

DARTMOUTH AND CISCO: BUILDING THE CAMPUS OF THE FUTURE

EXECUTIVE SUMMARY

Dartmouth College

- Located in Hanover, N.H. and established in 1769, nation's ninth-oldest college
- Private, four-year coeducational undergraduate institution
- More than 5000 students and roughly 1900 faculty and staff

BUSINESS CHALLENGE

- The mobile nature of the campus population requires network access from anywhere
- The college was maintaining three separate networks for data, voice communication, and cable TV
- The college wanted to maintain open access to the network and Internet while limiting the risks posed by worms, viruses, and hackers

NETWORK SOLUTION

- Cisco Business Ready Campus, including: resilient infrastructure, integrated security, wireless LAN, and IP communications

BUSINESS VALUE

- *Protect*—Firewalls, access control lists, and integrated security features help to ensure secure wired and wireless voice and data communication
- *Optimize*—Converged data, voice, and video network reduces cabling requirements and makes more efficient use of IT staff
- *Grow*—Being one of the leaders in using technology to improve campus life enhances the appeal of Dartmouth College to students and staff

When Dartmouth College set out to deploy advanced technologies to provide their students, faculty, and staff with a campus of the future, they looked to Cisco Systems®, Inc. And when Cisco® wanted to better understand how technology is being used in the higher-education environments, they looked to Dartmouth College.

Dartmouth College is the ninth oldest college in the United States and a member of the prestigious Ivy League of U.S. colleges and universities. Located in Hanover, New Hampshire, Dartmouth has a long history of innovation and leadership in research and teaching. It is also a pace-setter in computing: the entire 200-acre main campus has been wired since 1985, providing access for students, faculty, and staff to the campus LAN, which links all residence hall rooms, academic buildings, administrative offices, and mainframe computers on and off campus. Nearly all undergraduates and most graduate students live in a networked campus building.

THE CHALLENGE

In addition to maintaining its excellent reputation for high academic standards, Dartmouth College has a goal to establish themselves as one of the leaders in innovation in the higher-education arena by deploying advanced technologies to make significant improvements in campus life for their students, faculty, and staff. For their IT department, this goal can be broken down into the categories of user mobility, network convergence, IP communications, and network security.

- *User mobility*—In the late 1990s, Dartmouth College realized that although the entire campus was wired with more than 1900 ports, these fixed-location access ports were no longer sufficient to address the needs of the students, faculty, and staff. “Our Ethernet system was a substantial improvement over what had been available to the campus community before, but it wasn’t long before we knew we had to upgrade to the next level,” says Larry Levine, the college’s CIO. “Today’s society is highly mobile, with people working from anywhere and whenever they want to. It’s not a nine-to-five world anymore. People are constantly multitasking—especially students. You see them walking on campus doing homework or research, communicating, or accessing information. Our vision was to answer the needs of this mobile community by providing wireless access throughout the campus.”

- *Network convergence*—In 2003, Dartmouth College turned its focus to network convergence. At that time, Dartmouth College had three, disparate networks: one for data communication, one for voice communication, and one for the campus cable television network. “We used to worry about just the data network being converged—with all the protocols like AppleTalk, IP, and others. IP won, but we still had separate voice networks and separate video networks. And many institutions didn’t even own their own phone switch. Today, we talk about integrating all of that—anything you can see or hear can be digitized, so we are putting everything onto one converged network,” says Levine.
- *IP communications*—With the advent of cellular phones Dartmouth College was losing money with their current long distance phone plan. Dartmouth had an agreement with their long distance carrier for a minimum amount of usage each month. As students made long distance calls from their dorms, Dartmouth College would charge the student for the minutes used. In recent years, most students have virtually stopped using the phones in their dorms for long distance calls and instead are using their cell phones. But Dartmouth was still obligated to the minimum usage charge by their long distance carrier. Deploying an IP communications strategy that includes IP telephony would allow Dartmouth College to make optimal use of their converged network and lessen their dependency on traditional telephony service providers.
- *Network security*—As an educational institution, Dartmouth College is committed to providing open anytime, anywhere network access to its students, faculty, and staff. But, they are also very cognizant of the rise in security threats (including worms, viruses, and hackers) that could compromise the stability of their network. So a key component to achieving their goal of being an innovation leader is that the network must be easy to access for legitimate users but prevent access to would-be attackers and mitigate the risk of viruses and worms.

THE SOLUTION

To help Dartmouth College achieve their goal, Cisco and Cisco certified gold partner, Networked Information Systems (NIS), provided a comprehensive solution that includes a flexible, resilient, converged infrastructure with integrated security, a wireless overlay, and IP telephony and IP video services.

In the spring of 2001, Dartmouth College became the first Ivy League school to deploy wireless coverage across the entire campus. In 2003, Dartmouth College began converging their voice and data networks as well as incorporating their cable TV network.

User Mobility

Dartmouth College promotes a very open environment. Classes are not restricted to physical classrooms and ongoing interaction between students on project teams is an important aspect of the Dartmouth College teaching philosophy. Therefore, it was important to Dartmouth that their users enjoy untethered access to their network.

To provide this ubiquitous access, Dartmouth College installed an overlay network of more than 560 Cisco Aironet® Access Points across the entire campus, including all of the roughly 150 buildings. “Whether you are inside the building, outside the building, canoeing down the Connecticut river, watching football in stadium, or out at the Skiway, you can get wireless connectivity,” says Brad Noblet, CTO of Dartmouth College.

Converged Network Infrastructure

To create a network foundation that will accommodate their current need for convergence and position them to maintain leadership status in use of technology, Dartmouth College deployed a robust, resilient, adaptable network infrastructure. According to Bob Johnson, director of network operations at Dartmouth College, “When we made the decision to go with Cisco, the features inherent in IOS and what you can build on top of that was one of the driving factors.”

Dartmouth College’s campus infrastructure includes Cisco Catalyst® 3550 Intelligent Ethernet switches and Cisco Catalyst 6500 Series switches, both of which are designed to help maximize bandwidth management. “Better bandwidth management is a strong feature for us,” says Noblet. “We intend to take maximum advantage of the capabilities these switch families provide.”

Intelligent switching increases bandwidth availability at the network edge, where users are connected to the network. This is in contrast to previous practices, where the network intelligence that controlled data traffic was limited to the core or backbone. The advent of small and medium-sized networks has generated an increased need for high availability, advanced quality of service (QoS)—also featured in the Catalyst 6500 Series switch—and improved security at the network edge. Extending network intelligence to the edge makes it possible for data traffic to be classified at the source, thus permitting prioritization of both upstream and downstream traffic to minimize congestion. In addition, it enables network administrators to establish policies on a per-user basis, freeing up router processing power.

The Cisco Cluster Management Suite (CMS) software, embedded in both the Catalyst 6500 and 3550 Series switches, simplifies the time-consuming task of deploying intelligent services.

IP Communications

To make the most of their converged network, Dartmouth College recently deployed a Voice over IP (VoIP) strategy with two Cisco CallManagers—the Cisco IOS® Software-based call-processing program—and 700 IP phones.

Using a combination of this VoIP strategy and their wireless network, Dartmouth College also found a way to provide their students with wireless phone service. To do so, Dartmouth College purchased 1100 Cisco Softphone licenses. Starting in the fall of 2003, students can use the Cisco Softphone on their laptop to make unlimited local and long distance calls from anywhere on campus.

Softphone licenses have also been given to many of the faculty and staff. As they travel with their laptops, the faculty and staff can connect back into the Dartmouth College network and use their Cisco Softphone to make needed calls. “I can go anywhere in the world and through whatever Internet connection I plug into, I can run my SoftPhone program on my laptop to get a dial tone as if I were sitting in my office” says Levine. Because Dartmouth no longer charges for any domestic long distance calls, Softphone users are free to use this service liberally.

Dartmouth College also recently incorporated its cable television network into their converged voice and data network and is starting to deploy technology that provides improved services for multimedia over a wireless network. “With our converged architecture, you will be able to make phone calls, watch videos, participate in multimedia events, as well as surf the web from anywhere on campus,” says Noblet.

In a slightly different application of VoIP, Dartmouth College is experimenting with technology from Vocera Communications. Currently being deployed most frequently in hospitals, the Vocera Communication System can be described as a voice-based wireless instant messaging system. The Vocera Communications Badge uses voice commands to establish wireless communications between two or more participants over the existing Cisco Wireless LAN. Dartmouth College is testing the use of the Vocera Communications System to promote spontaneous interaction between members of project groups and research teams.

Network Security

As is the case with most networks today, security is a focus area for Dartmouth College’s IT department. “We (in higher-education) have always tried to be quite open and for a long time, we could get away with it. Now higher-ed is entering a phase where the network cannot be so open anymore,” says Levine. Higher-education, however, has some unique challenges in that, unlike a corporate environment, they do not have control of the diverse computing platforms that are brought to campus.

At the network edge, Dartmouth College is using Cisco PIX® firewalls, which support up to 500,000 simultaneous connections and nearly 1.7 Gbps aggregate throughput. In addition, Dartmouth College is beginning to deploy some of the Catalyst Integrated Security Features, such as DHCP snooping and rate limiting, to help mitigate the risks that come with having an open-access network.

“I can go anywhere in the world and through whatever Internet connection I plug into, I can run my SoftPhone program on my laptop to get a dial tone as if I were sitting in my office.”

Lawrence M. Levine
Director of Computing
Dartmouth College

For travelling students, faculty, and staff, remote access to the resources of the Dartmouth College network is secured through a Cisco Virtual Private Network (VPN) 3030 Series concentrator.

THE RESULTS

Today, Dartmouth College is well on its way to a secure, converged data, voice, and video network that is accessible from anywhere on the campus. They have made significant achievements in reaching their goal of “secure computing for anybody—anytime, anywhere” (as summarized by Larry Levine).

Dartmouth College believes that by deploying and using advanced technologies, such as wireless and IP telephony, they are better able to attract students. It also gives the students a leg up with future employment because they gain experience with the advanced technologies used on the campus and many have been involved with post-graduate work that involves research related to these technologies.

University Research Program

The University Research Program (URP) is dedicated to soliciting, reviewing, funding, and cooperatively working with researchers at leading universities and other research organizations around the globe in order to promote and support directed research on technologies in topics of current or future interest to Cisco.

Dartmouth College is the proud recipient of three research grants under the Cisco URP. The first grant, awarded in 2001, was given to David Kotz and Kobby Essien (members of the Computer Science department at Dartmouth College) to study the usage patterns of the campus-wide wireless network. For eleven weeks, Kotz and Essien traced the WLAN activity of approximately 2000 users chosen from the general Dartmouth College campus population. Among the results, Kotz and Essien found that “residential traffic dominated all other traffic, particularly in residences populated by newer students; students are increasingly choosing a wireless laptop as their primary computer. Although web protocols were the single largest component of traffic volume, network backup and file sharing contributed an unexpectedly large amount to the traffic.”

This sort of research is very valuable to developers of WLAN devices and applications as well as to network designers and planners who deploy WLAN technology. For example, it indicates the potential for collaboration over a wireless network, which could lead to the development of new applications designed specifically for that purpose.

The second grant, awarded in 2003, was given to Kotz and Noblet to study the usage patterns of VoIP users at Dartmouth College over the wireless network. The goal of this research is “to measure the characteristics of voice users and their traffic and to measure the load on the wireless network.”

The third grant, also awarded in 2003 to Kotz and Noblet, is for the study of wireless security, specifically the use of digital certificates and 802.1x.

In all three cases, the research performed by Dartmouth College is helping Cisco (and other technology companies) better understand their higher-education customers and their needs.

NEXT STEPS

Dartmouth College is pleased with its progress, but they are not resting. To provide greater wireless coverage, the number of wireless access points will double over the next 12 to 18 months. "The entire campus is covered, but higher demands on bandwidth will mandate greater access point density," Noblet says. With that in mind, Dartmouth College is starting to deploy the Cisco Aironet 1200 Series and, over time, all of the existing Cisco Aironet 350 Series access points will be replaced.

Dartmouth College will also expand their IP communications deployment and will convert the remaining voice network to VoIP in the next 24 to 36 months.

In the area of security, Dartmouth College is working with Cisco to continue to investigate which security appliances, products, and features will best suit their needs. One of the options Dartmouth College is considering is the Cisco Security Agent (CSA), which identifies and prevents malicious behavior on network endpoints, such as laptop computers. "We are presently evaluating additional security options but are guided by the proviso that access to the wireless network be as trouble-free and simple as possible for our campus community," says Levine.

Dartmouth Digital Dorm

In their continuing effort to improve campus life through technology, Dartmouth College has launched a project called the "Digital Dorm." Inspired by other experimental communities, Dartmouth College polled students and employees in the office of Residential Life for their ideas of services and features that would improve dorm life. The resulting design for the Digital Dorm, which is actually a community of dorms, will incorporate the latest advances in communications to allow such things as the monitoring of washer and dryer availability, real-time measurements of energy and water consumption within the dorms, and instant tracking of inhabitants current locations.



Corporate Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 526-4100

European Headquarters
Cisco Systems International BV
Haarlerbergpark
Haarlerbergweg 13-19
1101 CH Amsterdam
The Netherlands
www-europe.cisco.com
Tel: 31 0 20 357 1000
Fax: 31 0 20 357 1100

Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
www.cisco.com
Tel: 408 526-7660
Fax: 408 527-0883

Asia Pacific Headquarters
Cisco Systems, Inc.
Capital Tower
168 Robinson Road
#22-01 to #29-01
Singapore 068912
www.cisco.com
Tel: +65 6317 7777
Fax: +65 6317 7799

Cisco Systems has more than 200 offices in the following countries and regions. Addresses, phone numbers, and fax numbers are listed on the **Cisco Web site at www.cisco.com/go/offices**

Argentina • Australia • Austria • Belgium • Brazil • Bulgaria • Canada • Chile • China PRC • Colombia • Costa Rica • Croatia
Czech Republic • Denmark • Dubai, UAE • Finland • France • Germany • Greece • Hong Kong SAR • Hungary • India • Indonesia • Ireland
Israel • Italy • Japan • Korea • Luxembourg • Malaysia • Mexico • The Netherlands • New Zealand • Norway • Peru • Philippines • Poland
Portugal • Puerto Rico • Romania • Russia • Saudi Arabia • Scotland • Singapore • Slovakia • Slovenia • South Africa • Spain • Sweden
Switzerland • Taiwan • Thailand • Turkey • Ukraine • United Kingdom • United States • Venezuela • Vietnam • Zimbabwe

Copyright © 2004 Cisco Systems, Inc. All rights reserved. Cisco, Cisco Systems, the Cisco Systems logo, Catalyst and Aironet are registered trademarks or trademarks of Cisco Systems, Inc. and/or its affiliates in the United States and certain other countries. All other trademarks mentioned in this document or Website are the property of their respective owners. The use of the word partner does not imply a partnership relationship between Cisco and any other company. (0304R)

Printed in the USA

DOC ID REV DATE