Orchestrating a brighter world

NEC

High Performance Computing

NEC GxFS Storage Appliance

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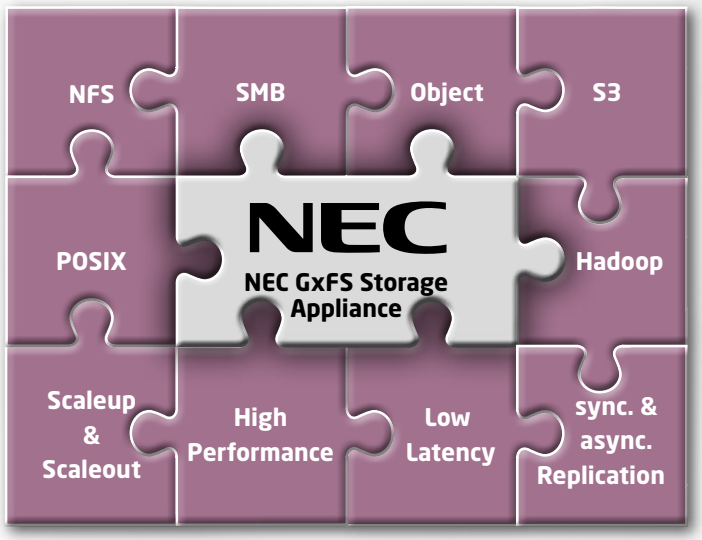
Technical and scientific computing creates huge amounts of data, therefore scalable filesystems and storage systems became critical components for building HPC systems. Furthermore the immense increase of data, transactions, and digitally-aware devices which are part of the digital transformation, change the way storage is handled in HPC and enterprise IT environments. Optimizing data management is one of the key factors for successful IT operations. The NEC GxFS Storage Appliance offers the possibility to build a private cloud open to connect using different protocols in a single namespace which if required can be extended seamlessly to public cloud. NEC GxFS Storage Appliance is more than just another storage solution by introducing a high performance scale-out cluster with a global name space for all types of data; a software defined infrastructure for data.



Highlights

- NEC GxFS Storage Appliance powered by IBM Spectrum Scale™ and NEC hardware.
- Software defined storage solution designed for HPC and business critical environments.
- NEC GxFS Storage Appliance enables low-latency access to data from anywhere in a single name space.
- Sharing and accessing of data and resources up to a global scale.
- Support for data compression, encryption and secure deletion.
- High density, hybrid and flash storage options available for best mix of capacity and performance.
- Fully redundant hardware and high-availibilty solution design.
- Support for POSIX, NFS, SMB, Object based access in one single namespace.
- Seamless integration of Hadoop ecosystems.
- Tiering based on heat maps to match optimum performance tier based on access patterns.
- Seamless capacity and performance scaling
- Flexibility to support a wide variety of platforms- Linux, AIX, Windows
- NEC is the only one support contact during lifetime of the NEC GxFS Storage Appliance.
- Differentiated support options available via NEC UltraCare.

NEC GxFS Storage Appliance Building Blocks

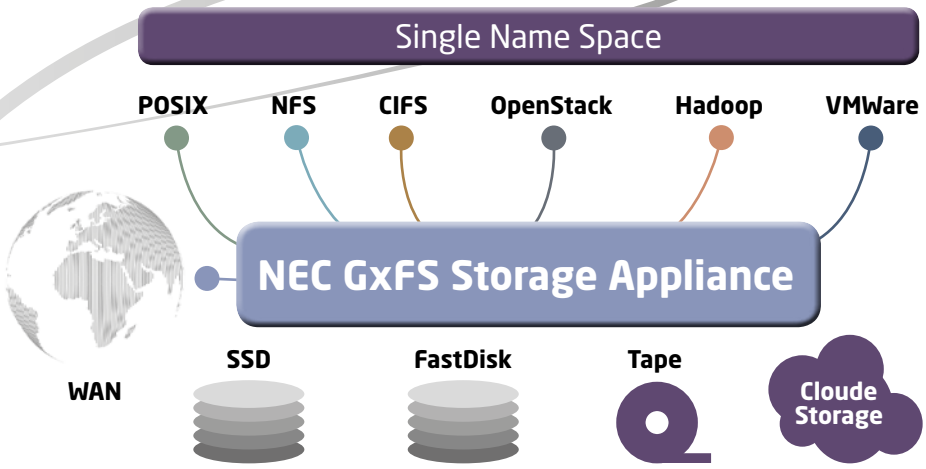
Building Blocks are the basic units of a NEC GxFS Storage Appliance. A NEC GxFS Storage Building Block consists of two certified NEC SNA800 series storage blocks and two NEC server blocks in a **high availability** configuration. The storage systems are fully redundant connected to the servers using state of the art SAS-3 technology. Storage Servers provide the parallel file system functionality whilst dedicated redundant RAID controllers in the storage building blocks provide storage to the Storage Server. NEC GxFS Storage Appliance comes fully configured and ready for use.

NEC GxFS Storage Appliance modular building block concept allows easy sizing and scaling of any I/O setup and data workflow. The concept of building blocks allows to grow in capacity or bandwidth according to your demands. GxFS Building blocks are delivering high performance and are due to the fully redundant configuration **without single points of failure** designed for always on operation.

Simplify Storage Management

NEC GxFS Storage Appliance provides a powerful **graphical user interface** and various integrated management tools to ease administration of your GxFS environment.

The graphical interface provides not only administration tools, it offers a bunch of tools to monitor a NEC GxFS Storage Appliance. NEC GxFS Storage Appliance can be included in almost any **monitoring system** or can be monitored using a preconfigured monitoring appliance form NEC.



IBM Spectrum Scale

Data placement

NEC GxFS Storage Appliance lets you define on which storage tier your data is located. Place often used data on Flash while less used data will be migrated automatically to near line storage. Storage tiers are not limited to local attached storage devices you can even offload data to external storage entities like tape or Amazon S3. From a users perspective the data will still be in the same place within its directory structure. NEC GxFS Storage Appliance enables you to deploy a **policy based Information Lifecycle Management (ILM)** solution for all data types from a single management pane. It redefines the economics of data storage using policy-driven automation: as time passes and organizational needs change, data can be moved back and forth between flash, disk and tape storage tiers without manual intervention. Integration in existing **backup and disaster recovery concepts** is a proven setup and supported by integrated snapshot technology and data moving tools.

Storage tiering ILM for object and file

Data accessibility

Single Namespace Information in one place

NEC GxFS Storage Appliance enables you to access your data via various protocols – NFS, SMB, GPFS, Hadoop,S3, Block & Object – world wide. Via the integrated **WAN cache** feature you can integrate remote sites that have only a limited network bandwidth. You can also connect multiple clusters within the same data center or across long distances over a WAN to build a geo cluster. So NEC GxFS Storage Appliance unifies block devices, objects, and files within a single name space. **Unified access** for file and object based access can be established using LDAP or Active Directory with RFC 2307 extensions as a common identity management. Integrated **quota management** limits the amount of disk space and the number of inodes that are assigned for a specified user, group of users, or fileset and can be granularly applied using the CLI or the GUI.

Data performance management

The NEC GxFS Storage Appliance scales in multiple dimensions. You can scale up increasing bandwidth and IOPS and scale out by just increasing capacity. You only have to choose the matching building block. Also special performance options like a local read only cache based on NVMe can be easily integrated. But it's also possible to integrate other protocols – like SQL - with ease and transferring your NEC GxFS Storage Appliance into a database cluster. Furthermore NEC GxFS Storage Appliance scales in time. Because of its unique features you can replace the underlying hardware without any impact to your running applications and services. NEC certifies hardware for the GxFS Storage Appliance, ensuring that the latest technology is running stable and flawless. Together with rolling updates, this allows you to operate your NEC GxFS Storage Appliance without downtime.

Unmatched performance and scalability

Data availability

High Availability without additional software

The NEC hardware used in a building block for NEC GxFS Storage Appliance will stay online as long as more than 50% of its quorum servers are available. Extension or removal of quorum or standard servers in a running cluster has only impact on performance not on availability. Rolling updates allow the NEC GxFS Storage Appliance to stay in production for almost 24x7 since only a single cluster server is under maintenance at a given time. With the integrated **High Availability Subsystem** the application will become HA aware without additional HA Software. NFS, SMB and Object services are high available out of the box. The replication feature that enables multiple copies of data and metadata in different locations can be used to increase data availability and for disaster recovery scenarios.

GxFS Storage Appliance Use Cases

Compute Clusters

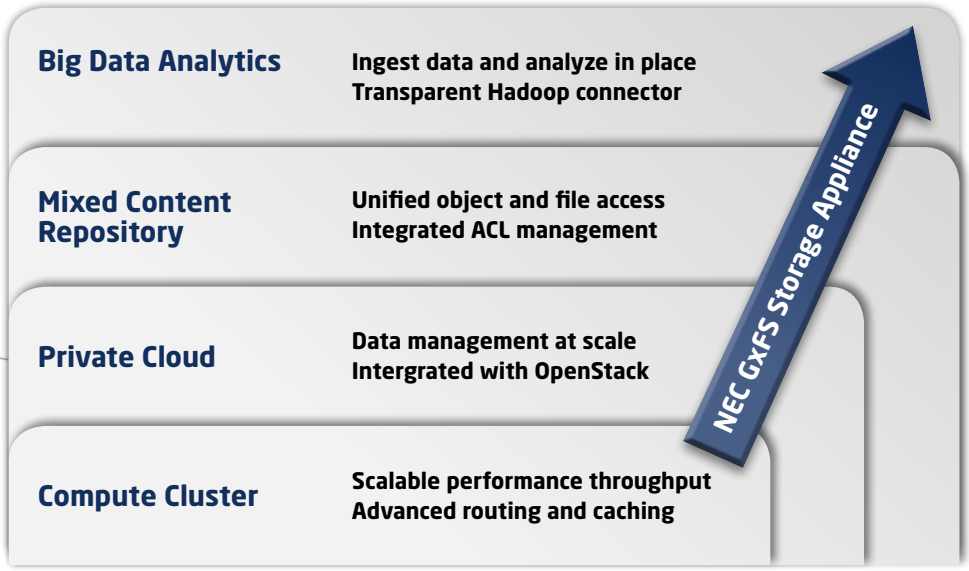
HPC-Clusters are the most common use case for a parallel file system appliance like the NEC GxFS Storage Appliance. Scalability in terms of performance and capacity serving **Petabyte of data** with a sustained performance of more than **100GB/s** is the domain of the NEC GxFS Storage Appliance. Providing reliable, stable low-latency and high-performance access for thousands of clients over low latency networks like InfiniBand without management overhead is achieved using the power of the NEC GxFS Storage Appliance.

Private Cloud

Deploying **OpenStack** over NEC GxFS Storage Appliance offers benefits provided by the many enterprise features in NEC GxFS Storage Appliance as well as the ability to consolidate storage for various OpenStack components and applications running on top of the OpenStack infrastructure under a single storage management plane. One key benefit of NEC GxFS Storage Appliance is that it provides uniform access to data under a single namespace with integrated analytics. All storage centric parts of Openstack like **Cinder, Swift, Manila** and Glance are fully integrated and functional in the NEC GxFS Storage Appliance software stack. If no external keystone services is available, an internal keystone with in-built HA is provided as part of the Object protocol.

Mixed Content Repository

As workflows in technical computing are changing **unified access** becomes more and more important. Instead copying data between object and file based users, share data transparent and protocol independent with the NEC GxFS Storage Appliance. As data represent for most companies and organisations one of the most valuable assets, data access has to be regulated. Secure data access independent of the protocol required is a key factor to protect data from **unauthorized access**. NEC GxFS Storage Appliance offers an integrated ACL management to solve this issue. **Encyrption in flight** or at rest with independent **key management** that integrates with leading enterprise key management systems is an optional feature providing even more data security.



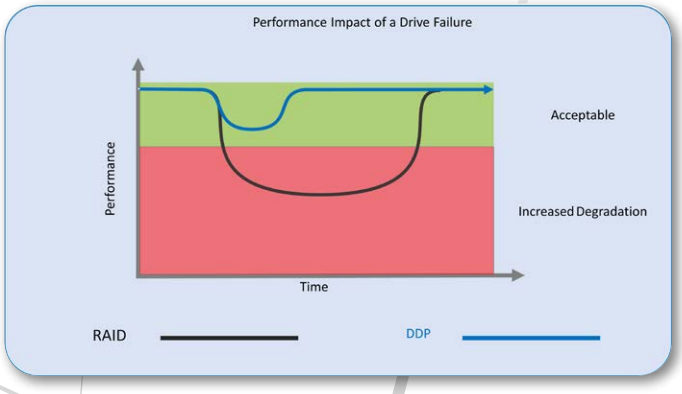
The increase of demand for video storage often driven by massive video surveillance is a typical use case for NEC GxFS Storage Appliance. Leading intelligent video security, combined with NEC GxFS Storage Appliance, handles the bandwidth-intensive streaming environments of next-generation video surveillance infrastructures. High availability access to media content and bandwidth-intensive streaming can be established using the modular NEC GxFS Storage Appliance. NEC's building block architecture is designed as a true pay-as-you-grow solution to address growing data storage requirements generated by video surveillance environments.

Big Data Analytics

As Data driven science is getting the norm, high performance computing gets integrated into the experiments to analyse huge amounts of measured data. The number of sensors, sequencers etc. and the amount of data captured is steadily increasing. NEC GxFS Storage Appliance offers the possibility to support a typical **Big Data workflow** from data acquisition which is typically transferred in a burst buffer provided by the high performance tier of the NEC GxFS Storage appliance online reviewed and then transferred to the central Storage pool for further analysis. Gaining **insights** using analytics using for example with a SAS® Grid or other applications can be achieved in place without copying data. After analysing the data, raw data and results can be transferred to long term storage for **compliance** and archival purposes.

GxFS Storage Building Block

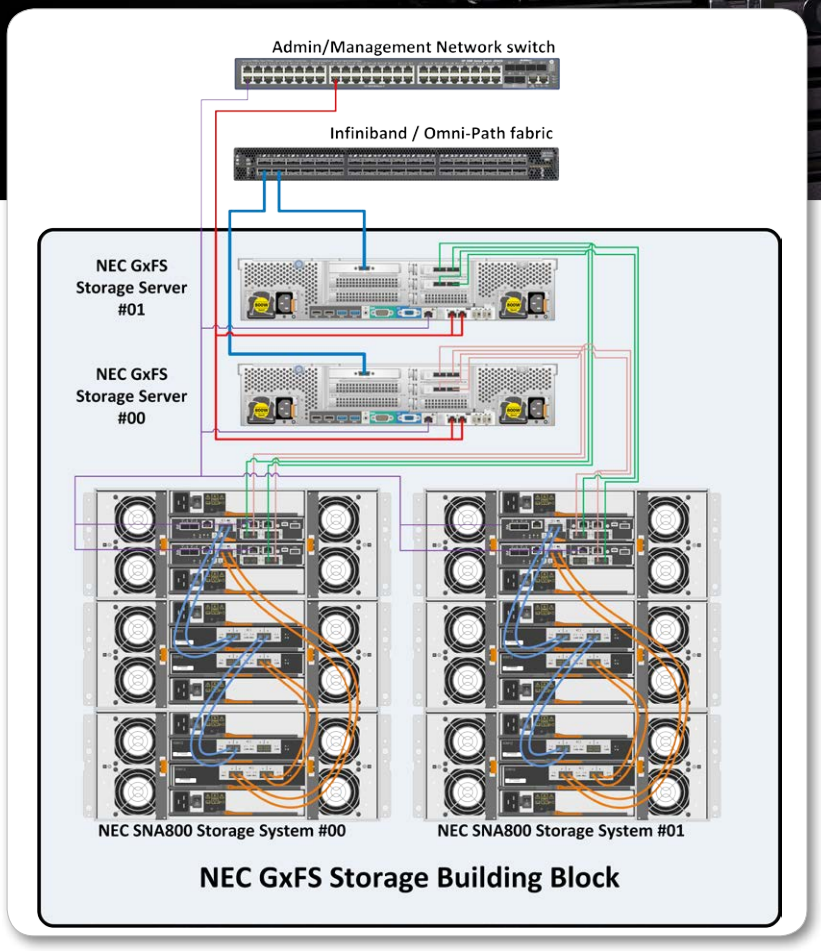
Base of the NEC GxFS Storage Appliance are the storage building blocks. The NEC SNA860 storage array delivers high-performance and low latency with a proven availability of **99.999%.** The fully redundant hardware design is complemented by state of the art software defined storage technologies. One of this features is **Dynamic Disk Poools** a high performance variant of **declustered RAID**. Dynamic Disk Pooling (DDP) dynamically distributes data, spare capacity, and protection information across a pool of disk drives. Unlike traditional RAID, there is no specific spare drive, rather all drives have spare space that is reserved. When a drive fails, the remaining drives are read, the missing data is recomputed, and the result is written to multiple drives in their spare space. This operation is done on the pieces of data that are missing. The result is parallel reads and parallel writes, which significantly speeds up the rebuild time after a single drive failure. **Shorter rebuild times** return the system significantly faster to optimal state thus reducing exposure to multiple cascading disk failures. With DDP, customers do not have to define RAID array sizes, hot spares, and drive maintenance schedules.



Dynamic Disk Pools is designed to maintain high performance even after drive failure and to decrease rebuild time.

To avoid the risk to lose data as a result of "silent data corruption" the NEC SNA800 series provides **standard T10-PI** (Protection Information) feature checking for errors that might occur as data is transferred from the host through the RAID-controllers and down to the drives. The T10-PI model provides protection of user data by appending protection information to each block of user data. This feature is also referred to as End-to-End Data Protection or Data Integrity Field (DIF) protection. As 99.9% of errors are occurring at disk level, NEC SNA860 offers the highest level of data protection covered by the NEC SNA800 series T10-PI implementation. All major components like controller, power supplies, fans and disks are hot swappable to ease serviceability. NEC SNA860 can be managed out of band either by CLI or with **SANtricity Storage Manager**. SANtricity Storage Manager offers unmatched proactive monitoring capabilities in addition to administration and configuration features. Connectivity to the storage server can be realised using 12 Gb/s, 32Gb/s or 16Gb/s Fibre Channel. Each NEC SNA860 array can host up to 480 disk drives with up to 7 NEC SNA860c disk enclosures. A typical high-availability setup would start with two SNA860 storage arrays and two GxFS servers with an optional highspeed interconnect like **InfiniBand or Omni-Path** and a connection to the client network. Each of the two SNA860 arrays offers a proven performance of 10 GB/s for writes and 12Gb/s for reads, thus providing an aggregate performance of at least 20GB/s per building block with a raw capacity of up to 9.6 PB. The NEC SNA860 arrays support the intermix of SSD, SAS and NL-SAS drives. As the GxFS Storage Appliance supports **automated storage tiering**, there is no additional hardware necessary to enable this feature, just mix and match performance tiers within one SNA860 array to achieve performance optimised data placement. The NEC R5800 R120h-2M focuses like theSNA860 array on reliability, availability and serviceability. The powerful **NEC EXPRESS-SCOPE Engine 3** provides extensive remote management and monitoring capabilities for the GxFS Servers. Thanks to the versatility of the NEC GxFS Storage Appliance it's also possible to integrate existing storage systems into a GxFS concept.

One of NEC core values is **passion for innovation**. This also applies for the NEC GxFS Storage Appliance. Therefore the next NEC GxFS Storage Appliance generation can run the whole software stack directly on the controller of the NEC SNA800 series, eliminating the need for storage server hardware. Based on **Docker** containers the NEC GxFS-e Storage Appliance with native InfiniBand support, provides a high density solution with an **unmatched TCO**.



NEC GxFS Storage Appliance high-availability reference design.

NEC as a provider of Storage Appliances

The building blocks of the NEC GxFS Storage Appliance are architected, integrated, tested, and optimized to work flawlessly together, thus cutting complexity and eliminating risks. This results in easier deployment and upgrades, and more efficient data and systems management. NEC not only provides hardware, but also provides optimal storage solutions based on know-how and experience of our employees. Consulting, benchmarking, implementation and support during all stages of a project from first design to 3rd level support are covered by NEC experts.

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