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Global Leader in Software-Defined Storage.

NexentaEdge DevOps Edition

Scale-Out Storage for Container-Converged Infrastructure

Executive Summary

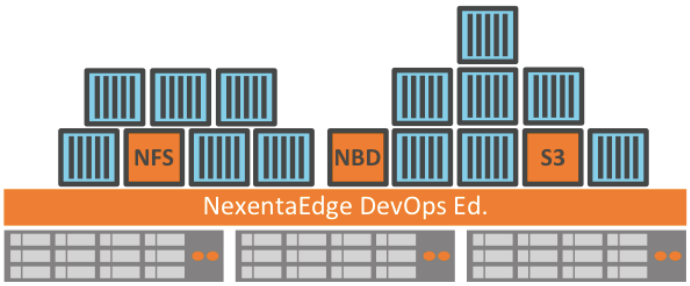
Docker probably puts it best when they simply state “Build, Ship, Run, Any App Anywhere”. Thanks to tools and frameworks like Docker, Kubernetes or Mesos, today’s application developers have access to unprecedented levels of speed, flexibility, agility and control, making building applications and deploying them at scale simpler than it has ever been. To properly meet the needs of these rapidly evolving application frameworks, data center infrastructure will have to profoundly change.

Infrastructure services the past 15 years, whether on premise private clouds, or public clouds have more or less been about one thing: supporting and running ever larger numbers of virtual machines. In the process, infrastructure teams lost track of applications. Instead of allocating resources to applications, infrastructure management boiled down to allocating resources to virtual machines. Microservice based architectures, container technologies and the wider adoption of DevOps methodologies provide a unique opportunity to refocus infrastructure management around the specific needs of applications.

Software-defined storage, scale-out architectures, fast networks and high performance industry standard x86 storage servers provide the necessary building blocks for a new breed of ***Container-Converged Infrastructure***: software-defined infrastructure that seamlessly integrates with container management frameworks to deliver the storage, networking and compute services necessary to support run modern containerized applications, simply, reliably and at any scale.

Container-converged infrastructure builds on the same hardware trends that fueled the growth of hyper-converged infrastructure solutions popularized by VMware, Nutanix and others: powerful x86 servers with high-performance internal storage interconnected over 10GbE fabrics. The key difference is that where hyper-converged infrastructure is built around the hypervisor to optimize support of virtual machines, container-converged infrastructure is built around containers to simplify support of applications.

Recognizing the potential of container-converged infrastructure, Nexenta released NexentaEdge DevOps Edition, a free version of its high-performance scale-out block, file and object storage solution, specifically designed for container-converged deployments.



NexentaEdge DevOps Edition is available on Docker Hub and is packaged, deployed and managed as a set of infrastructure service containers, integrating seamlessly with container management frameworks such as Docker Swarm or Kubernetes. Containerized applications get direct access to a scale-out pool of reliable persistent storage, accessible via block, NFS file or S3 object interfaces. All application data is stored and protected by NexentaEdge across all nodes and devices in the cluster, providing continuous access to application data from any node in the cluster. As new servers get added to the Docker Swarm or Kubernetes cluster, storage performance and capacity grows automatically and linearly, ensuring that applications benefit from simpler to scale and manage, reliable, agile software-defined infrastructure.

From Virtual Machines to Applications

Infrastructure management has come a long way compared to the days of mainframe and Unix based open systems, when infrastructure really boiled down to talking about complex proprietary hardware stacks catering to specific operating systems and there proprietary application ecosystems.

Thanks to Intel, VMware, Linux and Microsoft, infrastructure became about assembling stacks of standard x86 servers, switches and SAN or NAS storage appliances to run a common hypervisor supporting large numbers of virtual machines. To further simplify buying and deploying virtual machine infrastructure, large OEM vendors moved to offer hardware-centric *converged-infrastructure*: pre-assembled racks of hardware with x86 compute, networking, storage appliances and professional services all bundled into pre-defined configurations.

The more recent advent of x86 server based hyper-converged infrastructure is in many ways a natural evolution of that same trend. Increasing network speeds and compute density enabled storage services to be provided via software running in the hypervisor or in virtual machines on scale-out server architectures. The only hardware required is x86 server with dense internal storage interconnected over a fast network fabric. Rapid adoption of hyper-converged solution has been fueled by its simpler deployment, as well as its ability to start small and linearly scale in pre-defined resource increments.

While the hardware architectures evolved, servers got more powerful, networks got faster and storage appliances got subsumed as software in hyper-converged appliances, one thing remained constant: extreme focus on simplifying support or ever larger numbers of virtual machines. Applications ended up a second-order concern. And what is most exciting about the ongoing massive adoption of containers, microservice based architectures and DevOps methodologies, is that after 15+ years of designing infrastructure for relatively opaque virtual machines, containers are putting applications back in focus as the main reason why infrastructure services are needed in the first place.

Containers and Container-Converged Infrastructure

The benefits of containers for application development are widely recognized by now.

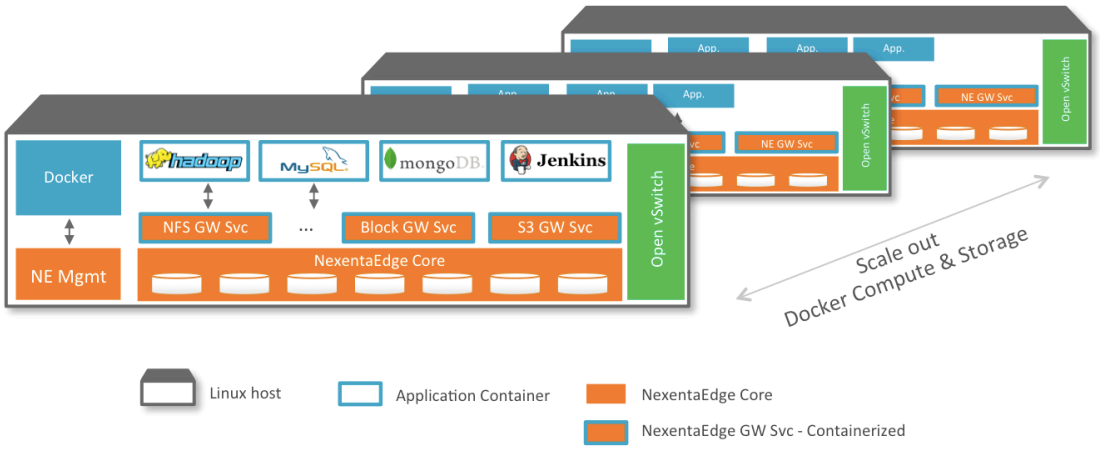
First are the technical benefits of packaging applications and microservices into containers: containers provide a standard mechanism to wrap application components, their runtime and system dependencies into a lightweight, portable, standardized unit that allows that software to run the same way, anywhere where the container can be deployed. Because they are lightweight, containers provide a number of operational benefits such ultra fast start time, runtime efficiencies and rapid shut down.

Second are the ecosystem benefits of tapping into large communities of active developers and open-source tools that make building complex applications simpler than ever. For example, Docker Hub provides thousands and thousands free containerized applications, ready for any developer to leverage and build upon. While not all containers require persistent storage, being able to simply and reliably provide storage to the applications that do is a key requirement for broader container adoption.

Similar to how hyper-converged platforms emerged to provide a simply scalable foundation for virtual machines, the growing requirement to support containerized applications and their data is driving the need for container-converged infrastructure, optimized to support and protect containerized applications on scale-out clusters of industry standard x86 servers. Container-converged builts on the same hardware trends that have enabled hyper-converged: fast networks and powerful dense x86 based servers with high-performance internal storage. The real difference is in the software stacks involved.

From a functional perspective, a container-converged platform should:

- Be seamlessly integrated with the leading container management frameworks, such as Docker and Kubernetes
- Provide reliable scale-out infrastructure (compute, network and storage) for any containerized application, stateless and stateful
- Be software-defined and supported on a wide range of industry standard x86 servers
- Deliver high-performance, full-featured, multi-protocol storage services including block, file and object protocols, enabling to support of a wide range of containerized applications
- Protect application data from device and server failure
- Provide location independent data access: containers must be able to access their data regardless of where they are running in the cluster
- Be deployed as containers, run as containers and managed as containers through standard tools

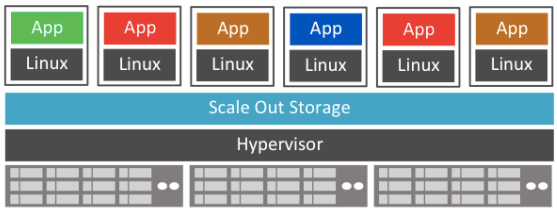


The foundation of NexentaEdge DevOps Edition container-converged infrastructure is the NexentaEdge storage software that is running concurrently with Docker Engine on each node. NexentaEdge pools the storage capacity across all the servers in the cluster, distributes and protects all application data stored in the cluster, and provides standard block, NFS file and S3 object storage services to the application containers that are running on the servers.

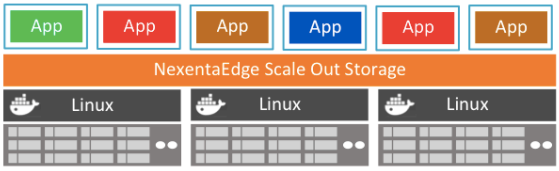
Using standard Docker commands, Docker Compose files and the built-in Docker Volume plugins for NexentaEdge block and NFS services, complex multi-container applications can be deployed in a matter of seconds on the cluster infrastructure, with all data stored and protected by the underlying NexentaEdge scale-out software.

Unprecedented Simplicity, Agility, and Infrastructure Efficiency

The ability to combine Docker Engine, Swarm, Compose and advanced built-in scale-out storage functionality on the same nodes enables greater simplicity, agility and efficiency. All focus can be placed on building, deploying and running applications, simply pulled from Docker Hub, Docker Store or an Enterprise Docker Trusted Registry. Applications can be run on any node in the cluster with the assurance that all application data will be available the next time the application is started, anywhere in the cluster.



Hyper-Converged
Virtual Machine Centric



Container-Converged
Application Centric

In many ways, container-converged infrastructure shares deployment benefits with hyper-converged infrastructure and adds to it the inherent benefits of containers compared to virtual machines. The previous diagram provides a simple comparison of hyper-converged and NexentaEdge based contain-converged infrastructure. The virtual machine centric approach in hyper-converged deployments translates into extra resources spent to store, run and manage the virtual machines and their various operating system images. From an operational perspective, each of these virtual machine needs to be managed, secured, patched, etc. Each virtual machine consumes extra CPU, memory and storage resources.

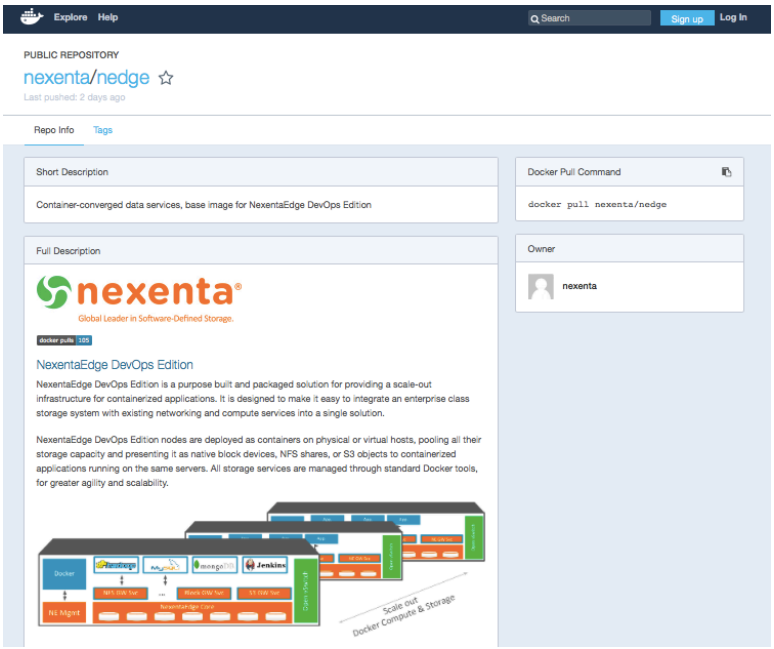
On the other hand, the application centric approach of container-converged deployments on leverages Docker or Kubernetes to automate and orchestrate deployment of the containerized application. Each application gets to consume just the right amount of CPU, memory, network and storage resources it requires, with very little overhead. This translates into faster start times, more agile infrastructure, simpler support of modern scale-out applications and overall better runtime performance at any scale.

From a storage service perspective, hyper-converged solutions are typically limited to providing direct block service to the virtual machines they support. In a VMware environment for example, storage is only provided as vmdk files that are dedicated to a particular virtual machine. Standard shared storage services, or standard protocol services like NFS or S3 object are generally not available from the platform.

A NexentaEdge based container-converged deployment on the other hand benefits from a full-featured scale-out storage platform that provides standard block, NFS file and S3 object services to any applications. This allows a wide variety of application to be supported, whether they depend on block, file of object. NexentaEdge also supports unified namespace across file and object, allowing applications to access the same data via either method.

Free Scale-Out Storage for Container-Converged Deployments

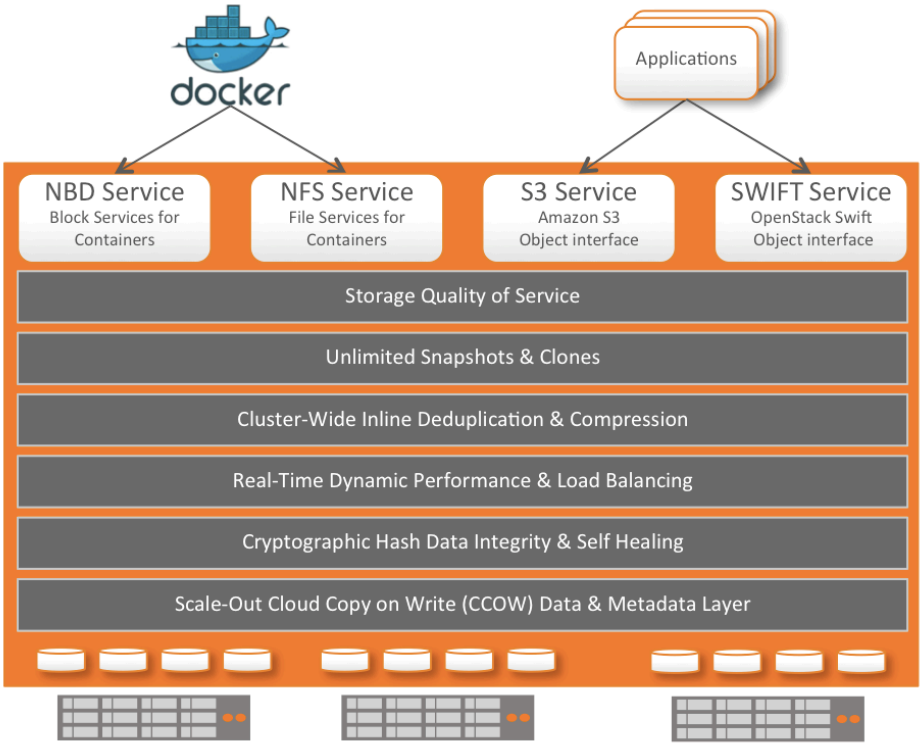
NexentaEdge DevOps Edition is available free of charge on Docker Hub and packaged to support developers looking to experiment with container-converged and containerized applications requiring persistent storage. It supports up to 3 physical or virtual nodes and up to 16 Terabytes of user data in the cluster. Production environments that require support services or larger configurations should contact Nexenta and upgrade to the NexentaEdge Enterprise Edition.



Standard Docker commands are used to deploy NexentaEdge Data Containers that will store and protect data, as well as Gateway Containers that provide standard block, NFS and S3 protocol support to containerized applications. Packaging the core NexentaEdge storage services as containers provides unique flexibility for deploying these services and moving them using standard Docker commands across the cluster.

The solution delivers the same advanced set of storage features as NexentaEdge Enterprise edition. As shown in the following diagram, NexentaEdge is based on a patented scale-out Cloud Copy On Write (CCOW) data layer. A core principle of CCOW is to store all data in the cluster as content addressed immutable variable size chunks. The solution provides extremely strong data integrity and self-healing. CCOW also treats metadata as just another set of chunks, provided virtually unlimited scalability to the number of nodes and amount of data that can be stored in a cluster.

Another unique attribute of NexentaEdge is its real-time dynamic performance and load balancing algorithms. As data gets stored in the cluster, the system continuously optimizes in real-time where the data should placed to most efficiently use available resources (capacity, IOPS, queue depth) across all storage devices in the cluster.



NexentaEdge is also unique in its ability to provide high performance storage services with extreme storage efficiency thanks to cluster wide inline deduplication and compression. It

supports block, NFS and S3 object services. The same namespace can be accessed concurrently via NFS and S3 object APIs, allowing applications to store data as files, process them as object and share them back as object, or vice versa.

NexentaEdge DevOps Edition comes pre-configured with Docker volume plugins for block and NFS services to simplify mapping of storage capacity to application containers. This allows developers to specify in details the storage requirements for their application containers in standard Docker Compose files. All application data that gets stored in the cluster is available anywhere, anytime in the cluster, allowing containers to be moved and restarted on any node in the cluster and continue to access all their data without interruption.

Next Steps

Containers are revolutionizing the way developers "build, ship, and run" applications. This creates a unique opportunity to take another look at how infrastructure services are delivered. The simplicity, performance, scalability and efficiency benefits of NexentaEdge based container-converged infrastructure are too big to ignore. Solutions like NexentaEdge are ideal complements to a software-defined container-converged infrastructure deployment, providing high-performance, highly scalable, multi-protocol storage services to containerized applications.

NexentaEdge DevOps Edition is purpose built for teams experimenting with DevOps methodologies and container-converged principles. It is available free of charge to be deployed using standard Docker commands from Docker Hub. More information, downloads and deployment instructions can be found at: https://github.com/nexenta/edge-dev

