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英特尔信息技术峰会

UEFI 固件增强 Linux* 安全性并带来全新优势

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议程

- 针对 Linux* 的 UEFI 注意事项
- 针对企业系统的安全启动 – Insyde*
- Ubuntu* UEFI/安全启动的实现与工具
- 总结

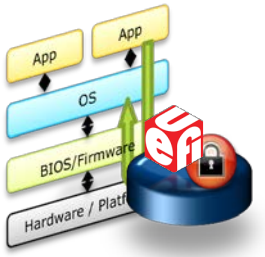
本课程演示文稿（PDF）发布在技术课程目录网站:
intel.com/go/idfsessionsBJ

该网址同时打印于会议指南中专题讲座日程页的上方

针对 Linux* 的 UEFI 注意事项

- UEFI 安全启动概述
- Linux* 下安全启动面临的挑战
- Linux 发行版安全启动支持的最新进展

UEFI 安全启动技术概述



- **系统启动面临的问题**
  - 越来越多的恶意软件开始以启动路径为攻击目标
  - 通常情况下，唯一的解决办法是重新安装操作系统
- **UEFI 安全启动使启动过程更安全**
  - 启动过程中，所有的固件和软件必须由可信的证书权威(CA)进行签名
  - 利用固件策略对OS加载程序、Option Cards等进行验证
  - 为用户提供一种阻止外部入侵的系统保护方式
  - 减少 rootkits, bootkits 和其它恶意软件的可能性

Linux* 支持安全启动所面临的挑战

- 双操作系统部署挑战
  - 用户可以通过禁用 UEFI 安全启动进行 Linux* 的安装，但这并非最佳部署方案
  - 当其它操作系统已经启用 UEFI 安全启动时，用户必须有一个其它方案继续安装 Linux
- 如果满足以下条件，Linux 亦可受益于 UEFI 安全启动技术
  - 客户能够在无需禁用该功能情况下安装 Linux
  - 平台所有者能够设置安全策略并定制系统
- 对于UEFI，Linux 发行版还存在其它注意事项
  - 内核如何处理已签名和未签名的代码
  - 驱动程序从传统的 BIOS 调用（ INT中断处理）迁移到 UEFI

Linux 发行版必须确定如何实现安全启动技术

来自 Linux* 发行版的进展信息

- Ubuntu* 12.10 – 已发布的64位 Ubuntu 12.10 利用Shim方案支持UEFI安全启动
- Fedora* 18 – 已包含支持 MOK(Machine Owned Key) 功能的 Shim 解决方案
- Red Hat* 和 SUSE* 都将在各自的发布版本中加入对第三方签名的支持
- OpenSuse* 12.3 发布版支持 MOK 管理器和多签名的Shim 加载器
- Linux Foundation 安全启动系统已发布
- Linux 社区采用 UEFI 技术†

结合 MOK 提供第三方签名支持的 Linux 发行版已经实现

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

UEFI，安全启动和企业版系统

Jeff Bobzin
副总裁，系微股份有限公司

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- 为什么企业用户需要安全启动
- 安全启动功能的技术解析
- Linux*系统上的安全系统软件更新
- 我的平台为Linux的安全启动做好准备了吗？

2012的进展

Windows 8 和 Windows Server 2012 的推出*

“我想补充的是，安全机制的改进，可能成为许多企业用户购买的理由。 [...] 例如 Windows 8 和 Windows Server 2012 已取代了传统的ROM-BIOS，运用的就是新的、改进的被称为UEFI安全强化的 2.3.1 版本的业界启动标准”

Roger Grimes, infoworld.com

UEFI 版本的 Fedora 和 Ubuntu* 的推出*

“UEFI将为所有的软件层提供一个基础的信任链，它可以阻止企图在**[Linux*]**电脑上安装非法、有害的软件”

Joab Jackson, pcworld.com

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企业已经准备好安全启动技术

系统固件
OpRom 固件

系统主板
外插卡

恢复软件
操作系统

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安全启动为企业用户带来的好处

- UEFI 启动针对企业用户，具有诸多优势
  - 支持大容量磁盘
  - 支持复杂的分区结构
  - 包括IPv6在内的丰富的网络支持
  - 更好地支持 PXE 预装和 iSCSI 启动
  - 更好的错误报告与管理工具

- 但是，UEFI 启动需要安全启动机制去保护对关键启动文件的访问

项目规划很关键

- 强化系统启动的好处是明显的，但是，
- 要记住，一个具有足够安全性保护，可信赖的企业用户产品，从固件开始一直延续到 Linux*的启动过程中，都需要选择优先考虑安全性的合作伙伴

合作伙伴可以协助您达到您的安全性目标!

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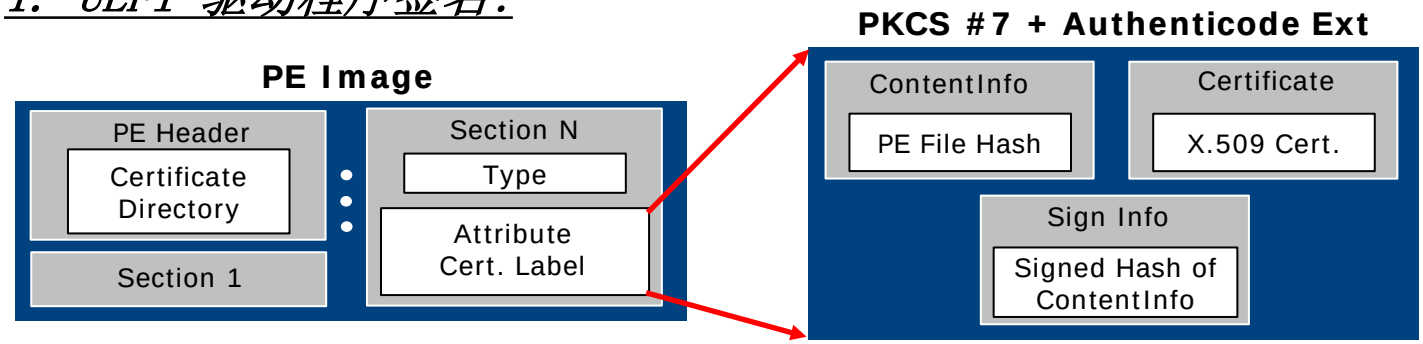
快速回顾 – 何谓安全启动?

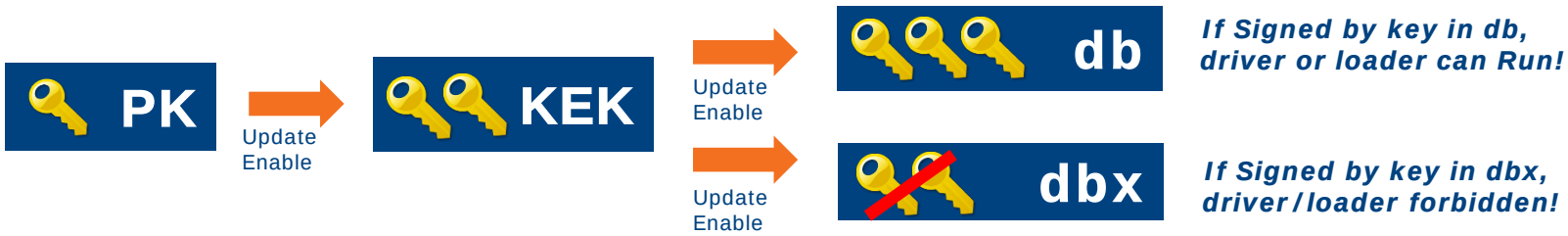
- 所谓 UEFI 安全启动，是消除从 UEFI 固件执行到 UEFI 操作系统过程中重大安全漏洞的一项技术
- Option ROMs 和 OS bootloaders 需要由私钥进行签名，而其对应的证书，则存放于系统安全数据库中
- 数据库由电脑制造商在生产时提供。需要撤销时，则由OS端来负责维护

安全启动 – 逐步解析

1. UEFI 驱动程序签名:

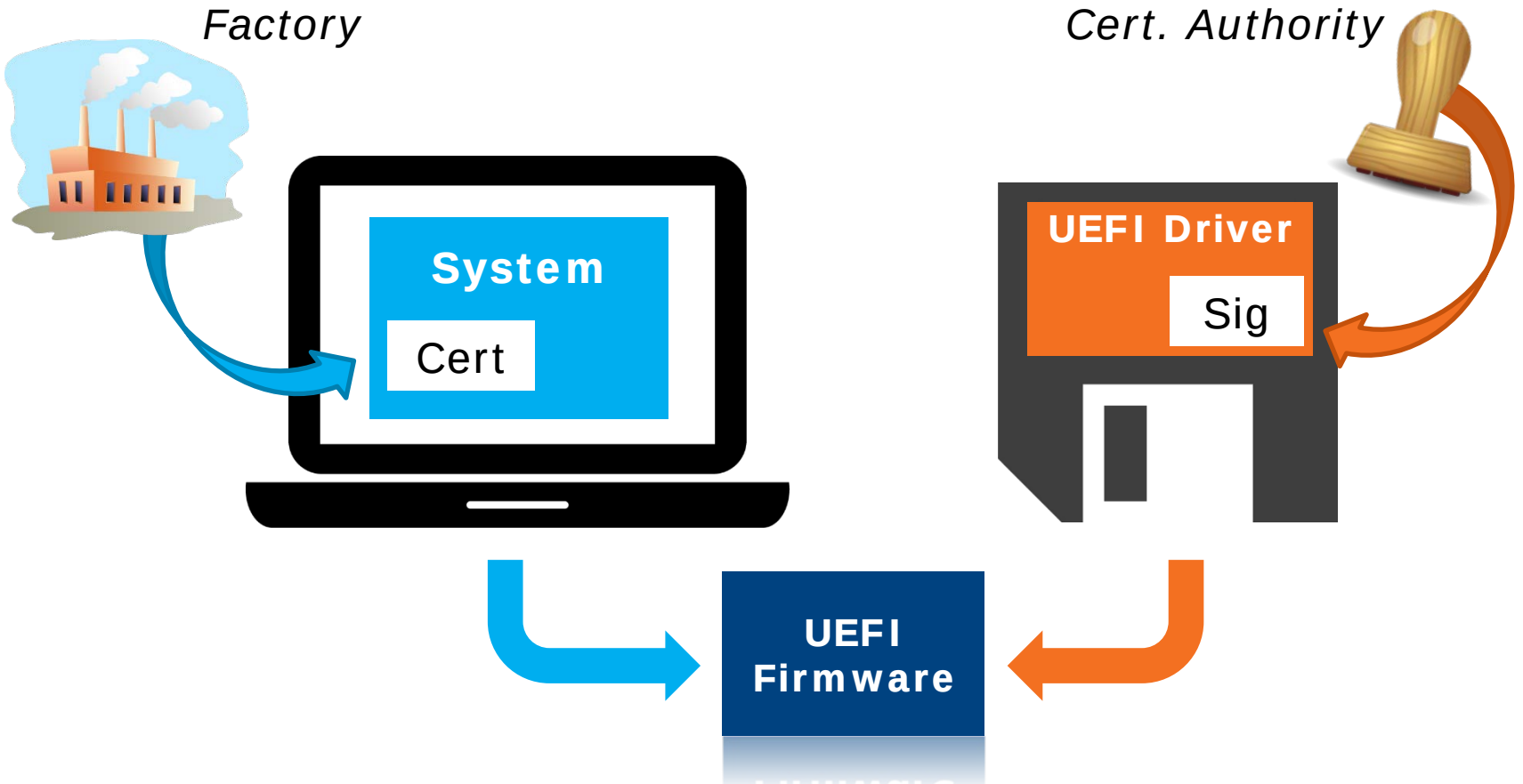


2. UEFI 安全启动数据库:



安全启动 – 逐步解析

3. 平台负责 UEFI 驱动程序检查:



固件负责校验数字签名以及数据库中的签名者信息，当满足所有要求时，驱动程序将被获准执行

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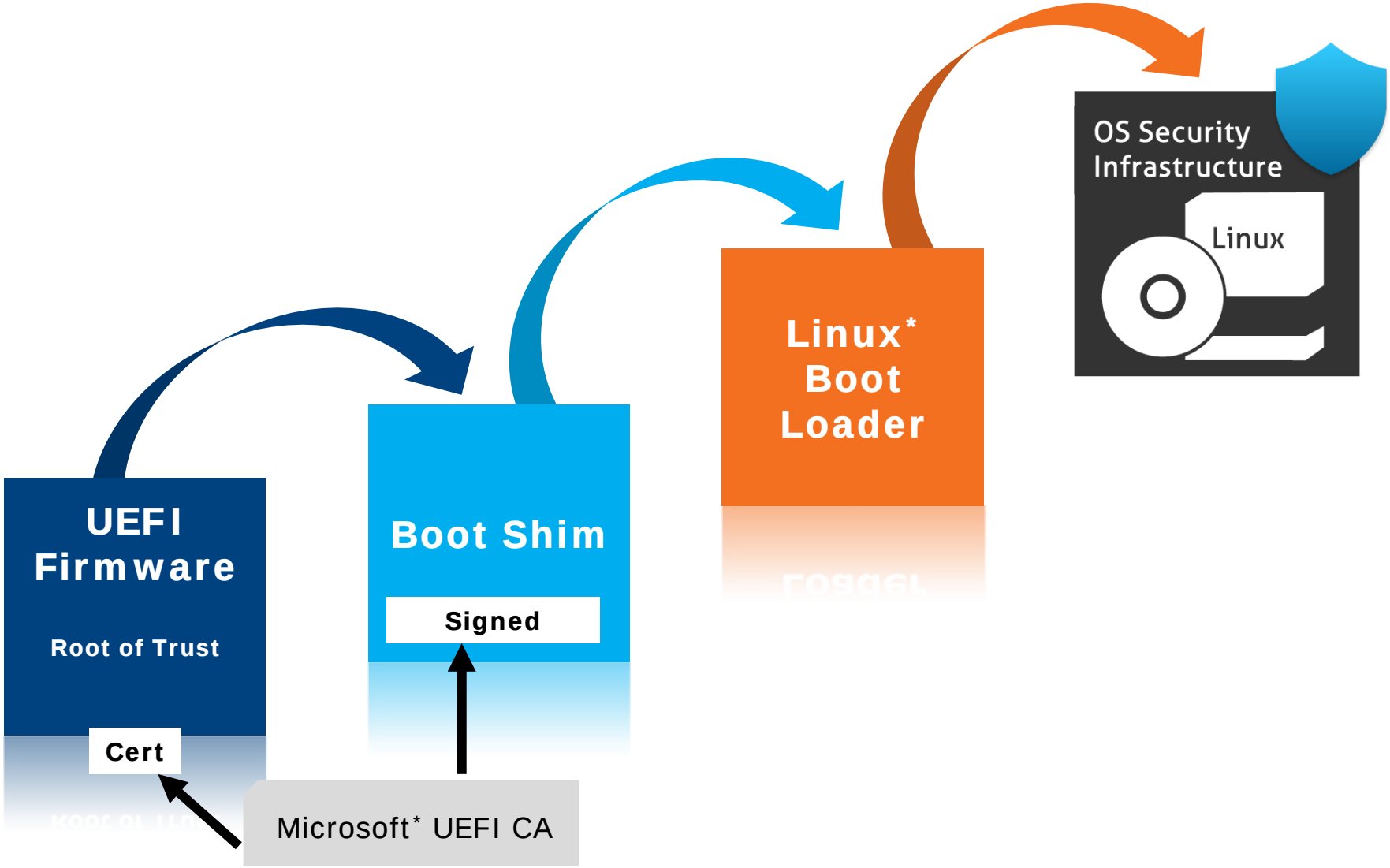
微软* 为 UEFI 提供 CA 支持

- UEFI Option ROMs 需要被广泛信任的 CA 所签名
- 微软* 具有CA运营经验，并志愿提供首个面向整个工业界的 UEFI CA
- 鼓励制造商将 MS CA 证书导入“Allowed”数据库
- 微软的政策是非歧视性的，例如，微软的 CA 已签发了 Linux* ‘Shim’启动驱动程序
- 是否可能出现另一个可信 CA?
  - 有可能，足够的数据库空间
  - 需要说服OEM厂商预先导入

安全启动，Linux* 和信任链



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固件是信任根

- 安全启动的有效性取决于：是否能够保护固件代码和数据的存储免受攻击
- 目前的硬件保护机制:
  - 所有的Flash更改需被保护在 SMI 的特权代码等级之下
  - 针对代码存储或安全系统数据库的修改，必须由 SMI 下的代码来测试其签名的有效性
- 操作系统需定制专用的固件更新工具
- 系微为 OEM 提供 Windows* 和 Linux* 操作系统下的安全固件更新工具

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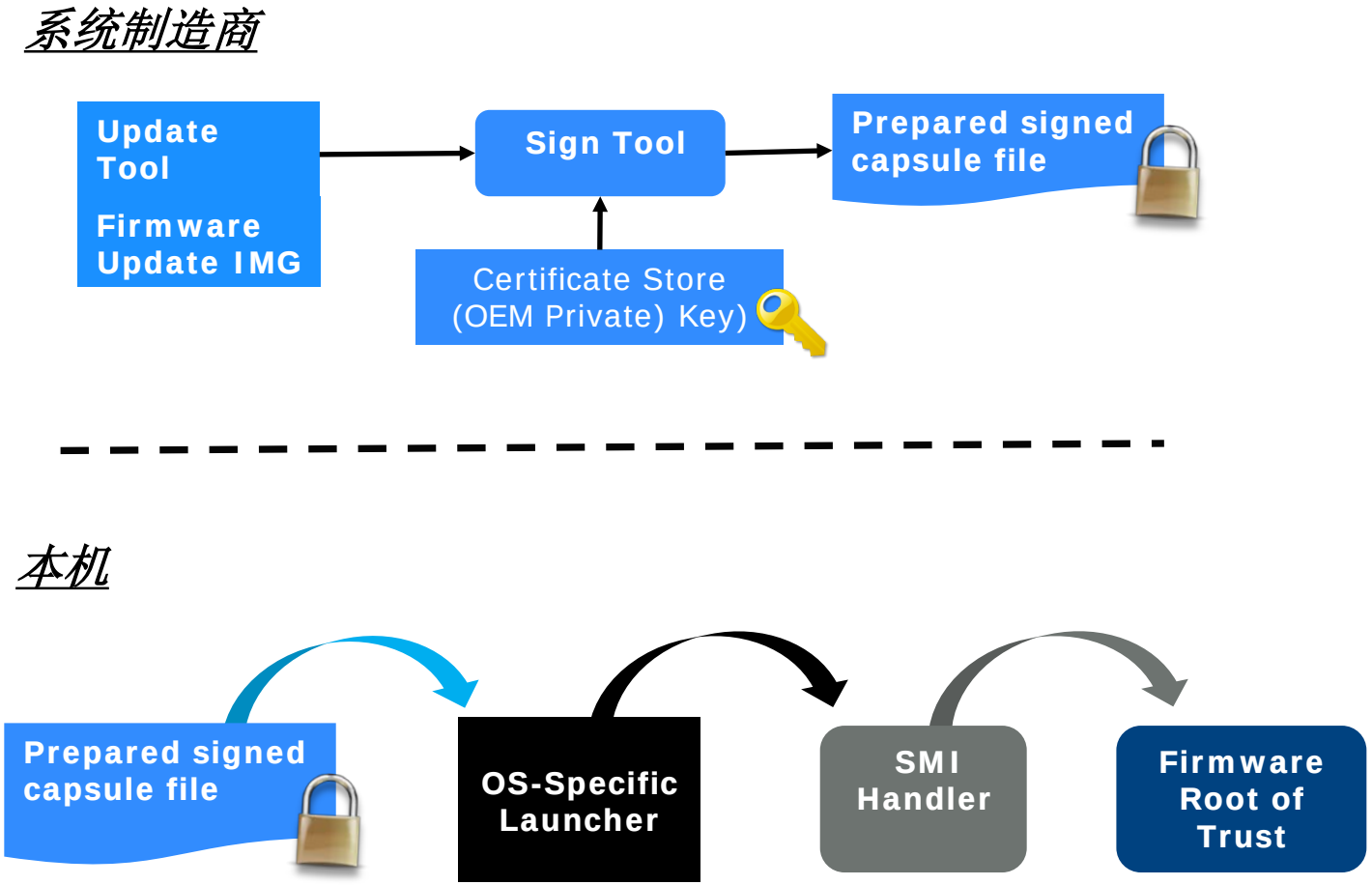
当前的安全固件更新机制



Linux* 系统上安全固件更新的准备步骤

OEM 步骤

1. 生成已签名的包含更新的Capsule文件 (与Windows*相同)
2. 生成适用于目标 OS 的 Linux* Flash* 更新工具

   注: 系微提供驱动程序的源代码
3. 对于非常见发行版的用户，需要生成驱动程序

用户步骤

1. 下载包含固件更新工具的软件包，解压缩并设定权限
2. 复制已签名的 “isFlash.bin”到 InsydeFlash 文件夹
3. 固件更新程序需要管理员（root）权限才能执行
4. 执行 Linux Flash工具, 应用程序会检查是否存在正确的安全 BIOS 映像
5. 是 -> 执行 SMI 去启动安全刷新模式
6. 重启平台，在固件启动过程中应用固件更新

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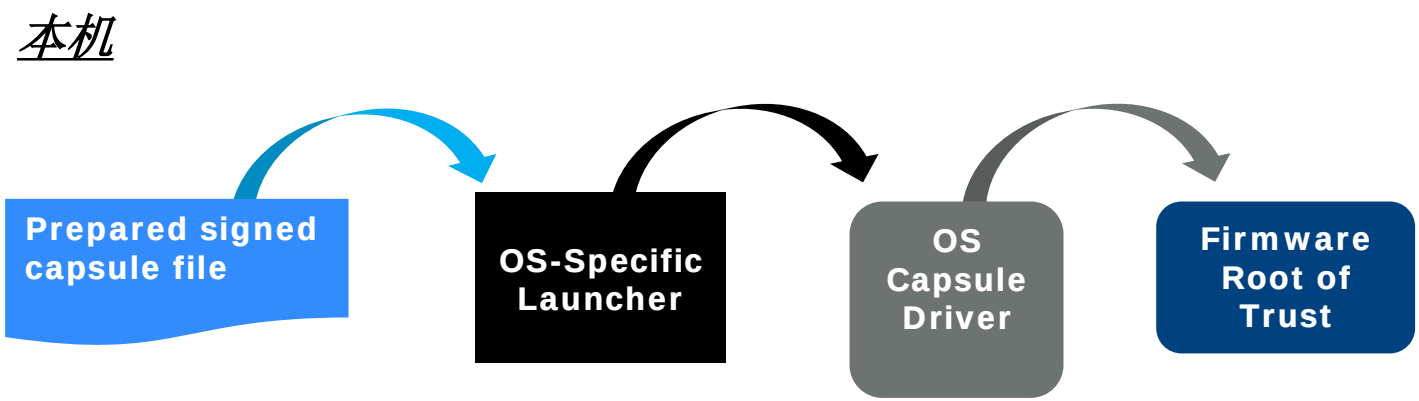
工业界正致力于确保安全更新更简单、更可靠

- UEFI 提供一个针对固件更新的 UpdateCapsule 接口.期待OS厂商在2013年增加这一重要功能
  - 内嵌于Linux*，用户不必自行编译!
- 也期待针对 UEFI 扩展卡进行固件更新的工具



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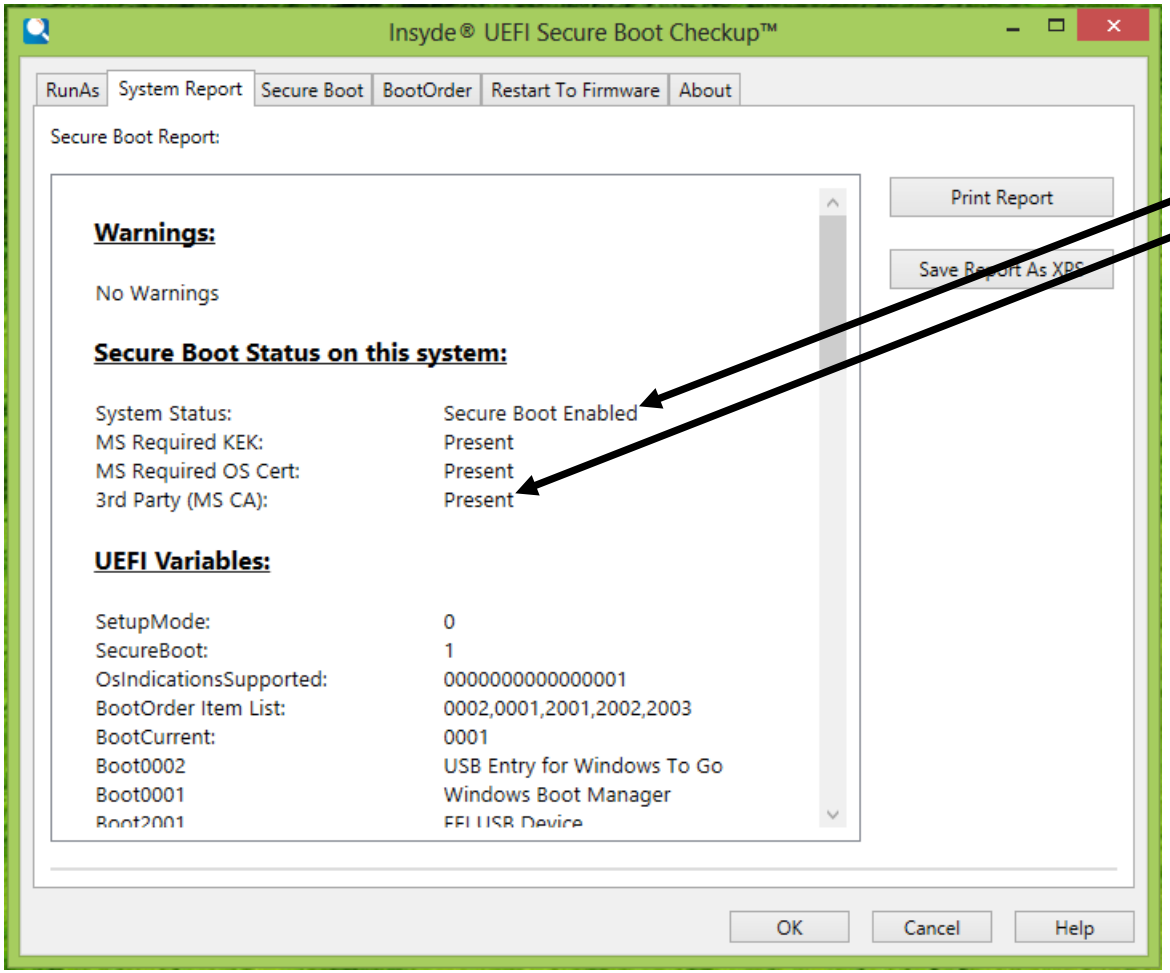

1. 安全启动已启用
2. MS CA 证书已部署

下载 Checkup Tool： http://apps.insyde.com

2013年UEFI论坛针对企业用户的目标

- 企业用户的广泛采用是个非常重要的目标!
- 对 UEFI 安全固件更新提供更流畅的用户体验

- 为达到此目标，UEFI 社区承诺:
  - 关注生态系统的所有环节 – 系统厂商、扩展卡厂商和企业级操作系统
  - 宣传其优势
  - 响应用户需求

Ubuntu* UEFI/安全启动 实现与工具

胡立聖
BIOS工程师，肯诺软件股份有限公司

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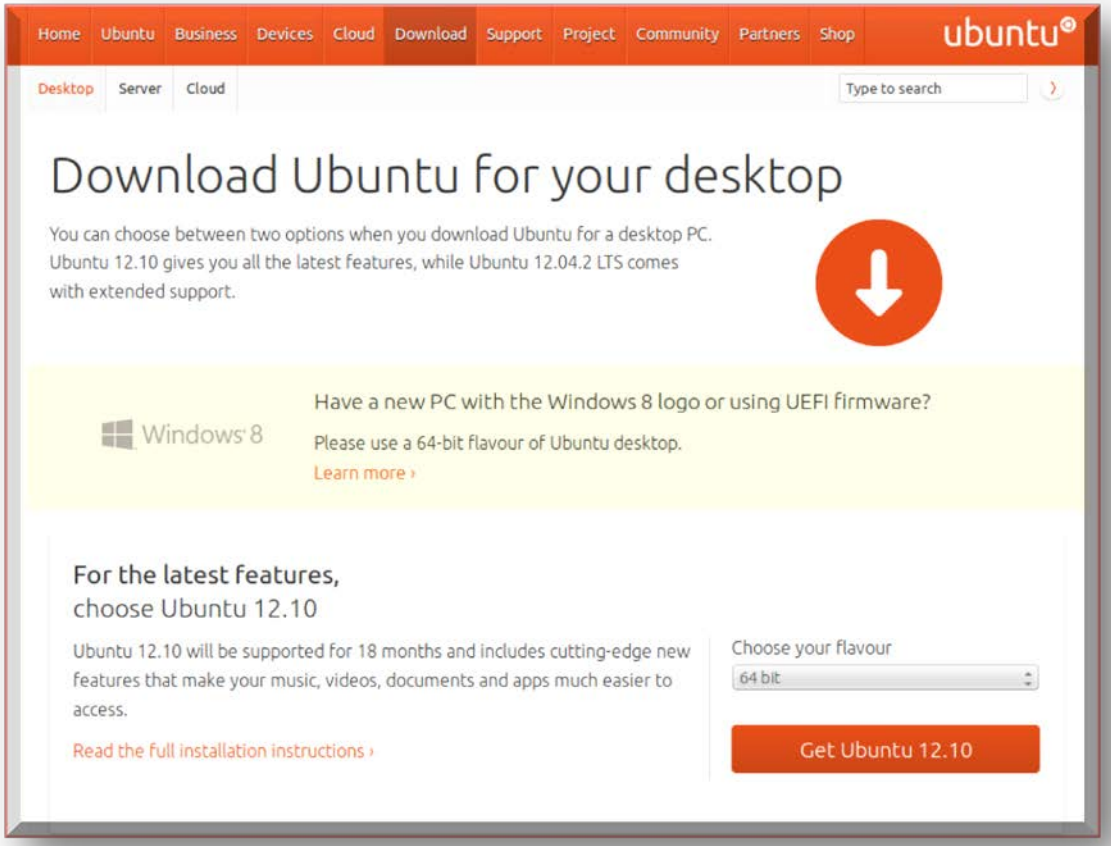
议程

- UEFI/安全启动实现
- 固件测试套件 / 固件测试套件 – Live
- 演示

UEFI/安全启动实现

UEFI/安全启动

- Ubuntu* 12.10 实现了 UEFI 安全启动
- 下载：http://www.ubuntu.com/download/desktop



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UEFI/安全启动实现

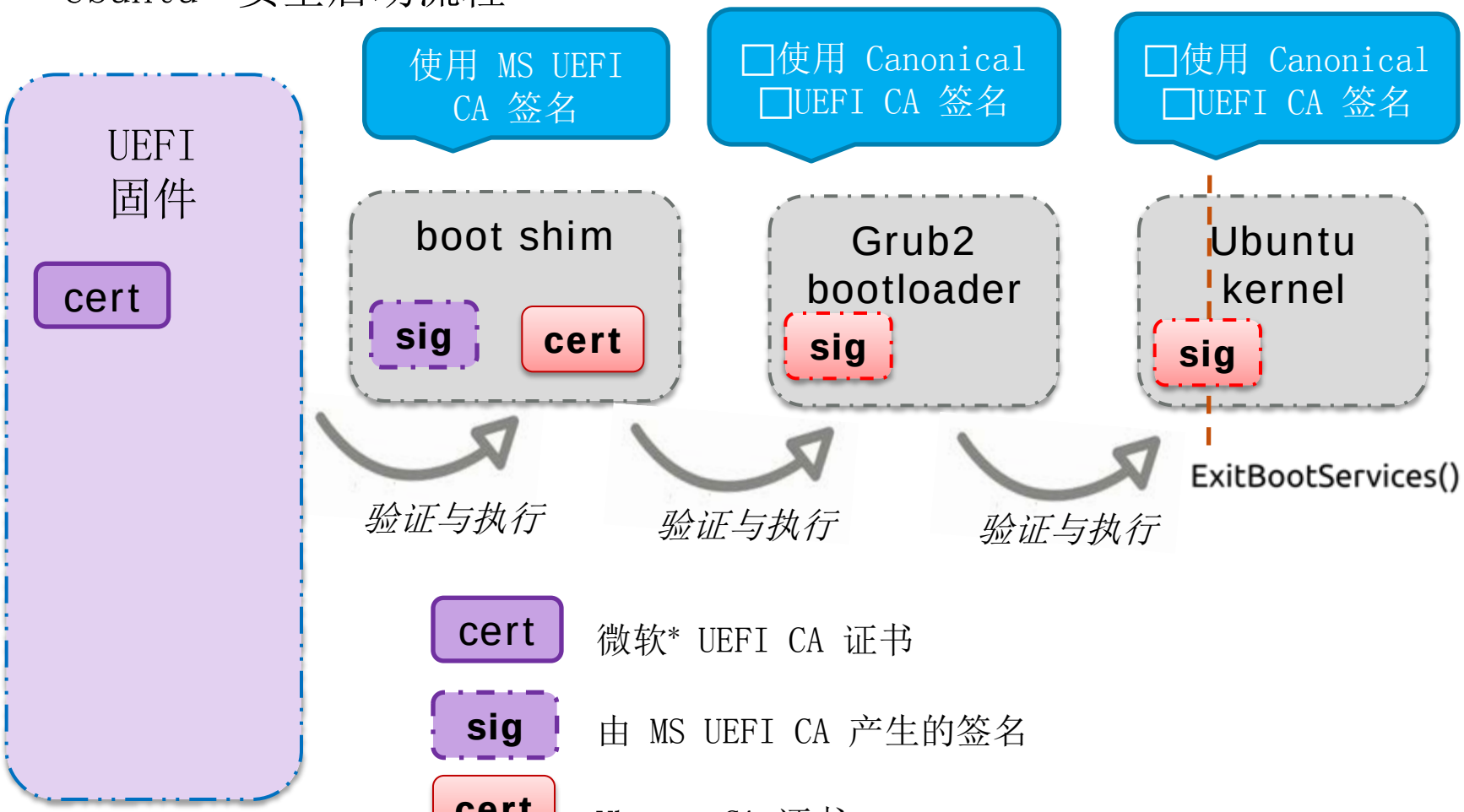
BIOS/UEFI 要求

- 兼容 UEFI 2.3.1 规范
- UEFI 启动时/运行时服务
- UEFI 启动管理器
  - 变量 Boot#### 及 BootOrder
  - BIOS 缺省状态重置

UEFI/安全启动实现

UEFI/安全启动

- Ubuntu* 安全启动流程



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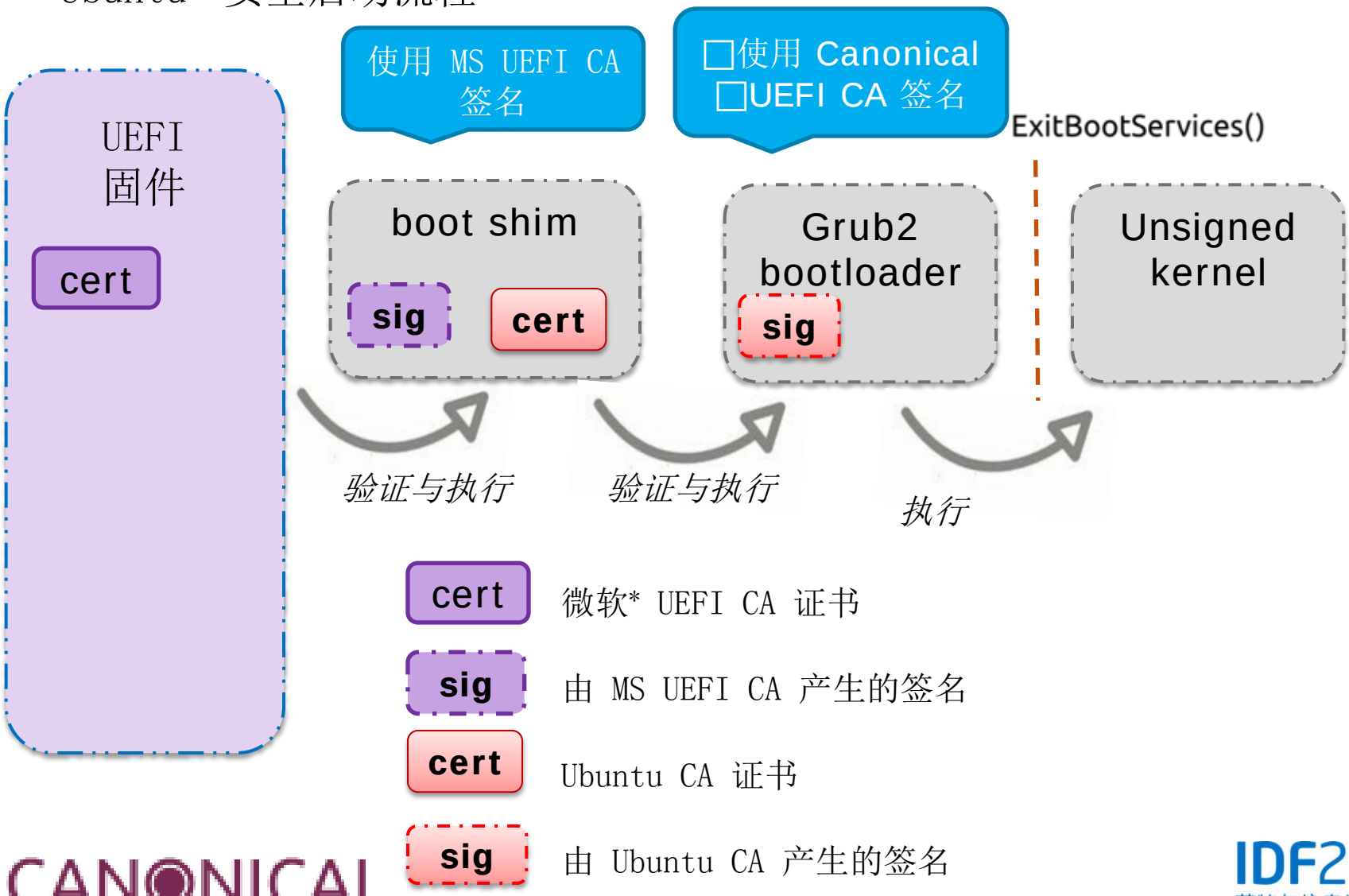
UEFI/安全启动实现

UEFI/安全启动

- Ubuntu* 安全启动流程



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UEFI/安全启动实现

Ubuntu* 安全启动的实现

- Ubuntu 12.10 版本对安全启动的实现
  - 由微软* UEFI CA 签名的启动加载程序 shim
  - Ubuntu 签名的启动加载程序
  - Ubuntu 签名的Kernel
  - 支持未签名的 Kernel
  - 不强制模块签名
- Ubuntu 认证规范
  - 初始密钥数据库配置
  - 用户密钥重配置功能
  - 启用/禁用安全启动的设置功能
- 支持运行时的密钥重配置
  - 使用 efivars 接口对 PK, KEK, db, dbx进行更新
  - 安全启动签名工具“sbsingtool”

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固件测试套件（fwts）

什么是 fwts?

- Fwts是一套 Linux* 自动化固件测试工具，致力于 Bug 检测及固件修复
- 基于英特尔2007年10月发布的Linux可用的固件开发包衍生而来

- 自动检测错误
- 核心功能的正确性检测
- 确保 Linux 和固件之间的交互性
- 捕获 Linux Kernel 产生的警告
- 提供可用的解决方案建议
- 为调试收集固件数据

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固件测试套件（fwts）

关键功能（1/2）

- 命令行
  - 设计可供其它测试工具使用
  - 亦可单独运行
  - 并为开发者收集相关数据
- 批量测试
  - 自动化运行
- 交互性测试
  - Hot-key, lid, AC Power
- 完整的测试日志
  - 每个测试项目都有 PASS/FAIL结果
  - 解释可能失败的原因（ADVICE lines）
  - 严重性分类（CRITICAL, HIGH, LOW…）
- 结果总结
  - 提供结果日志格式设定

固件测试套件（fwts）

关键功能（2/2）

- 稳定性测试
  - 挂起/唤醒，休眠/唤醒
- 工具
  - ACPI，UEFI 变量导出…
- UEFI 运行时服务测试
  - Variable，time，其它服务
- 安全启动测试
  - 安全启动变量和证书测试

固件测试套件（fwts）

Fwts 针对安全启动的测试项目

- UEFI 安全启动的变量测试
  - SetupMode, SecureBoot 变量
- 针对微软* UEFI CA 签名数据库（“db”）的检测
- Ubuntu* 主 CA 证书是否存在于 KEK 中的检测

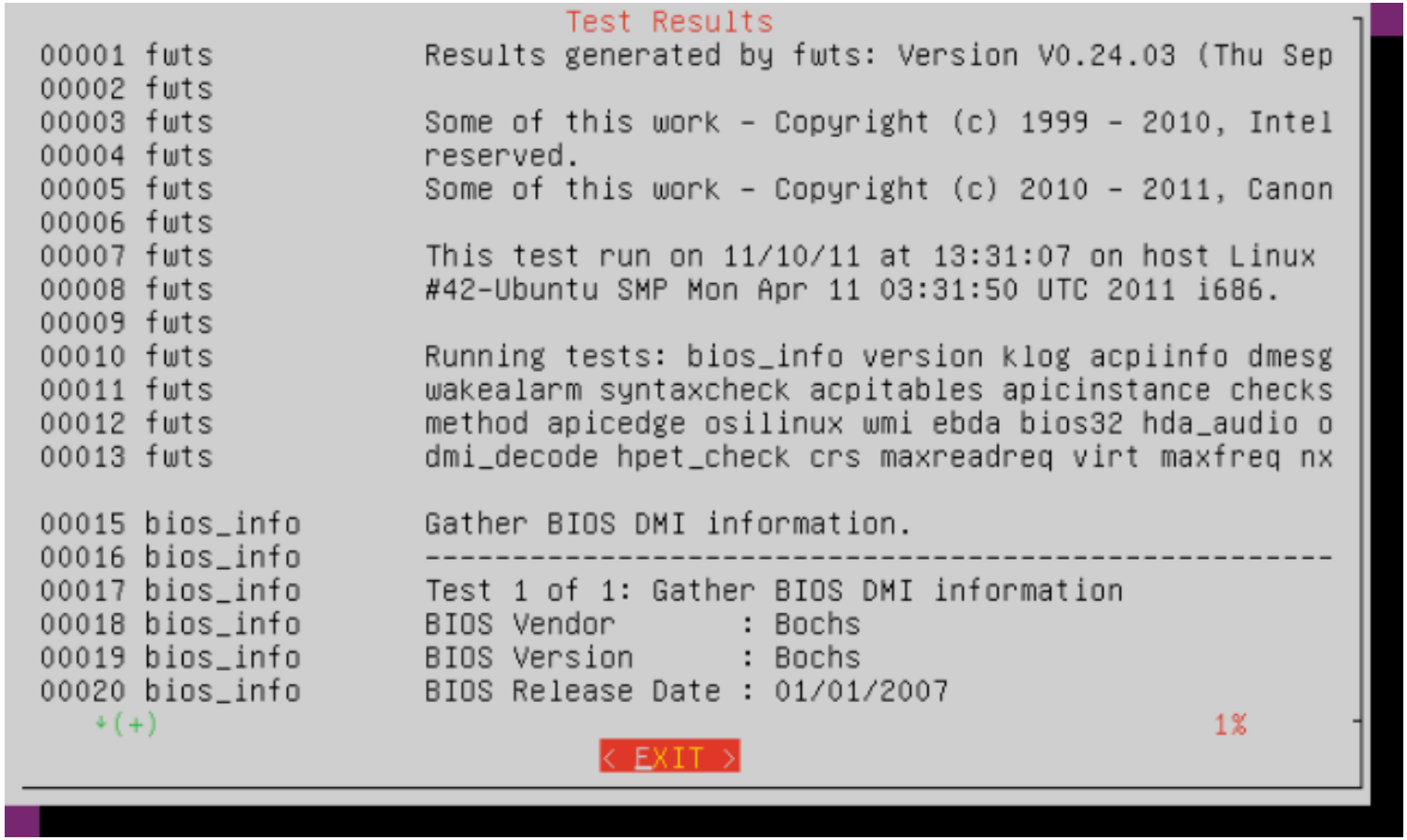
固件测试套件 Live 版 (fwts-live)

什么是 fwts-live?

- fwts-live 是一个可启动的 USB 映像，能够在未安装 Linux*/Ubuntu* 的情况下，完成启动并运行固件测试套件。结果日志直接存储在 USB 磁盘中，供日后分析使用。

- 无需安装
- 易于使用
- 随最新 Ubuntu 发布

固件测试套件 Live 版 (fwts-live)



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演示：固件测试套件（fwts）

信息

寻求更多信息

- Ubuntu* ODM 网址 - http://odm.ubuntu.com/
- 安全启动签名工具 - git://kernel.ubuntu.com/jk/sbsigntool
- Fwts
  - https://wiki.ubuntu.com/Kernel/Reference/fwts
- Fwts-live
  - https://wiki.ubuntu.com/HardwareEnablementTeam/Documentation/FirmwareTestSuiteLive

报告 fwts 错误?

- Fwts
  - https://bugs.launchpad.net/ubuntu/+source/fwts

Ubuntu* 的 UEFI 实现

- Ubuntu* 12.10 是第一个支持安全启动的版本
- Ubuntu 的安全启动在保持灵活性的同时，也保障了固件免被恶意代码攻击
- Ubuntu认证要求系统提供用户可控的安全策略
- 固件测试套件（FWTS）能够自动检测固件 - 包括对 UEFI 和安全启动的检测

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总结

- UEFI 安全启动使启动过程更安全
- 针对 UEFI 安全启动，生态系统已然就绪
- 基于已有的不同方案，Linux* 发行版必须确定如何实现安全启动
- Ubuntu* 支持 UEFI 安全启动，同时还提供支持自动化固件测试的FWTS套件

立即行动

- 使用已有的丰富资源，学习 UEFI 安全启动相关技术
- 为部署 UEFI 安全启动，请评估您的平台是否就绪
- 下载并测试支持 UEFI 及安全启动技术的最新 Linux* 发行版
  - Ubuntu* 安全启动相关资源：
    https://wiki.ubuntu.com/UEFI/SecureBoot
  - SUSE* 安全启动细节信息：
    https://www.suse.com/blogs/uefi-secure-boot-details/

关于这一主题的其它信息，请参照：

- Intel UEFI 社区 - http://intel.com/udk
- UEFI 论坛学习中心
  - http://www.uefi.org/learning_center/
- 使用 TianoCore edk2-devel mailing list，寻求来自其他 UEFI 开发者的支持
- 从 tianocore.org 获取白皮书 “A Tour Beyond BIOS into UEFI Secure Boot”
- 关于 Ubuntu* 的更多信息…
  - Ubuntu ODM 网址 - http://odm.ubuntu.com/
  - 安全启动工具 - git://kernel.ubuntu.com/jk/sbsigntool
- 关于 Fedora* 的更多信息…
  - http://fedoraproject.org/
- SUSE* UEFI安全启动支持计划: https://www.suse.com/blogs/tag/secure-boot/

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