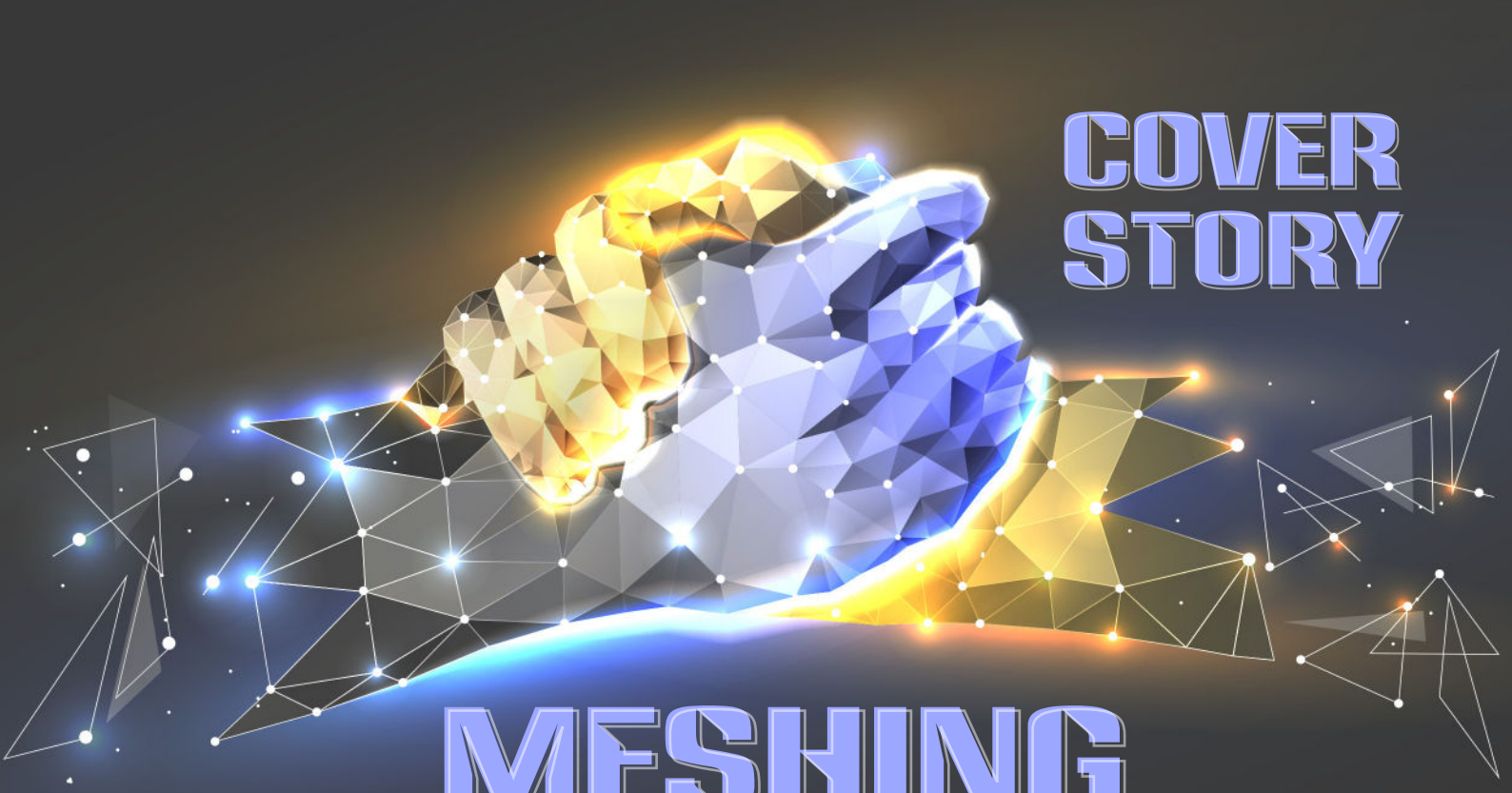

COVER STORY

MESHING MINING WITH TECHNOLOGY

Sagar Chandra, Rajant Corp., USA, explores how key digital innovations in the mining industry can help keep workers safe and leverage increasing asset productivity, and details the requirements of a network to support these next-generation applications.

It is no secret that mining operations pose harsh conditions and can be hazardous. The priority of all employees and managers is to ensure safety while maximising operational efficiency. As such, rapid advances in technological innovation have a fundamental impact on the mining sector, and communications play a vital role in improving individuals' safety and increasing operational efficiency.

The mining industry continues to invest in various technologies, ranging from standard fleet monitoring to advanced tele-operation and collision avoidance solutions. As such, the need for a stable and scalable wireless communications foundation is critical in keeping all these technologies working effectively. Rajant Corp. is a proven provider of private wireless industrial networks helping mining companies realise their vision.

It is important to remember that when choosing a connectivity supplier, the technology needs to support productivity and safety-enhancing applications that mines require, combined with the unwavering, mission-critical reliability they demand.

Mission-critical connectivity

High-bandwidth and robust networks are imperative for the exacting and critical communications within the mine. This holds true above and below ground. However, there are many challenges when selecting wireless technology; connectivity and throughput demands are high, but spiralling designs, slopes, and mine depth place limitations on how far wireless signals can travel. Traditional wireless networks run via fixed infrastructure, such as point-to-multipoint (PMP) and Wi-Fi, meaning they cannot be easily relocated. Installation costs can be high and labour-intensive.

Since mining operations are subject to constantly changing conditions, if the network in place fails to adapt immediately and automatically, the impact can be costly, as the mine cannot efficiently utilise the real-time applications that are crucial to ensuring constant productivity and safety. Expenses can also arise from technician visits stemming from issues if networks are not robust enough to withstand the environment. Mines will struggle to meet production targets and maximise operational efficiency if a network has

downtime or cannot fully support the critical applications it requires.

Not only this, but mining companies also need continuous connectivity for safety reasons. They want to always be aware of employees' locations and status, such as when operating in dangerous areas or using hazardous equipment. Monitoring the health of equipment in real time equipment can also support staff in such scenarios to recognise potential hazards or malfunctions with assets, therefore avoiding any potential risks. From the machine's current location to its tyre pressure, operators can gain full visibility into every asset's health status and performance, arming them with the insights needed to keep fleets fully optimised and safe.

A reliable network that can remain connected to all corners of the mine is key to overcome these challenges. Maximising operational efficiency and safety in mines is only possible with an unfailing connection that can support 24/7 activities and withstand any emergencies when working in the mines. When every insight is of value to improving production yields, the network must enable instant access to real-time voice, video, and data without fail, dropped packets, or high latency. Importantly, it must uphold these mission-critical requirements in an environment that is rugged and ever-changing, supporting continuous connectivity to people and assets that are always in motion across the mine.

Figure 1. Mining can be a dangerous trade. Communications play a vital role in improving individuals' safety and increasing operational efficiency.

Figure 2. Key digital innovations are available for mines to keep workers safe and leverage increasing asset productivity.

A flexible solution

Data is the lifeblood of successful mines, meaning that the ability to transmit and receive data is critical to delivering real-time visibility of personnel and assets. However, a mine's ability to capture and act on equipment data will rely solely on its network infrastructure.

Unfortunately, many wireless networking options fall short of mining requirements because of their inability to support dynamic mobility. However, reliable mesh networks are explicitly built to suit the mining industry's characteristics, as they provide highly mobile connections in industrial environments. Through its robustness and mobility, these networks can provide unwavering connection in the adverse and changing conditions typical of the underground mining industry and deliver reliable communication for operators.

With a self-optimising mesh network, nodes work via multiple-frequency peer-to-peer connections and can be fixed or mobile. For example, connections can be made between moving assets, such as trucks or people, enabling all-to-all communications between mobile equipment. Every node in a reliable mesh network can act independently and with full routing capabilities. They can receive and transmit data simultaneously, meaning they can be receiving information from any other connected device. Additionally, whilst providing this resilient mesh network connectivity, they can simultaneously act as a local Wi-Fi transmitter. This critical functionality allows the adoption of real-time location solutions for tracking and tagging machinery and personnel.

This ubiquitous connectivity and flexibility of applications are made possible through a networking protocol, which dynamically and automatically selects the fastest route for traffic and re-routes communications to the next best path if the first becomes blocked or unavailable. This will ensure that downtime is avoided to ensure underground mining's subterranean conditions will not compromise network performance and maximise operational efficiency and safety.

As in the mining industry, wireless networks should have proven success in other rugged environments like military, oil and gas, ports, and utilities. It is clear that these sectors all have one factor in common: equipment in motion over extreme, unpredictable environments that can pose bandwidth challenges. As a result, Rajant has developed its Kinetic Mesh™ network to handle these types of critical environments.

Connectivity when it is needed most

To provide an example of how companies can generate value through responsible mining, a few years ago a Canadian-based international gold mining company needed a solution for its mine in Brazil. With ongoing large-scale projects and mines in the US, Brazil, and beyond, the gold producer invested more than US$300 million in its operations and equipment over the last decade. But change was needed to ensure reliability across its vast coverage areas, improve its network infrastructure, and align with its business aspirations.

As a result, the company decided to replace its dispatch system and invest in a new network. Firstly, it called upon SITECH/Grupo Sotreq to find solutions to run more of its applications, improve coverage areas, speeds, bandwidth, and mobility. Here it was recommended by that the mine should deploy a Kinetic Mesh network from Rajant. Doing so would

mean it could collect valuable data from shovels, trucks, dozers, and other mining equipment connected to the network optimising fleet operation to manage tasks and information. Due to its solid networking foundation enabling reliable data insights, they went on to explore additional improvements toward enhancing productivity, including adding cameras to their fleet and autonomous drilling vehicles.

Meeting changing demands

With mines growing vaster, deeper, and more competitive, it is becoming abundantly clear that technology will have a considerable part to play in the coming years, and the sector needs to foster innovation. A report by the World Economic Forum and Accenture forecasts that by 2025, digitalisation will have added more than the US$425 billion of value to the mining industry, with around 1000 lives saved and 44 000 injuries prevented.[1] As such, the sector will rely more and more on next-generation technology as it increasingly demands higher efficiency and profits.

Connectivity must deliver reliable, secure, and pervasive capabilities with scalable bandwidth and signal resilience over an increasingly broader operation that is interconnected, autonomous, and mobile. Thus, the network becomes a critical asset like any other for a digitised mine. The move of data flow to and from processes, people, and equipment over the network enables decision making in any part of the mine that is ongoing, proactive, and in real time.

Many wireless networking options, unfortunately, fall short of these requirements because of their inability to support dynamic mobility with always-on connectivity. Constant movement over large stretches of often rough terrain and around obstacles needs unblocked signal to carry out mission-critical productivity, efficiency and safeguarded tasks. Required to support performance optimisation and safety-enhancing applications is a network with industrial-strength to overcome any disruptions of dropped data packets, high latency, and compromised application performance.

By having both production pressure combined with the need for increased employee safety, mines need a network that can remain continuously connected, no matter the situation. On top of this, applications that enable operators to proactively monitor equipment health, predict maintenance needs, make real-time adjustments to improve fleet performance, and seamlessly control manned and unmanned roaming assets have become essential to enhancing asset productivity. With the right solution in place, significant cost savings can also be heightened. All of this empowers a bright future for the mining industry with a reliable network at the forefront. GMR

References

1. World Economic Forum, 'Mining and Metals: digital transformation and the industry's 'new normal', reports.weforum.org/digital-transformation/mining-and-metals-digital-transformation-and-the-industrys-new-normal