Meshing well

Ailbhe Goodbody talked to Robert Schena, CEO and chairman of Rajant Corp, and Charles Byrd, director of sales engineering at Rajant, about the importance of good underground communications networks and how demand has exploded in recent years

Above right: Robert Schena and Charles Byrd

Q Why is it so important to maintain connectivity underground?

Charles Byrd (CB): From our conversations with mining equipment manufacturers and the mines themselves, safety is the number one reason to have reliable communications underground.

Knowing the location of people and devices is very important – especially as underground there are sight and distance limitations. It is imperative that autonomous equipment and devices have perimeter protection to avoid injuring people.

Robert Schena (RS): There is a general industry trend towards autonomy, and you can't have autonomy without reliable communications.

All the benefits that float from autonomy, from keeping people out of harm's way to extending the life of expensive equipment, simply require that the network that you choose be reliable under adverse conditions.

"The accelerating trend towards autonomy is driving the requirement for better communications"

I think the accelerating trend towards autonomy is driving the requirement for better communications – not only more reliable, but also more secure as well, because if you think of the speed and weight and size of these types of machines and then contemplate somebody hacking them and somehow getting control of them, you see the risk that has to be managed by having exceptionally high levels of security.

So the trend towards autonomy is driving the requirement for reliable networks, and then the reliance on those networks to run powerful equipment drives the need for higher levels of security.

Q What are the benefits for production in mines?

CB: The major benefits for production would start with lower costs. If you've got fewer people in the mine due to new breakthroughs in automation, you can run that equipment a lot more efficiently and also run it 24 hours a day. With fewer people in harm's way, even insurance costs can go down. Having that communication allows you to run production more efficiently, too; you can also follow maintenance schedules better, letting the equipment tell you when something is about to break before it breaks, so you can get it to the shop without having to go in and shut down production to haul a multi-million dollar device out of an underground mine.

Once networks such as Rajant's became pervasive, data from sensors on mining vehicles became available in real time

RS: As we've seen in above-ground mines, having the various sensors that equipment has today be able to chirp and send data 24/7 really prevents catastrophic equipment failures.

As a result, you're able to maintain the schedule – you don't have a piece of equipment failing in a mine and have to shut things down to go haul it out because a motor blew or engine blew, so there's endless gain from being able to do predictive maintenance.

> "Having the various sensors able to chirp and send data 24/7 really prevents catastrophic equipment failures"

Q Can you expand on how reliable connectivity underground can increase mine safety?

CB: In mines, especially underground mines, there is blasting and then ore being hauled out, so you've got a lot of dangerous areas. Not only do you need to protect the people in the mines, but also the equipment.

To be able to do that, you can place sensors around the areas ▸

where there's digging, the areas where ore is being moved. You also can put seismic sensors that tie into, in our case, a mesh network that will allow communication to try to prevent cave-ins or other dangerous situations, and having that communication will greatly increase safety in these situations.

RS: An added benefit of high-bandwidth communications is that you can begin to add different types of sensors that you couldn't add historically – so LiDAR; radar; things that can measure minute shifts in the wall, floor or ceiling of a mine; things that can measure changes in topography; and very small time sections. This allows miners to predict when there might be a cave-in and pull out people in advance.

So in addition to the safety benefits of autonomy, where you have fewer people in the mine, you can actually use communications and sensor technology to create predictive circumstances where you can tell that a cave-in is going to happen before it happens – pull people out, pull equipment out – so it's just another way to leverage reliable communications.

Q Have you noticed an increased interest in recent years in establishing networks to collect data from mining machinery; for example, for asset tracking or equipment health monitoring?

CB: In underground mines, we've run into situations where they're now starting to run large numbers – 10 to 15 applications – for each vehicle; everything from telemetry, location and maintenance, to things like perimeter protection systems.

Having a reliable, high-bandwidth communications system such as the Rajant mesh allows them to cut down on the amount of third-party equipment needed to transmit and collect data.

RS: It is a continuation and extension of what's been going on the last few years above ground.

Think back a few years – Komatsu and Caterpillar had hundreds of sensors on a vehicle but a real-time, reliable communications network was absent – the data gathered by the sensors was only accessed when the vehicle got back into a repair bay and somebody could plug in a computer to the on-board diagnostic computer.

Then once networks like ours became pervasive, the same data that was only available in batch became available in real time. Once you have real-time data, then you can have applications that monitor and see changes in the data; and based upon the changes in data over time, you can do predictive maintenance.

That's been going on for many years now above ground, and as reliable high-data-rate networks and wireless networks move into the underground world, there will be the same ability to exploit the advantages of predictive aspects that come from having real-time data from multiple sources on basically all the equipment underground.

Q Do you have any recent examples of mining operations where Rajant has supplied communications solutions?

CB: We're constantly expanding into different mines. We are currently designing and implementing a wireless mesh system in Africa where the

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overall bandwidth needed for the entire mine is in the several hundred megabits/second (Mbps) range as a result of the 15 autonomous drill units and high-definition video required, in addition to standard mining data and applications.

These drills need to be able to send telemetry and drilling data, and they've got several high-definition camera systems on them.

Being able to pull several hundred megabits off any wireless network at one time is a challenge, but we developed a new network configuration so that we could add multiple pathways for getting that data off the mesh.

We actually designed a completely new mesh product – it is a high-throughput wired mesh node we call SlipStream – to be able to handle this network.

Q What do you feel makes Rajant stand out?

CB: We're constantly pushing ourselves, in our development groups and our field engineering, to adapt to a market vertical that has realised the benefits of high-speed communications.

We're constantly trying to stay ahead of everything by pushing ourselves in that aspect.

RS: Since the start of the company, we have been continuously developing and advancing our technology, and our customers always have a voice in that.

So when there's something we're thinking of doing, adding, changing or modifying, we look to get input from current customers and prospective customers about what they like, what they've used, what they wouldn't like, what they'd never use, what they give value to, and what they don't give value to.

Really, the product that is out there today is the result of lots of conversation and interactivity between our development group, our service and support people, and the customers themselves.

Q Has the customer input ever taken you in a direction that you weren't expecting?

RS: It is interesting, because at first, our customers would say: "What are we going to do with 5Mbps?"

Then there were a couple of advancements in radio technology, and all of a sudden it went from "There'll never be enough applications that we would want to run to consume 5Mbps", and now we're at "We need hundreds of megabits per second".

So the customers were sceptical at first, which is a natural reaction, because lots of times new technology comes along and people make a lot of promises that don't deliver, so the industry folks who are at the pointy end of the sword that actually have to run mines every day are naturally sceptical, since they don't want to mess up.

Once they got confident in the reliability of the latest generation of wireless technology, then the floodgates opened and customers were like, "Oh, instead of five applications could we do 18 applications, and now instead of 5Mbps can you give me 500Mbps".

I think that, particularly in the last couple of years, the demand curve for bandwidth has surprised us.

CB: It is a bit of a challenge to spread several hundred Mbps over a large area that a mine might be covering, and so being able to adapt it and grow a network large enough to do it – it is a challenge, but it's a fun challenge that we enjoy stepping up to.

Q This area of technology must move and evolve quite quickly?

RS: You could go from being ahead to behind in a blink.

CB: One of the things that Rajant does better than our competitors is being able to expand the network to huge sizes and still be able to maintain the reliability without having to constantly overhaul and put in new infrastructure. Rajant is able to do that infrastructure on a grand scale.

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