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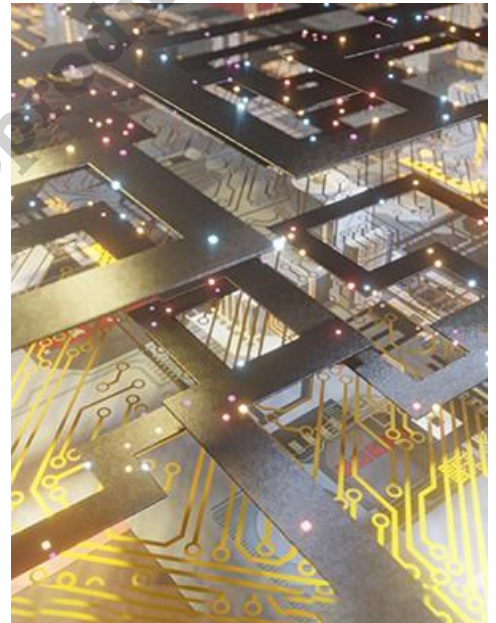
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Supporting Large-Scale Wireless Networks Through Interoperability and Certification

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Increasing internet connectivity capabilities continue to evolve the modern business environment. Through the Internet of Things (IoT) and other connected devices, it is now easier than ever to connect and monitor key assets, increase productivity within operations, and negate unplanned downtime. Now, businesses can place sensors within their assets, and - so long as there is sufficient connectivity to link them to remote applications - benefit from a wealth of third-party data and service integrations held in the cloud.

By 2030, there will be an estimated [32.1 billion IoT devices](#) in use across the globe. A large proportion of these will be found in the utility and smart city markets, driven by advancements in smart grid and metering, as well as new initiatives for connected street lighting and environmental monitoring.



As the adoption of IoT technology increases, choosing the right network protocol is critical. This will dictate how much bandwidth is required, how long a battery-powered device can last when in use, and the total cost of ownership for any given application deployed. For example, having to send out engineers to visit a device once deployed in a network can be capital intensive, especially for large-scale networks. Users need networks that are self-reliant and require minimal oversight. These requirements have made wireless mesh networks an increasingly critical necessity.

A Key Network Technology

Wireless mesh network protocols can enable all devices within a network to communicate with each other seamlessly, with data transmitted from node to node to reach long distances, making them perfect for the larger networks required for managing energy grids or smart cities.

Mesh networks differ from star network topologies like Wi-Fi or LTE, which are often susceptible to the signal blockages caused by everyday topologies within utility operations and cities such as narrow streets, high rise buildings or moving vehicles. The decentralized nature of mesh networks is not reliant on centralised infrastructure like star networks; instead, it dynamically routes data through multiple pathways, ensuring that communication remains uninterrupted even if nodes fail, become overloaded, or are obstructed.

These networks can also be self-forming and self-healing, meaning it is simple to add new nodes when required, and if a pathway fails the network will automatically re-route to available gateways. This self-healing capability allows operators to scale in both capacity and size, improving network reliability with each node added and, therefore, making it the best option for overcoming future network demands.

Mesh networks are already being used to support a number of key applications – everything from Advanced Metering Infrastructure (AMI), electric vehicle charging and direct load control, to traffic management and lighting can all be underpinned through them. Additionally, as more and more devices adopt the standard and become certified, operators will gain greater flexibility in their operations, fostering IoT innovation.

The Importance of Certification

As many of these networks are based on open standards, they encourage greater interoperability and an accelerated time to market for IoT products. These efforts towards openness are supported by certification programs to ensure authorities can use devices that will adhere to these open standards. Certification programs are vital as they ensure devices and services meet specific standards for quality, security, and performance, fostering end-user trust and promoting industry-wide consistency. To a communications profile, derived from open standards and their ability to allow interoperability with other essential products. This advantage of interoperability can eliminate single vendor lock-in, providing network builders with a much wider choice of devices for their deployments. Proprietary systems are no longer sufficiently flexible or cost-efficient as solutions based on open standards, and are already losing relevancy in today's market. Each manufacturer that certifies their products are helping to develop a global ecosystem of standards-based products, reducing risk of stranded assets within a network.

Certification also ensures that devices will not only work together effortlessly, but also securely. Some programs will ensure devices include a digital certificate to authenticate entry into a mesh network, which significantly reduces vulnerabilities to potential cyber security threats. Considering that the utilities industry experienced an average of [1,339 attacks per week](#) in the third quarter of 2024 alone, the use of certified devices can reassure users that their networks remain secure and resilient.

Supporting Urban Development

A recent City of London initiative has demonstrated the importance of mesh networks and interoperable devices. The city itself remains a centre of commerce and one of the largest financial hubs in the world, yet its medieval street pattern and tall buildings have created large “conflict areas” where carrying signals is a challenge. Turning to street lighting was seen as a solution to this problem, yet most of the lighting stock was found to be reaching obsolescence.

As such, a project was planned to replace these old units, converting them into IoT canopies. This initiative embraced new technologies to reduce maintenance costs and energy consumption, and allowed for the monitoring of environmental elements. The use of LEDs and a central management system also allowed the city to effectively light its historic assets through the tunable settings of digital lighting more suitable than traditional analog lights.

Through the Wi-SUN FAN mesh network and its open nature, over 12,000 lights have now been deployed within the city since 2020. Supported by 10 gateways which use the protocol's self-forming and self-healing functions to continually add devices to the network, the large-scale network continues to grow and enable new and emerging technologies to the benefit of London's residents and visitors.

Paving the Way for Game Changing Applications

To support the use of modern IoT technologies, wireless networks must be secure, fast, scalable and energy efficient. Organizations are already using these networks for applications that would have seemed like science fiction a mere decade ago, but this pace of innovation means they need protocols that are future-proof.

Wireless mesh networks have continually proven themselves for years in a range of harsh and remote environments across the globe. Capable of reliably connecting tens of millions of end points, the use of an IoT mesh network based on open standards can help achieve the ubiquity and scalability essential to support large-scale projects for utilities, smart cities and beyond. Certification programs for these networks are available for a wide range of consumer, enterprises, and other operator-specific products like smart meter devices. By certifying devices, manufacturers are playing their part to ensure greater IoT interoperability and reliability, and drive a more sustainable connected future for all.

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