



Interconnect Your Future

Enabling the Best Datacenter Return on Investment

TOP500 Supercomputers, November 2019



Mellanox InfiniBand and Ethernet Accelerate World-Leading Supercomputers on the Nov'19 TOP500 List

- InfiniBand Accelerates Six of the Top Ten Supercomputers in the World, Including the Top Three, and Four of the Top Five on November's TOP500
- Mellanox InfiniBand and Ethernet Solutions Connect 297 Systems or 59% of Overall TOP500 Platforms, Demonstrating 12% Growth Year over Year (Nov'18-Nov'19)
- InfiniBand Accelerates 141 systems, 12% Growth Compared to June 2019 TOP500 List
- 200G HDR InfiniBand Accelerates 31% of New InfiniBand Systems on November's TOP500, Including Fastest 2019-Built TOP500 Supercomputer
- Mellanox 25 Gigabit and Faster Ethernet Solutions Connect 60% of Total Ethernet Systems, Representing 20% Growth Year over Year

Key Takeaways From the November TOP500 2019 List

- Mellanox connects 59% of overall TOP500 platforms (297 systems, InfiniBand and Ethernet), demonstrating 12% growth year over year
- 200G HDR InfiniBand accelerates 31% of new InfiniBand systems on November's TOP500, including fastest 2019-built TOP500 supercomputer
- InfiniBand accelerates the world's fastest HPC/AI supercomputer – Oak Ridge National Laboratory 'Summit' supercomputer
- InfiniBand accelerates the top 3 supercomputers in the world – #1 (ORNL - USA), #2 (LLNL - USA), and #3 (Wuxi - China), and 6 of the top 10 – #5 (TACC - USA), #8 (AIST - Japan), and #10 (LLNL - USA)
- InfiniBand accelerates the fastest industrial supercomputer at Total Oil and Gas, #11 on the list
- InfiniBand connects 141 supercomputers, demonstrating 12% growth compared to the June 2019 TOP500 list
- Mellanox connects 156 Ethernet systems (25 gigabit and faster), or 60% of the total Ethernet systems – 20% growth year over year (Nov'18-Nov'19)
- InfiniBand is an ideal interconnect for HPC and AI infrastructures
- Mellanox Ethernet with ROCE is the superior choice for cloud and hyperscale platforms

InfiniBand is the Interconnect of Choice for HPC and AI Infrastructures
Mellanox Ethernet is the Interconnect of Choice for Cloud and Hyperscale Platforms

SUPERCONNECTING the #1 Supercomputers



OAK RIDGE
National Laboratory



1

TOP 500
The List.

Lawrence Livermore
National Laboratory



2

TOP 500
The List.

国家超级计算无锡中心
National Supercomputing Center in Wuxi



3

TOP 500
The List.

TACC
TEXAS ADVANCED COMPUTING CENTER



5

TOP 500
The List.

AIST
NATIONAL INSTITUTE OF
ADVANCED INDUSTRIAL SCIENCE
AND TECHNOLOGY (AIST)



8

TOP 500
The List.

Lawrence Livermore
National Laboratory



10

TOP 500
The List.

InfiniBand Accelerates 6 of Top 10 Supercomputers



SUPERCONNECTING the #1 Supercomputers



148.6 Petaflops



Mellanox InfiniBand Connects the World's Fastest
HPC and AI Supercomputer

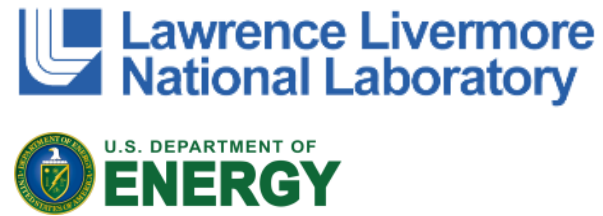
Mellanox Accelerates Leading HPC and AI Systems

World's Top 3 Supercomputers



1

Summit CORAL System
World's Fastest HPC / AI System
9.2K InfiniBand Nodes



2

Sierra CORAL System
#2 USA Supercomputer
8.6K InfiniBand Nodes



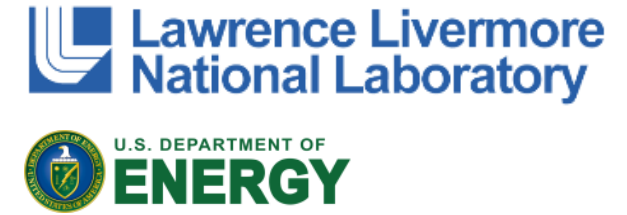
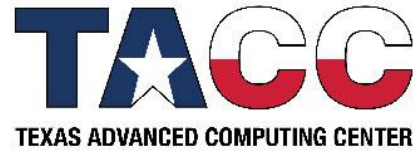
3

Wuxi Supercomputing Center
Fastest Supercomputer in China
41K InfiniBand Nodes



Mellanox Accelerates Leading HPC and AI Systems

World's Top 10 Supercomputers



5

23.5 Petaflops
8K HDR InfiniBand Nodes



8

Fastest HPC / AI System in Japan
1.1K InfiniBand Nodes



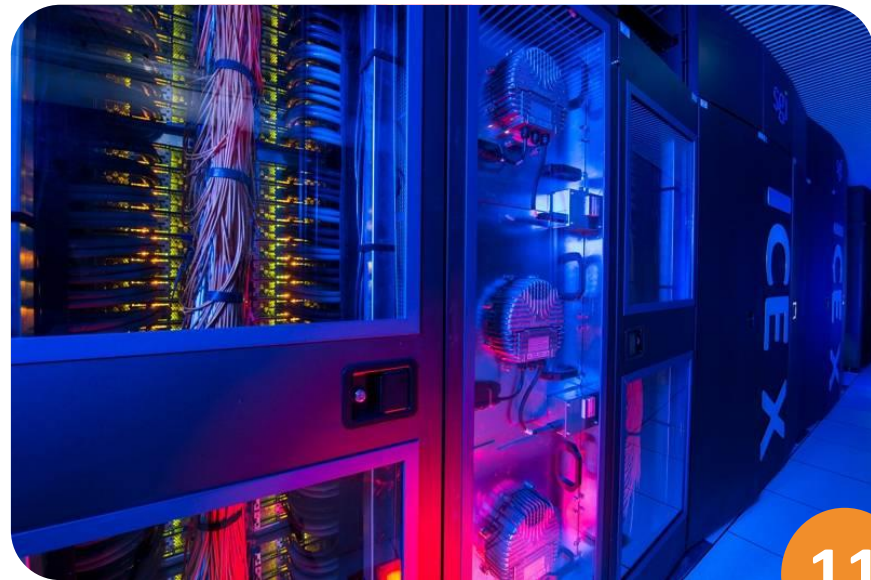
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1.5K EDR InfiniBand Nodes



Mellanox Accelerates Leading HPC and AI Systems

World's Top Supercomputers



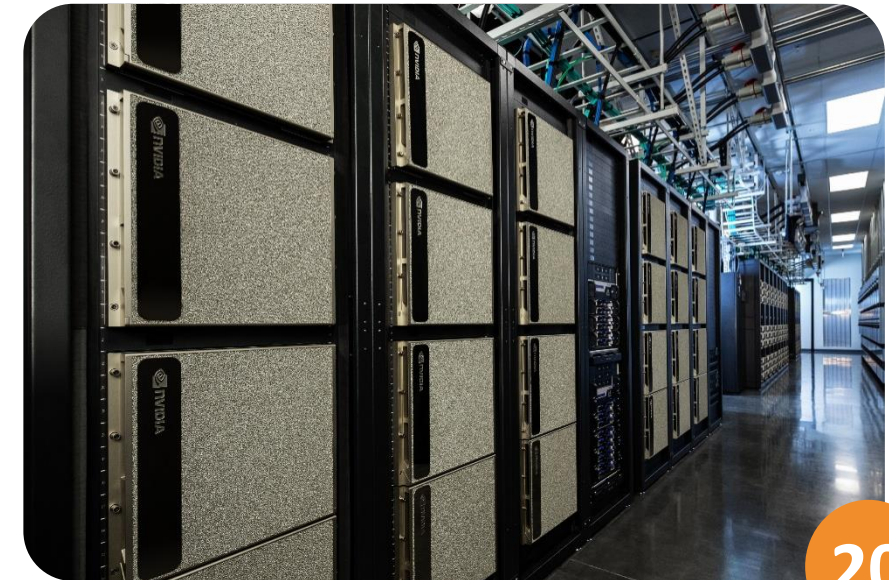
11

The World's Fastest Industry Supercomputer
Dual-Rail EDR InfiniBand



16

The world's Second Fastest Industry Supercomputer
1.6K InfiniBand Nodes



20

NVIDIA DGX SuperPOD Supercomputer
10 EDR InfiniBand Adapters per Node
1 Terabit/second throughput per node



HDR 200G InfiniBand Wins Next Generation Supercomputers

(Examples)



23.5 Petaflops
8K HDR InfiniBand Nodes
Fat-Tree Topology



50 Petaflops
7.2K HDR InfiniBand Nodes
Dragonfly+ Topology



Australian National University

3K HDR InfiniBand Nodes
Dragonfly+ Topology



3.1 Petaflops
1.8K HDR InfiniBand Nodes
Fat-Tree Topology



FINNISH METEOROLOGICAL INSTITUTE

1.7 Petaflops
2K HDR InfiniBand Nodes
Dragonfly+ Topology



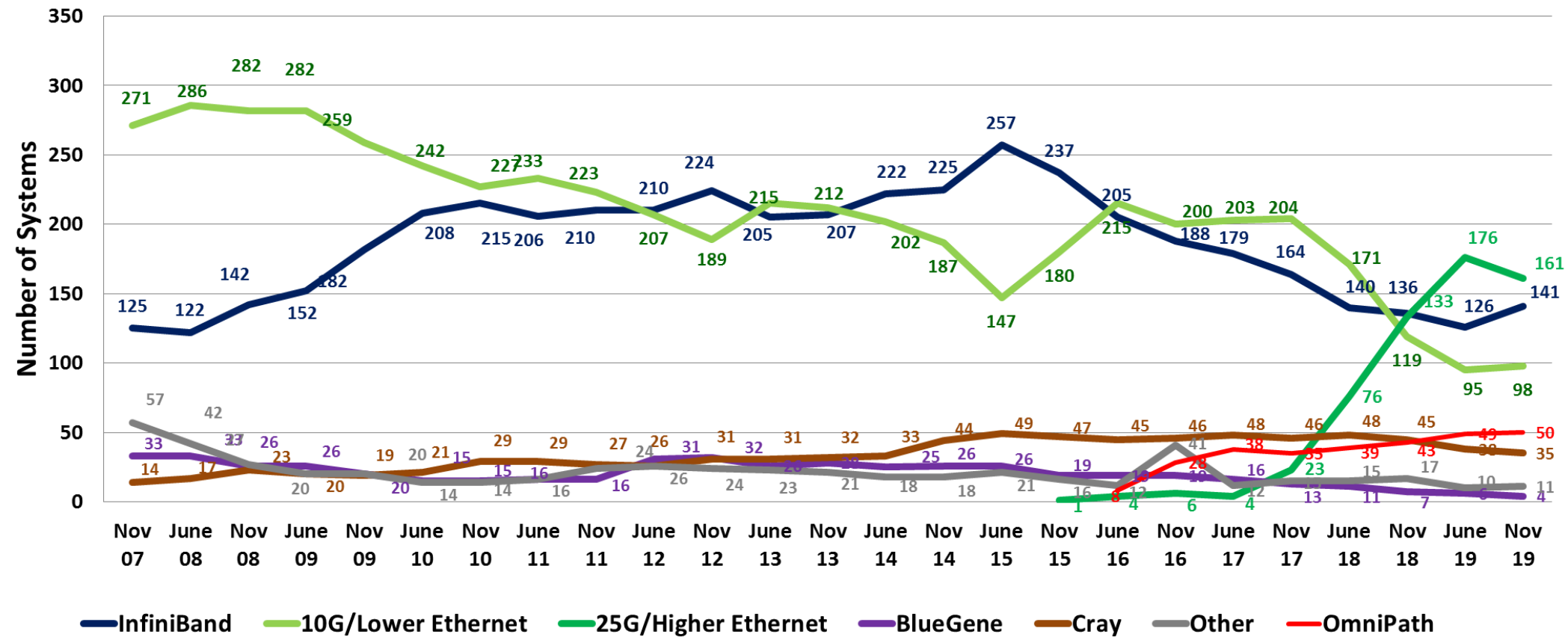
Highest Performance Cloud



1.6 Petaflops
Hybrid CPU-GPU-FPGA
Fat-Tree Topology

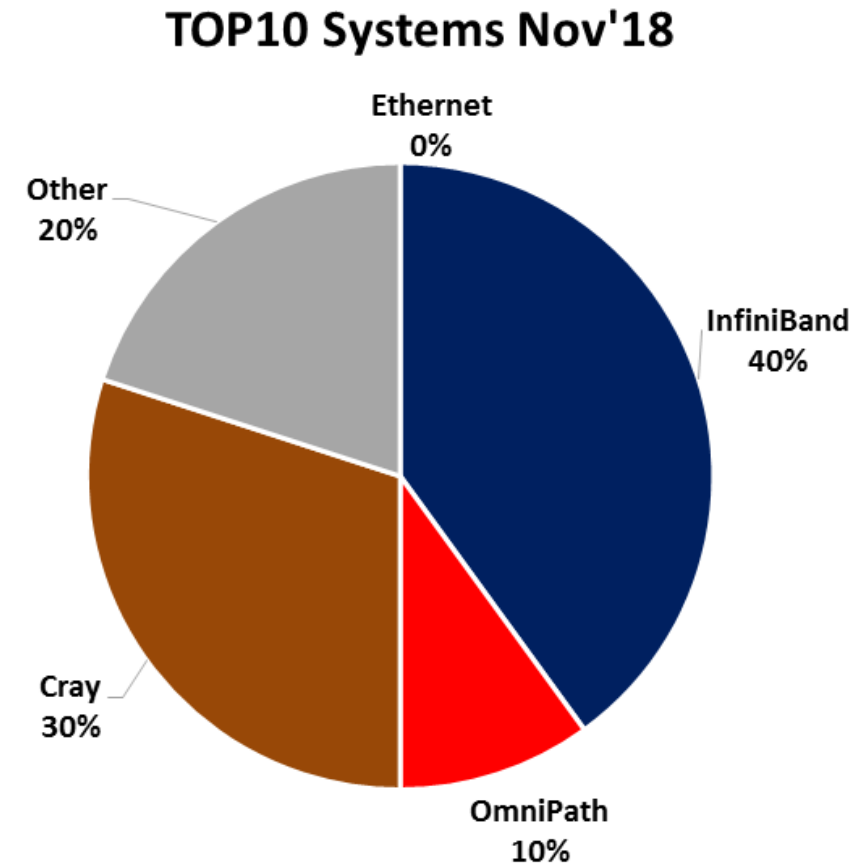
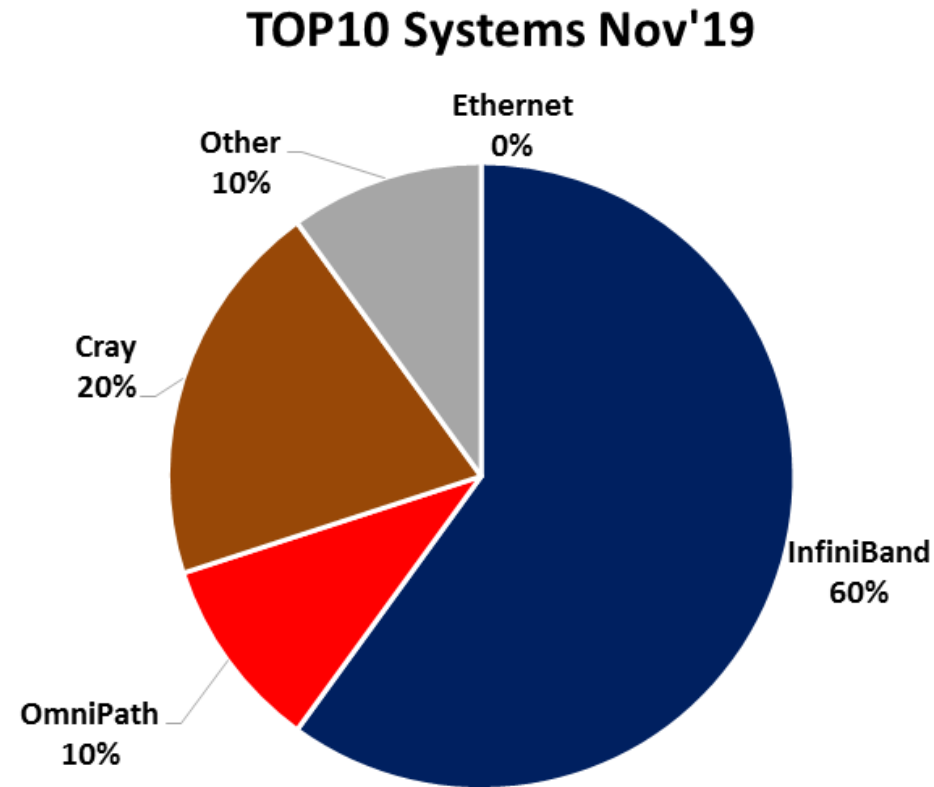
TOP500 Interconnect Trends

TOP500 Interconnect Trends



The TOP500 List has Evolved to Include Both HPC and Cloud / Web2.0 Hyperscale Platforms
 InfiniBand Continues its Leadership as the Most Used Interconnect Solution for HPC Platforms
 Mellanox Connects most of 25G and faster Cloud and Hyperscale Ethernet Systems

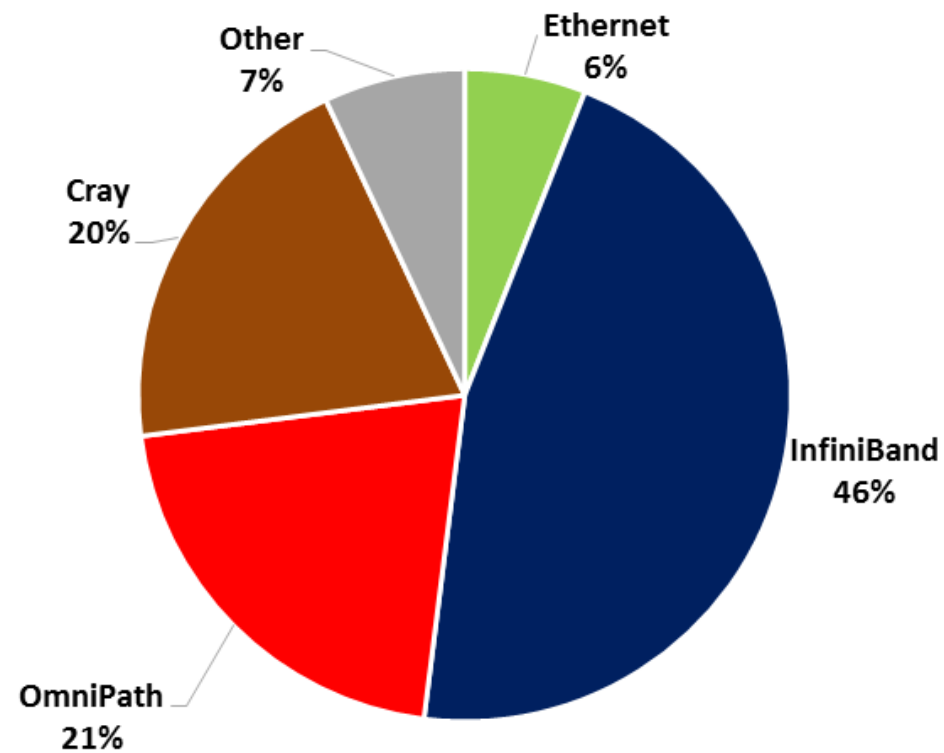
Interconnects - TOP10 Supercomputers



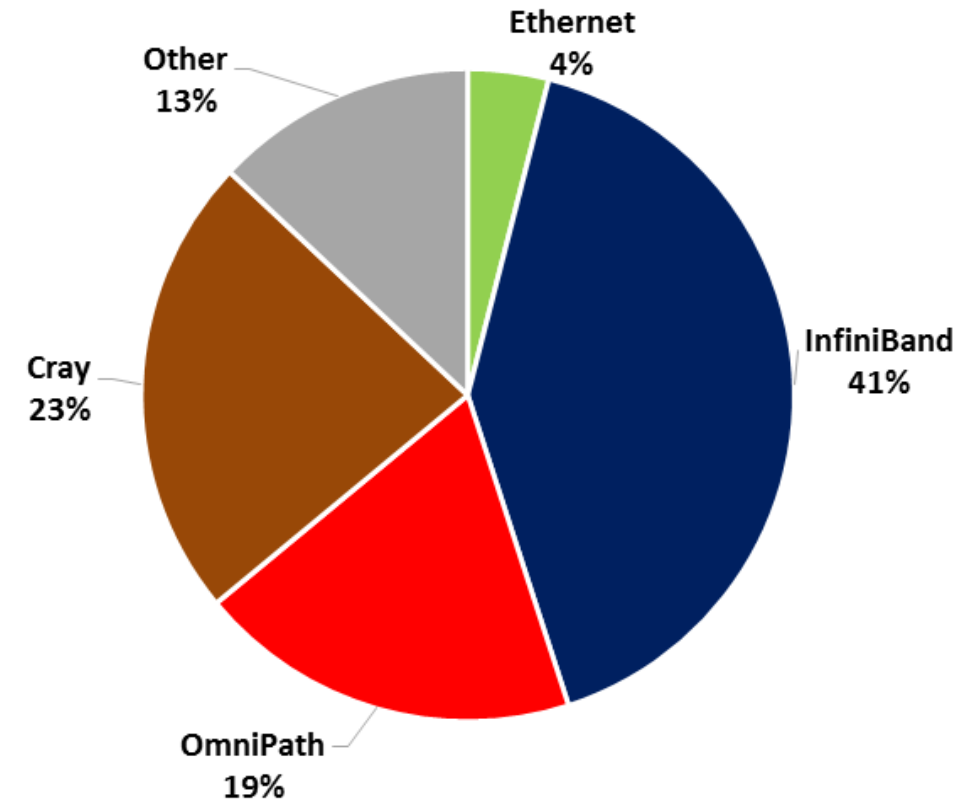
**InfiniBand Accelerates 6 of Top 10 Supercomputers (Compare to 4 Systems in Nov'18)
Including First TOP5 HDR InfiniBand Supercomputer**

Interconnects - TOP100 Supercomputers

TOP100 Systems Nov'19

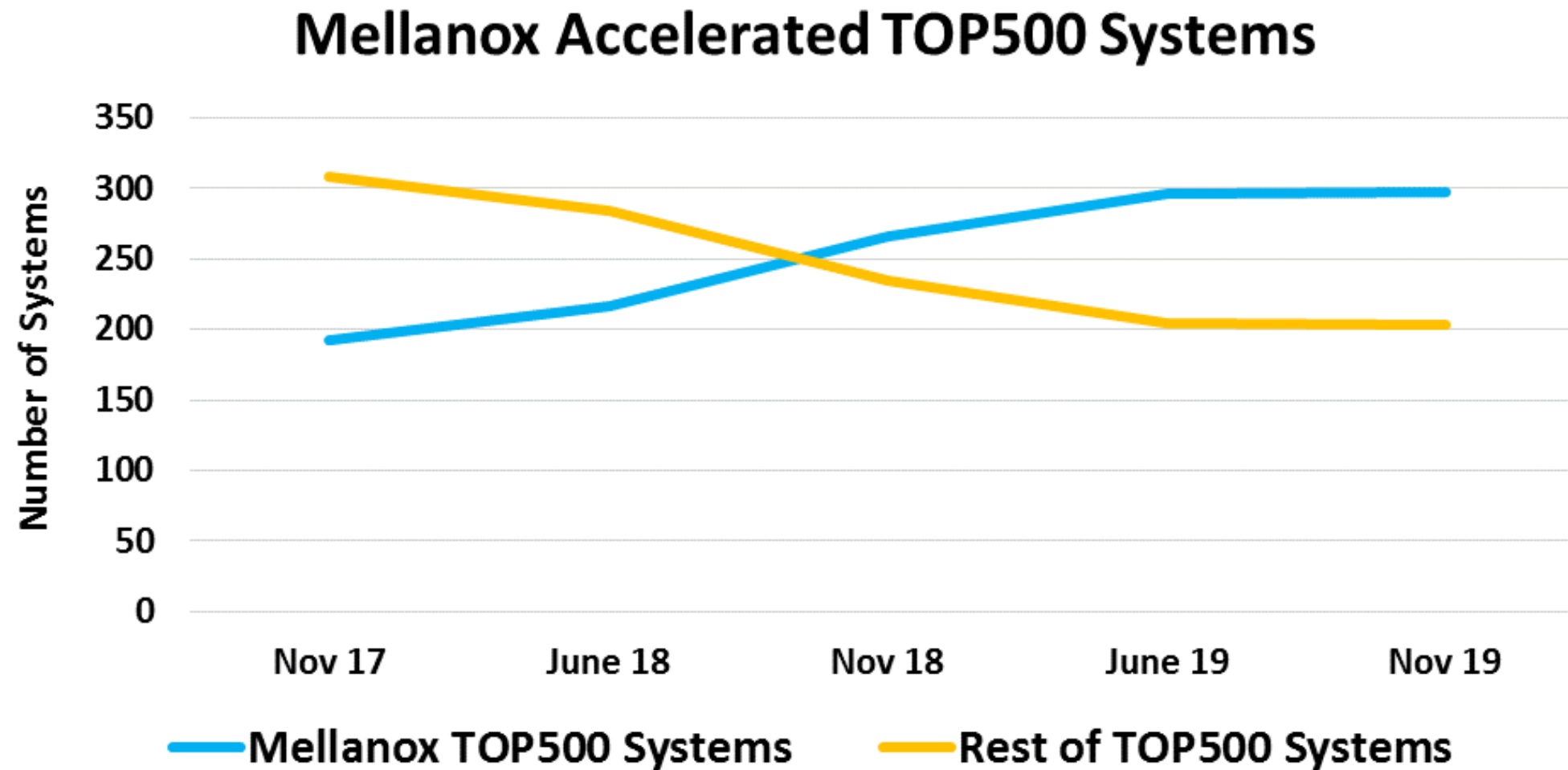


TOP100 Systems Nov'18



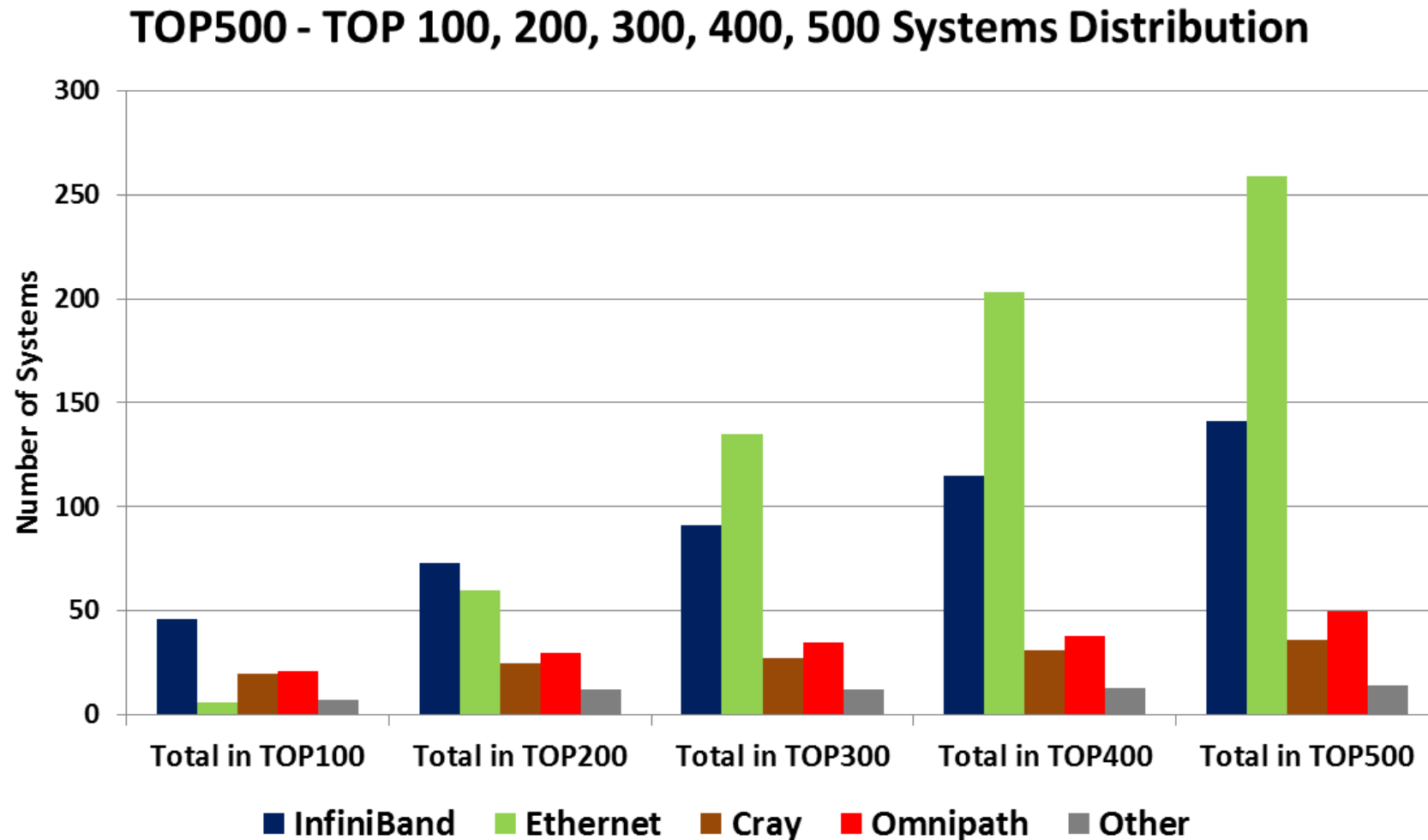
InfiniBand Accelerates 46 of Top 100 Supercomputers
12% Increase Year over Year (Nov'18 to Nov'19)

Mellanox Accelerates 59% of TOP500 Systems



Mellanox InfiniBand and Ethernet Solutions Accelerate Majority of TOP500 Platforms on the November TOP500 Supercomputers List

Interconnects – TOP100, 200, 300, 400, 500

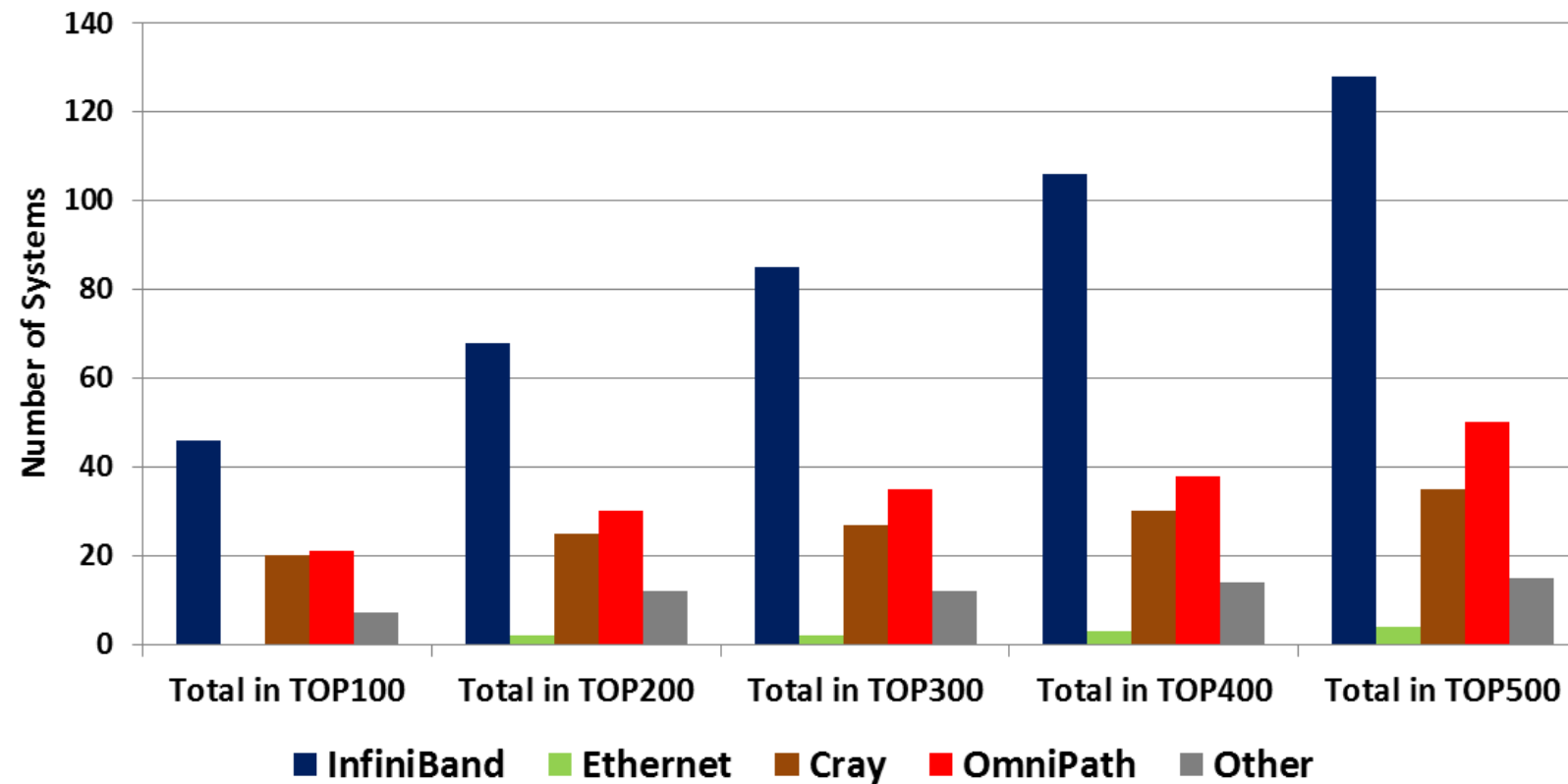


InfiniBand is The Most Used High-Speed Interconnect of Top Supercomputers
Superior Performance, Scalability, Efficiency and Return-On-Investment

InfiniBand Solutions – TOP100, 200, 300, 400, 500

HPC Systems Only (Excluding Cloud, Hyperscale etc. Systems)

**TOP500 - TOP 100, 200, 300, 400, 500 Systems Distribution
HPC Systems Only**



**InfiniBand is The Most Used Interconnect For HPC Systems
Superior Performance, Scalability, Efficiency and Return-On-Investment**

Unleashing the Power of Data

Exponential Growth of Data & Real Time Analytics

Enhanced By Mellanox High Throughput, Low Latency, Smart Interconnect Solutions



Enabling Leading Artificial Intelligence Solutions

Mellanox Unleashes the Power of Artificial Intelligence

More Data



Better Models

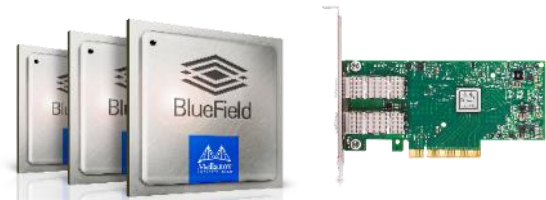


Faster Interconnect



GPUs
CPUs
FPGAs
Storage

High Performance Computing and Artificial Intelligence Enhanced By the Most Intelligent Interconnect



SmartNIC



System on a Chip

Higher

Data Speeds

Faster

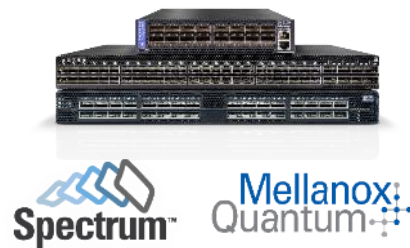
Data Processing

Better

Data Security



Adapters



Switches



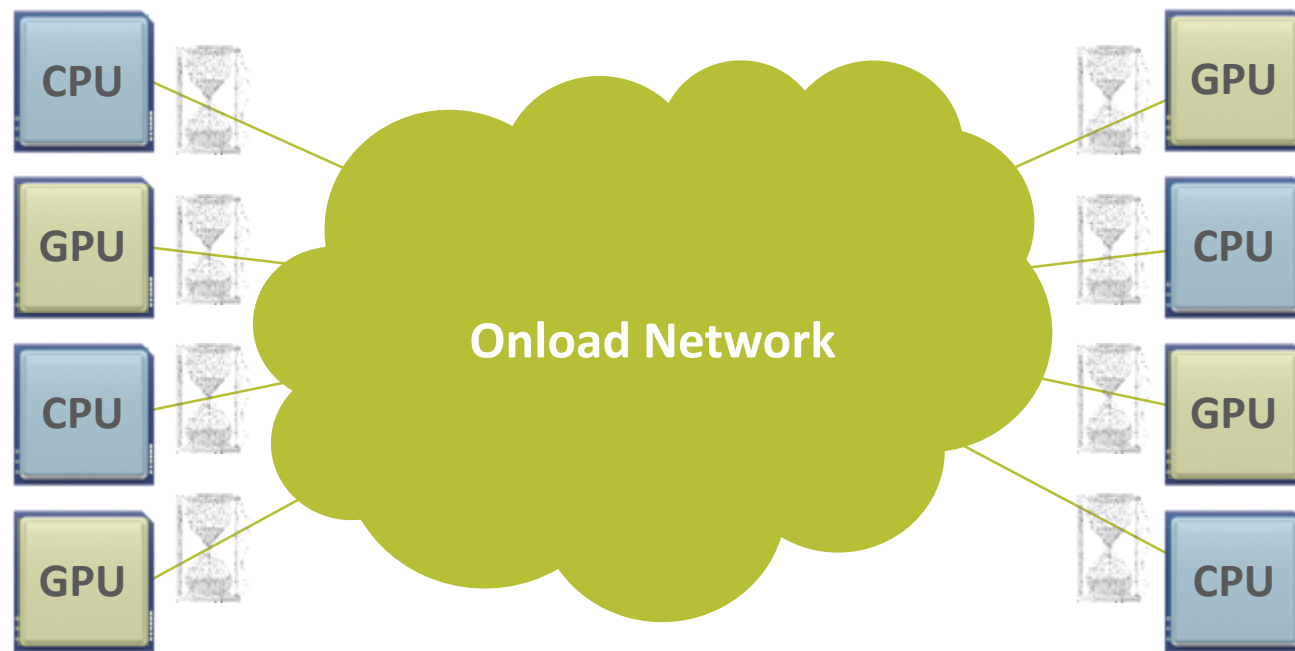
Link X
Cables &
Transceivers



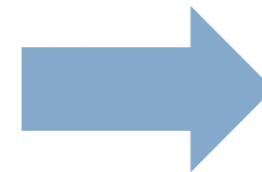
The Case for Intelligent and Faster Interconnect

Faster Data Speeds and In-Network Computing
Enable Higher Performance and Scale

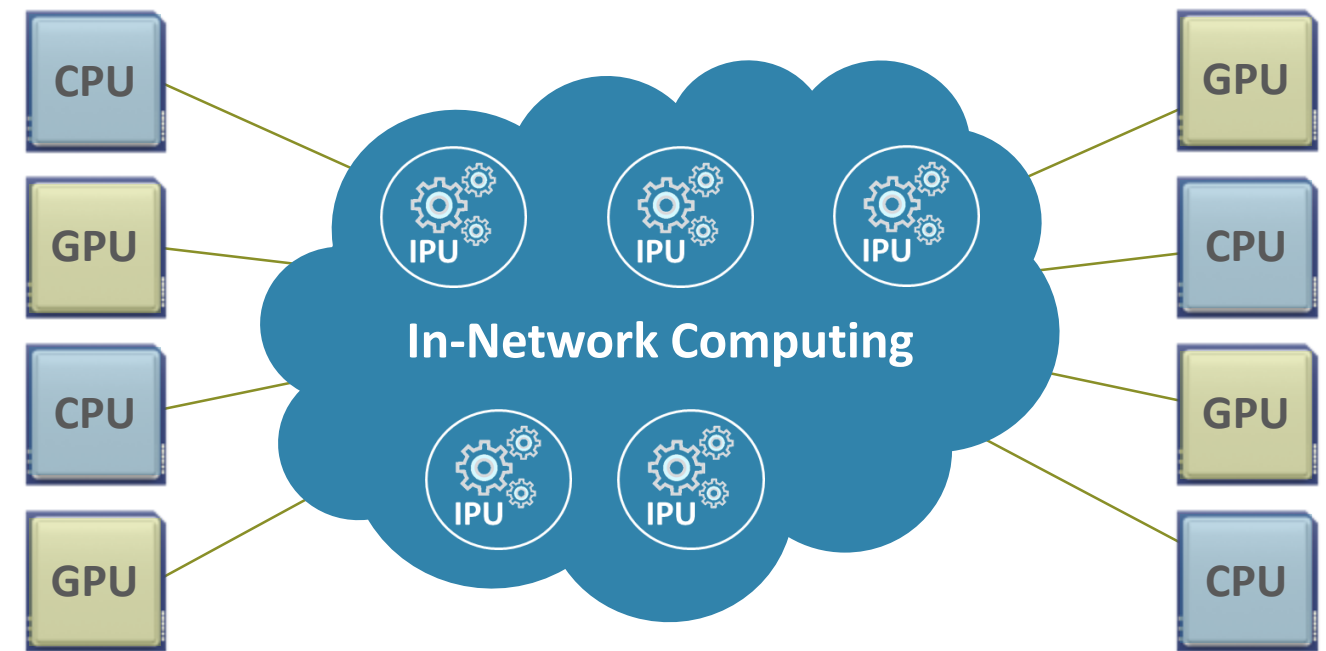
CPU-Centric (Onload)



Must Wait for the Data
Creates Performance Bottlenecks



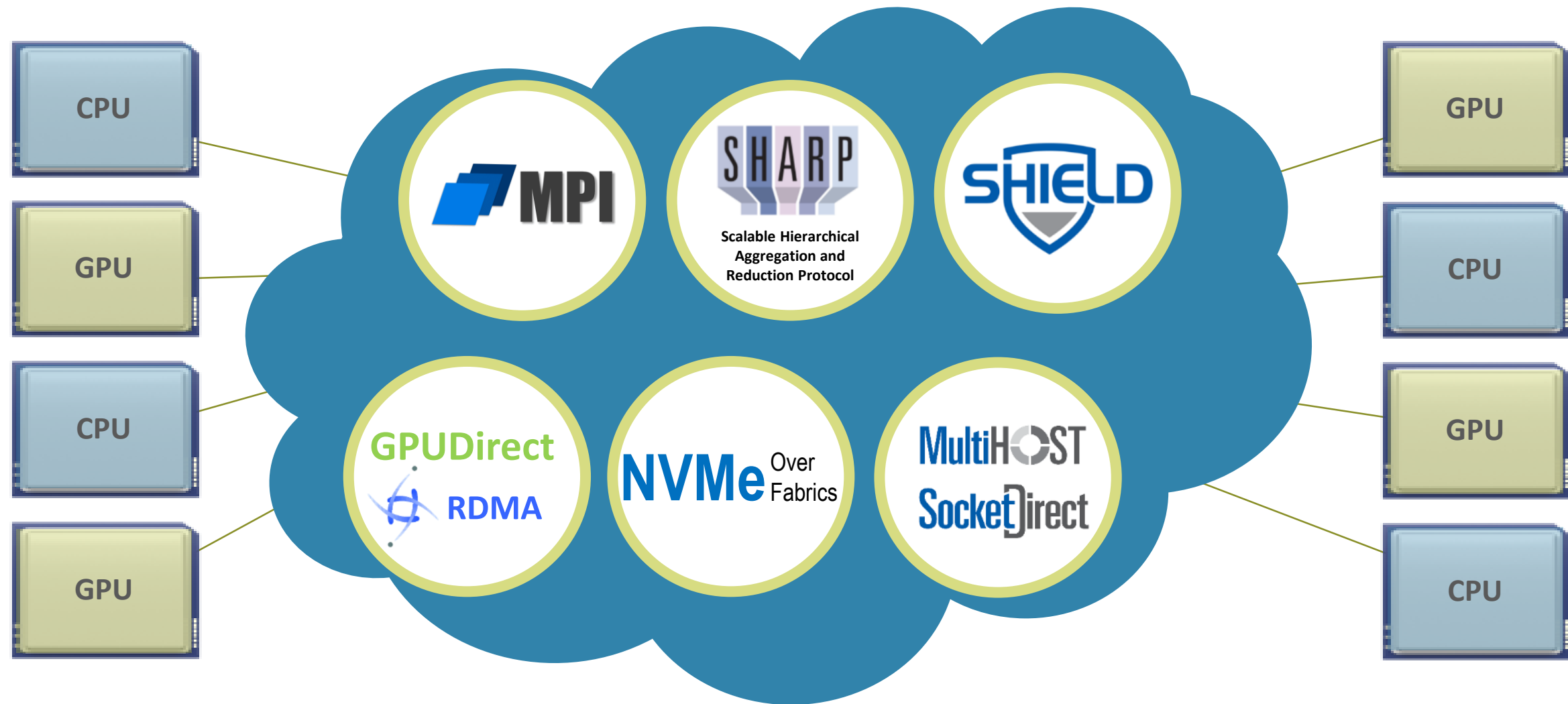
Data-Centric (Offload)



Analyze Data as it Moves!
Higher Performance and Scale

In-Network Computing to Enable Data-Centric Data Centers

Faster Data Speeds and In-Network Computing Enable Higher Performance and Scale



Mellanox In-Network Computing and Acceleration Engines

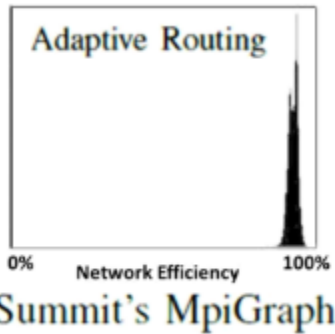
Highest Performance and Scalability for Exascale Platforms

OAK RIDGE
National Laboratory

SHARP SHIELD
SELF-HEALING



96%
Network
Utilization

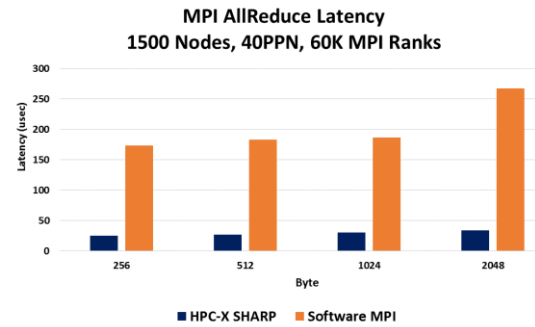


UNIVERSITY OF
TORONTO
SciNet

SHARP

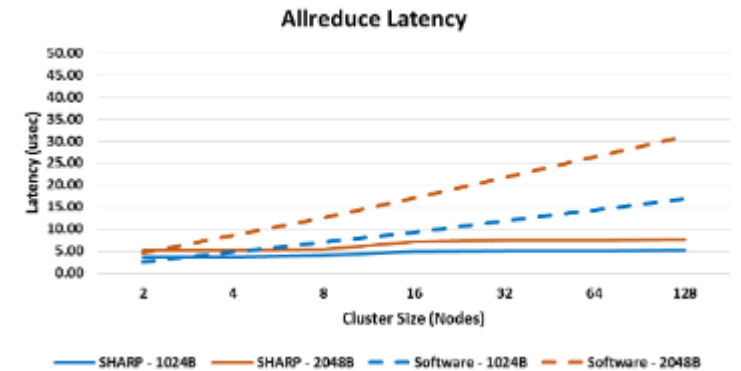


7X
Higher
Performance

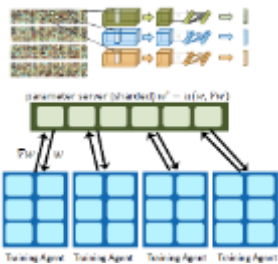


SHARP
Scalable Hierarchical
Aggregation and
Reduction Protocol

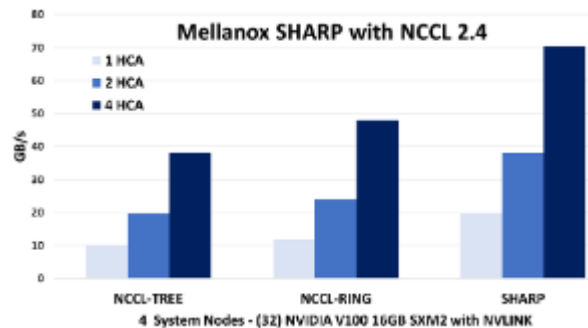
**Flat
Latency**



**Deep
Learning**

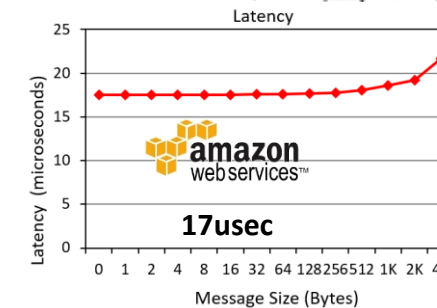
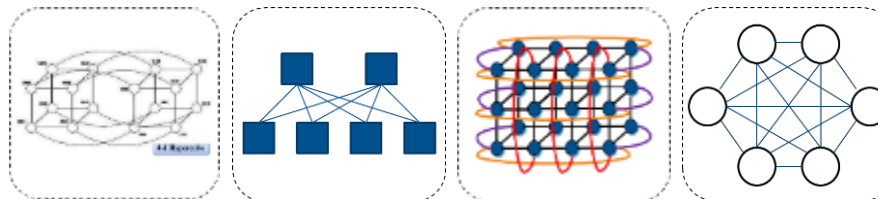


2X
Higher
Performance

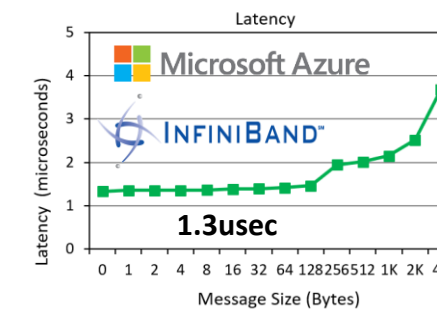


SHIELD
SELF-HEALING

5000X
Higher
Resiliency



13X
Higher Cloud
Performance



Unlocking the Power of Artificial Intelligence

RDMA Supercharges Leading AI Frameworks



Mellanox Supercharges Leading AI Companies



60%
Higher ROI

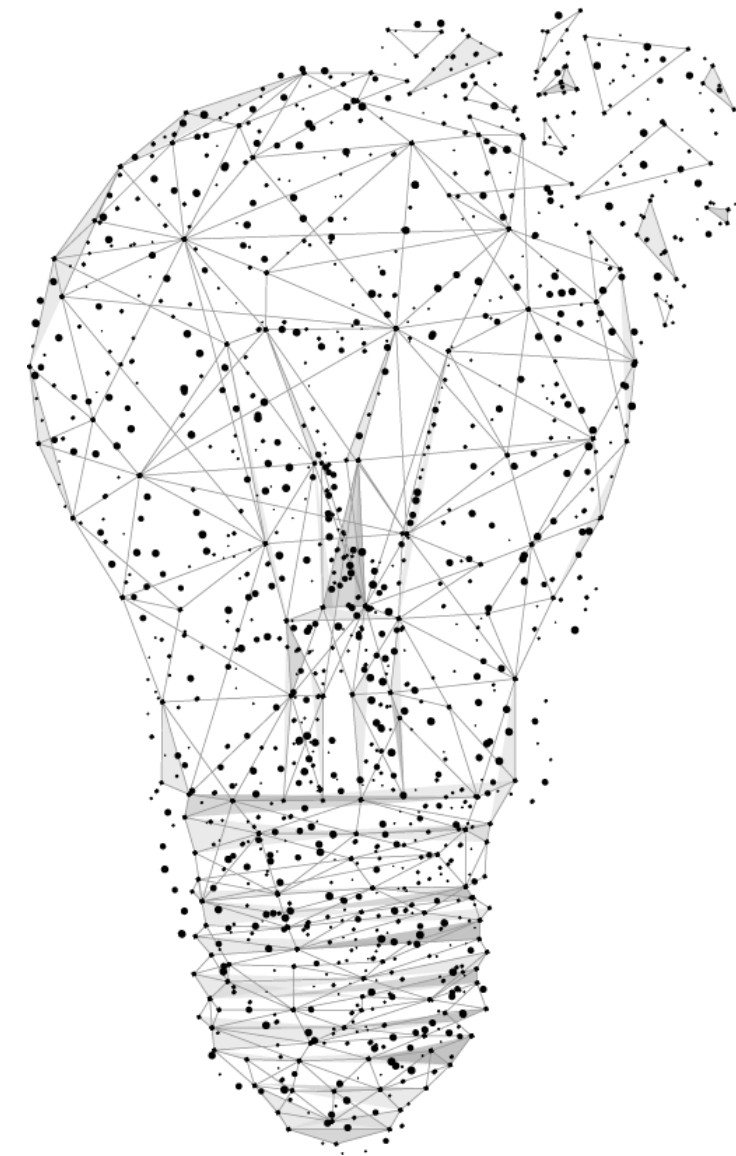
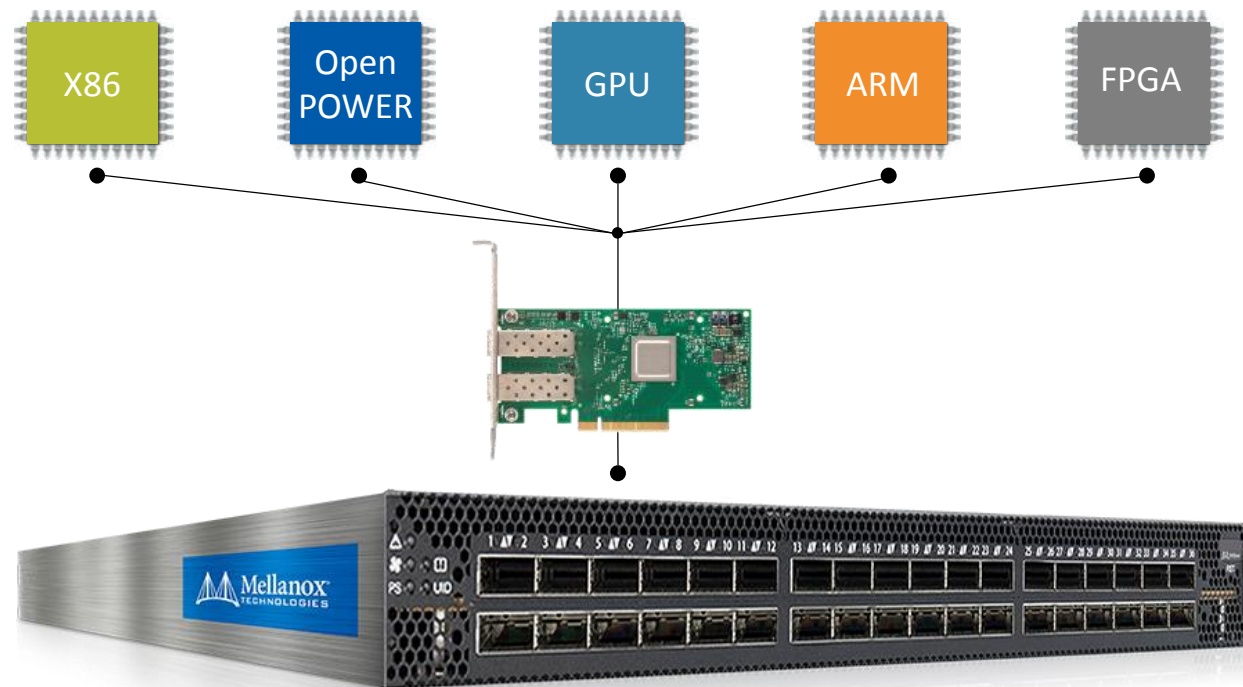
50%
Lower CapEx
& OpEx

Highest-Performance 200Gb/s Solutions

Adapters		<p>200Gb/s Adapter 215 million messages per second (10 / 25 / 40 / 50 / 56 / 100 / 200Gb/s)</p>	
Switch		<p>40 HDR (200Gb/s) InfiniBand Ports 80 HDR100 InfiniBand Ports Throughput of 16Tb/s, 130ns Latency</p>	
Switch		<p>16 400GbE, 32 200GbE, 128 25/50GbE Ports (10 / 25 / 40 / 50 / 100 / 200 GbE) Throughput of 6.4Tb/s</p>	
SoC		<p>System on Chip and SmartNIC Programmable adapter Smart Offloads</p>	
Interconnect		<p>Transceivers Active Optical and Copper Cables (10 / 25 / 40 / 50 / 56 / 100 / 200Gb/s)</p>	
Software		<p>MPI, SHMEM/PGAS, UPC For Commercial and Open Source Applications Leverages Hardware Accelerations</p>	

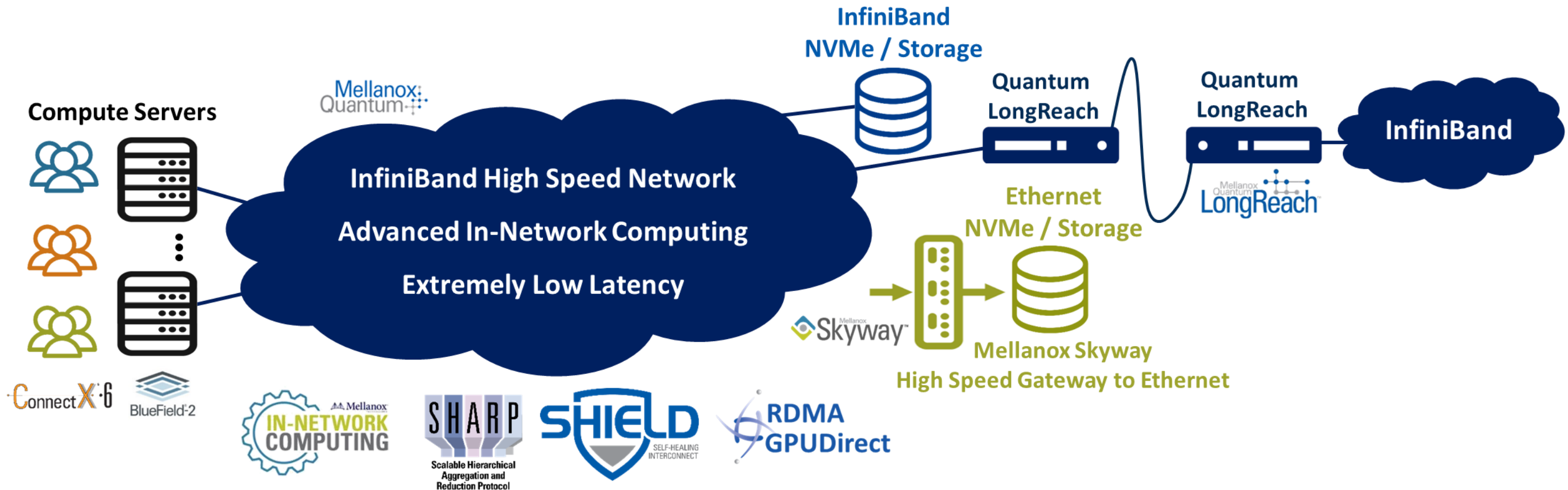
End-to-End Solutions for All Platforms

Unleashing the Power of all Compute Architectures



Highest Performance and Scalability for Intel, AMD, IBM Power, NVIDIA, ARM and FPGA-based Compute and Storage Platforms at 10, 20, 25, 40, 50, 100, 200 and 400Gb/s Speeds

InfiniBand Delivers Highest Performance and ROI



- 200G HDR InfiniBand end-to-end, extremely low latency, high message rate, RDMA and GPUDirect
- Advanced end-to-end adaptive routing, congestion control and quality of service
- In-Network Computing acceleration engines (Mellanox SHARP, MPI offloads)
- Self Healing Network with SHIELD for highest network resiliency
- Mellanox Skyway high speed gateways to Ethernet, Mellanox Quantum LongReach extend InfiniBand reach to 40 Km
- Standard, backward and forward compatibility

InfiniBand The Smart Choice for HPC and AI Platforms and Applications

“We chose a co-design approach supporting in the best possible manner our key applications. The only interconnect that really could deliver that was Mellanox’s InfiniBand.”



Dr. Thomas Eickermann
Deputy Head - Jülich Supercomputing Centre
Head of the Communication Systems Division



[Watch Video](#)

“InfiniBand gives us the very high bandwidth we need to address some of our most important applications. The Switch based collective operations dramatically improve the performance for our applications.”



Jack Wells
Director of Science,
Oak Ridge National Laboratory



[Watch Video](#)

“One of the big reasons we use InfiniBand and not an alternative is that we’ve got backwards compatibility with our existing solutions.”



Prof. Jean-Baptiste Cazier
Professor of Bioinformatics,
Director of the Centre for Computational Biology
Director of the Centre for Computational Biology



[Watch Video](#)

“InfiniBand is the most advanced interconnect technology in the world, with dramatic communication overhead reduction that fully unleashes cluster performance.”



Jianwen Wei
System Manager
HPC Center of Shanghai Jiaotong University



[Watch Video](#)

“In HPC, the processor should be going 100% of the time on a science question, not on a communications question. This is why the offload capability of Mellanox’s network is critical.”



Rick Wagner
SDSC, HPC Systems Manager



[Watch Video](#)

“InfiniBand is the best that is required for our applications. It enhances and unlocks the potential of the system.”



Dr. Happy Sithole
Director, Centre for High Performance Computing



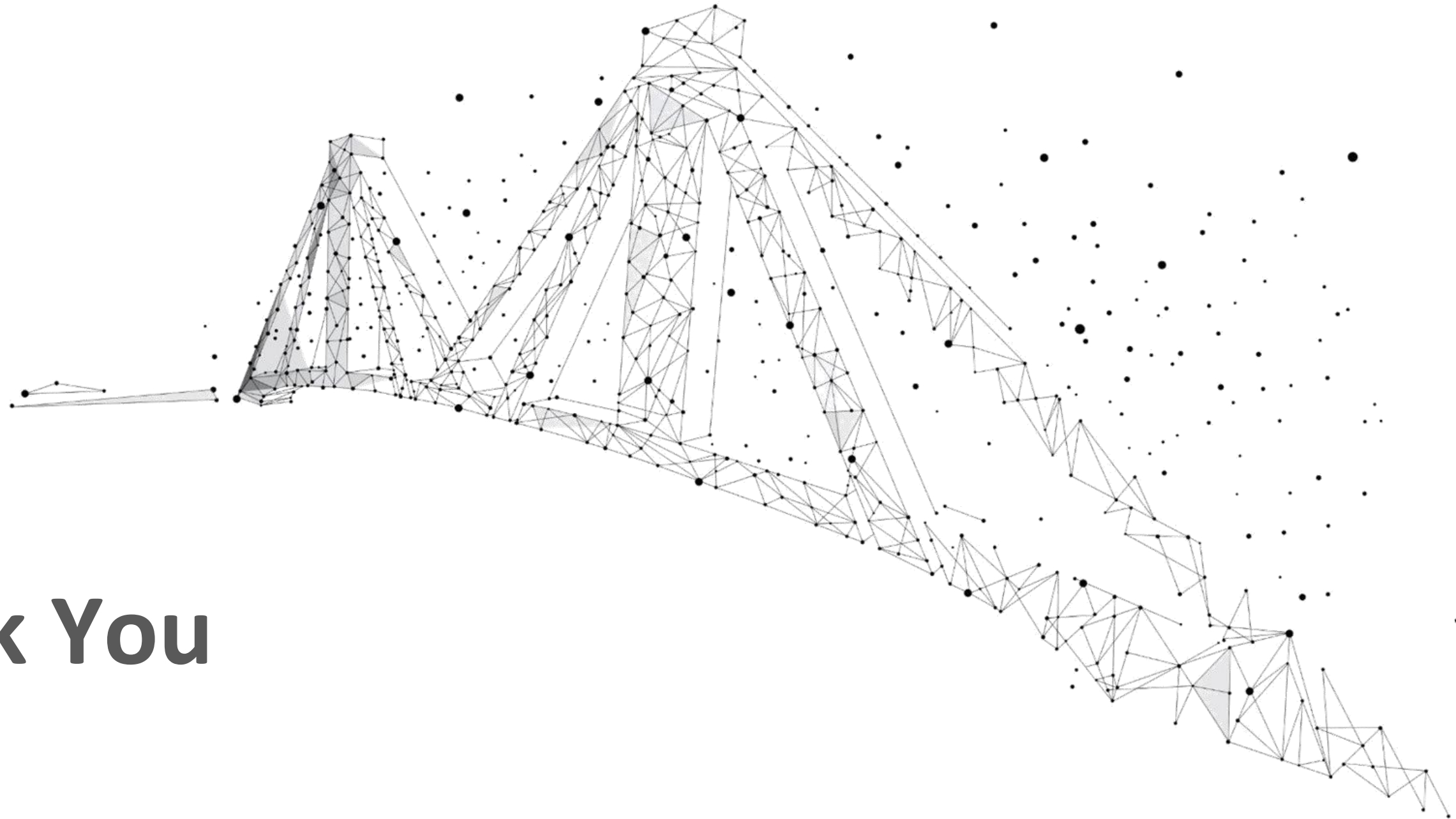
[Watch Video](#)

Proven Advantages

- Scalable, intelligent, flexible, high performance, end-to-end connectivity solutions
- Standards-based (InfiniBand, Ethernet), supported by large eco-system
- Supports all compute architectures: x86, Power, ARM, GPU, FPGA etc.
- Offloading and In-Network Computing architecture
- Flexible topologies: Fat Tree, Mesh, 3D Torus, Dragonfly+, etc.
- Converged I/O: compute, storage, management on single fabric
- Backward and future compatible



Enabling the Best Datacenter Return on Investment



Thank You

