

TV-band Wireless Extends Tribal Internet Service

On frequencies in the TV broadcasting band, California's largest Native American tribe deployed the first wireless broadband service for a remote public safety environment to use TV white-space technology.

By Kim Miyade

The future has arrived at the Yurok Reservation in Northern California. Historically, the entire Native American reservation, including every public safety agency, was forced to share a single T1 line, causing communications bottlenecks and connections slower than dial-up. Now, the Yurok community has a dedicated public safety line in order to access criminal databases and will soon have the ability to conduct live video training with its firefighters and support clinics that can perform virtual telemedicine. It will have the ability to implement



The YurokConnect Project will deliver Internet, networking and telecommunications services to the tribal headquarters (shown here) and throughout the Yurok offices and education facilities spread across the reservation — and in particular, the public safety offices.

a self-sufficient emergency services plan. TV white-space technology and the backbone network being built to support it will transform the Yurok community's public safety communications system, ultimately paving the way for other Native American tribes to follow.

Native American beneficiaries

The transformation began when Carlson Wireless engineered one of the first software-defined radios two years ago. The company engineered the radio for the sole purpose of bringing broadband telecommunications service to remote locations using TV white-space frequencies. The company focused on Native Americans as the technology's first beneficiaries. It has long been the company's mission to support rural communities with affordable communication solutions that work well in challenging terrain. Now, with the newly available radio-frequency spectrum, there is an opportunity to make great strides within the territories of Native American reservations.

The Yurok Tribe, the largest Native American tribe in the state of California, has a reservation just north of the Carlson Wireless office in Arcata. The reservation spans more than 44 miles of mountainous, heavily forested land that presents many obstacles to wireless signals.

YurokConnect Project

"We call our project the YurokConnect Project," said Jim Norton, broadband manager for the Yurok Tribe. "It

came about essentially as a result of years of frustration experienced by our IT director, Paul Romero, in trying to deliver Internet, networking and telecommunications services throughout the Yurok offices and education facilities that are spread across the reservation — and in particular, the public safety offices."

The project must be able to serve not only public safety entities, but also provide Internet access for businesses and tribal offices on the reservation along with the majority of the Internet-starved population on and surrounding the reservation.

"All data access at this point is via our point-to-point wireless links through our main offices, where we have a single T1 for the Internet," Norton said. "That is all shared by up to 100 other computers and users at any given time. So, during the day, for any kind of Internet access or interoffice contact, we see dial-up speeds. We can't support things like online conferencing or training of any sort, particularly if it requires a video feed — we just don't have the bandwidth. Not only are our regular operations affected, but also our public safety."

Research conducted several years ago to reveal possible ways to improve the reservation's Internet service made it apparent that older technologies such as directional antennas, T1 data lines or satellite links would be cost prohibitive or would deliver unreliable connections. Nevertheless, the tribe needed progress, and Romero's team proceeded to acquire grants and begin the process of building



At frequencies much lower than wireless networks such as Wi-Fi use, networks that use TV white-space frequencies have much better signal propagation over rugged, vegetated terrain. The Yurok Reservation, shown in this aerial view, fits that description.

towers. Then the ability to use TV white-space frequencies changed everything.

Better signal propagation

White-space technology did not exist when the project was first conceived. The TV broadcasting transition from analog to digital technology a couple of years ago freed the spectrum that is now being reused primarily in rural areas for services other than broadcasting. The spectrum supports much better signal propagation over rugged, vegetated terrain, a description that fits the Yurok reservation.

“Let me give you an idea of the impact that this technology has on our project,” said Norton. “We had projected being able to serve approximately 70 to 80 percent of the reservation and the people on it with the existing technologies. Each location would require a site visit by our technician and then the installation of external, directional antennas oriented toward the towers — the typical type of telecommunications install that you see with cable or telephone.”

Norton said that the TV white-space technology represents a significant reduction in the near line-of-sight and antenna

requirements compared with other technologies. “The frequencies have a much better terrain-following capability and a punch for the dense foliage that we have here — one that the other technologies just can’t match,” he said.

But here’s the real kicker: The new customer experience for most of the Yurok subscribers will be completely transformed. Norton said that with the TV white-space equipment, the customer receives a preconfigured box, takes it home, sets it on a desk, attaches the antenna, plugs the unit into the wall and into a computer port, and the service is ready. “That makes a huge difference not only to our customers, but also to us,” he

said. “It certainly cuts our cost.”

On Jan. 26, 2011, the FCC granted the experimental license for the project. The FCC’s Office of Native Affairs, headed by Geoffrey Blackwell, was instrumental in pushing it through.

“The FCC moved mountains for us so we could get an experimental license that allows us to use this bandwidth, this new white space — tremendous cooperation there, and you don’t hear that about government very often,” Norton said.

The Yurok project is conducted in phases in order to reach the entire population scattered in and around the reservation, with an expected completion date of summer 2011.

TV Bands White Space

The FCC has adopted rules to allow unlicensed radio transmitters to operate in the broadcast television spectrum when that spectrum is not used by a licensed service. The unused spectrum is often referred to as white spaces and can represent a significant amount of unused spectrum in some areas. Subject to certain rules the spectrum may be used for new and innovative products and services.

Source: <http://transition.fcc.gov/oet/whitespace/>

Recently, the YurokConnect Project acquired a dedicated line from the U.S. Department of Justice to the tribe's Klamath, Calif., public safety office. The office uses the line for accessing criminal databases; it cannot be used for other communications. But the most fundamental and arguably the most valuable application of the white-space technology is that the tribe will be able to connect every tribal office with the new network, enabling the offices to exchange information among their computers quickly, securely and dependably.

Another of the first links to be installed will serve the Klamath Fire Station. The firefighters will have a faster, more reliable Internet connection for live video training.

"These folks are all volunteers, they

work during the day, and they come in the evening to get training," Norton said. "It works much better if they have a solid connection to the training resources."

Disaster management

When it comes to emergency management, during a major catastrophe the towers will be fully autonomous. Yurok communications will be independent and capable of operating for days off-grid via broadband wireless, reaching everyone on the reservation. It won't be necessary to rely on outside resources for communications. With the advent of this new system, the tribe will have a vital resource for managing virtually any kind of disaster imaginable.

"Right now, the plan for our new emergency services coordinator is that,

in the event of a disaster, he'll take the mobile command trailer out to one of our new towers," Norton said. "It's up above anything that comes along, such as flooding from the river. Wherever they station the mobile command center, our towers will be able to see it and be able to communicate with it. They'll have power from our generators that they can tie into if necessary."

The reservation has two clinics that have reasonable Internet access via T1 data lines. However, this new wireless network deployment will allow them to conduct virtual telemedicine. They will be able to exchange files between them and with Tribal members. Patients will be able to go into the clinic and be online live with doctors in other areas. That saves tremendous amounts of travel time, not to mention the stress on medical staff having to reach remote locations to see their patients. In many cases, the teleconferencing that will be enabled with this new technology can be life-saving.

Sources of funding

Funding for the YurokConnect Project comes from a variety of sources, including the California Consumer Protection Foundation, the California Emergency Management Agency, Public Safety Interoperability grants and the Infrastructure Protection Grants unit in Sacramento, Calif. However, the bulk of the funding came from the U.S. Department of Agriculture Rural Utilities Service Community Connect grant program.

"We've had amazing support from our tribal council and the membership at large, but when it comes to funding, I can't believe how people have been really on board to help us," Norton said. He said he and his team hope to be able to expand the system, upgrade, and then reach out and help other local tribes that need the vital communication services. And it doesn't stop with helping just other tribes.

Equipment collocation

"One of our partners is the County of Del Norte, Calif.," Norton said. "Part of the reservation lies in the south portion of the county. We have collocated some of our equipment in the county's com-



This tower, shown being erected on a mountain peak within the Yurok Reservation, is one of only three new towers necessary for the new TV white-space system being installed.

munications hub. When our expansion allows us to link into the networks of different regions, we then would be able to provide emergency backup communications services for the county's emergency responders in the event that their primary services are compromised. In an area where such redundant services aren't available, that's a very cool concept."

Deploying the Carlson Wireless broadband radio not only represents the use of a new technology that reuses vacant TV airwaves for broadband Internet access and a proactive step for the Yurok Tribe, it also demonstrates how implementing broadband wireless service on tribal lands can be funded, deployed and managed. ■

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Visible in this aerial view are a telecommunications tower and several dwellings. The new wireless network will extend Internet service to far reaches of the Yurok Reservation.

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