RED HAT STORAGE

RED HAT CEPH STORAGE AND MySQL DATABASES

IOPS-intensive workloads with Percona Server for MySQL on Supermicro storage servers

SOLUTION OVERVIEW

Red Hat Ceph Storage provides a high-performance solution for IOPS-intensive MySQL workloads when coupled with flash storage and the high-performance Percona Server for MySQL.

The solution offers performance and latency in line with public cloud storage offerings, while providing operational fidelity with cloud models.

Local cloud storage provides a cost-effective solution compared with available public cloud storage.

A range of Ceph-optimized platforms are available from Supermicro, letting organizations accelerate throughput-optimized, cost/capacity-optimized, and IOPS-optimized workloads.

INTRODUCTION

The number of MySQL databases is growing dramatically. Many database administrators (DBAs) now report that they manage hundreds to thousands of separate databases. While virtualized server environments have helped to enable this growth, rigid and monolithic storage infrastructure has become a limitation—impeding both effective database scalability and cost-effective management of multidatabase environments.

Diverse organizations want to model successful public cloud Database-as-a-Service (DaaS) experiences with private or hybrid clouds that use in-house hardware and resources. The combination of OpenStack® and Red Hat® Ceph Storage can provide an environment that is familiar to anyone who has built applications atop services like Amazon Elastic Compute Cloud (EC2) and Elastic Block Store (EBS) or Google Compute Engine and Persistent Disk. Providing a high level of fidelity with public cloud platforms gives both developers and operators a familiar environment in which to work, increasing application agility while offering better price performance.

Any storage solution for MySQL must provide sufficient low-latency input/output operations per second (IOPS) throughput to support the needs of key databases and applications, at a cost comparable to public cloud infrastructure. Working closely with Percona and Supermicro, Red Hat has extensively evaluated and tested MySQL workloads on Red Hat Ceph Storage clusters. Coupled with flash storage technology, results clearly demonstrate that Percona Server for MySQL running on Red Hat Ceph Storage and Supermicro servers compares favorably with common public cloud solutions in terms of both cost and performance (Figure 1).[1]

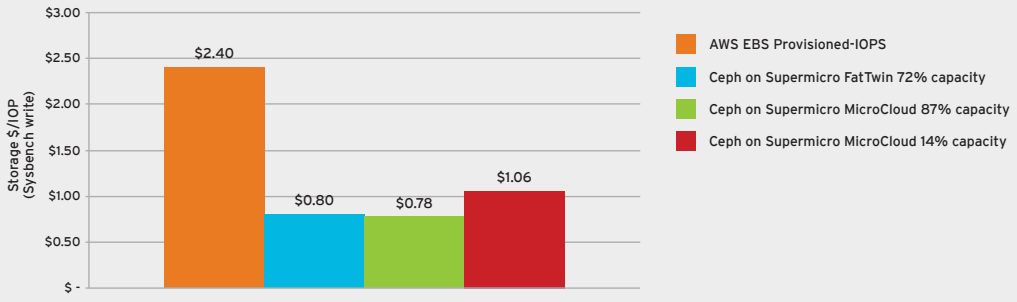

Figure 1. Three-year amortized CapEx of various Red Hat Ceph Storage configurations compares favorably to the OpEx of Amazon Provisioned IOPS. The target is one third cost per IOP, as power, cooling, and administrative costs must be added to Ceph CapEx costs for a complete comparison.

1 *For detailed information on Red Hat and Percona testing, see "Deploying MySQL Databases on Red Hat Ceph Storage" whitepaper at: redhat.com/en/resources/mysql-databases-ceph-storage-reference-architecture.*

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As an open software-defined storage platform, Red Hat Ceph Storage provides a compelling solution for MySQL database storage.

DEPLOYING MYSQL ON RED HAT CEPH STORAGE

Many organizations have become comfortable with deploying MySQL for their applications in the public cloud. Therefore, storage technology for hybrid or private cloud MySQL deployments should emulate public cloud methods as closely as possible. Ceph and MySQL represent highly complementary technologies, providing:

- **Strong synergies.** MySQL, OpenStack, and Ceph are often chosen to work together.[2] Ceph is a leading open source software-defined storage solution. MySQL is the leading open source relational database management system (RDBMS).[3] Moreover, Ceph is the number-one block storage for OpenStack clouds,[4] with LAMP (Linux®, Apache, MySQL, and Python) figuring as the number-one OpenStack workload and MySQL as the number-four workload.
- **Operational efficiencies.** Ceph storage contributes directly to operational efficiencies for MySQL databases by providing a shared, elastic storage pool with flexible volume resizing and dynamic database placement. Live instance migration is supported. With Ceph, operators can back up to an object pool and read replicas are easily created via copy-on-write snapshots.
- **Public cloud fidelity.** Developers want platform consistency, and effective private or hybrid clouds require familiar patterns to those established by existing public clouds. Ceph provides block and object storage like public cloud solutions with consistent storage features (Table 1), while letting organizations use their own hardware, datacenters, and staff.

TABLE 1. COMPARING CEPH WITH PUBLIC CLOUD STORAGE SOLUTIONS

FEATURE	CEPH (RBD)	GOOGLE PERSISTENT DISK	AMAZON ELASTIC BLOCK STORE (EBS)
FAULT TOLERANCE	Yes	Yes	Yes
SNAPSHOTS	Yes	Yes	Yes
VOLUME RESIZING	Live	Live	Detached
VOLUME MIGRATION	Yes	Yes	Yes
VOLUME LIVE MIGRATION	Yes	Yes	No
ZONE MIGRATION	Detached	Live	Detached
READ CHECKSUMS	No	Yes	No

SOLUTION ELEMENTS

Ceph storage clusters can serve diverse types of workloads with carefully chosen and configured hardware. Though throughput-intensive and cost/capacity-focused workloads are common, using Ceph to serve IOPS-intensive MySQL workloads is increasingly seen in production environments. Cloud-like MySQL storage solutions are made possible by the availability of flash storage media, high-performance MySQL implementations from Percona, and Ceph-optimized hardware platforms from companies like Supermicro.

2 *Brent Compton. "Building MySQL DBaaS on OpenStack and Ceph Clouds." December. 2016. informationweek.com/partner-perspectives/redhat/building-mysql-dbaas-on-openstack-and-ceph-clouds/a/d-id/1327638*
3 *Gartner. "The State of Open-Source RDBMSs, 2015." gartner.com/doc/3033819/state-opensource-rdbmss*
4 *65% chose Ceph according to the April 2017 OpenStack User Survey (openstack.org/assets/survey/April2017SurveyReport.pdf)*

Percona Server for MySQL is a free, fully compatible, enhanced, open source drop-in replacement for MySQL that provides superior performance, scalability, and instrumentation.

RED HAT CEPH STORAGE

Red Hat Ceph Storage significantly lowers the cost of storing enterprise data and helps organizations manage exponential data growth. The software is a robust, petabyte-scale storage platform for public, private, or hybrid clouds. As a modern storage system for cloud deployments, Red Hat Ceph Storage offers mature interfaces for enterprise block and object storage, making it well-suited for cloud infrastructure workloads like OpenStack. Delivered in a unified self-healing and self-managing platform with no single point of failure, Red Hat Ceph Storage handles data management so businesses can focus on improving application availability, with properties that include:

- Scaling to tens of petabytes.
- No single point of failure in the cluster.
- Lower capital expenditures (CapEx) by running on industry-standard server hardware.
- Lower operational expenditures (OpEx) by self-managing and self-healing.

Importantly, Red Hat Ceph Storage can effectively provide persistent storage for containerized applications. Red Hat testing revealed that Red Hat Ceph Storage support for Linux containers technology offers performance parity with bare-metal servers while delivering persistent storage for convenient containerized MySQL applications.[1]

PERCONA SERVER FOR MYSQL

Percona Server for MySQL is a free, fully compatible, enhanced, open source drop-in replacement for MySQL that provides superior performance, scalability, and instrumentation. With over 2,700,000 downloads, Percona Server's self-tuning algorithms and support for extremely high-performance hardware deliver excellent performance and reliability. Percona Server for MySQL is optimized for cloud computing, NoSQL access, and modern hardware, such as solid-state drives (SSDs) and flash storage.

Percona's database solutions provide better performance, reliability, diagnostics, and lower total cost of ownership. These solutions have true nonblocking online backups, tight data compression, and extended instrumentation and tooling for quick diagnosis and issue resolution.

In addition, Percona Server for MySQL offers:

- Cloud readiness by dramatically reducing downtime on servers with slow disks and large memory.
- Software-as-a-Service (SaaS) readiness by increasing architectural flexibility for environments that include co-located databases with hundreds of thousands of tables and heterogeneous backup and retention policies.
- Vertical scalability and server consolidation, scaling to over 48 CPU cores, with the ability to achieve hundreds or thousands of IOPS on high-end solid-state hardware.
- Query-, object-, and user-level instrumentation for detailed query logging with per-query statistics on locking, I/O, and query plans, as well as performance and access counters per-table, per-index, per-user, and per-host.
- Enterprise readiness with advanced, fully enabled external authentication, audit logging, and threadpool scalability features typically only available in Oracle's commercial MySQL Enterprise Edition.

SUPERMICRO STORAGE SERVERS

Supermicro offers a range of storage servers, optimized for different types of workloads.[5] For IOPS-intensive MySQL database workloads, Supermicro offers the SYS-5038MR-OSD006P (Figure 2), a three rack-unit (3U) system comprised of eight individual object storage daemon (OSD) nodes and 3.2TB of usable capacity with 2x data replication. Each OSD node is comprised of:

- **CPU/memory**: A single Intel Xeon Processor E5-2650 v4 with 32GB of memory
- **OSD storage**: A single Intel SSD Data Center (DC) P3700 800GB NVM Express (NVMe)
- **Boot device**: Mirrored hot-swap Intel SSD DC S3510 80GB, SATA 6Gb/s MLC 2.5-inch
- **Networking**: Single-port 10Gb Ethernet (GbE) SFP+ port

Figure 2. Supermicro SYS-5038MR-OSD006P offers a Ceph-optimized platform with eight IOPS-focused nodes in only three rack units.

CONCLUSION

Red Hat Ceph Storage works well as IOPS-optimized cloud storage for MySQL and similar databases. Red Hat and Percona testing with Percona Server for MySQL and Supermicro storage servers has shown that this flexible software-defined storage platform can provide the necessary performance and low latency in a cost-effective solution.[1] Together these complementary technologies let organizations cost-effectively deploy private and hybrid cloud storage for a range of MySQL applications.

5 Supermicro Total Solution for Ceph (supermicro.com/solutions/storage_ceph.cfm).

ABOUT RED HAT

Red Hat is the world's leading provider of open source software solutions, using a community-powered approach to provide reliable and high-performing cloud, Linux, middleware, storage, and virtualization technologies. Red Hat also offers award-winning support, training, and consulting services. As a connective hub in a global network of enterprises, partners, and open source communities, Red Hat helps create relevant, innovative technologies that liberate resources for growth and prepare customers for the future of IT.

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