



THREAD TECHNICAL BRIEF

Thread Overview for Industrial and
Enterprise IoT Applications



Mission-critical applications in today's industrial environments require wireless networks that are reliable, secure, low power and cost effective. While existing wireless protocol standards have had good success in freeing users from reliance on cables, those standards also suffer from some key limitations.



Thread Wireless Networking Protocol

Thread is a new wireless networking protocol designed to balance and improve on existing wireless standards in the aspects of power consumption, security, and cost effectiveness, and allow multiple devices to communicate easily and reliably, 24/7. In July 2015, The Thread Group released its first technical specification, Thread Version 1.0, designed to combine the best of what's out there in an effort focused on helping the Internet of Things realize greater potential for handling the M2M connectivity needs of tomorrow.

The Thread stack is based on the IEEE 802.15.4 standard (fig 1) operating at 250Kbps in the 2.4GHz band, which leverages proven reliability in basic message handling and congestion control. This balances decent bandwidth with a readily available frequency. In order to reduce the potential for single point of failure, Thread builds on this time-tested solution by implementing IPv6 addressing architecture with 6LoWPAN header compression and mesh capabilities for maximum routing efficiency and redundancy. Thread technology also features banking-class, AES security and commissioning features across all layers of the IP stack, providing encrypted, secure, simple installation, start-up and operation.

Another key advantage of Thread is that the application layer is completely separate, making it agnostic and flexible for use with independently defined application layer standards including the familiar ZigBee protocol, as well as other popular protocols. This allows a level of forward compatibility between existing and new devices, making Thread attractive for designers and consumers alike.

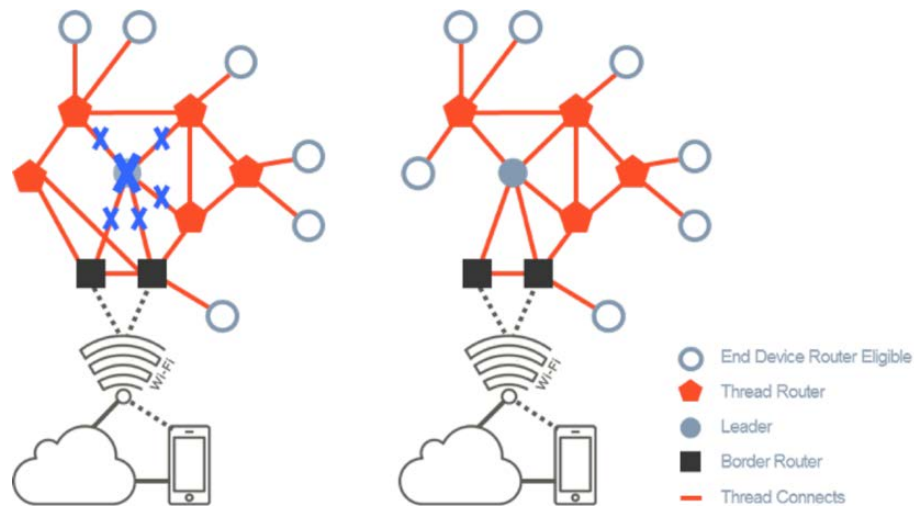
Figure 1



Courtesy of Thread Group © 2015

The network topology, shown in figure 2 below, is based on the number of routers in the Thread network. This means a network can scale automatically from a basic star topology with a single router to a mesh topology when multiple routers are present. This flexibility in network formation makes systems more reliable by allowing radios to forward messages to other radios in a redundant fashion, thus eliminating the potential for single points of failure.

Figure 2



Courtesy of Thread Group © 2015

Potential Industrial Applications

Although Thread is initially focusing on the home, it has clear advantages that also make it attractive for the commercial and industrial markets. An example of a mission-critical industrial application that could leverage the strengths of Thread technology is Industrial Street Lighting for municipalities. Intelligent, connected street lighting systems are quickly becoming a critical part of the smart city ecosystem, and as this market continues to grow, municipalities are demanding the highest levels of security and addressability. IPv6 will be a standard requirement for many deployments beginning in 2016 and is required by governments to ensure compatibility between devices deployed across their smart city ecosystems. Deployability and ease of installation will also be critical, as systems are often installed by third-party technicians that don't typically possess specific technical knowledge of the hardware being installed.

One of the unique advantages of Thread is the ability to use an open-source mobile application for Android/iOS devices to enable quick, easy device installation and network provisioning. Redundancy of the network will be

critical for intelligent lighting systems. If communications on a street light fail, the cost to send a truck and physically address the problem can be astronomical. Therefore, eliminating any single points of failure in a network is critically important, and Thread's network topology utilizes self-healing mesh networking and redundant border routers to help eliminate this risk.

Another area where Thread technology could prove beneficial is the booming residential and commercial solar markets. Monitoring power generation and system performance are critical to meet industry regulations and to lessen the potential for post-installation expenses. Also, the sheer number and close proximity of deployed systems can make the commissioning of wireless networks complex. Thread addresses these challenges with its simple network provisioning tools. Because Thread network topology leverages redundant border routers, it adds a level of reliability that is also specifically beneficial for larger commercial installations where system outages can have major financial impacts.

High level comparison chart of various RF protocols:

	Thread	Wi-Fi	BLE	802.15.4	DigiMesh	ZigBee	ZigBee SE
Low Power Consumption	✓ ✓		✓ ✓	✓	✓ ✓	✓	✓
Mesh Network	✓				✓ ✓	✓	✓
No Single Point of Failure	✓				✓		
Open Standard for Interoperability	✓	✓	✓	✓		✓	✓
Application Layer Defined					✓	✓	✓
Security	✓ ✓	✓ ✓		✓	✓	✓	✓ ✓
IPv6 Support	✓	✓					✓
Network Size	✓	✓			✓ ✓	✓	✓
Simple Provisioning	✓ ✓	✓ ✓	✓ ✓	✓	✓		



Summary

Thread is an advanced and interesting new wireless network protocol that provides some compelling advantages. Paired with ZigBee 3.0 and other application layer protocols, Thread will have a significant impact on the rapid growth of secure, distributed short-range RF networks and will ultimately lead to massive adoption across application and industry.

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