Thread's Value and Its Fit with oneM2M

June 2017
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
Requirements:
New wireless home network

✔️ Low power
Requirements:
New wireless home network

- Low power
- Resilient (mesh)
- IP-based
- Open protocol
- Secure and user friendly
- Fast time to market
- Existing radio silicon
Device-to-device communication within Thread network

Border router forwards data to Wi-Fi / Ethernet / Cloud

Wi-Fi connectivity to mobile devices when at home

Cloud connectivity to mobile devices when not at home

Thread Home Area Network

= “M2M Area Network” in oneM2M terms
**Thread Group | Network Topology Roles**

**Border Router**
- Forwards data to and from cloud/other networks
- Provides optional Wi-Fi connectivity

**Thread Leader**
- Manages network parameters
- Coordinates commissioners
- Makes network decisions

**Thread Router**
- Routes traffic among devices
- Form the mesh topology
- Eligible to become the Leader

**End Device**
- Designed for low power operation
- May be powered or sleepy
- May be router-eligible if powered

Many + One + Up to 32 + Up to 511 per Router = Hundreds of Devices per Network
Benefits of Thread
The Internet: Today, mostly “large” devices

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<tr>
<th>Applications</th>
<th>Internet / Web applications</th>
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<tr>
<td>Web Transfer</td>
<td>HTTP</td>
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<td>TLS</td>
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<td>Addressing</td>
<td>IPv6 / IPv4</td>
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The Internet: Now available in “small!”

<table>
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<tr>
<th>Applications</th>
<th>Large devices</th>
<th>Small devices</th>
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<td>Mains powered</td>
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<td>Fast networks</td>
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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
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 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
LWM2M
Standardized, light-weight device and asset management.

COAP
Simplified, web connectivity for constrained devices. Integral part of the Thread management construct.
oneM2M AE / CSE
Standardized, oneM2M-specified entities / interfaces.

COAP
Simplified, web connectivity for constrained devices. Integral part of the Thread management construct.

Thread and oneM2M

CoAP binding

COAP
UDP
IP Routing
6LoWPAN

IEEE 802.15.4 MAC
IEEE 802.15.4 PHY
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 no 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
Need for security

• 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
Need for low power

- 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
True **multi-vendor interoperability** between $\geq 3$ 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
No Single Point of Failure

• 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)
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