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Cisco Enables AI, Fleet Management Tele-Remote, and Autonomous Vehicles

Cisco industrial wireless powers the autonomous operations zone, driving large productivity gains and improved mine safety.

Big data

A mobile fleet produces a huge amount of data: temperature, RPM, speed, direction, vibration, tire pressure, etc. Some of this data is perishable and has a "shelf life." For example, if you were able to use the data to understand that the transmission on a haul truck was about to have a catastrophic event, and you were then able to fix the transmission before the major event occurred, the time and money savings to the company would be huge. Imagine if the truck had sensors and was capable of communicating that a catastrophic event with the transmission was about to take place. However, if the current solution deployed for the fleet cannot collect this data and move it to a location for AI or someone to review it in real time and take action before the catastrophic event occurs, the data is no good to you. This is why it is so important to have the equipment connected and collecting the data at all times. This collection is done through the secure and resilient wired and wireless network in the mine.

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Safety

Mining is sometimes done in very remote locations that can be very unstable both physically and politically. Flying people out to these remote sites and having them work long hours in harsh conditions can create safety problems for these workers. When companies convert their haul trucks to autonomous operation, the loaders to tele-remote operation, and the drills to assisted autonomous operation, they remove the need for drivers to be in harm's way in the mine. This conversion also requires a secure and resilient wired and wireless network, coupled with diverse WAN paths to the Remote Operations Center (ROC).

This transition from a driver-based system to an autonomous system has significant human safety benefits but also comes with sizable financial benefits. As a point of reference, the typical aboveground mine with 60 haul trucks can see a positive impact of $50M or more per year.

Attracting and retaining skilled workers

The mining workforce is aging, and recruiting new, talented workers to go to these extremely remote locations for extended periods of time to work in harsh and challenging conditions is becoming increasingly difficult. Moving mining operations and the bulk of your employees to a metropolitan area is a great way to attract quality candidates. As stated above, this requires a secure and resilient wired and wireless network, coupled with diverse WAN paths to the ROC.

Mine equipment

Heavy industrial vehicles

Haul trucks
Loading shovels
Dozers
Drills

Medium industrial vehicles

Graders
Water trucks
Fuel trucks

Light vehicles

Service trucks
Pickup trucks

Autonomous operations center

Multiple HD screens
Mine management software
Light vehicle dispatch system

The network is the cornerstone

Tele-remote and autonomous systems depend on continuous communication between the onboard control system and the infrastructure-side safety system. If the communications are broken, the emergency stop will engage and shut down the vehicle. This issue can create a daisy-chain effect. If location data is missing from any vehicle, all vehicles in the Autonomous Operations Zone (AOZ) may need to shut down.

Designing and implementing dependable and resilient communication networks is what Cisco does. To make this happen, Cisco partners with other companies that also have experience in the mining industry and know how to deliver excellence as one team.

The key challenges that the solution needs to address include the following.

- Predictable wireless performance: A number of wireless technologies can be applied. Solid performance requires that the appropriate wireless technology be engineered and implemented to fit the system requirements.

- Ruggedized industrial equipment: Mines can be in remote and rugged locations with extreme weather conditions and very rough roads. Success depends on meeting heavy industrial specifications.

- Resiliency and fast reconvergence: The network must be resilient to recover from the failure of individual components or network links. When a failure occurs, the reconvergence must be fast enough to minimize impact to the autonomous system.

Cisco and its partners work together to provide a wide range of networking infrastructure for this type of industrial wireless system. The solution elements include onboard devices that can be configured to provide connectivity for the mobile assets and the onboard applications, wireless access points, and network infrastructure, from the switches servicing the infrastructure access points all the way to the data center and the server infrastructure within the data center. All of these elements are engineered into a solution that overcomes the challenges that need to be addressed.

Summary

The network foundation for the overall solution is brought to life with a collection of routers, switches, and wireless access infrastructure. It is implemented by Cisco and its partners.

Solution

Wireless

Cisco® IW9167 Heavy Duty Series Access Points

Cisco Catalyst™ 9800 Series Wireless Controllers

IoT-OD management system for Cisco Ultra-Reliable Wireless Backhaul virtual fiber fixed wireless

Routing and switching

Cisco Catalyst IE9300 Rugged Series Switches

Cisco Catalyst IE3400 Series Switches

Security infrastructure

Cisco Identity Services Engine (ISE)

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Wireless in the mine needs RF skills

Great equipment is only one part of the solid communication system. A robust and resilient communication system is also heavily dependent on planning, design, and deployment skills in very tricky geographic terrain with difficult environmental conditions. Operation of the mine requires the movement of large portions of the earth away from the mine face. Over time the mine becomes a large hole in the ground, with shifting edges and growing piles of earth that significantly change its RF characteristics. The communication system design must be able to adapt to these changes and remain robust.

The specialized skills needed to assess the RF characteristics of the mine are found only in companies that specialize in mine communication. Although Cisco and many Cisco partners have wireless experience, only a limited number of Cisco CX specialists and Cisco partners have mine wireless experience. In deploying this autonomous system, the customer can depend on Cisco to provide people with these skills and engage them in the planning, design, and deployment of the mine communication system. Deployment and operation of an autonomous system is a high-stakes venture. Investing in the right people is essential to ensure the best possible outcome.

Server infrastructure

Cisco UCS C-Series Rack Servers

Management

Cisco Catalyst Center / IoT-OD

Professional services

Cisco Advanced Services

Vehicle endpoints

Cisco Catalyst 9100 Access Points

Industry commitment

"… will deploy more than 150 electric autonomous haul trucks at its company-operated mines over the next six years."

– January 2018
President of Mining Company,
Northern Canada

Rough roads become smoother

Deploying an autonomous system for haul trucks in the mine results in corporate savings and means subjecting fewer people to the danger and fatigue of the mine pit. Cisco and its partners provide the foundational communications infrastructure this system relies on for each truck to communicate with the central autonomous system.

The success of this infrastructure depends on a strong product base that is combined into a well-engineered and robust system for the harsh mining environment. Designing and implementing this solution depends on specialized skills that grow from experience in the mine. These skills include a clear understanding of the unique operational imperatives in the mine's dangerous and extreme working conditions.

Cisco has the products, services, and partnerships required to deliver a robust communications infrastructure for an autonomous haul solution in the mine.