



IoT Architecture : Elements of Connectivity Technologies

Usman Sarwar

17 Oct 2015

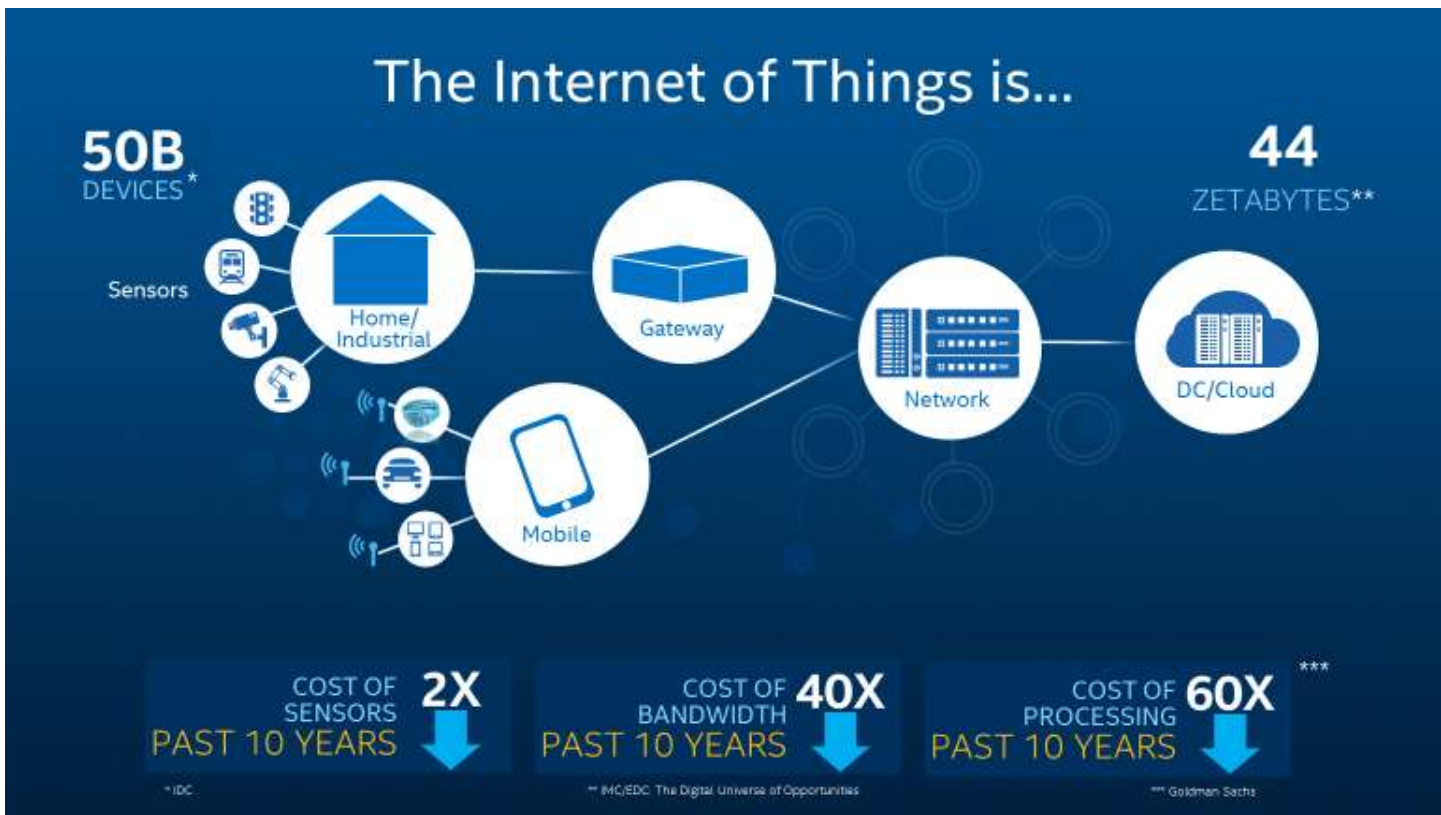
Presenting @ IET Malaysia Network

Internet of Things Group

Agenda

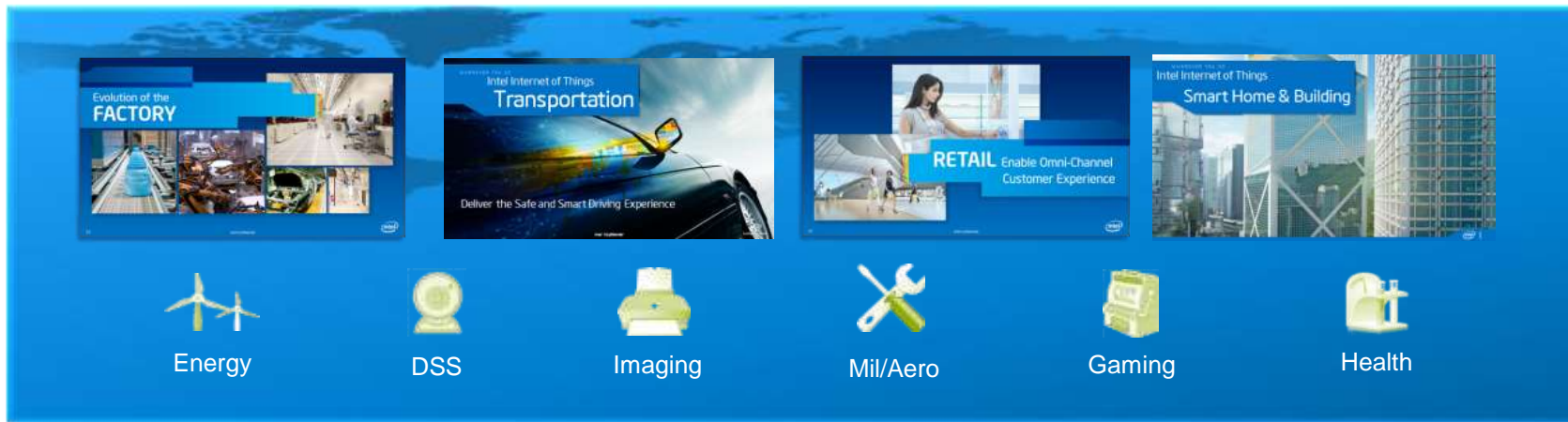
- What and why of IoT?
- IoT connectivity landscape
- IEEE 802.15.4 standards and communication stacks

IoT?



Connectivity Solutions for IoT

- Robust connectivity is the foundation of the Internet of Things.
- IoT - commercial and industrial “things” ranging from vending machines to planes, trains and automobiles.
- Opportunities are vast in connecting new as well as legacy “things” across these global markets
- Diverse requirements



IoT Unique Requirements



Broad Customer Base

- Large Customer Base



Long Life

- 3-10 years
- Longer ramp and demand cycle
- Stringent Q&R Requirements



Power

- Devices run on battery
- Application that can not have coin cell



Operating Systems

- Linux, Android, Windows, and Proprietary systems
- Version N and N-1, N-2



Bandwidth and Latency

- More BW is not always better
- Appropriate for application
- Stringent Latency/Jitter



Functional Safety

- Redundancy
- Traceability

Essential Elements for IoT deployment



Connectivity

- Provides an extensive network of connectivity
 - Wired
 - Wireless
 - Cellular
 - Short-range



Security

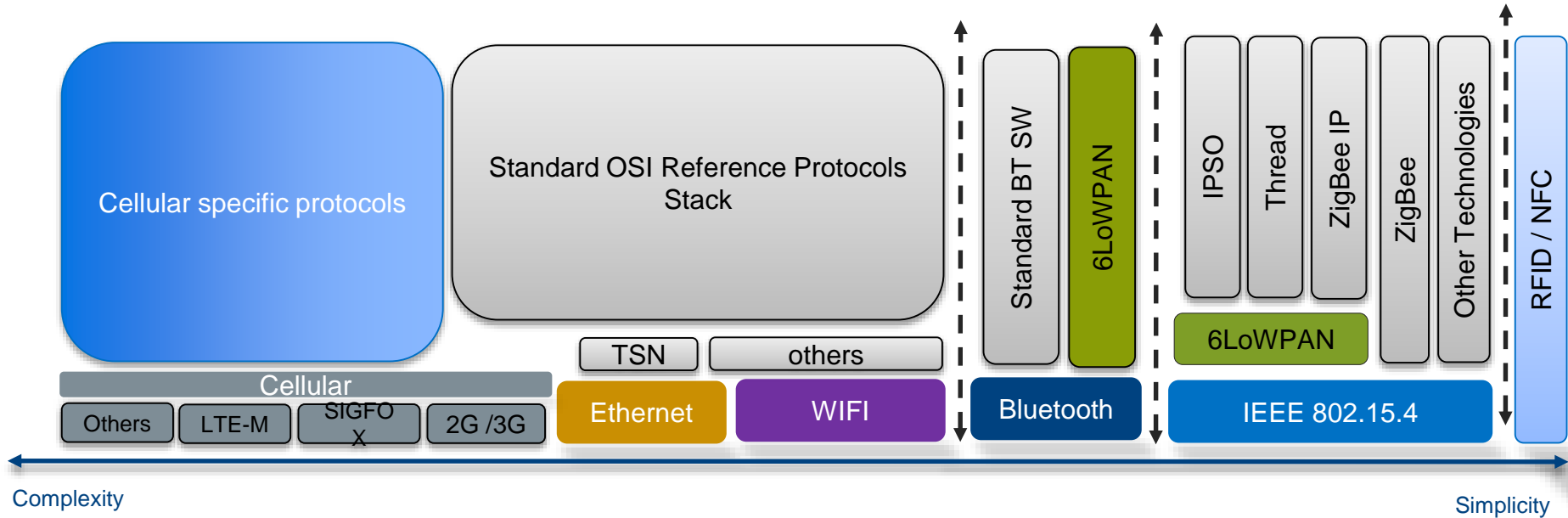
- Protect devices for trust and control
- Protect the Device
- Protect the application



Manageability

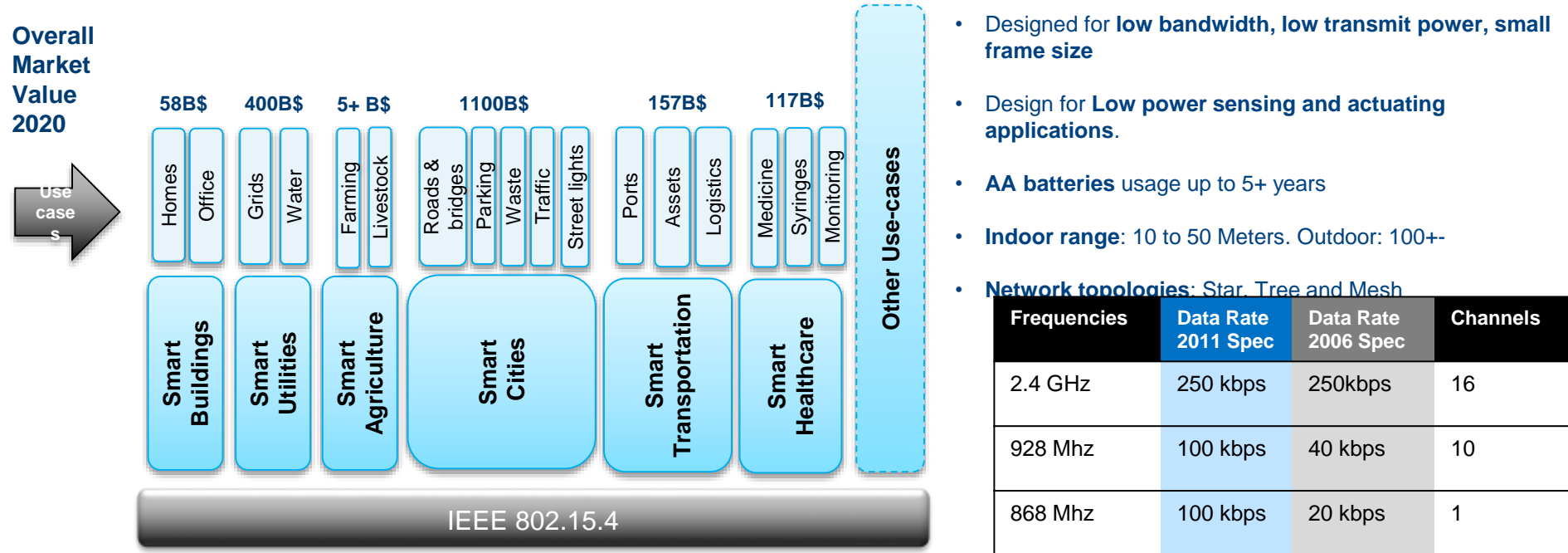
- Enable common provisioning frameworks
- Enable remote, secure upgrades
- Provide web-based configuration utilities

IoT Connectivity Landscape



IEEE 802.15.4 landscape

IoT based infrastructure use-cases with IEEE 802.15.4



IEEE 802.15.4 standards

	Description
802.15.4	General sensing and actuating
802.15.4c	Phy for China (314 – 316 MHz, 430 – 434 MHz, and 779 – 787 MHz)
802.15.4d	Phy for Japan (920 MHz)
802.15.4e	Mac Enhancements (eg. minimized listening costs, link reliability), Industrial applications, improved security
802.15.4f	PHY Amendment for Active RFID,
802.15.4g	PHY Amendment for Smart Utility Networks, <u>upto 1Km range, outdoor usage, larger frame size</u>

Ref: IEEE 802 Standards. <http://www.ieee802.org/>

IEEE 802.15.4 standards

	802.15.4	802.15.4e	802.15.4g	802.15.4f
Frequency	2.4Ghz (DSSS + oQPSK), 868Mhz (DSSS + BPSK) 915Mhz (DSSS + BPSK)	2.4Ghz (DSSS + oQPSK, CSS+DQPSK), 868Mhz (DSSS + BPSK) 915Mhz (DSSS + BPSK)	2.4Ghz (DSSS + oQPSK, CSS+DQPSK), 868Mhz (DSSS + BPSK) 915Mhz (DSSS + BPSK)	2.4Ghz (DSSS + oQPSK, CSS+DQPSK), 868Mhz (DSSS + BPSK) 915Mhz (DSSS + BPSK) 3~10Ghz (BPM+BPSK)
Data rate	Upto 250kbps	Upto 800kbps	Up to 800kbps	
Differences	–	Mac Enhancements (time synchronization and channel hopping)	Phy Enhancements	Mac and Phy Enhancements
Frame Size (bytes)	127	N/A	Up to 2047	N/A
Range (m)	1 – 75+	1 – 75+	Upto 1km	N/A
Goals	General Low-power Sensing/Actuating	Industrial segments	Smart utilities	<ul style="list-style-type: none"> • Active RFID bi-directional • location determination applications
Products	Many	Few	Connote (6LoWPAN)	LeanTegra PowerMote

Ref: IEEE 802 Standards. <http://www.ieee802.org/>

IEEE 802.15.4 and BLE

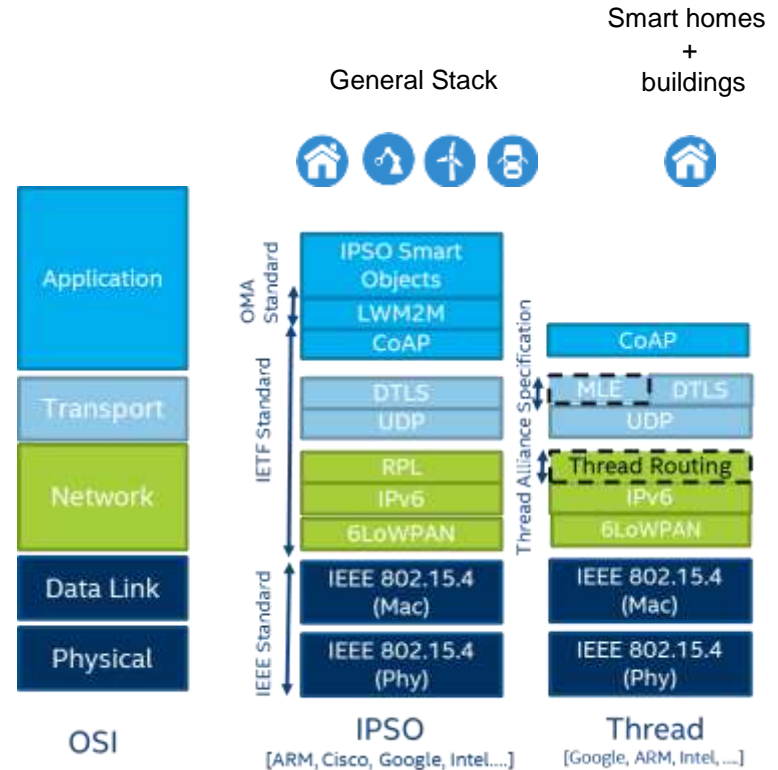
	IEEE 802.15.4	BLE (Bluetooth smart)
Applications	Sensing and actuating in industrial, utilities, medical	Beacons, healthcare, fitness, home entertainment
Characteristics	<ul style="list-style-type: none">• Low power mesh personal area network• Large size network• Very Low cost	<ul style="list-style-type: none">• Wireless personal area network• Small size network• Low cost
Target usage	Utility meters, bulbs, smart	Mobile phone, tablet and computer, wearables
Deployment Time	Years	Weeks to Years
Overlapping area	Smart home (eg. bulbs, plugs) thru <u>gateway or hub</u>	Smart home (eg. bulbs, plugs) directly thru <u>smart phones or tablets</u>
Network Type	Star, tree and mesh	Master - slave, mesh (new specification)

Ref: IEEE 802 Standards. <http://www.ieee802.org/>

IEEE 802.15.4 Software Stacks

What is 6LoWPAN?

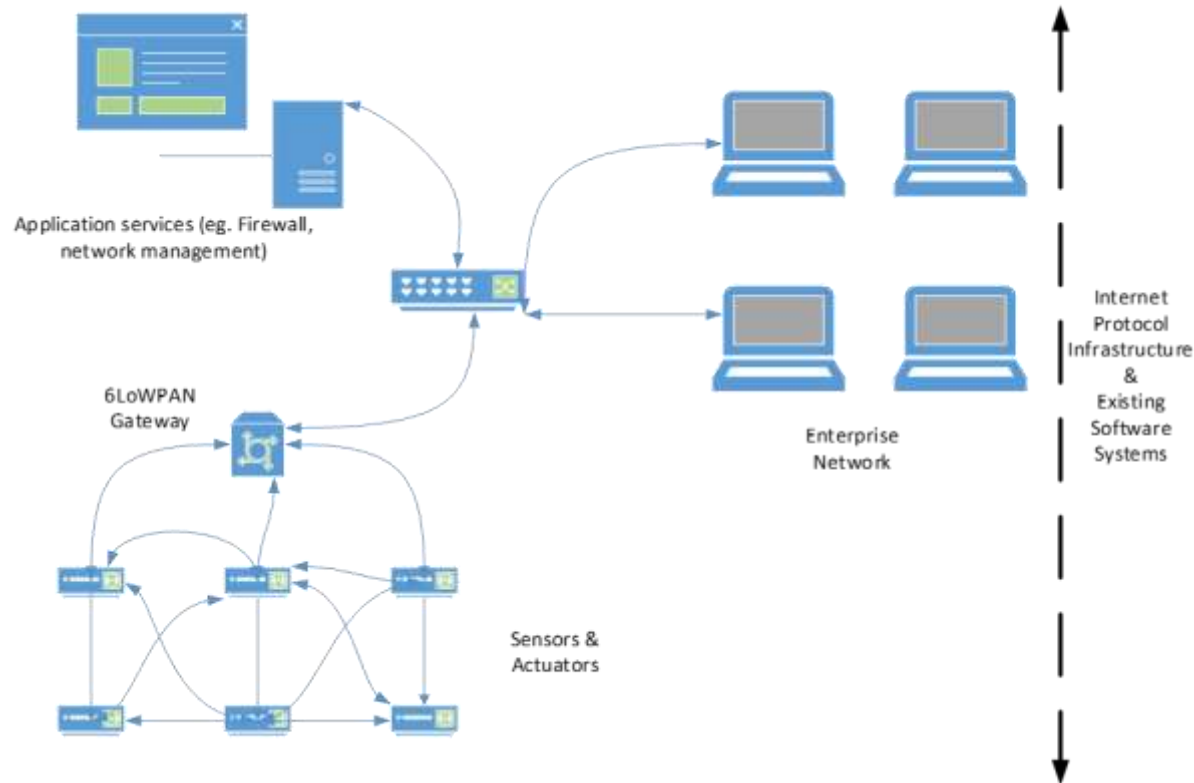
- Acronym for IPv6 over Low power Wireless Personal Area Networks.
- Constrained devices (eg IEEE 802.15.4, BLE)
- Standard from the maker of Internet (IETF) which works with existing Internet infrastructure (30+ years)



Google Thread

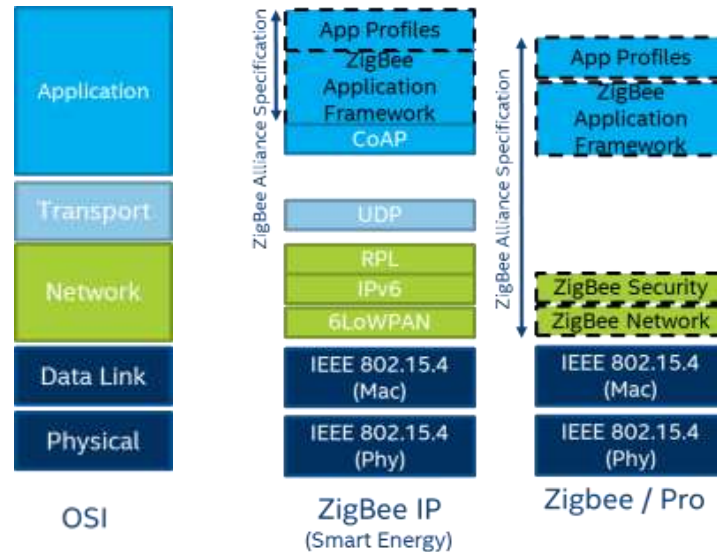
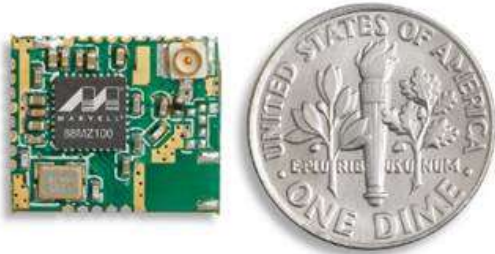
- Specification 1.0 released on 14 July 2015
- Targeted for Smart homes and buildings
- Members include ARM, Samsung, Silicon labs, Freescale, Intel, Philips..

Why 6LoWPAN and what are the possibilities?

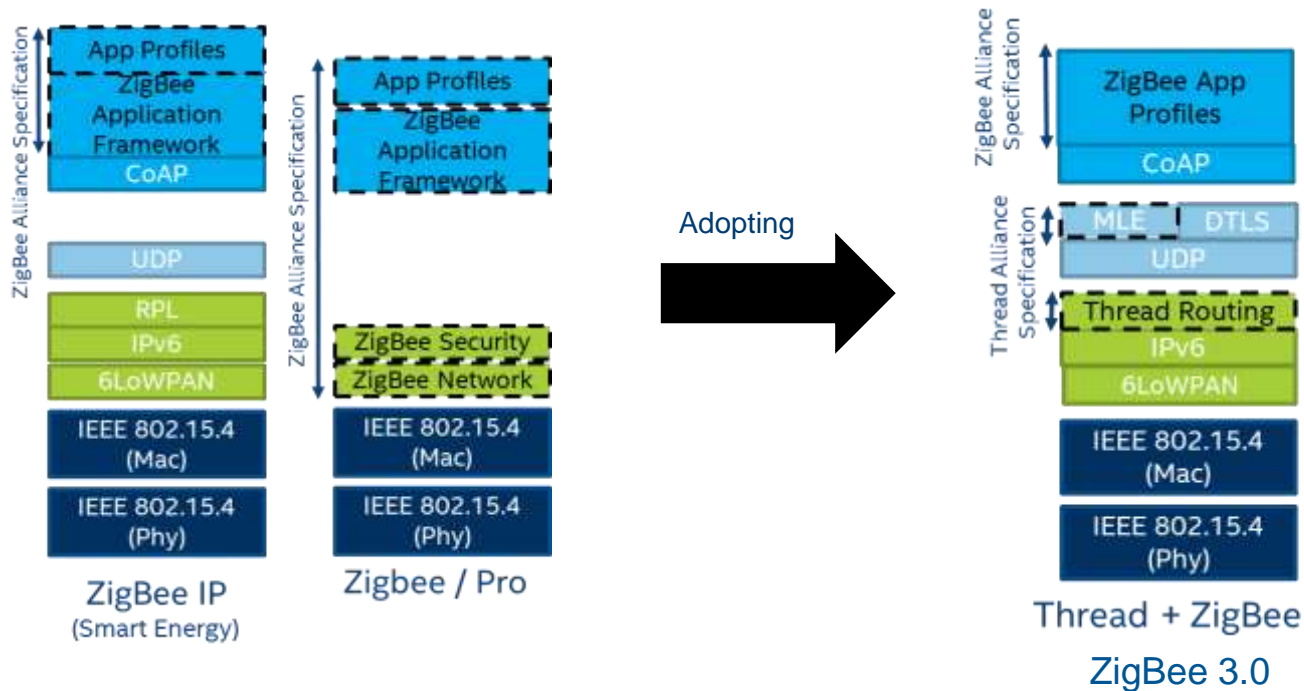


What is ZigBee?

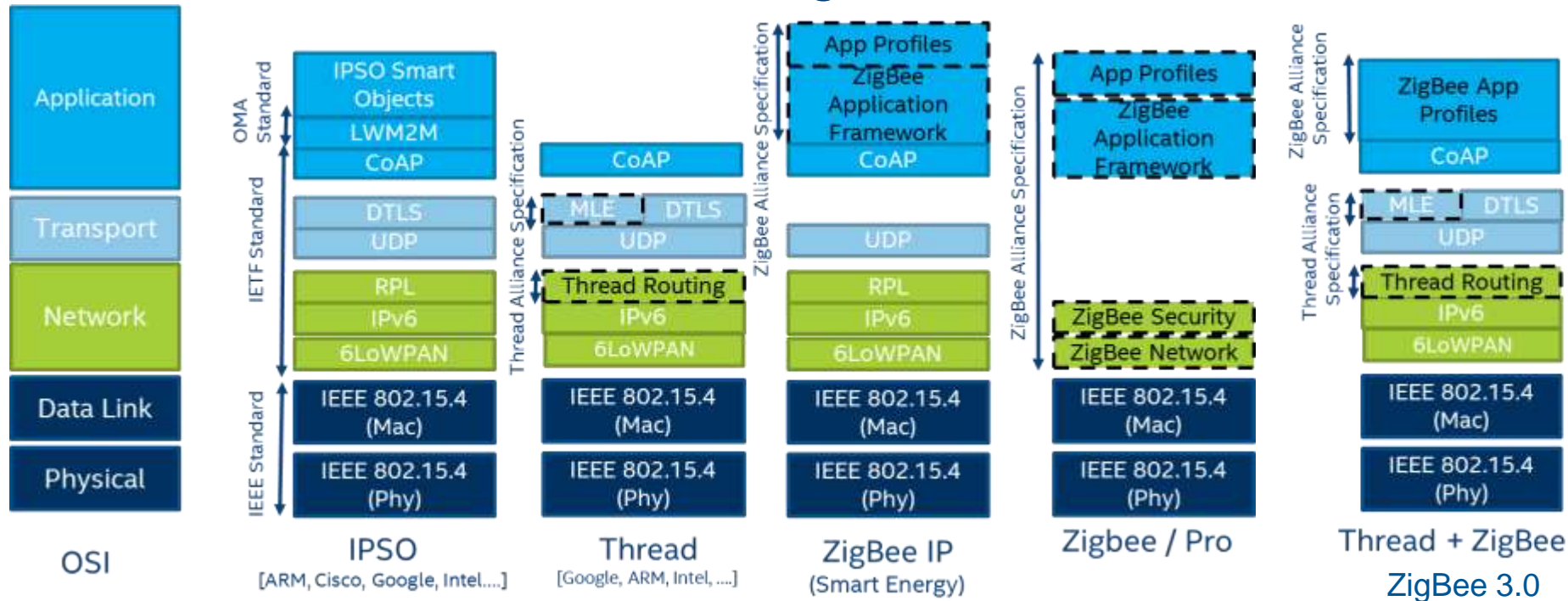
- ZigBee Alliance specification for a suite of high-level communication proprietary protocols
- ZigBee Application Profiles
 - ZigBee Home Automation 1.2
 - ZigBee Light link
 - Smart Energy 1.1b



New emergence of ZigBee combining with Thread



IEEE 802.15.4 Stack comparison for IPSO, Thread and ZigBee



Ingredients of the Intel IoT Gateway

Intel



Scalable architecture

Wind River



Integrated operating system

McAfee



End-to-end security



Introducing Calypso Island

winhec

Shenzhen 2015

IoT Gateway Investments



Quanta

Home gateway

ADANTECH



UTX-3115 Gateway

NEXCOM



NISE 105/105A Gateway

Demo: IoT Gateway

ADANTECH



UTX-3115



Microsoft Azure

Conclusion

- Impact of IoT
- Importance of connectivity
- importance of IEEE 802.15.4 technology



experience
what's inside™