **Secure flash update ensures that all BIOS updates come from a trusted source and are genuine**
- **Implementing user authentication according to the UEFI specification can enable an OEM or ODM the ability to allow users to authenticate using new sources**
  - **For assistance implementing your new credential sources please visit AMI's website**

Windows Server Active Directory



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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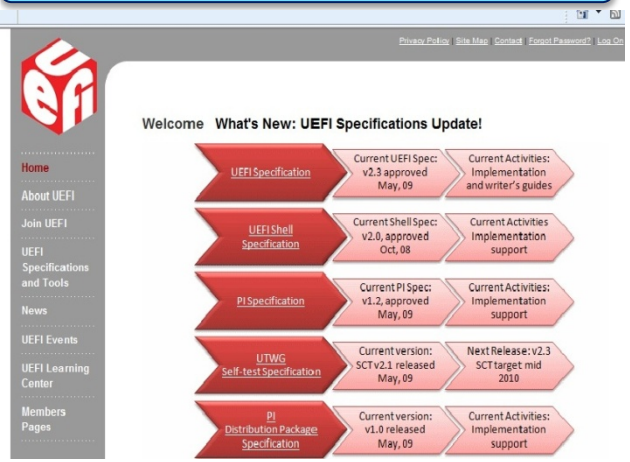
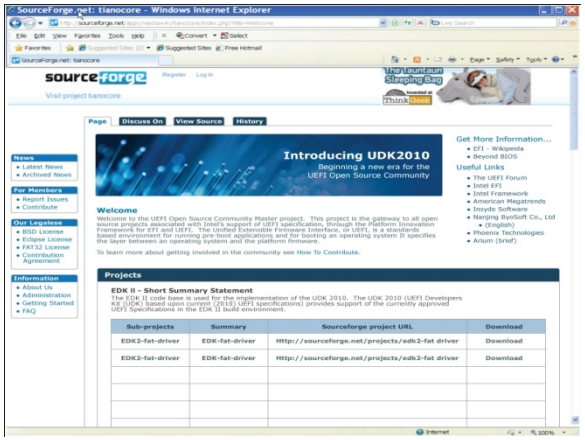
UEFI Industry Resources

UEFI Forum



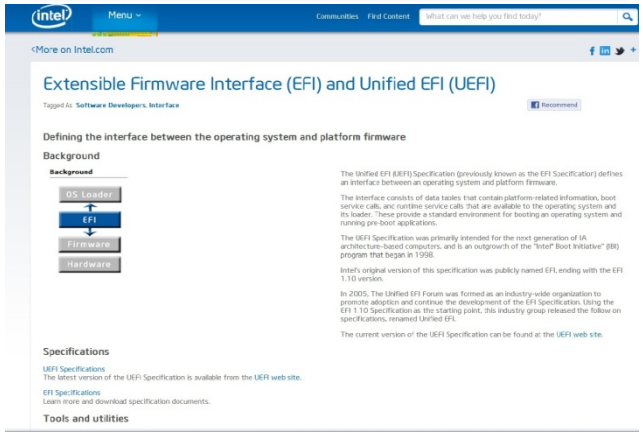
www.uefi.org

UEFI Open Source



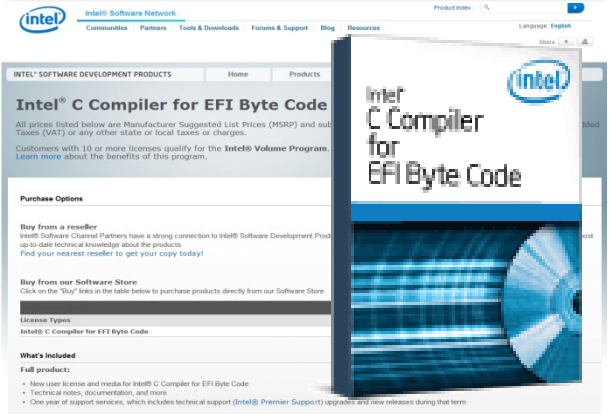
www.tianocore.org

Intel UEFI Resources



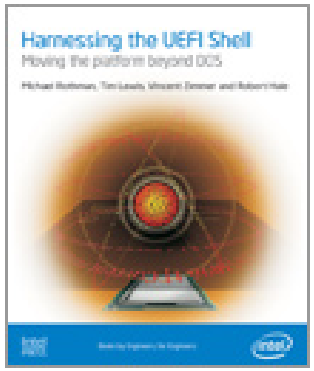
www.intel.com/technology/efi/index.htm

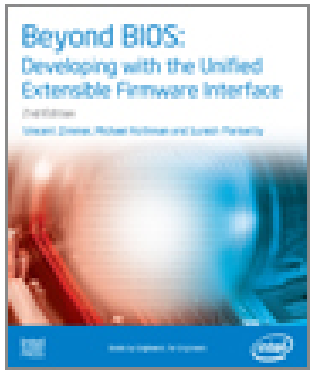
Intel EBC Compiler



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

UEFI Books





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Training/IHVs Contact

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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 8 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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