NetApp Solutions for ML/DL/AI

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11 October 2021

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Top challenges of AI today

- Expertise
  - Right team, right tools at the right time
  - Maximizing researcher efficiency
- Data
  - Model management and data integrity
  - Data pipeline management
- Technology
  - Building optimized AI PaaS, reporting & tools
  - Performance tuning and managing burst modes
- Infrastructure
  - AI environment configuration
  - Power and Cooling Density

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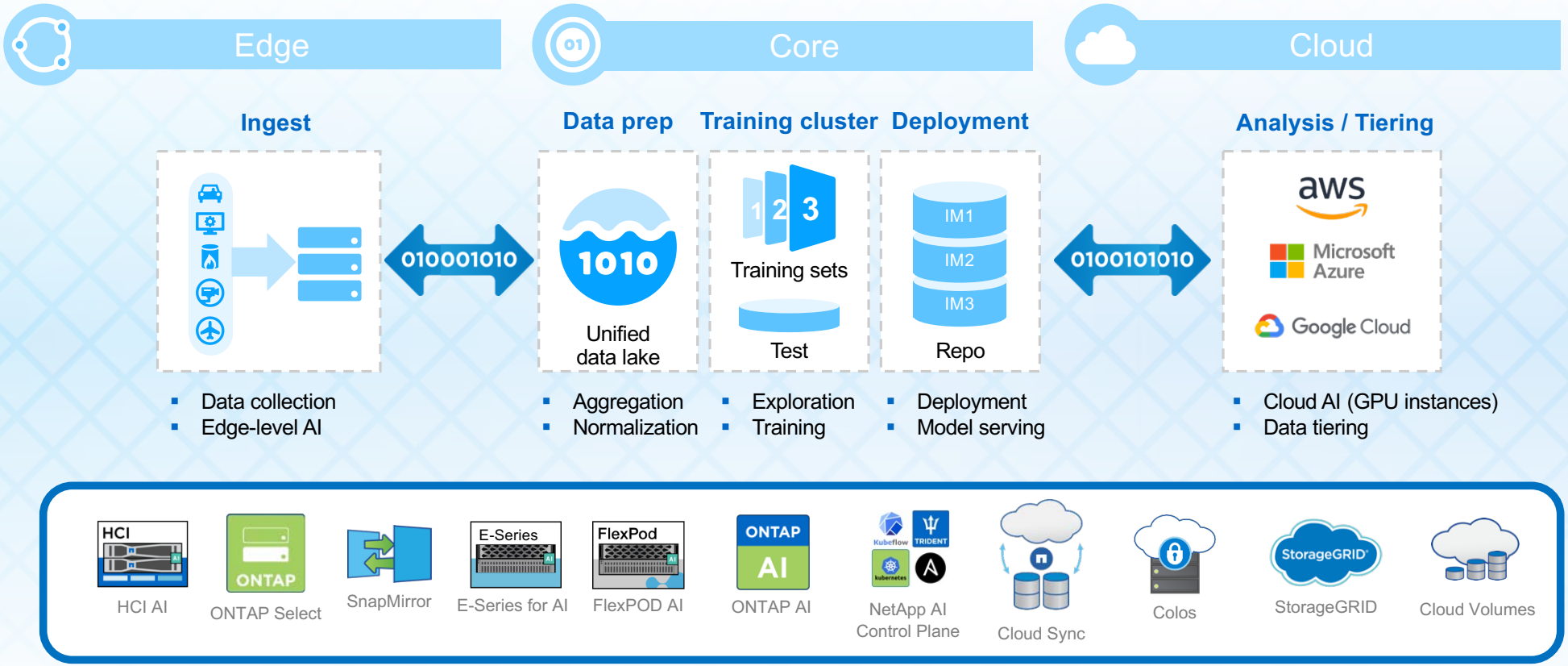
Edge to Core to Cloud Data Pipeline

Strategic Vision: Be the trusted partner and advisor for customers on AI/Data Pipeline



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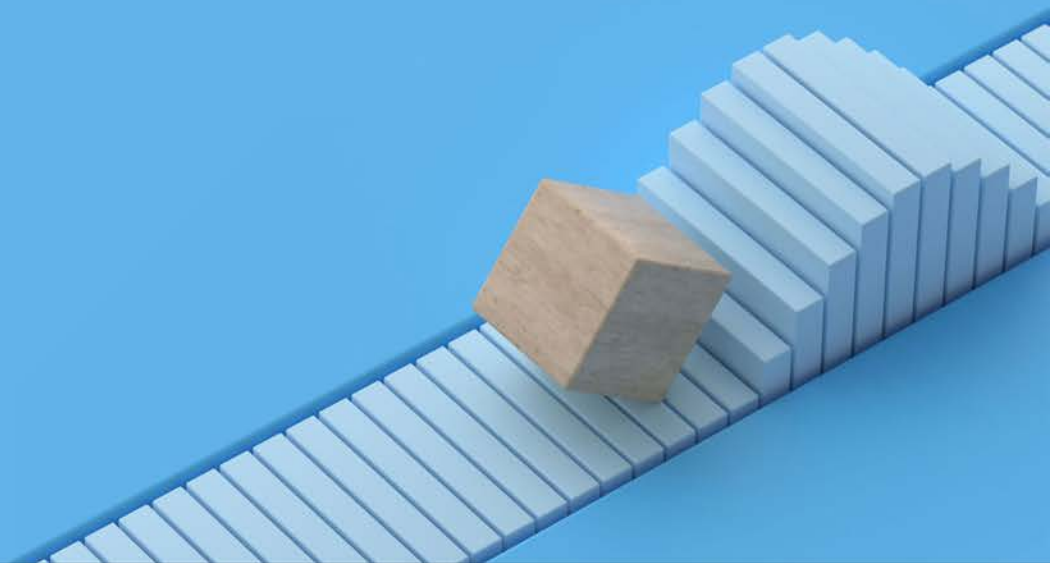
High-performance AI/ML training tier

High-performance compute and storage



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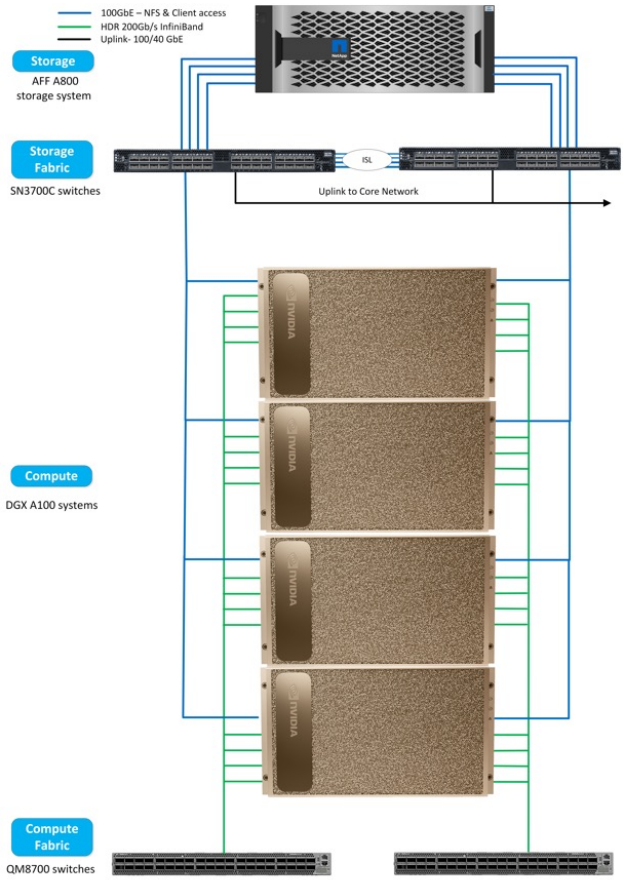
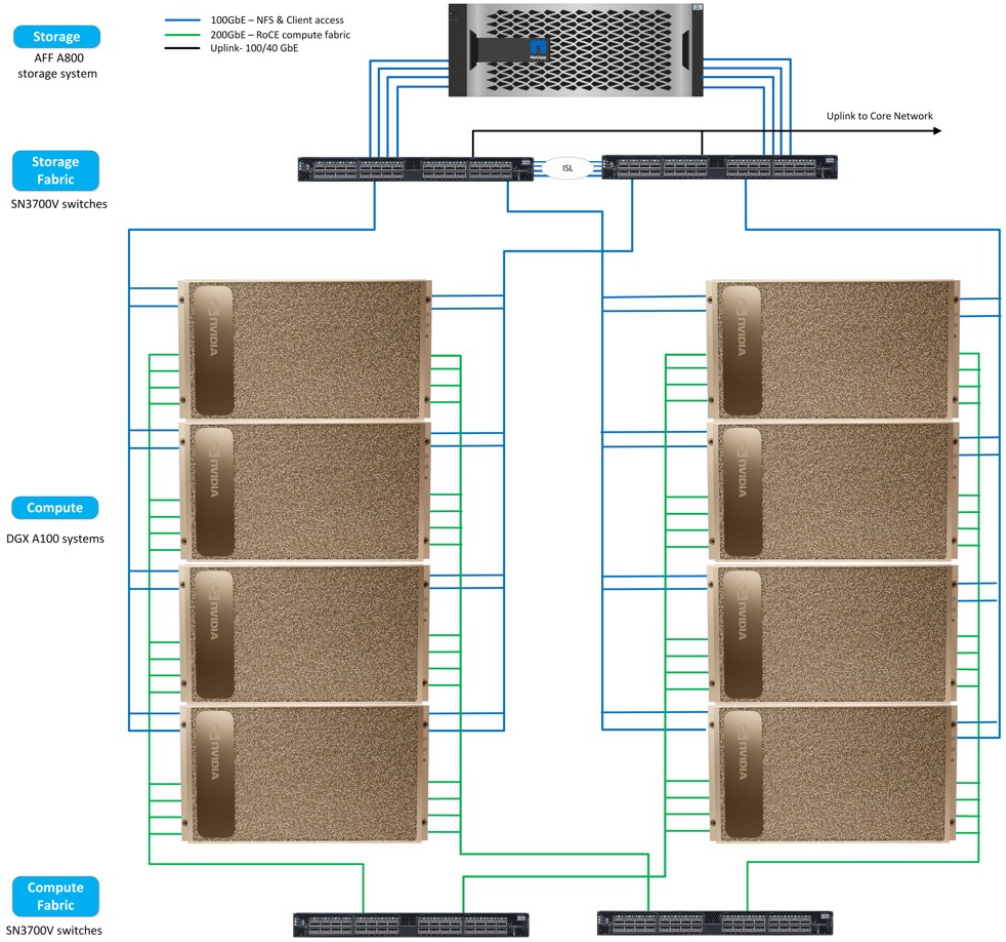
ONTAP AI Reference Architecture



InfiniBand Compute Fabric

Ethernet Compute Fabric



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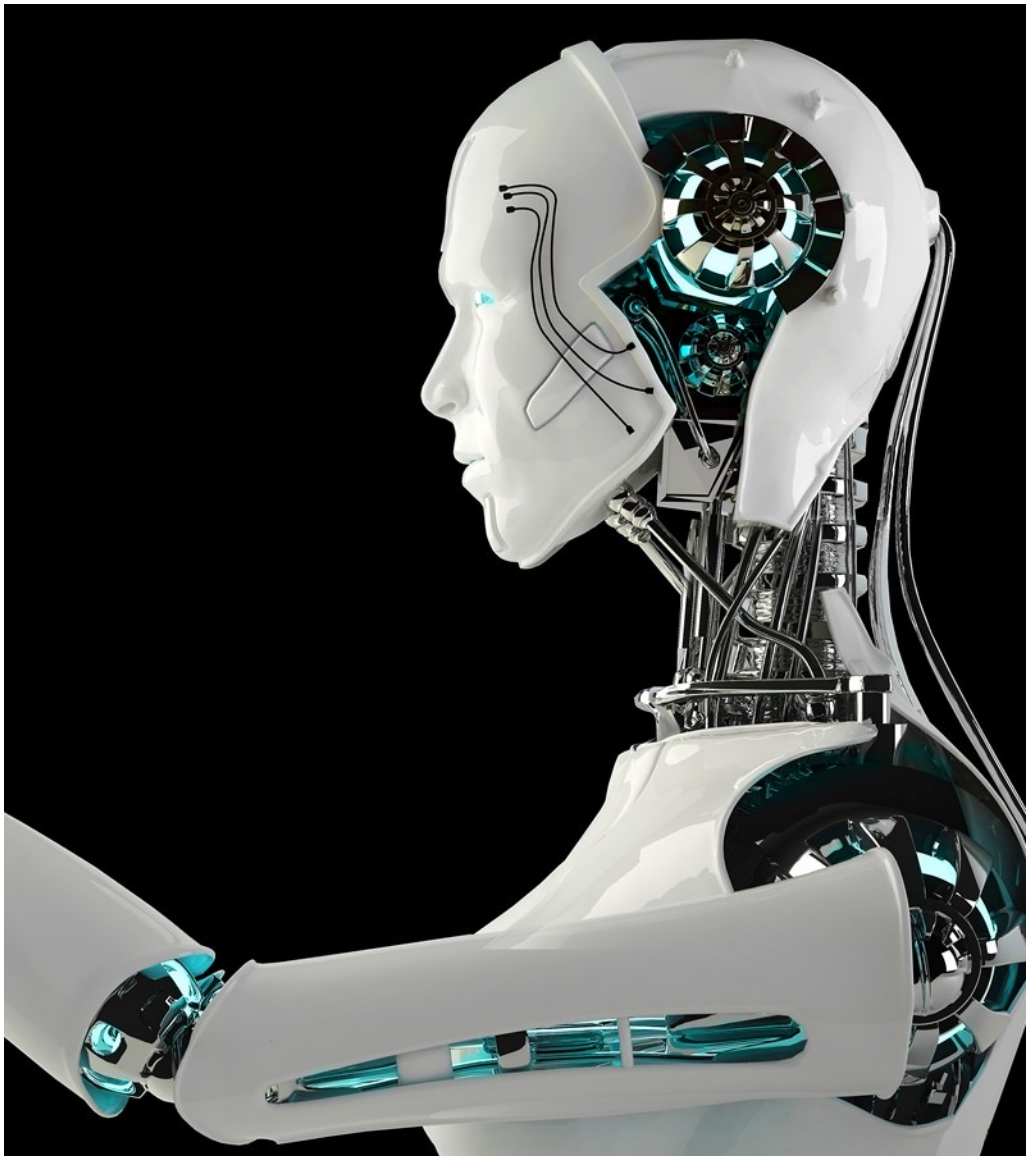
Top reasons to deploy NetApp ONTAP AI

Go faster, spend less, better results…

1) Simplify deployment of AI environments
2) Save up to 70% over cloud-based deployments
3) Solve data center power and cooling challenges
4) BYOT – Bring your own tools
5) 50% Faster than DIY AI



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NetApp ONTAP AI integrated solution

Preconfigured offering from NetApp and NVIDIA for optimal performance

Field proven AI
Simplify procurement, configuration, installation, and support with validated best practices.

+

Full configuration
Validated solution from NVIDIA and NetApp® configured and installed by Arrow

+

Effortless support
Complete solution supported by NVIDIA, backed by NetApp

Predefined, configured, delivered, installed, optimized, and supported

Available machine learning operations environment from Domino Data Lab

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Three available configurations, each with two capacity options

	Small		Medium		Large	
Compute	2-node NVIDIA DGX A100		4-node NVIDIA DGX A100		8-node NVIDIA DGX A100	
Storage	NetApp® AFF A400		NetApp AFF A700		NetApp AFF A800	
Capacity	65TB	131TB	131TB	263TB	263TB	526TB

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EF-Series with BeeGFS and DGX A100

4-Node Configuration

- Validated architecture with building blocks
- Simple to size, setup, and scale up & out
- Decouple compute & storage
- Maximize GPU utilization with GPUDirect Storage
- Support for the whole storage solution

DGX A100 Servers

8x A100 SXM2 GPUs –

55k CUDA cores, 3456 TensorCores – Up to 5 PFLOPs FP16

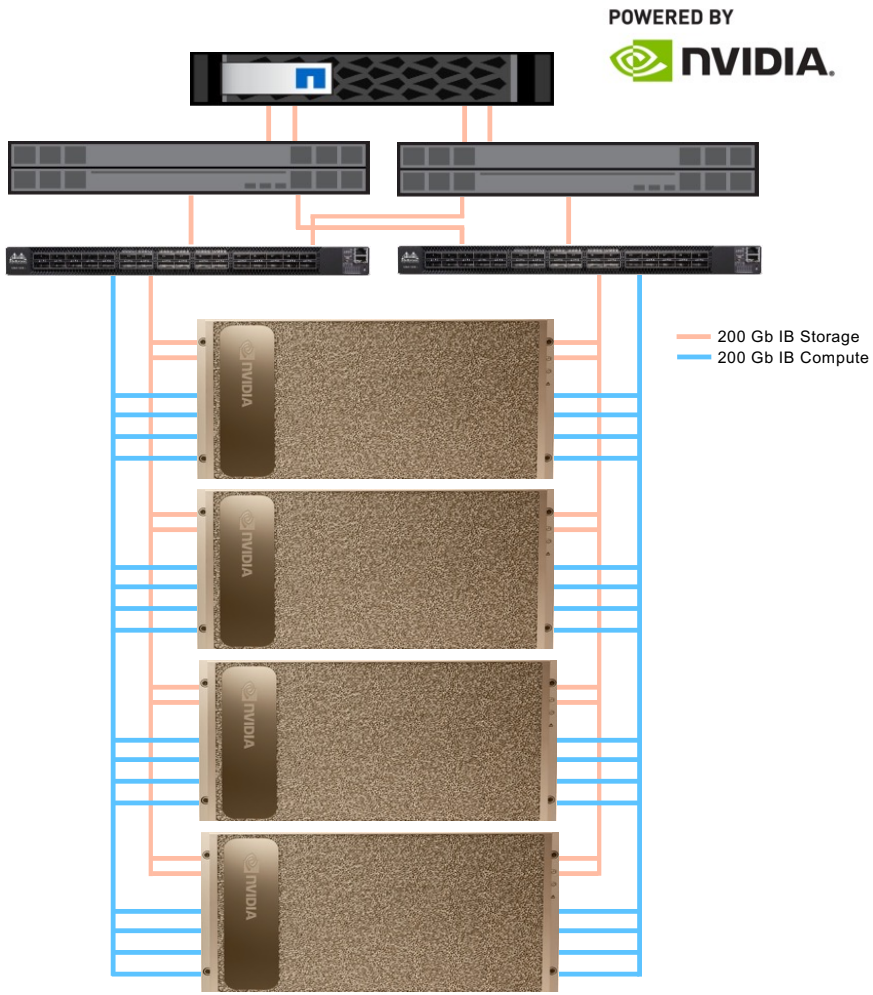
600GB/s NVLink

8x HDR IB ports, 2x 100Gb Eth ports

BeeGFS Building Block

1x HA Pair of x86 servers

2x EF600 200 Gb NVMe/IB, 24 NVMe SSDs



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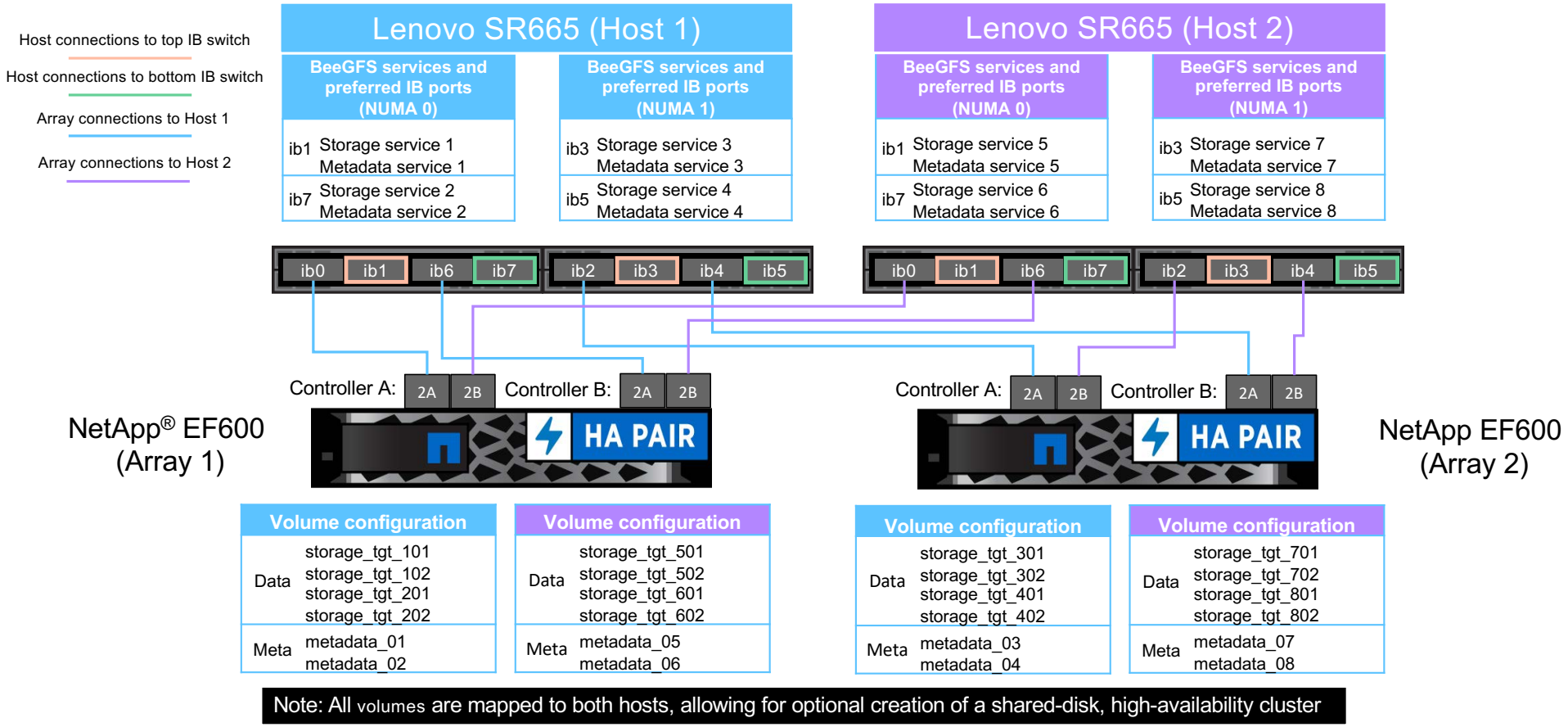
Gen2 Building-block Details

This configuration will be replicated for BeeGFS building block



Note: All volumes are mapped to both hosts, allowing for optional creation of a shared-disk, high-availability cluster

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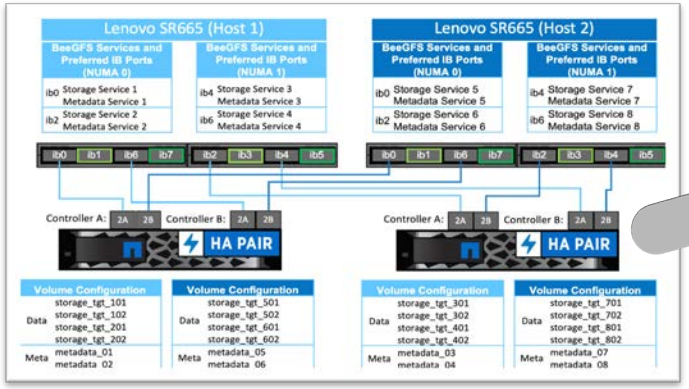
Storage at Massive Scale

NetApp BeeGFS solution with EF-Series

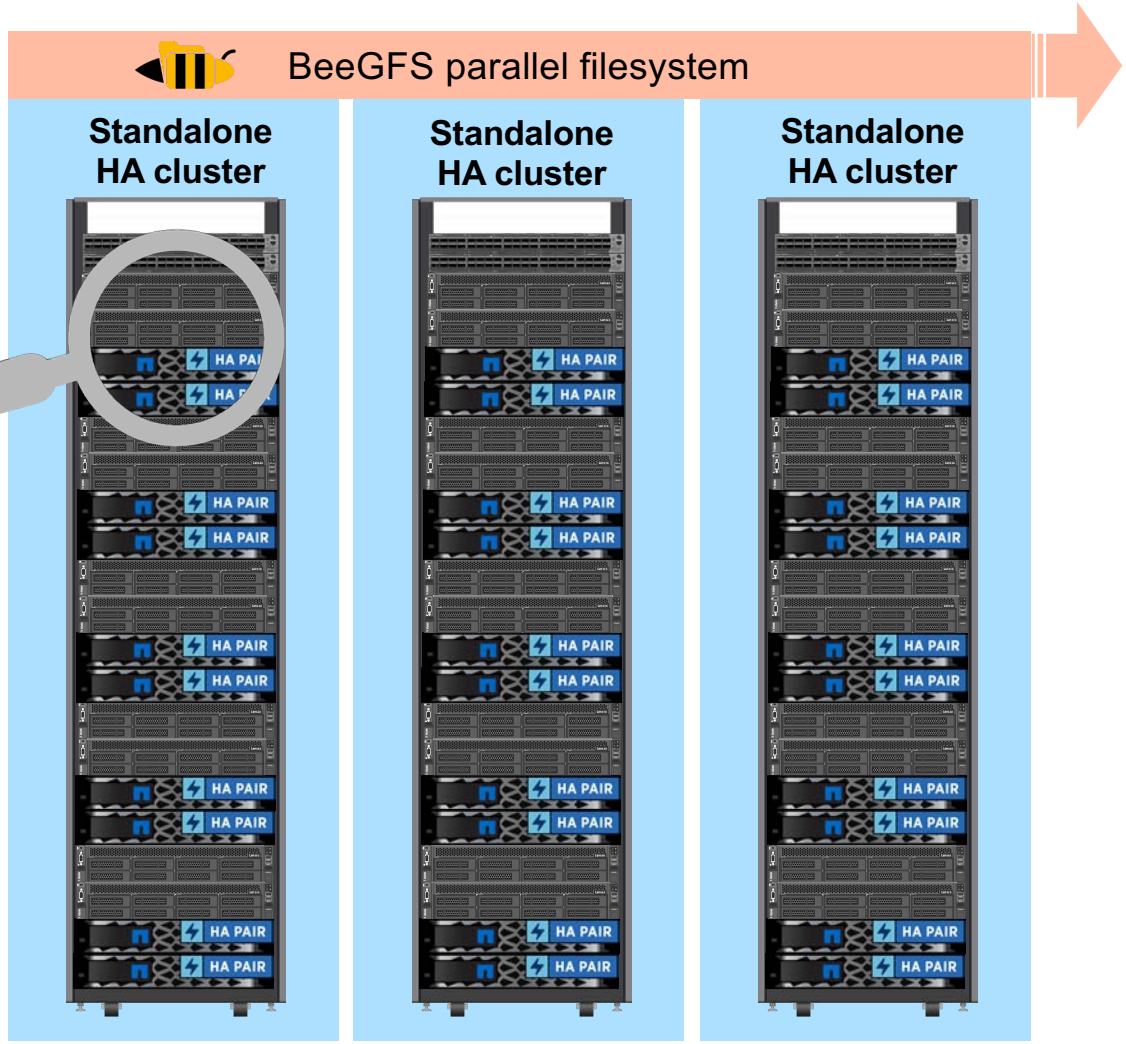


Ansible: To deploy/manage at scale

Grafana/BeeGFS Mon: For monitoring

Pacemaker/Corosync: For high availability

BeeGFS CSI driver: For cloud-native integration



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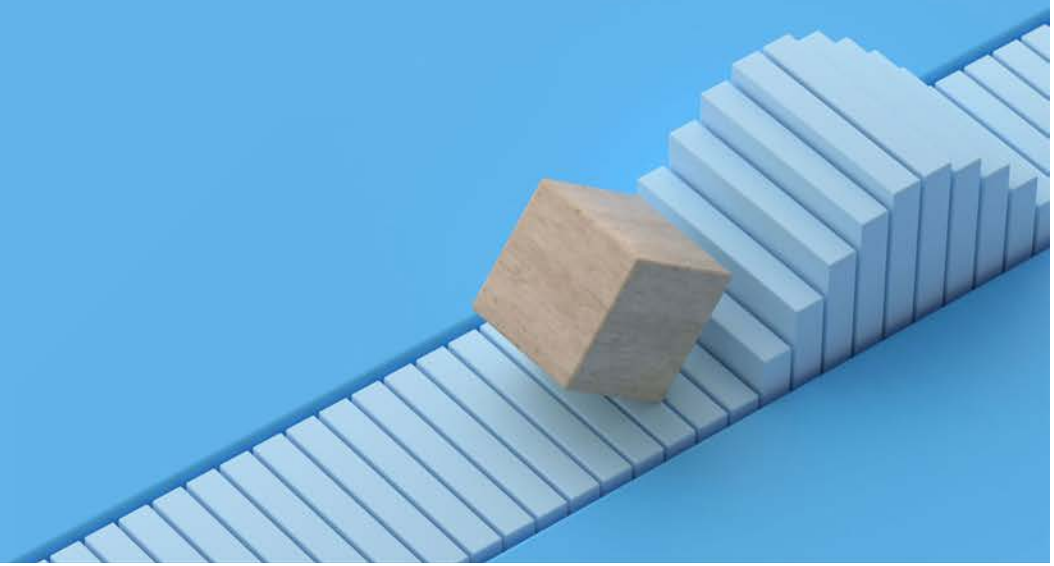
BaseCommand Platform

An Optimized AI Experience



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Saturn V….

How NVIDIA does AI

- NVIDIA's AI Platform-as-a-Service
- Built By NVIDIA for their AI teams
- Used by over 1200 NVIDIA researchers
- Over 5 years of design & optimization
- Predictable performance at scale
- Optimized environments and validated tools
- Retail, Medical, Genomics, Gaming…

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What is BaseCommand Platform?

A new partnership between NVIDIA and NetApp

AI Expertise from NVIDIA & NetApp
NVIDIA shares own their AI platform & practices

Your Pods, Our Teams & NVIDIA's managed datacenter
Controlled tenant and prebuilt data center power and cooling

Best of Breed AI Tools and Services
optimized tools for AI models, data management & inferencing

Business Results, Reporting and ROI
Maximize your researchers & lower costs

The leaders in AI will help you deploy the best AIOPS for your business

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BaseCommand Platform– simplicity, performance and value

Control your environment, know your costs and protect your assets

Faster & Easier than On-Prem

- Prebuilt Power and Cooling for AI environments
- Pre-specified configs accelerate “Time-to-Model”
- Expert deployment team saves time
- Pre-configured PaaS tools and curated tools
- Dedicated AI environment for your business
- Lower operating costs
- Constant performance optimization
- NetApp Data Fabric management services
- NetApp AI Control Plane

More Cost Effective than Cloud

- Go faster with NVIDIA PaaS and curated tools
- More efficient AIOPS with Multi-Instance GPUs
- Reduce licensing costs
- Eliminates the ”Stew of Services”
- Predictable Infrastructure costs for AI
- More predicable ROI
- No egress fees for storage
- Expert deployment team saves time
- NetApp Data Fabric and AI control plane optimization

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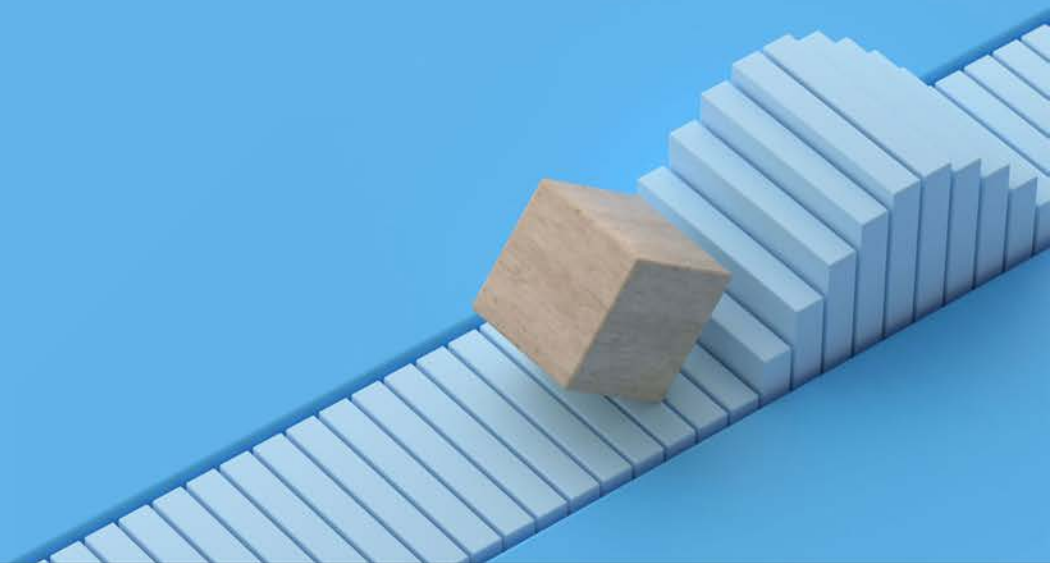
Object storage data lake

Flexibility and manageability



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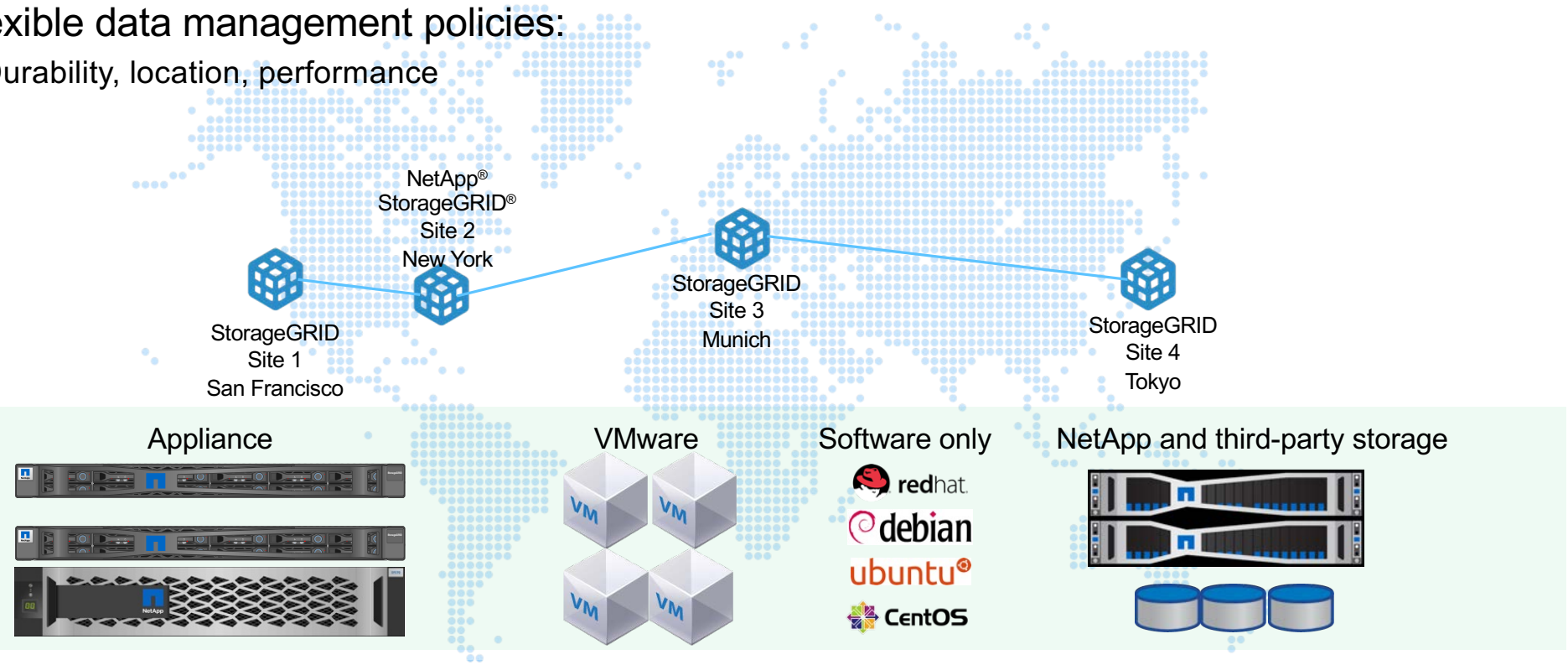
What Is NetApp StorageGRID?

Software-defined data management for unstructured data

- Flexible data management policies:
  - Durability, location, performance



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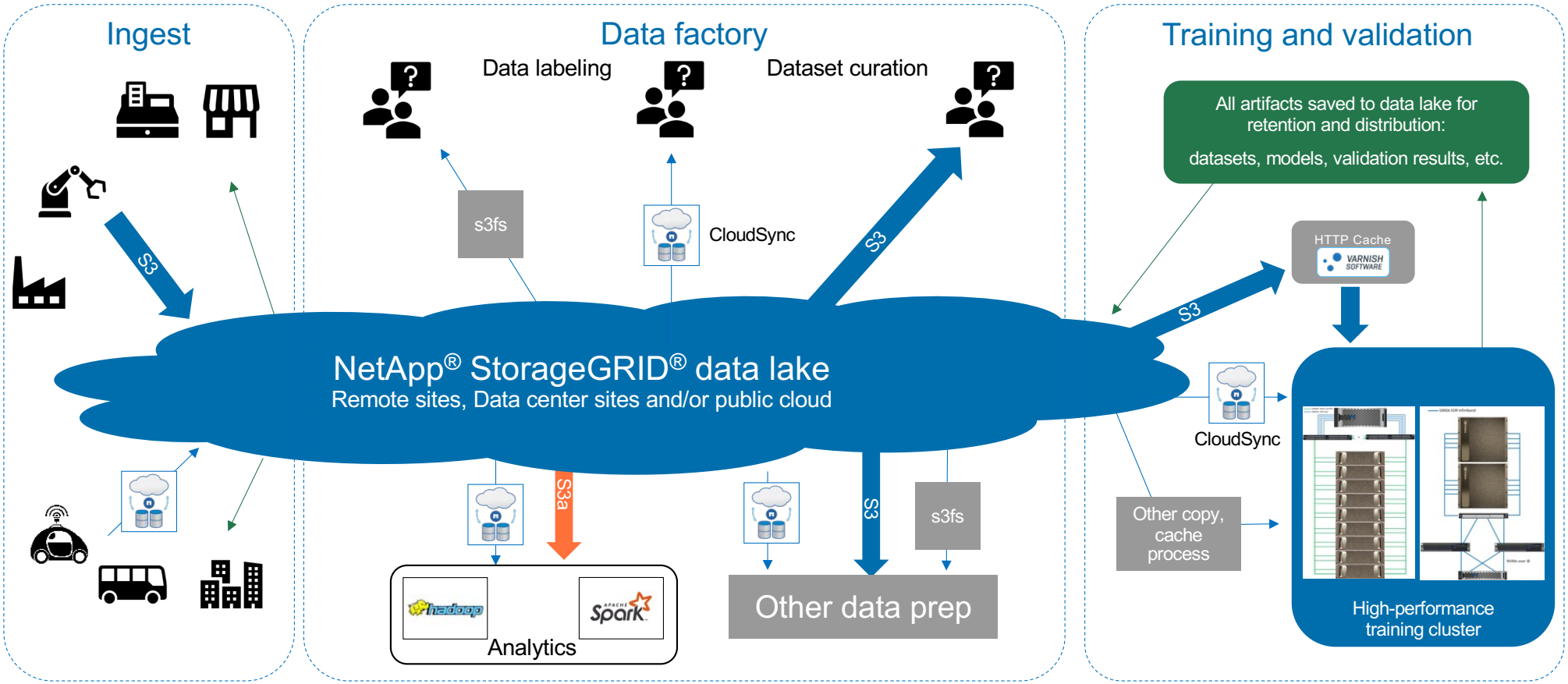
Many Workflows, Many Workloads



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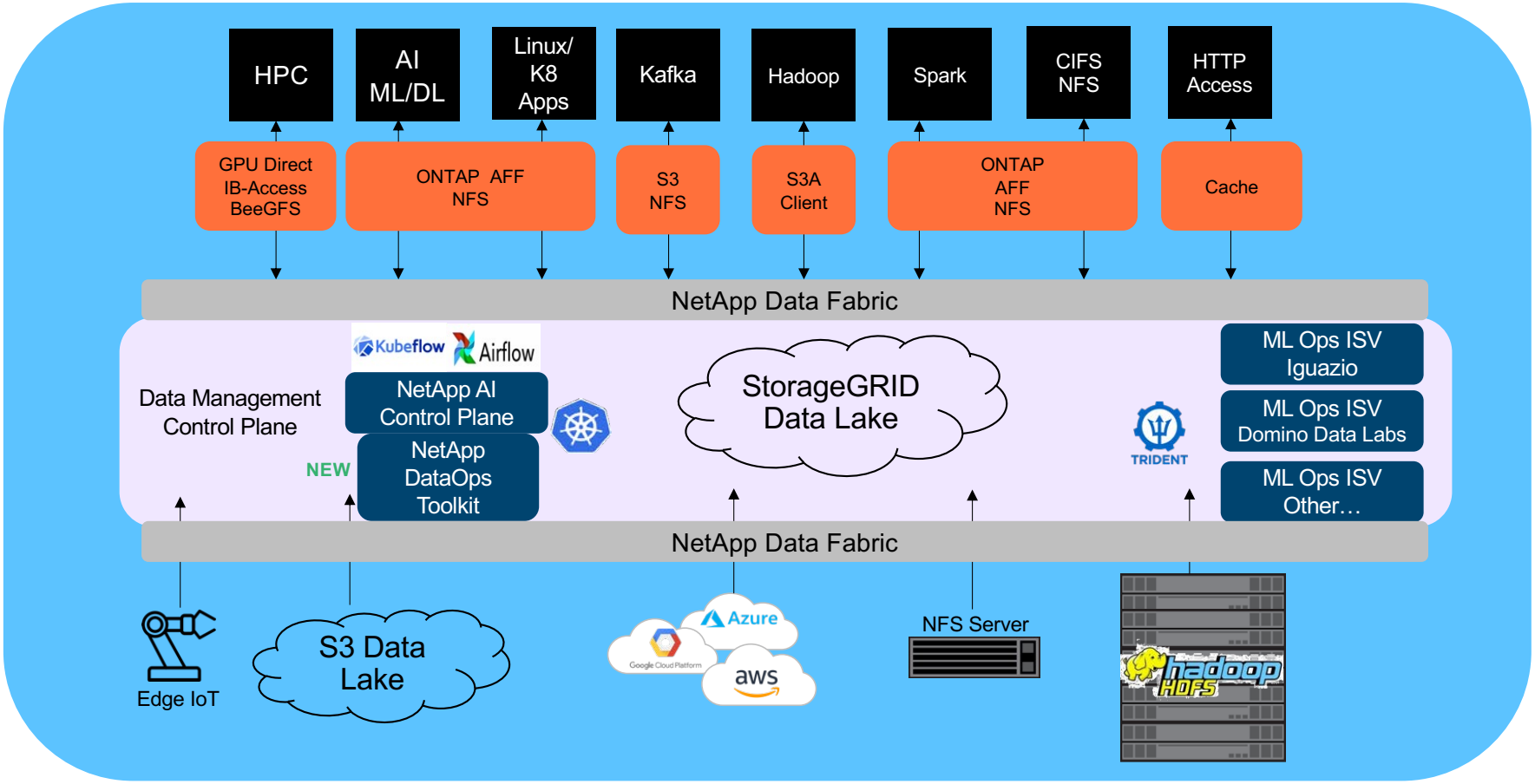
Data Modernization with NetApp Data Management Control Plane



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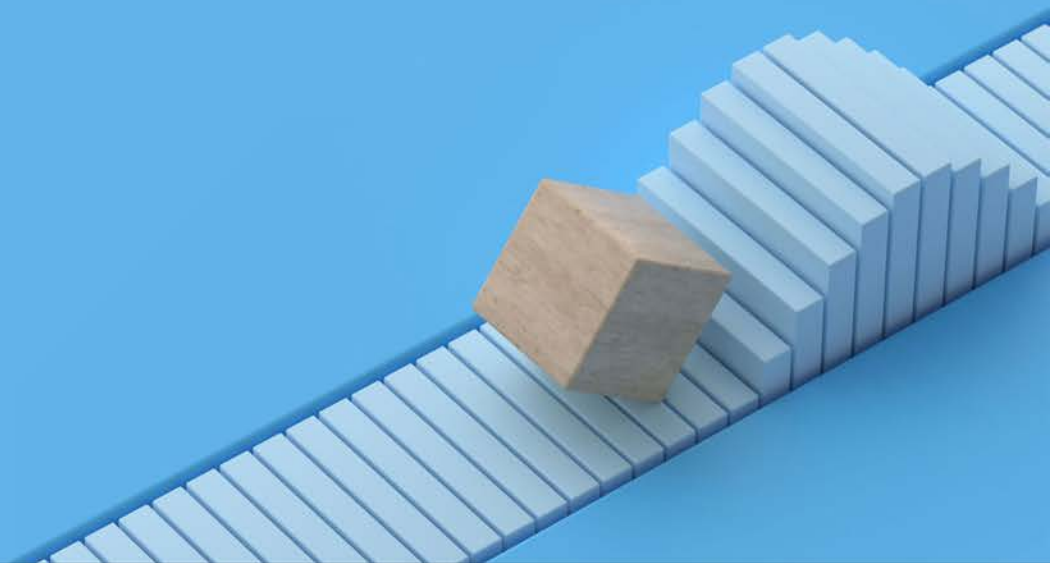
Moving the data

Build your data pipeline



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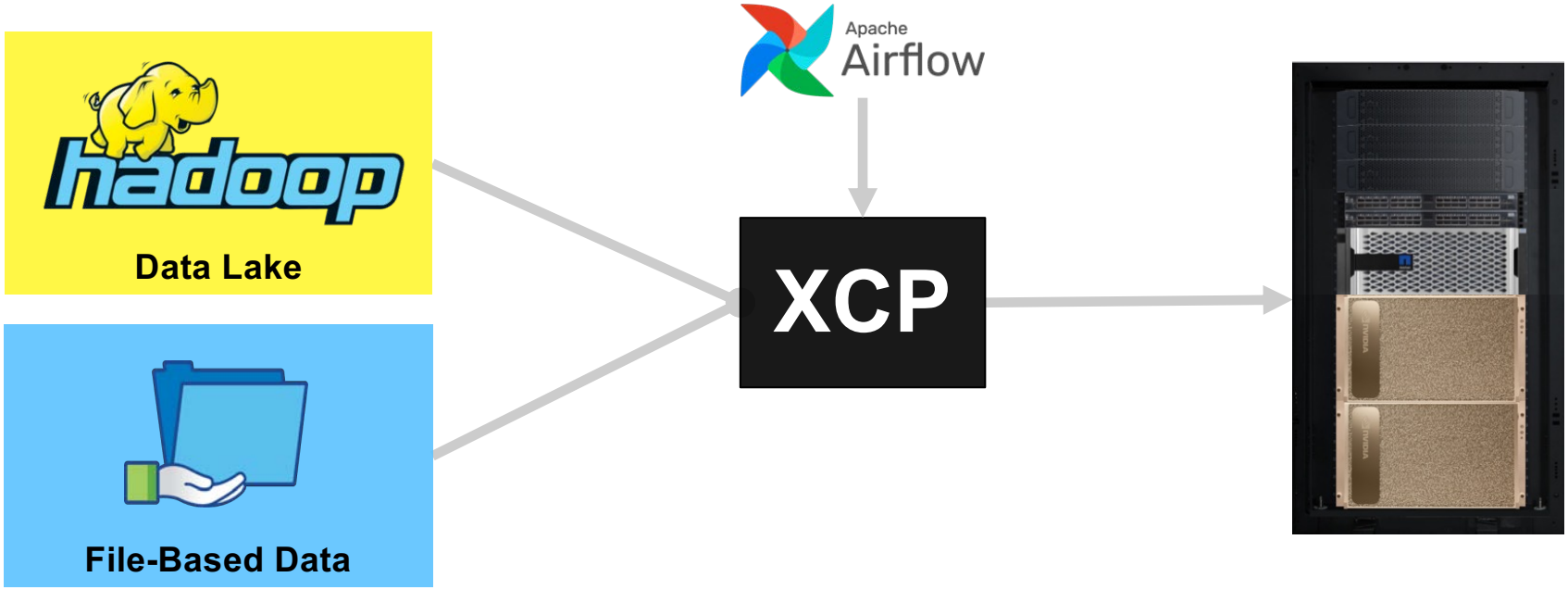
Ultra-high-performance Data Replication

NetApp XCP



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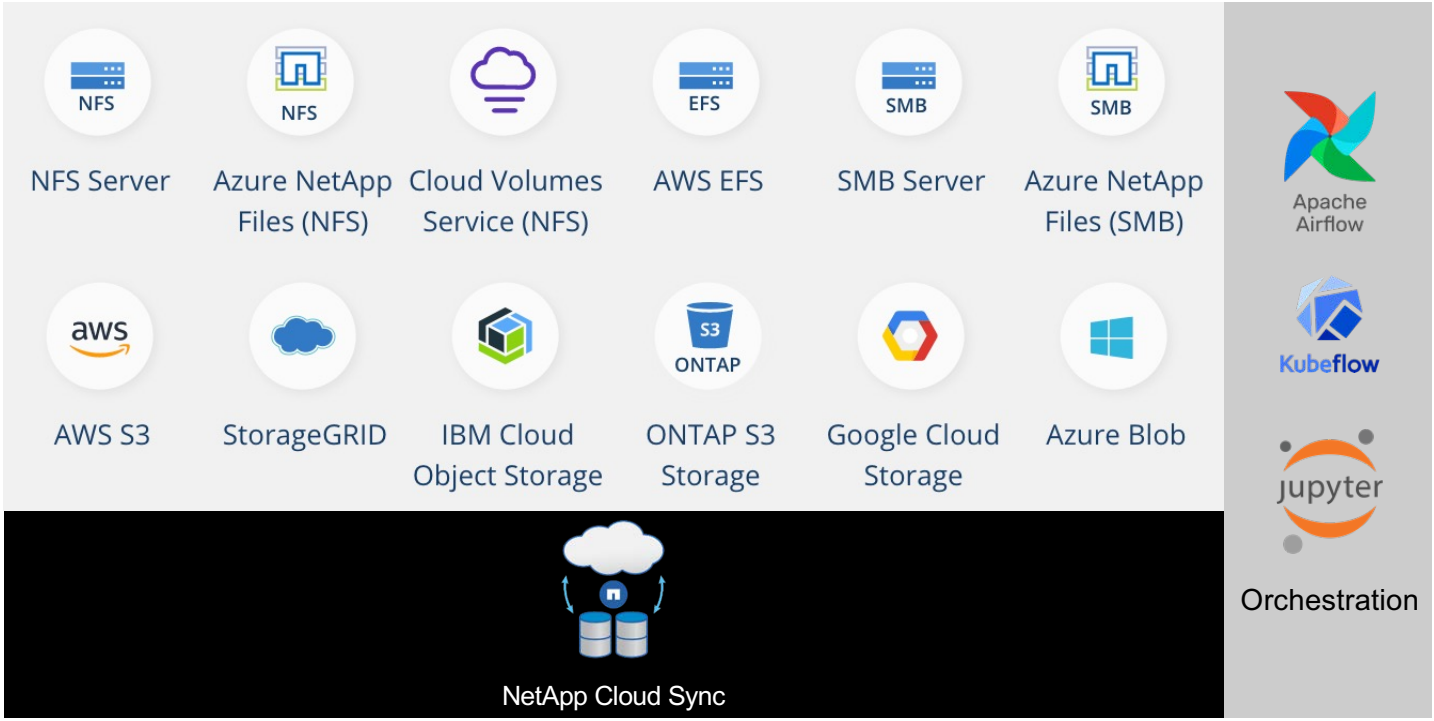
Unified Data Pipeline

Integrate heterogeneous data sources, centrally orchestrated



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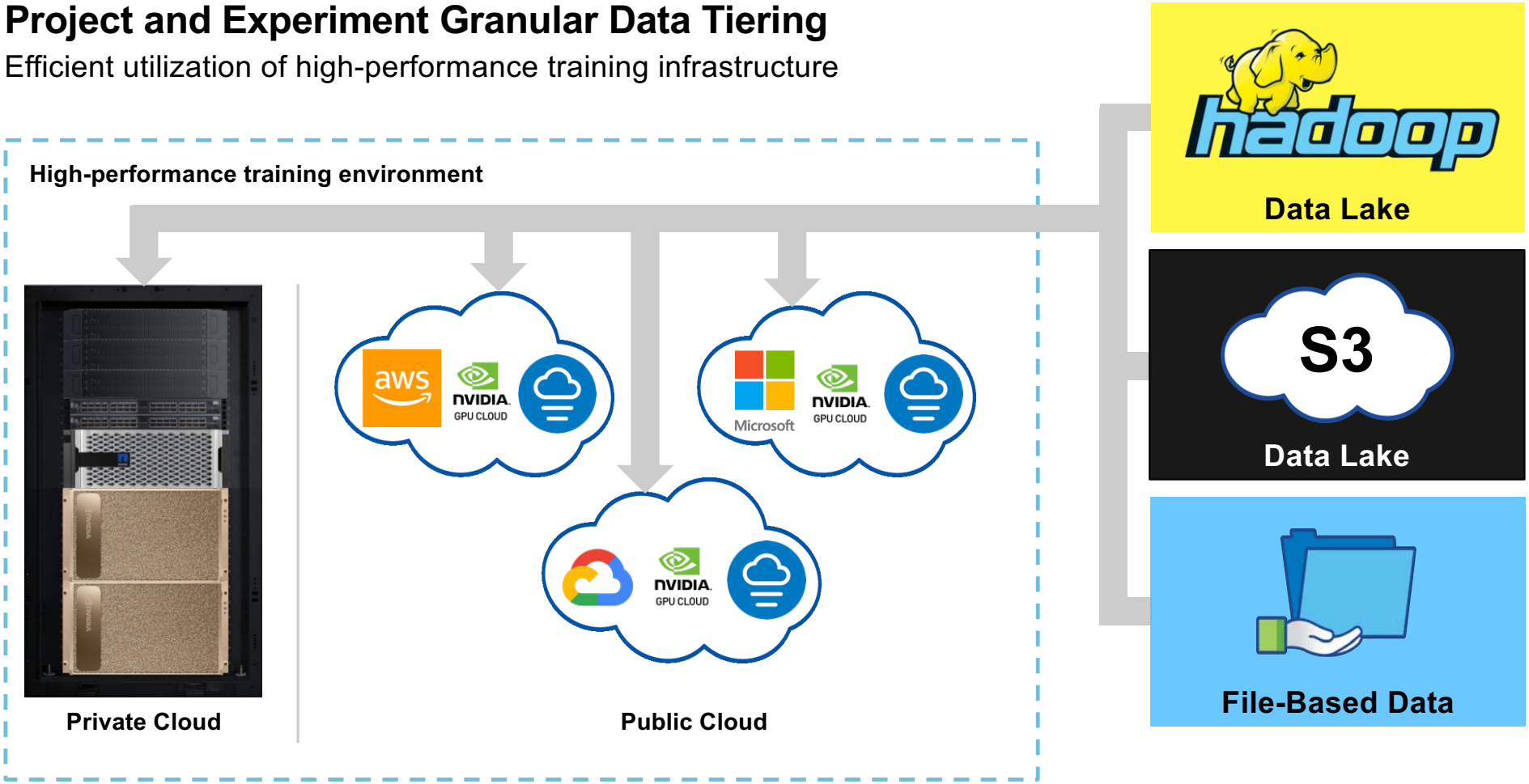
Project and Experiment Granular Data Tiering

Efficient utilization of high-performance training infrastructure



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NetApp DataOps Toolkit

Simplifying AI data management

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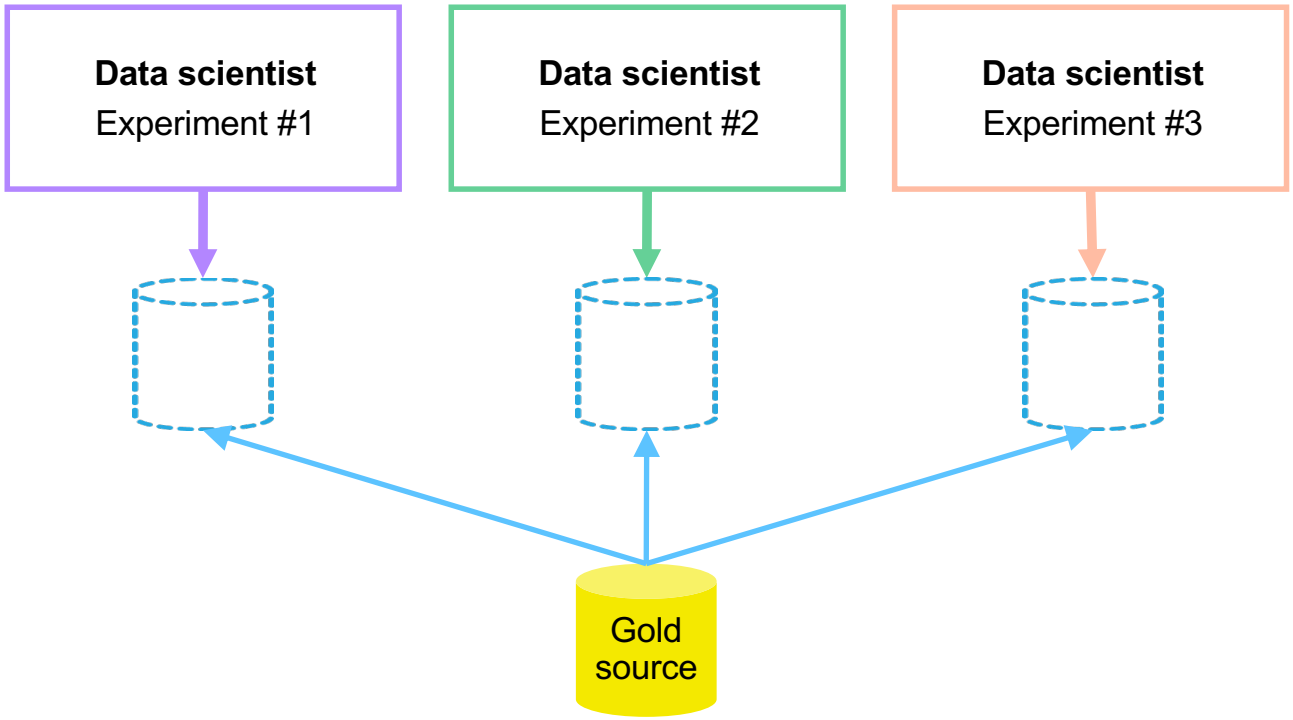
Training accurate models

Rapid experimentation is necessary



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2 seconds

vs. 17 hours

Accelerating the AI training workflow, efficiently

- Copying a dataset takes seconds instead of hours/days
  - Ex. 10 TB dataset – 2 seconds vs. up to 17 hours
- Copies are stored efficiently
  - Ex. 10 copies of each dataset – up to 90% reduction in storage space

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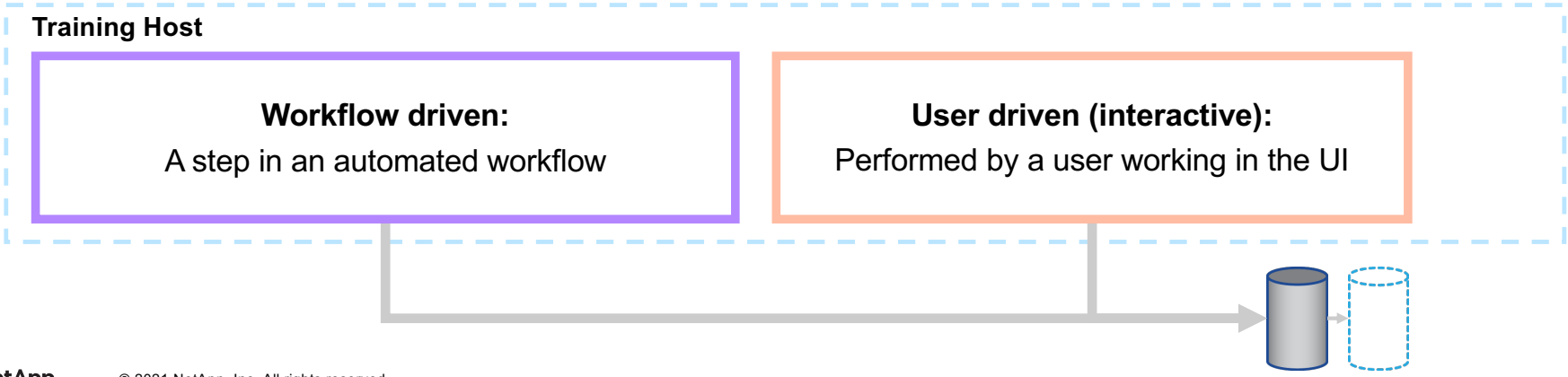
Explainable AI

Traceability is mandatory

- The challenge:
  - As AI moves into highly regulated/sensitive industries – dataset-to-model traceability and reproducibility is a ***mandatory requirement***
  - Traditional versioning tools (e.g. Git) are designed for code, not data
- The solution:
  - Utilize existing, proven tech: ***volume snapshots***–long and proven history of being used to ***quickly and efficiently version datasets***
  - Snapshot name can be saved in code or model repository to implement traceability



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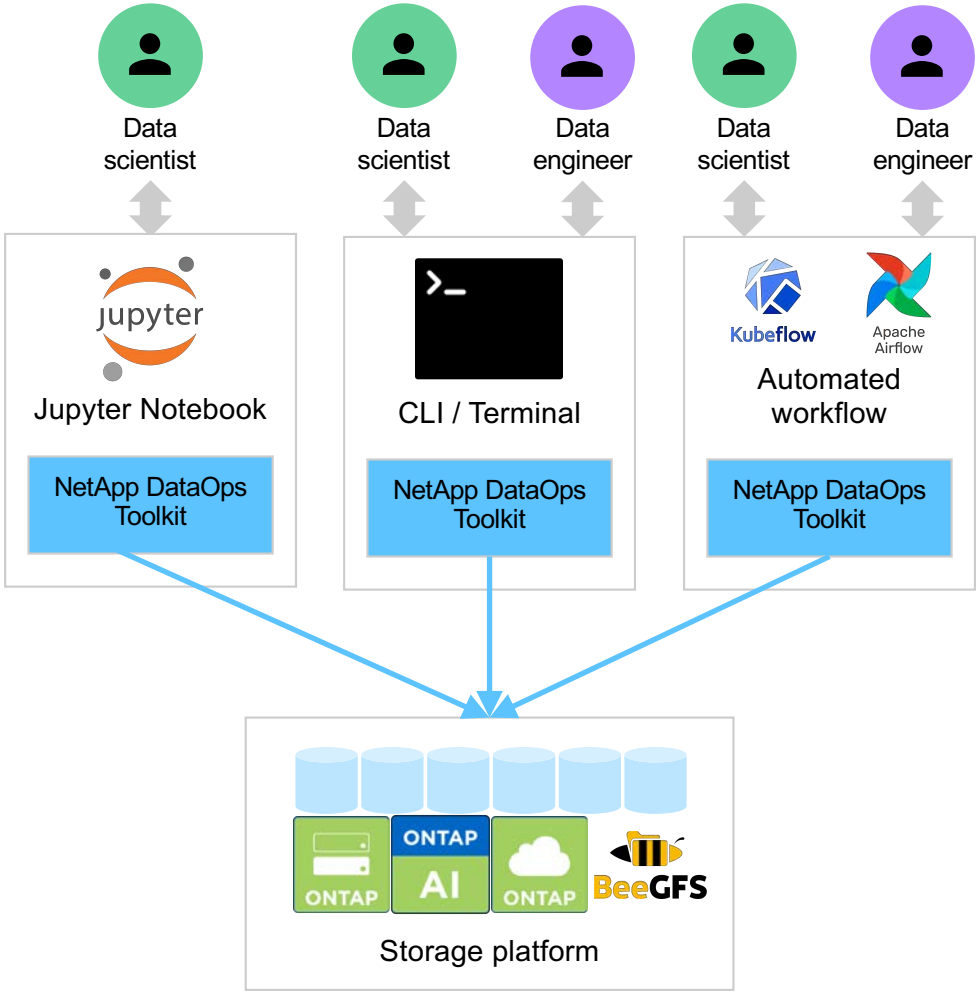
NetApp DataOps Toolkit

Simplifying AI data management

- NetApp's industry-leading, multitenant data management capabilities
  - Traditional toolkit: Supports ONTAP (AFF, FAS, Cloud, Select)
  - Kubernetes toolkit: Supports ONTAP (AFF, FAS, Cloud, Select), Azure NetApp Files (ANF), Cloud Volumes Service (CVS), and BeeGFS (limited)
- Simple, easy-to-use interfaces; designed for data scientists and data engineers
  - CLI utility
  - Importable library of Python functions
- Provides access to advanced features that would normally require help from storage admin
- Key capabilities
  - Rapidly provision a new data volume
  - Near-instantaneously clone a data volume
  - Snapshot a data volume for traceability/versioning
  - Trigger data sync



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NetApp DataOps Toolkit for Kubernetes

Manage workspaces, not data volumes

- Kubernetes-native version of toolkit…
  - Supports upstream Kubernetes and OpenShift
- Provision/clone/snapshot/delete JupyterLab workspaces
  - Use cases: Rapidly provision/clone/delete data scientist workspaces; rapidly snapshot data scientist workspaces for backup/traceability
- Provision/clone/snapshot/delete Kubernetes PVCs
  - Use cases: Rapidly provision/clone/delete Kubernetes-native persistent data volumes; rapidly snapshot Kubernetes-native persistent data volumes for backup/traceability

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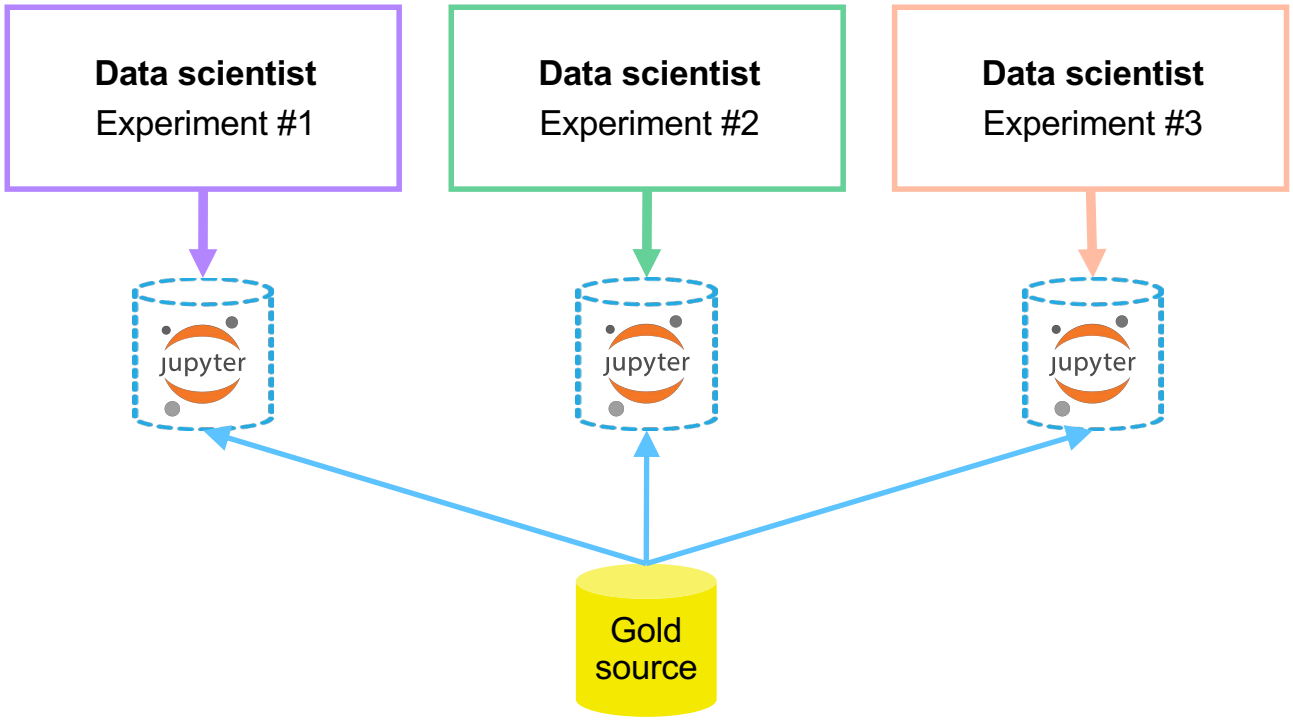
Driving rapid experimentation

Clone workspaces and data together



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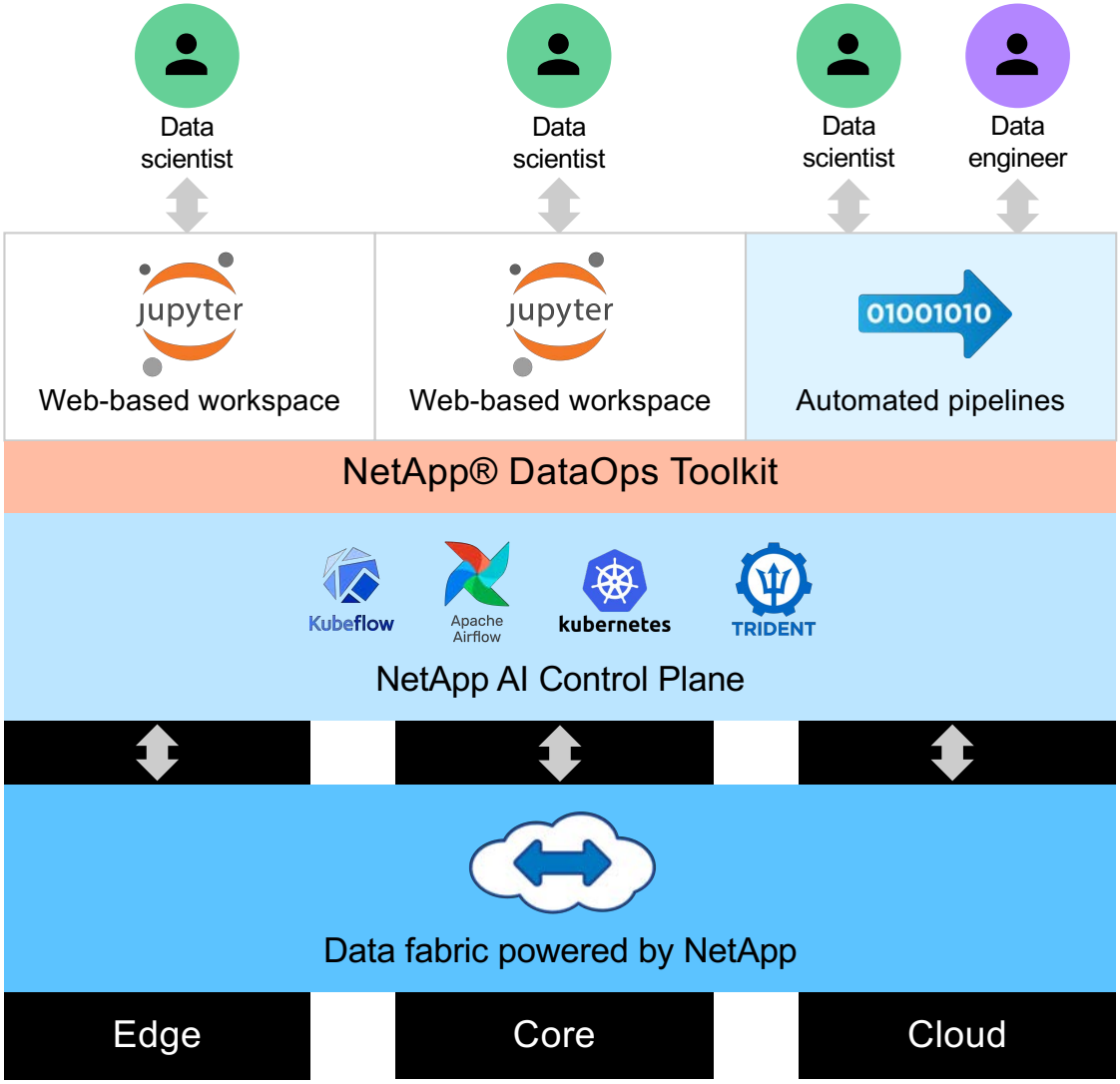
Use cases

Multiple deployment options

- Standalone AI data management solution for smaller teams
  - Easy-to-use, simple-to-manage
  - No MLOps or storage expertise required
- Use with NetApp AI Control Plane
  - Full-stack MLOps reference architecture built around popular open-source tools
  - Simplifies invoking of data management operations from within Jupyter notebooks, Kubeflow pipelines, and/or Apache Airflow workflows
- Use with other MLOps platforms
  - Incorporate advanced NetApp data management capabilities into any MLOps platform
  - For example: proprietary, custom, and homegrown MLOps platforms



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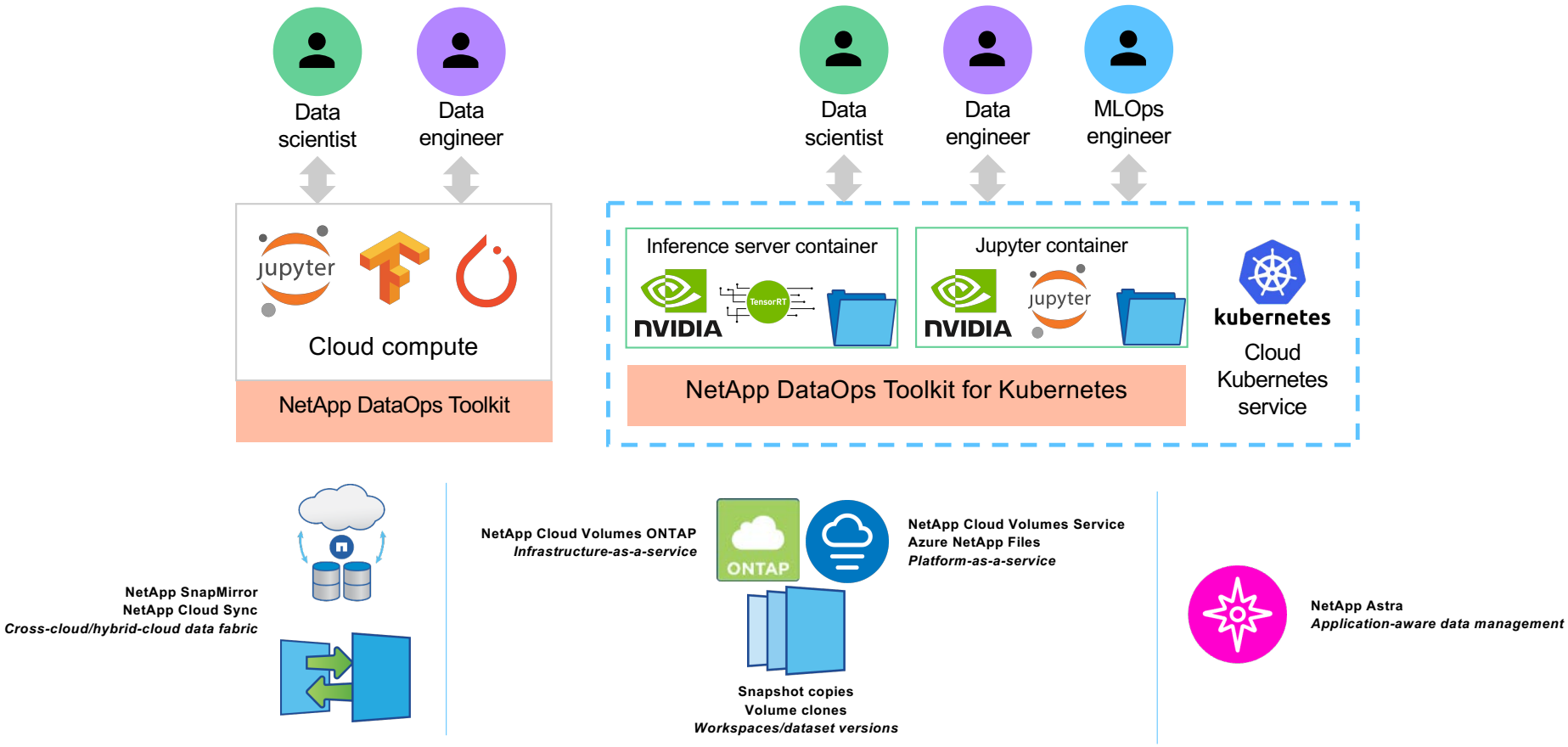
NetApp AI in the cloud

Cloud-based AI accelerated by the NetApp



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