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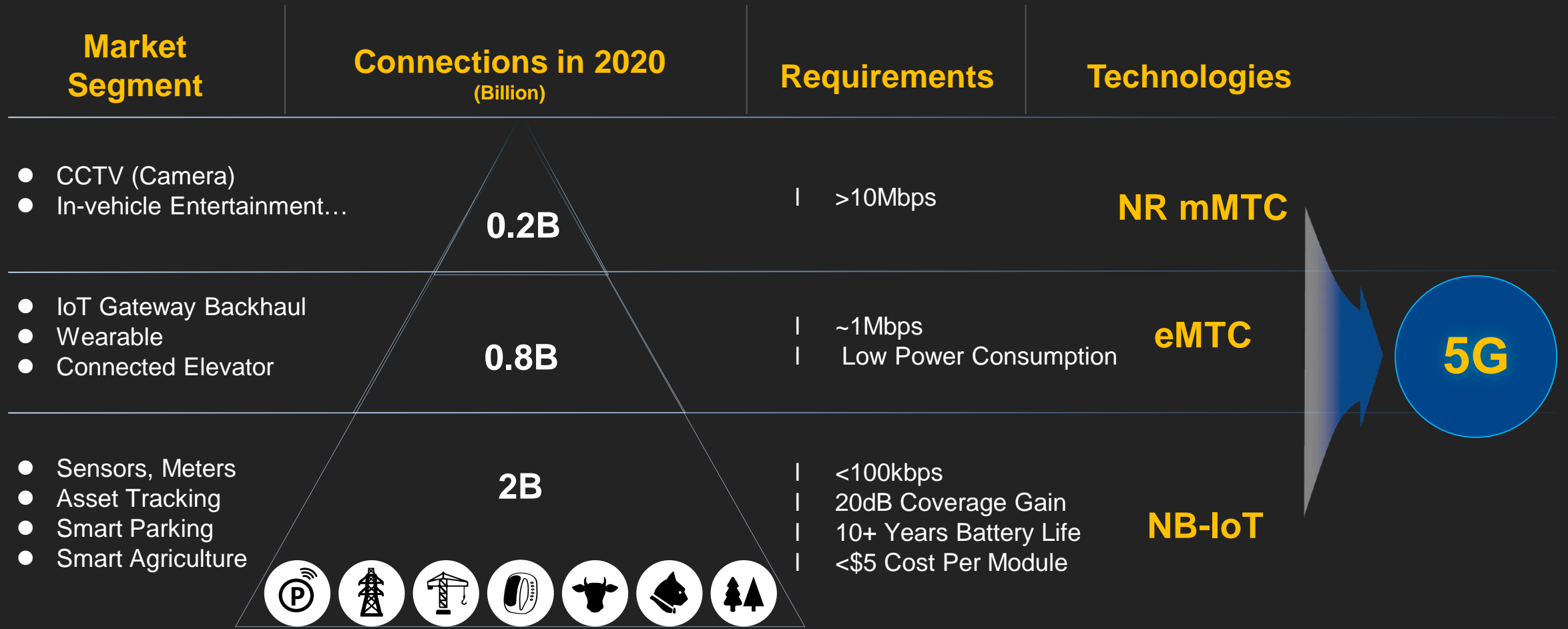
Building A Fully Connected World With NB-IoT

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Future Cellular IoT Network = NB-IoT + eMTC + NR mMTC

Market Segment	Connections in 2020 (Billion)	Requirements	Technologies
• CCTV (Camera) • In-vehicle Entertainment…	0.2B	I >10Mbps	**NR mMTC**
• IoT Gateway Backhaul • Wearable • Connected Elevator	0.8B	I ~1Mbps I Low Power Consumption	**eMTC**
• Sensors, Meters • Asset Tracking • Smart Parking • Smart Agriculture	2B	I <100kbps I 20dB Coverage Gain I 10+ Years Battery Life I <$5 Cost Per Module	**NB-IoT**

5G

For R16, no NR based solution will be studied or specified for the LPWA* use cases, LPWA use cases will continue to be addressed by evolving eMTC and NB-IoT *(RP-180581, 3GPP TSG RAN Meeting #79)*
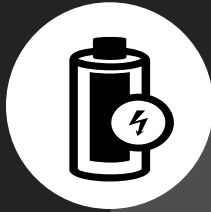
"Mobile IoT in the 5G Future" paper explains how NB-IoT and LTE-M technologies are an integral part of 5G. https://www.gsma.com/iot/news/mobile-iot-and-5g-complementary-technologies-central-to-the-iot

*LPWA: Low Power Wide Area
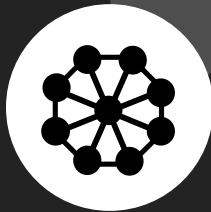
Highlights of NB-IoT Technology

NB-IoT Big Bang in 2018

Networks

100

36

Now   2018.12

Territory Coverage

45%

25%

Now   2018.12

Population Coverage

65%

40%

Now   2018.12
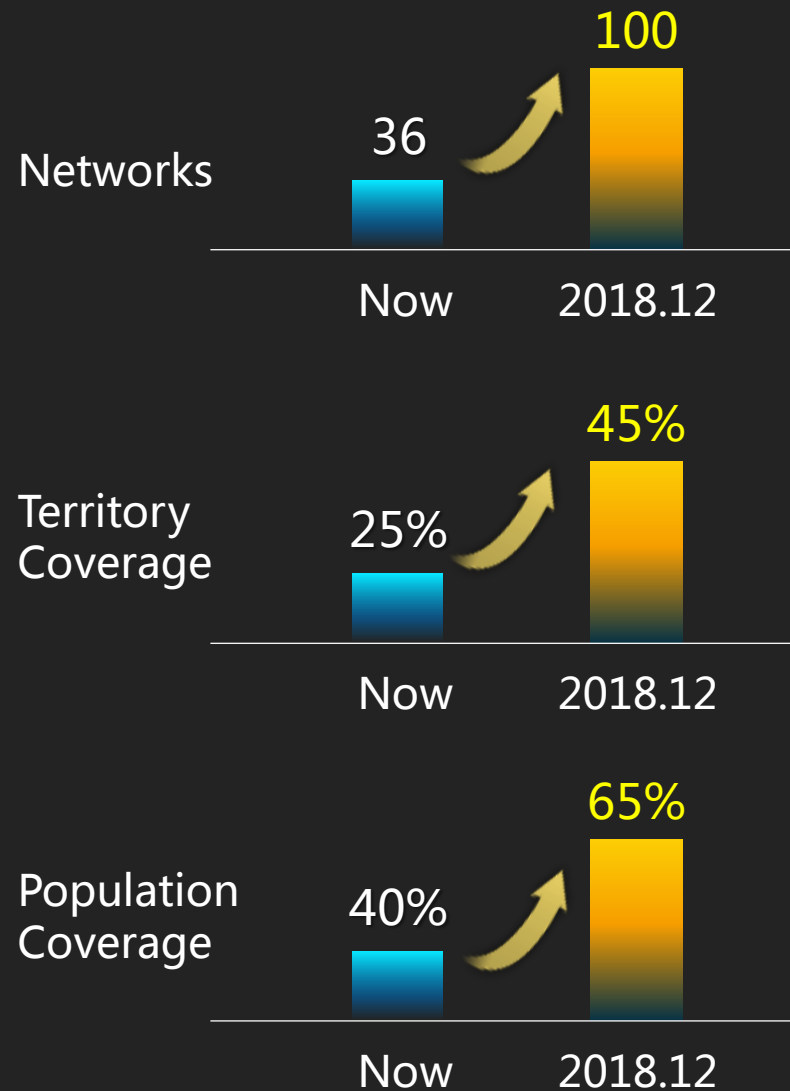
Huawei estimates

45+ Commercial NB-IoT Networks

Ireland Netherland Norway

Austria

Germany

Italy

Spain

Czech Republic

Turkey

South Africa

South Korea

China

Sri Lanka

UAE

Singapore

Australia

Commercial   Trial

vodafone   中国电信 CHINA TELECOM   中国移动 China Mobile   China unicom中国联通   T··   TURKCELL   DNA

U+   kt   m1 etisalat   3   vodacom   TIM   TeliaSonera   Dialog

NB-IoT Use Cases are Booming…

2017: 40+ Industries

12 replicable use cases

| Water metering | Smart Parking | Smart Lighting | Gas metering | Sharing bicycle | Fire detector | … |

35+ cases in incubation

| Electricity metering | Cold chain | Pipeline monitoring | Grid monitoring | Pet tracking | Vending machine | … |

2018: 100+ Industries

40+ replicable use cases

Public Industry 15M

| Smart Water | Smart Gas |

Smart Traffic 10M

| Motor Monitoring | Sharing Bicycle |

Smart Home 20M

| Smart Lock | White Goods |

Smart Fire 6M

| Smoke Detector | Smart Hydrant |

Smart Agriculture 1M

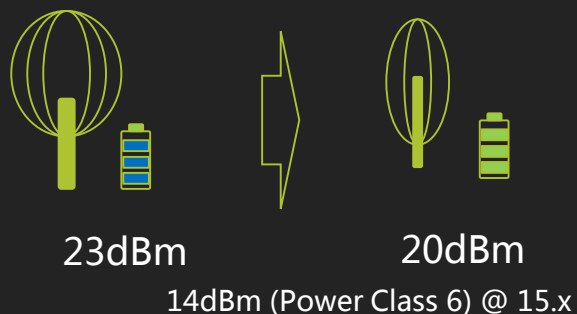| Connected Cow | Smart Shed |

Smart City 2M

| Smart Light | Smart Dustbin |

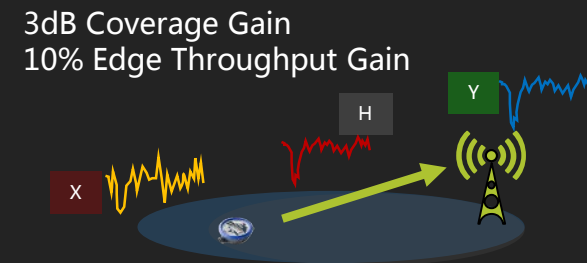# Fully Replace GPRS IoT with Huawei 13.1 Version
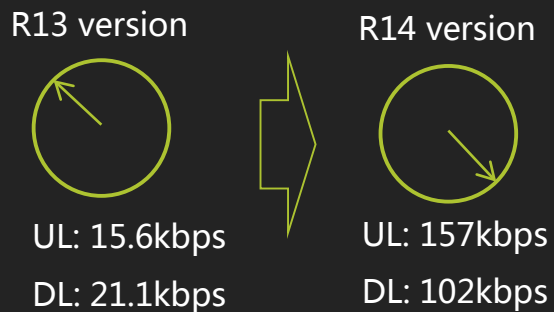
New Power Class
(Power Class 3/5)

23dBm → 20dBm

14dBm (Power Class 6) @ 15.x

Significant Capacity Gain
(Multi-PRB)

50K → 80K
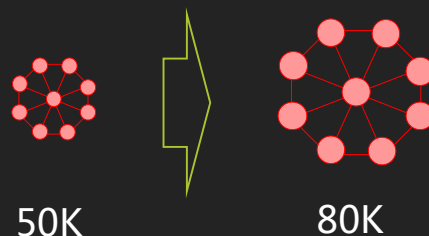
Coverage Enhancement
(UL COMP+UL Estimate Enhancement)

3dB Coverage Gain
10% Edge Throughput Gain

X   H   Y

5~7 Times Throughput
(TBS Extension + Dual HARQ)

R13 version → R14 version

UL: 15.6kbps   UL: 157kbps

DL: 21.1kbps   DL: 102kbps

Things Coverage
(IoT Service Prediction Capability)

Power Consumption

Coverage

Capability
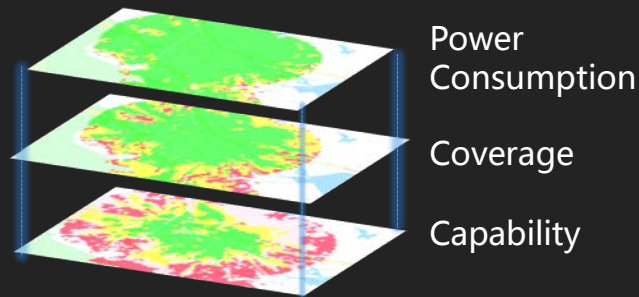
Positioning Without GPS
(OTDOA, 50m Accuracy)

TA   TA   TA
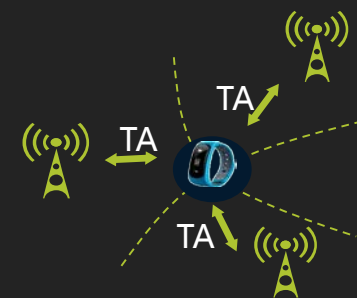
Extend Battery Life Through Features and Design

UE Power Consumption (mA)

Data Transmission

UE Communication Procedure

Time

UE Power Consumption involves : Data Transmission // Connected Mode // Idle Mode // Paging Monitoring // PSM Mode
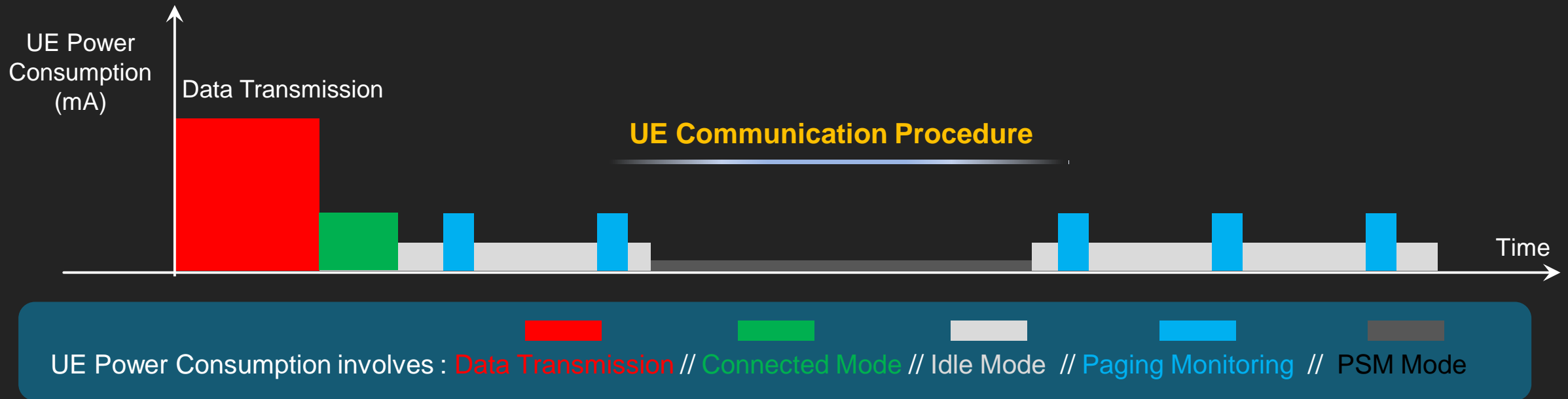
Five Advices In Device Design

Reduce signal quantity
- Signal merge
- Reduce heartbeat signal

Reduce signal size
- Data compression

Configure longer TAU timer

Reduce active timer (T3342) value and enter PSM mode ASAP

Choose PSM mode instead of power-off mode

Smart Gas Example – UE Design Advice

Adjust Metering Frequency

1 time per day

Residential Gas Meter

12 times per day

Industrial Gas Meter

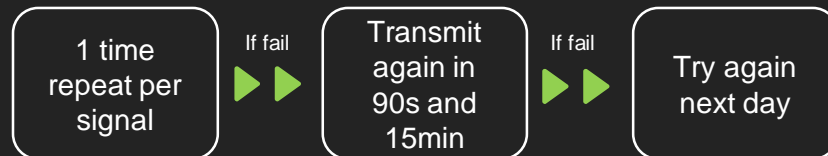## Optimize Packet Size Design

Uplink
<200 bytes
Metering Update

Downlink
<50 bytes
Configuration

Event
<50 bytes
Alarm Update
Remote Control

Reduce UL Signal Repetition

To optimize low power consumption, frequent repetitions are not advised.

| 1 time repeat per signal | If fail ▶ ▶ | Transmit again in 90s and 15min | If fail ▶ ▶ | Try again next day |

Optimize Reporting Time of Meters

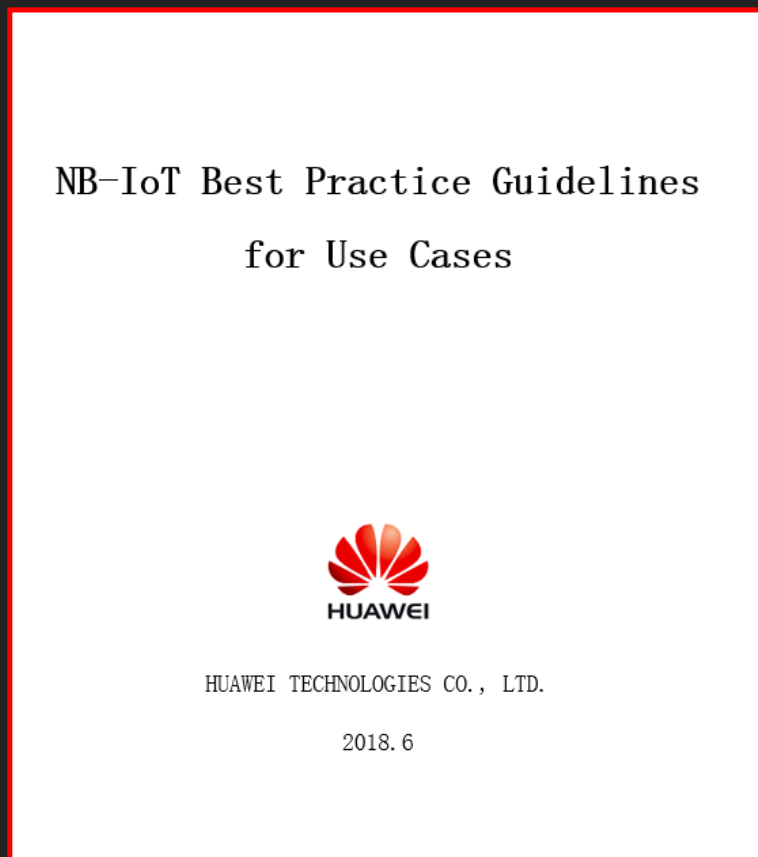Set Different Transmission Times For Every Meters

Basic Time + (meter number * ratio + x)

↑
0 clock
(configurable)

Minute level
(configurable)

Second level
(configurable)

Thank you!