

Intel[®] Rapid Start Technology

Implementation Guide for Corporate Customers

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1 Introduction

Intel® Rapid Start Technology enables a system to suspend to an ultra-low power state but resume into the user's desktop in seconds. This allows companies to save on power costs associated with keeping systems powered on or in a regular S3 state while also keeping employees productive by getting them back into their desktop in seconds versus potentially minutes. Intel Rapid Start Technology accesses a dedicated partition on the SSD to store the contents from main memory (DRAM) and move the platform to a deeper sleep state (S4).

This document provides detail about how Intel Rapid Start Technology works and covers information that will help provide a successful deployment of the feature in a business environment.



2 What is Intel® Rapid Start Technology?

2.1 Quick Start

PC manufacturers are the ones who integrate the necessary components described in Section 4 to deliver Intel Rapid Start Technology as a solution. Actual settings for Intel Rapid Start Technology are left to PC manufacturers' preferences. Please refer to their documentation for actual settings. Intel recommends that this feature be enabled at the factory and the entry timer set to 60 minutes after entering S3 (Sleep).

2.2 Overview

Saving the S3 Sleep State on the SSD. With Intel Rapid Start Technology enabled, the firmware starts a timer when the platform transitions to Sleep Mode (S3) from the operating system. The default value of the timer is set by the manufacturer and may be changed at a later time by the user. Intel recommends a 60 minute timer. When the timer expires, the system will transition to the rapid start state. To do this, the system will first wake into a transitional state, S0-Lite, and move the memory contents (DRAM) to the Intel Rapid Start Technology partition located on the SSD. This partition is normally configured during manufacturing by the OEM but can also be reconfigured by an end user.

Once the memory content has been copied, the BIOS will then tell the system to power down to an S4 state. The power consumption in this state will vary between OEM implementations but is typically much lower than Sleep (S3). The main power savings comes from removing power from the DRAM. In addition, OEMs may remove battery power from other components to increase battery life.

When the user returns to the system and powers it on, the BIOS will write the information from the partition in the SSD back into memory and the system will resume as if it was still in Sleep (S3). The operating system still believes it is in Sleep mode which means it will abide by the same authentication methods as used with wake from Sleep. Because of this, the rapid start state should be considered an extension of the Standby state.

Critical Battery Level during S3 sleep. Intel Rapid Start Technology can also be used to initiate an immediate transition to the rapid start state once a critical battery level is reached. This will only occur while the system is in Sleep (S3) mode. If the battery falls below a predetermined level while the system is in S3, the platform will perform an immediate transition to the rapid start state to save battery and preserve the user



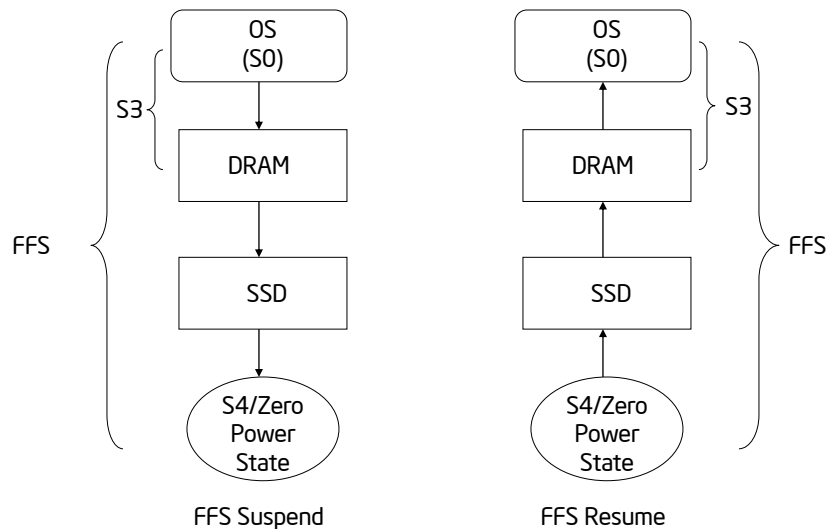
context. This is set by the OEM but can be changed by the end user through the Intel Rapid Start Technology Manager user interface.

2.3 Architectural Overview

Intel Rapid Start Technology is an improvement over the standard hibernate feature that is found in today's PC platform. This technology provides a simple and agile solution that is significantly faster than Microsoft* Windows* 7 OS-based hibernate on the same SSD solution.

Intel Rapid Start Technology moves data between system DRAM and fast SSD solutions (such as SATA2 or SATA3 SSDs) to improve performance. This is done in a way to keep software (operating system and BIOS) overhead to minimum while maximizing the hardware through-put. During Suspend with Intel Rapid Start Technology, the operating system context is moved from memory to the fast SSD solution. On resuming from the sleep state, the process is reversed. With Intel Rapid Start Technology this is all done independent of the operating system.

Figure 1. Intel® Rapid Start Technology Overview



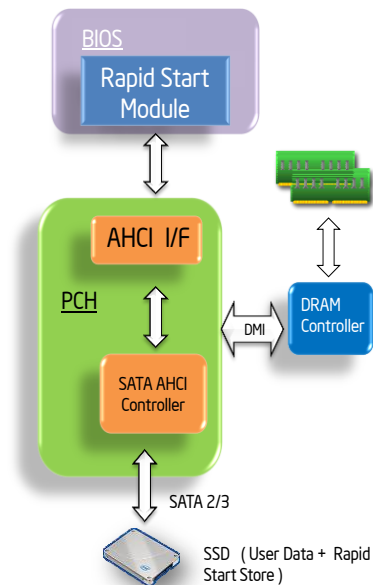


2.4 How is it Implemented?

Intel Rapid Start Technology uses the BIOS as a single point enabling agent. It is therefore a BIOS managed solution regardless of the location of the SATA controller.

Intel Rapid Start Technology is only supported on PCH SATA/m-SATA SSD based solutions. (PCIe-based solutions are not supported at this time.) Intel Rapid Start Technology supports both Intel and third-party SSDs; however, the performance will depend on the particular SSD and through-put of the SATA interface (SATA2 or SATA3).

Figure 2. Example of a System with Intel® Rapid Start Technology



2.5 Integration with Platform Power Transitions

This section will provide a closer look at how Intel Rapid Start Technology works during the following two transitions:

- The platform booting phase from Power off (S5) to Power on (S0)
- Transitioning from Power on (S0) to Sleep (S3)



2.5.1 During Platform Boot

During each platform boot (S5-to-S0), the BIOS checks to ensure that the platform meets the necessary requirements. If Intel Rapid Start Technology is enabled, the BIOS checks to make sure the partition on the SSD is greater than, or equal to, the amount of DRAM in the system. If it is, then the platform will be allowed to transition to the rapid start state. If it is not, then the system will remain in Sleep mode (or follow other platform policies) and will not transition to the rapid start state.

There is an optional feature OEMs can implement called *Active Page Threshold*, which amends this BIOS process. This will be discussed in the following section.

2.5.2 During the Platform Transition to Sleep

Most of the activity during this state is related to minimizing the amount of memory that will need to be moved to the SSD partition. The Rapid Start Runtime Service in the operating system will discard Standby pages and flush Modified memory pages to the disk. The purpose of moving these non-critical pages is to maximize the entry and exit performance. This process uses APIs provided by the operating system.

Flushing Active Memory Pages: Another service provided by the operating system that is optional for OEMs to implement is the ability to flush Active Memory Pages. This would also occur on S3 entry and is an OS service that will maintain the memory pages critical for a platform resume and flush the rest of the pages to disk. This feature improves resume performance. This can be activated by editing the registry for Intel Rapid Start Technology. All values are type REG_DWORD and go in the following key:

- For 32 bit OS: [HKEY_LOCAL_MACHINE\SOFTWARE\Intel\irstrt\Parameters]
- For 64 bit OS:
[HKEY_LOCAL_MACHINE\SOFTWARE\Wow6432Node\Intel\irstrt\Parameters]

The registry key to enable active memory page flushing is FlushActivePagesEnabled and should be set to a value of 1. To change the Standby and Modified page flushing behavior the keys are FlushStandbyPagesEnabled and FlushModifiedPagesEnabled respectively. Similarly, a value of zero disables the feature and a value of one enables it.

Active Page Threshold Feature: If an OEM or system administrator wants to take advantage of a smaller partition they will need to enable the Active Page Threshold feature. Instead of comparing the partition size and DRAM at start up, this feature will perform a check during S3 entry. It compares the size of the active pages needing to be moved to the SSD to ensure there is enough space. If so, Intel Rapid Start Technology is enabled. If not, the system will remain in S3.

NOTES: *this feature requires that the OEM enable support in BIOS. Check with the system OEM to ensure this feature is supported.*



Also note: This feature also requires installation of the Intel Rapid Start Technology Software.

2.6 Integration Consideration for Enterprise IT

As noted previously, Intel Rapid Start Technology requires a dedicated partition on the SSD to write data to and read data from. This partition exists outside of the normal operating system partition and may require special consideration depending on security policy.

2.6.1 Removing Data from the Intel Rapid Start Technology Partition

Data is only written to the dedicated partition right before entering the low power S4 state. During the resume path, after contents from the partition are read back into memory, a TRIM command is issued to the SSD controller signaling that the LBAs (Logical Block Addresses) can be deleted. TRIM is a command in the Serial ATA specification that tells the SSD controller which LBAs are no longer being used and the data in those LBAs can be deleted. The main purpose of this feature is to help prevent access to data in the partition during runtime. This command may not be available on all SSDs and implementation of this command may vary by SSD manufacturer. Check with the manufacturer on support details.

2.6.2 Use with Full-Disk Encryption Solutions

2.6.2.1 Intel Rapid Start Technology with Hardware-based Full-Disk Encryption Solutions

Intel Rapid Start Technology is compatible with ATA security features (aka Drive Password), including self-encrypting drives (SEDs) that use the ATA Security feature set for locking/unlocking. These solutions will provide the same level of protection to the Intel Rapid Start Technology partition as they do the system data in the OS partition. To encrypt the Intel Rapid Start Technology partition, enabling a SSD's hardware based full-disk encryption and enabling an ATA security password is recommended.

2.6.2.2 Use with Software-based Full-Disk Encryption

Using Intel Rapid Start Technology with software-based full disk encryption is not recommended. Since Intel Rapid Start Technology works from Sleep (S3) power state and software-based full-disk encryption solutions typically re-authenticate the user only when coming out of Hibernate (S4) and power off (S5) they can coexist on the same system. However, the information in the Intel Rapid Start Technology partition will not be

What is Intel® Rapid Start Technology?



encrypted by software-based full-disk encryption. The encryption keys are stored in memory and will be written to the unencrypted Intel Rapid Start Technology partition on the SSD. Due to this is a concern, Intel recommends one of the following when software-based full disk encryption is in use:

- Enable an ATA security password on the SSD to encrypt the Intel Rapid Start Technology partition.
- Or, disable Intel Rapid Start Technology in BIOS. Alternatively, when initially deploying a system, remove the Intel Rapid Start Technology partition (Hibernate Partition). This has the same effect as disabling Intel Rapid Start Technology in the BIOS.

If your system has been running software-based full disk encryption where Intel Rapid Start Technology has been enabled, the following steps are recommended to help secure your drive:

- Perform a full backup of the user data
- Perform a secure erase in accordance with the SSD or Hybrid drive manufacturer's guidelines
- Disable Intel Rapid Start Technology in the BIOS
- Reimage the drive and restore the user data from backup
 - § Disable Intel Rapid Start Technology in the OS if it is not available in the BIOS. This must be done before any transition to Sleep occurs.

2.6.2.3 Use with Opal SEDs

Intel Rapid Start Technology is currently not compatible with Opal self-encrypting drives. This is under evaluation for future improvements.



3 Hardware and Software Components

This section discusses the hardware and software components required for Intel Rapid Start Technology. Note that these requirements are integrated during manufacturing by PC OEMs.

3.1 Hardware Elements

Intel Rapid Start Technology is available on both mobile and desktop platforms.

3.1.1 Intel Processor Requirements

Intel Rapid Start Technology requires one of the following platforms:

- 2nd generation Intel® Core™ i3, i5, or i7 processors
- 3rd generation Intel® Core™ i3, i5, or i7 processors
- 4th generation Intel® Core™ i3, i5, or i7 processors

3.1.2 Storage Controller

Hardware elements of Intel Rapid Start Technology architecture include a SATA2/3 AHCI capable storage controller and associated solid state (SSD) drive. For the best performance, Intel recommends using a SATA3 based controller and SSD.

3.1.3 Storage Device

Intel Rapid Start Technology requires fast non-volatile storage such as a SSD device to store its data. The size of SSD storage device has to be big enough to allow a portion of the SSD to be reserved for Intel Rapid Start Technology usage without impacting other storage features.

Examples of suitable SSD storage devices include Intel SATA2 and SATA3 AHCI based SSDs as well as 3rd party SSDs that meet SATA2 performance.

Note that Intel Rapid Start Technology performance is highly dependent on the SATA interface and SSD performance; therefore the Intel Rapid Start Technology benefits will vary depending on the SATA and SSD performance.



3.2 Software Elements

3.2.1 System BIOS

Intel Rapid Start Technology is a BIOS-managed feature. The OEM must provide a BIOS for the PC that includes support for Intel Rapid Start Technology.

The BIOS performs all Intel Rapid Start Technology specific tasks including saving and restoring of Intel Rapid Start Technology data to the SSD storage devices.

The OEM has the option to implement the following features (check with your OEM for support on your PC):

- Detection of DRAM memory size configuration, and disabling Intel Rapid Start Technology if the detected memory size is not supported by Intel Rapid Start Technology
- Issuing the ATA TRIM command over the used LBA range in the Intel Rapid Start Technology partition as a security requirement
- Support for the Active Page Threshold feature (this enables smaller size SSDs to work with large size DRAM capacities)

3.2.2 Intel Rapid Start Technology Software

This is a single installer package for Windows 7 and Windows 8. It is optional for the use of Intel Rapid Start Technology but provides benefits such as faster resume and control of Intel Rapid Start Technology settings from a graphical interface in Windows. It is comprised of three components (described in the following subsections).

3.2.2.1 Intel Rapid Start Technology Virtual Device Driver

To support runtime configuration and overrides, a virtual device driver is provided to allow configuration of Intel Rapid Start Technology BIOS settings from a user mode application.

3.2.2.2 Intel Rapid Start Technology Runtime Service

This service provides a runtime mechanism to flush standby memory pages on entry to Sleep (S3) mode to improve performance. Optionally, users can flush active memory pages as well. This ensures that the number of active pages saved and restored by Intel Rapid Start Technology is kept to minimum for faster performance. Upon resume, the operating system will page-in active pages based on application usage. The flushing of memory pages is done using an operating system provided API. Directions for enabling this feature are in Section 2.5.2.



3.2.2.3 Intel Rapid Start Technology Manager

This tool provides a GUI-based approach for controlling Intel Rapid Start Technology settings. This application handles the interaction with the operating system Hibernate settings to ensure that there is no contention with Intel Rapid Start Technology settings.

3.2.3 Intel Rapid Start Technology Partition

Intel Rapid Start Technology requires a dedicated partition (called the hibernation partition) on the SSD for storing its data. The BIOS will only enable Intel Rapid Start Technology after it has detected this partition. Any standard disk partition tool can be used for this purpose as long as it allows designation of Intel Rapid Start Technology partition type.

3.2.4 Operating System

Intel Rapid Start Technology Software requires Windows 7 or Windows 8.

Intel Rapid Start Technology uses the Windows runtime API to flush certain memory pages to further optimize its resume performance.

For the base level functionality, Intel Rapid Start Technology does not require any specific features from the operating system other than the standard S3 ACPI support.



4 Reimaging Systems

You can reimage a system to add or change the Intel Rapid Start Technology partition on the SSD. You can also reimage the SSD to support both Intel Rapid Start Technology and Intel® Smart Response Technology. Intel Rapid Start Technology must have a dedicated partition on the SSD. If a partition is not detected, the BIOS will disable Intel Rapid Start Technology during the initial boot. This section will discuss installation requirements and walk through the process.

- Section 4.2 covers reimaging a single disk system
- Section 4.3 covers reimaging a system with two SSDs configured in RAID1
- Section 4.4 covers a system that implements both Intel Rapid Start Technology and Intel Smart Response Technology. Please pay special attention to this section because the order of installation is very important for these two technologies to work together.

4.1 Configurable Components

4.1.1 Disk Partition

This is required for Intel Rapid Start Technology to operate. As noted above, the simplest setup is to create a partition equal to the maximum amount of DRAM that the system can hold. This will accommodate any upgrades that occur during the lifecycle of the PC. At a minimum the partition needs to be equal to the amount of DRAM currently in the system.

The partition can be created with most standard partitioning tools. For example, the Windows native disk partition tool (diskpart.exe) can be used to create Intel Rapid Start Technology partition.



Below is a guideline for how large the partition should be based on the amount of memory on the system and whether or not Active Page Threshold is enabled in the BIOS. In addition, it is recommended that the Intel Rapid Start Technology Software is loaded to help clean up memory usage. See additional information about this feature in section 4.1.2 for Active Page Threshold and section 4.1.3 for Intel Rapid Start Technology Software.

		Active Page Threshold Disabled	Active Page Threshold Enabled
Amount of System DRAM	2 GB	2048 MB	2048 MB
	4 GB	4096 MB	3072 MB
	8 GB	8192 MB	4096 MB

NOTE: Memory manufacturers and SSD manufacturers measure capacity two different numbering systems. Memory manufacturers calculate using Base 2 and storage vendors use Base 10. Ensure you translate accordingly when creating your partition.

In order to implement a smaller partition to maximize usable disk space the system will have to support the Active Page Threshold feature in the BIOS. Support of this feature will vary between OEMs.

4.1.2 Active Page Threshold Setting in BIOS

The benefit of this setting is to allow Intel Rapid Start Technology to work with a partition size less than the amount of DRAM on the system. This feature needs to be supported in the BIOS of the OEM system in order to enable it. If supported, here are the settings available:

- Active Page Threshold – Enables or disables the feature
- Threshold Value – This is set a value, in MB, that matches the partition size. However, once set this will stay the same regardless of upgrades to the SSD, partition or DRAM. (For example, if it is set to 4000 MB, then Intel Rapid Start Technology will only look for and use 4000 MB of space) Intel recommends this be set to the value 'zero.' This is the value that will enable auto threshold and provides maximum flexibility. It will set the threshold to match the partition created. This allows for future upgrades and increased partition size without making changes to the BIOS settings.

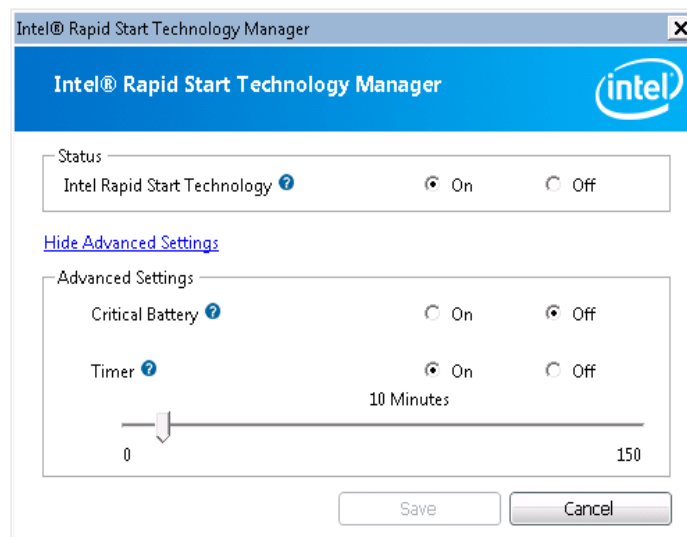


4.1.3 Intel Rapid Start Technology Software

Intel Rapid Start Technology software components are optional but recommended. The Runtime Service and Driver are needed for “memory hygiene” to provide a more consistent resume time as active pages accumulate. (Memory hygiene refers to the process of identifying which pages in memory that must be saved when the system goes into Sleep.) The Runtime Service will minimize the amount of information that needs to be moved between memory and the SSD. The driver is required to pass information from the user interface (Intel Rapid Start Technology Manager) to the BIOS. The driver is also required for the Rapid Start Runtime Service to function.

The Intel Rapid Start Technology Manager allows the user to easily change the settings right from the operating system. The user can enable Intel Rapid Start Technology, adjust the entry timer, and, for mobile platforms, to enable the transition from S3 to S4 before the timer expires if the battery level is critical.

Figure 3. Intel Rapid Start Technology Manager



4.2 Partitioning for Single SSD Configuration

Intel Rapid Start Technology requires a dedicated SSD partition or contiguous blocks on a SSD. The disk partition can be in one of two formats:

- An **Master Boot Record (MBR) format** with 0x84 partition type which shows up as a “Hibernate Partition” in windows. Windows 7 provides a disk partition tool (diskpart.exe) that can be used to create this type of partition.
- An **EFI GUID partition** with partition name “Intel FFS Reserved” and GUID: D3BFE2DE-3DAF-11DF-BA40-E3A556D89593



- **NOTE:** *Implementing a primary partition is part of the basic support for Intel Rapid Start Technology and what is covered in this section. Other partitioning support, like logical partition, is dependent on the OEM support in the BIOS. Contact your PC manufacturer for more information and options about supported partitioning schemes.*

Intel does not provide a tool/driver to create the partition automatically. The partition will need to be created manually by the OEM or end-user. There are many possible ways to create a partition for Intel Rapid Start Technology.

The following steps are one example. In this example, Windows is already installed on the disk with a default partitioning scheme. To make room for Intel Rapid Start Technology Partition, the C: partition is shrunk. Then, the Intel Rapid Start Technology Partition is created with the proper ID.

See <http://technet.microsoft.com/en-us/library/cc731894.aspx> for more information on shrinking partitions with diskpart.

1. Identify the disk that will host the Intel Rapid Start Technology Partition.
 - a. Open CMD as administrator
 - b. Diskpart
 - c. List Disk
 - d. A list of disks in the system is displayed. Decide which to use for the Rapid Start Partition. Remember the disk number. It will be used later. (Note, this disk must be an SSD.) This document will use disk 0 as an example.
 - e. Also, check the GPT column and remember if this disc is configured for GPT.

Check the free space on the disk. If there is enough room for the Intel Rapid Start Technology Partition skip to step 4 Create the Intel Rapid Start Technology Partition.

```
DISKPART> list disk
```

Disk ###	Status	Size	Free	Dyn	Gpt
Disk 0	Online	167 GB	0 B		

2. Identify the Volume you wish to shrink.
 - a. Select Disk 0



- b. Detail Disk
- c. A list of volumes on Disk 0 is displayed. Decide which volume to shrink to make room for the Intel Rapid Start Technology Partition. Remember the volume number. It will be used later. (Note, most often this will be drive C). This document uses volume 1 as an example.

```
Administrator: Command Prompt - diskpart
DISKPART> detail disk
INTEL SSDSCMMW180A3L
Disk ID: AAFEA427
Type : SATA
Status : Online
Path : 0
Target : 0
LUN ID : 0
Location Path : UNAVAILABLE
Current Read-only State : No
Read-only : No
Boot Disk : Yes
Pagefile Disk : Yes
Hibernation File Disk : No
Crashdump Disk : Yes
Clustered Disk : No

  Volume ###  Ltr  Label           Fs      Type          Size      Status       Info
  -----
  Volume 0          C  System          NTFS    Partition     499 MB    Healthy     System
  Volume 1          C  OSDisk          NTFS    Partition    159 GB    Healthy     Boot

DISKPART>
```

3. Shrink the volume

- a. Select Volume 1
- b. Type `shrink desired=SIZE` (where SIZE is the size in MB of the rapid start partition).
- c. The volume will shrink and the disk now has free space for the Intel Rapid Start Technology Partition. Note, if the shrink fails it is due to non-movable files being in the shrink space. Check <http://technet.microsoft.com/en-us/library/cc731894.aspx> for more details.

```
DISKPART> select volume 1
Volume 1 is the selected volume.
DISKPART> shrink desired = 8092
DiskPart successfully shrunk the volume by: 8092 MB
DISKPART> _
```



4. Create the Intel Rapid Start Technology Partition

a. If the disk is configured for GPT:

- i. Type `create partition primary size=SIZE ID=d3bfe2de-3daf-11df-ba40-e3a556d89593` (where SIZE is the size in MB of the rapid start partition)

b. If the Disk is NOT configured for GPT

- i. Type `create partition primary size=SIZE ID=84` (where SIZE is the size in MB of the rapid start partition)

```
DISKPART> create partition primary size=8092 ID=84
DiskPart succeeded in creating the specified partition.
DISKPART>
```

5. Exit Diskpart and reboot. Upon boot the BIOS will detect the Intel Rapid Start Technology Partition and enable Intel Rapid Start Technology.

4.3 Using Intel Rapid Start Technology and Intel® Smart Response Technology Together

Intel Smart Response Technology uses a solid state drive (SSD) to cache a Hard Disk Drive (HDD). This increases system performance while reducing overall system cost. See the Intel Smart Response Technology Deployment Guide for more information.

4.3.1 System Setup

Intel Smart Response Technology requires a HDD and an SSD and uses the Intel RAID BIOS module. The HDD is configured as a pass through volume. The SSD is configured as a Cache volume and is linked to the HDD pass-through volume.

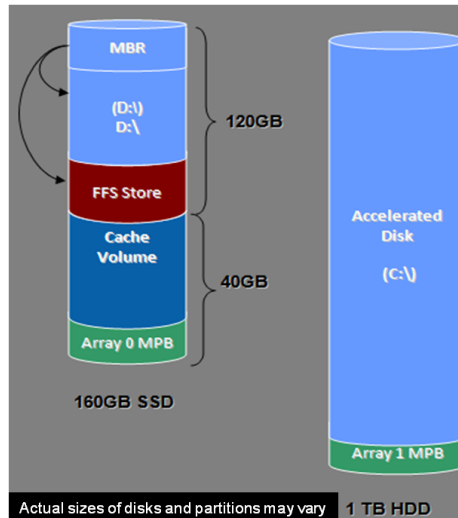
To support Intel Rapid Start Technology and Intel Smart Response Technology, the SSD must be configured with two volumes as in the diagram below. One volume is the Cache volume. The other volume is a pass through volume and is used to contain the Intel Rapid Start Technology Partition (labeled FFS Store in the diagram). Other partitions may also be placed in the SSD's pass-through volume.

NOTE: *If the system has an EFI BIOS, convert the SSD disk to GPT format before enabling Intel Smart Response Technology to ensure that the cache volume is in GPT format. You*



may encounter errors when creating the Intel Rapid Start Technology partition in GPT format if your cache volume is in MBR format.

Figure 4. Example of Intel® Rapid Start Technology and Intel® Smart Response Technology



4.3.2 Configuration Example

Computer configuration in this example:

- 1 TB HDD connected to SATA Port 0
 - 160 GB SSD connected to SATA Port 1
 - RAID enabled in BIOS
 - Both disks configured as pass through devices in the RAID BIOS extension
 - Windows installed to on a partition on the 1 TB Hard Disk (this disk may contain multiple partitions)
 - SSD has no partitions - **this is important!**
 - Windows has the Rapid Storage Driver and the RSTCLI tool installed
1. Decide how large the cache volume should be. Note that it must be at least 18.5 GB, but no larger than 64 GB. Be sure to save enough room for the Intel Rapid Start Technology Partition. See the chart above for details.
 2. Decide which cache mode to use: enhanced or maximized.
 3. Open a command prompt as administrator.
 4. Create the Cache Volume:
 - `Rstcli -accelerate -createCache -SSD 0-1-0-0 -cache-size SIZE` (where SIZE is the size in GB for the cache volume. Also note that 0-**1**-0-0 denotes the disk on SATA port 1).
 5. Accelerate the HDD

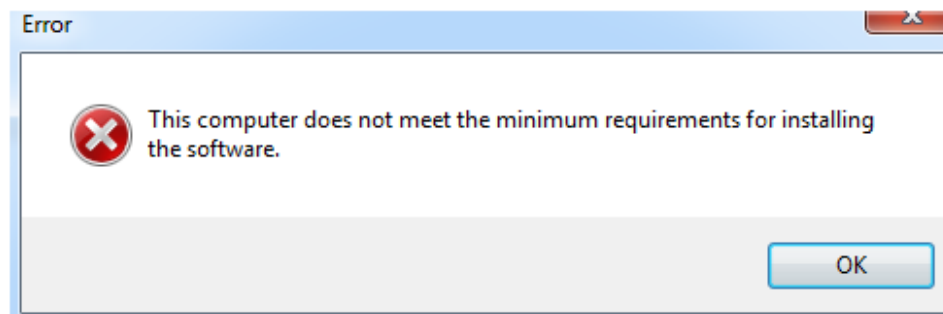
- Rstcli -accelerate -setAccelConfig -disk-to-accel 0-0-0-0 -mode MODE (where MODE is the mode for the cache. Also note that 0-0-0-0 denotes the disk on SATA port 0).
6. The remainder of the SSD space is automatically configured as a pass through device. Create the Intel Rapid Start Technology Partition by following steps in **Partitioning for Single SSD Configuration**. Ensure the disk used is the SSD's pass through volume. Optionally, normal Windows partition(s) may be created as well, given enough free space is available on the SSD's pass-through volume.

4.4 Troubleshooting

4.4.1 Trouble Installing the Driver

If you encounter the below error when executing setup.exe it means that Intel Rapid Start Technology is not properly enabled and the Intel Rapid Start Technology virtual device is most likely missing.

Figure 5. Missing Minimum Requirements Error



Reasons may include, but not restricted to:

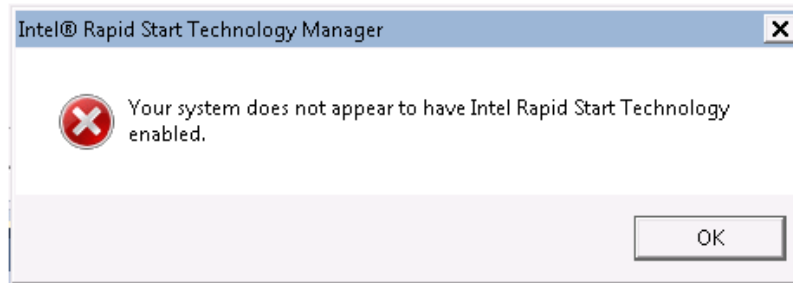
- Mismatch between memory size and the Intel Rapid Start Technology partition size
Resolution: Increase partition size
- The Intel Rapid Start Technology Partition is not found during BIOS initialization
Resolution: Check that the partition was created with the correct partition type (i.e. 0x84 for MBR format) or GUID (for GPT format)
- Intel Rapid Start Technology is disabled from the BIOS Setup Menu
Resolution: Go into BIOS and enable Intel Rapid Start Technology

4.4.2 After the Driver Is Installed

If the system does not have Intel Rapid Start Technology enabled, the below warning message will be displayed and the application will quit:



Figure 6. Intel Rapid Start Technology not Enabled Error



Ensure that Intel Rapid Start Technology is enabled in the BIOS. Also, ensure the Intel Rapid Start Technology partition has not been deleted.



5 Considerations for Remote Deployment

The Intel Rapid Start Technology Partition may be installed prior to the OS install or after the OS installation. Most deployment tools allow for creating hard drive partitions, but do not allow for setting the required partition IDs. Further, many tools, such as the Microsoft Deployment Toolkit, require separate task sequences for different partitioning schemes.

Intel recommends creating the Intel Rapid Start Technology partition after the initial OS is installed. In this way, a single application package can be used for both scenarios; initial OS deployment, or installation after the user has been using their computer for some time. Another advantage to this method is it reduces the amount of change needed to the OS deployment Task Sequence.

This is accomplished by creating a script that will do the following:

1. Create the Intel Rapid Start Technology Partition
 - a. Check for the prior existence of the Intel Rapid Start Partition
 - b. Identify the drive to use (usually disk 0)
 - c. Identify the volume to shrink if no space is available (usually C:)
 - d. Shrink the volume if needed
 - e. Create the Rapid Start Partition
2. Reboot
3. Install the Intel Rapid Start Technology Software
 - a. Install with /S

This script, along with the Intel Rapid Start Technology Software Installer is deployed as a single application package.

Below is a sample script to create the Intel Rapid Start Technology Partition (step 1 above). At the top of the script, adjust the SIZE and LTR parameters. These are the size of the Intel Rapid Start Technology Partition to create and the drive letter to shrink.

```
@echo off
SETLOCAL ENABLEDELAYEDEXPANSION

:: ##### User Variables #####

:: Drive letter to shrink
set LTR=C

:: Size of Rapid Start partition in MB
set SZ=8092
```




```
:: ### End User Variables ###

:: Clear and Define Vars
:: Disk that already has Rapid Start Partition
set DSK=
:: Disk where Rapid Start Partition will be created
set DSK2SHRNK=
:: Volume to shrink to make room for Rapid Start Partition
set VOL=
:: Partition that already has Rapid Start ID
set PART=
:: Is the Disk with the Rapid Start Partition a GPT disk? yes || no
set GPT=
:: Is the Disk to shrink a GPT disk? yes || no
set GPT2SHRNK=

:: Loop through the disks
:: to find the desired target
:: and check if the Rapid Start partition already exists
:: Do these together to save a little time
for /F "tokens=2,6,7" %%A IN ('echo list disk ^| diskpart ^| find "Online"')
do (
  :: Find the desired target disk and volume to shrink
  echo select disk %%A > tmp.txt
  echo detail disk >> tmp.txt
  for /F "tokens=1,2,3" %%F IN ('diskpart /s tmp.txt') do (
    if "%%F"=="Volume" (
      if "%%H"=="%LTR%" (

        set DSK2SHRNK=%%A
        set VOL=%%G
        set FRE=%%B
        set MET=%%C
        echo select disk %%A > tmp1.txt
        echo uniqueid disk >> tmp1.txt
        set GPT2SHRNK=no
        for /F %%Q IN ('diskpart /s tmp1.txt ^| find "{") do (
          if not "%%Q"==" " set GPT2SHRNK=yes
        )
        del tmp1.txt
      )
    )
  )
  del tmp.txt

  :: Find the Rapid Start partition
  echo select disk %%A > tmp.txt
  echo list partition >> tmp.txt
  for /F "tokens=1,2 skip=10" %%F IN ('diskpart /s tmp.txt') do (
    echo select disk %%A > tmp1.txt
    echo select partition %%G >> tmp1.txt
    echo detail partition >> tmp1.txt
    for /F "delims=" %%Q in ('diskpart /s tmp1.txt ^| find "Type" ^| find "84"') do (
      if not "%%Q"==" " (
        set PART=%%G
        set DSK=%%A
        set GPT=no
      )
    )
  )
)
```



```
)
)
for /F "delims=" %%Q in ('diskpart /s tmp1.txt ^| find "Type" ^| find "d3bfe2de-3daf-11df-ba40-e3a556d89593") do (
    if not "%%Q"==" " (
        set PART=%%G
        set DSK=%%A
        set GPT=yes
    )
)
del tmp1.txt

)
del tmp.txt
)

:: If %PART% has a value, it's the Rapid Start Partition
:: Report for debug
if not "%PART%"==" " (
    echo Found Rapid Start Partition
    echo Disk: %DSK%
    echo Partition: %PART%
    echo GPT: %GPT%
    goto install
)

:: If %DSK2SHRNK% has a value, it's the disk we want to shrink.
:: If not, exit because we don't know what to do.
if "%DSK2SHRNK%"==" " (
    echo Didn't find the Rapid Start Partition.
    echo Didn't find the Disk to shrink.
    echo.
    echo Unable to continue
    goto :eof
)

:: Notify the user for debug
echo Disk to Shrink
echo Disk: %DSK2SHRNK%
echo Volume: %VOL%
echo GPT: %GPT2SHRNK%
echo Desired Size = %SZ% MB
::echo Free Space = %FRE% %MET%

:: Note, this script does not check for existing free space.

:: Make the partition
:: Shrink
echo select volume %VOL% > tmp.txt
echo shrink desired=%SZ% >> tmp.txt
:: diskpart does the job
diskpart /s tmp.txt
if not %ERRORLEVEL%==0 (
    Echo unable to shrink disk %DSK2SHRNK%.
    echo.
    echo Unable to continue
    del tmp.txt
    goto :eof
)
```



```
)
:: cleanup
del tmp.txt

:: New partition
echo select disk %DSK2SHRNK% > tmp.txt
if %GPT2SHRNK%==no echo create partition primary size=%SZ% ID=84>> tmp.txt
if %GPT2SHRNK%==yes echo create partition primary size=%SZ% ID=d3bfe2de-
3daf-11df-ba40-e3a556d89593>> tmp.txt
:: diskpart does the job
diskpart /s tmp.txt
if not %ERRORLEVEL%==0 (
Echo unable to create the Rapid Start Partition.
echo.
echo Unable to continue
del tmp.txt
goto :eof
)
:: cleanup
del tmp.txt

:install
:: Need to reboot before the install.
:: This is so BIOS will detect the Rapid Start Partition and enable the
feature
:: shurdown /r /t 0
::
::
:: After Reboot run
:: echo Install Rapid Start now
:: setup /s
```



6 *Verify Intel Rapid Start Technology is Working*

Intel Rapid Start Technology is so well integrated into OS suspend routines that it is difficult to notice that anything has changed. This section outlines a few methods to verify that Intel Rapid Start Technology is working.

6.1 System LEDs

Systems with a Power LED will usually pulse on and off when the system is in ACPI S3. However, in S4, the power LED turns off. Also, hard disk LEDs indicate hard drive activity.

To observe Intel Rapid Start Technology, set the Timer to 1 min. Then, place the system into S3 sleep. When the system reaches S3, the power LED will flash. Begin a 1 minute timer. When the timer goes off, observe the hard disk LED begin to flash. At this point the system is in S0-lite and is copying the contents of RAM onto the Rapid Start Partition. In a few seconds, observe that all LEDs have turned off. At this point the system is in S4. However, the OS and Intel AMT still think the system is in S3. Now, press the power button to wake the system. Observe the hard disk LED flashes. Data is being copied from the Rapid Start Partition to RAM. After a few seconds the system resumes to S0.

If desired, a comparison can be made to demonstrate the value of Intel Rapid Start Technology. First, turn Rapid Start Technology off. Then, place the system into S4 (Hibernate). Notice how much longer it takes to go to sleep and wake up. Now, place the system into S3. Notice that resuming from S3 is slightly faster than when waking with Rapid Start. However, Rapid Start power use is much closer to that of S4.



7 Acronyms

Term	Definition
NVM	Non-volatile Memory
S3	Suspend-to-DRAM
S4	Suspend-to-Disk
BIOS	Basic Input Output System
Chipset	Combination of ICH & MCH
Platform	Fully assembled PC that contains an internal drive, DRAM, and IO devices
DRAM	The system's main memory
OEM	Original Equipment Manufacturers
LBA	Logical Block Addressing – locations of blocks of data used in computer storage
SATA2; SATA3	Serial ATA is an interface for connecting storage devices. The numbers indicate generations. SATA2 has a maximum throughput of 250MB/s. SATA3 offers a max throughput of 500MB/s.
mSATA	Mini-SATA which usually applies to smaller SSDs.
RAID 1	Creates an exact copy of the data on two different disks.