Cornering the market

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How Mosaic's Four Corners mine capitalises on phosphate production through its powerful kinetic mesh network

Mining phosphate rock from a total of more than 81,000ha acres of company-owned land in central Florida, US, the Mosaic Company is one of the leading producers and marketers of concentrated phosphate and potash.

Its products are processed into crop nutrients and then shipped to major agricultural centres around the world. Mosaic focuses on maximising efficiency to reduce its environmental footprint and has won multiple awards in recognition of its efforts. They recognise opportunities and focus remains on continuous improvements to their facilities.

The challenge

Mosaic's Four Corners mine and facility spans over 24,000ha at the crossroads of Hillsborough, Manatee, Hardee and Polk counties in Florida. This location is its largest centre of operation for mining and processing phosphates as well as the most complex, with multiple-critical applications that must run simultaneously to maximise efficiency. Operating 24 hours a day, 365 days a year, Mosaic ships its phosphate products to major agricultural centres of the world, driving a significant amount of economic activity in North America.

Prior to installing a Rajant kinetic mesh network, Four Corners operated on a rudimentary mesh network. Running at about 900MHz, its standard point-to-point radios had very low bandwidth and were spaced as far as 1.6km apart from one another, resulting in frequent network communication breaks, which slowed operations and delayed phosphate production.

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Additionally, Four Corners' phosphate production is dependent upon draglines, which are constantly moving and come with a high capital cost. Actively monitoring dragline operations via ruggedised cameras can minimise costs and user error, but with its low-bandwidth network, Mosaic Four Corners could only support two cameras, making it difficult to pinpoint problems or failing procedures.

Ivan Hartley, Mosaic Four Corners' on-site electrical and automation supervisor, had higher hopes for the mesh system and saw it as a major factor in the mine's continued success due to the productivity gains it could yield. Believing that Mosaic could do more to leverage the capabilities of a mesh network, Hartley began to seek a way to modernise the network, improve automation and productivity within the mine.

The solution

To improve the Four Corners communication network, Mosaic partnered with Rapid Systems, a full-service provider of wireless solutions. Dustin Jurman, CEO of Rapid Systems, says: "Mosaic Four Corners is a complex environment because of its large size and infrastructure. It was imperative that we install a resilient wireless network that could support multiple mobile applications without a break."

To update Four Corners' previous mesh network, Rapid Systems leveraged Rajant's kinetic mesh network, a type of wireless network that has been successfully deployed in other mining facilities and has been battle-tested by similarly demanding environments, including military operations and oil & gas.

With this type of wireless network, there is no static infrastructure; each radio, or node, serves as singular infrastructure, which enables all devices and the network itself to be mobile – a critical component in a mining facility, where vehicles and equipment are constantly on the move. It employs multiple radio frequencies and any-node-to-any-node capabilities to continuously and instantly transmit data in real time via the best available traffic path and frequency.

Because there is no central control node – and thus no single point of failure – routes are built automatically, and are evaluated for quality and performance with every received and sent packet. If a certain path becomes unavailable for any reason – due to power loss to a piece of equipment, for example – nodes on the network use an alternate route to deliver data.

This allows the network to adapt to node location, local interference and congestion dynamically, eliminating downtime even in the most rugged conditions. All infrastructure components give and get real-time information, enabling an end-to-end view of mining operations and allowing timely analysis and decision-making. The network can be redeployed in multiple ways simply and easily by repositioning the nodes.

Jurman and his team optimised operations by using Rajant's network and its BreadCrumb nodes to prevent the mine's former frequent breakdowns in network communication.

Hartley explains: "A big challenge was integrating the kinetic mesh network without disrupting the existing radio network and applications we already had in place. We called on Rajant to help us optimise our processes and generate higher yields."

When Mosaic initially tested Rajant's network for production control, Hartley quickly saw an increase in efficiency and phosphate production. He notes: "Rajant's network functioned even better than we expected. With an updated wireless network, we were able to add more functionality to our pumping systems, make remote program changes and create better processes."

Improvements

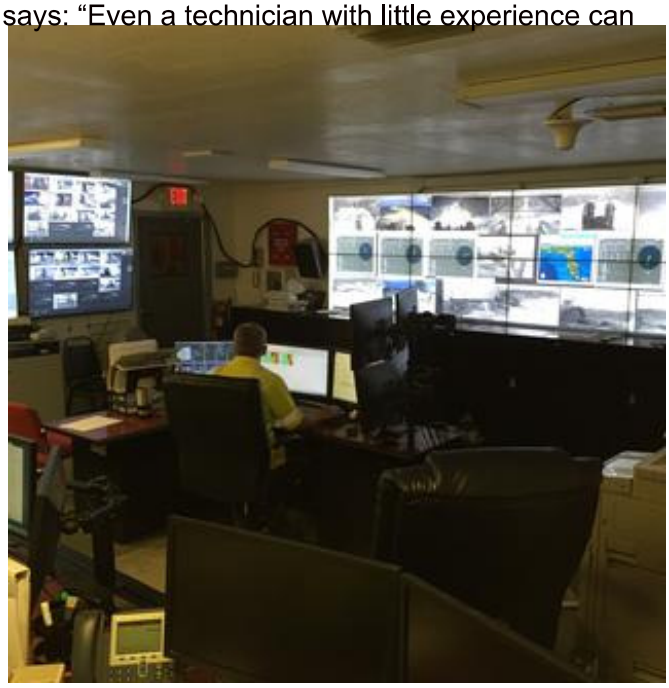
As Rapid Systems continued to work in the mines, it discovered more ways to innovate and improve the communications infrastructure. Following the initial installation, Rapid Systems, Hartley and Four Corners mesh radio technician Steve Jones integrated and optimised additional radios, most at approximately 6.1m high and directly attached to automation devices, which allows mine technicians like Jones to access them quickly and service them more easily. Some 192 BreadCrumb (58 LX4, 120 LX5, and 14 JR2 models) now comprise Mosaic's Four Corners network, giving operators the opportunity to constantly create new applications without compromising its existing network and applications.

The command centres at Four Corners allow Mosaic to monitor mobile gear such as draglines and pit cars

Once Mosaic Four Corners had a structured wireless network in place, it deployed – and now operates concurrently – a multitude of new applications, including a company intranet, VoIP phones and video monitoring systems for dragline excavators. Hartley says: "The use of video, in particular, has been extremely helpful in our operations. We have implemented highly functioning command centres with detailed dashboards that allow us to monitor even our mobile gear such as draglines and pit cars, ensuring that nothing ever sits idle to maximise productivity."

Jurman adds: "Ivan and his team are continually innovating and improving their processes, which makes Mosaic Four Corners a unique mining site. The opportunities to add value are endless."

Hartley notes that the Rajant radios were easy to work with. He says: “Even a technician with little experience can replace a radio quickly and easily, and, if it’s moved, reconfigure or repoint the radio antennas.”



Jones is the mine’s go-to mesh expert and assists with new layouts as needed.

Perhaps most importantly for mining operations, Rajant’s network has allowed Mosaic to create and install new applications that aid in the company’s commitment to safety.

Wireless information transmitted via the network enables continuous tracking and monitoring of key performance indicators. Static and mobile devices placed at strategic locations help operators track miners and maintain computerised attendance. This monitoring equipment not only improves productivity, but also reduces the risk of failures and warns miners of adverse conditions and equipment malfunctions. In the event of a failure, the equipment contributes to a speedy repair operation.

Mosaic expects to have more than 200 Rajant wireless network radios by the end of 2016. Its mines have been running on kinetic mesh networks for five years now, and Wingate, another mine in the Mosaic network, is now beginning to fully utilise the mesh network by adopting the same network configurations as the Four Corners mine with the help of a technician trained by Hartley and Jones.

Hartley’s vision of a highly sophisticated communications network has helped Four Corners optimise its mesh network and maximise its productivity.