



# Low-Latency Ethernet Solutions for High-Performance Computing

Leverage an integrated, scalable HPC system to assure high-level application performance—using proven Ethernet technology

## The Reality of HPC Powered by Ethernet

High-performance computing (HPC) delivers both the capacity and capability to operate the advanced applications needed to tackle today’s real-world computing challenges. In the early 2000s, before 10 Gigabit Ethernet was standardized, InfiniBand was the popular choice to deliver the speed, throughput, and latency required for HPC. Yet today, in a majority of the world’s “Top 500” supercomputers—more than 40 percent—the high performance and low latency required to power these applications is delivered by ubiquitous Ethernet technology.

Fabric in Top 500 Supercomputers	Number of Fabrics Deployed in 2016
1G Ethernet	23
10G Ethernet	178
40/100G Ethernet	6
InfiniBand FDR	154
InfiniBand Other	33
Other Connect Technology	106

(From Top500.org)

The prevalence of Ethernet in HPC may be surprising to many who understand Ethernet’s role as the interconnect standard for traditional data centers but would consider other technologies for the compute interconnect. However, Ethernet HPC has proven to be a viable solution for high performance and technical computing.

In fact, Ethernet is versatile enough for any environment. Over time, the technology’s roots in local area networking have evolved to meet users’ ever-growing bandwidth requirements—to 100 Gigabit Ethernet. Wide area networking and nearly all wireless connectivity today is based on Ethernet, and Ethernet is also becoming a common option for storage. The reasons for this broad adoption are simple: Ethernet is an easy-to-deploy, well-understood, plug-and-play technology, which is so widely used that finding a building without some degree of Ethernet connectivity would be the anomaly. This means that leveraging Ethernet for HPC can simplify deployment and reduce cost and complexity; there are real advantages in consolidating technology onto a single high-performance Ethernet network.

Importantly, this reduction in cost and complexity does not require a sacrifice in performance. Ethernet can deliver the high speed and low latency—true HPC performance—over 10 and 40 Gigabit Ethernet to equal competitive technologies, and 100 Gigabit Ethernet is an option as well.

With a single Ethernet environment, there is no need for a separate hardware infrastructure or a separate tool chain. In addition, with Ethernet, the longevity of the technology is assured; Ethernet has evolved, and will continue to evolve, to meet users’ changing requirements.

## HPC Solutions from Cisco: Low-latency Ethernet Switches and usNIC Technology

An HPC network is only effective if the high-level user applications it supports perform well, and Cisco Ethernet switches—including Cisco Nexus 9000 and 3000 families—are designed to provide the performance and low-latency needed to support HPC. These Nexus switches all provide sub-micro-second latency; for example, the Nexus 3500 switch offers latency of less than 150 nsec.

Integral to Cisco's HPC solution is usNIC (userspace NIC). To help assure the low-latency communications required among parallel processes, usNIC provides a block transport for MPI applications, eliminating the need for kernel interaction and thus increasing performance. The greatest latency is generally found at the OS TCP/IP stack in kernel, where typical latency from one-way, app-to-app communication over TCP/IP is 10s of micro-seconds. With usNIC, latencies of less than two micro-seconds can be achieved.

## Advantages of Cisco Low-latency Ethernet-based Solutions in HPC

- **Broadly recognized technology.** Ethernet is widely understood, making the technology easy to use and troubleshoot. Plus, the market for Ethernet continues to grow, as a wealth of players offer innovative new solutions.
- **Complete interoperability.** An Ethernet-based HPC cluster can communicate natively with other Ethernet-based systems without the need for a gateway or translation, enabling operation of virtual cluster resources with a single set of network assets.
- **Flexible design.** Ethernet's flexibility allows for virtual port channeling, which provides a full mesh configuration with a one-hop maximum design for redundancy.
- **Comprehensive workload support.** HPC workloads evolve, and Ethernet solutions offer support for everything from small message, such as MPI, to jumbo frames for storage reads and writes.
- **Deployment flexibility.** The HPC lifecycle is shorter than that of campus IT, and as HPC solutions are replaced, these Ethernet-based cluster resources can easily be repurposed for campus use.

## Learn More

Ethernet technology is a proven option for high-performance and technical computing, and Cisco leverages Ethernet technology to deliver the speed and low latency required by today's critical applications. [Click](#) to find out how.

