Advances in Storage Security Standards

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Objectives

- Provide background on Trusted Computing Group (TCG) Storage Work Group Goals
- How Use Cases are expanding
- Describe work in progress to align with NVMe
- The importance of Opal assurance
- Highlight other recent, storage-related security specifications, goals, and benefits

TCG Storage WG Goals

- Expand current use cases
  - Opalite, Pyrite
- Enhance deployability and assurance
  - NVMe/Namespace interactions
  - TCG Storage Opal Test Cases, Collaborative Protection Profile
- Introduce new features based on IT, OEM, IHV, ISV pain points; expand basic threat model
  - Secure Messaging, PSID

Opal SSC

Opal SSC:

•Defines the full-featured interface for managing security features in a storage device, including device encryption.

•Threat model: protect confidentiality of stored user data against unauthorized access once it leaves the owner's control (when drive and system are powered off)

Important Points:

•Supports division of Storage Device user data space into multiple "LBA Locking Ranges"

•Each LBA Locking Range has its own media encryption key.

•Locking Ranges are locked after a storage device power cycle.

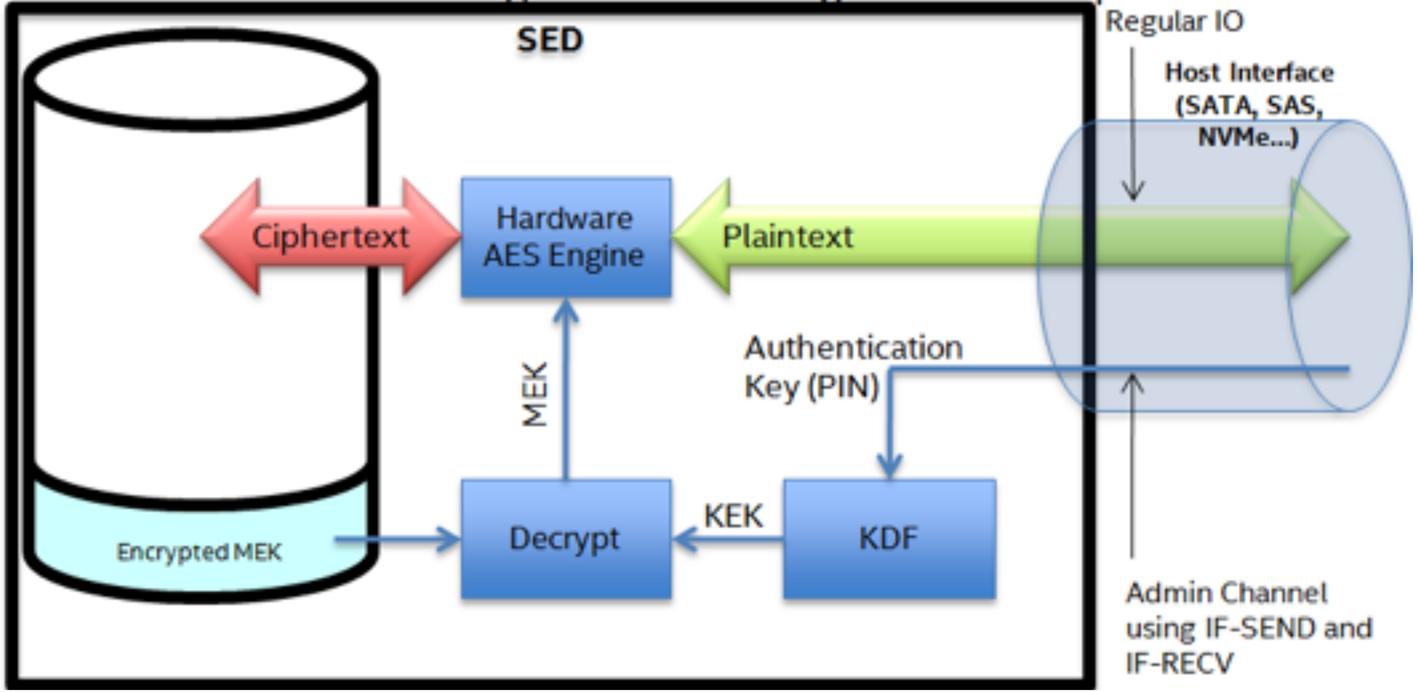
•Admin assigns access to unlock Ranges to 0 or more Users.

•Each Locking Range can be independently cryptographically erased.

•The Shadow MBR region stores ISV SW "Pre Boot Environment" to capture unlock password and unlock Ranges to allow OS boot.

Self-Encrypting Drive (SED)

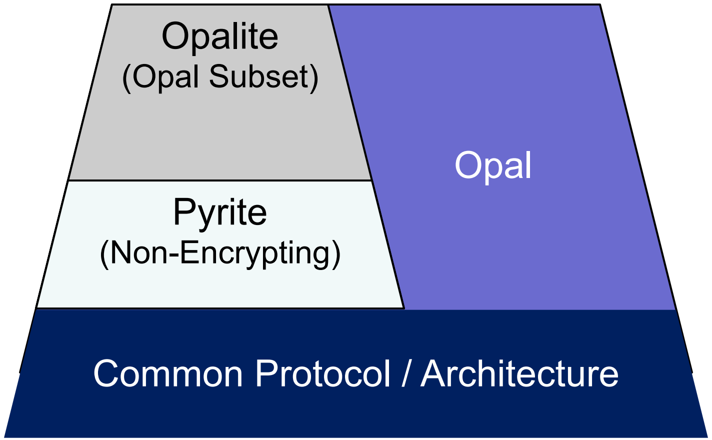
How the Crypto Works: A High-Level Example



Opalite SSC and Pyrite SSC

- NVMe’s strategy: align on Opal SSC-based solutions
  - Scale across the needs of NVMe in different Client and Enterprise (data center) solutions
- At the request of NVMe WG, TCG Storage WG developed additional “Opal Family” specifications, to address additional Use Cases
  - **Opalite SSC**: Subset of and command compatible with Opal (functionally equivalent to ATA Security)
  - **Pyrite SSC**: Similar to Opalite, does not specify a requirement for media encryption
  - **Block SID Feature Set**: Provides function similar to “Freeze Lock”, to help control Take Ownership process

Opal “Family”



Opal and Pyrite expand use models beyond corporate client.

Opal and Assurance

- Opal SSC Test Cases Specification
  - Baseline for Opal Certification
    - Covers Opal 1.00, 2.00, and 2.01
  - ***Currently in pre-publication review***
- Common Criteria Encryption Engine and Authorization Acquisition cPPs (Feb 2015)
  - Specifies security evaluation for Self-Encrypting Drives (SED) and SED management software

Opal compliance and assurance are high priority OEM/customer requests.

WIP: Namespace Interactions

- TCG Storage Interface Interactions
  - Updates to Namespace Interactions in progress (targets SIIS v1.05)
- Specifies required support for 2 scenarios:
  - Multiple namespaces can be supported with all mapped to the Opal Global Range
  - A single namespace can be supported with multiple Opal “Locking ranges” all mapped within the 1 namespace

Multiple Namespaces

Opalite	
Range	Namespace
Global	NS1
	NS2
	...NSN
Pyrite	
Range	Namespace
Global	NS1
	NS2
	...NSN
Opal	
Range	Namespace
Global	NS1
	NS2
	...NSN
Range1	“Blocked”
Range2	“Blocked”
Range3	“Blocked”
Range4	“Blocked”
Range5	“Blocked”
Range6	“Blocked”
Range7	“Blocked”
Range8	“Blocked”

If multiple namespaces are created, then locking of all are controlled together.

If multiple locking ranges are configured, then they all are within a single namespace, and additional namespaces cannot be created.

Multiple Locking Ranges

Opalite	
Range	Namespace
Global	NS1
Pyrite	
Range	Namespace
Global	NS1
Opal	
Range	Namespace
Global	NS1
Range1	NS1
Range2	NS1
Range3	NS1
Range4	NS1
Range5	NS1
Range6	NS1
Range7	NS1
Range8	NS1

WIP to align with NVMe to enable a strong collaboration between the organizations.

WIP: Namespace Interactions

- Architecture of enhanced configurability also in progress
  - When namespaces are created, the Global Range settings apply.
  - Namespaces can be associated with one or more Locking objects, to enable separate locking of that namespace or LBA ranges within that namespace.
- TCG SWG is seeking input on use cases.

Range	Namespace
Global	NS1 NS3 NS7
Range1	NS2
Range2	NS4
Range3	NS4
Range4	NS5
Range5	NS6
Range6	NS6
Range7	NS8
Range8	NS9

One or more locking ranges associated with “configured” namespaces, allowing these namespaces to be unlocked separately, with differently configurable access controls.

Secure Messaging

- When managing Opal configuration, the authentication credential is sent from a host (local or network) to the storage device
  - The credential is sent in the clear across the storage interface
    - Could result in capture of an admin credential
- Use Cases:
  - Protects TCG Storage management traffic
    - Allows for secure, remote updates of Opal configuration
    - Traffic could be protected from a back-end management/key server all the way to the storage device

Developing new features and expanding the Opal threat model to incre

Secure Messaging Specs

- New Specs:
  - Core Spec Addendum: Secure Messaging
    - Maps TLS v1.2 handshake protocol to TCG Storage session startup
      – ISV Opal Management SW is the TLS “Client”, Opal SED is the “server”
  - PSK (Pre-Shared Keys) Feature Sets
    - Map TLS PSKs configuration and usage to the TCG Storage communications protocol

PSID

- PSID Feature Set
  - PSID = “Physical Security Identifier”
  - The specifies a means to implement a ***physical presence credential*** (e.g. a password printed on a label).
    - This enables recovery/repurpose/end-of-life in the event of lost/unavailable password
    - Use Cases/Benefits for IT departments, OEMs, IHVs, and ISVs

IEEE 1667 and NVMe

- IEEE 1667 TCG Transport Silo is a requirement for "eDrive" support
  - eDrive in 30 seconds:
    - Starting with Windows 8, MS BitLocker is able to manage SEDs that implement Opal 2.00, Single User Mode Feature Set, and the IEEE 1667 TCG Transport Silo
- IEEE 1667 has begun working on a IEEE 1667 transport technical proposal for NVMe
  - Enables general access to IEEE 1667 silos over NVMe, including 1667 TCG Transport Silo
    - TCG Transport Silo – alternate transport for TCG Opal commands
  - Enables management of Windows eDrive for NVMe Opal SEDs which use Opal 2.00

See www.ieee1667.com for more information on IEEE 1667

Plus: Other Recent Storage Security Standards Releases

- NIST SP 800-88 rev. 1 (Dec 2014)
  - Provides guidelines for media sanitization, including provisions for NAND-based devices, NVMe interface, and cryptographic erase
- ISO 27040 (2015)
  - Provides security guidance for storage systems and ecosystems as well as for protection of data in these systems.
- TCG Enterprise SSC: Locking LBA Ranges Control Feature Set (May 2014)
  - Defines mechanisms for additional locking criteria for Locking ranges

Storage Interface Interactions Spec

- TCG Storage Interface Interactions Specification:
  - SIIS v1.03: mappings for UFS, eMMC
  - SIIS v1.04: enhances interactions with T10/T13 Sanitize Feature Sets, minor updates to NVMe interactions

Summary

- A variety of new storage security standards enable broader applicability of TCG Opal and other specs; introduce enhancements to features; and enable increased assurance of implementation.

References

- TCG Storage Specifications
  - http://www.trustedcomputinggroup.org/developers/storage/specifications
- Opal Test Cases Specification (Public Review)
  - http://www.trustedcomputinggroup.org/resources/specifications_in_public_review
    - http://www.trustedcomputinggroup.org/files/resource_files/99188CB2-1A4B-B294-D0DB1CF3A7136274/Opal_SSC_Certification_Test_Cases_v2_00_r1_85_Public%20Review.pdf
- Common Criteria Collaborative Protection Profiles
  - http://www.commoncriteriaportal.org/pps/?cpp=1
- NIST SP 800-88 rev. 1 (Dec 2014)
  - Provides guidelines for media sanitization, including provisions for NAND-based devices, NVMe interface, and cryptographic erase
    - http://csrc.nist.gov/publications/PubsSPs.html
- ISO 27040 (2015)
  - Provides security guidance for storage systems and ecosystems as well as for protection of data in these systems.
  - http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=44404
- TCG Enterprise SSC: Locking LBA Ranges Control Feature Set (May 2014)
  - Defines mechanisms for additional locking criteria for Locking ranges
  - http://www.trustedcomputinggroup.org/resources/tcg_storage_enterprise_ssc_feature_set_locking_lba_ranges_control_specification

Thank you!

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