Wireless connectivity standard for indoor lighting (+ perhaps Parking Lot/Garage/Site & Area)

- Connected lighting is at the early stages of emerging as a mainstream application.

- Benefits for indoor commercial lighting (offices, schools, government, hospitals, industrial front offices) becoming well understood.

- Such systems are typically specified by the end user based on the benefits of the overall systems proposition.

- These specifications are driven down to fixture OEMs who must accommodate the specification in order to participate in these projects.

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# Likely too early to claim a predominant wireless standard…..not at same maturity as intra-luminaire connectivity

- If you cannot wait: zigbee

- But not yet ready for prime time (integrated in driver, or as special co-processor)

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Indoor (Renovation[1]) use case going towards stock & flow:

- Task tuning, biggest saving

- Occ. Detection

- Day light dimming

- User gives manual override

- Schedule the lights

- Report power consumption

Beyond DLC
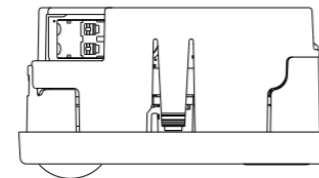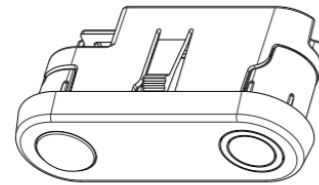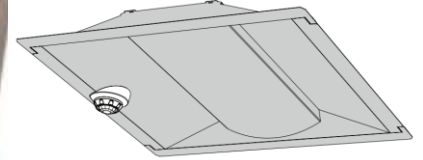
Vive Integral Fixture Control (scale 1:1)
(DFCSJ-OEM-OCC shown)

[1]Renovation is the carrier that opens up big volume

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How to come to a protocol choice (1)

Enocean protocol
902 MhZ   Zigbee   BLE

Proprietary solution from
Network Lighting Company

1. Switches: require wide variation

ZGP & ZLL

2. In groups: with Occ. Sharing or through coordinator

Can be done through 'cascading', but usually done through gateway/coordinator

Coordinator
Router
End Device

3. Daylight dimming

Can (best) be done fully stand alone, but sharing and grouping fine, or run through gateway

4. Scheduling & Report power

For Zigbee, wide range of IP/BACnet bridges available

.....

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4

How to come to a protocol choice (2)

5. Solution providers/integrators that are open at the bottom[1], and proven large scale installations:
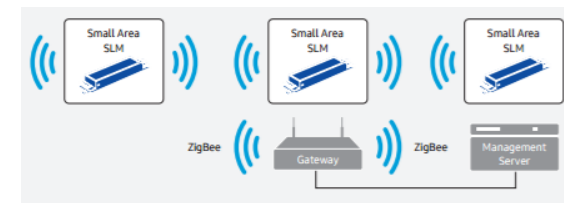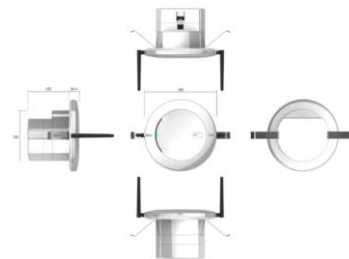
Product Bulletin for
Lumina™ RF Standalone Room Controller System

LEVITON®

Smart Energy Saving Retrofit with
Lumina™ RF Wireless Room Controller System and
Philips® InstantFit LED T8 Lamps with EasySmart

autani
building controls

DaintreeNetworks

Going further than Lighting by integrating other 'Zigbee-stuff': Smart meters, occ. Sensors, plug loads, thermostats, HVAC's…

intwine connect

6. Large volume (projections) from residential success of Zigbee

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hue PERSONAL WIRELESS LIGHTING

// IKEA Trådfri: Internet of Things done right
• **Based on open standards.** It uses Zigbee between devices and CoAP/dTLS to talk to the gateway. This means that you are not locked into a single vendor. You can pair it with Philips Hue bulbs and other compatible vendors.

GreenPeak shipped 100 million Zigbee chips as of last August, said Cees Links, chief executive of the company, estimating the ink could have an installed base approach a billion units.

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5

(1) There is no SLV/TALQ yet = no open standard at the top

What (more) challenges ahead, to make it a real standard?

Lighting is where people are[(*)]. **If** you can anticipate and facilitate their behaviors, value can be created beyond illumination. This will fuse the lighting world w Internet (IoT).

[(*)] Be aware: smart phones and cars are everywhere too

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Lighting Application Funnel Smart Building

Personal Efficiency

Enhancing the performance of occupants of the space

- Environmental monitoring (temperature, noise)
- Bio Adaptive
- Positioning

Space Utilization

Optimizing the rent by making more effective use of spaces

- Asset Tracking
- Energy Maps
- Noise Maps
- Emergency Inspection reports
- Occupancy Maps

Energy Efficiency

optimizing the energy bill while meeting regulatory requirements
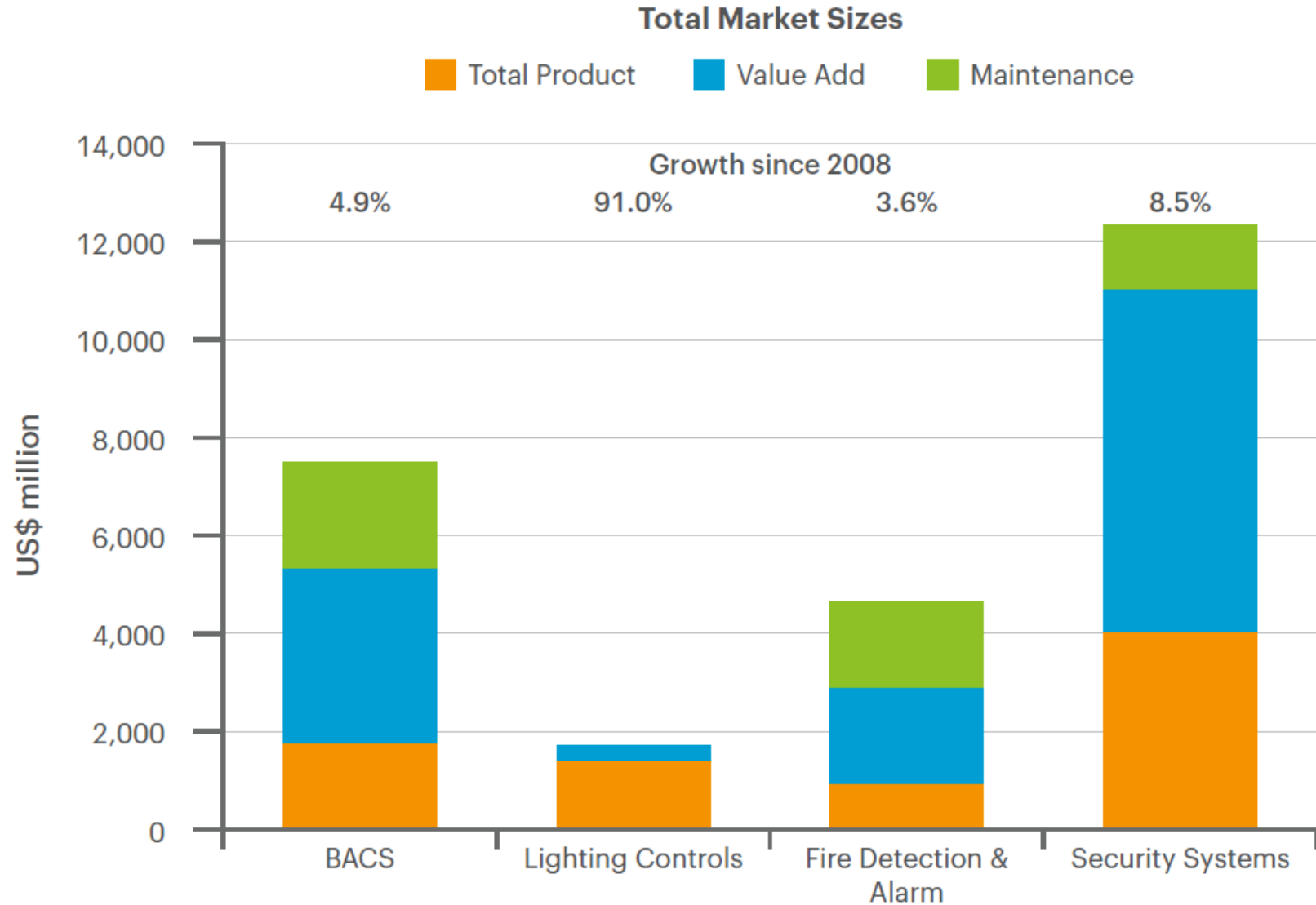
- Serviceability
- Demand Response
- Power Reports
- Task Tuning
- Schedules

PG Smart

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Value beyond: from BACnet(/IP) to wireless lights

Figure 5   Total market sizes, North America

Total Market Sizes

Smart Lights Are a Bright Idea, With Alexa and Siri

Light switches are so last century. Geoffrey A. Fowler explains the right—and wrong—ways to improve your home lighting with connected bulbs, plugs and switches.

It's finally time to invest in connected lighting, says WSJ Personal Tech columnist Geoffrey A. Fowler, thanks to advances from Philips Hue, Lutron Caseta and others—plus more able assistance from Amazon's Alexa and Apple's Siri.

By Geoffrey A. Fowler

Updated March 29, 2017 04:36 p.m. EDT

On movie night, you could peel yourself off the couch to turn off the lights. You could also churn your own butter for the popcorn.

circuit breaker

Ikea's cheap smart lighting will be Apple HomeKit, Google Home, and Amazon Alexa compatible

Coming this summer and fall

by Thomas Ricker | @Trixxy | May 23, 2017, 7:41am EDT

What Happens When Your Car Gets Hacked?

Amazon, Apple, Google, …

World is moving by couple of big companies (towards all-IP), Lighting might need to consider IP stacks (i.e. Thread) …??

Google has an indoor positioning tech in the works, called VPS

BY NATASHA LOMAS
May 17, 2017

Most of the web-connected products don't have a team of engineers working to make them more secure. That's a problem.

Locally combining Fabrics: winner takes all.
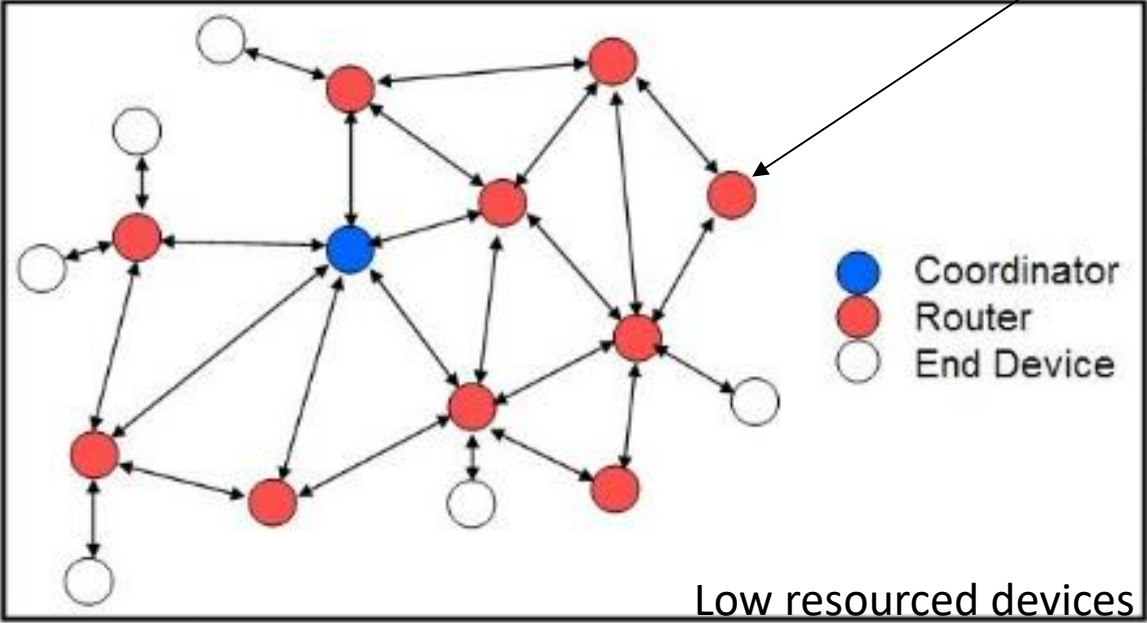

Cheap end-node

troffer — Many Lights, many occupancy sensors

To cloud

Higher capability: 100 Mb/s

Verizon launching nationwide LTE Cat M1 network for IoT

by *Monica Alleven* | Mar 30, 2017 11:55am

AT&T Launches Nationwide LTE-M Network for Internet of Things

Coordinator
Router
End Device

Low resourced devices

Longer range networks

LED Electronics

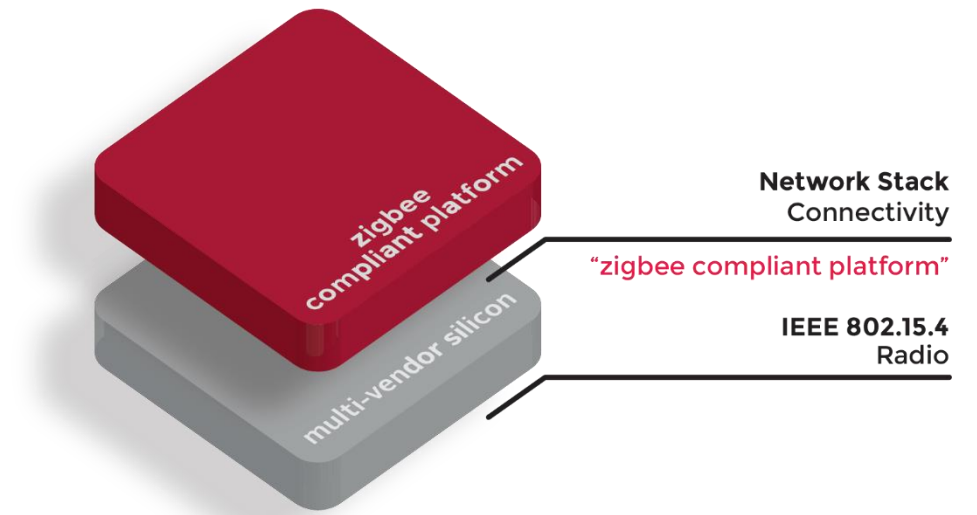**PHILIPS**

Mesh Networking

First to market as an open standard for low-power mesh networking.

Technology merits and wide industry support led to success in proprietary solutions.

Market Feedback
Devices from different vendors need to be interoperable.

Network Stack
Connectivity

"zigbee compliant platform"

IEEE 802.15.4
Radio

zigbee compliant platform

multi-vendor silicon

Interoperable application layer

zigbee "profiles" are the first open, interoperable, certified application layer for key verticals.

Multi-vendor ecosystems drove major successes in Smart Energy, Smart Home, & Lighting.

Market Feedback
Interoperability *between* verticals is important.

Certification & Logo
Conformance
"zigbee certified product" under specific profile(s)

Application Layer
Interoperability
Interoperability within profiles

Network Stack
Connectivity
"zigbee compliant platform"

IEEE 802.15.4
Radio
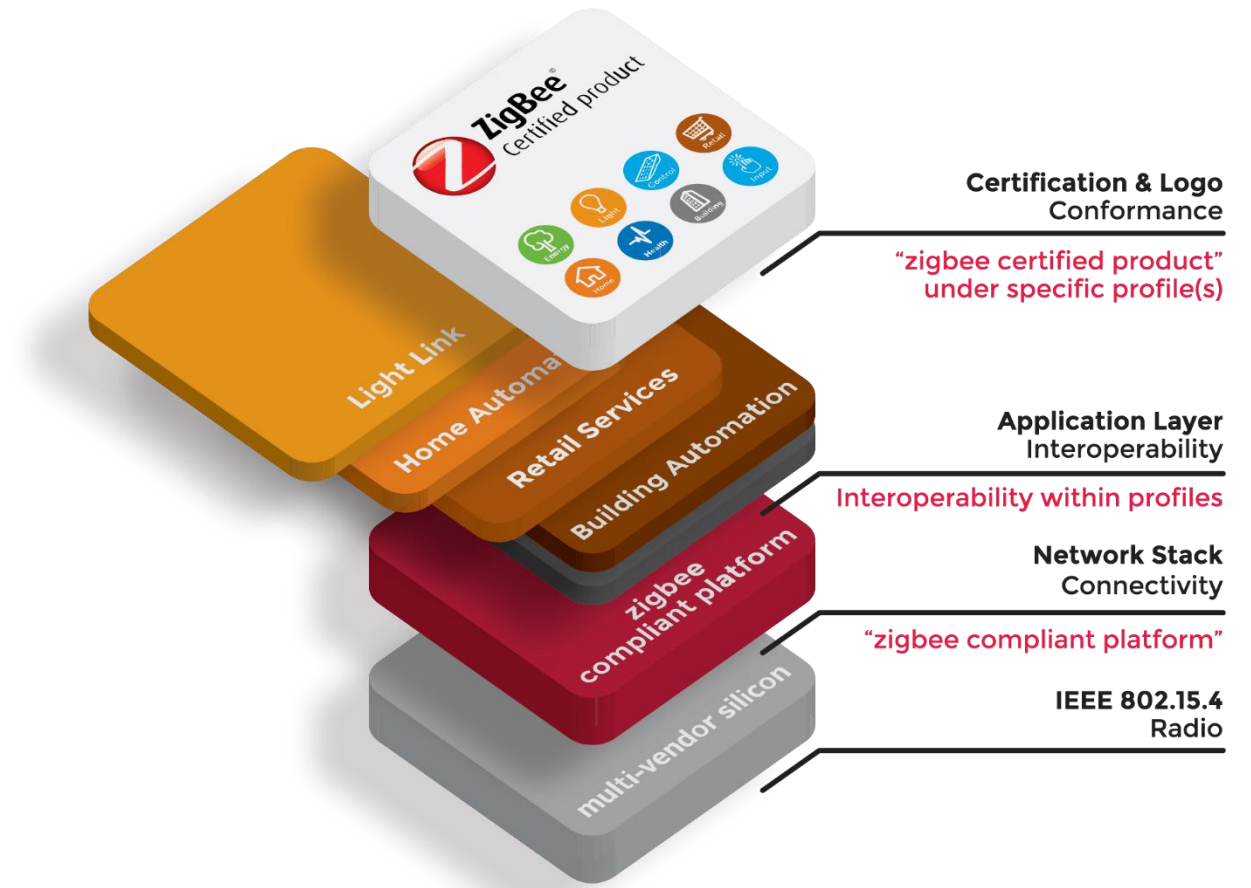
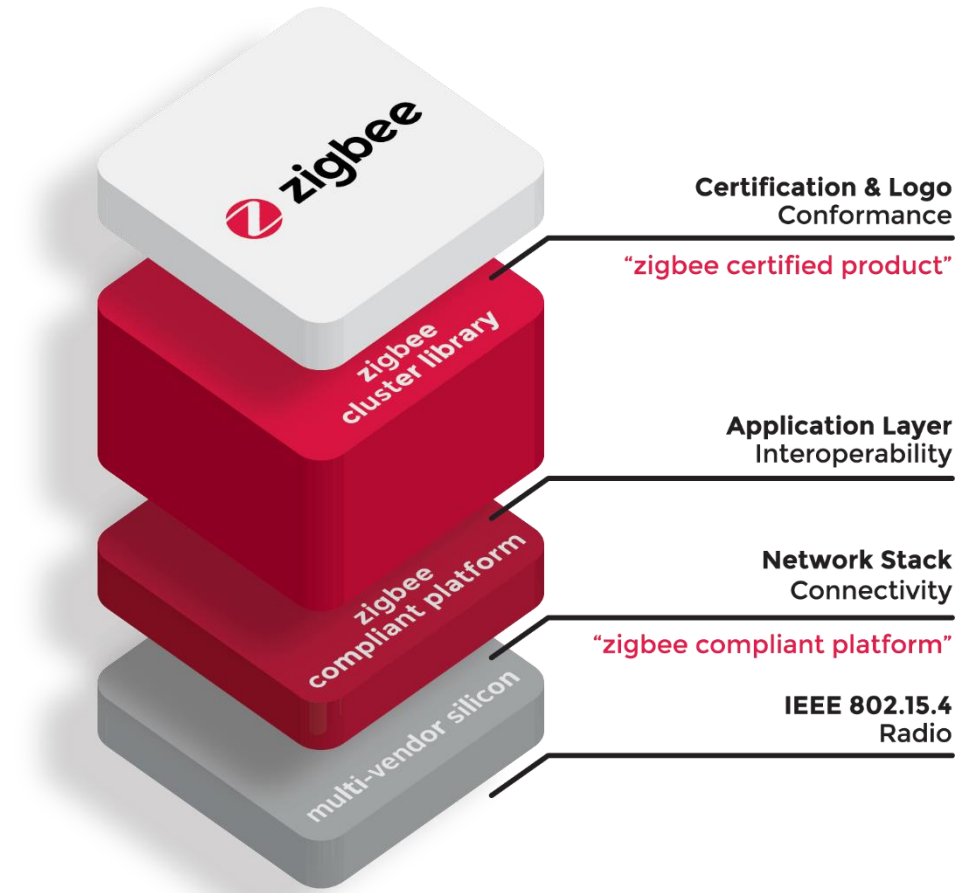# Consolidated application layer

zigbee 3.0 consolidates profiles. Backwards compatibility grows the large existing zigbee ecosystem.

Evolution of the most mature, well-supported application layer. 30+ Compliant Platforms to build on.

Market Feedback
Interoperability across *networks* is now important. As the most mature application layer, there is high demand to bring zigbee's interoperability to other networks.

Certification & Logo
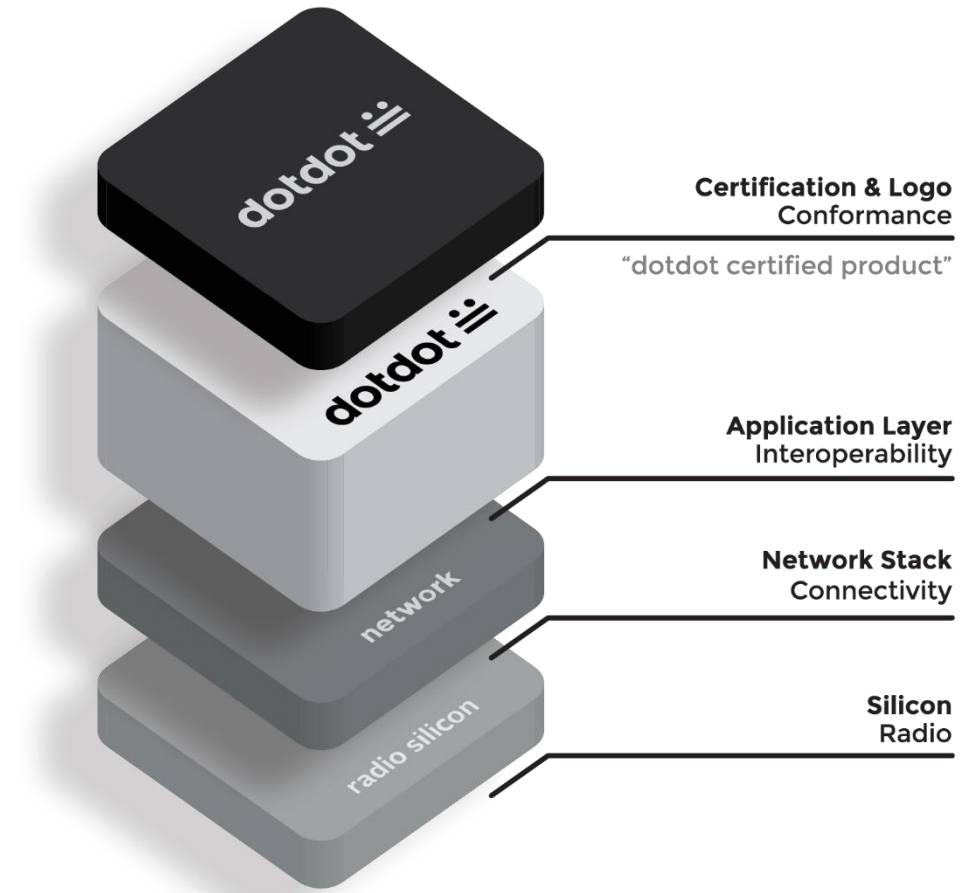Conformance

"zigbee certified product"

Application Layer
Interoperability

Network Stack
Connectivity

"zigbee compliant platform"

IEEE 802.15.4
Radio

zigbee cluster library

zigbee compliant platform

multi-vendor silicon

A universal language for the IoT

Name and program for our application layer, across zigbee, IP and other transports.

Comes to market with maturity, and an ecosystem of suppliers, manufacturers, and experts.

IoT vendors' investment in zigbee & dotdot will scale across multiple markets and applications.
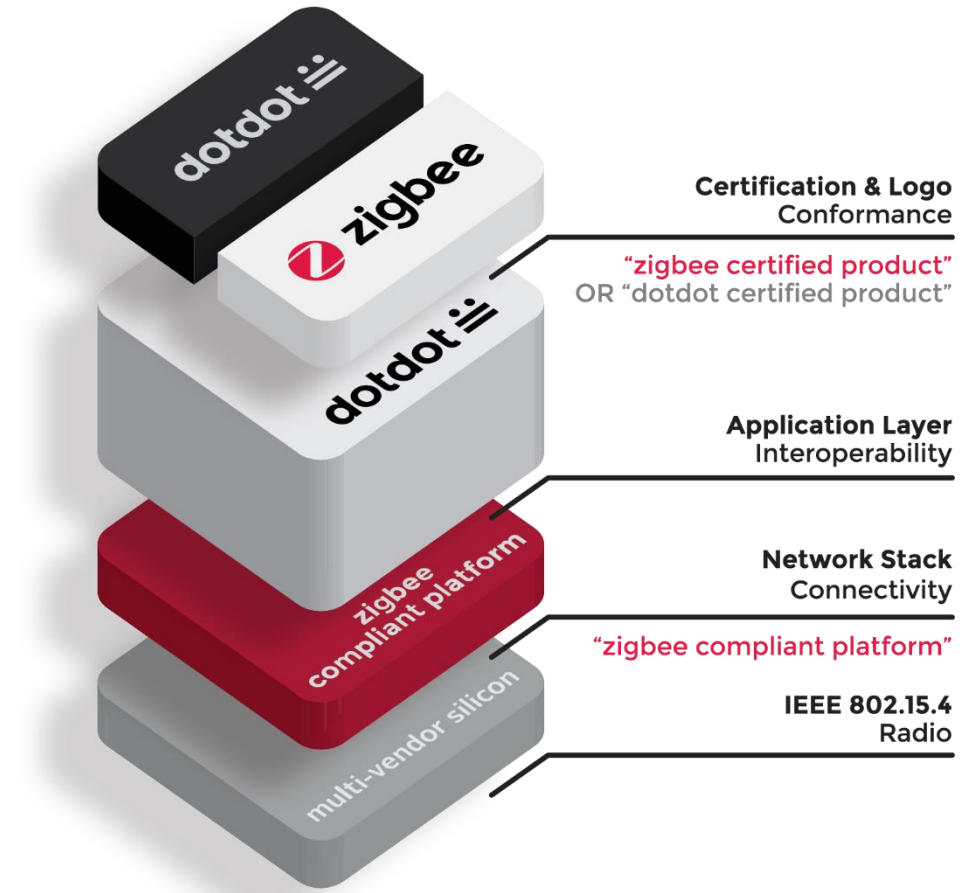
Certification & Logo
Conformance

"dotdot certified product"

Application Layer
Interoperability

Network Stack
Connectivity

Silicon
Radio

dotdot and zigbee

zigbee devices already speak dotdot and will be part of the dotdot family

Products will be able to certify & label as both, for continuity and to indicate connectivity
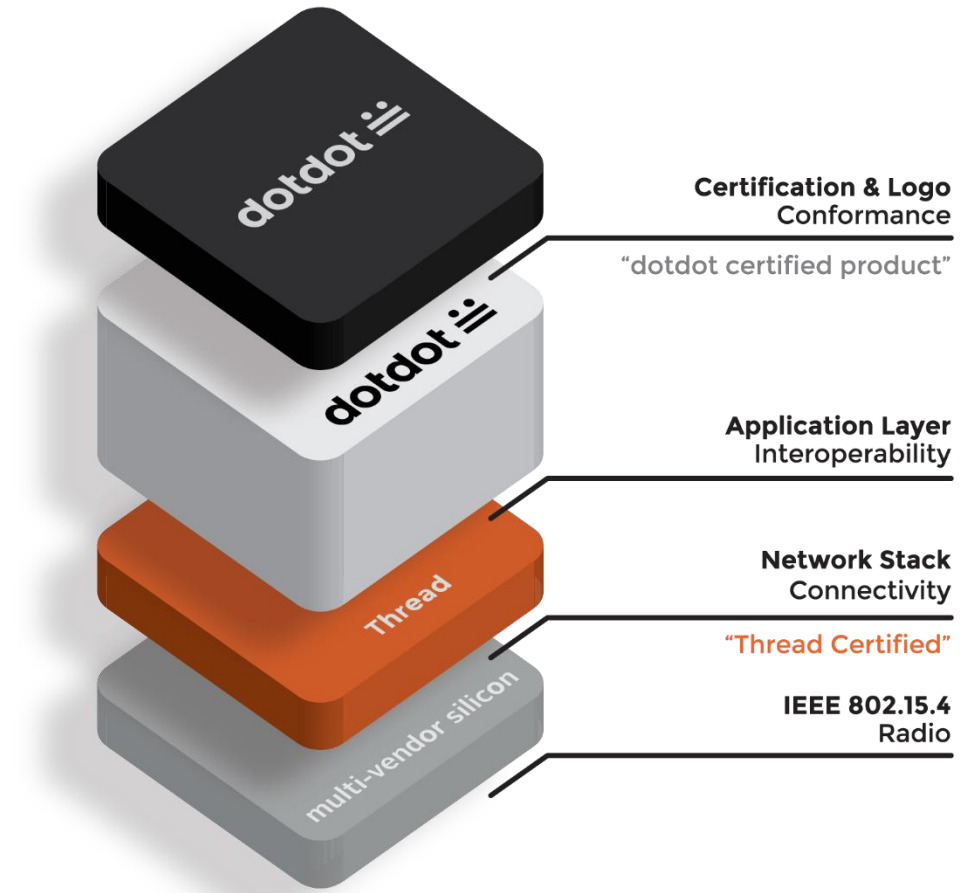
Certification & Logo
Conformance

"zigbee certified product"
OR "dotdot certified product"

Application Layer
Interoperability

Network Stack
Connectivity

"zigbee compliant platform"

IEEE 802.15.4
Radio

dotdot and Thread

dotdot brings a universal application layer to Thread's IP mesh networking.

First qualified network. The result of successful liaison between both organizations.

Leading companies have already demonstrated early products at CES.
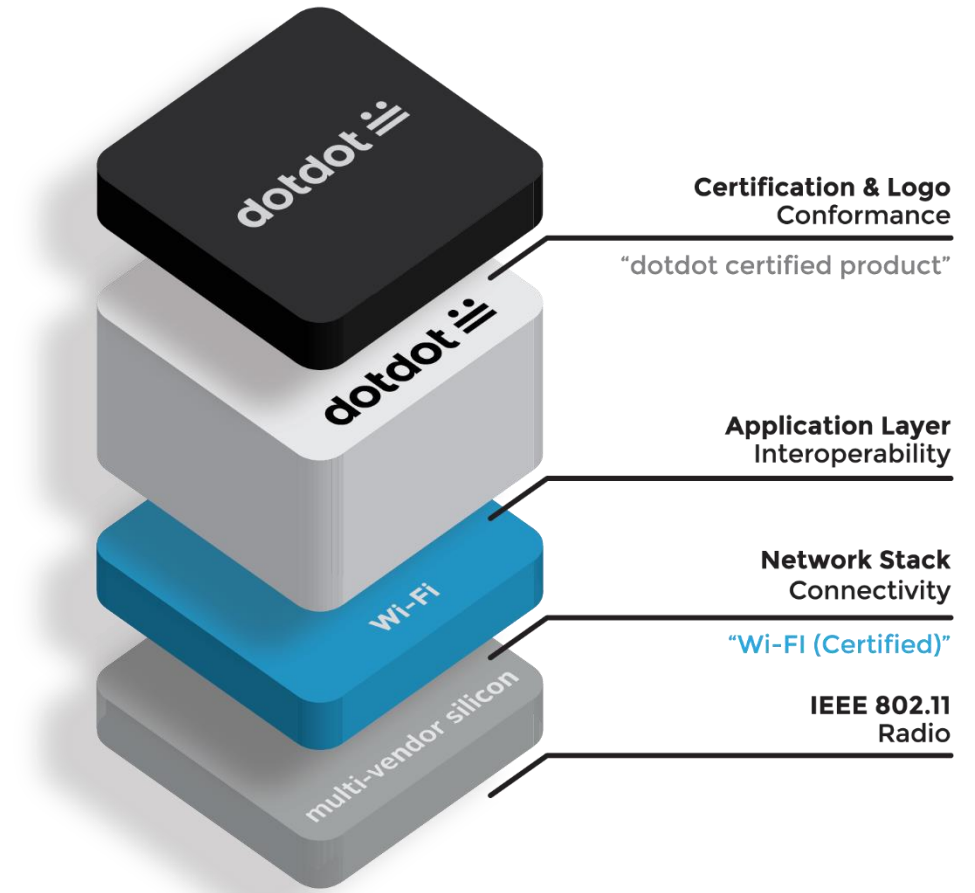

Certification & Logo Conformance

"dotdot certified product"

Application Layer Interoperability

Network Stack Connectivity

"Thread Certified"

IEEE 802.15.4 Radio

dotdot and other transports

dotdot means freedom of choice for developers, manufacturers, and consumers.

The zigbee alliance will be adding additional qualified networks with certification, logo programs, and interoperability.

Certification & Logo Conformance

"dotdot certified product"

Application Layer Interoperability

Network Stack Connectivity

"Wi-FI (Certified)"

IEEE 802.11 Radio

zigbee is coming a long way (= where the money goes)

- Provides the best place to start learning: if you are interested in the future, work with Zigbee devices today.
- It makes Stock-and-flow per-fixture control
- But it is still very early days.
- Standardization at top is badly needed

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