OCP SUMMIT

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ONIE
Securing the Install Process

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March 2018

Curt Brune | Cumulus Networks

Talk Overview

- Quick Annual Roundup
- Root of Trust Concepts
- Booking ONIE Securely
- Verifying Installers

Since Last Year's Summit

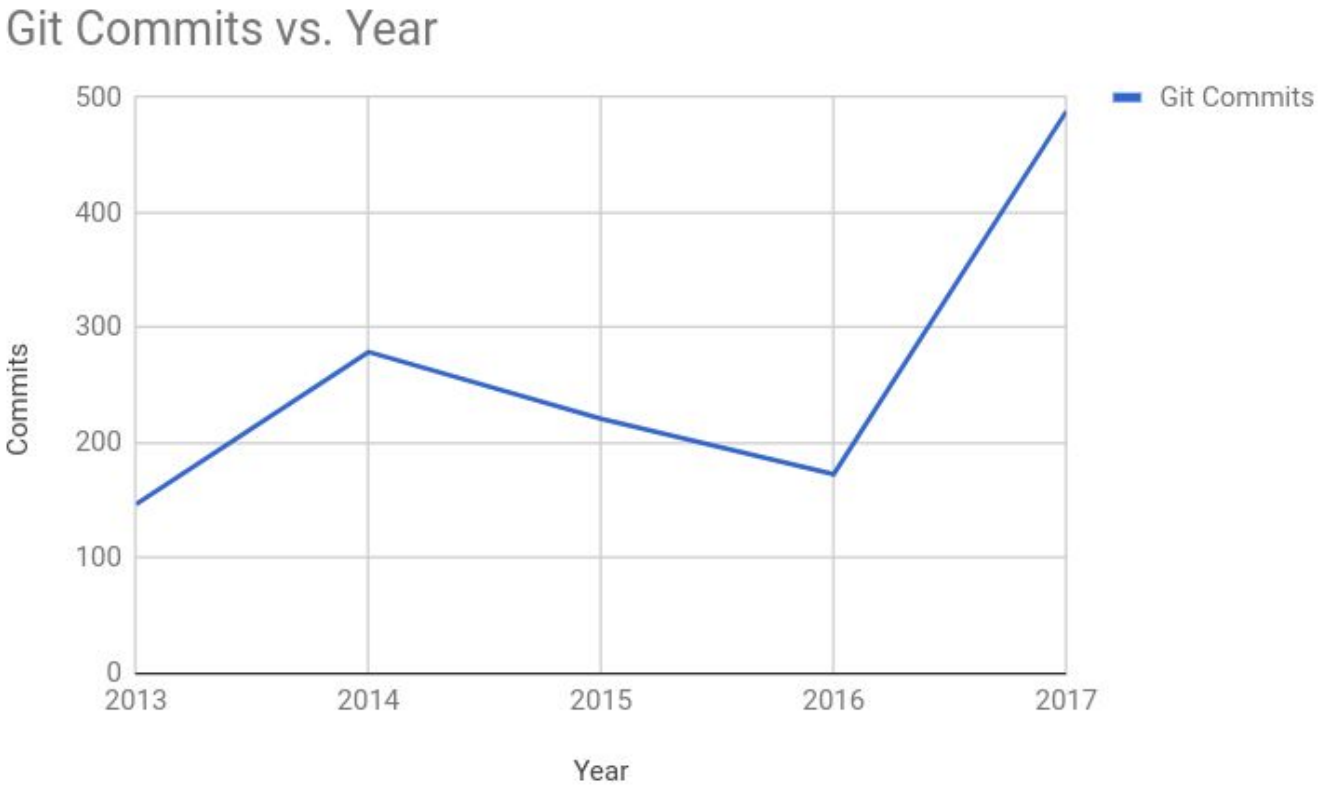
Contributions

- New machine definitions: 49 (more than 4 per month)
- Contributing individuals: 24
- Contributing organizations: 20

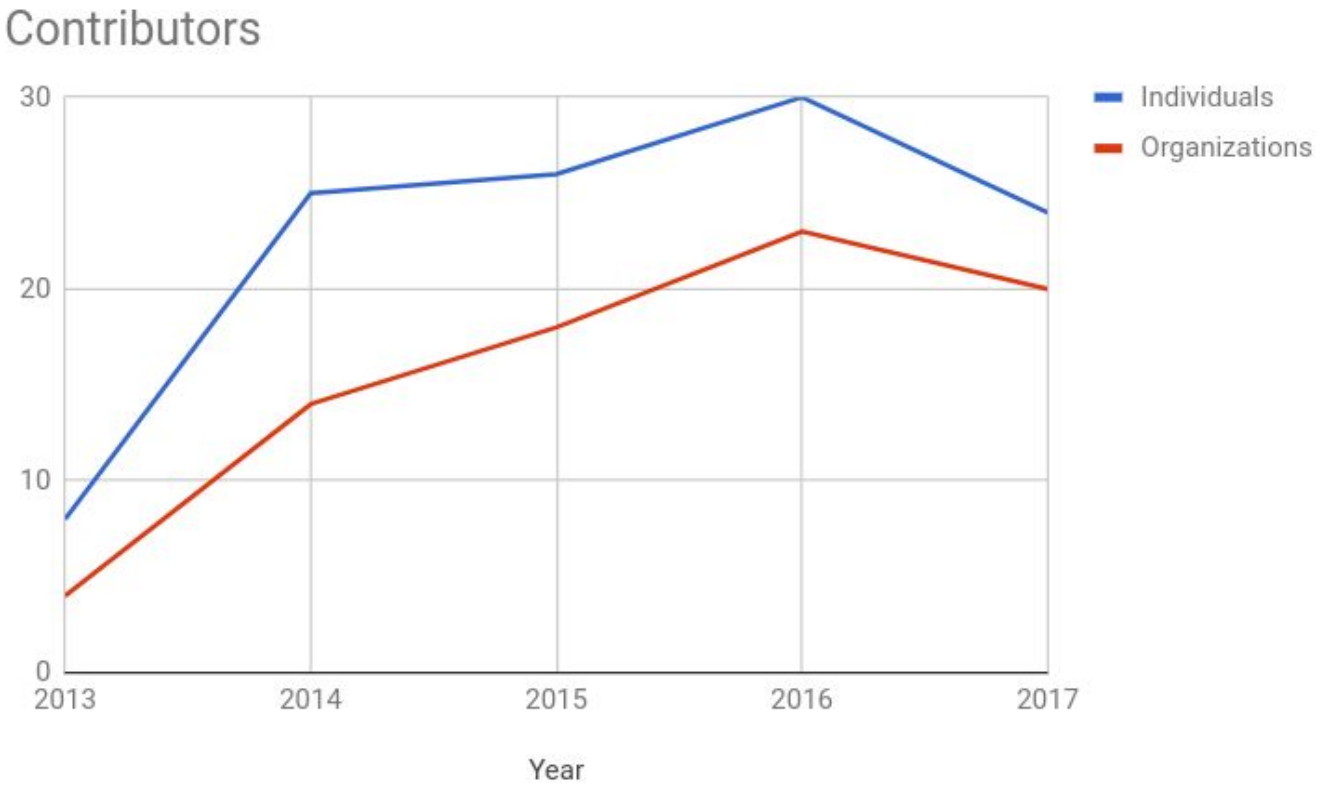
New Developments

- Improved Documentation
- Reduced Build Times
- Support Common CPU modules
- Moved to Linux kernel 4.9.y
- Hooks for Network ASIC drivers

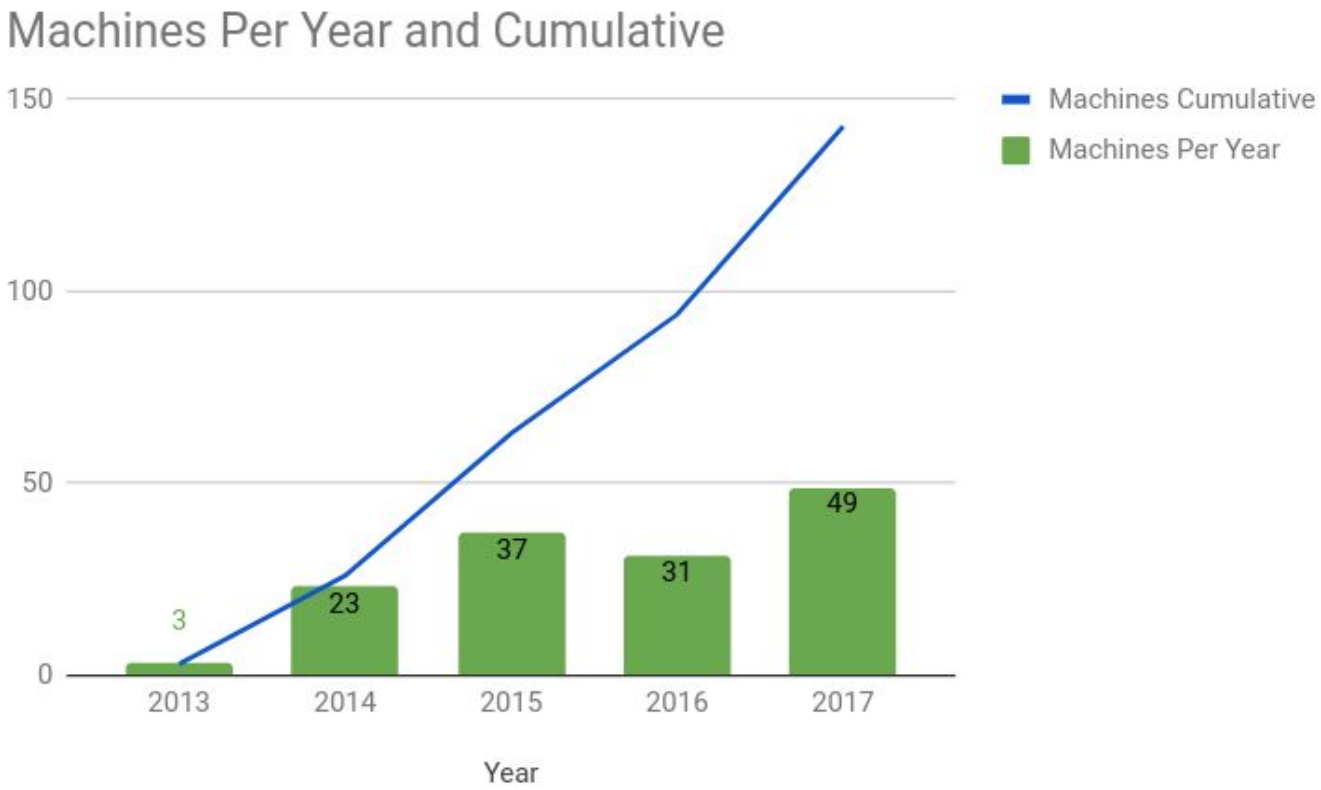
ONIE Project Statistics



ONIE Project Statistics



ONIE Project Statistics

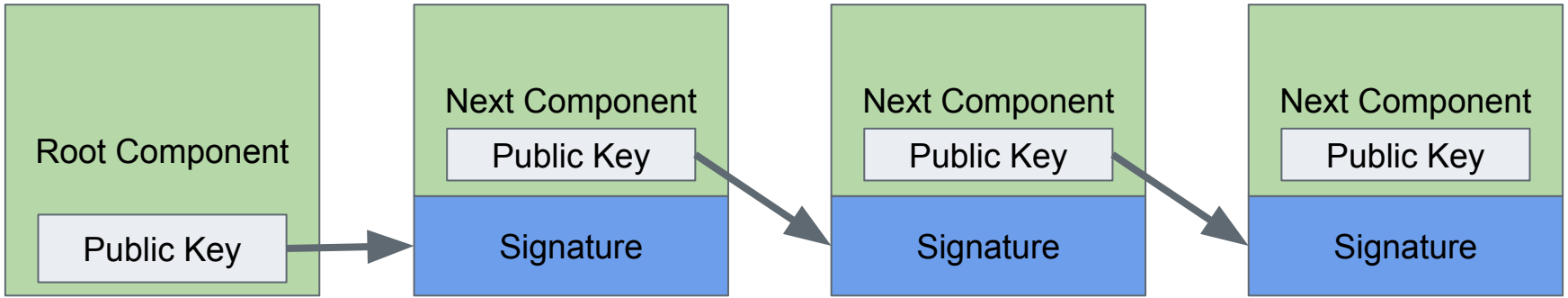


ONIE Project Contributors – Thanks!!

- Cumulus Networks
- Mellanox
- Lenovo
- Celestica
- NXP (Qualcomm)
- Alpha Networks
- Inventec
- Juniper Networks
- Canonical
- Foxconn
- Ingrasys Technology
- Accton / Edgecore
- DELL EMC
- Delta Networks
- Quanta
- Interface Masters
- Centec Networks
- Ciena
- Intel
- Broadcom
- Platina Systems

Securing the ONIE Boot Process

Root of Trust, Chain of Trust

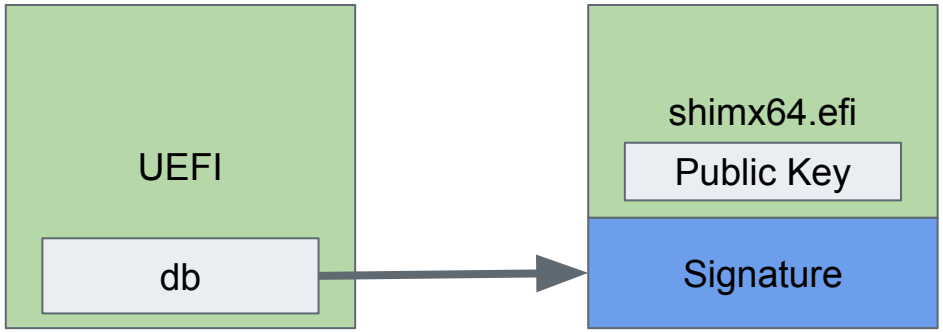


Each component verifies the next component

ONIE Secure Boot on x86_64

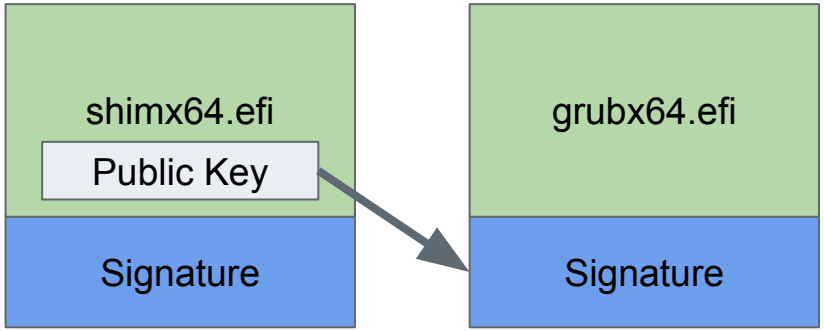
- Unified Extensible Firmware Interface (UEFI) firmware
  - Maintains a database of authorized public keys - **db**
  - Maintains a database of blacklisted (revoked) keys - **dbx**
- shimx64.efi
  - Thin EFI application, signed by private key whose public key is in UEFI db
  - Contains a public key for verifying the next stage
  - Verifies and loads next stage
- MokManager.efi
  - Machine Owner Key (MOK) database
  - Supplementary database of keys for verification
  - Used by shimx64.efi during image verification

ONIE Secure Boot on x86_64, Cont.



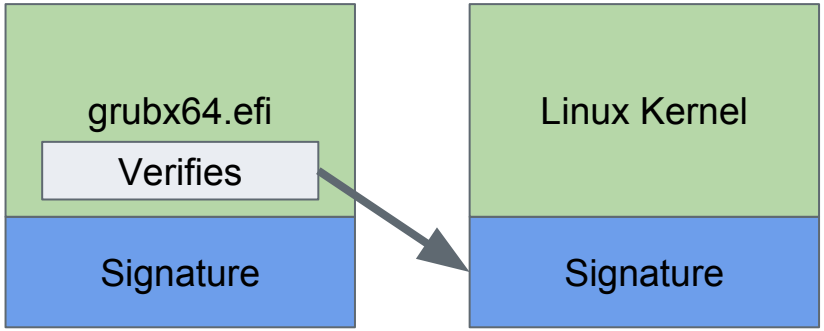
- UEFI verifies shimx64.efi
- shimx64.efi is signed by a private key, whose public key is in the UEFI db

ONIE Secure Boot on x86_64, Cont.



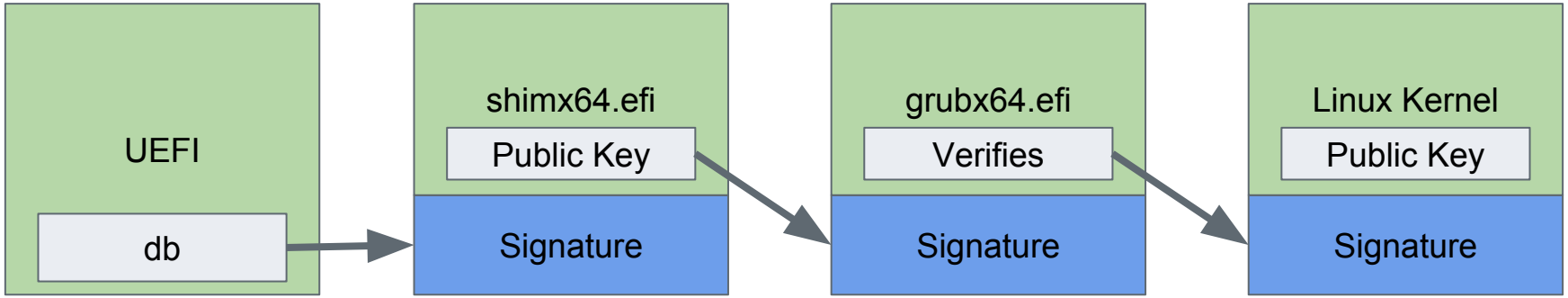
- shimx64.efi verifies grubx64.efi using one of:
  - Internal key
  - UEFI db, dbx
  - MOK db, dbx
- Registers verification interface for grubx64.efi to use

ONIE Secure Boot on x86_64, Cont.



- grubx64.efi verifies Linux kernel
- Uses interface provided by shimx64.efi for verification
  - consults UEFI db, dbx, MOK db, MOK dbx

ONIE Secure Boot on x86_64, All Together



- UEFI verifies shimx64.efi
- shimx64.efi verifies grubx64.efi
- grubx64.efi verifies Linux kernel
- Linux kernel verifies kernel modules, etc.

ONIE Secure Boot Available Today

- Includes Build System Modifications:
  - create shimx64.efi for external signing
  - sign grubx64.efi with ONIE vendor key
  - sign Linux kernel with ONIE vendor key

- For testing see the **`kvm_x86_64`** virtual machine
  - QEMU with OVMF Tiancore UEFI Firmware
  - Pre-made keys and certificates
  - Exercises the entire secure boot flow

Future: Verifying Installers

- Locate an installer via the image discovery waterfall
  - Local file
  - DHCP options
  - etc...
- Verify the signature on the installer before execution
  - UEFI kek, db, dbx
  - MOK db, dbx
  - Continue waterfall if verification fails
- Execute the Installer
  - NOS installer prepares its NOS for Secure Boot

Future: Installer Root of Trust

- NOS Vendors Sign Their Installers
- NOS Vendors Publish Their Public Key Certificate
- End User Enrolls NOS Vendor Cert into MOK database
- ONIE Verifies NOS Vendor Signature on the Installer
- ONIE Runs the Installer

Thank you!

Visit us at cumulusnetworks.com or follow us @cumulusnetworks

Further Reading

- ONIE Secure Boot Proposal
  - Version 2, April 217
  - http://mirror.opencompute.org/onie/docs/ONIESecureBootv2.pdf
- Unified Extensible Firmware Interface Specification
  - Version 2.7a, September 2017, http://www.uefi.org/

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