用合适的无线互联来连接智能照明

Connect Smart Lighting

with right wireless connectivity

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Philips lighting/飞利浦照明

May, 2017

innovation + you

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What's smart/connected lighting?

BOOKS | HOTELS | ADS | CARS | TAXI | LIGHTING

Beyond illumination

- 开关
- 调光
- 调色温
- 调色
- 分组
- 场景

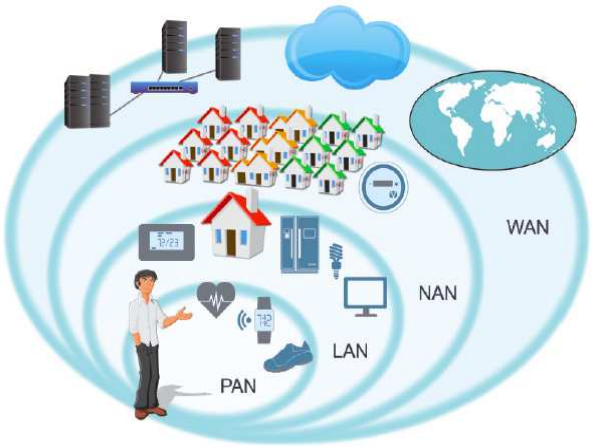
Target

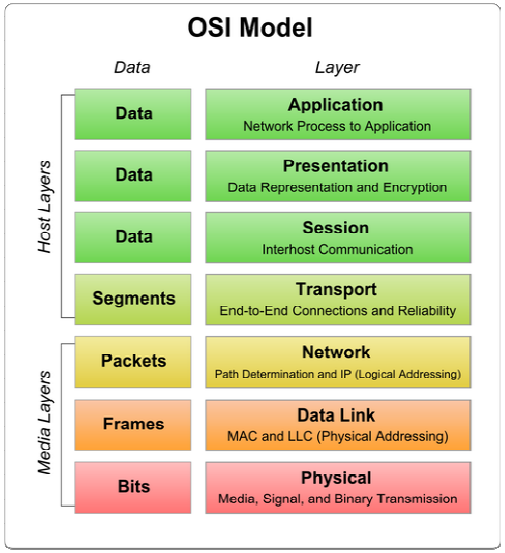
- On demand lighting
- Health lighting
- Human centric lighting

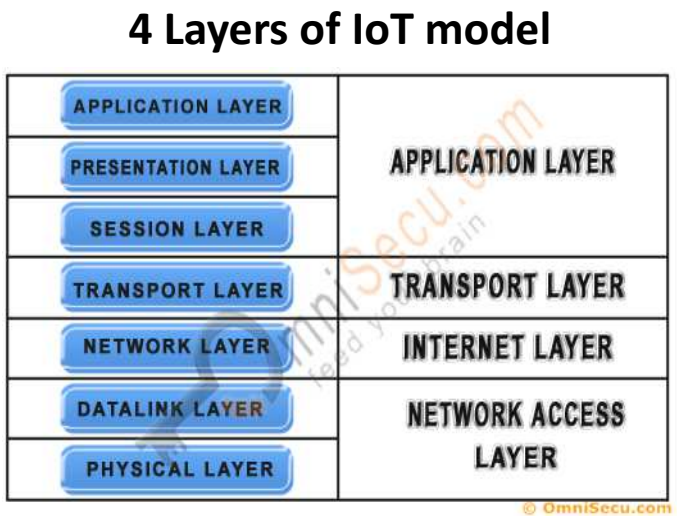
光-超乎照明

眼之所见，情之所感，心之所想

Connectivity Architecture

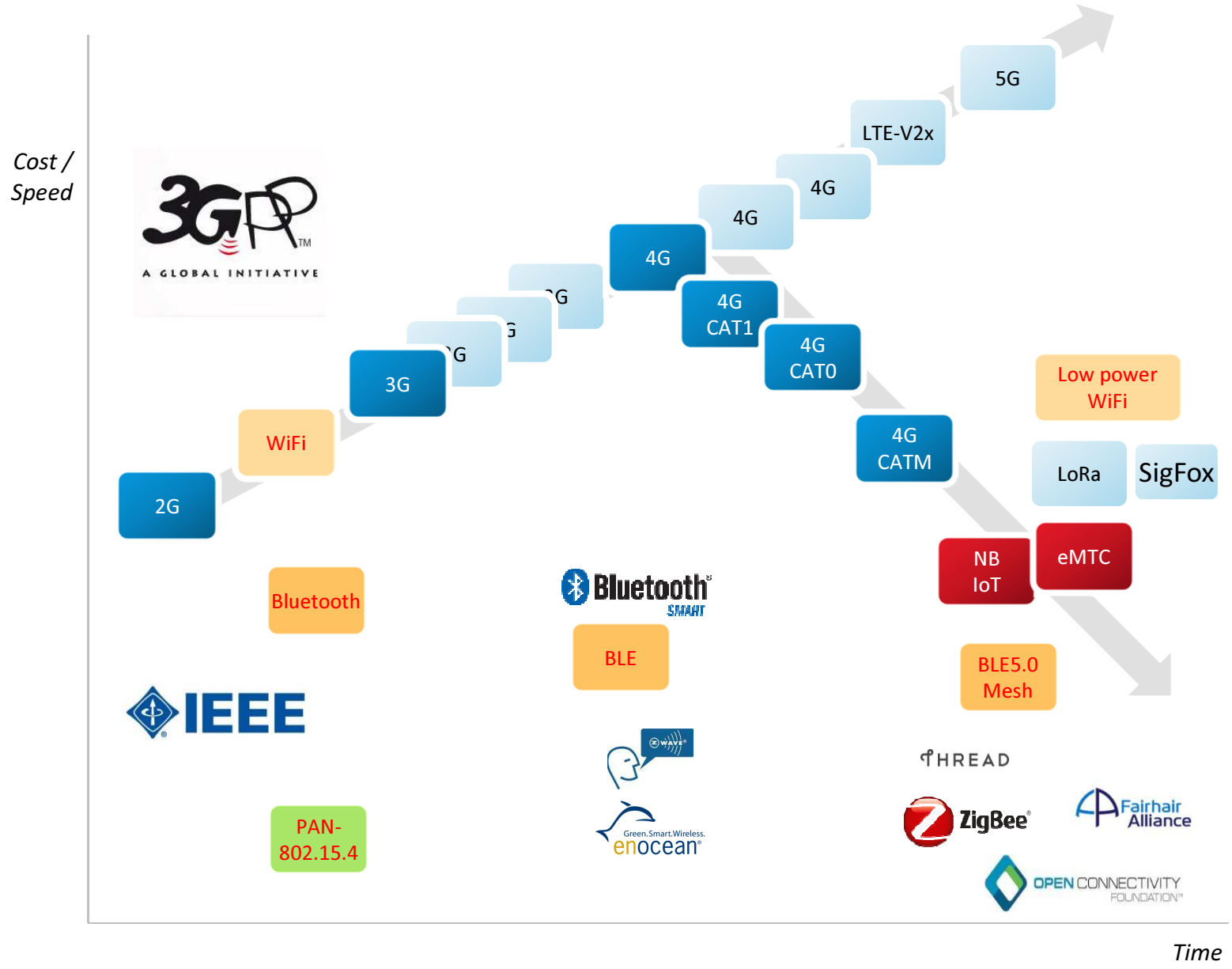




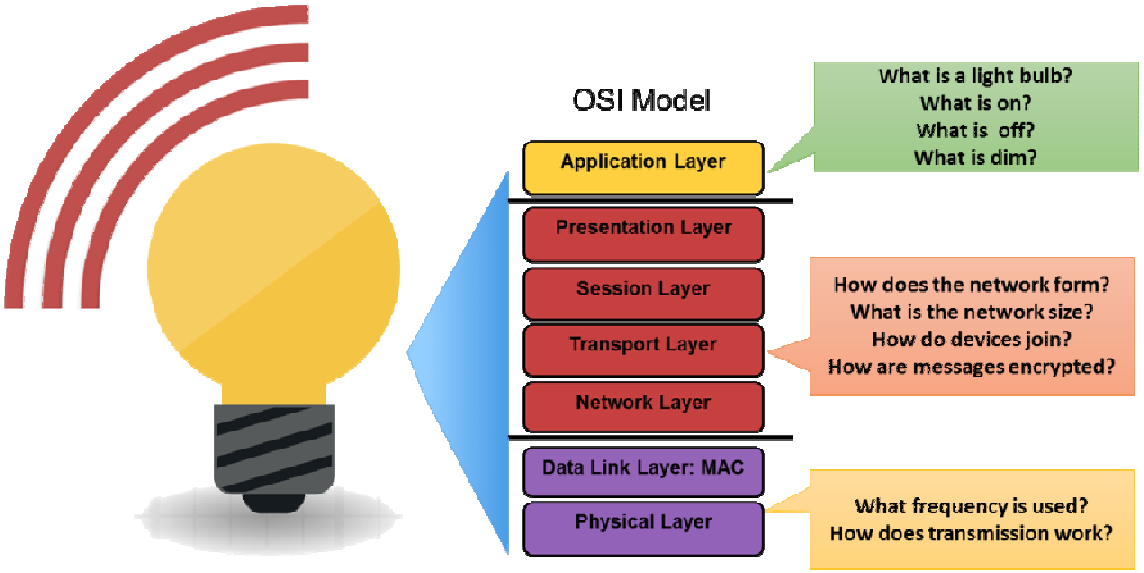


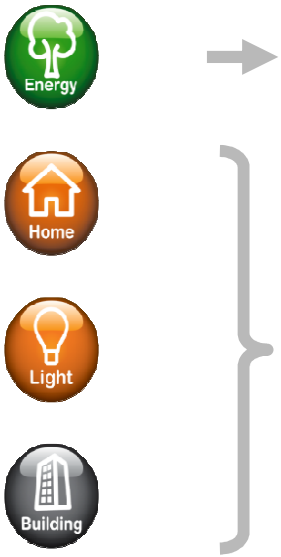
Connectivity technologies are mainly driven and defined by standard organizations. But recently, open source software is becoming another major force to drive and enable connectivity innovation.

Connectivity-wireless



ZigBee





One Spec – One Light

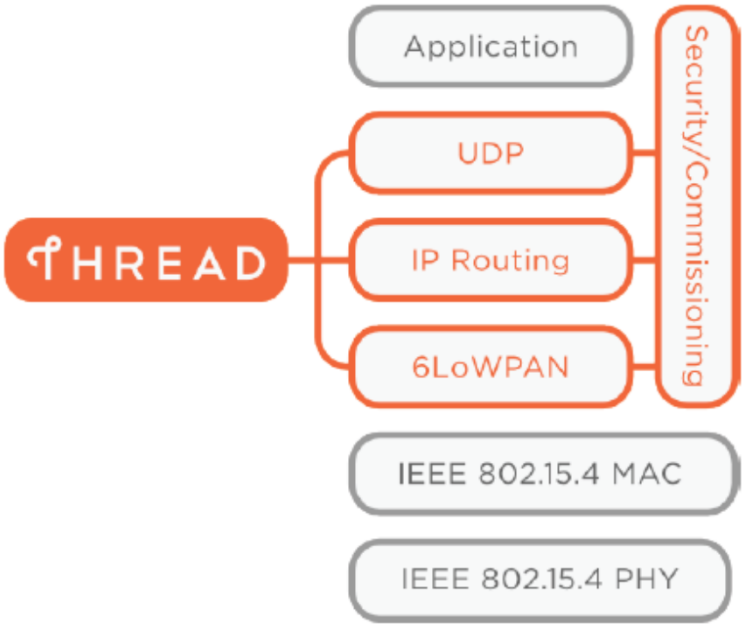
ZigBee 3.0

dotdot

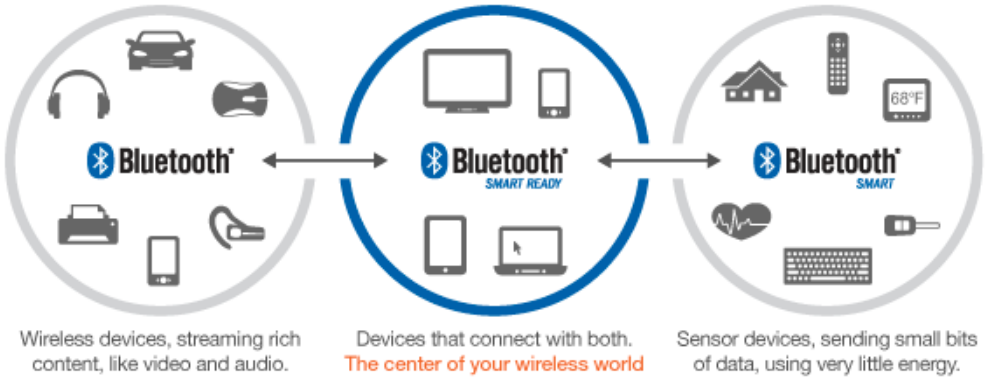
Thread/OCF

[OIC-Open Interconnect Consortium]

Thread	Standard
Application Layer	
UDP + DTLS	RFC 768, RFC 6347, RFC 4279, RFC 4492, RFC 3315, RFC 5007
Distance Vector Routing	RFC 1058, RFC 2080
IPv6	RFC 4862
6LowPAN	RFC 4944, RFC 6282, RFC 6775
IEEE 802.15.4 MAC (including MAC security)	IEEE 802.15.4 (2006)
Physical Radio (PHY)	



Bluetooth



BLE5.0: 4/2/8
BLE MESH

Advantage	Feature	End user example
Quadruple the range(4)	Deliver robust, reliable Internet of Things (IoT) connections that make full-home and building and outdoor use cases a reality)-4	400m(100mw)
Double the speed(2)	Send data faster and optimize responsiveness-2	2Mbit/s, 1Mbit/s, 125kbps
Increase data broadcasting capacity by 800% (8)	Propel the next generation of “connectionless” services like beacons and location-relevant information and navigation-8 **Bluetooth 5.0**	Support better position service(无需配对接受信标的数据),3 broadcast channel to 37 broadcast channel, support for larger data packets: 31-octet to 255-octet packages.

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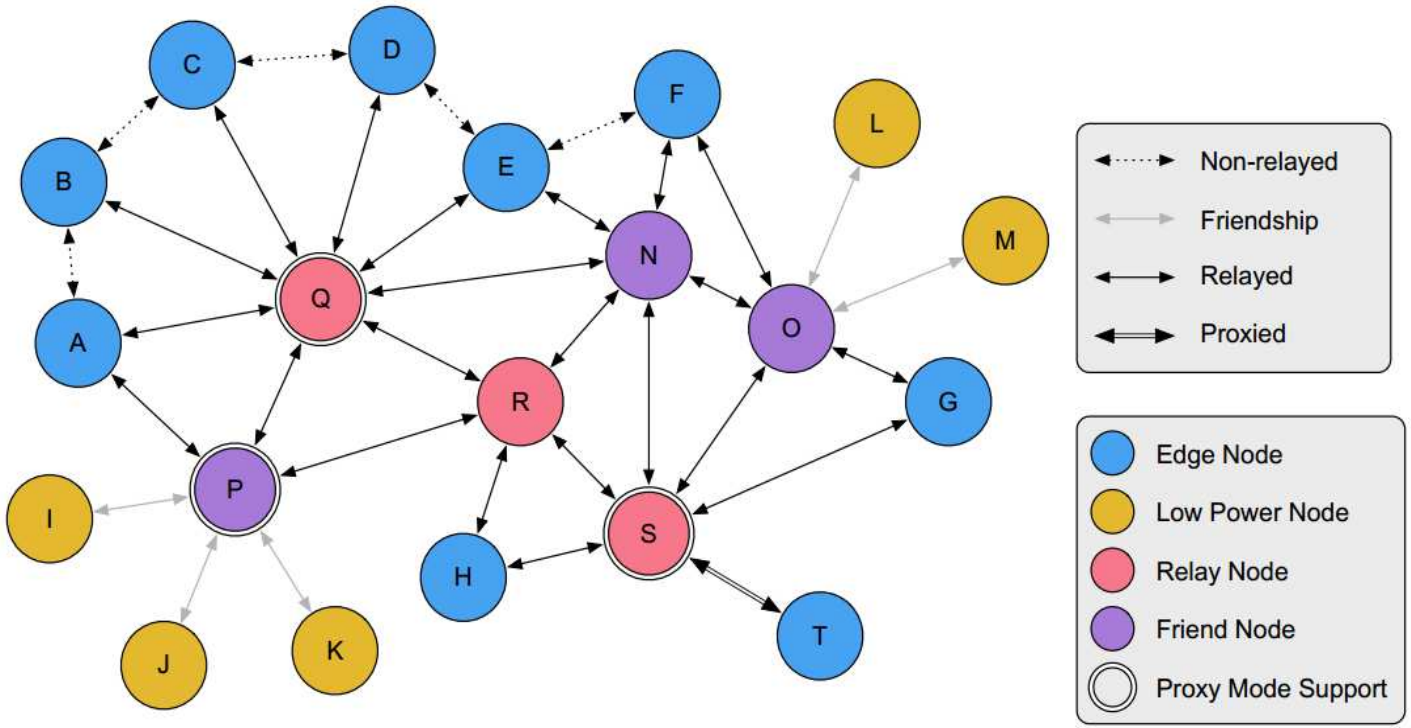
Smart mesh v1



The initial version of this specification is a flooding-based mesh network. A flooding-based mesh network uses broadcast channels to transmit messages so that other nodes can receive messages and relay these messages, thus extending the range of the original message.

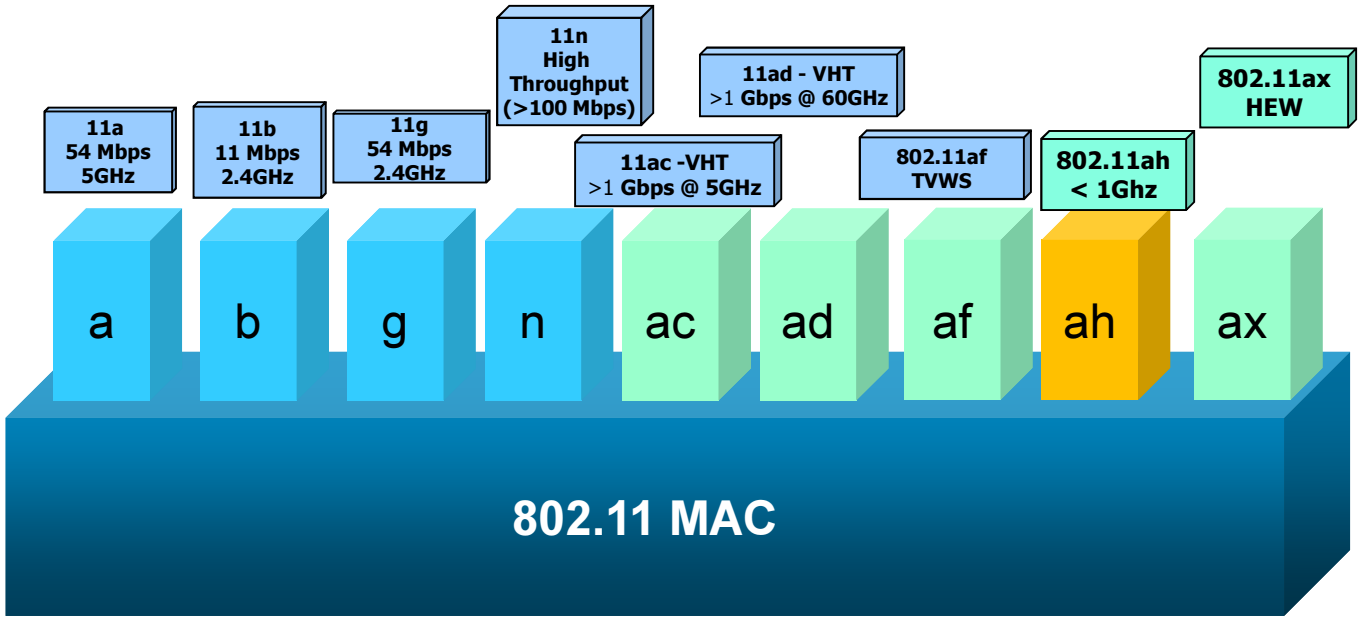
Loop and broadcast prevention

SmartMesh_Supplement

Message Name	Opcode
Generic Delta Set Final	0x80 0x07
Generic Delta Set Update	0x80 0x06
Generic Level Get	0x80 0x04
Generic Level Set	0x80 0x03
Generic Level Status	0x80 0x05
Generic Binary Get	0x80 0x01
Generic Binary Set	0x80 0x00
Generic Binary Status	0x80 0x02
Light Color Temperature Set	0x80 0x33
Light Level Duration Set	0x80 0x35
Light Level Set	0x80 0x30
Light Level Set Update	0x80 0x34
Light Get	0x80 0x32
Light Status	0x80 0x31
Power Get	0x80 0x11
Power Set	0x80 0x10
Power Status	0x80 0x12
Scene Number Select	0x80 0x43
Scene Number Status	0x80 0x44
Scene Number Store	0x80 0x42
Scene Number Supported Get	0x80 0x40
Scene Number Supported Status	0x80 0x41

802.11 Architecture Overview

- Multiple Over the Air PHY options
- One common MAC based on CSMA/CA



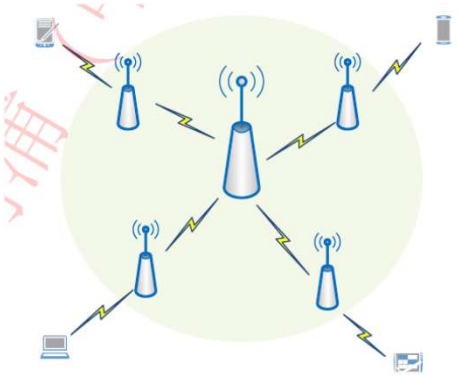
Low power WiFi-IEEE802.11ah

While maintaining the IEEE 802.11 WLAN user experience for fixed, outdoor, point to multi point applications, data rates > 100 kbit/s, defines an Orthogonal Frequency Division Multiplexing (OFDM) Physical layer (PHY) operating in the license-exempt bands below 1 GHz, e.g.,

868-868.6 MHz (Europe), 950 MHz -958 MHz (Japan), 314-316 MHz, 430-434 MHz, 470-510 MHz, and 779-787 MHz (China), 917 - 923.5 MHz (Korea) and 902-928 MHz (USA),

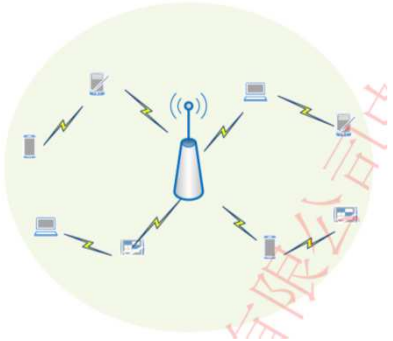
Supports:

- transmission range up to 1 km (sub Ghz, relay)

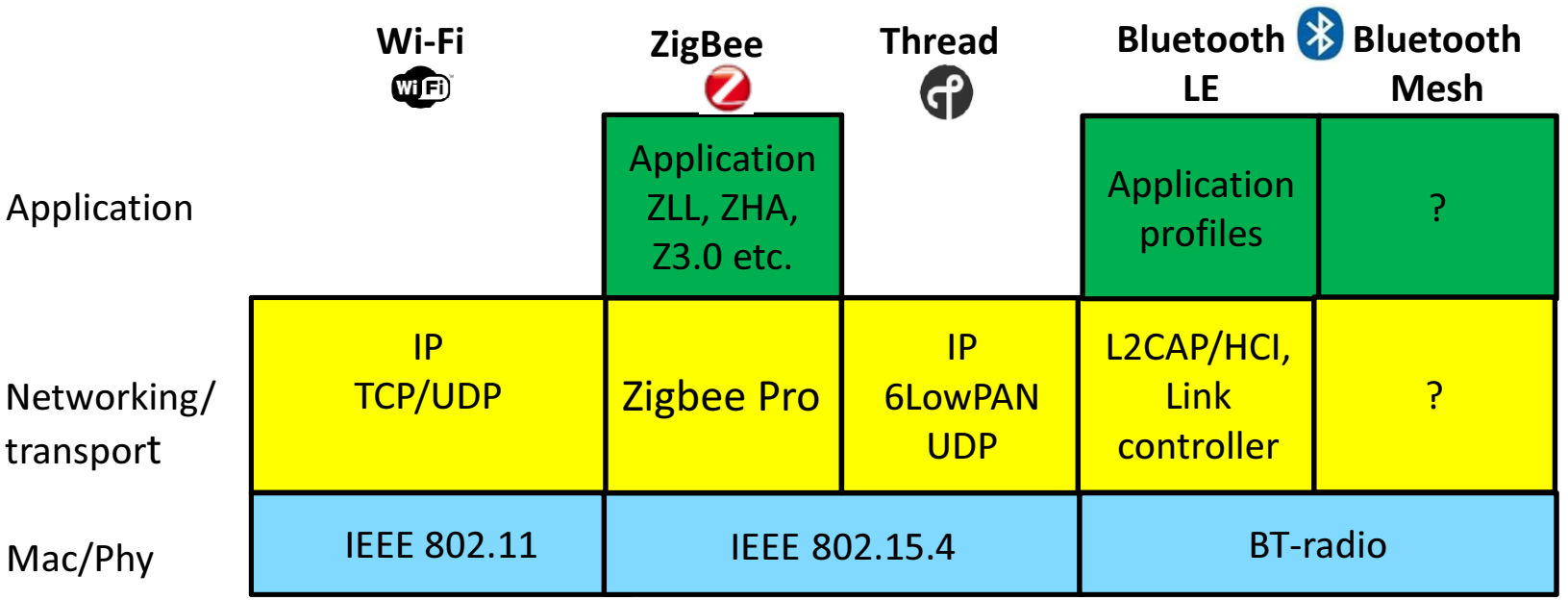


- Low power: sleep/wakeup

- User transmission simultaneously (fragment)



Wireless technology standards



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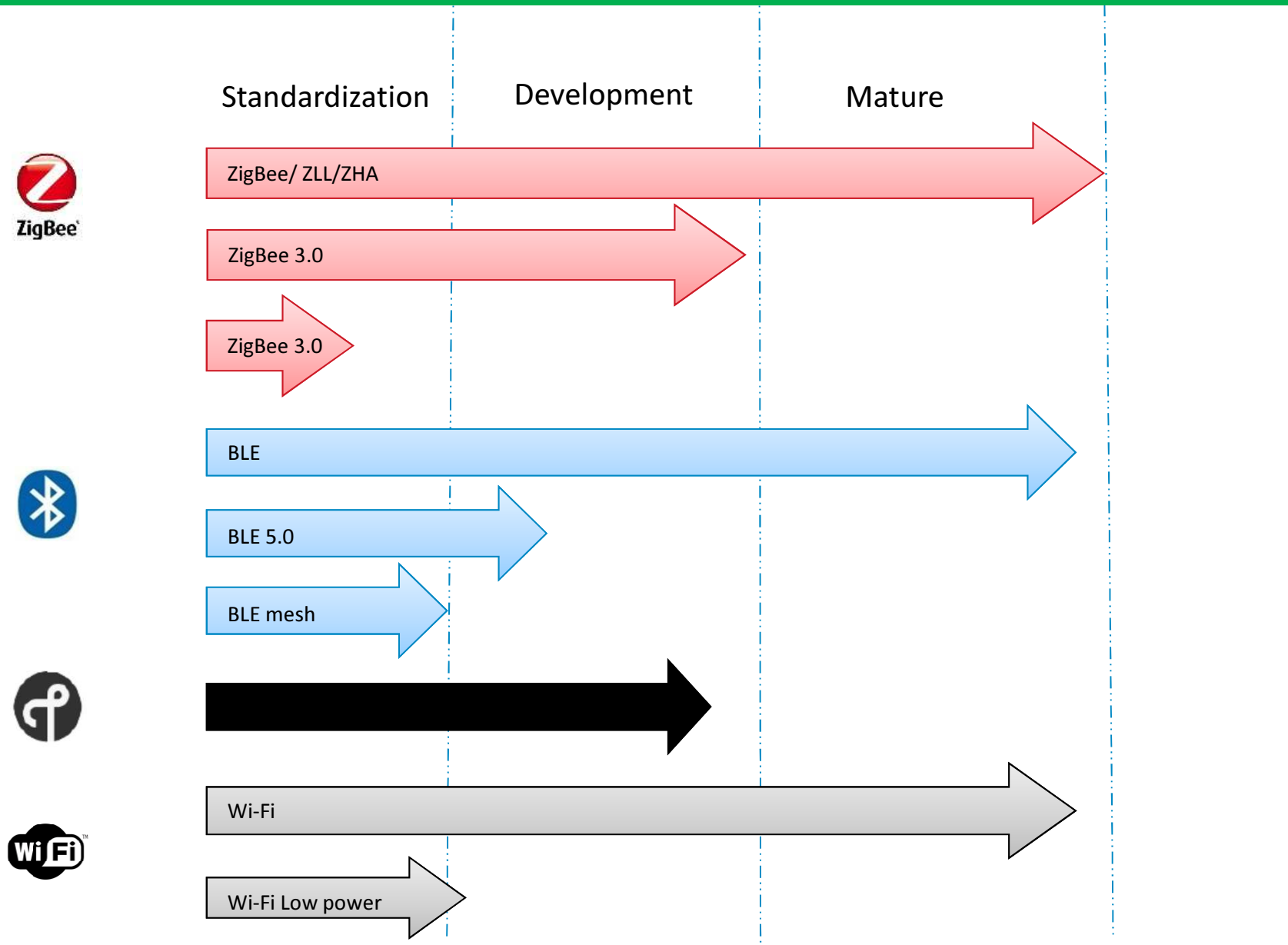
Wireless technology standards



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OCC and LiFi

- Camera Sensing requires Super Nodes in network:
  - New sensing technologies like camera based sensing in innovation that provides valuable high quality data.
  - Furthermore due to cost of processing sensors in the beginning will be deployed more sparse (not in every luminaire). This introduces **“super nodes”** that require more bandwidth on the local communication than the other nodes.

- Li-Fi:

Other alternative connectivity technologies available.

NB-IoT

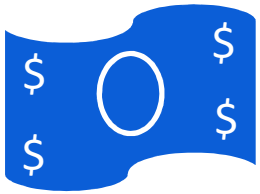
Better Indoor Coverage

Extend 20dB beyond GPRS

Low Power Consumption

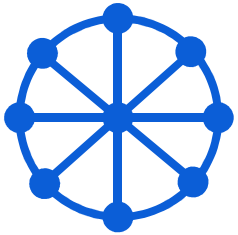
10 year battery life with Wh battery capacity

Low Device Cost



$1-2 per chipset
$5-10 per module

Massive Number of Devices



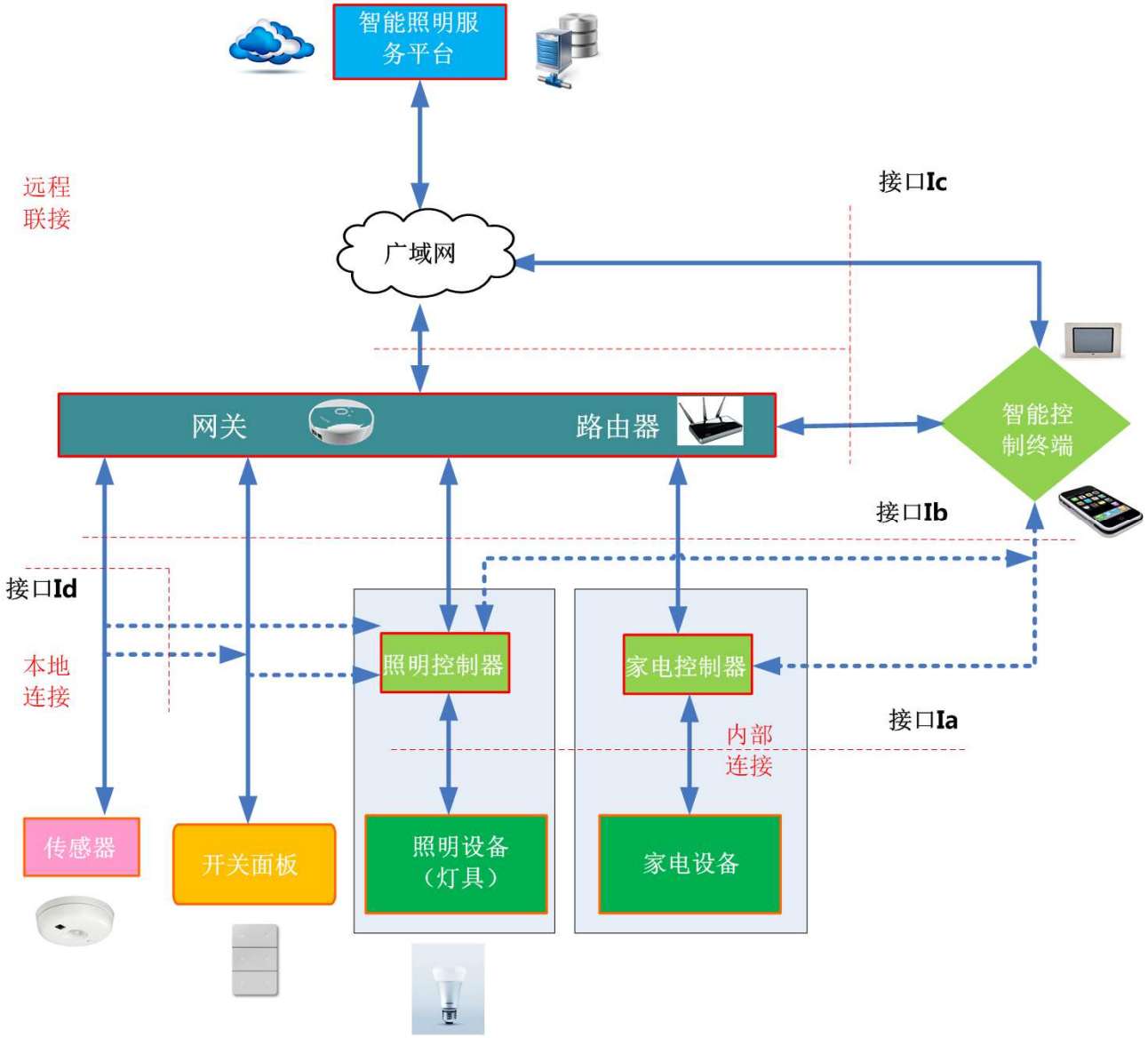
50K connections per cell

NB-IoT vs eMTC

比较项	NB-IoT	eMTC
频段	FDD	FDD, TDD
部署	LTE带内, LTE保护带, 独立	LTE带内
双工	HD	HD/FD
天线个数	1/2 (RxD)	1/2 (RxD)
载波带宽	200KHz	1.4MHz
上行		
下行		
峰值		
子载		
TTI		
调制		
多址		
移动		
时延		
语音		
小区		
定位	待标准支持 (R14, E-CID/UTDOA/OTDOA, 目标<50m)	标准已支持 (约50m)
功耗	PSM, eDRX	PSM, eDRX
芯片成本	目标<1$ (比eMTC更低)	目标1-2$
模组成本	目标2-5$	相比NB-IoT更高
标准引入版本	R13, 2016	R13, 2016

技术指标		NB-IoT	LTE FDD eMTC	LTE TDD eMTC (3:1)
载波带宽		200kHz	1.4MHz	1.4MHz
峰值速率	上行	66.7 kbps	375kbps(半双工)/ 1Mbps(全双工)	200kbps
	下行	32.4 kbps	FD：800kbps HD：300kbps	750kbps
覆盖 (与GSM相比)		好20dB	好11dB	
功耗		约10年	约10年	
模组成本		初期小于5美金	初期小于10美金	
连接数		约5万/小区	未做针对性优化，预计能力弱于NB-IoT	
移动性		空闲态小区重选	连接态小区切换	
语音能力		不支持	具备支持能力，但容量有限，目前产业规划不多	受上行速率低影响，支持语音能力比FDD版本差

Connected home



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Connected home

通信技术	家居整体照明系统	智能照明单品	扩展照明
ZigBee Control your world	适合	一般 （需要网关支持）	不适合，无法提供高带宽传输
Wi Fi	不适合 需要改进： 1. 增加接入节点数目 2. 降低功耗 3. 定义应用层协议	一般： 需要改进： 1. 定义应用层协议	一般： 需要改进： 1. 定义应用层协议
4.0 Bluetooth	不适合： 需要改进： 1. 增加接入节点数目 2. 定义应用层协议	一般： 需要改进： 1. 定义应用层协议	一般： 需要改进： 1. 定义应用层协议

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