Intel® Virtual RAID on CPU (Intel® VROC) 8.0 PV Release for Eagle Stream

Customer Release Notes

November 2022

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1 Introduction

1.1 Overview

The Intel® Virtual RAID on CPU (Intel® VROC) 8.0 PV release is a family of products providing enterprise RAID solutions targeted to support Eagle Stream Sapphire Rapids based platforms.

The Intel VROC 8.0 family of products provides enterprise RAID solutions for both NVMe SSD and SATA devices for enterprise servers and workstations. The product family includes the following products.

1. Intel VROC (VMD NVMe RAID) – This product provides an enterprise RAID solution on Intel® Xeon® Scalable Family Platforms that support the Intel VMD technology.
2. Intel VROC (SATA RAID) – This product provides an enterprise RAID solution for SATA devices connected to SATA, sSATA or tSATA (Eaglestream server platform only) Intel Platform Control Hub (PCH) configured for RAID mode.

Note: Intel VROC 8.0 is a high-level blanket product reference for Intel VROC (VMD NVMe RAID) and Intel VROC (SATA RAID).

1.2 Terminology

Table 1: Terminology

Term	Description
AHCI	Advanced Host Controller Interface
API	Application Programming Interface
ASM	Intel® Accelerated Storage Manager (Intel® ASM)
BIOS	Basic Input/Output System
GB	Gigabyte
GUI	Graphical User Interface
HII	Human Interface Infrastructure
Hot-Plug	The unannounced removal and insertion of a drive while the system is powered on.
I/O	Input/Output
KB	Kilobyte

Term	Description
Matrix RAID	Two independent RAID volumes within a single RAID array.
MB	Megabyte
Member Disk	An NVMe drive used within a RAID array.
NVMe	Non-volatile Memory Express
OS	Operating System
POST	Power On Self-Test
PreOS	The Intel VROC images incorporated into the platform BIOS to access the drives and providing the interface to configure Intel VROC UEFI Drivers.
RAID	Redundant Array of Independent Disks: allows data to be distributed across multiple drives to provide data redundancy or to enhance data storage performance.
RAID 0 (striping)	The data in the RAID volume is striped across the array's members. Striping divides data into units and distributes those units across the members without creating data redundancy but improving read/write performance.
RAID 1 (mirroring)	The data in the RAID volume is mirrored across the RAID array's members. Mirroring is the term used to describe the key feature of RAID 1, which writes duplicate data from one drive to another; therefore, creating data redundancy and increasing fault tolerance.
RAID 5 (striping with parity)	The data in the RAID volume and parity are striped across the array's members. Parity information is written with the data in a rotating sequence across the members of the array. This RAID level is a preferred configuration for efficiency, fault-tolerance, and performance.
RAID 10 (striping and mirroring)	The RAID level where information is striped across two drive arrays for system performance. Each of the drive in the array has a mirror for fault tolerance. RAID 10 provides the performance benefits of RAID 0 and the redundancy of RAID 1. However, it requires four hard drives so it’s the least cost effective.
RAID Array	A logical grouping of physical drives.
RAID Volume	A fixed amount of space across a RAID array that appears as a single physical drive to the operating system. Each RAID volume is created with a specific RAID level to provide data redundancy or to enhance data storage performance.

Term	Description
Spare	The drive that is the designated target drive in a RAID Volume recovery. The Spare drive is a global setting (not designated to a specific RAID volume). Spare drives on a SATA Controller are not available on the sSATA Controller (and visa-versa). Spare drives designated on Intel VROC (VMD NVMe RAID) are exposed and available on all Intel VMD domains.
Strip	The size of the data block that is to be written in each write cycle across the RAID array.
Stripe	Block size that is assigned to evenly distribute portions of the stripe across a designated number of drives within a RAID array. A collection of Strips is called a Stripe
Intel® RSTe	Intel® Rapid Storage Technology enterprise.
RWH	RAID Write Hole
SSD	Solid State Drive
TB	Terabyte
UEFI Mode	*Unified Extensible Firmware Interface*. Refers to the system setting in the BIOS
Intel® VMD	Intel® Volume Management Device
Intel® VROC	Intel® Virtual RAID on CPU

1.3 Defect Submission Support

With this release, Intel will accept, and process issues reported by customers via the Intel Premier Support (IPS) portal.

To submit an issue, please use the Intel Premier Support (IPS) tool. Information, training and details can be found at the below website. Your local FAE can also provide you the necessary requirements to enable you to submit an IPS issue (also known as a "case") including an account setup if you do not already have one.

http://www.intel.com/content/www/us/en/design/support/ips/training/welcome.html

When submitting a case, please include the below as an example of information that needs to be included the following Fields in order to flag Intel VROC AE support:

- Product/Project Info -> Case Category = TechnologyInitiative
- Product/Project Info -> Case Subcategory = Intel® Virtual RAID on CPU (Intel ® VROC)

1.4 Supported Platforms/Chipsets/SKUs

The Intel VROC 8.0 PV package was designed to work on customer platforms that are based on the following Intel reference platforms:

1.4.1 Supported Platforms for Intel VROC (VMD NVMe RAID)

CPU	Platform	VMD 1.0 Device ID	VMD 2.0/3.0 Device ID	# of VMD
Intel® Xeon® Scalable Processor family – W	Intel® Xeon® Scalable Processor family workstation†	201D	N/A	3 per CPU
Intel® Xeon® Scalable Processor family – SP	Intel® Xeon® Scalable Processor family server and workstation†	201D	28C0	3 per CPU
Intel® Xeon® Processor D-2100 Product Family	Intel® Xeon® Processor D-2100 Product Family based platform†	201D	N/A	3 per CPU
The Intel® Xeon® Processor Scalable Memory Family	Intel® Xeon® Scalable Processor family server and workstation†	201D	28C0	4 per CPU (VMD 1.0) 4 per CPU / 1 for PCH (VMD 2.0/3.0)
Intel® X299 High End Desktop	Intel® Xeon® Scalable Processor family server and workstation†	201D	N/A	3 per CPU

† Unless Otherwise Specified in the Release Notes

Note: Intel VROC (VMD NVMe RAID) support on the Intel X299 High End Desktop platforms is restricted to Intel NVMe SSDs only. This is a platform limitation. As a result, when Intel VROC is installed onto an Intel X299 High End Desktop platform, the customer will only see Intel NVMe SSDs plugged into the platform.

Note: Intel VROC (NonVMD NVMe RAID) is no longer included in the Intel VROC PV release package. If support for this product is required please reference the Intel VROC 7.X based family of products.

1.4.2 Supported Chipset SKU for Intel VROC (SATA RAID)

Chipset	Platform	RAID controller Device ID	# of Ports

Intel® C610 series chipset	Platforms containing the Intel® C610 series chipset†	2826 (SATA) 2827 (sSATA)	6 SATA 4 sSATA
Intel® C610 series chipset	Platforms Refreshes containing the Intel® C610 series chipset†	2826 (SATA) 2827 (sSATA)	8 SATA 6 sSATA
Intel® C220 series chipset	Platforms containing the Intel® C220 series chipset†	2826 (SATA)	6 SATA
Intel® C230 series chipset	Platforms containing the Intel® C230 series chipset Platform†	2826 (SATA)	8 SATA
Intel® C240 Series Chipset	Platforms containing the Intel® C240 Series Chipset†	2826 (SATA)	8 SATA
Intel® 620 series chipset	Platforms containing the Intel® 620 series chipset†	2826 (SATA) 2827 (sSATA)	8 SATA 6 sSATA
Intel® C422 series chipset	Platforms containing the Intel® C422 series chipset†	2826 (SATA)	8 SATA
Intel® C741 chipset	Platforms containing the Intel® C741 series chipset†	2826 (SATA) 2827 (sSATA) 282F (tSATA)	8 SATA 6 sSATA 6 tSATA

† Unless otherwise specified in the Release Notes

1.5 Supported Operating Systems

Only 64bit Windows OS support is available

The Production Version (PV) release package for the Intel VROC 8.0 family of products was designed to work with, tested and validated on the following Windows OSs.

Platform†	Windows*10 (RS4, RS5††, 19H1, 19H2, 20H1, 20H2, 21H1, 21H2)	Windows* 11	Windows* Server 2016 RS4 Enterprise	Windows* Server 2019 Enterprise	Windows* Server 2022 Enterprise
Intel® C610/C620/C741 series chipset based platforms	Y	Y	Y	Y	Y
Intel® C220/C230/C240	Y	Y	Y	Y	Y

series chipset based platforms					
Intel® Xeon® Scalable processor family based platforms	Y	Y			
Intel® Xeon® Scalable processor family Workstation based platforms	Y	Y			
Intel® Xeon® Scalable processor family Server based platforms			Y	Y	Y
Intel® Xeon® Processor D-2100 Product Family based platform			Y	Y	Y
Intel® Xeon® Processor W790 series chipset	Y	Y			

†Only 64bit OS is supported on all platforms
†† Introduces/Includes WinPE Support for this Version

2 Supported PCIe NVMe SSDs List

All shipping Intel® Data Center and Professional NVMe* SSDs are supported by Intel® VROC 8.0 PV, except dual port NVMe* SSDs. For the latest list of supported Non-Intel PCIe NVMe SSDs, please visit Intel® Virtual RAID on CPU (Intel® VROC) Supported Configurations

Platform providers are now allowed to self-validate their own list of NVMe SSDs for use with Intel VROC (VMD NVMe RAID). For more details, please contact your designated Intel VROC PAE.

3 New Features

3.1 New Features Introduced with Intel VROC 8.0 EGS

3.1.1 LED management on PCH-VMD

There are 2 PCIe ports designed and controlled under PCH, Emmitsburg, and this feature with LED management is implemented in the circuit and the on-board secondary CPLD. Designers need to implement the same or similar logic control as this CPLD does to control 2 LEDs designed on-board to represent the RAID status.

Note: The detail reference design guide is in "LED-Mgmt-PCIe-SSDs-RAID-TechnologyBrief.pdf.

3.1.2 Intel VROC 8.0 New GUI Design

Warning message displayed when GUI and driver version is mismatching

When this warning message condition is detected from one major version or 2 minor versions difference, GUI will not allow to manage the storage controller, but can provide a set of functionalities corresponding to the lowest driver version. GUI still can start even there is no driver installed.

3.1.3 PEIM support

Intel VROC is a software RAID solution for NVMe and SATA drives. Intel VROC starting with version 8.0.1 introduces VROC Pre-EFI Initialization Module (PEIM) to support BIOS recovery scenario during the boot.

VROC PEI module for SATA – provides access to RAID volumes and SATA drives connected to Intel SATA controller.

VROC PEI module for VMD – provides access to RAID volumes and NVMe drives connected to single Intel VMD controller.

Both modules have common code base with PEI interface implementation and RAID logic. The main difference between them is different transport implementations (AHCI vs. VMD and NVMe). Every VROC PEI module installs two PEIM-to-PEIM interfaces (PPI), defined in PI Specification:

EFI_PEI_RECOVERY_BLOCK_IO_PPI

EFI_PEI_RECOVERY_BLOCK_IO2_PPI

These PPIs are used to read data from pass-through drives and RAID volumes, enumerated by VROC PEI modules.

VROC 8.0 PEI modules have several limitations:

VROC VMD PEI module enumerates single VMD device, regardless how many VMD devices are present in the system.

RAID engine does not support RAID Write Hole protection mechanism for RAID 5. While RAID Write Hole condition occurs for RAID 5, the VROC UEFI PEI module will provide data access to this RAID volume without RAID Write Hole recovery procedure. The data read in PEI phase from RAID 5 may be affected by the RAID Write Hole scenario.

RAID engine does not support drives with 4kiB block size – such drives will not be enumerated. Pass-through drives will not be exposed as block devices. RAID volumes consisting of such drives will also not be exposed.

3.1.4 Physical Drive Location Information in UEFI

When intel VROC product displays how Intel VMD controller enumerate the drives. The drive information is showing in VROC HII like below figure. The information is not straightforward and not easy to interpret. In order to present the drive location information in a user-friendly manner, Intel VROC offers a protocol that will allow customers to report how the drives are connected and how customer would like the information reported in customer platform. Please find the detail in Intel VROC UEFI physical drive location document.

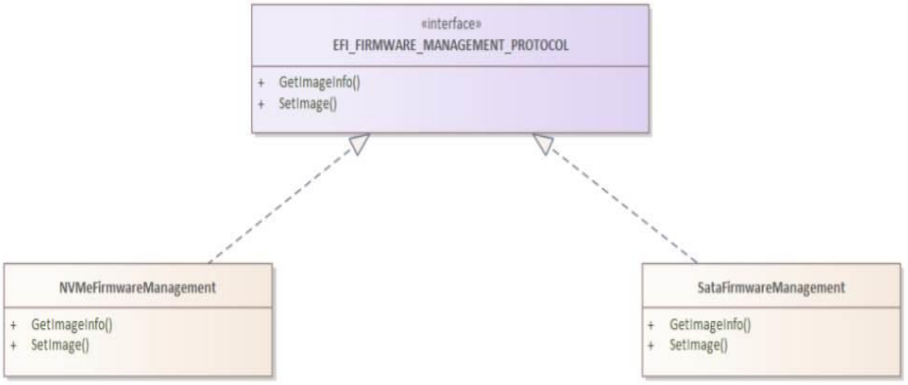
3.2 UEFI New Features Introduced with Intel VROC 7.7

3.2.1 Firmware Management Protocol Support

Intel VROC 7.7 introduces limited support for the UEFI Firmware Management Protocol (FMP) as outlined in UEFI Specification version 2.9. The Intel VROC UEFI drivers will provide support for updating drive firmware (through UEFI FMP) when the drive is managed by Intel VROC. This includes both Intel VROC (VMD NVMe RAID) and Intel VROC (SATA RAID). The Intel VROC UEFI driver has implemented a subset of protocol functions defined in the UEFI Specification, which is reflected in the below table.

EFI Firmware Management Protocol functions	**Intel VROC UEFI implementation**
GetImageInfo	Supported
SetImage	Supported

The following diagram highlights the process flow to support both NVMe and SATA drives.



3.2.2 Intel VROC (SATA RAID) Support of EFI_ATA_PASS_THRU_Protocol

The Intel VROC 7.7 release package introduces limited support for EFI_ATA_PASS_THRU_PROTOCOL commands to provide information on the SATA drives managed by Intel VROC (SATA RAID).

3.2.3 Disable Locate LED within Intel VROC LED Management

The Intel VROC provides support for the OEM/ODMs to disable the Locate LED functionality within the Intel VROC LED Management. By enabling the feature, the OEM/ODM can use their own tools to initiate a Locate LED functionality within their platform.

3.3 New Features Introduced in the Intel VROC 7.6 Release

The Intel VROC 7.6 release package introduces two new features. These two features are Intel VROC PreOS Failed RAID Volume (limited) recovery as well as UEFI ATA Passthrough protocol support for Intel VROC (SATA RAID)

3.3.1 Intel VROC PreOS Environment RAID Volume Failure Recovery

Intel VROC 7.6 PV introduces a new feature in the VROC HII page that will allow the user to attempt to recover from a failed RAID volume. When a failed RAID volume is encountered during boot, the option is made available in the VROC HII page for which the user can select. This is a multi-step process.

The first is to select the RAID volume in “Failed” state and then select the option to force it to “Degraded” state. This will expose the next option to specify the drive to enable this action.

Once the RAID volume is changed to “Degraded” state, the standard RAID volume recovery process initiates the rebuilding process.

NOTE: Intel makes no guarantee of successful recovery from a failed state using this option. This must be treated as a last chance effort and there is no guarantee that there won't be some data loss. Intel always recommends recovering a Failed RAID Volume by recreating the RAID volume from scratch and restore the data from the latest platform image backup.

3.3.2 Intel VROC (SATA RAID) UEFI Support for EFI_ATA _PASSTHRU

Intel VROC 7.6 VROC (SATA RAID) PV introduces support for EFI_ATA_PASS_THRU protocol support by the Intel VROC (SATA RAID) UEFI driver. The following specific options are supported in Intel VROC 7.6:

- PassThru;
    - IDENTIFY
    - ATA_READ_LOG_EXT
- GetNextPort;
- GetNextDevice;
- BuildDevicePath;
- GetDevice;

3.4 Features Introduced in the Intel VROC 7.5 Release

The Intel VROC 7.5 PV release package introduces several new features to support the latest Intel Platforms as well as improve the user experience. The key new feature introduced are:

- Intel VMD 2.0 support which includes
    - Increase in MSIX vectors to 64
    - Intel VMD Support for NVMe Devices Attached to the Platform Controller Hub (PCH)
    - Increase in the number of PCI-E lanes that can be controlled by VMD from 48 to 64
    - Increase in the number of VMD devices from 3 to 5

3.4.1 Intel VMD 2.0 Features

3.4.1.1 Increasing MSIX Vectors to 64

Intel VROC 7.5 introduces support for customer configurations that can support 64 MSIX Vectors. On platforms that support Intel VMD 1.0, the MSIX support is limited to 32 MSIX vectors. For these (Intel VMD 1.0) platforms, a single VMD domain can support up to 24 NVMe SSDs. This means that those 24 NVMe SSDs will share a single Intel VMD MSIX vector. As the number of vectors, in newer NVMe devices, increase beyond 32, this can result in a platform performance impact. With the introduction of Intel VMD 2.0, and Intel VROC 7.5, this increase to 64 MSIX vectors should help to alleviate this problem. This is because the average dual socket server will have between 48 and 64 cores, which limits the number of MSIX vectors on a given NVMe SSD to 64, for optimal usage.

3.4.1.2 Intel VMD (PCH) Support

Intel VROC 7.5 introduces support for the Intel (VMD NVMe RAID) management of NVMe SSDs connected to the Platform Controller Hub (PCH). Utilizing the Flex-IO capabilities of the PCH, Intel VMD 2.0 technology can now take ownership of two of the slots allowing Intel VROC (VMD NVMe RAID) to control and manage the NVMe SSDs attached to those slots. This is accomplished by utilizing the Function Level Assignment of the PCH PCI functions. Utilizing the BIOS setup menus, the user will be able to enable Intel VMD on the designated slots, or PCH functions (depending on the BIOS implementation) and the PCH functions will be reassigned to an Intel VMD (PCH) controller. To be able to accomplish this, there must be NVMe SSDs present on the slot(s) and the slots used must support Slot Implemented Capabilities. Otherwise, Intel VMD (PCH) cannot be enabled. Please refer to the Intel® C620 Series Chipset Platform Controller Hub datasheet (document No. 336067) and/or the **Ice Lake PCH External Design Guide**, document No. **572631** for details on the Flexible I/O feature.

When this feature is fully enabled, it will reassign sSATA ports 2-5 to be PCIe lanes managed by Intel VMD (PCH). This is translated into PCIe root ports 8-11 and Flex I/O ports 14-17. The general configuration is 2 - X2 PCIe lanes.

This feature is intended for supporting a simple RAID 1 boot using 2- NVMe SSDs attached directly to the PCH. However, if the platform supports expanded configurations, using retimer or switch Add-In-Cards (AIC), full Intel VROC (VMD NVMe RAID) support can be obtained. Intel VROC (VMD NVMe RAID) was only validated with 2 NVMe SSDs directly attached to the PCH. Any configurations beyond two directly attached NVMe drives is not recommended.

Note: With this new functionality, when Intel VMD is enabled, a DUMMY function/device will be seen in the Windows Device Manager as a “Yellow Bang”. This function is the result of a PCIe requirement for a device with multiple functions. Once the Intel VROC installation process is complete this DUMMY function/device will be hidden in the list of System functions.

3.4.1.2.1 Intel VMD (PCH) PreOS Support

Intel VMD (PCH) PreOS support is included in the Intel VROC (VMD NVMe RAID) PreOS images, which is part of the Intel VROC release package. There are no other PreOS images required.

3.4.1.2.2 Intel VMD (PCH) Pass-thru Boot Support

Intel VROC 7.5 provides Intel VROC (VMD NVMe RAID) PreOS support for NVMe SSDs attached to the PCH when Intel VMD (PCH) is enabled. This will allow an OS to be installed onto and boot from an NVMe device managed by Intel VROC (VMD NVMe RAID). No Intel VROC Upgrade key is required to utilize this feature.

3.4.1.2.3 Intel VMD (PCH) RAID Boot Support

Intel VROC 7.5 provides Intel VROC (VMD NVMe RAID) PreOS support for NVMe SSDs attached to the PCH when Intel VMD (PCH) is enabled. When an Intel VROC Upgrade key is present and Intel VMD (PCH) is enabled, the user will be able to use the Intel VROC (VMD NVMe RAID) PreOS HII to setup and manage a RAID volume using the NVMe SSDs attached to the PCH. This will allow an OS to be installed onto and boot from an Intel VROC (VMD NVMe RAID) volume attached to Intel VMD (PCH).

3.4.1.2.4 Intel VMD (PCH) RAID Data Volume Spanning

Once Intel VMD (PCH) is enabled, Intel VROC (VMD NVMe RAID) will treat it like any other Intel VMD controller. Spanning Data RAID volumes are supported as they are currently outlined in this document. This applies to the Intel VROC PreOS tools, the Windows OS GUI and the CLI tool. The option to span VMD controllers is supported, but not recommended

Note: This is supported but not recommended due to a performance penalty using the PCH.

Note: Boot Volume spanning is not supported. All devices used to create a boot volume must reside on the same controller (Intel VMD Controller Domain or SATA Controller).

3.4.1.2.5 Intel VMD (PCH) Designations

The Intel VROC (VMD NVMe RAID) management tools (PreOS tools, Windows GUI and CLI tool) are used to manage devices attached to the Intel VMD (PCH) controller, the corresponding information displayed will indicate “PCH” with any device or controller associated with Intel VMD (PCH).

3.4.1.2.6 Intel VMD (PCH) Hot Plug Support.

Intel VROC does not support Hot Plug when NVMe SSDs are attached to the Intel VMD (PCH) controller.

3.4.2 Number of Intel VMD Increased

Intel VMD 2.0 technology and increased the number of PCIe lanes controlled by the Intel VMD from 48 to 64. This, along with the Intel VMD (PCH) support increases the total number of Intel VMDs to 5.

- 4 Intel VMDs off the CPU
- 1 Intel VMD of the PCH (Intel VMD (PCH))

3.4.3 Native PCIe Enclosure Management (NPEM)

Intel VROC 7.5 introduces support for the Native PCIe Encloser Management (NPEM) standard for LED management in a PCIe 4.0 based environment. This capability is discoverable in each switch-downstream-port. If it is discovered to be present, the Intel VROC LED utility will use NPEM control, capability and status registers to visually indicate the various drive and volume states.

3.4.4 Limited Out of Band Support

Intel VROC 7.5 introduces limited Out of Band support. This support is not outlined in this TPS. If additional information is required extent and limitations to this support, please contact you Intel FAE.

3.4.5 Limited Self Encrypted Drives

Intel VROC 7.5 introduces Self Encrypting Drive (SED) key management support. The implemented key management is only in the UEFI environment but allows secure booting with SEDs into all Intel VROC OS environments. The specific support details are not outlined in this TPS. If detailed information is required, please contact you Intel FAE.

3.4.6 Intel VROC 7.5 GUI UWD Upgrade Limitations

Due to some updates required by the Intel VROC 7.5 GUI, a platform with 7.0 based drivers or 6.x based driver won't be able to upgrade to the Intel VROC 7.5 GUI, from the Microsoft App Store, until after the drivers have been updated. This is due to the potential of not being able to properly manage the Intel VROC RAID volumes already established in the system, after the upgrade. Once the platform is upgraded to the Intel VROC 7.5 drivers, the GUI can be updated.

3.4.7 Intel VROC 7.5 CLI

Intel VROC 7.5 CLI tool now supports the creation of a RAID volume size down to two digits after the decimal point.

3.4.8 Unsupported Drives

When an unsupported drive is encountered by the Intel VROC 7.5 GUI and/or CLI, the displayed information will show the usage as 'Pass through'.

3.5 Features Introduced in the Intel VROC 7.0 Release

3.5.1 Removal of AHCI mode support

With the release of the Intel VROC 7.0 PV package, the package will no longer include drivers to support the PCH configured for AHCI mode. All support for this configuration will be via the Microsoft inbox AHCI driver. Please contact your Intel FAE if you have any further questions.

- For fresh clean (OS installation) configurations, the Intel VROC 7.0 installer will bypass the PCH if it is in AHCI mode.
- For existing platforms that has Intel VROC AHCI driver installed, running the Intel VROC 7.0 installer will remove/uninstall the Intel VROC AHCI driver so the Microsoft inbox AHCI driver can be used. A message will be displayed to inform the user of the upcoming change.

3.5.2 Removal of Legacy Option ROM Support

With the release of the Intel VROC 7.0 PV package, the package will no longer include the Intel VROC (SATA RAID) Legacy Option ROM PreOS components. All PreOS support for Intel VROC (SATA RAID) will only be through the UEFI environment. If Intel VROC (SATA RAID) support, through the Legacy Option ROM environment, is required please continue to use the Intel VROC 6.3 release package. Please contact your Intel FAE if you have any further questions.

3.5.3 Removal of Windows 7 Support

With the release of the Intel VROC 7.0 PV package, the package will no longer include support for Windows 7. All components and support for Windows 7 (Windows drivers and PreOS components) have been removed. If Windows 7 support is required, please continue to use the Intel VROC 6.3 release package. Please contact your Intel FAE if you have any further questions.

4 Drivers, Images and Utilities

The Intel® VROC 8.0 Release Package is constructed of several components. The following is the list of those components and their corresponding version numbers.

Note: Due to the components being different entities (but are required for the product to work properly), the component version number may not match and will be different from the package version number.

Feature	Notes

Intel UEFI Drivers	• Intel® VROC UEFI Driver version 8.0.0.4006
	  ○ VMDVROC_1.efi (HW key enforcement in effect)
	• Intel® VMD UEFI version 3.0.0.1079
	  ○ VMDVROC_2.efi
	Note: All these images are required and intended to support Intel VMD and Intel VROC (SATA RAID) functionality as a combined installed package.
	• Intel® VROC (SATA RAID) SATA / sSATA UEFI Driver version 8.0.0.4006
	  ○ SataDriver.efi
	  ○ sSataDriver.efi

Intel® VROC Windows Drivers	• Intel® VROC Windows GUI version 8.0.0.4030
	• Intel® VROC Windows Installer Package version 8.0-1.0.10.0
	  ○ SetupVROC.exe (Multi-lingual)
	• Intel® VROC (SATA RAID) Windows F6 Driver version 8.0.0.4028– Win10
	  ○ \ iaStorE.free.win10.64bit.8.0.0.4028\iaStorE (SATA)
	  ○ \ iaStorE.free.win10.64bit.8.0.0.4028\iaStorB (sSATA)
	• Intel VROC CLI version 8.0.0.4030

UEFI Based RAID Configuration Utility	• Intel® VROC version 8.0.0.4006
	  ○ RCfgVROC.efi
	• Intel® VROC SATA / sSATA version 8.0.0.4006
	  ○ RCfgSata.efi
	  ○ RCfgsSata.efi
	• Note: Secure Boot must be disabled to use this tool

UEFI Based Comply Utility	• Intel® VROC version 8.0.0.4006
	  ○ RcmpVROC.efi
	• Intel® VROC SATA / sSATA version 8.0.0.4006
	  ○ RCmpSata.efi
	  ○ RCmpsSata.efi
	• Note: Secure Boot must be disabled to use this tool

Feature	Notes

UEFI based SATA SGPIO/LED Test utility	• Intel® VROC SATA / sSATA version 8.0.0.4006
	  ○ LedToolSata.efi
	  ○ LedToolsSata.efi
	• Note: Secure Boot must be disabled to use this tool

UEFI based Intel VROC LED Test utility	• Intel® VROC version 8.0.0.4006 ○ LedToolVROC.efi • Note: This tool can be used to exercise LEDs for NVMe disks behind VMD

UEFI Based Clear Metadata Utility	• Intel® VROC SATA / sSATA version 8.0.0.4006
	  ○ RClrSata.efi
	  ○ RClrsSata.efi

UEFI Based Intel VROC HW Key Checker	• Intel® VROC Activation Key Checker version 8.0.0.4006 ○ HWKeyCheckVROC.efi • Note: This tool will check for the presence and type of the HW key

5 Intel VROC Limitations

5.1 Microsoft .NET Framework Removal

The Intel VROC product installation application does not include Microsoft .NET Framework. Please visit Microsoft to download the latest version. Instillation may not complete successfully without this feature.

5.2 Surprise Hot Plug Limitations

Due to Microsoft Windows time restrictions for resuming from S3 and S4, and Intel VMD device identification requirements, Hot Plug of Intel VMD enabled NVMe devices is not supported during S3 and S4 states.

Surprise removal of multiple NVMe SSDs at one time are not supported. The user must wait until a device is reflected as removed / inserted in device manager for spacing surprise hot plug of Intel VMD enabled PCIe NVMe SSDs in Microsoft Windows.

Due to these limitations, Intel strongly discourages performing Hot Plugs during an S3 power state change.

5.3 Expect Longer Rebuild Times for RAID 5

On a RAID 5 volume, disk cache is being turned off when a volume is degraded. Due to this, the rebuilding times have increased expectedly until the rebuild is completed, and disk cache is enabled again.

This extends to drives being added to a RAID 5 volume as well.

5.4 Intel VROC Command Line Interface

The Intel VROC Command Line Interface (CLI) does not support the RAID Volume name beginning with blank space.

5.5 Intel VROC Trial Version Limitations

Data RAID Only (No Boot Support)
Data RAID must be installed on same make/model of NVMe devices

Once an Intel VROC Upgrade Key has been inserted into the system, the trial version is concluded. Removing the upgrade key does not re-enable the trial version. As a result, any existing RAID volumes present while the upgrade key was installed, won't be seen and could be in an unknown state.

When creating a RAID volume using the Trial version, don't mix NVMe vendors. Mixing vendors may result in unexpected behavior.

Please refer to the Intel VROC Trial Version section in the Intel VROC Technical Product Specification for 5.4PV for more details

5.6 Intel VROC PreOS UEFI Driver Uninstall limitations

The Intel VROC UEFI RAID drivers comply with UEFI Specifications for PCI Driver Model for PCI Device Drivers (Section 13.3.3) and may return Status Code “access denied” from UninstallProtocolInterface routine from Boot services (spec. 6.3). This is expected behavior.

5.7 Intel NVMe Wear Leveling Recommendations

NVMe SSD Wear Leveling refers to techniques used to prolong the service life of NVMe drives. This section outlines recommendations to maximize Wear Leveling on RAID 5 volumes.

5.7.1 Intel NVMe Wear Leveling Recommendations

NVMe Wear Leveling refers to techniques used to prolong the service life of NVMe drives. This section will outline the recommended configurations (number of drives vs strip size) to maximize Wear Leveling on Intel NVMe SSDs when configured as part of RAID 5 volume. When creating an Intel VROC (VMD NVMe RAID) RAID 5 volume, several configuration parameters can be selected, and the number of drives used along with the strip size chosen can have an impact on the wear leveling. The following table outlines the different options for number of drives vs strip size to achieve the optimal wear leveling on Intel NVMe SSDs. For default settings, please see the section

Strip Size / No of drives	4	8	16	32	64	128
3	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
4	Optimal	Optimal	Optimal	Optimal	Suboptimal	Suboptimal
5	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
6	Optimal	Optimal	Optimal	Optimal	Optimal	Suboptimal
7	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
8	Optimal	Optimal	Optimal	Suboptimal	Suboptimal	Suboptimal
9	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
10	Optimal	Optimal	Optimal	Optimal	Optimal	Suboptimal
11	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
12	Optimal	Optimal	Optimal	Optimal	Suboptimal	Suboptimal
13	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
14	Optimal	Optimal	Optimal	Optimal	Optimal	Suboptimal
15	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
16	Optimal	Optimal	Suboptimal	Suboptimal	Suboptimal	Suboptimal
17	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
18	Optimal	Optimal	Optimal	Optimal	Optimal	Suboptimal
19	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
20	Optimal	Optimal	Optimal	Optimal	Suboptimal	Suboptimal
21	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
22	Optimal	Optimal	Optimal	Optimal	Optimal	Suboptimal
23	Optimal	Optimal	Optimal	Optimal	Optimal	Optimal
24	Optimal	Optimal	Optimal	Suboptimal	Suboptimal	Suboptimal

Note: It is left to the customer to determine the most effective combination of parameters (number of drives vs. strip size) to achieve their desired performance goals, usage models and drive endurance.

If a RAID volume is being migrated to RAID 5 (or a new RAID 5 volume is being created), the strip size chosen should be based off the most optimal performance as defined in the above table.

5.8 Must use F6 Install Method

The use of the included Intel VROC F6 drivers are required to install an OS onto an Intel VROC managed device(s). There is no Microsoft "inbox" driver that supports Intel VROC 8.0.

The supported Microsoft Operating Systems for this product include inbox drivers that support the Intel® C620, C422 and C741 series chipset Platform Controller Hub (PCH) when configured for RAID mode. It is strongly recommended that the Intel VROC (SATA RAID) F6 drivers included in this release be used instead of the available "inbox" driver. The provided "inbox" driver is intended only for those customers who may not have the Intel VROC (SATA RAID) F6 drivers readily available and ONLY for installing to a single drive (NOT to a RAID volume). Once the OS is installed, it required for VROC support is that the Intel VROC 8.0 installer package be installed immediately. At that point, it will be safe to migrate the SATA system disk into a RAID Volume (using the Intel VROC GUI).

5.9 Intel C620 and C422 series chipset Port Limitations

This limitation is in reference to platforms having a PCH that supports more than 6 SATA ports. The Intel C620 and C422 series chipset SATA controller supports 8 SATA ports. As referenced above, The Microsoft Windows Operating systems that contain the "inbox" drivers for the Intel® C620 and C422 series chipset Platform Controller Hub (PCH) when configured for RAID mode, only support 6 ports. Drives on ports 7 and/or 8 are not enumerated. For this reason, Intel recommends not using these 2 ports as part of the Windows* OS boot installation (as a pass-thru drive or as part of a RAID volume). However, if you do need to use these ports as part of your Windows* boot volume, the steps below can be used as a workaround.

Note: you will need a USB drive with the Intel VROC IntelVROCCLI.exe utility.

1. After you have created the desired RAID volume that includes ports 7 and/or 8 (which you intend to use as your Windows* boot volume) in the PreOS environment, begin the Windows* installation process. ***Make note of the RAID volume name.***
2. Navigate to the Windows* disk selection window. At this point, select the Load Driver button and install the Intel VROC F6 driver (included in this package).
3. Attempt to continue installing the Windows OS onto the RAID volume. If the installation process does not continue, this error has been encountered.
4. Press f10 to invoke a CMD window.
5. If you have not already done so, please insert the USB drive into the system. Navigate to your USB drive with the RstCLI.exe utility.
6. Run command: IntelVROCCLI.exe --manage --normal-volume <volumeName>
7. This will reset the volume to a normal state.
8. Close the CMD window.
9. In the Windows* disk selection window, reload the Intel VROC f6 driver.
10. Once completed, Windows* should allow installation on the RAID volume.

5.10 Intel VROC Key Removal/Upgrade Limitation

With Microsoft* Windows* 10, Fast Startup is enabled by default. Disable Fast Startup prior to removing/upgrading the Intel VROC HW key. OR, perform a complete reboot when removing/inserting a HW key when Fast Startup is enabled.

5.11 NVMe Port Assignment by Intel VROC

In Windows and UEFI, the port number shown in the Intel VROC interfaces depends on disk enumeration order by the Intel VMD-enabled NVMe driver, which can be different on each platform. The port numbers shown does not reflect the physical PCIe slot. After each hot plug, there is an enumeration process which is NOT fixed.

Please see the **Intel® VROC Windows Technical Product Specification** for information on the new Intel VROC UEFI Device Info Protocol for unique NVMe physical slot locations.

5.12 Windows* 10 RS5/Server 2019

5.12.1 Idle Power increased

Installing Intel VROC 8.0 PV onto a platform running Windows* 10 RS5. In Windows and UEFI, the port number shown in the Intel VROC interfaces depends on disk enumeration order by the Intel VMD-enabled NVMe driver, which can be different on each platform. The port numbers shown does not reflect the physical PCIe slot. After each hot plug, there is an enumeration process which is NOT fixed.

Please see the **Intel® VROC for Windows Technical Product Specification** for information on the new Intel VROC UEFI Device Info Protocol for unique NVMe physical slot locations.

5.12.2 Intel VROC Support for Windows 10 RS5 / Server 2019

Intel RSTe 5.5.0.2013 introduces support for Windows* 10 RS5 and Windows* Server 2019.

Note: There is a known issue trying to install Windows* 10 RS5 / Server 2019. Installing Windows* 10 RS5 or Server 2019 onto an Intel VMD managed device is limited to a single CPU. For more information please see the Known Issues section below.

Note: This limitation only applies to Intel RSTe 5.5 and earlier releases. Intel VROC 6.X and newer are not impacted.

5.13 Intel VMD Support on 8 Socket Platforms

Due to restrictions on NVM Express implementations that reside behind PCI compliant bridges, address space is limited to 32 bit assigned base address registers (for non-prefetchable memory). This means that there is only 4 Gigabytes of addressable (non-prefetchable) memory space available. This memory space must be shared between the entire platform. As a result, there is a limitation on the number of Intel VMD controllers that can be enabled (due to these resource constraints). The following two configurations can be used without encountering memory restriction errors:

1. 3 Intel VMDs can be enabled on CPU0 up to CPU6. Intel VMDs on CPU7 need to remain disabled. This results in a maximum of 21 Intel VMDs that can be enabled in this configuration.
2. No more than two (2) Intel VMDs can be enabled on each CPU in the 8-socket platform. This resulting in a total of 16 Intel VMD domains.

Note: This limitation does not apply to 1, 2 or 4 socket platforms.

5.14 Intel VROC SATA LED Management

When designing a Hot Swap Backplane (HSBP) into a new platform, please make sure that the backplane design supports the platforms External Design Document specification for HSBP support. Also, please contact your Intel FAE to obtain the latest platform CPLD reference code and information.

5.15 Intel VROC Creation Volume Sizes

When Creating a RAID volume, there will be a Volume Size difference seen when comparing a RAID Volume created using the Intel VROC PreOS HII environment and volumes created in the OS. This has to do with the way the size information is displayed and computed between the two environments.

5.16 MCERR/P_CATERR/Bus Uncorrectable Error with Intel VMD enabled

When CTO occurs, Intel VMD must be chosen to handle these conditions when the root port of the Intel VMD controller that is enabled. This is accomplished by disabling IOMCA on the x16 Intel VMD enabled lanes.

5.17 NVMe Drive Model Number Does Not Display Properly in Device Manager

NVMe Device name in Device manager is created by Microsoft. Within The device manager, the model number of NVMe device may not be completely displayed once Intel VMD is enabled. A workaround with a new parameter in UnitControl, ScsiUnitRichDescription to show all Model Number in the device name. The workaround can only solve the problem when the drives have the same model number but different sizes.

5.18 VROC RAID driver is not producing AtaPassThru protocol

When using AtaPassThru protocol to get information on attached devices from the Intel VROC PreOS, the value of GetNextTargetLun may not be successful. A work-around is to set the value of "Timeout" field inside "Packet" to a large value (e.g. 3 seconds).

5.19 Intel VROC 8.0 New GUI Design

Warning message displayed when GUI and driver version is mismatching

When this warning message condition is detected from one major version or 2 minor versions difference, GUI will not allow to manage the storage controller, but can provide a set of functionalities corresponding to the lowest driver version. GUI still can start even there is no driver installed

5.20 Pre-boot DMA feature needs to be disabled

RAID Creations could not be created after enabling “Pre-boot DMA Protection” and “DMA Control Opt-In Flag.” This feature enablement is targeted to be corrected by EGS-R timeframe.

5.21 Intel® Virtual RAID on CPU (VROC): Intel VROC (SATA RAID) Compatibility Issue with Microsoft Windows* Operating System Versions Released After June 2022

Beginning with Microsoft Windows 11 SV2 release timeframe, Microsoft has implemented a correctness fix to address a potential race condition that could result in a system failure (bugcheck). The issue corrected was in the device PnP removal process. This correctness fix has been backported to Microsoft Windows 11 SV from 2021.10C, Windows Server 2022 from 2021.08C and Windows 10 22H2. As a result of this Microsoft correction, one of the Windows inbox RAID drivers; the Intel Rapid Storage Technology (RST) driver now fails the device PnP removal process. This process failure blocks the Intel RST driver from being properly removed. As a result, a replacement driver cannot be installed. Long-term solutions to resolve this issue has been brought up to Microsoft to enact corrective measures. A current viable workaround has been discovered, if it is needed, please contact your FAE for more information.

5.22 Raid TRIM has been Disabled for this Version

A potential silent data loss/corruption condition exists in all Intel® Rapid Storage Technology enterprise (RSTe) Windows drivers, beginning with 5.4.0.1465, as well as all Intel Virtual RAID on CPU (VROC) Windows driver versions (latest available version is Intel VROC 7.7.6.1003). This potential silent data loss/corruption condition occurs on Intel VROC managed RAID 5 volumes, consisting of at least one Solid State Drive (SSD) that supports TRIM/UNMAP commands, by methods other than the use of zeros.

6 Intel VROC Issues

This section outlines the issues reported and internally found that customers need to be aware of. The issues are broken down into "Known Issues" and "Resolved Issues".

6.1 Known Issues in Intel VROC 8.0 PV

These are the known issues in this PV release package.

Internal ID	Title
14015389340	When using AtaPassThru protocol to get information on attached devices from the Intel VROC PreOS, the value of GetNextTargetLun may not be successful.
18015334984	Warning Message "Warning: The AHCI driver will be updated to the latest Microsoft AHCI driver in the system" Does Not Occur When Installing Intel VROC in AHCI Mode Using Installer.
18020541368	While within SED Manager, Unencrypted drives that are unplugged and then are selected to have a security key to be setup may experience a platform hang.
18020894568	Migrating OS from a RAID 0 volume to a RAID 5 may result in unexpected error messages in both CLI and GUI interfaces.
15010088464	When SATA controller is switched to RAID mode, SATA drive information will be displayed in VROC SATA HII instead. So user can reference the device information in VROC SATA HII.
18016767645	Within Intel VROC SED Manager, a physical drive may appear in twice.
1805900436	Intel VROC F6 Drivers may not properly load and a refresh may be required.
15011986293	When booting the platform with a degraded intel VROC RAID 1 data volume, the Intel VROC 8.0 GUI may not properly display the RAID volume.
18012869559	Intel VROC GUI And CLI May Not Forbid Performing Operations That Use Self Encrypting Drives In Locked State. Creating RAID Volume With Locked Member May Result In Failed Volume State

Internal ID	Title
18021555907	The “Increase Size” button within the VROC GUI may experience issues refreshing incorrectly.
18022812016	When the OS performs a TRIM command onto an Intel VROC RAID1 or RAID10 comprised of drives that perform TRIM activities in different ways may encounter a data inconsistency on those areas that had been TRIMed.
15012192390	VROC SATA HDD may have a problem unlocking after sending the 0xf2 command
18024185962	A RAID volume may become degraded after the Initialization process completes, if two of the drives encounter a Bad Block condition in the same sector.

6.2 Resolved Issues in Intel VROC 8.0 PV

18015582447	When attempting to rebuild a degraded RAID 10 matrix (second RAID volume is a RAID 5) with 2 drive failures (RAID 10 - Degraded; RAID 5 - Fail), the Intel VROC driver may become unresponsive.
1808018122	Trying to clear a SMART event from a drive after a RAID volume is rebuilt (to another drive), may show up as an Unknown disk
18010986194	Intel VROC PreOS may not Properly show a Boot RAID Volume as Bootable after the RAID Volume Encounters a FAIL Condition.
18012964787	Number of Media Errors Reported in Intel VROC GUI May Be Different than Expected After Performing Verify and Fix on RAID 1.
18016591025	I/O may become unresponsive with NVMe VROC for Windows under heavy I/O while using matrix RAID
14014436257	Exceptional boot delay with WD Gold HDD used as SATA data drive attached to RAID mode port, but not in a RAID volume.
18011148984	Intel VROC GUI May Not Indicate Which Drives Are Connected To PCH For Pass Through System Drives And System RAID Volumes.

18016453364	When using the Intel VROC HII to Create a RAID Volume, the Warning Message that All Data on The Member Disks Will Be Lost, may not be Displayed.
18023331378	Intel VROC Bad Block Management (BBM) Logging may report the wrong drive serial number when logging BBM events
1808094827	The Intel VROC (VMD NVMe RAID) PreOS environment may only show 32 NVMe SSDs in the Intel VROC HII
18012896024	Intel VROC GUI May Not Report Proper Number of Media Errors Encountered During Initialization of RAID 5.
18010956435	Output May Not Appear In Intel VROC CLI After Attempt To Create RAID 1 Volume From Two Parts of x8 Drive
1508749788	A second RAID volume may not rebuild to the hot-spare drive after resetting one member disk to Non-RAID.
18015729524	Intel VROC OOB Management May Report Wrong Error Message During Attempt to Create RAID Volume From Third Party Vendor Drives When Using Intel SSD Only Key.

6.3 Resolved Issues in Intel VROC 7.7 PV

id	customer_id	release_notes
18016058101	00580596	Title: Intel VROC Bad Block Management Process May Take (3 to 4 times) Longer than in Previous Versions
18014127243	Internal	Title: Performing an Intel VROC (SDATA RAID) RAID 5 RAID Write Hole Recovery on a Degraded SATA RAID 5 Volume may not Complete Successfully
14014598311		Title: Intel VROC SATA/sSATA RAID volumes may degrade or fail under high I/O load if a ATA pass through command is issued.

id	customer_id	release_notes
14013794942		Title: The IntelVROCCLi may terminate operation with an error if the user attempts to use the command with -M option, with a drive volume that does not exist.
14013356415	00567412	Title: [CPX-6] Install Protocol Interface failure message after loading VMD UEFI driver
1508964983	IPS 00600901	This issue is caused by unsigned iaNullVMD.inf.
1508793548	IPS 00588770	Fail to install Windows server 2019 with QWMB CPU
1508747791	22012122800 / 00586202	Title: Hot Removal of a Matrix RAID Member May Result in a System Failure
22011598177	00548154	NVMe drives connected to certain Icelake CPU sku may not be accessible by VROC when VMD is enabled
18016895347	00553285	Title: Intel VROC (SATA RAID) PreOS Health Protocol May not Properly Report the Driver/Controller Information
18015474102	Internal	Title: Trying to clear a SMART event from a drive after a RAID volume is rebuilt (to another drive), may show up as an Unknown disk.
18014791546	Internal	Title: Using the Intel VROC CLI Tool to Remove the Metadata on all of the Specified Drives May not Complete Successfully on Drives Identified as "Unknown"
18014524336	Internal	Title: When using the Intel VROC CLI Tool to Identify the Attached Devices on the SATA/sSATA Controller, Attached ATAPI Devices may not be Properly Reported
18013439721	Internal	Title: When Running in a Matrix RAID Configuration (Two RAID Volume in a Single RAID Array), the Bad Block Management Process may not Properly Detect Bad Blocks.
18011530136	Internal	Title: The Intel VROC RCfg Tool may not Properly Display the Warning Message when Trying To Rebuild a Volume to a Drive that is at Least 10% Bigger Than the Largest Member Drive.
1806564424	Internal	Title: System May Fail to Start After an Unexpected Power Loss
18012842292	Internal	Title: An Incorrect Error Message ("REQUEST_FAILED: Request is formatted correctly but failed to execute.") May Be Reported By Intel VROC CLI Tool When Trying to Perform a Migration to Unsupported RAID Level.
18012255612	Internal	Title: The Intel VROC CLI Tool may Return the Wrong Error Message ("INVALID_DEVICE: Request not formatted correctly, device does not exist.") When Trying to Rebuild Degraded RAID Volume To Drive In an Incompatible State.

id	customer_id	release_notes
18012236043	Internal	Title: Intel VROC CLI May Report Wrong Error ("REQUEST_FAILED: Request is formatted correctly but failed to execute.") When Trying To Remove Member Drive Of System RAID Volume.
18011483476	Internal	Title: When using the Intel VROC HII to Create a RAID Volume, the Warning Message that All Data on The Member Disks Will Be Lost, may not be Displayed.
1808963497	Internal	Title: RAID Initialization may not be Automatically Performed when Verify or Verify And Repair is Initiated by the Intel VROC CLI Tool, on an Uninitialized Volume
18018934449	Internal	On Wolfpass platform NVMe RAID submenu is not available and RCFG needs to be used to manage RAID functionalities in UEFI.
22011592946	Internal	Intel VROC (SATA RAID) PreOS Health Protocol May not Properly Report the Driver/Controller Information

6.4 Resolved Issues in Intel VROC 7.6 PV

Internal Reference Number	IPS Reference Number	Issue Title
22012232430	00588652	Using the IntelVROCCLi.exe Tool with the -R Option may not Properly Result in the RAID Volume Rebuild Occurring
14013209937	00580596	Intel VROC Bad Block Management Process May Take (3 to 4 times) Longer than in Previous Versions
1508906750	00596519	[VROC] Drive failure messages seen on initiating IO
14012975200/ 1508768056/ 22011598177	00554443/ 00584537/ 00548154	Not able to install Windows on VROC-managed NVMe or may not be able to access NVMe drives behind VMD with certain Icelake CPU sku.
22011073918	Internal	A potential silent data loss condition exists in both the Intel VROC (SATA RAID) and the Intel RSTe windows-based products. The potential silent data loss condition exists when the Intel VROC Read Patrol feature is enabled for redundant SATA RAID volumes (RAID1, 5 or 10) and one of the RAID member drives is found to have a Bad Block condition. The Read Patrol process, of using the redundant data to correct the Bad Block, can result in invalid data being written.

Internal Reference Number	IPS Reference Number	Issue Title
1509073224	Internal	The Intel VROC 7.5 PV Installation application may not properly install the Null Driver to support Device ID 0x09AB.
18016160241	600901	This issue is caused by unsigned iaNullVMD.inf.
14012975200	00554443	NVMe drives connected to certain Icelake CPU sku may not be accessible by VROC when VMD is enabled
1508793548	IPS 00588770	Fail to install Windows server 2019 with QWMB CPU
1507753655	486129	When Running Stress Testing on M.2 Slots Managed by the sSATA Controller, an "isStorB" Error may be Logged. -

6.5 Resolved Issues in Intel VROC 7.5 PV

Internal Reference Number	IPS Reference Number	Issue Title
22011196948		Intel VROC may not properly calculate the LBA locations when performing the Read Patrol Bad Block Recovery Process, Inadvertently missing some Bad Blocks.
22011073918		A potential silent data loss condition exists in both the Intel VROC (SATA RAID) and the Intel RSTe windows-based products. The potential silent data loss condition exists when the Intel VROC Read Patrol feature is enabled for redundant SATA RAID volumes (RAID1, 5 or 10) and one of the RAID member drives is found to have a Bad Block condition. The Read Patrol process, of using the redundant data to correct the Bad Block, can result in invalid data being written.
14012886123	00556241	Intel VROC RAID Write Hole Parity Calculation may be Computed Incorrectly.
22011547837		NVMe drives listed in the VROC BIOS HII page may state incorrect CPU on which it is connected to. Fixed with 7.5 PV
22010691032	Internal	Intel VROC Installer Help Dialog does not Contain All Available Setup Options.
14011249412	00509350	Activate Led Option May not Work For Non-Intel Drives when Using Intel Only SSD License.
14011049937	00247935	The Order of the SATA Drives Attached to the sSATA Controller May not Match that of how they May be Reported in the SATA Controller
1808275753	Internal	The Wrong RAID Volume State may be Displayed After a Dirty Shutdown
1507753655	486129	When Running Stress Testing on M.2 Slots Managed by the sSATA Controller, an "isStorB" Error may be Logged. - Expected under such heavy I/O loads.

Internal Reference Number	IPS Reference Number	Issue Title
18012678098	Internal	When Installing VROC Using Installer With Option "-nodrv" All Drivers Are Uninstalled And No Driver Is Installed In Replacement. This Option May Break Operating System And It Shall Not Be Used.
18011258092	Internal	Clearing RAID Metadata Using the RCfg Tool may Result in a Platform Hang in UEFI and an ASSERT.
18010905203	Internal	Creating a RAID Volume in Intel VROC (VMD NVMe RAID) PreOS from Drives Connected through a JBOF may not Succeed and Result in Error Message: "Create volume failed! Cannot write to disk".
1806564424	Internal	System May Fail to Start After an Unexpected Power Loss
1508007585		VROC HII may display the RAID volume capacity improperly when it is larger than 10000 GB
1507520073	2209571335 / 00472167	Uninstall VROC Windows driver may encounter an error when it is installed and uninstalled multiple times
1306412122	Internal	Setting LED Configuration of Empty Slot as Fail may not show Fail when slot is empty.
22011382393	00543426	Locate LED may not work properly in VROC HII when using PCIe switch with NPEM support

6.6 Resolved Issues in Intel VROC 7.0.2 PV

This section identifies those issues that have been resolved in the Intel VROC 7.0.2 PV release.

Internal Reference Number	IPS Reference Number	Issue Title
22011071259	00527379	With Read Patrol Enabled, Recovering from a Bad Block Could Result in a Data Loss Condition.

6.7 Resolved Issues in Intel VROC 7.0 PV

This section identifies those issues that have been resolved in the Intel VROC 7.0 PV release

Internal Reference Number	IPS Reference Number	Issue Title
14010261577	00470911	Intel VROC IAStorIcon Scheduled Task may be Inadvertently Removed During a Package Upgrade.
22010314523	00493707	Migration of one RAID10 Volume to a RAID5 Volume May Cause an other RAID10 Volume, in the System, to Automatically Re-Initialize.
18011792455	Internal	When using a Hot Spare Back Plane from a Whitley Platform in CedarIsland Platform, the SATA LEDs may not Work Properly. - Not an Intel VROC Issue.
14010852023	00492469	Intel VROC HII may not Display RAID Volume Information Correctly When the RAID Volume is Greater than 10 Terabytes.
1808514953	Internal	Booting a Platform with 48 NVMe Drives may Result in a System Failure.
1808389290	Internal	The Intel VROC Rebuild LED behavior may not operate properly when Customized to blink all LEDs during a RAID rebuild
1806994368	Internal	Performing Hot Plug drive replacement on a degraded RAID volume, with Rebuild on Hot Insert enabled, may not properly initiate an automatic RAID rebuild.
1507501583	Internal	When Resuming From and S3 Power State Change, the "System" Label may not be Displayed Properly in the Intel VROC GUI.
1409667894	448534	LED Locate from HII BIOS VROC Menu Causes Page to Exit Prematurely
1808703820	Internal	When Using the Intel VROC CLI Tool to Adding a Drive to an Existing Array, the Volume Strip Size may no be Displayed Properly.
1808580403	Internal	When Performing a Drive Hot Plug, the Event Logger may Show Other Drives (Not Involved in the Hot Plug) having Encountered Hot Plug Events
1807170210	Internal	An Intel VROC GUI Volume Creation Warnings Message May Overlay ontop of a Submenu
1806564426	Internal	Event Lot May Not Poroperly Show "RAID volume {VolumeName} is normal" Message after a Rebuild Completes
18011690000	Internal	Activate LED Option may not Work in VROC CLI and UI, When Using Intel-SSD-Only License. - Internal Testing Issue

6.8 Resolved Issues in Intel VROC 6.3 PV

This section identifies those issues that have been resolved in the Intel VROC 6.3 PV release.

Internal Reference Number	IPS Reference Number	Issue Title
14010267807	2209520253 / 00471069	Performing a Drive Surprise Hot Remove from a Matrix RAID Array May Result in a Platform Failure.
1507649523	IPS 00482474	Using the CC_CSMI_SAS_GET_DRIVER_INFO Command May Not Report Correct Drive and Driver information.
18010792702	00470911	Intel VROC IAStorIcon Scheduled Task may be Inadvertently Removed During a Package Upgrade.
1809577436		An Intel VROC spanned RAID10 Volume may not Start Rebuilding Automatically after a Rebuild on Hot Insert Condition.
1806397184	Internal	IIntel RSTe NVMe Pre-Purley Platform with 48 NVMe Drives and Max Volumes. Degraded RAID Volume May Encounter a System Failure While Booting
1507369786	Internal	Migrating a single NVMe boot drive to an Intel VROC (VMD NVMe RAID) Volume and Performan a System Sleep Power State Change May Result in a System Crash
1806411891	Internal	RAID Volume May Become Degraded After Reboot
1806397164	Internal	Intel RSTe NVMe Pre-Purley Platform with 48 NVMe Drives and 24 Volumes May Encounter a boot Failure
1507522222	2209595864 / 00473612	Intel VROC LED Management may Illuminate the Locate LED Option During Another RAID Operation and may not stop when the Operation Completes.
1806930160	Internal	An Error message in event viewer “The driver detected a controller error..” may be displayed when performing platform power state changes with Intel VROC installed.

Internal Reference Number	IPS Reference Number	Issue Title
1806419240	Internal	Intel VROC (VMD RAID) NVMe Drive May be Marked as Available After Removal

6.9 Resolved Issue in Intel VROC 6.2 PV

This section identifies those issues that have been resolved in the Intel VROC 6.2 PV release.

id	customer_id	release_notes
1606900429	405188	System Crash May Occurred when load Intel VROC (VMD NVMe RAID) F6 driver while the Intel VROC RAID is Under an Initialize State.
1409230595	424290	Intel VROC UEFI May Not Properly Report the VMD Controller BDF in the HII
1409017125	416904	"UEFI Driver Hangs When the Metadata is Malformed"
1408968353	404672	Intel VROC (VMD NVMe RAID) UEFI HII Menu May Cause the BIOS Setup Menu to be Improperly Displayed
1409194760	424543	Activity LED is not blinking when SATA drive in RAID mode
1808452676	Internal	A system, with the OS installed onto a RAID volume, may not properly resume after several Hybrid Sleeps
1808377588	Internal	A system running Intel VROC, with the OS installed onto a RAID volume, may not properly resume from a Hybrid Sleep state, after performing multiple Hybrid Sleeps.
1808060543	Internal	The Intel VROC 6.2 UWD UI Application may not properly function on a platform with Intel VROC 6.0 driver package. Please make sure that when using the Intel VROC UWD UI Application, that the UI version matches the driver package (i.e. both should be Intel VROC 6.0 or both should be Intel VROC 6.2)
1807345165	Internal	The CLI Tool May Not Properly Expand Existing RAID Volumes
1807107325	Internal	When using the Intel VROC CLI Tool to Create RAID Volumes One of the Disks May Show an Disk Size of 0 GB after the Volume Creation Completes.
1806677977	Internal	Bad Blocks May Not be Properly Reported in a RAID 5 Volume
1806534894	Internal	The Intel VROC CLI Tool May Allow Data Migration With a Smaller Drive
1806503629	Internal	Creating a RAID 1 Volume from an Existing Drive May Result in a Failed RAID Volume

1507222187	438747	VROC icon is missing in system tray Issue description: VROC GUI icon is not exist in system tray in Windows10.
1409784946	455468	Hot Removal of a RAID 5 RAID Write Hole (RWH) Journaling Drive may cause the platform to become unstable and may cause a system failure System Instability and BSODs
1409371408	Internal	Intel VROC GUI May Require the "Proceed with deleting data" Box be Selected when not Expected.
1407853994	325087	Degraded SATA RAID 5 may not boot if disk on SATA controller port 0 is removed or fails Waiting for 6.2.0.1108 confirmation from HP.
1407801045	325604	The Intel VROC RWH Policy May inadvertently Change from Journaling to Distributed if one member drive is missing
1407219909	246717	New VMDVROC_1.efi / VMDVROC_2.efi driver will increase boot time around 4 seconds
1806782204	429264	Intel VROC GUI may not Properly Open Unless "Run as Administrator"
1506398660	281938	RAID10, hot-plug two member disks, re-plugged second disk can't rebuilding.
1409584095	445268	Event Log Error 4156/4155 Seen during stress testing
1807977956	Internal	The platform may encounter a system failure as a result of performing a Hybrid Sleep cycle on an Intel VROC RAID5 Volume (the first Hybrid Sleep after running the Intel VROC installation application).
1807962656	Internal	The Intel VROC PreOS UEFI may not properly display the full serial number of a removed/offline Volume member drive in the UEFI Health Protocol information.
1807158496	Internal	The Intel VROC RWH Policy May Change from Journaling to Distributed after a Drive Hot Unplug
1806564409	Internal	Platform May Not Properly Boot After a Dirty Shutdown with I/O on a RAID 4 volume (RWH Distributed)