

## German University Powers Supercomputing Research with IPv6 Network

Leibniz Supercomputing Centre uses Cisco® network to deliver next-generation IPv6 services for groundbreaking research.

### EXECUTIVE SUMMARY

#### LEIBNIZ SUPERCOMPUTING CENTRE (LRZ)

- Higher Education
- Garching near Munich, Germany
- 175 employees

#### BUSINESS CHALLENGE

- Provide advanced network services to more than 100,000 higher-education students and researchers, and meet escalating network demands

#### NETWORK SOLUTION

- Scalable, flexible network infrastructure based on Cisco Catalyst® 6500 Series Switches delivers parallel IPv4 and IPv6 services without equipment upgrades or additional costs

#### BUSINESS RESULTS

- Secure, manageable IPv6 network infrastructure enables LRZ clients to support advanced research and applications, while easing network administration and controlling costs

### Business Challenge

Since 1962, the Leibniz Supercomputing Centre (Leibniz-Rechenzentrum, LRZ) has been a leader in supporting groundbreaking research and education for universities in the Munich area, Germany. The center provides general IT services for more than 100,000 university customers and for the Bavarian Academy of Sciences and Humanities. LRZ also supports a variety of advanced research initiatives, and has pioneered some of the latest communication technologies.

LRZ depends on its network to give its research and education customers the tools and infrastructure that they need to stay ahead in academic exploration. Over the past few years, the higher education community has been particularly focused on IPv6, the next-generation Internet Protocol.

“Educational organizations worldwide are strongly encouraging the deployment of IPv6 services,” says Bernhard Schmidt, Network Engineer and Internet Consultant at LRZ. “LRZ is basically the service provider for the university. We provide IPv6 to our customers to enable them to pursue their initiatives.”

Previously, LRZ utilized an IPv4 network to deliver the services that its clients needed. Although the infrastructure was fine for many applications, the inherent limitations of IPv4 addressing began to create some administrative issues.

“The main issue with IPv4 is that public addresses are a scarce resource, and we have to employ mapping to conserve address space,” says Schmidt. “Every new application that we deploy has to support Network Address Translation (NAT) in one way or another, which can be quite a hassle for applications like voice over IP. NAT can potentially introduce problems with every protocol we deploy.”

“Our Cisco IPv6 network lets us meet customer needs with a ‘one size fits all’ approach. We don’t have to discuss how many systems our customers are going to connect in the next month, or even the next year.”

—Bernhard Schmidt, Network Engineer and Internet Consultant, LRZ

With its much larger address space, IPv6 would enable LRZ to deliver the scalability and flexibility its clients need. To meet the bandwidth and performance demands of IPv6, LRZ needed a solution that would provide the same proven stability as its existing network, to facilitate transition and allow widespread use. The solution would have to be cost efficient, to enable IPv6 services without significant new hardware and software expenses.

## Solution

LRZ has long used Cisco network technology. Its network backbone utilizes Cisco Catalyst 6509 Switches, deployed in eight points of presence in the greater Munich area. Cisco Catalyst 6509 Switches deliver the flexibility and high port densities that are ideal for the wiring closet, distribution, and core network. Running with the Cisco Supervisor Engine 720, the switches deliver scalable performance and rich features like quality of service and security. Schmidt and his team were pleased that the Cisco solution could scale to accommodate IPv6 without major upgrade expenses. “We didn’t want to introduce additional hardware because of the additional costs,” says Schmidt.

Schmidt and his team reconfigured the Cisco Catalyst 6509 backbone switches with dual stack services to run IPv6 in parallel with IPv4. LRZ also deployed Open Shortest Path First Version 3 and Border Gateway Protocol, enabling the network to deliver IPv6 services with no additional network equipment.

“We were able to complete our core network migration in about two months,” says Schmidt. “Our top priority was making sure that our network equipment was capable of supporting IPv6. Fortunately for us, Cisco already supported IPv6 on our existing Cisco Catalyst 6500 Series Switches.”

The upgraded LRZ dual-stack network is not a limited experimental environment, but a full production network that provides real IPv6 services alongside the organization’s traditional IPv4 services. The new network delivers native IPv6 connectivity to approximately 45 university departments and ten student dormitories. The Cisco network has been able to smoothly accommodate a thousand percent increase in traffic, while maintaining the same high performance and reliability, with no additional hardware. The new network lets LRZ support its wide range of research initiatives, from supercomputer and grid environments to video and mobile projects.

For example, the IPv6 network supports the LRZ Linux cluster, which can be accessed by researchers from the Munich universities. The Linux cluster powers a diverse range of applications, providing support for developing and testing serial and parallel programs. Together, the networked platforms at the LRZ Supercomputing Centre deliver a more cost efficient, systematic, and faster alternative to costly, time-intensive experiments.

The LRZ network has also provided a fertile environment for rich-media applications, including IPv6 streaming video initiatives at the Technical University of Munich. Now available as a consumer product, the NetCeiver system from BayCom GmbH lets consumers transmit television and radio content over the network.

“The solution was completely compatible with existing APIs,” says Schmidt. “You install a NetCeiver and a driver on your computer, and it simulates a digital TV card. This project would have been impossible using IPv4, because it depends on the increased address space of IPv6 for multicast groups. It provides extremely high reliability and scalability.”

IPv6 is also a promising protocol for mobile applications, providing secure connectivity to multiple devices and support for unplanned networking. “One of our customers is looking into mobile IPv6,” says Schmidt. “We can simply provide his network, and give him the addresses, and he can use them however he would like.”

## Results

The Cisco Catalyst 6500 Series Switches support a variety of new IPv6 services that would have been impossible under IPv4. The Cisco solution lets LRZ unlock a variety of benefits, easing network administration while enabling the organization to support the services that its customers need.

“The most important difference we have enjoyed with IPv6 has been a huge improvement in manageability,” says Schmidt. “Because our previous system did not offer an unlimited number of IPv4 addresses, we had to carefully monitor how we allocated addresses to customers. Over the years, this process became very cumbersome, because we often had to expand and reduce customer network assignments. It became more and more difficult to maintain accurate views of our network configuration.”

The unlimited addresses available under the IPv6 configuration enable LRZ to meet its clients’ needs quickly and easily. “Our Cisco IPv6 network lets us meet customer needs with a ‘one size fits all’ approach,” says Schmidt. “We don’t have to discuss how many systems our customers are going to connect in the next month, or even the next year.”

The Cisco network was able to smoothly accommodate the additional bandwidth overhead required by IPv6, with no impact on performance. “Traffic on our external interface to the German Research Network has increased by a factor of ten since our deployment, which is very impressive,” says Schmidt.

The new solution also enables LRZ to streamline its operations and improve efficiency, delivering additional services without adding new equipment. Schmidt hopes the new IPv6 infrastructure will deliver a substantial return on investment on the long run.

“In the future, the new network may provide us with the opportunity to shut down some of the IPv4 services that are no longer needed,” says Schmidt. “For example, we can circumvent the central network gateway, which would save us a lot of effort and money. Of course, the transition involves some additional work, but in the end it will be well worth the effort.”

Perhaps most importantly, the Cisco solution enables LRZ to meet its commitment to offer the latest networking technology to support the most advanced research and education projects. “Utilizing the latest networking technology underscores our focus on staying ahead,” says Schmidt. “LRZ cares about future capabilities and scalability. We want to be involved first hand in the latest experimental and production networks. And we want to contribute our operational knowledge to the product, to help make it better.”

### PRODUCT LIST

#### Routing and Switching

- Cisco Catalyst 6509 Switches
- Cisco Supervisor Engine 720

#### Security and VPN

- Cisco ASA-5580-40 Adaptive Security Appliance
- Cisco SSL-VPN Solution

### Next Steps

With its IPv6 network fully operational, LRZ is exploring ways to add new applications and improve the features and performance of its infrastructure. Security is always a top concern for every organization, and LRZ is considering using Cisco SSL VPN solutions as an IPv6-ready replacement for its previous VPN solution.

“We support a wide variety of users with VPNs, from teleworkers and students at home to branch offices,” says Schmidt. “We are also hoping to use VPN technology to better safeguard wireless LAN access.”

Schmidt and his team are confident that the flexible Cisco architecture will enable LRZ to easily support a broad range of new features well into the future.

### For More Information

To learn more about Cisco Catalyst Switches, visit <http://www.cisco.com/go/switching>.



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