



Intel Advanced Technology in the Enterprise: Best Security Practices

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EFIS001

Sponsors of Tomorrow: 

Agenda

- Trusted Computing Elements
 - Problems to solve
 - Firmware and trusted computing
 - OS usage
 - Platform perspective
- Best practices
 - H/W rules
 - PI overview
 - Firmware rules
- Futures





Trusted Computing Elements **and** Security Features in the platform

Shiva R. Dasari

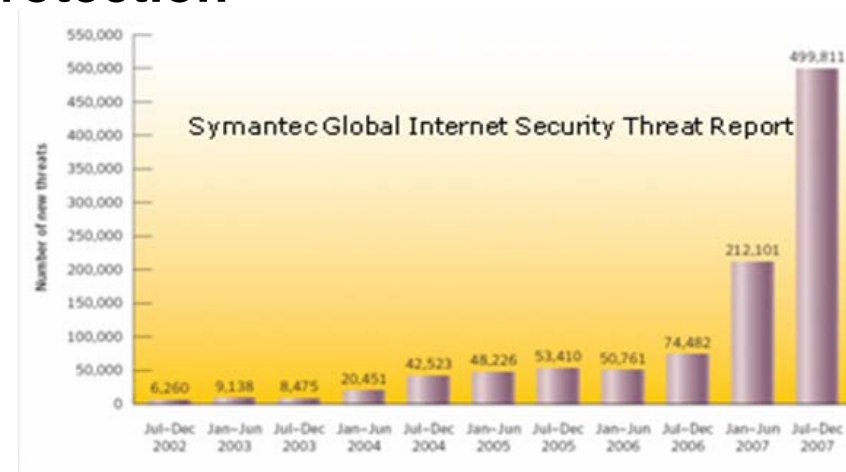
Senior Software Engineer, IBM

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Platform Security – The Problem Statement

- **Protection Against Malicious Code**
 - Worms, patching
- **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



Source: Symantec

Security isn't hype, but real market need

Dictionary Terminology

- **Trust**

- An entity can be trusted if it always behaves in the expected manner for the intended purpose

- **Measurement**

- The process of obtaining the identity of an entity

- **Security**

- “. . .¹ maintenance that ensure a state of inviolability from hostile acts or influences”



Trust needs an agreed upon lexicon

¹ www.wikipedia.org

Agenda

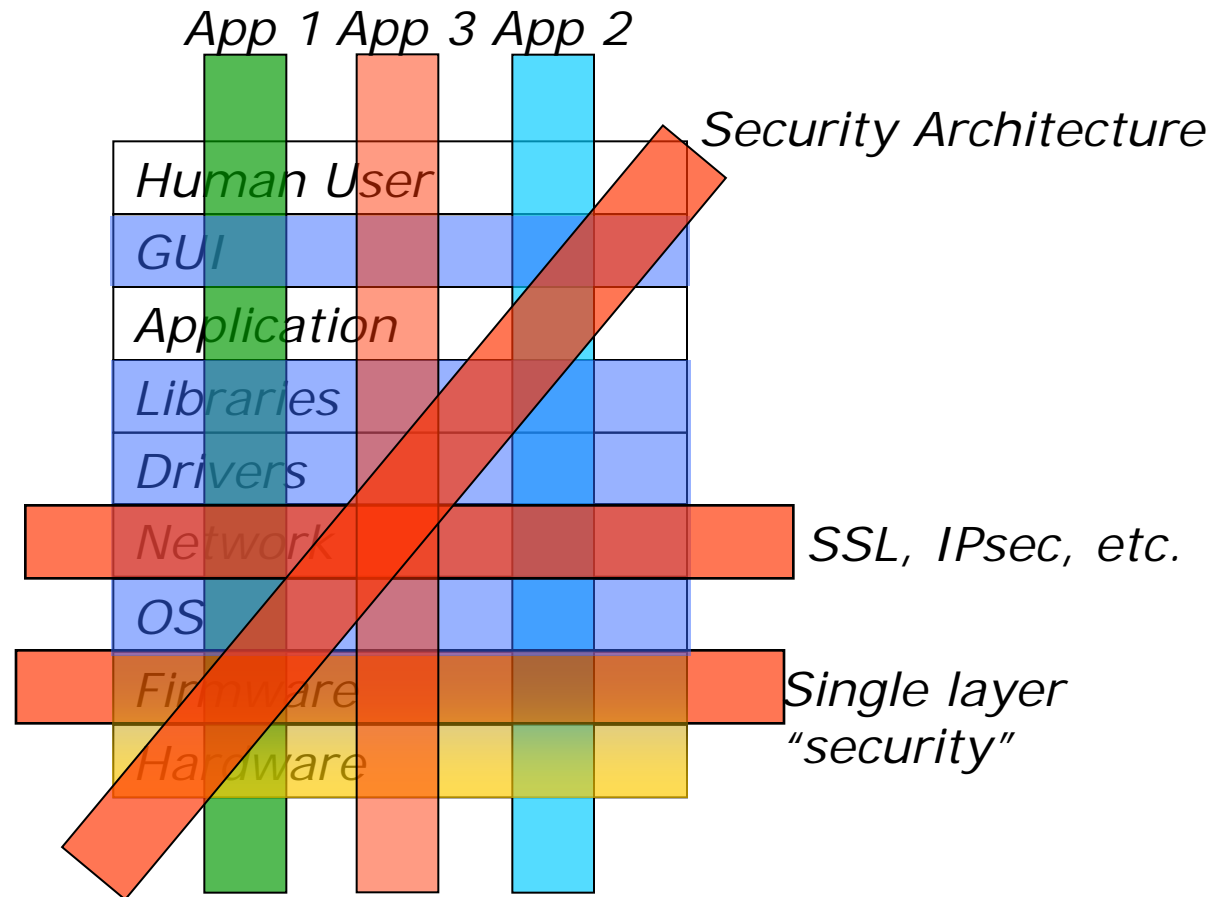
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Elements of trust

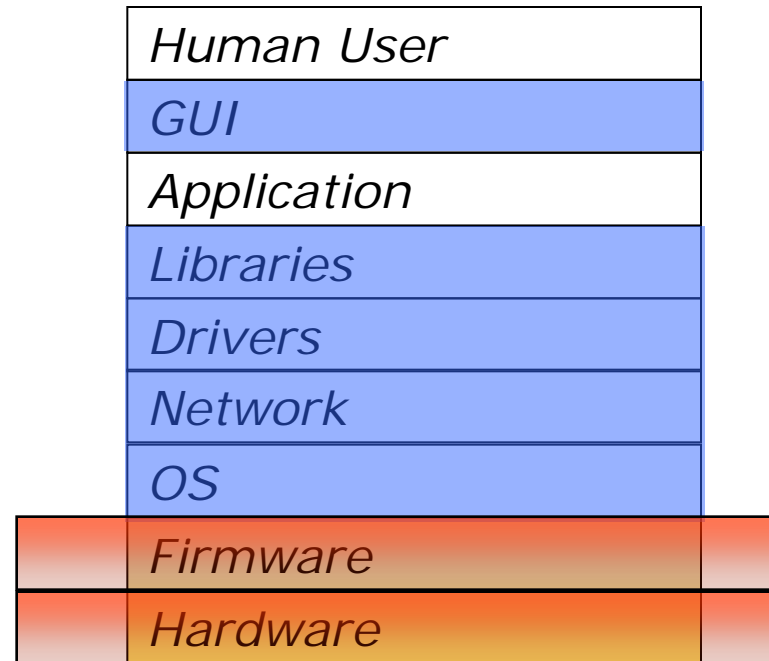


Providing 'Trust'

Security architecture to deliver trust



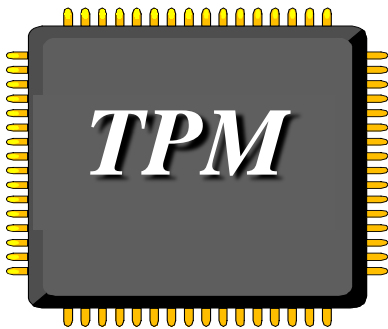
Roots of trust of security architecture



Hardware and firmware are the roots of trust

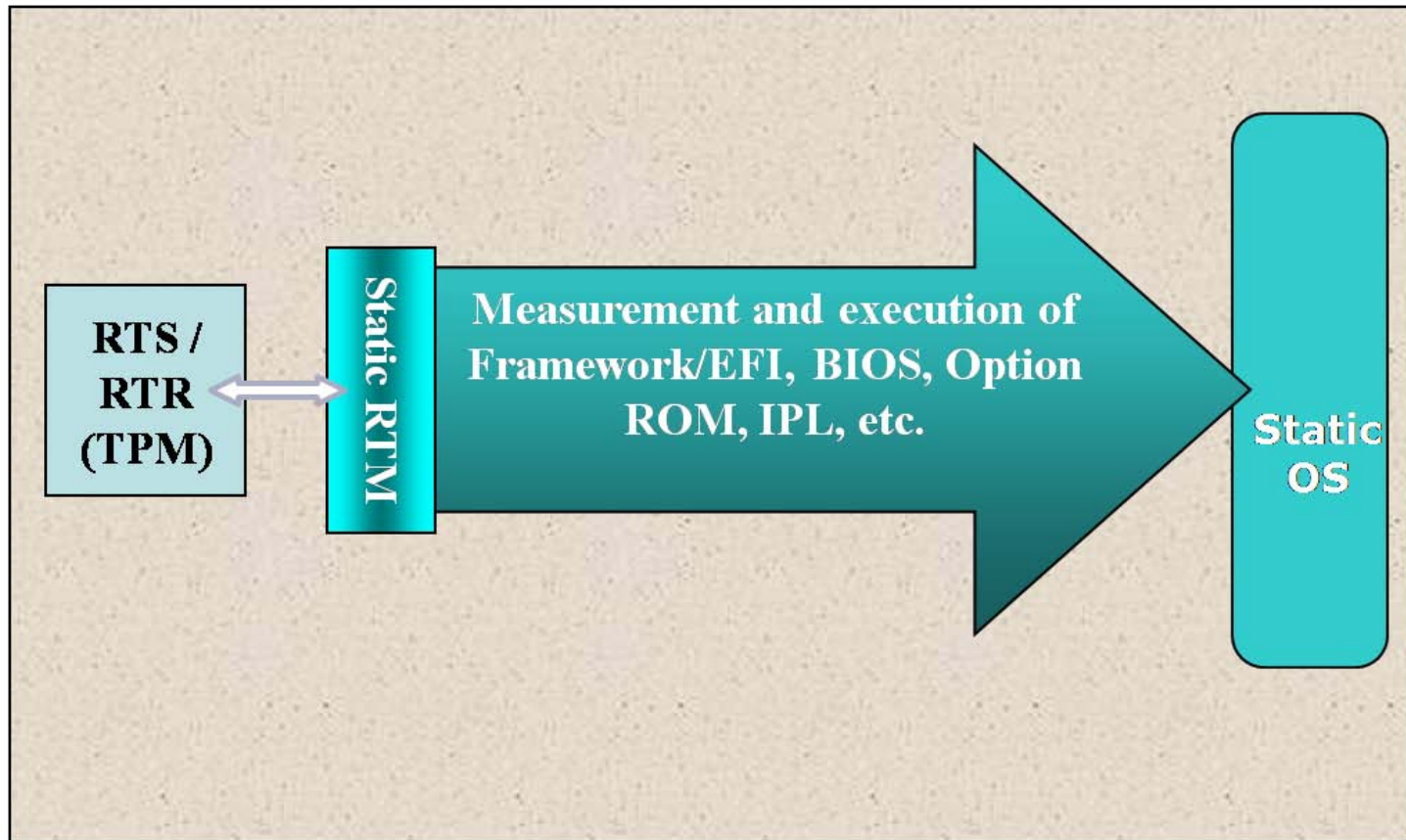
What is the heart of Trust

- The hardware root of trust includes
 - TPM
 - Flash
 - Binding of above into system
- TCG defines TPM's functionality
 - Protected capabilities
 - Shielded locations
- Not the implementation
 - Vendors are free to differentiate the TPM implementation
 - Must still meet the protected capabilities and shielded locations requirements



Need a hardware root of trust

SRTM¹ for Platform Firmware



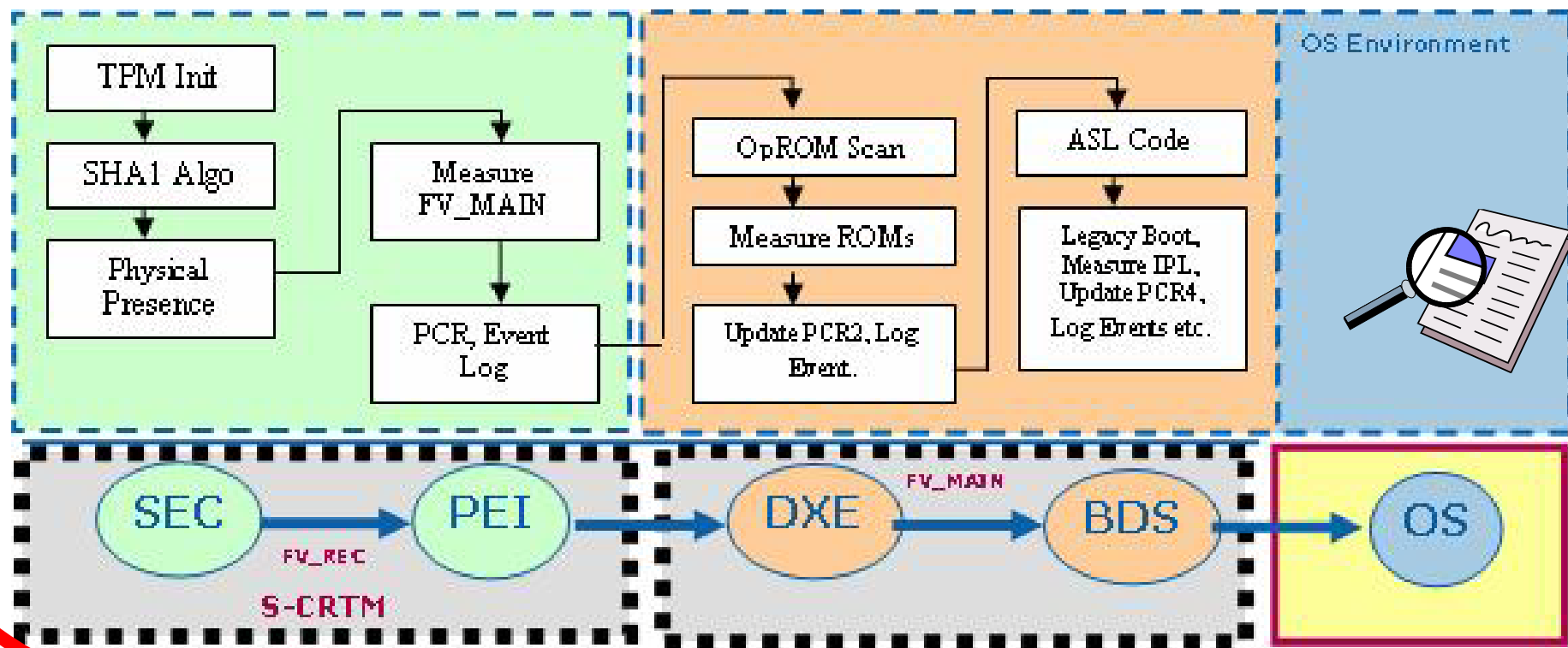
Firmware use of TPM and Measurements

CRTM

- What is CRTM
 - Core root of trust for measurement
 - Detects physical presence and initiates measurements for rest of firmware bootstrap
- Properties of CRTM
 - immutable, or never changed in the field
 - appropriate cryptographic techniques need to be employed in order to update the CRTM.
- For updatable CRTM
 - A signed capsule is one implementation path.
 - Need manufacturer-approved/secure update process

CRTM is the firmware foundation of trust

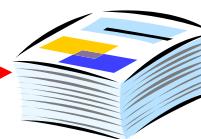
UEFI/PI Architecture Boot Flow – Create/Evaluate Integrity List



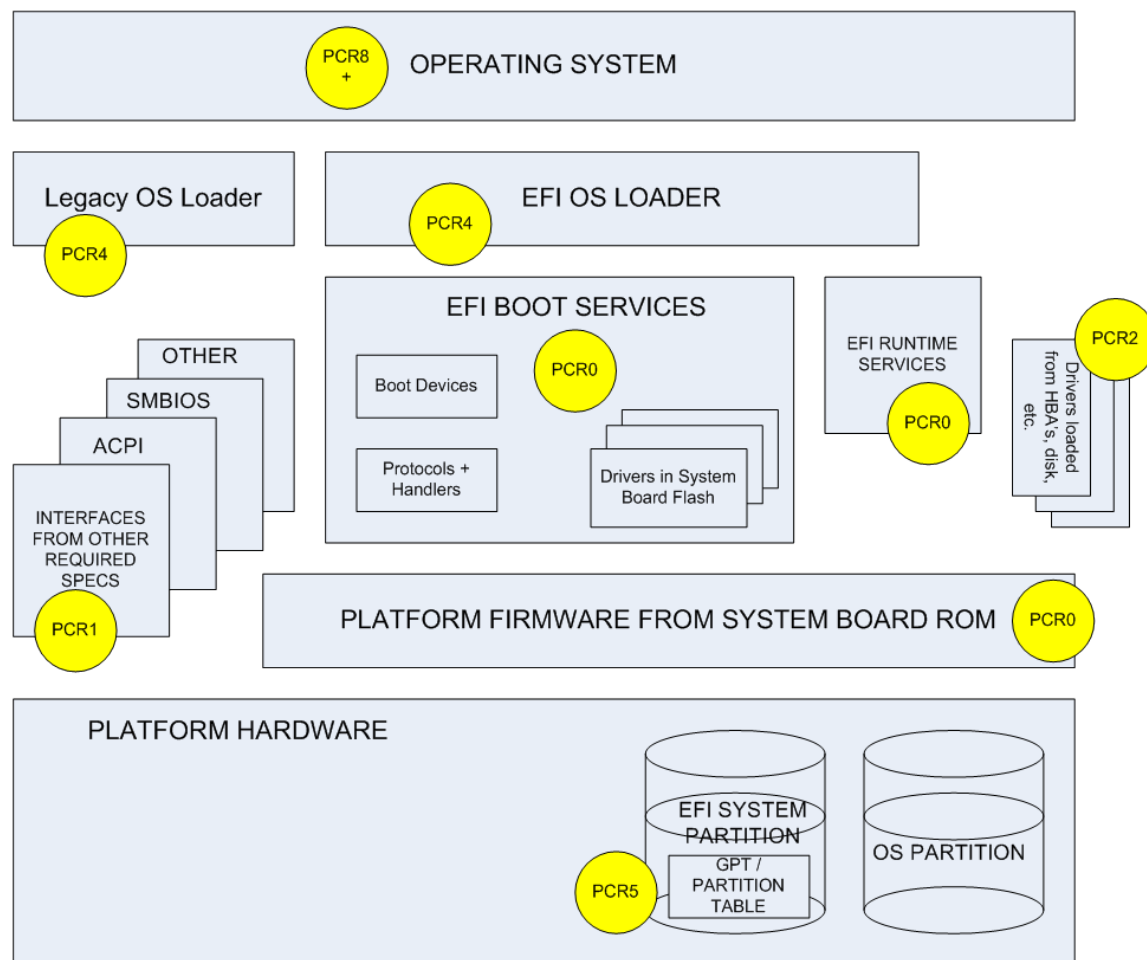
**Measure
Into PCR's**



**Measure &
Create**



Measured items in UEFI



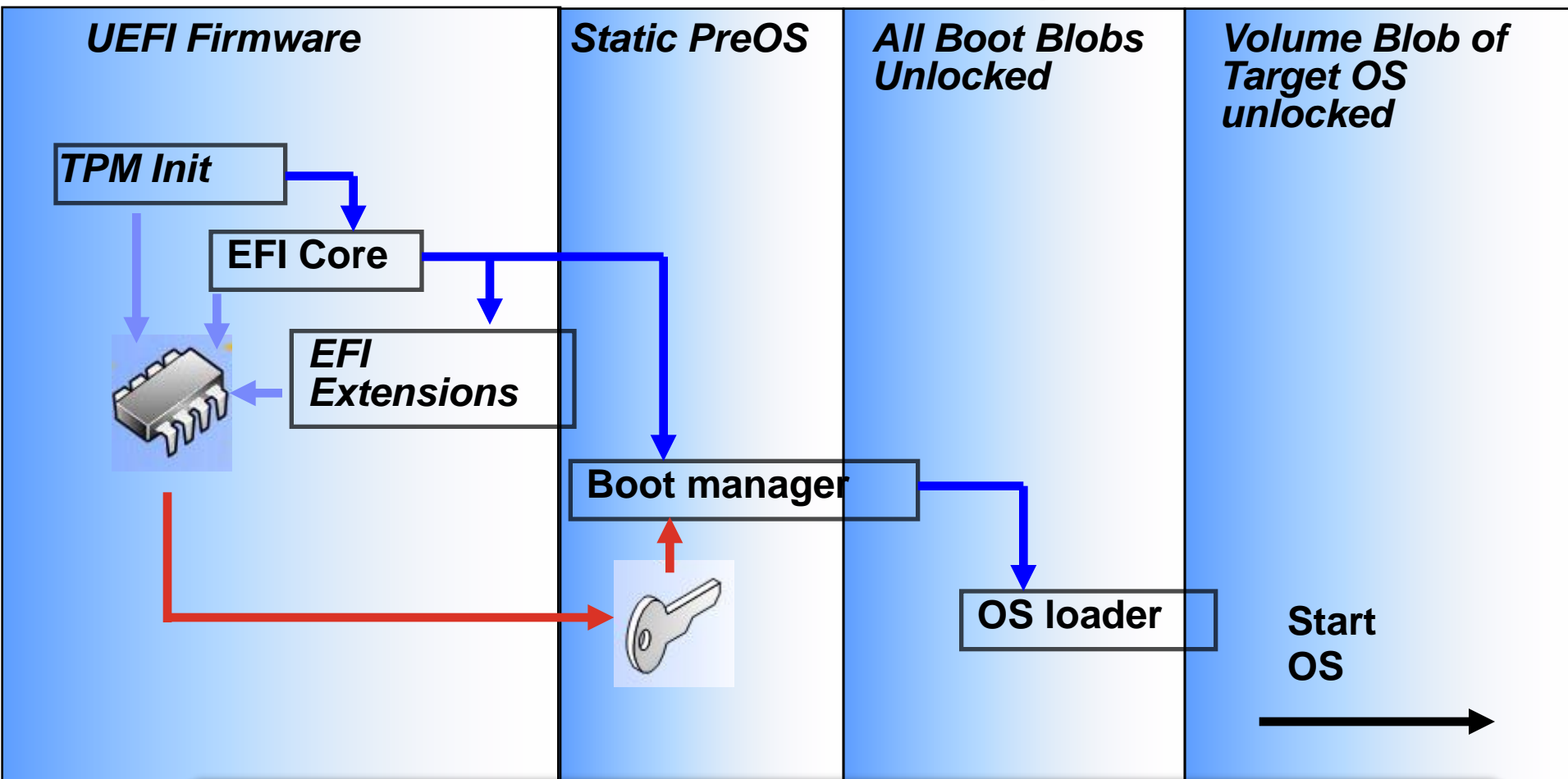
Standardized way to measure and report

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BitLocker™ Drive Encryption

Static Root of Trust Measurement of early boot components



UEFI Windows* is using SRTM

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IBM System x Servers



- Comprehensive System x portfolio Transition to UEFI based firmware
 - UEFI 2.1 PI 1.0 specification compliant
 - Improved management and configuration capabilities
 - Advanced “Touchless” Compatibility Support Module (CSM)
- **Trusted Platform features: TPM enablement, TCG and Core Root of Trust for Measurement support**



Blade

- HS22



Rack-mount

- x3650 M2
- x3550 M2
- X3250 M3



Tower

- x3500 M2
- x3400 M2
- x3200 M3



Vincent Zimmer

Principal Engineer, Intel

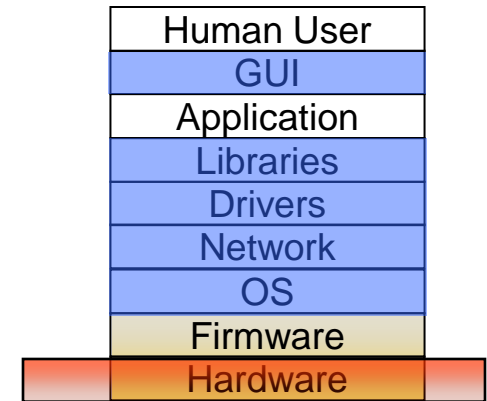
Background on Best Practices

- Many of these prescriptions covered below are already treated in various TCG documents and design guides
- The intent of this section is to provide a platform and UEFI PI-focused summary of rules and practices

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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

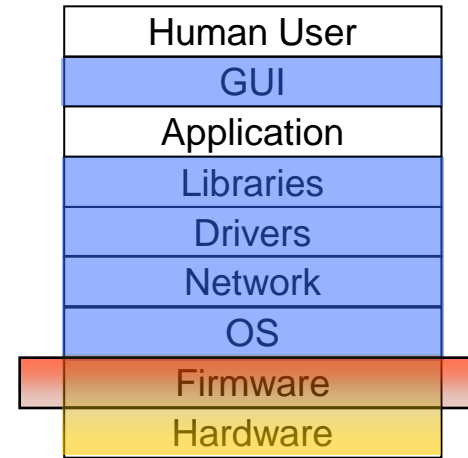
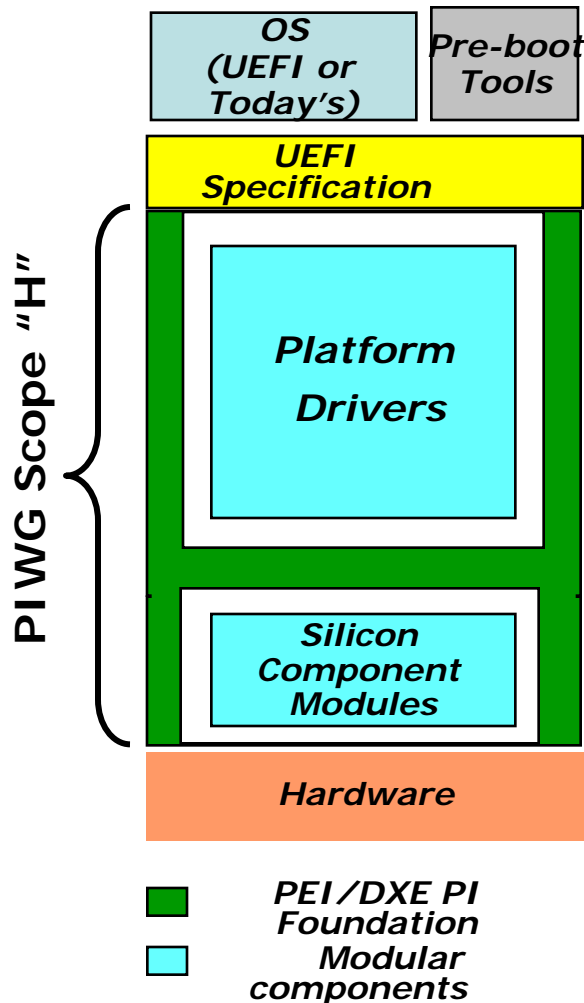
Hardware is a key part of root of trust

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What About Firmware Practices?

UEFI PI Overview



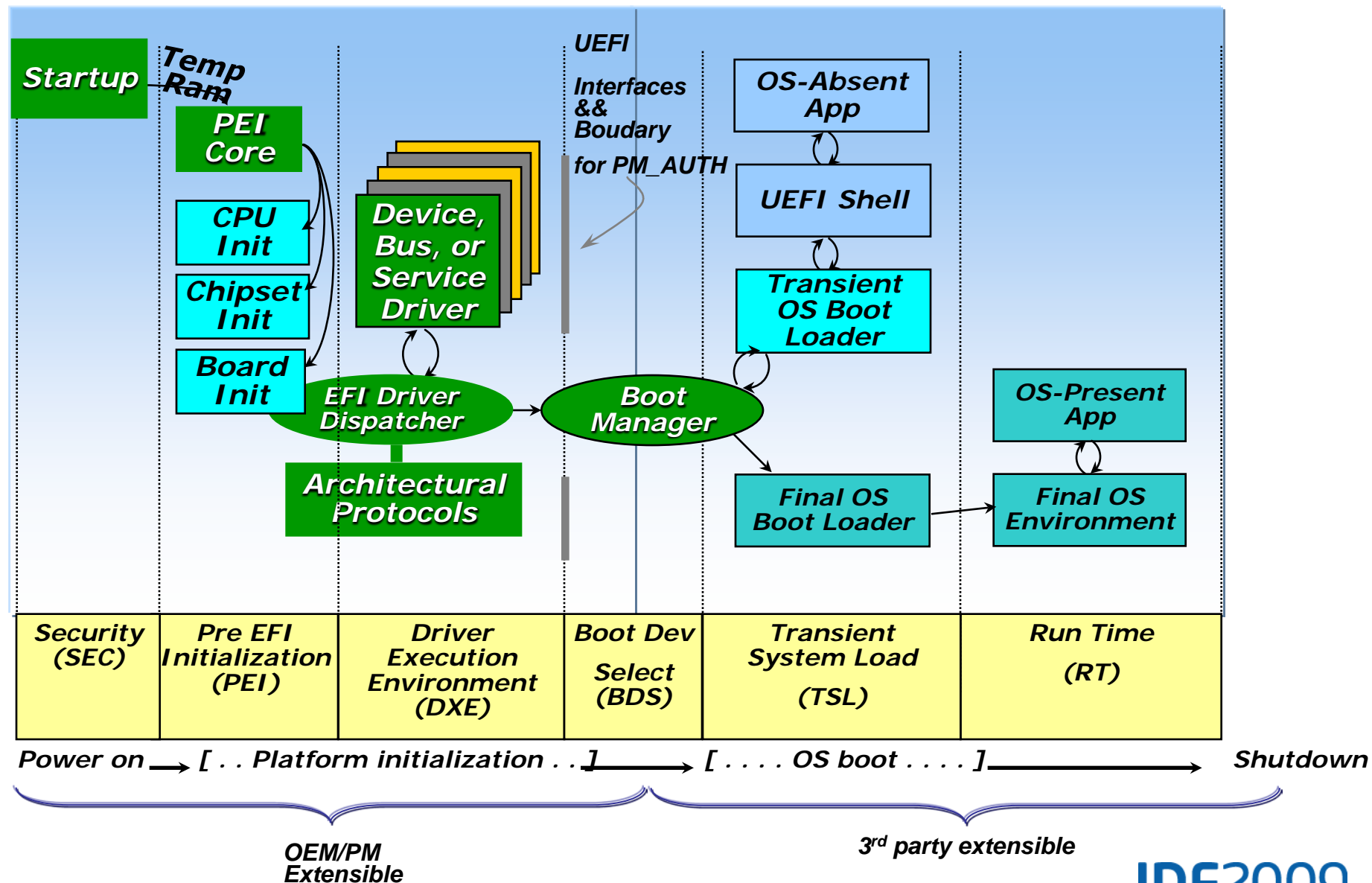
- UEFI 2.3 (published) specifies how firmware boots the OS loader
- UEFI's Platform Initialization Architecture specifies how modules initializing SI and the platform interact and provides common services for those modules
- PI DXE is the preferred UEFI Implementation
- PEIMs and DXE drivers to implement 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

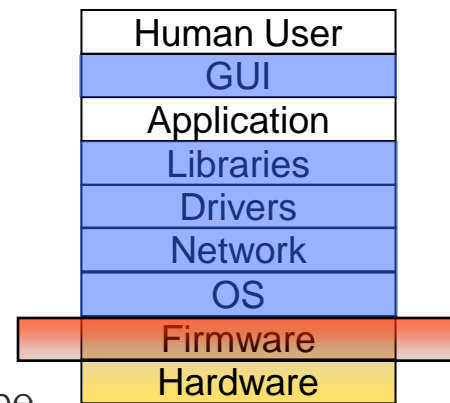
Overall View of Boot Time Line



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UEFI PI Best Practices



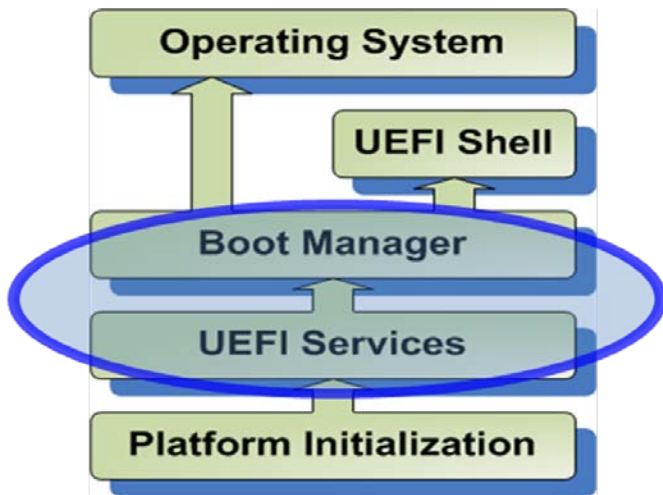
- HW mis-configuration:
 - Appropriate set locks and other hardware configuration should be set by the PM-only PI code prior to running 3rd party code, such as UEFI drivers or operating system loaders
- Callouts
 - Don't call out from PM_AUTH PI code to non-PM_AUTH code
 - Measure any code before loading
- 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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Futures - UEFI



UEFI User Identification

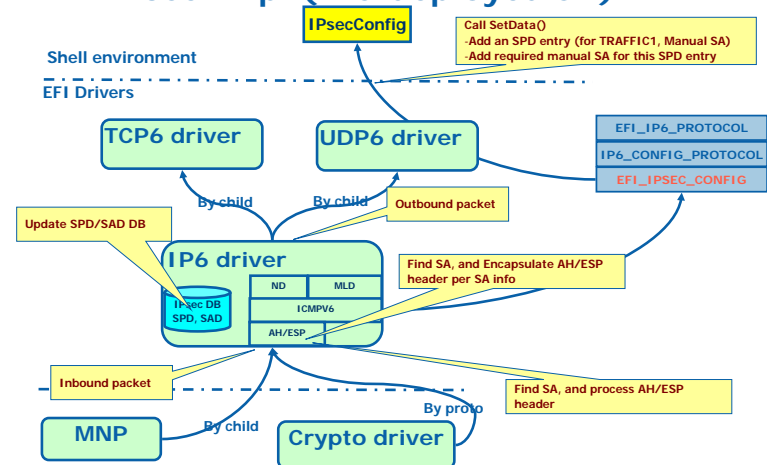


- Standard framework for user-authentication devices such as smart cards, smart tokens & fingerprint sensors.
- Uses UEFI HII to display information to the user.
- Introduces optional policy controls for connecting to devices, loading images and accessing setup pages.

Driver Signing

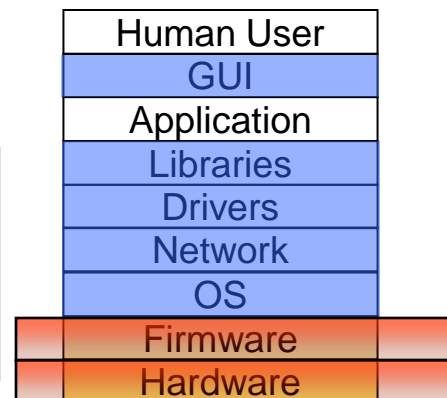
- Expands the types of signatures recognized by UEFI
 - SHA-1, SHA-256, RSA2048/SHA-1, RSA2048/SHA-256 & Authenticode
- Standard method for configuring the “known-good” and “known-bad” signature databases.
- Provides standard behavior when execution is denied to provide policy-based updates to the lists.

EFI IPsec Impl (Pre-deployed SA)



UEFI Security continues to evolve

Trust Models: S-RTM & D-RTM



- S-RTM measurement chain starts at reset and includes components from various sources
- D-RTM measurement chain starts with a trusted secure event trigger such as SINIT. D-RTM leads to a smaller TCB, reduced attack surface and thus a more secure system
- MLE provider must make assurances that the MLE maintains the TCB. Smaller TCB simplifies MLE design.

Firmware & Hardware security evolution

Summary

- Security problems in the industry are real
- Trust and a security architecture can address some needs, esp h/w and f/w
- UEFI f/w and TCG hardware for SRTM, BitLocker usage, IBM platforms
- Follow best practices on implementing hardware and firmware
- UEFI and hardware security evolution

Call to action- Security Requirements

- Use the TPM
- Follow best practices on hardware and firmware
- Get involved in UEFI and TCG forums
- Get the white paper
 - http://download.intel.com/technology/efi/docs/pdfs/SF09_EFIS001_UEFI_PI_TCG_White_Paper.pdf

Additional resources on UEFI:

- Other Technical and UEFI Sessions – Next slide
- Intel / IBM Security Whitepaper:
http://download.intel.com/technology/efi/docs/pdfs/SF09_EFIS001_UEFI_PI_TCG_White_Paper.pdf
- Visit UEFI Booth #136
- More web based info:
 - Specifications and Implementation sites:
www.tianocore.org, www.uefi.org,
www.intel.com/technology/efi
- Technical book from Intel Press: “Beyond BIOS: Implementing the Unified Extensible Firmware Interface with Intel’s Framework”
www.intel.com/intelpress

IDF 2009 UEFI & Other Security Sessions

ECT#	Company	Description	Time	RM	D
S002 ✓	Intel, Vmware	Intel® Trusted Execution Technology (Intel® TXT): A More Secure Launch Environment for the Enterprise Cloud	11:15	2007	T

EFI#	Company	Description	Time	RM	D
P001 ✓	Dell, HP, IBM, Intel, Microsoft	Using UEFI as the Foundation for Innovation	10:10	2005	T
S001 ✓	IBM, Intel	Intel Advanced Technology in the Enterprise: Best Security Practices	16:15	2001	W
S002	Dell, Intel, Insyde SW	Secure FW Lockdown through Standardized UEFI Management Protocols	17:15	2001	W
S003	Intel, AMI	Best Technical Methods for UEFI Development -Reducing Platform Boot Times -Firmware Debugging: UEFI and USB for platform forensics	11:10	2002	Th
S004	Microsoft, Insyde SW, Intel	UEFI Boot Time Opt. Under Microsoft Windows 7	13:40	2002	Th
S005	Phoenix, Intel	Transitioning the Plug-In Industry from Legacy to UEFI: Real World Cases	14:40	2002	Th
Q001	Intel, All	Q & A session	15:40	2002	Th

✓ **DONE**

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