WHITEPAPER

TYPICAL SOVSYS-MESH AND LEO (LOW EARTH ORBIT) SATCOM DEPLOYMENT

ADVANTAGES AND CHALLENGES OF LEO AND GEO SATCOM

For as long as we can remember, geo-stationary (GEO) satellite communications has been the "go to" method of communications backhaul in the absence of a cellular network. GEO satellites, such as Thuraya, Iridium, Inmarsat, are those that orbit the Earth at altitudes of about 36,000km, matching the Earth's rotation. They have several benefits for SATCOM users, such as high availability, high stability, and high coverage. High availability means that the satellites are always in the same position relative to the ground station, which allows for continuous and reliable communication. However, GEO satelites also have some challenges for SATCOM users, such as high latency, low bandwidth, and low diversity.

High latency means that the signals take longer to travel between the satellite and the ground station, which can affect the quality and performance of real-time applications, such as voice and video. Latency can be anywhere from 400ms- 1000ms. Low bandwidth means that the satellites can transmit and receive less data per unit of time, which can limit the resolution and capacity of imagery and data-intensive applications. Typical bandwidth is 500kbps-1mbps. Low diversity means that the satellites have a fixed view of the Earth's surface, which can create blind spots and gaps in coverage. LEO satellites, such as StarLink, OneWeb, are those that orbit the Earth at altitudes of less than 2,000 km. They have several benefits for SATCOM users, such as low latency, high bandwidth, and global coverage. Low latency means that the signals travel faster between the satellite and the ground station, which is important for real-time applications, such as voice and video. Latency can be as low as 30ms in some cases, but typically around 80ms-100ms. High bandwidth means that the satellites can transmit and receive more data per unit of time, which is important for high-resolution imagery and data-intensive applications.

Quoted throughput is >150mbps, for StarLink, while in practice we are achieving 80mbps-100mbps while "on the move". Global coverage means that the satellites can reach any point on the Earth's surface, which is important for remote and polar regions. However, LEO satellites also have some challenges for SATCOM users, such as high complexity, high cost, and low availability. High complexity means that the satellites have to deal with more orbital dynamics, atmospheric drag, and interference from other satellites and debris, which requires more sophisticated engineering and control systems. High cost means that the satellites have to be launched more frequently and replaced more often, which increases the operational and maintenance expenses. Low availability means that the satellites have a limited time window to communicate with the ground station, which requires more coordination and planning.

DMX-2023-08

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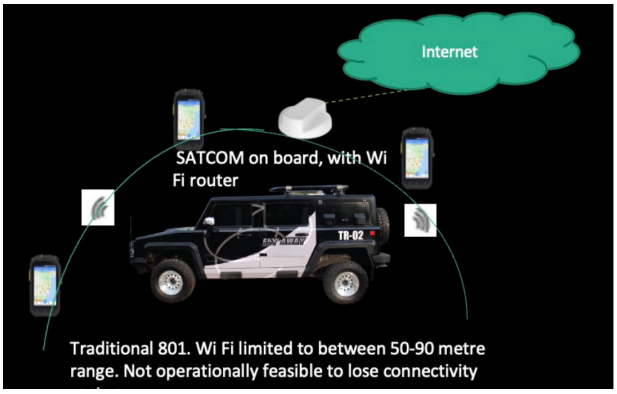
SovSys-Mesh and SATCOM

Traditional SATCOM deployment meant that the user who is transmitting over the SATCOM backhaul had to either be hard wired via an Ethernet cable to the SATCOM modem, or connected by Wi Fi, typically within about 50 metres to 80 metres from the modem. This is still the norm even with the advent of the new LEO SATCOM systems. The advent of battery-operated, hand-held IP Mesh MANET radio networks has changed the deployment possibilities. Now, tactical operations can be extended at ranges never before possible with SATCOM. By connecting just one SovSys IP Mesh radio to the SATCOM modem, every other IP Mesh radio that is connected to the Mesh network, has access to the SATCOM network. In addition, with the unique, integrated Wi Fi hotspot in every SovSys IP Mesh radio, any mobile phone, or other Wi Fi enabled device, such as IoT sensors etc., also has real-time access to the network.



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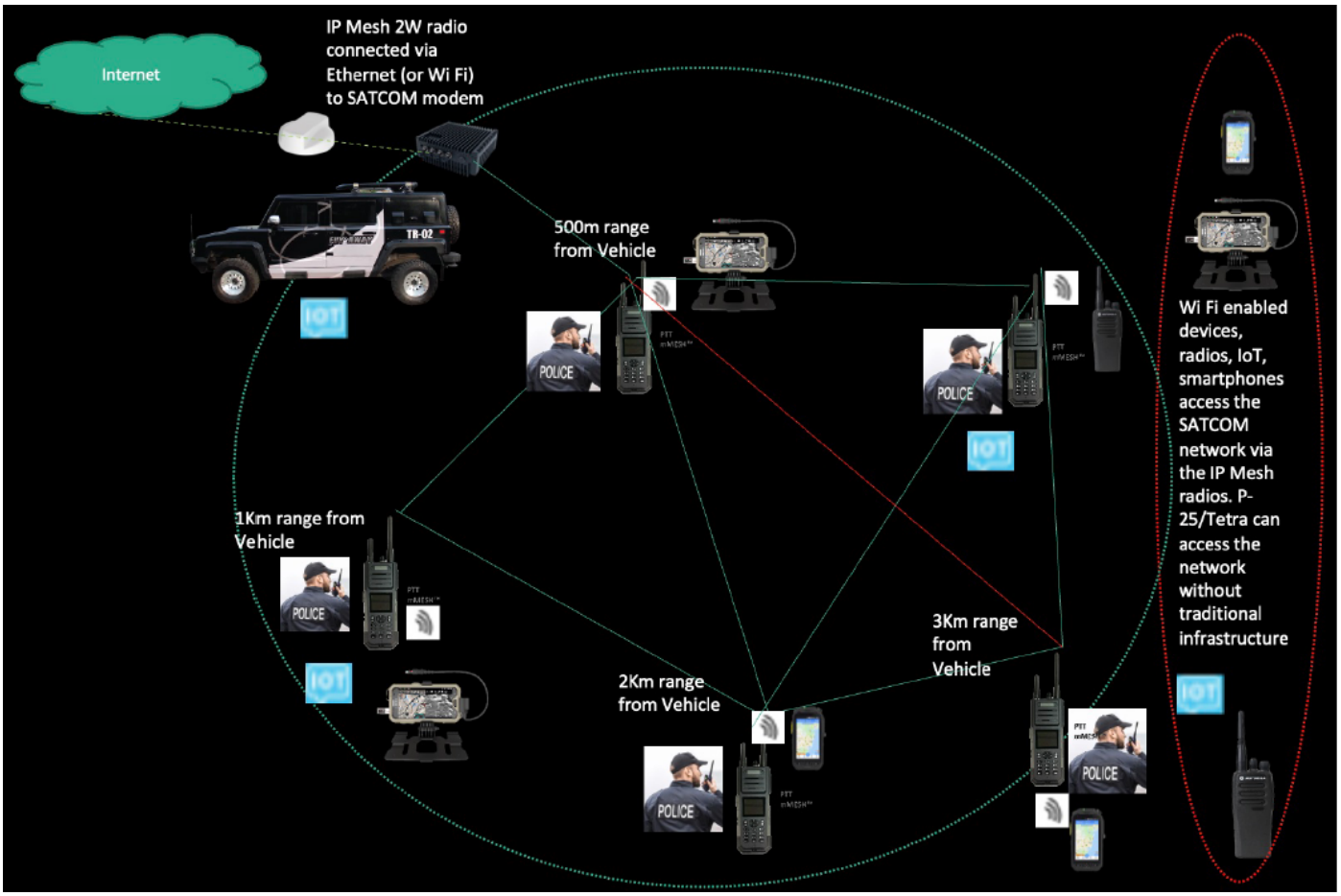

The Mesh network depicted here is operating at up to 28mbps throughput, delivering data, audio and hi quality video at greatly extended ranges from the SATCOM modem. However, the SATCOM modem is the bottleneck as uplift speed is only ~500kbps.

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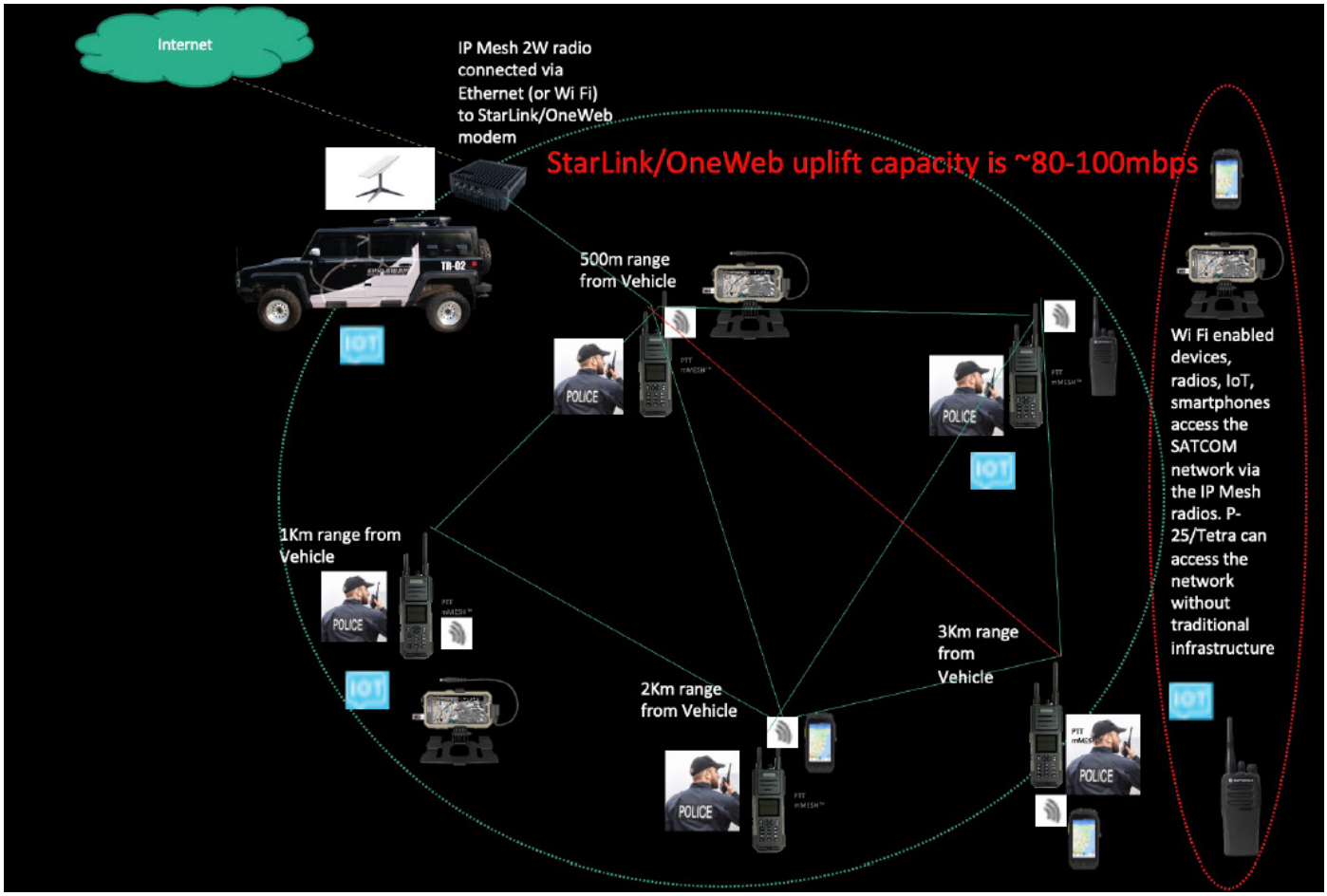
In situations such as that above, the GEO SATCOM cannot cope with the throughput of the SovSys Mesh network. Also, latency becomes an issue as most modems will struggle to perform adequately at latency above 400ms-500ms and the GEO SATCOM in this instance will be around 800ms-1000ms. Experience has shown us that we need to throttle back the output of the Sovsys Mesh network to be able to utilise the SATCOM backhaul so, typically we will separate out the video streaming from the audio component, transmitting only the audio over the SATCOM modem. Video streaming will be kept running in the local network with the Mesh radios, and/or recorded for later analysis, debrief.

Now, let's consider the deployment with the LEO SATCOM, which delivers an average of up to 100mbps. This throughput means that the full network capacity of the PTT Mesh handheld network, at 28mbps, can be uplifted to the LEO SATCOM network, eliminating the need to throttle back any of the output. Even if using SovSys MIMO IP Mesh radios, with up to 100mbps throughput, there will be no need to reduce output. This delivers huge tactical and operational benefits for the users.



The Mesh network depicted here is operating at up to 28mbps throughput, delivering data, audio and highquality video at greatly extended ranges from the SATCOM modem. The high-capacity throughput of the LEO SATCOM backhaul negates the need to reduce throughput from the SovSys IP Mesh network.

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Now consider the other tactical advantages of the SovSys IP Mesh network being able to deliver extended connectivity to mobile devices up to 20Km distant from the SATCOM modem. Both Motorola, with their Smart Connect, and Harris with it's BeOn, have P-25 radios running PTT apps, VOIP, natively, and also on mobile devices.

All of these devices require either a cellular or P-25 radio infrastructure to operate. What happens then when none of these connectivity options are available?

They are all Wi Fi enabled radios, so just connect them to the LEO SATCOM modem I hear you say!! But how do we do that, especially if the user has to operate at range of more than about 50m-80m (Wi Fi range) from the SATCOM modem? First Responders in Australia and California typically need connectivity at ranges up to 2Km from the SATCOM equipped vehicle, way beyond normal Wi fi range from the SATCOM modem.

If any user within the team working at range is using a SovSys IP mesh radio, this will allow up to 6 users of Motorola Smart Connect and/or Harris BeOn radios/devices and/or any mobile device, to access the real SATCOM network by connecting to the Wi Fi hot spot of the SovSys IP Mesh radio….even at 500 metres, 1Km, 5Km, 10Km, 20Km range from the SATCOM modem. Similarly in tunnels, or any other environment (below decks on ships, underground basements, car parks etc.) where these VOIP devices are looking for a network, the SovSys IP mesh network will deliver the connectivity they require, enabling access to their core.

Traditional deployments of competitor IP mesh solutions have focused on connecting devices such as helmet cameras and audio devices, to the Mesh radios to allow the output to be shared across the network. Our approach, which focuses on delivering wireless connectivity to Wi Fi enabled devices, in addition to the traditional voice, data and video deployments, but at an affordable cost to allow First Responders access to this technology, is proving to be a game changer. First Responder users across the world are realising the benefits of the SovSys IP mesh technology and are implementing these SATCOM/SovSys-IP Mesh solutions.

Above images represent real live deployments of SovSys/Hypha Mesh radios, delivering connectivity in cellular denied environments, deep underground, and kilometres away from the LEO SATCOM modem in use by the SAR teams.*
**Hypha Mesh, manufactured in Australia by Hypha Networks, uses the SovSys IP Mesh technology at its core.*

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