

An Intelligent Edge and Wireless Mesh Network for Your Last Mile Success in Underground

Rajant's industrial wireless mesh networks bring seamless integration to underground mines to enhance your existing communications and environmental monitoring data-highway to improve safety, production, and operations. Save significant OPEX and maintenance costs while adding more scalable network capacity and mobility for capabilities beyond what fiber and copper systems can support.

Underground mines and tunnels are some of the most challenging environments in which to deploy network systems. Integration and throughput demands are high, but circular ramps and declines, stopes, and mine layout place limitations on how far wireless signals can travel. Many mines, therefore, depend on fiber to achieve reliable underground communications, but installing fiber in active drives, panels and declines is difficult to schedule and can create operational and maintenance nightmares. In addition, development and drill and blast areas can rarely support any fiber infrastructure. It is not uncommon for trucks to accidentally catch and rip down sections of fiber and when that happens connectivity across the entire underground mine can be lost.

An Intelligent Underground Solution Above the Rest

Rajant provides a robust alternative to fiber and traditional single radio wireless systems using our multi-radio, multi-frequency BreadCrumb® nodes combined with the Poynting wide-band, bi-directional, circular polarized antenna system. BreadCrums maintain multiple simultaneous connections between peers for inherent redundancy and can simultaneously send and receive information on different frequencies, mitigating issues due to interference, congestion, and equipment outages. This also increases transceiver capacity to ensure low latency and enables mines to cascade BreadCrums together as many as 10 hops or more without throughput degradation. Poynting antennas provide bi-directional coverage with dual-frequency Wi-Fi connections to assist in propagating signals around tunnel bends and to and from moving machinery.

Together they create a complete underground and tunnel-wide wireless network for mission-critical data, video, and voice communications. The system can also be used to supplement existing fiber and cable "hot spot" networks, provided via vertical shaft access levels, portals and tunnels.



Rajant Cardinal and Hawk BreadCrums®

Enable Next-Gen Applications, No Fiber Needed

With the Rajant solution, underground mines can enhance network capacity and mobility to run advanced applications that power greater safety, efficiency, and autonomy—all without the use of expensive fiber. Part of this performance comes from Rajant's patented InstaMesh® networking software, which is loaded onto every BreadCrumb node. InstaMesh enables the network to dynamically and automatically adapt to quickly- or constantly-moving network elements, providing reliable network-wide mobility.

The protocol directs traffic via the fastest path over the multi-hop network, switching radios at each hop for minimal latency over long distances to enable and support applications, including: operations and fleet management, automated haulage, conveyor and train equipment, automated drilling, personnel and asset tracking, seismic and gas monitoring, ventilation control, mobile surveying and scanning, and mine-wide SCADA/pumps and control monitoring.

Personnel and Asset Tracking

Rajant's industry-leading MeshTracer® technology can effectively track Rajant BreadCrums, and any Wi-Fi device that uses a static MAC address. MeshTracer is the most effective mustering and tracking, incident management, and communications platform on the market today. Rajant's personnel and asset tracking software uses Real-Time Location System (RTLS) technology to identify people and assets across all zones and areas of a mining site. The system uses standardized communication protocols, allowing devices to exchange messages, define incidents, and monitor the flow of users throughout a physical environment. MeshTracer is easily adopted, highly adaptable, and simple to use.

Autonomous Systems

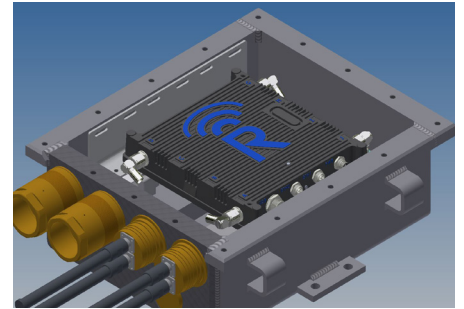
Underground mines are also looking to leverage autonomy to meet increasingly stringent safety and productivity mandates. The challenge is that autonomous applications are not only bandwidth-intensive but most require continuous uninterrupted communication otherwise the autonomous vehicle has to stop due to safety reasons until communications is re-established.

Rajant is the only wireless network that is designed to provide continuous integration, connectivity, and consistent high throughput across multiple hops. Rajant uniquely delivers on this demand because in our network, no connections need to be broken for new ones to be made. BreadCrums can be deployed on moving autonomous equipment to dynamically form multiple connections with other fixed infrastructure nodes as they come into range, and InstaMesh selects the best available path to maintain high throughput and low latency even due to a signal blockage. This is especially applicable in a block cave autonomous haulage operation at draw points and in panels.

An example is the Explora underground mapping and inspection robot by Australian Droid + Robot, which has Rajant's BreadCrumb technology onboard—enabling its ability to independently perform visual inspections, thermal imaging, laser survey scanning, gas sensing, and other tasks to identify and or operate in hazardous mine conditions. Rajant's network also uniquely enables these autonomous systems to communicate vehicle to vehicle to create an autonomous mesh network to manage their movements throughout the mine.

The #1 Choice for Mine Networking Around the World

Rajant and our infrastructure partners provide comprehensive surface and underground solutions to mines seeking to make transformative gains in safety, efficiency, and cost savings along their path to mine digitalization.



A Rajant Hawk BreadCrumb outfitted in an EX-BOX for use in Longwall mines.



Enables tele-operation of an LHD between shifts and autonomous control from the muck pile to the ore pass.

Learn more about Rajant's Intelligent Edge capabilities to enhance your existing communications and environmental monitoring data-highway to improve safety, production, and operations at www.rajant.com

Tel: 484.595.0233 | www.rajant.com

BreadCrumb, CacheCrumb, InstaMesh, Kinetic Mesh, and BCICCommander and their stylized logos are the trademarks of Rajant Corporation. All other trademarks are the property of their respective owners.

© Copyright 2025 Rajant Corporation. All rights reserved.



RAJANT
INTELLIGENT EDGE
Enabling Industrial AI