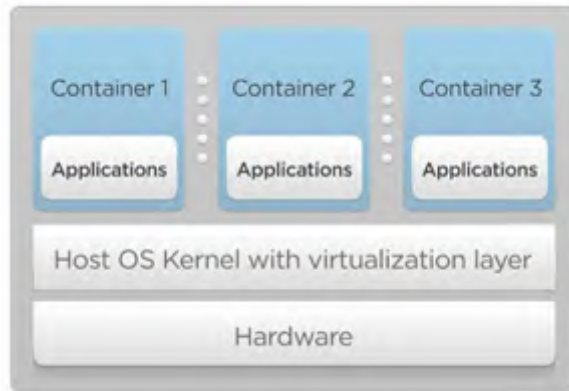


^zVirtuozzo

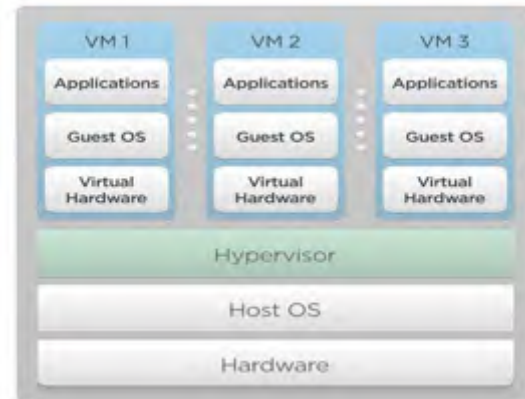
*Virtuozzo Solution
Overview*

Virtuozzo 6.0 Virtualization Options



Operating System Virtualization

- System Containers
- High density - 3X hypervisors
- High performance
- Cloud Ready
 - Elastic - easily scale up and down
 - Instant-on provisioning
 - Ideally suited for PaaS/SaaS applications

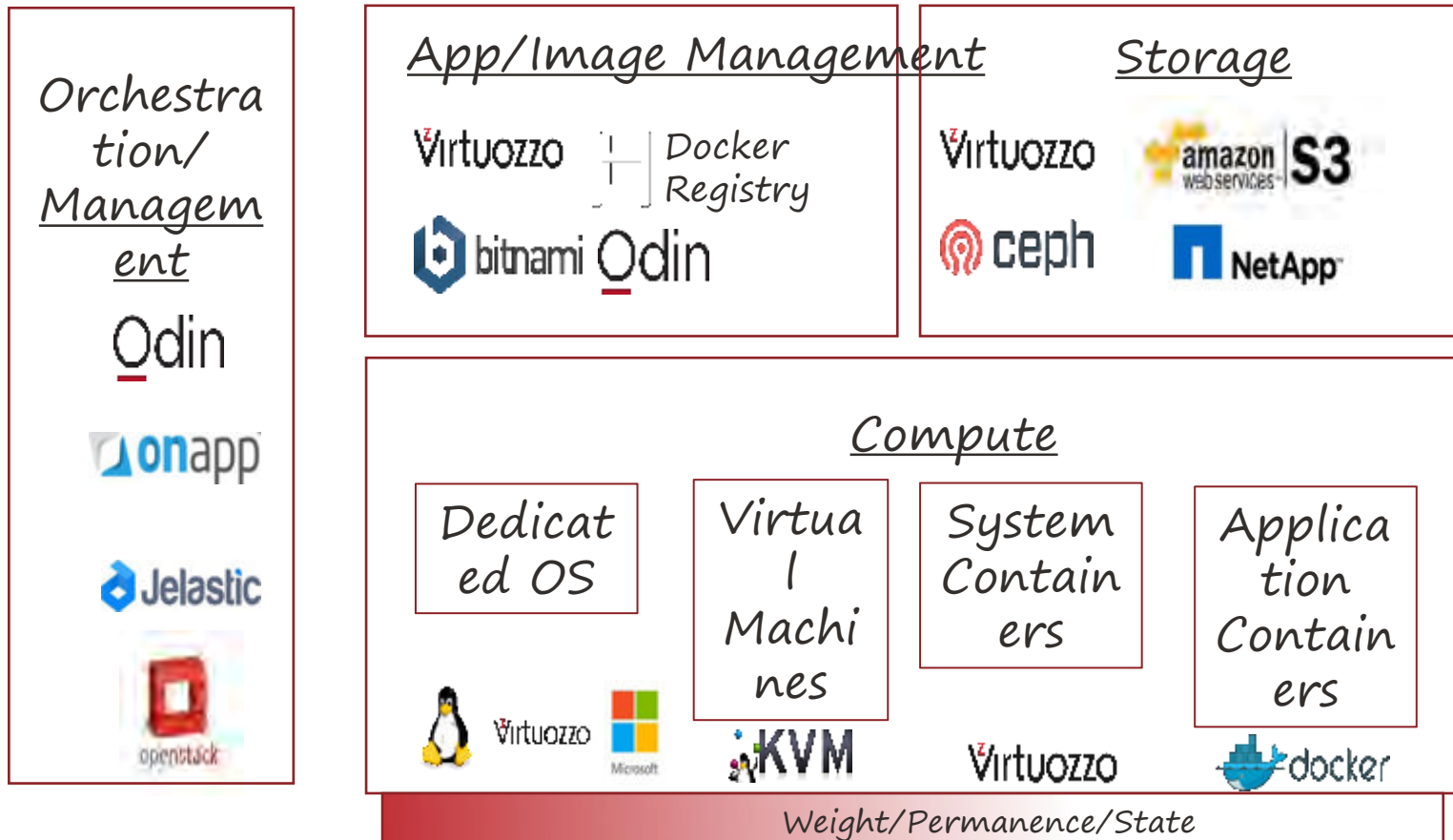


Hardware Virtualization

- Hypervisors or Virtual Machines
- Higher overhead = lower density
- Allow different operating systems on the physical server

Unified management of technology- and location-agnostic data center workloads

- Supports entire range of virtualization options from full OS to VMs to all types of containers
- Mix and match technologies and locations



Virtualization built for delivering profitable cloud services

- **Advanced Resource Management**
 - Support multiple VPS and cloud server packages at varying levels of CPU, memory, disk I/O and storage space.
- **On-the-fly virtual server elasticity**
 - Enables flexibility for customers and ease of upgrading for service providers.
- **Immediate provisioning and activation**
 - The fastest availability time for new VPS and cloud server subscriptions, allowing your customers to add new services instantly.
- **Application templates**
 - Automate the rapid deployment and configuration of applications into virtual servers enabling you to easily extend existing services.
- **Comprehensive integration**
 - Third party systems are enabled with command line and API interfaces, simplifying the complete automation of delivering and billing.
- **Performance and resource isolation**
 - Enable service providers to guarantee SLAs and provide highly reliable and secure virtual servers.

Features we brought to market in Virtuozzo 6

New container layout

Stores all files in a single image, enabling easier migrations and backups

Improves server performance

Memory and IOPS deduplication

Efficiently caches identical files found in multiple containers to reduce I/O and memory bottlenecks and increase the number of running containers per Parallels server.

Rebootless updates

Eliminates service outages for end users during system updates.

Console access to containers

Use the container console to log into a running container and view the progress of the startup and shutdown processes.

Updates with yum

The vzup2date utility has been replaced with the standard yum utility, greatly simplifying the procedure of updating all components of your system.

Containers with preinstalled application templates

Pre-install application templates to OS EZ template caches to speed up container creation

Increased virtual machines limits

Create virtual machines with up to 32 CPU cores, 128 GB of RAM, and 5 TB of virtual disk space.

Supported Operating Systems – Virtuozzo 6

Containers / Virtual Machines



Virtual Machines



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*Virtuozzo Application
Catalog*

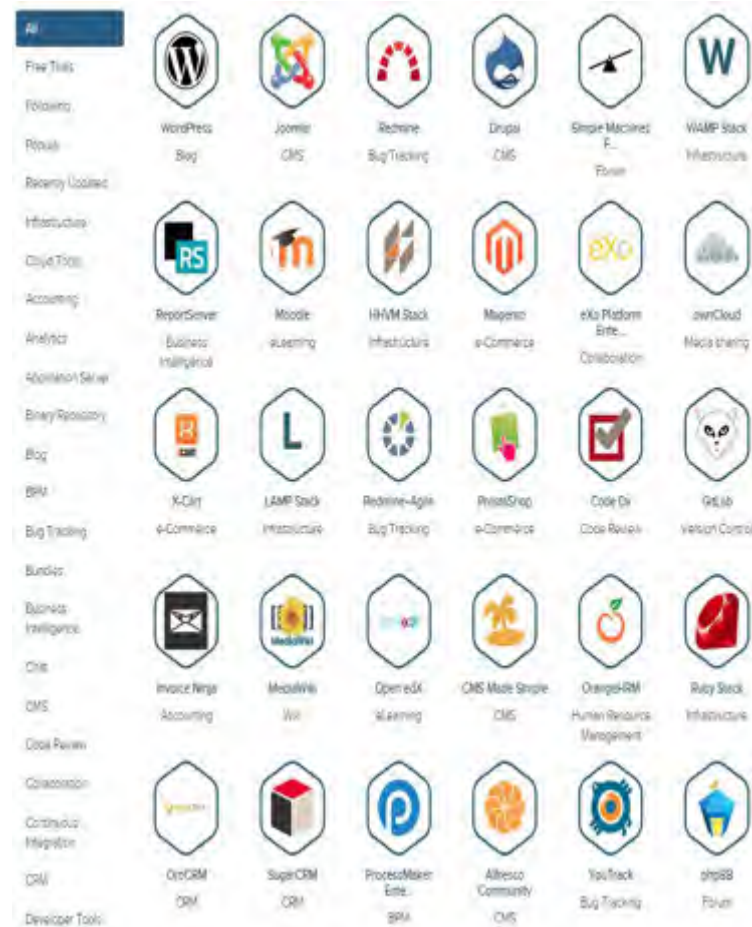
Virtuozzo Application Catalog Is ...

- Most popular open source server applications
- Easy to use and pre-integrated
- Continuously updated with SLA
- Available as containers, virtual machines or standalone installers
- No changes in management interfaces

Virtuozzo Application Catalog

Is ...

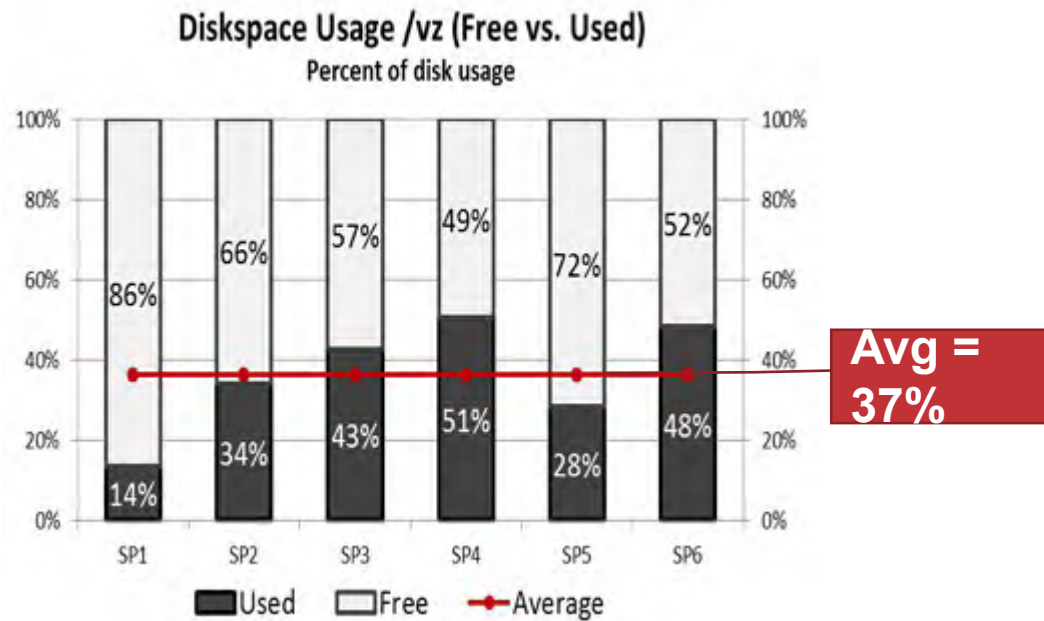
- 100+ applications
- More than a dozen categories
- All open-source
- Top requested new applications are added regularly



^zVirtuozzo

Virtuozzo Storage

Why did we build Virtuozzo storage?

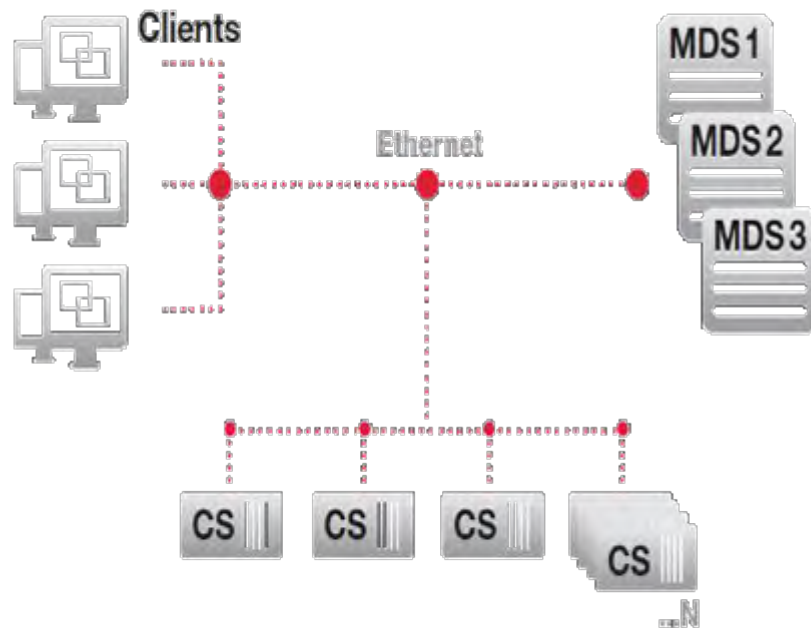


Virtuozzo Storage is purpose-built for hosters

We surveyed our hosting partners and found lots of unused disk space – locked to servers

Disks + VZ storage is relatively cheap, failures and SANs are not!

Virtuozzo Storage Architecture



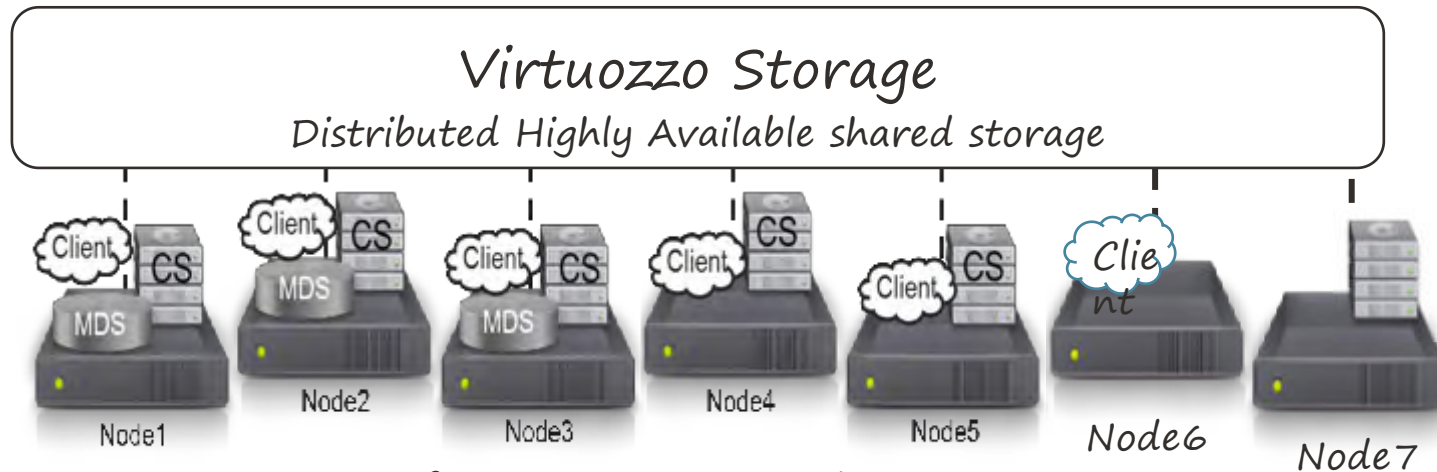
Meta Data Server (MDS)

- Stores metadata in memory
- Tracks data chunks and their versions
- Is highly available
- Can run on the same server as the chunk server and client

Chunk Server (CS)

- Stores data chunks
- Manages data chunks
- Performs read/write operations on data chunks
- Can run on the same server as the client

Flexibility & Scalability



- Any mix of roles in one node
- Any mix of HDDs in a cluster – Choose what fits best for your needs
- Modular design – easy to add new nodes
- Go Big! Scalable up to hundreds of nodes and PBs of disks
- Automatic data and performance balancing
- Virtuozzo Storage gets faster and more reliable as it scales

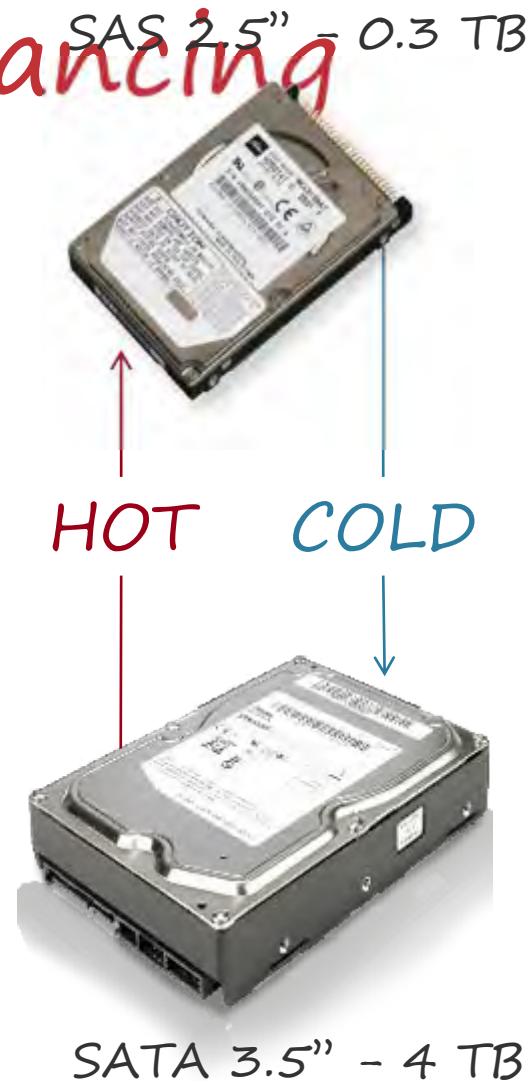
Hot Data Auto Balancing

Maximize performance by distributing IOPS and minimizing network traffic
Automatic rebalancing of hot data:

- Move data closer to where it is needed.
- Distribute “hot data” across the cluster
- SSDs with modest capacity can still improve overall performance

Auto tiering:

- Hot data moved to faster or less utilized disks
- Hot data will automatically go to faster chunk servers, cold data will move to slower chunk servers



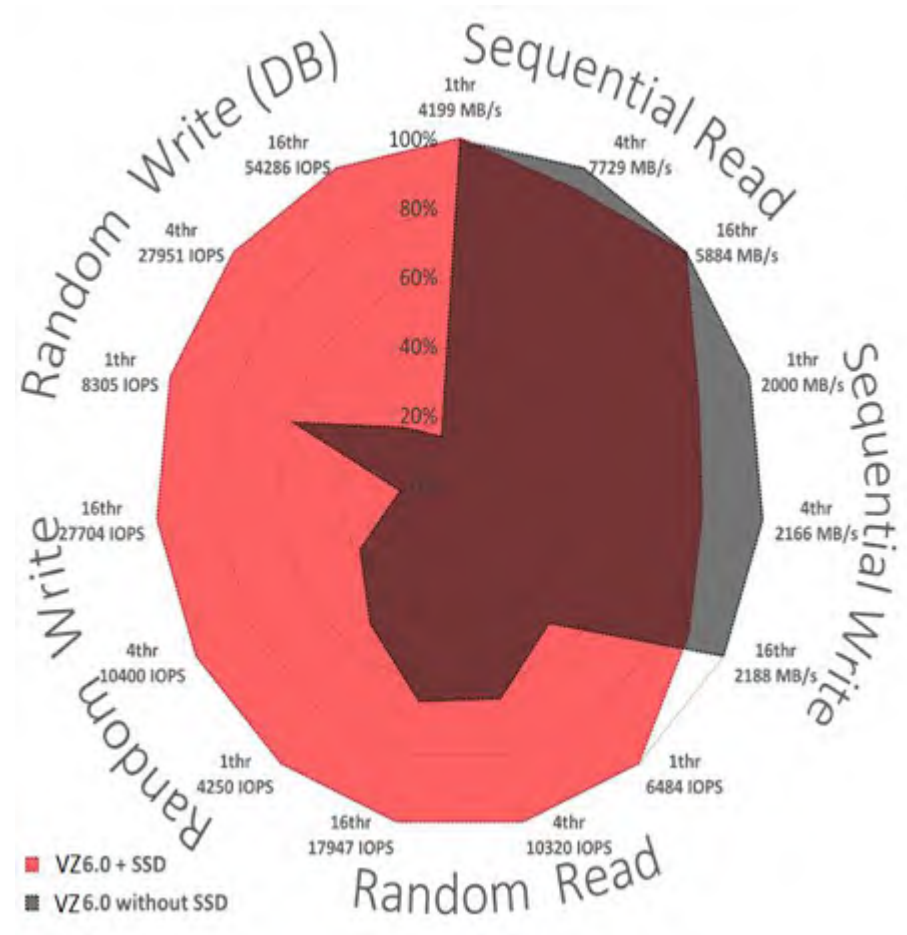
SSDs Boost Performance

Performance Improvement

- Increase IOPS up to:
 - 6x on random writes
 - 2x on random reads

Recommended Configuration

- One SSD per each 2-4 HDDs
- Enterprise or DC grade SSDs
- Even 100GB SSDs are helpful
- Most recommended: **Intel S3700**

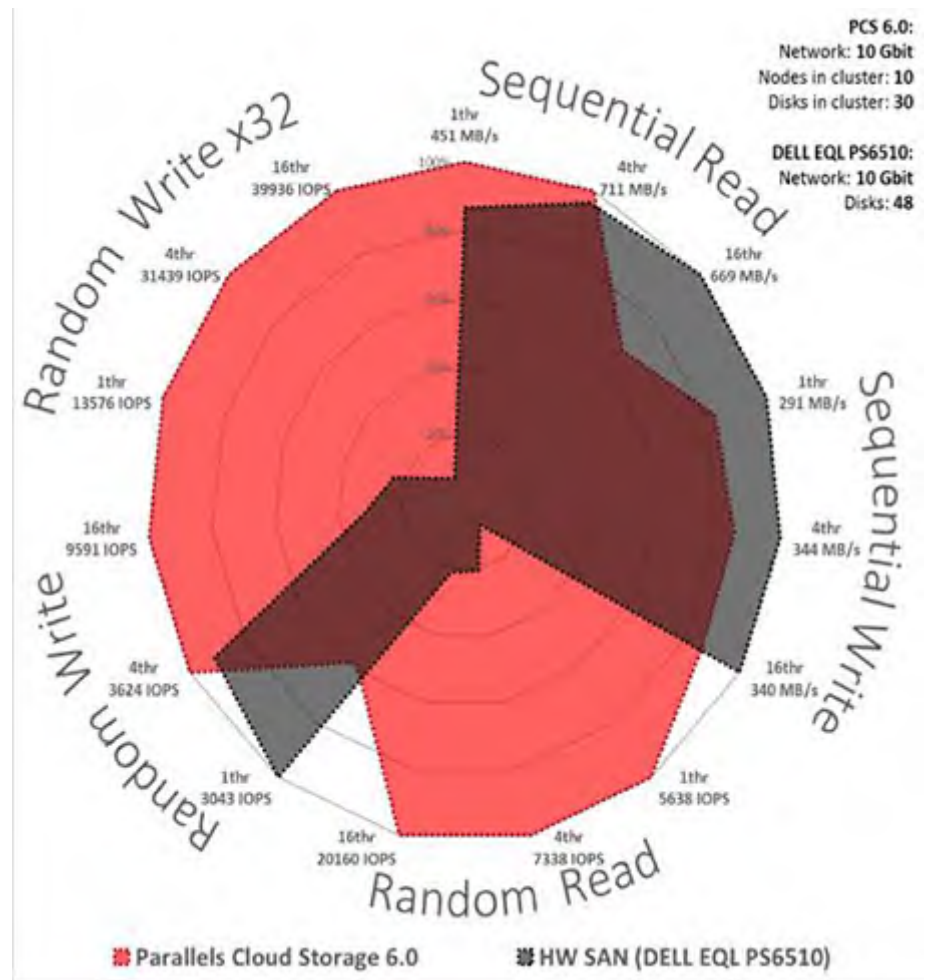


Nodes in cluster: 32 | Disks in cluster: 96 | Network: 1Gbit

Virtuozzo Storage – Performance

Virtuozzo is faster than HW SAN

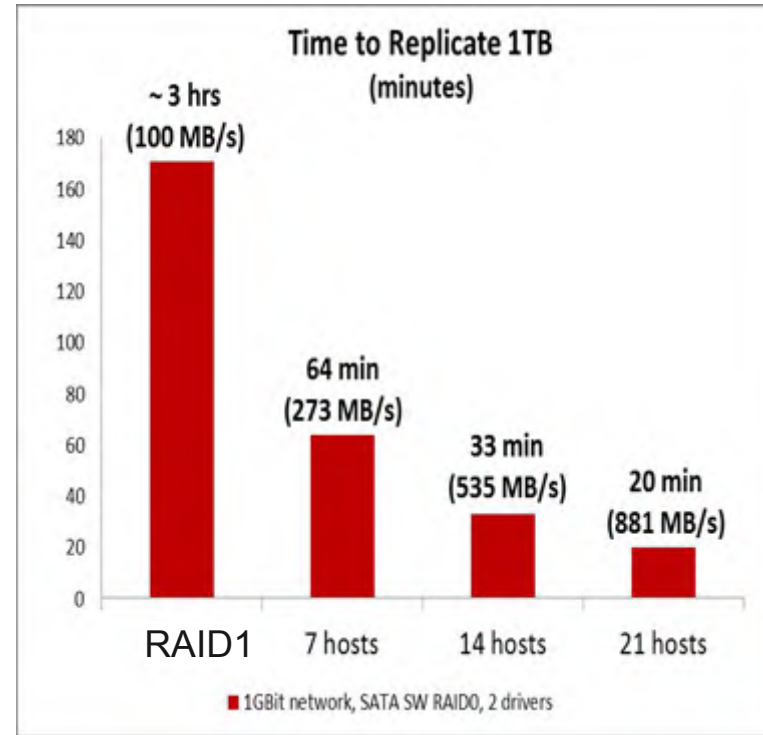
Just 10 nodes VZ storage cluster faster than DELL EQL SAN (\$97000) in most



Virtuozzo Storage Recovery Performance

High availability and fast recovery

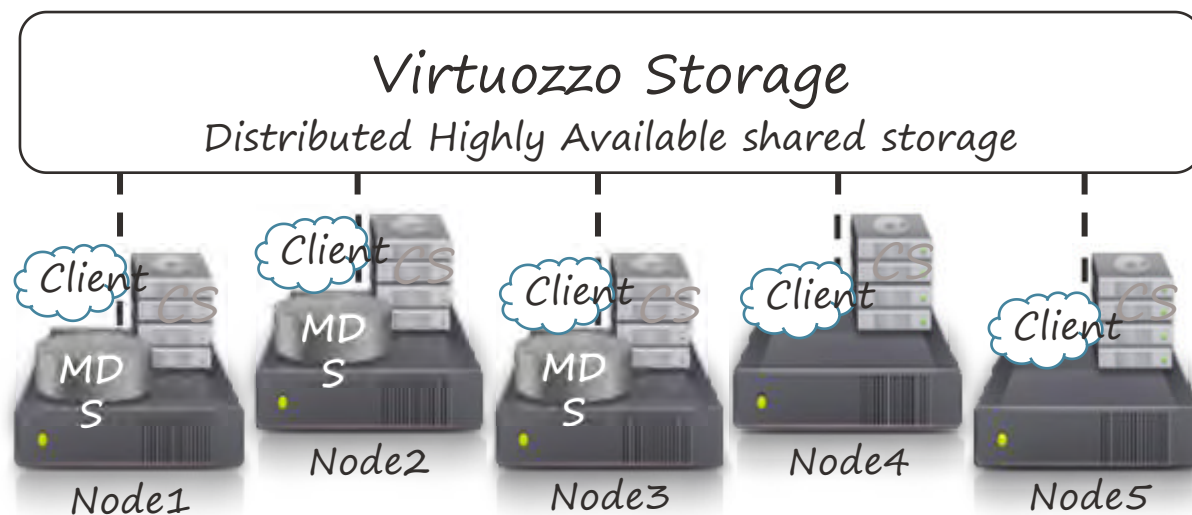
- Replication performance defines time of reduced redundancy level. Critical!
- The shorter period of replication leads to the less probability to lose data
- In theory Mean Time To Data Loss $\sim 1/T^2$, where T is time to recover



The bigger the cluster, the faster your recovery process is!

Virtuozzo Storage performs replication in parallel.

Minimal cluster configuration



System Requirements:

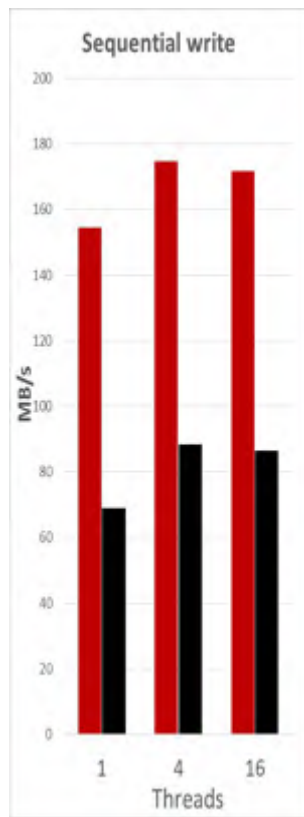
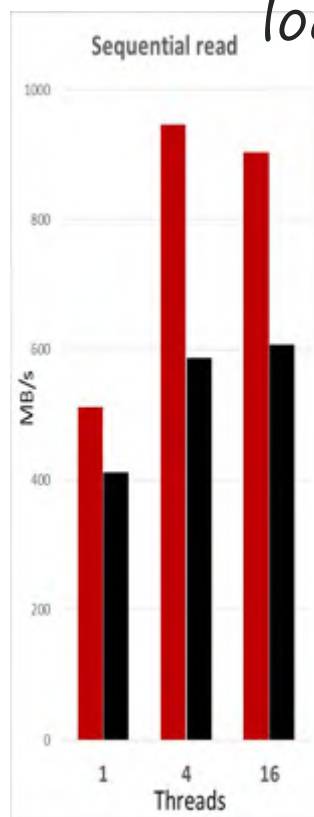
- MDS: 1 GB free memory for each 100 TB stored data
- CS/client: 1 GB free memory
- Dedicated storage network (1GigE or faster)
- 5 or more nodes

Competitive Comparison

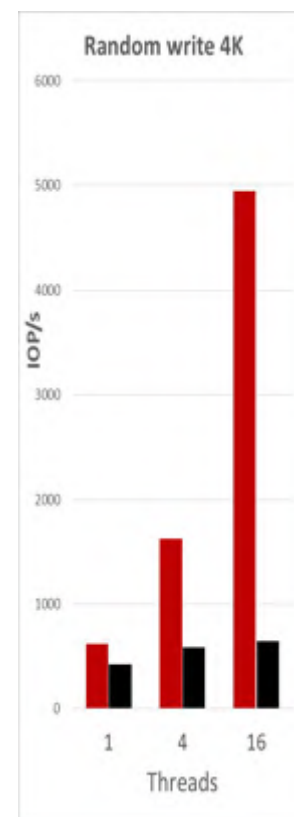
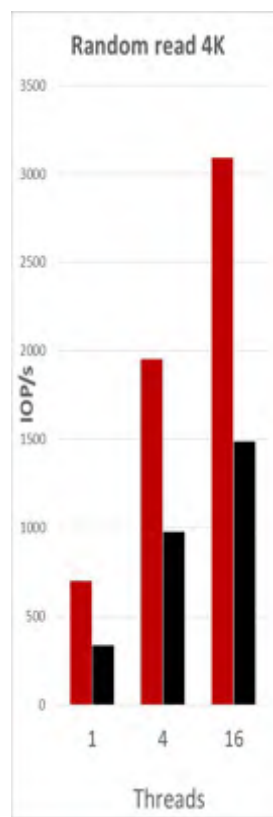
Product	Virtuozzo Storage	CEPH	Red Hat® Storage (GlusterFS)	NetApp	Dell/HP
Price	\$	Free*	Free*	\$\$\$\$\$	\$\$\$
Disaster recovery	✓	✓	✗	✓	✓
Strong Consistency	✓	✓	✗	✓	✓
Scalability	✓	✓	✓	✓	✗
Performance	★★★	★	★	★★★	★★
SSD caching/journaling	✓	✓/✗	✓/✗	✓	✓
Rebalancing	✓	✗	✗	✓	✓
S3 object storage	Q1'16	✓/✗	✗	✓	✗
RAID6 for hot data	H2 2016	✗	✗	✓	✓
Tiering, scrubbing, checksumming	✓	✗	✗	✓	✓/✗
Data splitting	✓	✓	✗	✓	?
Type	software	software	software	HW	* HW Paid support

Performance results: CEPH vs. VZ Storage

Sequential load



Random load



■ Virtuozzo Storage
■ CEPH

Cluster: 5 nodes,
1 Gbit

Amazon S3 compatible object storage

Object storage is like a file hosting that stores billions of files(objects)

User applications works with the object storage via HTTP based Amazon S3 compatible API



- S3 is hyper-scalable storage with access via HTTP
- Objects can be read via Browser
- S3 is broadly used
- In fact much of the static content (like pictures) your browser shows is stored in S3!

You use it every day on the Internet, even if you do not notice it!

Who offers S3 compatible storage today?



And many more...

Virtuozzo Storage Highlights

Cost-effective

- Reuses existing hardware to create a distributed, highly-available virtual SAN
- No need for dedicated, expensive hardware
- Works over existing 1Gb or 10Gb network infrastructure



Lowest
Cost

High performance

- Improve overall throughput by utilizing idle and underutilized nodes
- Out-of-the-box SSD caching improves read and write performance by an order of magnitude, outperforming even Directly Attached Storage.



Fast

Scalable

- Expands easily by automatically identifying new additional nodes and devices and rebalancing the cluster
- Virtual server storage capacity and bandwidth no longer limited by individual nodes
- Customize your disk configurations - use flash drives to match the performance requirements for your workloads while scaling cheap rotational drives to keep up with your storage needs



No single
point of
failure

Failure tolerant and redundant

- Users can set the level of redundancy required
- Automatically detects failed nodes and adjusts to maintain the required redundancy level and load balance across the cluster

S3 API Compatible Object Storage available Q1 2016

- Deliver profitable fault tolerant object storage
- Directly monetize excess storage capacity