Dig into the future of resource exploration and exploitation
Nokia Industrial-grade Private Wireless for Mining
In this guide we look at how industrial-grade private wireless can help ambitious mining companies do extraordinary things, zooming in on practical use cases for creating more safe, efficient and productive digital mines.

› Industry 4.0
Robust, high-performance connectivity for the digital mine.

› Autonomous vehicles
Gain the wireless network coverage, capacity and reliability to support 24/7 operations.

› Situational awareness
Monitor all mining operations in real time to respond quickly to critical events.

› Automation and innovation
Take your digital mine capabilities further.
Make Industry 4.0 a reality

The fourth industrial revolution is well underway – but how can mining companies turn the possibilities of Industry 4.0 into operational realities?

In robotics, industrial IoT, AI, machine learning and more, the technologies are available to help you sharpen your competitive edge. They can bring automation-powered efficiency and productivity, so you can protect profitability against volatile commodity prices. They can also enable you to operate mines with increased safety, security and sustainability and avoid unplanned shutdowns, workplace injuries and environmental incidents.

But gaining all those advantages hinges on one thing: connectivity.

The trouble is, the Wi-Fi networks that most mines rely on simply weren’t built for the demands of business-critical mining use cases. They were designed for tasks such as web browsing and email communications, and they’re characterized by unpredictable performance, patchy coverage and poor security. What’s more, the critical person-to-person and group communications that are so essential in mining are done today over dedicated mobile radio, adding further complexity to mines’ connectivity challenges.

To make Industry 4.0 work for your mines, you need industrial-grade, pervasive wireless connectivity. With a private LTE/4.9G network, you can deliver real competitive advantage right now using your existing ecosystem of machines, sensors and systems. And you can prepare your mines for what’s next – a seamless transition to 5G.

“77% of mining occupations will be enhanced or redesigned by 2030 because of technological advancements”

The Future of Work: the Changing Skills Landscape for Miners, EY, 2019
Nokia Industrial-grade Private Wireless is here

The LTE networks that were once only available to telcos are now within reach for mines

Around the world, governments and telcos are opening up LTE spectrum for industry, and Nokia has been pioneering small cell technology ideal for private industrial networks – even in the most demanding environments. That means you can deploy a private wireless network with 4.9G capabilities that’s ready to meet your needs today, with a clear roadmap for a simple evolution to 5G tomorrow.

You can meet critical operational connectivity requirements with a dedicated LTE network built to handle the demands of digital mining applications, offering you:

- **Intrinsic security** to ensure truly safe and reliable connection
- **Mission-critical reliability** for near-continuous operations
- **Deep, wide coverage** to connect everyone and everything
- **Predictable performance** for industrial automation and real-time asset coordination
- **High capacity** to easily handle rapidly growing numbers of devices, sensors and data
- **Greater operational control and flexibility** to enhance safety and respond quickly to changing business needs
- **Effortless mobility** built on trusted 3GPP mobile standards

Nokia Industrial-grade Private Wireless is here

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Robust, high-performance connectivity for the digital mine

With rapid shifts in supply and demand, stringent environmental constraints, and hefty regulatory mandates, it’s no surprise that mining companies are accelerating their move to automation.

Automating critical processes – from drilling and blasting to hauling and crushing – is vital to increase operational efficiency and mine productivity while improving worker safety. But providing the robust wireless connectivity that’s so essential for extreme automation is beyond the capabilities of today’s Wi-Fi networks. They were designed for sending emails, not automating mining operations – while TETRA and P25-based radio networks were never built for broadband data or video communications.

For mines to realize the promise of automation, they need industrial-grade private wireless.

“Mining automation will bring 10-20% productivity benefits”

The digital revolution: Mining starts to reinvent the future, Deloitte, 2017
 Increase safety, efficiency and productivity – in open pit and underground mines

Nokia Industrial-grade Private Wireless delivers robust, reliable and secure low-latency connectivity to support safer, more efficient and more productive mines.

Greater network coverage and capacity make it simpler to manage and automate remote operations. An intrinsically secure, high-performance wireless network provides a single, dedicated infrastructure for critical communications and digital mining applications. And with a fraction of the configuration, management and maintenance effort of Wi-Fi networks, private wireless offers a simple way to deploy advanced 4G connectivity now and be ready for 5G tomorrow.

From now to next

- **Automated drilling and blasting:** Safer, more precise, and near-continuous operation
- **Automated loading, hauling and rail operations:** Optimum efficiency and minimum downtime from pit to port
- **Operation-critical communications:** Reliable, secure connectivity for person-to-person and group communication, and between the mine site and the integrated remote operations center (IROC)
- **Situational awareness:** Increased safety and sustainability with full visibility of people, assets and infrastructure through IoT sensors, CCTV cameras and drones

Operational-critical comms
- PTT/PTV
- Remote/Autonomous ops
- Critical M2M/IoT

Situational awareness
- People, trucks & equipment
- Sensor network
- CCTV cameras
- Drones

Safety & sustainability
- People, trucks, machines
- Geo-fencing
- Health & fatigue
- Slopes, air, water, weather

Efficiency through automation
- ADS & AHS
- Remote control & collaboration
- Asset maintenance & optimization
Autonomous vehicles

Gain the wireless network coverage, capacity and reliability to support 24/7 operations.

Use ultra-reliable, industrial-grade, low-latency wireless connectivity to power autonomous drilling and hauling for near-continuous mining operations. Level up your autonomous fleet with AI decision-making and predictive alerts to avoid obstacles and collisions. And monitor all your remote, automated operations in real time for complete visibility and control.

- Remote operations monitoring
- Autonomous drilling and hauling
- AI decision-making and predictive alerts
- Monitor vehicle tire wear and pressure
- Obstacle and collision avoidance
- 24/7 operations

Remote-controlled drilling and blasting

Enable remote operators to manage multiple drills simultaneously and conduct precision blasting with automated blast trucks. Improve the safety of workers and equipment and reduce drill cycle times to increase mine productivity.

“As the leader in autonomous haulage technology, we are firmly on our way to helping the industry move the next billion tons of material with autonomous technology. We have come together with Nokia to further this vision of delivering increased value to the mining industry.”

Luiz Steinberg, former Komatsu Global Officer and President/CEO of Modular Mining Systems

Autonomous hauling

Use autonomous haul trucks and trains to dramatically reduce downtime and increase productivity. And gain ultra-reliable, high-capacity LTE connectivity to operate huge AGVs on steep roads and difficult terrain, and to remotely monitor and intervene in automated operations.

Obstacle detection and collision prevention

Provide the low-latency network needed to enable safe operation of autonomous vehicles, enabling them to detect and avoid obstacles.

24/7 automated pit-to-port operations

Implement extreme automation through vehicles, machines and robots across mine sites, rail and ports to enable round-the-clock productivity.
Situational awareness
Monitor all mining operations in real time to respond quickly to critical events.

Use data from IoT sensors, cameras, and drones to gain 360° situational awareness for remote operations. Understand and remediate issues quickly, connecting machines, vehicles and personnel using a single converged network for all communications, broadband, video and IoT data. And improve worker safety with video feed analytics enabling timely removal of remote workers from hazardous situations.

- 360° situational awareness
- IoT sensors monitor machines, vehicles, environment, and workers’ safety/health
- Analytics for video feeds
- Data connectivity from/to machinery, vehicles, staff and IoT sensors

Critical communications and worker monitoring
Use smart personal protective equipment (PPE) to monitor environmental conditions, worker biometrics and man-down situations, and to warn miners of hazards. And replace inadequate TETRA and P25 networks with LTE for mission-critical push-to-talk and push-to-video services.

“This is an important milestone for Minera Las Bambas as it will enable a series of new automation technology solutions increasing productivity in our mining operation as well as supporting more advanced automation to improve worker safety.”

Miguel Canz, Regional Technology Manager at Minera Las Bambas

Geo-location and geo-fencing
Use high-accuracy location services to track people and assets, indoor and outdoor, above and underground. Combine smart PPE wearables and LTE geo-fencing to ensure your miners aren’t entering no-go zones.

Video surveillance
Meet the extreme bandwidth demands of video cameras covering operations from pit to port. And use video analytics capabilities to alert operators to anomalous behavior that requires their attention.

Geological, meteorological and environmental monitoring
Connect remote operations centers to real-time sensor data for timely insights into mine conditions, so they can take action to prevent productivity losses or mitigate environmental risks.

Drone inspection
Use drones to automatically survey and map constantly changing mine surfaces and to monitor stockpiles, tailings ponds and dams. And equip drones with gas sensors and HD cameras that stream data to monitor the environment for leaks.
Take your digital mine capabilities further

With a private wireless network in place, you can bring new levels of automation and innovation to your mines, supporting use cases that will enable the next wave of business transformation.

New site exploration and prospecting
Set up a private wireless network serving up to 400 users in minutes, even in the most extreme conditions and remote locations. Provide high-bandwidth connectivity for sensors, field workers and drones to collect data. And use edge computing capabilities to analyze exploration data on-site, reducing analysis cycles from weeks to hours.

Air and water management
Create more sustainable mining operations with a smarter, data-driven approach to water management and ventilation. Improve air quality and reduce energy costs in your underground mines with remotely managed, on-demand ventilation. And use data from smart sensors to reduce water consumption, manage pollution risk and mitigate the impact of extreme weather events on tailings ponds and dams.

IoT and analytics for predictive maintenance
Collect data from IoT sensors to understand the condition of every asset in real time. Predict failure times and use condition-based maintenance to reduce costs, increase utilization, and extend asset life. And minimize delays and revenue loss by using actionable operations intelligence to optimize the lifecycle of your assets.

Digital twins
Harness data from sensors, cameras, drones and mobile devices to build a digital model of your mining site. Use virtual simulations to make accurate estimates of resourcing and production results. And simulate every aspect of your mine to test new methodologies for critical processes that could revolutionize efficiency, safety and productivity.

Augmented reality
Use AR and VR systems to give off-site and on-site workers real-time information and scenario simulations. Accelerate site inspections with heads-up display checklists and digital data capture. And enable maintenance staff to fix problems fast, with guidance on AR glasses to take them step by step to a rapid resolution of the issue.
From now to next with Nokia Industrial-grade Private Wireless

To compete today, you need to transform your mining operations now. But it’s difficult to get the most out of the Industry 4.0 technologies that will support your transformation when you’re relying on existing wireless networks that just aren’t up to the task.

You need industrial-grade private wireless: a dedicated LTE/4.9G network that offers the predictable performance, massive coverage and capacity, and built-in security and mobility of 4.9G right now – and a simple evolution into 5G next.
Go Allwhere with Nokia Industrial-grade Private Wireless

We deliver networks that solve unique, industrial-scale challenges, giving you:

- **Connectivity:**
  Connect every site, device, asset and person for greater visibility, control and collaboration

- **Tele-operations:**
  Get greater visibility and control of machines, vehicles, and personnel at remote locations

- **Reliability:**
  Support efficient, round-the-clock operations and enhance worker safety

- **Security:**
  Gain peace of mind with an intrinsically secure, private network

- **Capacity:**
  Handle multiple HD video streams and thousands of sensor feeds

- **Performance:**
  Enable extreme automation, real-time coordination, and autonomous operations

- **Local applications:**
  Add a local computing platform that enables onsite data processing, analytics and applications

- **Agility:**
  Make rapid decisions and operational adjustments to meet changing demands

- **Choice:**
  Deploy on-premises or in the cloud, owned or as-a-service
Why Nokia?

They might not know it, but more than a billion cellphone users worldwide rely on Nokia networking technology and expertise every day. And they’re not the only ones.

With more than 1,300 mission-critical networks and more than 130 private wireless deployments around the world, our industrial customers trust us because we have:

• Extensive real-world experience in key industrial sectors, like manufacturing, utilities, railways, ports, airports, and – of course – mining
• A comprehensive portfolio of industry-leading 4G and 5G technologies that includes small cells, cloud packet core, IP and optical transport, and common management and orchestration
• A rich analytics and application suite
• A powerful ecosystem of industrial partners
• Consulting services to help build the business case and plan for the future
• End-to-end management and orchestration
• Professional services to assist with design, deployment and maintenance
• Nokia Bell Labs innovations feeding market-leading solutions

Let’s get started

To learn more about what you could achieve now with Nokia Industrial-grade Private Wireless – and where it could take you next – get in touch with one of our experts: nokia.ly/private-wireless
Nokia Industrial-grade Private Wireless gives you a powerful, dedicated network that solves the unique connectivity challenges your mines face now – and the ones they’ll face next.

Want to learn what reliable, secure, high-performance wireless connectivity could do for your mines? Get in touch with one of our Private Wireless experts today:

nokia.ly/private-wireless-mining
About Nokia
We create the critical networks and technologies to bring together the world's intelligence, across businesses, cities, supply chains and societies.

With our commitment to innovation and technology leadership, driven by the award-winning Nokia Bell Labs, we deliver networks at the limits of science across mobile, infrastructure, cloud, and enabling technologies.

Adhering to the highest standards of integrity and security, we help build the capabilities we need for a more productive, sustainable and inclusive world.

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