KYMETA™

A HYBRID NETWORK SOLUTION FOR RELIABLE, WIDE-COVERAGE FIRST RESPONDER COMMUNICATIONS

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INTRODUCTION

Digital technologies continue to change our everyday lives, and they are also shaping and improving the way first responders communicate. Better communication means more accurate and timely information, which enables a safer and more efficient response. Efficiency leads to more lives saved.

First responders around the world are relied upon every day to provide advanced first aid and assistance at the scenes of accidents, disasters, and emergencies.

However, their communications require infrastructure. Terrestrial communications networks, such as Long-Term Evolution (LTE), which rely on a fixed network of towers and radios, can become unreliable during a disaster. Physical damage to cell sites or network congestion can significantly reduce performance.

Recently, there has been a renewed focus on building resilient and protected cellular networks that give responders priority on the network and implement rapidly deployable infrastructure to mitigate physical damage. But terrestrial networks alone are not reliable enough for many first responder situations.

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To complete the connectivity fabric and provide ubiquitous mobile connectivity, Kymeta is developing a hybrid satellite and cellular network solution that blends resilient public safety grade networks with survivable satellite networks to provide communications that are always available.

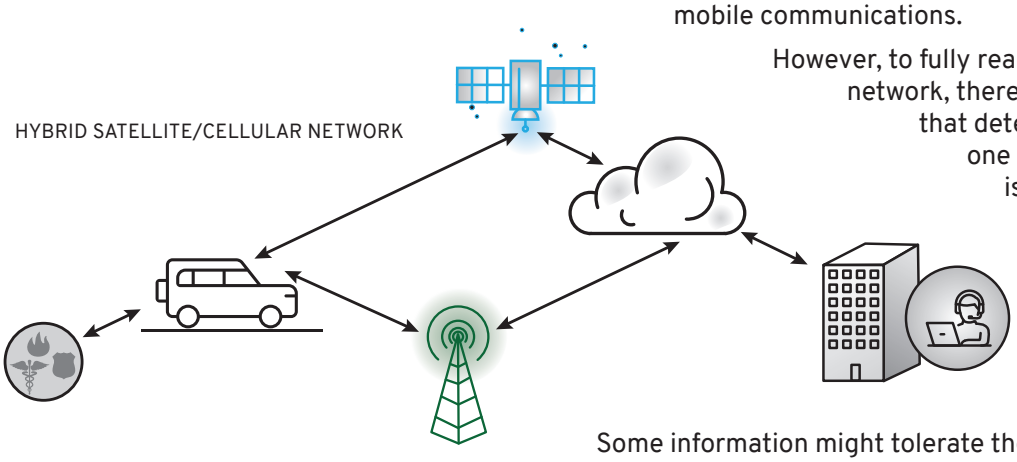
THE METAMATERIALS-BASED FLAT-PANEL ANTENNA

Kymeta has commercialized a novel, electronically-scanned satellite antenna based on a diffractive metamaterials concept called Metamaterial Surface Antenna Technology (MSAT). MSAT enables electronic scanning from a single flat panel with no moving parts. By using liquid crystals as a tunable dielectric at microwave frequencies, Kymeta has achieved large angle (>75°) beam scanning and fast tracking (>20°/second). This provides high-throughput connectivity to satellites from even small moving platforms with little to no operator intervention.

This antenna has been deployed around the world on a wide variety of mobile platforms, including 2-seat all-terrain vehicles, small inflatable boats, super yachts, tractors, passenger vehicles, and first responder vehicles. Once the terminal is powered on, an internal global positioning system (GPS) receiver and inertial measurement unit (IMU) determine the position and attitude of the antenna. From there, the antenna automatically determines the location, frequency, and polarization of the optimal satellite to track, and forms an electronic beam to that satellite. As the vehicle moves, continuous inputs are made to the antenna's tracking algorithm to keep the beam locked on the satellite.

HYBRID NETWORK SOLUTION

The hybrid network solution Kymeta is developing combines satellite and cellular networks. MSAT connecting to geosynchronous Ku-band commercial satellites provides reliable internet access from almost anywhere on the planet. Commercial cellular networks cover a significant portion of the world's populated areas. Combining the low cost, high performance cellular network with the reliable and resilient satellite network leads to a promising solution for always-connected mobile communications.



However, to fully realize a seamless and connected hybrid network, there must be logic within the network that determines how to route the data. If only one network is available, then the answer is simple. But when multiple networks are available, then a decision must be made. Furthermore, not all network traffic is the same. Some information might need to be shared instantly or might not function well on the higher latency satellite network. Some information might tolerate the latency but require the ultra-high reliability and dependability that the satellite network provides. Also, since situations are typically dynamic, a moving platform might move outside the coverage area of an LTE network and need to change the routing of the data to the available satellite network. Once the LTE coverage is reestablished, it could be beneficial to switch back to LTE.

Kymeta is partnering with Cradlepoint to implement a software-defined wide area network (SD-WAN) router to implement these decisions.

The SD-WAN provides seamless switching of the backhaul network from LTE to satellite and back again as needed. It allows for dynamic traffic shaping and flow rulesets that incorporate both the destination and nature of the traffic.

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FIELD TRIAL #1

FIRST RESPONDERS IN A POST-DISASTER ENVIRONMENT

On October 10, 2018, Hurricane Michael hit the community of Mexico Beach, Florida. This Category 4 storm was one of the most intense to make landfall in U.S. history, and caused over $30 billion in property damage and other short-term losses. In the days following, a major mobile network operator deployed two complete hybrid network-equipped all-terrain vehicles (ATVs) to Mexico Beach. The vehicles were the result of a collaboration between Kymeta, Cradlepoint, and other partners.

Following the hybrid network model, the systems on the ATVs provided continuous connectivity from cellular networks when available and satellite networks when the cell networks were overloaded or unavailable. This was key in the days following the hurricane, as the majority of fixed infrastructure was damaged in the storm. Cellular providers worked tirelessly to rebuild infrastructure, but quickly restoring adequate coverage to fully support the recovery efforts was an impossible task.

The hybrid network was able to determine if the cellular networks were available and suitable for backhaul use. If the cell network was unavailable or congested, the network used the satellite network for primary backhaul purposes. The system performed these functions autonomously and provided users with the highest performing connectivity.

With a reliable backhaul service provided to the ATVs, mobile network engineers integrated small cells and tactical mesh networks with the hybrid network. This provided fronthaul data services to responders using existing equipment. Devices such as smartphones, IP radios, and other IP-based systems were easily integrated with the hybrid network so that responders were able to continue using their tools and communications devices normally, without having to learn a new system.

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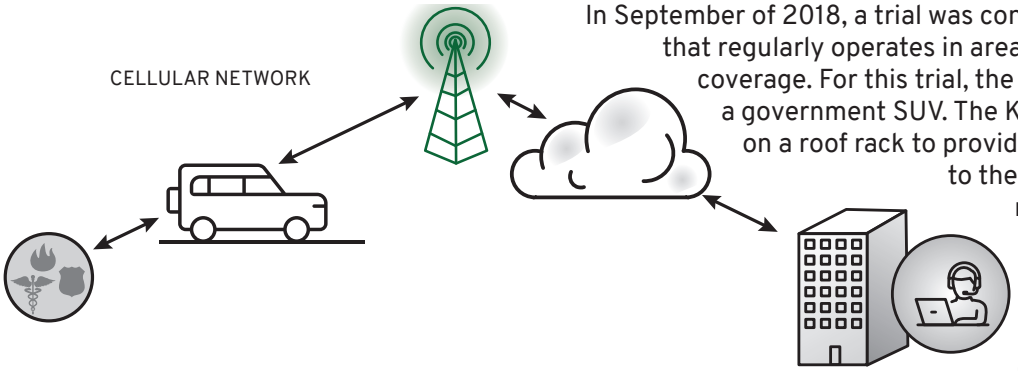
FIELD TRIAL #2

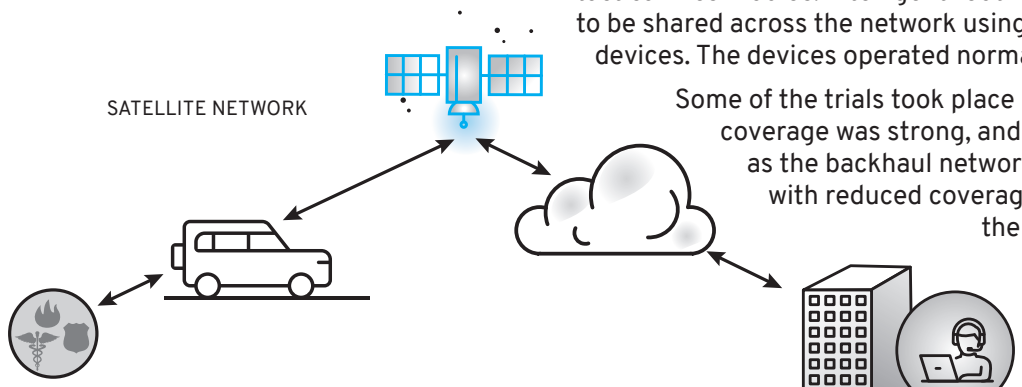
GOVERNMENT AGENTS OPERATING IN REMOTE AREAS

Disasters or other unplanned events can lead to the degradation of terrestrial networks in places where coverage is normally adequate. There are also situations where terrestrial-based networks are unavailable or do not exist.



In September of 2018, a trial was conducted with a government agency that regularly operates in areas without terrestrial network coverage. For this trial, the hybrid network was integrated with a government SUV. The Kymeta MSAT antenna was installed on a roof rack to provide continuous satellite connectivity to the vehicle, and the hybrid network router with a commercial LTE modem was integrated internally. The system provided secure Wi-Fi access for several hundred meters around the vehicle with high-gain Wi-Fi antennas. Additionally, tactical mesh network radios extended fronthaul connectivity more than 1 km away from the vehicle.

Government agents connected their devices, smartphones, drones, infrared cameras, and other devices to the local Wi-Fi network and tactical mesh radios. Intelligent routing enabled video, voice, and data to be shared across the network using existing configurations at the end devices. The devices operated normally when using the hybrid network.



Some of the trials took place in areas where local cellular coverage was strong, and the hybrid solution selected that as the backhaul network. As the operation moved to areas with reduced coverage, the hybrid network switched the backhaul to the satellite network and operations continued with no notable outage to the end user. Using this hybrid network, agents were able to continue their standard operations well beyond the terrestrial coverage areas.

The ability to operate anywhere, regardless of terrestrial coverage, represents a significant improvement in operational efficiency. Also, the demand on field agents is not significantly increased, since no additional training or tools are needed. This solution allows agents to operate effectively anywhere.

CONCLUSION

For first responders, government agents, and other field personnel whose efficiency and safety demand reliable communications, a seamless communications network is key. The hybrid connectivity solution provided by Kymeta completes the connectivity fabric and provides backhaul connectivity over satellite and cellular networks to ensure optimal connectivity anywhere at any time. The simplicity of use and intelligence of the hybrid network reduces the configuration and planning efforts required by end users. With the hybrid connectivity solution, responders can always have established and reliable communications in any scenario.

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