

A journey to cellular and the safer, smarter, more sustainable mine

Newmont's private cellular networks meet stringent mining demands for performance, availability, and agility

ERICSSON



Newmont



Predictable and scalable connectivity is the foundation of data-driven mining

Case Study:
Newmont Corporation

Industry:
Mining

Executive summary

Newmont, the world's leading gold company, is widely recognized for its principled environmental, social, and governance practices. As resources become deeper and harder to access, the company must strive to become more efficient and profitable while continuing to pursue sustainability and protect workers.

Newmont embarked on a smart-mining initiative to increase automation, improve worker safety, and increase mining productivity, yet the miner's Wi-Fi infrastructure could not meet demands for increased performance, availability, and agility. Predictable, high-capacity connectivity is fundamental for smart mining, but was simply not achievable with Wi-Fi.

Newmont partnered with Ericsson to create a private 5G cellular network architecture to support its smart-mining plans across multiple sites. The private cellular network architecture eliminates the functional limitations and cost constraints of legacy Wi-Fi, providing predictable, high-throughput connectivity for production-critical workloads above and below the ground.

Ericsson's cellular network architecture supports more remotely controlled machines, autonomous vehicles, and intelligent applications, helping Newmont increase production efficiency and safety, improve business performance and maximize its technology investments.

Smart mining enhances safety and optimizes operations

Newmont's purpose is to create value and improve lives through sustainable and responsible mining. In line with this commitment, the company is continuously seeking innovative ways to increase worker safety, optimize operations, and boost efficiency. Newmont's approach to mining includes using advanced technology to increase automation for improved safety and productivity.

The smart-mining strategy includes an array of current and future technologies and intelligent applications such as:

- Remote-controlled and autonomous drills, haulers, and excavators
- Smart fleet management and collision avoidance systems

- Automated structural and environmental monitoring systems
- Preventative and predictive maintenance solutions
- Artificial intelligence (AI), machine learning (ML), and video analytics solutions

Smart mining requires a fresh approach to networking

Smart mining introduces more applications, endpoints, and traffic to the network, considerably increasing performance, scalability, and capacity requirements. Many smart-mining applications are bandwidth-intensive and delay-sensitive, requiring high-throughput, low-latency networking and dependable and deterministic connectivity.



At-a-glance

Goal:

Lay the foundation for smart-mining initiatives at Tier One* surface and underground mines across the world.

Approach:

- Partner with Ericsson on a private operational cellular network architecture that delivers predictable, high-throughput connectivity for production-critical applications above and below the ground
- Remove legacy Wi-Fi network performance, financial, and operational constraints
- Enable widespread adoption of automated machines and vehicles and other smart-mining technologies
- Protect investments by deploying 5G-ready infrastructure

Results:

- Ericsson-powered private 4G networks eliminate above-ground range, latency, and packet-loss impediments
- Removal of Wi-Fi trailers reduces safety hazards, costly network downtime, and expensive network equipment repairs and replacements
- Underground trial demonstrates 5G fully addresses immediate and long-term smart-mining plans across the globe

*Tier One mines are long-life, low cost operations in favorable mining jurisdictions with an annual output of more than 500,000 ounces of gold.

Open pit mines and underground mines each pose a unique set of network engineering challenges. Surface mining operations can extend over vast areas and require large-scale wireless coverage. And below the ground, narrow and twisting drives and uneven surfaces can limit signal propagation, making Wi-Fi deployments problematic.

Mines also subject network equipment to extreme temperatures, vibration, and moisture. Installing and maintaining equipment can be hazardous. Mines are also in remote, hard-to-reach locations, creating equipment repair and replacement challenges.

Moving beyond Wi-Fi

Newmont, like many mining companies, has previously used Wi-Fi in its open-pit and underground operations. However, conventional Wi-Fi networks can no longer meet the increased performance, safety, and economic requirements of the modern mine.

Wi-Fi access points have limited reach, which means most open-pit mines need multiple costly Wi-Fi trailers. These range-constrained Wi-Fi trailers also need to be removed from pits during blasting, costing precious time and increasing risk.

Mines are highly dynamic environments where mine plans and landscapes continuously evolve.

When combined with diverse and variable application traffic, this means technicians are constantly retuning, reconfiguring, and troubleshooting Wi-Fi mesh networks, as well as constantly repositioning Wi-Fi trailers.

Many Wi-Fi networks also lack the advanced over-the-air quality-of-service (QoS) features and resource management capabilities required to prioritize fluctuating, production-critical workloads, and cannot provide the deterministic connectivity and predictable performance required for smart mining.

Excessive packet loss and latency can disrupt applications, triggering auto-stop safety systems and delaying mining in 24/7 operations.

Private cellular network architecture brings the smart-mining vision to life

To address these challenges, Newmont adopted a private cellular network architecture, partnering with Ericsson to turn its smart-mining vision into reality. This approach to smart-mine connectivity overcomes traditional Wi-Fi functional limitations and cost constraints and meets

stringent performance, availability, and agility requirements for open-pit and underground operations.

The private wireless network provides a scalable, whole-of-mine solution that supports Newmont's immediate needs while enabling its long-term digital transformation vision. The private wireless network helps the company accelerate time-to-value, ensuring Newmont maximizes the full potential of its investments.

"Smart mining significantly increases bandwidth and performance demands, and requires an entirely new approach to networking," explains Luis Canepari, Newmont's Chief Information Officer. "The Ericsson private cellular network has been a real game changer. It allows us to roll out more autonomous machines and helps us improve worker safety and increase production efficiencies above and below the surface."

Today, Newmont leverages Ericsson private cellular networking solutions in several locations including mines in Lihir, Papua New Guinea; Peñasquito, Mexico; and Cadia, New South Wales, Australia. Ultimately, Newmont's long-term vision is to deploy Ericsson private 5G cellular networks across all of its Tier One mines worldwide.



Improving worker safety at Lihir Island

Lihir, one of the world's largest gold mines, is situated on a remote, geothermally active island off the coast of Papua New Guinea. The active open-pit mine is a harsh environment, with extreme temperatures (up to 80°C) and dangerous gases and vapors.

To enhance worker safety, Newmont instituted a "nil-on-bench, nil-on-foot" strategy to reduce the number of workers on a bench and eliminate workers on foot. The mine operator planned to introduce remotely controlled drills, shovels, and dozers to keep people out of harm's way, but the increased application traffic would have overwhelmed Lihir's capacity-constrained Wi-Fi network.

The legacy network was already underperforming, impairing the operation of the mine's haul fleet and dispatch management system. And bandwidth requirements were projected to skyrocket from 3 Mbps to 320 Mbps with the introduction of new equipment.

High-performance private cellular network paves the way for remotely controlled machines

Newmont replaced Lihir's aging Wi-Fi network with a high-capacity private cellular network powered by Ericsson technology. The advanced network met stringent smart-mining performance and scalability



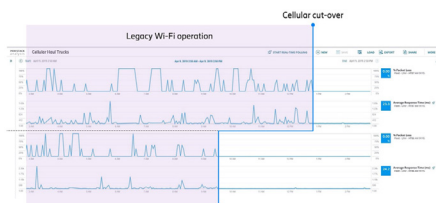
Private cellular network alleviates safety concerns by keeping networking gear and technicians out of the pit.

requirements, enabling Newmont to support high volumes of bandwidth-intensive, delay-sensitive vehicle and machine traffic, and achieve its nil-on-bench, nil-on-foot objectives. The private cellular network significantly boosted network capacity, providing an order of magnitude increase in both uplink speeds and downlink speeds throughout the mine.

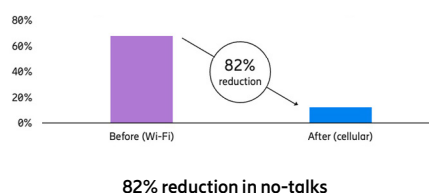
The new cellular network also extended wireless coverage to the mine's processing plant, other areas of the island, and out to sea to reach transport barges. Remote control systems for heavy machinery that sat idle beyond the reach of the legacy Wi-Fi network became operable with the improved connectivity.

The cellular network immediately resolved the performance issues with the mine's haul truck fleet and dispatch management system. It eliminated the high latency and packet loss that were impairing fleet efficiency and it dramatically reduced no talks and missed beacons that were impacting the fleet management system and hindering operations.

Latency and packet loss eliminated



Average no talks – before and after cellular migration



Solution Highlights

Ericsson's private cellular network helps Newmont achieve its worker safety goals by providing predictable performance for automated mining technology and by moving wireless networking equipment and technicians out of the hazardous pit area.

Radio network

- Ericsson private 4G radio network

Core network

- Ericsson private 4G/5G core network¹

Network management

- Ericsson Core Network Operations Manager

Professional services

- Design and configuration services from Ericsson including pre-deployment testing
- Design, work instruction creation, and network integration and optimization services from Ericsson systems integration partner Telstra

Solution advantages

- Significantly greater capacity and throughput to satisfy increased traffic demands
- Predictable performance to support production-critical workloads
- Extended range to improve safety, expand coverage, and eliminate costly trailer replacements
- Extendable hardware supports 4G and 5G for seamless and cost-effective upgrades

¹ Newmont originally deployed a 4G private cellular network. The company has subsequently updated to the Ericsson Private 5G platform to simplify operations and establish a mixed-mode 4G and 5G foundation for a 5G Radio Access Network upon regulatory approval.

The private cellular network also supported Newmont's strategic safety objectives by removing networking equipment and technicians from the pit; the Ericsson cellular radio towers are deployed outside of the active mining area. "We had several dozen Wi-Fi trailers, and we always had people in the active pit, removing and realigning the trailers, checking the battery, or performing other operations," explains Chris Twaddle, Newmont's Director of Process Control Networks and Operational Cellular. "The cellular network alleviates those safety concerns by keeping the networking gear and the technicians out of the pit."

Additionally, the new network reduces maintenance expenses by relocating the radio equipment away from the corrosive environment of the island's pit area. Previously, Newmont had to regularly repair and replace expensive Wi-Fi trailers that rusted in severe pit conditions. The cellular deployment also streamlines ongoing network engineering and frees up valuable resources by eliminating time-consuming Wi-Fi mesh network reconfiguration and troubleshooting tasks.

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Improving operational productivity at Peñasquito

Peñasquito is a large surface mine located in a remote area of Mexico, producing gold, silver, lead, and zinc. The operation spans a vast area and includes an open-pit mine, two processing facilities, and a tailings storage facility.

The Wi-Fi network at Peñasquito was costly and impractical to operate and maintain, and failed to meet the stringent performance demands and coverage requirements of the mine's production-critical applications.

Unlike Lihir, the surface operations at Peñasquito are widespread, necessitating several dozen Wi-Fi trailers to support its extensive operating footprint. Reconfiguring the Wi-Fi mesh network and repositioning the trailers was a resource-intensive, time-consuming undertaking. "We were constantly shifting trailers around and disrupting connectivity. In addition, we had to dismantle the network and move the trailers out of the pit several times a day during blasting," recalls Twaddle.

The legacy Wi-Fi network also hindered the operation of the mine's remotely controlled drills and the fleet management system used to track and control vehicles. Similar to Lihir, Peñasquito faced challenges with

excessive latency, packet loss and coverage gaps that affected these production-critical applications, encumbering connectivity and disrupting mining operations.

Extended-range private cellular network eliminates production disruptions

Newmont implemented a private cellular network based on Ericsson technology, replacing dozens of expensive, impractical Wi-Fi trailers with six radio towers strategically deployed outside the active mining area. The implementation includes two portable towers that can be repositioned by workers to accommodate evolving mining operations, traffic patterns, and network requirements.

The new cellular network provides dependable, deterministic, high-speed wireless connectivity throughout the entire site. It meets the demanding throughput, performance, and availability requirements of the remotely controlled drills and fleet management systems while extending coverage to previously underserved areas.

With the private cellular network in place, Newmont has significantly enhanced mining productivity and efficiency, eliminating the need to pause operations for network

reconfiguration or trailer relocation. "When we installed the cellular network, all the network availability issues and operations disruptions went away," explains Twaddle. "The network stays up during blasting, so we can quickly resume production."

Solution Highlights

Ericsson's private cellular network helps Newmont improve mining efficiency and productivity by avoiding frequent production disruptions. The cellular network eliminates burdensome and costly Wi-Fi trailers and provides predictable, highly available connectivity for production-critical workloads throughout the entire site.

Radio network

- Ericsson private 4G radio network

Core network

- Ericsson private 4G core network

Network management

- Ericsson Core Network Operations Manager

Professional services

- Design, installation, optimization and network support services from Ericsson systems integration partner Ambra Solutions

Solution advantages

- Continuous network availability; network is no longer dismantled for blasting
- Increased performance and capacity for bandwidth-intensive, delay-sensitive applications
- Vast, continuous coverage area; no dead zones as trucks move throughout site
- Superior economics; entire operation supported by six towers
- Increased agility; movable towers are easily relocated to support evolving mining operations and traffic patterns



The new cellular network provides dependable, deterministic, high-speed wireless connectivity throughout the entire site.



Ericsson-powered network dramatically increases coverage.

Expanding surface operations at Cadia

Newmont's Cadia mine in New South Wales, Australia ranks among the largest gold and copper operations globally. Its underground panel cave is supported by surface gold, copper, and molybdenum processing facilities.

Newmont planned a major surface works expansion that would substantially extend the area of operations, quadruple the number of surface vehicles, and significantly increase the mine's fleet management system and telemetry traffic demands and reach requirements. Cadia's Wi-Fi network was ill-equipped to meet the ambitious range requirements, capacity demands, or cost goals of the project. In addition, the legacy Wi-Fi equipment had reached end-of-life and was no longer supported by the manufacturer.

Ericsson-powered network extends coverage to all transportation routes

Building on the success of the open-pit mine deployments, Newmont replaced the Wi-Fi implementation with an Ericsson-based cellular network, replicating the field-proven Lihir deployment. The new network dramatically increases coverage, eliminating drops and dead spots, providing dependable, high-throughput, low-latency connectivity for the fleet management and vehicle telemetry apps, for a fraction of the cost of a new Wi-Fi network. In fact, the Ericsson radio network

was 20% of the cost of a new Wi-Fi buildout on a total cost of ownership basis.

The Ericsson-powered network supports Newmont's ten-year vision for Cadia's surface operations, providing a scalable and extendable foundation for various future applications including:

- Tablets to enable paperless workflows and improve decision-making
- Automated vehicles and robotics to optimize mining productivity
- High-resolution cameras and unmanned aerial vehicles to improve surveillance
- Battery-powered sensors on tailings storage facilities and processing plants to feed digital twins and micro-weather stations

The flexible Ericsson radio platform supports both 4G and 5G networks and can be easily and cost-effectively upgraded to support future requirements.

Solution Highlights

Ericsson's private cellular network helps Newmont increase capacity and extend coverage for surface operations. The future-proof network lays the foundation for an array of intelligent applications that will help the miner improve productivity and business performance. Ericsson systems integration partner Telstra provided design and network integration services.

Solution advantages

- Superior economics: 20% of the total cost of ownership of alternative Wi-Fi-based approach
- Increased performance, capacity, and range; continuous, high-speed connectivity across the entire surface operations area
- Extendability: single radio platform supports 4G and 5G networks

Global replication of surface operations

Based on its initial cellular deployments, Newmont replicated their cellular strategy with Ericsson equipment at other surface mining operations around the world, including Merian in Suriname, Boddington in Australia, and Ahafo in Ghana. Going forward, Newmont plans to extend the approach to other Tier One mines including Cerro Negro in Argentina, Tanami in Australia and Brucejack and Red Chris in Canada.

Eliminating barriers underground at Cadia

Newmont's Cadia operation stands as one of the world's most technologically advanced underground mines, using a range of autonomous equipment including ore loaders, vehicles and remote-controlled mining machines.

However, the mine's capacity-constrained Wi-Fi network was impairing equipment operation and hindering productivity. With maximum upload speeds of only 20–30 Mbps, the network struggled to accommodate the increased traffic densities as more autonomous machines were added to the fleet.

Excessive latency and packet loss impeded connectivity, triggered safety stops, and disrupted mining operations. Operations teams were forced to limit and schedule equipment use around networking constraints, negatively affecting production rates.

Ericsson 5G private network delivers massive performance improvements

Based on the above-ground success at Cadia, Newmont once again partnered with Ericsson to conduct a 5G trial aimed at exploring the potential of cellular technology underground. This trial assessed various delivery approaches to determine a solution blueprint for all their underground operations.

The results were transformative. The Ericsson private 5G cellular network delivered massive performance improvements, achieving upload speeds of around 90 Mbps along access drives and declines throughout the underground complex.

In critically important extraction drives, upload speeds reached 150 Mbps, with download speeds hitting 500 Mbps, with potential for speeds to double with the latest generation of 5G devices. The Ericsson private 5G network also provided persistent and reliable connectivity, effectively resolving the limitations of the previous Wi-Fi setup.

These trial results pave the way for the increased use of automated equipment and other smart applications, which will enhance worker safety, improve productivity, and provide Newmont with a competitive advantage not only at Cadia, but also in its other underground mines.

"The trial results show the extraordinary potential of 5G to improve safety, increase the number of machines that can be operated on a single network and boost production efficiencies in underground mining," says Luis Canepari, Chief Information Officer at Newmont Corporation. "These trials are part of the new frontier of technology in mining — using innovation to make our people safer and our mines more productive."

Following the trial, 5G has been firmly integrated into Newmont's data communications strategies for Cadia and its other tier-one underground and surface mines worldwide. The mining company plans to leverage 5G to roll out more autonomous machines and vehicles, such as drill rigs, graders, and auto-haul trucks and to deploy additional safety controls like collision avoidance systems.

"The trial results show the extraordinary potential of 5G to improve safety, increase the number of machines that can be operated on a single network and boost production efficiencies in underground mining."

— Luis Canepari, Chief Information Officer, Newmont Corporation

Trial highlights

Ericsson Private 5G network eliminates legacy Wi-Fi network capacity constraints and mining productivity barriers. The new network provides predictable, high-throughput connectivity for production-critical applications under load.

Radio network

- Ericsson Private 5G radio network

Core network

- Ericsson Private 5G core network

Solution advantages

- Increased performance and throughput for bandwidth-intensive, delay-sensitive applications
- Up to 150 Mbps upload speeds and 500 Mbps download speeds
- Deterministic connectivity eliminates safety stops and production disruptions
- High-capacity network supports more machines and more workloads



5G network delivers massive performance improvements underground.

About Newmont

Newmont is the world's leading gold company and a producer of copper, molybdenum, zinc, lead and silver. The company's world-class portfolio of assets, prospects, and talent is anchored in favorable mining jurisdictions in Africa, Australia, Latin America & the Caribbean, North America, and Papua New Guinea. Newmont is the only gold producer listed in the S&P 500 Index and is widely recognized for its principled environmental, social, and governance practices. Newmont is an industry leader in value creation, supported by robust safety standards, superior execution, and technical expertise. Founded in 1921, the company has been publicly traded since 1925.

About Ericsson

Ericsson enables communications service providers and enterprises to capture the full value of connectivity. The company's portfolio spans the following business areas: Networks, Cloud Software and Services, Enterprise Wireless Solutions, Global Communications Platform, and Technologies and New Businesses. It is designed to help our customers go digital, increase efficiency and find new revenue streams. Ericsson's innovation investments have delivered the benefits of mobility and mobile broadband to billions of people globally. Ericsson stock is listed on Nasdaq Stockholm and on Nasdaq New York. www.ericsson.com

