Intel® Virtual RAID on CPU (Intel® VROC) 6.2 PV Release

Customer Release Notes

October 2019

Revision 1.0

Revision History

Revision	Description	Date
1.0	Intel VROC 6.2 PV Initial Release	October 2019

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Contents

1 Introduction

1.1 Overview

The Intel Virtual RAID on CPU (Intel VROC) 6.2 Production Version (PV) release package is intended for all customers designing platforms that are based off of Intel's Purley Refresh design.

The Intel VROC 6.2 family of products provide enterprise RAID solutions for both NVMe SSD and SATA devices for enterprise servers and workstations. The product family includes the following three 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 the Intel Platform Control Hub (PCH) configured for RAID mode.
3. Intel VROC (NonVMD NVMe RAID) – This product provides an enterprise RAID solution for Intel NVMe SSDs attached to PCIe slots managed by the Platform CPU. Intel VROC (NonVMD NVMe RAID) is not intended for, nor supports:
    a. Non-Intel NVMe SSDs.
    b. Platforms that have on Intel® Xeon® Scalable Family Platforms CPUs that contain Intel VMD technology (weather enabled or disabled).

Note: Intel VROC 6.2 is a high level blanket product reference for Intel VROC (VMD NVMe RAID), Intel VROC (SATA RAID) and Intel VROC (NonVMD NVMe RAID).

Along with the above mentioned packages, included in this PV package are the Intel VROC 6.2 Pre-OS environment

1. Intel VROC (VMD NVMe RAID) UEFI drivers
2. Intel VROC (SATA RAID) UEFI drivers
3. Intel VROC (SATA RAID) Legacy OROM images are included.

Please see the ***Supported Platforms*** section for additional information on older platforms supported with this release.

Note: It is always recommended to update your system BIOS to the included PV release of Pre-OS drivers to take advantage of the most optimal and updated features of each Production Version release.

1.2 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 following Fields in order to flag Intel VROC AE support for Intel® Xeon® Scalable platforms.

- Case Information -> Product = Purley
- Case Details -> Subject= <Add short title summary of issue>
- Case Details -> Case Description = <add description and how to reproduce error)
- Case Details -> Case Type = <fill in type of request>
- Case Details -> Severity = <fill in severity of issue>
- Case Details -> End Customer = <name of OEM>
- Case Details -> Issue Source = IPS Cloud
- Case Details -> Severity
- Product/Project Info -> Case Category = TechnologyInitiative
- Product/Project Info -> Case Subcategory = Intel® Virtual RAID on CPU (Intel ® VROC)
- Environment Details -> Purley-PCH = lbg-4
- Environment Details -> Purley-CPU = skx-2s (or skx 4s)
- Environment Details -> BKC or SW Version = 6.0

1.3 Supported Operating Systems

Only 64bit OS support is available for the following OS versions

- Windows* Server 2012 R2 Enterprise (supported on Server platform only)
- Windows* 10 RS3 / RS4 / RS5 / 19H1 (supported on Workstations platforms only)
- Windows* Server 2016 Enterprise (supported on Server platform only)
- Windows* Server 2019 Enterprise (supported on Server platform only)

Note: Microsoft* Windows* 7 will not be supported in future releases

1.4 Operating Systems Not Supported In This Release

- Windows* Vista (Support/Updates concluded with 4.1.2.1011)
- Windows* Server 2003 (Support/Updates concluded with 4.0.2.1019)
- Windows* Server 2008 (Support/Updates concluded with 4.0.2.1019)
- Windows* 8 (Support/Updates concluded with 4.2.2.1005)
- Windows* Server 2012 (Support/Updates concluded with 4.2.2.1005)
- Windows* 8.1 (Support/Updates concluded with 4.7 PV)
- Windows* Server 2008 R2 (Support/Updates concluded with 4.7 PV)

- Windows* 10 RS1 / RS2 (Support / Updates concluded with 5.4 PV)
- Windows* 7 SP2 (supported on Workstations only) (Support / Updates concluded with 5.5 PV)

Intel C600 series chipset support/updates concluded with 4.5 PV

Any Showstopper issues reported in any of the above configurations will be addressed in their corresponding (identified) baselines.

1.5 Supported Platforms

Intel® Xeon® Scalable Platforms

- Intel® C620 series chipset
- Intel® C422 series chipset family

Intel® Xeon® Processor D-2100 Product Family

Intel VROC (NonVMD NVMe RAID) support on the following platforms:

- Intel® Xeon® Processor E5 v3, v4 Families with the Intel® C610 series chipset
- Intel® Xeon® Processor Families with the Intel® C220 series chipset
- Intel® Xeon® Processor E3 v5 Families with the Intel® C230 series chipset
- Intel® Xeon® E Processor Family with the Intel® C240 series Chipset

Note: It is strongly recommended to update your system BIOS to the 6.2 Pre-OS.

Please see the Intel VROC Technical Product Specification included in this release for specific details

Note: For answers to questions concerning the Intel PCH series chipsets support and/or to obtain other technical collateral, please contact your local Intel FAE.

2 Supported PCIe NVMe SSDs List

All shipping Intel® Data Center and Professional NVMe* SSDs are supported by Intel® VROC 6.2 PV, except dual port NVMe* SSDs.

2.1 Non-Intel PCIe NVMe SSDs supported in Intel 6.2:

Vendor	Model
Lenovo*	Atsani
Huawei*	ES3600P
Samsung*	SM951
Samsung*	SM961
Samsung*	PM961
Samsung*	PM953
Samsung*	PM963
Samsung*	PM983
Toshiba*	PX04PMB
Toshiba*	XG3
Toshiba*	XG5
Micron*	9100 Series
Micron*	9200 Series
Western Digital*	PC SN720

3 New Features Introduced in Intel VROC 6.2 Release

3.1 Intel® Xeon® W-3200 Processor Support

The Intel VROC 6.2 release package includes support for the 4 Intel VMD Domains available on the Intel® Xeon® W-3200 processors.

3.2 Intel VROC Preloaded Driver Support

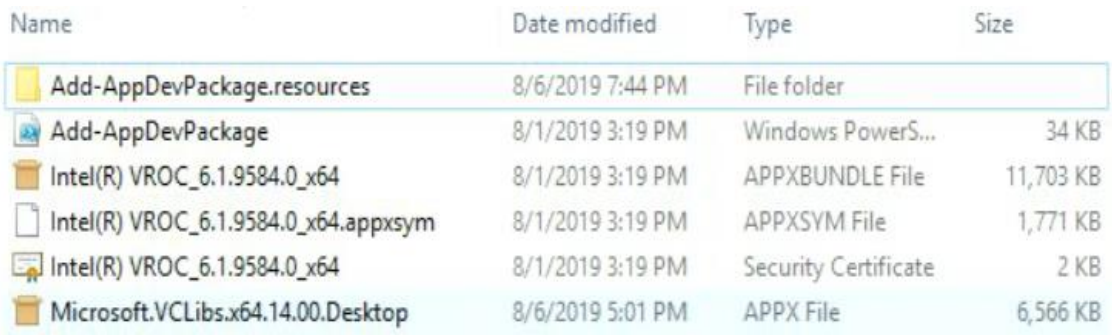
The Intel VROC 6.2 release package includes support for preinstalling the Intel VROC (VMD NVMe RAID) driver. When the Intel VROC 6.2 installer is executed, with the Intel VMDs disabled, the Intel VROC (VMD NVMe RAID) drivers will be loaded into the platform. This will allow this driver to be installed when the Intel VMD is enabled, without having to rerun the installer executable.

3.3 Intel VROC UWD GUI Application

The Intel VROC 6.2 release package includes support for the ability to load the Intel VROC UWD GUI without running the installer or going to the Microsoft* Application Store. Within package there is a standalone compressed file that can be copied to the target system, unzipped and used to load/install the Intel VROC UWD GUI application. As with the application uploaded to the Windows* Application Store, this process requires that all of the Intel VROC drivers have already been installed via the .inf installation process. The following is an example of how the Intel VROC UWP GUI package might be installed manually:

1. Open PowerShell (Admin) by right click on start and select PowerShell (Admin).
2. When prompt with PowerShell window, navigate to release folder **/SW_Packages/UserInterface_UWD/VROC_<release>_UI/UWP** using cd command. The files in the destination folder should be similar to the screenshot below.

```
cd "release UWP Folder Path"
```



Name	Date modified	Type	Size
Add-AppDevPackage.resources	8/6/2019 7:44 PM	File folder	
Add-AppDevPackage	8/1/2019 3:19 PM	Windows PowerS...	34 KB
Intel(R) VROC_6.1.9584.0_x64	8/1/2019 3:19 PM	APPXBUNDLE File	11,703 KB
Intel(R) VROC_6.1.9584.0_x64.appxsym	8/1/2019 3:19 PM	APPXSYM File	1,771 KB
Intel(R) VROC_6.1.9584.0_x64	8/1/2019 3:19 PM	Security Certificate	2 KB
Microsoft.VCLibs.x64.14.00.Desktop	8/6/2019 5:01 PM	APPX File	6,566 KB

3. Enable UWP app side-loading

```
REG ADD HKLM\Software\Policies\Microsoft\Windows\Appx /v AllowAllTrustedApps /t
REG_DWORD /d 1 /f
```

4. Install certificate

```
CERTUTIL -addstore -f "TrustedPeople" "<Certificate File.cer>"
```

5. Run DISM to install app.

```
DISM /Online /Add-ProvisionedAppxPackage /PackagePath:"<appxbundle file>"
/DependencyPackagePath:"Microsoft.VCLibs.x64.14.00.Desktop.appx" /LogPath:dism.log
/SkipLicense
```

6. Restart the system.
7. After a restart, launch Intel® Virtual RAID on CPU. When prompted with UAC dialog, please press yes to launch it.

Note1: The files may differ depending on release version. Please substitute filenames inside <> with appropriate file names.

4 Features Introduced in Intel VROC 6.1 PV

4.1 Microsoft* .NET and Intel ASM No Longer Included

To address functional and security updates, this version of the Intel® Virtual RAID on CPU (Intel® VROC) 6.1 PV Release Package has removed the Microsoft .NET Framework as well as the Intel Acceleration Storage Manager (ASM). Users should update to the latest version.

For the customer's convenience, the Intel VROC product installation application was designed to automatically install the Microsoft .NET Framework and provide an option to install the Intel Acceleration Storage Manager (ASM).

The .NET Framework was included because the Intel VROC user interface relies on the .NET Framework to operate properly. To ensure that customers are able to get the latest version available, Intel is no longer including .NET Framework in the Intel VROC production package. This is not needed because the supported Windows operating systems already include a version of .NET Framework. If the latest version of the .NET Framework is not installed, it can be obtained/downloaded either via a Web update or offline directly from https://dotnet.microsoft.com/.

In addition to removal of the .NET Framework installation, this release also removes the Intel ASM component. The Intel ASM installer has some dependencies on 3rd party libraries and Intel would like to reduce or eliminate these dependencies. Until this is accomplished, the Intel ASM component is being removed. Please contact your Intel FAE for future release details.

For more information please refer to Technical Advisory Reference Number 610700.

4.2 Windows* 7-64bit Support

The Intel VROC 6.1 release package includes targeted support for Windows* 7-64bit. Within this package, is included Intel RSTe 5.6 specifically for Windows* 7-64bit. This was added back into the product packaging to support the older platforms.

On platforms that are installing Windows* 7-64bit, the Intel RSTe 5.6 driver from the F6 directory should be used. Once the OS is successfully installed, running the Intel VROC 6.1 installation application will install the Intel RSTe 5.6 GUI and middleware and update/install the driver.

This configuration is the exception to the backwards compatibility of the Intel VROC PreOS. Meaning, that after the platform BIOS has been updated to include the Intel

VROC 6.1 PreOS, the Intel RSTe 5.6 package (for Windows 7-64bit) will be supported. Table 1 shows the Intel VROC PreOS versions to Intel RSTe 5.6 OS version support.

4.2.1 Intel VROC Package Upgrade

The Intel VROC package upgrade is the process of transitioning to the latest/newest version of the Intel VROC PreOS and/or Intel VROC OS components. Table 1 shows the compatibility matrix outline of the Intel VROC Windows driver component vs. the Intel VROC PreOS environment:

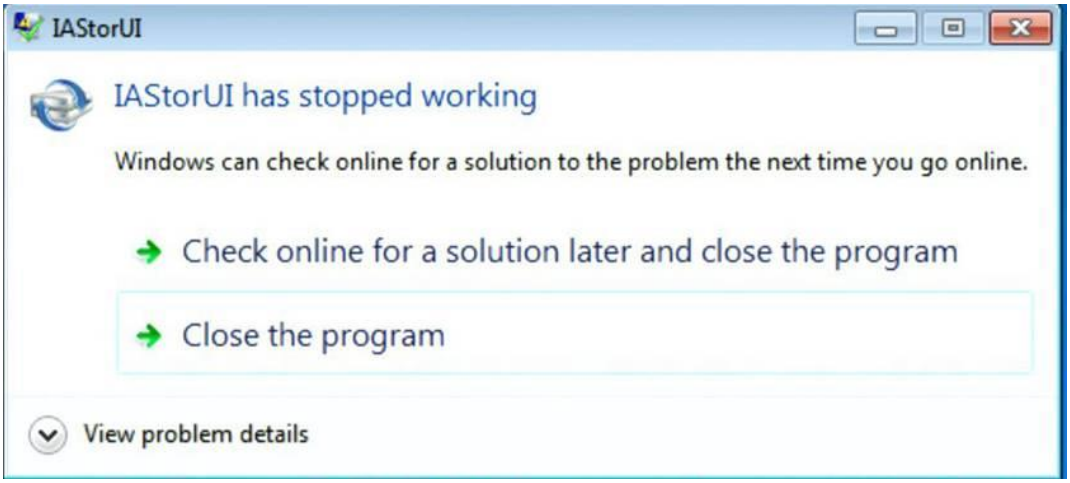
Table 1: Intel VROC OS Driver vs. PreOS Compatibility Matrix

	Intel RSTe 4.7 PreOS (Intel Xeon Processor)	**Intel RSTe 5.4 PreOS (Intel Xeon Scalable Processor)**	**Intel RSTe 5.5 PreOS**	**Intel VROC 6.0 PreOS**	**Intel VROC 6.1 PreOS**
Intel RSTe 5.5	Supported but not Validated	Supported but not Validated	Supported	Not Supported	Not Supported
Intel VROC 6.0	Supported but not Validated	Supported but not Validated	Supported	Supported	Not Supported
Intel VROC 6.1	Supported but not Validated	Supported but not Validated	Supported	Supported	Supported
Intel RSTe 5.6 (Win7 only)	Supported but not Validated	Supported but not Validated	Supported	OS Driver Version	Supported but not Validated

Intel VROC Windows OS backwards compatibility to Intel VROC PreOS is supported to N-3 versions. Validation will be on N-1 version.

4.2.2 Windows* 7-64bit .NET Limitations

When installing Intel VROC 6.1 onto a platform with Win7 the following message may be displayed after the package installation reboot:



To resolve this issue, the Microsoft .NET Framework needs to be updated to version 4.5.1. The following link can be used to download:

https://www.microsoft.com/en-us/download/details.aspx?id=40779

Note: For all other supported operating systems, please download the latest version of .NET Framework.

5 Features Introduced with Intel VROC 6.0 PV

5.1 Intel VROC 6.0.0.1359 Release Package

To address functional and security updates, this version of the Intel® Virtual RAID on CPU (Intel® VROC) 6.0.0.1359 PV Release Package has been updated to remove the Microsoft .NET Framework as well as the Intel Acceleration Storage Manager (ASM). Users should update to the latest version.

For the customer's convenience, the Intel VROC product installation application was designed to automatically install the Microsoft .NET Framework and provide an option to install the Intel Acceleration Storage Manager (ASM).

The .NET Framework was included because the Intel VROC user interface relies on the .NET Framework to operate properly. To ensure that customers are able to get the latest version available, Intel is no longer including .NET Framework in the Intel VROC production package. This is not needed because the supported Windows operating systems already include a version of .NET Framework. If the latest version of the .NET Framework is not installed, it can be obtained/downloaded either via a Web update or offline directly from https://dotnet.microsoft.com/.

In addition to removal of the .NET Framework installation, this release also removes the Intel ASM component. The Intel ASM installer has some dependencies on 3rd party libraries and Intel would like to reduce or eliminate these dependencies. Until this is accomplished, the Intel ASM component is being removed. Please contact your Intel FAE for future release details.

For this release, the device drivers and internal tools have not been updated.

For more information please refer to Technical Advisory Reference Number 610700. For information on how to manage the impacts of these changes, please refer to section Microsoft .NET Framework Removal in this document.

5.2 Introduced in Intel® VROC 6.0.0.1357 is the support for the Purley Refresh platform

This section features Intel's commitment to excellence; always improving and listening to our customers' needs.

5.3 Intel RSTe Name Changes

The Intel VROC 6.0 family of products provide enterprise RAID solutions for both NVMe SSD and SATA devices for enterprise servers and workstations. The product family includes the following three 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. In previous releases, this was simply referred to as Intel VROC.
2. Intel VROC (SATA RAID) – This product provides an enterprise RAID solution for SATA devices connected to SATA/sSATA the Intel Platform Control Hub (PCH) configured for RAID mode. In previous releases, this was simply referred to as Intel Rapid Storage Technology enterprise (Intel RSTe).
3. Intel VROC (NonVMD NVMe RAID) – This product provides an enterprise RAID solution for Intel NVMe SSDs attached to PCIe slots managed by the Platform CPU. Intel VROC (NonVMD NVMe RAID) is not intended for, nor supports:
    a. Non-Intel NVMe SSDs.
    b. Platforms that have on Intel® Xeon® Scalable Family Platforms CPUs that contain Intel VMD technology (weather enabled or disabled).

    In previous releases, this was simply referred to as Intel RSTe NVMe.

5.4 Intel VROC Support for Windows 10 RS5 / Server 2019

Intel VROC 6.0.0.1357 release package includes 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: It may be noticed that installing Intel VROC 6.0 when installing or using Windows* 10 RS5 /Server 2019 that installation may take longer than previous OS versions. This is being investigated.

6 Drivers, Images and Utilities

List of Modules supported on Intel® Xeon® based platforms delivered with Intel® VROC 6.2.0.1239 Release Package.

Feature	Notes

Intel UEFI Drivers	• Intel® VROC UEFI Driver version 6.2.0.1034
	  ○ VMDVROC_1.efi (HW key enforcement in effect)
	• Intel® VMD UEFI version 1.7.0.1003
	  ○ VMDVROC_2.efi
	Note: All of 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 6.2.0.1034
	  ○ SataDriver.efi
	  ○ sSataDriver.efi

Legacy OROM Images	• Intel® VROC (SATA RAID) SATA OROM pre-OS image version 6.2.0.1034
	  ○ SataOrom.bin
	  ○ sSataOrom.bin

Feature	Notes

Intel® VROC Windows* Drivers	• Intel® VROC Windows GUI version 6.2.0.1238
	• Intel® VROC Windows GUI for Win7 version 5.6.0.1018
	• Intel® VROC Windows Installer Package version 6.2_4.0.18
	  ○ SetupVROC.exe (Multi-lingual)
	• Intel® VROC (VMD NVMe RAID) Windows F6 Driver version 6.2.0.1234– Win8 (Includes Intel VMD enabled NVMe Driver version 1.7.0.1005)
	  ○ \iaVROC.free.win8.64bit.6.2.0.1234\iaVROC
	• Intel® VROC (VMD NVMe RAID) Windows F6 Driver version 5.6.0.1016 – Win7 (Includes Intel VMD enabled NVMe Driver version 1.7.0.1005)
	  ○ \iaVROC.free.win7.64bit.5.6.0.1016\iaVROC
	• Intel® VROC (SATA RAID) Windows F6 Driver version 6.2.0.1238 - Win8
	  ○ \iaStorE.free.win8.64bit. 6.2.0.1238 \iaStorE (SATA)
	  ○ \iaStorE.free.win8.64bit. 6.2.0.1238 \iaStorB (sSATA)
	• Intel® VROC (SATA RAID) Windows F6 Driver version 5.6.0.1006 – Win7
	  ○ \iaVROC.free.win7.64bit.5.6.0.1006\iaStorE (SATA)
	  ○ \iaVROC.free.win7.64bit.5.6.0.1006\iaStorB (sSATA)
	• Intel® VROC (NonVMD NVMe RAID) Windows F6 Driver version 6.2.0.1234– Win8
	  ○ \iaRNVMe.free.win8.64bit. 6.2.0.1234\iaRNVMe
	  ○ \iaRNVMe.free.win8.64bit. 6.2.0.1234\iaRNVMeVirt
	• Intel® VROC (NonVMD NVMe RAID) Windows F6 Driver version 5.6.0.1006 – Win7
	  ○ \iaRNVMe.free.win7.64bit.5.6.0.1006\iaRNVMe
	  ○ \iaRNVMe.free.win7.64bit.5.6.0.1006\ iaRNVMeVirt
	• Intel VROC CLI version 6.2.0.1239
	• Intel VROC CLI version 5.6.0.1019

Intel® VROC UWD GUI Application	• Intel® VROC UWD GUI Application 6.2.0.1238 ○ \UserInterface_UWD\VROC_6.2.0.1239_UI

UEFI Based RAID Configuration/Management Utility	• Intel® VROC version 6.2.0.1034
	  ○ RCfgVROC.efi
	• Intel® VROC SATA / sSATA version 6.2.0.1034
	  ○ RCfgSata.efi
	  ○ RCfgsSata.efi
	Note: Secure Boot must be disabled to use this tool

DOS Based RAID Configuration/Management Utility	• Intel® VROC SATA / sSATA version 6.2.0.1034
	  ○ RCfgSata.exe
	  ○ RCfgsSata.exe

Feature	Notes

UEFI Based Comply Utility	• Intel® VROC version 6.2.0.101034
	  ○ RcmpVROC.efi
	• Intel® VROC SATA / sSATA version 6.2.0.1034
	  ○ RCmpSata.efi
	  ○ RCmpsSata.efi
	Note: Secure Boot must be disabled to use this tool

DOS Based Comply Utility	• Intel® VROC SATA / sSATA version 6.2.0.1034
	  ○ RCmpSata.exe
	  ○ RCmpsSata.exe

UEFI based SATA SGPIO/LED Test utility	• Intel® VROC SATA / sSATA version 6.2.0.1034
	  ○ LedToolSata.efi
	  ○ LedToolsSata.efi
	Note: Secure Boot must be disabled to use this tool

UEFI based Intel VROC LED Test utility	• Intel® VROC version 6.2.0.1034 ○ 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 6.2.0.1034
	  ○ RClrSata.efi
	  ○ RClrsSata.efi

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

7 Intel VROC Limitations

7.1 Microsoft .NET Framework Removal

As previously described, the Intel VROC product installation application has removed the Microsoft .NET Framework as well as the Intel ASM component.

The following table shows how the removal of the Microsoft .NET Framework may impact the launching of the Intel VROC GUI, based off the Windows operating system installed:

	Server 2k12 R2	Server 2k16	Windows 2k19	Win 10 RS3	Win 10 RS4	Win 10 RS5
VROC 6.0	Install Latest .NET Framework	Install Latest .NET Framework	No Impact	Install Latest .NET Framework	No Impact	No Impact

If the system configuration requires the .NET Framework version to be updated and the system has internet access, a web installer can be used, which should go out and install the latest version. For example: (https://support.microsoft.com/en-us/help/4054531/microsoft-net-framework-4-7-2-web-installer-for-windows).

If the system is not connected to the Internet, then an offline version must be downloaded, moved to and installed on the system. The following are some additional instruction to help in this process:

1. Download the latest version of .NET Framework from Microsoft
2. Compress the downloaded image (to avoid potential undesirable side effect as outlined in https://docs.microsoft.com/en-us/dotnet/framework/install/troubleshoot-blocked-installations-and-uninstallations#compat)
3. Copy the compressed file to a USB drive
4. Copy the compressed file from the USB drive to the Download directory of the platform being configured
5. Uncompressed the file
6. Run the executable file as administrator

For more information please refer to https://dotnet.microsoft.com/.

Once the latest version of the .NET Framework is installed, rerun the Intel RSTe product installation application. This helps ensure that all components will start properly.

7.2 Intel VROC (NonNVMe NVMe RAID) Support

Intel VROC (NonVMD NVMe RAID) support is included in the Intel VROC 6.2 release package. This package supports only Intel NVMe SSDs and does not support (nor can be installed on) platforms that support Intel VMD. Intel VROC (NonVMD NVMe RAID) supports DATA RAID. Boot support is not available. For more information, please refer to the Intel VROC TPS included with this package.

NOTE: This functionality is not supported on Purley Refresh platforms

7.3 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.

7.4 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.

7.5 Intel VROC Command Line Interface

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

7.6 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

7.7 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.

7.8 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.

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.

7.9 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 6.2.

The supported Microsoft Operating Systems for this product include inbox drivers that support the Intel® C620 and C422 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 is strongly recommended that the Intel VROC 6.0 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).

7.10 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.

7.11 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.

7.12 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.

7.13 Windows* 10 RS5/Server 2019

7.13.1 Idle Power increased

Installing Intel VROC 6.2 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.

7.14 Intel VROC 6.0 on Windows* Server 2012 R2

When installing Intel VROC 6.2 onto Windows* Server 2012 R2, the following Microsoft* updates must first be applied:

1. KB4054566
2. KB2999226
3. KB2919355
4. KB3172729

8 Known Issues in this Release

This section outlines the known issues that are being actively worked on with the Intel VROC 6.2 PV release

Internal Reference Number	Issue Description
1408968353	Title: Intel VROC (VMD NVMe RAID) UEFI HII Menu May Cause the BIOS Setup Menu to be Improperly Displayed
1507139562	Title: System May Encounter a System Failure Resuming from S3/S4 Power Management While a Migrating a RAID Volume
1409194760	Title: Activity LED is not blinking when SATA drive in RAID mode
1808452676	Title: A system, with the OS installed onto a RAID volume, may not properly resume after several Hybrid Sleeps
1808389290	Title: The Intel VROC Rebuild LED behavior may not operate properly when Customized to blink all LEDs during a RAID rebuild
1808377588	Title: 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.
1808160495	Title: The Intel VROC UI and CLI tools that manage Intel VROC (NonVMD NVMe RAID) Intel NVMe SSDs may not properly gray out those drives when they are attached to the platforms PCH controller. Intel VROC (NonVMD NVMe RAID) currently does not support Intel NVMe SSDs attached to the platform PCH.
1808094827	Title: The Intel VROC (VMD NVMe RAID) PreOS environment may only show 32 NVMe SSDs in the Intel VROC HII.
1808060543	Title: 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)
1807789361	Title: When performing a Hot Plug (removal and insertion) of a RAID member drive, during a RAID Volume migration, may not properly initiate an automatic RAID rebuild after the migration completes.
1807345165	Title: The CLI Tool May Not Properly Expand Existing RAID Volumes
1807107325	Title: 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.

1806994368	Title: Performing Hot Plug drive replacement on a degraded RAID volume, with Rebuild on Hot Insert enabled, may not properly initiate an automatic RAID rebuild.
1806588250	Title: Creating a RAID5 System volume from a Pass-through System Disk (Windows 10 RS5/Server 2019) May Fail
1806530337	Title: The Intel VROC Driver Re-Installation Process May Cause a System Failure While the System is Rebooting.
1806397184	Title: IIntel RSTe NVMe Pre-Purley Platform with 48 NVMe Drives and Max Volumes. Degraded RAID Volume May Encounter a System Failure While Booting
1805900436	Title: Intel VROC F6 Drivers May Not Properly Load
1507369786	Title: 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
1409667894	Title: LED Locate from HII BIOS VROC Menu Causes Page to Exit Prematurely
1408610353	Title: The Intel RSTe Upgrade (Uninstall/re-install) Process May Encounter a System Crash
1407853994	Title: Degraded SATA RAID 5 may not boot if disk on SATA controller port 0 is removed or fails
1806782204	Title: Intel VROC GUI may not Properly Open Unless "Run as Administrator"
1806411891	Title: RAID Volume May Become Degraded After Reboot
1806397164	Title: Intel RSTe NVMe Pre-Purley Platform with 48 NVMe Drives and 24 Volumes May Encounter a boot Failure
1409584095	Title: Event Log Error 4156/4155 Seen during stress testing
1807170210	Title: An Intel VROC GUI Volume Creation Warnings Message May Overlay ontop of a Submenu
1807158496	Title: The Intel VROC RWH Policy May Change from Journaling to Distributed after a Drive Hot Unplug
1807073364	Title: Intel VROC GUI May Show a Pop-up Unknown Error Message when a RAID Volume Migration Begins
1806930160	Title: 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.
1806564426	Title: Event Lot May Not Poroperly Show "RAID volume {VolumeName} is normal" Message after a Rebuild Completes
1806564424	Title: System May Fail to Start After an Unexpected Power Loss
1806564409	Title: Platform May Not Properly Boot After a Dirty Shutdown with I/O on a RAID 4 volume (RWH Distributed)
1806559207	Title: Installing the OS onto a RAID5 volume May Result in a Degraded Volume

1806522520	Title: Drive Hot Insert May Report the Drive was Removed Followed by Detection
1806419240	Title: Intel VROC (VMD RAID) NVMe Drive May be Marked as Available After Removal
1407347823	Title: RSTe RCfgRSTeRS.efi Disk IDs are not consistent and RAID 5 create with journaling drive hangs
1306412122	Title: Setting LED Configuration of Empty Slot as Fail may not show Fail when slot is empty.

9 Issues Resolved in 6.2 PV

Internal Reference Number	Issue Description
1805474763	Title: Intel VROC Driver Upgrade May Mark Volume as Initialized
1606761987	Title: BSOD occurred after loading F6 driver during Win10 RS5 installation
1506077912	Title: Intel VROC Negotiated Link Rate Reported May Not be Accurate
1408572195	Title: A System Crash May Occur After Loading F6 Driver During Win10 RS5 Installation
1407219909	Title: New VMDVROC_1.efi / VMDVROC_2.efi driver will increase boot time around 4 seconds
1406945370	Title: NVMe LED blinking Issue on RAID when Locate sent after Rebuild
1806420960	Title: Intel RSTe NVMe 5.5 on a Windows 7 64-bit Platform May Report the Incorrect Filter Driver Version Number
1506226285	Title: Intel VROC mismatch error after changing RAID 5 RWH Values in BIOS setup
1504750338	Title: Can Not Disable All RAID Levels in BIOS Setup
1306751503	Title: VMD Windows is not setting the SRB status to SUCCESS when there is no NVMe child device during S4.
1807640358	Title: Certain NVMe SSDs may not be visible after hot inserting into a Switch managed by Intel VMD
1409080745	Title: A System Crash may be Observed with Windows Install on a drive behind a Switch managed by Intel VMD
1409231052	Title: A system crash observed with Win 2019/2016 installed on an NVMe drive on some multifunction switches managed by Intel VMD
1409277350	Title: Intel VMD UEFI May Not Report VMD Controller Number
1409098352	Title: A System Failure May Occur with Surprise Hot-Plug After Removing 2nd Device and reinserting

10 Issues Resolved in 6.1 PV

Internal Reference Number	Issue Description
1506951451	Title: BSOD 0x50 occurred sporadically when system run Win10 HLK test item "PNP/Sleep with IO Before and After"
1407931496	Title: Intel VROC RAID Volumes May Not Properly Show in the BIOS
1506852286	Title: BSOD randomly occurs during RAID CFG migrating via RSTe APP
1407996572	Title: The unit of RAID volume capacity may not display properly when creating SATA RAID in legacy SATA OROM

11 Issues Resolved in 6.0 PV

Internal Reference Number	Issue Description
1805474763	Title: Intel VROC Driver Upgrade May Mark Volume as Initialized
1606761987	Title: BSOD occurred after loading F6 driver during Win10 RS5 installation
1506077912	Title: Intel VROC Negotiated Link Rate Reported May Not be Accurate
1408572195	Title: A System Crash May Occur After Loading F6 Driver During Win10 RS5 Installation
1407219909	Title: New VMDVROC_1.efi / VMDVROC_2.efi driver will increase boot time around 4 seconds
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