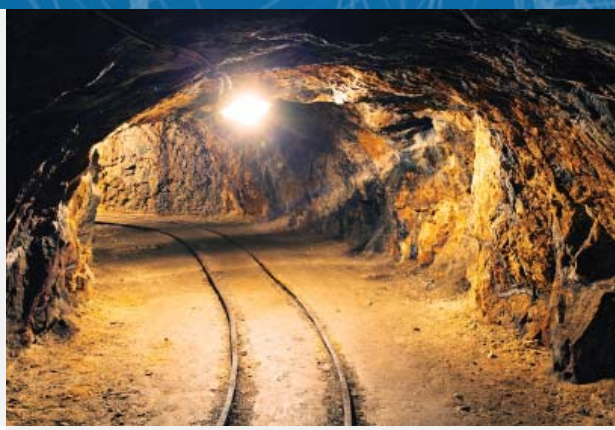
RAJANT

CASE STUDY

Rajant Radios Maintain Connection in Challenging Underground Mine



An underground mining site located in Brazil presents significant challenges to the successful deployment of a wireless network. Establishing a network is particularly important on the active stope, where connectivity and throughput demands are high, and no wired infrastructure currently exists. A lack of infrastructure throughout the mine levels, limited access to power, and a lack of Ethernet on all levels further limits wireless connectivity.

While the company desires mining application connectivity throughout the job site to correct these issues, several factors hamper the realization of this goal.

The Challenge

A system of extensive tunnels – 160 kilometers of tunnels underground in total – comprises the mine. Communications across the majority of the site are conducted via a two-way voice radio system; there are no IP or data radios to direct communication out of the tunnels. Additionally, the mine is made up of multiple levels, each connected to its neighbor by spiraling ramps. This tight spiral design limits the distance wireless communications can travel.

Workers follow the ore at an angle, as opposed to straight down. However, the levels sit atop one another. Several vertical shafts run all the way down, serving as the pathway for the ore, man shaft elevators, ventilation shafts, etc.

At each level, an Ethernet switch is fed by fiber from one of the vertical shafts. Systems on each level are able to connect to the core network through these switches, but currently there is no wireless connectivity.

Company Profile

- Large mining company operating an underground mind in Brazil.

The Challenge

- Expand the reach of wireless communications throughout the shaft architecture, which includes multiple levels connected by tight spiraling ramps.

Typical Applications

- Improve safety with proximity communications
- Connectivity for autonomous mining
- Connectivity for dispatch and onboard machine health systems
- Access to business systems, asset tracking, wireless and wired VoIP systems, and IP cameras

The Solution

- Rajant Kinetic Mesh™ Private Wireless Network

Test & Kinetic Mesh Solutions Partner (KMSP)

- 3D-P: global provider of value added, technology based services and products to enhance the productivity of the industrial community.

Test Date

- October 2014

And a wireless network is important to the company, as it wants to utilize applications on equipment to pull data. For example, a proximity application could keep workers informed of where equipment and operators are, promoting safety and productivity. Executives are also interested in establishing voice communication throughout the entire mine for all employees, using a cell phone with an application enabled for this purpose. In order to accomplish all of the above, the organization needs a robust, high bandwidth, low latency network in the mine.

The Results

Ron White, CTO at 3D-P, tested five solutions, with Rajant and three other vendors offering mesh technology. The remaining product was not a mesh solution.

In order to test the impact of the spiral design, White created two test environments. He conducted the first onsite at the mine. In this test, he set up an infrastructure radio at one end and tested it against different radios and antennas, monitoring signal strength and throughput, and then continued around the spiral to measure how far he could get without the signal faltering. In this test, as expected, the signal dropped quickly when line-of-sight was lost.

Onsite Test Locations, with minor and steep bends and turns (some more than 90 degrees), limited tunnel widths that have the potential to create severe Fresnel zone infringement, and a complete spiral.

White utilized a non-working mine of the same design in the US for the second test. Using a radiating cable to connect the mesh networks on each level, a Rajant 2.4 GHz radio and two 5 GHz antennas on the spiral, he was able to maintain connectivity all around the spiral, up to a distance of 500 meters. White did not lose bandwidth with the Rajant dual radio because the InstaMesh® protocol allows the traffic to traverse a multihop network by switching radios at each hop, preventing throughput loss. Multiple Ethernet systems provided additional, and necessary, redundancy. Based on these results, White recommended Rajant's technology.

> "I prefer Rajant's technology in this case. It enables communications to travel 10 hops or more and maintain a robust network with the necessary high throughput these mining applications demand."
>
> **— Ron White**
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> Chief Technology Officer, 3D-P

Specifically, he devised a highly effective plan that involved placing multiple Rajant nodes at each level, connecting them to the Ethernet switch, and meshing them with the rest of the infrastructure on that level. At each spiraling ramp, radiating cable connect the mesh networks on each level, ensuring redundancy as the core network can now be accessed on either level, preventing a single point of failure. A second level of redundancy was realized by placing the individual radios at distances throughout the mine so that should a failure of a single node occur, a connection to the next radio in the tunnel could be established, although at reduced data rates.

In order to address the stope issue, White advised workers place nodes on the vehicles, a mobile application for which Rajant's technology is perfectly suited. A battery-powered BreadCrumb® was also recommended, that could be placed in strategic locations to provide connectivity to the core network. As the operators work in the stope area, these mobile nodes would maintain communications with the rest of the network.

"I prefer Rajant's technology in this case. It enables communications to travel a minimum of 10 hops and maintain a robust network with the necessary high throughput these mining applications demand," White said.

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