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Tamper Resistant Secure Digital Silo for Log Storage in Critical Infrastructures

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GROUP

Why another secure storage system?

- Clouds are not yet ready for the CIs due to various security challenges*
  - Unavailability, Cross-Border Policies, Metadata spoofing, Insecure API etc.
- SW based solutions lack memory protection
  - Potential disclosure of the keys to attackers
- HW based solutions have limitations
  - Share keys or do calculation without memory protection
  - Functional limitations of HW
- Most of them do not address Truncation attack.

* Younis, Y.A., Merabti, M., Kifayat, K.: Secure Cloud Computing for Critical. Infrastructure: A Survey.

Our goal

- Build a practical tamper resistant log storage system

Where the system has-

- no shared secret with user or OS
- memory protected operations
- separation of secrets for local storage
- remote integrity verification capability
- detection of system power cycles
- COTS hardware reliance

To provide-

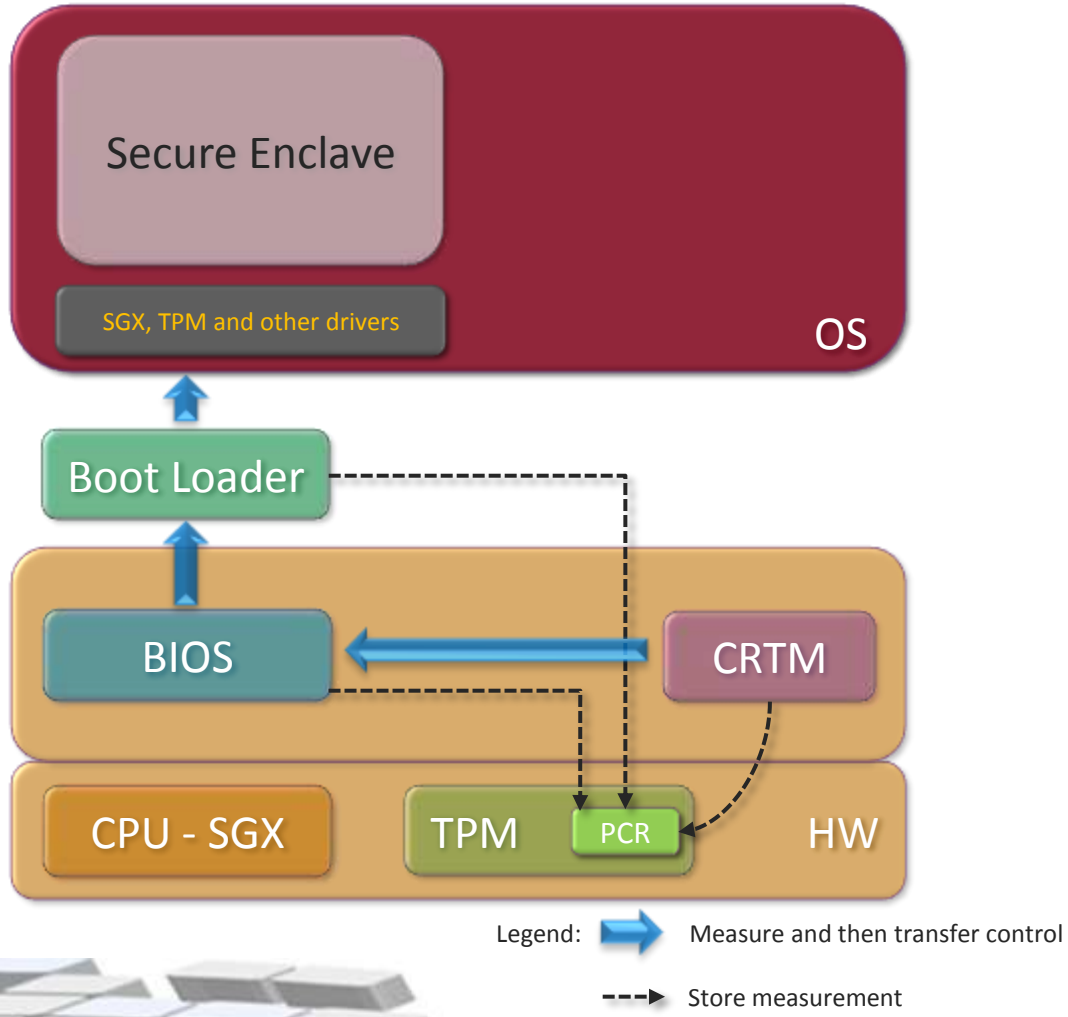
- integrity
- unforgeability
- availability
- authenticity
- remote verification
- fail-safe
- accountability
- safety
- correctness
- seamlessness

Our Solution

Based on:

- TPM: Trusted Platform Module to initialize the system in good state
- Intel SGX: completely memory protected cryptographic operations with muti-core support
- eCryptfs: first layer of security to prevent non-root attackers
- SBD: second and tamper-proof layer of security to prevent even privileged attackers

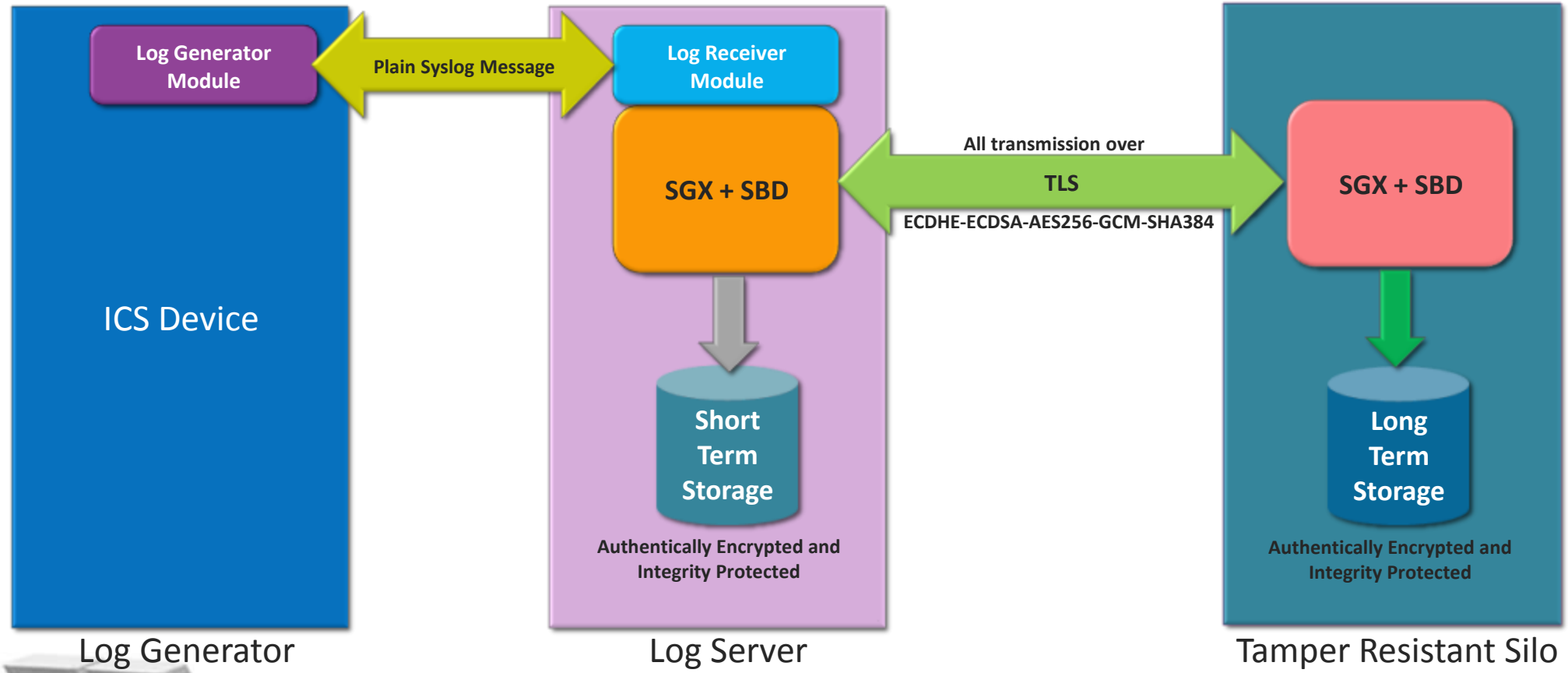
Our Solution



- The integrity measurement architecture (IMA), available in Linux, can measure the system initialization steps, but unable to detect TOCTOU class of attacks
- Execution inside SGX supported Secure Enclave, after the trusted initialization of OS and drivers, prevents such attacks and guarantees run-time integrity

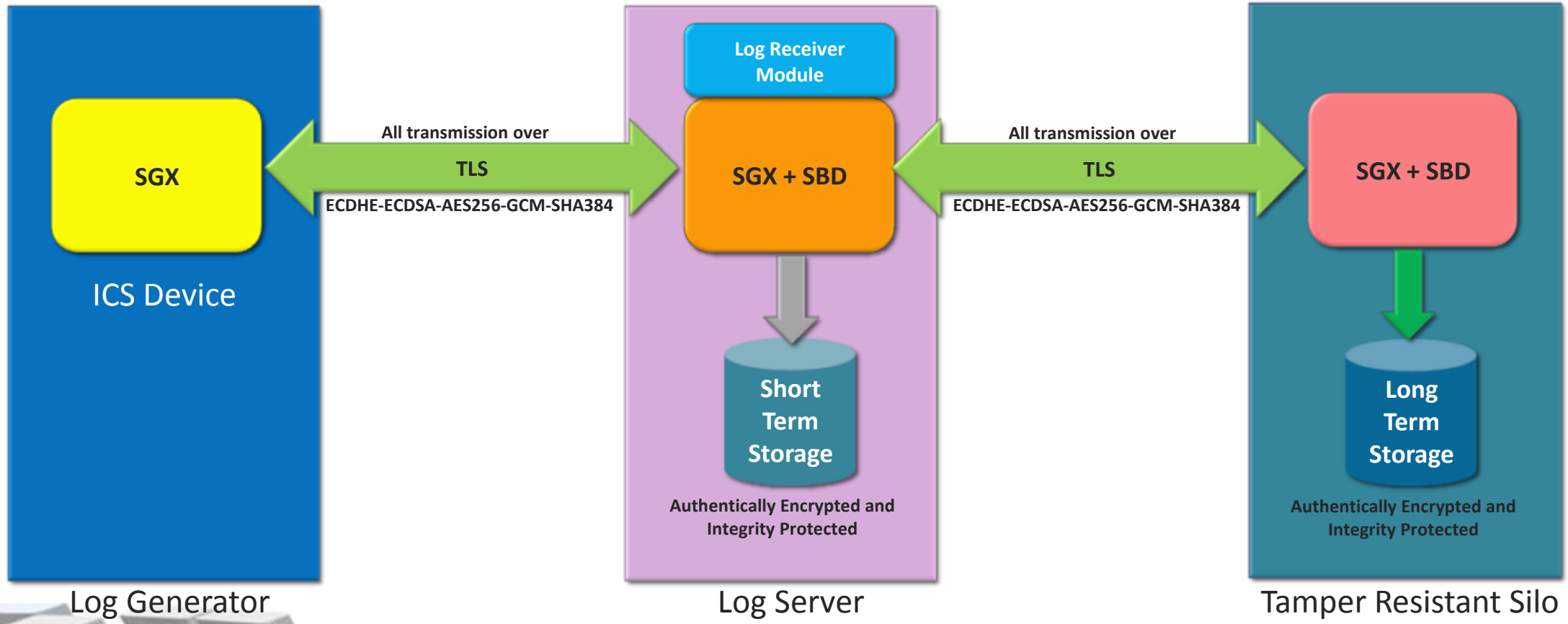
Our Solution

Proprietary Log generator:



Our Solution

Customized Log generator:



Is our goal fulfilled or not?

- Build a practical tamper resistant log storage system

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Thank you.