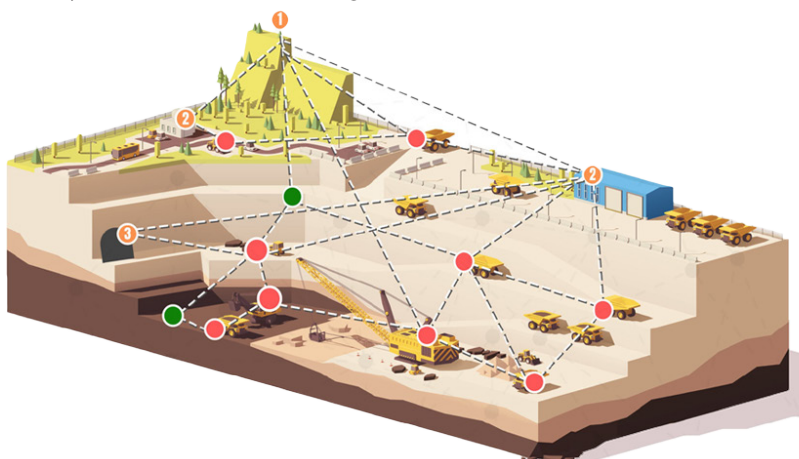# OPENCAST AND BELOW GROUND MINING APPLICATION

OPEN CAST MINING APPLICATION

Mining operations require reliable communications, delivering data, telemetry, audio and video. Due to the fluid, dynamic nature of operations in an open cast mine, the control room requires low latency data on equipment movement, personnel movement, IoT sensor status, and perimeter surveillance, to mention just a few considerations. It may also be undesirable or impractical to erect radio infrastructure such as masts and/or towers in the interests of economy or environmental impact. In today's mining industry the use of unmanned platforms is growing exponentially.

The need to remotely operate and control these platforms safely is of paramount importance. Traditional LMR/DMR radio technology is restricted to voice and very low data rates. P-25 and/or Tetra radio systems are also restricted to voice and low data, and they require a core to function, and common to all these technologies is the need for infrastructure. Private Cellular networks, such as Private LTE and/or 5G are being increasingly employed due to the ability to carry high data rates as well as voice. However, these technologies are expensive and the network topology is, by design, a star network, with a single, central point of failure.

02IP Mesh technology delivers a high speed, encrypted IP network, carrying data, voice and video and does not require any infrastructure. There is also no single point of failure. If a radio leaves the Mesh network, the network re-forms dynamically and carries on operating with all the remaining radios. When the dropped radio comes back into range, it automatically re-joins the network, without the need for any IP address management, or human intervention.

The network evolves dynamically as more radios are deployed. Up to 250 radios can operate in a single Mesh, using an occupied bandwidth as narrow as 5MHz. Network capacity ranges from 28mbps to >100mbps. Each IP Mesh radio deployed has integral GPS and Wi Fi access. Up to 6 Wi Fi enabled devices can connect simultaneously to each IP Mesh radio, thus gaining access to the Mesh network. Apps such as PTToCellular, or operational related apps that do not require a server connection, can continue to function natively within the local area network delivered by the IP Mesh radios. Should any one IP Mesh radio be connected to a SATCOM or cellular modem (via Ethernet) then every Mesh radio in the network has access to the external network, as does any device connected over Wi Fi to a Mesh radio.This capability is unique to IP Mesh networks, and unique to the Ace6/Hypha Mesh networks as these are the only IP Mesh radios built with integral Wi Fi access.

1. 2W on high point covering exterior of mine
2. 2W on building of Control Room
3. 2W at entrance of mine
- 500mW bodyworn
- 500mW vehicle mounted
  (ALL VEHICLES WOULD HAVE RADIO, LINES ALL OMITTED FOR CLARITY)

DMX-2023-08

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WHEN YOU NEED TO TALK

BELOW GROUND MINING APPLICATION

Above we have considered the application of IP Mesh in an open cast mine, where conditions are, in general, likely to be favourable for RF propagation. However, delivering reliable communications in a below ground mining environment presents very different challenges. Traditional HF/VHF radios, LMR/DMR and cellular devices struggle to maintain connectivity to the surface, even for low traffic rates such as voice.

Deep mine shafts tend to deliver personnel and supplies to tunnels that are at right angles to the shaft, and very narrow and confined. These conditions defeat traditional communications technologies and most IP Mesh technologies that use OFDM modulation to manage the network. Ace6 and Hypha radios use COFDM modulation, which adds forward error correction to the network traffic, thus ensuring the arrival of every IP packet at its destination. This type of modulation and network management (token passing algorithm) delivers exceptional RF performance below ground and in tunnels, basements, collapsed structures etc. Thus the application of Ace6 and/or Hypha IP Mesh radios to underground mining environments has proven highly successful.

The ability to penetrate up to 9Km in narrow tunnels in Australia with low power IP mesh radios has convinced the NSW Fire & Rescue agency to invest heavily in Hypha IP Mesh as the communications backbone for the Snowy Mountain tunnel project.

Small 2W radios will be installed at intervals along the tunnel, typically 1Km to 2Km apart, depending on the tunnel topology. All they need is a power source. Then, when any other Hypha IP Mesh radio (either body worn/hand held, or appliance-, or vehicle-mounted) is turned on within range of any 2W Node, or any other Node for that matter, the radio is in the network. As the radios move along the tunnel, connectivity is automatically "handed over" to whichever Node or radio offers the most efficient network path. Nodes are placed strategically along the tunnel route. The only location that would mandate the location of a Node or radio would be a right-angled turn. Most tunnel construction avoids right angles so this condition would rarely be encountered.

Note:

We use the term radio and node. We normally refer to a hand-held IP Mesh device as a radio as it looks and operates very similar to a traditional radio. We refer to Robust 2W IP mesh devices as Nodes as they are built in a housing that is intended for permanent installation, either in/on a vehicle, or a wall, or any piece of infrastructure real estate.

In essence IP Mesh radios and IP Mesh Nodes are the same functionality. We mention Ace6 and Hypha IP Mesh radios. The Hypha Mesh IP Mesh radios are manufactured in Australia, with the Ace6 Technology IP Mesh OEM radio at its core. Ace6 technology, as the OEM manufacturer is Singapore based. The Hypha Mesh radio has won numerous design awards for its unique approach to delivering connectivity to First Responders, with a rugged IP67 housing and 12 hours of "hot swap" battery life.
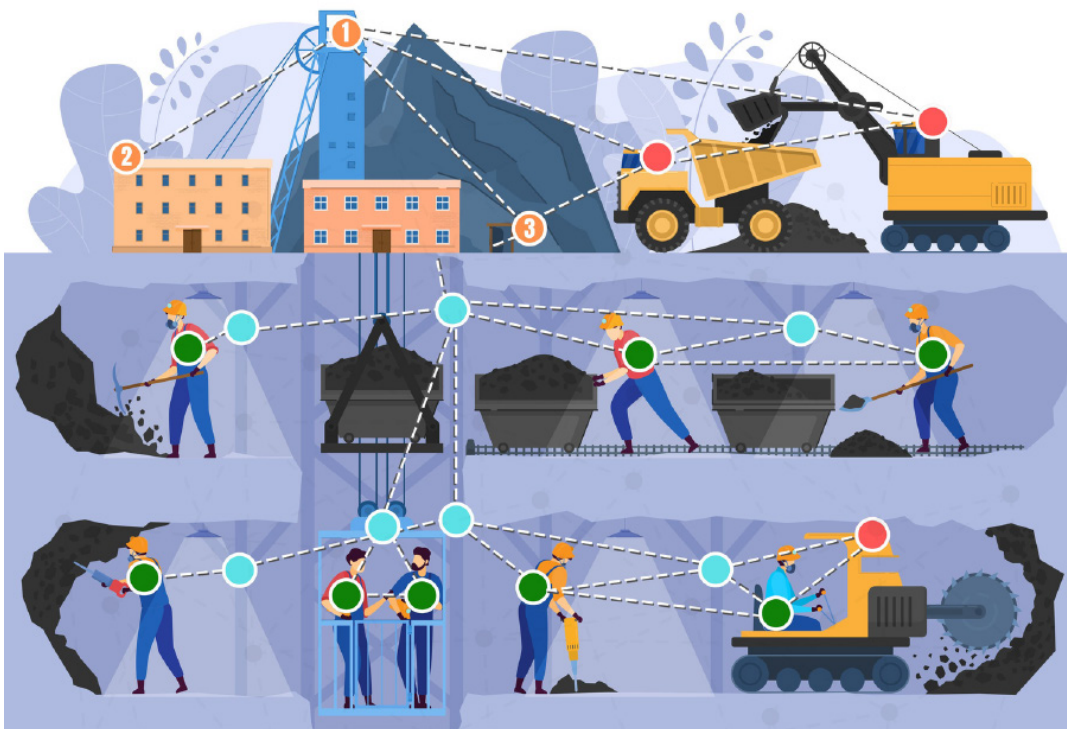
- ❶ 2W on high point covering exterior of mine
- ❷ 2W on building of Control Room
- ❸ 2W at entrance of mine
- 🔵 2W at various points in the horizontal and vertical shafts
- 🟢 500mW bodyworn
- 🔴 500mW vehicle mounted