Wireless Networking at Salt Lake Community College
EDUCAUSE is a nonprofit association whose mission is to advance higher education by promoting the intelligent use of information technology.

The mission of the EDUCAUSE Center for Applied Research is to foster better decision making by conducting and disseminating research and analysis about the role and implications of information technology in higher education. ECAR will systematically address many of the challenges brought more sharply into focus by information technologies.

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Preface

The EDUCAUSE Center for Applied Research (ECAR) produces research to promote effective decisions regarding the selection, development, deployment, management, socialization, and use of information technology (IT) in higher education. ECAR research includes research bulletins, short summary analyses of key IT issues; research studies, in-depth applied research on complex and consequential technologies and practices; and case studies designed to exemplify important themes, trends, and experiences in the management of IT investments and activities.

ECAR has investigated the state of wireless networking in higher education and has issued “Wireless Networking in Higher Education.” This research was undertaken in three phases:

- an online survey of 391 EDUCAUSE members to establish the state of wireless networking in higher education and to understand its implementation characteristics;
- follow-up, in-depth telephone and on-site interviews, covering 17 selected institutions, with IT personnel and university members who are directly involved with the creation, operation, or use of wireless networks; and
- best practices cases studies with six higher education institutions about their wireless network implementations.

Between March and May 2002, ECAR and IDC began with a list of approximately 150 colleges and universities that had experience implementing wireless networks. From this list, 20 were interviewed extensively by telephone, and six were selected for either on-site visits or extensive telephone follow-up. On-site visits are rigorous and involve nearly two days of interviews and meetings with the widest variety of institutional representatives associated with—or affected by—the technologies or practices being investigated.

This case study was undertaken to draw on the direct experience of others to provide insights into what has—and, as appropriate, what hasn’t—worked in wireless implementations. It is assumed that readers of the case studies will also read the main report, which incorporates the findings of the case studies within the generalized context of the report.

ECAR wishes to thank the leadership of Salt Lake Community College for their time, assistance, and diligence in support of this research. We hope readers of this ECAR case study will learn from their experiences.
**Introduction**

Salt Lake Community College (SLCC) is a fully accredited, student-focused urban multicampus college serving the Greater Salt Lake City community. With more than 60,000 enrolled students, SLCC is the largest institution of higher education in Utah. SLCC operates three full-service campuses as well as eight teaching centers and an “eCampus” for distance learning.

With early roots as a vocational technical school, SLCC now offers 112 programs in the sciences and technology, along with the humanities, business, and industry. SLCC’s degree offerings include associate of arts, associate of science, and associate of applied science. As part of its workforce education mission, the college maintains active partnerships with approximately 500 businesses and school districts.

**IT Organization**

SLCC’s technology planning, deployment, and support are performed by the Office of Information Technology (OIT), headed by John LaPlante, SLCC’s information officer. While the OIT exercises centralized control for strategic IT issues—for example, infrastructure planning—smaller scale issues such as day-to-day support are delegated to IT staff at each of the three major campuses. The OIT consists of four main areas:

- **Administrative Computing**—Responsible for the college’s mainframe-based administrative systems, which include human resources, student records, and financial applications. Staff is located on the Redwood campus.
- **Telecom**—Responsible for administering voice services and network cabling at all campus locations. Staff is located on the Redwood campus.
- **Network Services**—Core responsibility is the support and maintenance of the college’s wide-area networks (WANs) and local-area networks (LANs) and servers. Additional responsibilities include working with telecom service providers, establishing and enforcing security protocols, and maintaining applications. Staff is dispersed.
- **User Services**—Core responsibility is the maintenance of desktops and laptops across all campuses. Delivers both on-site support and telephone-based help-desk services.

**Technology Profile**

Under SLCC’s WAN architecture, campuses are linked via a combination of leased T1 and DS3 lines (including lines leased from a video service provider) in a hub-and-spoke fashion, with all traffic tying back to the Redwood campus. For its LAN, the college has adopted a standard configuration of 1-gigabit-per-second (Gbps) Ethernet on the backbone and 100-megabit-per-second (Mbps) Ethernet to the desktop. On the hardware side, SLCC uses Cisco core switches and routers; its network operating system is Microsoft Windows 2000. LAN security is provided through Microsoft Active Directory.

**Drivers of SLCC’s Wireless Deployment**

The most important stimulus behind SLCC’s wireless initiative was the appointment of Dr. H. Lynn Cundiff as the college’s president in August 2000. Prior to his arrival at SLCC, Cundiff had been an active proponent of using information technology to improve the overall academic experience. At Floyd College in Rome, Georgia (where Cundiff had been president from 1992 to
2000), he had been the principal driver behind a project designed to create a completely wired environment with ubiquitous laptop ownership, making Floyd College the first two-year college to deploy such a program.

That project, which began in 1994, taught Cundiff lessons directly relevant to the wireless project that would kick off seven years later at SLCC. According to Cundiff, the need for mobility in an academic setting was one of the most important conclusions to come from his experience. “One of the things we found in wired classrooms was that it contributed to a rigidity of practices. You can’t move desks, add people, or change the configuration of a discussion group,” said Cundiff. “We found that while a wired environment was very robust, paradoxically it was very limiting from an academic standpoint.”

Bringing the Vision to SLCC

When Cundiff assumed office in 2000, none of SLCC’s classrooms were wired—a situation similar to the one he’d faced in his previous position. While his fundamental goal remained the same—to enable technology access for students, faculty, and staff—the situation demanded that he consider wireless as an alternative to a wired infrastructure.

As Cundiff pointed out, the potential cost of a wired infrastructure was a major factor. “We were clearly influenced by the lower cost of deploying a wireless infrastructure,” he said. “For a college like Salt Lake, with 11 campuses to potentially wire, the lower cost of a wireless infrastructure was a huge factor.” On top of its inherent cost advantages, wireless technology was seen as a way to avoid the complexities and difficulties of wiring the campus’s older buildings, some of which date to the college’s founding in the late 1940s and have walls 3 feet thick.

Using Wireless to Address Community Needs

While pragmatic needs go a long way toward explaining SLCC’s embrace of wireless, it is also instructive to view the wireless initiative in the context of the college’s self-defined mission. As its motto (“...the community’s college!”) implies, SLCC, like most other community colleges, considers outreach one of its core priorities. Among its broadly defined outreach goals, SLCC considers the extension of educational opportunity and the bridging of the “digital divide” to be two of its most important goals, explained Cundiff. “We see our unique niche as providing innovative ways of making education more readily accessible and convenient to the Greater Salt Lake community,” he said. “And we look at technology in general—and wireless technology in particular—as a way to bridge that opportunity gap.”

A key factor influencing the mission of higher education in Greater Salt Lake is its geographic dispersion. Indeed, the SLCC campus network itself is spread over some 35 miles end to end. This dispersion makes it more difficult for students, especially those with challenging schedules, to attend traditional classes. Another by-product of the Greater Salt Lake area’s remoteness is a general lack of broadband connectivity, which effectively prohibits students from leveraging SLCC’s distance-learning capabilities. Here again, SLCC sees wireless as filling an important infrastructure need by letting students access the college’s resources via a wireless connection from home. “Our vision would be to provide all of our students with
24 x 7 access to the college, whether they’re on campus or at home,” noted Cundiff. “We see wireless as having a potentially important role to play in that plan.”

In addition to students, the Salt Lake City business community also represents an important outreach constituency. Under SLCC’s plan, it would deliver courses and/or training material directly to businesses in and around downtown Salt Lake via high-speed lines. “We believe that wireless could play a big part in interacting with the business community,” said Cundiff. “As a channel for reaching out to our community, wireless fits very well with the unique needs of SLCC.”

**Rolling Out Wireless at SLCC**

With strong support at the top, the planning of SLCC’s wireless initiative was performed by staff from the Telecom and Network Services Groups. The Telecom Group played a central role in the project’s earliest phases because of its familiarity with infrastructure installation issues (an outgrowth of its role as an installer of physical cabling). Because SLCC opted to outsource installation of the solution, project management became the most important competency in the mid to late stages of the wireless deployment. As the focus shifted from planning to project management, the Network Services Group assumed a more prominent role.

There is a clear delineation of roles between the individual departments and the OIT with regard to wireless planning. The departments are expected to initiate wireless projects, articulate the related infrastructure requirements, and procure all necessary end-user devices (for example, PDAs). The OIT is responsible for putting in place the infrastructure and for providing guidelines (standards, compatibility, and so on) for departments to use when procuring end-user devices.

**Budgeting**

SLCC has yet to fully define how wireless will affect its core budgeting processes. Under the current practice, departments are responsible only for the cost of end-user devices, while infrastructure spending comes from the general IT budget. The initial outlay to put the infrastructure in place (approximately $600,000) was appropriated by the Utah State Legislature. While a budgeting policy has yet to be set for future wireless expenditures (such as equipment upgrades and expansion of coverage areas), SLCC is leaning toward increasing student fees to provide additional revenue. Other budget variables include donations from private industry “partners,” which usually take the form of either discounted equipment or pro bono deployment assistance.

**Architecture and Technology Overview**

SLCC’s wireless network employs approximately 180 Cisco Aironet 350 wireless access points (APs); 125 are deployed at the Redwood campus and 40 are deployed at the South City campus. The remainder are distributed across SLCC’s other campuses. SLCC’s wireless network is based on a shared-bandwidth, hub-based architecture. The college deployed IEEE 802.11b as its wireless LAN standard and expects to move toward either 802.11a or 802.11g.

According to CIO John LaPlante, SLCC’s approach to building a wireless network architecture (placement and number of APs) was guided by an initial goal of maximizing coverage. “Some colleges design their wireless networks to ensure a certain density,” said LaPlante. “We chose to first design our network to maximize coverage across our campuses [such as Redwood and South City] and address density at a later time.” At these locations, SLCC’s network delivers 100-
percent coverage inside buildings. SLCC elected not to place APs outdoors, instead relying on indoor coverage to bleed approximately 150 feet from the buildings, thus providing de facto outdoor coverage.

**Wireless Security Profile**

SLCC's wireless solution uses LEAP (Cisco's authentication scheme based on the extensible authentication protocol, or EAP). Under SLCC's security scheme, users must log on via a user name and password (the same information they use when logging on to the wired LAN's Windows 2000 Active Directory). The LEAP protocol passes the user ID and password request to a back-end remote authentication dial-in user service (RADIUS) server, which then authenticates into an Active Directory server and grants access to the network.

**SLCC's Wireless Deployment Experience**

Most of SLCC's wireless solution was designed and implemented by a consortium of vendors it selected after soliciting bids through an RFP sent out in early 2001. SLCC's staff provided ongoing project management and assisted in the deployment by providing input on optimal cabling locations. Cisco, in addition to providing discounted hardware, lent valuable expertise on network design and AP placement. Deployment of the solution began in July 2001. By September, the solution was approximately 85-percent complete; it was 100-percent complete by the following March.

**Wireless in Action at SLCC**

Although SLCC's wireless initiative is targeted to a wide range of constituencies, faculty have been the most immediate beneficiaries. (This shouldn't be surprising, because in the fall of 2001, some 335 full-time SLCC faculty received wireless-enabled laptops as part of the overall wireless initiative.)

SLCC's learning enhancement professor, Ray Emett, sees his wireless laptop as an invaluable way to improve his teaching techniques and keep in closer touch with students. “I feel I can use the laptop in three areas,” Emett said. “First, I will use it for better communication with my students. I will be able to check their progress at any time and place, as long as I have the laptop with me. Second, I will be able to improve student learning, since some things can be taught better using the features available for class computer presentations. Third, a wireless laptop will be able to create alternative forms of class structures and developing curriculum for blended and distance formats.”

A key benefit cited by Dan Martinez, SLCC finance and economics professor, is an improved format—Microsoft PowerPoint presentations—for delivering course material to students in a classroom setting. “This gives the students a presentable format, which enhances my pedagogy of lecture and discussion,” said Martinez. “The laptop turns the classroom into a technologically advanced learning environment that should be compatible with the working world for the students when they graduate.”

While faculty has represented the leading edge of wireless usage, SLCC President Cundiff also sees a host of benefits accruing to students. Among the most important is the ability to keep in closer contact with the college from wherever they are. “Because Salt Lake City has a robust transportation infrastructure, many students ride the light rail system or take buses,” explained Cundiff. “A wireless linkage with the college would allow a student during a 30-minute bus ride to be constantly connected...
with either an instructor or some other source of information. Wireless has the capacity to keep a highly mobile, geographically dispersed student body uniquely connected.” Other examples cited by Cundiff include e-mail notifications sent to students regarding campus activities, special announcements, or cancellations.

One potential roadblock to student wireless usage at SLCC is the cost of a laptop, which is presumed to be beyond the means of most. To get around this, SLCC has begun rolling out innovative programs designed to get laptops into students’ hands. For example, SLCC is developing a program whereby it will buy laptops and lease them to students at low rates. Another program will let students use laptops free of charge within SLCC’s libraries to perform online research and similar functions.

**The Future of Wireless at SLCC**

The first phase of SLCC’s wireless initiative unfolded like most other standard infrastructure rollouts, with the IT organization putting the solution in place with relatively little input from other parties. As CIO LaPlante said, “We had a mandate to deploy wireless across the campuses, and we went out and did it.” But as SLCC enters the next phase of its wireless evolution, the level of interaction between LaPlante’s group and key groups within the college has risen, signaling a shift of priorities.

“Now that we’ve achieved our coverage goals, it’s time to begin focusing on density,” said LaPlante. “From this point forward, we expect to be conducting much more integrated discussions, involving faculty, students, and administration, that will guide our future wireless investments.” To this end, the OIT has been actively working with student organizations on an architecture redesign that will put a significant amount of bandwidth in open student areas. Likewise, the IT group is working with faculty organizations, such as the faculty senate, to provide adequate wireless coverage in meeting places.

Over the longer term, SLCC plans to embrace emerging technologies to increase both the capacity and the performance of its wireless network. At present, LaPlante estimates that the SLCC network can accommodate approximately 5,000 users; the college’s ultimate goal is to support 24,000 users. Therefore, he anticipates a move to either the 802.11a or 802.11g standard to take advantage of the bandwidth gains either would deliver. “As the usage of wireless on campus increases and applications become more demanding, we intend to be ahead of the curve by providing more bandwidth,” said LaPlante. “Our goal is to unleash the full potential of wireless in an institution of higher learning, and I feel that we’ve already come a long way toward that goal.”