Quantum.

A NEW STORNEXT 7 ARCHITECTURE

Virtualized, Containerized, and Cloud Ready

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INTRODUCTION

The problem of managing exploding volumes of unstructured data isn't new, but some industries have been dealing with it for longer than others. Media and entertainment, oil & gas exploration, and HPC-driven scientific applications were some of the first to hit the limits of traditional storage methodologies. Quantum StorNext® software was originally designed to serve those and similar use cases. Today, thanks to cheap sensors, ubiquitous cameras, and new data sources (DNA sequencers, for example) nearly every industry is struggling with the problem. StorNext software has continuously evolved meet the expanding need, remaining the most efficient high-performance file system for video[1] and the best system for storing and accessing all types of unstructured data.

This tech brief describes the latest evolution of StorNext software, which leverages virtualization and containerization technology along with software-defined storage and software as a service (SaaS) concepts. Now, as unstructured data moves between on-prem, cloud, and even multiple clouds, StorNext can be there too.

A MODERN ARCHITECTURE TO BRING THE POWER OF STORNEXT ANYWHERE

StorNext has built its reputation over decades by enabling some of the most demanding data environments in scientific research, industry, government, and entertainment. Historically, to make use of the full power of StorNext required dealing with some complexity, including a SAN, multiple servers and storage arrays, multiple networks, and the associated multiple user interfaces. To eliminate complexity and expand the places in which StorNext software could be used, the architecture had to be modernized and simplified.

The new architecture takes advantage of several advancements and opportunities that combine synergistically. The result is a new, modern, flexible architecture and user experience for StorNext that was not previously possible.

StorNext and Block Services, Virtualized: StorNext 7 is now truly decoupled from the hardware and can run in a VM. This makes StorNext portable, able to run on a range of hardware platforms and virtual environments, both on-prem and cloud. Combined with the new licensing model in StorNext 7, this enables 'as a service' style deployments.

Quantum produces block storage systems of our own design, including the F-Series and H-Series. These systems run Quantum's block storage software stack, which is optimized for use with StorNext. Because Quantum controls both the block storage and StorNext software, it is possible to converge both onto a single hardware platform, as in the new H4000 systems.

Represents a major architectural step toward enabling public- and hybrid-cloud deployments of StorNext. Makes it possible to use StorNext on additional cloud and hardware platforms in the future.
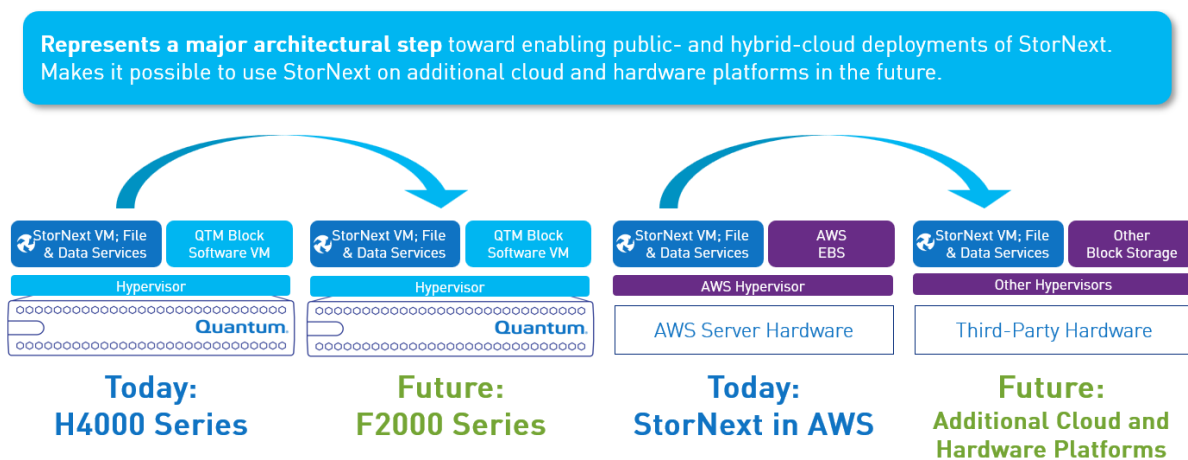

Figure 1 - New Architecture Opportunities

1 Based on SPEC SFS 2014 results vs. the nearest two competitors, StorNext delivered similar or better performance with ¼ to 1/3rd the investment in hardware.
http://spec.org/sfs2014/results/sfs2014vda.html

UIs, Unified: Having control over the entire software stack also enabled the creation of a unified UI that allows managing the block storage and all StorNext functions from a single place, including file systems, clients, and data services. The new UI is entirely web services-based, presenting information in a logical, intuitive, and visually attractive fashion. It is being developed using a continuous development / continuous integration (CI/CD) model to provide for frequent updates and enhancements.
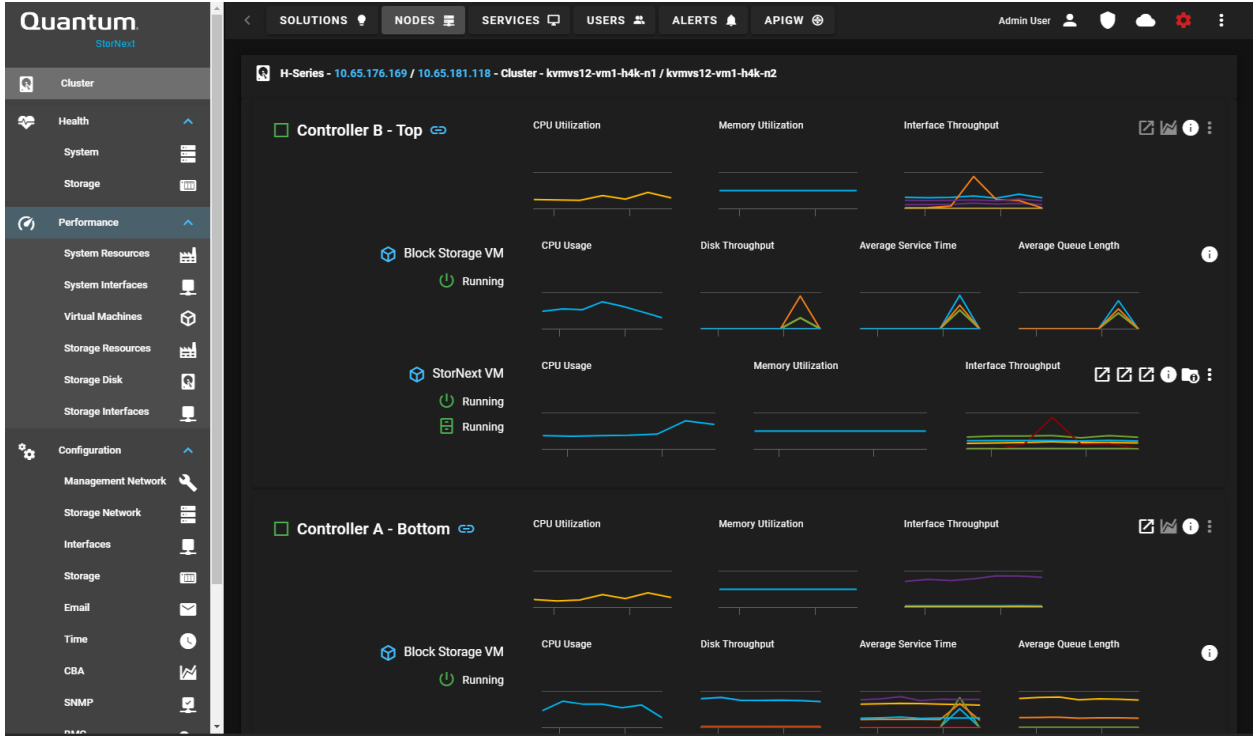
Figure 2 - StorNext Unified UI

UX, Modernized: The need to create a new, unified UI provided an opportunity to modernize the entire StorNext user experience to make it faster to install and easier to use. The new H4000 systems are the first embodiment of the new and improved StorNext user experience.

Applications, Converged: Running StorNext on a hypervisor enables additional convergence, by running other applications on the same hardware with StorNext and the block storage.
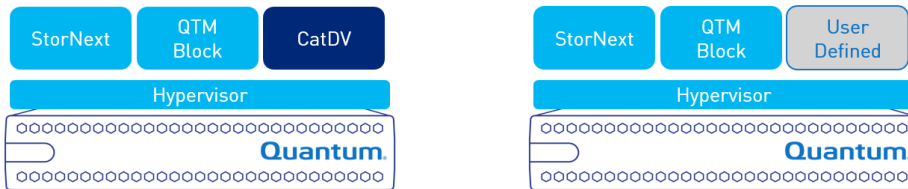
Example: H4000 with CatDV   **Future: Host Other Applications**

Figure 3 - Application Convergence

Under the Hood

The new architecture consists of several software components. Some of these are new, many will be familiar to those with StorNext experience. This section describes the components, their functions, and how they interact with each other, with a focus on the new items. For more background on the StorNext File System and Data Services, download the white paper "StorNext File System: Architecture, Features, and Differentiators" from Quantum.com.

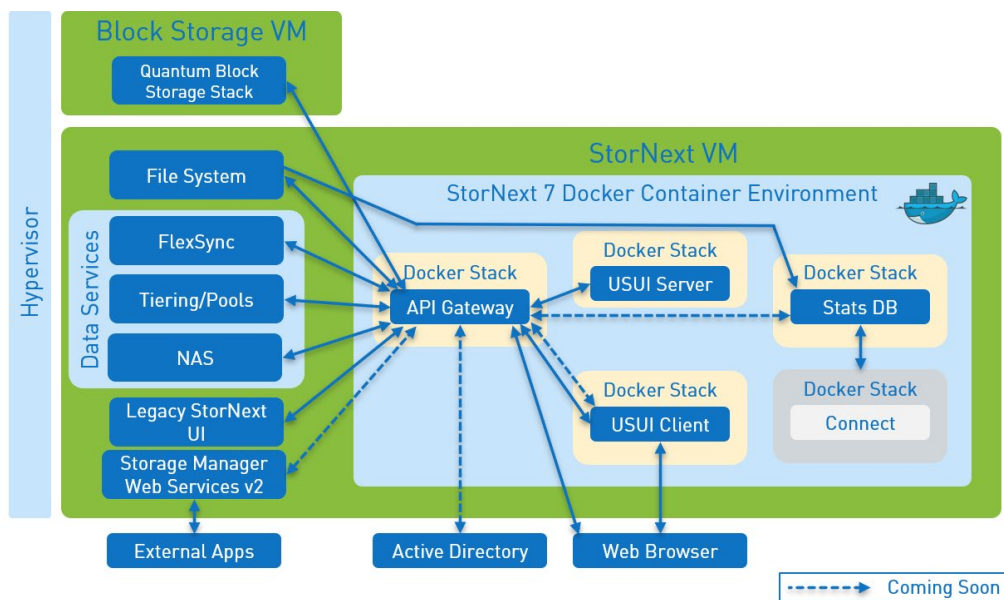*Figure 4 - New Architecture Block Diagram*

Virtual Machines

For StorNext, virtualization provides multiple benefits, including hardware independence, reduction in physical footprint, application convergence, ease of scaling, and improved resilience.

For converged deployments, two VMs run on the hypervisor – one is the block storage VM, running the Quantum block storage software stack. This VM "owns" the physical storage devices and presents appropriately configured LUNs for use by StorNext. The second VM is the StorNext VM, which can have several functions depending on its role in a StorNext cluster.

While the two VMs are designed to work together and be managed easily as a unit, StorNext is still storage-agnostic. Using the Quantum block storage VM is not required, and some implementations may omit it. For example, cloud-based implementations leverage the block storage services provided by the cloud vendor, and in the future, customers will be empowered to run the StorNext VM on servers that they supply. Implementations that combine StorNext VMs with both Quantum and third-party storage will also be supported.
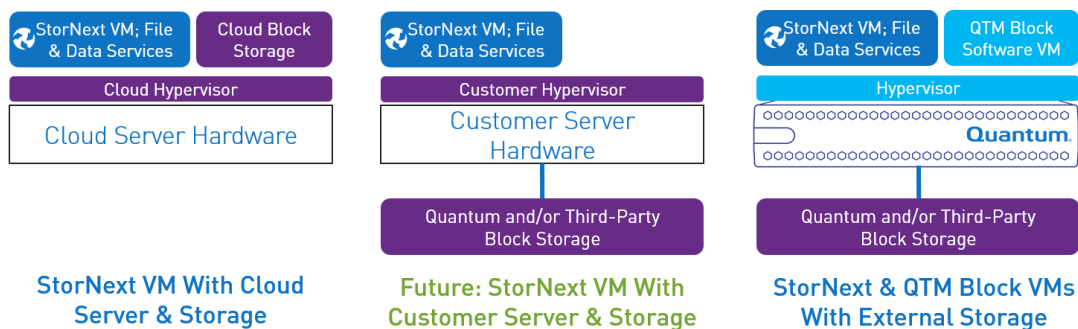
StorNext VM; File & Data Services	Cloud Block Storage
Cloud Hypervisor	
Cloud Server Hardware	

StorNext VM With Cloud Server & Storage

StorNext VM; File & Data Services	
Customer Hypervisor	
Customer Server Hardware	
Quantum and/or Third-Party Block Storage	

Future: StorNext VM With Customer Server & Storage

StorNext VM; File & Data Services	QTM Block Software VM
Hypervisor	
Quantum	
Quantum and/or Third-Party Block Storage	

StorNext & QTM Block VMs With External Storage

Figure 5 - StorNext VM Deployment Options

It's important to note that although only a single StorNext VM is shown in the diagrams above, they are almost always deployed in a cluster of two or more to provide redundancy and failover. In larger clusters additional StorNext VMs may be deployed to scale out data services, such as NAS or FlexSync (replication). Depending on the platform the VMs are running on, multiple StorNext VMs may run in the same physical machine or multiple machines. Quantum's H4000 series appliances, for example, are dual-controller systems, with a StorNext VM running on each controller.

When sufficient system resources are available, additional VMs hosting customer applications may run on the hypervisor, further collapsing and converging the infrastructure, as illustrated in Figure 3 on page 4.

Containers
Containers may seem like an internal detail that only application developers care about, but using a microservices architectural approach with containers has real benefits for StorNext users too.

	Containerization Benefits
Portability	Containerized code can be deployed anywhere, including on bare metal and VMs
Agility	Features, fixes, and updates can be created more rapidly
Isolation	Updates to software components are independent of the platform operating system
Scalability	For larger deployments, containers may be distributed among multiple systems

Table 1 - Benefits of Containerized Software

Containerization breaks software into small, independent modules that are much easier to maintain and test than a large, monolithic application. This means that new features, updates, and fixes can be coded, tested, and released much more frequently, with less effort and risk. The associated faster pace of development and higher product quality enable a much better user experience and higher customer satisfaction.

Although there have been changes made to them to support the new architecture, the components listed in the blue bubbles on the left side of the StorNext VM in Figure 4 are all existing StorNext features and functions. The items contained in the light blue "StorNext 7 Docker Container Environment" box however, are all new, and deserve a closer look.

In true microservices fashion, the container environment consists of dozens of individual containers, organized into Docker stacks (clusters of containers) for ease of orchestration and monitoring. If you aren't a Docker Ninja, don't worry. StorNext administrators and users don't need to know anything about Docker or ever interact with Docker directly. In the unlikely event that an admin needs to manipulate these components, there are custom CLI tools available at the Linux command line for controlling the container stacks.

If you are a Docker power user, you may wonder if you can manipulate these containers and stacks directly or run your own containers within the StorNext Docker environment. The answer to both questions is "not at this time," but that could change in the future.

API Gateway Stack
The API gateway is the central player in this architecture. It is the hub consolidating API connections to the StorNext file system, all the data services, and other internal components. Security is centralized at the API gateway as well. Where in previous versions of StorNext the individual APIs were exposed and handled their own security, in the new architecture any use of these APIs is authenticated through the API gateway. The one temporary exception is the Storage Manager Web Services API, which is used by external applications to integrate with the data service that enables secondary storage tiering. In a future release, access to this API will be routed through the API gateway as well. Also in the near future, the API gateway will be fully integrated with Active Directory, for centralized management of access credentials.

USUI Client Stack
When an administrator fires up their web browser to interact with StorNext 7, the USUI client stack is the first component they interface with. The USUI client serves the required code to the admin's browser to render the web interface and establish a connection to the API gateway, with additional code served out as needed to drive different UI screens or functions.

USUI Server Stack
The new StorNext UI may be used to manage multiple StorNext systems, including their associated block storage arrays. The USUI server is responsible for discovering all devices eligible for management by the UI. Access to the USUI server by other components is via the API Gateway.

Connect and Stats DB Stacks
When StorNext performance monitoring and visualization was introduced in StorNext Connect, a time-series database was incorporated to store and query the saved data. Connect has been containerized, and the stats DB pulled out into its own stack. Once the performance dashboards from Connect have been built into the new UI, the stats database will become another endpoint accessed through the API gateway. At that point all functions of Connect will have been migrated into the new UI, and it can be phased out.

CONCLUSION

The new StorNext 7 architecture has many benefits, from a greatly enhanced user experience, to a smaller hardware footprint converging storage, file system and applications, to true portability across hardware platforms and clouds. No matter where your unstructured data lives, where it moves to, or how much you have, StorNext 7 will help you store it, manage it, protect it, and derive value from it.

LEARN MORE

Quantum H4000 Series storage appliances

Quantum H2000 Series block storage arrays

Quantum F-Series NVMe storage servers

StorNext high-performance file system and data management

CatDV asset management software

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