Technical white paper

Secure Volatile Storage

Software Encryption of Customer Data on FutureSmart Firmware Products

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Overview

Solid State Drives (SSD), Solid State Modules (SSM), and enhanced MultiMediaCard (eMMC) technology used in some models of HP printing devices do not support data overwrite or native encryption. Files deleted from these storage devices are not immune from forensic recovery. To protect customer data, HP is implementing firmware encryption to specific areas of the storage device containing job data. The encrypted data is volatile as the encryption keys are not preserved after a system power cycle, effectively performing a cryptographic erase of the customer data.

This behavior is similar to a non FutureSmart firmware printer without a HDD, which stores job data in volatile system memory. Customers are assured that job data is not recoverable on printing devices after powered off, allowing for secure redeployment and decommission use cases.

Data Encryption

File encryption is accomplished using Microsoft's encrypting file system filter. File encryption and decryption use the Microsoft Enhanced Cryptographic API using either AES-128 or AES-256 encryption. The filter encrypts the data for all files written to and read from the customer partitions.

Key Management

Initially a cryptographically strong key is generated called a MasterKey, which is then encrypted with AES. The MasterKey is then used to create a symmetric session key generated based on the MasterKey, random data and additional entropy. The session key is then used to protect the data.

Secure Cryptographic Erase of Customer Job Data

Data required to reconstruct the encryption key for the customer data partitions is stored in RAM. Since the encryption key can't be regenerated after a device restart all customer data partitions are cryptographically erased.

Note: A "Cryptographic erase" is a method of rendering access to encrypted data impossible by destroying the encryption key needed to decrypt the data.

Customer Data Encrypted

The following classes of customer data are encrypted using Secure Volatile Storage:

- Customer Data

  Stored print jobs, maser (multiple copies) temporary job files, PJL and PostScript filesystem files including downloaded fonts, extensibility customer data (if stored there by the extensibility solution).

- Commit to Buffer data

  When the imaging system runs low on memory, it will render the current page data and store it in this section of the disk. This allows the system to free memory and continue imaging the page.

- Interrupt data

  Stored page data when a job is interrupted (e.g. interrupted by an inter-cycle calibration job).

  Note: Customer configuration settings are not stored in these areas.

Erase Job Data

The Erase Job Data command will include an option for "Secure Cryptographic Erase" when Secure Volatile Storage is active.   The other erase selections will be unavailable.
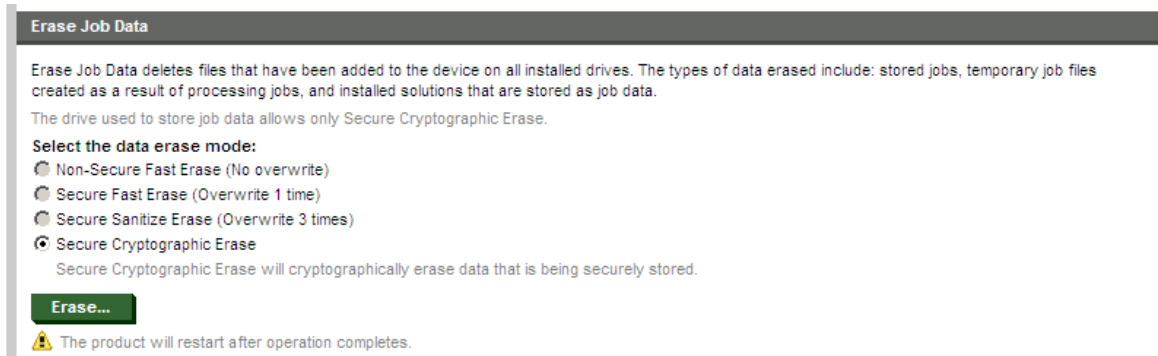
If these options are not present for Secure Cryptographic Erase, change the encryption from the default AES-128 to AES-256.
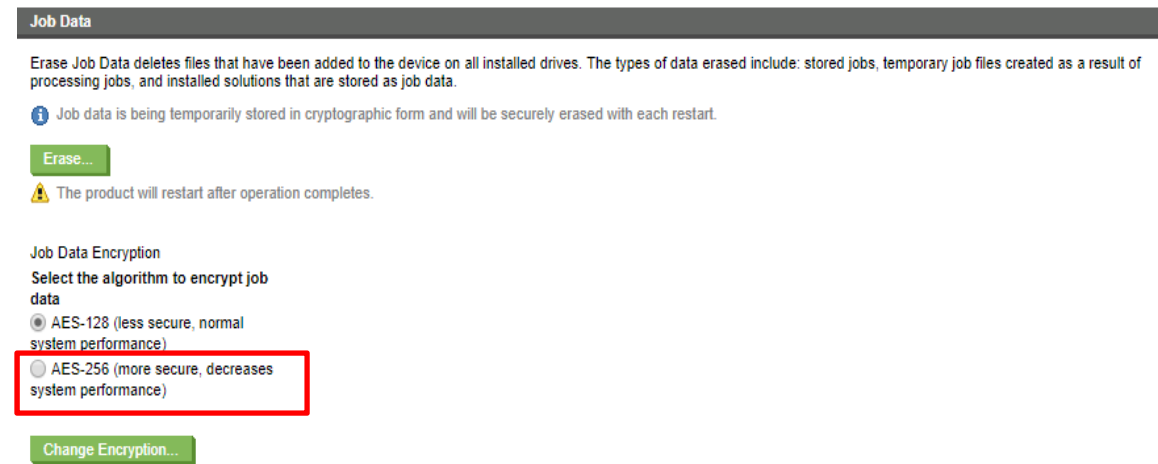
Ram Disk Replacement

Secure Volatile Storage replaces the RAM Disk feature on supported devices for storing job data. Since encrypted data partitions are cryptographically erased at system restart the behavior is similar to a RAM Disk, while hosting the customer data on the SSD or eMMC provides greater capacity than a RAM Disk architecture.

Backup/Restore Feature

The Backup/Restore feature uses the customer data storage area, since the backup contains customer data and is required to be securely stored. Devices using Secure Volatile Storage will not save restore data across a system power cycle. The following changes to Backup/Restore options will be seen:

- Schedule Backup will not be available as an option.
- Backup Now will require the user to insert a USB drive as the backup image cannot be stored on the Customer Partition. A system restart would cryptographically delete the backup image.
- Export Last Backup will not be available as no backup images are stored on the device.
- Restore Data will require that a USB drive with the backup image be inserted.

Device List

The following HP printing devices include SSD storage:

- HP Color LaserJet CP5525n, dn
- HP LaserJet Enterprise M4555 MFP base (EMEA only)
- HP LaserJet Enterprise 600 M601n, dn, x; M602n, dn, x; M603n, dn
- HP LaserJet Enterprise MFP M630dn
- HP LaserJet Enterprise M651n, dn
- HP LaserJet Enterprise 500 M525 dn, f
- HP LaserJet Enterprise 500 color M551n, dn
- HP LaserJet Enterprise 600 M601n, dn, x; M602n, dn, x; M603n, dn
- HP LaserJet Enterprise MFP M630dn
- HP LaserJet Enterprise M651n, dn
- HP LaserJet Enterprise 700 M712 n
- HP OfficeJet Enterprise X555

The following HP printing devices include eMMC storage:

- HP LaserJet Enterprise M604, M605, M606 series
- HP LaserJet Managed M605 series
- HP LaserJet Enterprise M607, M608 series
- HP LaserJet Enterprise M609dn, M609x
- HP Color LaserJet Enterprise M652, M653 series
- HP LaserJet Enterprise M506 series
- HP LaserJet Managed M506 series
- HP LaserJet Enterprise M527 dn
- HP LaserJet Managed MFP M527dnm
- HP Color LaserJet Enterprise M552, M553 series
- HP Color LaserJet Managed M553 series
- HP Color LaserJet Enterprise M652 series
- HP Color LaserJet Managed M651dnm
- HP Color LaserJet Managed E55040dw
- HP LaserJet Managed E50045dw
- HP LaserJet Managed MFP E52545dn
- HP Color LaserJet Managed E55040dw

HP LaserJet Managed E60055,65,75 series

HP LaserJet Managed MFP E62555dn

HP Color LaserJet Managed E65050dn

HP Color LaserJet Managed E65060dn

HP PageWide Enterprise Color 556 series

HP PageWide Color 755dn

HP PageWide Enterprise Color 765dn

HP PageWide Color MFP 774 series

HP PageWide Color MFP 779 series

HP PageWide Managed Color E55650

HP PageWide Managed Color E75160dn

HP PageWide Managed Color P75250dn

HP PageWide Managed Color MFP P77440dn

HP PageWide Managed Color MFP P77940, 50 series

The following HP printing devices include Secure Volatile Storage encryption:

HP Color LaserJet CP5525n, dn

HP LaserJet Enterprise M506 series

HP LaserJet Managed M506 series

HP LaserJet Enterprise 500 M525 dn, f

HP LaserJet Enterprise M527dn

HP LaserJet Managed MFP M527dnm

HP LaserJet Enterprise 500 color M551n, dn

HP Color LaserJet Enterprise M552, M553 series

HP Color LaserJet Managed M553 series

HP LaserJet Enterprise M577 series

HP LaserJet Enterprise 600 M601n, dn, x; M602n, dn; M603n, dn

HP LaserJet Enterprise M604, M605, M606 series

HP LaserJet Managed M605 series

HP LaserJet Enterprise M607, M608 series

HP LaserJet Enterprise M609dn, M609x

HP LaserJet Enterprise MFP M630dn

HP Color LaserJet Enterprise M651n, dn

HP Color LaserJet Managed M651dnm

HP Color LaserJet Enterprise M652, M653 series

HP LaserJet Enterprise 700 M712 n

HP LaserJet Managed E50045dw

HP LaserJet Managed MFP E52545dn

HP Color LaserJet Managed E55040dw

HP LaserJet Managed E60055,65,75 series

HP LaserJet Managed MFP E62555dn

HP Color LaserJet Managed E65050dn

HP Color LaserJet Managed E65060dn

HP OfficeJet Enterprise X555

HP OfficeJet Enterprise X585

HP PageWide Enterprise Color 556 series

HP PageWide Enterprise Color MFP 586 series

HP PageWide Color 755dn

HP PageWide Enterprise Color 765dn

HP PageWide Color MFP 774 series

HP PageWide Color MFP 779 series

HP PageWide Managed Color E75160dn

HP PageWide Managed Color P75250dn

HP PageWide Managed Color MFP P77440dn

HP PageWide Managed Color MFP P77940, 50 series

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