



Intel[®] Virtual RAID on CPU (Intel[®] VROC) and Intel[®] Rapid Storage Technology Enterprise (Intel[®] RSTe) Linux* OS – 5.4 PV Version Release

Release Notes

March 2018
PV Release 1.0



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Revision History

Package Definition	Intel® VROC	Release Date
1.0	Intel RSTe Linux 5.4 PV Release	March 6 2018



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 5.4 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
- mdadm and ledmon Userspace components
- The Intel® Volume Management Device (Intel® VMD) 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 Accelerated Storage Manager (ASM)

Intel® Virtual RAID on CPU (Intel® VROC) is the term describing Intel® RSTe 5.4 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 5.4 Linux TPS and Linux User Guide for instructions.

WARNING: Immediately discontinue the use of the Intel VROC 5.3 VC UEFI driver version 5.3.0.1041. Please update your Bios to Intel VROC UEFI 5.4 PV included with this package.

1.1 Supported Operating Systems

Intel VROC 5.4 PV version includes support packages for RHEL 7.3 and RHEL 7.4

Important note: Most, but not all issues resolved in this release have been upstreamed to the latest kernel; please refer to the release notes for issues resolved in your specific releases.

Intel VROC 5.4 PV packages are designed to support updating RHEL 7.3 GA or RHEL 7.4 GA and z-streams versions

Intel VROC is available in the following Linux distributions:

- Red Hat Enterprise Linux (RHEL) 7.3 (Intel VROC) GA– requires Intel VROC package
- Red Hat Enterprise Linux (RHEL) 7.4 (Intel VROC) GA – Intel VROC 5.1 support available “out of box”
- SUSE Linux Enterprise Server (SLES) 12 SP3 (Intel VROC) – Intel VROC 5.1 support available “out of box”
- Upcoming Distros with Intel VROC 5.3 out-of-box:
 - RHEL 7.5, SLES15 (not yet released)

NOTE: Intel VMD 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

Intel® Xeon® Processor Skylake D-2100 Product Family



1.3 New Feature in v5.4 - LEDMON and LEDCTL version 0.90

New configurable LED blinking pattern can now be constructed using the ledmon.conf file, available for VMD-enabled NVMe, and Intel RSTe SATA, and SCU.

There are 3 new man pages for the following:

- ledmon
- ledctl
- ledmon.conf

Please refer to the man pages within Linux with this new package installed, or Linux RSTe User guide for more details on all available fields for customizing LED Blinking patterns.

1.4 Intel VROC Hardware Key Checker introduced in v5.3

Intel VROC Hardware Key Checker for Linux. This is included with Open Source License and also included with this Intel VROC Linux 5.4 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.

1.5 Linux Upstreamed Fix for Panic During Heavy I/O on RAID 5

RHEL 7.3 and RHEL 7.4 displays an issue with heavy I/O on RAID 5 volumes. An issue 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 heavy I/O on RAID volumes, the system may experience a kernel panic and reboot

Intel VROC Linux 5.4 PV includes this upstreamed patch to fix kernel panic and reboot when testing heavy I/O on RAID 5.

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>

1.6 Limitations

TRIM and Driver Assisted Striping Issues seen with > 2TB Intel® SSD DC P4500 and P4600 and RHEL 7.3

Some installation and filesystem issues may be seen on Intel® SSD DC P4500 and P4600 NVMe SSDs due to the creation of XFS file system and large TRIMs requested by XFS filesystem on larger than 2TB devices. These devices support Driver Assisted Striping, however, due to a bug in RHEL 7.3, the IO takes the longer path, and a timeout is occurring during Dataset Management commands.

Workaround: add "nvme.io_timeout=200" to kernel parameters

User can also add this in various of other ways - for example - adding it to boot parameters, or grub configuration file, so it is added for every grub entry that will be created in the future.



ASM and LED Behavior

When using ASM Web Client to blink locate LED on NVMe and remove the device from the system will impose FAIL state to the drive slot once it disappears from the system. This is the current default behavior.

ASM 1.4 and Intel VROC 5.4 package with ledmon 0.90 version can be configured when using ledmon.conf file to only blink FAIL state when removing a member of a RAID volume.

There is an option in ledmon.conf: RAID_MEMBERS_ONLY

If set to true – this prevents ledmon from changing states of pass thru drives' slots to FAIL when they are removed, unless the device is a RAID member.

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 5.4 PV for RHEL7.3

Important Note:

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

Hot plug Recommended Wait times and limitations

Recommendations for hot plug removal / insertion wait times depend on system notification or sysfs recognizing that the device has been hot inserted before hot removing that same drive. Therefore, hotplug interval recommendation is to wait one second after removing a drive before inserting a new one into the same slot, and waiting at least 5 seconds after inserting a drive before hot removing it again.

Removal or insertion of PCIe NVMe SSDs while in S4 is not supported

S3 power state will only be supported on workstation platforms

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 RHEL7.3.z (z-stream/BU).

To work around this issue, QAT kernel module needs to be blacklisted. This can be done by adding the following kernel parameter:

```
modprobe.blacklist=qat_c62x
```



RAID WRITE HOLE Closure 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 Closure Policies. For Linux RAID 5, to support the RAID WRITE HOLE closure, choose the Distributed PPL policy option only. Linux RAID 5 does not support Journaling RAID WRITE HOLE closure policy.

1.7 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)
- 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 Closure	Resolves RAID Write Hole closure on RAID 5 with Premium Key
Intel VROC Premium	Intel VROC Premium SKU upgrade key – Please reference the Linux 5.4 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 in this Intel VROC release

Feature	Notes
Intel VROC UEFI Driver Intel VMD UEFI Driver	<ul style="list-style-type: none">• Intel® VMD/VROC UEFI Driver version 5.4 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 1.4.0.66 Linux
Intel VMD Linux* Driver	<ul style="list-style-type: none">• Linux* Kernel v4.14 contains latest upstreamed fixes for Intel® VMD current to this release date. All current upstreamed fixes are also included in this package.
Linux* MD Driver	<ul style="list-style-type: none">• Intel® RSTe and Intel® VROC use the Linux MD driver as the RAID engine. This package contains the latest fixes for Linux* MD driver upstreamed.



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-5.4.zip

- Efi_sata and Efi_ssata directories contains the EFI RAID driver to support the platform SATA/sATA 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 and Legacy_ssata directory contains the legacy Option ROM to support the platform SATA /sATA 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 or RHEL 7.4 GA Installations, depending on the package chosen. The instructions included in the user guide outline the steps required to apply the supplied patches for Intel VROC RAID support on platforms that supports Intel VMD.

- Intel_VROC_5_4_PV_Linux_RHEL7_3(4)_ReleasePackage.zip
 - RSTe_PreOS-5.4.zip
 - Intel OBL VROC Commercial Use License.pdf
 - Intel_VROC_Linux_5_4_PV_Release_Notes.pdf
 - RSTe_NVMe_for_Linux_SW_User_Guide_RHEL_Combined_1.10.pdf
 - rste-5.4_PV_rhel7.3(4).iso
 - Intel_ASM-1.4-Linux.zip
 - RSTe_5.4_Linux-TPS-Rev1.5.pdf
 - Vroc_hwkey_tool.sh



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 5.4 PV Known Issues

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

Title	I/O Hangs for few Seconds if RAID Member Drive is Removed
Ext/Int Reference #	1504683331 / 2006705057 / 00209200
Version	Linux RHEL 7.3 VROC 5.3 / 5.4 PV release
Issue Description	During IO testing with FIO, hotplug removal of RAID 1 member results in IO stopping for several seconds
Workaround	None at this time

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	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	NA
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

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 Fixed in RHEL 7.4



6 Resolved Issues - Intel VROC Linux Driver 5.4 PV Release

Title	Migrating RAID 1 to RAID 0 Fails when Changing Chunk Size
Ext/Int Reference #	1504679385 / 2201593582 / 00207917
Version	Linux 5.1/5.3 PV RHEL7.3 RHEL 7.4 SLES 12 SP3
Issue Description	Failure occurs when trying to migrate RAID 1 to RAID 0 while sending command to also change chunk size at the same time. In this case, Online Capacity Expansion cannot be processed successfully.
Workaround	Fixed in Intel VROC 5.4 PV for RHEL7.3 and RHEL7.4. Still occurs in SLES 12 SP3. Upstreamed fix: https://git.kernel.org/pub/scm/utils/mdadm/mdadm.git/commit/?id=a3b831c9e167d1b7fd4f1ec371dc1b95ccf54a5d

Title	HDD would bright Predictive Failure LED, after start execute ledmon service under RHEL 7.3 (after installed RSTe driver ledmon)
Ext/Int Reference #	2201428127 / 00204530 / 1504655662
Version	Linux 5.3 PV RHEL7.3
Issue Description	The system with SAS expander (SAS card->SAS expander), and see Predicted Failure is being set to 1, that might cause the fault led blink.
Workaround	Fixed in ledmon 0.90 included in Intel VROC 5.4PV



Title	FAULT LED will be on randomly when plug-out and plug-in NVMe SSD quickly
Ext/Int Reference #	1406678126 / 2201704618 / 00210401
Version	Linux 5.3 PV RHEL7.3 / RHEL7.4 / SLES 12 SP3
Issue Description	Hot insertion quickly after hot removal causes the fault LED to be on randomly. Expected behavior is for Fault LED to be off.
Workaround	Fixed in ledmon 0.90 included in Intel VROC 5.4PV + recommended Wait times under "Hot plug Recommended Wait times and limitations" section in this document. Still occurs on all distros without ledmon 0.90.

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	Fixed in Linux 5.4 PV

Title	LED Locate one SATA SSD in a degraded RAID array behaves abnormally after hot-plugging out one drive
Ext/Int Reference #	1504689471 / 2201535594 / 00207717
Version	Linux 5.3 PV RHEL7.3 / RHEL7.4 / SLES 12 SP3
Issue Description	Transition from "locate" to "in critical array" does not clear physical locate pattern blinking on slot's LED. As a result, degraded RAID member is still blinking locate LED pattern.
Workaround	Fixed in ledmon 0.90 included in Intel VROC 5.4PV



Title	Using ASM Web to Remove RAID Member causes LED to blink as FAIL Status
Ext/Int Reference #	1504664214 / 2201426400 / 00204516
Version	Linux 5.3 PV RHEL7.3 / Intel ASM 1.3
Issue Description	When using ASM Web to click to remove a RAID member device, ledmon sends the FAULT Blinking pattern instead of locate.
Workaround	Fixed in ledmon 0.90 included in Intel VROC 5.4PV + ASM 1.4 + editing ledmon.conf file (See New LED Management Feature)



7 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 and RHEL7.4

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 for RHEL7.3 and RHEL 7.4

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 and RHEL7.4



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 Intel VROC 5.3PV for RHEL7.3 and 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 for RHEL7.3 and RHEL7.4 and Fix is upstreamed https://bugzilla.redhat.com/show_bug.cgi?id=1497215

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 RHEL7.4 included in 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 / RHEL 7.4



Title	Suspend to Memory / Disk Not Working
Ext/Int Reference #	NSD-2872
Version	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 for RHEL7.3 and RHEL7.4



8 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