Introduction to Thread

OpenThread Workshop Shanghai

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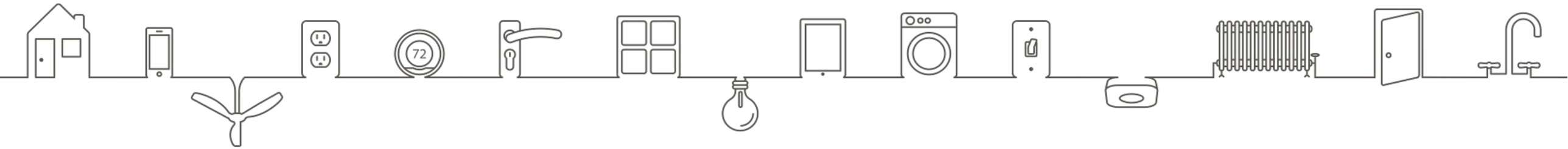
Nest

Create a home that’s thoughtful – one that takes care of the people inside it and the world around it.

Problem

How to **securely** and **scalably** connect an ecosystem of **low-power** products end-to-end, to cloud services, and to consumers?



Requirements

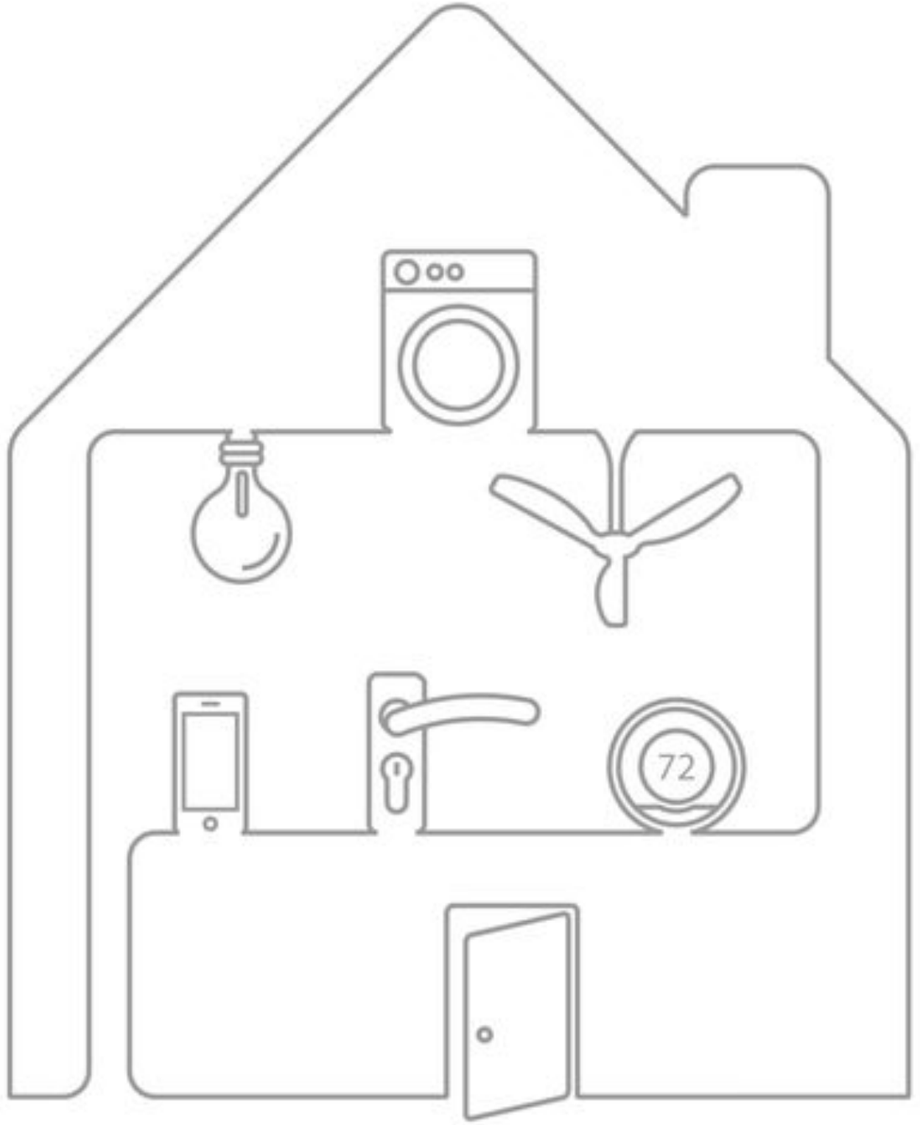
IP-based

Scalable

Resilient

Low power

Secure



No existing technology satisfied the requirements

Others agreed

DoB: July 2014

What is Thread?

What is Thread?

1

Built for IoT

Securely and reliably connect products in homes and buildings.

2

IPv6-based protocol

End-to-end device-to-device, device-to-mobile, and device-to cloud connections.

3

Built-in security

Provides security at the network layer.

4

Low energy footprint

Based on the power-efficient IEEE 802.15.4 MAC/PHY.

5

Market ready

Broad selection of silicon, stacks, and components globally.

Thread in Homes

Appliances

Access control

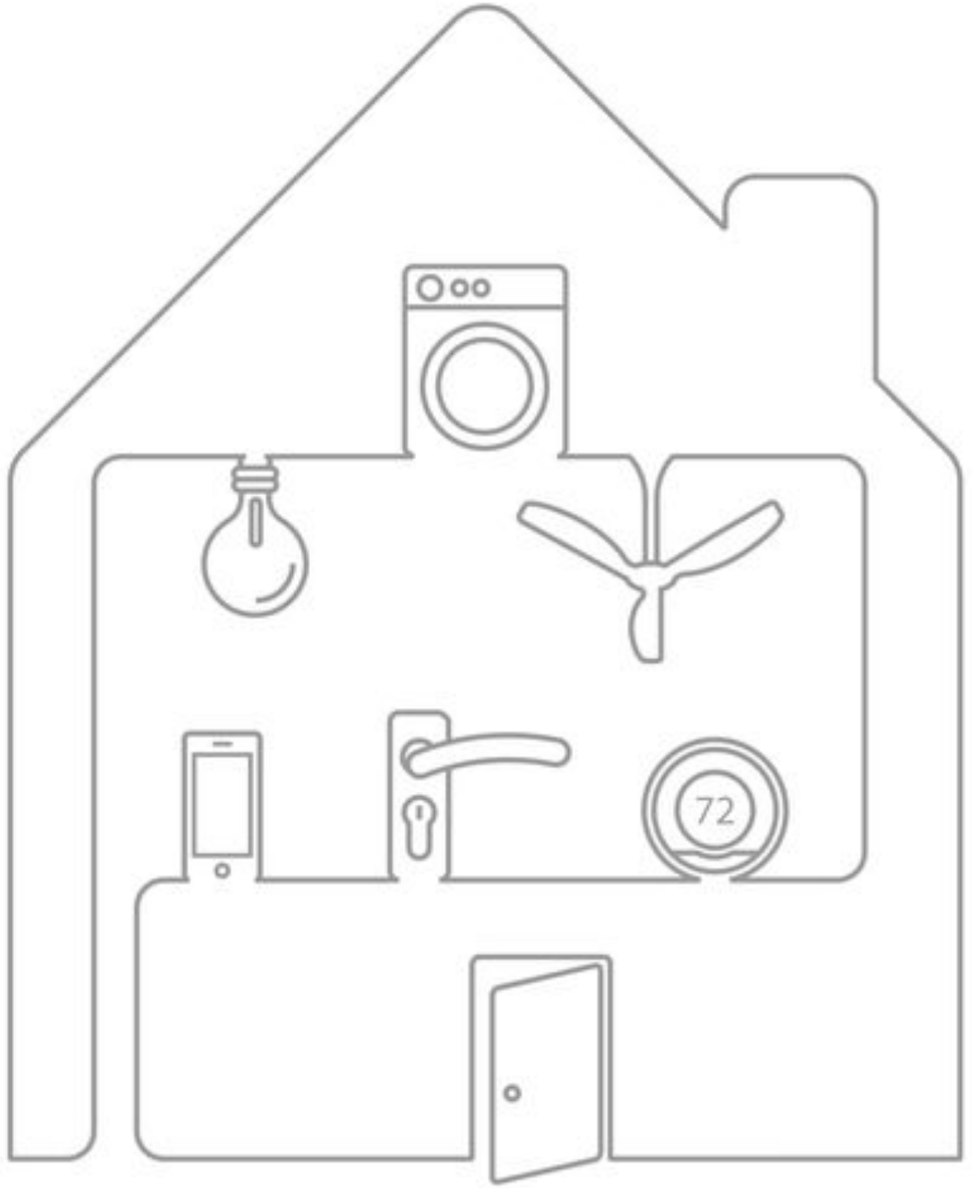
Climate control

Energy management

Lighting

Safety

Security



Beyond the Home

Office Buildings

Hotels

Factories

Universities

Outdoor

Smart Cities

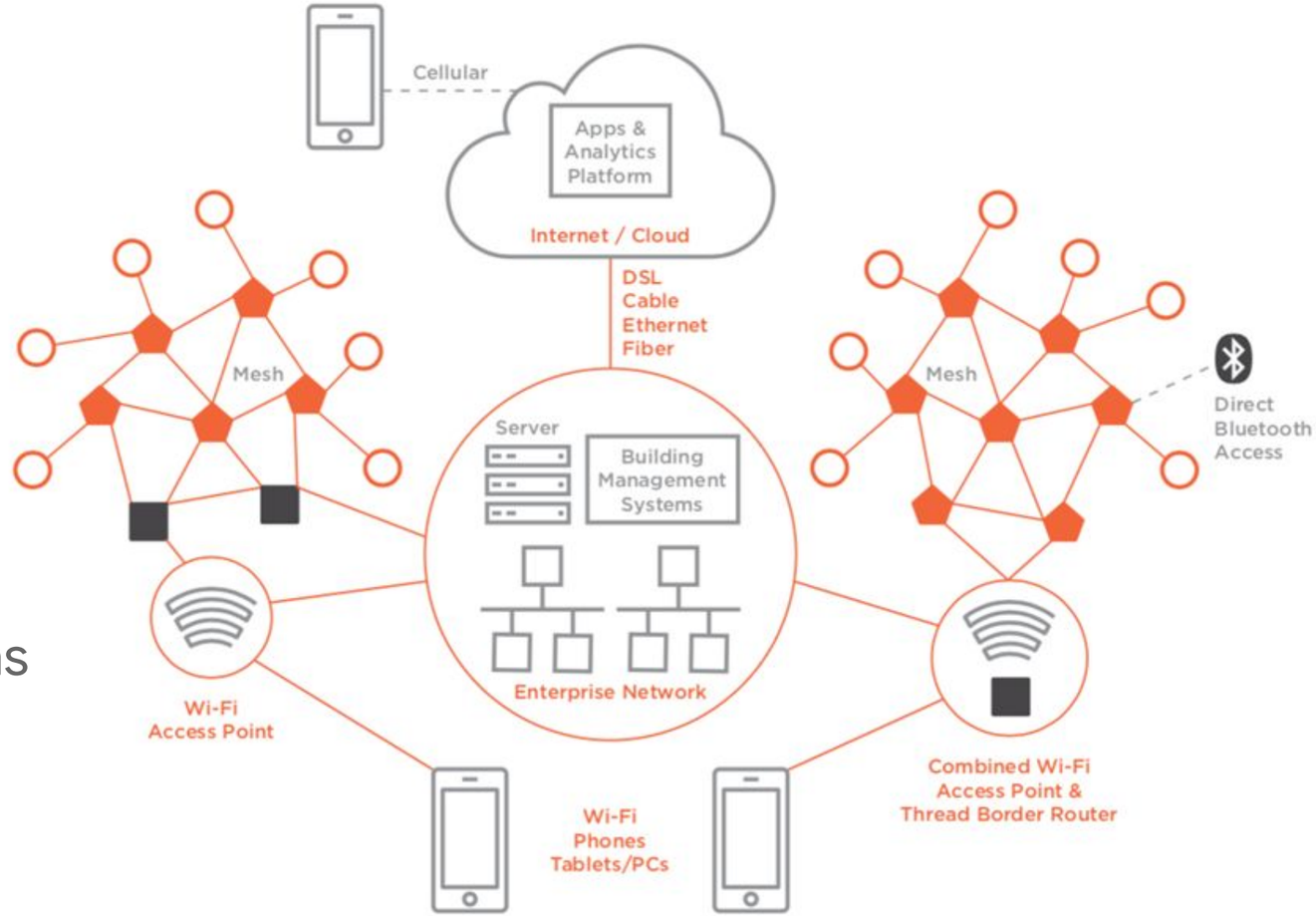
Thread in Commercial

Enterprise-level security

Scaling up to thousands of devices

Automatic roaming to nearby networks

Easy handoff from installers to network admins



Who is Thread?

Thread Group is...

1

A technology alliance, not just another standards defining organization (SDO).

2

A nonprofit market education group promoting Thread's use in connected products.

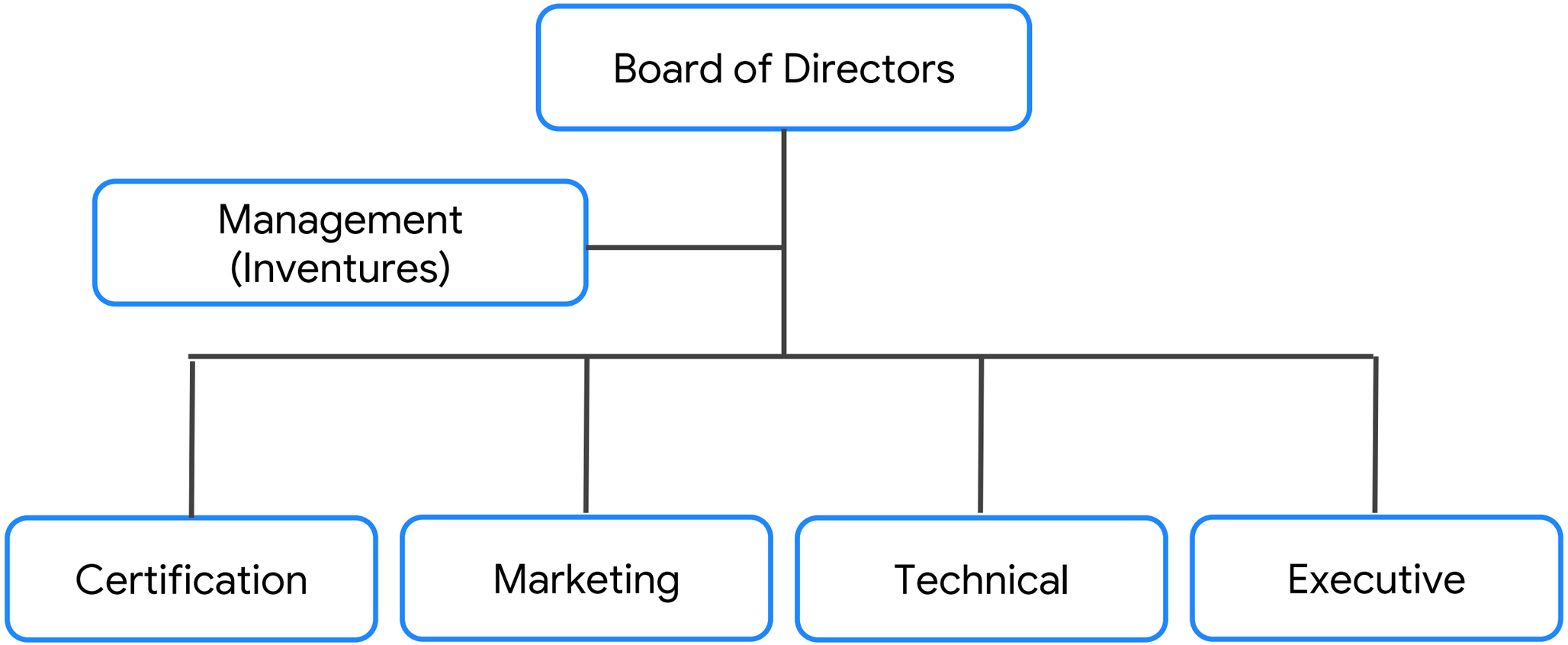
3

Ensuring a great user experience through rigorous, meaningful product certification.

Board of Directors and Team

President	Grant Erickson	Google
VP of Marketing	Sujata Neidig	NXP
VP of Technology	Jonathan Hui	Google
Treasurer	Kevin Kraus	Yale
Secretary	Bill Curtis	ARM
Director	Vividh Siddha	Apple
Director	Pär Håkansson	Nordic Semiconductor
Director	Arnulf Rupp	OSRAM
Director	Rolf De Vegt	Qualcomm
Director	Cam Williams	Schneider Electric
Director	Klaus Wächter	Siemens
Director	Skip Ashton	Silicon Laboratories
Director	Jean-Michel Orsat	Somfy
Director of Certification	Tom Sciorilli	Thread Group

Organization Structure



Intellectual Property

Copyrights and Trademarks

Licensed to participants royalty free.

Other Intellectual Property policy

Policy designed to maximize adoption of Thread.

Applies to all Thread members.

Commitment to grant RAND-RF (royalty free) license to members for essential patents.

Membership Benefits

Access to technology and specification

Access to intellectual property

Access to Thread Certification program

Use of Thread Test Harness

Participation in Marketing and PR campaigns

Participation in committees

Networking with an ecosystem of companies

Membership Tiers

Membership Benefits	Academic	Affiliate	Contributor	Sponsor
Receive member communications	✔	✔	✔	✔
Access to members only website	✔	✔	✔	✔
Use of alliance member logo	✔	✔	✔	✔
Participation in press articles & interviews	✔	✔	✔	✔
Access final specification / documents	✔	✔	✔	✔
Access draft specification / documents	✔	✔	✔	✔
Access to intellectual property			✔	✔
Participation in general or annual meetings			✔	✔
Participate and vote in committees and work groups			✔	✔
Certify compliant products and utilize certification logo			✔	✔
Access to Thread Reference Commissioning App			✔	✔
Approve operating budget				✔
Approve final specification / documents				✔
Initiate work groups or committee				✔
Automatic Seat on Board of Directors				✔
Annual fee	$0K	$2.5K	$15K	$100K

Thread Group Liaisons

CABA	Marketing
EEBus	Application Framework
Fairhair Alliance	Standards
KNX	Application Framework
Linaro	Marketing
OCF	Application Framework
Zigbee Alliance	Application Framework

> By 2023, 4.5 billion cumulative 802.15.4 mesh devices will be sold worldwide. The majority of these will use smart home protocols such as Zigbee and Thread.

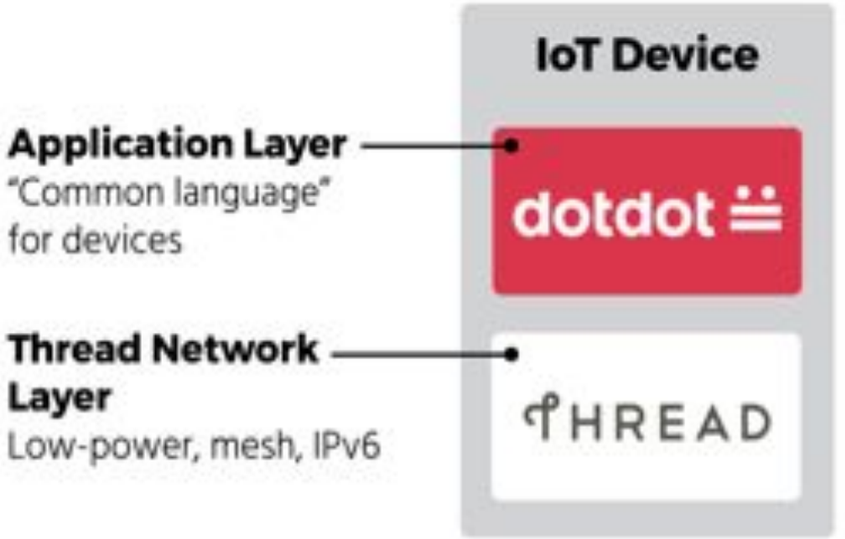
ON World

Thread + dotdot

dotdot's common device language over Thread's IP network brings this foundation for innovation to the Internet of Things

The first open, interoperable device language running over an IP network.

Open, universal protocols like HTTP over IP unlocked and accelerated innovation on the Internet.



Thread Protocol Fundamentals

Thread Protocol

An **open, IPv6-based, low-power, and secure mesh** networking technology for IoT products.

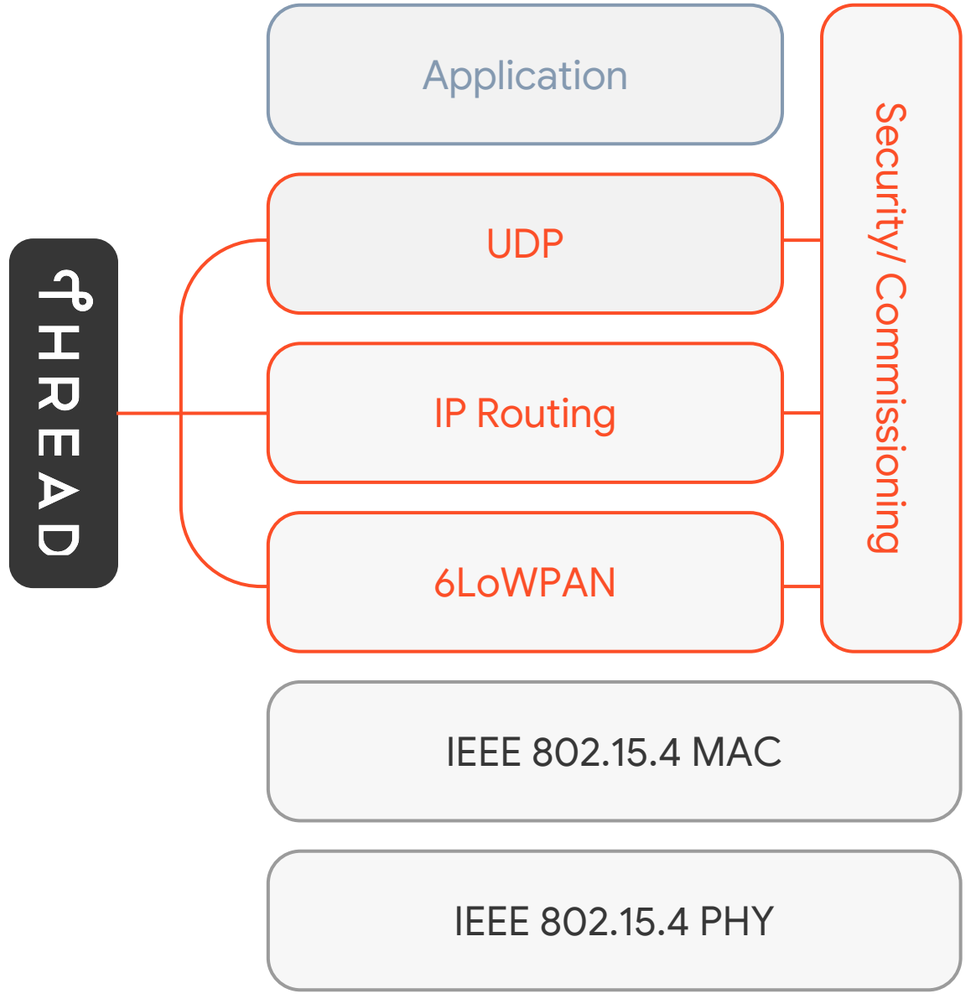
Built on the **same IP technology** that drives every Internet-connected device, but designed specifically for the needs of IoT devices.

Builds on Existing Technologies

Same radio used by ZigBee.

Fast time to market.

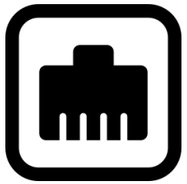
Low-cost implementations.



Why IP?

A converged network layer

Build **end-to-end applications** that utilize **multiple link technologies**



Why IP?

A multi-service network

Host **multiple applications** using a **common network infrastructure**

Scalable Mesh

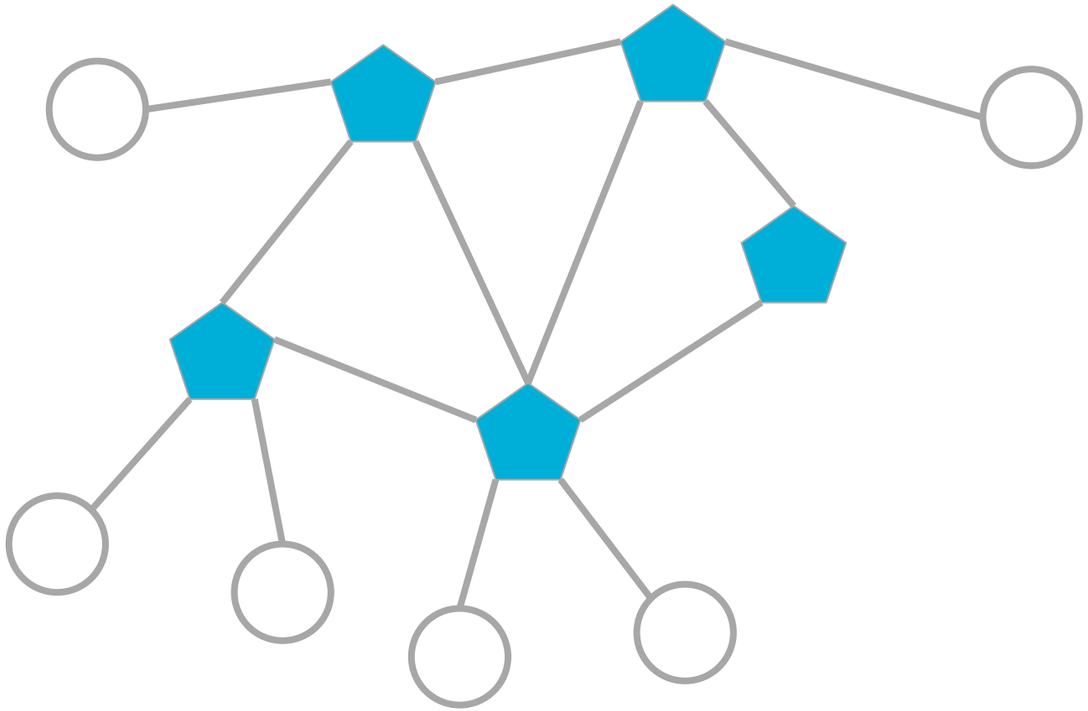
Routers forward messages between neighbors

Up to 32 per network

End devices communicate via a router

Up to 511 per router

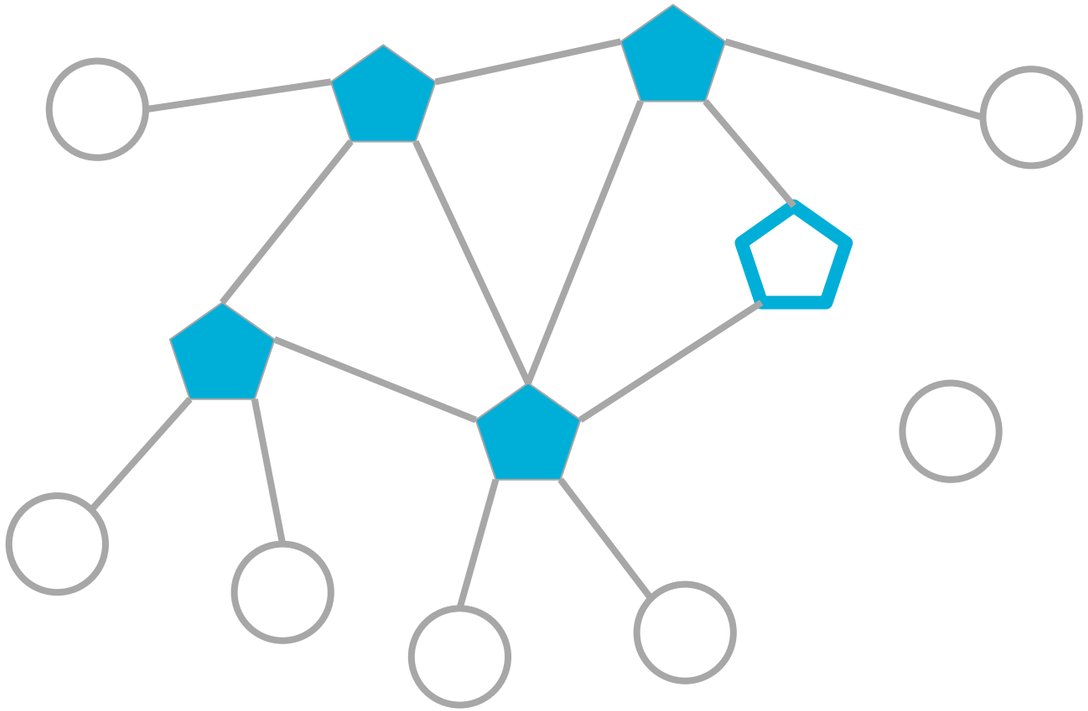
Hundreds of devices per network



Self-Configuring Routers

Add to **increase connectivity and range**

Remove to **reduce redundant connectivity**



Resilient Mesh Routing

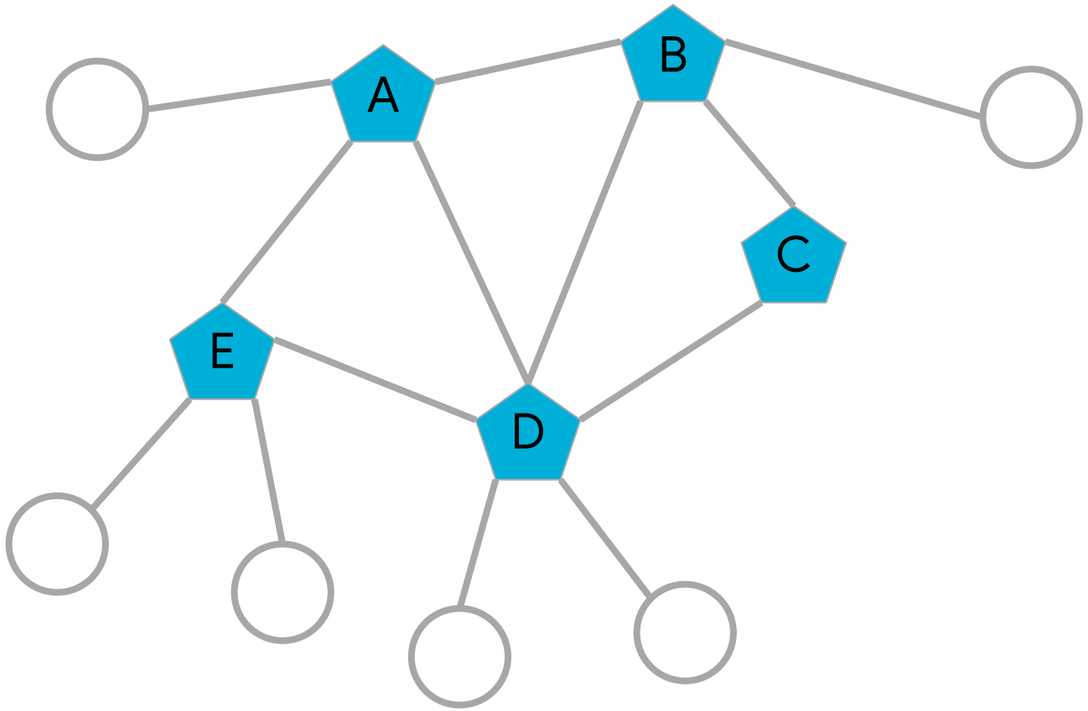
Shortest-path any-to-any routing

Distance-vector routing protocol

Similar to RIP

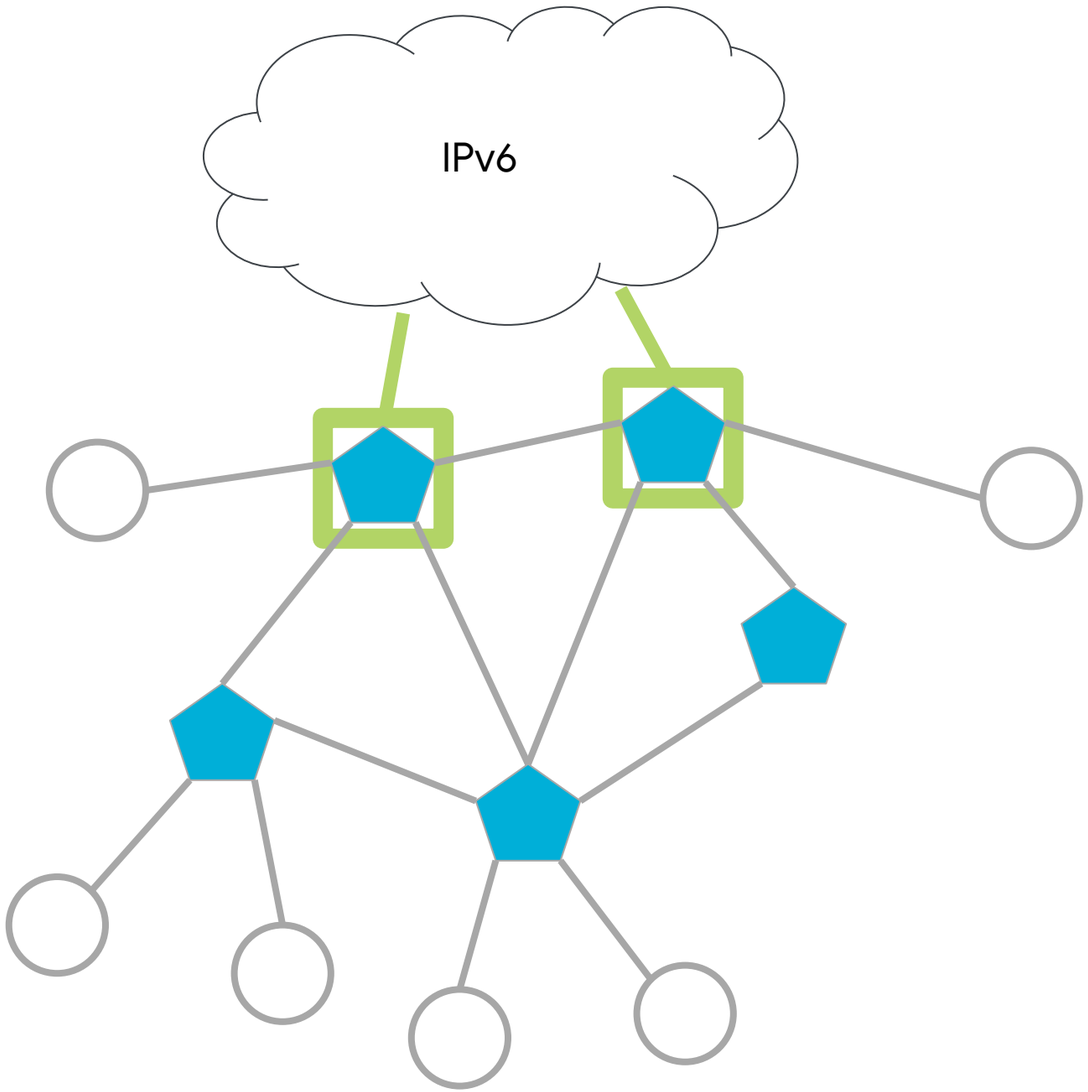
Maintain and advertise best next hop towards each Thread Router.

Dest	Next	Cost
B	B	1
C	B	2
D	D	1
E	E	1



Resilient Border Routing

Multiple border routers to connect Thread to non-Thread networks.

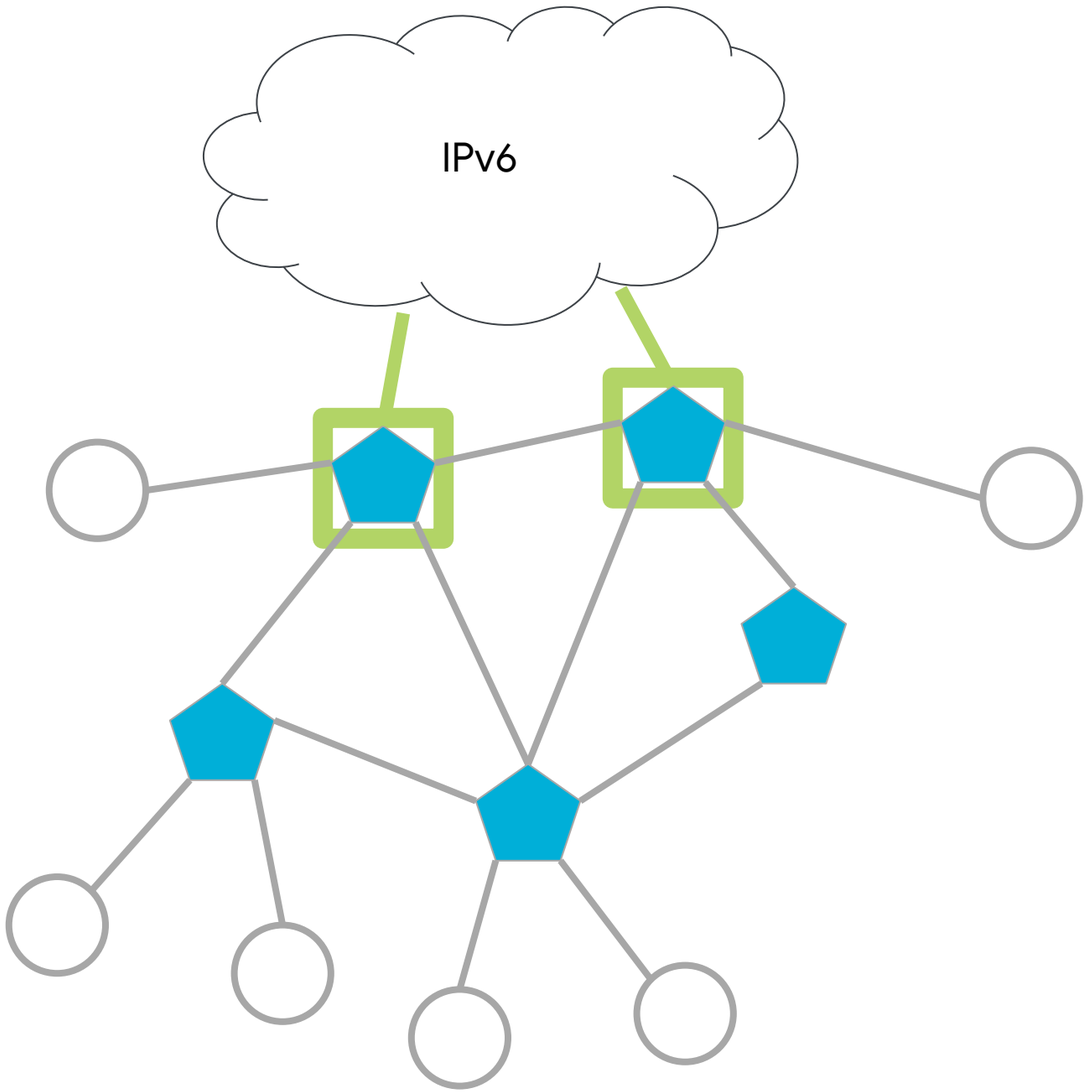


Low Power

Receive power **one-tenth of WiFi**

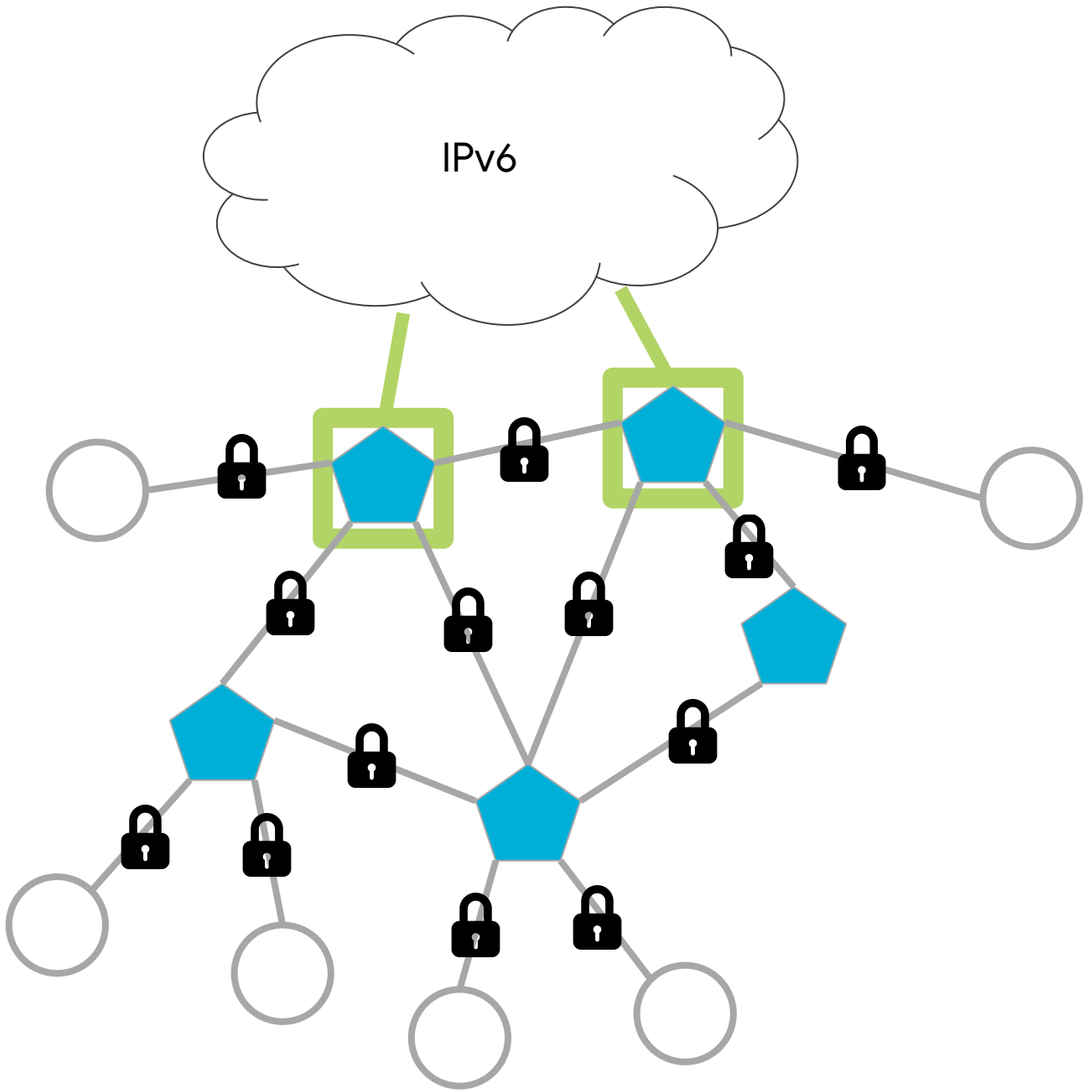
Sleepy end devices **duty-cycles receiver**

Lifetime in **years** with coin-cells



Mandatory Security

All link frames protected using AES-128 **encryption** and **authentication** with **replay protection**.

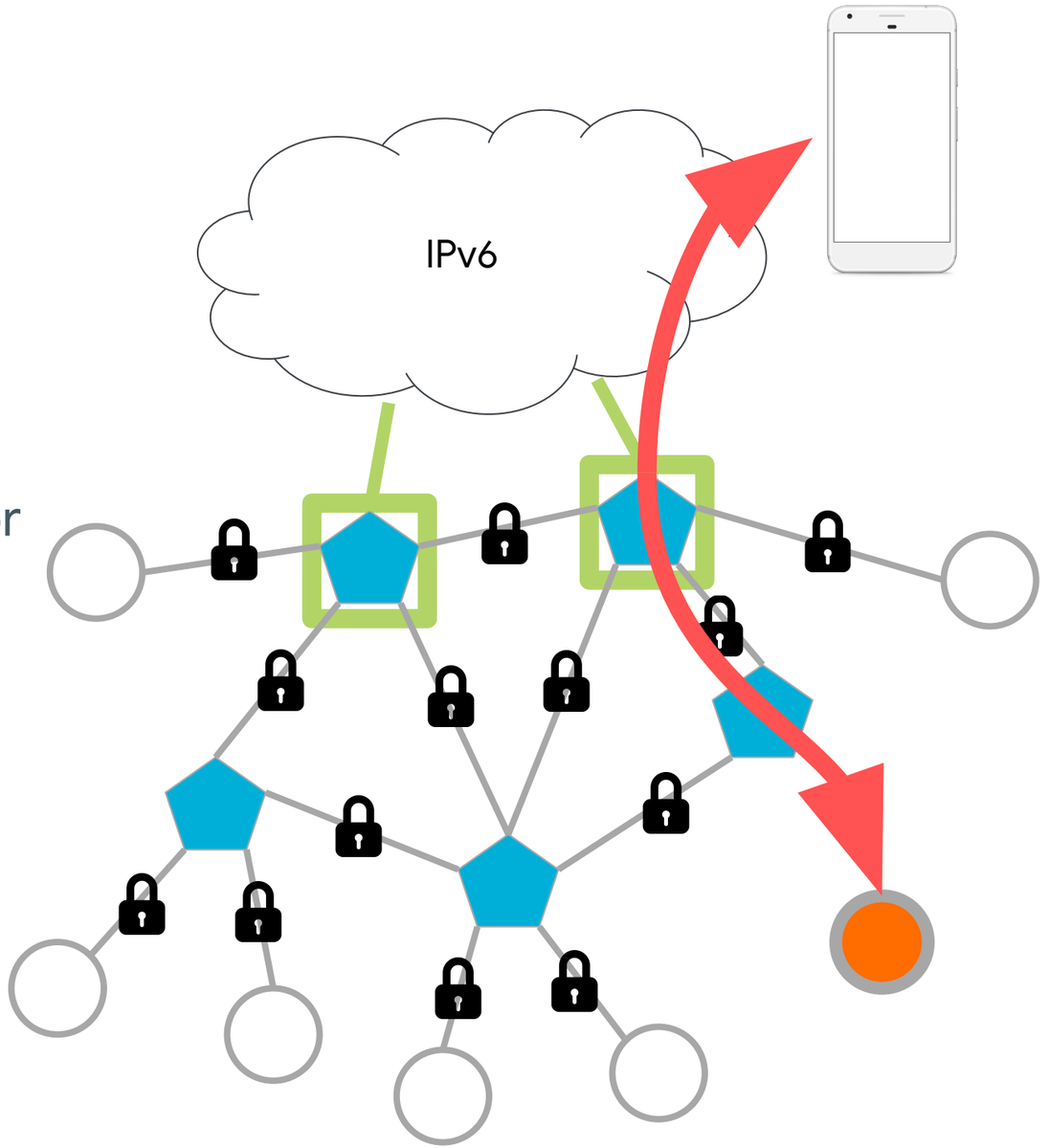


Device Commissioning

User-initiated process involving a physical factor

End-to-end DTLS session via border router

EC J-PAKE ciphersuite for **short pairing codes**



Thread is...

IPv6

Scalable

Resilient

Low power

Secure

No other technology satisfies these requirements.

Thank you

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