Powering Italy's Information Society

Cineca takes supercomputing performance to new levels and lays the foundations for virtualization.

EXECUTIVE SUMMARY

Customer Name: Cineca

Industry: Service Provider

Location: Bologna, Italy

Company size: 500 employees

Challenge

- Address immediate priority to accelerate customer projects
- Provide path for data center evolution and virtualization

Solution

- Adopt Cisco Data Center 3.0 approach
- Deploy Cisco Nexus 7000 Series Switches for improved supercomputing performance

Results

- Reduced computing lead times and overall time-to-solution
- Ability to support future supercomputing needs of Italy and Europe
- Consolidation of infrastructure and devices to help drive down TCO

Challenge

Cineca powers Italy's information society. The nonprofit consortium provides high-performance computing (HPC) services that enable scientists, researchers, educators, students, government, and commercial organizations to share ideas, information, and learning with maximum efficiency and effectiveness.

In Bologna, behind the walls of Italy's largest computing center, Cineca has some 500 employees and 1300 HPC servers. Each day, these advanced systems process about 1000 terabytes of data, helping to accelerate innovation in science, medicine, chemistry, geophysics, the discovery of oil and gas resources, and other high-profile projects. The data center also houses 200 information and communication technology (ICT) servers and 10,000 enterprise servers that support the day-to-day operations of businesses and public administration.

Having established full virtualization between academic and research traffic and commercial user traffic as part of an earlier project with Cisco and IBM, Cineca's focus has shifted towards optimizing its computing capabilities. The supercomputer architecture provides a meshed internal interconnection. This arrangement allows the data center to reuse computing algorithms based on Message Passing Interface libraries. However, traditional connections from the cluster boundary to international destinations had started to become a hindrance to data transfer.

Sanzio Bassini, director of systems and technology at Cineca, says: "Supercomputers will often need to run continuously for a week or more, for example, processing terabytes of data and completing complex calculations. We have to search out new ways to improve front-end computing speeds and shorten these cycles. It is a constant challenge, but one that is crucial to our customers because it means that the overall time-to-solution can be greatly reduced."

These high-speed capabilities will become even more critical in the future. The supercomputing system is intended to become the main facility for GARR (the Italian research network). Cineca is also part of the DEISA (Distributed European Infrastructure for Supercomputing Applications) project, which aims to build a distributed architecture among computing centers in Europe using 10 Gigabit connections. There are also plans for data mirroring between Cineca supercomputers and Italy's science community.

Solution

Cineca decided against a series of tactical IT deployments and instead took a more holistic approach. "By aligning our strategy with Cisco Data Center 3.0, we believe we have increased our chances of success," Bassini says. "It means that we can confidently evolve our data center, knowing that we have invested in best-practice architectures, for example, for virtualization, plus technical support services that are second to none."

Rather than focus on specific challenges, Cisco Data Center 3.0 addresses the data center as a whole. It provides a practical roadmap for infrastructure transformation based on three key phases: consolidation, virtualization, and automation. The end result is tighter integration of servers, networks, and storage systems, which in turn helps to deliver new improvements in performance and cost efficiency.

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> **–Denis Pavani, Network Architect, Cineca**

The first step of this architectural roadmap has seen Cineca implement the Cisco Nexus 7000 Series platform. This ultra-fast switching solution has been designed around three principles:

- Infrastructure scalability: using virtualization, power and cooling efficiency, density, and performance to support efficient data center infrastructure growth
- Operational continuity: integrated hardware, software, and management tools designed to support zero downtime environments
- Transport flexibility: engineering foresight to enable the adoption of new technologies in an incremental, cost-effective manner.

Like all IT investments, however, the numbers still had to add up. Denis Pavani, network architect, Cineca, says, "The business case made sound commercial sense when you consider that we would have had to implement eight pairs of Cisco Catalyst 6500 Switches to achieve the same levels of performance as the Cisco Nexus 7000. Also, you quickly realize that consolidation is not just about legacy equipment."

The Cisco Nexus 7000 platform will initially act as the main "brain" for coordinating cluster and infrastructure services. These services include login, batch development (nodes for testing new applications), DEISA 10 Gigabit connections and associated servers, grid computing exchange (exporting around 600 terabytes of data), File Transfer Protocol servers for data output retrieval, and systems backup. In addition, high-speed storage interfaces enable Cineca to complete back-end operations, such as archiving, very quickly.

Security of the network is enhanced by Cisco ASA 5500 Series Adaptive Security Appliances. The solution, a key component of the Cisco Self-Defending Network, integrates the best firewall, unified communications security, VPN, intrusion prevention, and content security services within one unified platform. These intelligent threat defense capabilities enable Cineca to stop attacks before they penetrate the network perimeter, control network and application activity, and deliver secure remote access as well as site-to-site connectivity.

Results

The first phase of the collaboration is expected to deliver significant improvements in supercomputing performance. Cineca intends to pass these benefits directly on to its customers in the form of valuable project savings.

"Before, we might have a project involving terabytes of information," says Bassini. "At basic connection speeds of 1 Gigabit, this data could sit in the WAN awaiting transfer for several days. Now, with 10 Gigabit links and dedicated nodes for each customer, we can complete this process faster and provide results much earlier, in some cases, within a day."

In accordance with Cineca's overarching strategy, the Cisco Nexus 7000 platform will assist with further consolidation, helping to simplify infrastructure and reduce total cost of ownership (TCO). "We can start to evaluate new projects to consolidate storage devices," says Pavani. "Fewer devices also mean less cabling. We currently spend about US$ 140,000 a year on fiber alone and expect to make significant savings here."

More importantly, the solution will allow Cineca to implement the second phase of Cisco Data Center 3.0 and extend virtualization into the data center. The ability to dynamically allocate resources makes it possible to lower TCO further still and realize new benefits, such as increased agility, greater portability, and improved server utilization.

"Virtualization is a very exciting prospect," Pavani says. "We currently have many standalone servers, multiple operating systems, and various middleware technologies. This means that we have to write different sets of operational procedures. It is also difficult and time-consuming to exchange specialist skills and knowledge between staff. Virtualization can help to remove these layers of complexity and inefficiency."

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–Sanzio Bassini, Director of Systems and Technology, Cineca

Over the forthcoming months, Cineca plans to scope this opportunity, while at the same time using the Cisco Nexus 7000 platform to set up a test bed where it can research and try out new virtualization features and advanced routing techniques, such as Border Gateway Protocol and Open Shortest Path First.

With 10 Gigabit interfaces becoming a future prerequisite and an impending explosion in data growth, Cineca is already looking ahead. The decision to implement the Cisco Nexus 7000 platform has provided valuable investment protection. It means that Cineca can migrate to Blue Gene mainframes, as planned over the next three years, without having to undertake a complete rebuild of its high-performance network infrastructure.

"Our collaboration with Cisco gives us a roadmap to move forward with our data center evolution," says Bassini. "It means that we have the scalability and advanced technology necessary to succeed today and in the future."

PRODUCT LIST

Routing and Switching

- Cisco Nexus 7000 Series Switches

Security and VPN

- Cisco ASA 5500 Series Adaptive Security Appliance

For More Information

To find out more about Cisco Data Center 3.0 please visit:
http://www.cisco.com/en/US/netsol/ns340/ns394/ns224/index.html

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