

**Customer**  
Cornell Theory Center

**Industry**  
Scientific  
Research



CTC  
high-performance | solutions

**Applications**  
Cluster/Grid Computing

**Highlights**  
Force10 Networks E-Series switch/router delivers nonstop availability to leading research center's 320-node high-performance cluster.

# Cornell Theory Center Harnesses Best-of-Breed Technology from Force10 Networks and DELL: High-performance 10 Gigabit Ethernet and PowerEdge server technology deliver performance and reliability

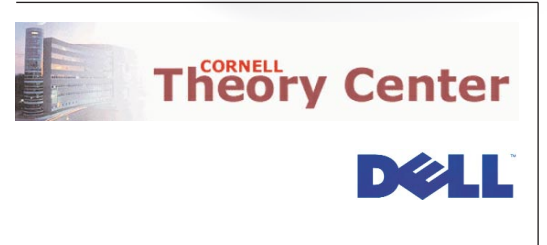
*Many of today's top research institutions run their most data- and processor-intensive applications on high-performance computing clusters or grids. With scientific breakthroughs and funding riding on the outcomes of their experiments, the researchers who depend on clusters need always-on availability, whether they're running theorem calculations or genetic modeling.*

To meet the availability needs of its researchers, the Cornell Theory Center (CTC) at Cornell University recently deployed the Force10 Networks E1200 resilient switch/router and DELL PowerEdge 2650 servers in its newest high-performance cluster. The Force10 E1200 links 320 servers in a Windows-based cluster, delivering the availability and port density that enables the CTC to develop new applications across a range of scientific fields.

## Researchers Need Application Availability

The CTC is a high-performance computing and interdisciplinary research center located on the Ithaca campus of Cornell University in upstate New York. The center also has additional offices in Manhattan. Scientific and engineering projects supported by the CTC represent a variety of research disciplines including bioinformatics, behavioral and social sciences, computer science, engineering, geosciences, mathematics, physical sciences, and business.

The center currently operates a DELL PowerEdge 2650 Intel/Windows cluster complex consisting of more than 1,500 processors. These clusters allow the more than 100 researchers affiliated with the CTC to run extremely complex simulations to support their research in areas ranging



from astrophysics to pollution remediation. For these scientists, high-performance computing is an indispensable tool, and a highly available switching and routing solution is essential. Computational interruptions or even momentary network failure can result in lost calculations, requiring the research segment to be run from the beginning.

"The system interconnect is an important piece of the high-performance computing equation," said Dave Lifka, CTC chief technical officer.

To effectively perform research on which their careers depend, the scientists need reliable access to computing bandwidth around-the-clock. Unfortunately, the earlier configuration of the 320-node cluster that supported three critical applications — nonlinear finite element simulation, bioinformatics simulation and molecular dynamics simulation — began experiencing operating system and hardware instability in their legacy switches and routers. As a result, the cluster was often unreliable in its performance and frequently unavailable.

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## Customer PROFILE

### Massive Scalability

For the cluster interconnect, the CTC team required non-blocking line-rate Gigabit Ethernet on all ports, with no congestion either into or out of the cluster.

With critical research depending on the cluster, the CTC turned to Force10 Networks. The center knew that Force10's E-Series resilient switch/routers provide line-rate, non-blocking Ethernet switching and routing to some of the world's largest high-performance computing clusters and Grid networks.

The CTC selected the Force10 E1200 switch/router based on several key factors. Massive density and scalability were at the top of the list. With up to 336 Gigabit Ethernet ports or 28 ten Gigabit Ethernet ports per chassis, the Force10 E-Series delivers the line-rate copper Gigabit Ethernet ports the CTC requires to link its 320 dual-processor cluster servers at 1.503 teraflops per second.

In addition, the ability to support the entire cluster with a single Force10 system reduces configuration and maintenance time, as well as the physical space, power and cabling requirements, resulting in cost savings and lowered total cost of ownership (TCO). The Force10 E-Series switch/routers combine full Layer 2 switching and Layer 3 routing functionality on a single platform, allowing the CTC to reduce the complexity of its network architecture and the overall number of devices in its network, thereby simplifying operations.

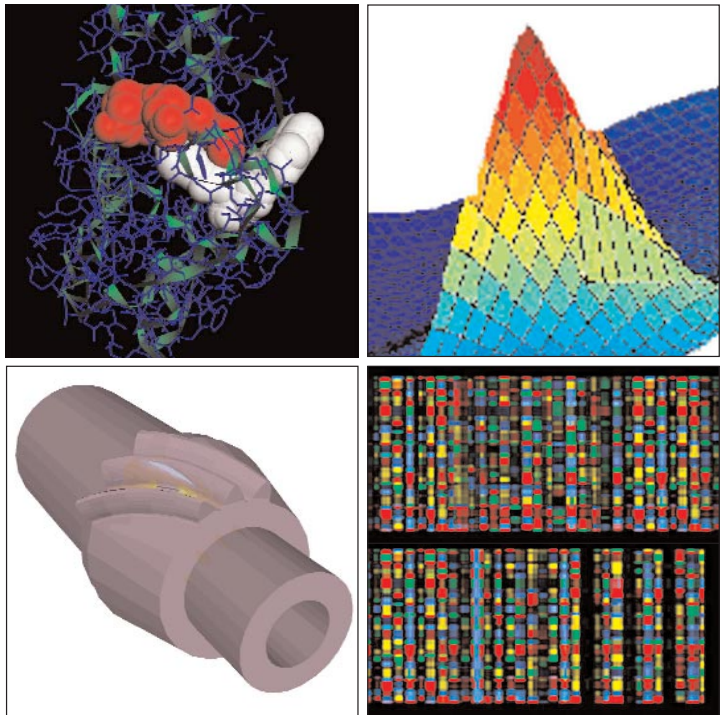
Force10's partnership with DELL enabled easy design and implementation of both the E-Series interconnect and DELL's PowerEdge servers for the computing fabric.

### Reliable, Line-rate Performance

Force10's innovative E-Series architecture delivers non-blocking, line-rate forwarding across all line cards. Throughput and line-rate

“The E1200 from Force10 Networks enables CTC to meet the needs of our users, who expect reliable availability and stellar performance.”

**Dave Lifka**  
Chief Technical Officer,  
Cornell Theory Center



**CTC 3D models** (clockwise from upper left): biomedical research, computational finance, computational materials science and computational genomics. For more information about the CTC scientific and engineering research projects, please visit <http://www.tc.cornell.edu/>

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performance are guaranteed, even with features like Access Control Lists (ACLs) and Quality of Service (QoS) enabled. In addition, the E-Series switch fabric provides advanced queuing, multicast and jumbo frame support.

The Force10 E1200's multicast support was especially important to the Center, since some of the CTC's bioinformatics applications require full-motion video capabilities. For example, a researcher might create .WAV files to show a series of time-lapse images that they then need to share with other researchers across the Internet. Up to 100 scientists may stream the video at the same time the cluster is running a separate bandwidth-intensive research application. Such high-performance demands are not a problem for the Force10 E1200, which can switch and route, manage traffic and still handle a broadband stream with multicast technology, all at line-rate throughput.

To ensure predictable performance even under tremendous traffic loads or intensive processing tasks, the unique E-Series architecture features separate control and data planes, distributing routing, switching and system management between three CPUs. The first processor handles Layer 2 traffic; the second, Layer 3; and the third management traffic. This patented architecture allows any faults to be contained while protecting other parts of the system.

### Predictable Cluster Performance

Force10 worked closely with the CTC to configure the physical and logical links between the DELL PowerEdge server cluster and the Force10 E1200 to ensure that everything worked together. The result is a network on which researchers can depend.

"The Gigabit Ethernet switching and routing from Force10 Networks enables the CTC to meet the needs of our users who expect reliable availability and stellar performance," says Lifka.

Leveraging the advanced hardware and software reliability of the Force10 E-Series, the CTC can run the advanced computing and processing applications that enable it to develop advanced treatments for diseases such as Alzheimer's and Cystic Fibrosis, investigate new optimization algorithms for large-scale portfolio analysis and predict the structural integrity of a wide range of engineered and natural structures.

The Force10 E-Series, as the foundation of the CTC's high-performance cluster, delivers guaranteed predictability and availability to advance scientific research and position the CTC as a world class research organization.



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