



Wireless Technologies in Industrial Markets

An Examination of Mesh Technologies in Mining



Executive Summary

Consumers and enterprises around the globe use standards-based 802.11a/b/g/n WiFi as their wireless technology of choice, providing high-speed connectivity and Internet access for a range of devices, including laptops, PDAs and mobile phones. However, when the environment becomes challenging and applications more demanding other technologies or a combination of technologies must be considered.

Motorola's Wireless Broadband Mesh product portfolio has been designed to offer maximum flexibility, offering both 802.11-based solutions and solutions with Motorola's industrial strength MEA (Mobility Enabled Access) technology for critical applications and harsh environments. When paired with Motorola's advanced MeshConnex™ routing algorithm, either access technology can provide a robust connectivity solution for a city, an agency or a business.

The best way to compare the practical benefits of each of these technologies is by identifying a range of real world applications and examining the use cases for each. This paper is the first in a series of solutions papers on how 802.11 and MEA technologies can be used in the most demanding RF environments in the world. In this paper we will examine real world applications for mining, and the unique strengths and capabilities of each of the wireless technologies. We will also demonstrate how wireless mesh networks are improving efficiency through automation and providing Rapid Return on Investment (RROI).

WiFi and MEA – Access Choices

When addressing wireless communications WiFi and MEA are two distinct access technologies to consider. MEA provides an industrial strength network specifically designed to perform in high interference mobile environments. Users access networks through purpose built client devices. On the other hand WiFi uses a standards based architecture built around 802.11 with off-the-shelf WiFi client devices accessing the network.

WiFi

Originally WiFi or 802.11 technology was developed to extend the wire between the LAN port in the wall and the desktop computer. In the enterprise WiFi uses radio waves to provide wireless high speed connectivity to the network for access to the Internet, email and other office applications. This standard originally developed by the Institute of Electrical and Electronics Engineers (IEEE) has evolved over the years and the generic WiFi term not only covers the 2.4 GHz 802.11b standard, but also includes products based on any of the 802.11 standards as well as dual-band solutions.

MEA

MEA or Mobility Enabled Access technology is a purpose-built technology originally developed by the US Department of Defense, Defense Advanced Research Projects Agency (DARPA) for battlefield communications, prospering in the world's harshest RF situations. Through its client meshing, MEA allows each client device to act as a router to and from every other device. Signals do not have to try to penetrate difficult environments, but they simply use other client devices to pass the signal along while bypassing interference-causing barriers. MEA meshing works with the environment and not against it, resulting in communications that are fast, reliable, and mobile.

Considering Multiple Wireless Technologies

WiFi and MEA technologies are increasingly being thought of as complimentary, differentiated only by the applications and environments they best support. This is becoming increasingly important for customers in industrial sectors that are investigating indoor and outdoor wireless strategies, and need solutions for video surveillance or remote access to critical data. Both WiFi and MEA can be used in wireless mesh networks and each access technology has strengths and trade-offs.

In the past WiFi traded throughput for range, making it the technology of choice for short-distance environments in unlicensed radio bands. However, with improved standards, such as 802.11n the increase in bandwidth enables more advanced applications using WiFi, such as video surveillance. There are still tradeoffs concerning the environment, interface and noise floor, but 802.11n enables servicing of the outlying areas of industrial environments, and enables standards-based outdoor networks to connect with indoor WLAN networks.

In harsh environments such as a mining pit Motorola's Solo (6300 series) product with MEA access is often the solution of choice. Why has MEA become the standard?

MEA's strength is its ability to handle harsh environments, offering consistent throughput with exceptional interference mitigation. Its "bullet proof" reliability guarantees there is no loss in connectivity even in the most difficult RF environments ensuring that communication is not missed and revenue is not lost.



The key differentiators of each option are focused largely on two matters:

- The type of physical network
- The types of applications that are driving the network

Many hybrid networks consisting of both WiFi and MEA are leveraging the strengths of both technologies. The ability to support off-the-shelf clients and higher throughputs due to WiFi in some parts of the network and the range, mobility and reliability of MEA technology in other parts can provide the optimal connectivity, performance and cost-efficiency for a significant number of network operators.

The Adoption of Mesh Wireless Networks in Mining

Today's mining industry does virtually everything on a gigantic scale. There are vast mining deployments on almost every continent producing everything from coal, ore, and minerals to other natural resources. These sites must work around the clock to be operationally efficient and productive and must experience minimal downtime due to communication failures.



How can Motorola's Mesh technology help alleviate operational and financial issues?

Mining operations around the globe are turning to wireless technology to help alleviate these operational and financial issues by streamlining communications and providing real-time telemetry to help identify and stop problems before they cause costly operational shutdowns and delays. According to one mining company in Australia if it is forced to stop for a day, the mining company loses two million dollars. Mining operators must focus on increasing their profitability. Meshing technologies can support numerous applications that can help, including:

- Telemetry that monitors vehicle and equipment health through real-time diagnostics to enable preventive maintenance and provide advanced routing capabilities.
- GPS services that offer real-time vehicle location information, accurate time stamps and much more.
- Fleet management capabilities that streamline dispatch, provide alerts and event notification and enable data logging.
- Standards-based access and CCTV/Video monitoring solutions

TURNKEY MOTOROLA WiFi, MESH AND HYBRID NETWORK SOLUTIONS

Motorola is the only solutions provider offering a full complement of mesh products and solutions that include 802.11, MEA and hybrid networks that combine the strengths of both. The Motorola mesh products portfolio includes:

- MOTOMESH Solo, a single radio solution based on MEA in the 2.4 GHz band
- MOTOMESH Duo, a dual radio solution based on WiFi in 2.4, and 4.9, 5.4 or 5.8 GHz bands.
- MOTOMESH Quattro, a four-radio solution with two WiFi and two MEA radios operating in the 2.4 and 4.9 GHz bands.

What is MEA's role in the mining industry?

Mining operations, whether deep cast or open pit, pose significant wireless networking challenges that affect the choice of technology. This choice more often than not, results in choosing MEA for the mission critical applications at a mining operation.

To ensure communication reaches its desired end destination MEA uses an advanced rake receiver to absorb multi-path errors. Multi-path is a common issue in surface mining communications where large rock walls and metal vehicles cause strong reflected signals to be received out of synch with the original data. WiFi can see the interference, but MEA can capture these reflected signals and use them to strengthen the link.

MEA also offers channel agility to pick the best 2.4GHz channel to send and receive data transmissions. MEA networks are able to aggregate the entire 80 MHz of WiFi spectrum and decide on a packet by packet basis, which portion of the spectrum to utilize. This enables MEA networks to avoid interference caused by inter-modulation, other users or even WiFi utilized by the company. MEA works in conjunction with the harsh environment, not against it.

MEA's unique capabilities do not stop there either. MEA provides true mobile connectivity, including vehicle-to-vehicle handoffs, and client meshing for heavy equipment and other assets moving at both low and high speeds. The client meshing capability enables the network to grow as the number of clients increases.

The network coverage is automatically extended to the new areas of operation as the signal hops from client to client. This allows the operator to deploy and power fewer infrastructure devices, knowing that client meshing will fill in the areas in between.

Can standards based WiFi be used as well in a mining operation?

Motorola MEA can firmly support mission critical applications in a mining operation, but standards-based WiFi products can also play a part in the wireless network for a mine. Communications not only happen at the pit face, but also extend to the offices and perimeters too. Handheld devices need the ability to roam and have access both indoors and out.

With the increase in throughputs of 802.11-based products video and CCTV control can run over wireless networks resulting in enhanced perimeter security. Also wireless communications using a range of devices now offers enhanced mobility for workers who previously were confined to office environments.





Real World Scenarios in Mining

Enhanced Connectivity for Remote Coal Mining Operations

In the coal mining fields in the barren plains of Wyoming, one of the most successful mining operations in the world has adopted Motorola's MEA technology to solve typical strip mining communications and productivity challenges. Each of the coal mine sites has been outfitted with Solo networks with MEA access, providing a robust network offering exceptionally high availability, client meshing and, most important of all, fast switching for assets continually roaming the vast mining environment. The new system has decreased asset downtime since information can be communicated over the mesh network in fractions of a second.

Providing Universal Community Access

One mining company, which has mines located deep in Australia's rugged outback, builds residential communities for their workers. For these employees, who tend to work in days- or weeks-long shifts, it is essential to have connectivity to their families and loved ones, as well as to the outside world via VoIP and 24/7 Internet connectivity. Compounding the issue is the fact that, as mining operations shift locales, these communities are often moved en masse to follow the work. Motorola's mesh networks Duo solution, featuring WiFi access is a natural technology choice for these remote and nomadic communities offering them the connectivity they need.

A Gold Mine Goes Wireless

For one gold mine connectivity was needed from the equipment in the pit to ensure that the shovels positioned the buckets accurately and were digging and dumping at the correct locations. GPS and arm geometry sensors data needed to be quickly and reliably transmitted. In addition, essential survey data and maps needed to be sent to the shovel operators. The operation has successfully used the Solo solution with MEA technology to facilitate the communication of this key information in this challenging environment.

Conclusion

Motorola is the industry leader in seamless indoor-outdoor connectivity and the only provider offering both WiFi and MEA solutions. A growing number of mines are realizing that wireless solutions are more effective than the wired alternatives and are turning to Motorola for single technology or hybrid systems that enhance employee productivity, optimize ROI and empower sustainable business models in challenging mining environments.

About Motorola Wireless Broadband

Motorola's comprehensive portfolio of reliable and cost-effective wireless broadband solutions together with our industry leading WLAN solutions provide and extend coverage both indoors and outdoors. The Motorola Wireless Broadband portfolio offers high-speed Point-to-Point, Point-to-Multipoint, Mesh, Wi-Fi and WiMAX networks that support data, voice and video communications, enabling a broad range of fixed and mobile applications for public and private systems. With Motorola's innovative software solutions, customers can design, deploy and manage a broadband network, maximizing uptime and reliability while lowering installation costs.



MOTOROLA

motorola.com

Part number SP-MEA WIFI. Printed in USA 03/09. MOTOROLA and the Stylized M Logo are registered in the US Patent & Trademark Office. All other product or service names are the property of their respective owners. ©Motorola, Inc. 2009. All rights reserved. For system, product or services availability and specific information within your country, please contact your local Motorola office or Business Partner. Specifications are subject to change without notice.