SSD Encryption

This module gives an overview of SSD Encryption.

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SSD Encryption

Table 1: Feature History Table

Feature Name	Release Information	Feature Description
SSD Encryption	Release 7.5.1	This feature enables trust and security in the system's steady state by encrypting data at the disk level. The encrypted data can be accessed *only* with a specific key stored in the TAm.

Customers are concerned about the security of sensitive data present on persistent storage media. User passwords are limited in their capability to protect data against attackers who can bypass the software systems and directly access the storage media.

In this case, only encryption can guarantee data confidentiality.

Cisco IOS XR Software Release 7.5.1 introduces SSD encryption that allows encrypting data at the disk level. SSD encryption also ensures that the encrypted data is specific to a system and is accessible *only* with a specific key to decrypt them.

Data that can be encrypted is sensitive information such as, topology data, configuration data, and so on.

Encryption can be achieved through:

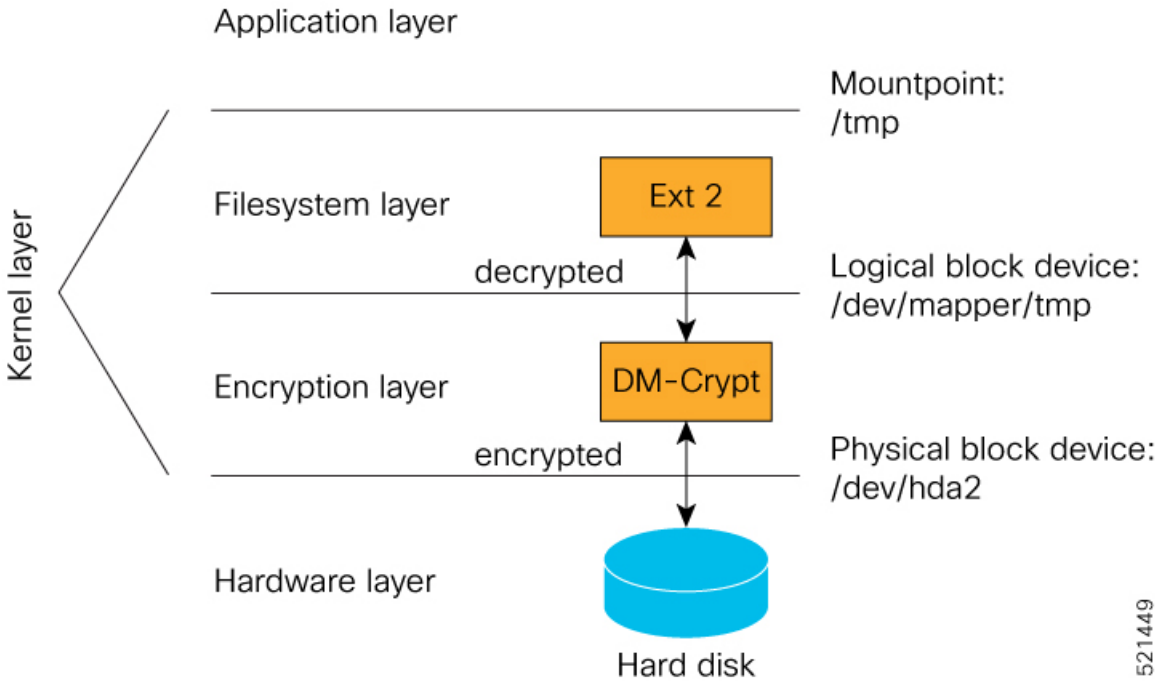
- DM-Crypt
- CPU with AES-NI support
- CryptSetup

DM-Crypt

DM-Crypt is a Linux kernel module that provides disk encryption. The module takes advantage of the Linux kernel's device-mapper (DM) infrastructure. The DM provides a way to create virtual layers of block devices.

DM-crypt is a device-mapper target and provides transparent encryption of block devices using the kernel crypto API. Data written to the block device is encrypted; whereas, data to be read is decrypted. See the following figure.

Figure 1: DM-Crypt Encryption

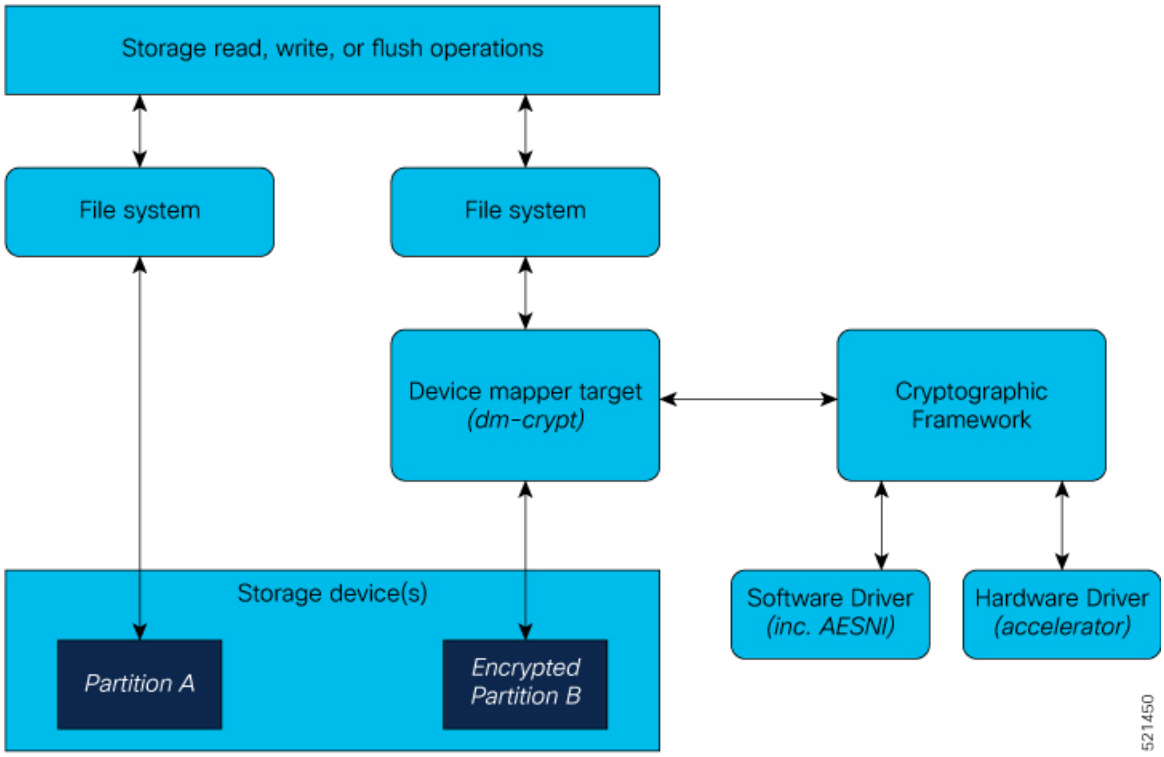


AES-NI Support

Intel's Advanced Encryption Standard New Instructions (AES-NI) is a hardware-assisted engine that enables high-speed hardware encryption and decryption. This process leaves the CPU free to do other tasks.

When the input-output operations are started, the read-write requests that are directed at the encrypted block device are passed to the DM-Crypt. DM-Crypt then sends multiple cryptographic requests to the Cryptographic Framework. The crypto framework is designed to take advantage of off-chip hardware accelerators and provides software implementations when accelerators are not available. See the following image.

Figure 2: AES-NI Support



CryptSetup

DM-Crypt relies on user space tools, such as cryptsetup to set up cryptographic volumes. Cryptsetup is a command-line-interface (CLI) tool that interacts with DM-Crypt for creating, accessing, and managing encrypted devices.

Encrypted Logical Volume

An encrypted logical volume (LV) can be created during software installation.

You can activate or deactivate the encrypted disk partition on demand. In addition to being activated, all sensitive files are also migrated from the unencrypted disk partition to the encrypted disk partition. The encrypted files can be migrated back during deactivation.

You can activate the data encryption by using the `disk encryption activate` *`location`* command.

The encrypted logical volume capacity is 150MB of disk space and is available as /var/xr/enc for applications to access.

Note Although applications can choose to use this space for storage, that data is not be part of data migration if the software image is downgraded to a version that does not support encryption.

SSD Binding

When encryption is activated on a system, each card on the system generates a random encryption key and stores it in its own secure storage—the Trust Anchor module (TAm). During successive reboots, the encryption key is read from the TAm and applied to unlock the encrypted device. Since each card stores its encryption key locally on the TAm, an SSD that is removed from one card and inserted into another cannot be unlocked by the key stored on that card, thereby making the SSD unusable.

If encryption is activated, the encrypted LV can only be unlocked by using the key stored in the TAm. So, if an encrypted SSD is removed and moved to another line card, the SSD cannot be unlocked. In other words, when you activate encryption, the SSD is bound to the card it is inserted in.

Data Zeroization

Zeroization refers to the process of deleting sensitive data from a cryptographic module.

Note In case of a Return Material Authorization (RMA), you must *factory reset* the data.

You can perform zeroization by using the `factory reset` *`location`* command from the XR prompt.

Caution Running this command while encryption is activated, deletes the master encryption key from the TAm and renders the motherboard unusable after the subsequent reload.