



Intel® Virtual RAID on CPU (Intel® VROC) and Intel® Rapid Storage Technology Enterprise (Intel® RSTe) Linux* OS – 5.3 PV Version Release

Release Notes

*October 2017
PV Release*



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Revision History

| Package Definition | Intel® VROC | Release Date |
|--------------------|---------------------------------|---------------|
| PV | Intel RSTe Linux 5.3 PV Release | October, 2017 |



1 Introduction

Intel Virtual RAID on CPU (Intel® VROC) and Intel® Rapid Storage Technology enterprise (Intel® RSTe) SATA Production Version (PV) release package for Intel RSTe 5.3 PV Linux supports both PCH based RAID as well as NVMe CPU attached RAID. This PV release package includes key/critical bug fixes resolved since the last release. These components include:

- The Production version of Linux MDRAID with Intel RSTe and Intel VROC
- The Intel® Volume Management Device (Intel® VMD) enabled NVMe driver
- The Intel VROC UEFI drivers and utilities
- The Intel RSTe UEFI drivers and utilities
- The Intel RSTe Legacy Option ROM images and utilities
- The Intel Acceleration Storage Manager (ASM)

Intel® Virtual RAID on CPU (Intel® VROC) is the term describing Intel® RSTe 5.3 with the Intel® VMD-enabled NVMe driver. The Intel VROC upgrade key is required to create, boot and manage RAID volumes across NVMe SSDs attached to the CPU.

Please review the 5.1 Linux TPS and Linux User Guide for instructions.

WARNING: Any continued use of the Intel VROC 5.3 VC UEFI driver version 5.3.0.1041 is not recommended. Using any previous 5.3 releases of UEFI is strongly discouraged. Please update your Bios to Intel VROC UEFI 5.3 PV included with this package

1.1 Supported Operating Systems

Intel VROC 5.3 PV version introduces support for RHEL 7.4 and SLES 12 SP3 with no need for the Intel VROC package update.

Important note: Most, but not all issues resolved in this release were resolved in RHEL 7.4 and SLES 12 SP3; please refer to the release notes from RHEL and SUSE for issues resolved in those releases.

Intel VROC 5.3 PV package is designed to support updating RHEL 7.3 GA and BU versions only

Intel VROC is available in the following Linux distributions:

- Red Hat Enterprise Linux (RHEL) 7.3 (Intel VROC) GA and BU – requires Intel VROC package
- Red Hat Enterprise Linux (RHEL) 7.4 – support available “out of box”
- SUSE Linux Enterprise Server (SLES) 12 SP3 (Intel VROC) – support available “out of box”

NOTE: Intel VMD-enabled NVMe driver has been upstreamed with latest updates in Linux v4.14 kernel

1.2 Supported Platforms

Intel® Xeon® Scalable Platforms

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



1.3 New In This Release

Intel VROC Hardware Key Checker for Linux. This is included with Open Source License and included with this Intel VROC Linux 5.3 Kit. This tool is a Linux script designed to be ran in factory process to speed up manufacturing when checking for the Intel VROC Hardware Key information on Intel® Xeon® Scalable platforms.

1.4 Linux Upstreamed Fix for FIO Performance on RAID 5

RHEL 7.3 and RHEL 7.4 displays an issue with FIO that was filed as a Bugzilla related to a long standing issue with Intel Matrix Storage Manager for Linux on RAID 5:

Issue: During Performance testing with FIO on RAID volumes, the system may experience an abnormal reboot

Bugzilla: https://bugzilla.redhat.com/show_bug.cgi?id=1497215

This release of Intel VROC Linux 5.3 PV includes this upstreamed patch to improve FIO performance testing for Intel VROC Linux customers when testing RAID 5 performance with FIO.

Upstreamed patch:

<https://git.kernel.org/pub/scm/linux/kernel/git/torvalds/linux.git/commit/drivers/md/raid5.c?h=v4.14-rc2&id=184a09eb9a2fe425e49c9538f1604b05ed33cfef>

1.5 Limitations

1.5.1 Command to enter S3 / S4 Does not Work in RHEL 7.4 and SLES12 SP3

Platforms Suspend to memory / Disk is not working and is a known issue for the Linux distributions supported in this release. This is not an Intel VMD issue, and must be followed up with SUSE or RHEL. Customers must consult their distributor for any upstreamed fixes for RHEL 7.4 and SUSE SLES 12 SP3. The upstreamed fix is included in this release of Intel VROC Linux 5.3PV for RHEL7.3 (see release notes for fixed issues)

Issue can be seen when sending rtcwake command:

```
"$ rtcwake -m mem -s 60  
"$ rtcwake -m disk -s 60
```

1.5.2 VT'd + Intel VMD enabled + IOMMU

RHEL 7.3 contains a known issue that child devices don't inherit the dma operations hooks that are needed to point dma operation source-ids to the Intel VMD endpoint. This makes dma operations get rejected by the IOMMU. **

This issue is fixed in RHEL7.4 and Intel VROC Linux 5.3 PV for RHEL7.3

Important Note:

** Intel VMD does **not** support direct assignment to a guest VM in this release



1.5.3 Hot plug limitations

1. Removal or insertion of PCIe NVMe SSDs while in S4 is not supported
2. S3 power state will only be supported on workstation platforms

1.5.4 Limitations on Platforms with Intel QS Lewisburg PCH

The following workaround is necessary when installing RHEL7.3 for these platforms. There are several Bugzilla issues listed for "QAT" as well as open issues related to Purley that are scheduled to be fixed in RHEL 7.4 and 7.3.z (z-stream/BU).

When installing RHEL7.3, the installation must be edited by appending the following:

```
modprobe.blacklist=qat_c62x
```

1.5.5 RAID WRITE HOLE Policy Selection Limitations

Linux supports only the Distributed PPL policy option. When creating a RAID 5 in UEFI or Windows environment, user is allowed to choose between Distributed PPL, and Journaling RAID WRITE HOLE Policies. For Linux RAID 5, to support the RAID WRITE HOLE, choose the Distributed PPL policy option only. Linux RAID 5 does not support Journaling RAID WRITE HOLE policy.

1.5.6 Updating to RHEL 7.3 Business Update

On platforms that are utilizing Intel VMD and Intel VROC functionality, prior to applying the RHEL 7.3 BU updates, the Intel VROC updates included in this package must be applied.

1.6 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 / Intel RSTe AE support for Purley Skylake SP 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® Rapid Storage Technology enterprise (Intel® RSTe)



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- Environment Details -> Purley-PCH = lbg-4
- Environment Details -> Purley-CPU = skx-2s (or skx 4s)
- Environment Details -> BKC or SW Version = 5.3



2 Included Features

Table 1. Feature Set

| Feature | Notes |
|--------------------|---|
| Surprise Hot-Plug | Requires Hardware / Firmware support |
| LED Management | VMD Method |
| Error Management | VMD First |
| RAID Write Hole | Resolves RAID Write Hole on RAID 5 with Premium Key |
| Intel VROC Premium | Intel VROC Premium SKU upgrade key – Please reference the Linux 5.1 TPS for a complete list of supported features |



3 List of Modules supported for Intel VROC

Table 2 List of Modules supported for Intel® Xeon® based platforms delivered with Intel VROC for this release

| Feature | Notes |
|---|--|
| Intel VROC UEFI Driver Intel VMD UEFI Driver | <ul style="list-style-type: none">• Intel® VMD/VROC UEFI Driver version 5.3.0.1052 PV<ul style="list-style-type: none">○ VMDVROC_1.efi○ VMDVROC_2.efi |
| Intel VROC RESTful API | <ul style="list-style-type: none">• ASM version 1.3.0.91 Linux |
| Intel VMD-enabled NVMe Linux* Driver Intel RSTe Linux Driver | <ul style="list-style-type: none">• Linux Kernel v4.14 contains latest upstreamed fixes for Intel VMD current to this release date |



4 Package Components

The following components are included in this package

4.1 Intel RSTe Pre-OS Components

For Intel VROC Supported Standard and Premium RAID features, you will need to connect either an ES or QS Intel VROC Standard (or Premium) key on the system motherboard.

We have included a tool to run via an EFI shell that can be used to check for the HW key presence (HWKeyCheckRSTeRS.efi). There are 3 possible scenarios; no key inserted, standard or premium key inserted.

RSTe_PreOS-5.3.0.1052.zip

- Efi_sata directory contains the EFI RAID driver to support the platform SATA controller in RAID mode
- Efi_ssata directory contains the EFI RAID driver to support the platform sSATA controller in RAID mode
- Efi_standalone_rste_rs directory contains the Intel VROC UEFI drivers and utilities
 - VMDVROC_1.efi and VMDVROC_2.efi both must be included in the platform BIOS
 - Rcfgrsters.efi is the command line tool executed from an EFI shell
 - HWKeyCheckRSTeRS.efi is the HW Key checking tool to help determine if there are issues reading the HW key on the platform
 - LedToolVMDRSTeRS.efi – utility for sending / testing LED blink patterns to slots occupied by Intel VMD-enabled NVMe devices
 - RCmpVROC.efi – Utility to help debug any Intel VROC platform compliance issues
- Legacy_sata directory contains the legacy Option ROM to support the platform SATA controller in RAID mode
- Legacy_ssata directory contains the legacy Option ROM to support the platform sSATA controller in RAID mode
- Legacy_ssata_dos directory contains some DOS based tools to help manage the system in legacy mode.

4.2 Intel VROC for Intel VMD enabled platforms

The contents of this zip file is specifically designed to be applied against a RHEL 7.3 GA / BU Installations. The instructions included in the user guide outline the steps required to apply the supplied patches for Intel VMD and Intel VROC RAID support on a platform that supports Intel VMD.

- Intel_VROC_5_3_PV_Linux_ReleasePackage.zip
 - PreOS
 - Intel OBL Commercial Use License.pdf
 - Intel_VROC_Linux_5_3_PV_Release_Notes.pdf
 - Intel_VROC_NVMe_for_Linux_SW_User_Guide_5_3_PV.pdf
 - rste-5.3_PV_rhel7.3.zip
 - Intel_ASM-1.3.0.91-Linux.zip



4.3 Intel VROC and Intel VMD Linux Source Code

The contents of the "SRC" directory (within the iso image) contains the associated source code for the rpm packages included with this release.



5 Intel VROC 5.3 PV Known Issues

Known issues in this release of Intel VROC and Intel RSTe SATA

| | |
|----------------------------|---|
| Title | Sometimes the fault LED is solid on when we use command "echo 0 > power" to remove NVMe SSD(OS:RHEL 7.3) |
| Ext/Int Reference # | 1504563871 / 220558837 / 00188473 |
| Version | Linux 5.3 PV RHEL7.3 / RHEL7.4 / SLES 12 SP3 |
| Issue Description | In Redhat 7.3, we issue the following command to remove NVMe SSD one by one, but got fault states randomly in each port. command: echo 0 > /sys/bus/pci/slots/xxx/power |
| Workaround | None at this time. Plan to push fix upstream for Ledmon in future |

| | |
|----------------------------|--|
| Title | Platform does not wake properly from S4 on Basin Falls WS |
| Ext/Int Reference # | 111451 |
| Version | Linux 5.3 PV release |
| Issue Description | While S4 cycle, platform does not wake properly. After about 10-20 iterations. Call Trace occurs and platform goes to reboot instead of resuming from S4 state |
| Workaround | None at this time |

| | |
|----------------------------|--|
| Title | Intel RSTe5.0 Linux VMD Mode Single and RAID Performance Issue |
| Ext/Int Reference # | 1209614337 / 00161150 |
| Version | Intel RHEL7.3 Linux 5.0 PV release |
| Issue Description | Using FIO for SEQ READS/Writes on Intel VROC RAID volume, performance is lower than expected |
| Workaround | None at this time |



| | |
|----------------------------|--|
| Title | Intel VROC RAID Performance Issue |
| Ext/Int Reference # | 1209614337 / 00161150 / 22807 |
| Version | Intel RHEL7.3 Linux 5.0 PV release |
| Issue Description | Using FIO for SEQ READS/Writes on Intel VROC RAID volume, performance is lower than expected |
| Workaround | None At This Time |

| | |
|----------------------------|--|
| Title | RSTe RAID Volume Stop Command May Fail |
| Ext/Int Reference # | 99799 |
| Version | Kernel 4.7-rc5 |
| Issue Description | When attempting to stop an RSTe RAID Volume, the command may fail. |
| Workaround | Retry the command |

| | |
|----------------------------|--|
| Title | PPL on Journal Drive Not Supported |
| Ext/Int Reference # | 100608 |
| Version | Kernel 4.7-rc5 |
| Issue Description | The volume will start without any warnings, even though the Journal Drive is not supported, and won't provide any RWH protection without notifying the user. |
| Workaround | DO NOT create RAID 5 with PPL Journaling Policy option in the HII or UEFI environment, use only the Distributed PPL option for Linux installations |



Intel VROC 5.3 PV Known Issues

| | |
|----------------------------|--|
| Title | Linux RHEL7.3 Install May Fail |
| Ext/Int Reference # | 22832 |
| Version | RHEL 7.3 GA with Purley Lewisburg QS PCH |
| Issue Description | When attempting to install RHEL7.3 GA to validate Intel VROC, the installation will fail on Lewisburg QS PCH |
| Workaround | During install please select 'e' and append the following command line after inst.updates=LABEL=RSTE modprobe.blacklist-qat_c62x |



6 Resolved Issues - Intel VROC Linux Driver 5.3 PV Release

| | |
|----------------------------|---|
| Title | After Sending Grow Command on 4 Device RAID 0, Volume is Degraded |
| Ext/Int Reference # | 1805489185 |
| Version | Intel RSTe Linux 5.1 PV / RHEL7.3 |
| Issue Description | After reshape raid volume using the Grow command, the volume is degraded with 5 devices and RAID level 4 instead of 0 |
| Workaround | Fixed in Intel RSTe Linux 5.3 PV |

| | |
|----------------------------|---|
| Title | Rebuild does not start on 2nd disk added to degraded RAID10 Volume |
| Ext/Int Reference # | 1805299895 / 220442552 / 00185514 |
| Version | Intel RSTe Linux 5.1 PV / RHEL7.3 |
| Issue Description | When 2 degraded states occur on RAID 10. Linux will not recognize the 2nd degraded state and will not rebuild to the newly added device |
| Workaround | Fixed in Intel RSTe Linux 5.3 PV |

| | |
|----------------------------|--|
| Title | Pull Out One HDD will Cause Another HDD Fault LED to Turn On (RHEL 7.3) |
| Ext/Int Reference # | 1504533878 / 220261771 / 00179945 |
| Version | Intel RSTe Linux 5.1 PV / RHEL7.3 |
| Issue Description | When pulling out one drive from one port it should not impact the LED behavior on the other port. As an actual result the LED on other port is impacted. |
| Workaround | Fixed in Intel RSTe Linux 5.3 PV |



| | |
|----------------------------|--|
| Title | RHEL7.3 do migrations from RAID 0 to RAID 5 or from RAID 10 to RAID 5 the state of migrating is Frozen reshape and migration 0 percent |
| Ext/Int Reference # | 1805299900 / 1805299965 / |
| Version | Intel RSTe Linux 5.1 PV / RHEL7.3 |
| Issue Description | Not VROC Issue. Issue is known issue of SELinux Policies: bugzilla: https://bugzilla.redhat.com/show_bug.cgi?id=1431617 |
| Workaround | Fixed in RHEL_7.4_EXT_001.02.1.823 - Boot system with additional kernel parameter "selinux=0" |

| | |
|----------------------------|--|
| Title | Creating RAID5 with Intel P3520 NVMe SSD or Intel P4500 NVMe SSD for FIO testing. During the test, the system has an abnormal restart |
| Ext/Int Reference # | 220547465 / 00188085 / 220547289 |
| Version | Intel RSTe Linux 5.1 PV / RHEL7.4 |
| Issue Description | Creating RAID5 with eight pieces of Intel P3520 NVMe SSD attached to 2*N4P Retimer cards or with eight pieces of Intel P4500 NVMe SSD attached to a N8P Switch card for FIO testing. The OS of RHEL7.3 was installed on the SSD attached to the On-board backplane. During the FIO test, the system has an abnormal restart. |
| Workaround | Fixed in Intel RSTe Linux 5.3 PV and Fix is upstreamed https://bugzilla.redhat.com/show_bug.cgi?id=1497215 |

| | |
|----------------------------|--|
| Title | SLES_12_SP3 – Install Boot Issue – Unable to verify that media mounted successfully |
| Ext/Int Reference # | 116557 / Bugzilla: https://bugzilla.suse.com/show_bug.cgi?id=1034647 |
| Version | SLES 12 SP3 |
| Issue Description | Although ISO is successfully mounted, the installer fails to verify ISO mounting, and installation cannot progress. |
| Workaround | Fixed in build SLES_12_SP3_004.01.0.807 |



| | |
|----------------------------|---|
| Title | Degraded RAID5 doesn't auto rebuild after hot adding the spare disk previously prepared |
| Ext/Int Reference # | IPS: 00182744 / 1805299969 |
| Version | RHEL7.3 and Intel VROC Linux 5.1PV |
| Issue Description | Degraded RAID5 doesn't auto rebuild after hot adding the spare disk previously prepared. |
| Workaround or Fix | Fixed in RHEL_7.3_INT_098.01.1.852 and Intel VROC 5.3 PV Bugzilla RedHat: https://bugzilla.redhat.com/show_bug.cgi?id=1484408 |

| | |
|----------------------------|---|
| Title | RAID 10 with 2 Devices removed and reinserted will not rebuild automatically for the 2nd device |
| Ext/Int Reference # | 220442552 / 00185514 / 1805299895 / 1406348766 / |
| Version | RHEL7.3 and Intel VROC Linux 5.1PV |
| Issue Description | When 2 degraded states occur on RAID 10. Linux will not recognize the 2nd degraded state and will not rebuild to the newly added device |
| Workaround | Fixed in RHEL7.4 and Intel VROC Linux 5.3 PV |

| | |
|----------------------------|---|
| Title | VMD and intel_iommu conflict under Linux |
| Ext/Int Reference # | 1504539957 / 1504537619 / NSD-2880 |
| Version | RHEL7.3 and Intel VROC Linux 5.1PV |
| Issue Description | Intel VMD + VT'd enabled, adding Intel_iommu=on, NVMe device is not present |
| Workaround | Fixed in RHEL7.4 and Intel VROC Linux 5.3 PV |



| | |
|----------------------------|---|
| Title | RHEL7.3 GA boot fail at Failed to start Kernel Module |
| Ext/Int Reference # | NSD-2842 / 1805299925 / 2006647632 |
| Version | Intel RSTe Linux 5.1 PV |
| Issue Description | "Failed to start load Kernel Modules" error message popup(about 3 sec) during reboot after installing |
| Workaround | Fixed in Intel RSTe 5.3 PV RHEL7.3 |

| | |
|----------------------------|---|
| Title | Suspend to Memory / Disk Not Working |
| Ext/Int Reference # | NSD-2872 |
| Version | SLES 12 SP3 / RHEL7.3 / RHEL7.4 |
| Issue Description | NOT An Intel VROC/VMD ISSUE. When using rtcwake command, the platform cannot enter S3/S4 due to insufficient CPU resource. Also logs from /proc/interrupts before and after S4 |
| Workaround | Upstreamed Kernel 4.14 Fix has been added to Intel VROC 5.3 PV Release. Issue may still be present in RHEL7.4 and SLES 12 SP3 |



7 Resolved Issues - Intel VROC Linux Driver 5.1 PV Release

| | |
|----------------------------|--|
| Title | All RAID Disks Blinking During Initialization |
| Ext/Int Reference # | 1209614204 |
| Version | RSTe_5.0.0.2192 |
| Issue Description | <p>On a Linux system, the fault LED will blink on all RSTe managed RAID volume member disks when the RAID volume is in initializing status. This is inconsistent with Windows Intel VMD LED behavior.</p> <p>The planned behavior change is to not have these LEDs blink during initializing state and to have a unified LED behavior across SATA to Intel VMD and RSTe 4.x to 5.x products.</p> |
| Workaround | Fixed in Intel RSTe SATA Windows 5.1 PV to match the Linux behavior |

| | |
|----------------------------|--|
| Title | Unable to Install RHEL 7.3 GA Workstation with RSTe 5.0 ISO |
| Ext/Int Reference # | 116252/ |
| Version | RSTe_5.0 PV Release |
| Issue Description | <p>If you try to install RHEL 7.3 GA Workstation with RSTe 5.0 ISO package and 'Development and Creative Workstation -> Additional Development' package set has been selected, installation fails with an error</p> |
| Workaround | Fixed in Intel 5.1 PV RHEL7.3 Linux |



| | |
|----------------------------|---|
| Title | [2017_WW13 BKC][BIOS:128.R08][Neon city FPGA]System cannot enter S4 on VMD Raid mode. |
| Ext/Int Reference # | 5346049 |
| Version | Intel RHEL7.3 Linux 5.0 PV release |
| Issue Description | RAID 1 Cannot enter into S4 when Intel VMD is enabled |
| Workaround | Fixed in Intel 5.1 PV RHEL7.3 Linux |

| | |
|----------------------------|---|
| Title | (Manual Migration) R0 to R5 migration broken for arrays with non-aligned size |
| Ext/Int Reference # | 5346049 |
| Version | Intel 5.0 PV RHEL7.3 Linux release |
| Issue Description | mdadm fails to add disks to RAID or to migrate from RAID 0 to RAID 5 for certain array sizes. |
| Workaround | Fixed in Intel 5.1 PV RHEL7.3 Linux |