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INDUSTRY DIRECTION

Of digital networks in large surface mines

One of the lesser considered aspects for the implementation of automation in the mining industry is the connectivity of this technology to the end user whether that is the operator of a piece of heavy equipment, the dispatch supervisor, or the mining engineer investigating the optimization of the mine's haulage network, for example. In each case, the data that are required is different but equally important for the end task to be completed.

As the mining industry begins to adopt more automation, ranging from autonomous haul trucks (AHTs) to dispatching and health monitoring systems, the volume of data that needs to be communicated wirelessly increases exponentially. In order to handle this increased volume of data throughput, as well as to mitigate the increased risks of the failure to do so, the mining industry needs to shift the thought process and attitude towards IT and data networks from an afterthought to being very much part of the planning process.

Existing systems and limitations

With automated dispatch systems, this is done without the need for operator input and truck solutions are then implemented using a real-time dispatching system, with or without the interaction of the truck dispatcher. In this regard, dispatching systems for open pit mines have attracted considerable attention in the last few years due to substantial gains in productivity achieved through their implementation. Initial Dispatch solutions, such as Modular's DISPATCH™ or Caterpillar's MineStar™ system, were often the catalyst for the installation of wireless networks though sometimes the installed network was simply to provide a radio communications network.

Harsh environment

Furthermore, particularly a large open pit mine is typically considered a harsh environment for the efficient working of wireless networks. The working environment is an unpredictable and uncontrolled setting where environmental factors such as vast fluctuation in temperatures, rain, vibration, humidity, chemicals, electrical shock, pressure, physical damage, may affect the normal operation of the platform or even render the platform inoperable. The unpredictable nature of these elements require the wireless network to be significantly more robust than that of a traditional wireless network and careful consideration must also be given to the viability of any future expansion of the network based upon these limiting factors.

Available networking options: 802.11 (Wi-Fi)

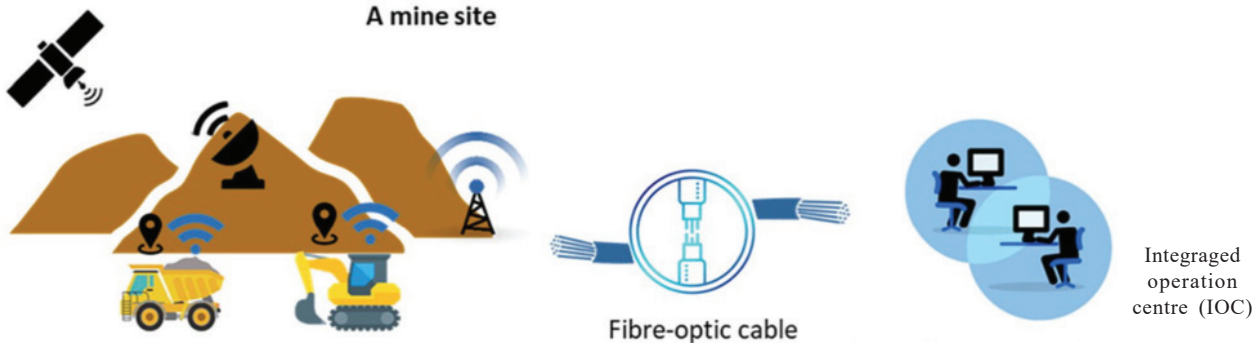
Most current wireless networks in open-pit mining are based around the 802.11 group of wireless networking standards that run on wireless local area networks on the 2.4 or 5 GHz frequency bands, which are unlicensed and free to use by both personal and commercial users. The 802.11-based technologies are governed by the IEEE standard 802.11TM-2012, the purpose of which is to provide wireless connectivity for fixed, portable and moving stations within a local area.

4G Long-term evolution (LTE)

One of the big issues with the LTE format, however, is the frequency band on which it operates because it is a licenced spectrum, as opposed to the unlicensed Wi-Fi spectrum. The spectrum range in which LTE operates is mainly around the 700 MHz, 1.8 and 2.6 GHz bands and these are auctioned off to wireless, primarily cell phone, operators. Due to this, any use of the LTE spectrum comes at a price, paid as a leasing fee to the wireless carrier that owns the band of the spectrum in which the company's wireless network is going to run.

This cost will not likely be a deciding factor when considering the technology but the big concern with LTE for the mining industry is that, ultimately, the carriers still own the spectrum that their network is operating on so they are also the ones responsible for the maintenance and upkeep of that piece of the frequency bandwidth.

As a result, there needs to be a close alliance between the carrier and the mine so that their priorities are in line. As an example, if a mine is running a fully autonomous haulage fleet, then the tolerance for any downtime in the network is extremely low and whilst a 24-h commitment to getting the network back online might seem like a quick turnaround to the telecommunications company it would likely end up



Combination of different communication technologies employable in the mines

costing the mine millions of dollars in lost production. This risk may be partially mitigated with an explicit contract around service agreements that could even see the wireless carrier relent control of that particular band of the spectrum to the company operating on it, but they would still have to liaise very closely with the provider during failure events and it would be more difficult to maintain than the variable, unlicensed network protocol of the Wi-Fi suite of technologies.

Own private LTE-network

Due, in part, to the difference in bandwidth allocation of the LTE network in Australia, Rio Tinto deployed its own private LTE network at the West Angelas mine in the Pilbara region of Western Australia back in 2013. This is the same mine where Rio Tinto rolled out a lot of the technology for the AHT's and it is understood that the desire for a faster wireless network was to facilitate the movement of much more data across the mine.