SPDM 1.3 and Beyond

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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.
Component Threat Vectors

- Attack on fabrics by hostile devices
- Snooping via probes
- Substitution of existing devices
- Hostile device insertion
- Supply chain compromise
- Compromise of platform firmware or configuration
- Compromise of device firmware

Any component is a potential attack vector

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SPDM’s Overall Goals

• All SPDM features fall into at least one of following main goals:
  • Device Attestation and Authentication  
    • The ability to attest various aspects of a device such as firmware integrity and device identity
  • Secure Communication over any Transport  
    • Provide the ability to secure communication of any data or management traffic over any transport  
    • Work with industry partners to ensure data in-flight is secure for all parts of the infrastructure (e.g. storage, network fabrics, etc.)
Alliance Partners and Adopters

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SPDM Feature Summary (2023)

- **Version 1.0:**
  - Measurement Support
  - Device Attestation and Authentication

- **Version 1.1:**
  - Secure Session
    - Public Key Exchange
    - Symmetric Key Exchange
  - Mutual Authentication

- **Version 1.2:**
  - Supports installation of certificates
  - Allows for alias certificates derived from device certificates
  - Send and receive large SPDM messages (chunks)
  - Added SM2, SM3, SM4 algorithms to supported list
  - New OIDs added
  - Deprecated basic mutual authentication in CHALLENGE and CHALLENGE_AUTH
SPDM 1.3 Features

- Event Notification Mechanism
- Multi Key Support
- New Measurements
- Measurement Extension Log
- Structured Manifest format
- End Point Info
Event Mechanism

- Subscribed events
  - Interested Event Types
- All event notifications in a Secure Session
- Event Types could be extended by other standards bodies
- Can discovery supported event types and subscribe
- Notifications are ACK’d
Multi Key Support

- Previous versions of SPDM only allowed one key pair per negotiated asymmetric algorithm
- Ability to use more than one key pair for a negotiated asymmetric algorithm
  - Up to 8 key pairs supported per asymmetric algorithm
- Every key pair could be dedicated for use case, like different key pairs for CHALLENGE and GET_MEASUREMENTS signature generations
- Requester is allowed to associate each key pair with an individual device certificate to enable one or more use cases
  - Multi Key Support enables additional use cases such as certificate provisioning in production or customer environments
  - Improved security posture
- Key pairs are identified by a unique KeyPairID
Generic Certificates Support

• What is a Generic Certificate or Certificate chain?
  • A Certificate or Certificate Chain that could not be qualified as a Device Certificate nor Alias Certificate

• New Feature
  • Generic Certificate model is introduced to support Multiple Asymmetric Keys use cases
  • Generic Certificate Model is the most flexible (or least restrictive) of the certificate models
  • Generic Certificate Model applies to certificates in slots greater than 0.
    • A Device or Alias Certificate is required in slot 0.

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New Measurements

• `NewMeasurementRequested` field is introduced in the request attributes of the GET_MEASUREMENTS request.
  • If Responder has any changes affecting measurements that are requested by Requester but not yet applied (for example, pending changes due to a firmware update), then these new measurement values should be returned instead of current measurements (if requested using the value in the field above)
  • If there are no pending changes, then current measurements are returned regardless of the value in `NewMeasurementRequested` field
• This enables the Requester to prepare as well as to apply policy as per the system
Measurement Extension Log (MEL) and Hash-Extended Measurements (HEM)

- Responder may support reporting of measurements thru an “extend” scheme
  - Initialize $\text{HEM} = \text{HashSize}$ bytes of 0s
  - For each extend operation, perform $\text{HEM} = \text{hash(Concatenate(HEM, DataToExtend))}$ for all data elements to extend
- The MEL is the collection of $\text{DataToExtend}$
  - Could include configuration measurements, firmware measurements, version number, etc.
  - The MEL may be preserved across resets
- An example of such a scheme is the Platform Configuration Register "extend" function in Trusted Platform Modules.
- There is a new MeasurementValueType 0x08 introduced for HEM
MEL and HEM

Requester

Verify signature of the Responder

GET_MEASUREMENTS
(Param2=an index of type 08h;
SignatureRequested)

MEASUREMENTS
(hash-extended measurement)

GET_MEASUREMENT_EXTENSION_LOG

MEASUREMENT_EXTENSION_LOG

Responder

Construct MEL during boot and runtime.

Extend MEL entries to hash-extended measurement as entries are added to MEL.

Sign hash-extended measurement with private key

Replicate extend operations and verify MEL against hash-extended measurement

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Structured Manifest format for a measurement block

• Data structure that describes the contents of other indices or contains measurements itself.

• Either Free Format or Structured
  • Free Format is implementation specific
  • Structured Format provides a Standards body or vendor-defined header, and manifest data in the format defined by the Standards body or vendor
The GET_ENDPOINT_INFO request message retrieves general information from an endpoint.

- The SubCode parameter is used to differentiate between operations.
- The message supports a signature.

Currently only one Subcode is defined: **DeviceClassIdentifier**

- The **DeviceClassIdentifier** response returns information that can be used to identify the class of device for the Responder in question.
  - For instance, DeviceClassIdentifier could contain PCI Vendor ID and Device ID fields.
And Beyond.....

FEATURES UNDER DEVELOPMENT BY THE SPDM WG
SPDM over TCP/IP Binding

- Adds a binding spec (DSP0287) to support SPDM over TCP/IP connections
  - Target is Ethernet-based fabrics and use in conjunction with RDMA
  - Provides standardized way to establish the security of a TCP/IP fabric before opening a memory window
  - Reuses existing SPDM protocol (DSP0274)

- Sample use cases
  - Provisioning certificates from a CA server to a device
  - Using a remote Attester to offload SPDM attestation from the local PA-RoT
  - Allowing an SPDM Requester to retrieve reference measurements
  - Secure data transfer between a device and server that is lighter than HTTP/TLS
SPDM over Storage Binding

- Adds a binding spec (DSP0286) to support SPDM over storage transports
  - Supports SAS, SATA, and NVMe over fabrics
  - Leverages existing storage commands (IF-SEND and IF-RECV)
  - Reuses existing SPDM protocol (DSP0274)

- Sample use cases
  - Authenticate a drive before using it for data storage
  - Attest the state of a drive
  - Establish a secure session to exchange secrets with a drive
Authorization Specification

- Creates a new specification to enable authorization
  - Provides a mechanism to determine whether the requesting entity has the correct privileges to perform a protected action
- Generalized approach
  - Leverages SPDM Secured Messages
  - Can be used for SPDM, PLDM, vendor-defined messages and more
- Supports multiple sets of privileges
- Scalable to support large numbers of endpoints (data centers)

![Diagram of Authorization Specification Process]

**AuthNonce**

\[ \text{AuthNonce} = (\text{User N nonce} || \text{Responder N nonce}) = \text{AuthNonce} \]  
\[ \text{AuthNonce} = \text{AuthNonce} + 1 \]  
...  
\[ \text{AuthNonce} = \text{AuthNonce}(N) + 1 \]  

**Legend**

- Authenticated and Encrypted Sessions

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Take Aways

• SPDM protocol is a prominent industry standard for Component and Device Attestation
• Has traction among other industry standard organizations and among component and system vendors
  • DMTF plans to submit the SPDM specification to ISO for ratification
• Use cases and specification work are expanding
• DMTF seeks participation, collaboration and input from the industry
SPDM over MCTP including Encrypted Messages