Blending Nature and Technology

A satellite link and wireless technology bring the Internet to Camp Huntington

By **Daniel R. Sidebottom, Joshua Peluso,** and **Scott Thomas**

Raquette Lake is located in the Adirondack Mountains, 160 miles from the campus of the State University of New York at Cortland. In the late 19th century, William West Durant established the first telegraph service in the area to stay connected with all of his business deals hundreds of miles away. Today, the area on Raquette Lake that Durant developed is part of SUNY Cortland's Outdoor Education Center.

The Outdoor Education Center includes the Antlers camp, on the west shore of the lake, and Camp Huntington. Camp Huntington, formerly known as Pine Knot, sits on a peninsula in Raquette Lake, one mile across the lake from the Antlers. Durant's telegraph office is still located in the Guide House at Camp Huntington.

SUNY Cortland has recognized the value of outdoor and environmental education since the mid-1930s, when it began requiring physical education students to participate in two-week camping programs as part of their formal training. Opportunities for study and field work in the outdoors have expanded greatly since that time, and many of Cortland's academic departments now use the facilities at Raquette Lake, which the university has developed to support outdoor and environmental education programs.

The Outdoor Education Center provides an outstanding natural setting for students to examine most aspects of the environment (see Figure 1). The Center's forests, bogs, and ponds serve as natural laboratories for courses in the biological sciences, and Raquette Lake provides a research area where students can examine unpolluted waters. Students from all disciplines enjoy opportunities at the Center to learn how to use the outdoors as a classroom for academic subjects and to develop an appreciation for the outdoor environment.

So, what would Durant say about incorporating computer technology at Pine Knot? We think he would approve.

Taking Technology Outdoors

The faculty teaching at Raquette Lake reported that they were having increasing difficulty teaching effectively without access to distance learning capabilities, the Internet, and other technologies. Students, also, had an increasing need to access their local files and e-mail while at the Outdoor Education Center. Being 160 miles from campus had its advantages, but the drawbacks became a significant hindrance to the educational process.

The challenge wasn't making the technology and knowledge available or whether we could install a workable network. The challenge was to introduce a network that preserved the beauty, integrity, and natural feel of the historic site. We needed a network that was not just unobtrusive but effectively invisible.

Logistics was the first challenge in addressing the need for technology at the Center. The Antlers serves both as a docking area for those going to Camp Huntington and as a site for conferences and classes. Camp Huntington consists of a cluster of historic buildings accessible only by boat in the summer and an ice road in the winter.

A wireless local area network (LAN) seemed to answer most of the problems we faced for the Center, but the next challenge was how to connect a wireless network to the Internet. There were extremely few telecommunications land services available for this area, and none was even close to fitting into the university's budget for this project.

Faced with the need for a cost-effective solution that would provide a wireless LAN and Internet service to the Outdoor Education Center, SUNY Cortland's Administrative Computing Services staff devised an innovative plan to bring technology to the wilderness. The answer was a totally wireless solution.

The Invisible Network

Members of Networking Services and two technical experts in the wireless communications field made a site visit to conduct a feasibility study. Our goal was to determine whether a wireless solution would be viable for this setting. We came away with enough information and confidence to proceed. With the needs identified and an outline of the solution, a project team was formed.

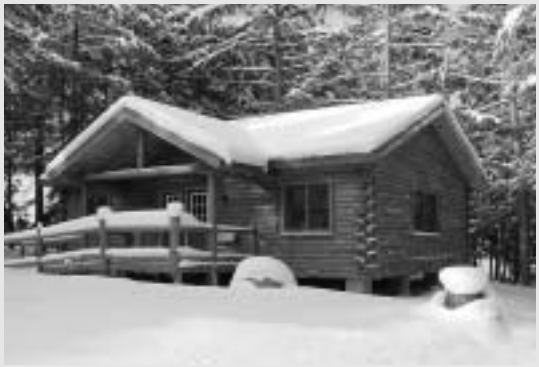
The project team quickly began the wireless network design stage. To make the connection across the lake, two wireless, point-to-point antennas were installed. The one on the rooftop of the

Figure 1

Camp Huntington

Figure 2

Carlson Classroom



Antlers lodge exists in an omni (bidirectional) configuration, and the other across the lake on the Camp Huntington fire tower exists in a directional configuration. This arrangement created a dedicated 11 megabytes-per-second point-to-point link approximately one mile in length. Once this link was established, work began on the wireless LAN.

On paper the first couple of plan designs looked good, but when the technicians began the physical installation, they encountered difficulties due mostly to antenna strength and positioning. We did not account for the "leaf density" of trees, tin roofs on buildings, and a small power substation. After revamping the antenna placement plan and trying more powerful directional and omni antennas, we were able to establish excellent connection strength and coverage to at least 80 percent of Camp Hungtington.[1]

We installed an access point on the Camp Huntington fire tower. We then buried a Category V cable connecting the tower to the Carlson classroom (see Figure 2). Inside the classroom a hub and two more access points were installed. The wireless LAN consists of three workgroups.

The network at Raquette Lake consists of wireless access points that provide client connectivity through the 802.11b wireless Ethernet protocol. The network consists of eight access points at Camp Huntington plus the one located at the Antlers site. They are located in the following areas:

- Water tower (1)
- Carlson classroom (2)
- Knox classroom (1)
- Dining hall (2)
- Staff house (2)
- Antlers (1)

In locations that have two access points, one provides the point-to-point function (the LAN backbone) and the other serves clients. Clients can connect at speeds of 11, 5.5, 2, or 1.5 megabytes per second, depending on signal quality and the distance from the access point. The point-to-point link across the lake and point-multipoint connections from the classrooms are dedicated links at 11 megabytes per second.

IP addresses for the network are handed out dynamically using dynamic host configuration protocol (DHCP). These addresses are in a nonroutable subnet that cannot be reached from any public network, which means that clients on the Raquette Lake network are not reachable from the Internet. Network administrators can monitor and prevent outside connections, which benefits network security, and all connections seen coming from Raquette Lake will have a single IP address that cannot be traced back to a single machine.

This setup limits functionality somewhat, in that we cannot make direct connections into the network, which would be useful for troubleshooting and monitoring. However, it has proven to be a major cost saver, as we can run the entire network on a handful of IP addresses. Using a technology called Network Address Translation (NAT), we use a single assigned public IP address and allow the entire camp on the Internet.

The configuration we implemented uses a wireless network service set identifier (SSID). Attached to packets sent over the wireless LAN, it functions as a password for joining a particular radio network (BSS). All radios and access points within the same BSS must use the same SSID, or their packets will be ignored. The SSID must be configured in each client machine on the network. Any 802.11b-compliant network card will work on the network.

This arrangement serves to secure the wireless network, as without the SSID, your packets will be dropped and you cannot gain access to the network. However, many sniffing utilities and Windows XP bypass this form of security.

Beyond installing a wireless LAN at the Outdoor Education Center, we had to address the question of connecting that LAN to the Internet. We extensively researched three possibilities. First we turned to the local telecommunications provider. This option proved to be very expensive and not cost-effective. We next looked for an ISP that could provide high-

speed Internet access over coaxial cable or digital subscriber line (DSL), but we were unable to find either cable modem or DSL service in this remote area.

The third possibility was to use a satellite feed to and from the Internet. After examining several options, we settled on satellite technology supplied by Tachyon. It's a resilient and reliable 2-megabyte Internet service via satellite, making it an attractive and convenient option for remote users. This solution satisfied all of our technical requirements, for a price that worked with our budget for the project.

Future Plans

The wireless LAN serves both the Antlers and Camp Huntington, making network and Internet access available using wireless technologies that do not damage the visual purity of the Outdoor Education Center. The technology provides an outdoor learning environment that combines the best of two worlds — the beauty and tranquility of nature, and the ever-growing necessity of modern technology. The most rewarding fact about this technology installation is that unless you use it, you never know it's there.

The next phase of this project will include extending connectivity to the Antlers. Initial plans indicate a need for multiple access points with omni antennas to provide adequate coverage. The third phase of the project will be upgrading the lake point-to-point backbone from 11 to 54 megabytes per second, using the 802.11a protocol. This will provide high-speed access across the lake and provide much improved transfer speeds. Wireless Ethernet technologies are progressing at a very rapid pace. The network infrastructure is installed and will provide a system for expansion to accommodate these future technologies. For instance, the 802.11g protocol was recently ratified, which allows connectivity at 54 megabytes per second to the desktop.

Many applications can potentially use the system at Raquette Lake. Currently we are exploring the possibility of installing remote data collection units in the lake to collect water samples that can be transmitted back to campus using the Internet. Another idea being considered is adding Web cams that would transfer still images of the environment back to the main campus. With satellite service supporting access, the Outdoor Education Center can offer a variety of unobtrusive technology options to benefit students and faculty, both on-site and at the main campus. *e*

Endnote

1. For more about SUNY Cortland's development of the Raquette Lake network, including technical diagrams of the installation, see <http://www.cortland.edu/adminc/networking/raq_lake/default. html>.

Daniel R. Sidebottom (daniels@em.cortland.edu) is Director of Administrative Computing Services, Joshua Peluso (joshuap@ em.cortland.edu) is a Network Specialist, and Scott Thomas (scottt@em.cortland.edu) is a Network Administer at SUNY Cortland in Cortland, New York.