

# Technical Advisory

## Intel® RSTe Problem Report — Intel® Rapid Storage Technology enterprise: RAID 5 Data Loss Exposure

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October 2, 2015

### Description

**Table 1: Affected Intel Products**

Product	Product (Driver) Versions
Intel® Rapid Storage Technology enterprise Driver	<b>All Windows* based production driver releases of the following baselines:</b> <ul style="list-style-type: none"><li>All currently available up to and including RSTe 4.2.0.1143 (Please contact your platform OEM or ODM for details on obtaining this version)</li></ul>

### Problem Statement

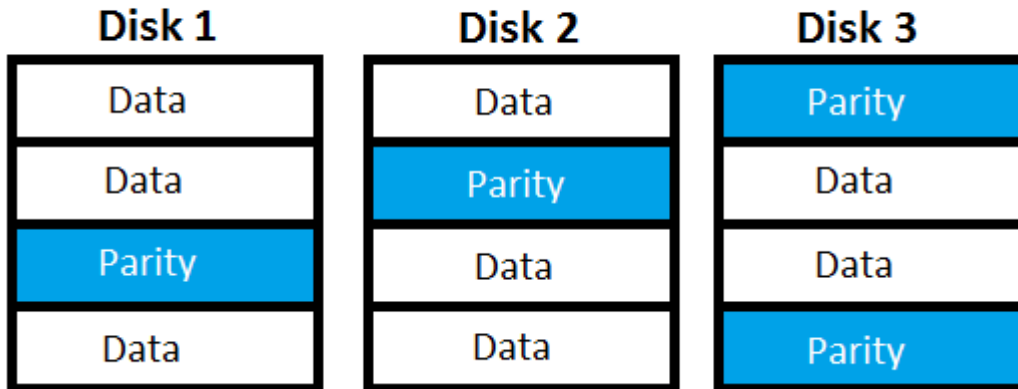
A potential data loss condition exists when an Intel® Rapid Storage Technology enterprise (Intel® RSTe) managed RAID 5 volume becomes degraded. The data loss exposure only exists after a RAID 5 volume becomes degraded and there is sustained heavy I/O (with I/O buffering disabled) for more than approximately 60 minutes.

### Root Cause

When an RSTe RAID5 volume resides on an N-disk matrix in normal mode, the RAID manager writes data blocks to N-1 disks and then computes a parity (XOR from data blocks) based off of the data written. The parity is then written drive N. The following is a simple diagram showing this on a 3 driver RAID 5 volume.



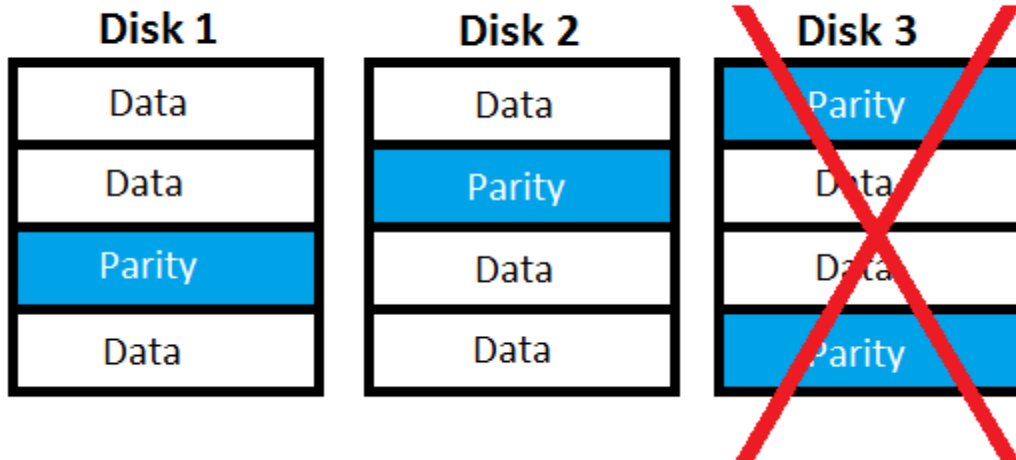
## Raid 5 volume "Normal" mode



When one of the RAID5 volume member disks fails, the RAID5 volume goes to degraded state. When processing 'read data' commands the RSTe RAID manager is able to recover the lost data from the healthy disks (data and/or parity) and is able to respond with the complete data blocks back up to the OS.

When processing 'write data' commands the RSTe RAID manager uses the RAID5 logic to write the data and parity blocks, skipping writes to failed drive.

## Raid 5 volume "Degraded" mode



In the failing scenario, a user runs a heavy IO traffic with buffering disabled, a race condition may occur when accessing the pointer to data blocks processing 'write data' commands. When the error occurs the correct pointers may be inadvertently overwritten and as a result incorrect data may be written to a disk.

This exposure to data loss does occur in any other RAID5 states, only degraded.

### Impact of Defect

Windows has buffering enabled by default. In order to expose the data loss condition, this buffer option must be manually disabled. Another condition that can expose this condition is using an application that provides an option to configure buffering and that option is set to not use buffering. Under these conditions, if a RAID 5 volume becomes degraded, after 60-plus minutes of heavy I/O, the platform could encounter data loss.



## Workaround

1. Ensure that buffering is always enabled.
2. When a RAID5 volume becomes degraded, replace the failed drive immediately and start the rebuild process as quickly as possible.
3. Add another drive to the system and mark that drive as a Hot Spare. This will result in the degraded RAID 5 transitioning to a rebuild state in a very short period of time (thereby closing the exposure window).

## Corrective Action/Resolution

Intel has resolved this issue and has release the following packages (Please contact your platform OEM or ODM for details on obtaining these driver versions):

1. For Windows Server 2003 and Server 2008
  - a. **Driver version number:** RSTe 4.0.2.1019
2. For Windows Vista and XP (64 bit)
  - a. **Driver version number:** RSTe 4.1.2.1011
3. For Windows 8 (32bit and 64bit)
  - a. **RSTe Kit version number:** RSTe 4.2.2.1005
4. For Windows 7, 8.1, Server 2008 R2, Server 2012, Server 2012 R2 and Windows 10
  - a. **RSTe Kit version number:** RSTe 4.3.0.1223



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