Quectel BC66&BC66-NA NB-IoT Module

Product Overview

October, 2019

Technical Background
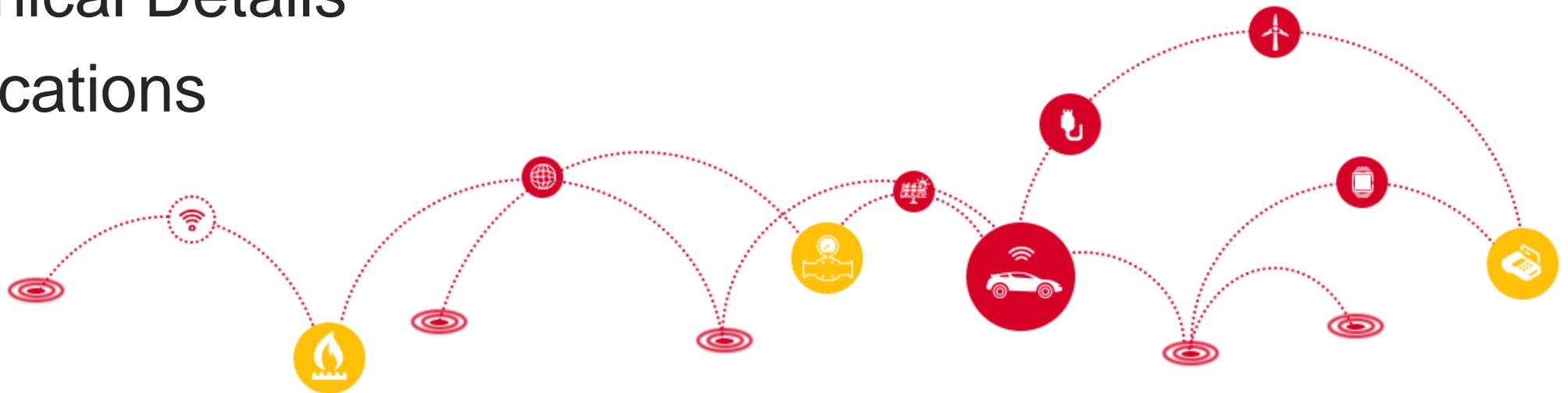
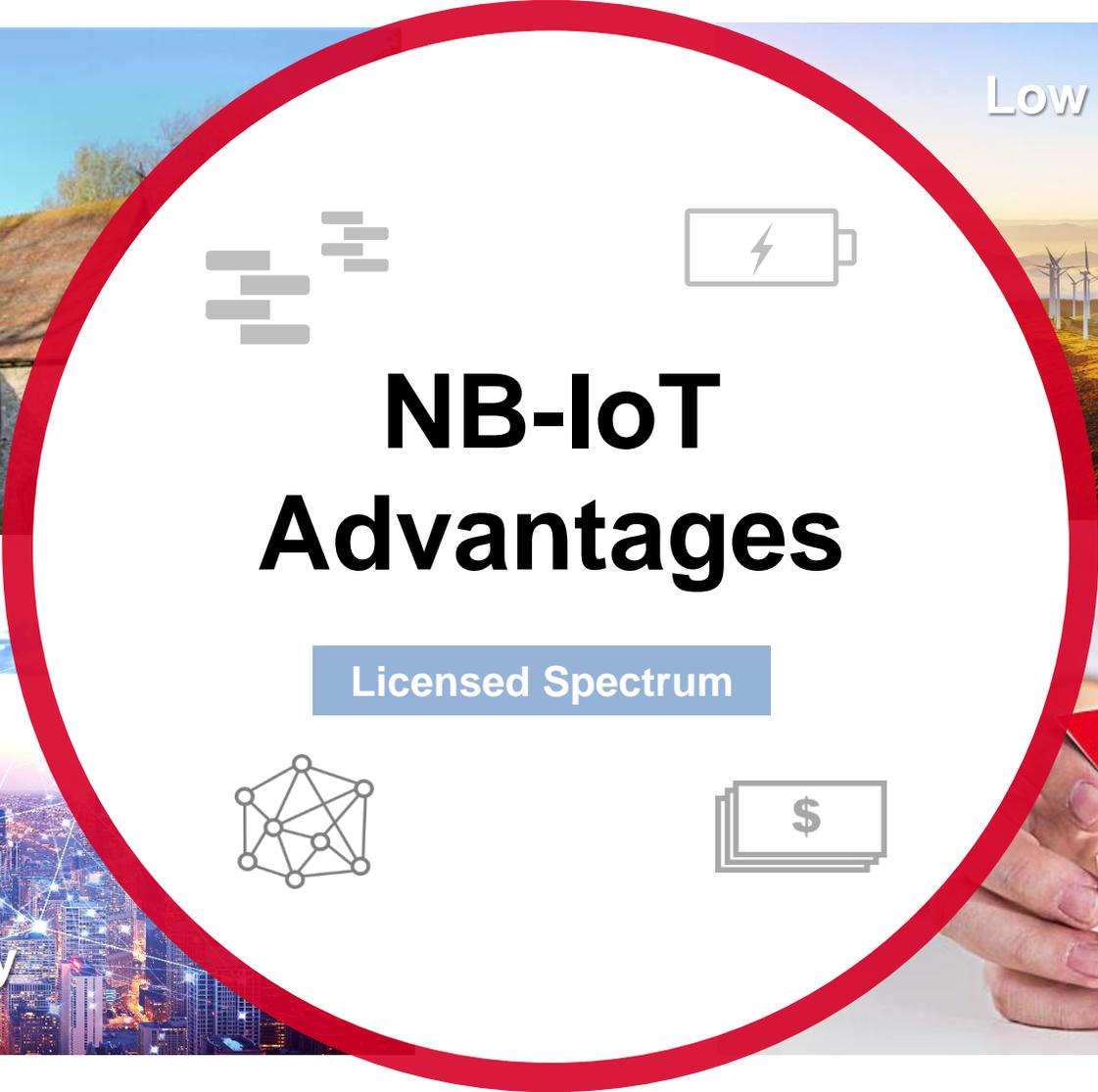NB-IoT Roadmap

Highlights & Specifications

Development Timeline

Technical Details

Applications

Extended Coverage
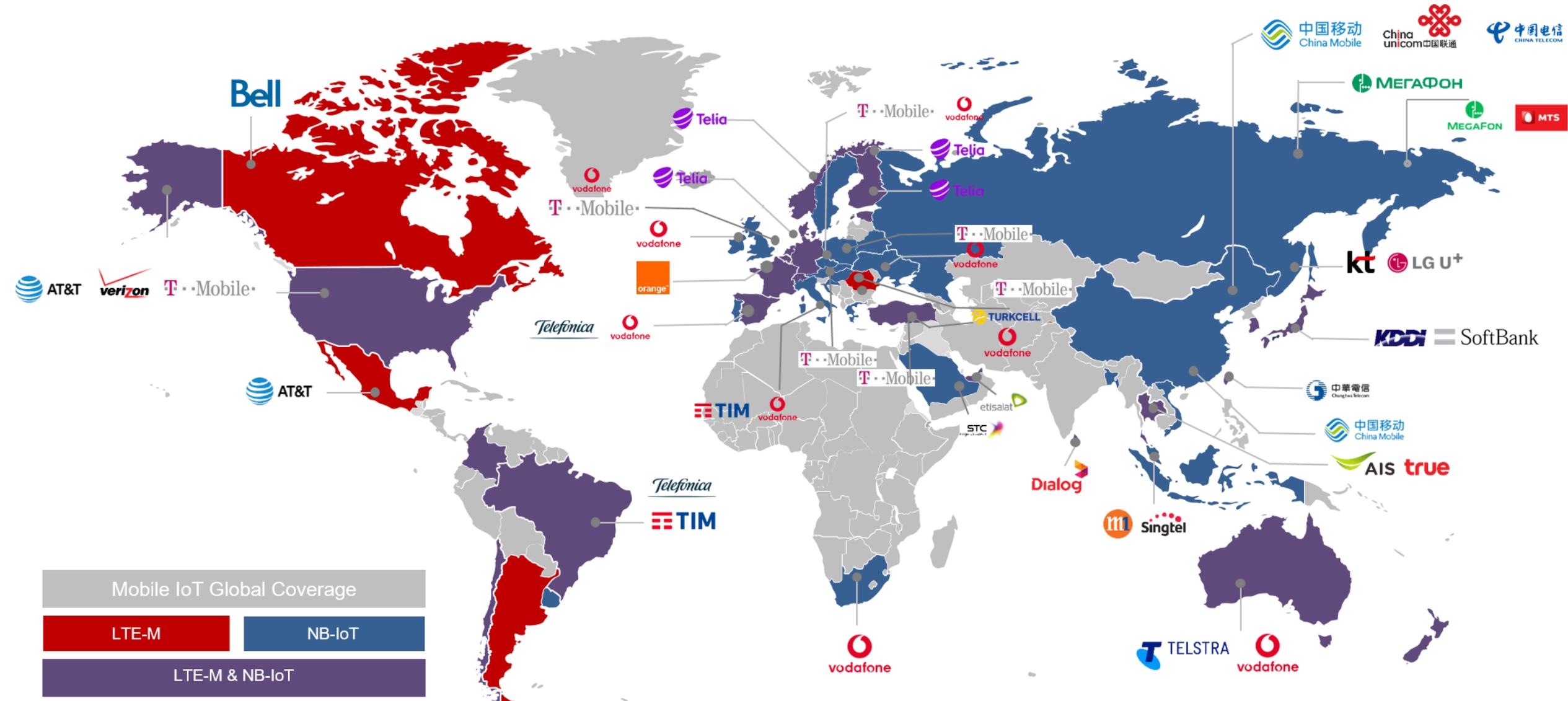
Low Power Consumption

NB-IoT Advantages

Licensed Spectrum

Massive Connectivity

Low Cost

LPWA Network Deployment (Based on GSMA Data up to Oct. 10, 2019)

Mobile IoT Global Coverage
- LTE-M
- NB-IoT
- LTE-M & NB-IoT

NB-IoT Global Coverage (1) (Based on GSMA Data up to Oct. 10, 2019)

NB-IoT = 90								
Operator	Country/Region	Bands	Operator	Country/Region	Bands	Operator	Country/Region	Bands
3	Hong Kong, China	8	Elisa	Finland	20, 3	Orange	Belgium	20
A1	Austria	20	Elisa	Estonia	20	Proximus	Belgium	20
A1	Croatia	20	Etisalat	UAE	20	SFR	France	20
AIS	Thailand	8	Entel	Chile	28	Singtel	Singapore	8
APTG	Taiwan, China	8	FarEasTone	Taiwan, China	28	SmarTone	Hong Kong, China	8
Altice	Portugal	20	Grameenphone	Bangladesh	3, 8 (TBC)	SoftBank	Japan	1, 3, 8
Antel	Uruguay	28	KT	South Korea	3	StarHub	Singapore	8
AT&T	United States	2, 4, 12	Kyvistar	Ukraine	3	STC	Saudi Arabia	12
China Mobile	China	8	LGU+	South Korea	5	Swisscom	Switzerland	20
China Mobile	Hong Kong, China	3	M1	Singapore	3, 8	Taiwan Mobile	Taiwan, China	3, 28
China Telecom	China	5	Maxis	Malaysia (6 Cities)	3	TDC	Denmark	20
China Unicom	China	3, 8	Mobitel	Sri Lanka	8	Telecom Italia	Brazil (TIM Brazil)	3, 28
Chunghwa	Taiwan, China	8	MegaFon	Russia	20, 8, 3	Telecom Italia	Italy	20
Dialog Axiata	Sri Lanka	3, 8	Mobitel	Sri Lanka	3	Telefónica	Spain	20
DNA	Finland	20, 3	MTS	Russia	3	Telefónica	Brazil	3, 28
DU	UAE	20	NOS	Portugal	20	Telefónica	Germany	8, 20
DT	Australia	8	NTT Docomo	Japan	1, 19	Telefonica	Colombia	2

NB-IoT Global Coverage (2) (Based on GSMA Data up to Oct. 10, 2019)

NB-IoT = 90								
Operator	**Country/Region**	**Bands**	**Operator**	**Country/Region**	**Bands**	**Operator**	**Country/Region**	**Bands**
Telenor	Denmark	20	T-Mobile	US	2, 4, 12, 66, 71	Vodafone	Turkey	8, 20
Telenor	Norway	8, 20	Turkcell	Turkey	20	Vodafone	United Kingdom	20
Telia	Finland	20	Velcom	Belarus	8	Vodafone	Ukraine	3
Telia	Norway	20	Vodafone	Australia	8	Verizon	North America	13
Telia	Sweden	20	Vodafone	Czech Republic	8, 20	Viettel	Vietnam	/
Telia	Denmark	20, 8	Vodafone	Germany	20			
Telia	Estonia	20	Vodafone	Greece	20			
Telkomsel	Indonesia	8	Vodafone	Hungary	20			
Telstra	Australia	28	Vodafone	Ireland	20			
True	Thailand	8	Vodafone	Italy	20			
T-Mobile	Austria	8	Vodafone	Malta	/			
T-Mobile	Croatia	8, 20	Vodafone	New Zealand	28			
T-Mobile	Germany	8, 20	Vodafone	Portugal	20			
T-Mobile	Greece	20	Vodafone	Spain	8, 20			
T-Mobile	Poland	20	Vodafone	South Africa	8			
T-Mobile	Slovakia	20	Vodafone	South Africa	8			
T-Mobile	Netherlands	20	Vodafone	Netherlands	20			

Technical Background

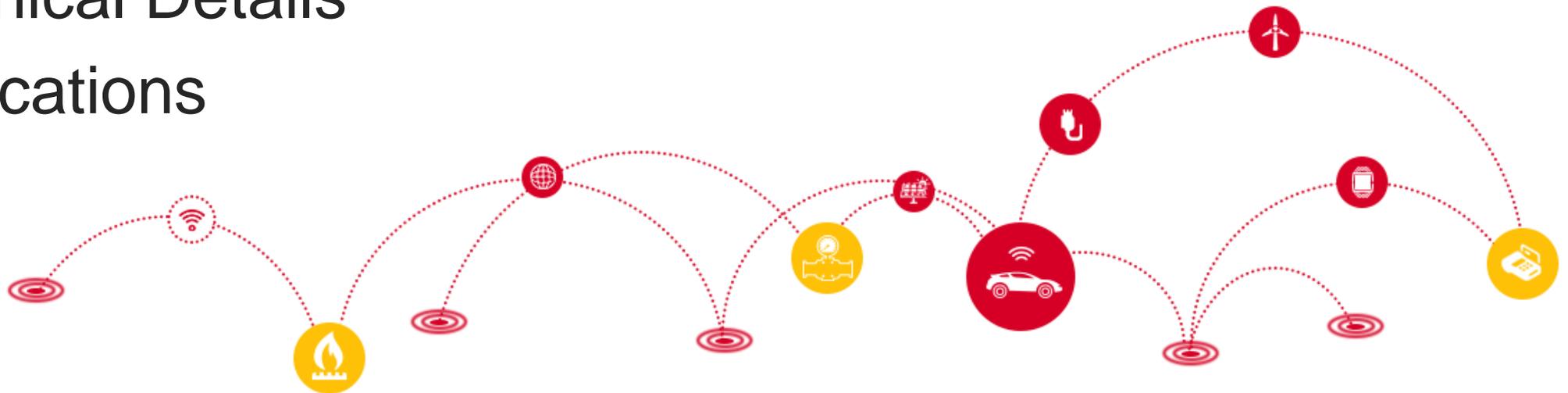**NB-IoT Roadmap**

Highlights & Specifications

Development Timeline

Technical Details

Applications

NB-IoT Modules (MTK) Roadmap

MEDIATEK

QUECTEL
Build a Smarter World

MT2625

BC950N-N1
- Cat NB1
- 25.5K DL/62.5K UL
- **450MHz Supported**

BC66-NA
- Cat NB2
- 103K DL/ 151K UL
- **B71/B85 Supported**
- Global Version

BC66
- Cat NB1
- 25.5K DL/ 62.5K UL
- Global Version

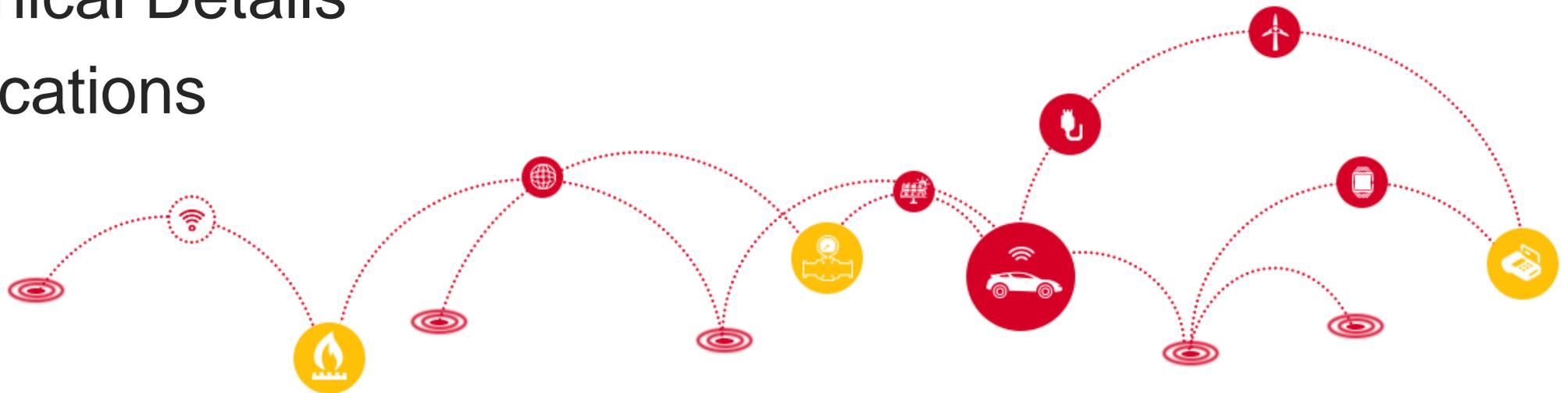| 2018	2019

Technical Background

NB-IoT Roadmap

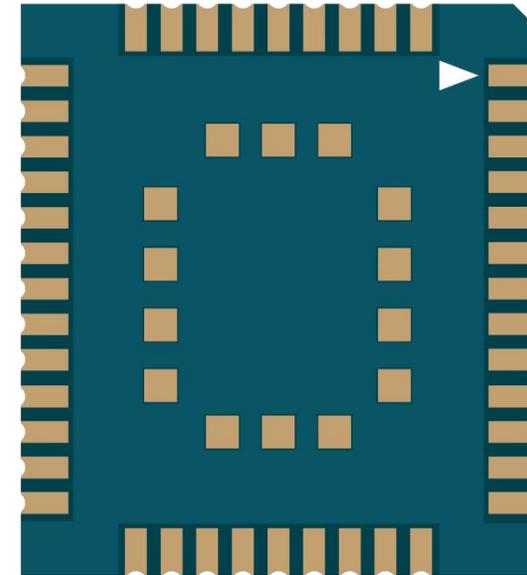**Highlights & Specifications**
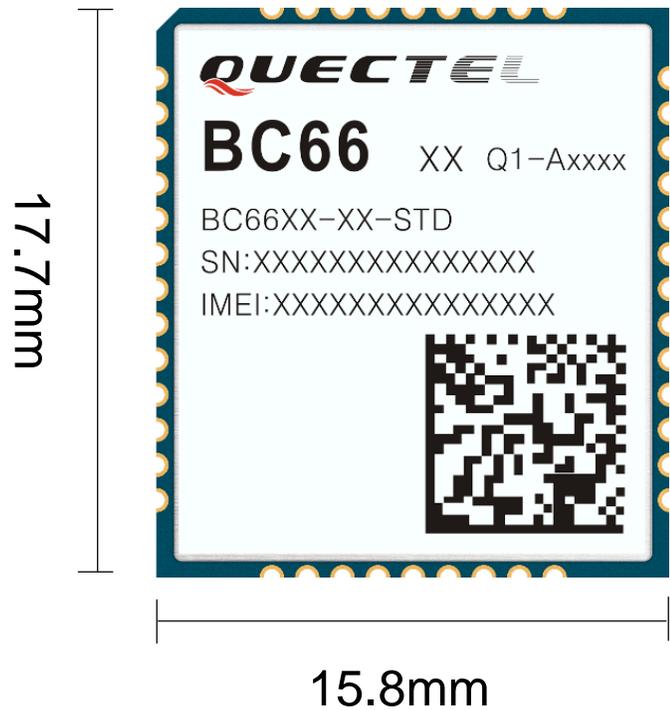
Development Timeline

Technical Details

Applications

BC66 Mechanical Dimensions

Multi-Band Cat NB1 Module (MTK MT2625)

17.7mm

15.8mm

2.0mm

Length: 17.7mm ($\pm$ 0.15mm)
Width: 15.8mm ($\pm$ 0.15mm)
Height: 2.0mm ($\pm$ 0.2mm)
Weight: Approx. 1.2g

BC66 Highlights

LTE Cat NB1
25.5kbps DL/ 62.5kbps UL

Highlight	Description
Global Bands	B1/B2/B3/B4/B5/B8/B12/B13/B17/B18/B19/B20/B25/B26*/B28/B66
Rich Hardware Interfaces	USB/ UART/ SPI[1]/ I2S[1]/ I2C[1]/ USIM/ ADC/ NETLIGHT/ PSM_EINT/ PWRKEY/ RESET
Abundant Protocols	UDP/ TCP/ LwM2M/ MQTT/ SNTP/ DTLS/ PPP*/ CoAP*/ TLS*/ HTTP*/ HTTPS*
Special Features	OpenCPU, DFOTA, eSIM[2]
Low Power Consumption	3.5µA (PSM), 0.24mA (eDRX), 0.35mA (DRX), 110mA (Active, 23dBm) *Average Value*
QuecLocator™ *	Location based on base station cell information
Power Supply Feature	Low power supply voltage (2.1V~3.63V, 3.3V typ.)
Wake-up Feature	Specialized PSM_EINT for module wake-up via external interrupt
Compatibility	Compatible with Quectel GSM module M66 and Quectel NB-IoT module BC68/ BC66-NA/ BC65

means under development.
[1] means supported only on OpenCPU version.
[2] eSIM is reserved and not included by default.

BC66 Main Interfaces

Interface	Description
USB	1
USIM	1
UART	3 (Main/Debug/Auxiliary UART)
PSM_EINT	1 (wake up device via external interrupt)
ADC	1 (10 bits)
RESET	1
PWRKEY	1
NETLIGHT	1
Antenna Pad	1
SPI	1 (for OpenCPU version only)
I2C	1 (for OpenCPU version only)
I2S	1 (for OpenCPU version only)
GPIO	Configurable (for OpenCPU version only)

BC66 Main Functions

| Function	Description
Protocols	UDP/ TCP/ LwM2M/ MQTT/ SNTP/ DTLS/ PPP*/ CoAP*/ TLS*/ HTTP*/ HTTPS*
SMS*	Text and PDU mode
DFOTA	Delta firmware upgrade over-the-air
eSIM	Supported ①
OpenCPU	• ROM: 200KB for APP image bin • RAM: 400KB (100KB static memory and 300KB dynamic memory)

means under development.

① eSIM is reserved and not included by default. If needed, a different OC will be provided.

BC66-NA Mechanical Dimensions

Multi-Band Cat NB2 Module (MTK MT2625)

17.7mm

QUECTEL

BC66-NA Q1-Axxxx
XX
BC66NAXX-04-STD
SN:XXXXXXXXXXXXXX
IMEI:XXXXXXXXXXXXXX
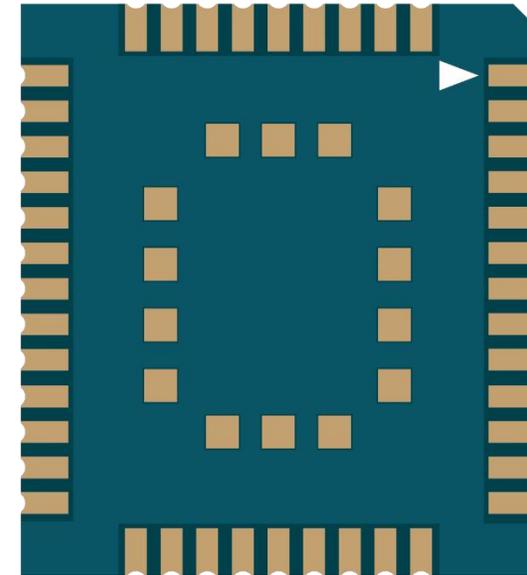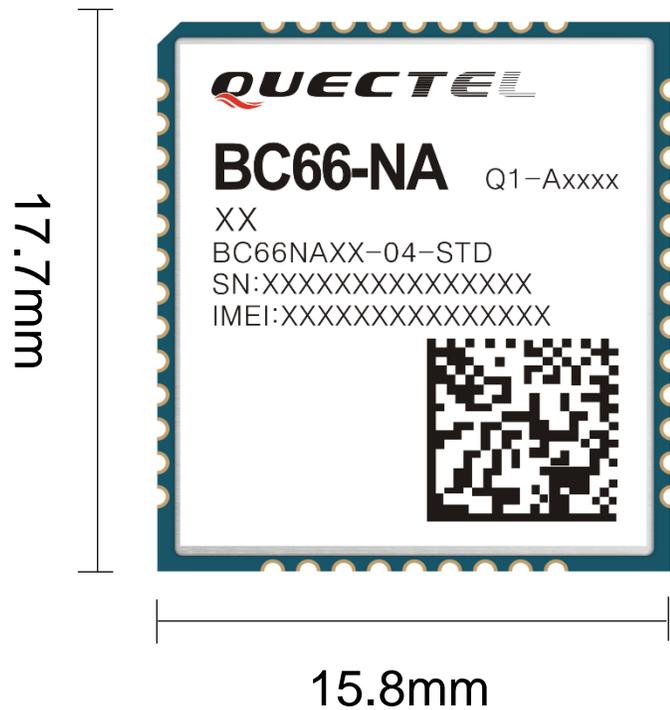
15.8mm

2.0mm

Length: 17.7mm ($\pm$ 0.15mm)
Width: 15.8mm ($\pm$ 0.15mm)
Height: 2.0mm ($\pm$ 0.2mm)
Weight: Approx. 1.2g

BC66-NA Highlights

LTE Cat NB2
103kbps DL/151kbps UL

Highlight	Description
Global Bands	B1/B2/B3/B4/B5/B8/B12/B13/B17/B18/B19/B20/B25/B26*/B28/B66/B71/B85
Rich Hardware Interfaces	USB/ UART/ SPI①/ I2S①/ I2C①/ USIM/ ADC/ NETLIGHT/ PSM_EINT/ PWRKEY/ RESET
Abundant Protocols	UDP/ TCP/ LwM2M/ MQTT/ SNTP/ DTLS/ TLS/ PPP*/ CoAP*/ HTTP*/ HTTPS*
Special Features	OpenCPU, DFOTA, OTDOA, eSIM②
Low Power Consumption	3.5μA (PSM), 0.13mA (eDRX), 0.25mA (DRX), 95mA (Active, 23dBm) *Average Value*
QuecLocator® *	Location based on base station cell information
Power Supply Feature	Low power supply voltage (2.1V~3.63V, 3.3V typ.)
Wake-up Feature	Specialized PSM_EINT for module wake-up via external interrupt
Compatibility	Compatible with Quectel GSM module M66 and Quectel NB-IoT module BC68/ BC66/ BC65

* means under development.
① means supported only on OpenCPU version.
② eSIM is reserved and not included by default.

BC66-NA Main Interfaces

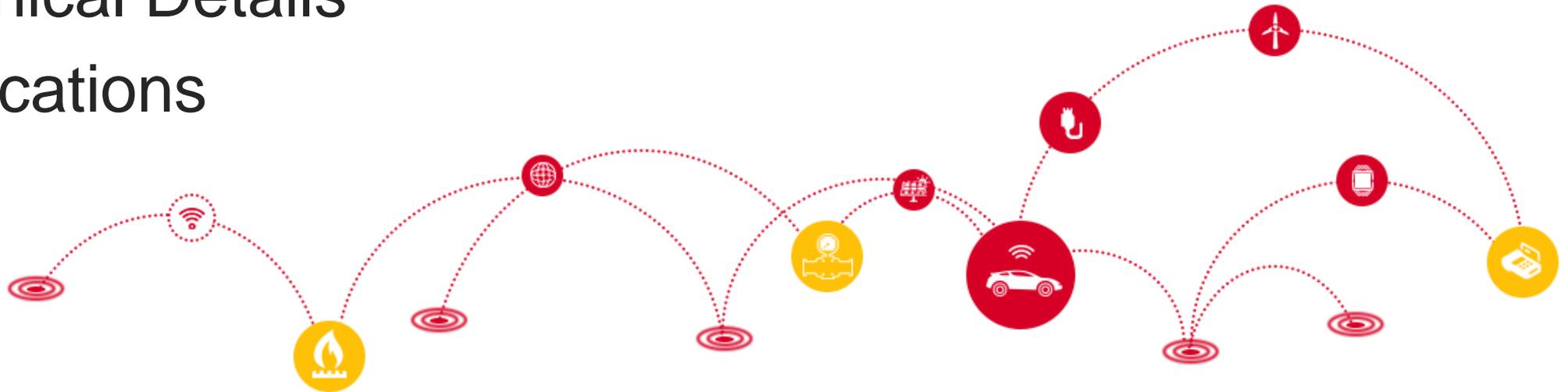| Interface	Description
USB	1
USIM	1
UART	3 (Main/Debug/Auxiliary UART)
PSM_EINT	1 (wake up device via external interrupt)
ADC	1 (10 bits)
RESET	1
PWRKEY	1
NETLIGHT	1
Antenna Pad	1
SPI	1 (for OpenCPU version only)
I2C	1 (for OpenCPU version only)
I2S	1 (for OpenCPU version only)
GPIO	Configurable (for OpenCPU version only)

BC66-NA Main Functions

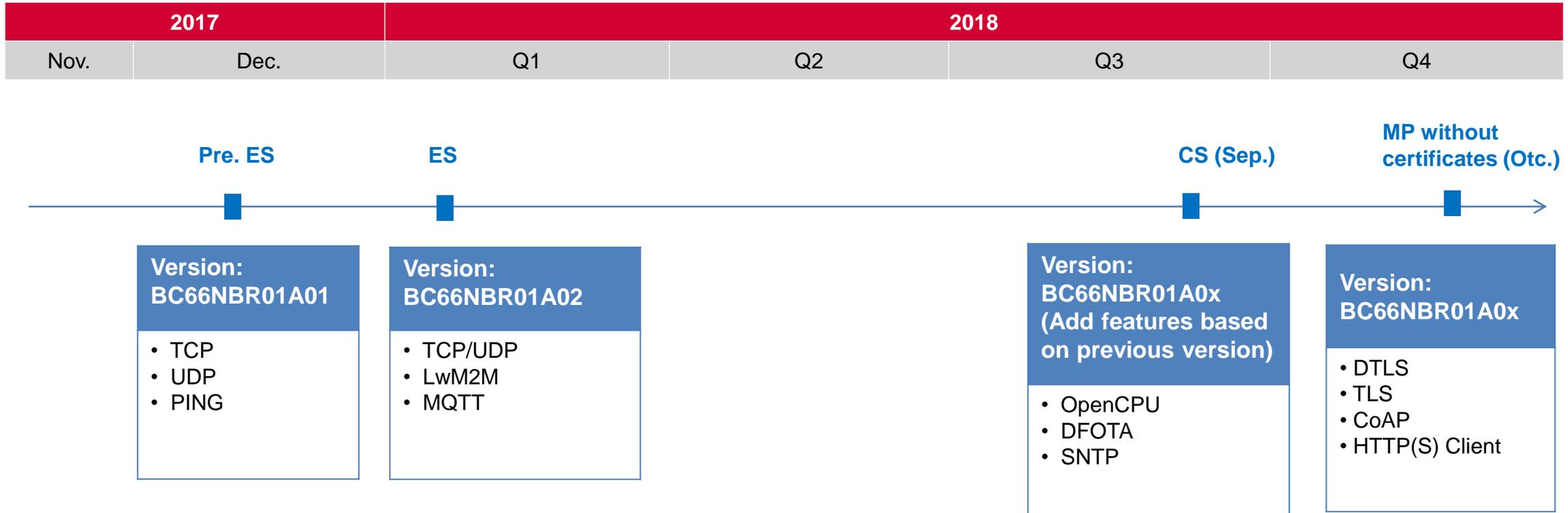| Function	Description
Protocols	UDP/ TCP/ LwM2M/ MQTT/ SNTP/ DTLS/ PPP*/ CoAP*/ TLS*/ HTTP*/ HTTPS*
SMS*	Text and PDU mode
OTDOA*	Observed Time Difference of Arrival
DFOTA	Delta firmware upgrade over-the-air
eSIM	Supported [1]
OpenCPU	• ROM: 200KB for APP image bin • RAM: 400KB (100KB static memory and 300KB dynamic memory)

* means under development.

[1] eSIM is reserved and not included by default. If needed, a different OC will be provided.

Technical Background

NB-IoT Roadmap

Highlights & Specifications

Development Timeline

Technical Details

Applications

BC66 Development Schedule

2017		2018			
Nov.	Dec.	Q1	Q2	Q3	Q4

Pre. ES

ES

CS (Sep.)

MP without certificates (Otc.)

Version: BC66NBR01A01

- TCP
- UDP
- PING

Version: BC66NBR01A02

- TCP/UDP
- LwM2M
- MQTT

Version: BC66NBR01A0x (Add features based on previous version)

- OpenCPU
- DFOTA
- SNTP

Version: BC66NBR01A0x

- DTLS
- TLS
- CoAP
- HTTP(S) Client

BC66 Timeline (1)

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		2019											2020								
Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.

Project Stage

BC66   MP

Carrier Certification Schedule

Vodafone/ AT&T/ T-Mobile   **Completed**
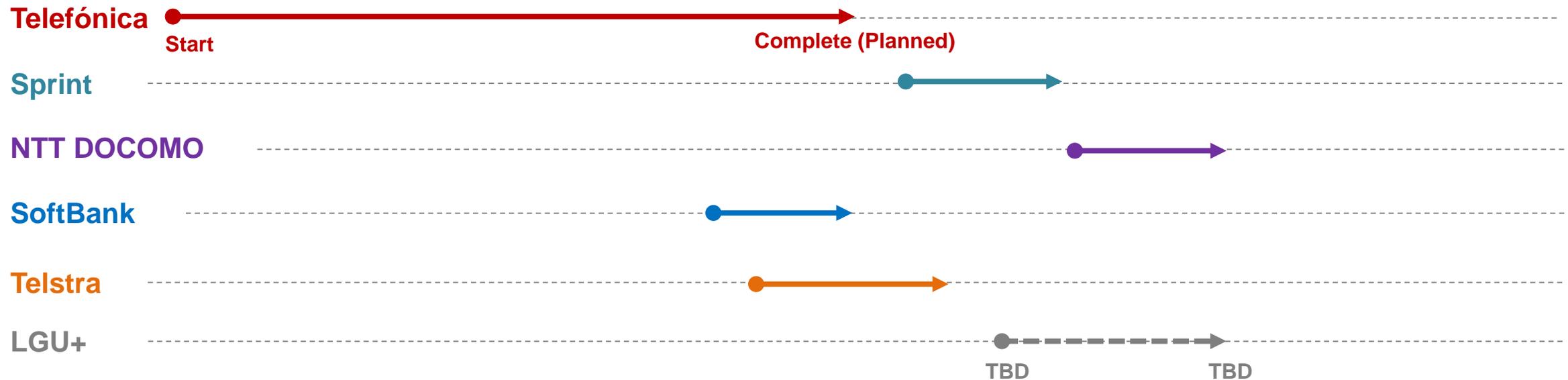
Telefónica   ●————————————————————►
                  Start   **Complete (Planned)**

Sprint   ●————————►

NTT DOCOMO   ●————————►

SoftBank   ●————————►

Telstra   ●————————►

LGU+   ●- - - - - - ►
                                    TBD   **TBD**

BC66 Timeline (2)

QUECTEL
Build a Smarter World

2019												2020								
Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.

Project Stage

BC66 MP

Regulatory/Other Certification Schedule

GCF/ CE/ FCC/ PTCRB/ IC/ KC/ NCC/ JATE/ TELEC/ RCM/ NBTC/ IMDA   **Completed**

ATEX   ●————————————————▶
                Start   **Complete (Planned)**

BC66-NA Development Schedule

2019								
Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.

Pre. ES   **ES**   **CS**   **MP**

Version: BC66NADAR01A01
- TCP
- UDP
- PING
- SNTP

Version: BC66NADAR01A02
- LwM2M
- MQTT

Version: BC66NADAR01A0x (Add features based on previous version)
- OpenCPU
- DFOTA

Version: BC66NADAR01A0x
- CoAP(s)
- HTTP(S) Client
- MQTT(s)
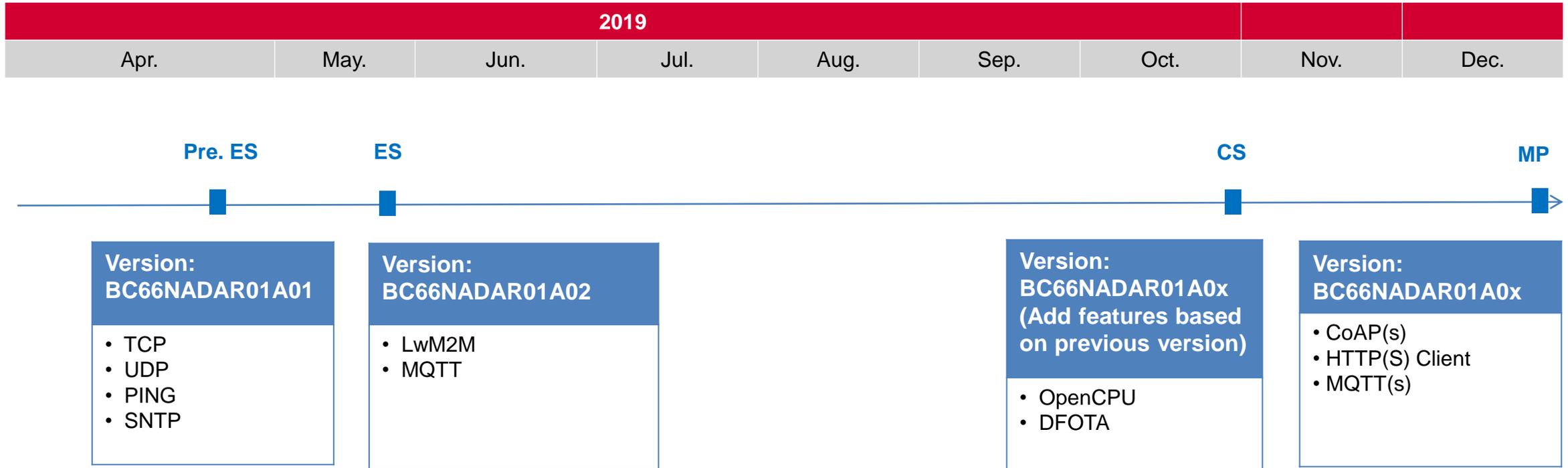
The timeline will be adjusted according to the actual development status.

BC66-NA Timeline (1)

2019									2020								
Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.

Project Schedule

ES   CS   MP
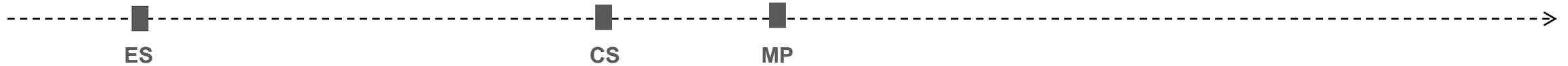
ES: Engineering samples ready. Basic functions are available for customers' simple demo purpose.
CS: Commercial samples ready. Stable hardware design and quite stable software design. New software features can be added upon request.
MP: Hardware and software ready for mass production. For certification status, please refer to the "certification schedule".

BC66-NA Timeline (2)

	2019									2020								
Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.

Carrier Certification Schedule

Vodafone — Start (Planned) ... Complete (Planned)

Verizon

AT&T

T-Mobile

Telstra

NTT DOCOMO/ SoftBank — TBD ... TBD
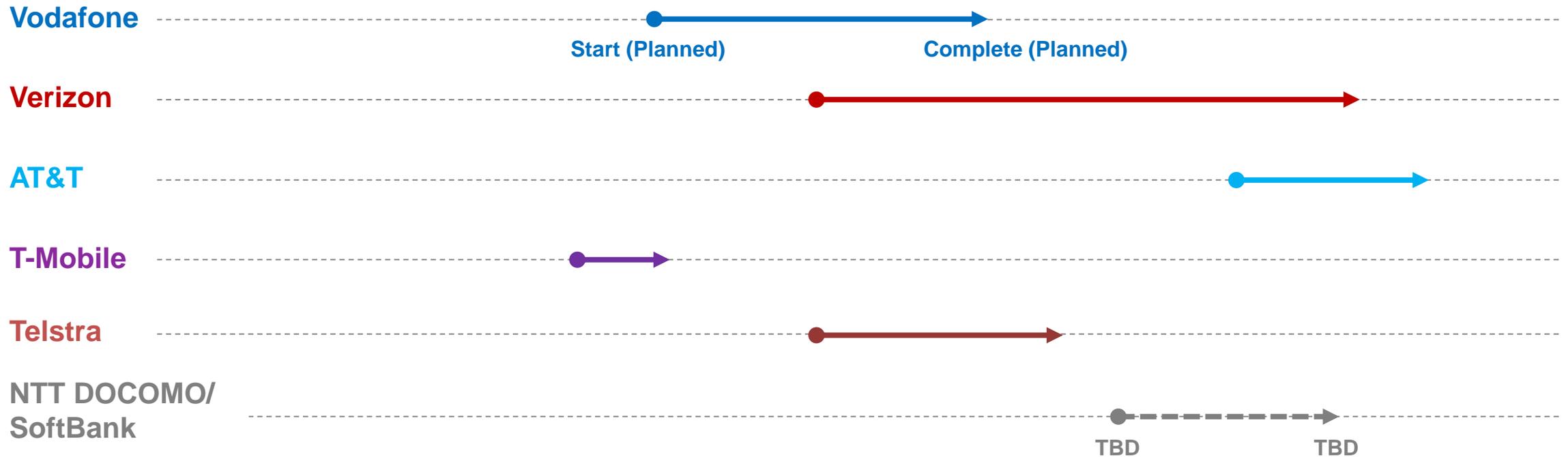
BC66-NA Timeline (3)

	2019								2020								
Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.

Regulatory/Other Certification Schedule

GCF/ CE/ FCC/ PTCRB/ IC/ RCM   **Completed**

KC

Start (Planned)   Complete (Planned)

NCC

JATE/TELEC

NBTC/IMDA

ATEX

Technical Background

NB-IoT Roadmap

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Applications
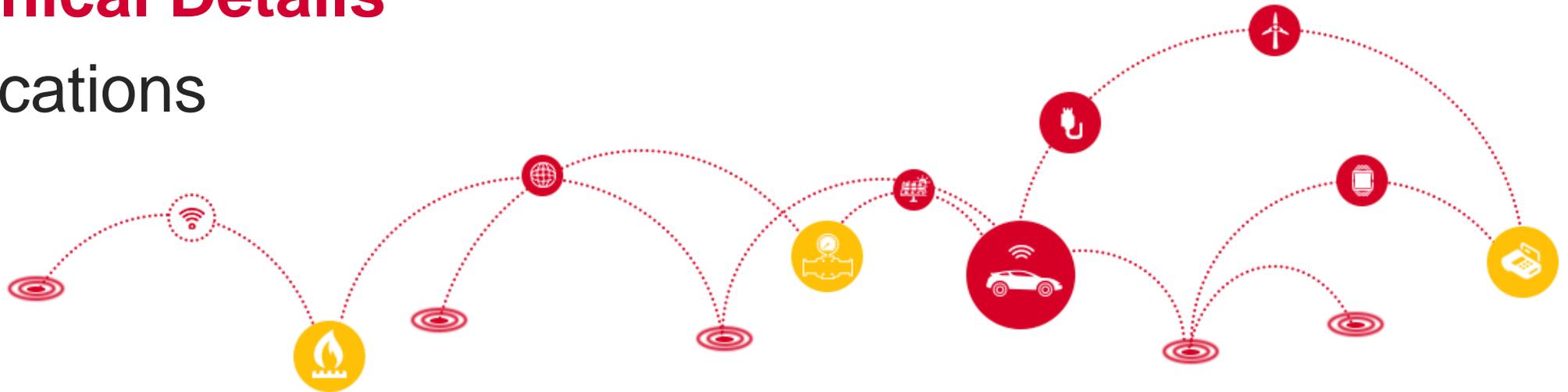
Hardware Architecture
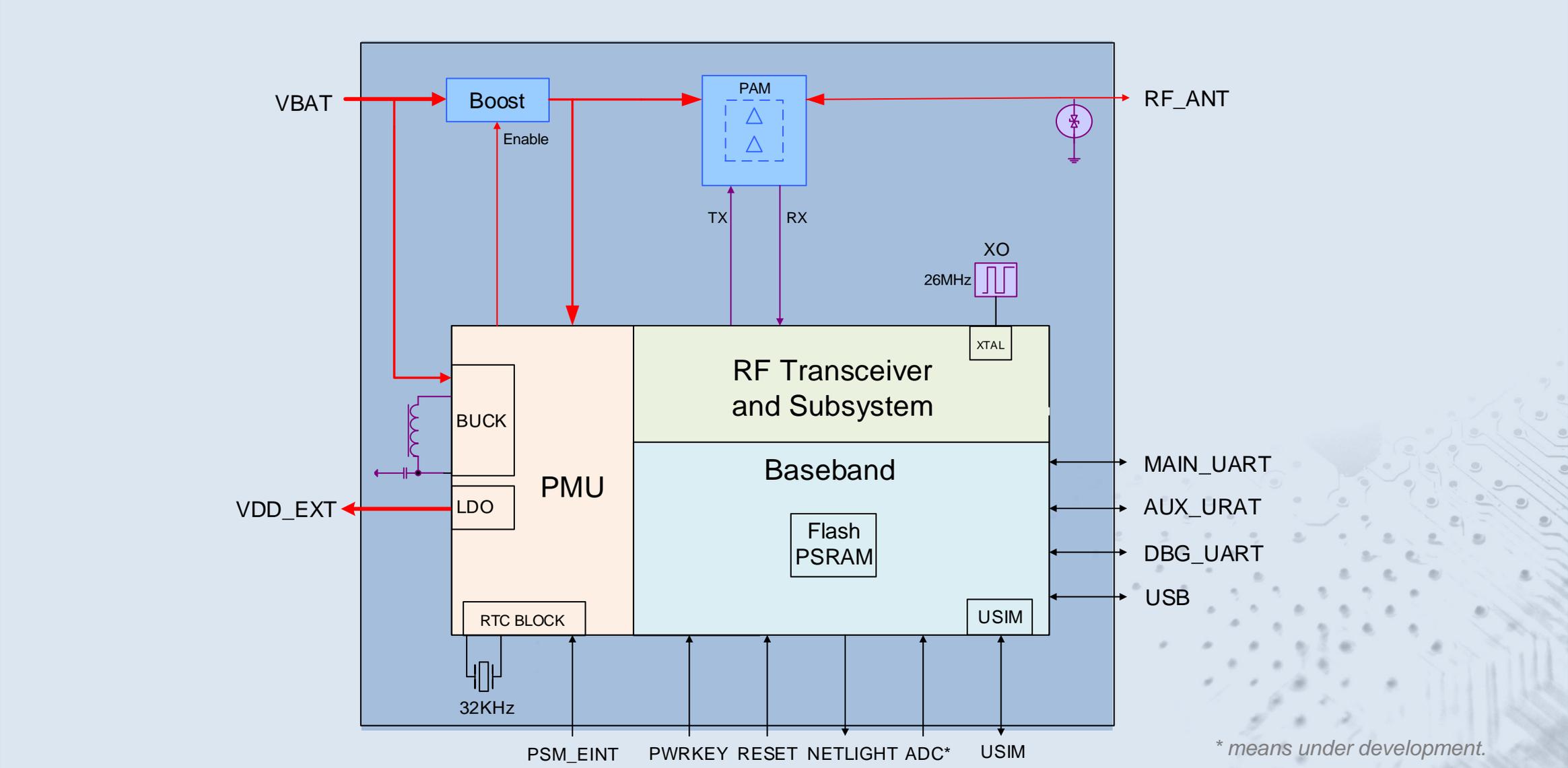
Key Technologies 1 - PSM

Power Saving Mode (PSM) is similar to power-off, but the module remains registered on the network. When the module is woken up from PSM, there is no need to re-attach or re-establish PDN connection. When the module in PSM, it is not immediately reachable for mobile terminating services. PSM is therefore intended for applications that are expecting only infrequent mobile originating and terminating services and that can accept a corresponding latency in the mobile terminating communication.

When the module wants to use the PSM it shall request an Active Time value during every Attach and TAU/RAU procedures. If the network supports PSM and accepts that the module uses PSM, the network confirms usage of PSM by allocating an Active Time value to the module.

The following figure illustrates the power consumption cycle of the module.
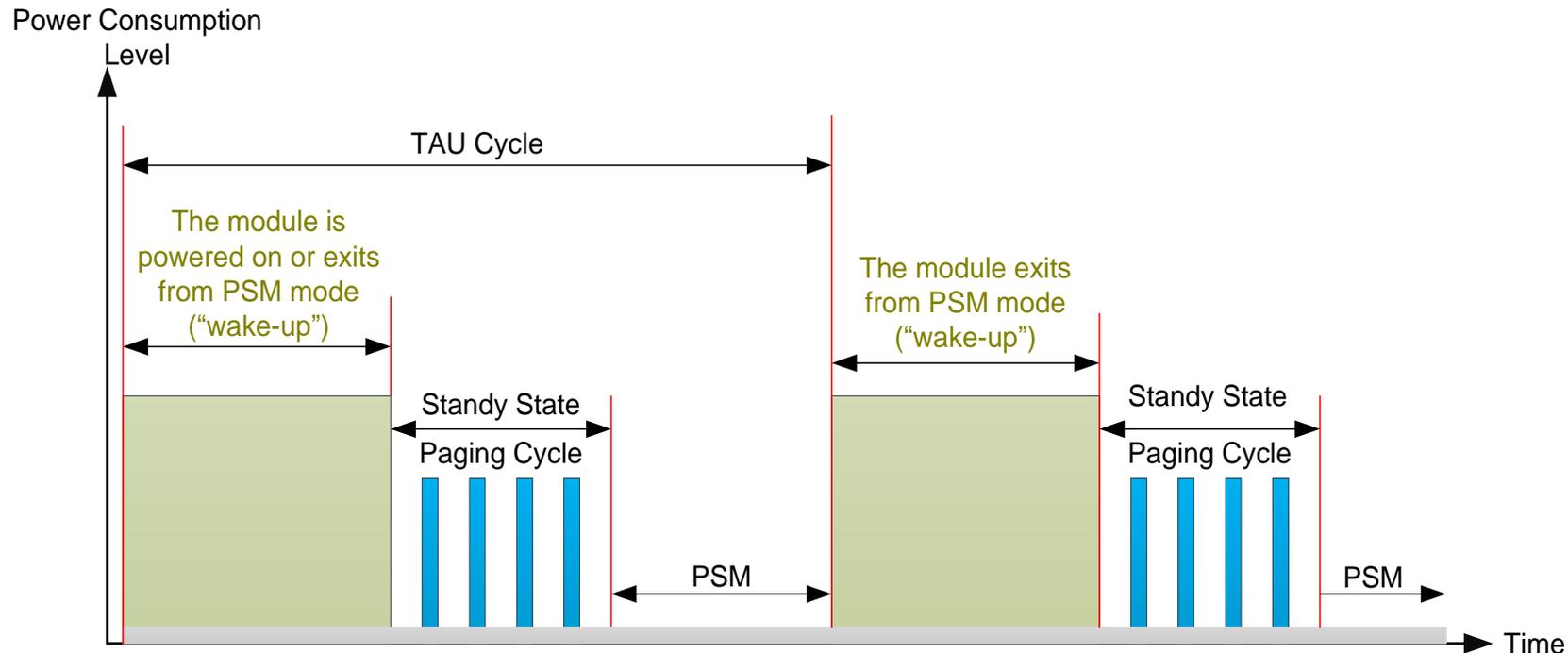
Key Technologies 2 – eDRX

The module (UE) and the network may negotiate over non-access stratum signaling the use of Extended Discontinuous Reception (eDRX) for reducing its power consumption, while being available for mobile terminating data and/or network originated procedures within a certain delay dependent on the DRX cycle value.

Applications that want to use eDRX need to consider specific handling of mobile terminating services or data transfers, and in particular they need to consider the delay tolerance of mobile terminated data.

The following figure illustrates the DRX and eDRX cycle of the module.
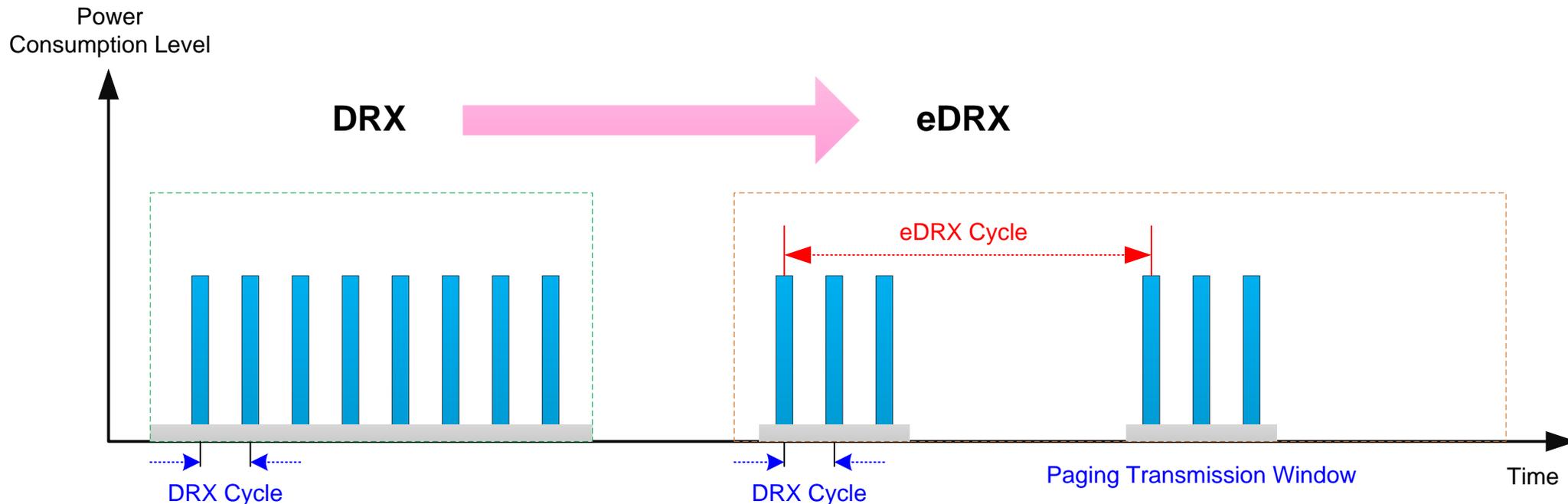
Quectel Comprehensive Technical Support

Quick Start
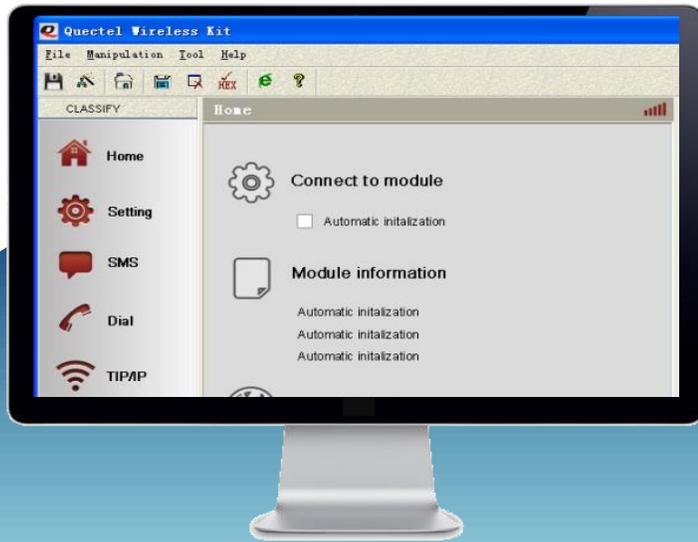
Quectel offers a GUI tool named **QNavigator**. It can help customers quickly test Quectel module's functionality.
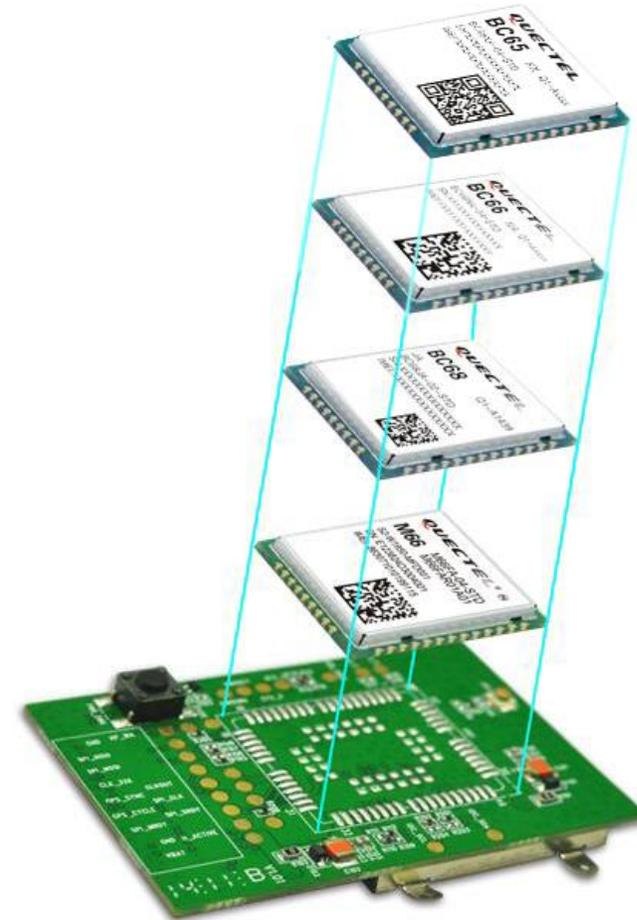
BC66-TE-B Kit

Layout Compatibility

BC66 & BC66-NA are compatible with

- Quectel NB-IoT BC68/BC65 module

- Quectel GSM/GPRS M66 module

For compatibility details, please refer to Quectel_BC65&BC66&BC68&M66_Compatible_Design.

The compatibility diagram shown above is for illustration purpose only. The actual appearance of the modules may be different.

Technical Background

NB-IoT Roadmap

Highlights & Specifications

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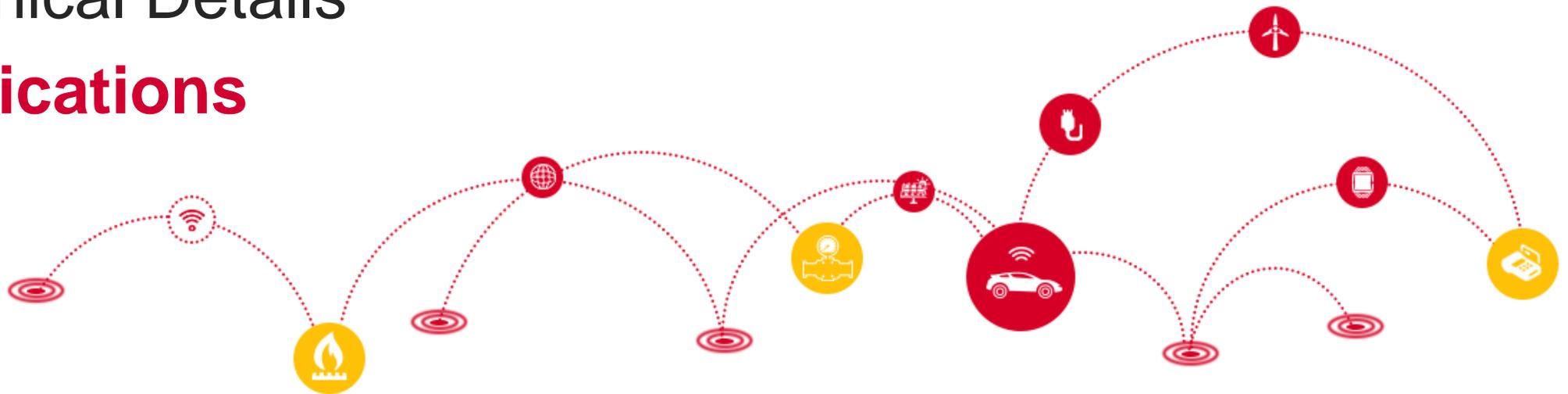
Applications

NB-IoT Application Market

Public Utilities

- Water/Gas Metering
- Parking
- Fire Hydrant
- Smoke Alarm
- Street Lighting
- Trash Bin

Personal Life

- Asset Tracking
- Wearable Devices
- Person/Pet Tracking

Industry & Agriculture

- Gas Detector
- Soil PH/Optical Sensor
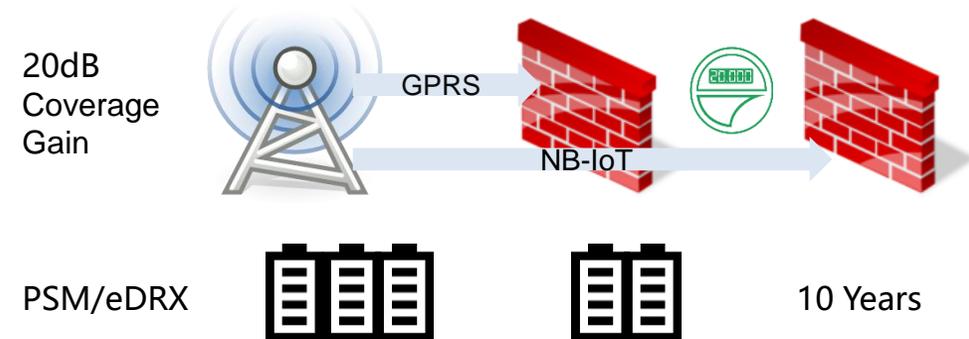- Machine Alarm
- Irrigation Controller

Smart Home

- Intelligent Door Lock
- Intelligent Control

Quectel

NB-IoT Module

Smart Metering

The most suitable solution for water meters

20dB Coverage Gain

GPRS

NB-IoT

PSM/eDRX

10 Years

- Battery driven
- Daily water data collection
- Automatic pipeline leakage, burst, blockage and temperature detection

Smart Home

- NB-IoT smart locks
- Smart smoke detectors
- NB-IoT white goods
- Higher safety, more convenient
- Easy connection to NB-IoT platform

Water Heaters

Air Cleaners

Smoke Detectors

Water Purifiers

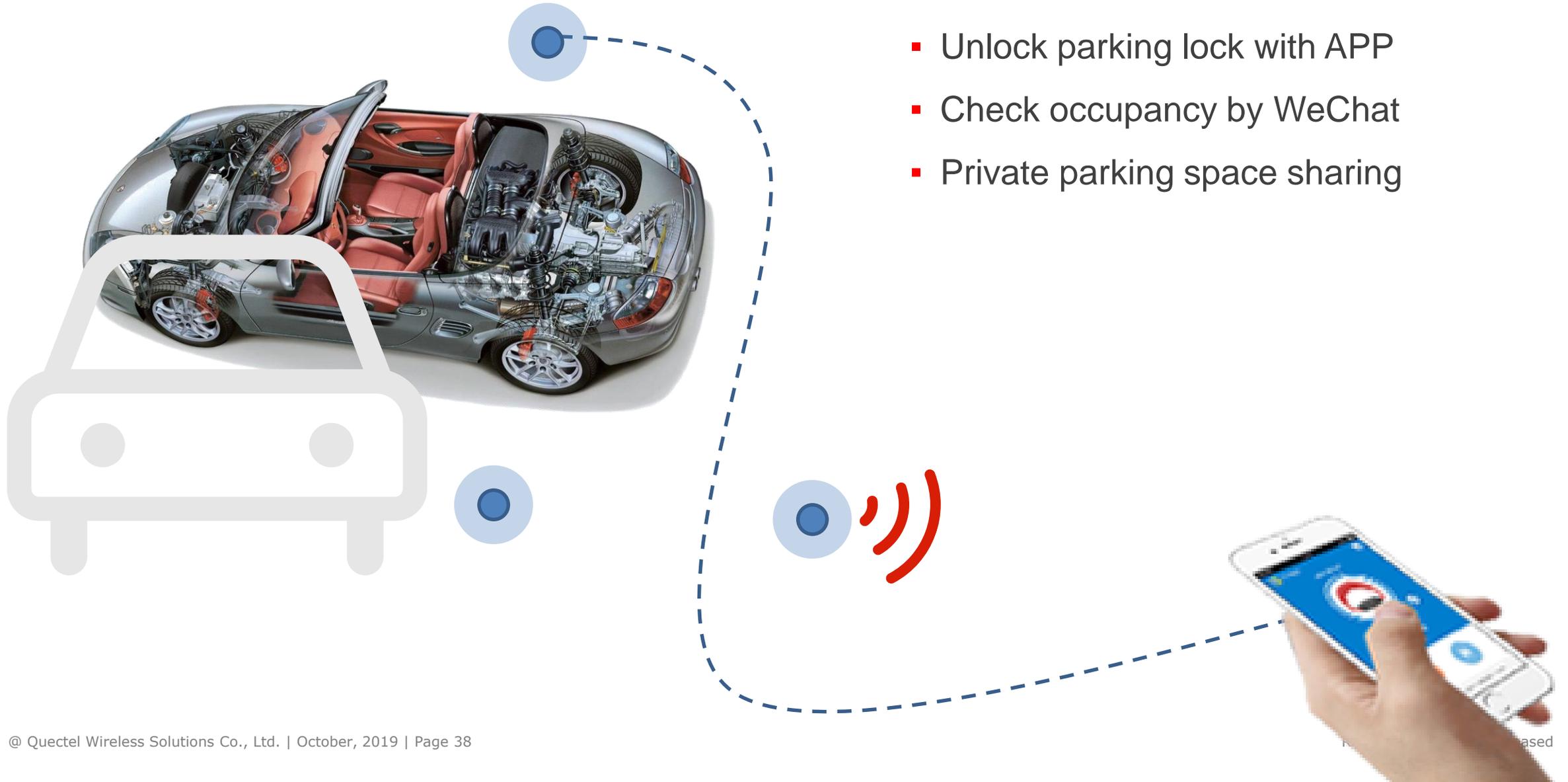Smart Door Locks

Air Conditioners

Washing Machines

Street Lighting
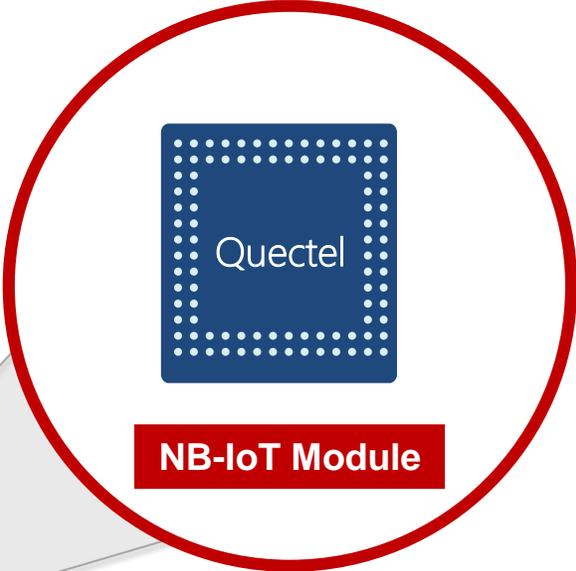
- Real time data feeds directly to the operation center

- Manual brightening of lighting when required

- Improved energy efficiency

Parking

- Unlock parking lock with APP

- Check occupancy by WeChat

- Private parking space sharing

Bike Sharing

NB-IoT Module

Animal Testing

- Monitor health and safety of the cattle
- Improve milk yield and ensure in-time cow breeding

Multi-gas Detector

- Monitors up to several threats, including VOCs, combustibles and toxics

- Real-time gas concentration reading, location, alarm and status indication

Thank you!

Building 5, Shanghai Business Park Phase III (Area B), No.1016
Tianlin Road, Minhang District, Shanghai 200233, China
Tel: +86-21-5108 6236 Email: **info@quectel.com**
Website: **www.quectel.com**

in https://www.linkedin.com/company/quectel-wireless-solutions

f https://www.facebook.com/quectelwireless

https://twitter.com/Quectel_IoT