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San Diego wireless net installs 72-mile, 2.4-GHz link

By Bob Brewin NOVEMBER 12, 2002

Most enterprises that deploy wireless LANS estimate their coverage area in terms of hundreds of feet.

Hans Werner-Braun, a researcher at the San Diego Supercomputer Center and principal investigator for the San Diego County High Performance Wireless Research and Education Network (HPWREN), plans and develops wireless circuits that routinely span miles, including HPWREN's current distance-record holder, a 72-mile-hop installed last month from San Diego to San Clemente Island.

Although standard 802.11b WLAN gear operating in the unlicensed 2.4-GHz frequency serves as the baseline hardware for the new network, Werner-Braun said that HPWREN, backed by grants from the National Science Foundation, uses far-from-routine hardware configurations to serve rural San Diego County.

The link to San Clemente Island -- used to carry data from a seismograph, data logger and Global Positioning System receiver -- runs with the maximum 1-watt power output allowed by the Federal Communications Commission for 2.4-GHz equipment, Werner-Braun said. At both ends of the link, HPWREN technicians installed high-gain, 2-ft. parabolic antennas to provide an additional boost to the signal.

Although the raw data rate for the 802.11b gear Werner-Braun uses -- Orinoco routers and bridges from Proxim Corp. -- for the San Clemente Island shot is 11M bit/sec., the extreme distance cuts the throughput on that link to 1M bit/sec. But since there are no other communications alternatives, that's still a good data rate for an installation whose fixed cost ran about $3,000, according to estimates by Robert Ma, a product manager at Sunnyvale, Calif.-based Proxim.

Low costs, ease of installation and no hassles with protracted FCC license proceedings are the hallmarks of HPWREN, which uses equipment operating in both the 2.4- and 5-GHz bands to provide broadband data service to scientific installations, schools and Indian reservations scattered throughout 10,000 square miles of rural San Diego and southern Riverside counties in California.

Despite a large population hugging the Pacific Coast, rural San Diego County includes some of the most telecommunications-starved areas of the U.S., including the Anza-Borrego Desert, "and you're not even going to get a phone line in the desert," Werner-Braun said.

"There's no other viable choice" for high-speed access for scientific installations such as the Palomar Observatory besides HPWREN, which an can easily, quickly and cheaply install wireless connections to backbone nodes on mountains such as Alliance Peak, Toro Peak and Monument Peak, he added.

The backbone nodes operate at a data rate of 45M bit/sec. in the same unlicensed 5-GHz frequency bands used by 802.11a WLAN equipment, with high-gain, 8-ft. antennas pushing the distance from feet to miles, Werner-Braun said. These backbone nodes require equipment not found in the standard corporate campus WLAN, but any extra costs are quickly mitigated by using an unlicensed spectrum instead of licensed fixed microwave links or fiber-optic high-speed circuits from a telecommunications carrier, Werner-Braun said.

Werner-Braun explained that HPWREN was built around the unlicensed spectrum because "I don't have to pay for it, and I don't have to go through the FCC."

Greg Ennis, technical director for the Wi-Fi Alliance, said that although wireless point-to-point bridging is "relatively routine," Braun's long shots are unusual. Whereas eight to 10 miles is common, Ennis said, a 72-mile, 2.4-GHz link pushes the technology to its limits.

Ma agreed. He said 72 miles "is a truly amazing feat," especially over water, where reflections can inhibit the signal.
Source: Computerworld

[Note: Ironically, this link -- as described -- was illegal under Part 15. HPWREN works with the Space and Naval Warfare Systems Center and may have been opperating under governmental authority. But to radiate 1 watt on the 2.4 GHz band through ultra-high gain antennas as described would create an EIRP that's above the FCC limits for Part 15 operation.

In responce to this they reduced the power from 1W to 250mW (to achieve Part 15 compliance). Their data rate dropped to ~300KBits/sec. Still, 72 miles is remarkable!