

IoT Gateway Blueprint with Thread and Matter

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**Name 3 things that come to your
mind when hearing IoT Gateway.**



Predicted Answers

- Connectivity: WiFi, Bluetooth, ZigBee, Z-Wave, ...
- One box for each system you use
- Not ***another*** one, please!
- Turn on and forget (to update)



Predicted Answers (primed)

- OpenThread
- Matter (former CHIP, Connected Home over IP)
- IPv6 as end-to-end solution all the way from backend to sensor
- Keep these devices ***updated***, please!



Agenda

- A discussion session, not a talk
- Ideas and implementations for an IoT gateway blueprint
- OpenThread and Matter open source projects
- IPv6 connectivity
- Zephyr nodes
- Assisted OTA service for nodes



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Context



IoT Gateway Blueprint

- Partners interest in reducing R&D costs by not having one hub each
- Could the zoo of smart IoT hubs be reduced?
- Ignoring branding and vendor lock-in topics here, technology only!
- Brainstorming on current landscape and technologies available and/or upcoming



All Scenarios OS Gateway

- Based on All Scenarios OS (ASOS) with Yocto and Linux
- WiFi AP functionality, headless WiFi onboarding (maybe BLE, PWA)
- OpenThread Border Router service (Threadgroup Android app)
- Basic Web UI
- Sysotad is running for updates
- Able to host containerized services to enable device-specific services
- Matter protocol support

<https://git.ostc-eu.org/OSTC/requirements/-/issues/13>



(Brave) Future Prediction

- The usual bundle of IoT gadget and companion hub will slowly fade
- We will ***not*** end up with a single IoT gateway for all devices :-/
- Non-IP(v6) based IoT protocols will fade away
- Devices have a mandatory update mechanism (not a bold prediction as it gets backed up by laws)



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Discussion



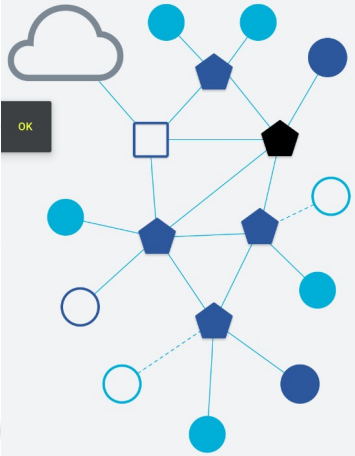
Discussion Topics

- Aim for end-to-end solution without translating proxies on the hub e.g. IPv6 from device to device or cloud
- IPv6-only solutions (OpenThread, Matter)
- Native IPv6 in a home setting e.g. prefix delegation from ISP router
- NAT64 for IPv4-only transit networks (tayga, jool)
- Sandboxes for vendor specific code (e.g. backend connection, updates, etc) to avoid an extra hub for just software



OpenThread

- Very active Open Source project (BSD3, but CLA)
- Border Router on Linux
- OpenThread nodes on Zephyr
- Product and app compatibility
- System plumbing for build, configuration and networking



Features

OpenThread implements all Thread networking layers (IPv6, 6LoWPAN, IEEE 802.15.4 with MAC security, Mesh Link Establishment, Mesh Routing) and device roles, as well as Border Router support.

APPLICATION SERVICES

- IPv6 configuration and raw data interface
- UDP sockets
- CoAP client and server
- DHCPv6 client and server
- DNSv6 client

CO-PROCESSOR SUPPORT

- Spinel, a general purpose Co-Processor protocol
- OT Daemon, a user-space Radio Co-Processor network interface driver/daemon
- Sniffer support via Spinel nodes

ENHANCED FEATURES

- Child Supervision
- Inform Previous Parent on Reattach
- Jam Detection
- Periodic Parent Search

BORDER ROUTER

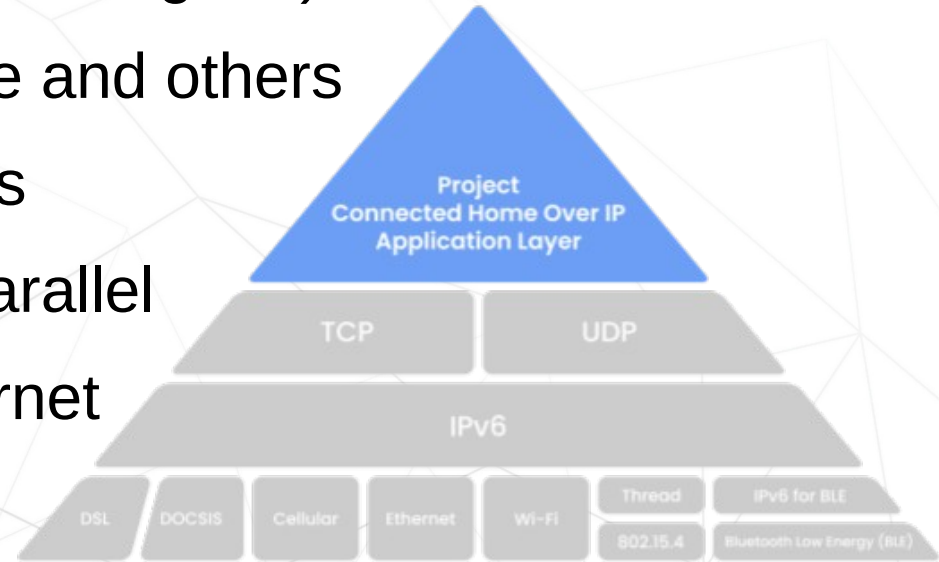
- Bidirectional IPv6 reachability between Thread and Ethernet/Wi-Fi
- Bidirectional DNS-based service discovery between Thread and Ethernet/Wi-Fi
- Extending Thread mesh over Ethernet/Wi-Fi links

Source: <https://openthread.io/>



Matter

- Connectivity Standards Alliance (former Zigbee)
- Driving companies are Google, Apple and others
- Final specification is work in progress
- SDK and test events developed in parallel
- Connectivity: WiFi, Thread and Ethernet
- IPv6 based

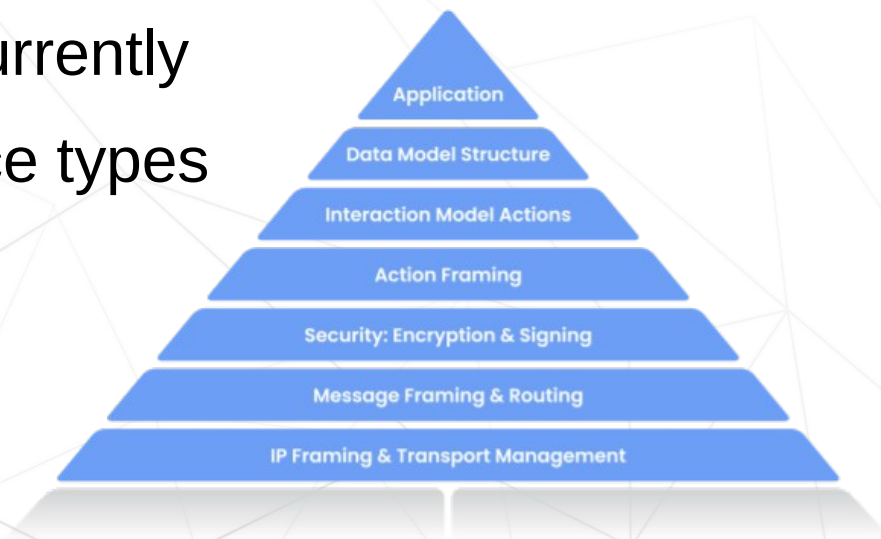


Source: <https://github.com/project-chip/connectedhomeip/>



Matter

- Active Open Source project (Apache 2)
- Fast moving target, hard to integrate currently
- Application layer, data model and device types
- Using Zigbee cluster library
- To much development discussions in members-only forums :-)



Source: <https://github.com/project-chip/connectedhomeip/>



IPv6-only Protocols

- 6lowpan paved the way for IPv6 on low-power standards e.g. ieee802154 in OpenThread
- IPv6 as default in new protocols like Matter as well
- We start to see IPv6-only IoT networks like we have seen IPv6-only data-centers before
- Some transition techniques could be re-used



IPv6

- Overview and interesting attributes for discussion
- Native IPv6 connectivity, prefix delegation
- NAT64 to transit through IPv4-only networks (e.g. your ISP)
- Tayga, jool or similar
- Connecting stub networks IETF draft

<https://datatracker.ietf.org/doc/html/draft-lemon-stub-networks-02>



Updated IoT Devices

- Mandatory update functionality by law is coming in some countries
- ASOS approach: direct OTA on powerful devices and assisted-OTA on devices that could not spare the resources
- Updates: Protocol specific vs application specific vs platform specific
- ASOS will provide platform specific updates
- Application and protocol specific can come through containerized services



Zephyr & Linux

- On the ASOS side we build for both from Yocto
- Gateway would be Linux, but sensors most likely Zephyr
- Sharing of projects and libraries: mbedtls, openthread, matter



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Thanks!



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Appendix



ieee802154 mlme

- Advanced functionality like scanning, joining, network coordinator, etc needs support for command and beacon frame processing
- Over the years various parties started work but it never found its way into mainline
- To make linux-wpan an option for real-world deployments this will be needed



Native ieee802154 Transport

- OpenThread as border router runs natively on Linux
- It uses a radio co-processor or network co-processor architecture where Linux networking is only involved on top
- PHY, MAC, 6lowpan are all firmware or userspace driven
- Alex mentioned raw frames with AF_PACKET which would, again, circumvent parts of the kernel stack
- More functionality needed if we want a linux-wpan OpenThread platform abstraction