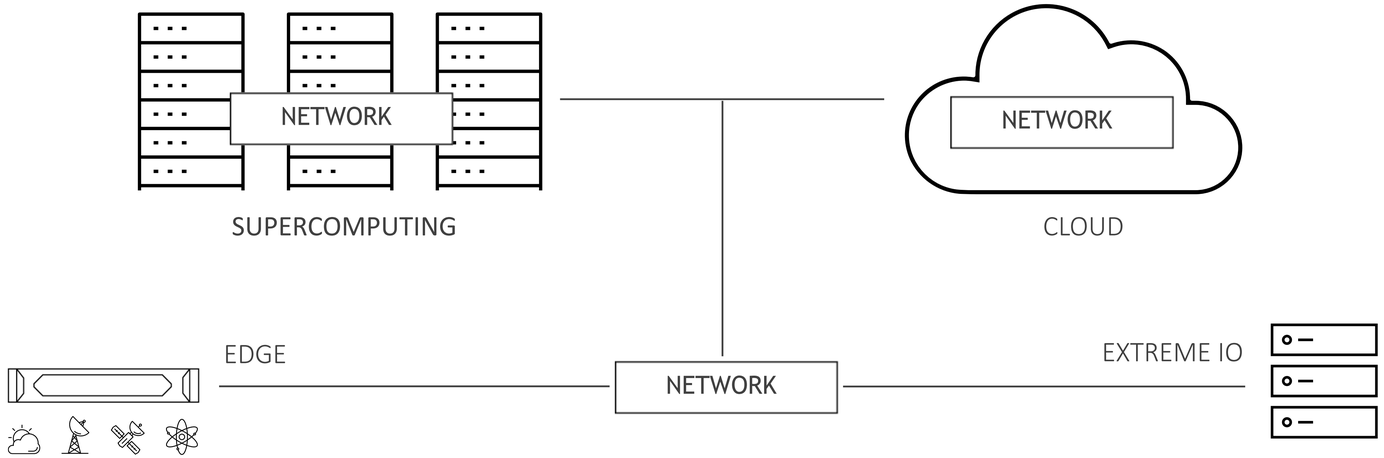
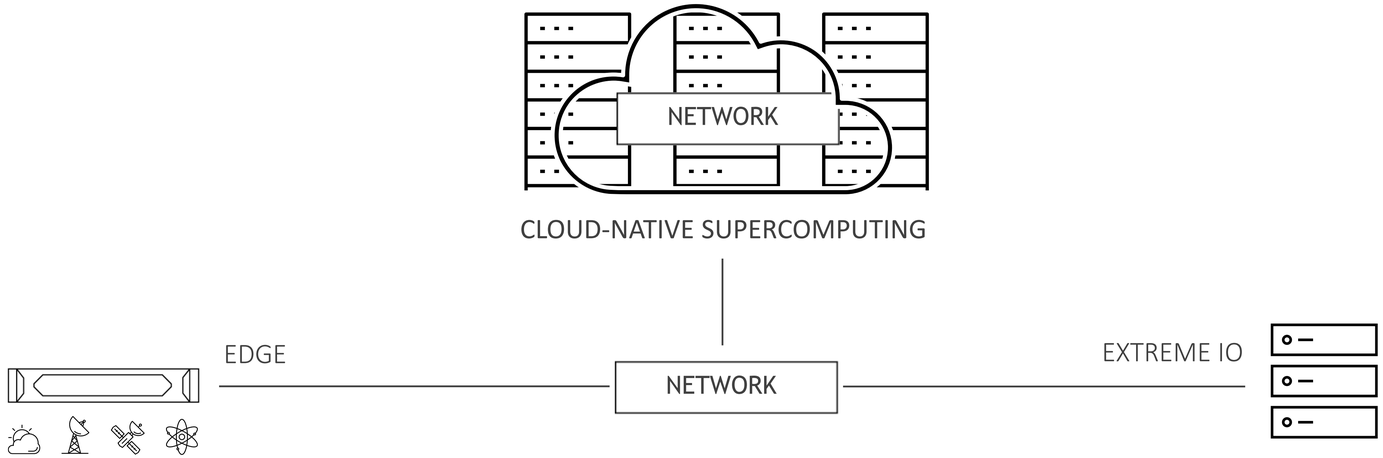
ACCELERATING SCIENTIFIC COMPUTING
NVIDIA QUANTUM INFINIBAND PLATFORM

NOVEMBER 2021

DIVERSITY OF APPLICATIONS REQUIRES ARCHITECTURAL FLEXIBILITY



DIVERSITY OF APPLICATIONS REQUIRES ARCHITECTURAL FLEXIBILITY



NVIDIA QUANTUM INFINIBAND INFRASTRUCTURE

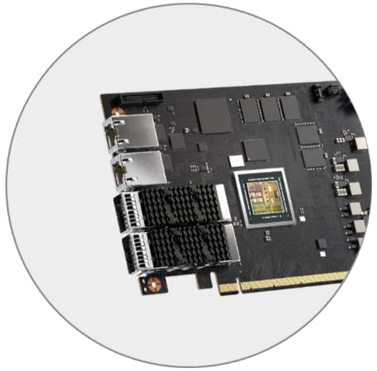
In-Network Computing Accelerated Network for Supercomputing

Metrox Long-haul

Skyway Gateway

UFM Cyber-AI

ConnectX Adapter



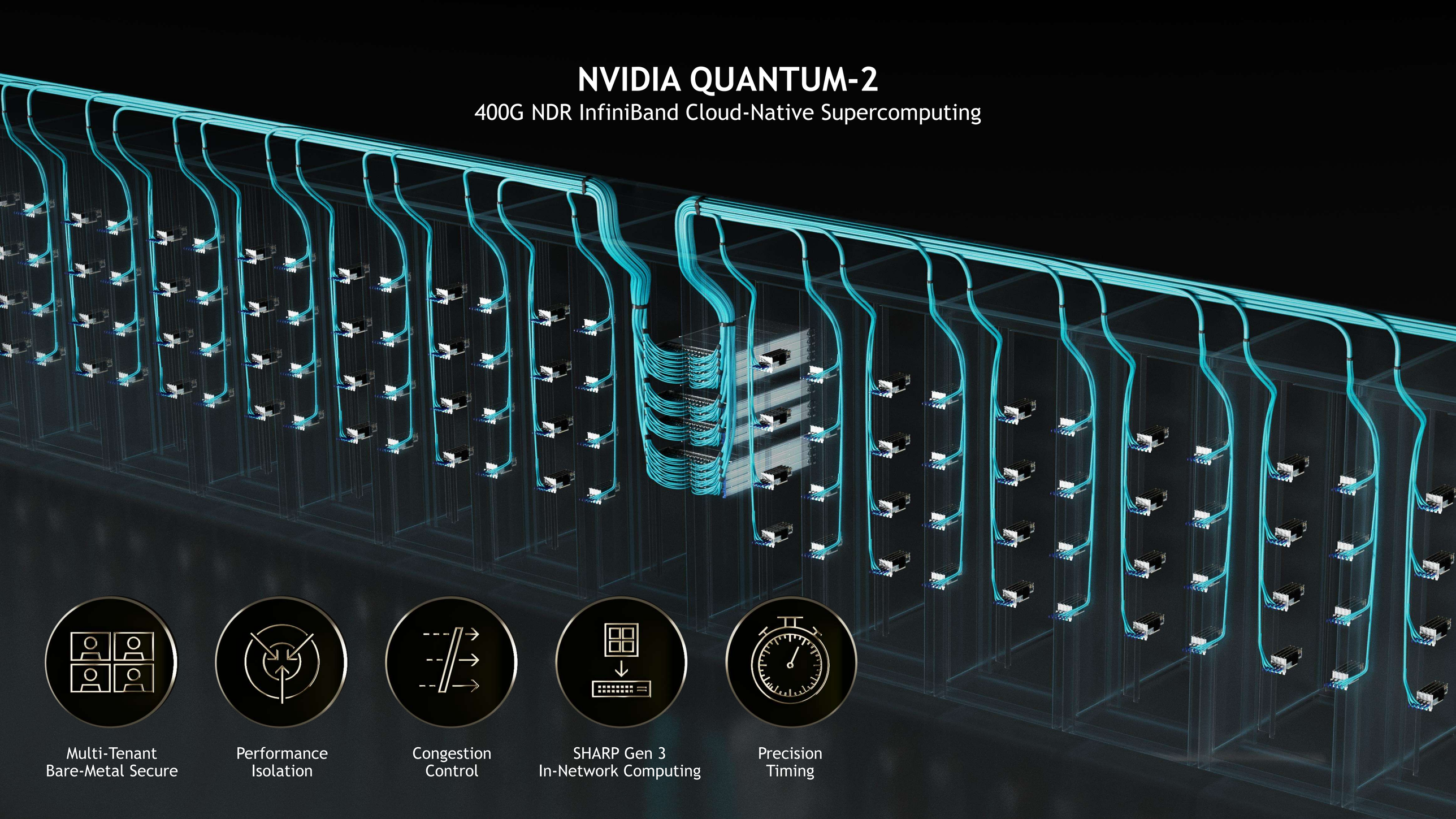
BlueField DPU

Quantum Switch

Linkx

NVIDIA QUANTUM-2

400G NDR InfiniBand Cloud-Native Supercomputing



Multi-Tenant
Bare-Metal Secure

Performance
Isolation

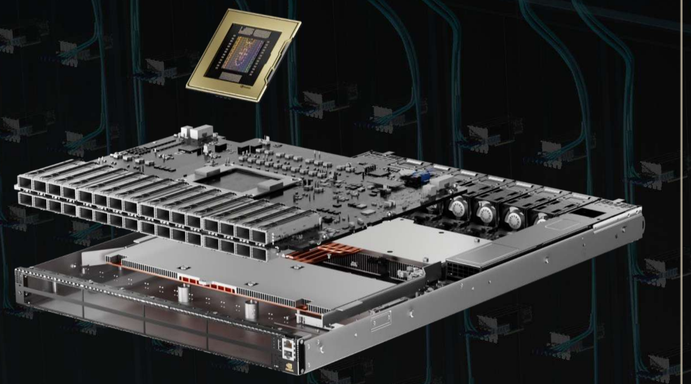
Congestion
Control

SHARP Gen 3
In-Network Computing

Precision
Timing

NVIDIA QUANTUM-2

400G NDR InfiniBand Cloud-Native Supercomputing



QUANTUM-2 SWITCH

Optimized Multi-Tenant In-Network Computing

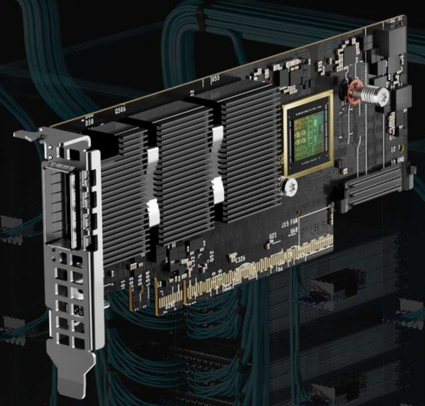
64-Ports of 400 Gbps or 128-Ports of 200 Gbps

3X Higher Switching Throughput

6.5X Higher Scalability >1M Nodes with DF+

32X More AI Acceleration Engines

Sampling Now



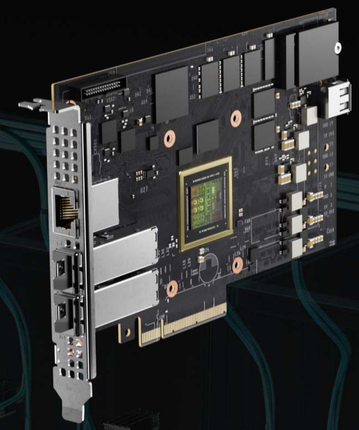
CONNECTX-7 INFINIBAND

400 Gbps Crypto Accelerations

4X In-Network Computing Performance

2X GPUDirect Throughput

Sampling Jan ‘22



BLUEFIELD-3 INFINIBAND

16 Arm 64-Bit Cores

16 Core / 256 Threads Datapath Accelerator

400 Gbps Crypto Accelerations

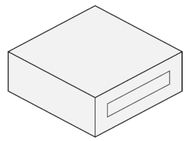
4X In-Network Computing Performance

2X GPUDirect Throughput

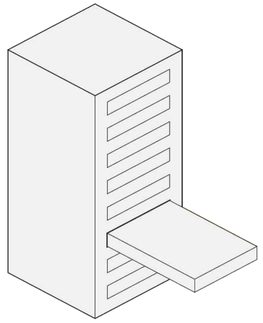
Sampling May ‘22

NVIDIA NDR 400G INFINIBAND SYSTEMS

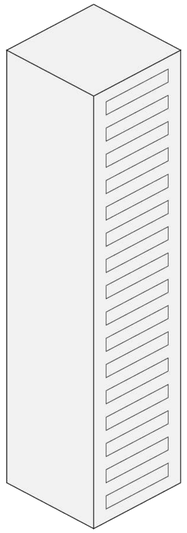
In-Network Computing Accelerates Cloud-Native Supercomputing at Any Scale



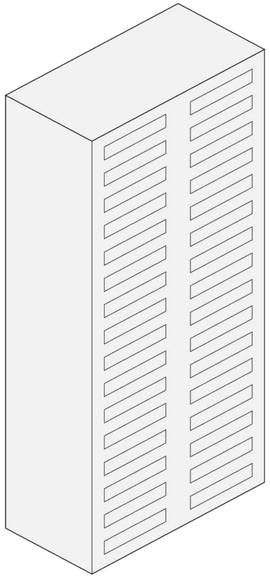
64 NDR Ports
128 NDR200 Ports



512 NDR Ports
1024 NDR200 Ports



1024 NDR Ports
2048 NDR200 Ports

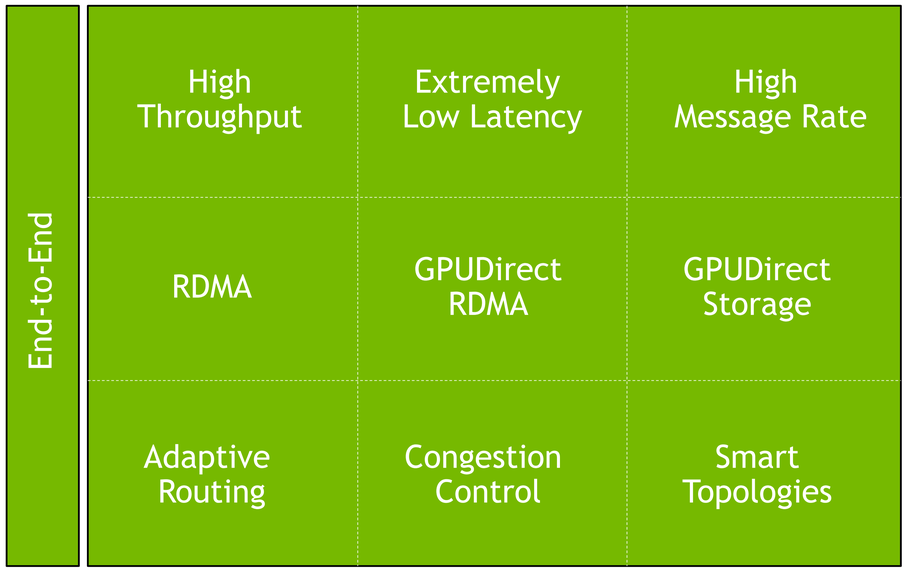


2048 NDR Ports
4096 NDR200 Ports

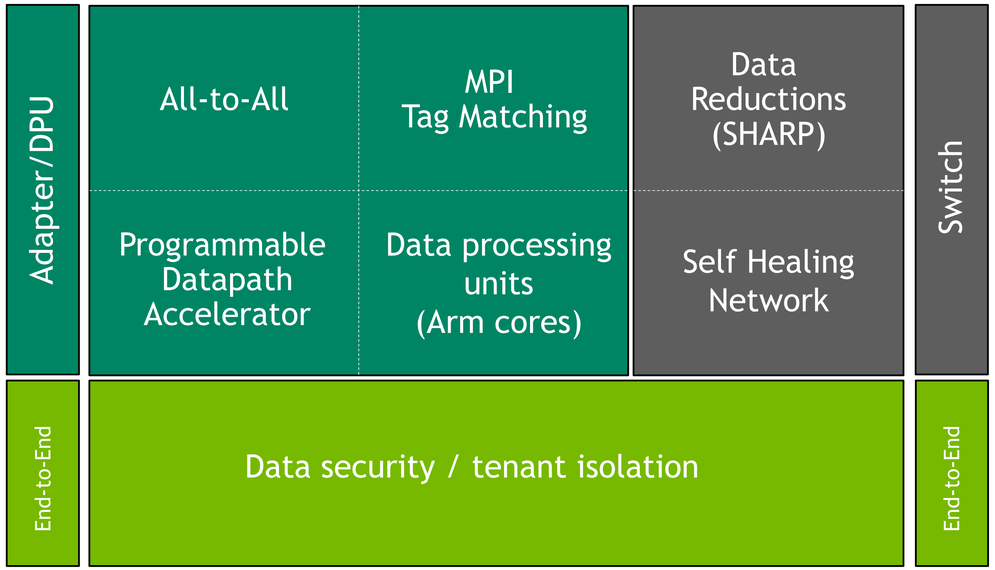
IN-NETWORK COMPUTING ACCELERATED SUPERCOMPUTING

Software-Defined, Hardware-Accelerated, InfiniBand Network

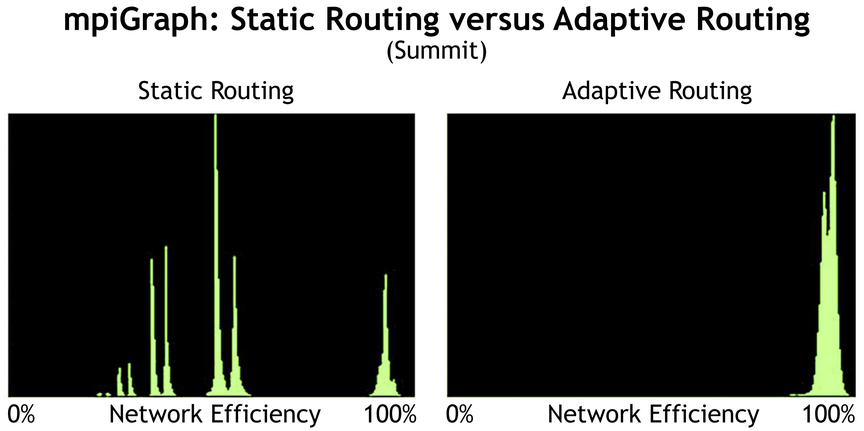
Most Advanced Networking

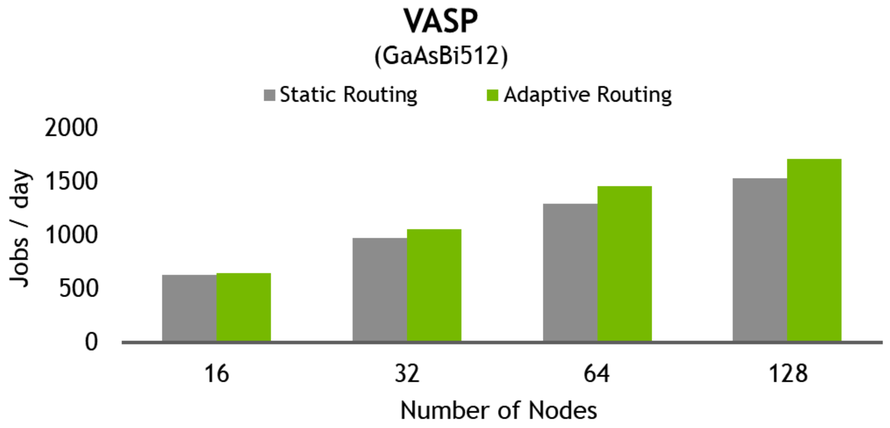


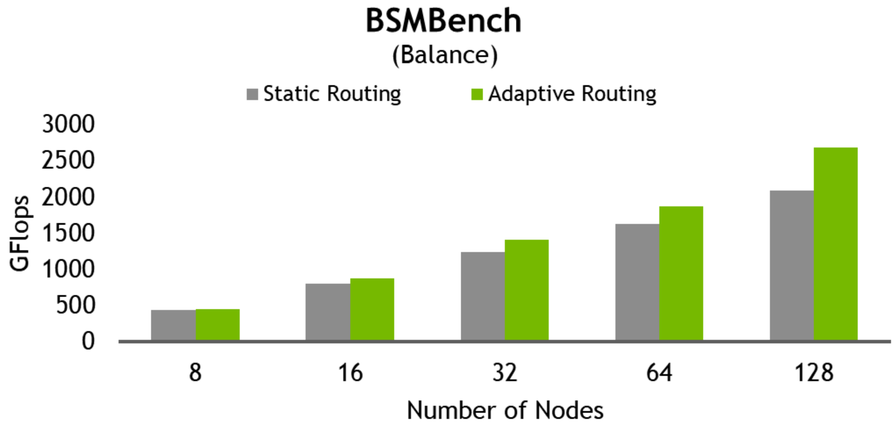
In-Network Computing



QUANTUM INFINIBAND ADAPTIVE ROUTING

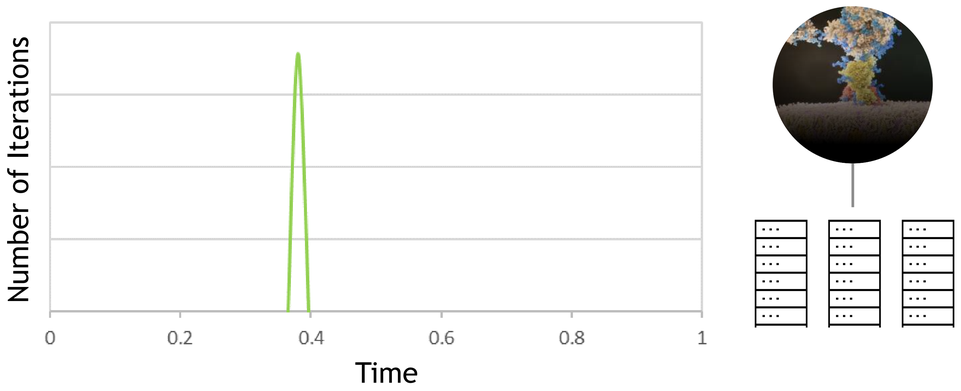






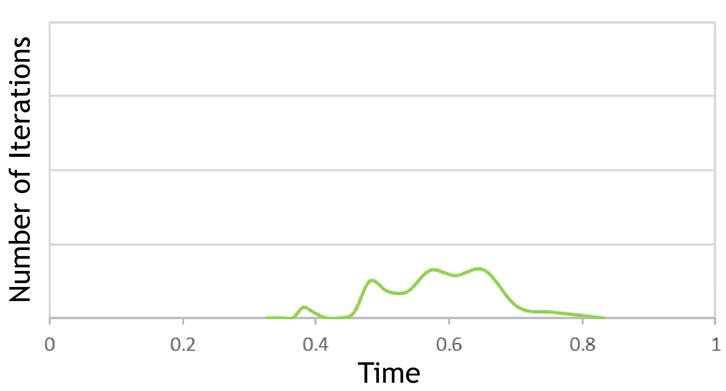
MULTI-TENANT SUPERCOMPUTING CLOUD — THE CHALLENGE

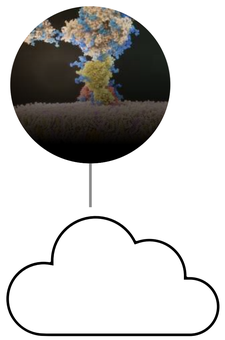
Molecular Dynamics (LAMMPS) Example



HPC ON SUPERCOMPUTING

Molecular Dynamics (LAMMPS)



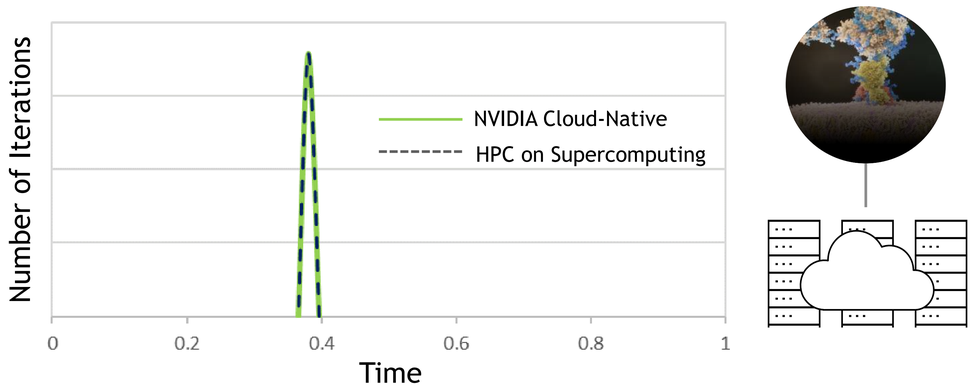


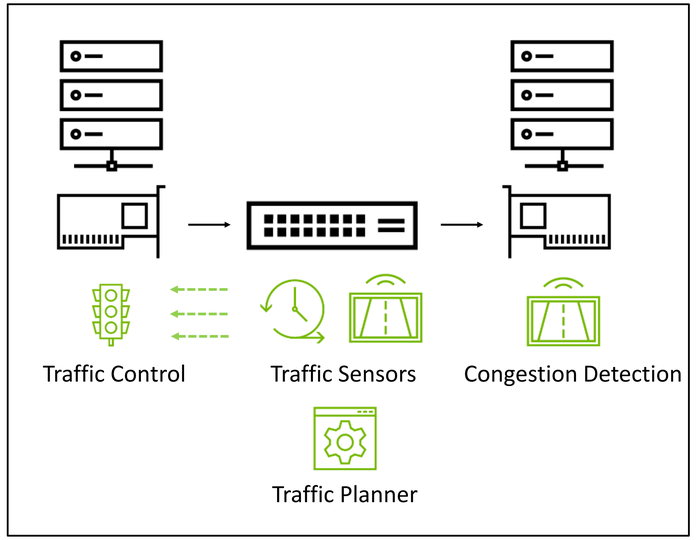
HPC ON THE CLOUD

Molecular Dynamics (LAMMPS)

CLOUD NATIVE SUPERCOMPUTING PLATFORM

Performance Isolations via Telemetry Based Congestion Control





HPC ON CLOUD-NATIVE SUPERCOMPUTING

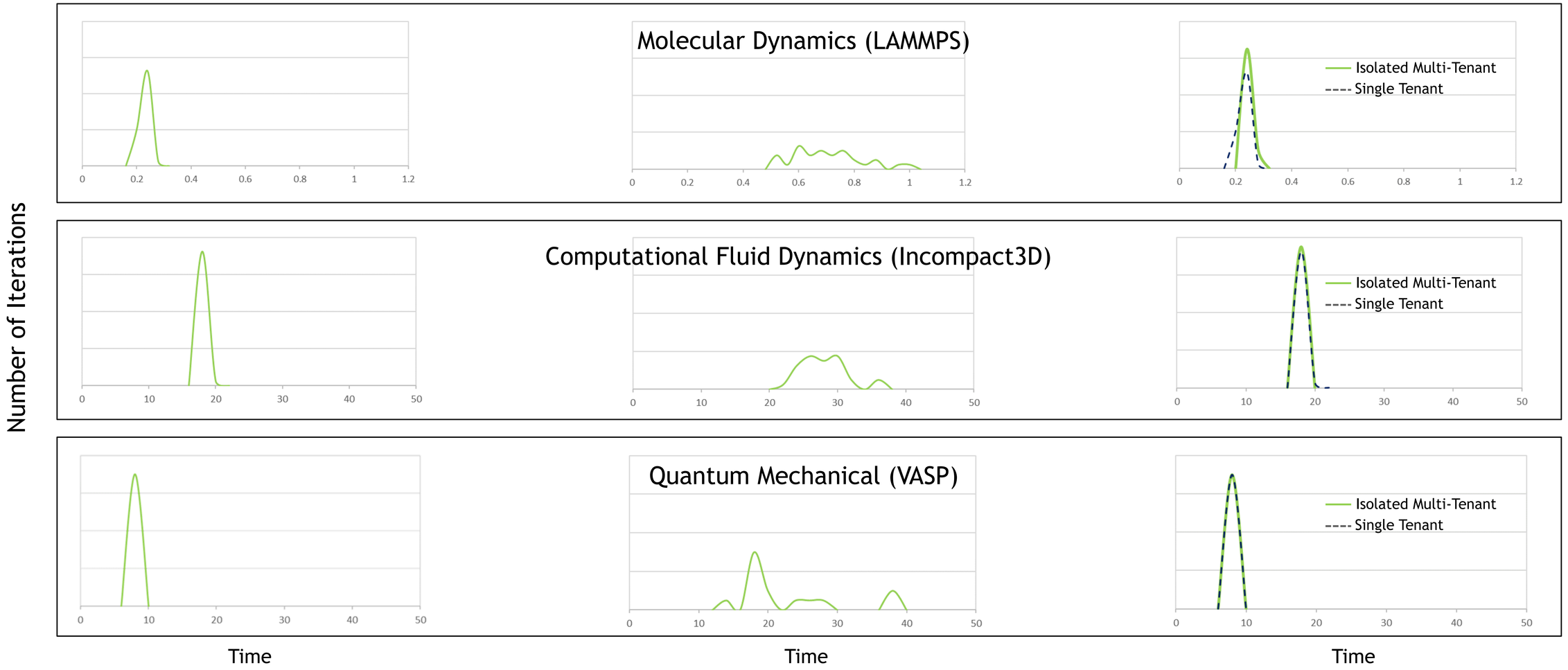
Molecular Dynamics (LAMMPS)

Proactive / Reactive

Telemetry Data
Time Sensors
Traffic Planners

PERFORMANCE ISOLATION – MICROSOFT AZURE

Quantum InfiniBand Congestion Control



IN-NETWORK COMPUTING ACCELERATED SUPERCOMPUTING

Software-Defined, Hardware-Accelerated, InfiniBand Network

In-Network Computing
Acceleration Engines

New generations Introduce and Enhance
Acceleration Technologies

NDR InfiniBand Includes SHARP v3
and All-to-all Engines

	Faster Data Communications	Higher Application Performance
Small Data Reduction SHARP v2	7x Faster All-Reduce	~15% higher Performance OpenFOAM, DL-POLY-4, Relion
Large Data Reduction SHARP v2	2.5x Faster All-Reduce	15% Faster Deep Learning Recommend. 17% Faster Natural Language Processing
MPI Tag Matching	1.8x Faster MPI Iscatterv 100% Overlapping	Up to 40% Higher Performance LAMMPS, Nekbone, 3D Stencil
All-to-All (Introduced with NDR 400G)	4x Higher Throughput	Coming Soon with NVIDIA NDR InfiniBand!

CLOUD-NATIVE SUPERCOMPUTING

Bare-metal Secured Infrastructure

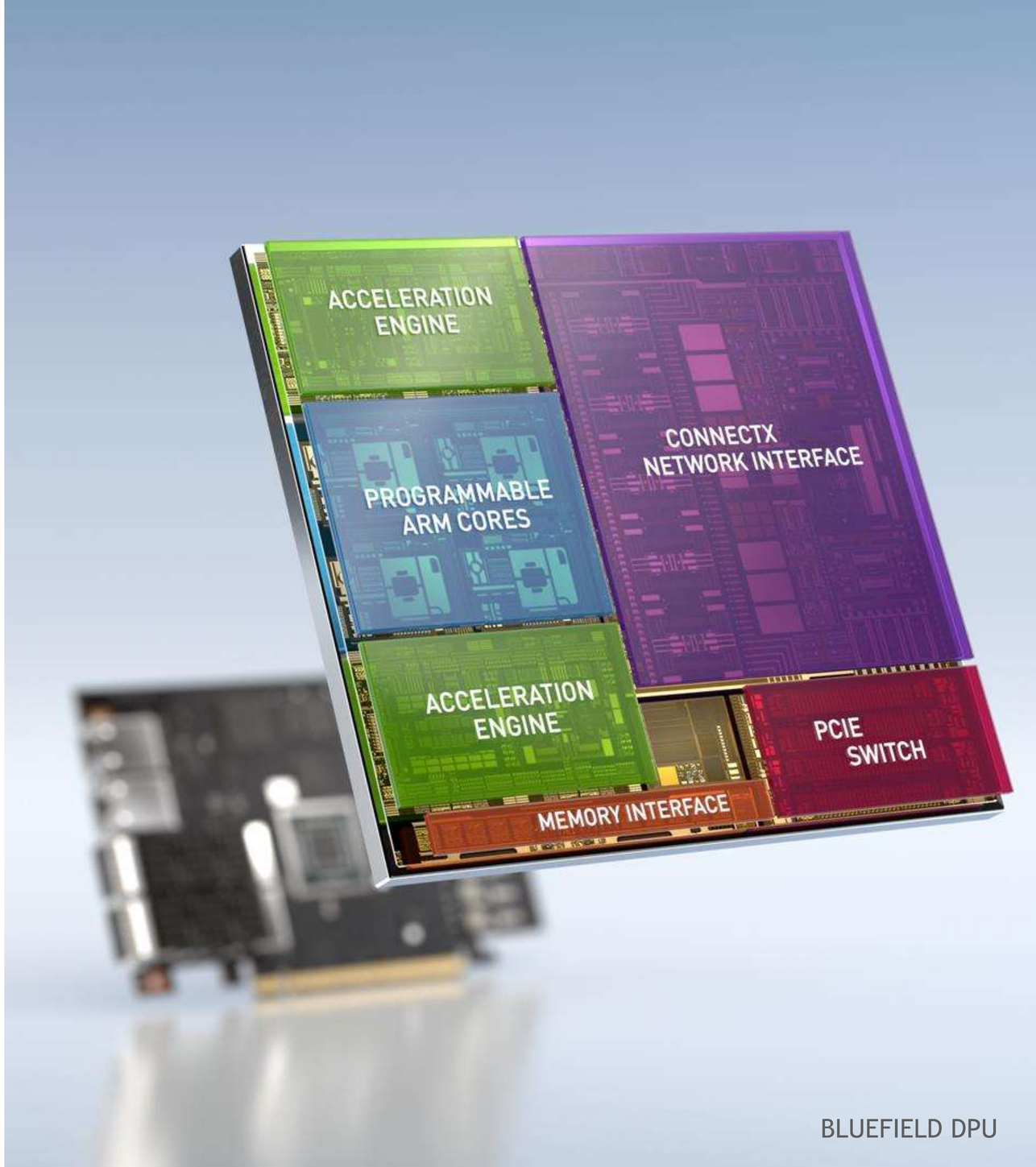
Higher Application Performance

From the Edge to the Main Data Center

BARE-METAL PERFORMANCE

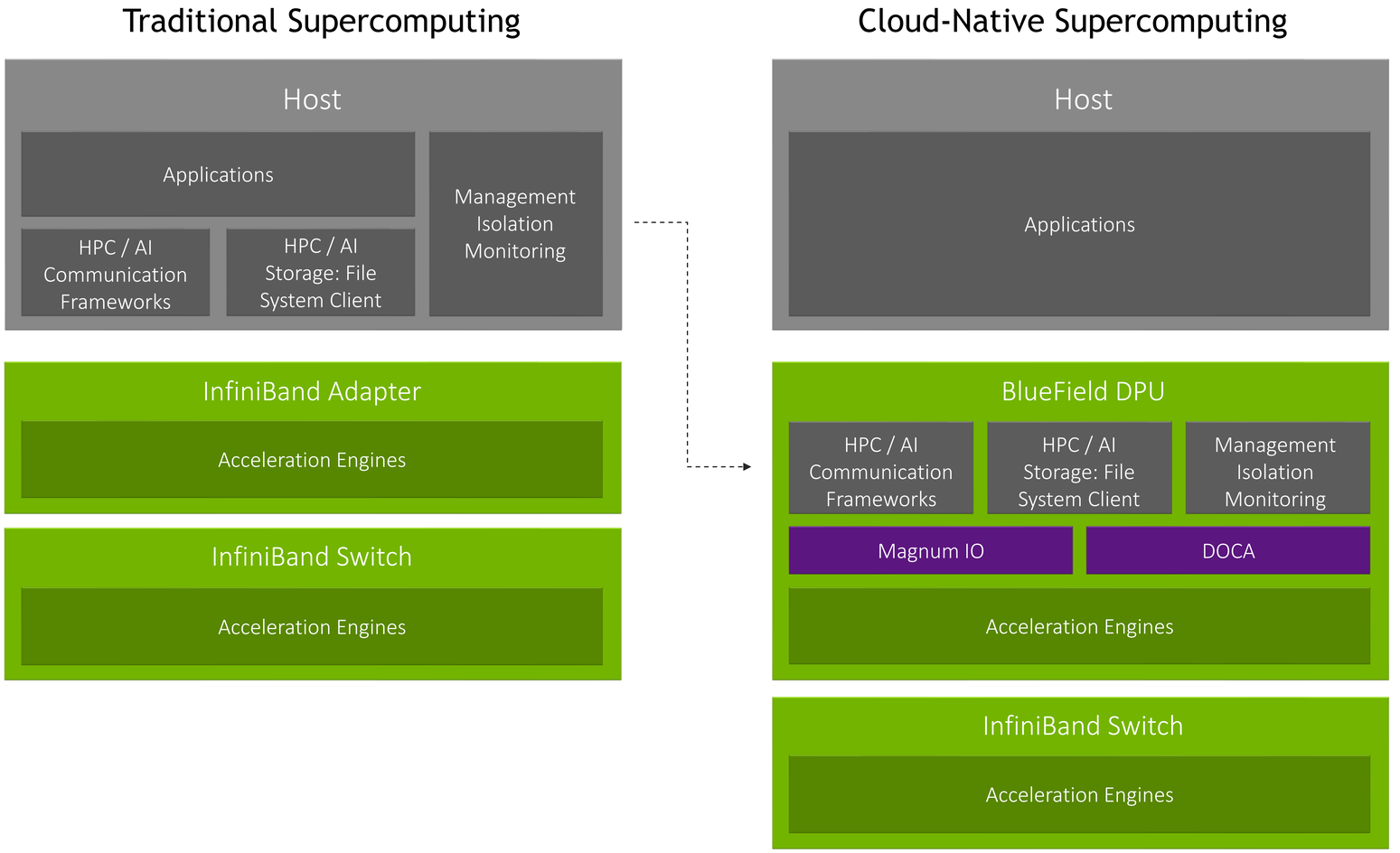
MULTI TENANCY

EDGE COMPUTING



BLUEFIELD DPU

CLOUD-NATIVE SUPERCOMPUTING INFRASTRUCTURE



MULTI-TENANT ISOLATION

Zero-Trust Architecture

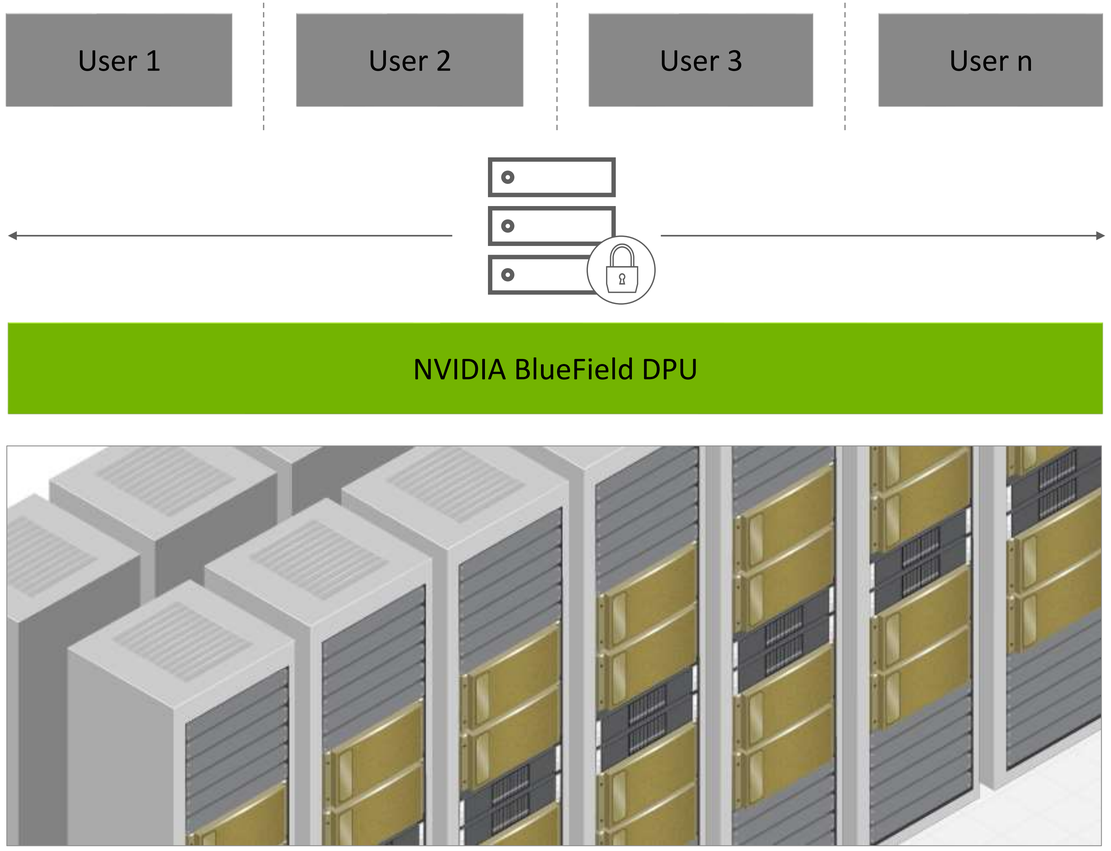
Secured Network Infrastructure and Configuration

Storage Virtualization

Tenant Service Level Agreement (SLA)

32K Concurrent Isolated Users on Single Subnet

Secure Partitioning with Bare-Metal Performance



HIGHER APPLICATION PERFORMANCE

DPU-Accelerated HPC Communications

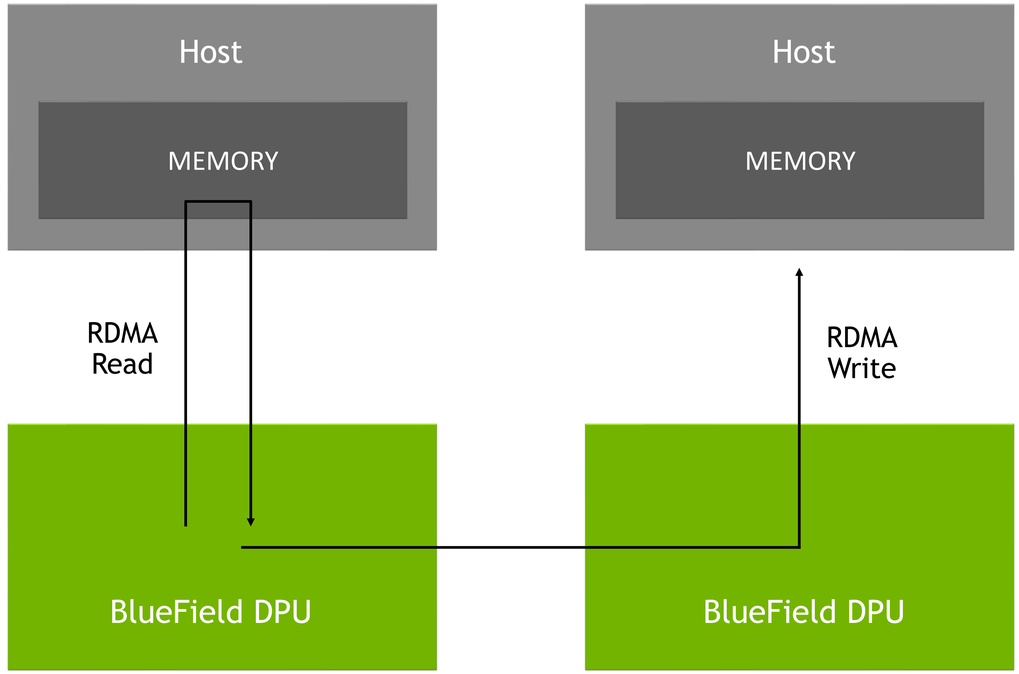
Collective Offloads

Active Messages

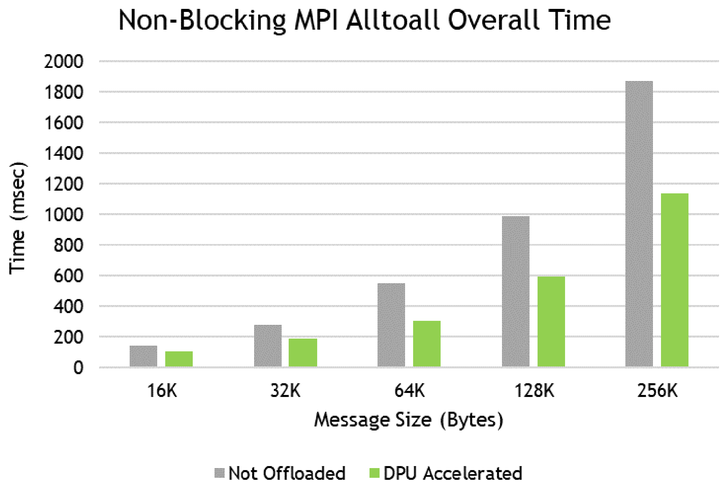
Smart MPI Progression

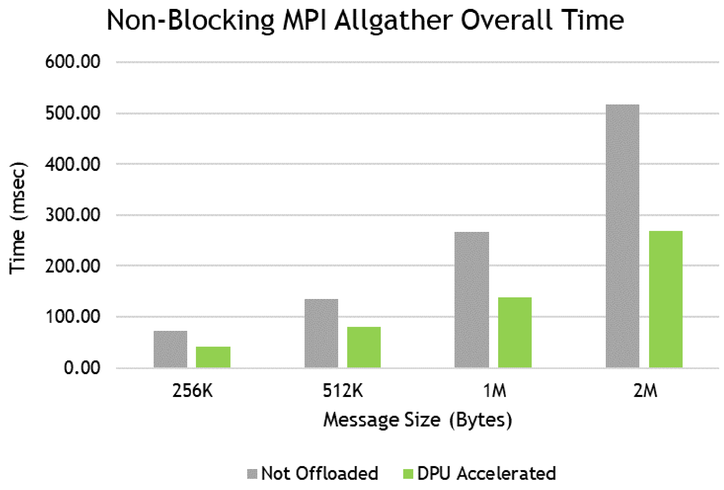
Data Compression

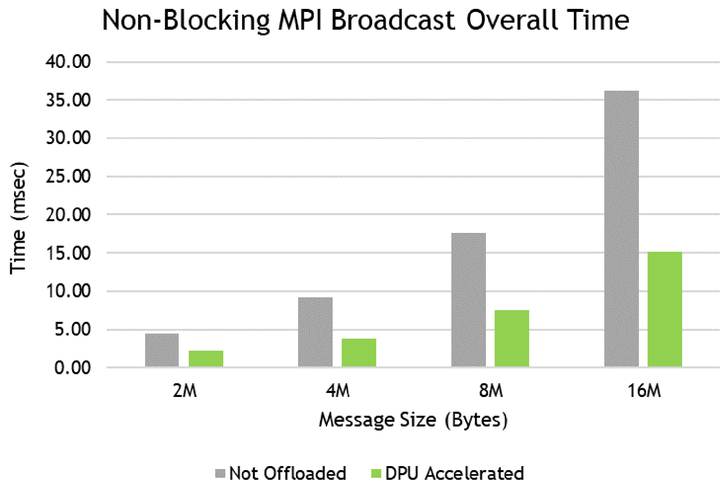
User-defined Algorithms



NON-BLOCKING MPI PERFORMANCE



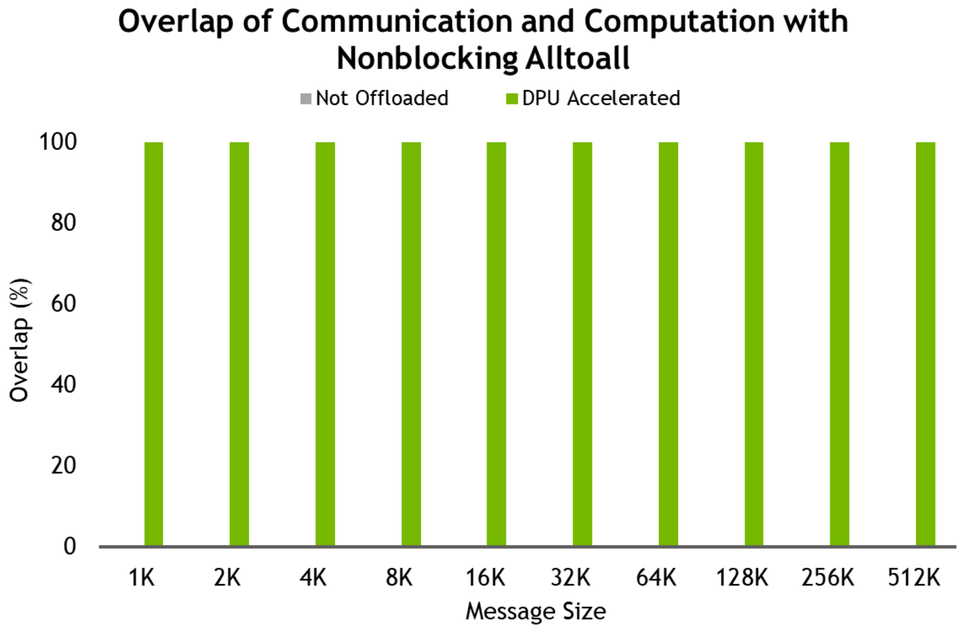




Courtesy of: Ohio State University MVAPICH Team and X-ScaleSolutions

HIGHER APPLICATION PERFORMANCE

100% Communication – Computation Overlap



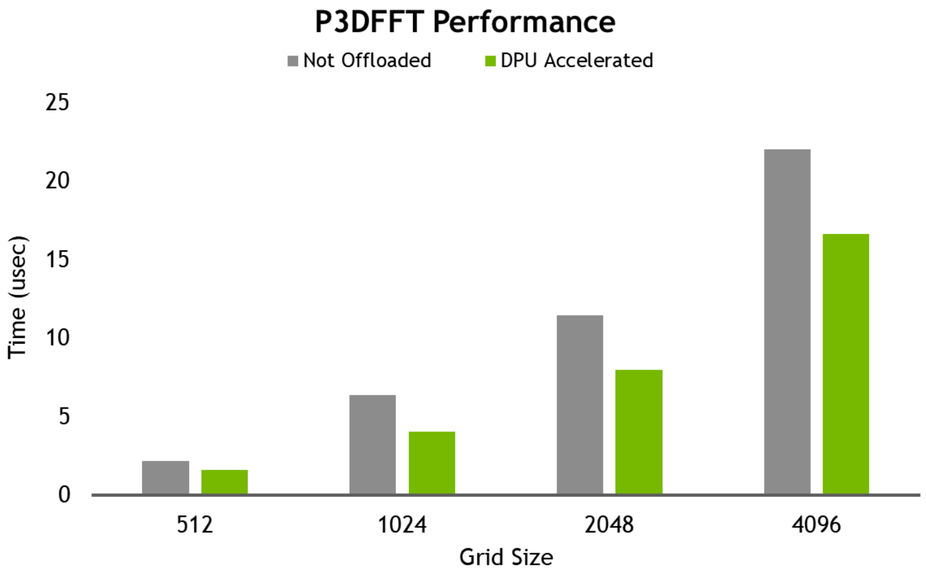
Courtesy of: Ohio State University MVAPICH Team and X-ScaleSolutions

MVAPICH X-ScaleSolutions

32 servers, Dual Socket Intel® Xeon® 16-core CPUs E5-2697A V4 @ 2.60 GHz (32 processes per node), NVIDIA BlueField-2 HDR100 DPUs and ConnectX-6 HDR100 adapters, NVIDIA HDR Quantum Switch QM7800 40-Port 200Gb/s HDR InfiniBand, 256GB DDR4 2400MHz RDIMMs memory and 1TB 7.2K RPM SATA 2.5" hard drive per node.

HIGHER APPLICATION PERFORMANCE

Higher App Performance, MPI Collectives Offload



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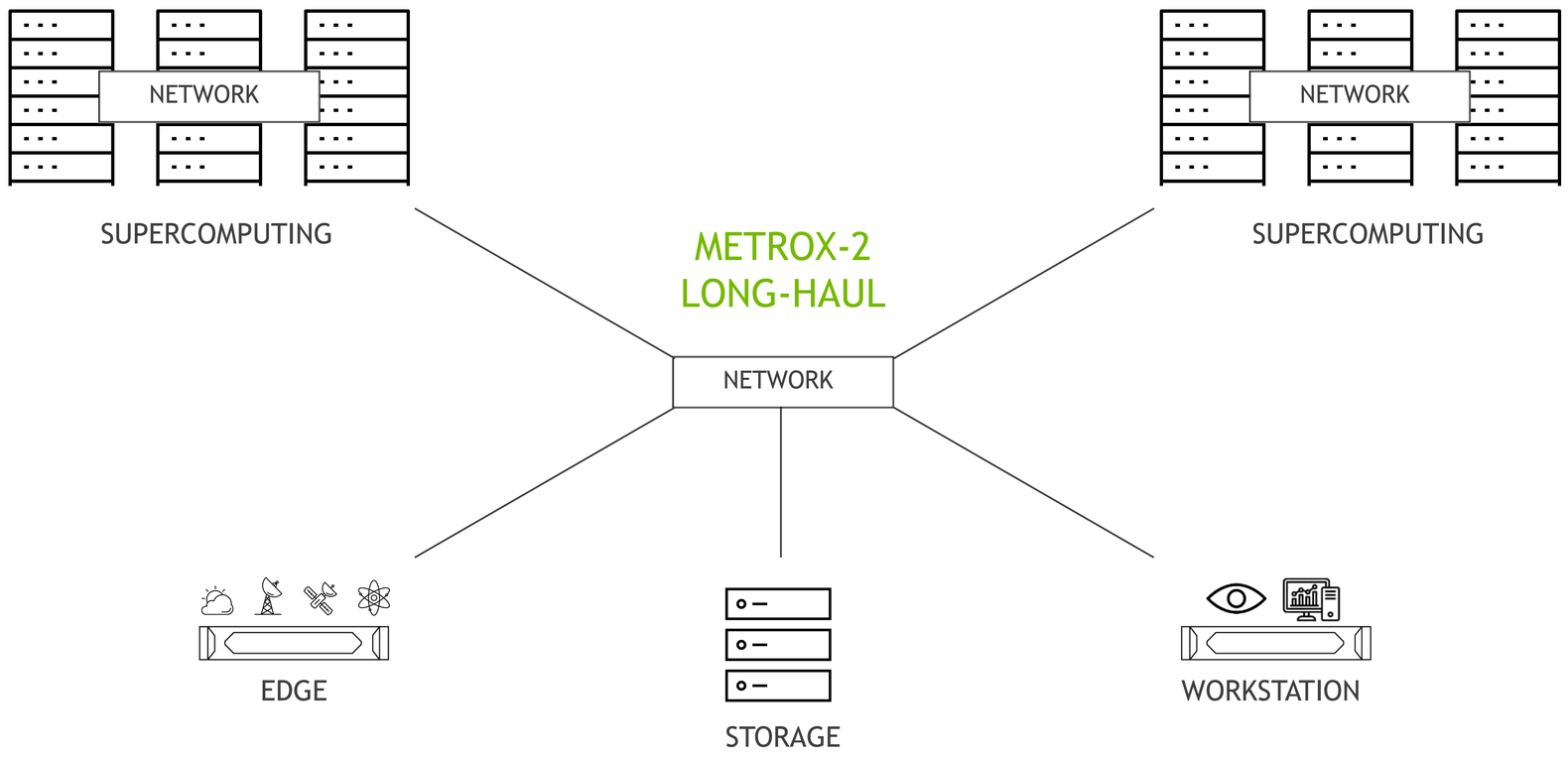
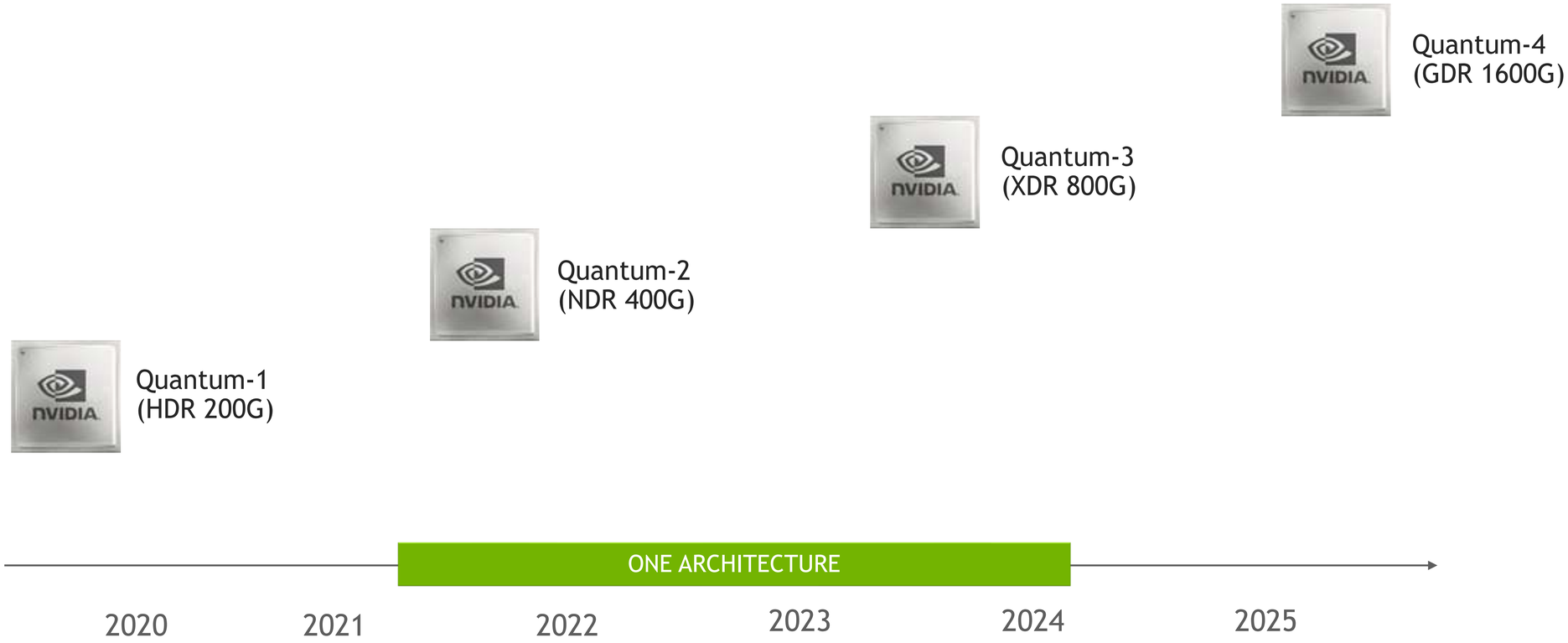
EXPANDING SUPERCOMPUTING UNIVERSE LONG-HAUL INFINIBAND



NVIDIA QUANTUM INFINIBAND TECHNOLOGY ROADMAP

In-Network Computing Accelerated Network for Exascale Supercomputing




NVIDIA