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Intel® Optane™ Memory System Acceleration

Corporate Re-imaging Guide

Ordering Information

Contact your local Intel sales representative for ordering information.

Revision History

Revision Number	Description	Revision Date
001	Initial release	October 2017
002	Minor updates to reference new products	May 2019
003	Added additional deployment flows	March 2020
004	Added example deployment details	July 2020
005	Minor updates to reference new product	February 2021

Contents

1 Overview

This guide provides an overview for IT administrators on how to apply their corporate operating system image to a system which ships from a manufacturer with the Intel® Optane™ memory system acceleration solution. This guide is not intended to teach an IT administrator how to create or deploy custom images, but focuses on "what's different" when deploying a custom image to an Intel Optane memory accelerated system. Resources to assist with technical details on image management and other approaches to installing the Intel Optane memory system acceleration solution are provided in the "Additional Resources" section of this document.

1.1 Corporate Re-imaging Introduction

In an enterprise IT environment, when a new PC is purchased, it is common practice to overwrite the operating system (OS) image delivered by the OEM and apply a custom image. The custom image usually includes the desired version of the OS, commonly used software for the user, as well as management and security software and settings for IT. Re-imaging is accomplished by a variety of methods, but is often applied using a Microsoft deployment toolset which requires infrastructure and trained resources. Re-imaging should be thought of as two distinct stages:

1. Image creation – the "one time" preparation of a custom image, often one per enterprise, or per PC model.

2. Image deployment – the process of using deployment tools to repeatedly apply the custom image to the specific PCs.

The appropriate Intel® Rapid Storage Technology (Intel® RST) drivers must be part of the custom image being deployed, and must be part of the boot image used by your deployment process. When these two requirements are met, image deployment should be no different — using Microsoft's WinPE, Microsoft Deployment Toolkit (MDT), or System Center Configuration Manager (SCCM)-based tools — than deployment to systems without the Intel® Optane™ memory system acceleration solution enabled.

1.2 Intel® Optane™ Memory System Acceleration Overview

Intel Optane memory is a system acceleration solution for compatible 7th Gen and newer Intel® Core™ processor-based platforms. This solution uses Intel Optane memory, based on Intel Optane memory media, along with the Intel® RST driver. This new memory media is conceptually located between the processor and slower storage devices (i.e. HDDs, NAND-based SSDs). Storing commonly used data and programs closer to the processor allows the system to access information more quickly, resulting in improved overall system responsiveness.

Products which are part of the Intel Optane memory system acceleration solution include:

- Intel® Optane™ Memory M10
- Intel® Optane™ Memory H10 with Solid State Storage
- Intel® Optane™ Memory H20 with Solid State Storage

1.3   What is the Intel® Optane™ Memory Volume?

The Intel Optane memory system acceleration solution concatenates Intel Optane memory and storage into one virtual drive, the Intel Optane memory volume. The accelerated volume is comprised of the "backing store" storage device (HDDs, NAND-based SSDs) and Intel Optane memory, which are concatenated and managed by the Intel RST driver. This volume is seen by the user and OS tools (e.g. Disk Management, Device Manager, Diskpart, WinPE) as a single drive.

Because the Intel Optane memory volume is managed by the Intel® RST drivers, these drivers must be present whenever working with the Intel Optane memory volume.

1.4   Re-imaging Overview

Re-imaging can be applied to Intel Optane memory-based systems with the same tools and methods as systems based on traditional storage. The flow may vary based on the starting configuration, but you can apply custom OS images to a system which has Intel Optane memory installed, whether it is enabled or not.

1.4.1   Re-imaging when Intel® Optane™ memory is enabled

When Intel Optane memory is enabled, the Intel Optane memory volume exists and is managed by RST. In this case, it is critical that the appropriate Intel RST drivers must be part of the custom image being deployed, and must be part of the boot image used by your deployment process. When these two requirements are met, image deployment should be no different — using Microsoft's WinPE, Microsoft Deployment Toolkit (MDT), or System Center Configuration Manager (SCCM)-based tools — than deployment to systems with traditional storage.

Following this flow, the Intel Optane memory volume exists before re-imaging, and the new OS image is deployed directly to the Intel Optane memory volume. No additional steps are required.

1.4.2   Re-imaging when Intel® Optane™ memory is not enabled

When Intel Optane memory is installed, but not enabled, two drives are visible: the Intel Optane memory component and the backing store. Platform implementation and configuration may vary, but often the Intel Optane memory component is seen as Disk 0 and the backing store is seen as Disk 1. In this scenario, the IT administrator has two choices:

1. Enable Intel Optane memory (create the Intel Optane memory volume), then deploy the image as in section 1.4.1
2. Deploy the image to the backing store, then enable Intel Optane memory later in the deployment flow

1.4.3   Enabling Intel® Optane™ memory

When Intel Optane memory is installed and the platform requirements are met, Intel Optane memory can be enabled in two main ways:

1. Intel Optane Memory and Storage Management application. This is a graphical application available from the Microsoft store. It replaces two grandfathered graphical user interfaces; Intel Optane memory graphical application and the Intel RST graphical application. This application is intended for users and IT administrators to view and change Intel Optane memory settings for a single PC.

2. RSTCLIPro.exe. This is a command-line interface (CLI) available with Intel RST 17.7 and newer. This utility can be integrated into your deployment flow to enable (or disable) Intel Optane memory. This utility is intended for IT administrators to view and change Optane memory settings for PCs via scripts. RSTCLIPro can be found here: https://downloadcenter.intel.com/download/29093/Intel-RSTCLI-Pro-for-Intel-Optane-Memory

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2 Image Creation

Image creation is the "one time" preparation of a custom image, often one per enterprise or per PC model. The output is the "gold build" that will be deployed to individual PCs before the PCs are delivered to specific users. The custom image usually includes the desired version of the OS, commonly used software for the user, as well as management and security software and settings for IT. The image is usually created by an IT administrator, and is captured for repeated deployment by the enterprise's chosen deployment method.

There are two common storage drivers that are used with custom Windows 10 images:

1. Microsoft "in-box" storage driver

2. Intel® Rapid Storage Technology (Intel® RST)

Intel® RST must be the storage driver that is integrated with the custom image.

- It is recommended that the version of Intel RST included with the custom image is the same as the version originally shipped with the PC, or newer.

- The process of integrating the Intel RST drivers is no different than integrating other drivers, such as chipset, graphics, network, etc.

- If the Intel RST drivers are not included in the custom image that is deployed, the "boot drive" will not be found and the OS will not load.

- Be sure to include the Intel RST drivers with the Windows recovery image, if that is deployed as part of the custom image.

See the "Additional Resources" section for links to additional information on creating and managing custom images.

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3 Image Deployment

Image deployment uses deployment tools to repeatedly apply the custom image to the specific PCs.

If the Intel Optane memory volume exists before deploying the image (Section 1.4.1), ensure the Intel RST drivers are injected in the deployment tool boot image and the custom OS image. If the Intel Optane memory volume doesn't exist before deploying the image (Section 1.4.2), the Intel RST drivers are optional in the deployment tool boot image.

3.1 Microsoft Windows PE (WinPE)

WinPE is a Microsoft utility generally used for operating system deployment and related support. Following is an example flow to deploy a captured image:

1. Boot to WinPE, and attach to a network resource containing captured images

2. Use the diskpart utility to clean and prepare the drive partitions

3. Apply the captured image using the Microsoft Deployment Image Servicing and Management (DISM) tool

4. Use the BCDBoot utility to set up the boot files on the system partition

3.1.1 WinPE resources

- Create the WinPE image:
  https://docs.microsoft.com/en-us/windows-hardware/manufacture/desktop/winpe-create-usb-bootable-drive

- Inject drivers to the WinPE boot image:
  https://docs.microsoft.com/en-us/windows-hardware/manufacture/desktop/winpe-mount-and-customize

- Sample Windows Assessment and Deployment Kit (Windows ADK) commands to inject the Intel RST drivers to the WinPE boot image and create the updated WinPE media:

  o dism /mount-image /imagefile:"c:\winpe\media\sources\boot.wim" /index:1 /mountdir:"c:\winpe\mount"

  o dism /add-driver /image:"c:\winpe\mount" /driver:c:\intel_rst /recurse

  o dism /unmount-image /mountdir:"c:\winpe\mount" /commit

  o makewinpemedia /ufd c:\winpe p:

3.2　　　Microsoft System Center Configuration Manager (SCCM)

Microsoft System Center Configuration Manager (SCCM) is a product for managing PCs in an enterprise IT environment. One of the many capabilities of SCCM is OS deployment. In concept, OS deployment through SCCM can be thought of as a graphical user interface (GUI) wrapper around the commands used with the WinPE deployment method.

More details on deploying images with SCCM to PCs with Optane memory can be found in Appendix A.

3.2.1　　　SCCM Resources

1. Create an SCCM task sequence to install an OS:
   https://docs.microsoft.com/en-us/sccm/osd/deploy-use/create-a-task-sequence-to-install-an-operating-system

2. Manage drivers in the SCCM catalog:
   https://docs.microsoft.com/en-us/sccm/osd/get-started/manage-drivers

3. Modify an SCCM boot image:
   https://docs.microsoft.com/en-us/sccm/osd/get-started/manage-boot-images#BKMK_ModifyBootImages

3.3　　　Microsoft Deployment Toolkit (MDT)

Microsoft Deployment Toolkit (MDT) is a product specifically for deploying and managing OS deployment. In concept, OS deployment through MDT can be thought of as a graphical user interface (GUI) wrapper around the commands used with the WinPE deployment method.

3.3.1　　　MDT Resources

- Deploy Windows 10 with the MDT:
  https://docs.microsoft.com/en-us/windows/deployment/deploy-windows-mdt/deploy-windows-10-with-the-microsoft-deployment-toolkit

- Extract and import drivers for the MDT boot image:
  https://docs.microsoft.com/en-us/windows/deployment/deploy-windows-mdt/deploy-windows-10-with-the-microsoft-deployment-toolkit

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As long as the Intel® RST drivers are injected in the deployment tool boot image, the deployment process is unchanged whether deploying to a PC with a single drive or a PC configured with an Intel® Optane™ memory volume.

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4   *Additional Resources*

- Installation and User Guide for Intel Optane Memory (includes driver injection instructions):
  https://www.intel.com/content/www/us/en/support/memory-and-storage/intel-optane-memory/000023989.html

- Intel Rapid Storage Technology (Intel RST) Download Page:
  https://downloadcenter.intel.com/download/29978?v=t

- Intel Rapid Storage Technology RSTCLIPro.exe Download Page:
  https://downloadcenter.intel.com/download/29093/Intel-RSTCLI-Pro-for-Intel-Optane-Memory

- How to Create and Manage a Windows Image Using DISM (Deployment Image Servicing and Management):
  https://msdn.microsoft.com/en-us/windows/hardware/commercialize/manufacture/desktop/create-and-manage-a-windows-image-using-dism

- Intel® Optane™ Memory Deployment and Management Guide for Enterprise IT:
  https://www.intel.com/content/www/us/en/support/articles/000025947/memory-and-storage/intel-optane-memory.html

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5   Appendix A – Deployment & Support Examples

5.1   Example 1: SCCM – Intel® Optane™ memory is installed and acceleration is enabled

In this example, Intel Optane memory H10 with solid state storage is installed in the PC, and Intel Optane memory system acceleration is enabled (the Intel Optane memory volume exists). This is possible if the PC manufacturer has enabled Intel Optane memory system acceleration at the factory, or if you are re-building an existing Intel Optane memory-based system in your environment.

When Intel RST is included in your boot image, Intel Optane memory is installed and system acceleration is enabled, one virtual drive is visible: the Intel Optane memory volume, drive 0.

For this example, we will deploy the custom image to drive 0 (the Intel Optane memory volume).

5.1.1   Pre-requisites

- Download Intel RST drivers from your OEM platform driver page, or from the intel.com link provided in Section 4. The drivers are in f6flpy-x64.zip.

- Inject the Intel RST drivers into your SCCM boot image: https://docs.microsoft.com/en-us/sccm/osd/get-started/manage-boot-images#BKMK_ModifyBootImages. This should be standard practice when managing any PCs which make use of Intel Optane memory.

- Include Intel RST as part of your captured Windows Image or using dynamic driver injection during the WinPE phase of PC setup. The use of Intel RST as part of the deployed OS image can be done only for platforms which make use of Intel Optane memory, or optionally for all PCs.

5.1.2   Steps

- There are no special steps required. The Intel Optane memory volume already exists as Disk 0, and the custom OS image will be deployed directly to Disk 0, as with any other drive.

5.1.3   Troubleshooting

- If you see two individual drives on the target PC, then either Intel Optane memory system acceleration is not enabled, or Intel RST is not injected into your SCCM boot image. Review pre-requisites.

5.2 Example 2: SCCM – Intel® Optane™ memory is installed, but acceleration is not enabled

In this example, Intel Optane memory H10 is installed in the PC, but Intel Optane memory system acceleration is not enabled (the Intel Optane memory volume does not exist). This is possible if the PC manufacturer has installed the hardware and OEM OS image, and intends to enable Intel Optane memory system acceleration during the Out Of Box Experience (OOBE), or after a service action to install a new Intel Optane memory H10 device.

When Intel Optane memory is installed but system acceleration is not enabled, and Intel RST is included in your boot image, two drives are visible: the Intel Optane memory component and the NAND backing store, Disk 0 and Disk 1. This is similar to a scenario where two separate drives are installed in the PC.

For this example, we will enable Intel Optane memory system acceleration, then deploy the custom image.

5.2.1 Pre-requisites

- Download Intel RST drivers from your OEM platform driver page, or from the intel.com link provided in Section 4. The drivers are in f6flpy-x64.zip. You must use driver version 17.7 or newer.

- Inject the Intel RST drivers into your SCCM boot image: https://docs.microsoft.com/en-us/sccm/osd/get-started/manage-boot-images#BKMK_ModifyBootImages. This should be standard practice when managing any PCs which make use of Intel Optane memory. This is the same process as installing other device drivers.

- Download Intel RST CLI Pro utility from the intel.com link provided in Section 4. Match the utility version to the version of Intel RST injected in the SCCM boot image.

- Include Intel RST as part of your captured Windows Image or using dynamic driver injection during the WinPE phase of PC setup. The use of Intel RST as part of the custom OS image can be done only for platforms which make use of Intel Optane memory, or optionally for all PCs.

5.2.2 Steps

- Clean the disks. Optional.

  - Diskpart; select disk 0, clean, select disk 1, clean

- If the PC has Intel Optane memory H10, and system acceleration is not enabled

  - Sample WMI query to see if the Intel Optane memory device is visible (meaning that acceleration is not enabled):

    - SELECT * FROM Win32_DiskDrive WHERE Index = "0" AND Size < 33000000000 AND Model LIKE '%intel%'
      SELECT * FROM Win32_DiskDrive WHERE Index = "1" AND Size < 33000000000 AND Model LIKE '%intel%'

  - If either WMI query is true, enable Intel Optane memory system acceleration ("create the association," "create the Intel Optane memory volume")

    - RSTCLIPro.exe --OptaneMemory --enable

- Reboot, then continue the task sequence, as with any other drive

  - Create partitions, deploy image, …

5.2.3 Troubleshooting

- Review pre-requisites.

5.3　　Frequently Asked Questions

Q1. When do you enable BitLocker relative to enabling Intel Optane memory acceleration?

- As long as Intel Optane memory system acceleration is enabled (the Intel Optane memory volume exists) before deploying the custom image, BitLocker can be enabled, disabled, re-enabled at will.

- If confidential data exists on the NAND component before Intel Optane memory system acceleration is enabled (due to a specific support action or deployment scenario where you deploy to NAND then enable Intel Optane memory system acceleration later), then complete the BitLocker encryption action first, then enable Intel Optane memory system acceleration.

Q2. What happens if Intel RST is not included as part of your boot image?

- The Intel Optane volume will not be recognized, and the system will not boot.

Q3. What changes do I need to make in the BIOS to enable Intel Optane memory system acceleration?

- This depends on the specific platform and Intel Optane memory product that is used, but for all systems shipped from the OEM with Intel Optane memory H10 or Intel Optane memory M10, there are no changes required in the BIOS.

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6 Appendix B – RSTCLIPro Utility

Intel Rapid Storage Technology (Intel RST) CLI Pro (RSTCLIPro.exe) is a command line utility for Windows 10 that can be used to perform basic operations on Intel Optane memory capable systems such as the following:

- Enable acceleration

- Disable acceleration

- View the status of hardware and acceleration

Notes:

- Please see the Readme and inline help for more details.

- The Intel RST driver must be part of your boot image before using this application.

- Intel RST CLI Pro is available with Intel RST version 17.7 and later. The version of RSTCLIPro.exe must match the version of Intel RST installed on the platform.

- See Section 4 for Intel RST driver and CLI Pro download links.

Example commands:

- Enable:
  - \<admin\> C:\temp\RSTCLIPro.exe --OptaneMemory --enable

- Disable:
  - \<admin\> C:\temp\RSTCLIPro.exe --OptaneMemory --disable

- Information:
  - \<admin\> C:\temp\RSTCLIPro.exe --OptaneMemory --information

- Help
  - \<admin\> C:\temp\RSTCLIPro.exe --OptaneMemory --help

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