IDF2012
INTEL DEVELOPER FORUM

Implementing Platform Security with UEFI

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Agenda

- UEFI Updates
- Security Feature of Intel® UDK2010 SR1 Release
- Secure Boot Factory Tools
- Secure Firmware Updates
- Summary

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UEFI Updates

- UEFI Specification
  - Version 2.3.1, Errata A published on Sept. 7, 2011
  - Clarifications from version 2.3.1
  - Additional ECRs are work in progress
- UEFI SCT
  - Published a UEFI Winter 2012 Plugfest Release in Feb, 2012
    - Version 2.3.1 compliance test preview
  - Investigating coverage for 2.3.1 Errata A
- Be Ready for Windows* 8
  - UEFI 2.3.1 support
  - UEFI drivers and applications
  - Secure boot (sign the executables)
  - Seamless boot, hybrid boot, fast boot
  - IPv6 and IPv4 network stack
  - UEFI Spring 2012 Plugfest in Taipei (May 8-10)
- PI Specification
  - Version 1.2 Errata C published in October 2011

2012 marks the ubiquitous adoption of UEFI on PCs

Intel® UDK2010 SR1 Key features

- UEFI 2.3.1 Secure Boot
- TCG Physical Presence v1.2 rev 1.0 support
- User Identification(UID) per UEFI 2.3.1a
- iSCSI over IPv6
- Networking Improvements - DHCP4/DHCP6 API & IPV6 identification
- Opal/eDrive SATA devices support per UEFI 2.3.1a
- USB 3.0 Controller support (XHCI)
- UEFI 2.3.1 Internal Forms Representation (IFR) support
- Modular and Faster Build Process
- Fast Boot support (asynchronous Block I/O)

HP Experience on Intel® UDK2010 SR1

- Advantages
  - Support for many of the new UEFI and Windows* 8 features
    - UEFI 2.3.1 support
    - Support for Windows 8 features
      - Secure Boot
      - Seamless Boot
    - Support for IPv6 and IPv4 network stacks
      - IPSec is implemented
  - Most of the code is ready-to-go and doesn't require changes

Intel® UDK2010 SR1 provides a valuable reference implementation for the industry

Intel® UEFI Development Kit 2010 (Intel® UDK2010)

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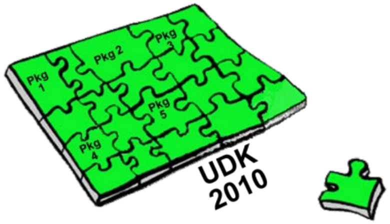
Intel® UDK2010 SR1 Security Features

- UEFI Secure Boot
  - UEFI variable support for UEFI Secure Boot as defined by UEFI 2.3.1a (EFI_VARIABLE_TIME_BASED_AUTHENTICATED_WRITE_ACCESS attribute with EFI_VARIABLE_AUTHENTICATION_2 and EFI_VARIABLE_AUTHENTICATION support)
  - DXE Image Verification library to support UEFI Secure Boot (UEFI 2.3.1a)
  - PK x509 Certificate Support
  - Support EFI_VARIABLE_AUTHENTICATION_2 for PK variable format (UEFI 2.3.1a)
  - Add enable/disable mechanism for UEFI Secure Boot
- TCG Trusted Boot
  - TCG EFI Platform Specification



Intel® UDK2010 SR1 Other Features

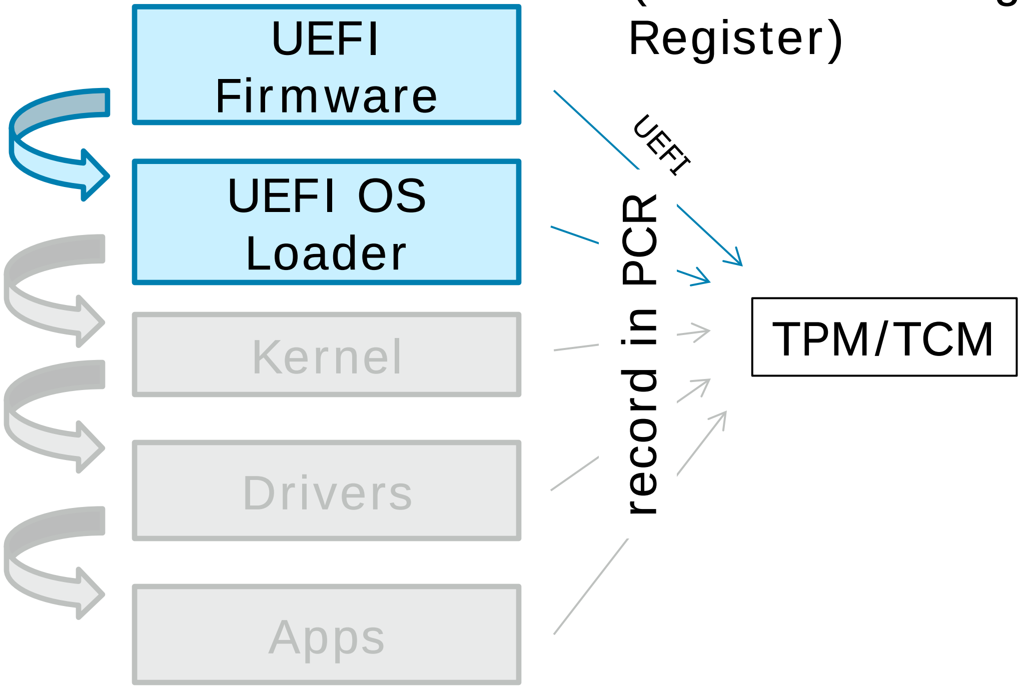
- User Identity (UID) Support (UEFI 2.3.1a)
- Secure Storage Protocol
  - Enable Opal/eDrive SATA devices using the EFI_STORAGE_SECURITY_COMMAND_PROTOCOL, ATA-8 Trusted Send/Receive and IEEE1667 Silo (UEFI 2.3.1a)
- Networking Improvements
  - Errata related to Netboot6-DUID
  - Provide more DHCP4 & DHCP6 API support
  - iSCSI (ip6) open source implementation for IPv6
- TCG Physical Presence (PP). Based on the Physical Presence Interface Specification Version 1.20, Revision 1.0.
- Support ATA Asynchronous Block Io (UEFI 2.3.1a)
- USB 3.0 Controller Support (XHCI)
- Update Internal Forms Representation (IFR) implementation to match UEFI 2.3.1 Specification

UEFI Secure Boot VS TCG Trusted Boot

UEFI authenticate
OS loader
(pub key and policy)

Check signature of
before loading

TPM/TCM will measure
OS loader into PCR
(Platform Configuration
Register)



UEFI Firmware

UEFI OS Loader

Kernel

Drivers

Apps

UEFI

record in PCR

TPM/TCM

- UEFI Secure boot will stop platform boot if signature not valid (OEM to provide remediation capability)
- UEFI will require remediation mechanisms if boot fails

- TCG Trusted boot will never fail
- Up to other SW to make security decision using attestation

UEFI Secure Boot Component:

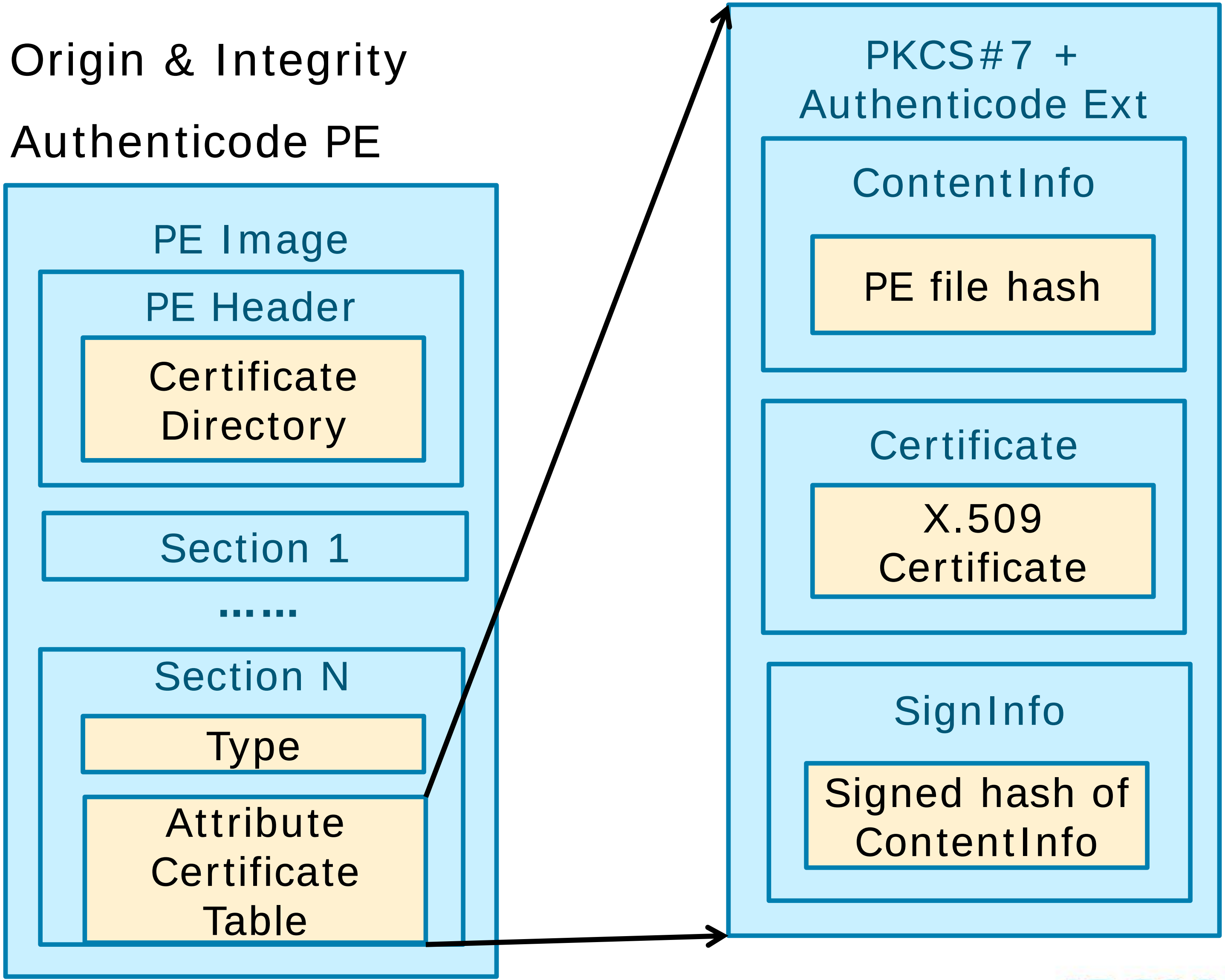
UEFI Driver **Signing** → The system provider may decide to authenticate either the origin of the executable or its integrity

Authenticated UEFI Variable → It provides a way to protect the critical variable being modified by malicious software.

Firmware/OS **Key** → We can create a trust relationship between the platform owner, the platform firmware, and an operating system.

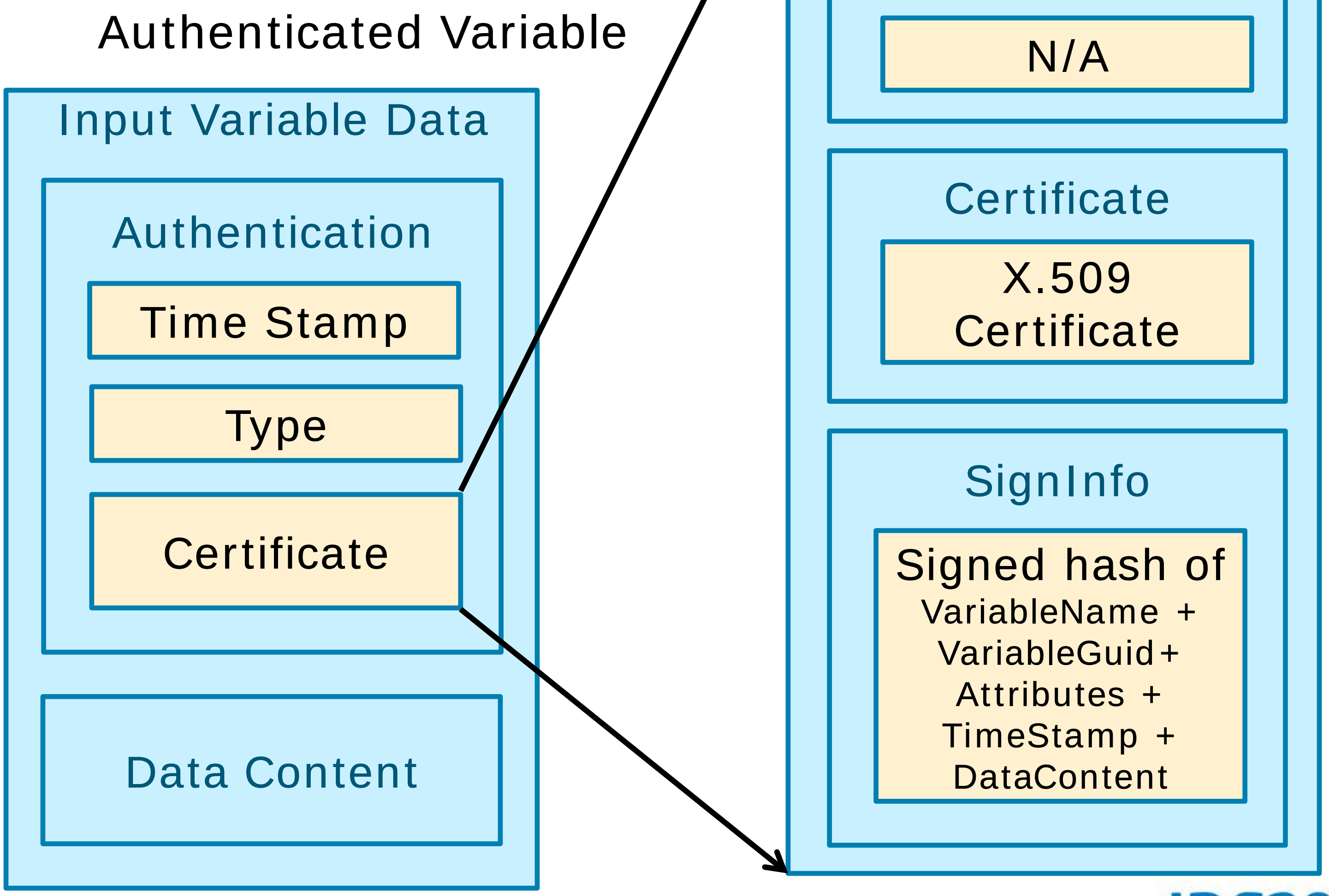
UEFI Driver Signing

- **Why**? – Origin & Integrity
- **How**? – Authenticode PE



UEFI Authenticated Variable

- **Why**? – Integrity (no confidentiality)
- **How**? – Time Based



Authenticated Variable

Input Variable Data

Authentication

Time Stamp

Type

Certificate

Data Content

PKCS#7

ContentInfo

N/A

Certificate

X.509 Certificate

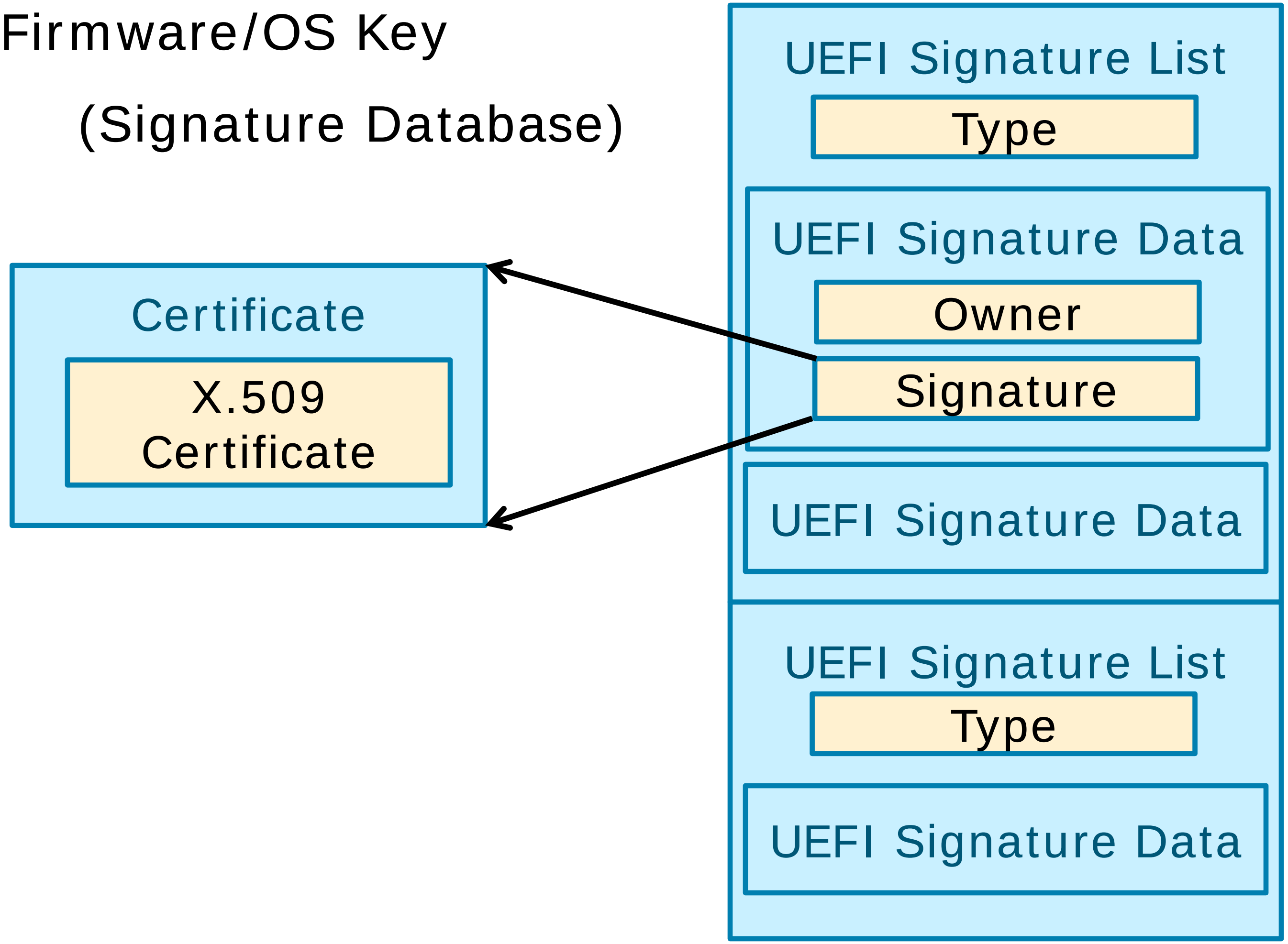
SignInfo

Signed hash of VariableName + VariableGuid+ Attributes + TimeStamp + DataContent

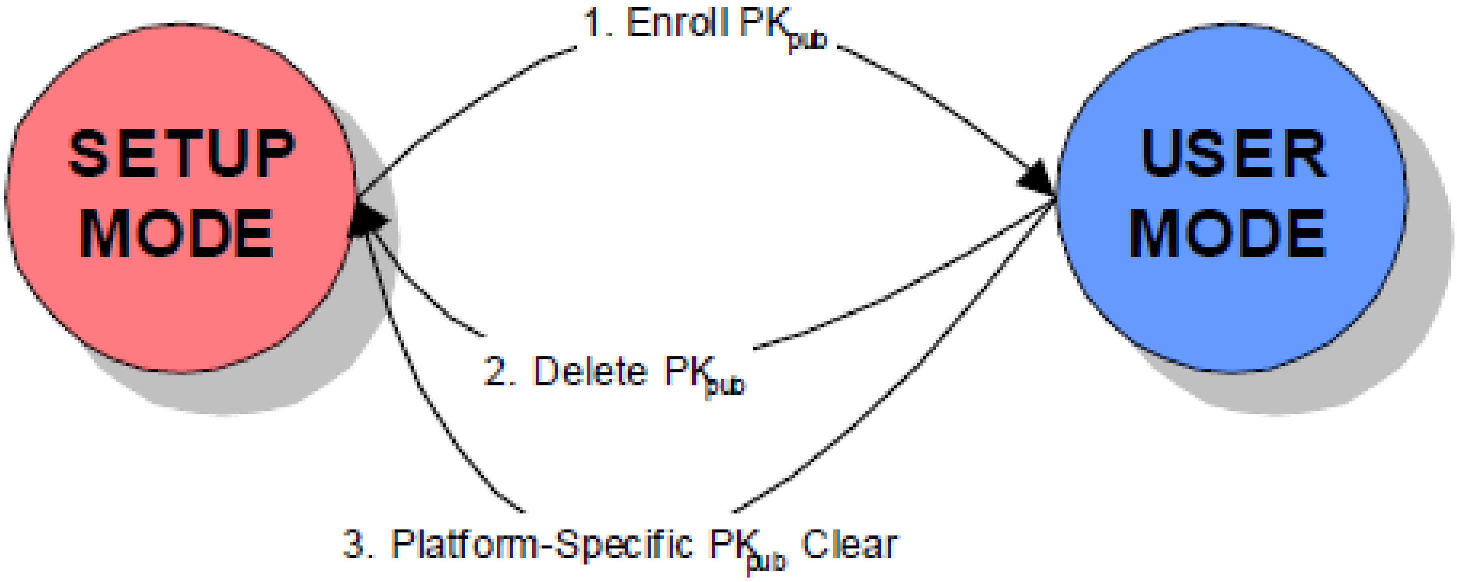
Firmware/OS Key

- **Why**? – How can firmware know if certificate is valid?
- **How**? – Firmware/OS Key

(Signature Database)



Put Them Altogether: UEFI Secure Boot



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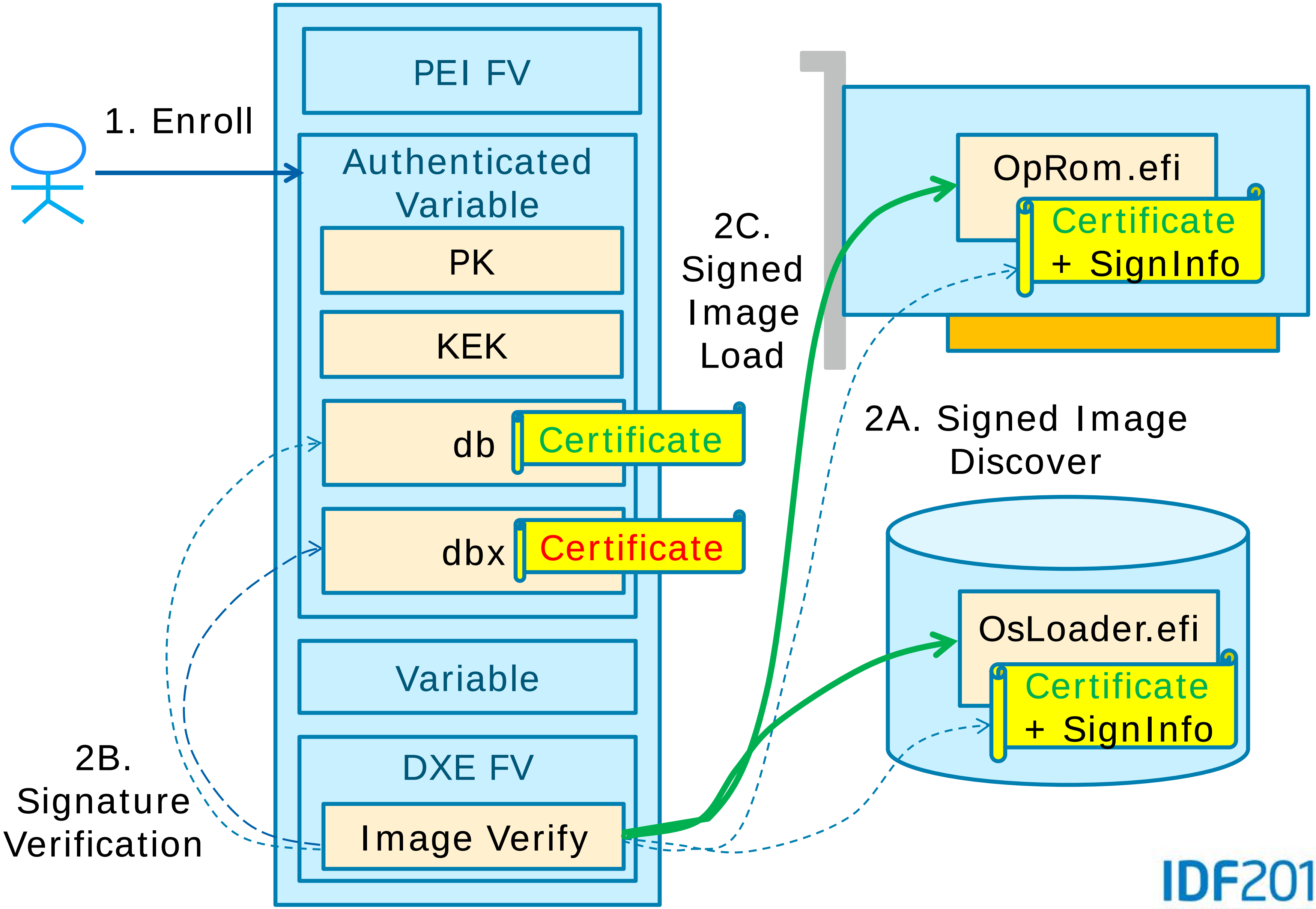

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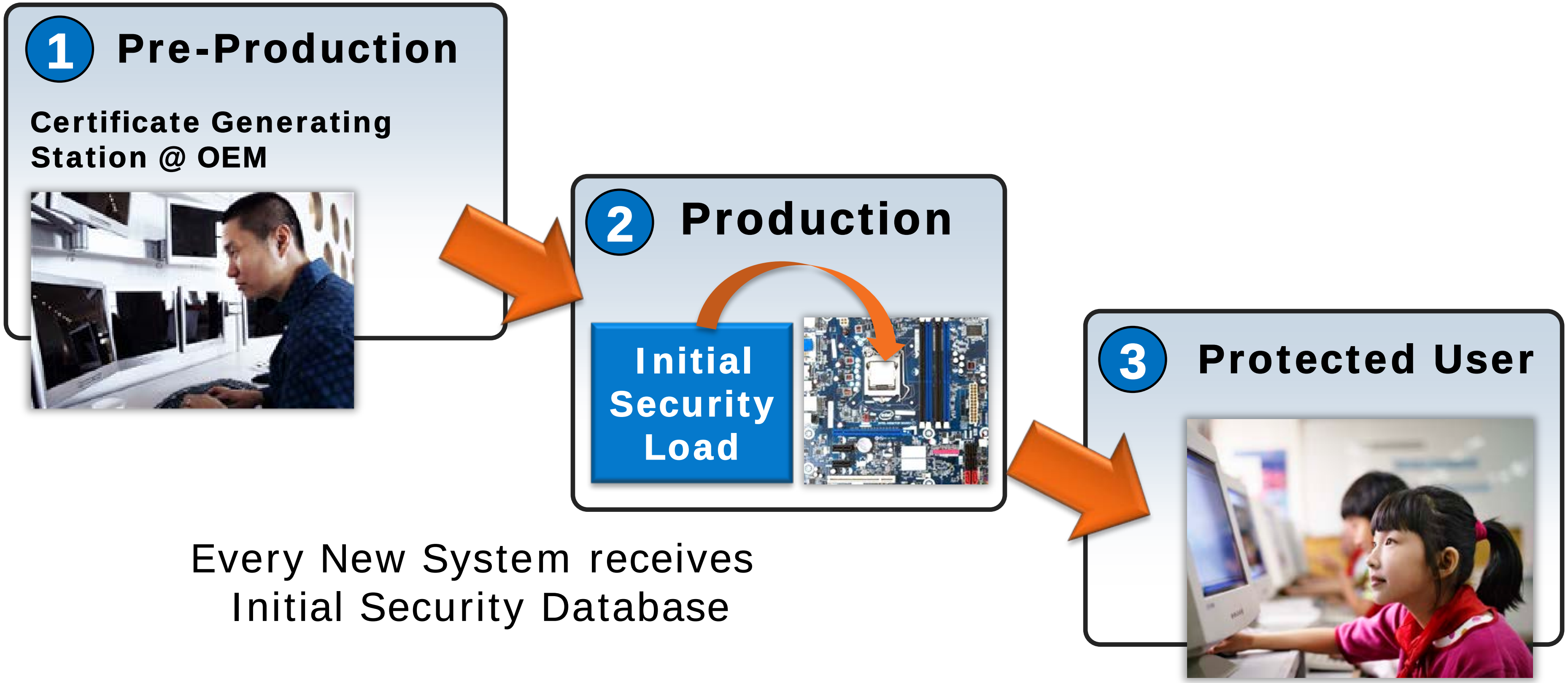
UEFI 2.3.1 Secure Boot Begins at the Factory



1 Pre-Production

Certificate Generating Station @ OEM

2 Production

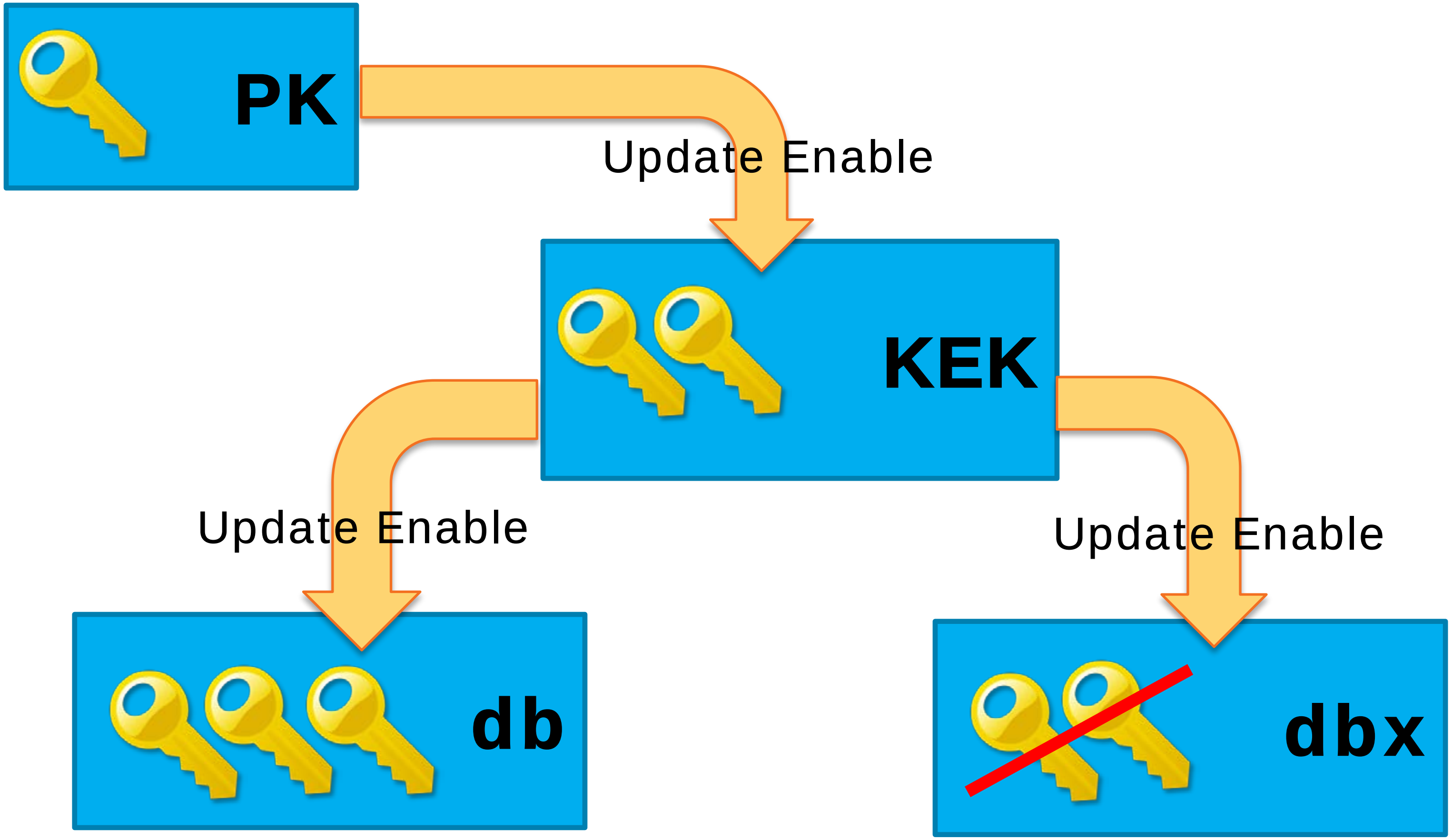
Initial Security Load

3 Protected User

Every New System receives
Initial Security Database

OEM is Responsible for Initializing Secure Boot

UEFI Secure Boot Database Review



If Signed by key in db, driver or loader can Run!

If Signed by key in dbx, driver/loader forbidden!

Public vs. Private Keys

- A pair of keys, one public, one private, are created
- Private keys stay secure at Partner or in the OEM’s Security Office
- Private keys are used to ‘sign’ objects
- Only Public keys loaded into the Platform
- Public keys are used to check signatures

Public
Private

Private Keys Must be Stored Securely!

Who "Owns" The System Security Keys?

- PK – Key pair is created by Platform Manufacturer

  Typically one PK pair used for a model or model Line

- KEK – Key supplied by OS Partner,

  Optional: Include 2nd key created by OEM

- db – OS Partner supplies Key,

  CA Partner supplies Key,

  Optional: OEM App Signing Key

Signature Tests using db Keys Block Rogue S/W!

OEM Administration

- Keys are installed for testing with target OS
- Keys are installed in the factory before shipping

- **Preparation Tasks**

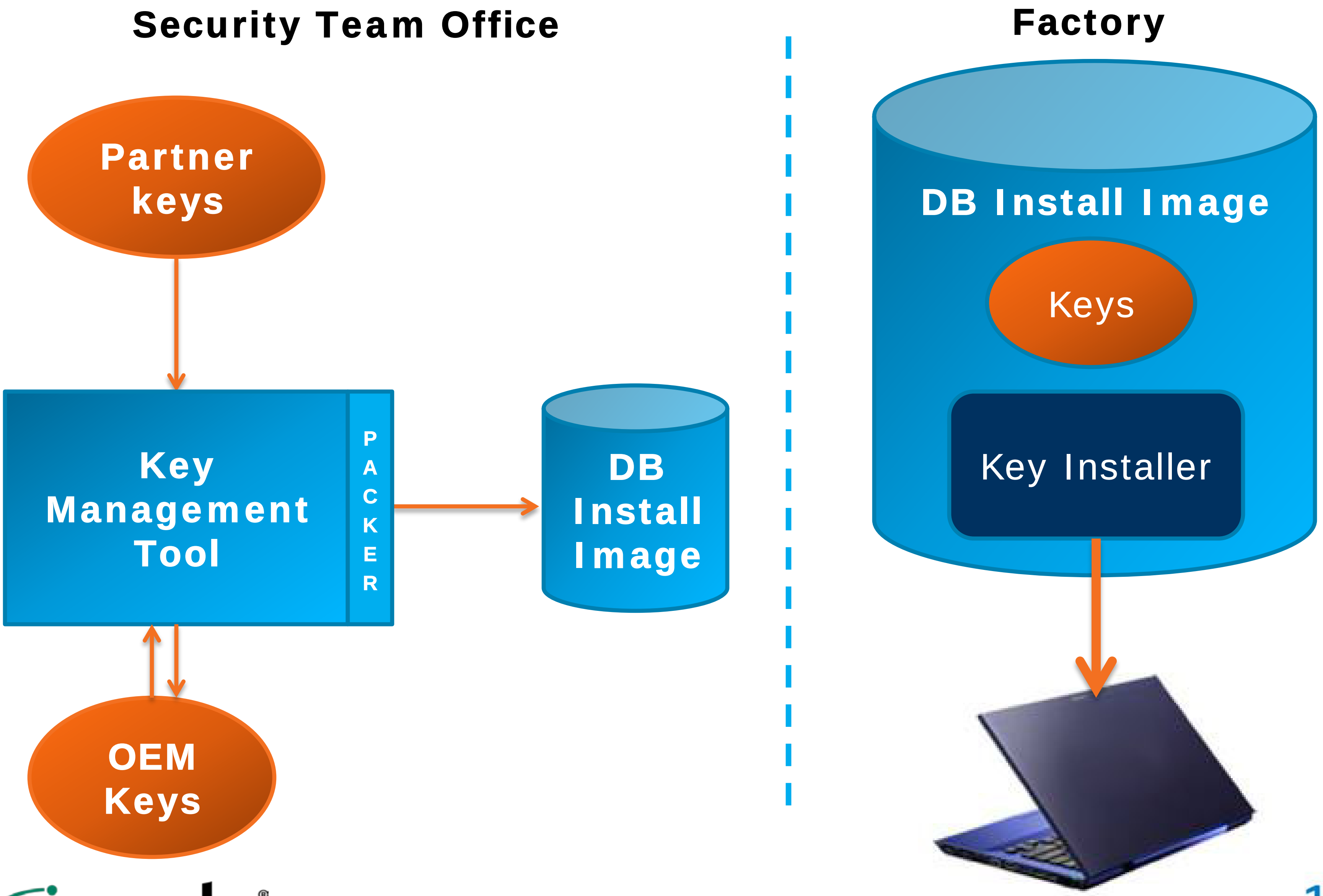
1. Gather public keys from partners
2. Generate PK for model
3. Make a package of initial key load
4. Occasional maintenance of forbidden list

- **Repetitive Tasks**

1. Factory will boot and install the initial key load

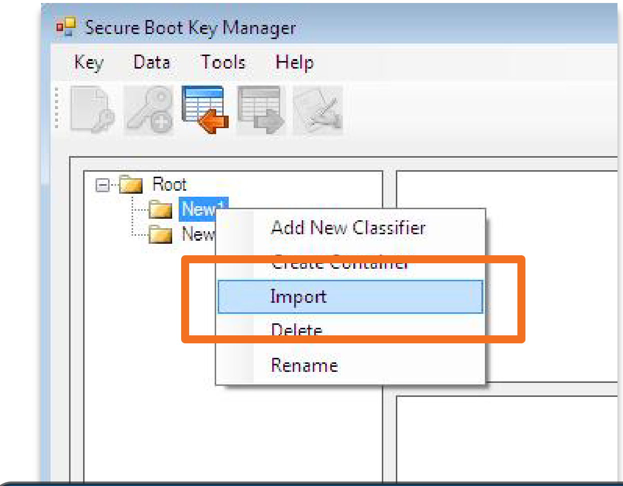
Careful Preparation Delivers Successful Launch

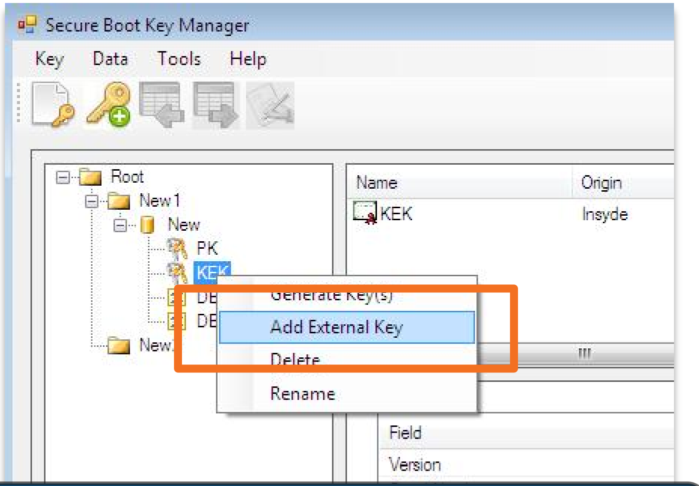
Major Components of the Tool Set



Key Generator and Management Tool

- InsydeH2O* Key Manager imports:
  - Partner's KEKpub
  - Public signing keys for db (example Microsoft Signing Authority, Windows Signing key, OEM signing authority)
  - Current Revoked keys or hash list for dbx

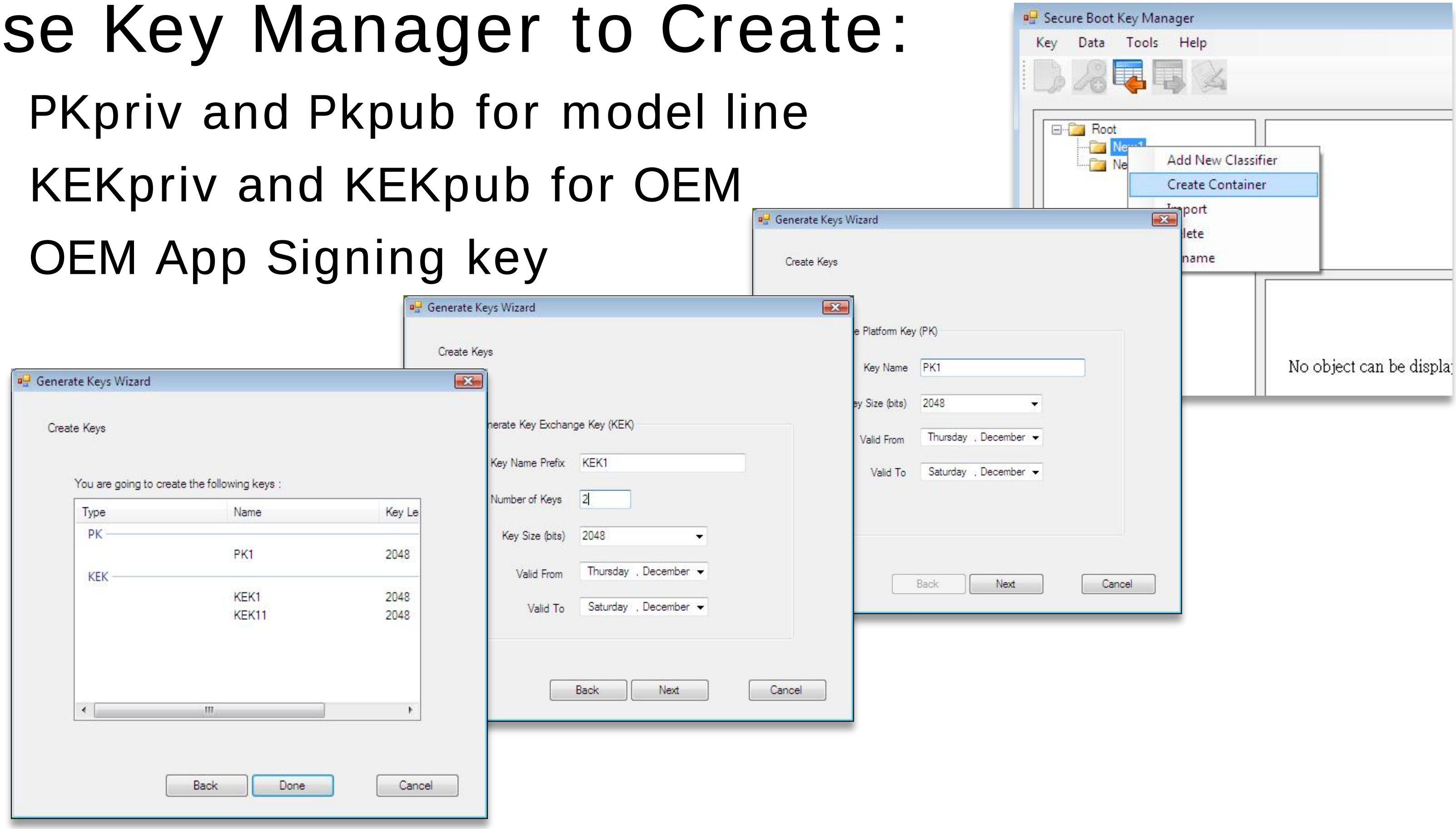




Key Manager Organizes Database Prep

Key Generator and Management Tool

- Use Key Manager to Create:
  - PKpriv and Pkpub for model line
  - KEKpriv and KEKpub for OEM
  - OEM App Signing key



No object can be displa

Create Keys

Platform Key (PK)

Key Name: PK1
Key Size (bits): 2048
Valid From: Thursday , December
Valid To: Saturday , December

Create Keys

erate Key Exchange Key (KEK)

Key Name Prefix: KEK1
Number of Keys: 2
Key Size (bits): 2048
Valid From: Thursday , December
Valid To: Saturday , December

Create Keys

You are going to create the following keys :

Type	Name	Key Le
PK		
	PK1	2048
KEK		
	KEK1	2048
	KEK11	2048

Key Manager Creates OEM Required Keys

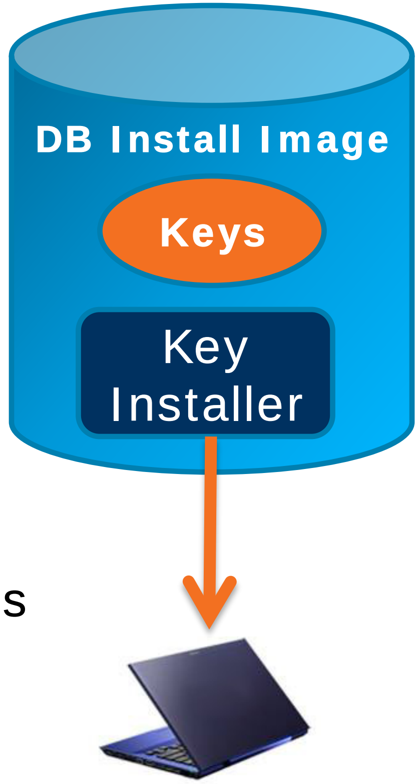
Insyde Factory Install Image File

(1) Key Installer

- Runs in WIN8 or WINPE
- Checks it's own integrity
- Installs the Secure Keys

(2) Initial Database Image

- PK – System Master Key
- KEK – OEM and Partner Management Keys
- db – Industry Recognized Driver/app signing Keys
- dbx – Revoked signing keys



DB Install Image

Keys

Key Installer

Single Signed Installer File Prevents Factory Tampering

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Secure Field Update to Firmware Store

- Field Firmware Update must support all elements of NIST 800-147 & Windows* 8 client recommendations
  - Any update to the firmware flash store but be signed by creator
  - Firmware must check signature of the update
  - Firmware updates are signed by another key – not PK
  - Policy must remain in effect even if Secure Boot Database is cleared by user

All Firmware Updates Must be Signed at Factory

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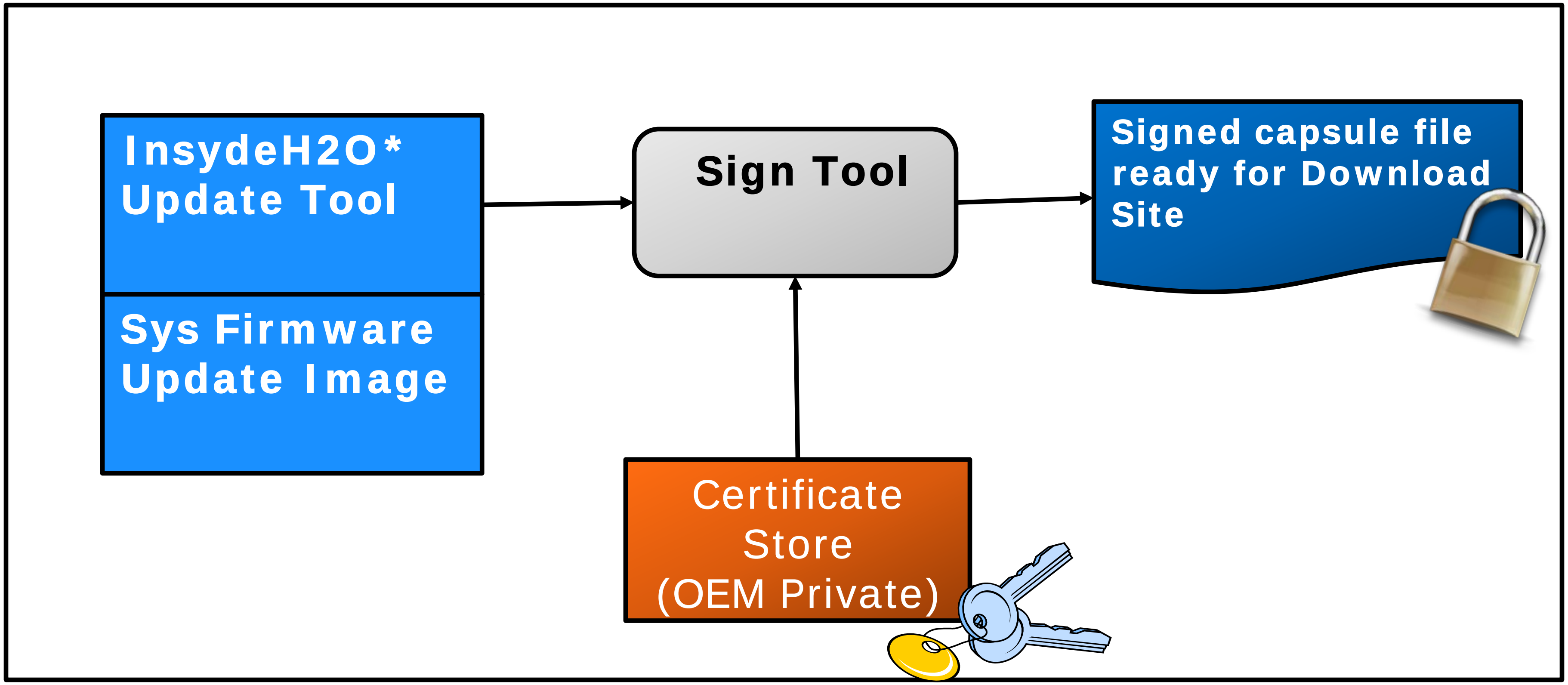
Signing Firmware Update Files:



InsydeH2O* Update Tool

Sys Firmware Update Image

Sign Tool

Signed capsule file ready for Download Site

Certificate Store (OEM Private)

InsydeH2O* Secure Update Meets Industry Requirements

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DEMO!

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Summary

- 2012 is the year for ubiquitous UEFI adoption
- With UEFI 2.3.1, the boot experience is fast, secure and beautiful leading to higher customer satisfaction and opportunity for product differentiation.
- Intel® UDK2010 SR1 is a good reference, especially for security features
- With the benefits of secure boot come new responsibilities for OEMs in management of security database.
- Modern standards require secure firmware updates

Call To Action

System OEMs and their partners need to plan the switch to UEFI 2.3.1 Secure Boot:

1. Use learning resources including Intel® UDK2010 SR1
2. Develop procedures and assign clear responsibilities for security tasks
3. Work with IBV for firmware implementation and new factory tools

Related Sessions

Session ID	Title	Day	Time	Room
GVCS001 ✓	Leveraging the Full Processing Power of Next Generation Intel® core Microarchitecture, Code Name Ivy Bridge	Wed	11:00	306B
GVCQ001 ✓	Hot Topic Q&A: Graphics and Visual Computing	Wed	17:15	306B
GVCC001 ✓	Poster Chat: Tools for Tuning Graphics and Heterogeneous Computing Applications for the Next Generation Intel® Processor Graphics	Wed	14:00	Poster Station 6
	Platform Technologies and Analysis Sessions			
PTAC001 ✓	Poster Chat: UEFI Application Development using Standard Libraries and Python*	Wed	14:00 16:25	Station 7
PTAC002 ✓	Poster Chat: Power and Thermal Analysis using Intel® Platform Profiling Tool	Wed	14:00 16:26	Station 8
PTAS001 ✓	System Behavior and Performance Prediction using System Modeling and Simulation Tools	Wed	14:15	310
PTAS002 ✓	Shift Left! Leverage Full System Simulation to Reduce Your Time To Market	Wed	15:20	310
PTAS003 ✓	Advanced UEFI Development Environment for Embedded Platforms	Wed	16:25	310
PTAQ001 ✓	Platform Technologies and Analysis Q&A	Wed	17:15	310
PTAS004 ✓	Implementing Platform Security with UEFI	Thurs	13:10	306B
PTAS005	Platform Optimization Using Open Computing Language (OpenCL*) Tool	Thurs	14:15	306B
	Software and Services Group Pavilion - Platform Technologies: UEFI, Analysis Tools, and Simulation Booth Number 16	Wed - Thurs		Show Case

✓ = DONE

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Q&A

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