End-to-End Infrastucture Security

Security Protocol and Data Model

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Disclaimer

- The information in this presentation represents a snapshot of work in progress within the DMTF.
- This information is subject to change without notice. The standard specifications remain the normative reference for all information.
- For additional information, see the DMTF website.

- This information is a summary of the information that will appear in the specifications. See the specifications for further details.

Cypher Security Report

- December 19, 2013
  - Target retail store data breach cost $252 million and Target's CEO his job.
- Mid-2016
  - Yahoo user accounts were hacked, cut $350 million from Verizon's Yahoo acquisition price.
- August 16, 2017
  - Maersk reported that the NotPetya cyberattack could cost their business $300 million in lost revenue
- October 4, 2018
  - Bloomberg report on a physical attack on a particular server vendor's platform.
  - Ultimately, no evidence was found but experts have re-created the alleged scenario.
- January 22, 2019
  - U.S. Cybersecurity and Infrastructure Security Agency issued an emergency directive to mitigate DNS infrastructure

Existing Security Solutions

- Two Categories
  - Inside the Platform
  - Remote-based Attack

- Inside The Platform
  - Security solutions that protect data inside the platform.
  - Examples:
    - Secure Boot
    - Secure Storage (of direct attach, on-board storage such as SPI Flash)

- Remote-based Attack
  - Security solutions that protect data that is being remotely accessed (often over the network)
  - Examples:
    - SSL (deprecated) / TLS
    - IPSec
    - Anti-Virus/Malware/Spyware
    - Firewalls

Missing Security Solutions

- Infrastructure
  - Mainly, Building Trust from End-to-End
  - Examples
    - Chip to Chip
      - In-the-box Wires (e.g. PCIe, I2C, I3C, SPI, USB, CAN, etc…)
    - Building Trusted Channel between Components
    - The Physical Aspect of an Infrastructure.
    - Platforms
      - Blades/Racks/Desktops
      - Mobile
      - IoT
    - Fabric-based Platforms
      - Remote Resources (outside traditional management domain)

Building Security in Infrastructure

- Need to start from the ground up. The ground builds the infrastructure.

- What is the ground?
  - The hardware that builds the infrastructure
  - Specifically:
    - Communicating Devices (e.g. network controllers, GPUs, video devices, storage devices, etc…)
    - Non-communicating components (e.g. power supplies, fans, etc…)
    - The Interconnects (i.e. the physical wires/buses)

- Why?
  - They are all subject to attack.
    - Threats include supply-chain attacks.
  - Exploitation is shifting from software to hardware/firmware.
  - If there is gain to be had, then it will be exploited.

Security Protocol and Data Model 1.0

- How?
  - Two Major Features
    - Authentication
    - Attestation
  - Capable of being referenced by other standards.
    - DMTF is initially mapping to MCTP.
    - Alliance Partners are considering mapping SPDM to their standards.

HDBaseT™
PCI SIG
mipi alliance
GEN Z™
OPEN Compute Project®

Security Protocol and Data Model 1.0

- Other Important Features:
  - Leveraged and Extended USB authentication.
  - Extensible
  - Negotiable Communication Details (e.g. version, algorithms, capabilities)
  - Flexible for Implementors
  - Transport Agnostic: Other Standards can leverage this.
  - Platform-Independent

SPDM 1.0 – Authentication

- Allows a platform to verify the identity of the attached component.
- Redfish
  - Identity is also exposed in Redfish.
- Enables a platform to determine what to do if the identity of a component did not verify correctly.

- Cryptography
  - Leverage X.509v3 certificates

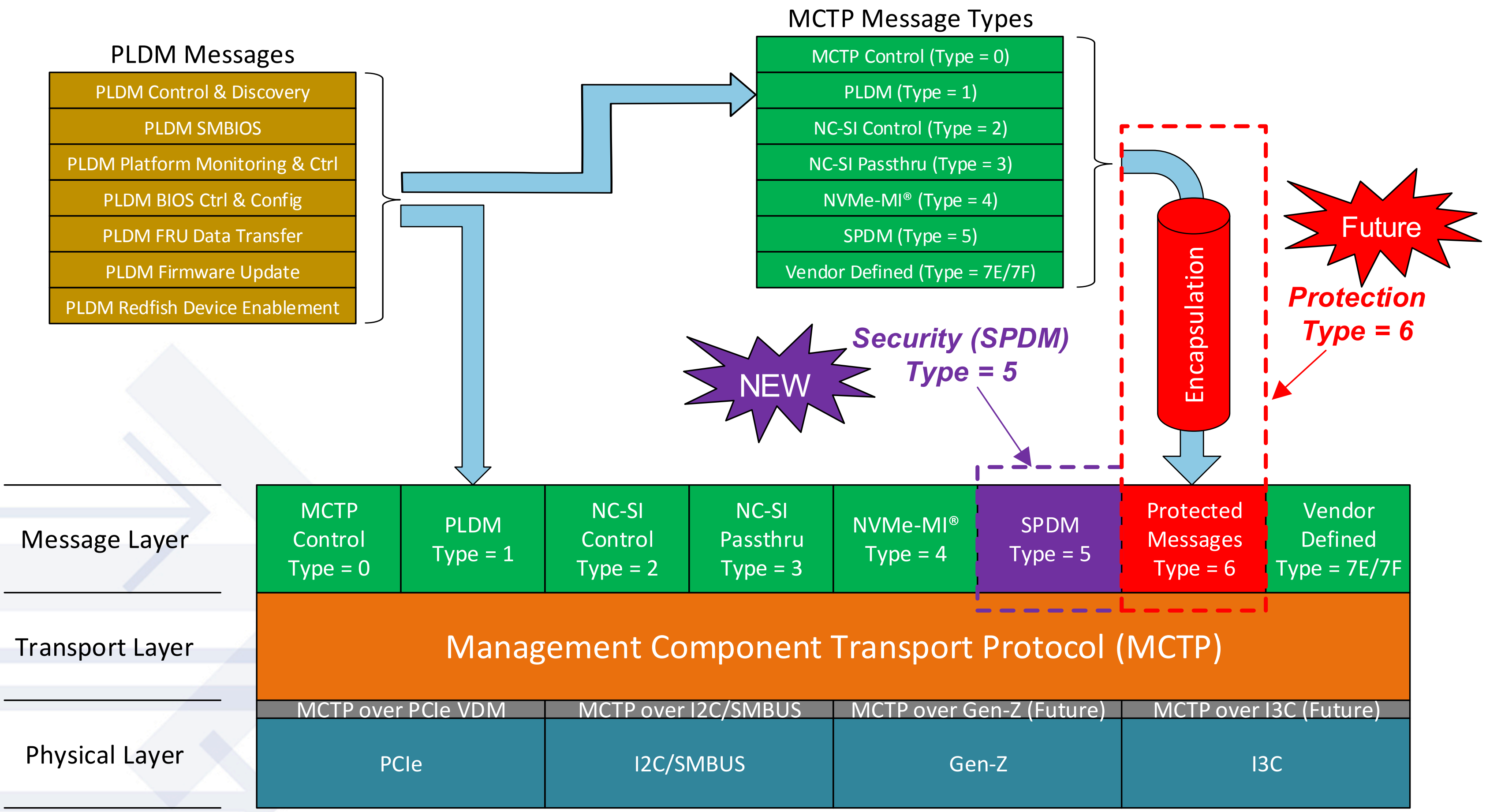
SPDM 1.0 – Attestation

- Allows a platform to verify the state of the component.
- Multiple measurements allow platforms to verify various configurations of the component.

- Measurements:
  - Hashes of various configurations of a component

- Examples of Measurement Coverage (Implementation Choices):
  - Immutable Code
  - Mutable Code
  - Boot Stages
  - Configuration Data
  - State Variables

PMCI MCTP Security Proposal – Diagram View



PLDM Messages

- PLDM Control & Discovery
- PLDM SMBIOS
- PLDM Platform Monitoring & Ctrl
- PLDM BIOS Ctrl & Config
- PLDM FRU Data Transfer
- PLDM Firmware Update
- PLDM Redfish Device Enablement

MCTP Message Types

- MCTP Control (Type = 0)
- PLDM (Type = 1)
- NC-SI Control (Type = 2)
- NC-SI Passthru (Type = 3)
- NVMe-MI® (Type = 4)
- SPDM (Type = 5)
- Vendor Defined (Type = 7E/7F)

Encapsulation

Future

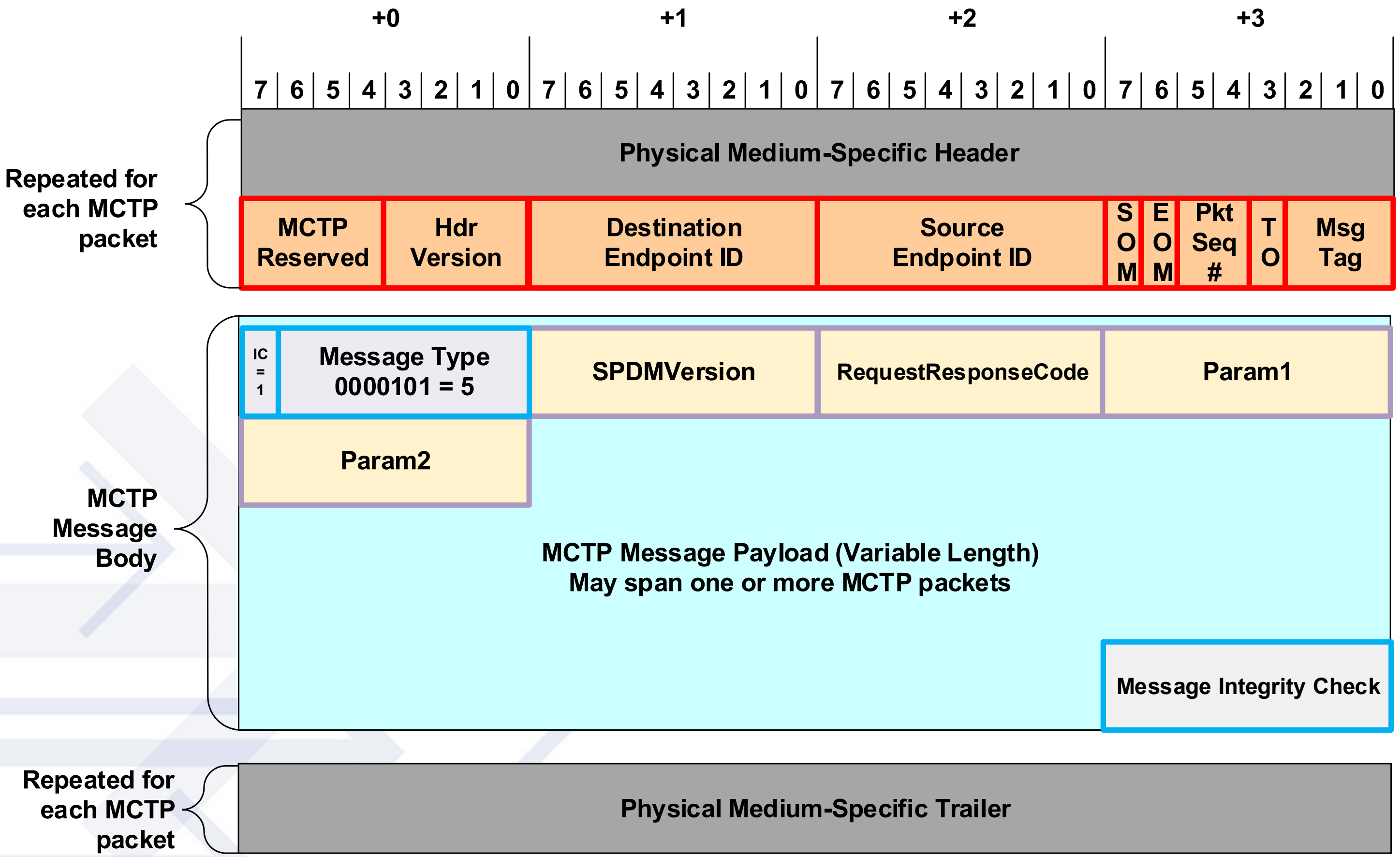
Protection Type = 6

NEW

Security (SPDM) Type = 5

Message Layer	MCTP Control Type = 0	PLDM Type = 1	NC-SI Control Type = 2	NC-SI Passthru Type = 3	NVMe-MI® Type = 4	SPDM Type = 5	Protected Messages Type = 6	Vendor Defined Type = 7E/7F
Transport Layer	Management Component Transport Protocol (MCTP)							
	MCTP over PCIe VDM		MCTP over I2C/SMBUS		MCTP over Gen-Z (Future)		MCTP over I3C (Future)	
Physical Layer	PCIe		I2C/SMBUS		Gen-Z		I3C	

MCTP Message Type 5 (Security Commands) Format



+0 +1 +2 +3

7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0

Repeated for each MCTP packet

Physical Medium-Specific Header

MCTP Reserved | Hdr Version | Destination Endpoint ID | Source Endpoint ID | SOM | EOM | Pkt Seq # | TO | Msg Tag

MCTP Message Body

IC = 1 | Message Type 0000101 = 5 | SPDMVersion | RequestResponseCode | Param1

Param2

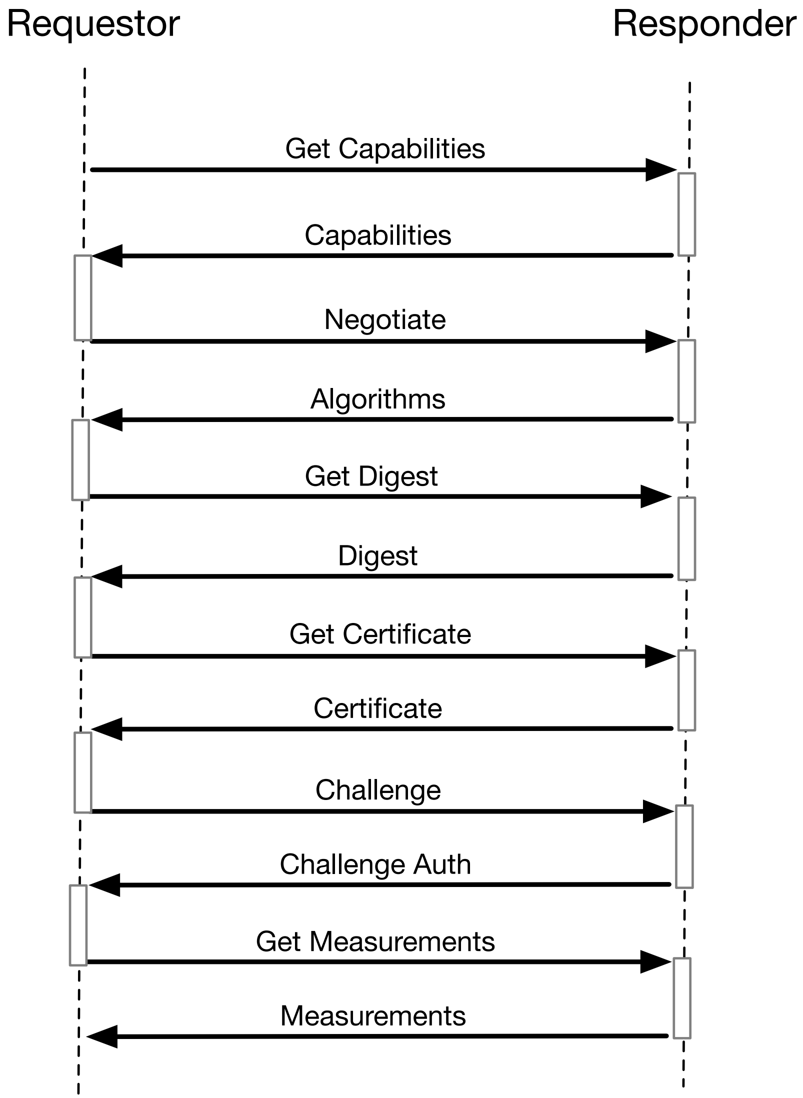
MCTP Message Payload (Variable Length)
May span one or more MCTP packets

Message Integrity Check

Repeated for each MCTP packet

Physical Medium-Specific Trailer

SPDM 1.0 - Ladder



Future Work

- Protection: Encryption / Integrity
- Measurement log
- Set certificate command
- Measurement manifest (Local attestation)

Summary

- SPDM 1.0
  - Provides Authentication and Attestation

- In general, SPDM
  - Provides building blocks and tools to secure the Infrastructure.

Call to Action

- Would like the Industry to use SPDM as a security protocol for their standard(s).
- Would like the Industry to work with DMTF (PMCI Security TF) to help extend SPDM for their needs.
  - Provide feedback via DMTF Portal.
  - Help us with future specification development.

References

- DMTF
  - Main Website: https://www.dmtf.org/
  - PMCI Workgroup: https://www.dmtf.org/standards/pmci
    - Updated News for SPDM
    - Security Protocol and Data Model (DSP 274)
    - SPDM MCTP Binding (DSP 275)
    - Upcoming White Paper
  - Redfish:
    - Workgroup: https://www.dmtf.org/standards/redfish
    - Developer's Hub : https://www.dmtf.org/standards/redfish

References

- News Links:
  - https://www.reuters.com/article/us-target-breach/target-cyber-breach-hits-40-million-payment-cards-at-holiday-peak-idUSBRE9BH1GX20131219Add link to dmtf.org
  - https://www.nytimes.com/2016/12/14/technology/yahoo-hack.html
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