NetApp Verified Architecture

NVIDIA DGX BasePOD with NetApp E-Series

NVA design

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Abstract

This NetApp Verified Architecture describes the design of the NVIDIA DGX BasePOD with NetApp® E-Series BeeGFS building blocks. This solution is a full-stack data center platform based on NVIDIA DGX SuperPOD with NetApp E-Series.

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Executive summary

Although AI enhances consumers' lives and helps organizations in all industries worldwide to innovate and to grow their businesses, it is a disrupter for IT. To support the business, IT departments are scrambling to deploy high-performance computing (HPC) solutions that can meet the extreme demands of AI workloads. As the race to win with AI intensifies, the need for an easy-to-deploy, easy-to-scale, and easy-to-manage solution becomes increasingly urgent.

The NVIDIA DGX BasePOD makes supercomputing infrastructure easily accessible for your organization and delivers the extreme computational power that you need to solve even the most complex AI problems. To help you deploy at scale today, this NVIDIA and NetApp Verified Architecture removes the complexity and guesswork from infrastructure design and delivers a complete, validated solution including best-in-class compute, networking, storage, and software.

Program summary

NVIDIA DGX BasePOD brings together a design-optimized combination of AI computing, network fabric, storage, software, and support. The BasePOD architecture is based on the SuperPOD architecture, which was validated on a dedicated acceptance cluster at NVIDIA.

Solution overview

NVIDIA DGX BasePOD is an AI data center reference architecture designed to support the most complex AI workloads facing today's enterprises. It simplifies deployment and management while delivering virtually limitless scalability for performance and capacity. In other words, DGX BasePOD lets you focus on insights instead of infrastructure.

With NetApp EF600 all-flash arrays at the foundation of your NVIDIA DGX BasePOD, you get an agile AI solution that scales easily and seamlessly. The flexibility and scalability of the solution enable it to support and adapt to evolving workloads, making it a strong foundation to meet your future storage requirements. Modular storage building blocks give you a granular approach to growth. You can scale seamlessly from terabytes to petabytes. By increasing the number of storage building blocks, you can scale up the performance and capacity of the file system, enabling your solution to manage the most extreme workloads with ease.

Solution technology

- NVIDIA DGX BasePOD is a validated deployment of at least two DGX A100 systems with validated, externally attached, shared storage.
- NetApp E-Series BeeGFS building blocks consist of two NetApp EF600 arrays and two x86 servers:
  - With NetApp EF600 all-flash arrays at the foundation of your NVIDIA DGX BasePOD, you get a reliable storage foundation backed by six 9s of uptime.
  - The file system layer between the NetApp EF600 and the NVIDIA DGX A100 systems is the BeeGFS parallel file system. BeeGFS was created by the Fraunhofer Center for High-Performance Computing in Germany to solve the pain points of legacy parallel file systems. The result is a file system with a modern, user space architecture that is now developed and delivered by ThinkParQ and used by many supercomputing environments.
  - NetApp support for BeeGFS places the assistance of NetApp's excellent support organization at your fingertips. You get access to superior support resources, early access to BeeGFS releases, and access to select BeeGFS enterprise features such as quota enforcement and high availability.

- The combination of NVIDIA DGX compute and NetApp E-Series BeeGFS building blocks provides an agile AI solution in which compute or storage scales easily and seamlessly.

Figure 1 shows a high-level view of the NVIDIA DGX BasePOD with NetApp E-Series solution.

Figure 1) A high-level view of the NVIDIA DGX BasePOD with NetApp E-Series solution.

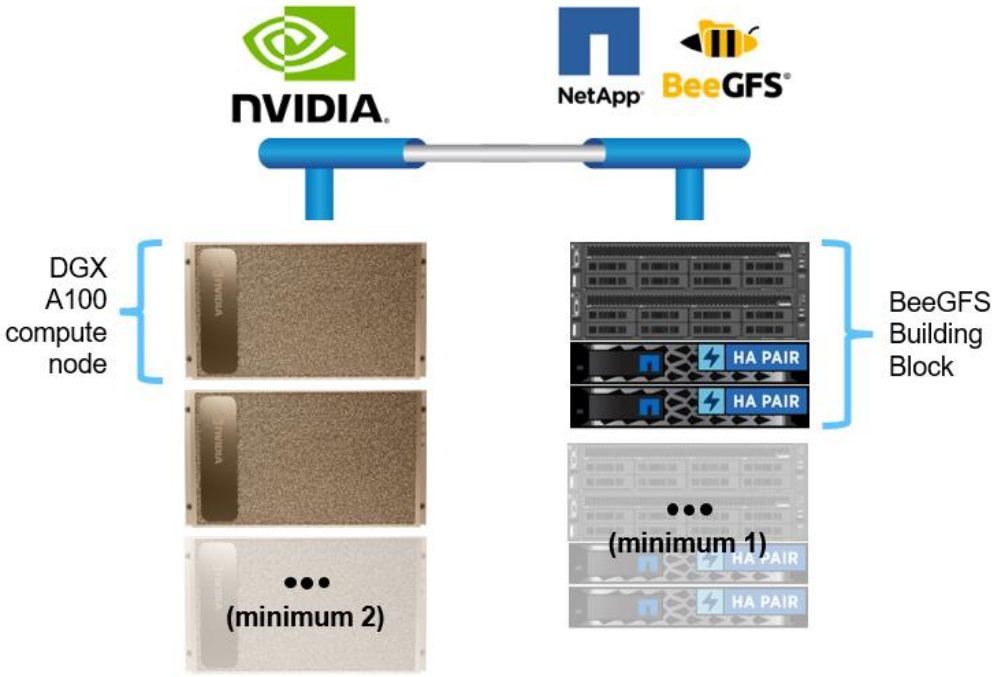
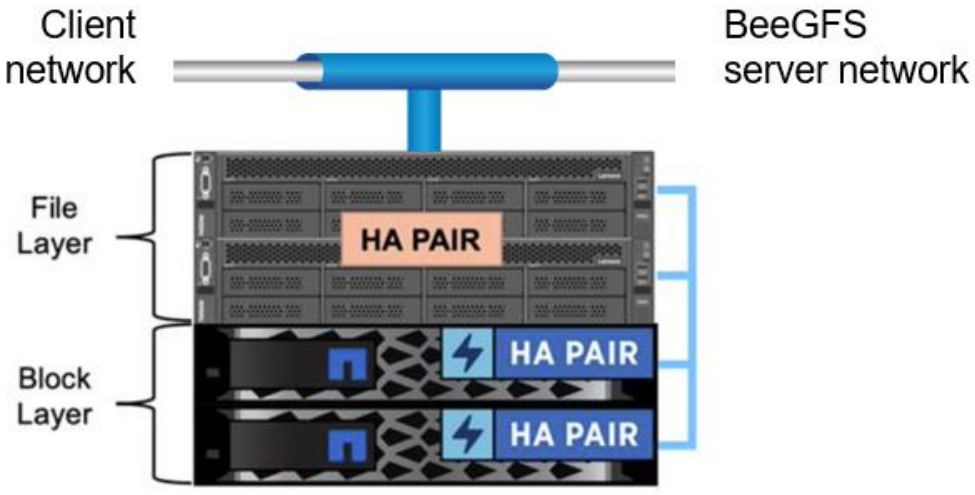


Figure 2 shows an overview of a NetApp E-Series BeeGFS building block.

Figure 2) NetApp E-Series BeeGFS building block.



Use case summary

This solution applies to the following use cases:

- Artificial Intelligence (AI) including machine learning (ML), deep learning (DL), natural language processing (NLP), and natural language understanding (NLU)
- Medium-to-large scale AI training
- Computer vision, speech, audio, and language models
- HPC including applications accelerated by message passing interface (MPI) and other distributed computing techniques
- Application workloads characterized by the following:
  - Reading or writing to files larger than 1GB
  - Reading or writing to the same file by multiple clients (10s, 100s, and 1000s)
- Multi-terabyte or multi-petabyte datasets
- Environments that need a single storage namespace optimizable for a mix of large and small files

Technology requirements

This section covers the technology requirements for the NVIDIA DGX BasePOD with NetApp E-Series solution.

Hardware requirements

Table 1 lists the hardware components that are required to implement the solution. The solution sizing starts with two NVIDIA DGX A100 systems and one NetApp E-Series BeeGFS building block.

A single NetApp E-Series BeeGFS building block consists of two NetApp EF600 arrays and two x86 servers. You can add additional building blocks as the deployment size increases. For more information, see the NVIDIA DGX A100 SuperPOD reference architecture and NVA-1164-DESIGN: BeeGFS on NetApp NVA Design.

Table 1) Minimum hardware requirements.

Hardware	Quantity
NVIDIA DGX A100s	Minimum 2
NetApp BeeGFS Building Blocks	Minimum 1
• x86 servers for BeeGFS	2 per building block
• NetApp E-Series EF600	2 per building block
Network infrastructure	varies

Networking requirements

Networking for BasePOD deployments is as flexible as it is complicated. Multiple protocols are supported to connect the various components in this solution.

BeeGFS server-client connections (BeeGFS building blocks to DGX compute nodes) are supported using IB and Ethernet (both RoCE and TCP). Due to the complexity of the networking, it is required that Ansible is used to set up these connections. You can view the available NetApp E-Series collections on Ansible Galaxy.

Inside each BeeGFS building block, the server-storage connection is supported using either switchless-IB or RoCE.

Software requirements

Table 2 lists the software components required to implement the solution. The software components that are used in any specific implementation of the solution might vary based on customer requirements.

Table 2) Software requirements.

Software
NVIDIA BaseCommand software stack
ThinkParQ BeeGFS parallel file system

Solution verification

NVIDIA DGX SuperPOD with NetApp E-Series was validated on a dedicated acceptance cluster at NVIDIA by using NetApp BeeGFS building blocks. Acceptance criteria were based on a series of application, performance, and stress tests performed by NVIDIA. For more information, see the NVIDIA DGX SuperPOD: NetApp EF600 and BeeGFS Reference Architecture.

NVIDIA DGX BasePOD with NetApp E-Series is validated by NVIDIA and NetApp based on similarity to the SuperPOD architecture.

Conclusion

NetApp and NVIDIA have a long history of collaboration to deliver a portfolio of AI solutions to market. NVIDIA DGX BasePOD with the NetApp EF600 all-flash array is a proven, validated solution that you can deploy with confidence. This powerful, scalable, and validated architecture takes the risk out of deployment and puts you on the path to winning the race to AI leadership.

Where to find additional information

To learn more about the information that is described in this document, review the following documents and/or websites:

- BeeGFS on NetApp with E-Series Storage
  https://docs.netapp.com/us-en/beegfs/index.html
- NVA-1167: NVIDIA DGX SuperPOD Design with NetApp
  https://docs.netapp.com/us-en/beegfs/index.html
- NVIDIA DGX SuperPOD Reference Architecture
  https://www.nvidia.com/en-us/data-center/resources/nvidia-dgx-superpod-reference-architecture/

Version history

Version	Date	Document version history
Version 1.0	December 2022	Initial release.

Refer to the Interoperability Matrix Tool (IMT) on the NetApp Support site to validate that the exact product and feature versions described in this document are supported for your specific environment. The NetApp IMT defines the product components and versions that can be used to construct configurations that are supported by NetApp. Specific results depend on each customer's installation in accordance with published specifications.

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