

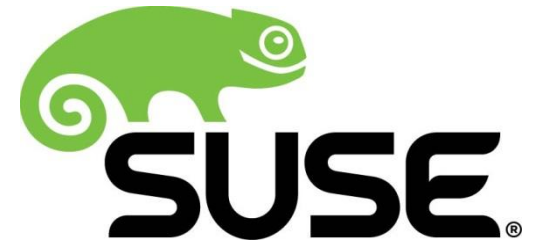
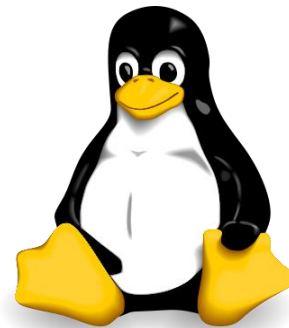
UEFI Secure Boot in Linux*

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STTS002

Agenda

- Problem Statement
- What is UEFI Secure Boot
- Introduction to Machine Owner Key
- Secure Boot in SUSE Linux
- Demo





Problem Statement

Secure Boot Problem

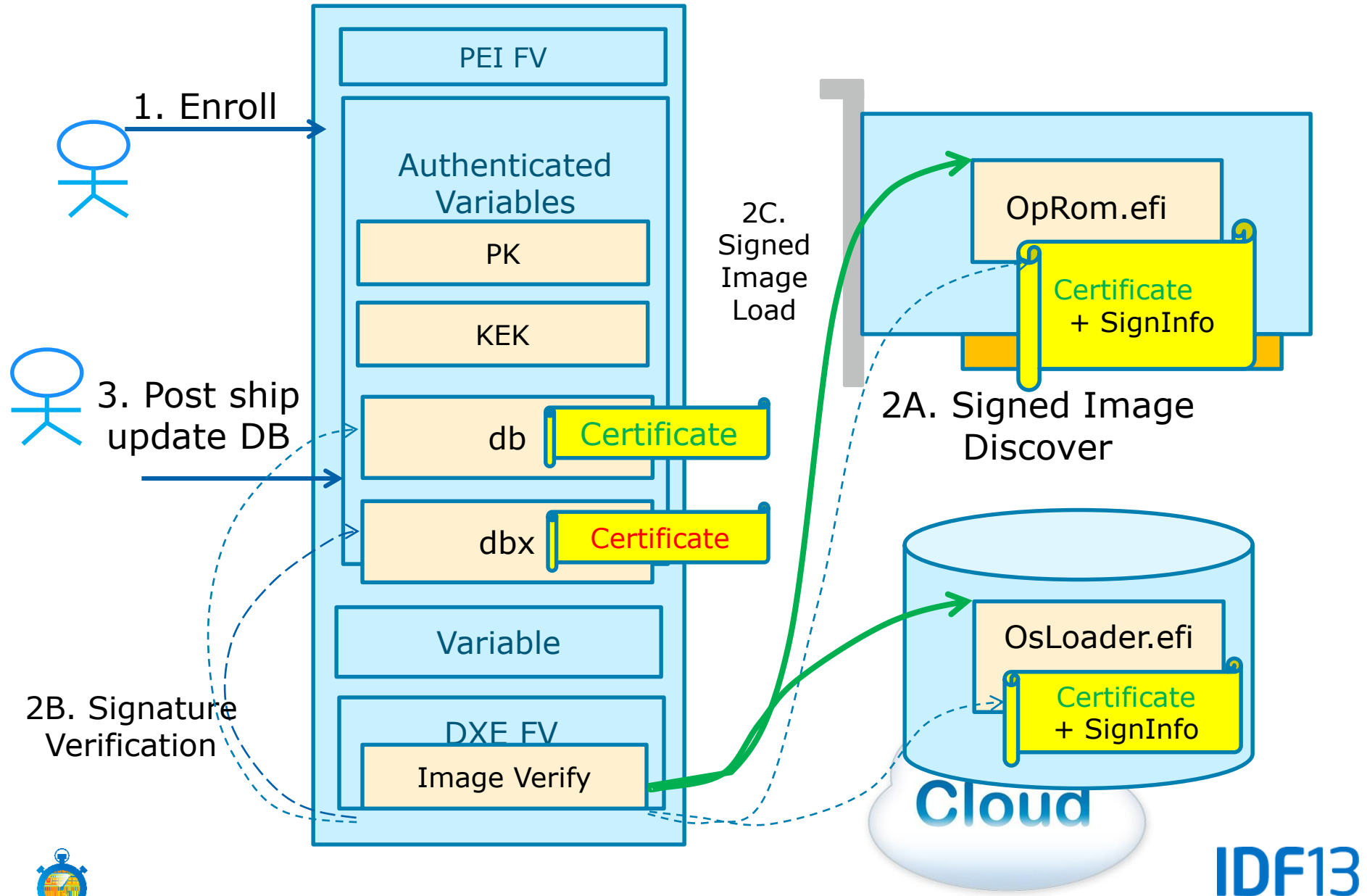
- Malware moving more into the platform
- UEFI extensibility can be exploited by unauthorized parties
- Attacks increasingly targeting the platform firmware
 - Black Hat 2007, 2009, 2013, CanSecWest 2013...
- Need to balance UEFI code loading controls and maintain platform owner and user choice
- For platform integrity and user flexibility:
 - Maintain ability to have several operating systems on the platform
 - Provide platform owner a choice for software



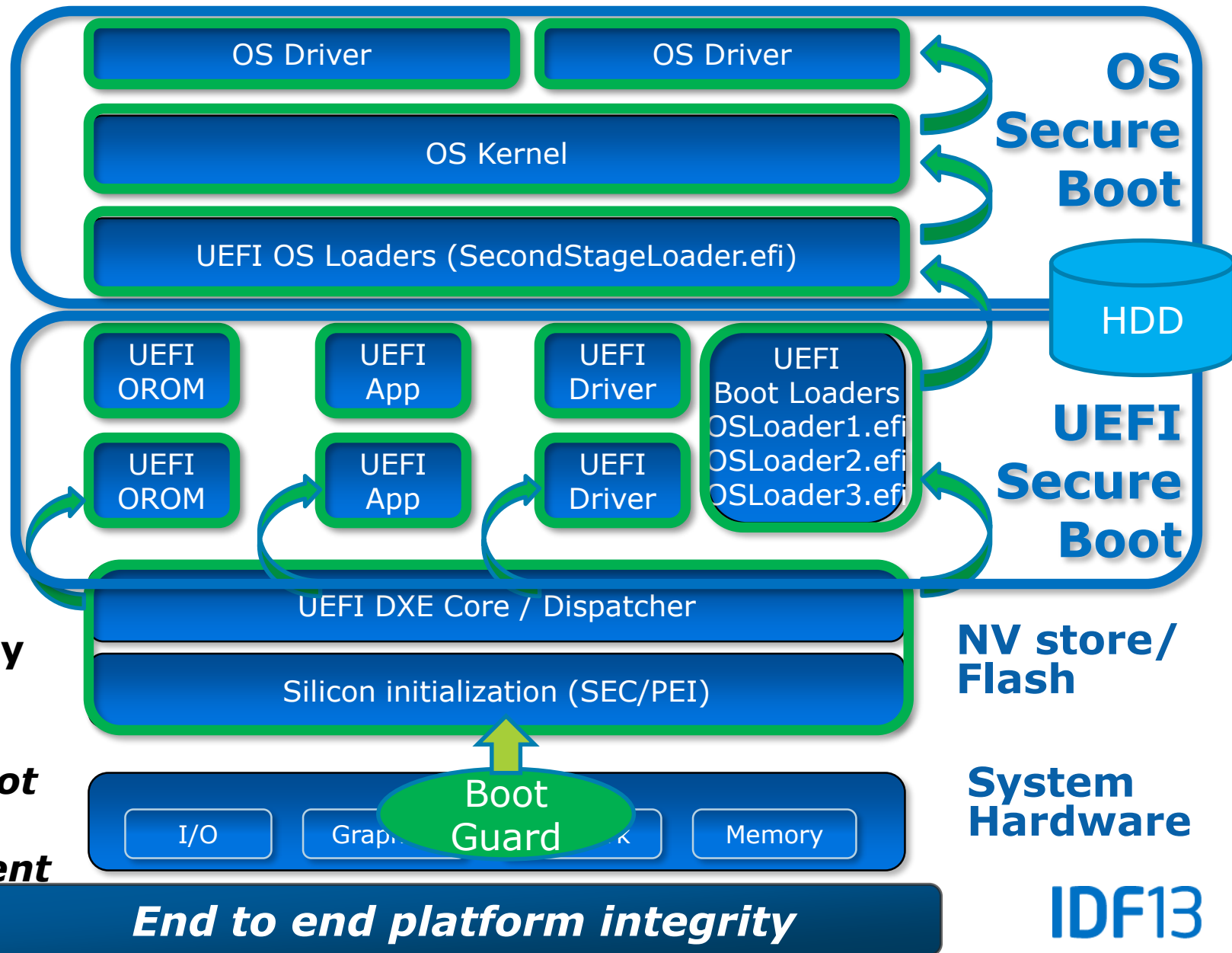


What is UEFI Secure Boot

UEFI Secure Boot



The full solution



Secure Boot Challenges for Linux*

- Dual OS deployment challenge
 - Users can disable UEFI Secure Boot to install Linux* but this isn't the best deployment plan
 - Users must have an option to install Linux alongside an OS, even when UEFI Secure Boot is enabled
- Linux can benefit from UEFI Secure Boot, if...
 - Customers can install Linux without disabling the feature
 - Platform owner can set security policy and customize system
- Different roles interact with UEFI Secure Boot
 - Kernel hacker – disable or enroll own keys w/firmware screens
 - Consumer – just want it to work, seamless boot of live images
 - Managed IT machine – IT is the 'owner.' Control end user actions.

Linux distributions have several options to implement secure boot

Introduction to Machine Owner Key



Machine Owner Key (MOK)

- To support UEFI Secure Boot in Linux*, there are two challenges to overcome
 - Coexist with other operating systems
 - Avoid the potential General Public License (GPL) copyright issues caused by the UEFI image signature
- MOK gives back the key management control to users or security admin

SUSE Solution

MOK comprised of 4 parts

shim

grub2, kernel, and kernel drivers

- A BSD licensed preloader of the OS loader(grub2) signed with the db key
- All involved components are signed

MOKList

MOK database - The key database implemented in a UEFI nvram variable, MOKList

MokManager

The UEFI program to manipulate the MOK database

mokutil

The Linux* utility program to issue requests to MokManager

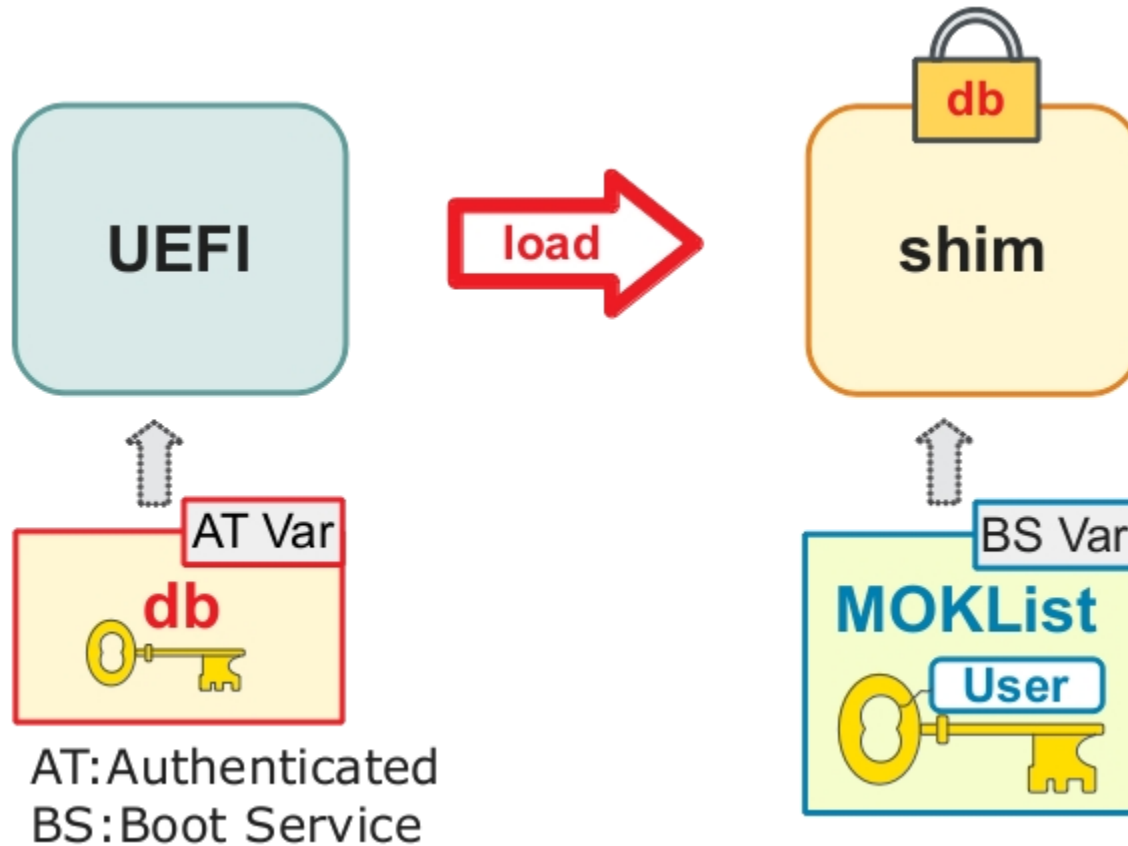
MOK Database

- The MOK database is used as a boot service non-volatile variable
- UEFI Boot Service non-volatile variables are immune from threats from OS
- MOKList is not the db and does not need to be controlled by KEK

	Boot Service	Runtime Service	Authenticated
UEFI - Read	Yes	Yes	Yes
UEFI - Write	Yes	Yes	Restricted
OS - Read	No	Yes	Yes
OS - Write	No	Yes	Restricted
	BS Var	RT Var	AT Var

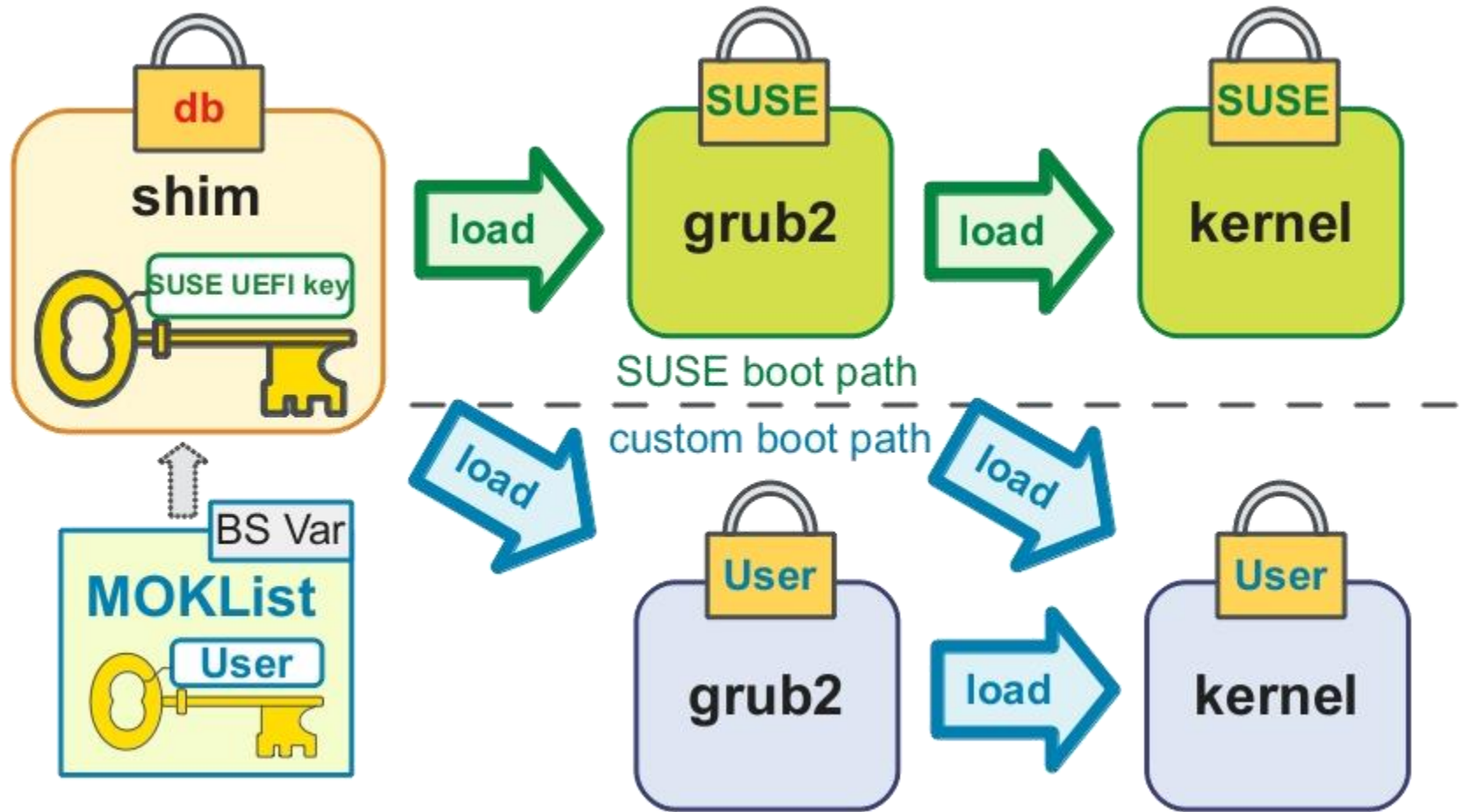
MOKList is not accessible at OS runtime

UEFI Secure Boot With MOK



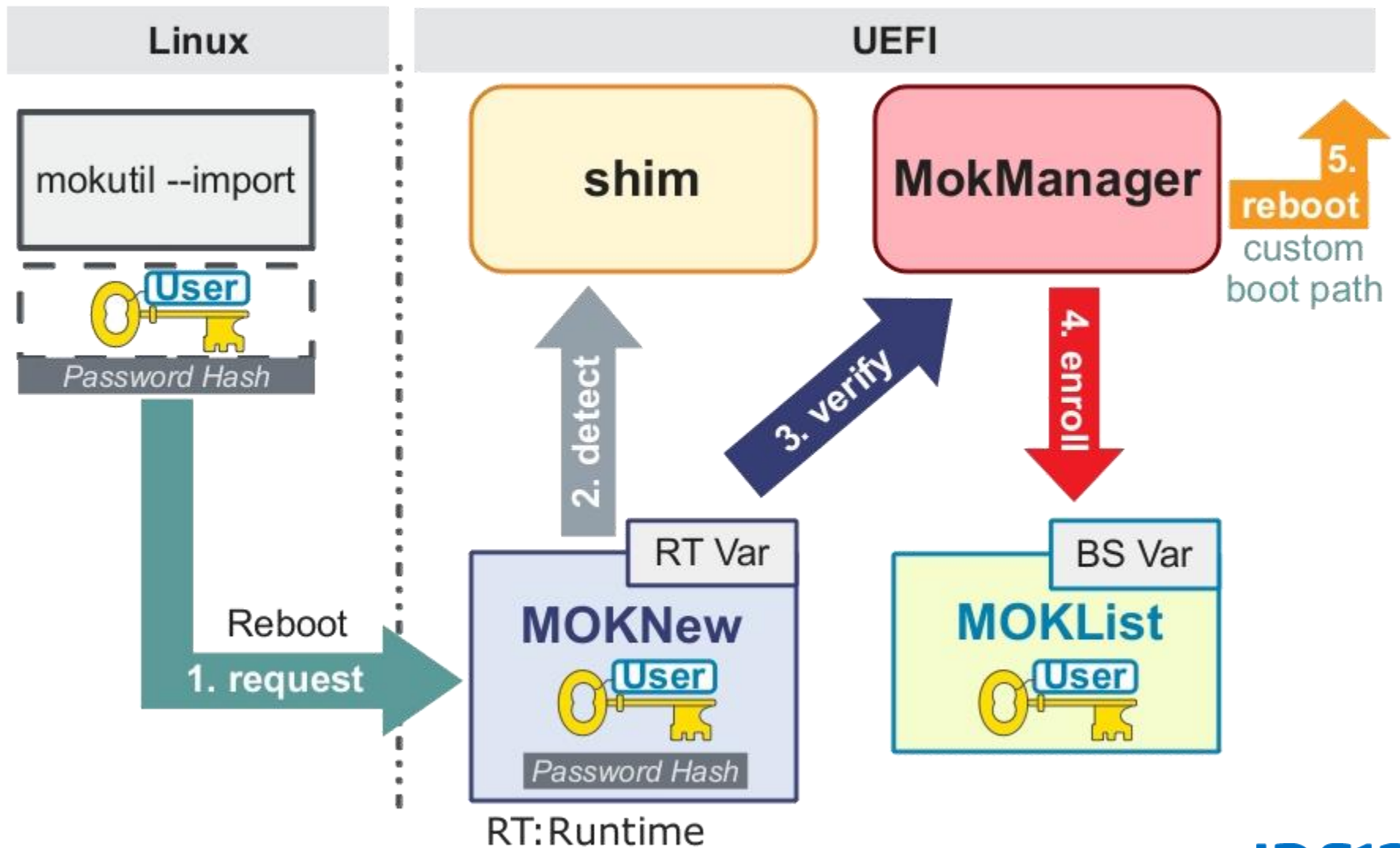
shim is loaded before other UEFI images

Multi-boot with MOK



Load the UEFI image as long as it is trusted

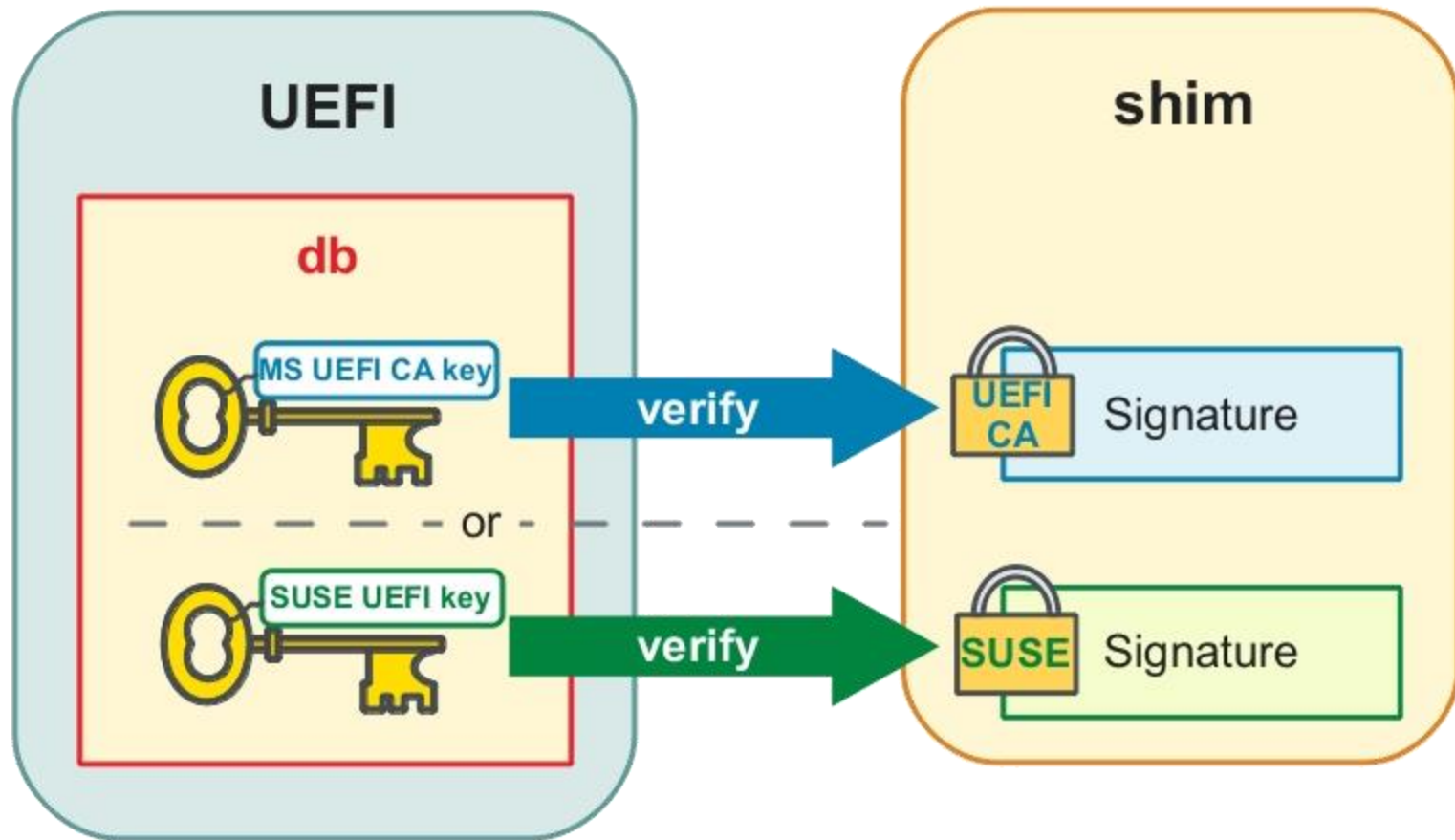
Enroll A New MOK Key



Secure Boot in SUSE Linux*



Multisigned shim



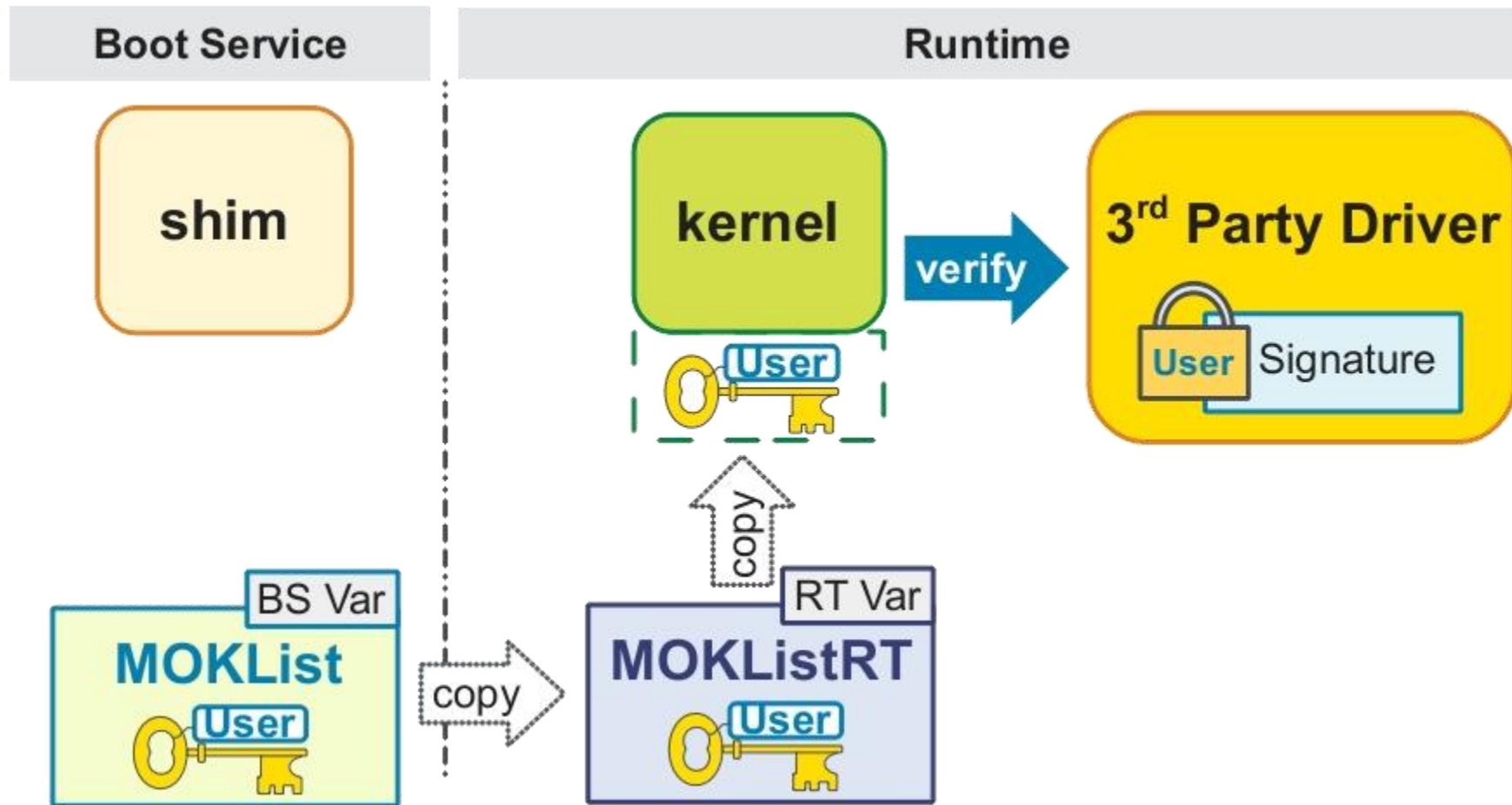
Either the UEFI CA key or SUSE key will let the shim boot with UEFI secure boot

Linux* Driver Verification

- All kernel drivers have to be signed with the SUSE key
- Linux* kernel verifies drivers with the built-in SUSE key or MOK keys
- SUSE will NOT sign any binary driver that is incompatible with GPLv2
- The user is free to enroll the key for the third party binary driver
- SUSE's Partner Linux Driver Program (PLDP) - simplifies MOK implementation

Users can get their 3rd party drivers included in the secure boot with MOK

Third Party Driver Verification



Demo



SUSE Summary and Call to Action

- UEFI Secure Boot no longer an issue to the Linux* World
- With MOK, users select the keys they trust
- Linux systems benefit from MOK to ensure the integrity of the drivers

Call to action:

- Use MOK in your Linux deployments
- Put SUSE key in UEFI database to test multi-signed shim
- Utilize SUSE's Partner Linux Driver Program for delivering kernel drivers compatible with SUSE Linux Enterprise and Secure Boot
 - <https://www.suse.com/partners/linux-driver-program/>

Summary

- Attacks against the platform will most likely continue
- Deploy UEFI Secure Boot to address pre-OS malware
- Design a robust platform implementation
- Avoid 'restricted boot' & continue to enable platform owner choice of UEFI Secure Booted code
- Emergent tools for choice include multi-signed images, the Shim Loader, and Machine Owner Key
- Machine Owner Key provides practical solution for implementing key management

Updates from Linux* Distributions

- **Ubuntu* 12.10** – 64-bit version of Ubuntu 12.10 shipped with Shim to support secure boot
- **Fedora* 19** – included Shim with MOK (Machine Owned Key) functionality
- **OpenSUSE* 12.3** release supports MOK manager and multisigned Shim loader
- **SUSE SLES 11 SP3*** - included multisigned Shim with MOK functionality and runtime Mokutil
- **Linux Foundation** Secure Boot System Released
- [UEFI Technology Adopted by Linux Community](#)[†]

Linux distro implementation with MOK 3rd party manager signing list implemented already

[†] <http://www.businesswire.com/news/home/20130319006268/en/UEFI-Technology-Adopted-Linux-Community>

Intel UEFI Community Resource Center

Intel UEFI Community Resource Center

Home | Learn | Communicate | Share | Develop | Find Solutions

Welcome to Intel UEFI Community Resource Center

Your gateway for developing UEFI firmware, drivers, and applications for use on Intel® architecture platforms.

[Learn more about UEFI >](#)

<http://uefidk.com>

- Learn.** Training courses and Intel® Developer Forum presentation library »
- Communicate.** Forum for discussions with Intel engineers and other developers »
- Share.** Upload and download files for sharing with the community »
- Develop.** Intel UEFI technology, software and tools, specs, and docs »
- Find solutions.** Get conforming devices, BIOS, and drivers from participating vendors »

Central resource for UEFI on Intel® Architecture

IDF13

Additional Sources of Information

PDF of this presentation is available is available from our Technical Session Catalog: www.intel.com/idfsessionsSF.

The URL is on top of Session Agenda Pages in Pocket Guide.

Visit the [Unified EFI Forum](#) for the latest specifications.

The EDK II project is hosted at <http://tianocore.org>.

Latest updates to [SUSE* UEFI secure boot](#):

OpenSUSE tools UEFI:

<http://download.opensuse.org/repositories/home:/jejb1:/UEFI/>
<http://build.opensuse.org/project/show/home:jejb1:UEFI>

Related Articles/Whitepapers at tianocore.org:

- [“A Tour Beyond BIOS into UEFI Secure Boot”](#)
- [Images with Multiple Signatures](#)

Other Sessions at IDF

Wednesday, Sept 11, Moscone Room 2008

ID	Title	Time
✓ STTS001	Creating UEFI Solutions Optimized for Mobile Devices	11:00
✓ STTS002	UEFI Secure Boot in Linux*	13:00
STTS003	Using UEFI for Secure Firmware Update of Expansion Cards	14:15
STTS004	Predicting Performance of Hadoop* and Data Center Clusters with Intel® CoFluent™ Studio	15:45
STTS005	Accelerating Software Development on Next Generation Intel® Architecture Microservers and Tablets with Wind River Simics*	17:00

See also

Technical Showcase Booths 408, 409, 410

"Intel® Device Protection Technology with Boot Guard - Secure *Boot Policy Enforcement*, booth #318"

✓ = DONE

IDF13

Software Developers: *Network & Have Fun!*

Don't miss out on some great IDF networking and social activities hosted by Intel Software & Services Group (SSG):

- ✓ Day 1, Tuesday, Sept 10th, 7pm-10:30pm
 - **Software Developer Networking Party**
 - **Pick up your Software VIP lanyard at the Software and Services Pavilion Info Counter to get party access!**
- ✓ Day 2, Wednesday, Sept 11
 - **SSG Inspiration Through Innovation Hour**
 - Location: Showcase Networking Plaza, 11am-12pm & 5pm-6pm
 - SSG/guests discuss how innovation has inspired their products
 - **Doug Fisher (Intel VP, GM SSG) Meet & Greet**
 - Software & Services Pavilion, 5-7pm



- Watch out for SSG Mobile lunch food and dessert carts outside Moscone throughout the conference
- Visit SSG Pavilion Showcase for great demos and games!

Additional Linux Resources

IDF 2012 – Developing UEFI Support for Linux*

<https://intel.activeevents.com/sf12/scheduler/catalog/catalog.jsp?sy=42>

For more information on Ubuntu* ...

Ubuntu ODM Portal - <http://odm.ubuntu.com/>

Secure Boot Tools - <git://kernel.ubuntu.com/jk/sbsigntool>
<https://github.com/vathpela/pesign>

Summary of secure bootloaders

<http://www.rodsbooks.com/efi-bootloaders/secureboot.html>

Matthew Garrett <http://mjg59.dreamwidth.org/>

Shim <https://github.com/mjg59/>

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You will receive an email with a link to the online session evaluation prior to the end of this session. Please submit the evaluation by 10am tomorrow to be entered to win.

Winners will be announced by email

**Sweepstakes rules are available at the Help Desk on Level 2
All sessions evaluations must be submitted by Friday, September 13 at 5pm**

Q&A

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Rev. 7/17/13

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Backup

Authenticated Variables

Authenticated Variables (AT):

Small signed named data containers

- Managed, protected by the system BIOS
- Read by BIOS, OS.
- Modified by BIOS, OS only if signature verifies (or local user on Intel® Architecture platforms)

Signed PE/COFF executables

- Op ROMs
 - Boot loaders
 - Applications
- Authenticode signing format

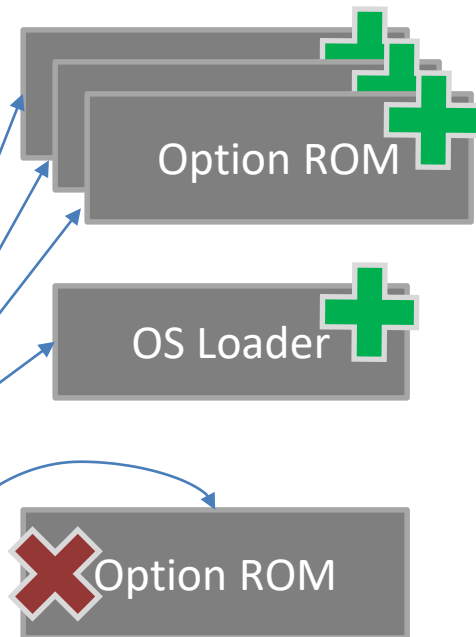
Relationships

PK: Platform Key: AT containing OEM's keys.
Party who can edit the KEK via s/w

KEK: Key Exchange Key: List of certificates of owners allowed to update white list (db), black list (dbx)

db: Authorization Database: AT containing authorized certs / hashes

dbx: Exclusion Database: AT containing excluded certs / hashes



The Full Solution

