LENOVO THINKSTATION P920, P720

INTEL VIRTUAL RAID ON CPU (VROC) SUPPORT

Contents

Section 1 – Intel Virtual RAID On CPU (VROC)

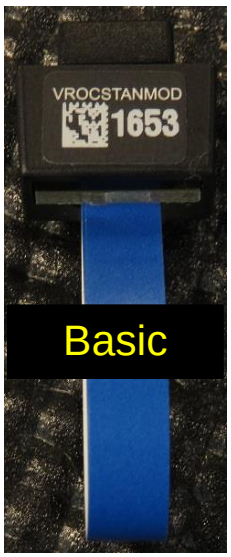
Intel Virtual RAID on CPU (VROC) provides an enterprise RAID solution on platforms that support Intel Volume Management Device (VMD).

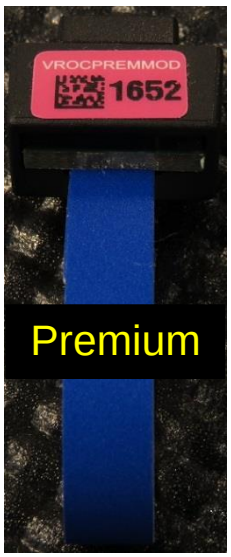
Intel Volume Management Device (VMD) provides support for RAID on PCIe NVMe Solid State Drives. Intel VMD's can use a minimum of 4 PCIe lanes and a maximum of 16 PCIe lanes. There can essentially be up to 4 NVMe SSD's per Intel VMD.

Intel VROC, combined with Intel RSTe 5.0 and VMD, allows bootable RAID on PCIe NVMe SSDs directly attached to the CPU PCIe lanes.

There are two types of VROC's supported on Lenovo Workstations:

- Intel Virtual RAID on CPU (VROC) – **Basic**
  - Supports RAID 0, 1, and 10.
- Intel Virtual RAID on CPU (VROC) – **Premium**
  - Supports RAID 0, 1, 10, and 5.





See Intel documentation for more details on Intel Virtual RAID On CPU (VROC):

https://www.intel.com/content/www/us/en/support/memory-and-storage/ssd-software/000024498.html

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CPU1

VMD0 | VMD1 | VMD2

PCIE Slot 1

CPU0

VMD0 | VMD1 | VMD2

PCIE Slot 4 | PCIE Slot 2 | PCIE Slot 3

M.2 Slot 1

M.2 Slot 2

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CPU1

VMD0 | VMD1 | VMD2

PCIE Slot 8 | PCIE Slot 6 | PCIE Slot 7

CPU0

VMD0 | VMD1 | VMD2

PCIE Slot 3 | PCIE Slot 1 | M.2 Slot 1

M.2 Slot 2

PCIE Slot 2

PCIE Slot 4

Section 2 – VROC Support/Limitations by Platform

The screenshots below correlate with the diagrams above in *Section 1* in regards to Intel VMD. Refer to the motherboard diagrams in *Section 3* to correlate the PCIe labels with the actual PCIe slot locations.

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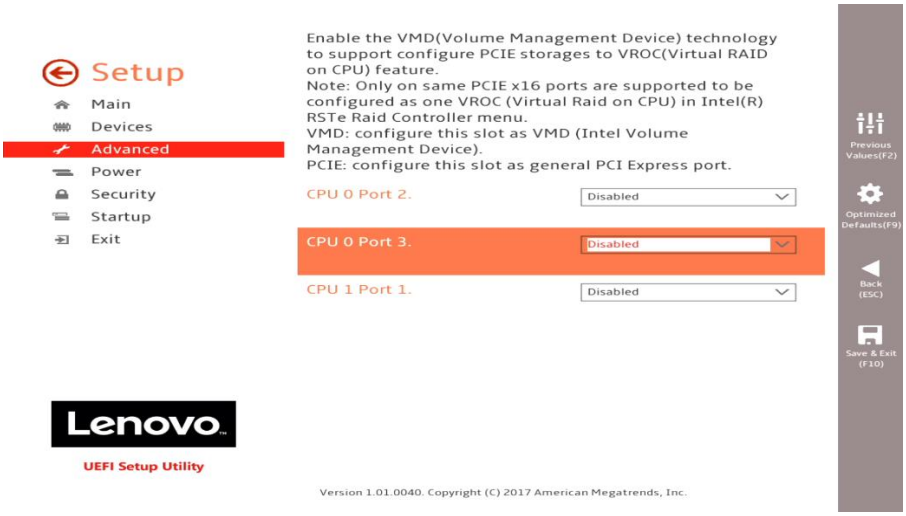

- ➔ "CPU 0 Port 2"
  - PCIE Slot 2 (x16 slot)
- ➔ "CPU 0 Port 3
  - M.2 Slot 1 (x4 slot)
  - M.2 Slot 2 (x4 slot)
  - PCIE Slot 3 (x8 slot)
- ➔ "CPU 1 Port 1"
  - PCIE Slot 1 (x16 slot)

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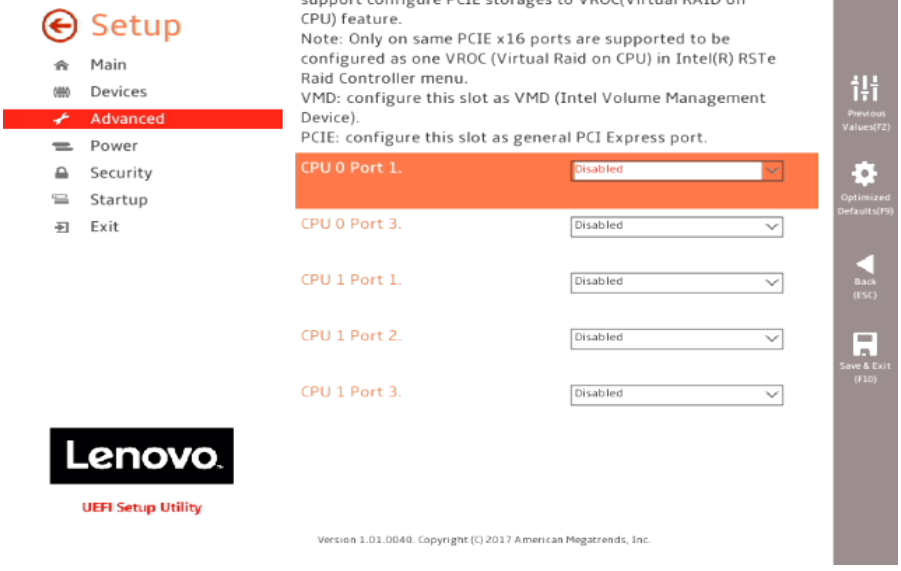

- ➔ "CPU 0 Port 1"
  - PCIE Slot 3 (x16 slot)
- ➔ "CPU 0 Port 3
  - M.2 Slot 1 (x4 slot)
  - M.2 Slot 2 (x4 slot)
  - PCIE Slot 2 (x4 slot)
  - PCIE Slot 4 (x4 slot)
- ➔ "CPU 1 Port 1"
  - PCIE Slot 8 (x16 slot)
- ➔ "CPU 1 Port 2"
  - PCIE Slot 6 (x16 slot)
- ➔ "CPU 1 Port 3"
  - PCIE Slot 7 (x16 slot)

Levels of Support:

- BOOTABLE RAID on NVMe SSDs – maximum of four NVMe SSDs.
  - Cannot span across multiple Intel VMD domains.
- DATA RAID on NVMe SSDs
  - Can span across multiple Intel VMD domains.
- Spanning across CPU's.
  - Not recommended as it could result in performance degradation.
- UEFI
  - Does **not** support nor provide a Legacy Option ROM.
- Three (3) Intel Volume Management Device (VMD) domains per single CPU.

➔ For **Debian** and **Ubuntu** Linux based operating systems, **VMD** mode is **NOT** supported; therefore, NVMe PCIe drives need to be set up as PCIE mode.

➔ For **RedHat** Linux based operating systems, VMD mode support is limited. RHEL 7.3/7.4 or equivalent operating systems can support VMD mode with a proprietary Intel RSTe/VMD driver. See "P520c-P520-P720-P920 RHEL 7 Installation" whitepaper for step-by-step instructions on how to get this to work.

Section 3 – How to Install the VROC Device

Refer to the motherboard diagrams below for the location of the VROC header on the motherboard.

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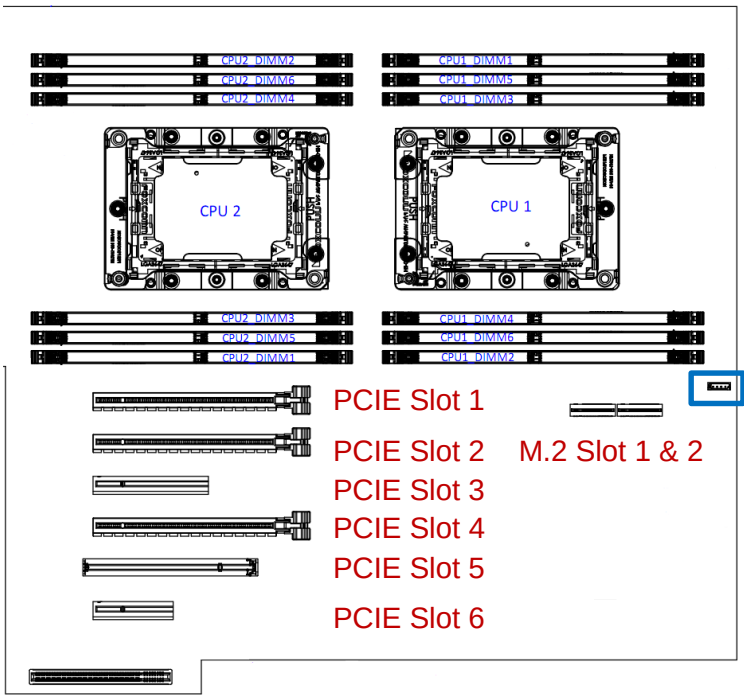
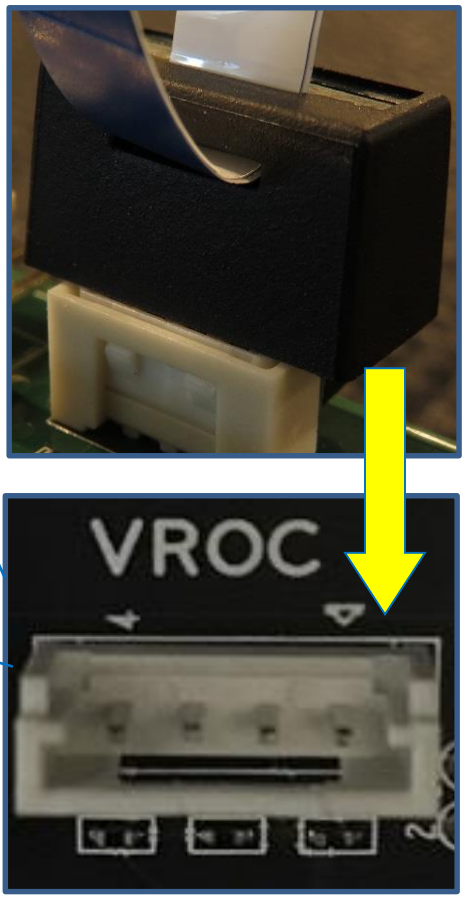
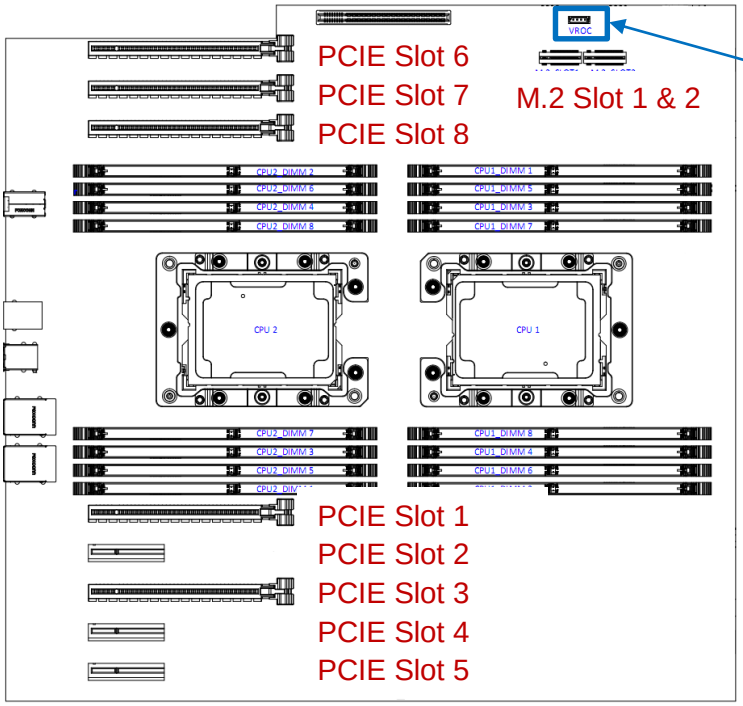




P920



Section 4 – How to Configure the VROC Device

Please see the following steps to configure VROC.

1. Boot into BIOS by pressing the function F1 key at the “Lenovo” splash screen.
2. Select “Setup” from the screen indicated below.

3. Select “Advanced” (left) and “Intel VMD technology” (right).

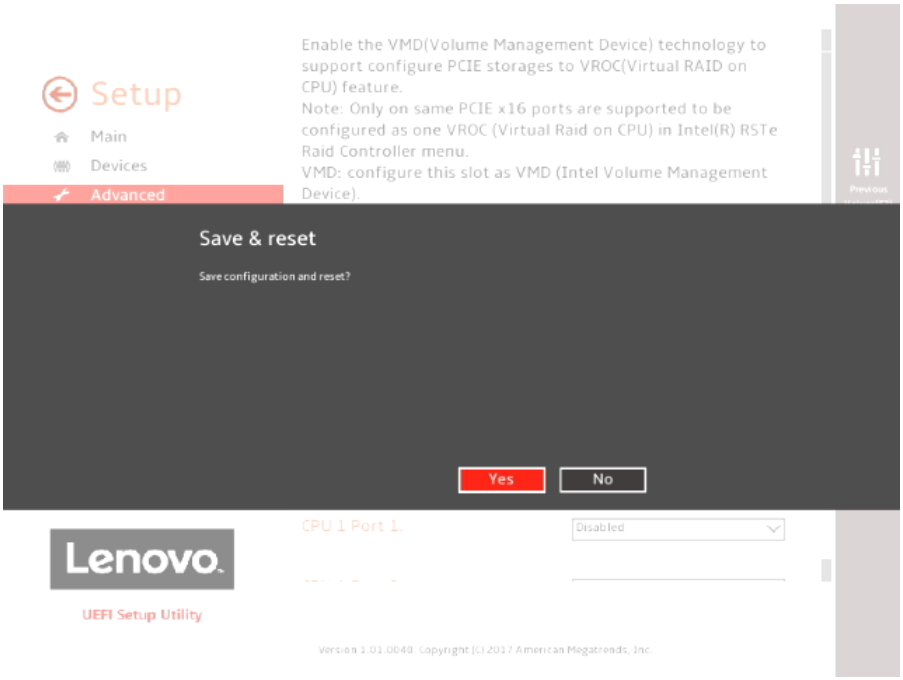
4. Enable the appropriate CPU *x* Port *y* based on where the NVMe SSDs are installed in the system.

   ****See Section 2 above for specific platforms.*

5. Set the appropriate slots where the NVMe SSDs are installed to “VMD”.

   ****See Section 2 above for specific platforms.*

6. Press F10 to Save and Exit the BIOS setup menu. .



Section 5 – How to Create the M.2 RAID Array

Please see the following steps to create the NVMe SSD RAID Array.

1. Boot into BIOS by pressing the function F1 key at the “Lenovo” splash screen.
2. Select “Setup” from the screen indicated below.

3. Select the “Advanced” menu option (left) and “Intel(R) Virtual RAID on CPU” (right).

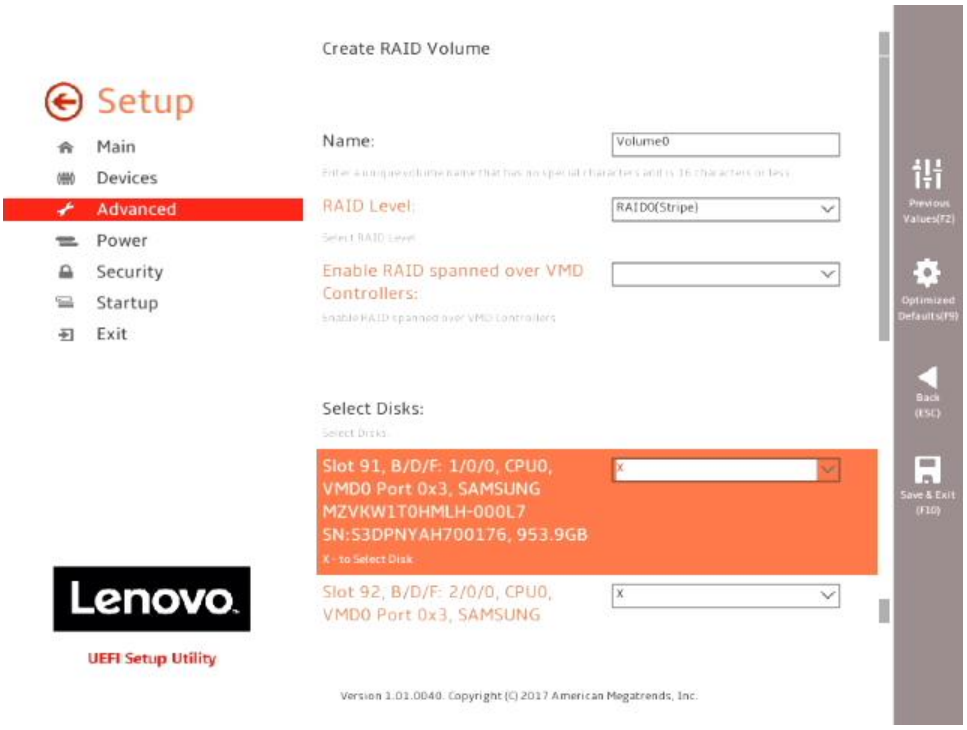
4. Select “All Intel VMD Controllers”.

5. Select “Create RAID Volume”.

6. Enter a unique volume name under the “Name” parameter.

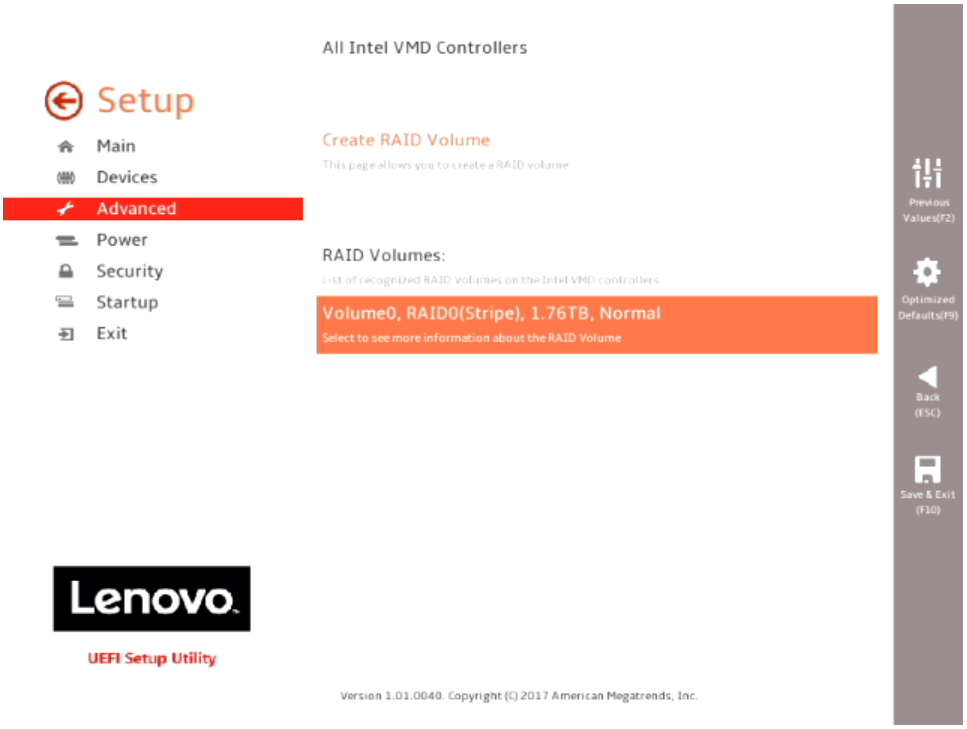
7. Select the RAID level. Only the available RAID levels will be shown in the drop-down menu based on the number of NVME SSDs and type of VROC installed.

8. Select Disks to use in the RAID level selected.

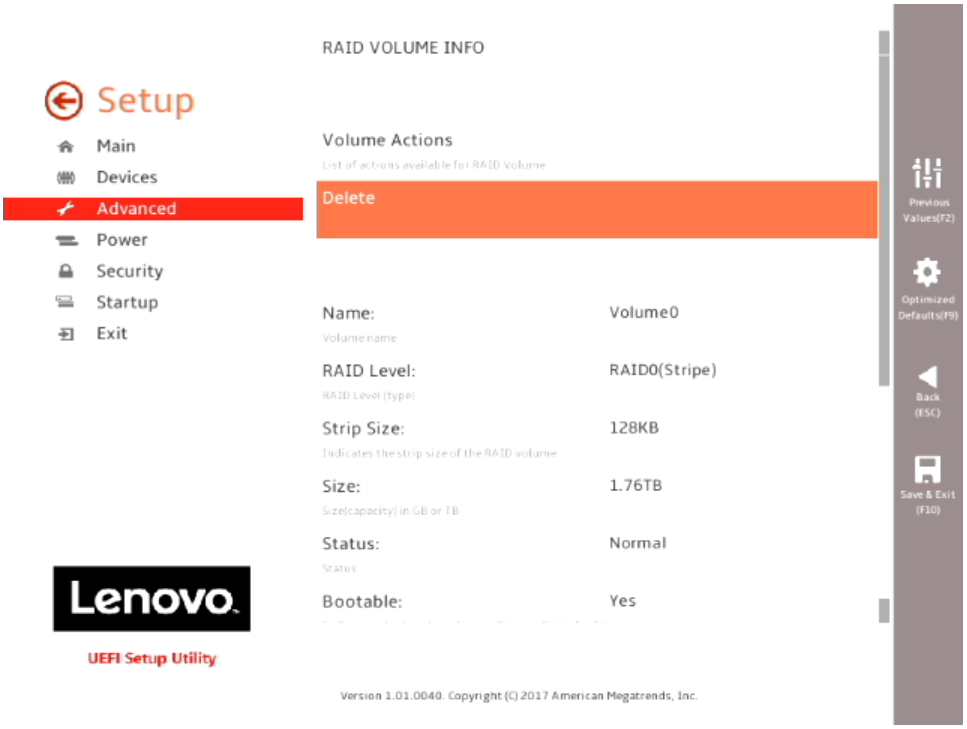


9. Select “Create Volume”.

10. Once a RAID volume has been created, the user should be able to see this under the “All Intel VMD Controllers” menu option.



11. To delete the RAID volume, select the RAID volume in the previous step and select “Delete” on the next screen.



Section 6 – Revision History

Version	Date	Author	Changes/Updates
1.2	11/7/2018	Jason Moebs	Added Linux levels of support. Changed CPU1/CPU2 to CPU0/CPU1 nomenclature.
1.1	11/8/2017	Jason Moebs	New cover page. Added ‘Contents’ section. Added ‘Revision History’ section.
1.0	10/2/2017	Jason Moebs	Initial launch release