

# Tock and Thread Networking

**Tyler Potyondy**, UC San Diego  
tpotyondy@ucsd.edu

# What is Thread Networking?

Thread is a low power, secure and future-proof mesh networking technology for IoT products.



## BUILT FOR IOT

Low power, secure and robust wireless mesh built on IP



## CONVERGENCE & COEXISTANCE

IP as a point of convergence



## GLOBAL SOLUTION

Open standard for smart homes and buildings



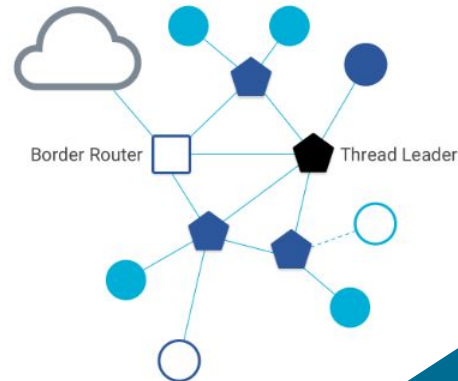
## FLEXIBLE & FUTURE PROOF

Enabling interoperability

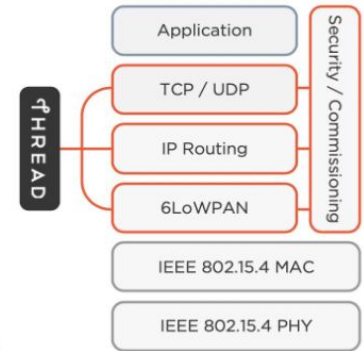
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# What is Thread Networking?

- Thread builds a networking layer on top of 802.15.4
- Utilizes IPv6 routing for each node, allowing for interoperability with existing networks
- Combines star and mesh topologies to provide a robust network

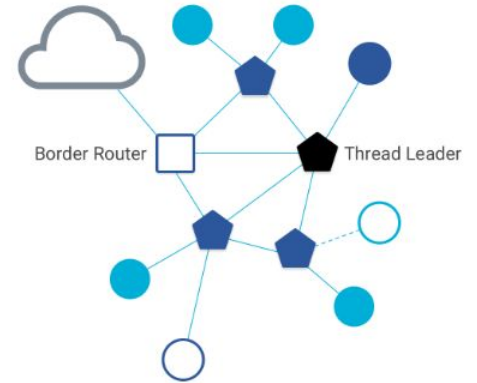


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Thread can support many application layer protocols

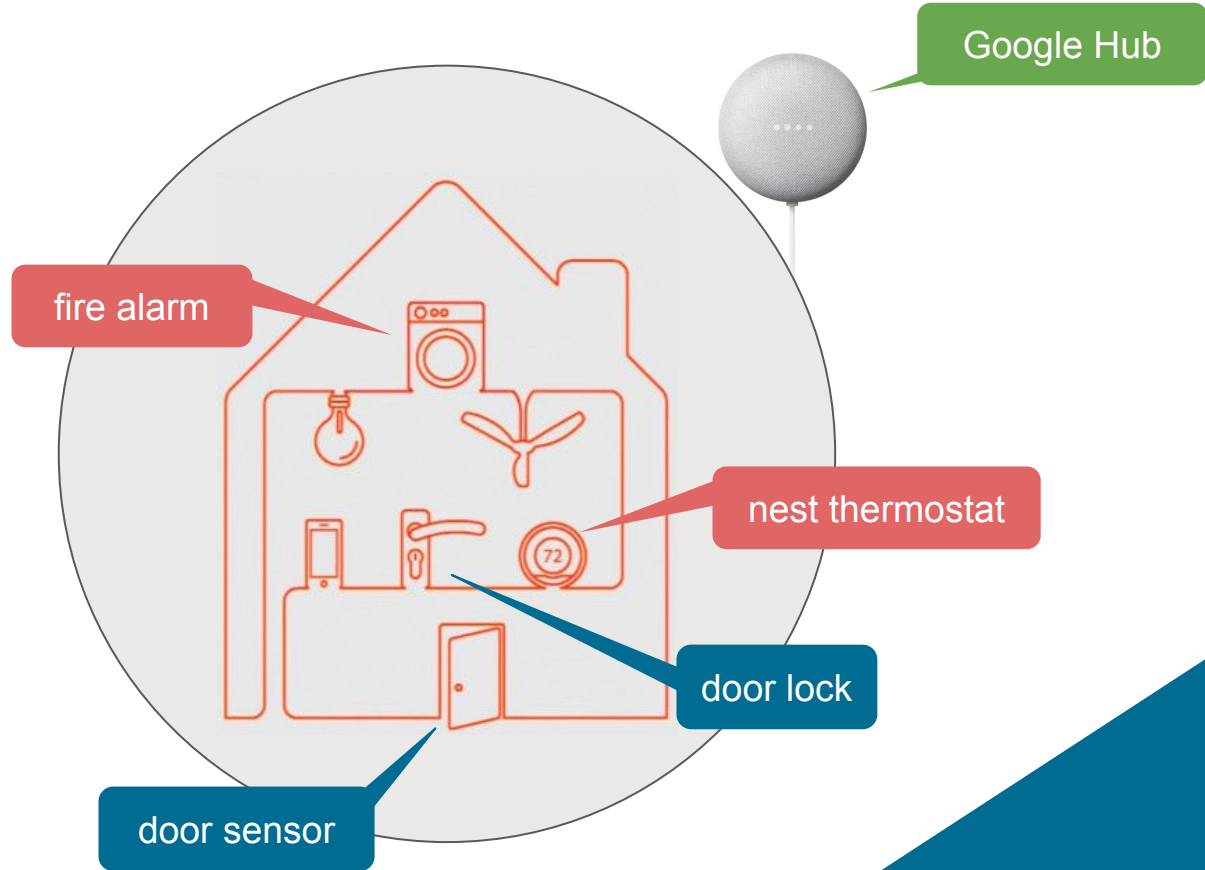


# Thread Networking - Node Types

- **Border Router**
  - Node providing bridge from Thread network to external internet
- **Router**
  - Responsible for maintaining network topology
  - Forwards packets for network devices
  - Mesh communication with other routers
  - Power intensive node
- **Child**
  - Communicates with one router
  - Does not forward packets
  - Can disable transceiver to enter low power state (sleepy end device)

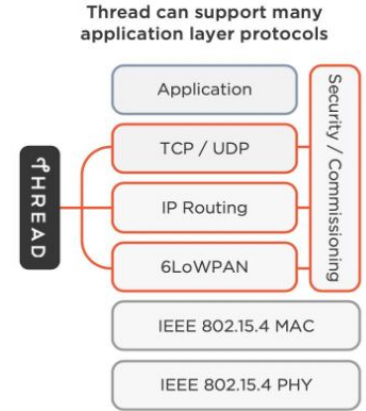


# Example of Real World Thread Network



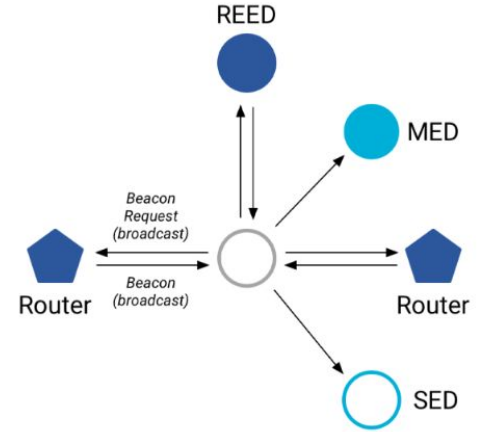
# Thread Networking and Tock

- Tock currently supports each networking layer theoretically required for deploying a Thread network
- Tock implements the AES128-CCM encryption needed to secure Thread payloads
- Can we add kernel support for Thread networking?



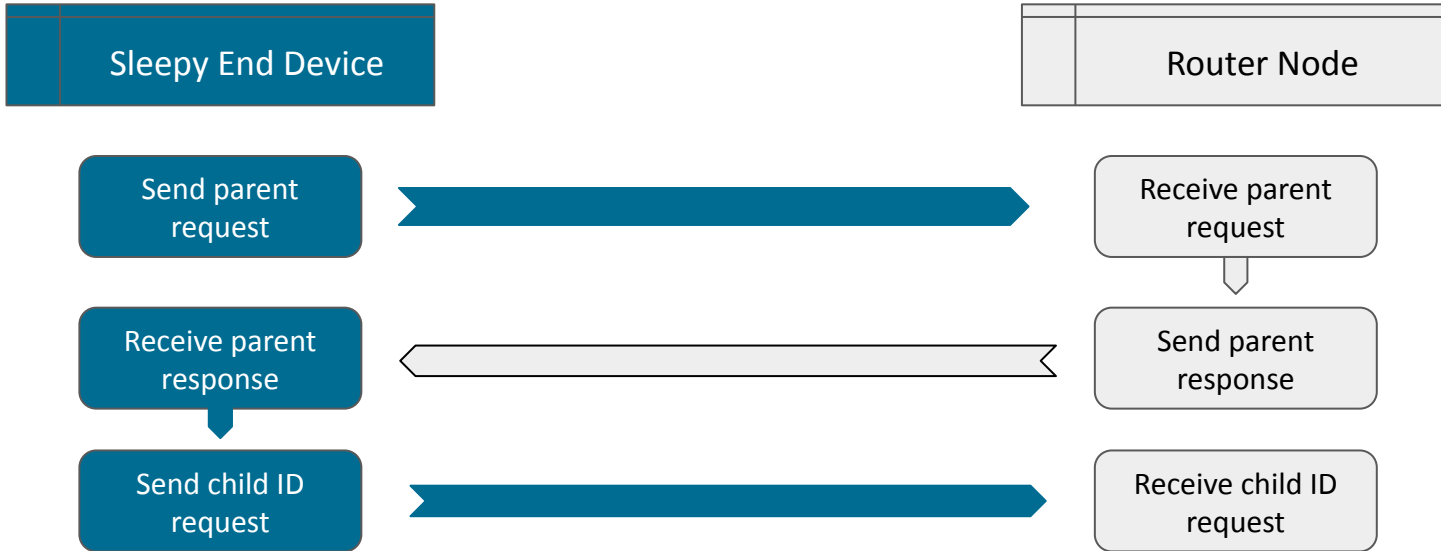
# Tock – Sleepy End Device

- A sleepy end device (SED) is the simplest of Thread node types
- OpenThread is Google's open source implementation of the Thread networking specification
- **Goal:** Tock kernel level support to successfully join an OpenThread network



OPENTHREAD  
released by Google

# Tock – Sleepy End Device





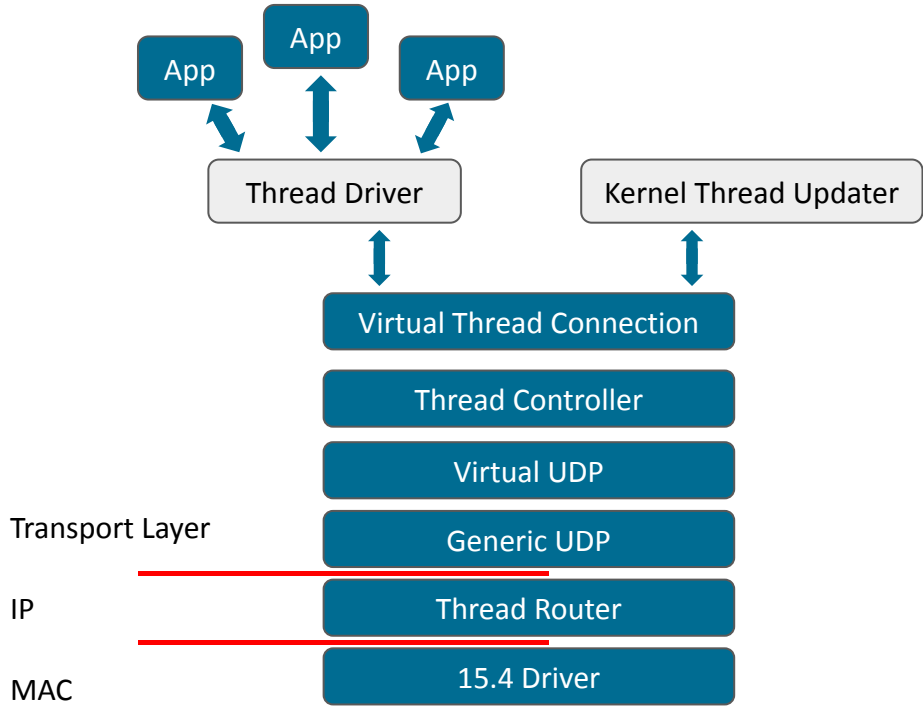
# Tock – Sleepy End Device

Successfully performed “handshakes” required for OpenThread to recognize a Tock SED as a node in the Thread network

Successfully proved that the Tock networking stack and AES128-CCM encryption can support a Thread network

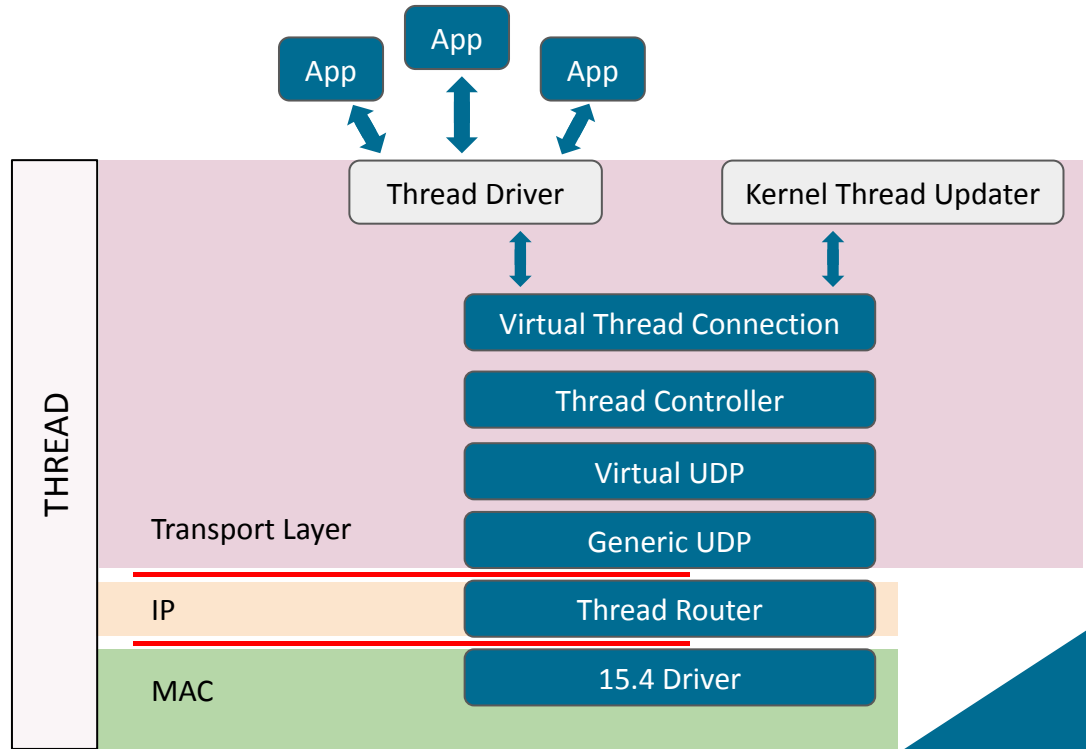
# Open Questions/Current Work

How to best design the Thread Networking Capsule to be generalizable?



# Open Questions/Current Work

**Unique Challenge:**  
Thread spans 3 layer of  
the networking stack



# Open Questions/Current Work

How to best track the device's Thread network state?

Will the kernel's sharing of cryptographic resources lead to starvation and subsequently dropped packets?

Should each device support multiple distinct Thread networks?

How to best incorporate Thread across the networking stack?

Should all apps be allowed to access the Thread Network?  
Should we possess a means to differentiate access?

# Questions?