Co-ordination of mine machinery is vital for improving efficiency

COMMUNICATIONS

The roadmap to optimal efficiency

Bert Williams of ABB Wireless highlights the importance of comprehensive wireless networks for successful fleet management at open-pit mines

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Open-pit mining is the delicate dance of multi-million dollar machinery against the backdrop of some of the most unforgiving terrain and weather conditions on the planet. That level of financial investment makes fleet management critical for success, as unplanned downtime can have a cascading effect across all aspects of mining operations.

The often-overlooked, yet crucial component to advanced fleet management is the network that makes real-time information possible: wireless networks. Open-pit mines have some of the most challenging functional requirements for wireless networks – fleet size, pit size, topology, etc. – but these networks are key to improving capital utilisation.

Wireless mesh technology reduces the need for large towers and, in some cases, eliminates them altogether. With built-in redundancy mechanisms, the technology has the ability to minimise the probability of transmission failures, and it can create long-term strategic value for the customers, as the fleet-management applications of today are perceived

as the foundation for autonomous operations in the future. If mining executives want a roadmap to optimal efficiency, the network cannot be overlooked. The underpinning of successful fleet-management implementation is a reliable, scalable, flexible, secure and multi-application broadband wireless network.

REAL-WORLD EXAMPLE

One of the world's largest iron-ore mines spans over 25ha in Australia. This open-pit mine operates 24/7 with 1,500-2,000 workers on site each day. The ore lies 20-70m below the surface and is extracted using heavy machinery, including face shovels, excavators and surface miners. Careful planning and orchestration of the mining equipment is important, and real-time telematics is essential for achieving accurate and safe extraction and removal, while optimising profits.

In setting up the iron-ore mine, operations selected a mine-management system to optimise productivity and safety, able to monitor, manage, report and control all aspects of mine operations.

Operations invited IT to the project to help outline the network communication requirements for operating the pervasive mine-management system. IT personnel identified key attributes for the communications network, including that it be rugged, reliable and flexible.

The network needed to be capable of:

● Operating in extreme heat and dust;
● Supplying mobile nodes able to withstand the high vibration typical in mining vehicles;
● 24/7 operation with self-configuring, self-healing nodes that automatically select the best route through the network from multiple radio-frequency (RF) paths, channels and bands;
● Offering high capacity with the ability to aggregate communications and implement quality of service for multiple IP applications, including fleet management, fuel polling management, lightning alert and IP video cameras; and
● Easily relocating and seamlessly scaling as additional nodes and coverage area are added, connecting hundreds of devices.

NETWORK OF CHOICE

After evaluating and testing several wireless solutions, an ABB Wireless mesh network was selected. It was able to meet the mine's requirements, including reliable, high-capacity communications from mesh routers, with extended operating temperature ranges, enhanced wind survivability and housings fabricated using specialised alloys and plating.

The mesh network serves as the core communications foundation, supporting a wide range of applications that improve operational efficiency and safety for the workers on site.

The Cat MineStar software system utilises this network, and has multiple modules for various functions:

● MineStar Terrain – iron-ore mining requires precision operation of mining equipment for precision excavation. Vehicles used in excavation (diggers, excavators, loaders, etc.) each have a GPS that communicates location and helps in guiding excavation accuracy (within ±100mm is needed) to increase productivity and provide real-time feedback for improving efficiency;

- MineStar FleetCommander – creates scheduling assignments for vehicles, white-line assignments (creates maps for where to drive), minimising waiting time and optimising utilisation;
- MineStar Production – gathers productivity information from trucks, loading tools and other equipment, increasing mine operation efficiency; and
- MineStar Health – centrally collects information related to fleet health in real time (tyre pressure and heat, fuel usage, and repairs and maintenance) and recommends preventative maintenance schedule to help avoid vehicle downtime.

Other key applications that utilise this network include:
- Security cameras – installed in the mine pit, the cameras are mounted to routers and provide real-time viewing of pit activities to operations (located in pit trailer). This also provides visibility for ensuring site and personnel safety in the pit;
- Survey equipment – collects and records information on ore samples, which is sent to operations for analysis;
- Lightning-alert system – an early-warning system with sensors that monitor for lightning strikes in the area and can alert, should conditions become risky for workers; and
- Mobile device connectivity – geology, mining and IT personnel use laptops and other mobile devices to connect to the network for email, access to information and recording information in the field.

FULL PRODUCTIVITY
Without the integrated connectivity and oversight, on-site personnel would be responsible for the entire site's maintenance, perhaps reactively, as well as operational requirements, without the use of real-time data. Given the challenge of recruiting a skilled workforce for remote locations, it's crucial that systems are in place to advance seamless operations.

Leading players have begun to treat mining and production data as company assets. Doing more with less requires timely data; therefore, the infrastructure that delivers access to that data becomes more valuable to the business.

Wireless field area networks implemented with mesh technology can enhance the efficiency, productivity, safety and security of open-pit mining. From total fleet management and control to asset tracking and mobile access, wireless networking solutions that address every aspect from the operations centre out to the sensor are critical to achieving greater operational efficiency. ▾

Ensuring adequate communications coverage throughout the site is often challenging in mine conditions
Photo: ABB Wireless

Bert Williams is the director, global marketing at ABB Wireless. See: new.abb.com