

Device Technologies to accelerate Cellular IoT

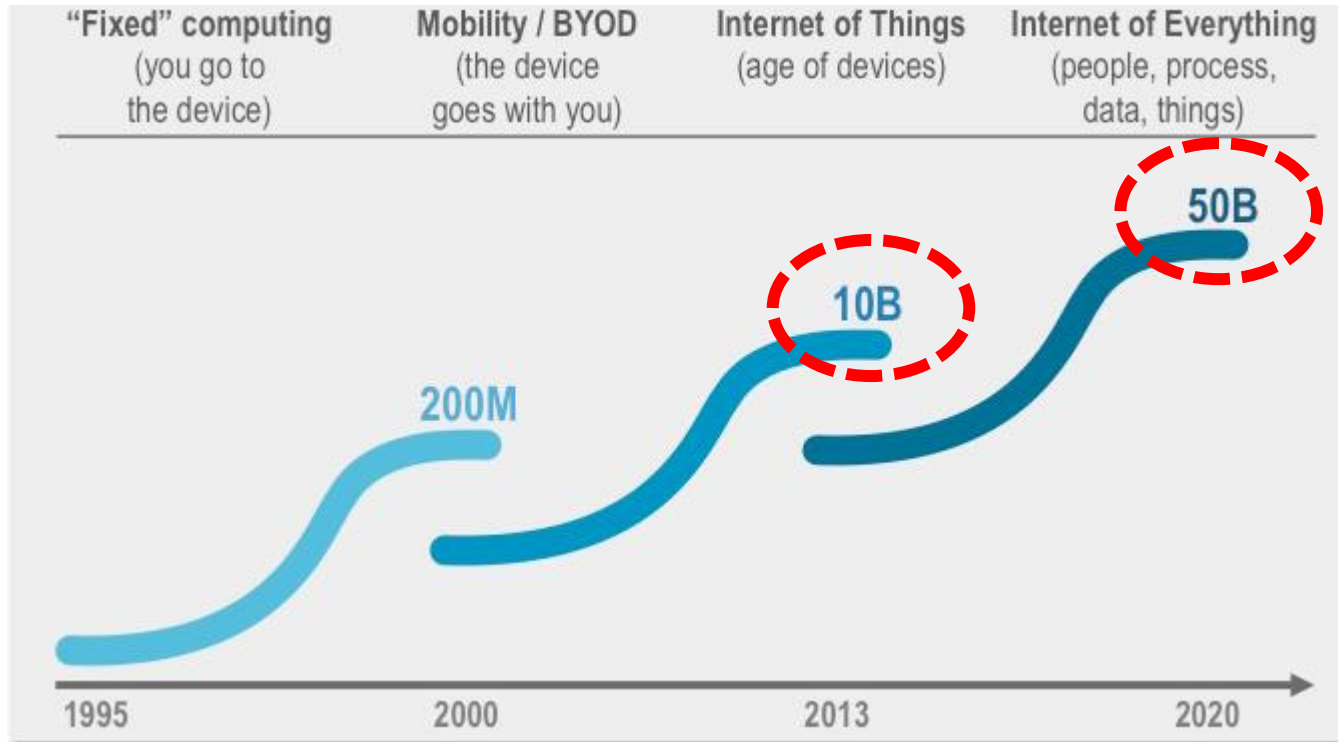
25th Nov. 2016

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General Manager
Product & Device Technology Department



Kicking into high gear toward IoT



Rapid Growth of the Number of Things Connected to the Internet.

Source: Cisco IBSG, 2013

Why didn't the IoT market expand until now?



LPWA (Low Power Wide Area) is boosting IoT

Low Power (Consumption)

Extended Battery Life
(10years / 2 AA Batteries)



Wide Area (Coverage)

Long-Range
More accessibility to
Non-residence area and underground

**Easy Installation Everywhere
and
Low Cost**



1. Standardization Activities for IoT

2. Technologies to accelerate IoT

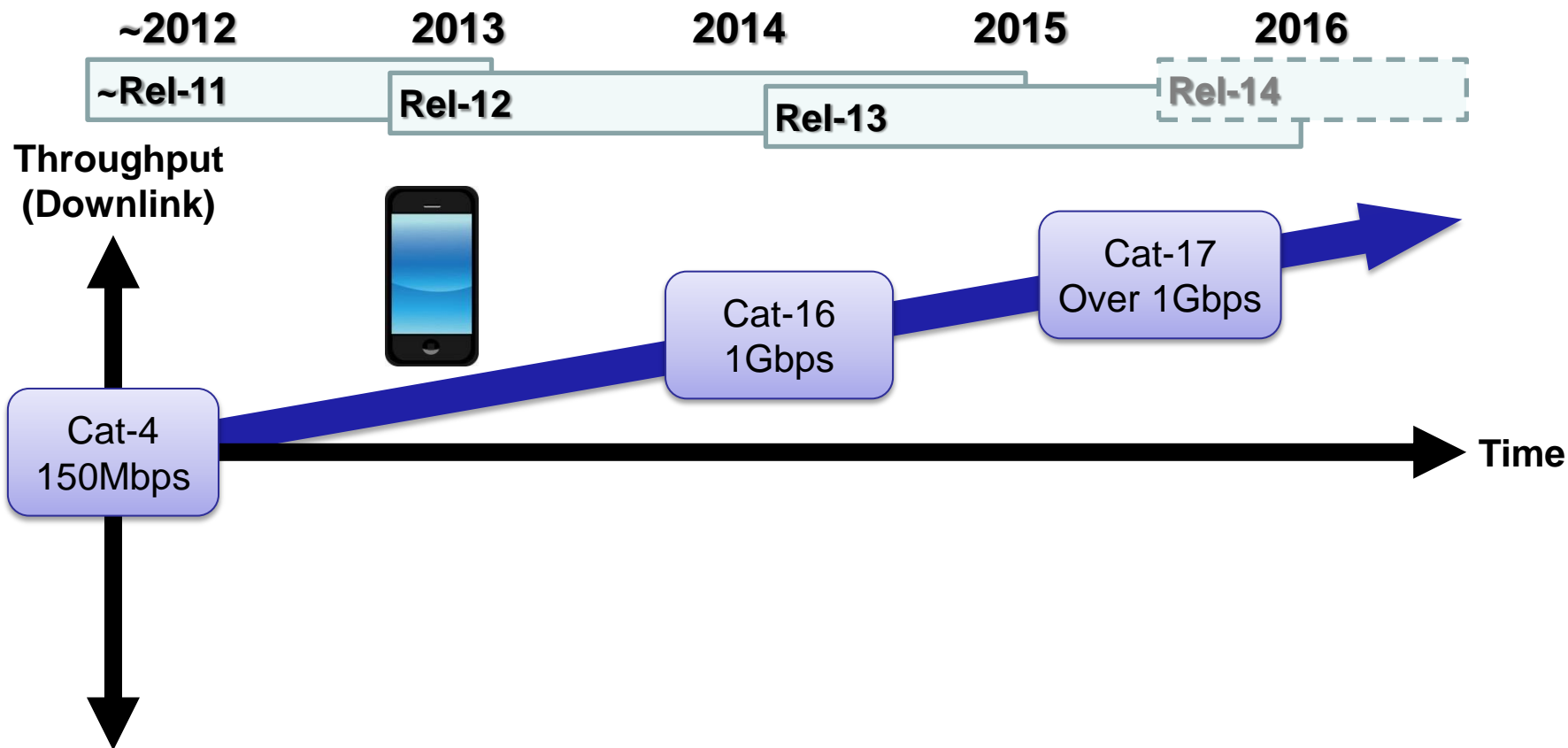
3. Technologies to commercialize IoT devices

1. Standardization Activities for IoT

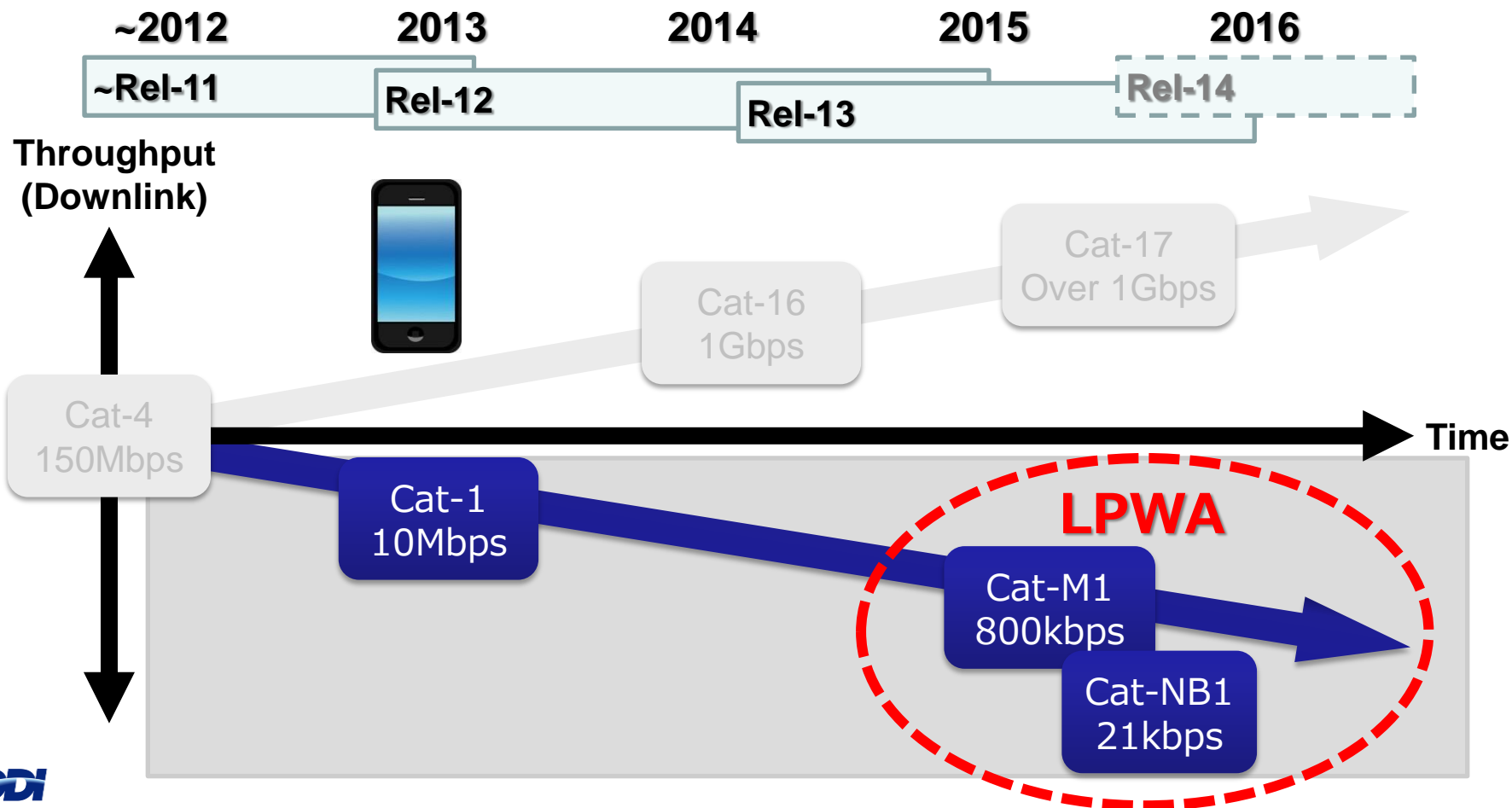
2. Technologies to accelerate IoT

3. Technologies to commercialize IoT devices

3GPP - Standardization Activities



3GPP - Standardization Activities



Comparison of Specifications



	Cat-4	Cat-1 <i>(w Rel.13)</i>	Cat-M1 <i>(LTE-M)</i>	Cat-NB1 <i>(NB-IoT)</i>
Throughput (DL/UL) bps	150M/50M	10M/5M	1M/1M	29K/63K
Battery Life (*1)	need large battery	need large battery <i>(10 years)</i>	~10 years	over 10 years
Coverage (Cell radius)	5km	5km	10km	15km
Module cost (*2)	1	1/2	1/4	1/4-1/5

*1) in case of using 2 AA batteries (Depending on applications, environment and etc.)

*2) source: TSR 2016 Cellular Broadband Device & Module Market

Service Image by Each Category



MOVIE



Automotive
Infotainment



Security
Camera



Drive
Recorder



Smart
Meter



Agriculture
ICT



Smart City
Traffic Survey

High Speed

Throughput

Low Speed
Low Power
Wide Area
Low Cost

1. Standardization Activities for IoT

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Technologies to accelerate IoT

i. How to **Lower Power Consumption** ?

ii. How to **Widen Area Coverage** ?

iii. How to **Lower Cost** ?

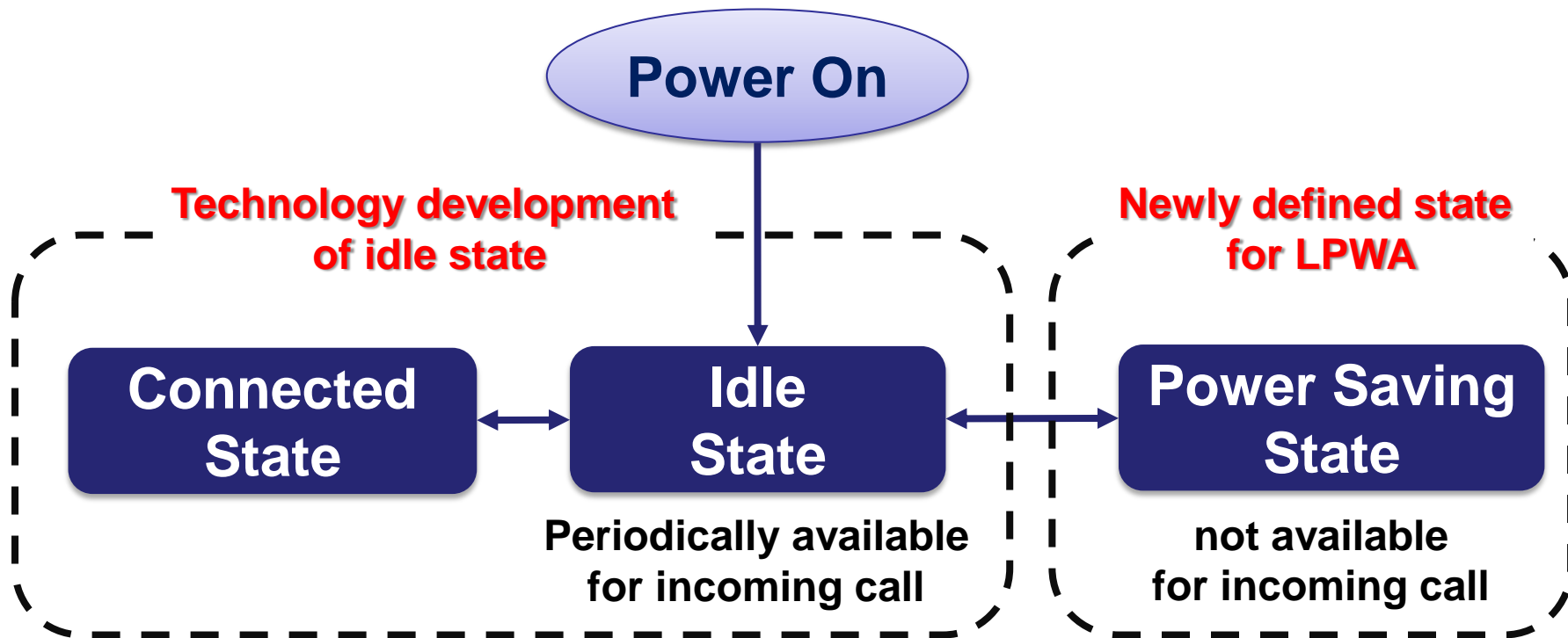
Technologies to accelerate IoT

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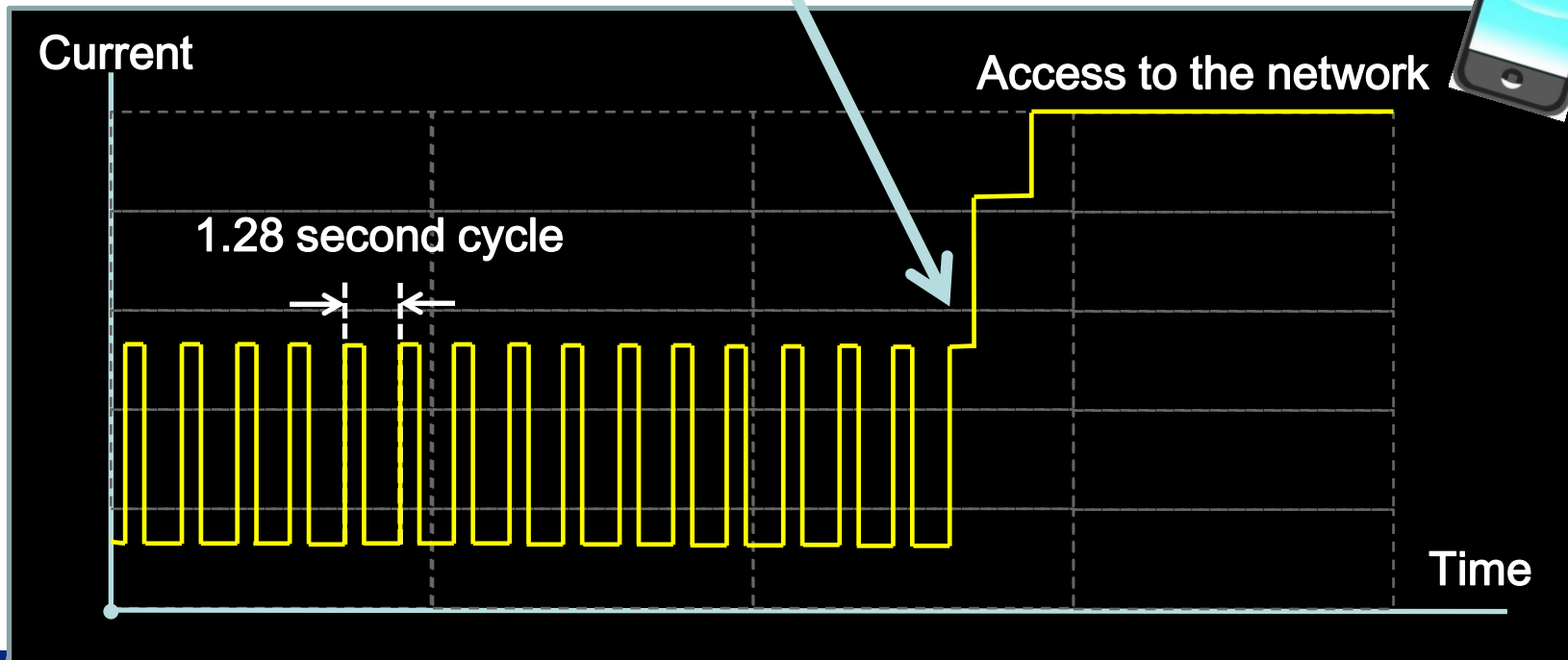
iii. How to Lower Cost ?

Technology to achieve Low Power Consumption



Current Power Consumption

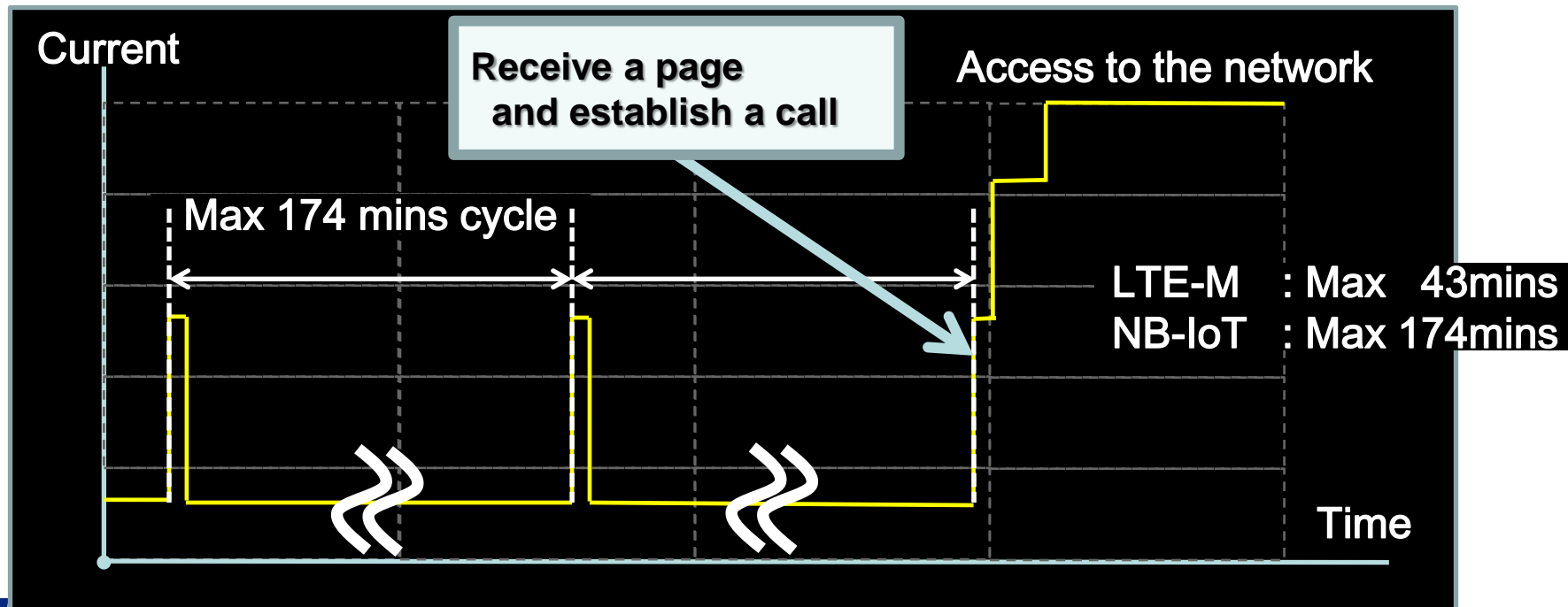
Receive a page
and establish a call



Technology to achieve Low Power Consumption

eDRX : Extended Discontinuous Reception

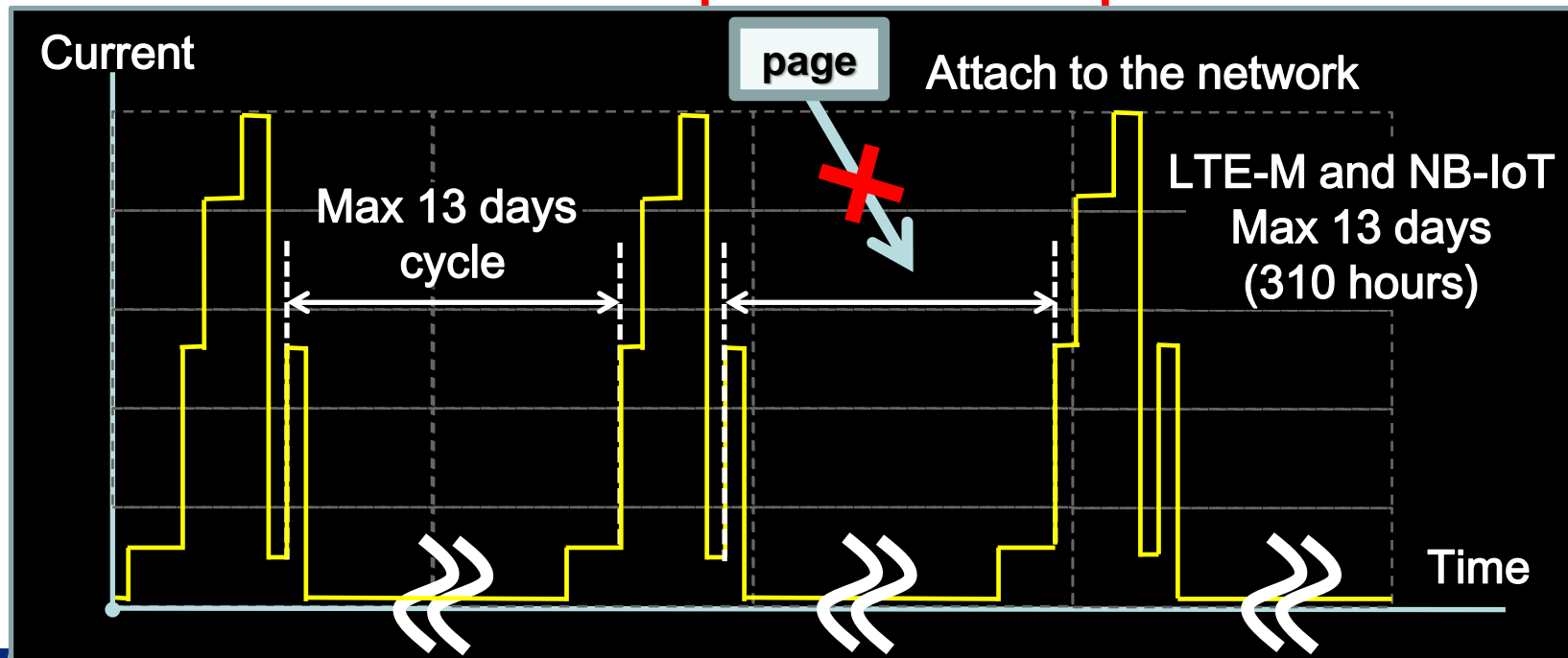
Extending incoming interval enables low power consumption



Technology to achieve Low Power Consumption

PSM: Power Saving Mode

Transitioning to a state that doesn't receive incoming call enables low power consumption



Technologies to accelerate IoT

i. How to Lower Power Consumption ?

ii. How to **Widen Area Coverage** ?

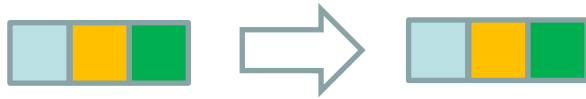
iii. How to Lower Cost ?

Technology to achieve Wide Area

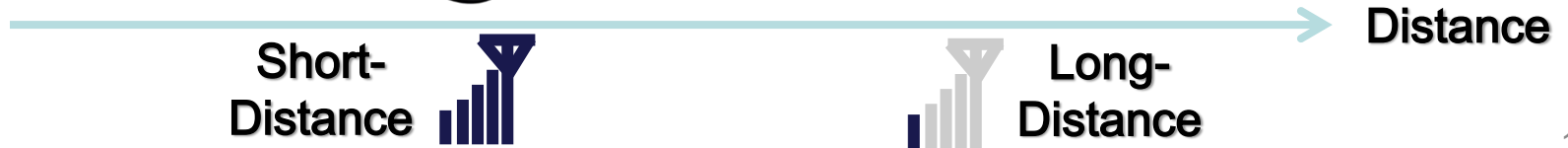
CE: Coverage Enhancement

This technology increases the reception rate in weak field areas by transmitting the same data repeatedly

Send data only once
(in case of stable environment)



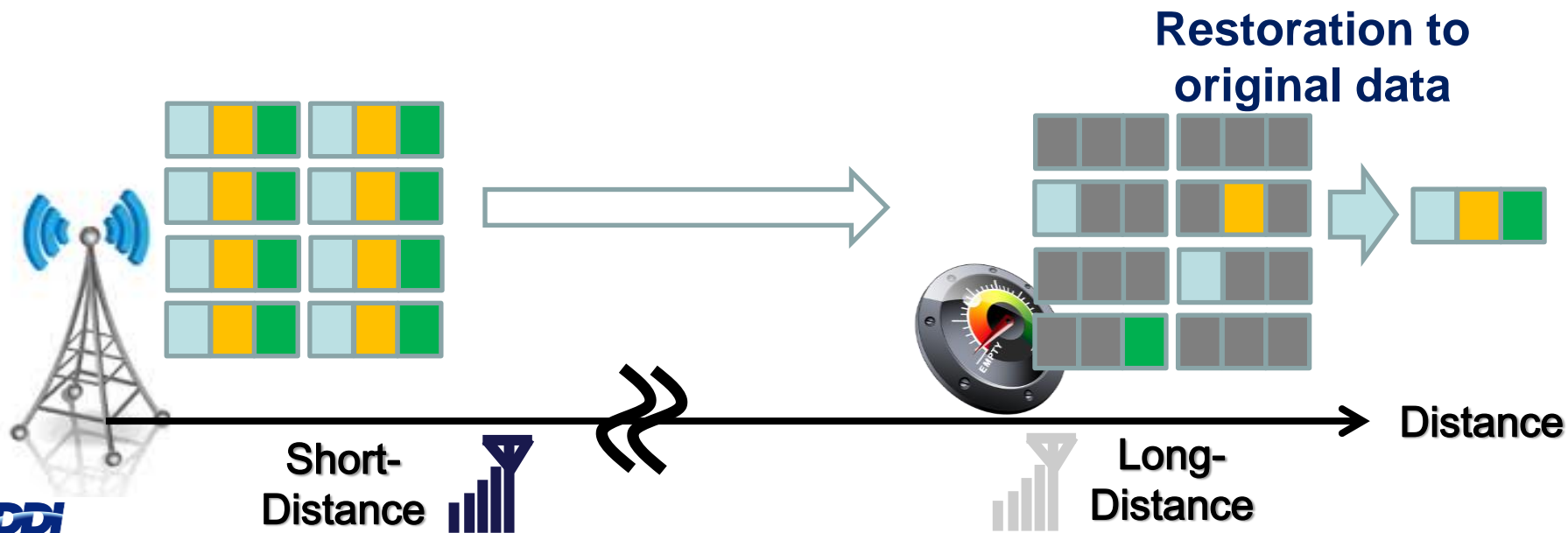
ex. Smart meter



Technology to achieve Wide Area

CE: Coverage Enhancement

This technology raise a reception rate in a weak field area by transmitting same data repeatedly



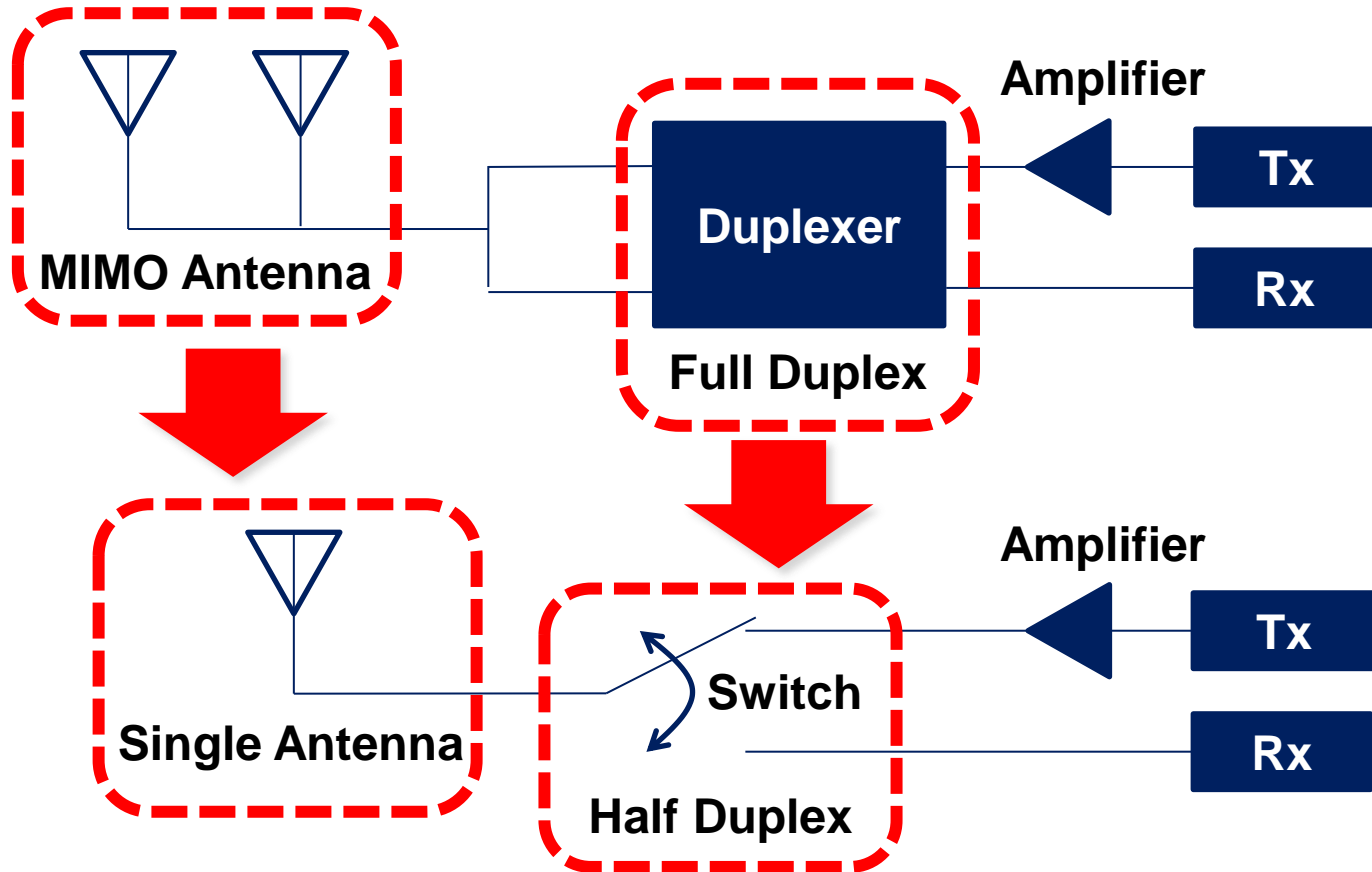
Technologies to accelerate IoT

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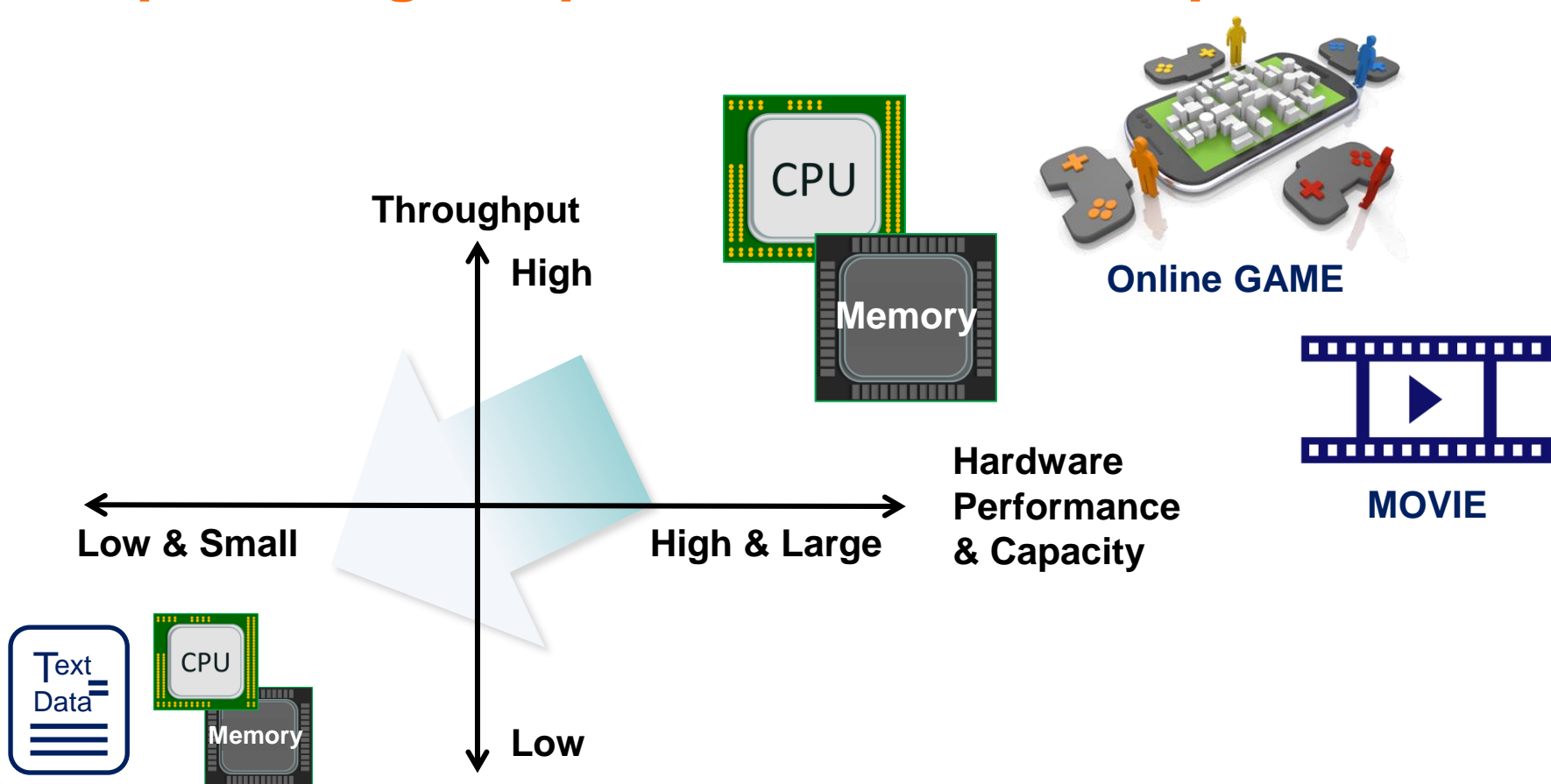
ii. How to Widen Area Coverage ?

iii. How to **Lower Cost** ?

Reducing the number of components



Optimizing the performance of components



1. Standardization Activities for IoT

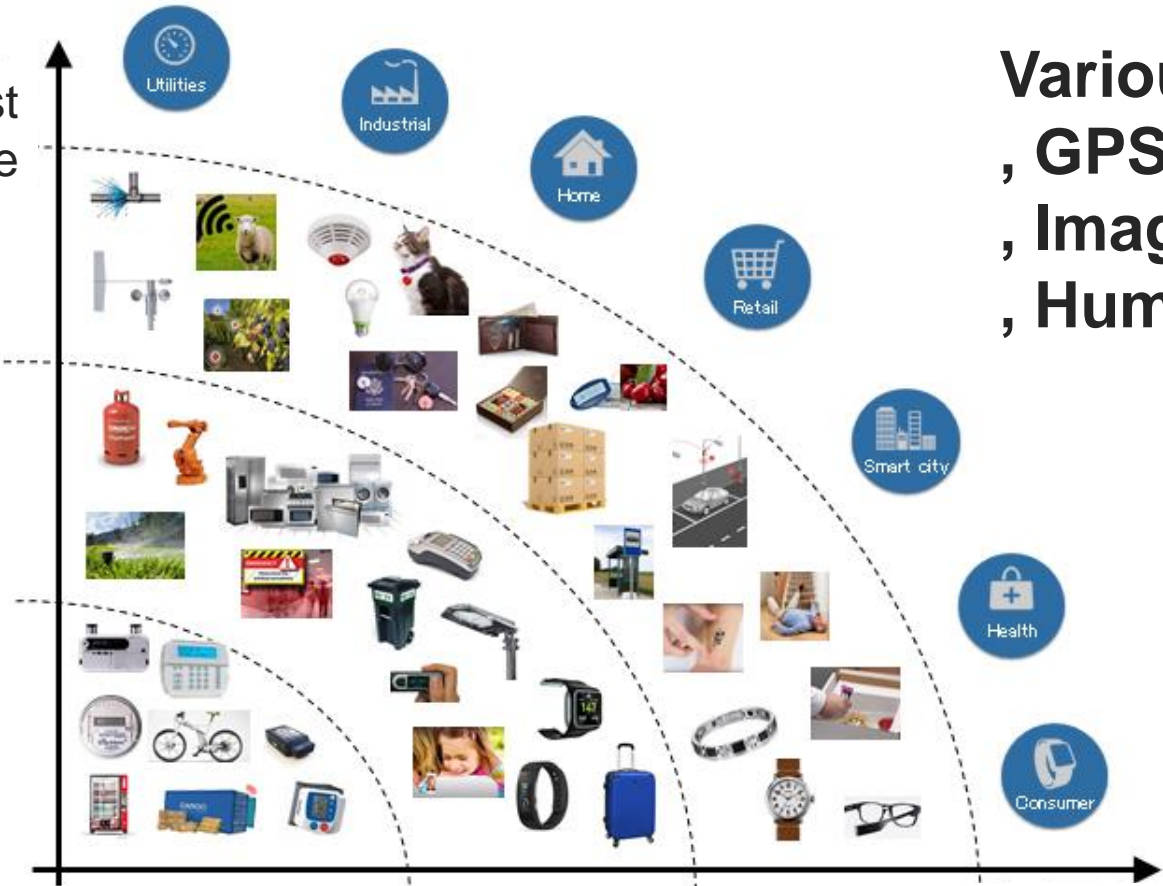
2. Technologies to accelerate IoT

3. Technologies to commercialize IoT services

Technologies to commercialize IoT Devices/Services

Low Cost
Small Size

Various Sensors
, GPS(GNSS)
, Image recognition
, Humidity and etc.



Source: Altair Semiconductor Corp.

Low Power Consumption

Technologies to commercialize IoT devices



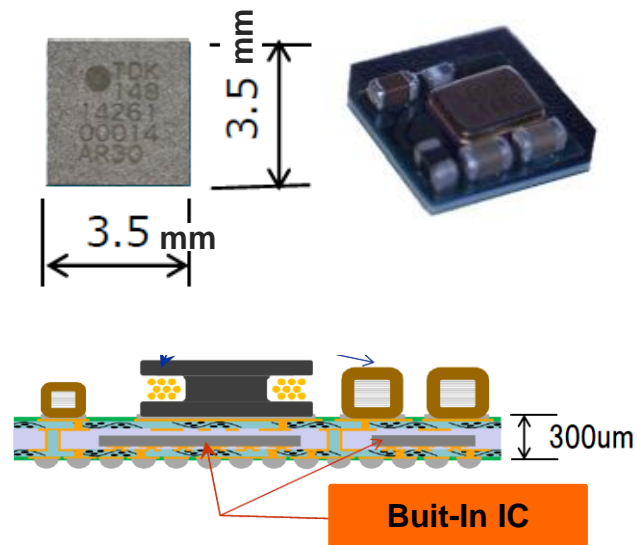
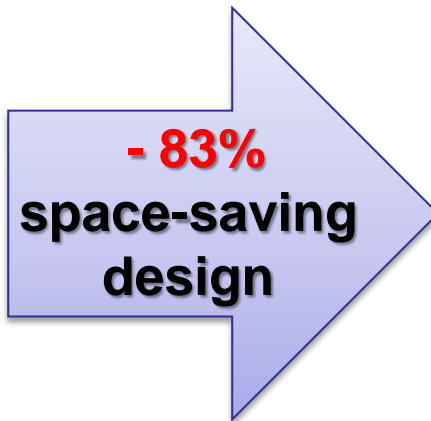
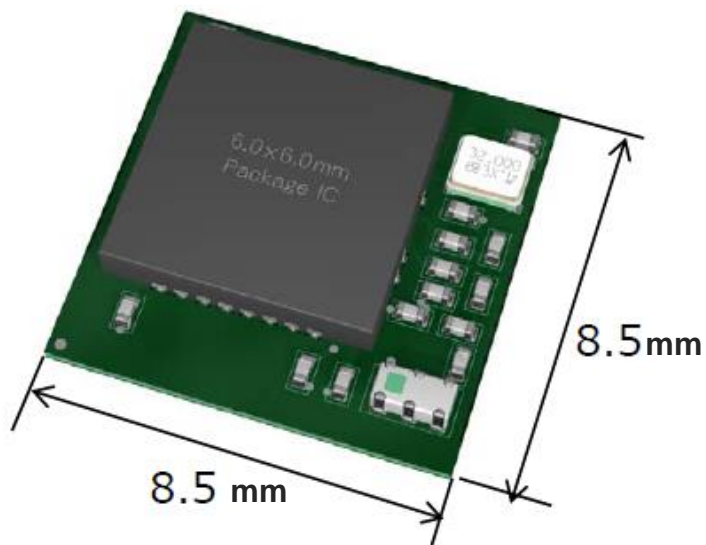
**Minimization
of Passive Components
(Resistor, Capacitor, etc.)**



**Downsizing
and
Lightening**

Technologies to commercialize IoT devices

SESUB: Semiconductor Embedded in SUBstrate Multi-Layers technology to minimize modules



Source: SESUB - Technology Introduction 2016 October
TDK Corporation

KDDI's partners have cutting edge technologies

Each customer has their own needs

Designing The Future



+ Our Partners

**Aiming to provide solutions
to your unique needs through partnerships**

Designing The Future

