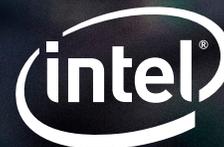


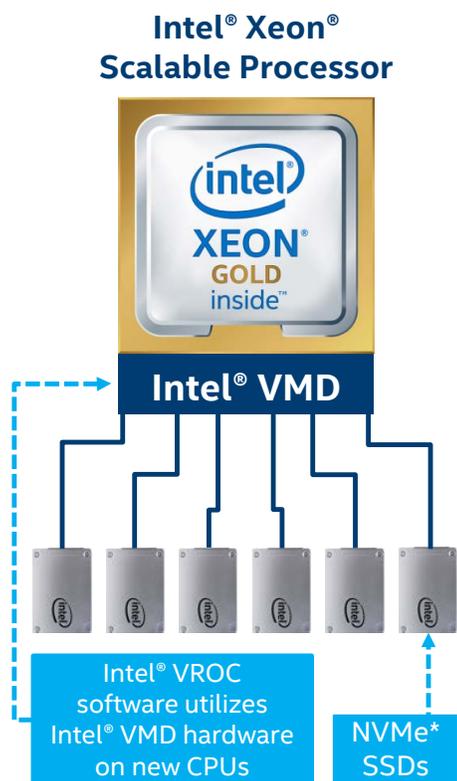
# PRODUCT BRIEF

Intel® Virtual RAID on CPU (Intel® VROC)  
Industry: Data Center



# Scalable RAID for CPU-Attached SSDs

**Intel® Virtual RAID on CPU (Intel® VROC) – an enterprise RAID solution for NVMe\* SSDs directly attached to Intel® Xeon™ Scalable processors.**



Enterprise data storage solutions are migrating to higher bandwidth and lower latency NVMe\*-based SSDs to address the performance bottlenecks of legacy SATA/SAS interfaces. With this transition, enterprises also require RAID data protection for NVMe SSDs.

Intel® Virtual RAID on CPU (Intel® VROC), a new enterprise RAID solution specifically designed for NVMe SSDs, provides expected reliability while unleashing the performance of NVMe SSDs. This is enabled by a new feature in next-generation Intel® Xeon™ Scalable processors called Intel® Volume Management Device (Intel® VMD), an integrated controller inside the CPU PCIe\* root complex. Because the NVMe SSDs are directly connected to the CPU, the full performance potential of reduced latency and increased bandwidth can be realized. Intel VROC enables this benefit without the complexity, cost and power consumption of traditional hardware RAID host bus adapter (HBA) cards placed between the drives and the CPU.

## Scalable RAID for Growth on Demand

A single Intel Xeon Scalable processor using Intel VROC is capable of supporting up to 12 NVMe SSDs directly attached to the CPU, and up to 6 RAID arrays.<sup>2</sup> By adding PCIe switches or dual-socket system configurations, that amount doubles. In addition, Intel VROC supports both boot volumes and data volumes, enabling the flexibility to use one array for both system and data volumes, or separating the arrays respectively. Although a boot RAID array needs to be within a VMD controller, data RAID arrays can span across multiple Intel VMD controllers, or even span across different processors on the same system. With a multitude of supported configurations, Intel VROC allows NVMe RAID solutions to start small, then scale simply and cost effectively.

## Rich Management Tools for Easy Maintenance

Intel VROC management tools support today's modernized data center infrastructure. Intel VROC allows data center administrators to create and delete RAID volumes in both pre-OS and OS environments. RAID settings can be configured with either a user interface or command line, plus the arrays can be managed locally or remotely through a web-based RESTful agent.

NVMe-based SSD management has never been easier. With support for surprise hot-plug, there is no need to reboot the server to replace a failed drive. Using the status indicator LED, administrators can visually identify the RAID status (normal, initialization, degraded, or fail), as well as locate a particular drive in hundreds of SSDs. Automatic email notifications are triggered to alert administrators of events requiring attention.

**Over 2M Mixed  
Read and Write IOPS  
in 4 disk RAID 0 with  
Intel® Optane™ SSDs<sup>1</sup>**

## Reliable RAID for Data Protection

For enterprises, it's critical to protect data when power loss occurs unexpectedly. Intel VROC takes that a step further. Data remains safe when RAID 5 is in a degraded state and power loss occurs at the same time. Most RAID solutions avoid this problem by requiring a backup power unit, which adds additional cost. Intel VROC solves this double fault challenge with journaling, and without the need of a backup power unit.

Note: Intel VROC RAID 5 double fault protection feature depends on state-of-the-art data center NVMe SSDs with power loss protection.

## Unleash the Power of NVMe SSDs Today

Quicker access to data means a more efficient business, and upgrading to NVMe SSDs is the first step to a faster storage solution. Unleash the full power of these NVMe SSDs with Intel Virtual RAID on CPU, a complete RAID solution that enables the unprecedented speed of NVMe SSDs while protecting data required by enterprise applications.

### FEATURES AT A GLANCE

Supported Platform	Platforms with Intel® Xeon® Scalable processor family
Supported Operating Systems	Windows* 2016, Windows* 2012 R2, Windows* 10, Windows* 7 SP2 Red Hat Enterprise Linux* 7.3 SUSE Linux Enterprise* 12 SP3
Supported NVMe-based SSDs	All Intel® SSDs for Data Center and Professional, with NVMe (Non-Volatile Memory Express)  3rd party SSDs: <ul style="list-style-type: none"> <li>• Samsung* SM951, SM961, PM953, PM961</li> <li>• Toshiba* XG3</li> <li>• Micron* 9100</li> <li>• Lenovo* Atsani</li> <li>• Huawei* ES3600P<sup>3</sup></li> </ul>
Supported Configuration	<ul style="list-style-type: none"> <li>• Up to 24 SSDs per Intel® VMD controller, per RAID array, per system</li> <li>• Up to 12 arrays per system</li> <li>• Up to 2 RAID volumes per array</li> <li>• Up to 2 levels of switches</li> <li>• Data volume can span across Intel VMD controllers, boot volume cannot span</li> </ul>
SKUs Available	Pass-Through: No RAID (except RAID 0 for Intel® SSD DC P3608 Series) Standard: RAID 0/1/10 Premium: RAID 0/1/5/10
Key Features	<ul style="list-style-type: none"> <li>• Surprise Hot-plug</li> <li>• Status LED Indication</li> <li>• Hot Spare and Auto-rebuild</li> <li>• Email Notifications for RAID events</li> <li>• RAID 5 Power Loss Protection for Degraded Volume (Double Fault Protection)</li> <li>• Bad Block Management</li> <li>• Various Strip Sizes (4k, 8k, 16k, 32k, 64k, 128k)</li> </ul>



Learn more at [intel.com/VROC](http://intel.com/VROC)

Register and download the VROC software at: [intel.com/downloadVROC](http://intel.com/downloadVROC)

Find the Intel® Solid State Drive that's right for you: [intel.com/ssd](http://intel.com/ssd)

1 System configuration: Intel® Server System S2600WF Family, Intel® Xeon® 8170 Series Processors, 2.1GHz, 26 cores. 32GB DRAM. BIOS Release SE5C620.86B.0X.01.0007.060920171037, MDADM 3.4.4x Intel® SSD DC P4800X Series 375GB, RAID 0, 128KB Strip size, OS: RHEL\* 7.3, Intel® VROC: RSTe\_5.1\_WW13.3, Workload Generator: FIO 2.21, 70:30 mixed read/write 4K random IOs: 16 Workers, IOdepth 16, No Filesystem, CPU Affinitized, Hyper-threading On.

2 The availability of the number of NVMe connections will vary with the OEM system designs

3 Huawei\* ES3600P will be fully supported in a 5.2 hotfix release

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