



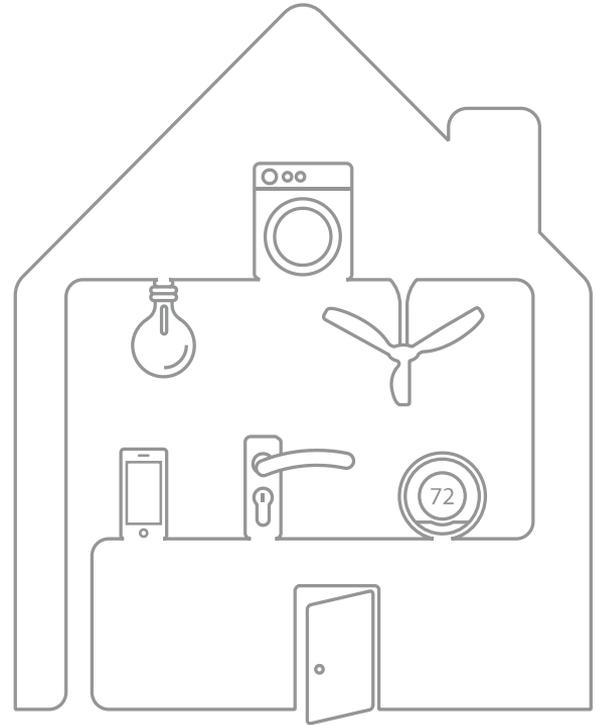
Thread's Value and Its Fit with oneM2M

June 2017

THREAD GROUP | Problem Statement

How do we securely and scalably connect an ecosystem of low power products to each other, to cloud services, and to consumers via their mobile devices supporting applications—including mission-critical ones—such as?

- Appliances
- Access control
- Climate control
- Energy management
- Lighting
- Safety
- Security



THREAD GROUP | Requirements

Requirements:

New wireless home network



Low power

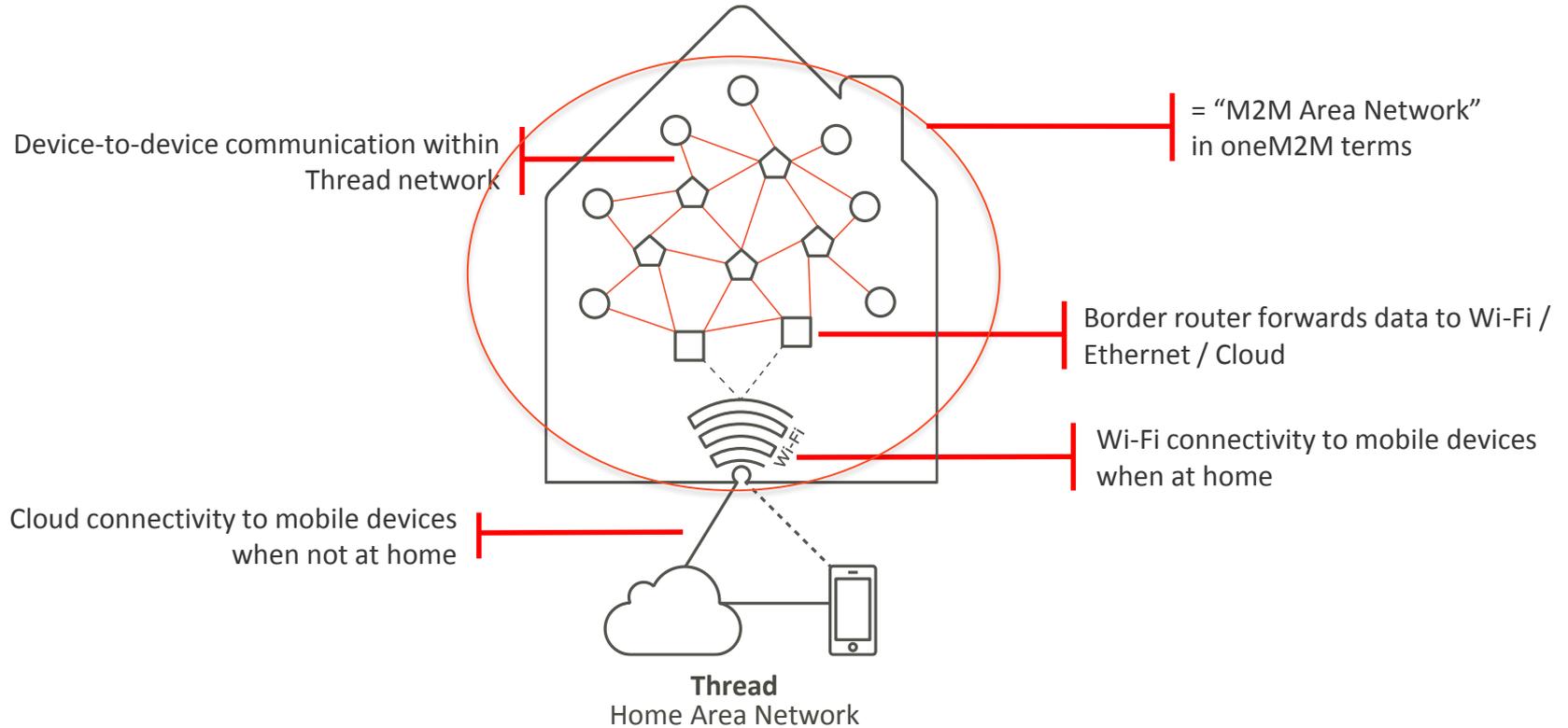
THREAD GROUP | Requirements

- ✓ No single point of failure
- ✓ Self-healing
- ✓ Interference robustness
- ✓ Self-extending
- ✓ Reliable enough for critical infrastructure

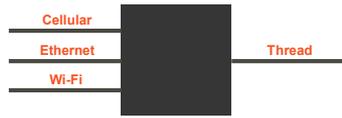
- Requirements:**
New wireless home network
- ✓ Low power
 - ✓ Resilient (mesh)
 - ✓ IP-based
 - ✓ Open protocol
 - ✓ Secure and user friendly
 - ✓ Fast time to market
 - ✓ Existing radio silicon



THREAD GROUP | Thread Home Area Network



THREAD GROUP | Network Topology Roles



Border Router

Forwards data to and from cloud/other networks

Provides optional Wi-Fi connectivity

Many

+



Thread Leader

Manages network parameters

Coordinates commissioners

Makes network decisions

One

+



Thread Router

Routes traffic among devices

Form the mesh topology

Eligible to become the Leader

Up to 32

+



End Device

Designed for low power operation

May be powered or sleepy

May be router-eligible if powered

Up to 511 per Router



Hundreds of Devices per Network

Benefits of Thread

THREAD GROUP | Internet Protocols Thread Uses

The Internet: Today, mostly “large” devices

	Large devices Mains powered Fast networks	
Applications	Internet / Web applications	
Web Transfer	HTTP	
Transport	TCP	
Security	TLS	
Addressing	IPv6 / IPv4	

THREAD GROUP | Internet Protocols Thread Uses

The Internet: Now available in “small!”

	Large devices Mains powered Fast networks 	Small devices Battery powered Constrained networks 
Applications	Internet / Web applications can work with large or small devices	
Web Transfer	HTTP	CoAP
Transport	TCP	UDP
Security	TLS	DTLS
Addressing	IPv6 / IPv4	6LoWPAN

THREAD GROUP | Need for IPv6



INTERNET PROTOCOL

Device-to-device, device-to-mobile and device-to-cloud

More application choices

Multiple ecosystems

No hub needed

End-to-end security

Eases development

Understood & available network management tools

Standards based

Unified convergence layer across all networks in the home and beyond

- Reuse software stacks

Enables direct device-to-device, device-to-mobile, and device-to-cloud, and one-to-many communication

- Nodes can communicate directly with each other and with multiple apps or backend services

Support for many application layers

- Any low bandwidth application layer that can run over IPv6 can run over Thread

THREAD GROUP | Many Wireless IoT Standards

Category 1: Connectivity layer

- Provide wireless connectivity
- Examples: Thread, Wi-Fi/HaLow, Zigbee PRO

Category 2: Application layer

- Provides interoperability with other devices or the cloud. Some can be run over multiple connectivity methods, or at different layers.
- Examples: IPSO, OCF (IoTivity), oneM2M, zigbee dotdot, many vertical-industry alliances

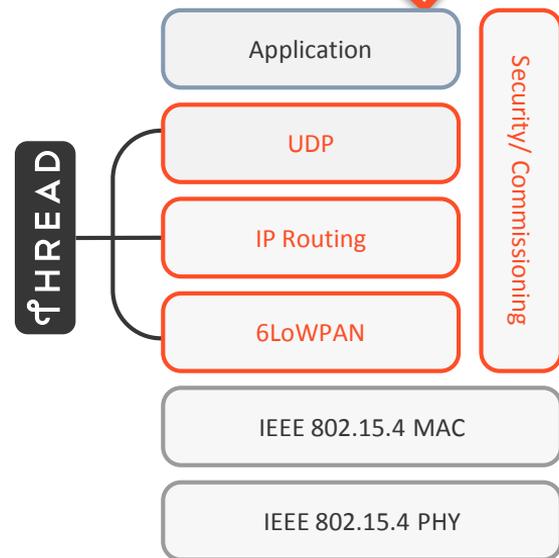
Category 3: Full-stack technologies – connectivity layer + application layer

- Examples: Bluetooth, zigbee 3.0, Z-Wave, ULE

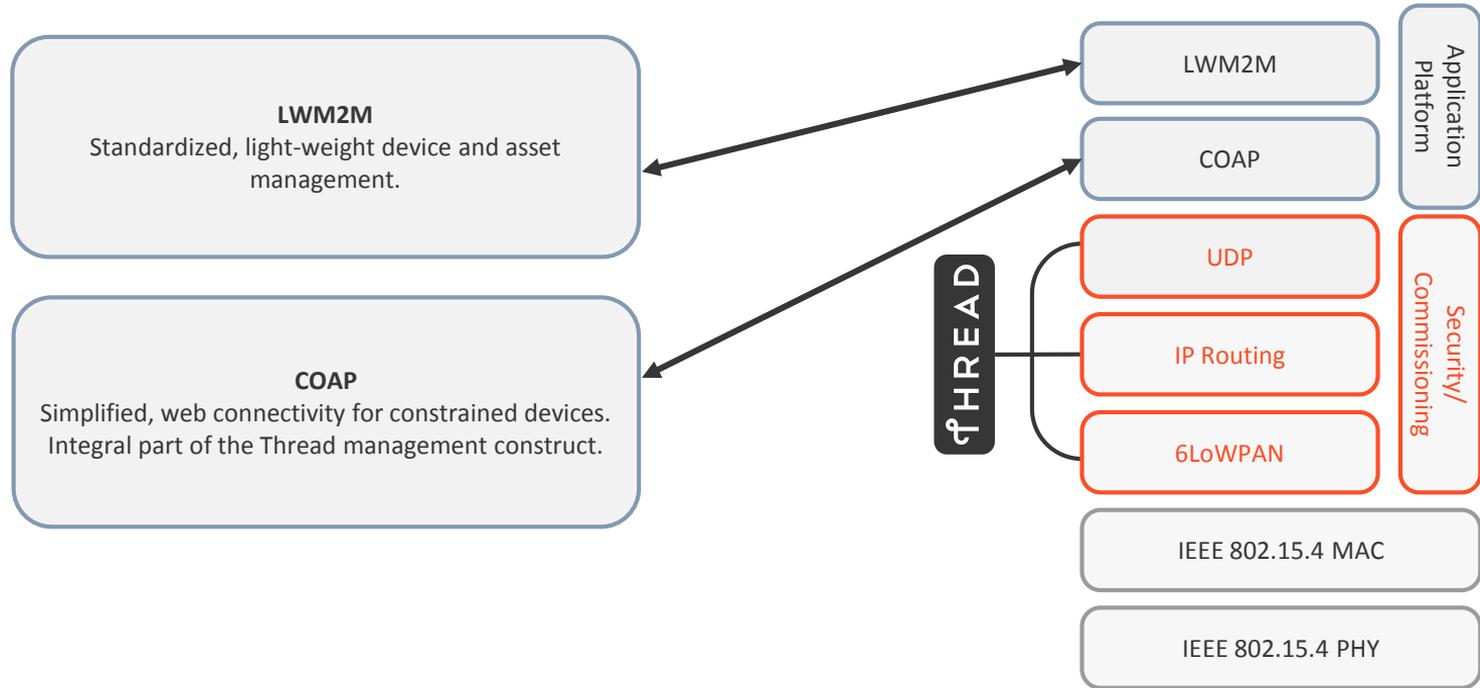
THREAD GROUP | Application Layer Diversity

Thread is an IP **network & transport** layer specification

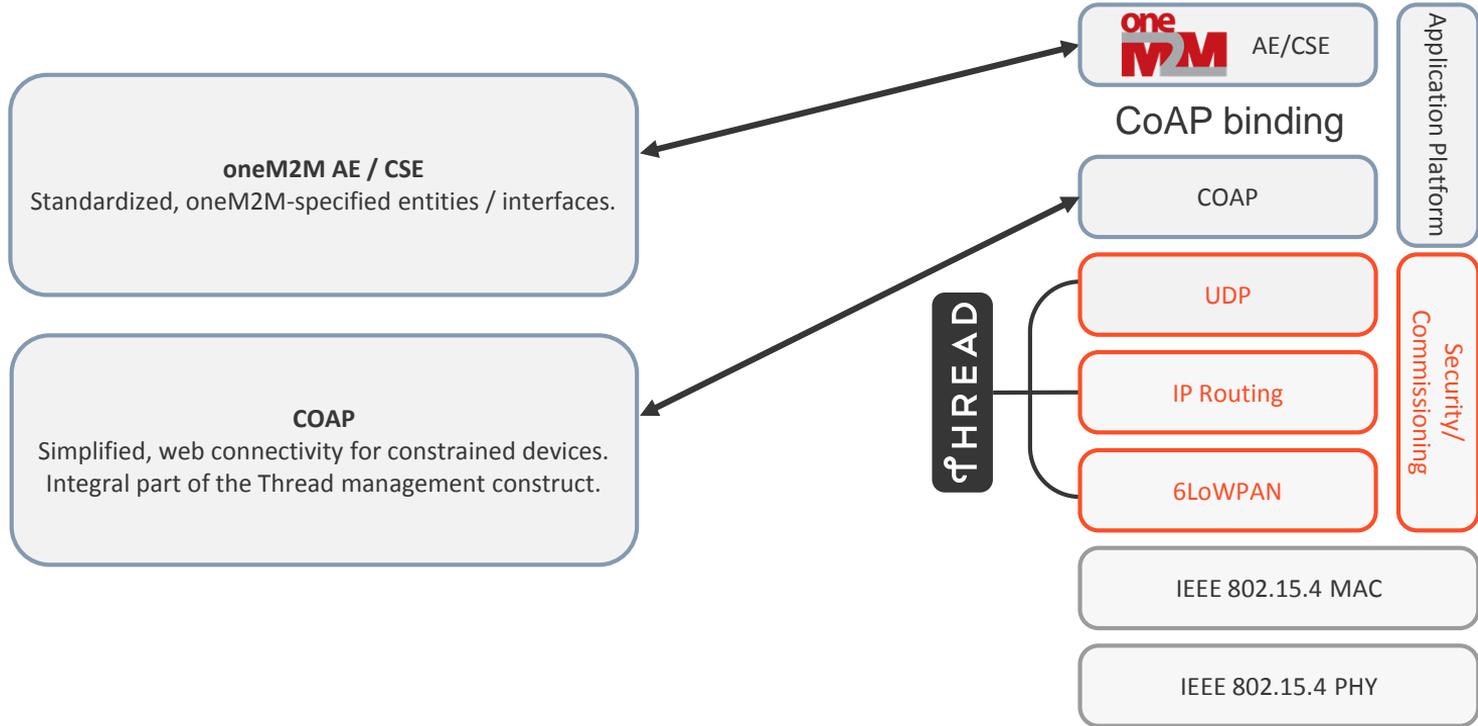
- Application Layer – A protocol & serializations for data models / information models running over an IP network layer
- Network layers – Ethernet, WiFi, cellular ... and Thread
- Application layers can use multiple IP networks – i.e. Thread and Wi-Fi
- Thread can support multiple application layers based on the use case and requirements
- App layers typically interoperate via services through public interfaces



THREAD GROUP | Thread and LWM2M



THREAD GROUP | Thread and oneM2M



THREAD GROUP | Synergies with oneM2M

Abstraction of connectivity

- Thread provides same type of connectivity and security as other UDP-capable transports
- Abstracts out the specifics of a meshed / 802.15.4-based network

Interworking / Integration

- oneM2M provides consistent application / service layer functionality across different types of connectivity with not need to be aware of any of the connectivity specifics.
- Common information models across different technologies create larger ecosystems (e.g. OCF & oneM2M over Thread)

Harmonized solution

- Target should be a harmonized solution with compatible transport and unified upper layers

THREAD GROUP | Need for security



SECURE

Link layer security

All network traffic is encrypted

Only authenticated nodes can
join the network

User-friendly commissioning

- **Simple Commissioning**
 - User authorizes devices onto the network using smart phone or web
 - Can be done on network if there is a device with a graphical interface
- **DTLS Security session**
 - Established between new device and commissioning device to authenticate and provide credentials
 - Once commissioning session is done, device attaches to network
- **Application level security**
 - Based on end-device requirements and application layer being used
- **MAC security used for all messages**

THREAD GROUP | Need for low power



LOW POWER

Extensive support for sleepy nodes

Based on power efficient IEEE 802.15.4 MAC/PHY

Short messaging conserves bandwidth and power

Streamlined routing protocol reduces network overhead and latency

- Designed from the ground up to enable extremely low power consumption and efficient device communication
 - Doesn't sacrifice a positive end-user experience
- Two technologies in particular, the 802.15.4 standard and 6LoWPAN, form the backbone of Thread's low-power solution.
 - 6LoWPAN provides a compression mechanism that reduces the IPv6 headers sizes sent over the air and thus reduces transmission overhead
 - 6LoWPAN layer has the ability to provide link-layer packet forwarding which provides a very efficient and low overhead mechanism for forwarding multi-hop packets in a mesh network
- Designed to run on readily available, low-power wireless system-on-chips

THREAD GROUP | Available Now



MARKET READY

Broad selection of silicon
shipping now

Four certified stacks

Publicly available specification

Active certification program
with fast-ramp tools
accelerating time to market

Global Solution

True **multi-vendor interoperability** between ≥ 3 stacks

Certification open with **four** certified stacks

Fast-ramp tools provided to speed time to market: Thread Commissioning App, Test Harness, Extensions for automated testing and Wireshark

ARM[®]

NXP

openthread
released by Nest


SILICON LABS[®]

THREAD GROUP | No Single Point of Failure



RELIABLE

True mesh network

No single point of failure

Self-healing

Better end user experience

Lower support structure
required

- Dynamic Leaders
 - If Leader fails, another Router will become Leader
- Router Promotion
 - Leader can promote Router Eligible devices to Routers to improve connectivity if required
- Multiple Border Routers can be used for off network access
 - Devices operate without Border Router
- Border Router can be anything with an 802.15.4 radio and another physical layer
 - Home Wi-Fi router
 - Set top box
 - Smart Thermostat (802.15.4 and Wi-Fi)

THREAD GROUP | Thank You!

Sign up for our newsletter to get quarterly updates

 SIGN UP FOR OUR NEWSLETTER

For more information, please connect with us:

- help@threadgroup.org
- www.threadgroup.org
- [linkedin.com/company/thread-group](https://www.linkedin.com/company/thread-group)
- @TheThreadGroup
- Check out Thread Group's Blog!



WHAT IS THREAD?

Thread was designed with one goal in mind: to create the best way to connect & control products in the home.

 Built on Thread

 WATCH VIDEO

The banner features a central orange background with white text and icons. The top and bottom edges are decorated with a series of white line-art icons representing smart home devices: a light switch, a light bulb, a window blind, a smart speaker, a smartphone, a smart plug, a plant, a smart light, a house, a smartphone, a smart thermostat, a smart door handle, a smart washing machine, a smart radiator, a smart door, and a smart faucet.