IDF2012
INTEL DEVELOPER FORUM

Developing UEFI Support for Linux*

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EFIS001

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Agenda

- UEFI Considerations for Linux*
  - Overview of the UEFI Boot Process
  - Using UEFI Secure Boot with Linux
  - Other Implementation Issues
- Implementing UEFI in Ubuntu* 12.10
- Implementing UEFI in Fedora* 18
- Latest Updates to SUSE* Secure Boot Plans
- Summary / Next Steps / Q&A

The PDF for this Session presentation is available from our Technical Session Catalog at the end of the day at:

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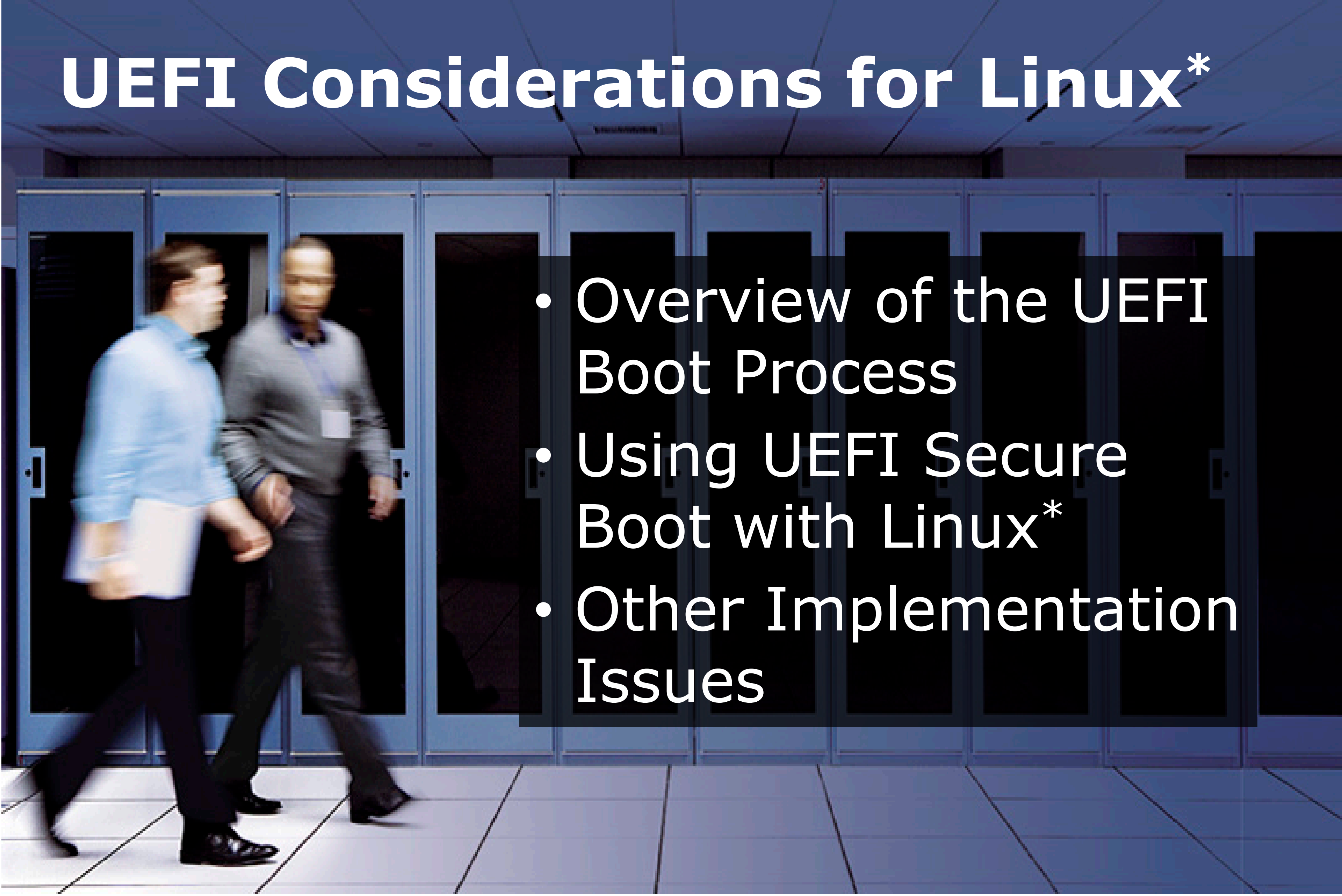
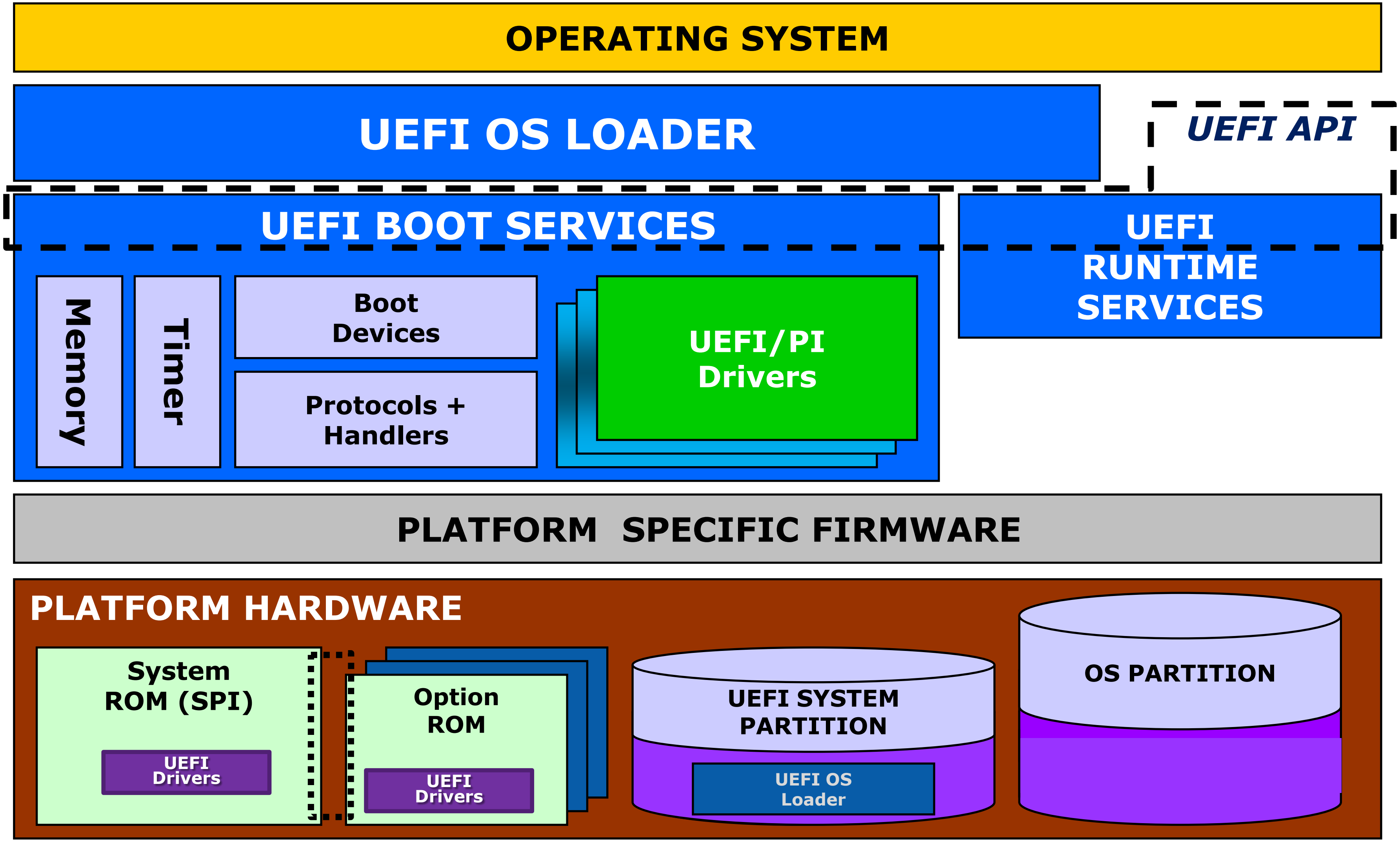
URL is on top of Session Agenda Pages in Pocket Guide

UEFI Considerations for Linux*



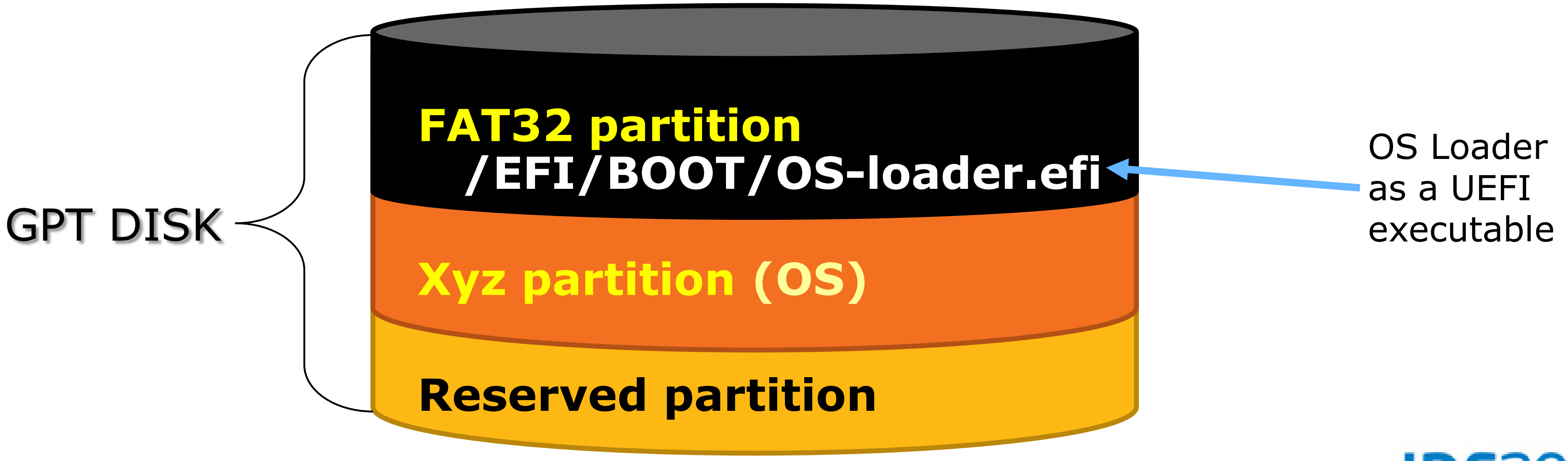
- Overview of the UEFI Boot Process
- Using UEFI Secure Boot with Linux*
- Other Implementation Issues

Overview of the UEFI Boot Process



Typical OS Loader Scenario for UEFI

- One GPT disk partition is FAT32 (service partition)
- OS installer puts the loader on the service partition
  - Under `/EFI/BOOT` or `/EFI/osname` directory
  - Ex: `/efi/boot/bootx64.efi`, `/efi/ubuntu/grubx64.efi`
- NVRAM `(Bootxxxx)` has a device path to OS loader
  - Maps to specific device, GUID partition & filename



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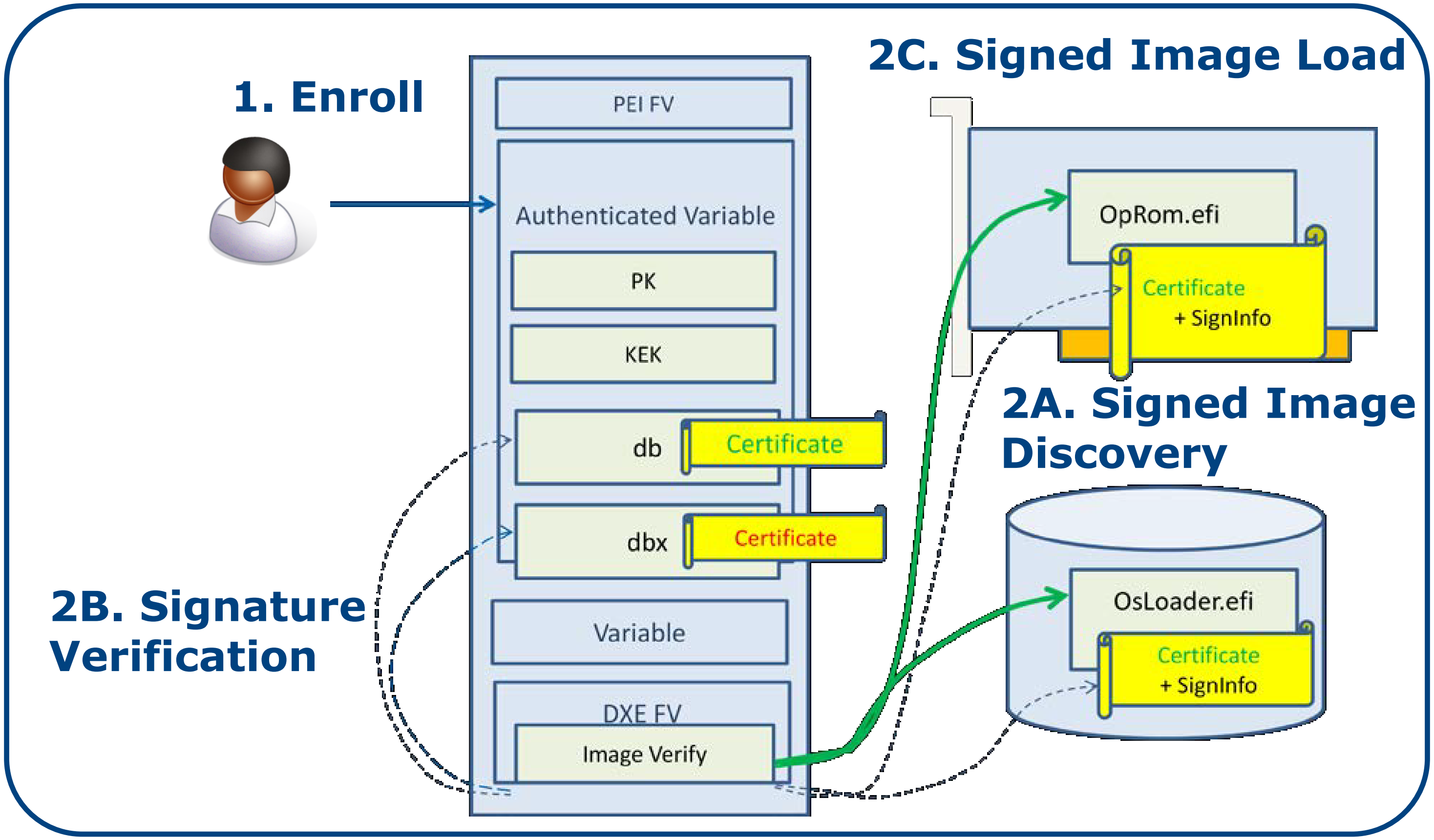
Advantages of UEFI Boot Process

- Extensible across multiple boot devices
  - SATA, SAS, USB, PXE/iSCSI (IPv4/IPv6), …
- Supports multi-boot operations
  - Multi-boot loaders w/o MBR chain-loading
  - UEFI Forum reserves directories to avoid collisions
  - Use `/efi/boot` directory for removable media
- Device path stored in boot options (NVRAM)
  - Pointer to specific boot device
- Boot image can be validated when loaded
  - Allows firmware loader to perform security checks

Using UEFI Secure Boot with Linux

The key is in the keys …
Signed images for the OS loader, UEFI Drivers & Option ROMs must reference some key in the db (and not be in the dbx)



Reference: Figure 11 from the "A Tour Beyond BIOS into UEFI Secure Boot" whitepaper at tianocore.org

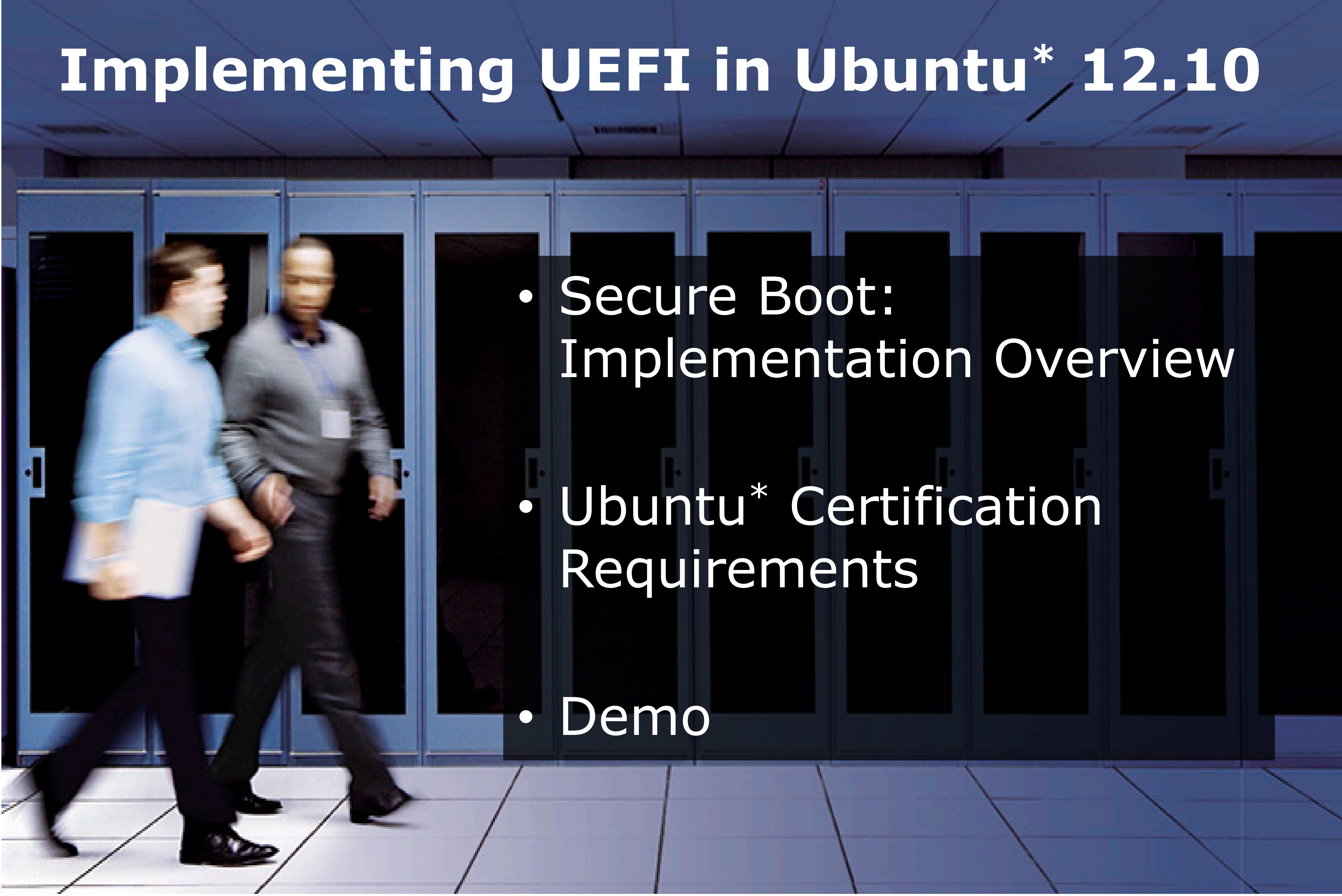
Secure Boot Challenges for Linux*

- 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 & customize system
- Distributions have other considerations for UEFI
  - How the kernel handles signed & unsigned code
  - Migrating drivers from legacy BIOS calls (INTxx) to UEFI

Linux distributions must determine how to implement secure boot

Implementing UEFI in Ubuntu* 12.10



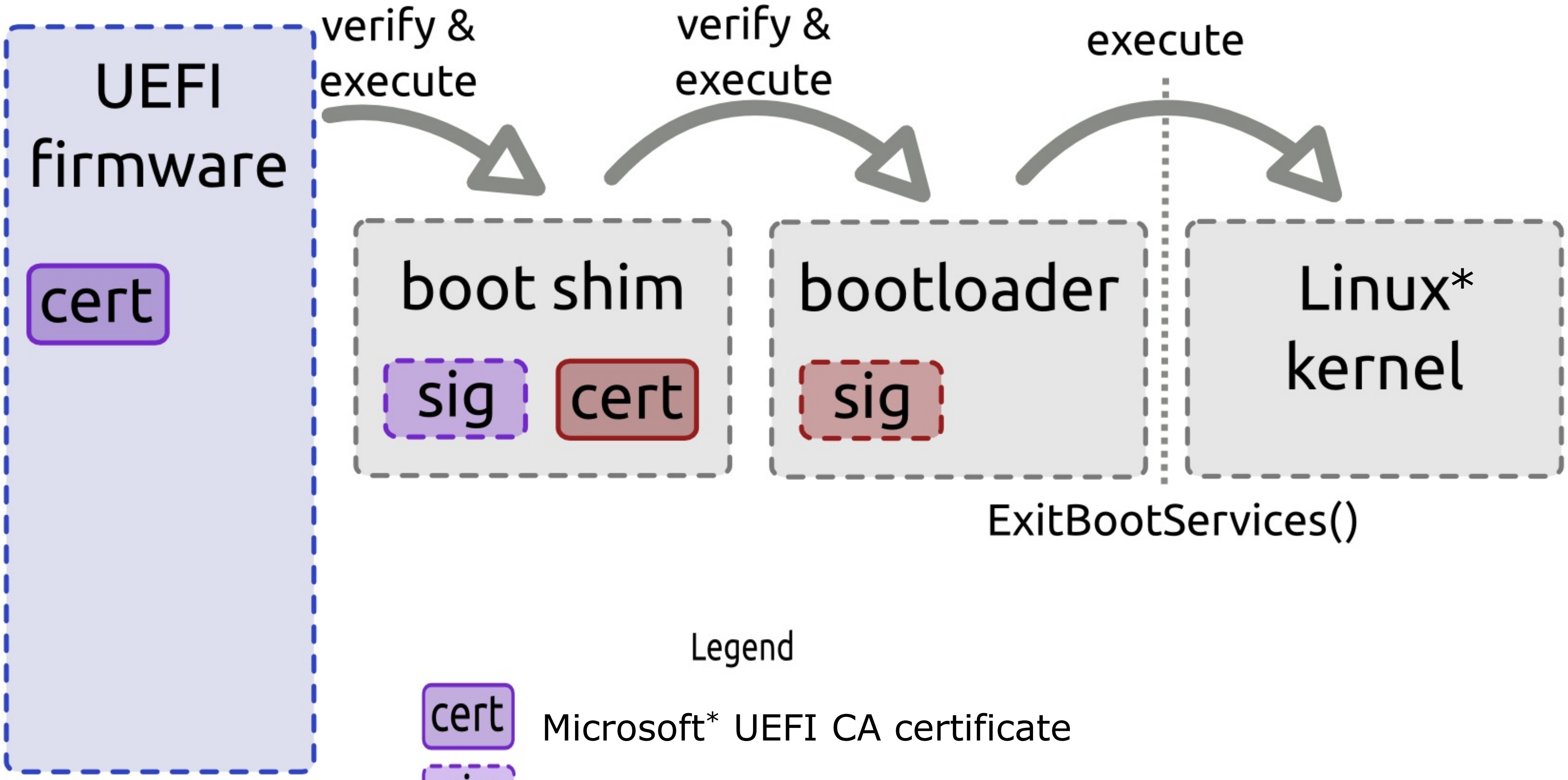
- Secure Boot: Implementation Overview
- Ubuntu* Certification Requirements
- Demo

Secure Boot: Implementation Overview

UEFI Secure Boot can’t interfere with Ubuntu’s* value…

- Must allow user modification
  - Allow user-defined trust verification
- Must work on generic hardware
  - Without reconfiguration!
- Must work with Ubuntu infrastructure

Ubuntu* Implementation



UEFI firmware

cert

verify & execute

boot shim

sig

cert

verify & execute

bootloader

sig

execute

Linux* kernel

ExitBootServices()

Legend

cert Microsoft* UEFI CA certificate

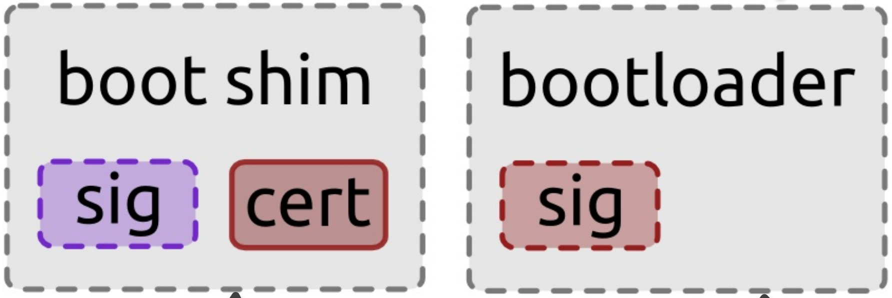
sig Signature generated from Microsoft UEFI CA

cert Ubuntu* CA certificate

sig Signature generated from Ubuntu CA

Ubuntu* Implementation

Code up to ExitBootServices() is signed



boot shim

sig

cert

bootloader

sig

Bootloader shim allows compatibility with Microsoft* UEFI CA

Bootloader images will be signed during build. No requirements for driver signing.

Ubuntu* Certification

System requirements for Ubuntu* preinstalls

UEFI requirements include:

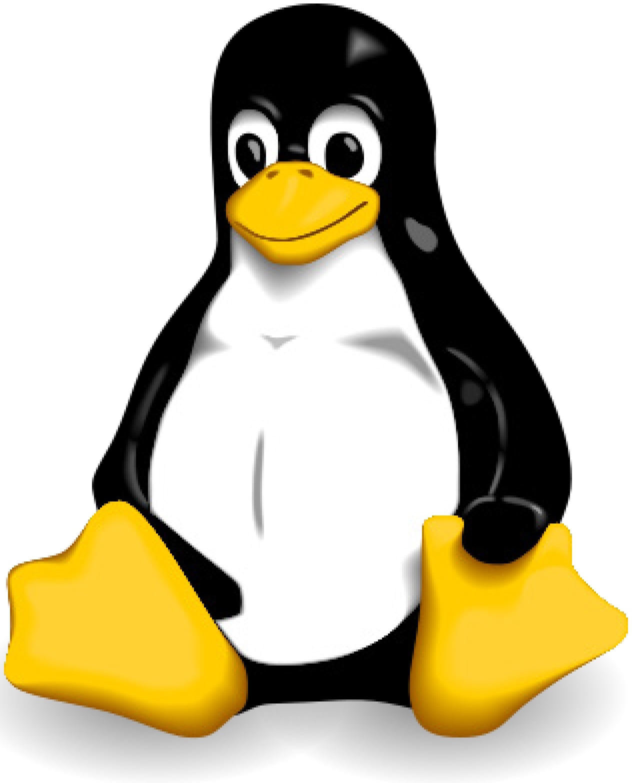
- Initial key database configuration
- User key reconfiguration functionality
- Facility to enable/disable secure boot

For more information …

- Ubuntu ODM Portal - http://odm.ubuntu.com/
- Secure Boot Signing Tools - git://kernel.ubuntu.com/jk/sbsigntool

Ubuntu* Demo with UEFI

- Key reconfiguration through standard firmware interfaces
- Ubuntu* images verified by firmware
- Key reconfiguration at OS level (with appropriate KEK installed)



Ubuntu* Implementation for UEFI

Ubuntu* 12.10 implements UEFI Secure Boot

- Boot loader shim signed by Microsoft* UEFI CA
- Ubuntu signed boot loader

Supports runtime key reconfiguration

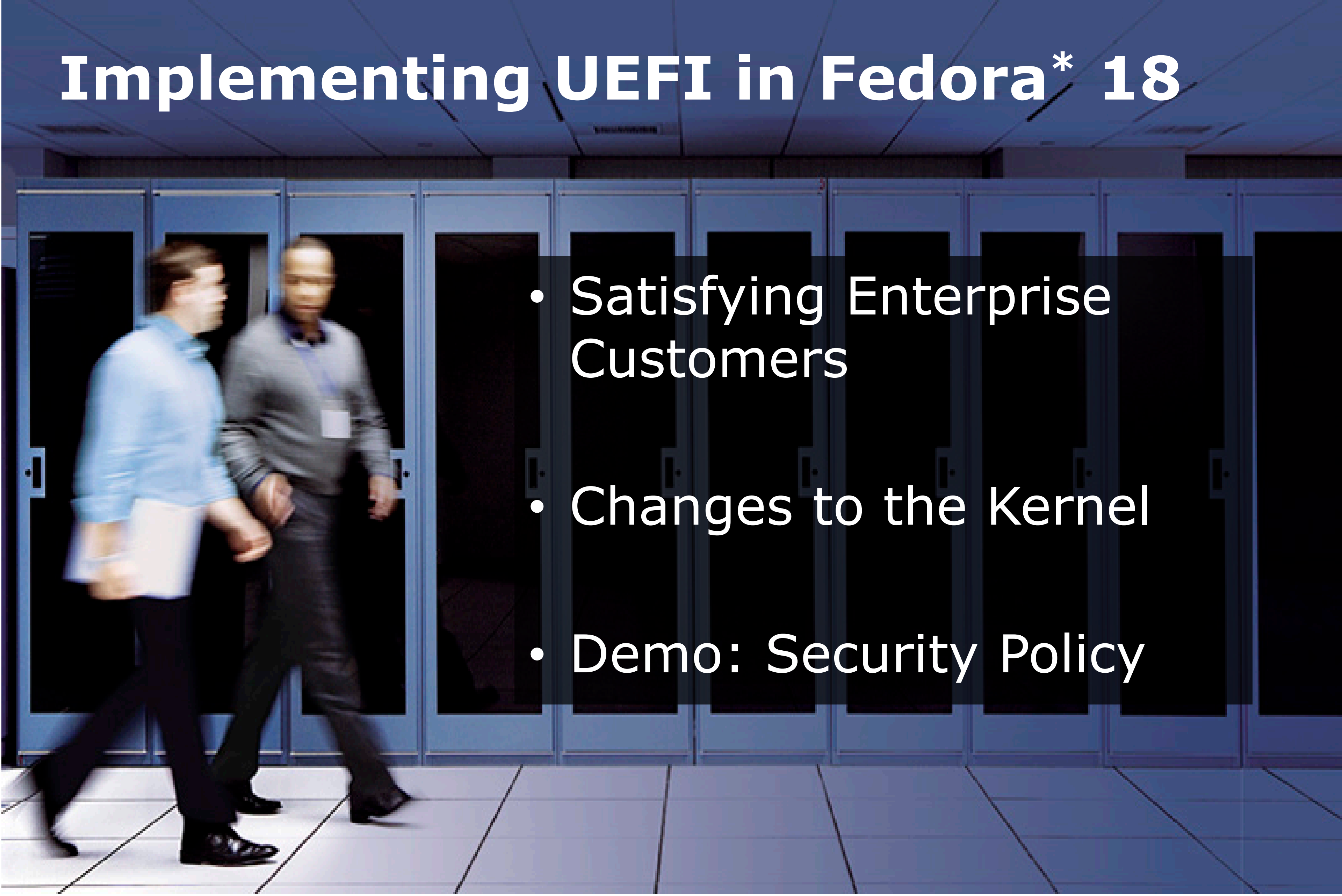
- Using efivars interface to update PK, KEK, db, dbx

Certification requires user-modifiable keys

- User control of security policy

Ubuntu uses existing Linux* infrastructure to support UEFI with Secure Boot

Implementing UEFI in Fedora* 18



- Satisfying Enterprise Customers
- Changes to the Kernel
- Demo: Security Policy

Implementing UEFI in Fedora* 18

- Fedora* 18 implements full UEFI Secure Boot support
  - Due for release early November 2012

- Uses UEFI for new enterprise-level features
  - Use UEFI for new functionality, not the bare minimum

- Implementing UEFI requires a surprisingly large set of functional changes

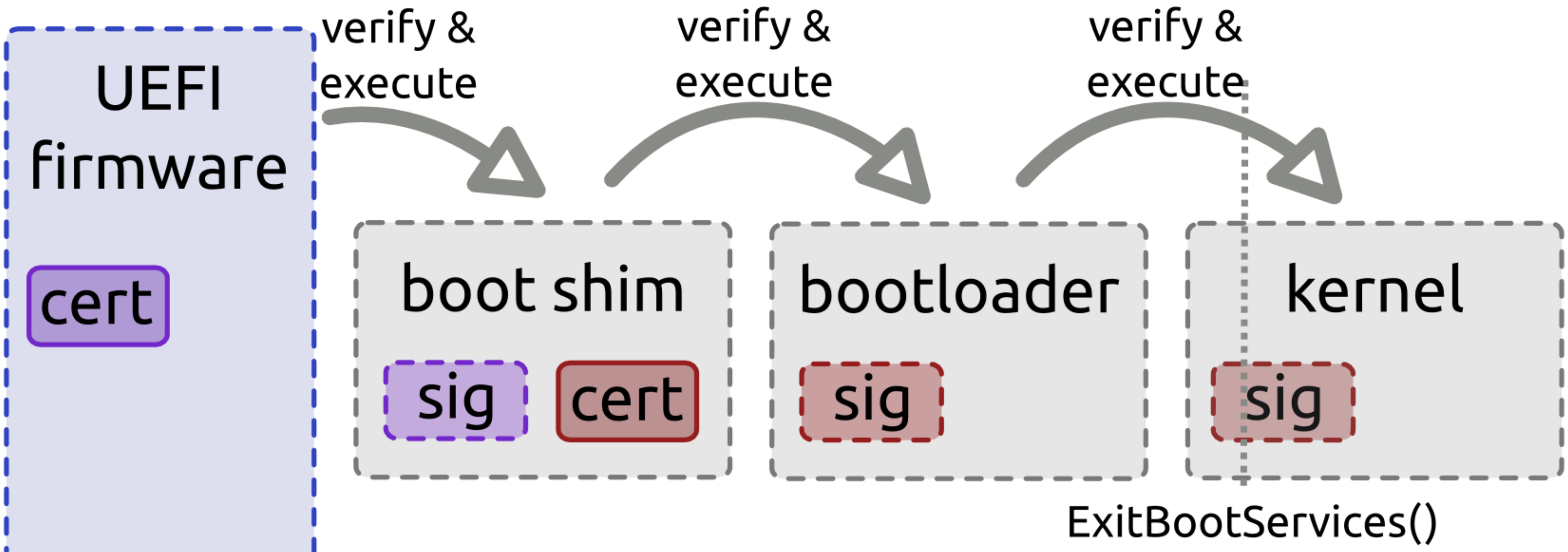
Satisfying Enterprise Customers

- UEFI Secure Boot can bring value to servers
  - However, customer configuration & integration is vital
  - Vital that trust be determined by the customer
  - Functionality for self-signing is hugely important
  - Integration into update system is also a key factor
- IPv6 support in the firmware permits net installs
  - Next generation network infrastructure support
- UEFI offers persistent NVRAM storage
  - Perfect for crash dumps and back-traces

Increased Kernel Security

- Signed drivers
  - Kernel refuses to load drivers unless signed with trusted key
  - Support for key installation
- Controlled hardware access
  - No direct user space access to hardware resources
  - All access mediated via the kernel
  - Graphics processor command streams validated to prevent DMA attacks
- Some debugging features disabled
  - Must be impossible for users to programmatically override security policy
  - Debug support must involve physically-present end user enablement

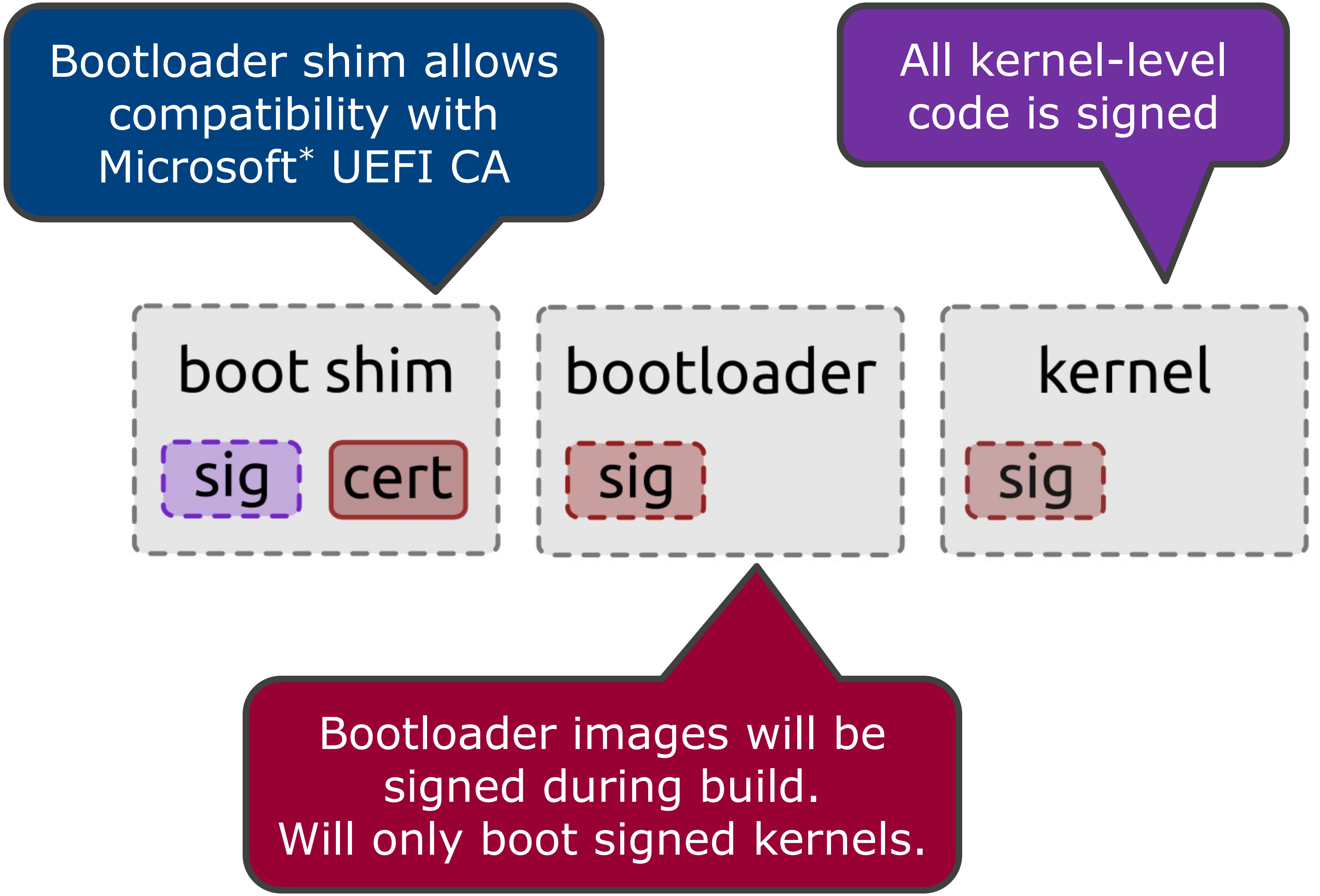
Fedora* Implementation



Legend

cert	Microsoft* UEFI CA certificate
sig	Signature generated from Microsoft UEFI CA
cert	Fedora* CA certificate
sig	Signature generated from Fedora CA

Fedora* Implementation



Bootloader shim allows compatibility with Microsoft* UEFI CA

All kernel-level code is signed

boot shim

sig

cert

bootloader

sig

kernel

sig

Bootloader images will be signed during build.
Will only boot signed kernels.

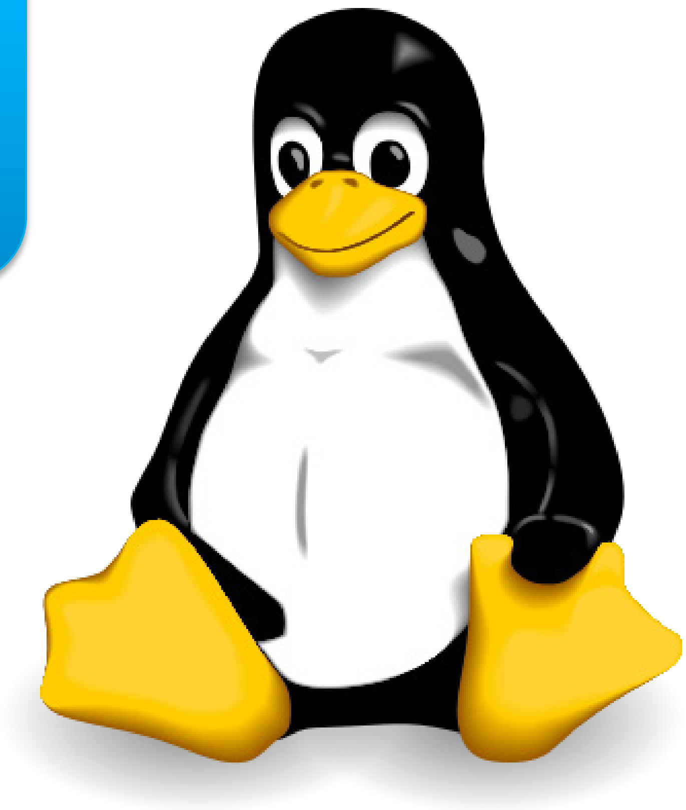
Hardware Enablement

- Kernel-mediated hardware access involves some new driver support
  - Added new kernel support for obsolescent graphics chipsets
  - Additional benefits in the form of power management
  - Server hardware environment very different to client
  - Still vital to provide full support

- The impact of UEFI & Secure Boot on the wider ecosystem will take time to determine

Demo: Security Policy in Fedora* 18

Use UEFI Secure Boot to enforce boot policy …
Fedora* 18 boot using only signed binaries and drivers



UEFI Support in Fedora* 18

Full system security

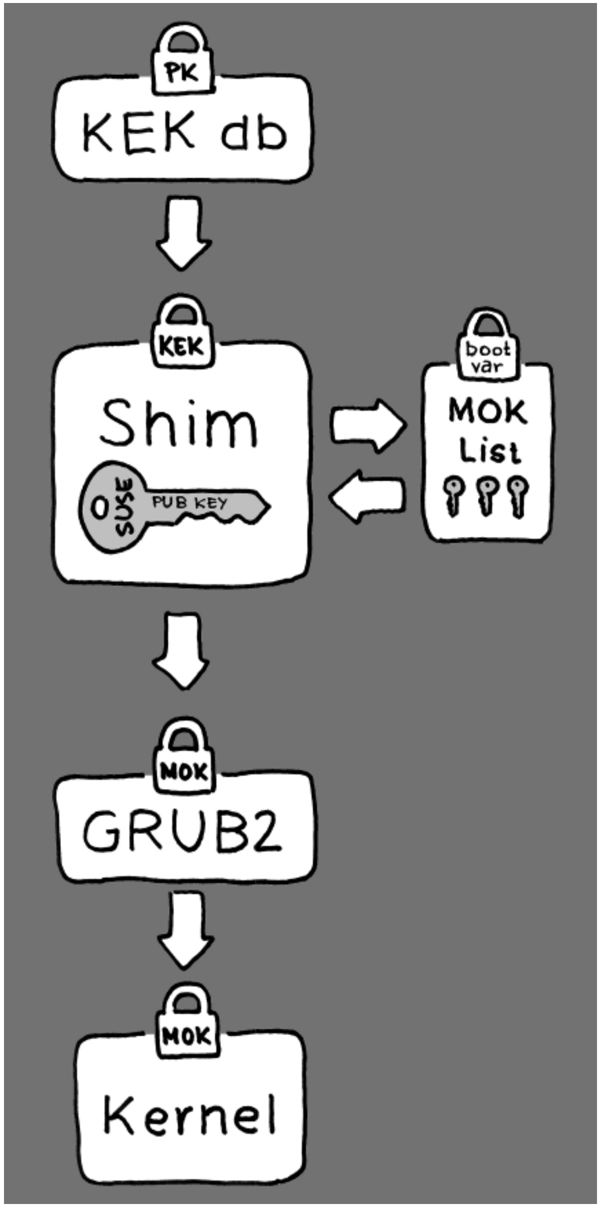
Designed to minimize impact on users

Available later this year

Fedora* uses UEFI Secure Boot as part of value-add for enterprise customers

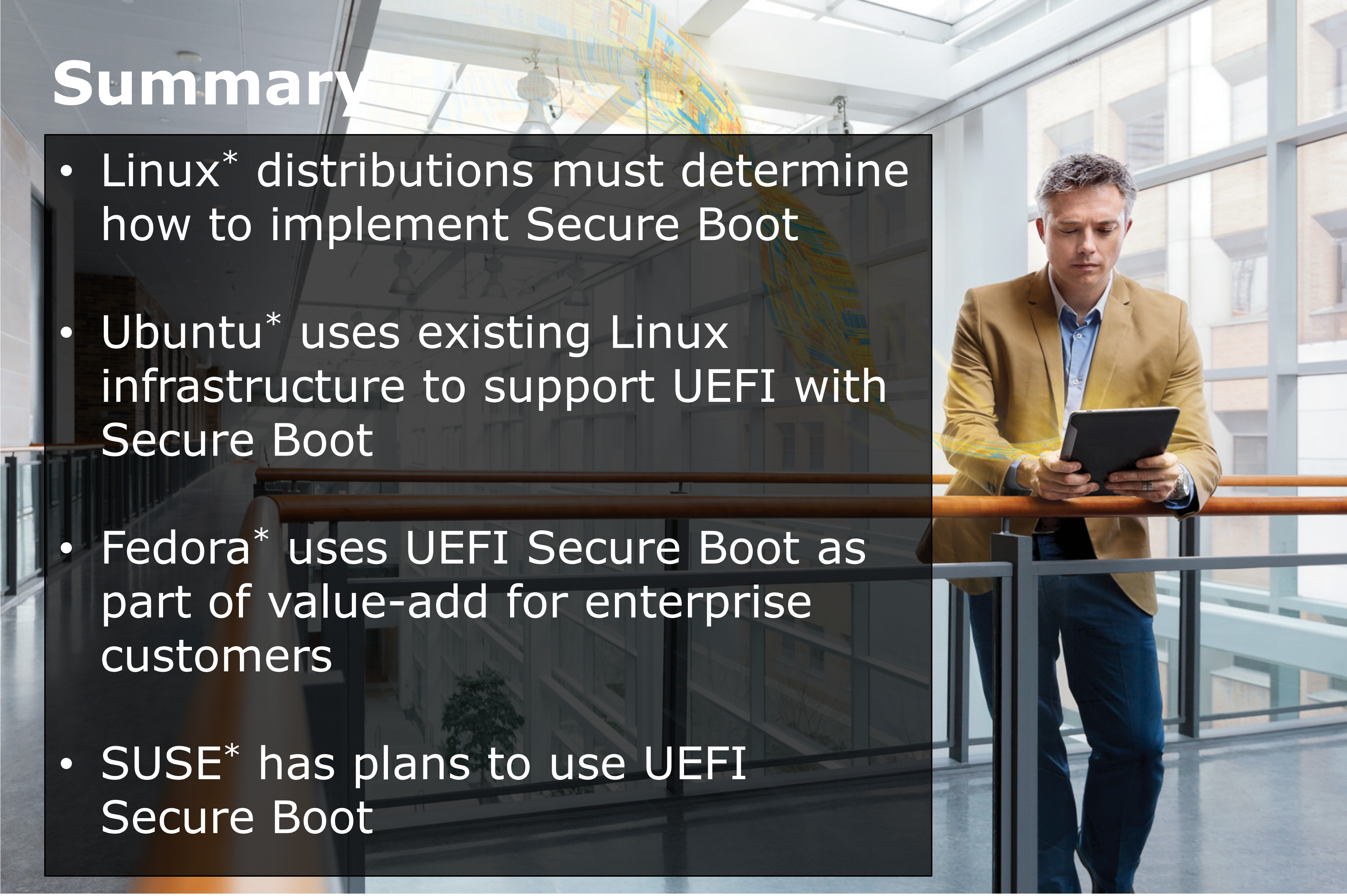
Latest updates to SUSE* UEFI secure boot plans

SUSE* Approach to UEFI Secure Boot



- SUSE has to balance two goals
  - Improving enterprise security by adopting UEFI Secure Boot
  - Reconcile UEFI Secure Boot with Linux developer's need to run a custom boot loader & kernel
- Aiming to support Secure Boot in SLE11 SP3* and openSUSE*
- Working with Linux* community and other vendors
  - Building on the shim loader created by Matthew Garrett
  - Extending it to allow machine owner to securely boot other kernels

Summary



- Linux* distributions must determine how to implement Secure Boot
- Ubuntu* uses existing Linux infrastructure to support UEFI with Secure Boot
- Fedora* uses UEFI Secure Boot as part of value-add for enterprise customers
- SUSE* has plans to use UEFI Secure Boot

Call to action

- Evaluate platform support for UEFI
- Become familiar with UEFI Secure Boot and how it effects your platform
- Download and test the latest Linux* distributions with support for UEFI & Secure Boot
  - The link for Ubuntu* Secure boot resources is at: https://wiki.ubuntu.com/UEFI/SecureBoot
  - Versions of Fedora https://fedoraproject.org/wiki/Secure_Boot_Testing

Get More Information

- Intel UEFI Community - http://intel.com/udk
- UEFI Forum Learning Center
  - http://www.uefi.org/learning_center/
- Use the TianoCore edk2-devel mailing list for support from other UEFI developers
- Read the "A Tour Beyond BIOS into UEFI Secure Boot" whitepaper at tianocore.org
- For more information on Ubuntu* …
  - Ubuntu ODM Portal - http://odm.ubuntu.com/
  - Secure Boot Tools - git://kernel.ubuntu.com/jk/sbsigntool
- For more information on Fedora* …
  - http://fedoraproject.org/
- Latest updates to SUSE* UEFI secure boot plans: https://www.suse.com/blogs/tag/secure-boot/

- Technical Showcase Booth #946

Other UEFI Sessions @ IDF

Session	Title	RM	Day	Date	Time
✓ EFIS001	Developing UEFI Support for Linux*	2008	Tue	11-Sep	10:30
EFIS002	Using Wind River Simics* Virtual Platforms to Accelerate Firmware Development	2008	Tue	11-Sep	12:45
EFIS003	Intel and McAfee: Hardening and Harnessing the Secure Platform	2008	Tue	11-Sep	3:30
EFIS004	Microsoft* Windows* 8 Firmware Developments and Intel® Platforms	2008	Wed	12-Sep	10:30
MSTS002	Shift Left! Leverage Full System Simulation to Reduce Your Time to Market	2003	Wed	12-Sep	2:00
EFIC001	Poster: Intel® UEFI Development Kit Debugger Tool	Poster	Thur	13-Sep	11:15
EFIC002	Poster: UEFI Driver Development Tools	Poster	Thur	13-Sep	11:15

✓ = DONE

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Q&A

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Backup

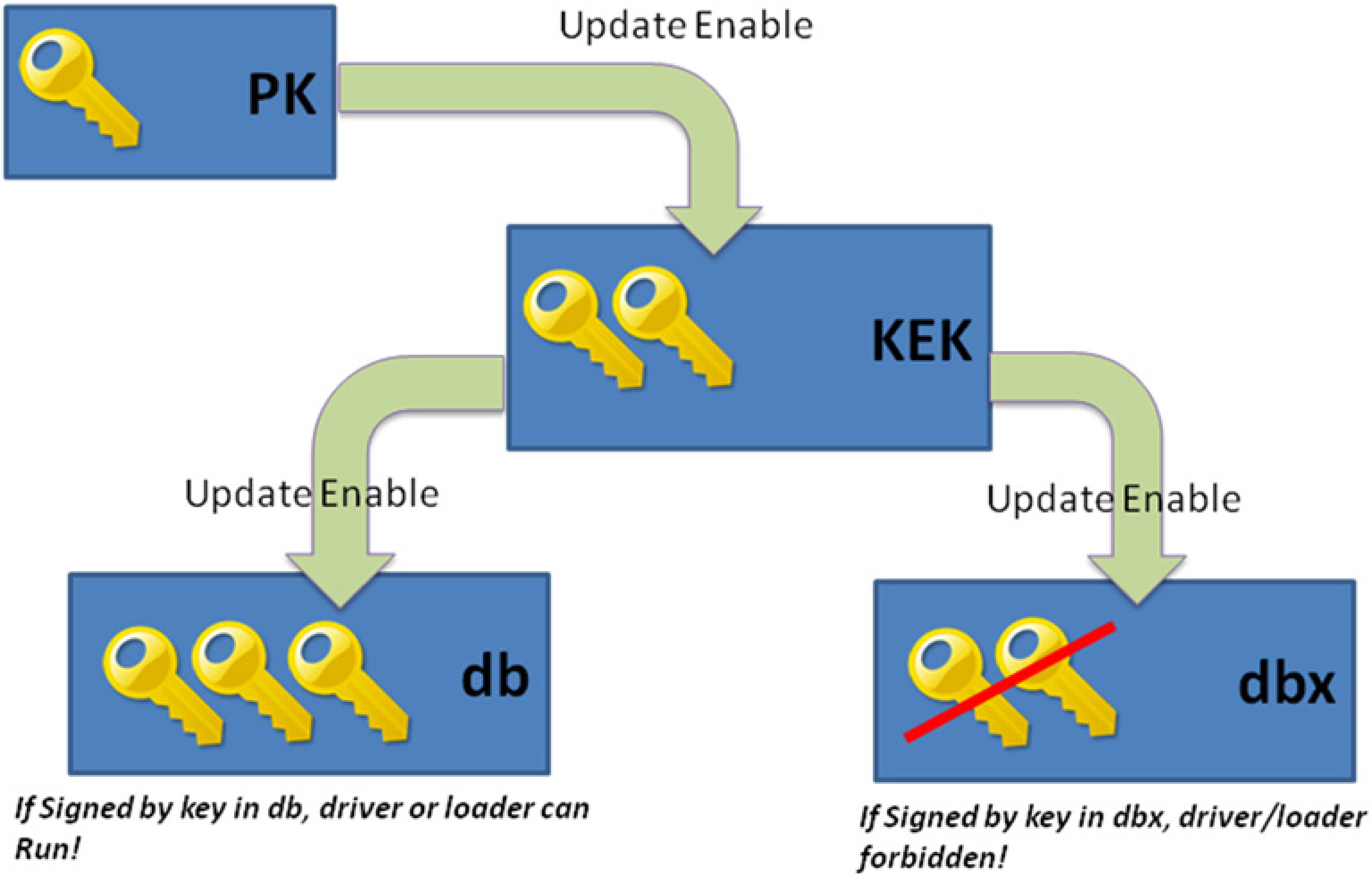
Update Enable
PK
KEK
Update Enable
Update Enable
db
dbx
If Signed by key in db, driver or loader can Run!
If Signed by key in dbx, driver/loader forbidden!

Figure 11 from the "A Tour Beyond BIOS into UEFI Secure Boot" whitepaper at tianocore.org