UEFI Spec Version 2.4 Facilitates Secure Update

UEFI Summerfest – July 15-19, 2013
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Agenda

- UEFI 2.4
- Background FMP
- New Capsule Defined
- Delivery on Disk
- Secure?
- Open Questions
UEFI 2.4 Spec is Public

• Some of the New Content:
  1. ARM 64-bit Bindings
  2. Custom Security Variable
  3. Variable Naming rules clarified
  4. Network driver changes including EFI_NO_MEDIA rules
  5. Async I/O Improvements
  6. Timestamp and Random Number protocols
  7. Time-based revocation
  8. Adapter Information Protocol and several AIP blocks defined
  9. Capsule Format containing FMP updates
 10. Deliver Capsule on Boot Disk
 11. Variable with Capsule processing status
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Firmware Management Protocol
Background - FMP

• Added with UEFI version 2.3 update
• Designed to
  – allow individual firmware components to expose data on current running image(s)
  – accept update images
FMP in the Industry

• Mostly used in Enterprise segment
• Popular for high-performance expansion cards with multi-element firmware onboard
• But FMP is run in Boot Services – how to get the downloaded update to the FMP instance?
Factors inhibiting FMP

• Using EFI shell delivery is not secure and awkward for system admin
• For security, designers want to lock firmware store before Shell or OS boot
• Secure Boot rules block many of today’s update delivery tools
UEFI 2.4 Update Has New Capsule
Targeting FMP
New Capsule for delivering FMP Updates

• UEFI Defines a Capsule header for UpdateCapsule() function
• UEFI 2.4 adds a complete description of internals of a Capsule targeting FMP
• System firmware unpacks the capsule and delivers updates to FMP instances early in pre-boot
Capsule Format

• EFI_FIRMWARE_MANAGEMENT_CAPSULE_ID_GUID is the ID
• In some cases complete FMP function cannot fit inside production firmware store,
• Therefore new capsule format allows 0-n driver(s) and 0-n image(s)
• Minimum is 1 driver or 1 image
Example with 2 drivers, multiple update payloads

 EFI Capsule Header

 Capsule Body

 EFI_FIRMWARE_MANAGEMENT_CAPSULE_HEADER

 Optional Driver 1
 Offset Within Body == itemOffset[0]

 Optional Driver 2
 Offset Within Body == itemOffset[1]

 Payload 1
 Offset Within Body == itemOffset[2]

 Payload 2
 Offset Within Body == itemOffset[3]

 ... 

 Payload n
 Offset Within Body == itemOffset
 [EmbeddedDriverCount + PayloadItemCount - 1]
Payload Structure

EFI_FIRMWARE_MANAGEMENT_CAPSULE_HEADER

Driver 1

Payload 1

EFI_FIRMWARE_MANAGEMENT_CAPSULE_IMAGE_HEADER

Binary Update Image
Image Length = UpdateImageSize

Vendor Code Byes
Data Length = UpdateVendorCodeSize
UEFI 2.4 Update Adds New Capsule Delivery Solutions
Problem Statement

• UpdateCapsule() is run-time but:
  – FMP is not runtime so capsule needs to be conveyed to the system firmware after a restart
  – Persist in memory is possible but has disadvantages including:
    • Need to reserve block of memory of unknown size
UEFI 2.4 defines Capsule Delivery Via Disk

• OS tool Copies Capsule Image to `\EFI\CapsuleUpdate` directory on Boot Drive

• Then Sets OS_Indications bit
  – `EFI_OS_INDICATIONS_FILE_CAPSULE_DELIVERY_SUPPORTED`

• After Restart F/W finds Capsule and processes
UEFI 2.4 Defines Result Var

• After Capsule Processed, the result including any error status is left in created UEFI Variable
• Examined by the update launcher after OS restarts
How Secure is This ‘New’ Method?
Driver Security

• Update driver launched from the capsule must be signed by CA trusted by the platform
• Same Security Level as the UEFI Option ROM (the thing that is being updated)
• The Updated Option ROM image is also checked at restart
Image Payload Security

• All FMP implementations should use IMAGE_ATTRIBUTE_AUTHENTICATION_REQUIRED

• FMP code doing check is signed, and download driver breaks any existing ROM size barrier and allows IHV to use crypto for strong image check
Discussion Questions
Non-FMP use

• I don’t use FMP for my card. Can I use this new Capsule for proprietary update?
  – Technically yes, a capsule could contain 1 or more drivers but no payloads.
  – But, the update image would need to be embedded inside the driver image and the combination sent to CA for signing...
Boot Drive Write-protected

• What about a system with a write-protected EFI System Partition?
  – Provide utility to use UpdateCapsule directly, but possible the device firmware store was locked before UpdateCapsule() caller can load?
  – What is the right event trigger for device firmware write-protect lock?
Thanks for attending the UEFI Summerfest 2013

For more information on the Unified EFI Forum and UEFI Specifications, visit http://www.uefi.org
BACKUP
E:\>type payloadoptions.ini
INDEX 1
GUID
{0x149473c0,0xbc36,0x4340,\{0x86,0x4d,0xf0,0xf2,0xf2,0x82,0xd0,0xa2\}}
IMAGE payload.img
OUTPUT FmpImage.bin

E:\>UefiPayloadBuild payloadoptions.ini
UefiPayloadBuild: Using ini file = payloadoptions.ini
Processing Complete
E:\>type capsuleoptions.ini
DRIVER FmpTest.efi  #comment - first driver
DRIVER FmpDump.efi  //comment - second driver
PAYLOAD FmpImage.bin
OUTPUT  FMPtest.capsule

E:\>UefiCapsuleBuild capsuleoptions.ini
UefiCapsuleBuild: Using ini file = capsuleoptions.ini
Processing Complete
C:\>Cap2Disk.exe FmpTest.capsule
INFO:   Boot Drive Device is: \Device\HarddiskVolume2
INFO:   EFI System Drive Mounted as: Z:
INFO:   \EFI directory Exists
INFO:   \EFI\UpdateCapsule Exists
INFO:   Output File Path and Name is - Z:\EFI\UpdateCapsule\FMPtest.capsule
INFO:   Copied 25292 Bytes
INFO:   Efi System Partition Unmounted
INFO:   Program Complete - Please Restart System to Process Capsule in Firmware
C:\>Cap2Disk.exe -v

Capsule Result Variable Found = Capsule0000
  Total Size    = 3A
  Capsule Guid  = 6dcbd5ed-e82d-4c44-bda1-7194199ad92a
  Processed     = 2013/07/10 07:29:45
  EFI_STATUS    = 0000000000000000
  Optional File Name = FMPtest.capsule
INFO: Search Took 0 seconds and found 1 Capsule Result Variables