

## Community Wireless Networks

With increasing frequency, communities are seeing the arrival of a new class of noncommercial broadband providers: community wireless networks (CWNs). Utilizing the same wireless technologies that many colleges and universities have used to create wireless networks on campus, CWNs are creating broadband access for free or at costs well below those charged for DSL or cable modems.

The rise of CWNs creates an opportunity for colleges and universities to form partnerships with their local communities, further their educational mission, serve students and faculty living off campus, and provide opportunities for students to participate in a community-based initiative. In addition, institutes of higher learning stand to reap two direct benefits from participating in CWN partnerships. First, such participation improves the reputation of the college or university with the local community and provides good publicity generally. In an era when college and university information systems are routinely pilloried as havens for file-swappers and music pirates, the value of demonstrating how the institution can contribute to the community at large should not be underestimated. Second, the college or university can use the network as a revenue stream—either by seeking funding for the project or by charging for use of the network.

Unfortunately, colleges and universities may hesitate to participate in CWNs for fear of being held liable for activity on CWNs or for fear of exposing their own networks to congestion and security issues. Yet these concerns have relatively

straightforward solutions that CWNs can easily incorporate into their networks. The success of partnerships such as the Champaign-Urbana Wireless Internet Network (CUWiN)—which partners the Champaign-Urbana community with the University of Illinois campus—showcases the opportunities that are available for institutions of higher learning and the ways that risk can be managed.

### What Are Community Wireless Networks?

Wireless networks use wireless connections to connect computers to the Internet. Some networks, like Verizon Wireless, use high-powered services licensed by the Federal Communications Commission (FCC). But many wireless networks use the “unlicensed spectrum,” a narrow slice of the airwaves open to anyone. Using unlicensed spectrum allows the network operator to create a network that matches his or her own needs. It also saves money, since creating a wireless network with unlicensed spectrum requires a one-time purchase of equipment and administrative costs rather than a monthly subscription fee set by the vendor.

Almost every campus has wireless networks in the form of “hotspots” that use WiFi to allow students to connect wirelessly to the campus network. Some campuses limit these networks to a few buildings, such as dorms or libraries or student centers. But other campuses

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have used these wireless networks to avoid the costly deployment of fiber optic cable. With a cheap directional antenna—similar to the satellite dishes that receive satellite TV services such as DirecTV or Dish Network—campuses can use the same low-cost unlicensed technology that creates hotspots and can link up buildings or even create a wireless “cloud” that allows anyone who is anywhere on campus to connect to the campus network.

Because this technology has become so affordable, many communities have begun to build wireless networks to connect whole neighborhoods or even whole cities. Connection speeds can easily exceed those of cable broadband or DSL. In some cases, cities have paid organizations to set up these networks, to stimulate growth. In other cases, volunteers have formed nonprofit associations to deploy these networks. Because using the unlicensed spectrum avoids costly wiring, it becomes possible to connect far-flung rural areas or to connect poor areas within urban communities.

### “Mesh” Networks versus “Hub and Spoke” Networks

Another critical factor in deploying wireless networks is the “architecture” of the network. Traditional wireless networks—such as cell-phone networks—rely on centrally located towers. Smaller devices send signals to one of the towers, which

communicates with other towers or with other devices in the local network. This is called a “hub and spoke” architecture because it resembles a wagon wheel; the tower acts as the hub and sends spokes to all the local devices. These networks need high power, and every new device attached is a drain on the capacity of the hub.

By contrast, most CWNs rely on “mesh” networking. In mesh, every receiver can also act as a transmitter, communicating with nearby devices to send signals from one end of the network to the other. In this way, a string of low-power, cheap devices can do the work of a high-power, expensive tower. It also means that every transmitter/receiver added to the network makes the network stronger by adding range or capacity within the network.

With mesh networks, it becomes possible to connect buildings one building at a time until a neighborhood is covered. Alternatively, broadband can come to those rural areas where cable and phone companies find it too expensive to lay wire. By putting transmitters on grain silos and hilltops, rural communities can use wireless links to route around difficult terrain and link isolated areas to the Internet.

### **Opportunities for Colleges and Universities**

Colleges and universities are uniquely positioned to serve as leaders in the growing CWN movement. Many already have wireless networks deployed, making it easy to extend the networks with additional mesh nodes. Even if a campus decides to create a separate network for security reasons, it can still offer its excess fiber capacity to transport data from the local wireless cloud to the broader Internet. The campus thus becomes the anchor and foundation for the broader community network.

In addition, campus IT departments can provide student and faculty volunteers to train local community members and to set up the physical networks. Even nonengineering students can benefit by contributing labor—in the same way that they participate in recycling and trash collection, Habitat for Humanity, or other community programs. Doing so enables

students to learn important lessons about civic responsibility.

CWNs also allow campuses to extend the reach of their campus networks to off-campus students and faculty. If the college or university has a cooperative extension program or some other program that enrolls members of the community, extending high-speed wireless broadband into the community will eliminate the digital divide between full-time students residing on campus and full- or part-time students living off campus. Using technologies such as voice-over IP and streaming media, schools can extend or create distance learning programs and can make them fully interactive between students in multiple locations and their instructors.

Finally, the campus can partner with CWNs to promote local economic growth. Simply extending the campus wireless cloud a few hundred yards can often bring wireless hotspots to areas where students congregate and to the small businesses that serve them. Local businesses that typically pay \$100/month for commercial DSL or even \$1,000 or more for a T1 connection will gladly pay \$10/month for wireless access. In communities where broadband Internet access is not generally available, a CWN can encourage businesses to stay—or even to relocate to areas covered by the network. This can potentially create a revenue stream to fund the project. Other CWNs have funded themselves through advertising (Hermosa Beach, California, has free public access for anyone willing to look at advertising first), through grants, and through payments from local government (CUWiN funds itself through a grant from the Open Society Institute and a contract with the local city council to provide wireless to the downtown commercial district).

Campuses concerned with security or liability issues can protect themselves by shielding their primary campus network with a firewall. The public network enjoys the same protection from liability that commercial ISPs enjoy when offering service to the public. Indeed, since the network is distributed among independent nodes, the campus can honestly say that with a CWN, unlike a campus network, there is no way the institution can exercise control over network activity.

### **The Champaign-Urbana Wireless Internet Network**

CUWiN (<http://www.cuwireless.net/>) provides a successful model for CWN/campus partnerships. CUWiN began as a voluntary project by a small group of students fascinated with the potential of wireless networks. The students enlisted the help of sympathetic faculty in the computer science department at the University of Illinois and began tinkering with cast-off computer equipment. Over time, the number of volunteers interested in setting up nodes grew. CUWiN developed educational materials to train new volunteers and shared its hardware and software innovations with other CWNs. The University of Illinois provided a home for the project and surplus fiber capacity to help move data to the broader Internet.

As the project continued to grow, CUWiN and the university decided to separately incorporate the network. CUWiN secured a grant from the Open Society Institute to further develop its mesh network. As the positive benefits of wireless networks became clear to the city government, the local city council offered CUWiN a contract to extend the CWN to the downtown area. The project has thus facilitated further cooperation between the local community and the University of Illinois campus, to the benefit of all.

### **Conclusion**

In an era when colleges and universities are constantly accused of using their high-speed Internet capacity to abet copyright violations, partnering with CWNs can provide an important demonstration of the power of college and university networks to serve the public interest. Particularly in those communities where the college or university campus is on the cutting edge of networking technology, partnering with CWNs offers an opportunity to serve the mission of higher education by bringing the benefits of networking technology to all.



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