HISTORY

The High Performance Wireless Research and Education Network (HPWREN) is supported by the National Science Foundation as a network research project, and provides a telecommunications capability in areas not well-served by other fixed or mobile highspeed wireless services. HPWREN functions as a collaborative cyberinfrastructure on research, education, and public safety activities. This includes creating and evaluating a non-commercial, high-performance, wide-area wireless network in San Diego, Riverside, and Imperial counties. The network includes backbone and access nodes at a number of hard-to-reach areas in remote environments. HPWREN originated in the year 2000 and has been continually evolving since then.

OVERVIEW

HPWREN supports a vast spectrum of network application requirements, ranging from the bursty, very-high-volume data, predominantly at night, of the Palomar Observatory, to continuous low-volume traffic of individual sensors that possibly have tight real-time requirements, such as earthquake sensors. HPWREN includes permanent sites, as well as those created temporarily and on short notice, such as firefighter Incident Command Posts (ICPs).

The network spans from San Clemente Island in the Pacific Ocean, via the southern California coast to the inland valleys, on to the high mountains, to elevations of more than 8,700 feet, and out to the remote desert, reaching almost to the Arizona border. The network's longest link is 72 miles in distance - reaching from UCSD's San Diego Supercomputer Center to San Clemente Island.

TECHNOLOGY

The HPWREN backbone itself operates in FCC-licensed radio spectrum, while integrating a system of off-the-shelf radio technology. To increase robustness, large portions of the network utilize a redundant topology to create more routes and to increase bandwidth. Access paths to the backbone utilize license-exempt or FCC-licensed radio links. The wireless link capacity ranges from full-duplex, 155Mbps FCC-licensed to license-exempt sensor access links with orders-of-magnitude less capacity, as driven by actual needs.

The HPWREN team focuses its research on network systems integration, workload profiling, performance analysis, and the application of Quality of Service (QoS) and Policy Based Routing (PBR) methodologies to steer the performance of the network.

IMPACTS

HPWREN influences many scientific disciplines and projects that monitor and sense the environment. A fundamental impact is the field deployment of wireless networks for obtaining real-time data across multiple disciplines ranging from environmental sciences, oceanography, biology and astronomy, to rural education. In addition, the impact on public safety objectives has been substantial, including connectivity to Incident Command Posts and other firefighter assets, as well as access to sensors and environmental cameras.

AREAS OF COLLABORATION

- Network Research
- Astronomy
- Biology, Ecology, and Wildlife Conservation
- Earth, Ocean, and Engineering Sciences
- Native American Education
- Distance Learning, including Live Interactive Virtual Exploration (LIVE)
- Public Safety
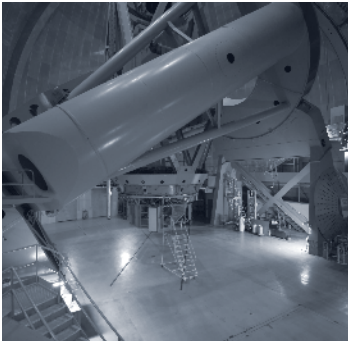
Left: Sensor tower the SDSU Santa Margarita Ecological Reserve
Right: Inside the 200 inch Hale telescope dome at Palomar Observatory

Left: LIVE presentation from the Cabrillo National Monument to Los Angeles inner city school children
Right: Native American education at the Pala Indian Reservation

Left: ICP networking support during the Mataguay Fire in 2004
Right: Permanent HPWREN connection to the La Cima Conservation Camp since after the 2003 Cedar Fire

High Performance Wireless Research & Education Network

http://hpwren.ucsd.edu