



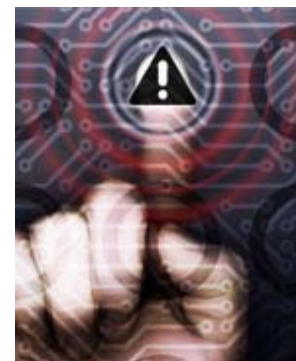
Unified Extensible Firmware Interface (UEFI): Best Platform Security Practices

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EFIS003

Agenda

- Background & Motivation
- Best Practices on Platform Security
 - Trusted Computing Elements
 - UEFI Security Overview
 - Hardware Rules
 - UEFI PI & Firmware Practices
- UID & Byosoft Practices on PBA



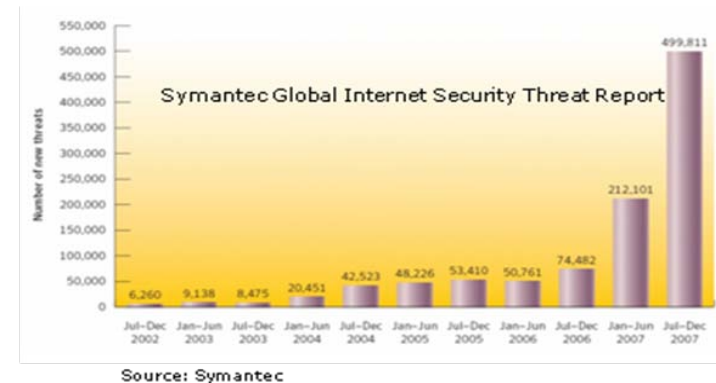
Background & Motivation



- Security is not only OS things: researchers have started to look for vulnerabilities in layers above, as well as underneath the OS.
- Real World: SMM configuration bugs, exploitable memory overflows, firmware downgrades triggered by malware, ...
- Challenges
 - Firmware is an interesting attack target: Early execution, Privileges, Asset Data, SMM, etc
 - Malicious software running underneath the OS is quite powerful: Difficult to detect; Cannot be eliminated by OS reboot or re-install; Information Leak; Identify Theft; ...
- Should consider more security things on Platform & Firmware now!

Platform Security – The Problem Statement

- **Protection Against Malicious Code**
 - Worms, Virus, Rootkit, Bootkit
- **Business Process Compliance**
 - Regulatory requirements from EU Privacy, SarbOx, Basel II, HIPAA, GLB etc.
- **Internal/External Access and Data Protection**
 - Secure provisioning of Infrastructure/Users
 - Managing access/identity across disparate applications



Security isn't hype, but real market need

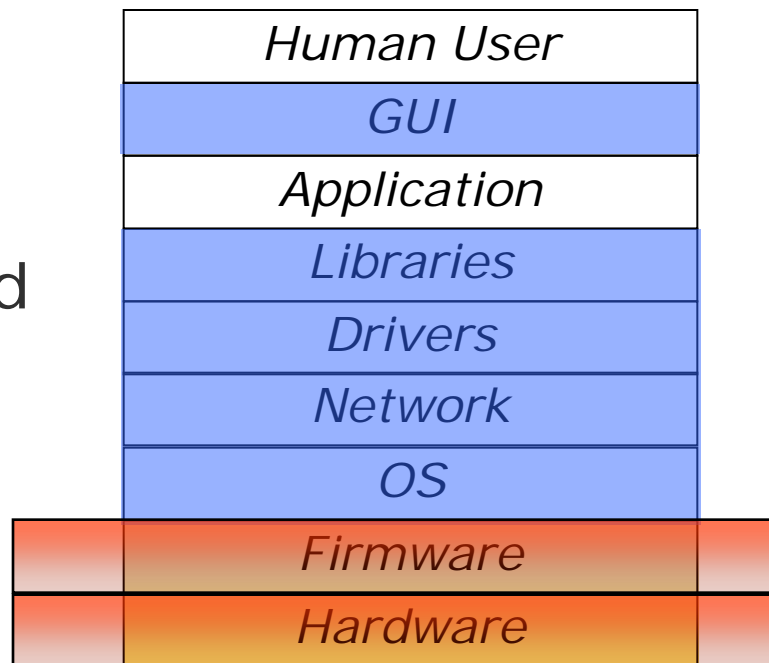
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Goals / Guidelines

- Potential Threats
 - ✓ Spoofing
 - ✓ Tampering
 - ✓ Repudiation
 - ✓ Information Disclosure
 - ✓ Denial of Service
 - ✓ Elevation of Privilege
- Platform and UEFI PI-focused summary of **rules** and **practices**
 - ✓ Integrity Protection
 - ✓ Data Protection
 - ✓ Verification
 - ✓ Platform Availability

Roots of Trust of Security Architecture



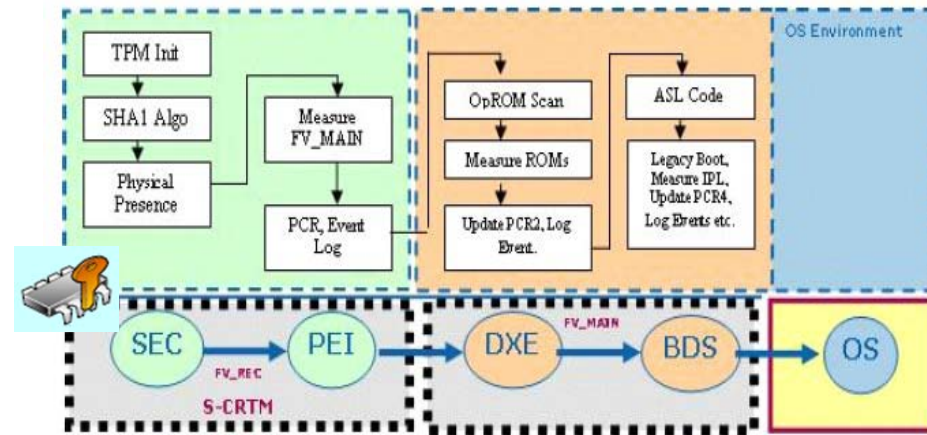
Hardware and Firmware are the Roots of Trust

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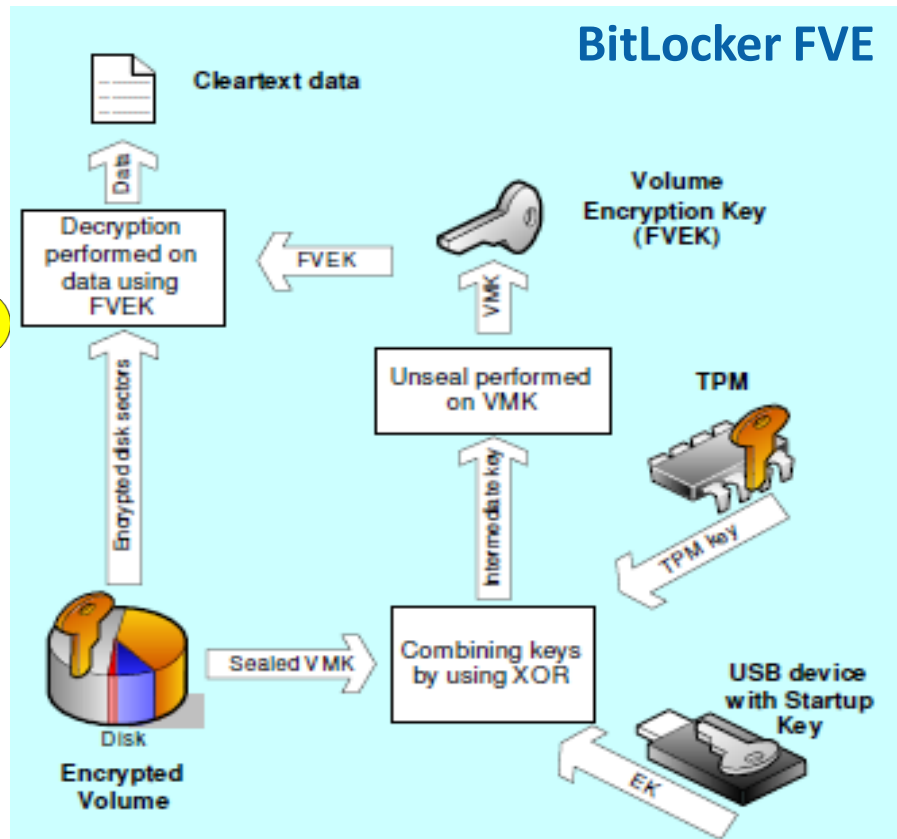
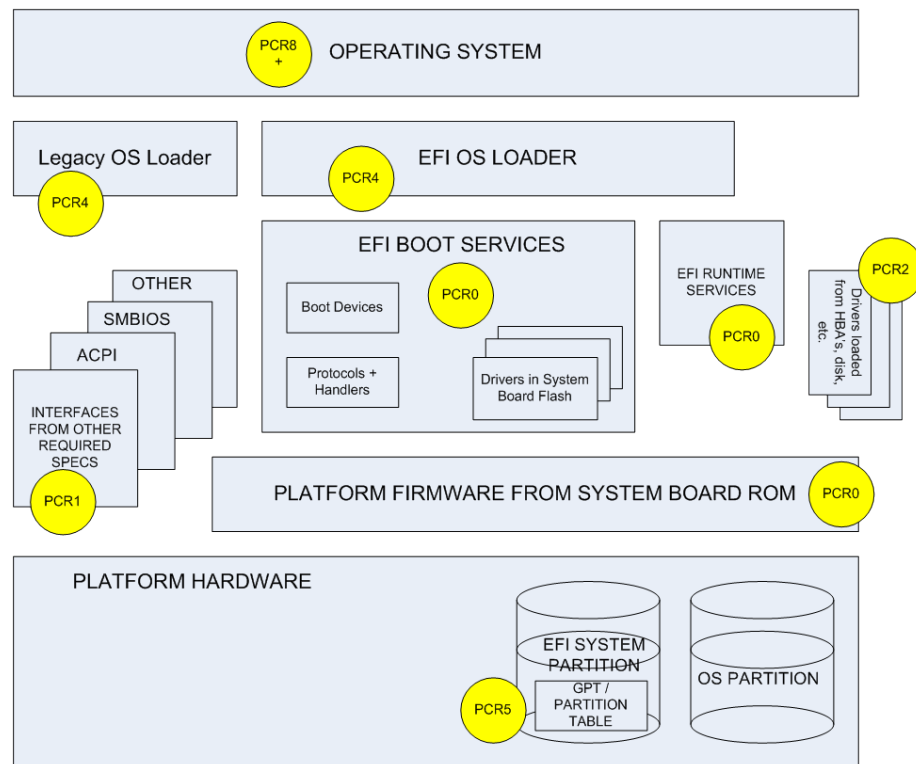
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Trusted Computing & Measured Boot

- The hardware root of trust includes
 - TPM
 - Flash
 - Binding of above into system
- Measured Boot
 - Provide an end-to-end solution for the customer to be TCG conformant
 - Recording the platform state of the machine into a PCR
 - Boot Flow
- S-CRTM
 - Core Root of Trust for Measurement
 - Detects physical presence and initiates measurements for Rest of firmware bootstrap



UEFI Measurement & OS Usage



Standardized way to measure and report

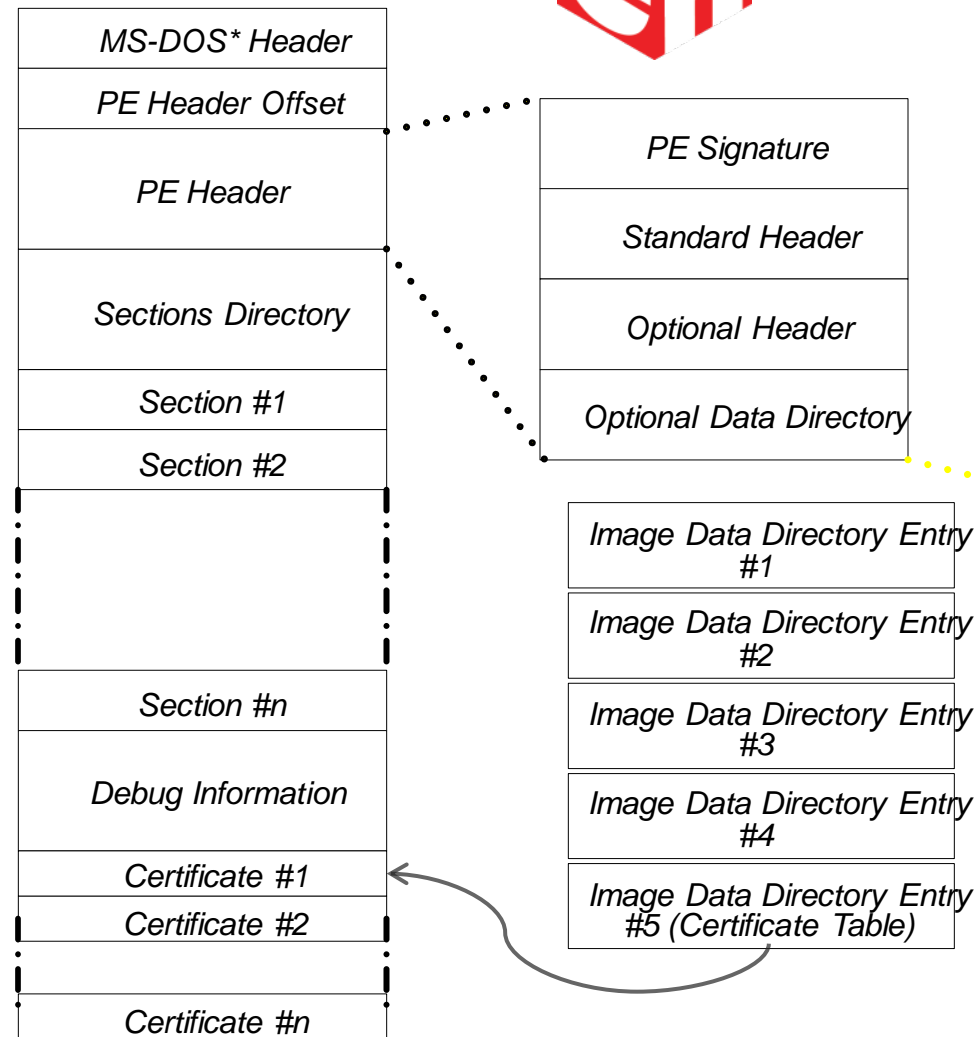
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UEFI Driver Signing



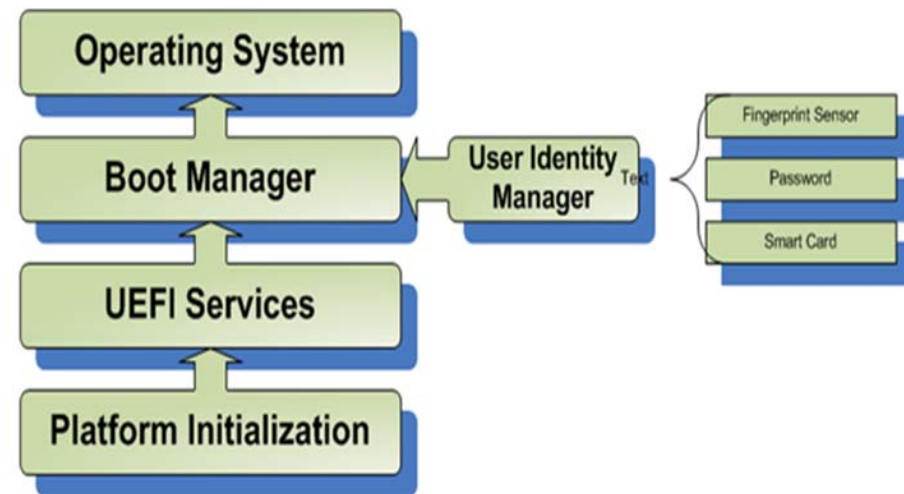
- Expand the types of signatures recognized by UEFI
 - EFI_CERT
 - Authenticode
- Core firmware verification of publisher identity and image integrity of all UEFI extensions
- Security / Trust Policy Configuration to identifies a small set of trusted root certification authorities
- Enable installation and verification of boot applications used to boot any operating system the customer selects for the platform



*Embed signatures
within executable*

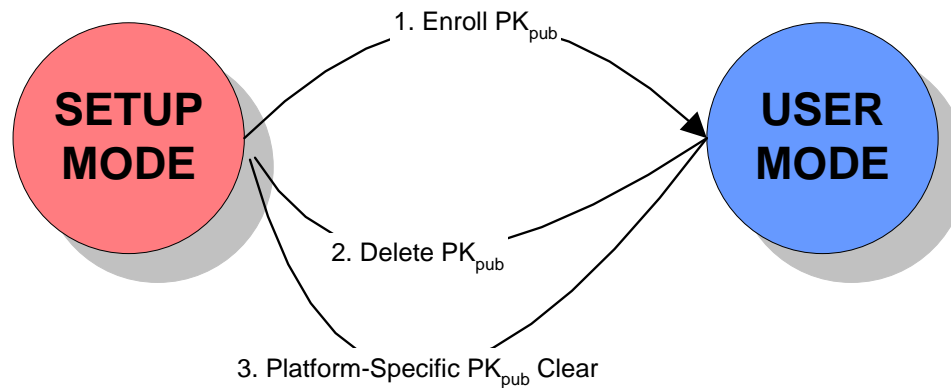
UEFI User Identification

- Standard framework for user-authentication devices such as smart-cards, smart-tokens & fingerprint sensors
- Uses UEFI HII to display information to the user
- Introduces optional policy controls for connecting to devices, loading images and accessing setup pages

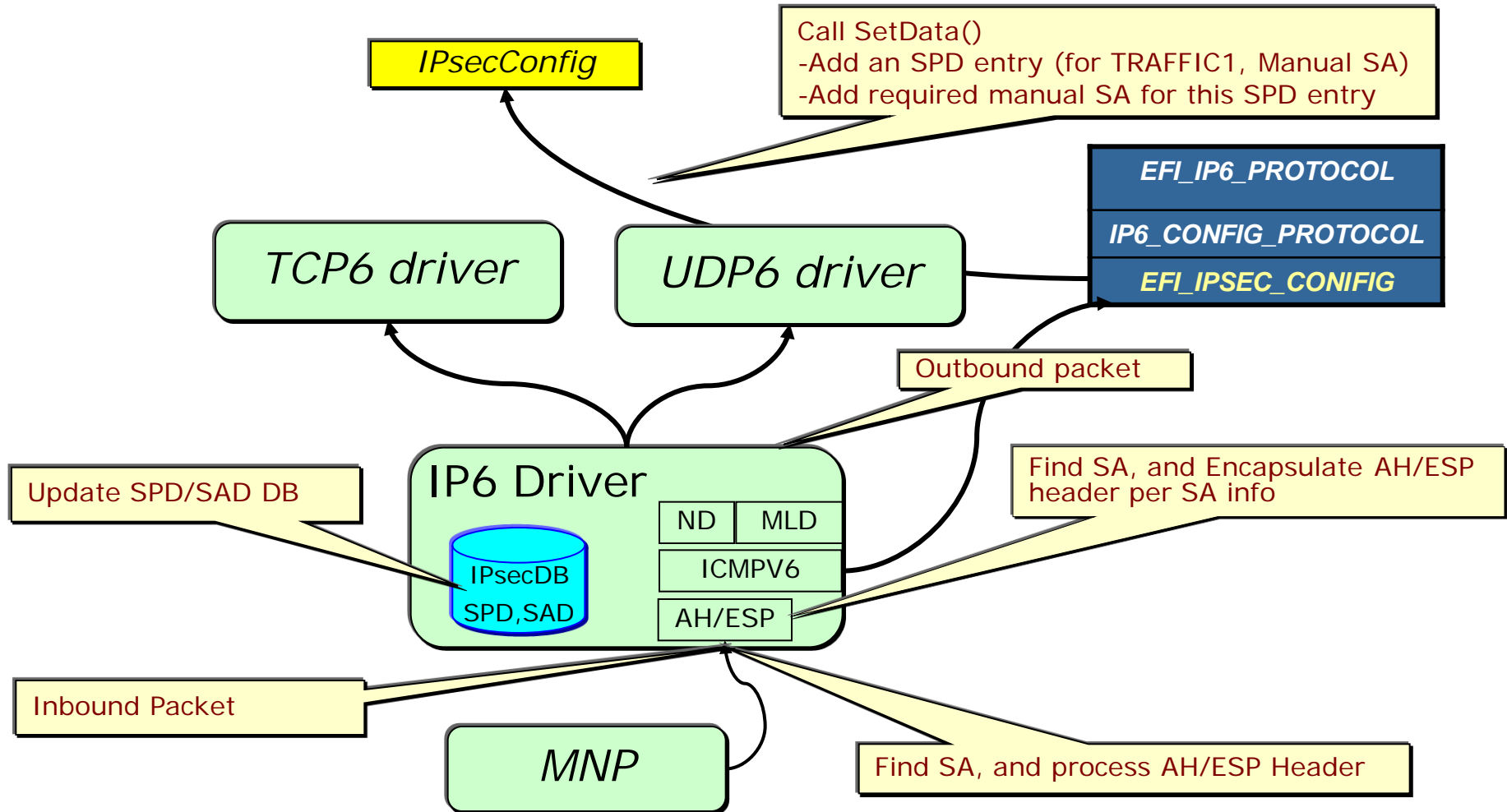


UEFI Authenticated Variable

- Variable is “valuable” information for platform
- Write-protected Variable service, based on asymmetric key technology
- Pre-defined variables for platform mode switching & key exchange between Firmware and OS



UEFI IPsec (Pre-deployed SA)

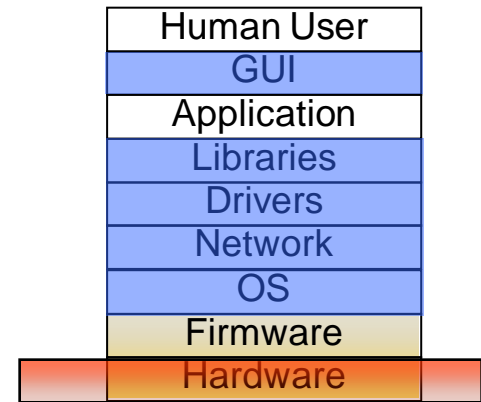


UEFI Security Continues to Evolve

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Hardware Best Practices



- CRTM Flash Protection
 - Locking must not be controlled by any un-trusted programmable entities
 - Once locked within CRTM code, it must not be un-lockable without going through a system reset
- Physical Presence
 - Physical Presence (PP) hardware must not be changeable by any un-trusted programmable entity
- Reset
 - TPM must get reset for any type of platform reset
 - No path available to manipulate reset vector in the system

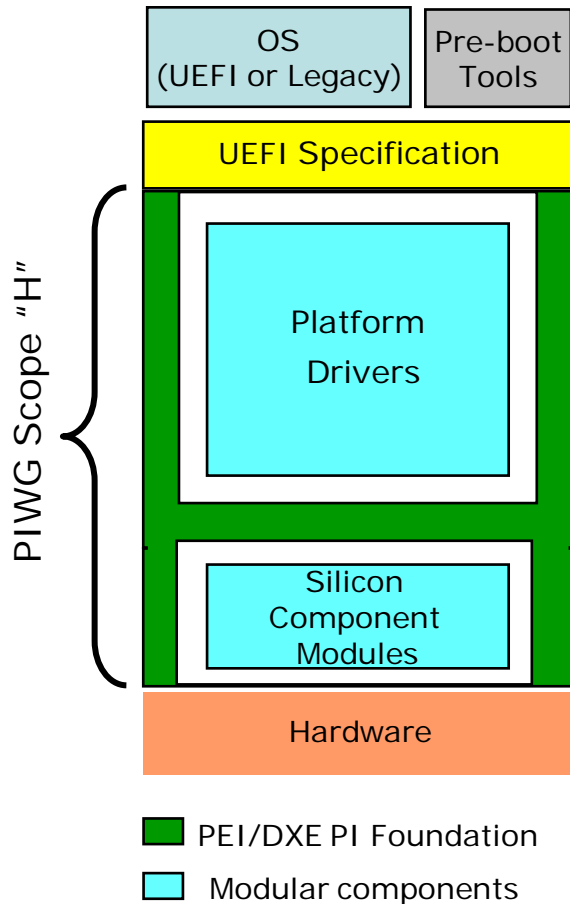
Hardware is a key part of root of trust

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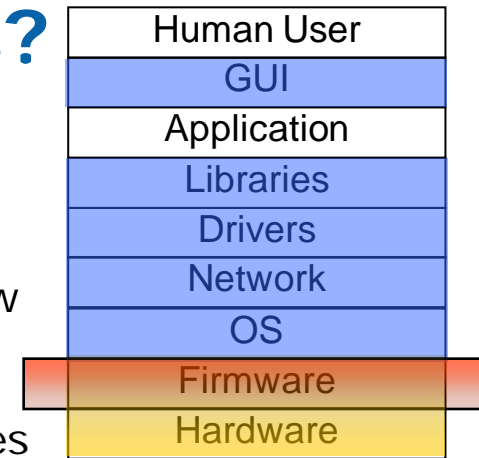
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What About Firmware Practices?

UEFI PI Overview

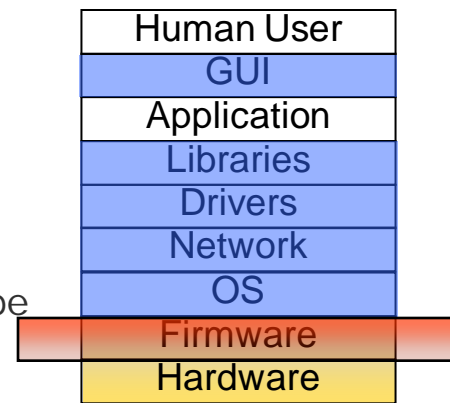


- UEFI 2.3 (published) specifies how firmware boots the OS loader
- UEFI's Platform Initialization Architecture specifies how modules initializing SI and the platform interact and provides common services for those modules
- PI DXE is the preferred UEFI Implementation
- PEIMs and DXE drivers to implement CRTM, SRTM, Update, other security features
- **Design Intent**
 - The PI phase is under control of the Platform Manufacturer (PM)
 - Updates to PI phase should occur under PM authorization (PM_AUTH)
 - PI phase can be decomposed into compartments
 - SEC
 - PEI
 - DXE
 - DXE SMM



Methods of building PI impacts trust

UEFI PI Best Practices



- Hardware mis-Configuration:
 - Appropriate set locks and other hardware configuration should be set by the PM-only PI code prior to running 3rd party code, such as UEFI drivers or operating system loaders
- Callouts
 - Don't call out from PM_AUTH PI code to non-PM_AUTH code
 - Measure any code before loading
- Interface Correctness
 - Pass compliance tests
 - Check & validate input, especially from non-PI PM_AUTH into PI code
- Flash Protection and Update Security
 - Appropriate update of PI and CRTM – either immutable or cryptographic update
- Denial of Service
 - Platform recovery/update strategy

Firmware completes the platform trust solution

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UEFI User Identification



Authentication over platform & identifier

- User authentication prior to the OS loading
- Better resource control - identifier-based platform
- SSO vision
- Independent of OS and applications (push authentication into pre-boot environment)

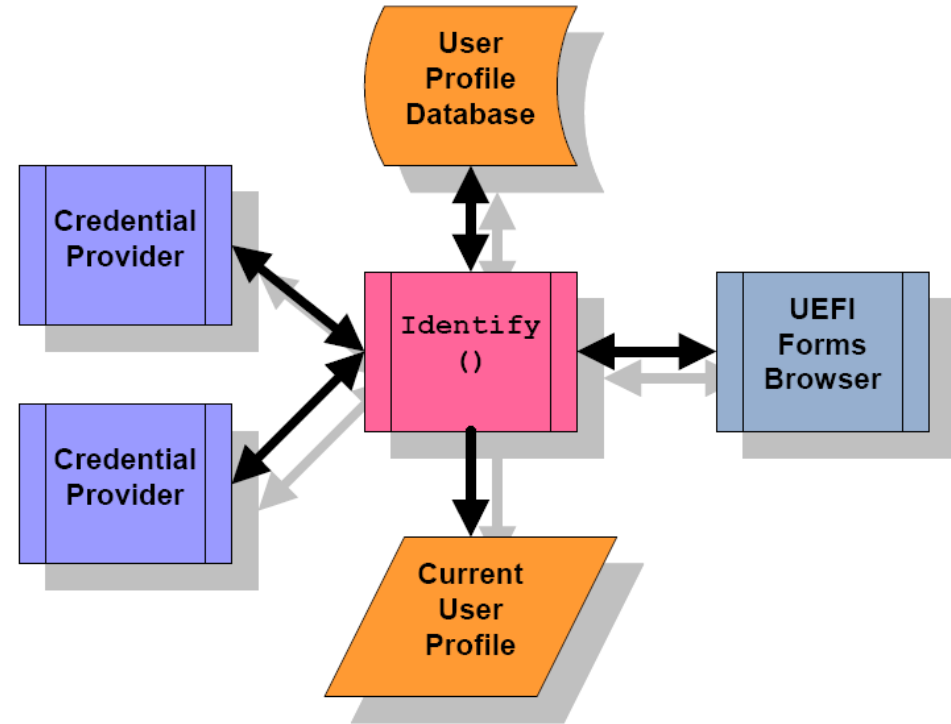
Concepts:

- User profile
- Single-factor/Multi-factor
- Enroll
- Credential
 - What you know (Password)
 - What you have (Smart Card)
 - What you are (Fingerprint)



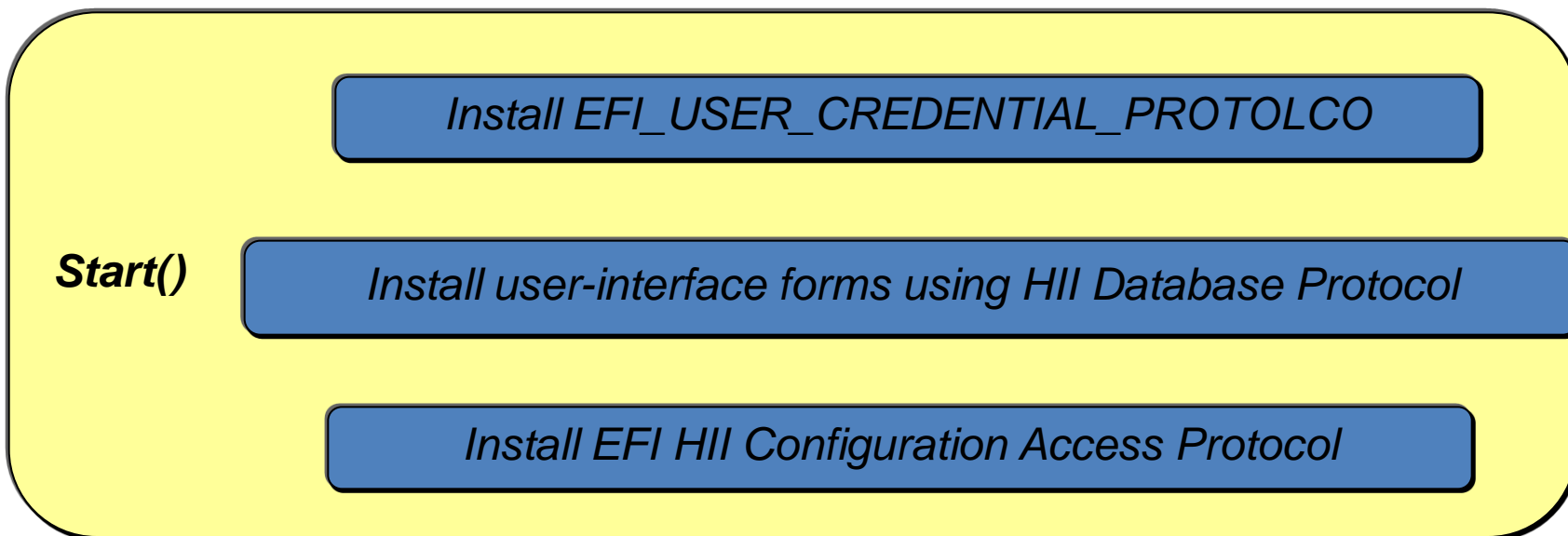
Components in UEFI UID

- User Identity Manager
 - User Information
 - User Identification Policy
 - User Privileges
- Credential Provider
 - Fingerprint sensor
 - Smart Card
 - Password
 - Network Authentication
- Access Control
 - Access Policy



Credential Provider Driver

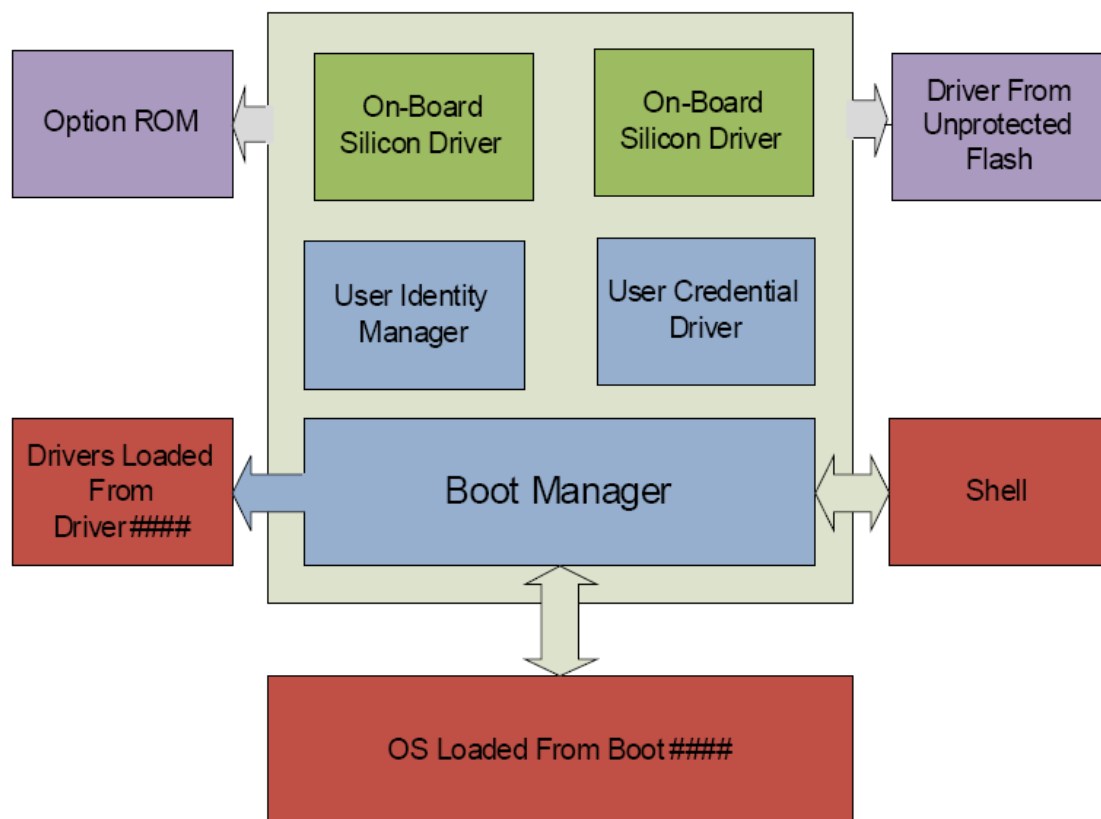
- Follow the UEFI Driver Model



- UEFI Spec does not explicitly support passing credential info to OS. The EFI System Configuration Table is a place to store the encrypt credential info to an OS-present driver or app.



Security Considerations

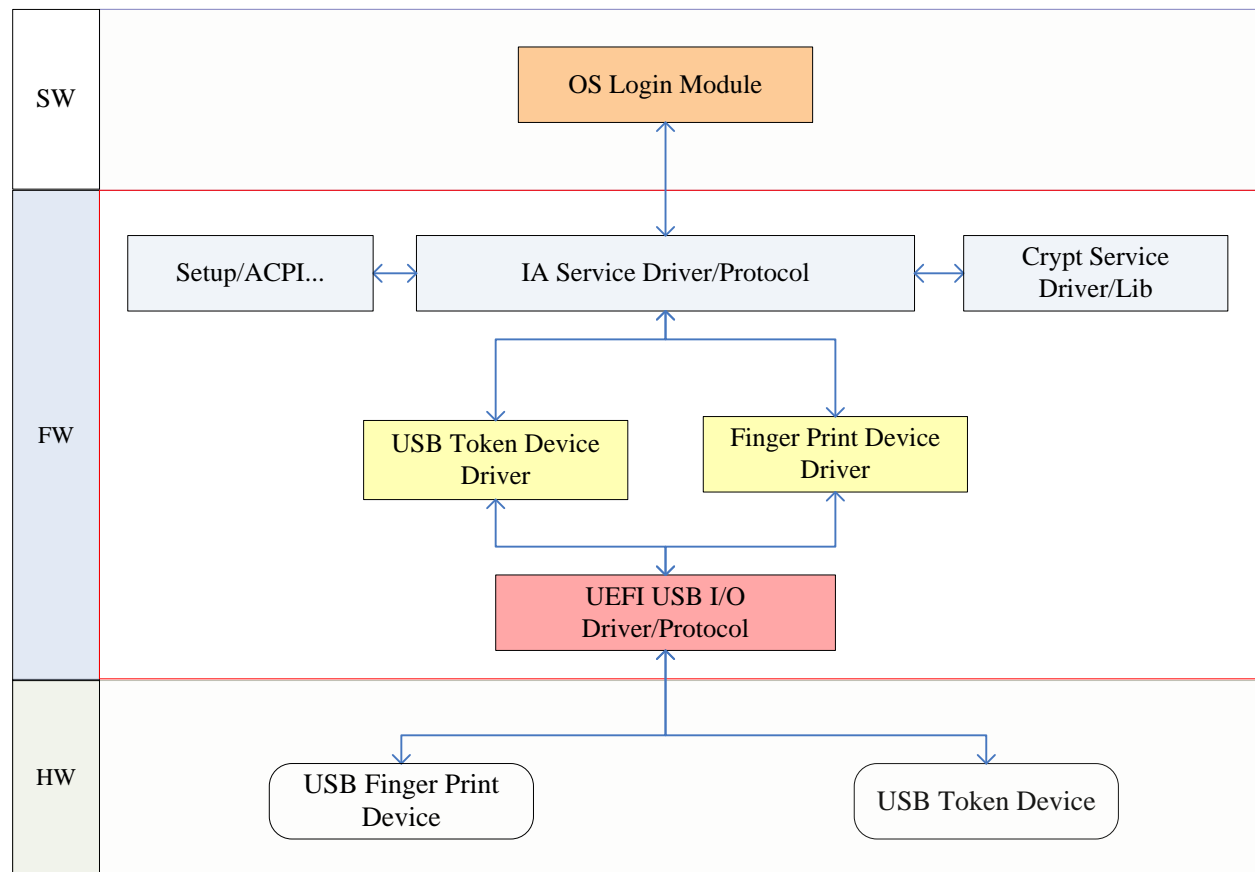


The drivers which be loaded from unprotected location should be verified.



Byosoft UID Practice

- Fingerprint and USB smart card implementation using two protocols



Byosoft UID Extension: Mutil-User/OS

UID is the foundation of many security functions, such as Mutil-User/OS

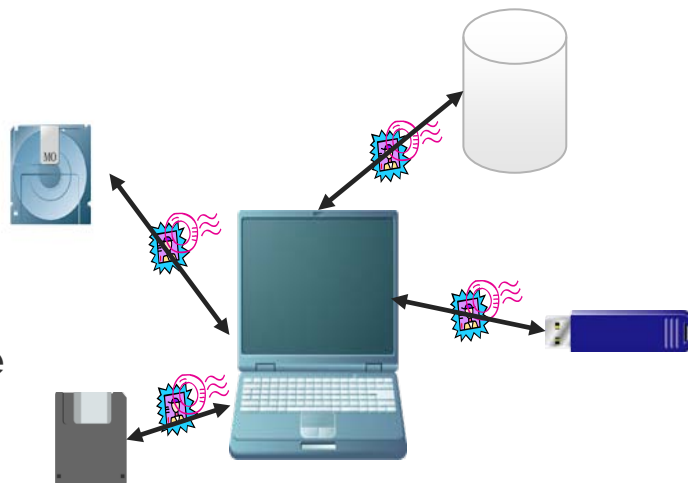


- **Separate storage space for individual**
- **Boot different OS from each space**
- **Feature:**
 - * One machine can be used by different users
 - * Combines with the UID, provides more functions



Byosoft UID Extension: Pre-boot Data Protection

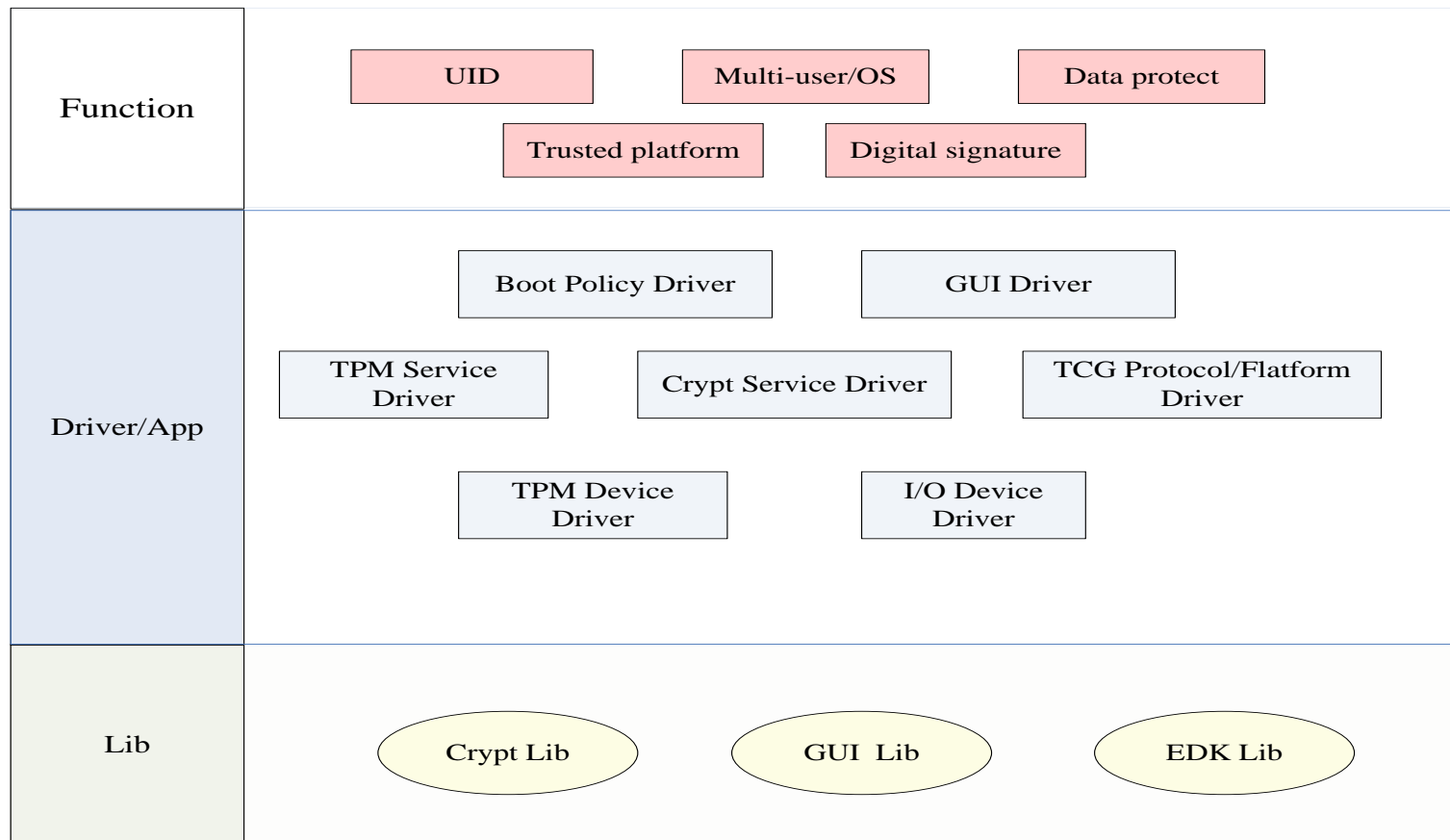
- One access control mechanism for preserving confidentiality
- Two methods:
 - * Pure software
 - * Using 3th party hardware (TPM or other) to improve the secure level
- Features:
 - * Be independent of OS
 - * Binds secret data with platform
 - * Simple to deploy



UID is the naturally KEY for Cryptology algorithms



Byosoft Platform Security Practices



Firmware completes the platform trust solution



Summary

- Security problems in the industry are real
- Trust and a security architecture can address some needs, especially hardware and firmware
- Follow best practices on hardware and firmware configuration and implementation
- UEFI and hardware security evolution

Next Steps – Security Requirements

- Use the trusted device
- Follow best practices on hardware and firmware
- Get involved in UEFI and Trusted Computing forums
- Download the Security white paper:
http://download.intel.com/technology/efi/SF09_EFIS001_UEFI_PI_TCG_White_Paper.pdf

Additional resources on UEFI:

- Other UEFI Sessions – Next slide
- More web based info:
 - Specifications and Implementation sites:
www.tianocore.org, www.uefi.org,
www.intel.com/technology/efi
 - Security Whitepaper:
http://download.intel.com/technology/efi/SF09_EFIS001_UEFI_PI_TCG_White_Paper.pdf
 - Technical book from Intel Press: “Beyond BIOS: Implementing the Unified Extensible Firmware Interface with Intel’s Framework” www.intel.com/intelpress
 - 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

EFI#	Company	Description	Time	RM
S001 ✓	Intel, IBM, HP	Using the Latest EFI Development Kit (EDK II) for UEFI Advanced Development and Innovation	11:10	302AB
S002 ✓	Intel, HP, Byosoft	Notebook Advancements for Unified Extensible Firmware Interface (UEFI) for Pre-boot Productivity	13:00	302AB
S003 ✓	Intel, Byosoft	Unified Extensible Firmware Interface (UEFI): Best Platform Security Practices	14:00	302AB
S004	Intel, Microsoft, Insyde	UEFI Fast Boot for Microsoft* Windows* 7 : Fast Boot Without Compromising your BIOS	15:00	302AB
S005	Intel, Inspur, Insyde	UEFI Firmware Solutions for Enterprise Servers: A Case Study in 8-way Processor Support	16:00	302AB

✓ **DONE**

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Q&A

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