ISAI-NLP-AIoT2022

RF-CMOS technology advances IoT

Nov. 6, 2022
Socionext Inc.

Agenda

1. About Socionext Inc.
2. Socionext's RF-CMOS technology
3. Wireless technology supporting IoT
4. LSI for IoT tag solution "ZETag"
5. Summary

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About Socionext Inc.

About Socionext

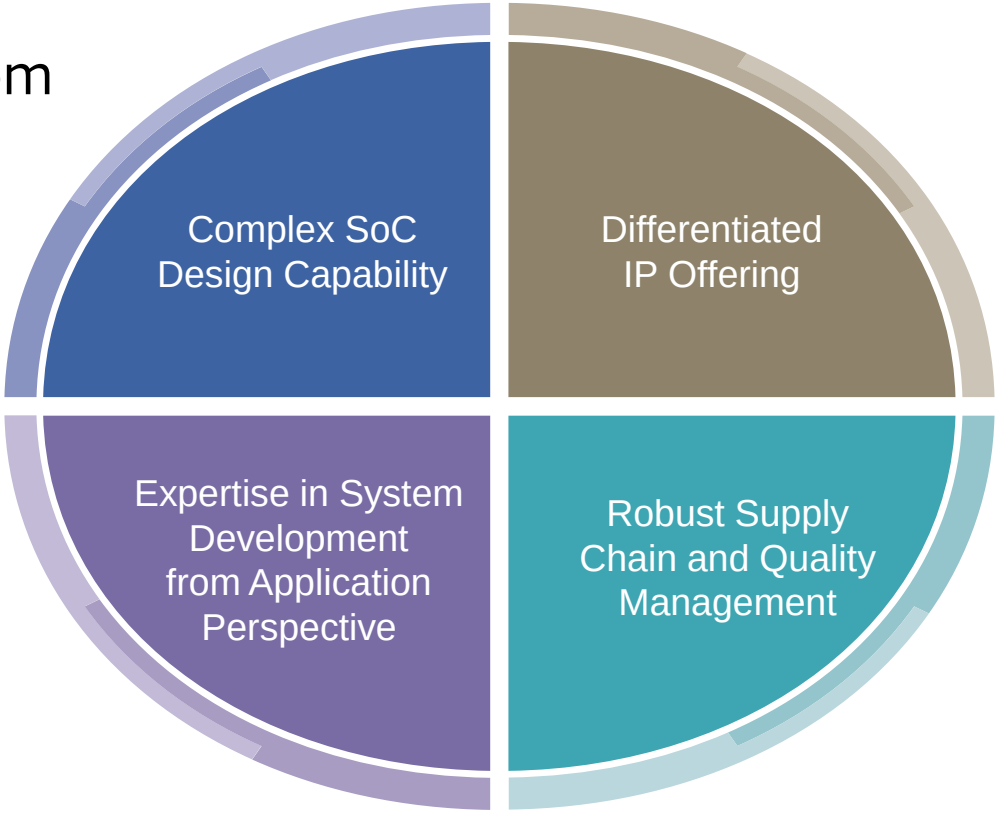
Company name	Socionext Inc.
Headquarters	Nomura Shin-Yokohama Bldg., 2-10-23 Shin-Yokohama, Kohoku-ku, Yokohama, Kanagawa, 222-0033, Japan
Capital	30.2 billion yen
Start of business	March 1st, 2015
Business description	Design, development, and sales of SoC and solutions/services centering on SoC
Employees	About 2,600 (2022.Apr.)
Group company	6 (North America 1, Europe 1, Asia 4)

Shin-Yokohama HQ

Socionext's Strengths

- "Solution SoC" drives customer's innovation

- Providing turnkey support from the system design phase to manufacturing, delivery, and quality assurance.



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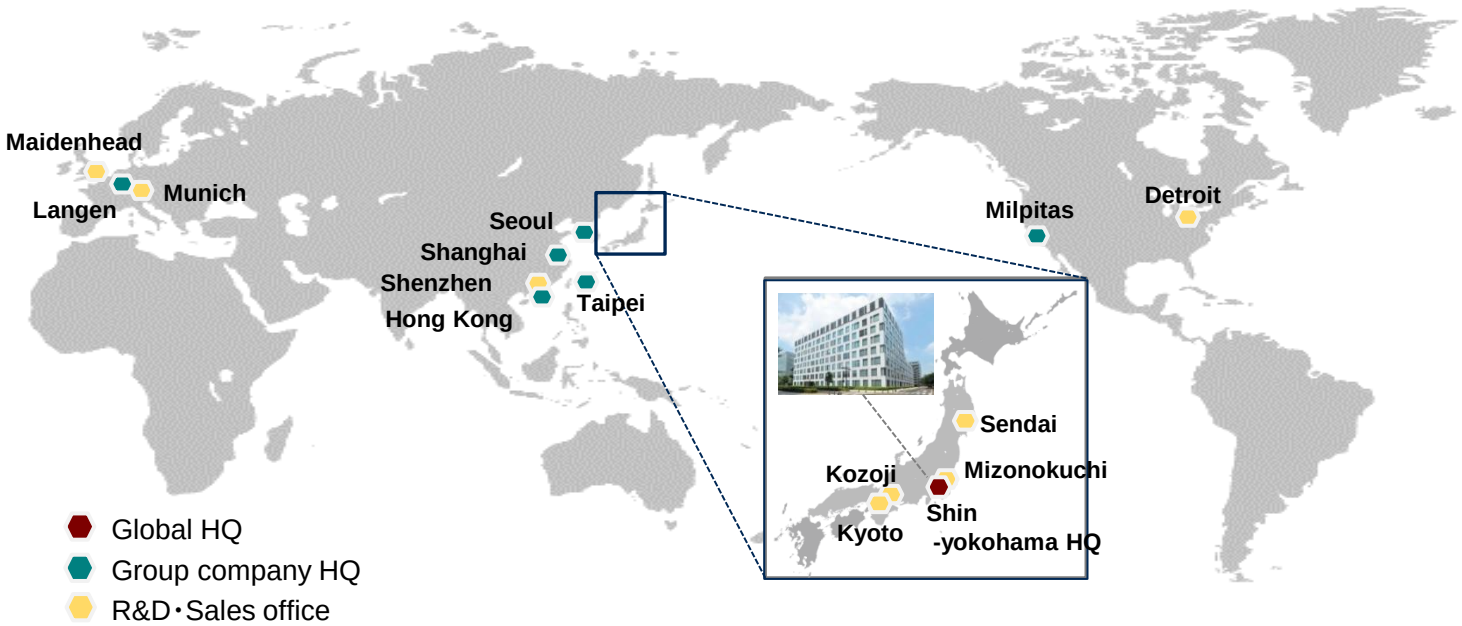
Locations Japan and global

R&D and sales locations worldwide



117 billion yen	#2	55%	75%
Revenue (FY2021 Act)	WW logic ASIC FY2021 revenue-based ranking Source: omdia	Ratio of Outside Japan revenue (Delivery destination) (2022.Mar.)	R&D Resource (Total 2,600 employees) (2022.Apr.)

Socionext’s RF-CMOS technology

Wireless (radio waves) applications

✓ Broadcast reception

- Use few hundred MHz

✓ Data communication

- Use few hundred MHz to few tens of GHz
- PAN/LAN/MAN

⇒ IoT communication : MAN

✓ Sensing

- Use few GHz to few tens of GHz

- Expanding radio applications using higher frequency bands for better service
- Functions of wireless enabled devices are evolving rapidly!

RF-CMOS Custom SoC Use Cases

- Broadcast Reception
- IoT Communication
- Satellite Connectivity with Ka band
- Vehicle to X Communication
- ADAS Sensor
- Motion Detection Sensor
- In-Cabin Monitoring

Socionext’s RF-CMOS technology introduction

socionext™

for better quality of experience

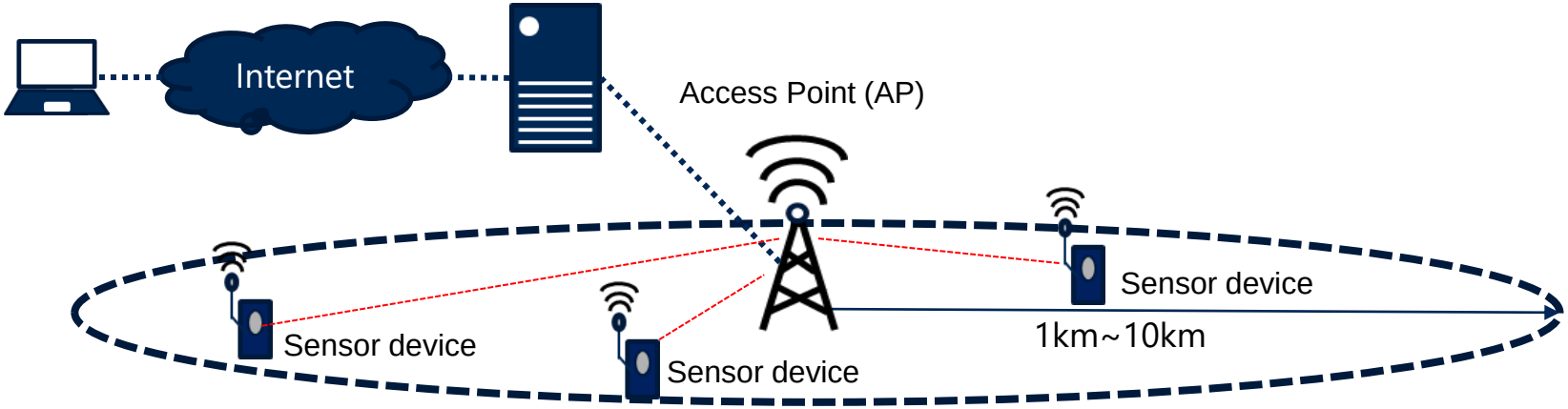
Socionext offers extensive experience in RF-CMOS LSI development in advanced semiconductor technologies for leading global markets.

Socionext supports wireless application products development including IoT devices.

Wireless technology supporting IoT

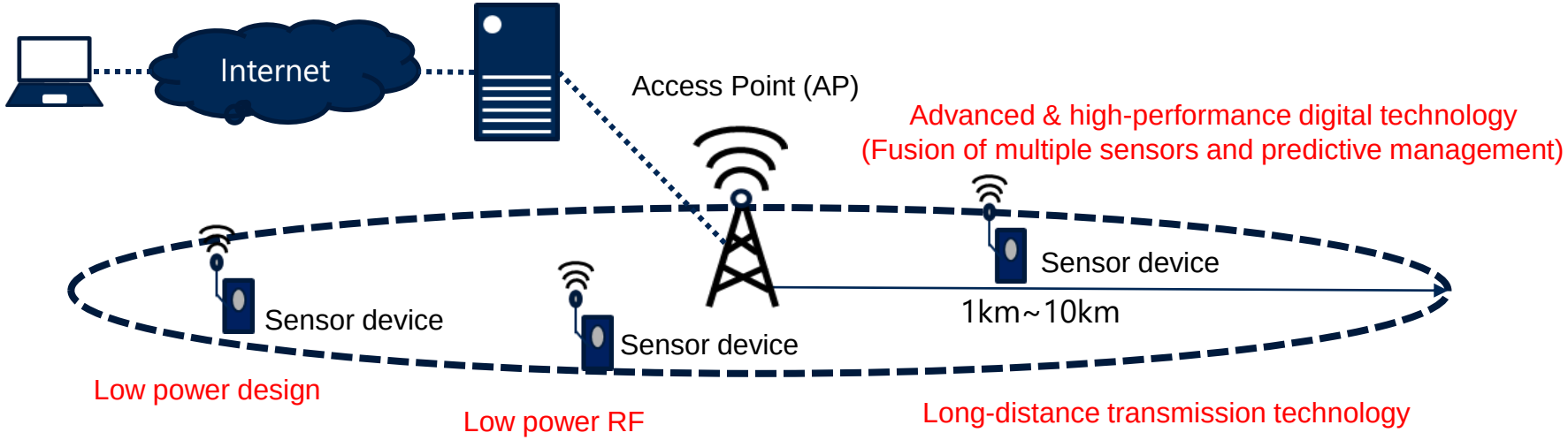
Examples of wireless communication systems - LPWA

- Collect data from devices within a distance of about 10km from AP
  Use low-power, wide-area wireless communication (LPWA)
- Send sensor device data to AP using LPWA.
- Transfer data from AP to the cloud server, and browse result on PC.



Requirements for IoT devices

- Wide communication coverage area
- Battery powered, long life
- Small data transfer
- "Intelligent edge terminals" that analyze acquired data at the edge



LPWA Sensors

- Various sensors according to applications
  - Sensors that acquire sensing data and periodic transmission
  - Sensors that acquire sensing data, analyze data and transmit results
  - Combination of the above

Sensors that seems to transmit acquired data

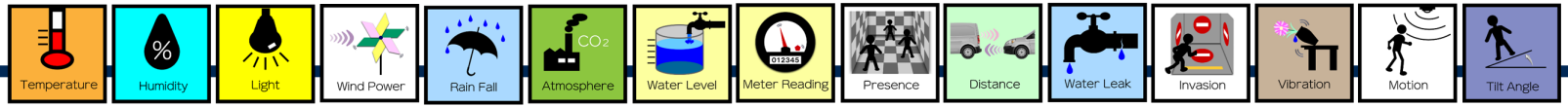
Sensors that seems to transmit after processing the acquired data

Therefore,,,

Wide coverage area	Small data transfer
Battery powered, long life	“Intelligent edge terminals”

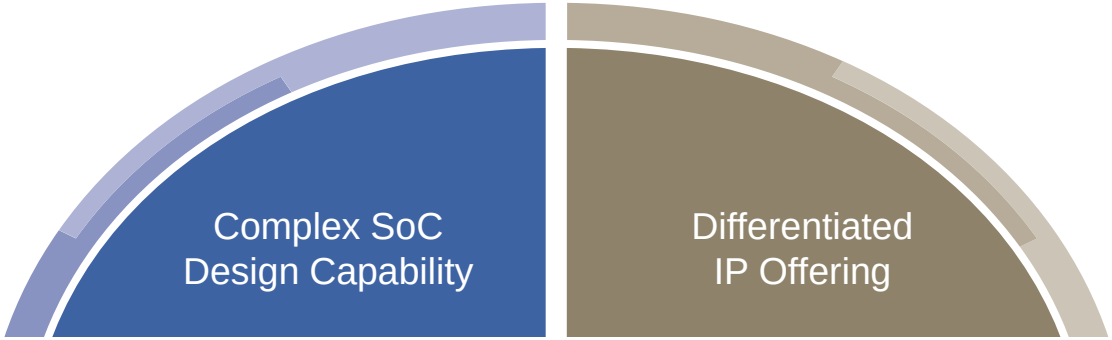
Requirements for IoT devices

For realization,,,

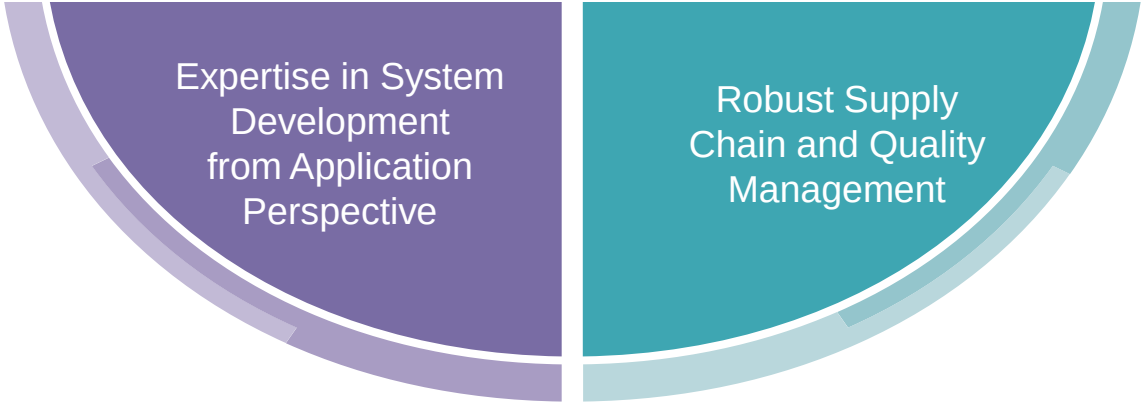


Integration with low-power, digital-rich RF circuits using advanced RF-CMOS technology is important

Socionext's Strengths



Socionext can realize RF circuits and large-scale digital circuits on a single chip



LSI for IoT tag solution “ZETag”

What is ZETA?

- LPWAN (Low Power Wide Area Network) standard developed by ZiFiSense

Examples of wireless communication systems - LPWA

- Collect data from devices within a distance of about 10km from AP
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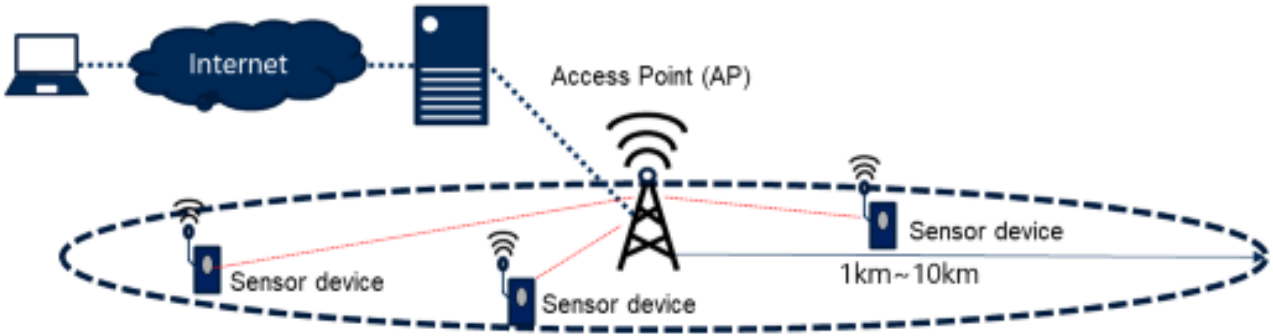

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ZETA alliance

https://zeta-alliance.org/

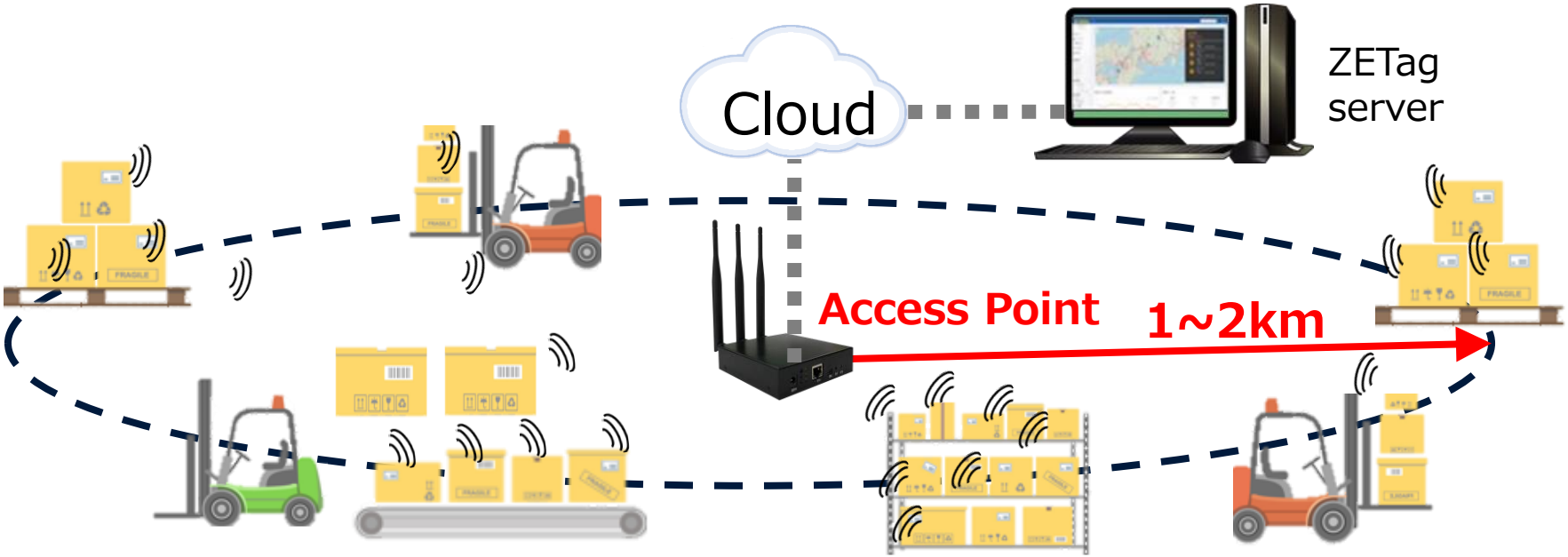
ZETA
We Make Pervasive IoT Happen

What is ZETag?

ZETag --- Active-tag using ZETA's long-distance transmission

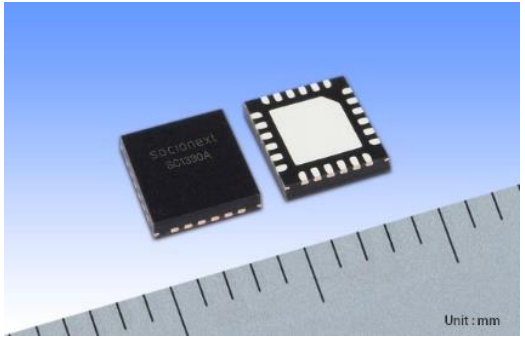
- Possible to manage “things” within 1 to 2 km from access point
- Periodically transfer its ID data to a dedicated access point

→ Able to use for tracking people and things!

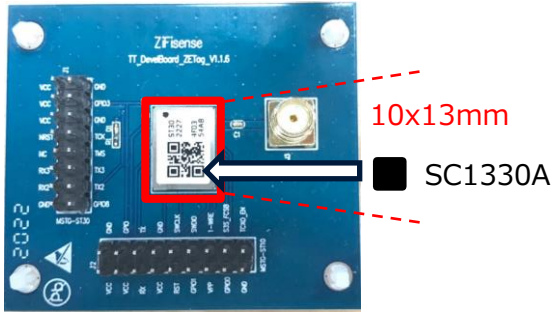


ZETag LSI unique point

Integrated “IoT-tag” function into 1-chip with Socionext's RF-CMOS technology
And supports Next Generation ZETA Standard Advanced M-FSK

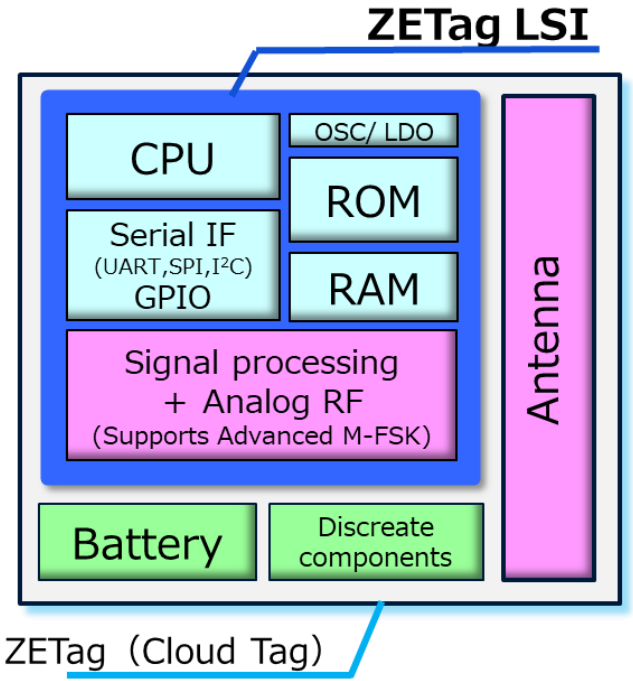


SC1330A (4mmx4mm)



ZiFiSense’s ZETag module

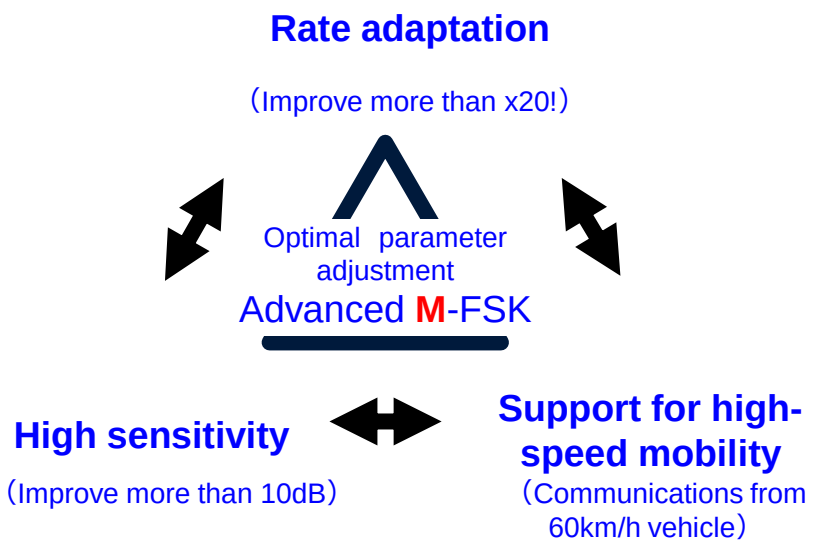
Item	Description
Frequency	400-950MHz
Channel width	2 KHz
Modulation	2-8 GFSK 100bps-250Kbps
Supply Voltage	1.8~3.6 V
CPU	32bit RISC
I/F	UART/SPI/I2C



What is Advanced M-FSK?

Compared with conventional ZETA, Advanced M-FSK is

- More than 20 times transfer rate
- Improved sensitivity more than 10dB
- Able to communicate from a moving object at 60 km/h



Feature	ZETA	Next gen. ZETA
Modulation	2FSK	2FSK/4FSK/8FSK
Data rate	300, 600bps	0.02～20K bps
Error correction	No	Yes
Frame structure	Simple	Complex

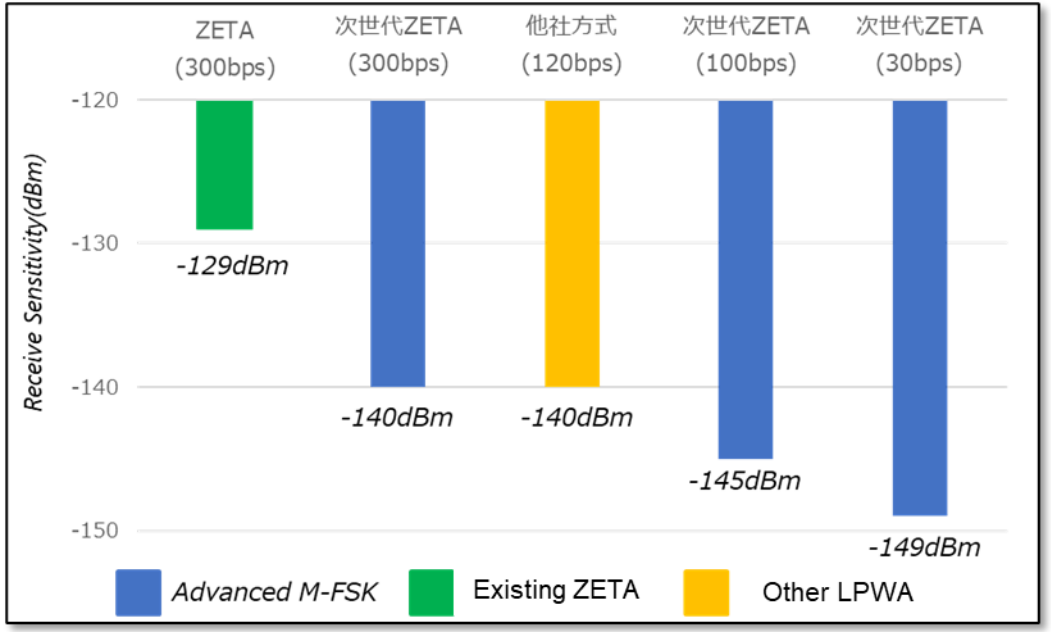
Advanced M-FSK performance

Sensitivity → 11dB improvement VS existing ZETA
5dB improvement VS other LPWAs at comparable transfer speeds
→ When bit-rate is 30bps, reception sensitivity is -149dBm

*** Advanced M-FSK can achieve "Requirements of IoT devices"

Requirements for IoT devices

1. Wide coverage area
2. Battery powered, long life
3. Small data transfer
4. "Intelligent edge terminals"



ZETag application – LTL (Less-than-truckload) tracking in China

LTL: shipping service for relatively small loads or quantities of freight.

- LTL provider combines the loads and shipping requirements of several different companies on their trucks. → causes difficult to track parcel.
- ZETag solve this problem!
  Set up APs on a highway in China, to track ZETag attached cargo.

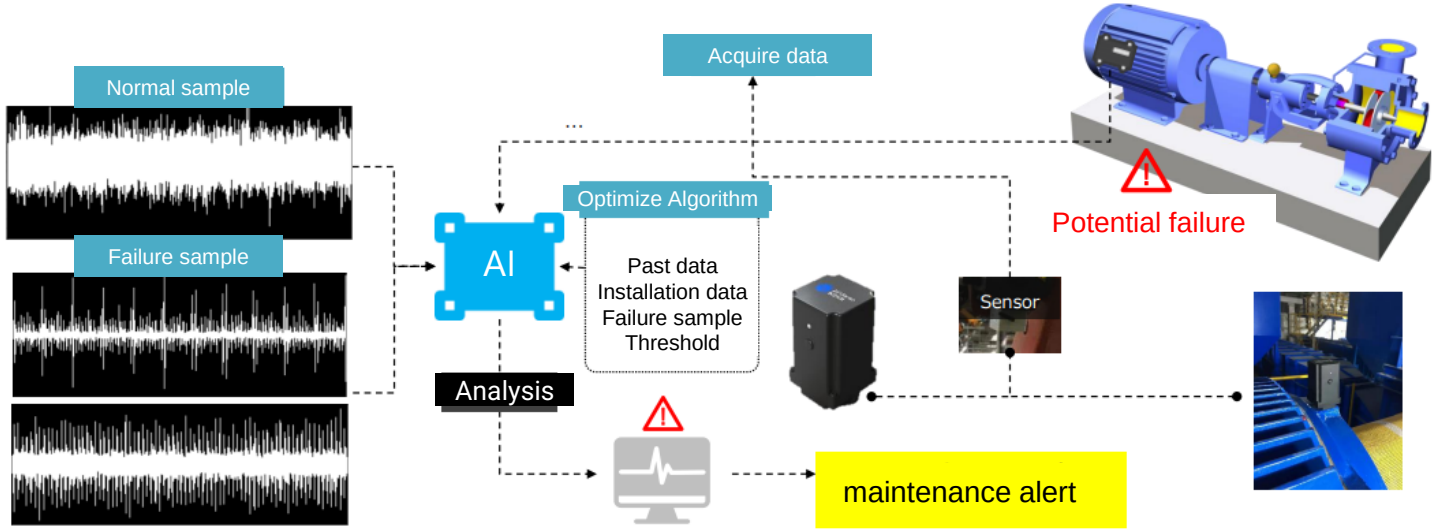
*** Original by ZiFiSense and Techsor ***

Example of AI+ZETA: Thailand company adopt ZETA vibration sensor

ZETA vibration sensor

TECHSOR ZETA Alliance

Embedded AI into the vibration sensor that detects machine failures regularly



2022/9/26

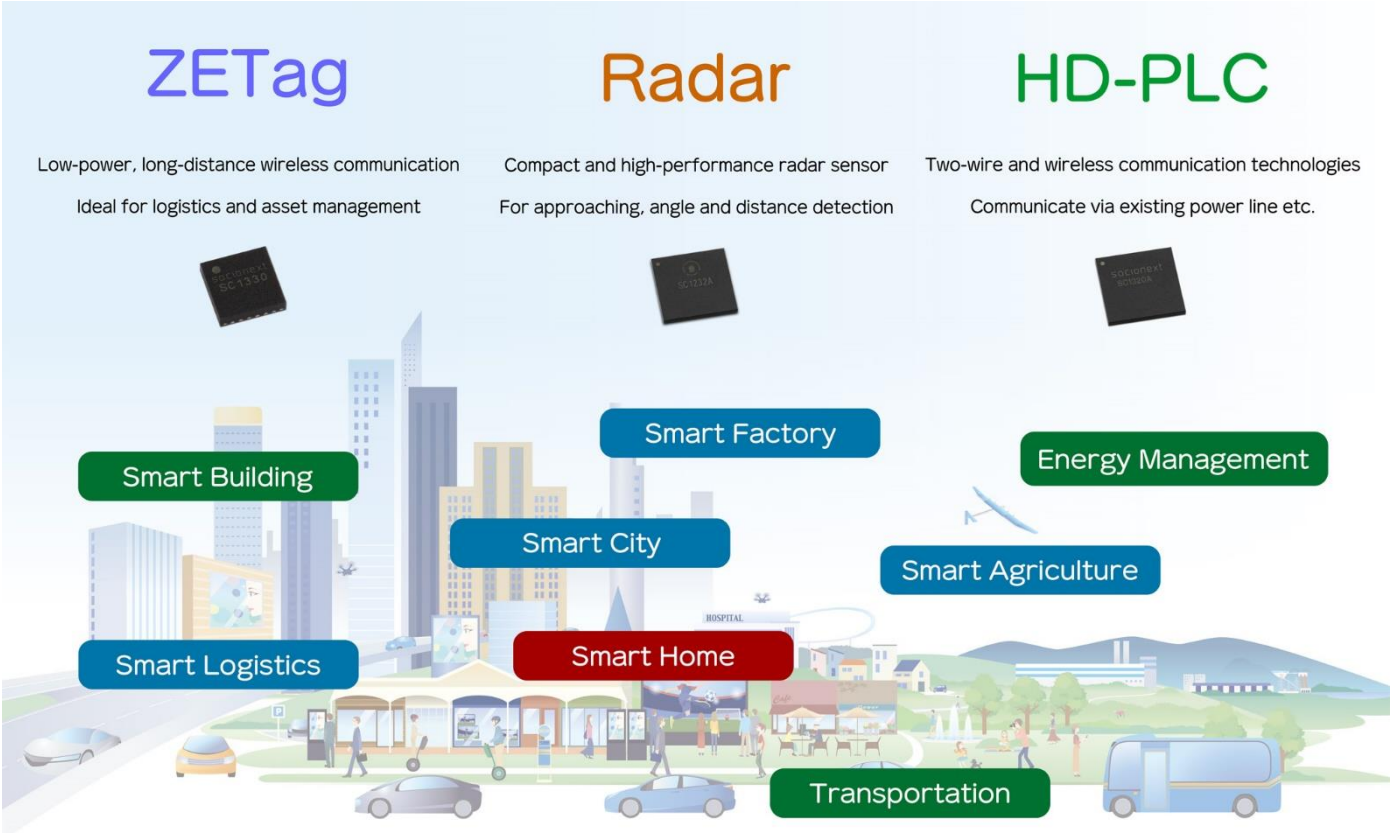
*** Original by ZiFiSense and Techsor ***

4

Summary

Summary

- Socionext offers “best” low-power RF LSIs for the customer’s system



Summary

To realize IoT society, intelligent edge terminals require

- High performance
- High functionality
- Low power consumption
- Low cost

LSIs.

→ RF-CMOS technologies are very important to achieve them.

→ Socionext's RF-CMOS solution is the answer.

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