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White Paper

Accelerating DevOps with Docker and SimpliVity OmniStack Hyperconverged Infrastructure

Executive Summary

Forward-looking IT organizations are implementing Docker to simplify DevOps and accelerate the pace of innovation. By packaging an application and all of its dependencies into standardized containers, the open-source platform streamlines software development, fundamentally transforming the way distributed applications are built, shipped and deployed.

SimpliVity OmniStack hyperconverged infrastructure provides a highly scalable, reliable and agile foundation for Docker-based development. OmniStack eliminates infrastructure cost and complexity by assimilating all IT products and services below the hypervisor (compute, storage, data backup and recovery, and more) onto commodity x86 building blocks, eliminating point products and inefficient siloed IT architectures.

Ideal for DevOps and agile development practices, OmniStack's inherent data efficiencies and global unified management capabilities dramatically simplify operations and boost IT service agility. With OmniStack, system administrators can spin up IT services and clone Docker development and test environments in just seconds. By deploying Docker on OmniStack, IT organizations can accelerate application development and accelerate IT service delivery, while reducing capital equipment and operations expenses.

Intended for system administrators, IT planners and architects, and other technology professionals, this white paper reviews the features and benefits of Docker and OmniStack for DevOps and Infrastructure as a Service (IaaS) initiatives and shares guidelines for running Docker on OmniStack.

Introduction – Docker Streamlines Distributed Application Development

Docker is an open-source platform that enables developers and system administrators to build, ship, and run distributed applications more quickly and efficiently. With Docker, an application and all its dependencies are packaged into a standardized unit known as a container. By segregating the application from the underlying development and operating environments, the container approach streamlines development and accelerates time-to-market. Docker enables a high degree of application flexibility and portability—a Docker container can run in any environment (e.g. development, test or production) or on any infrastructure (e.g. enterprise servers, private cloud, or public cloud).

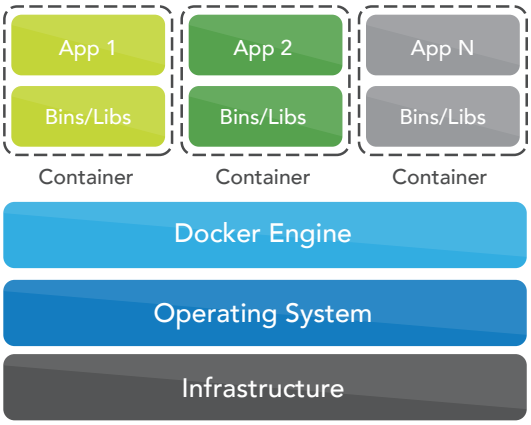


Figure 1 - Docker Containers Share the Kernel

Docker containers are conceptually similar to virtual machines in VMware; they both segregate a physical machine into logical, abstract compartments. While VMware virtualizes hardware, Docker isolates applications at the operating system level. Unlike a VMware virtual machine (VM), which includes a dedicated guest operating system, a Docker container shares its operating system kernel with other containers, eliminating overhead and reducing memory consumption. (See Figure 1)

Docker – Build, Ship and Run Any App, Anywhere

Docker is gaining popularity in agile software development and test environments. The solution accelerates DevOps by creating a common framework for building, testing, and administering distributed applications, independent of languages, development tools or environmental variables. Docker improves collaboration by allowing developers, QA teams and system admins to efficiently share code, exchange content and integrate applications.

And it enables DevOps teams to scale up development and test environments, quickly and cost-effectively, and to move applications from development, to test, to production in a seamless manner.

Docker benefits include:

- **Efficiency:** Containers running on a single machine all leverage a common kernel so they are lightweight, start instantly and make more efficient use of RAM.
- **Portability:** Applications, dependencies and configurations are all bundled together in a complete filesystem, ensuring applications work seamlessly in any environment, on any infrastructure.
- **Extensibility:** Applications running in Docker containers can be easily modified, updated or extended without impacting other containers.
- **Flexibility:** Developers are free to use whichever programming languages and development tools they prefer.

VMware Extends Docker Security and Manageability

Many IT organizations have made significant investments in VMware across their application lifecycle environments, from developer laptops to QA systems to production data centers. Many are looking to protect and extend previous investments by running Docker in trusted VMware environments. By combining Docker and VMware, IT teams can exploit the agility and flexibility advantages of containers while maintaining the enterprise-class security, stability and manageability they have come to expect with VMware.

Benefits of running Docker on VMware include:

- **Proven security:** While Docker is relatively new to the marketplace, VMware offers time tested, field-proven security. The hypervisor concept was conceived with workload isolation in mind. Over time, IT security expects have rigorously tested and vetted VMware, and today the virtual machine is widely accepted as a standard security building block in IT.
- **Fault isolation:** When running Docker natively, an OS failure (or security breach) can be catastrophic, impacting all containers and applications. In a VMware implementation, an application or guest OS failure (or security breach) only impacts a single tenant running in the VM.

- **Policy-based management and automation:** Operations teams can leverage VMware's full suite of vRealize lifecycle management and automation tools to simplify administration and enable self-service IT.
- **Third-party ecosystem:** Developers gain access to hundreds of third-party tools and applications through the VMware Solutions Exchange.

OmniStack Delivers Enterprise-Class Performance and Protection for Docker Deployments

SimpliVity OmniStack hyperconverged infrastructure provides a highly scalable, flexible and cost-effective foundation for Docker-based development. The SimpliVity solution is designed from the ground up to meet the stringent price-performance, scalability and agility demands of today's data-intensive, highly virtualized IT environments. OmniStack transforms the data center by assimilating all IT infrastructure and services below the hypervisor into x86 building blocks. The solution delivers the best of both worlds: the enterprise-class performance, protection and resiliency that today's organizations require, with the cloud economics businesses demand.

OmniStack eliminates infrastructure cost and complexity by consolidating a variety of IT functions (compute, storage, data backup and recovery, etc.) onto commodity virtualized x86 hardware. The solution provides a single, shared resource pool across the entire IT stack, eliminating point products and inefficient siloed IT architectures.

OmniStack is distinguished from other converged infrastructure solutions by three unique attributes: accelerated data efficiency, built-in data protection functionality and global unified management capabilities.

- **Accelerated data efficiency:** OmniStack performs inline data deduplication, compression and optimization on all data at inception across all phases of the data lifecycle, all handled with fine data granularity of just 4KB-8KB. On average, SimpliVity customers achieve 40:1 data efficiency while simultaneously increasing application performance.
- **Built-in data protection:** OmniStack includes native data protection functionality, enabling business continuity and disaster recovery for critical applications and data, while eliminating the need for special-purpose backup and recovery solutions. OmniStack's inherent data efficiencies minimize I/O and WAN traffic, reducing backup and restore times from hours to minutes.
- **Global unified management:** OmniStack's VM-centric approach to management eliminates manually intensive, error-prone administrative tasks. System administrators are no longer required to manage LUNs and volumes; instead, they can manage all resources and workloads centrally, using familiar interfaces such as VMware vCenter and VMware vRealize Automation.

Ideal for DevOps and IaaS initiatives, OmniStack's inherent data efficiencies and VM-centric management capabilities dramatically simplify operations and boost IT service agility. With OmniStack, system administrators can spin up IT services and clone containers in just seconds with two or three mouse clicks.

Running Docker on OmniStack Hyperconverged Infrastructure

SimpliVity customers can efficiently deploy Docker containers on VMware vSphere, as shown in Figure 2. By running Docker inside a VM on OmniStack, DevOps teams gain the application portability and efficiency benefits of Docker, the security and manageability benefits of VMware, and the service agility, price-performance and resiliency benefits of OmniStack hyperconverged infrastructure.

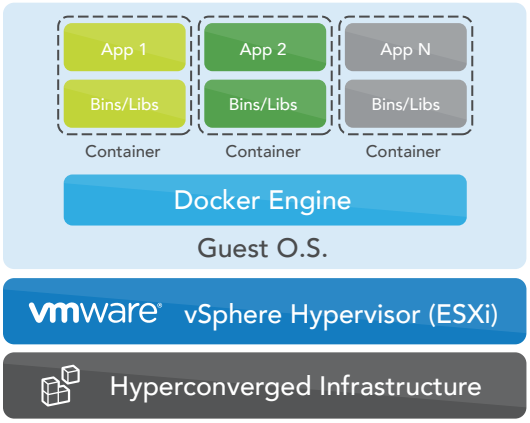


Figure 2 - Docker Containers Running on VMware on OmniStack

SimpliVity certified Docker running on OmniStack hyperconverged infrastructure by executing a series of performance benchmarks and functional tests. The validated configuration, test procedures and test results are detailed in an Appendix to this paper.

Consolidate Docker Development, Test, QA and Production Silos

OmniStack lets DevOps teams reduce CAPEX and OPEX by consolidating technology silos—collapsing development, test, QA and production systems onto common IT infrastructure. (See Figure 3)

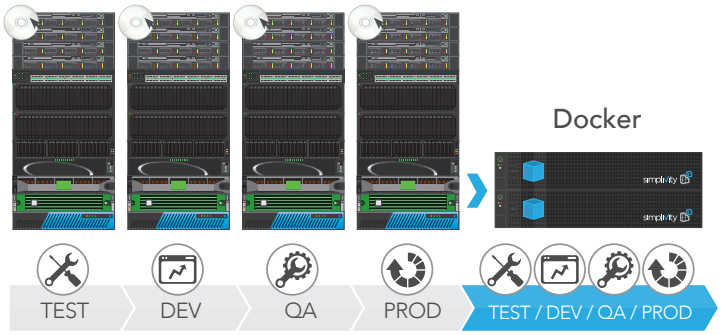


Figure 3 - Consolidate Development, Test, QA and Production Systems

Support Hybrid Application Environments

OmniStack helps IT organizations reduce TCO by providing a common operating environment for diverse applications and workloads. Docker containers can be instantiated alongside other applications to support staged migrations and mixed environments. (See Figure 4)

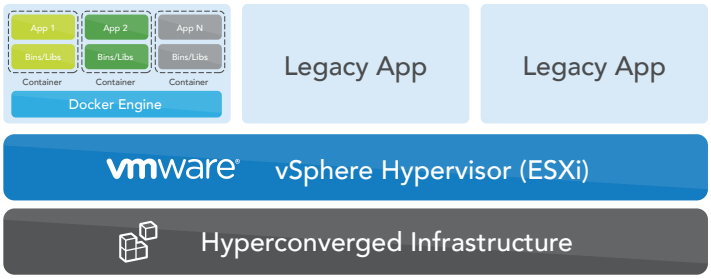


Figure 4 - Run Docker Containers alongside other Applications

Conclusion: Accelerate DevOps with Docker and OmniStack

Docker helps IT organizations build distributed applications more quickly and efficiently. SimpliVity OmniStack hyperconverged infrastructure provides a highly scalable, reliable and cost-effective platform for Docker-based development. By implementing Docker on OmniStack, DevOps teams can realize the agile development rewards of Docker, the security and manageability advantages of VMware, and the price-performance and IT service agility benefits of OmniStack.

By running Docker on SimpliVity DevOps teams can:

- Accelerate time-to-market: Speed up IT service delivery and application development.
- Unleash innovation: Allow system administrators and developers to focus on strategic applications rather than underlying infrastructure.
- Eliminate overhead and complexity: Consolidate technology platforms, build leaner apps and converge functional silos.
- Contain OPEX and CAPEX: Reduce system admin and development costs; contain recurring equipment power, cooling and rack space expenses.
- Mitigate risks: Ensure high availability and resiliency for business-critical applications and data.

Additional Reading

For additional information about running Docker on VMware, see:

VMware Blog Related to Docker Performance
Docker Containers Performance in VMware vSphere

Docker CEO Blog Endorsing VMware
Docker & VMware: 1 + 1 = 3

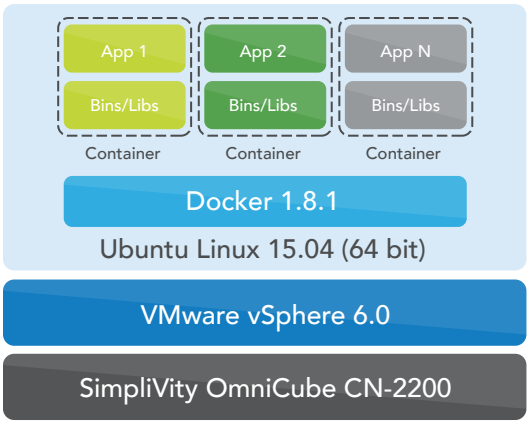
VMware CTO Blog Endorsing Docker
VMware and Docker – Better Together

VMware CTO Blog Reviewing Containers
VMware + Containers = Containers without Compromise

Appendix: Docker Validation and Performance Testing

SimpliVity tested Docker running on OmniStack hyperconverged infrastructure to ensure the solution functions as expected, without performance implications. The tests were conducted in a lab environment consisting of two SimpliVity OmniCube CN-2200 nodes running VMware vSphere and Docker (Note: Test results apply to all OmniCube and Omni-Stack based systems). The Docker engine was instantiated in a VMware virtual machine running Ubuntu Linux as a guest operating system. Oracle Vdbench was used to generate disk I/O workloads and to evaluate system performance. The validated OmniCube configuration is detailed below.

Test Setup



Hardware	2 OmniCube CN-2200 nodes
Hypervisor	VMware vSphere 6.0
Guest OS	Ubuntu 15.04 64-bit
Container engine	Docker 1.8.1
vCPU count	4
Memory	8 GB
Storage	6 virtual disks, 1 OS, 5 data drives
Test tool	Vdbench 5.04.03

Test Methodology

Tests were executed to verify OmniCube backup, restore and clone functions operated properly, to ensure data deduplication efficiencies were maintained, and to examine performance characteristics under simulated load conditions. In particular the following procedures were performed:

- Five virtual disks attached to the VM were partitioned and formatted and mounted to the VM host.
- An Ubuntu base image was downloaded from the Docker repository.
- Java and Vdbench were installed on the image and changes were saved to a new container host image.
- Five containers were created from the Ubuntu Docker base image; a virtual disk was mounted to the container at the time of creation.
- Vdbench was used to populate the drive mapped to the containers to 45GB.
- The Vdbench deduplication ratio was set to two
- Vdbench test load was executed on the five containers simultaneously. The load profile per container was set to 8K transfer size, 70:30 R/W, random IO, 25 IOPs.

Findings

The solution performed as expected throughout the tests, with no performance penalties detected or functional impediments observed. More specifically:

- OmniStack backup, restore and clone functions performed normally and completed successfully.
- OmniStack deduplication functionality performed as expected; no reduction in deduplication was detected.
- No performance implications were observed; Docker container performance characteristics were similar to those of a standalone VM.

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