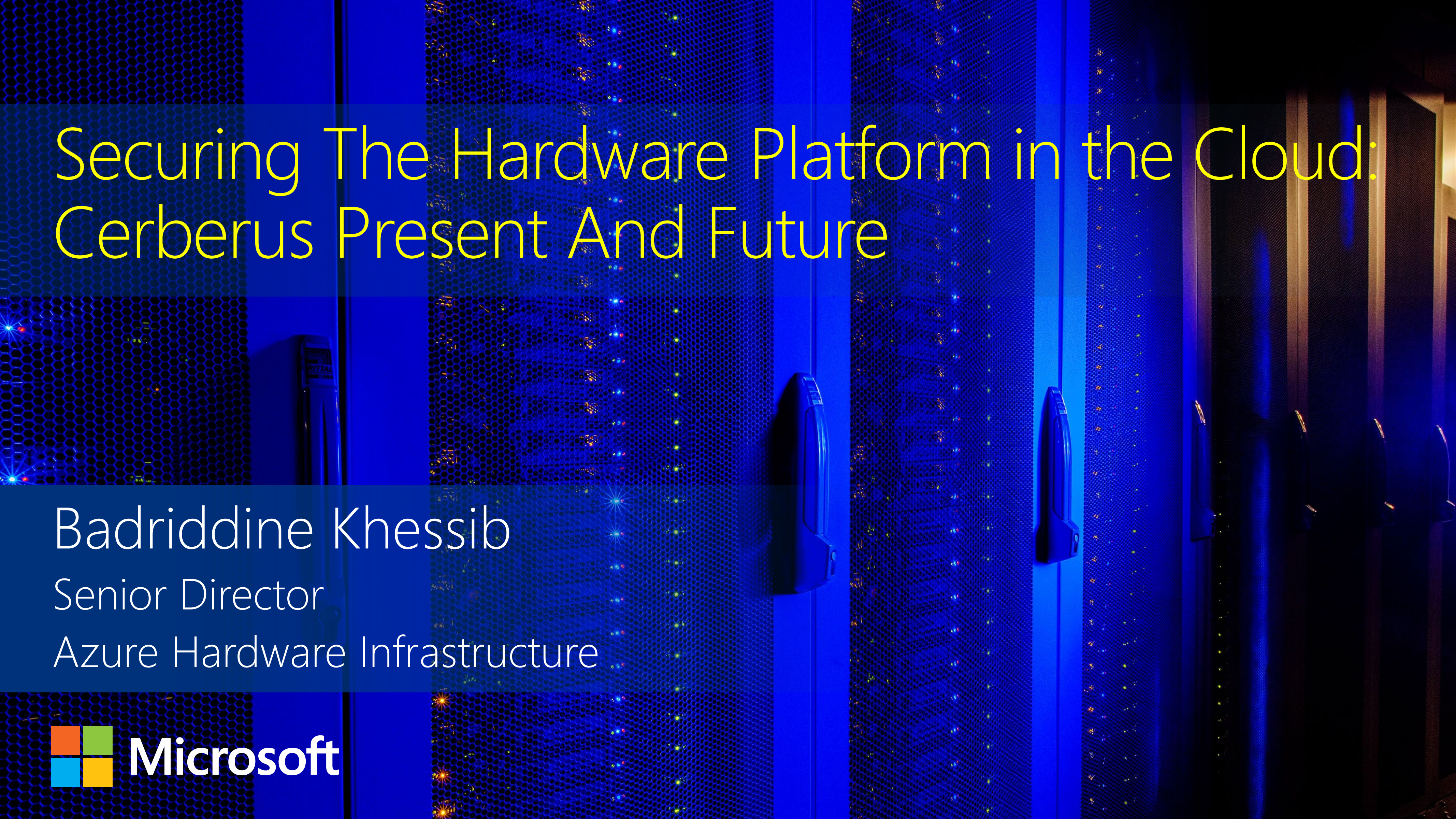


Securing The Hardware Platform in the Cloud: Cerberus Present And Future

Badriddine Khessib

Senior Director

Azure Hardware Infrastructure

Microsoft

Azure Hardware | Project Olympus

100% inhouse design by Microsoft

Contract manufactured by ODMs

Open Source Development Model

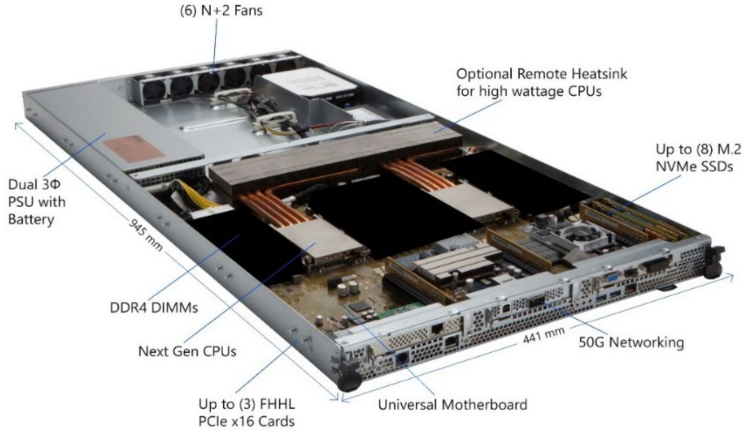
Develop hardware at cloud speed, jointly with community and industry

Industry Ecosystem

Vibrant ecosystem for next generation datacenter hardware

Project Olympus | Design

Open Source Hardware deployed in Azure Datacenters



Microsoft SSD

Flexible and Modular design to handle wide variety of public cloud workloads

Compute

Intel, AMD, ARM64 CPUs

High density GPU expansion for HPC/AI

NVM (DRAM+battery) and 3DXP for low-latency

Storage

High density HDD and Flash expansion

Microsoft custom designed SSDs

Networking

50 Gbps networking

Accelerated VMs using FPGAs

Rethinking system security at cloud-scale

LoJax: First UEFI rootkit found in the wild, courtesy of the Sednit group

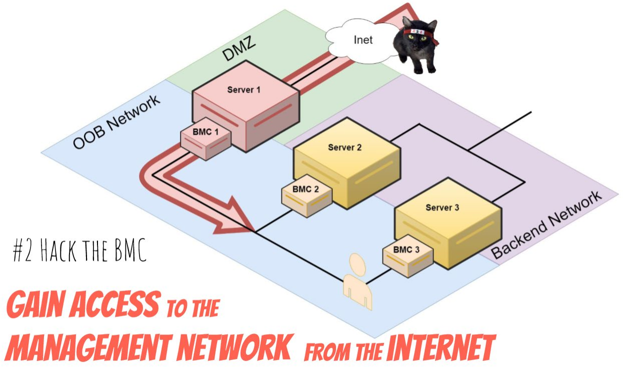
ESET researchers have shown that the Sednit operators used different components of the LoJax malware to target a few government organizations in the Balkans as well as in Central and Eastern Europe

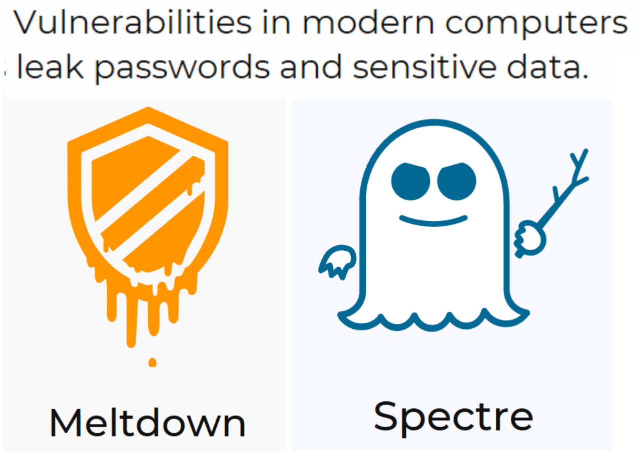
SGX side-channel attacks

Inferring Fine-grained Control Flow Inside SGX Enclaves with Branch Shadowing

Bloomberg Businessweek

The Big Hack: How China Used a Tiny Chip to Infiltrate U.S. Companies





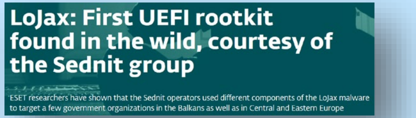
Vulnerabilities in modern computers leak passwords and sensitive data.

Microcode Updates for the USENIX 2017 paper: Reverse Engineering x86 Processor Microcode

OCTOBER 19, 2018 ~ HUCKTECH

Hardware Security Threats

Firmware Vulnerabilities



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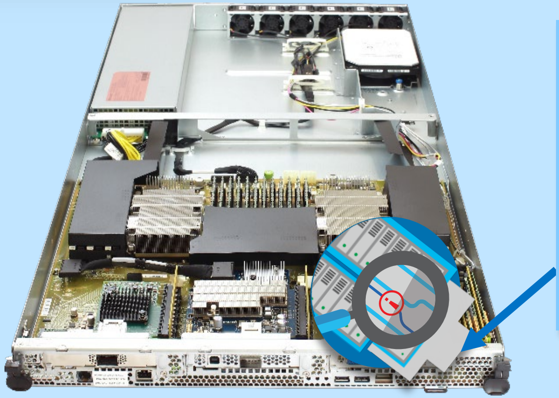


- BIOS
- BMC
- NIC
- FPGA
- SSD
- Option ROMs
- GPU’s
- HBA’s
- Etc…

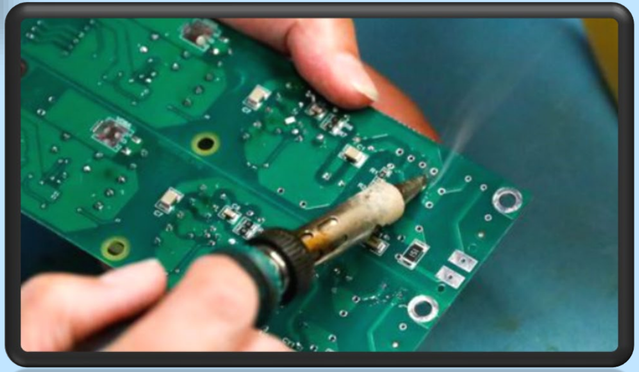
Higher Likelihood, medium sophistication
Can be mitigated with engineering investments

Hardware Tampering

Bloomberg Businessweek

The Big Hack

How China used a tiny chip to infiltrate America’s top companies



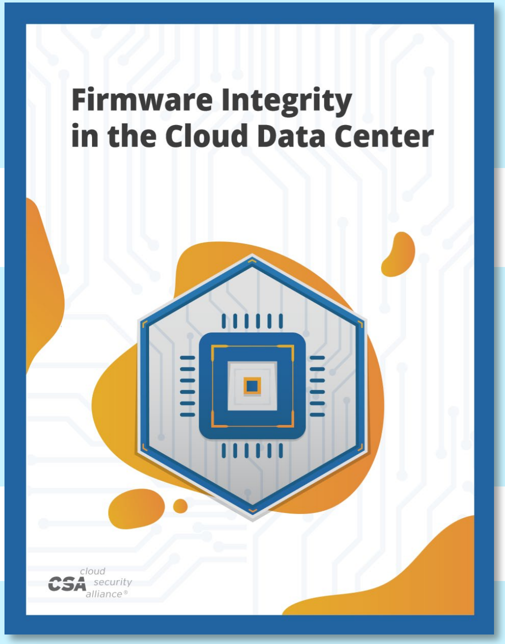
Very sophisticated, nation-state level
Risk mitigated mostly via supply chain controls

NIST 800-193 : Protect, Detect, Recover

Authenticate integrity of all firmware updates
Root(s) of trust & chain(s) of trust across the platform

Detect unauthorized access or corruption
Generate traces & events to help detect anomalies

Restore firmware to state of integrity
Automatic, Automatable and manual recovery scenarios



Firmware Integrity
in the Cloud Data Center

CSA cloud security alliance®

https://downloads.cloudsecurityalliance.org/assets/research/firmware/firmware-integrity-in-the-cloud-data-center.pdf

What is Cerberus

1. A set of **platform requirements**
   - E.g. Power sequencing while establishing trust

2. A set of **requirements** for ensuring **firmware integrity**
   - E.g. how to verify firmware integrity at boot
   - E.g. how to verify firmware signatures during updates

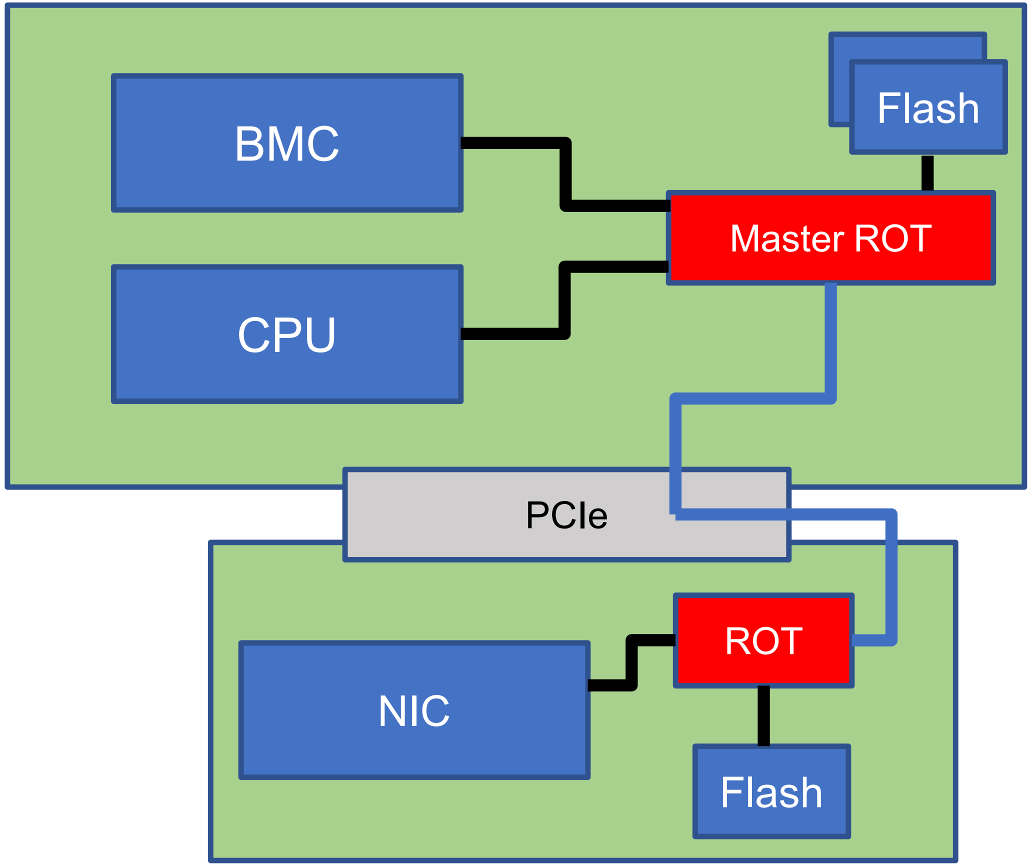
3. A **chip** that helps you implement the requirements

Project Cerberus – Hardware Root of Trust

Hierarchical topology provides scalable attestation

Prevents unauthorized access pre-boot, boot-time, run-time

Platform Secure Boot Policy enforcement



Project Cerberus Controller

Dedicated security microprocessor

- Internal secure SRAM, secure Flash.

Contains crypto acceleration blocks

- SHA / AES / TRNG / PKA

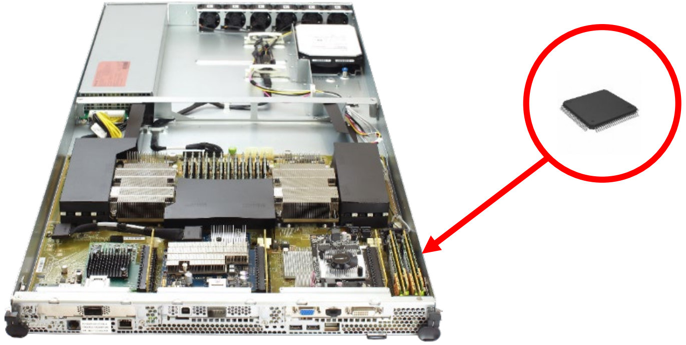
One Time Programmable (OTP) memory for Key persistence

Hardware Physically Unclonable Function (PUF)

Device Identifier Composition Engine (DICE)

SPI/QSPI bit-stream filter interface

Deployed on Project Olympus platforms



Micro Processor	AES-256	TRNG
	PKA	SHA2
Power & Clock Unit POR, OCS, PLL, Clock Out	SRAM PUF	OTP
Flash	ADC	I2C
SRAM	SPIFI	Temp Sensor
ROM	SPI/QSPI Filter	

Why Cerberus Next?

Standardize secure boot for peripheral devices

- Some implementations are not so secure!

Harden against physical intrusion scenarios

- Man-in-the-middle attack

Secure key/measurement storage

Advanced key management

Supply chain security

- DeviceID an ManufacturerID authentication and signing

Cerberus Continued Integration

Silicon Integrated RoT

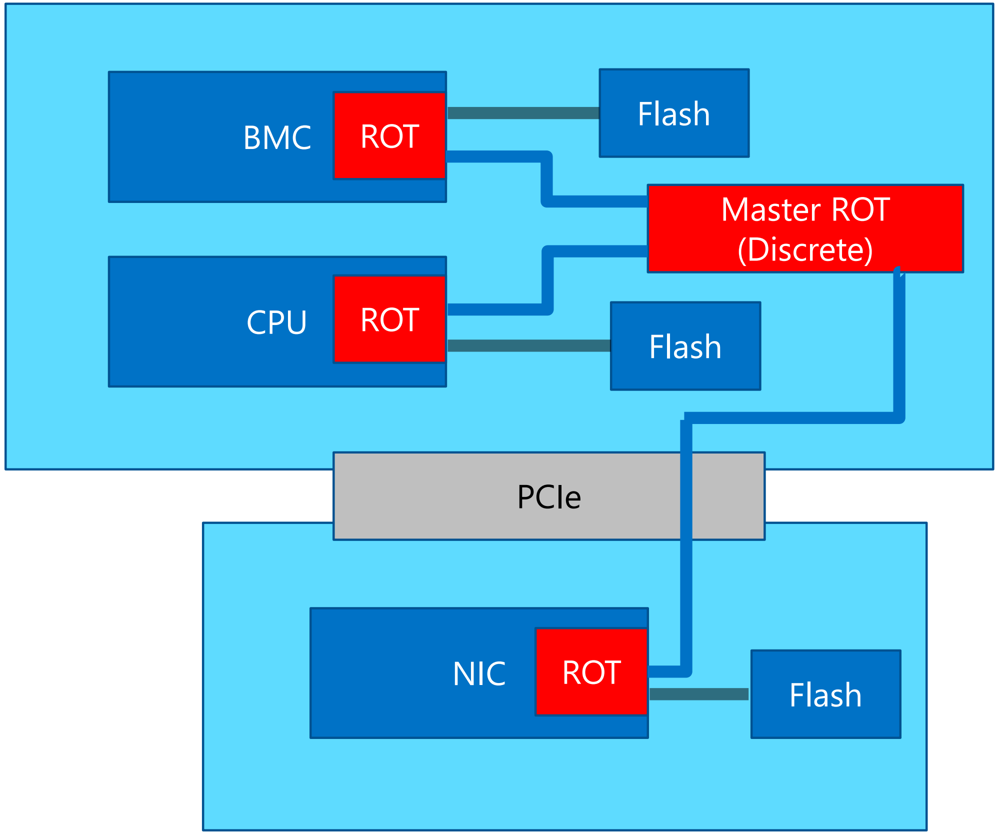
Compatible with Cerberus Discrete

Enhanced Features:

- Secure key/measurement storage
- Advanced key Management

Open Design

- Open Firmware
- Open RTL



Call To Action

Participate in OCP Security Project

- Complete Cerberus V1 Spec
- Start the Cerberus Next Silicon Definition

Visit MS and partner booths to see Cerberus in action

Microsoft

DNN Architecture and Benchmarks

Marc Tremblay
DE Azure CSI

THANK YOU