



LONG-RANGE WIRELESS NETWORK UPGRADE FOR ETHERNET: ZUMLINK 900 SERIES

Geophysical Institute of Peru (IGP)

Overview

Peru is a region of significant seismic activity, with as many as 200 earthquakes occurring on average each year. Sitting along the Pacific Ocean’s “Ring of Fire” (where 90% of the world’s earthquakes occur), Peru also is home to nearly 20 active volcanoes.

The Geophysical Institute of Peru (IGP) is responsible for the detection of natural disasters of a destructive magnitude like earthquakes, tsunamis, volcanic eruptions, and mudslides. Utilizing a network of seismic and volcanic sensors and stations, the IGP manages an early warning and data collection system for the safety of its residents and for the transfer of valuable knowledge to international scientific community.

The IGP relies on robust and rugged wireless data solutions like FreeWave’s ZumLink 900 Series (Z9-PE) for real-time data collection and long-range communications backbone of its early warning system. With RF data rates of 1 Mbps on a point-to-point link of 67 km and 115 kbps on a point-to-point link of 127 km, ZumLink 900 Series provides IGP the range and throughput needed for modern, remote data networks in unforgiving environments.

Needs and Pain Points

Because IGP installed an advanced broadband seismic sensor network with state-of-the-art seismometers and GPS reference functionality, it needed to boost wireless throughput and performance over its current 115 kbps radios which are of limited use due to their inherently lower bandwidth and feature set.

In addition, the network covers remote mountainous terrain with no access to grid power sources, therefore, the communications solution needed to be low power. ZumLink 900 Series is low-power (355mA @ 12V in Transmit and 100mA @ 12V in Receive) and operates from power sources like wind, solar, fuel cell and battery. Thus, it is ideal for portable and remote deployments like this where AC power is not available.



Solution

Equipment

For initial throughput and link testing, three 900 MHz ZumLink Series Z9-PE radios were deployed. IGP's live network implementation includes fifteen (15) Z9-PE radios at various geographically dispersed repeater locations and endpoints to bring in data from four (4) remote seismic stations. (See Figure 1).

The Z9-PE radios pull in sensor data from Trimble Reftek 130 Broadband Seismic Sensors via Ethernet connections. Integrating seamlessly with the Trimble sensors, the ZumLink 900 Series is specifically designed for outdoor networks and is reliable under extreme environmental conditions like those encountered in the Andes.

RF Testing (Wireless Data Links)

IGP performed a radio survey utilizing an 11 dBi Yagi antenna on 2.5 meter tall towers to communicate between the base station and endpoints.

The Z9-PEs met expectations with ping averaging 60 ms with 2 dropped packets over mountainous terrain (Figure 2). At its most extreme, the base station was linked to a radio at a distance of 127 km with a reception of 92db (Figure 3) and a RF data rate of 115 kbps. To boost the data rate, a second test was carried out at 67 km, resulting in a rate of 1 Mbps.

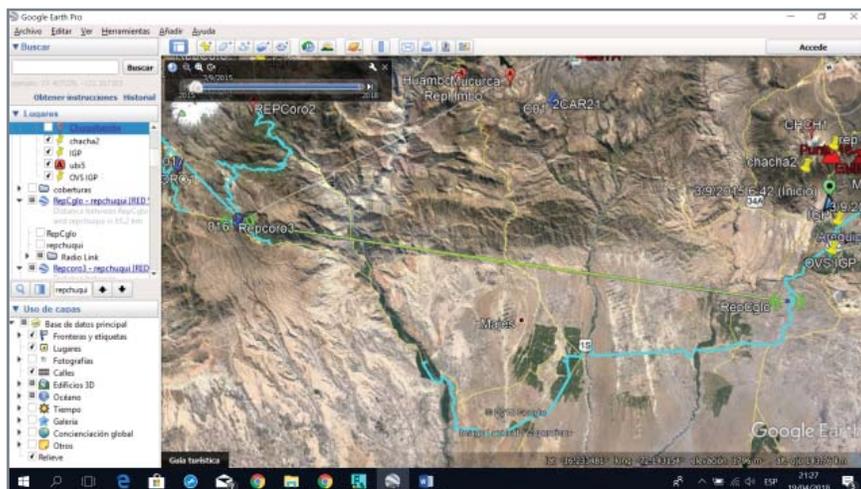


Figure 1

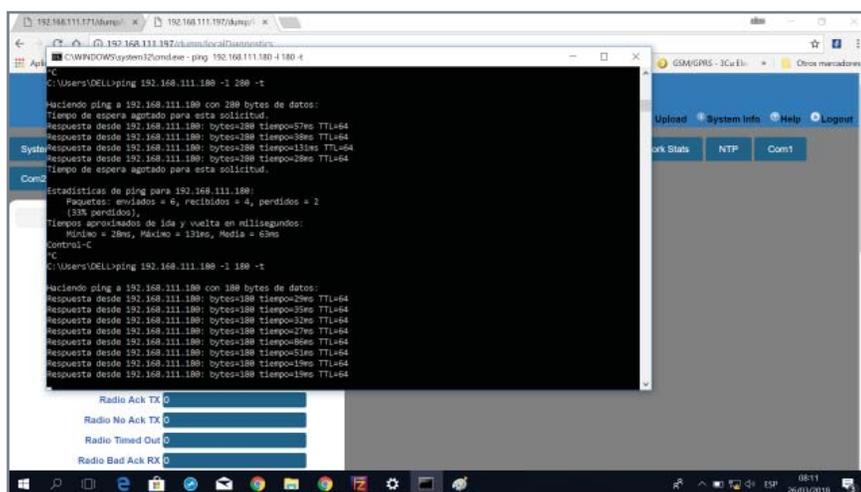


Figure 2

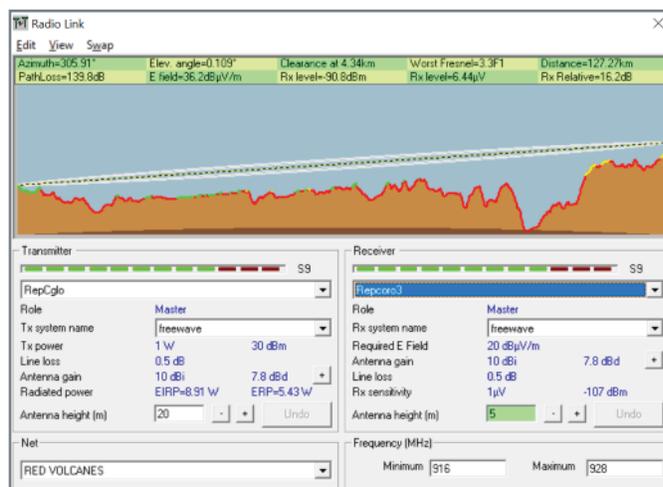


Figure 3

Future Needs: Custom Application Development and Deployment

Utilizing the ZumIQ Application Environment built into the Z9-PE platform, IGP software engineers would like to develop a custom application for transmission redundancy to be hosted on both the endpoint and base station Z9-PE radios. Each Z9-PE is application programmable and has 512 MB of RAM and 1 GB of flash that can store up to 30 days of site data. The application will enable the programming of static routings on the radios to ensure transmission redundancy. To avoid transmission cuts to the flow of vital data, static routing is often used as a complement to dynamic routing to provide a fail-safe backup in the event that a dynamic route is unavailable.



RESULTS

Although a longtime user of FreeWave's reliable and tough FGR2 Plus Series, IGP's migration to more robust Ethernet seismic sensors from Trimble necessitated the deployment of the higher throughput ZumLink 900 Series.

- > **RF data rate of 1 Mbps** on a point-to-point link of 67 km
- > **RF data rate of 115 kbps** on a point-to-point link of 127 km
- > **Reliable and robust communications links** over the rugged terrain of the Andes Mountains

- > **Compatibility** with modern smart sensors and Ethernet endpoints
- > **Network power** without electric grid sources
- > **A future-proofed network** via ZumIQ Application Environment programmability



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