

GOING GLOBAL

**Penn State
Becomes
“World
Campus”**

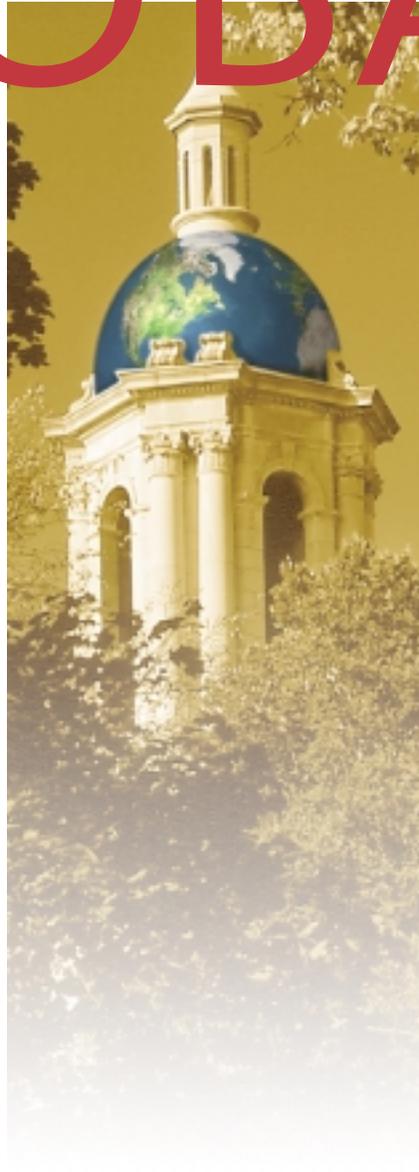
DISTANCE LEARNING AT Pennsylvania State University isn't a new facet of the curriculum—it's been around since the school began offering courses to farmers in 1892. In the 108 years since, the program has gone on line, serving a diverse student body around the world. The “World Campus” program at Penn State relies on a Cisco router and switch infrastructure and key features of Cisco IOS® software—including IP Multicast, quality of service (QoS), and the Internet Group Management Protocol (IGMP)—to keep the multimedia, interactive classes in session.

From agricultural college to world-class learning community, Pennsylvania State University's mission has grown dramatically since it was founded in 1855. The school's original goal was to apply scientific principles to farming, a radical departure from the traditional curriculum of the time, which was grounded in mathematics, rhetoric, and classical languages. That early focus on scientific principles has evolved at Penn State; today it is a leader in the use of technology for higher education.

“Unlike traditional computer-based training, we've taken a much more interactive, instructor-led approach,” says Dr. Gary Miller, Associate Vice President for Distance Education and Executive Director of the World Campus at Penn State. “In addition to online mentoring and guidance from professors, our courses stress team-oriented exercises and a lot of collaboration among students.”

Multicasting for E-Learning

Penn State requires a robust, manageable, secure, and scalable high-speed network to



enable a myriad of applications for students, faculty, and staff at campuses throughout the state and around the world. In addition to World Campus, the network facilitates advanced computational research, e-mail, Web access, video on demand, and projects for Internet2.

“Without the Cisco router and switch technology, combined with Cisco IOS software, we would not be able to provide the

infrastructure for all this,” says John Kalbach, Manager of Networking and Advanced Systems at Penn State. Kalbach and his staff are responsible for providing network services for Penn State's massive e-mail system, Web sites, dialup services, computational research, and advanced projects. Penn State's integrated backbone supports ATM and IP connectivity for more than 170 LANs and 40,000 hosts and provides access to computer resources and information available worldwide via the Internet. “With prioritized IP Multicast, we can guarantee that a user can watch an MPEG1 video stream in the building by routing the traffic between the video server and the PC, and guarantee that there's not going to be any degradation from congestion. We prioritize the traffic by using the interface and tweaking the traffic flows,” he adds.

An average day on the university network includes e-mail volume of 1.9 million messages (or 51 gigabits of e-mail data) and a million Web page views. More than 60,000 calls are made daily to the network from dialup modems.

“From a network operations perspective, a university is very different than a business, because students are a transient population,” says Kalbach. “Every fall we get 10,000 new students, and approximately 10,000 students graduate. So you're seeing 20,000 setup changes a year. Without the configurability that Cisco IOS software gives us, we wouldn't be able to keep up with the demand.”

Heavy Reliance on Security Features

As access and services on the network grow, security is a major focus for Penn State.

IGMP STREAMLINES MULTICAST TRAFFIC

In addition to the World Campus programs, the Penn State network is used to multicast full-motion video presentations for various departments. "If you have a network with multicast traffic, address management can be more complex," says Kalbach. "But with IGMP, now available with Cisco IOS Software Release 12.0, we have full control."

IGMP runs between multicast clients and routers. The university's Cisco switches are configured with IGMP to detect a video client initiating a multicast session. Multicast traffic destined for the video client is confined to that video client's switch port instead of being broadcast to all ports. This containment alleviates wasted network bandwidth that could negatively impact the performance of all stations connected to the switch.

Penn State has a Cisco 12000 series Gigabit Switch Router (GSR) connected to a Catalyst 6509 switch, which provides a high-performance, multilayer switching solution for the campus network. Coupled with Cisco IOS software, the Catalyst switch provides the required infrastructure to support high-capacity gigabit switching and the multilayer intelligence to efficiently manage network traffic.

Cisco IOS software runs on all of the Cisco equipment, and Kalbach and his staff count it as another advantage to be able to use the same Cisco IOS commands on both switches and routers. In the future, they plan to upgrade to 6-gigabit Ethernet links and to migrate from OC-12 to OC-48 to provide the bandwidth necessary to handle the university's demanding network applications.

"We need an infrastructure and network management that can filter at those speeds and not impact performance," says Kalbach. "There are no other devices or network operating systems on the market aside from Cisco's that can do everything we want and grow with us over time."

A MODEL FOR ENTERPRISES

While Penn State's e-learning model exists in an academic environment, this same model would translate perfectly into a business environment; for example, for use by a large enterprise to deliver e-learning to its employees and partners. A step up from computer-based training, Penn State's approach emphasizes mentoring and student collaboration, bringing together teachers and students from anywhere with access to the Internet.

day based on access policies. Those rights are then monitored and appropriately granted or denied based on the user's IP address and time of day. With the wide array of information available on the network and the shifting needs of students on a semester-to-semester basis, the ability to control access dynamically is crucial.

World Campus Grows

In 1998, its first year of operation, the World Campus attracted more than 600 students from across the USA as well as eight other countries. Today, enrollment is up to 1900. Sixteen general online programs are offered, all derived from vibrant academic programs already at Penn State.

Courses from Penn State's School of Information Science and Technology will be added to the World Campus in September. The university is also talking with Cisco about putting a portion of the Cisco Networking Academy Program™ on the Web for college and high school students.

As more students join the World Campus program, the underlying features of Cisco IOS software will become even more crucial for delivery of course content, student work, teacher guidance, and examination results to and from every continent. ▲▲

Cisco IOS Software Release 12.0 is the first release to include a standardized version of IP Security (IPSec), a framework of open standards for ensuring secure, private communication over IP networks.

"We use the protocol-filtering software features in the Catalyst® operating system to make sure that people are not doing anything illegal," says Network Operations Technician Mark Miller. "From the switch, we can detect what kind of clients are attached by reading the headers of all packets. The switch can be configured to automatically shield client sta-

tions from unnecessary protocol broadcasts." With the variety of scientific research going on at Penn State, this feature enables the network managers to turn the filtering feature on or off for all ports on the switch, for only specified virtual LANs on the switch, or for users on a port-to-port basis.

Another feature new to the security suite is access control lists (ACLs), a more granular form of access control, which gives Penn State's network administrators the ability to change a given user's access rights dynamically during various times of the