Flash Memory Summit

Evolution from Secure Boot to Real Time Platform Resiliency

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35 YEARS OF NAND FLASH MEMORY INNOVATION

Evolution from Secure Boot to Real Time Platform Resiliency

Attendees will understand the basics secure boot, how to extend secure boot from a Root-of-Trust (RoT) to a non-secure processor and the basics of attestation, why it is important, and how to implement it in their secure systems

Trust and Attestation

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- Root-of-Trust
  - Secure boot
- Resiliency
  - Protect, detect, recover
  - Real time monitoring
  - NIST 800-193
- What is Attestation?
  - Why is it important?
  - How does attestation work?
    - Dice/RIoT
    - OCP

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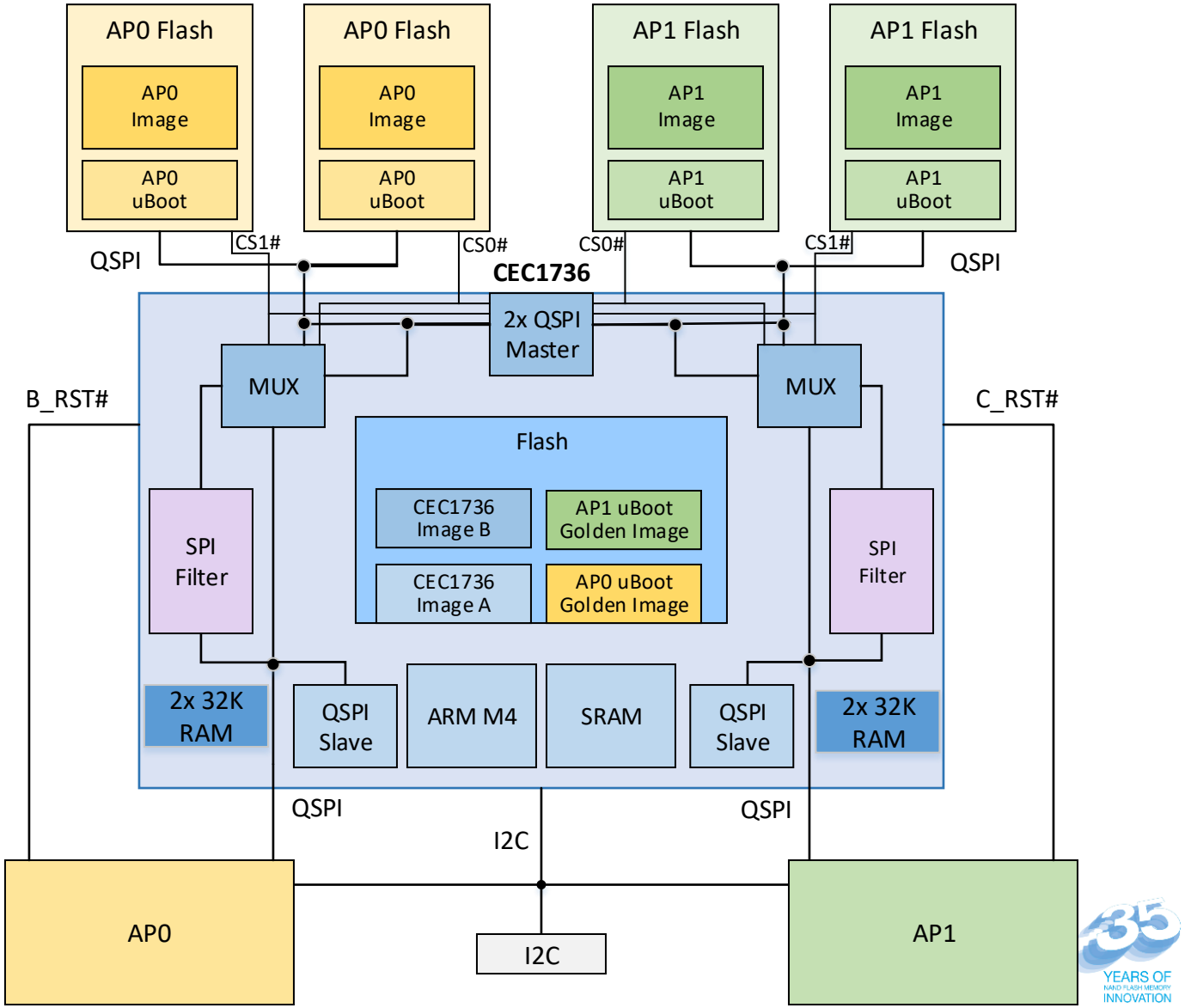
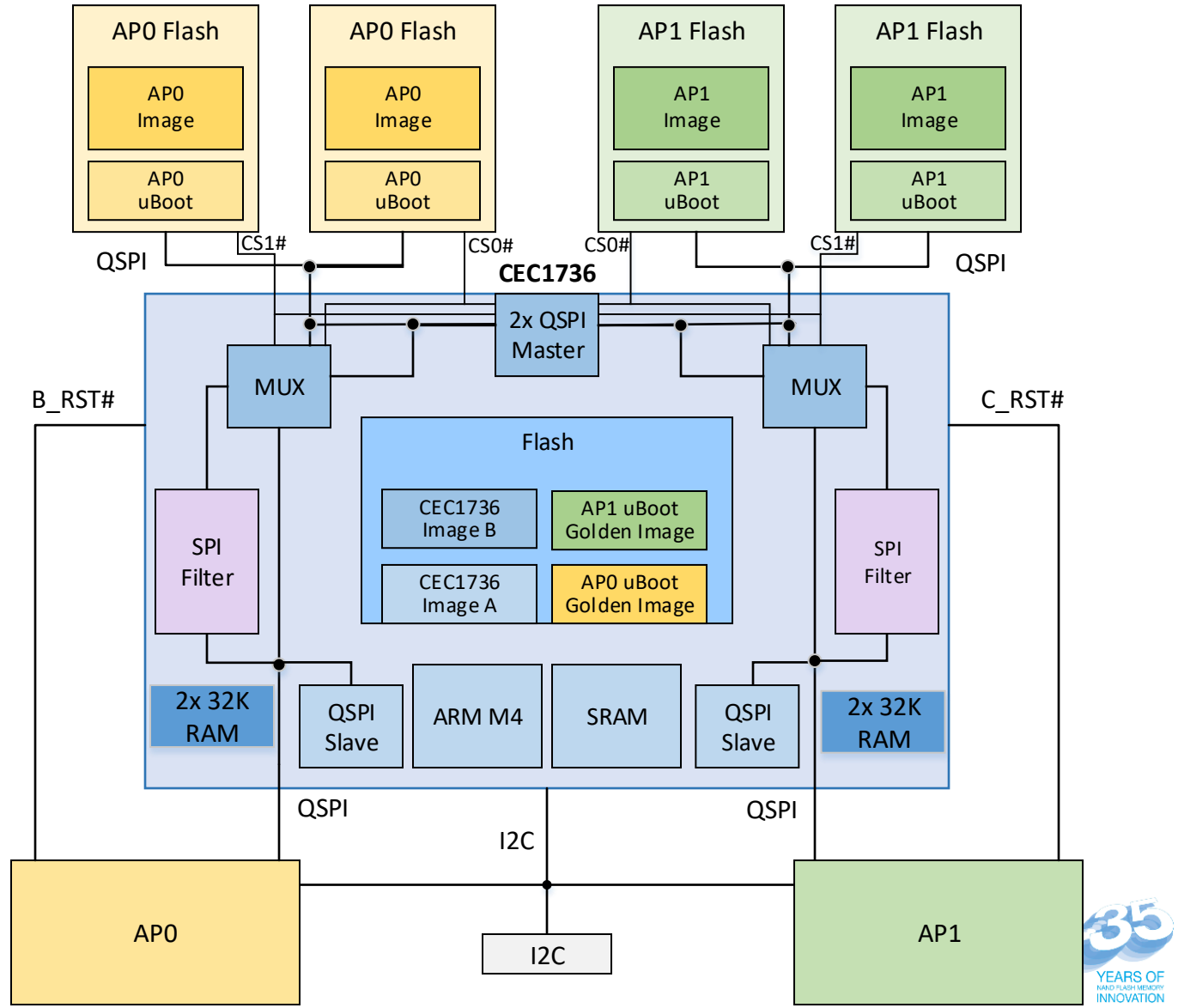
Root-of-Trust

- Secure Boot
  - Secure immutable code
  - All mutable code authenticated before use
  - Strong authentication (CNSA)
    - SHA2 – 384 minimum
    - ECC384 minimum
- Resiliency
  - Protect, detect, recover
  - Authenticate before use
  - Use backup image



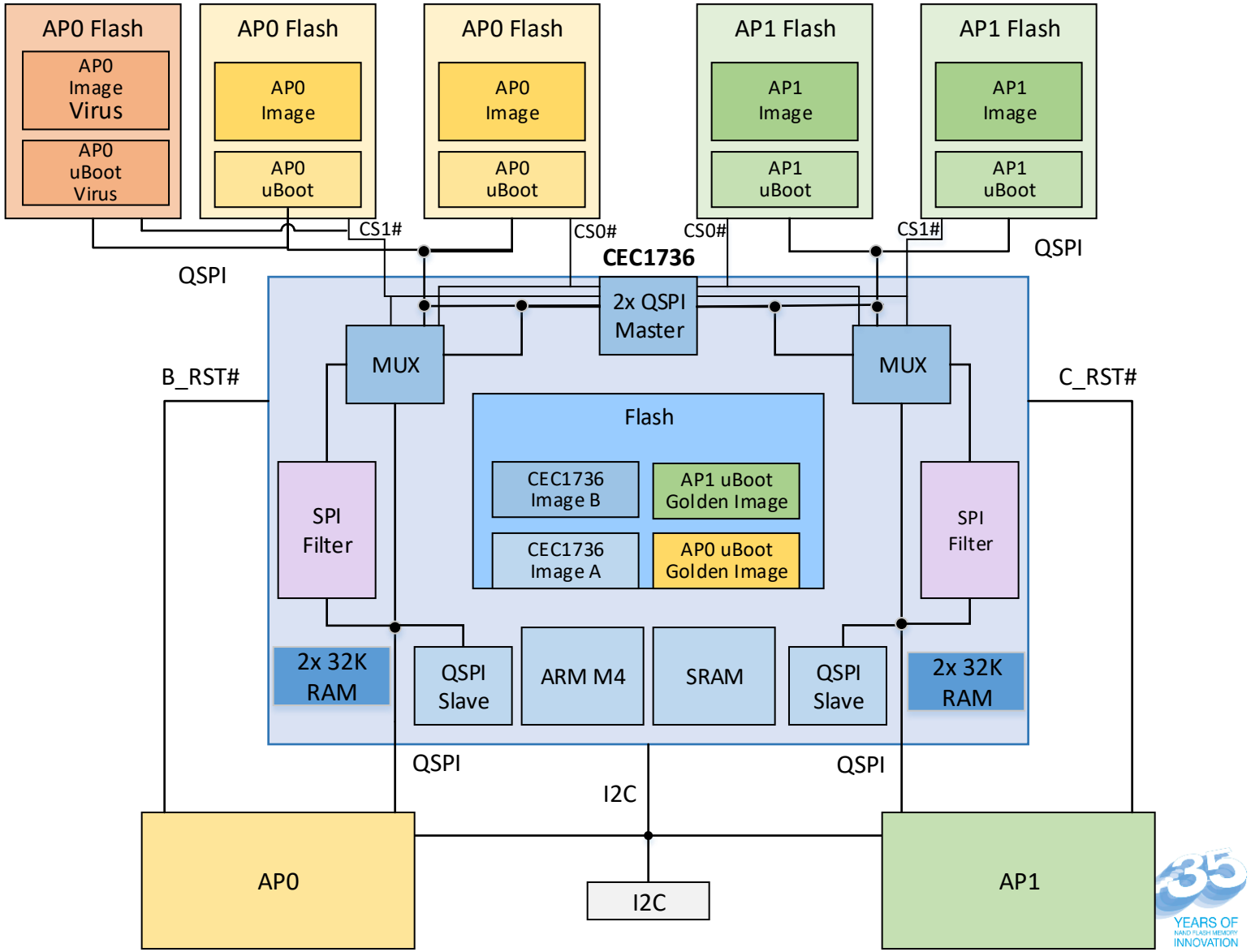
Extend Root-of-Trust

- Protect Application Processor (AP)
- Resiliency
  - Protect, detect, recover
  - Protect the APx code images
  - Authenticate before use
  - Time-of-Check (TOC)
  - Authenticate all images in APx FLASH
  - Generate hash tables



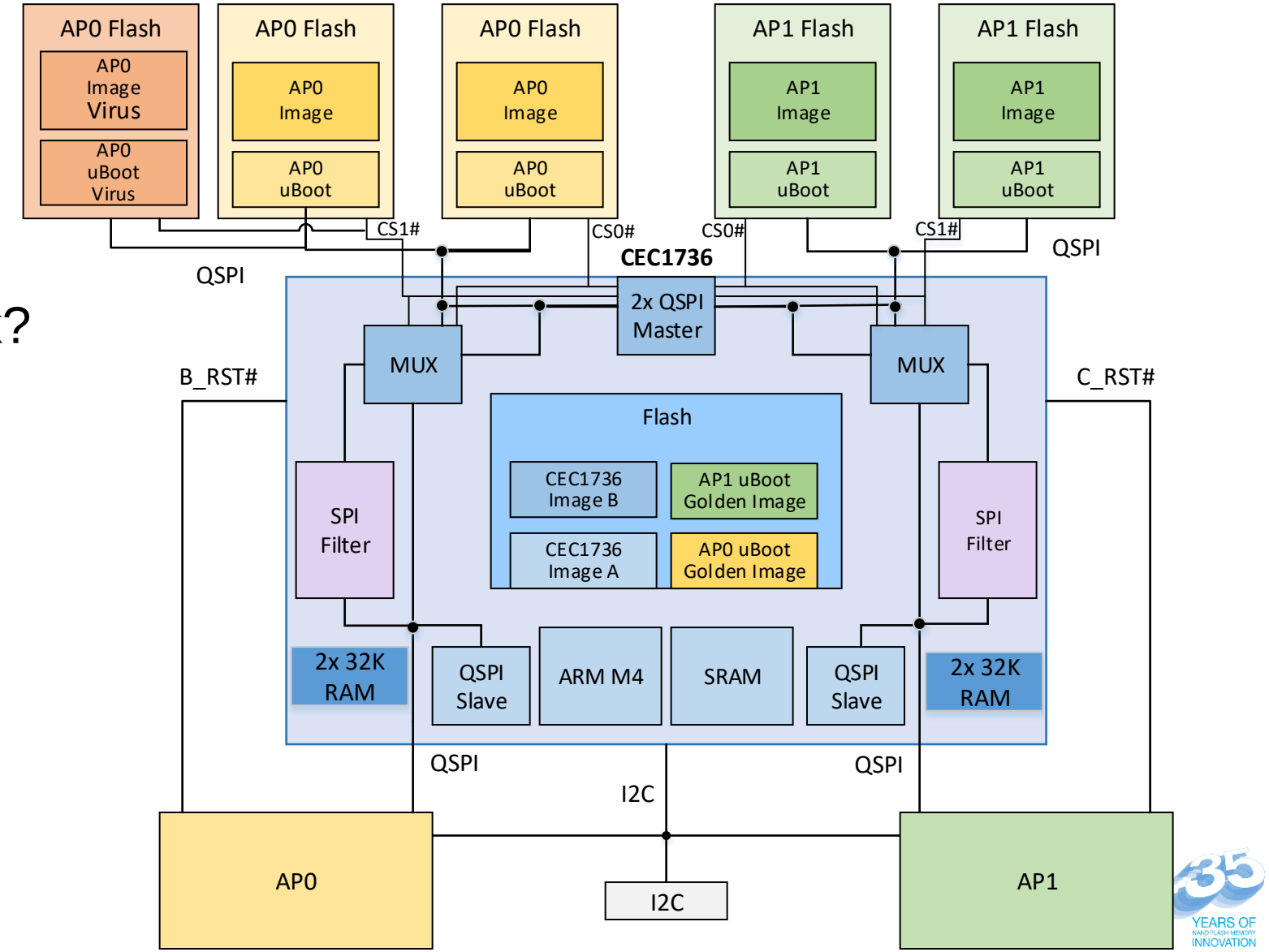
Real Time Monitoring

- Real Time Monitoring
  - Reauthenticate when loaded by the application processor (AP0/AP1)
  - Time-of-Use (TOU)
  - Monitor traffic to/from SPI
    - Read only
    - Read/write
    - No access



Trust and Attestation

- What is Attestation?
  - Why is it important?
  - How does Attestation work?
    - TCG - Dice/RIoT
    - OCP

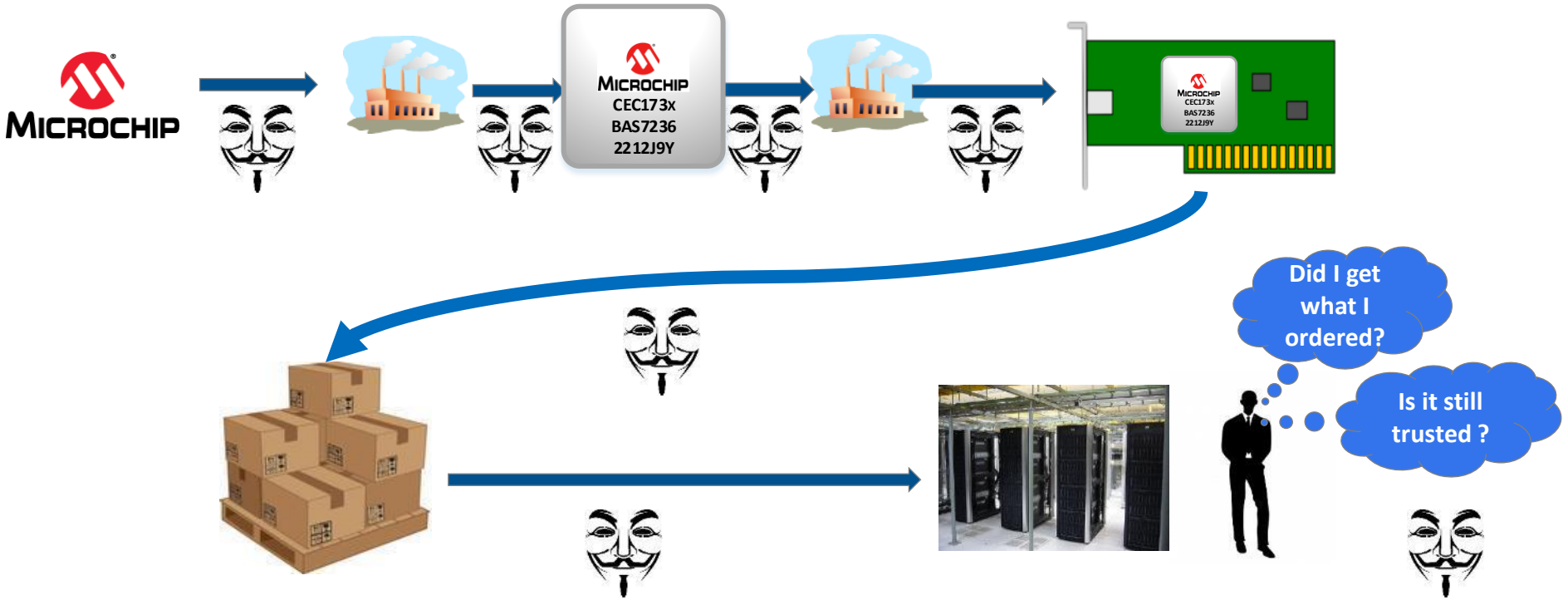


What is Device Attestation?

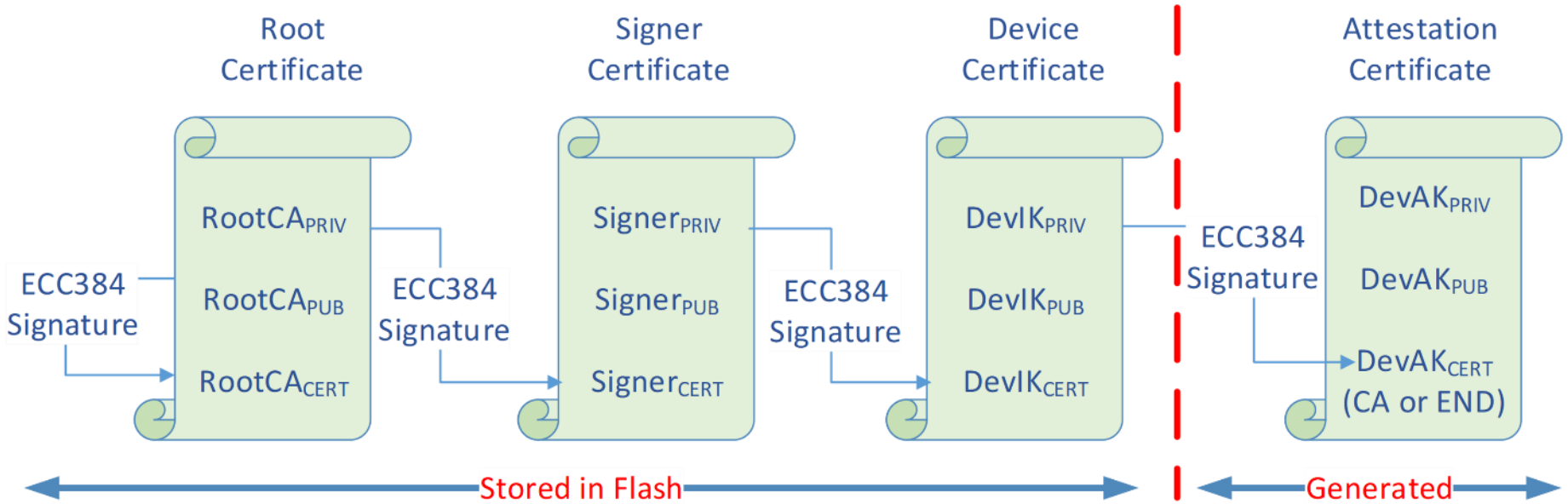
Upon request, a device must be able to provide credentials that provide clear evidence of the device's identity and the device's state of operation

Why Do We Need Attestation?

- Supply Chain Integrity
- Runtime System Integrity
- Owner Integrity



Manufacturing Certificate Chain



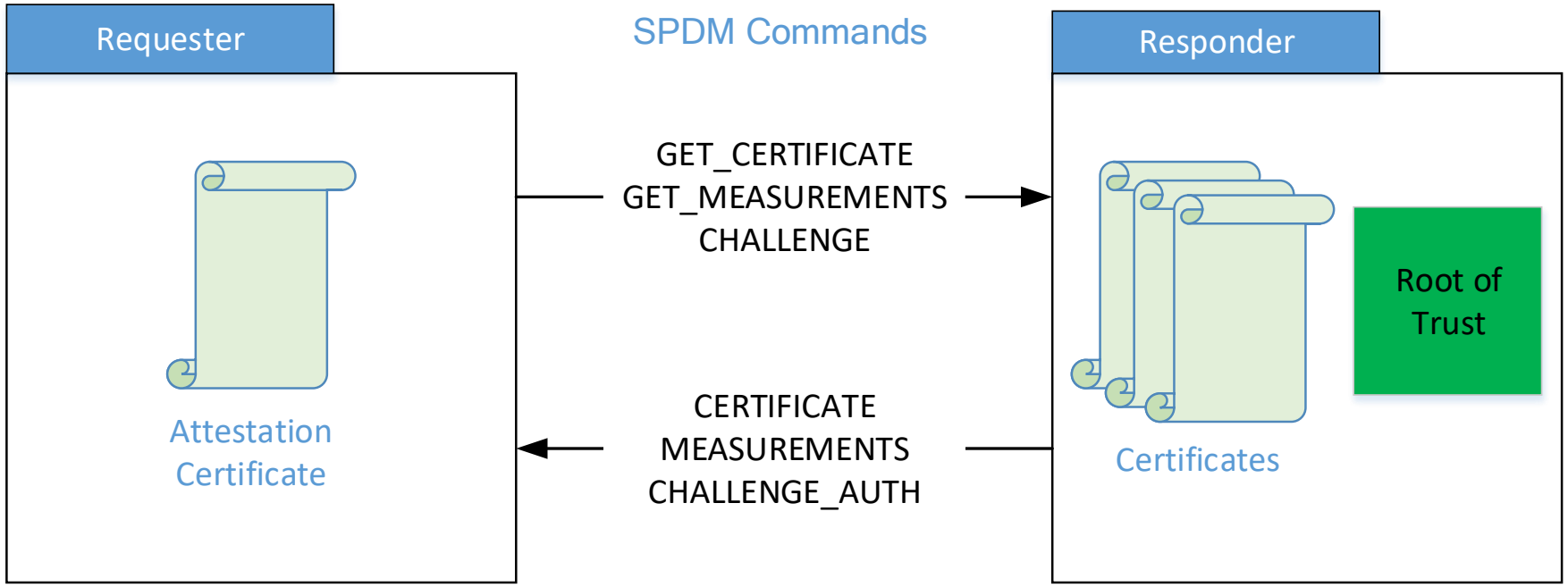
- Root certificate is unique per manufacturer or Certificate of Authority (CA)
- Signer Private Key (Signer$_{PRIV}$) is unique per customer (e.g., OEM)
  - Customer submits a Certificate Signing Request (CSR)
- Device Identity Key (DevIK$_{PRIV}$) is unique per device
- Manufacturer provisions the root, signer and DevIK certificates during manufacturing
- Device code (e.g., Boot ROM) generates and signs Device Attestation (DevAK) certificate
- Customer verifies certificate chain when product is received

Attestation Standards

Exchanging Device Attestation Information

- DMTF - Distributed Management Task Force
  - Security Protocol and Data Model (SPDM)
  - SPDM defines message formats and sequences for exchanging device identity and attestation certificates, measurements and challenge response commands

Security Protocol Data Model (SPDM)



- SPDM defines message formats and sequences for exchanging attestation information between devices

Attestation Standards

Generating Device Identity and Attestation Information

- TCG – Trusted Computing Group
  - Implicit Identity Based Device Attestation v1.0 specification
  - Describes the Device Identifier Composition Engine (DICE) use case that provides hardware-based Device Identity and Device Attestation
- OCP - Open Compute Project
  - Attestation of System Components v1.0 Requirements and Recommendations white paper
  - Describes attestation operations that produce information about ownership, system configuration and system components

TCG and OCP Attestation Options

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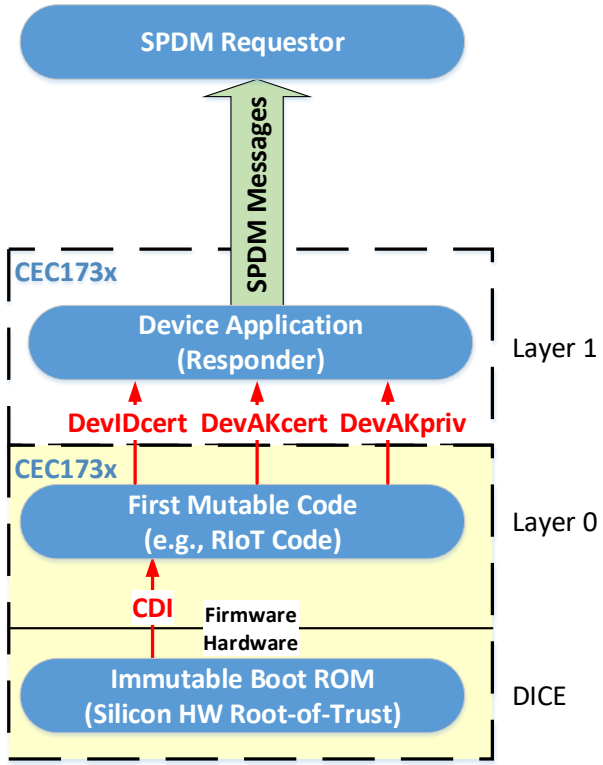
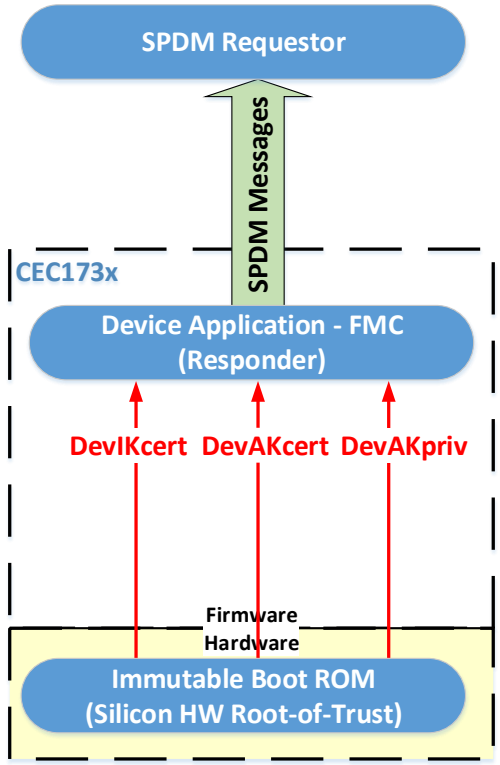
Device Identity

TCG DICE



- DICE Compound Device Identifier (CDI) is generated as a fx{UDS, Hash(FMC)}
- DeviceID key and alias key are generated as a fx{CDI}

OCP



- DevIK is generated on board by KDF or injected during provisioning - E.g., fx{UDS}
- DevAK is generated on board by KDF or by DevIK private key (optionally DICE compliant) – E.g., fx{UDS, Hash(FMC), hardware state, and owner}

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References

- National Institute of Standards and Technology, “Platform Firmware Resiliency Guidelines”, NIST SP 800-193, May 2018
- DMTF Security Protocol and Data Model (SPDM), DSP0274, Version 1.1.0
  - https://www.dmtf.org/sites/default/files/standards/documents/DSP0274_1.1.0.pdf
- OCP Attestation of System Components v1.0 Requirements and Recommendations
  - https://www.opencompute.org/documents/attestation-v1-0-20201104-pdf
- TCG: “Implicit Identity Based Device Attestation,” Version 1.0, Revision 0.93. March 5, 2018
  - https://trustedcomputinggroup.org/wp-content/uploads/TCG-DICE-Arch-Implicit-Identity-Based-Device-Attestation-v1-rev93.pdf

Questions?

- Come see our demo in Booth #613
- www.microchip.com/cec1736

Thank You

