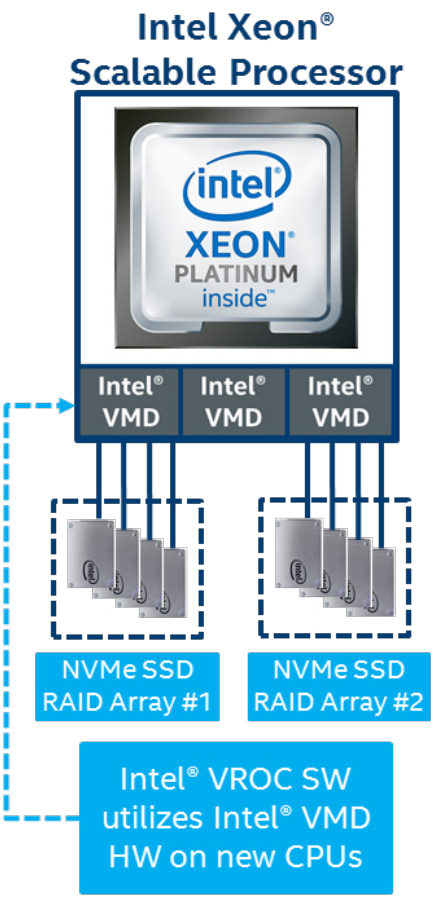
Product Brief

Data Center
Intel® Virtual RAID on CPU

Integrated RAID Designed for CPU Attached NVMe SSDs

Intel® Virtual RAID on CPU – an enterprise RAID solution for NVMe SSDs directly attached to Intel® Xeon™ Scalable processors



Today's data hungry business processes need access to data quicker than ever. Quicker access to data means faster decision making, better productivity, and quicker ROI on IT infrastructure. Therefore, 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) is an enterprise RAID solution specifically designed for NVMe SSDs that provides expected reliability, while unleashing the performance of NVMe SSDs. This is made possible by a 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 HBA cards placed between the drives and the CPU.

**Intel VROC also supports SATA RAID for SATA devices off the Intel chipset. Please see User Guide for more details.*

Integrated RAID architecture

Legacy hardware RAID products traditionally isolated the storage sub-system behind a discrete adapter (RAID HBA), controlling RAID arrays as an intermediary between the storage devices and the host. This design was ideal for slower storage technologies, but now with NVMe, a fundamentally new RAID architecture is required. Integrated RAID takes the robust functionality and enterprise quality of hardware RAID and combines it with the flexibility and speeds of software RAID. Intel VROC offers a premier Integrated RAID solution by working with platform providers to implement Intel VMD hardware and Intel VROC driver packages embedded directly into platform BIOS and OS components, becoming a native feature of the platform. This allows for easier enabling and a more efficient RAID design for NVMe SSDs.

Note: Platform providers implement Intel VROC functionality at their discretion, and all functionality may not be enabled. Please consult your platform provider for Intel VROC supporting platforms and features.

Next generation functionality

Two new features are being introduced with Intel VROC 7.5:

- **Intel VROC Integrated Caching**: By combining an Intel Optane SSD caching layer with Intel VROC RAID arrays, users can benefit from enterprise class storage protection plus next generation storage performance. Integrated caching is provided directly with the Intel VROC driver stack as a plug-and-play user experience for Intel Optane SSDs as a storage acceleratior. Also, by using Intel VROC RAID1 within the caching layer, all single points of failure can be removed from a storage subsystem.

- **Intel VROC Self-Encrypting Drive Support**: Data-at-rest security is of growing concern, especially for data sensitive industries like healthcare and financial services. Self-encrypting drives (SEDs) were created to protect data in case of physical drive theft or for easier storage device retirement. However, to implement these new device types, a complete key management solution is required. This includes the SED devices themselves, an encryption key storage location, and the software to connect them. Intel VROC SED support is a UEFI driver upgrade allowing Intel VROC and Intel VMD to own SED Opal NVMe SSDs and properly integrate with the complete SED infrastructure. This includes typical encryption key storage architecture such as a local security chip on individual platforms or a centralized key management server (KMS). Specific implementation details are unique to each platform provider.

The ideal redundant boot solution

To maximize uptime and reduce the chance of system failure, many systems utilize a redundant OS image volume by using RAID1 with 2 mirrored storage devices. Since pre-boot support and functionality outside the OS is required, hardware RAID solutions have been the only option for these server designs. With Intel VROC, this functionality can now be delivered as an embedded platform feature, without any additional hardware. Intel VROC UEFI drivers integrated with platform BIOS images, means RAID1 boot volumes can be created in the pre-boot environment and managed by the Intel VROC RAID stack. This allows for cost effective and flexible RAID1 boot solution which can connect directly to Intel VMD Domains on the CPU or PCH with a variety of form factors (M.2, U.2, E1.S).

Features at a Glance	
Supported Platforms	Platforms with Intel Xeon Scalable processor family processors, Intel® Xeon W processors, or Intel Xeon D processors Intel® Xeon® E (No Intel® VMD. Limited functionality supported)
Supported Configurations	For current list of supported NVMe SSDs, operating systems, and configurations, please reference the Intel VROC Support page at: https://www.intel.com/content/www/us/en/support/articles/000030310/memory-and-storage/ssd-software.html
Supported Operating Systems	Windows 10, Windows Server, RHEL, SUSE, Ubuntu, VMware ESXi (RAID1 Only), CentOS* For full Supported OS version detail, go to: https://www.intel.com/content/www/us/en/support/articles/000030310/memory-and-storage/ssd-software.html **CentOS is a community supported OS. CentOS is not a validated distribution for Intel® VROC, but is functionally aligned to RHEL)*
SKUs Available	Intel VROC Standard: RAID 0/1//10; 3rd Party SSD Support Intel VROC Premium: RAID 0/1/5/10; 3rd Party SSD Support Intel VROC Intel SSD Only: RAID 0/1/5/10; No 3rd Party SSD Support
Key Features	• Bootable RAID • Integrated caching with Intel Optane SSDs • Self encrypting drive (SED) key management in UEFI • RAID controller spanning for data volumes • Management tools (UEFI CLI, UEFI HII, OS CLI, GUI) • Surprise hot-plug • Status LED Indication • Hot spare and auto-rebuild • Email notifications for RAID events • RAID5 power loss protection for degraded volume (double fault protection) • Bad block management • Configurable strip sizes (4k, 8k, 16k, 32k, 64k, 128k)

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