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Data-At-Rest Protection at Data Center Scale with NVMe and Opal

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Agenda

- Motivations for Data-At-Rest Security
- TCG Opal family for SEDs
- Sedcli – new open source utility for SED management for data center scale (and client)
- Sedcli roadmap
- Call to action

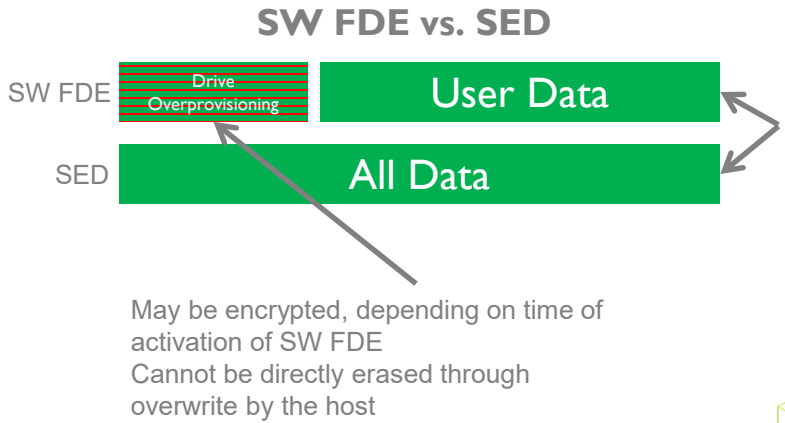
Motivations for Data-at-Rest security

- Data breaches continue to grow in scale and cost to organizations
- Governments are responding by developing new regulations such as the EU GDPR and Lot 9 requirements
- Provisions in these laws discuss topics such as user data rights for data retention, access control, knowledge of who has access to data, etc
- GDPR, in particular, mentions encryption as a path to potential mitigation in the event of data breach.
- Lot 9 requires Secure Data Deletion

https://securityintelligence.com/posts/whats-new-in-the-2019-cost-of-a-data-breach-report/

Motivations for Data-at-Rest security

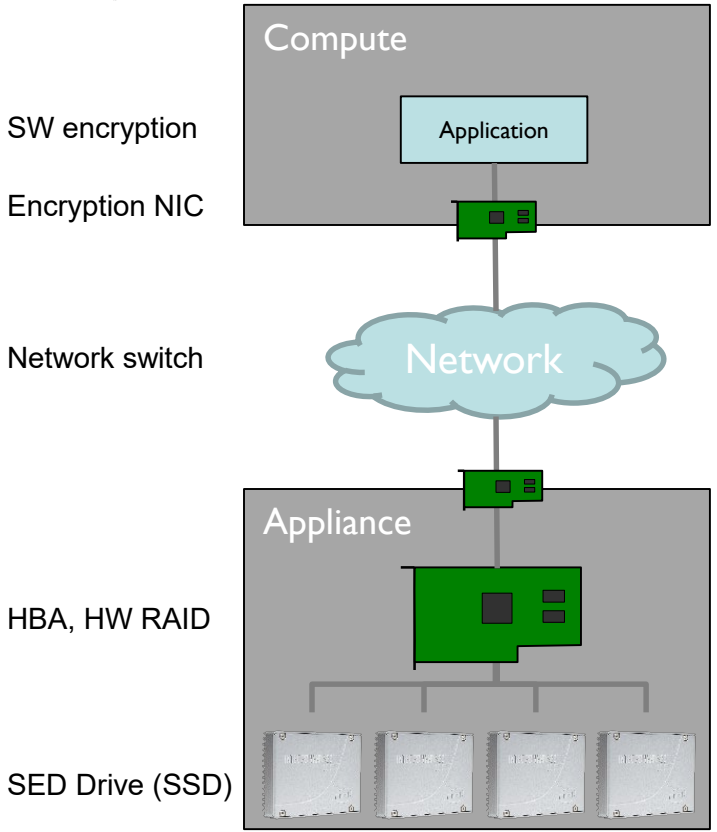
- All user data, regardless of wear leveling, is encrypted as of the first LBA write to the drive
- Data erasure using drive commands ensures erasure of all data – regardless of wear leveling
- SW-FDE does not provide these guarantees
- Increasingly, SED's are deployed to ensure "last mile" compliance and ensure that physical theft does not cause a data breach



Where encryption is done?

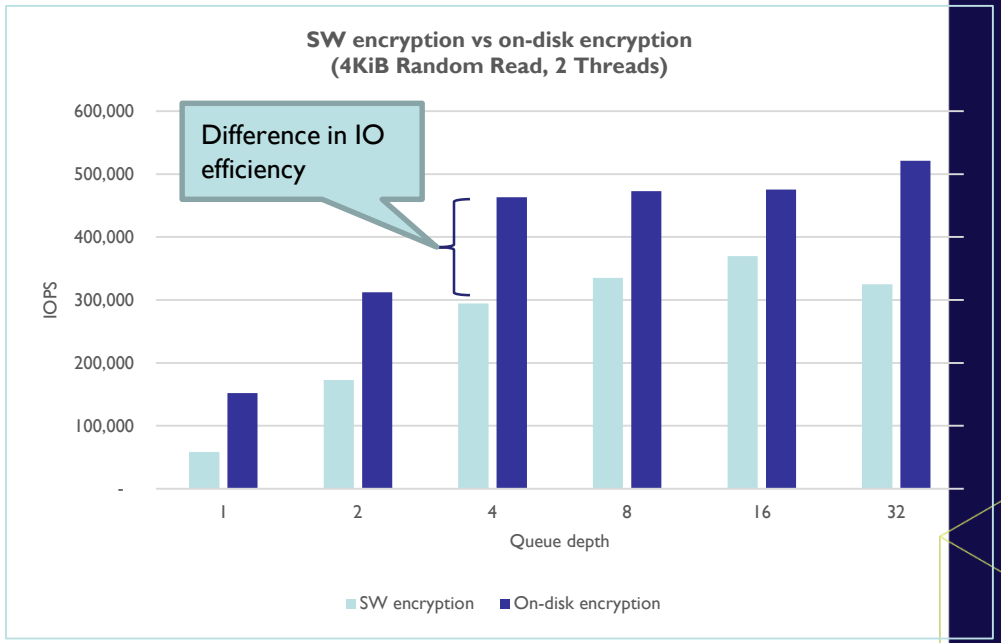
Encryption can be done on different levels. Factors to consider:

- Protection against threat
- Performance impact
- Regulations
- Impact on other processes:
  - Encrypted data may not be compressible



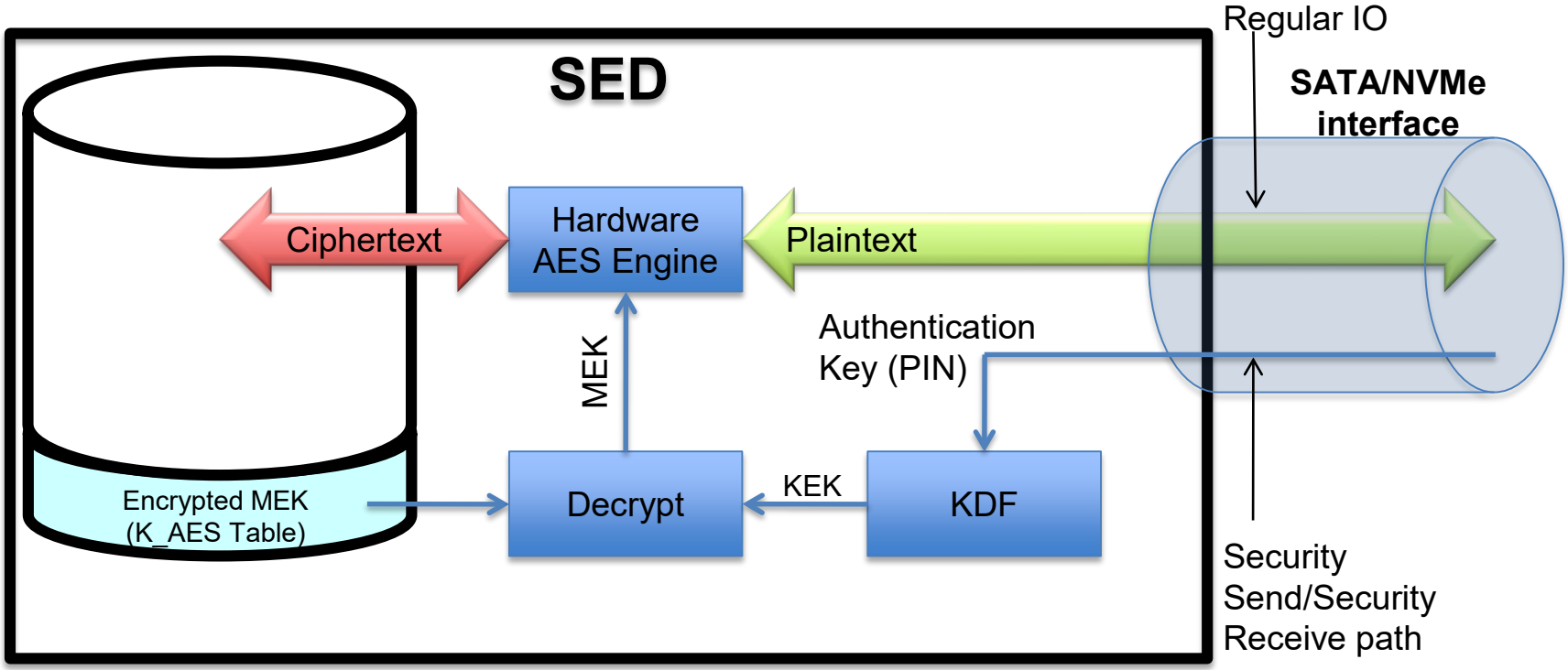
SW encryption versus on-disk encryption

- **SW encryption:**
  - Intel® Advanced Encryption Standard New Instructions (Intel® AES-NI) provide near full bandwidth crypto for SW FDE for large transfers
    - However, software overhead remains, adding extra latency – especially for 4K transfers
- **On disk encryption:**
  - SED AES performance provides low latency and bandwidth at interface speeds for all transfer sizes



Source: Intel. System Configuration: Intel ® Xeon Platinum 8200L CPU @ 2.70GHz, DRAM 4GB, Intel DC P4800X 800GB SSD, Debian (Linux 4.9.0-11-amd64 x86_64) with and without SW encryption using LUKS. Results have been estimated based on internal Intel analysis and are provided for informational purposes only. Any difference in system hardware or software design or configuration may affect actual performance. For more complete information about performance and benchmark results, visit www.intel.com/benchmarks Performance results are based on testing as of 9/17/2019 and may not reflect all publicly available security updates. See configuration disclosure for details. No product or component can be absolutely secure

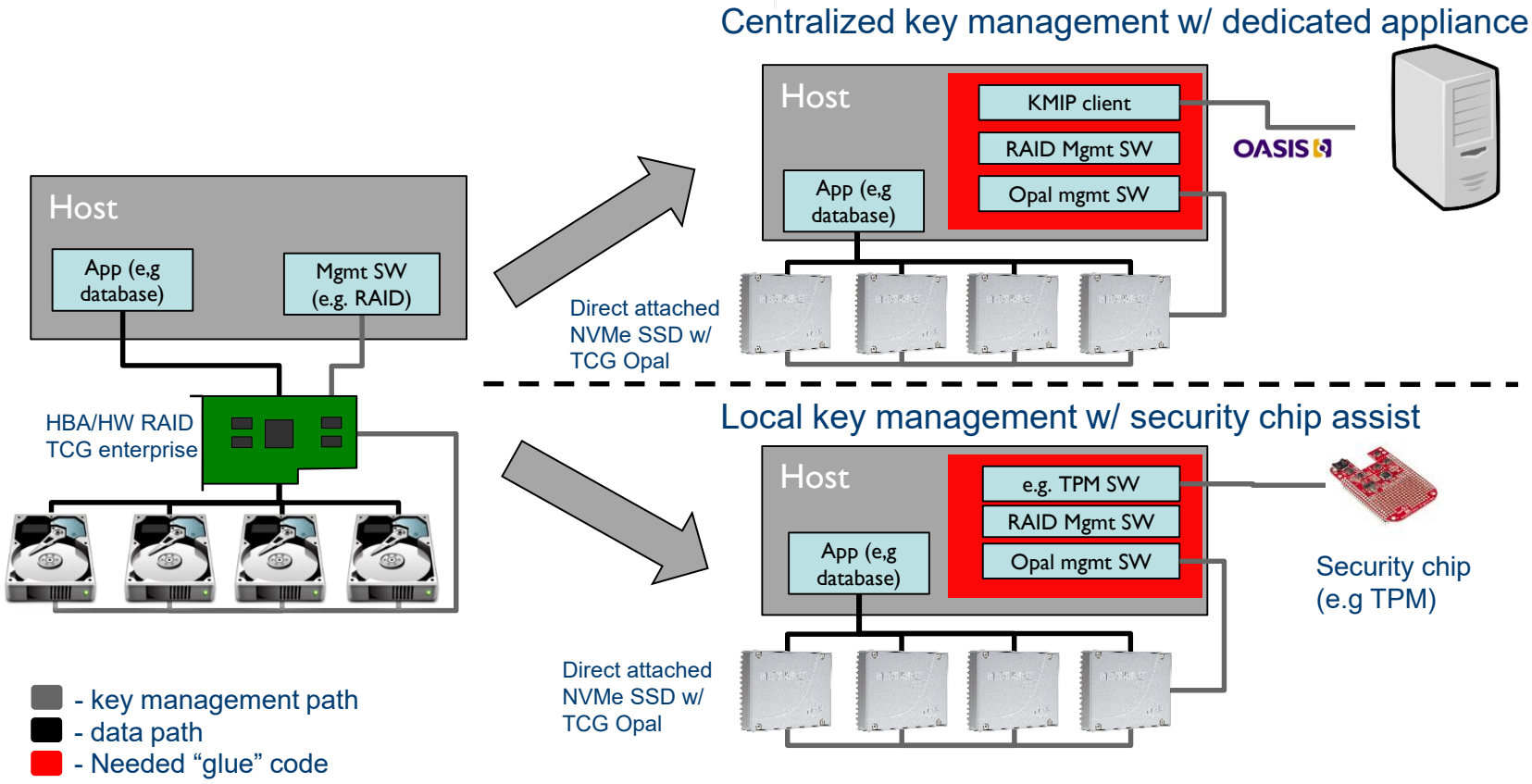
Key management in Opal



Client usages and data center usages are different

- **Client:**
  - Usually requires user to supply key (password) to the disk
  - Pre-Boot-Authentication via Shadow MBR
- **Data center:**
  - Need for automated key management during initial provision and auto unlock on day-to-day operation due to the scale
  - Need for periodic key rotation
  - Need for key backup

Shift to NVMe and the need for new SW tooling



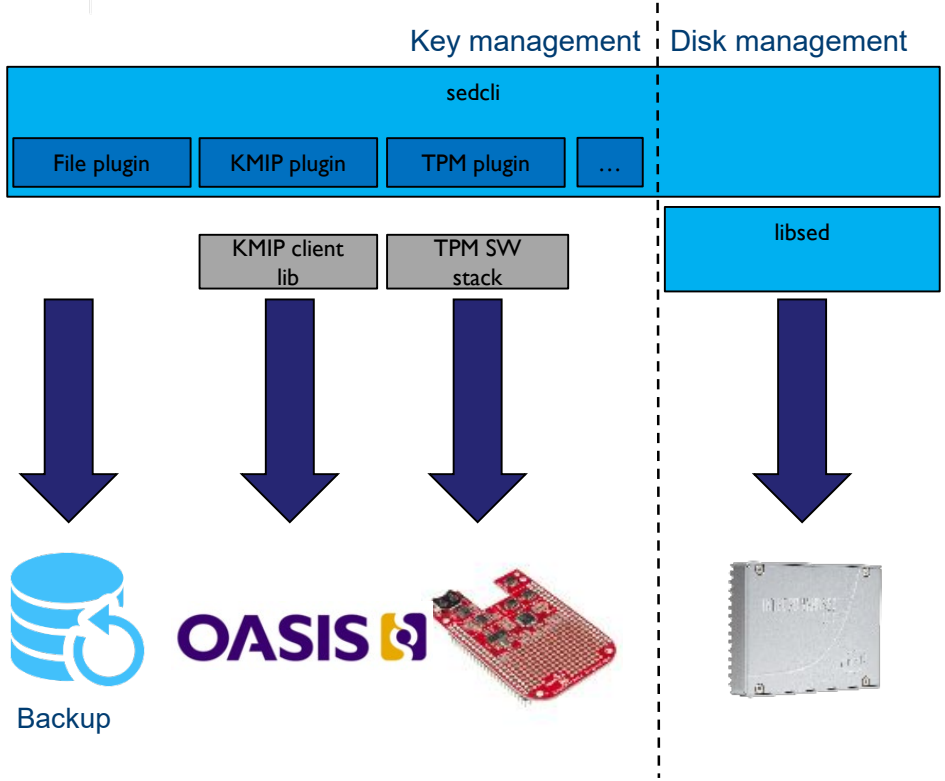
Sedcli SW proposal

Support for data center usages:

- Auto-provision on hot insert or OS boot
- Auto-unlock on hot insert or OS boot
- Support for multiple key managers (OASIS KMIP, TPM)
- Key backup functionality

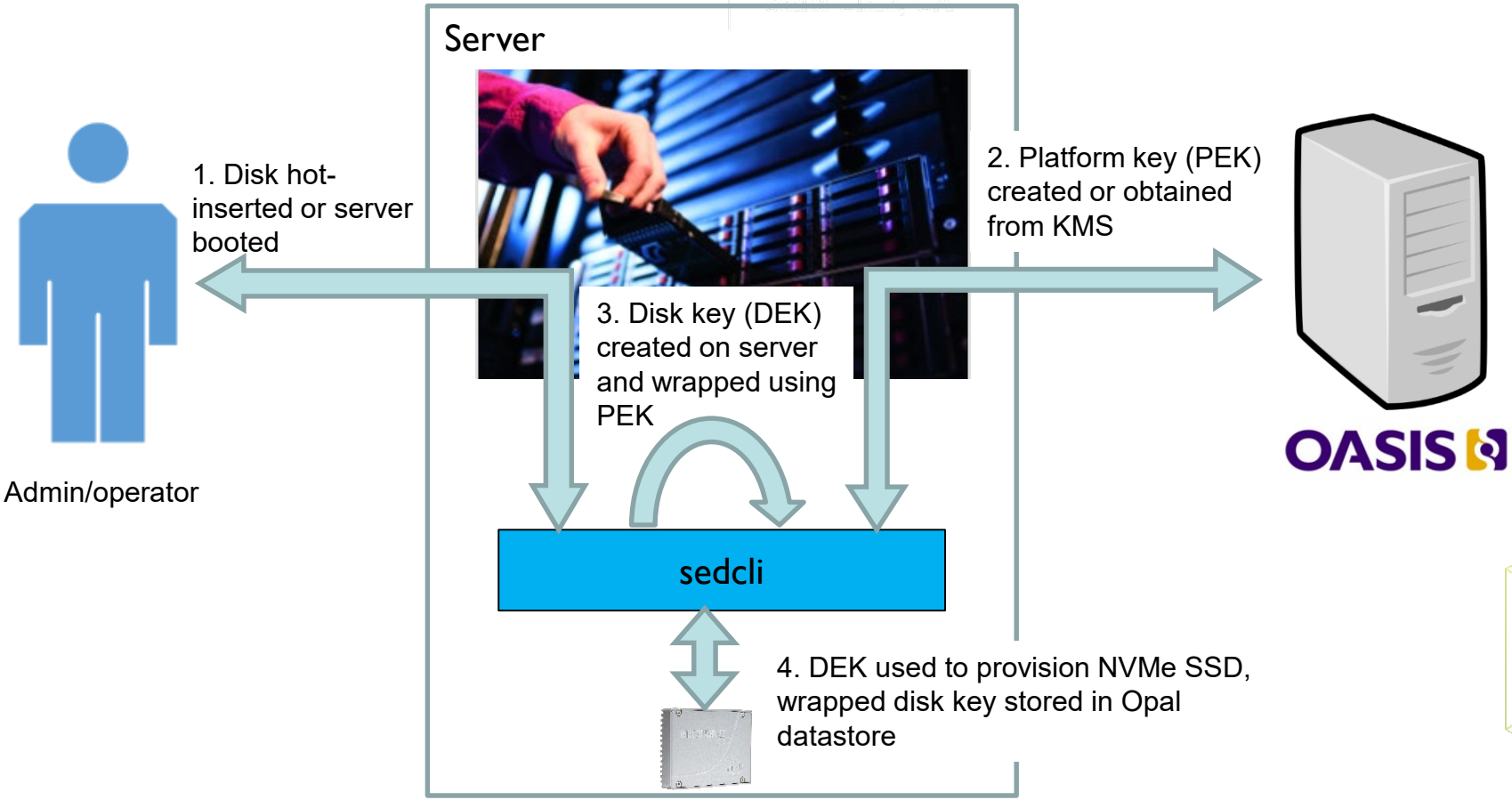
Key SW components:

- Sedcli – modular architecture allowing multiple key managers:
  - OASIS KMIP
  - TPM
- Libsed - enables extensions

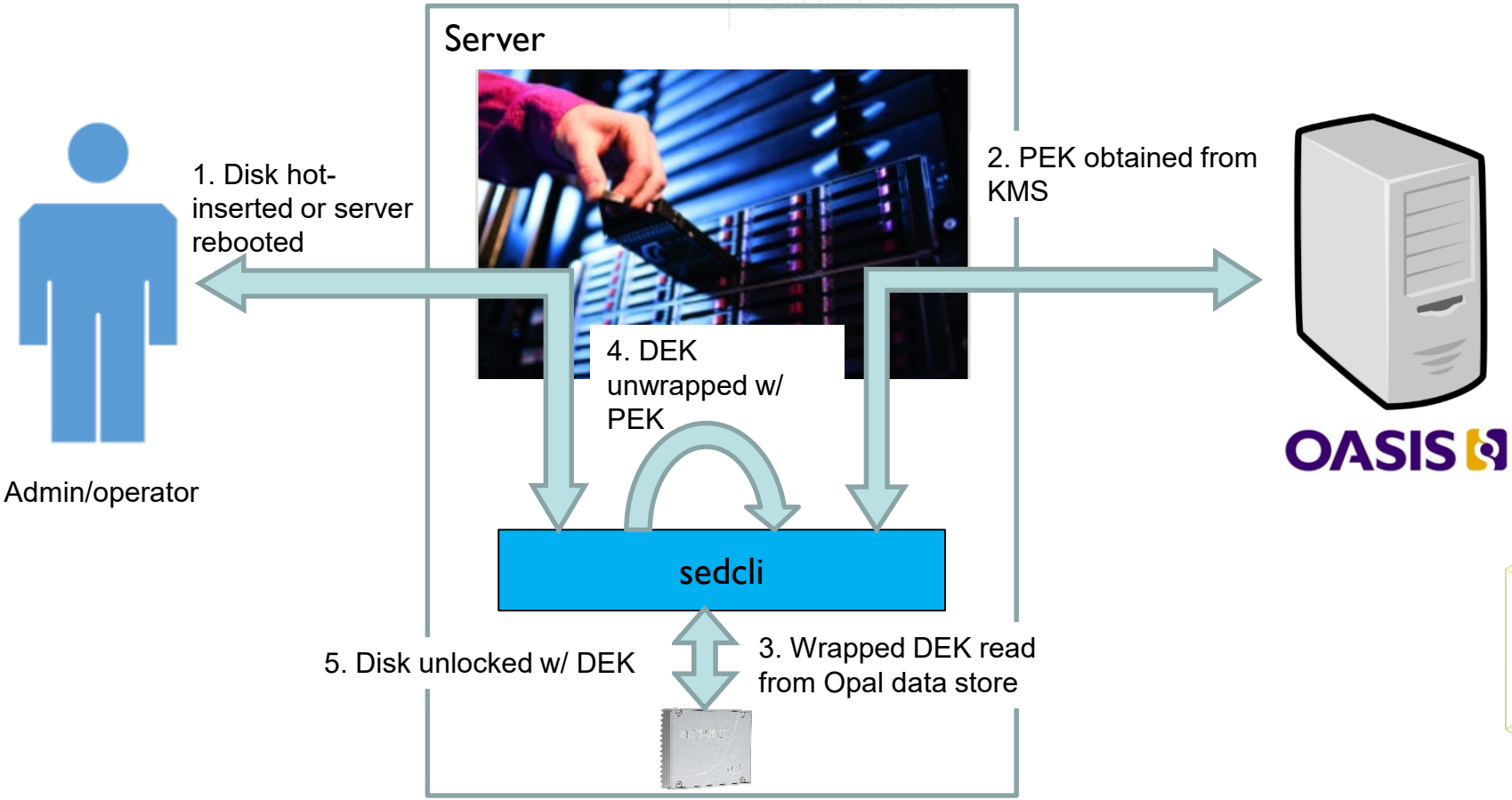


Source code available on https://github.com/sedcli

Envisioned data center auto-provision flow



Envisioned data center auto-unlock flow



Sedcli status and next steps

Client usages:
- Initial provision
- Explicit locking and unlocking
- Changing key for Admin1
- Revert TPER

Data center usages (KMS):
- OASIS KMIP key manager
- Auto initial provision
- Auto unlock
- Key backup

Data center usages (TPM):
- TPM 2.0 based key manager
- Auto initial provision
- Auto unlock
- Key backup

Support for emerging DAR security standards such as NVMe/TCG Key Per IO

Call to action

- Encourage usage and contributions to https://github.com/sedcli
- Provide feedback/additional usage models
- Reach out to us to learn more