

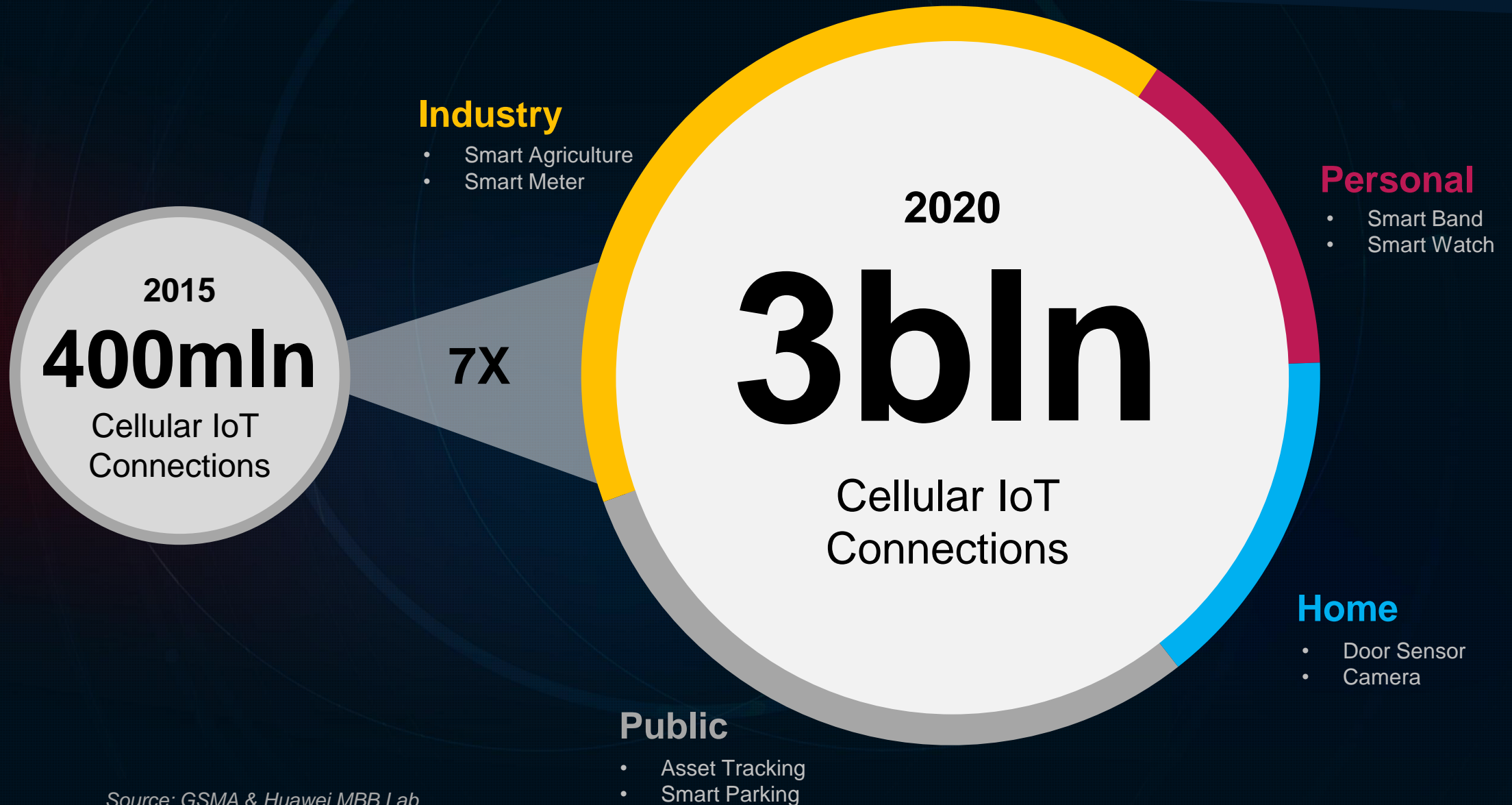


Narrow Band IoT

Keskenysávú IoT kommunikáció
az engedélyes spektrumokban

- ▶ **Cellular IoT, Iparági Áttekintés**
- ▶ **NB-IoT Összefoglalás**
- ▶ **NB-IoT Megoldások Áttekintése**
- ▶ **NB-IoT Ökoszisztéma és Javasolt Szakterületek**

Wide Range of Opportunities on Cellular IoT



Source: GSMA & Huawei MBB Lab

By 2020, LPWA to Represent 70% of Cellular IoT Connections

Market Segment	Connections in 2020 (Billion)	Requirements	Technology
<ul style="list-style-type: none"> ● Camera ● Electronic billboards... 	0.2B	<ul style="list-style-type: none"> >10Mbps 	3G/4G
<ul style="list-style-type: none"> ● Smart Home ● POS... 	0.8B	<ul style="list-style-type: none"> ~1Mbps Low power consumption 	GSM/GPRS/CDMA LTE MTC(R12, R13)
<ul style="list-style-type: none"> ● Sensors, Meters ● Asset Tracking ● Smart Parking ● Smart agriculture ... 	2B	<ul style="list-style-type: none"> Small Packet (<100kbps) Deep Coverage (20dB) Low power (10 Years) Low cost (<\$5) 	Zigbee, Bluetooth WiFi, Sigfox, LoRa NB-IoT...



LPWA: Low Power Wide Area

Coverage is NOT Enough for LPWA Market

European Commission Smart Grid and Meter 2020



200 million
Electronic Meters

45 million
Gas Meter



€ 45 billion
Investment

Saving
€ 160 for Gas
€ 309 for Electricity
Per Meter

2016-01-21统计情况如下

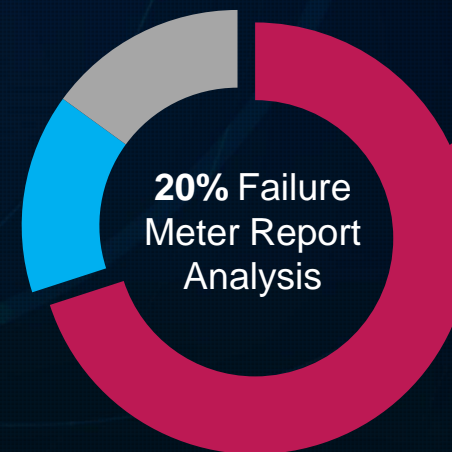
用户类型	总个数	上传个数	未上数个数	上数率
1-21楼门表和户数	11398	8832	2566 查看详情	77.49%
1-20楼门表和户数	11398	8941	2457 查看详情	78.44%
1-19楼门表和户数	11398	9015	2383 查看详情	79.09%
1-18楼门表和户数	11398	9097	2301 查看详情	79.81%
1-17楼门表和户数	11398	9097	2301 查看详情	79.81%
1-16楼门表和户数	11398	9154	2244 查看详情	80.31%

站点列表 [返回顶部](#)

鸿海家园二区	编号	600000621	仪器编号	0600000621
小红门新村二期A区	编号	600000623	仪器编号	0600000623
远洋天著	编号	100148080	仪器编号	0100148080

20%
Smart Meter
Report Failure Rate

Source: Yi Zhuang, BeiJing, China



¥ 150
Customer Visit Once

10 Years Battery Life for Many LPWA Use Cases

Demand



10 years

Battery Life

Requirement
Japan/Australia: 10 Years
China: 6 Years

2G/3G/4G Require



4
Batteries

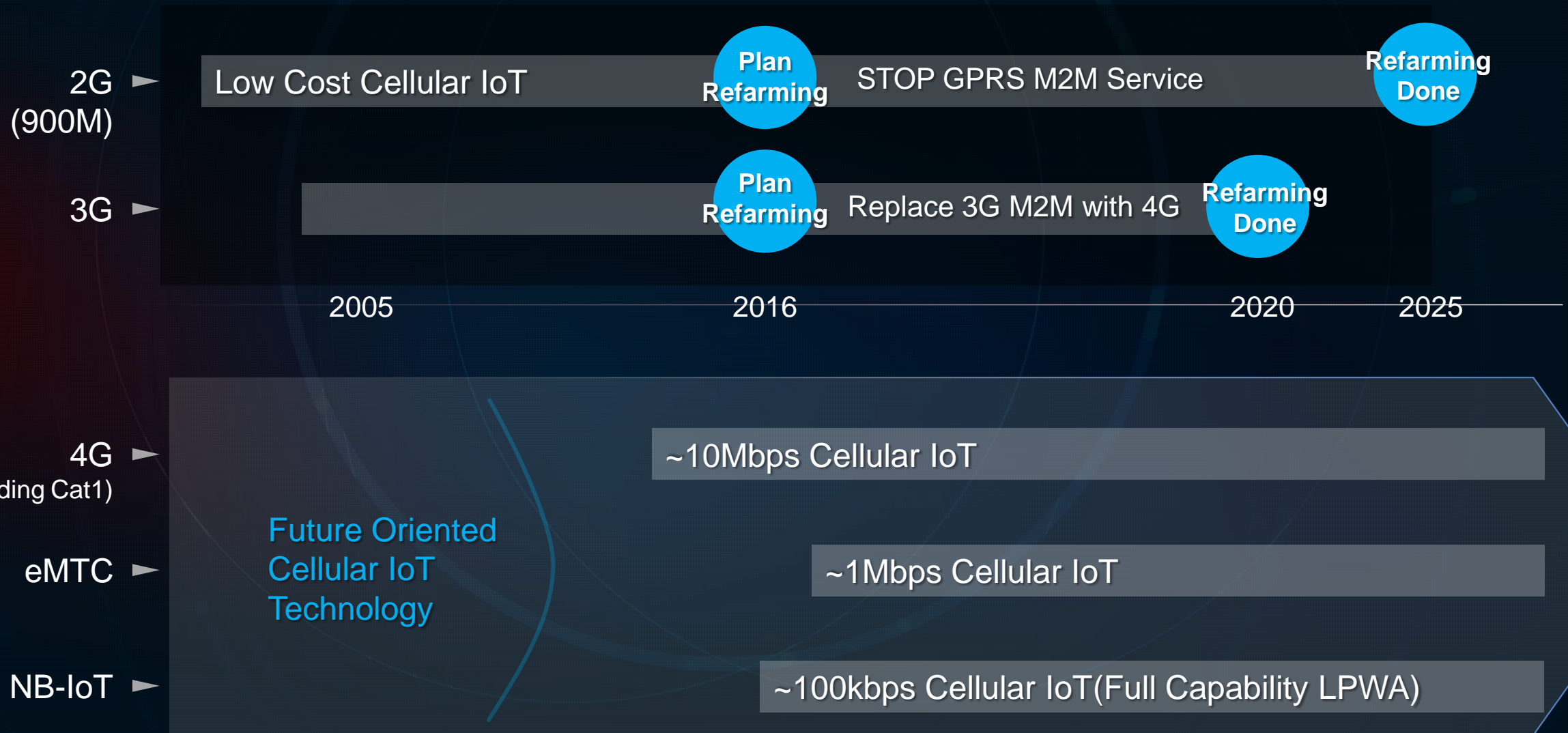
2400mAh
Gas meter traffic mode

Billions of Dollar Saving
for Utility Industry
If 2 Batteries for 10 years

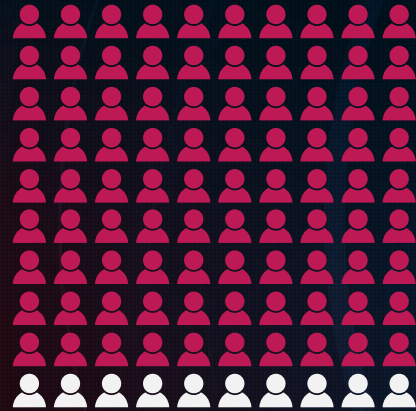
5 USD Module is Competitive for LPWA Market



NB-IoT is Future Oriented LPWA Technology



Leverage Existing Network and Deploy Wide Area NB-IoT



90%
Population
Coverage

VS
GAP

400mln
7%
of the Global
IoT Market 2015



Target 2020

3billion
30%
of the Global
IoT Market



70%
Geographic
Coverage

With New Standardized ClIoT
Technology Like NB-IoT/eMTC

Network 2015

- ▶ **Cellular IoT Industry Insights**
- ▶ **NB-IoT Industry Update**
- ▶ **NB-IoT Solution Overview**
- ▶ **NB-IoT Ecosystem and Typical Cases**

Huawei's Major Contribution on Standardization



NB-IoT Chipset/Module is Taking Shape



20 NB-IoT Commercial Network by the end of 2017



Source: Huawei and GSA

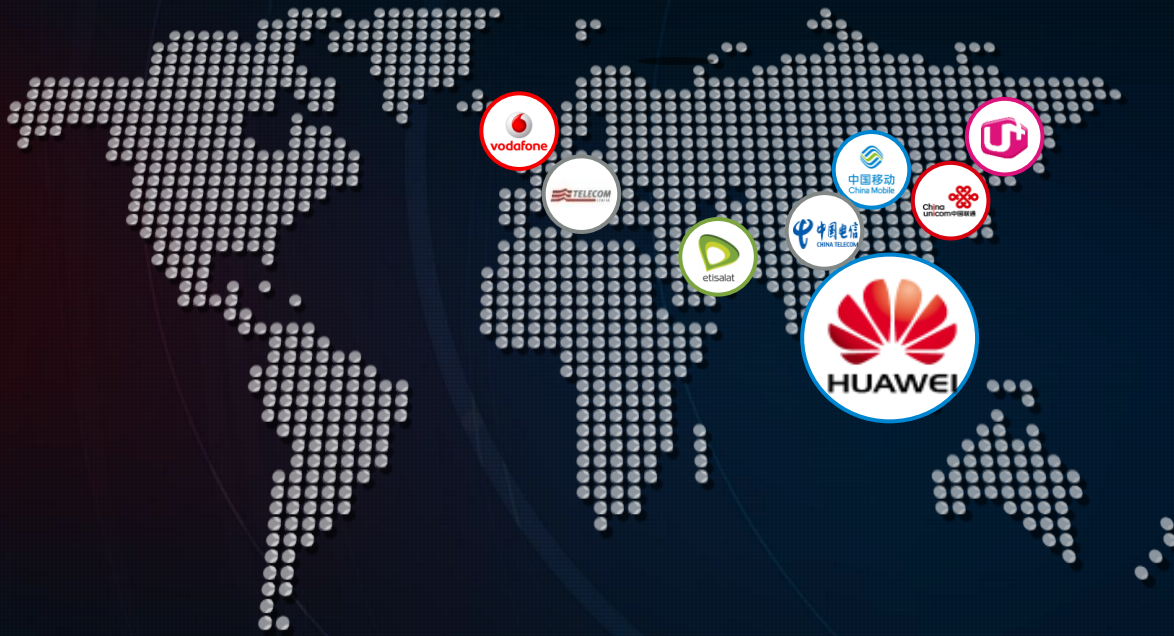
NB-IoT Forum Taking Off in MWC 2016



More members join
GSMA NB-IoT Forum

NB-IoT Open Lab Promotes Ecosystem

Global NB-IoT Open Lab



- **Openness** for Vertical Industry
- **Innovation** for New Business



Open Lab@Offline for Integration Anywhere

Global
Open Lab

Open Lab@offline

SoftRadio



Over internet, remotely, no travel

- ▶ **Cellular IoT Industry Insights**
- ▶ **NB-IoT Industry Update**
- ▶ **NB-IoT Solution Overview**
- ▶ **NB-IoT Ecosystem and Typical Cases**

Cellular IoT Architecture

IoT Applications



Telemetric



Smart Metering



LTE-VDC



Intelligent Supply Chain



Intelligent Production Line



Intelligent Artificial aid

IoT Platform

Unified IoT Platform

IoT Core

Option 1

EPC
(Software Upgrade)

New EPC

Option 2

Cellular IoT Access Technologies

LTE

NB-IoT

MTC/eMTC

LTE-V

2016

2017-2018

2018

202X

High Bandwidth

Low Bandwidth
and Low Power Consumption

Ultra-reliable and Low Latency

NB-IoT Solution Highlight



Coverage

PSD, Repetition
2R, 4R, UL CoMP



Power Saving

PSM, eDRX



Throughput

Single Tone,
Multi Tone, Multi Carrier



Site

GULM 4 mode,
900M/850M/US700
/DD800/APT700/1800M



Positioning

Nano GPS
UTDOA



Topology

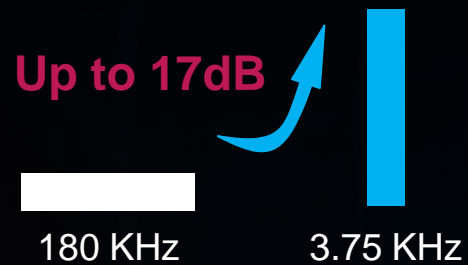
MOCN, MORAN, SFN

Coverage: NB-IoT Born to Provide Better Coverage

PSD (Power Spectrum Density)

PSD Gain

$$=10\log (\text{Power A/Bandwidth A}) /(\text{Power B/Bandwidth B})$$



Repetition

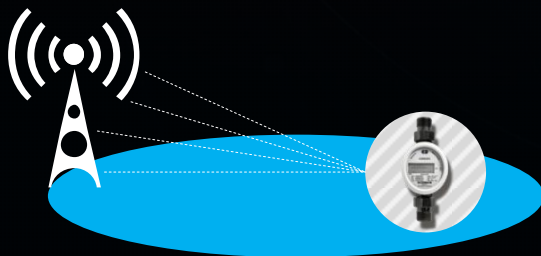
Repetition Gain

$$=10\log \text{ Repetition Times}$$



UL 4R Receive

planning

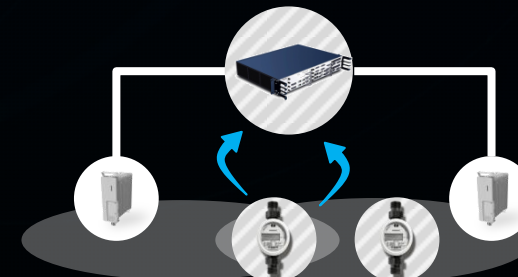


3dB Gain(vs 2R)

- GSM 1R
- NB-IoT 2R/4R

Inter-site UL CoMP

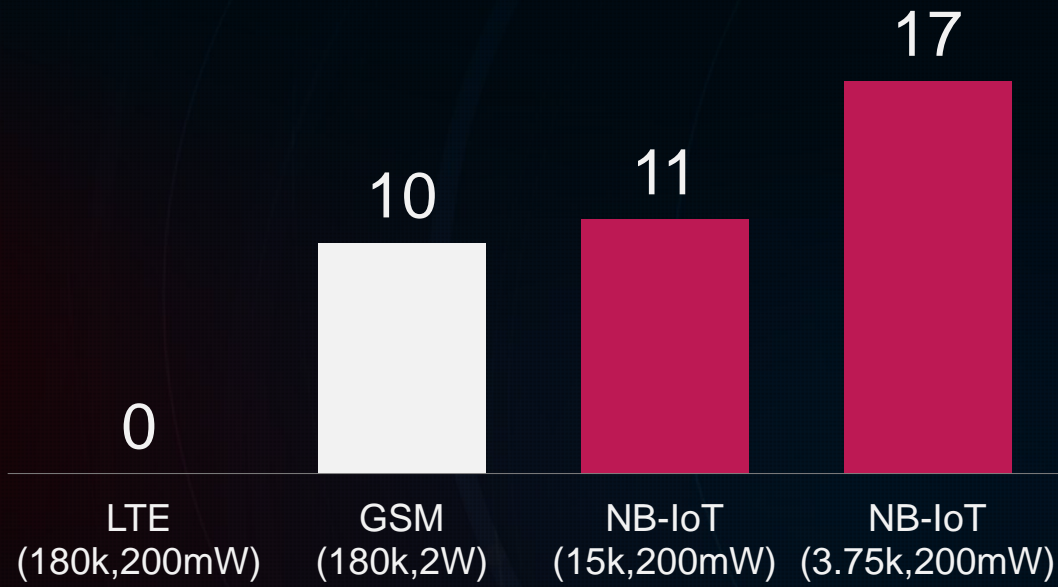
planning



3dB Gain

Coverage: 20dB Gain Break Down

Uplink PSD Gain



Total Uplink Gain

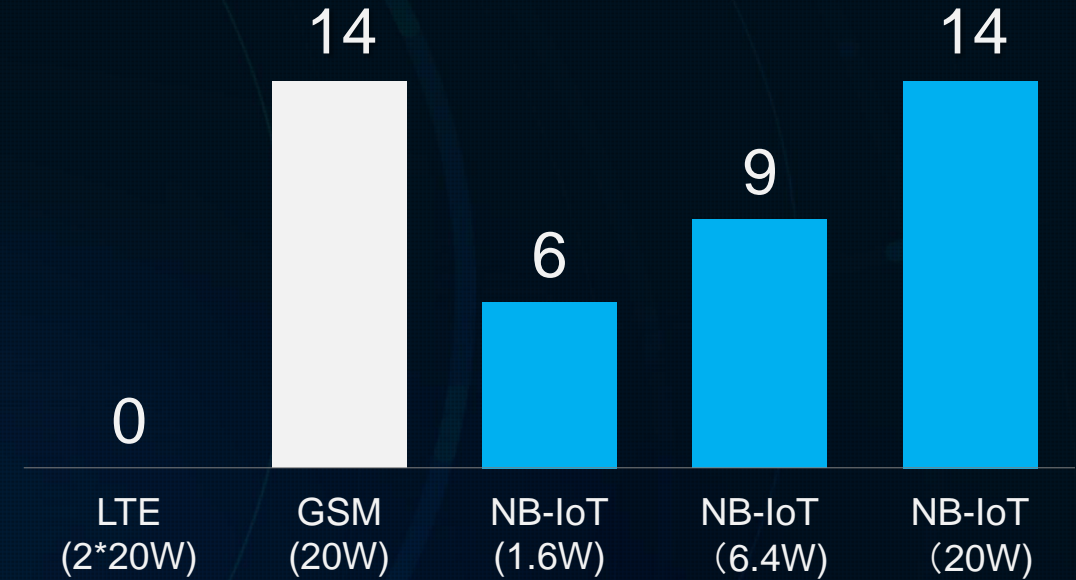
20dB (vs GSM)

= 7dB(PSD) + 3dB(2R) + 10dB(12times Repetition)

20dB (vs LTE)

= 17dB(PSD) + 3dB(2 times Repetition)

Downlink PSD Gain



Total Downlink Gain

15dB (vs GSM)

= 9dB(Coding) + 6dB(4times Repetition)

15dB (vs LTE)

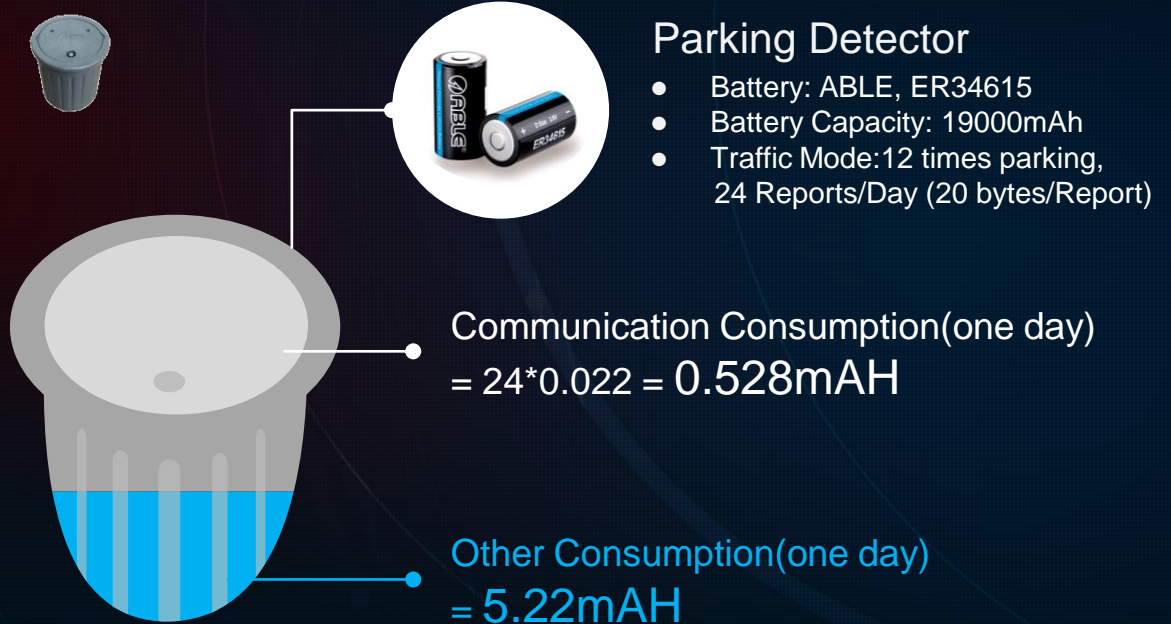
= 14dB(PSD) + 1dB(2times Repetition)

Power Saving: Battery Life Case Study

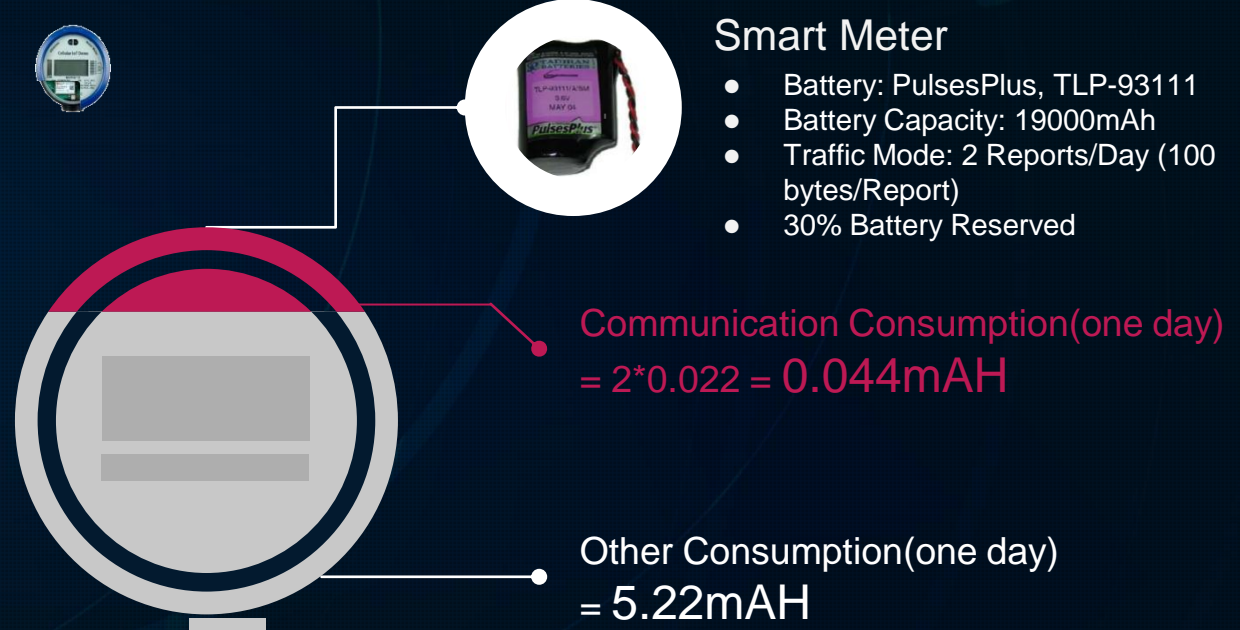
Battery life = Battery Capacity * Battery loss Factor / Device Consumption

Device Consumption = Average Communication Consumption + Other Consumption

Battery Loss Factor: Typical 75%



Battery Life= $19000\text{mAh} * 3 * 75\% / (5.22 + 0.528) / 365 > 10 \text{ years}$



Battery Life= $19000\text{mAh} * 3 * 75\% / (0.044 + 5.22) > 10 \text{ years}$

Site: SingleRAN Support Upgrading Smoothly to NB-IoT



eNodeB

NB-IoT
(add-on)



Reuse Existing Antenna



Reuse Existing RF



Reuse Existing Baseband



Reuse Existing OSS

NB-IoT

10 Years
Battery Life



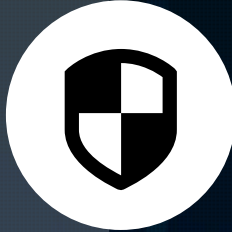
Re-use Existing
Network



20dB
Coverage Gain



Carrier-grade
Reliability



\$5 Module



4G-Like
Security



100k Device/Cell



Roaming



LPWA Technologies Overview

	Sigfox	LoRa	EC-GSM	Cat-1	Cat-0	eMTC	NB-IoT
Standardization	Private	Open	3GPP	3GPP	3GPP	3GPP	3GPP
Spectrum	Unlicensed	Unlicensed	Licensed	Licensed	Licensed	Licensed	Licensed
Channel BW	100Hz	7.8~500kHz	200kHz	1.4~20MHz	1.4~20MHz	1.4MHz	180KHz
System BW	100KHz	125kHz	1.4MHz	1.4~20MHz	1.4~20MHz	1.4MHz	180KHz
Peak Data Rate	UL:100bps DL:600bps	180bps~37.5kbps	DL: 74kbps UL:74kbps	DL:10Mbps UL:5Mbps	DL:2Mbps UL:1Mbps	DL:800kbps UL:1Mbps	DL:234.7kbps UL:204.8kbps
Max. number of Message per day	140(Device) 50000(BTS)	50000(BTS)	unlimited	unlimited	unlimited	unlimited	unlimited
Device Peak Tx Power	14dBm	14dBm	26dBm	23dBm	23dBm	23dBm	23dBm
MCL(Maximum Coupling Loss)	UL:156dB DL: 147dB	UL: 156dB DL: 168(SF12, BW7.8) 132(SF6, BW125)	164dB	144dB	144dB	156dB	164dB
Device Power Consumption	Low	Low-Medium	Low	Medium	Medium	Low-Medium	Low

- ▶ **Cellular IoT Industry Insights**
- ▶ **NB-IoT Industry Update**
- ▶ **NB-IoT Solution Overview**
- ▶ **NB-IoT Ecosystem and Typical Cases**

NB-IoT Module: u-blox



- Swiss Semiconductor Company, Founded in 1997
- Market Focus Automotive, Industrial and Consumer
- Product Offering Includes Integrated Circuits, Modules and Services
- Cooperation on NB-IoT from 14Q4

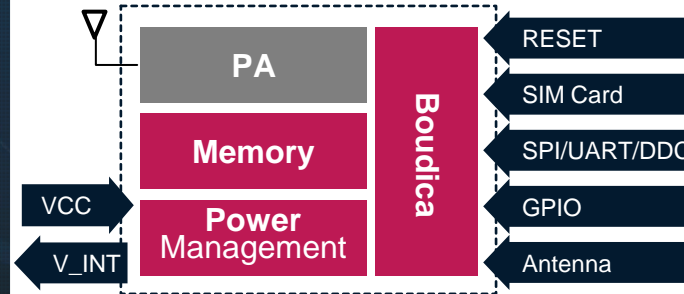


LISA

- Based on Icen1
- Dimension: 22.4*33.2*2.6mm
- Power Consumption: High
- 15Q1 Ready for Trial

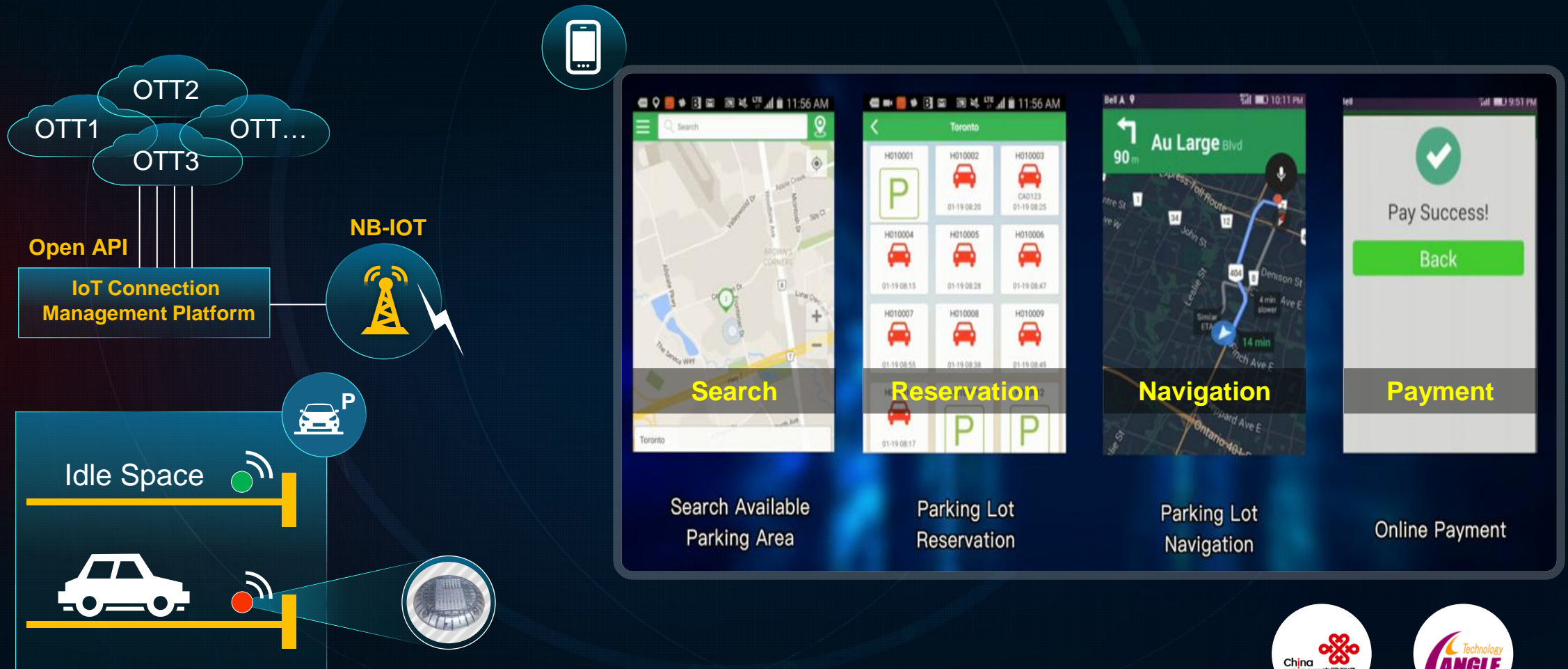


SARA



- Based on Boudica
- 1st Commercial NB-IoT Module
- Dimension: 16*26*3mm
- Support Band: Band 5, 8, Other Bands According to Market Requirement
- Power Consumption: Receive 90mA, Transmit 46mA, Standby 0.015mA
- 16Q1 pre NB-IoT; Software Upgrade to NB-IoT in 16Q3

Smart Parking



Smart Parking Cases

2015 Global Field Trial



2016 Commercial Deployment






Shanghai Disney Land

- 2016Q2: 300+ Parking Spaces
- 2016Q4: 9k Parking Spaces

Shanghai: Plan to Launch in whole City from 2017

Others Global Market: Planning

Water Utility Transforming to ICT

-  Smart Meter
-  Pipe Network Monitor
-  Tank/Water Bin Control



Challenges & Concerns

-  Coverage
-  High Power consumption
-  Still \$30~40 3G/4G Module Price
-  Security & Reliability With unlicensed technology

Trialing
NB-IoT

South East
Water

VHA

OPTUS
yes

深圳水务集团
SHENZHEN WATER GROUP

中国电信
CHINA TELECOM

Expeted

99.5% Coverage | 10 Years Battery Life | Millions of Dollar Cost Saving

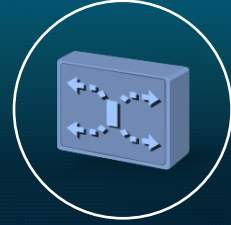
Street Lighting: Safe and Energy Saving City

- 1)   
- 2)   


Lighting Controller with NB-IoT





eNodeB



IoT Packet Core









IoT Platform



Lighting Mgmt



-  Remote control each individual light(On/off/tuning)
-  Report status in real time
-  Security and Reliability
-  Remote configuration
-  Remote troubleshooting & Lifetime Prediction
-  No Relay

Tracking: Cargo Tacking

Safe logistics

- Environmental Abnormality Report



Damage



Moisture



Salinity



Temperature

- Report for Abnormal Unlock



NB-IoT

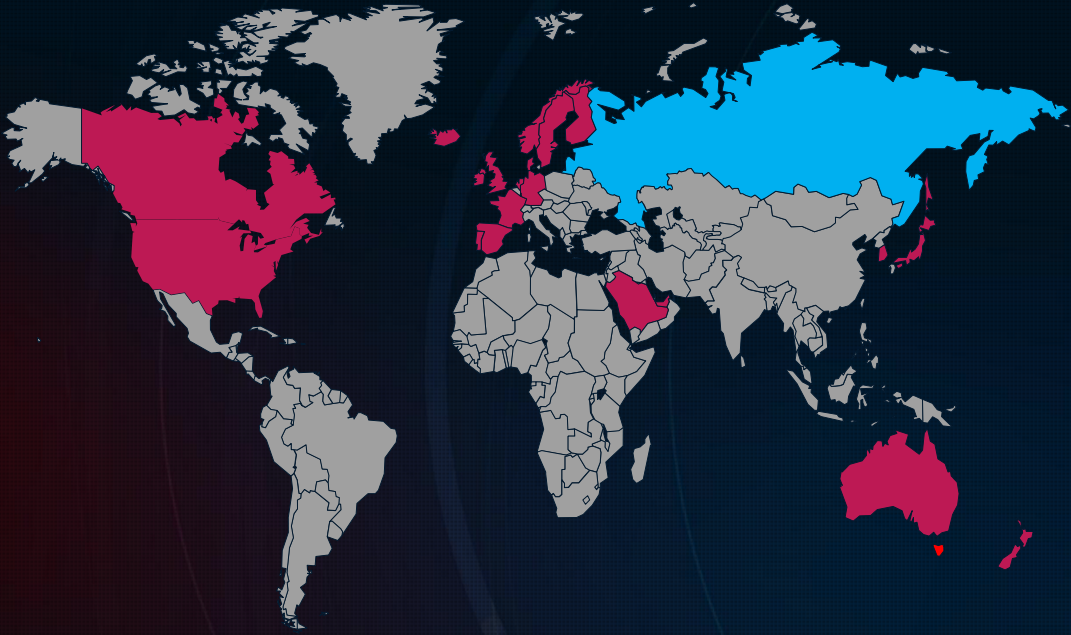
- Low Power Consumption
- Ubiquitous Coverage



Ascent

- Based in Singapore
- Product: Cargo Tracking, Fleet Management
- Plan to Support NB-IoT 2016Q3

Smart Trash Bin, Improving the Services



NB-IoT make waste management intelligent & efficiency

50% of waste collect companies is suffering decreasing profit



Trucks clutter up the road



Over-filling Overtime

Terminal 

- Monitoring in time
- Eliminate over-filling

Network 


- Status reported by NB-IoT network

Service 

- Plan efficient routes for dumpcart

-50% labor cost

+35% Operation Efficiency



KÖSZÖNÖM!

Szathmáry Gyula

Head of Sales, IoT

Huawei Technologies, Europe

gyula.szathmary@huawei.com

