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OTA-On-Demand (OOD) Services with AGL

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1. Self-introduction

Self-introduction

Stefan Aust

- Working for NEC Communication Systems in Japan since 2008.
- Expert in communication and standardization.
- Working in the automotive embedded systems
 - Car gateways
 - AVB and TSN
 - Linux OS, adaptive AUTOSAR



2. Motivation

The connected car

OTA-On-Demand (OOD)

Motivation

- There is a strong demand in the automotive and IoT industry to keep systems up to date.
 - Longer product life-cycle
 - Up-to-date security
- There has been security accidents reported when accessing vehicles over-the-air (OTA).
- Some OTA implementations utilize on wake-up sequences to start the connection with the vehicle (via SMS). There is a need to inform the vehicle to start the communication, thus a wake-up function is essential.
- This presentation outlines the use of ROD sender/receiver to create *trusted zones* for OTA (Over-The-Air) software upgrades.

Digital car and need for up-to-date software.

Needs and seeds analysis

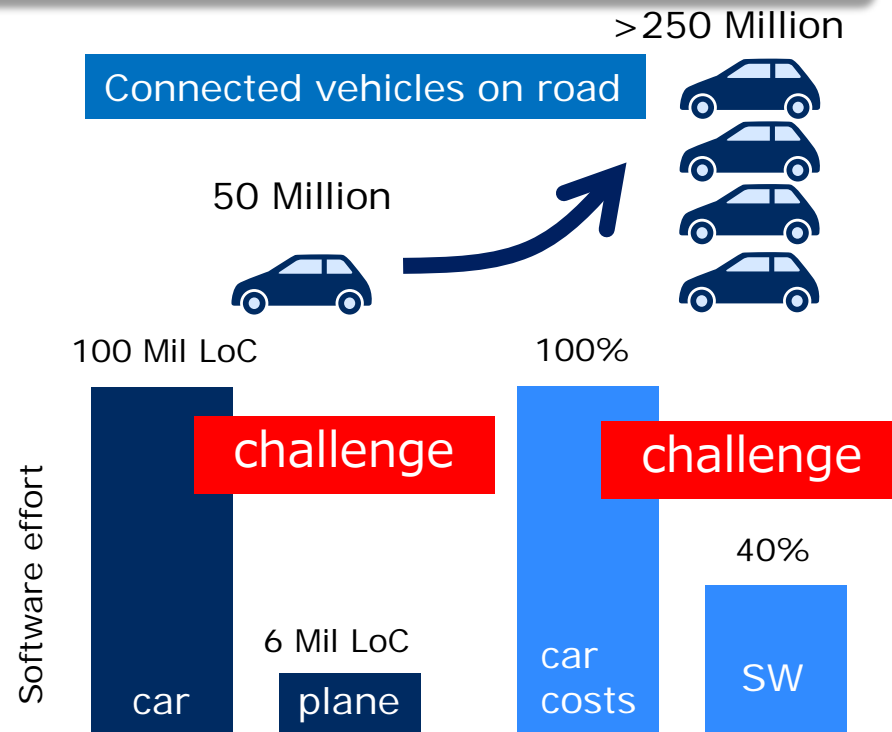
I) Automotive service

- ❑ Over-the-air (OTA)
- ❑ Secure OTA
- ❑ Firmware OTA (FOTA)
- ❑ Service platform



II) Automotive IoT access

- ❑ Car-GW
- ❑ IEEE 802.11p
- ❑ D2D/LTE
- ❑ Connected car



3. Remote configuration

Push message or “shoulder tapping” – Current state

- There is a need in the automotive industry to signal the vehicle that a SW upgrade is under way.
- A push-message is used to inform the vehicle about the SW upgrade.
- This push message or “shoulder-tapping” information can be used in 4G, LTE networks through short message services (SMS).
- Such SMS are then sent to the vehicle as “shoulder-tapping” to wake-up the OTA communication and to start the SW upgrade after successful identification (car/user/server).

Proposed idea – New shoulder tapping = ROD

In order to further improve the security of OTA in vehicles, only in distinct locations the vehicle should be accessed for software upgrades. Such locations, called *trusted zones*, may include:

- OEM (during production)
- Garage (during maintenance)
- Home (owner)

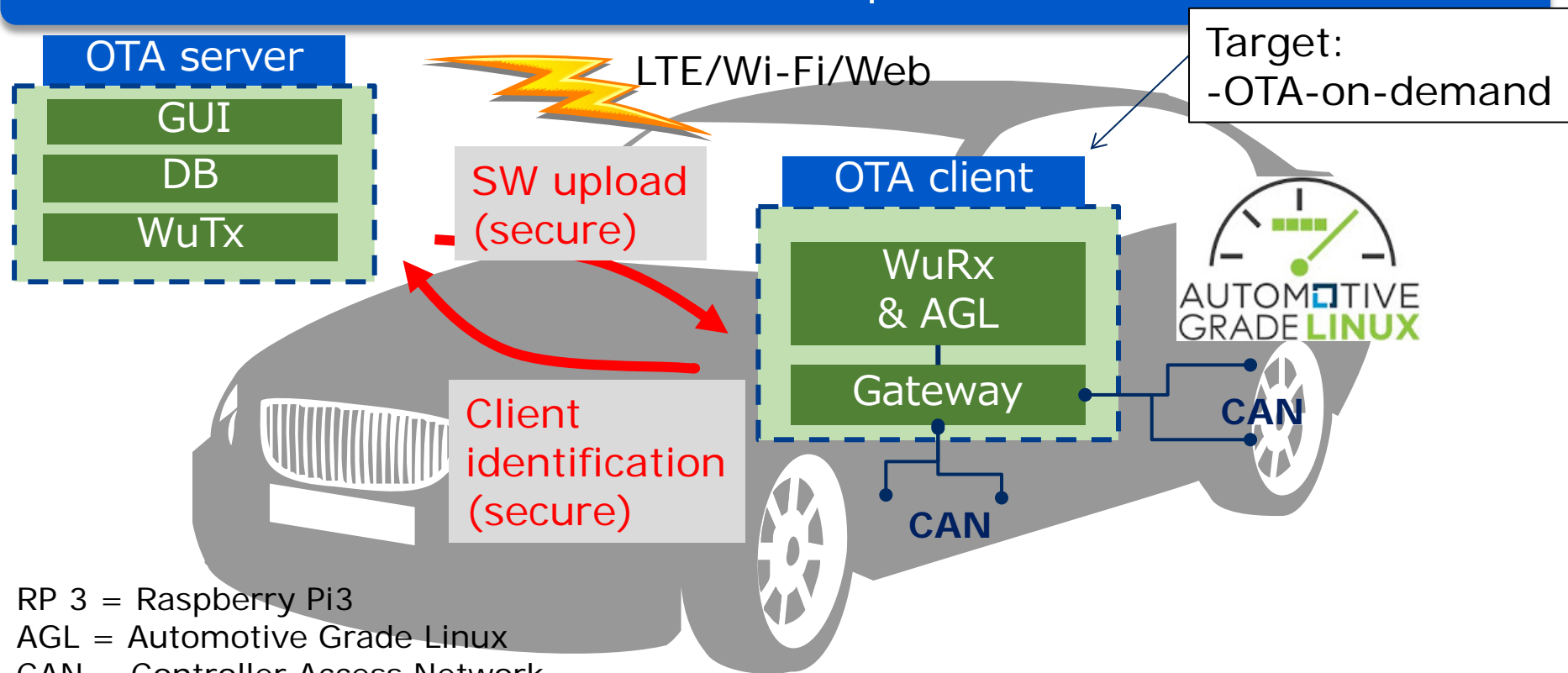
Trusted zones are protected from hacking on the road.

NCOS provides radio-on-demand (ROD) sender/receiver to realize wireless wake-up functions over-the-air.

In addition, some OTA utilizes SMS messages to realize over-the-air wake-up. As an alternative to SMS, this could be easily realized with ROD receivers.

Connected Car and secure SW updates

To realize OTA-on-demand, a wake-up sensor will be installed.



RP 3 = Raspberry Pi3

AGL = Automotive Grade Linux

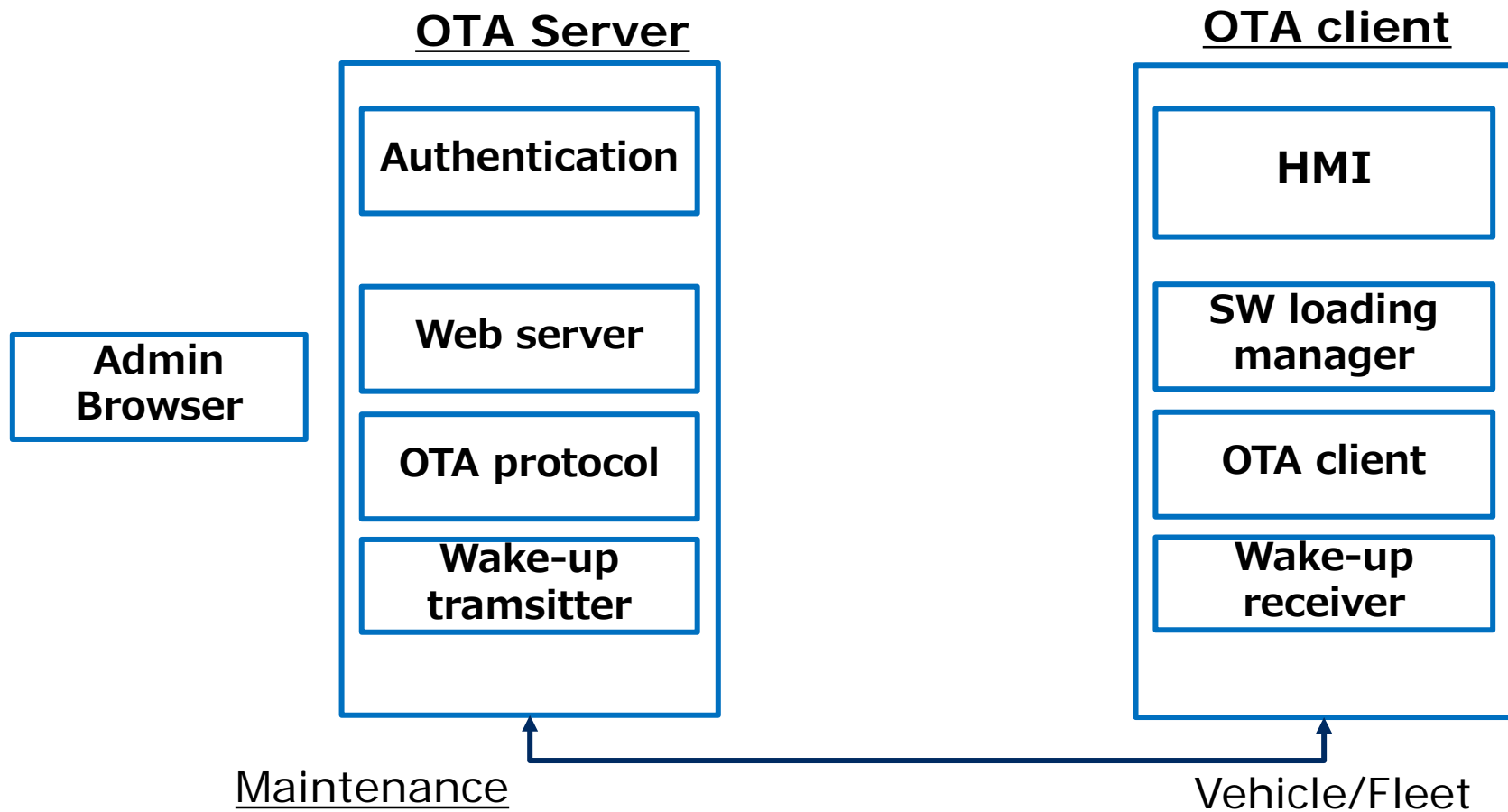
CAN = Controller Access Network

4. OTA-on-demand

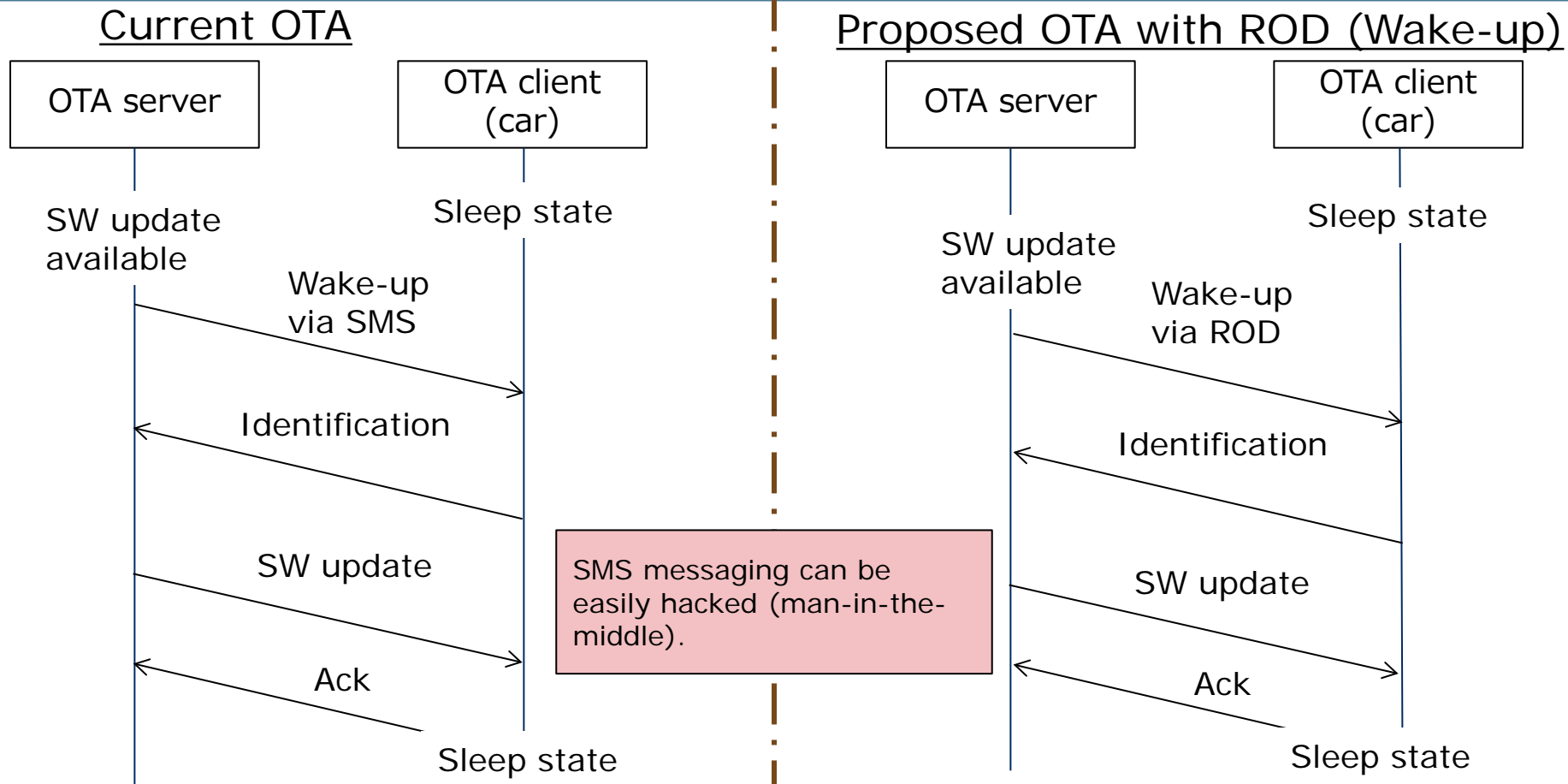
OTA-on-demand Advantages

- Creation of trusted zones, e.g., at the OEM and the dealer by installing specific hardware (Wi-Fi AP with ROD function).
- Creation of trusted zones, e.g., even at home. It allows SW updates by OTA via the public network (4G, LTE) or via the Internet (via ROD device).
- Safe and reliable OTA SW updates when ROD is used, e.g., trusted and reliable connection via “single-point-of-access”.
- Stronger utilization of Wi-Fi access technology when using ROD as alternative to 4G, LTE networks.

OTA-On-Demand (OOD) Client/Server architecture

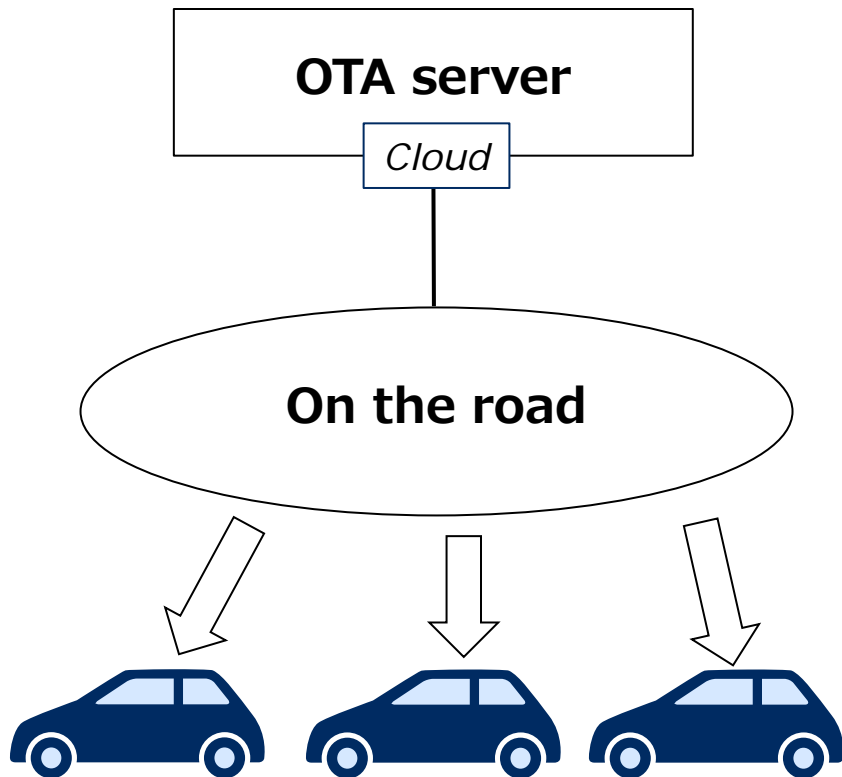


OOD Sequence chart

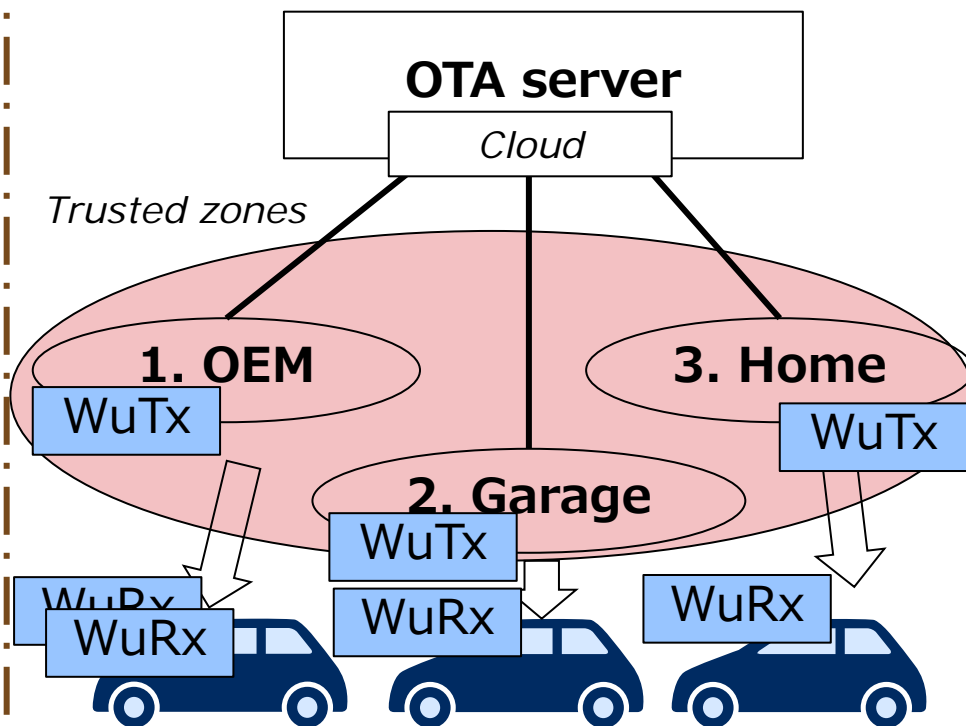


Trusted zones

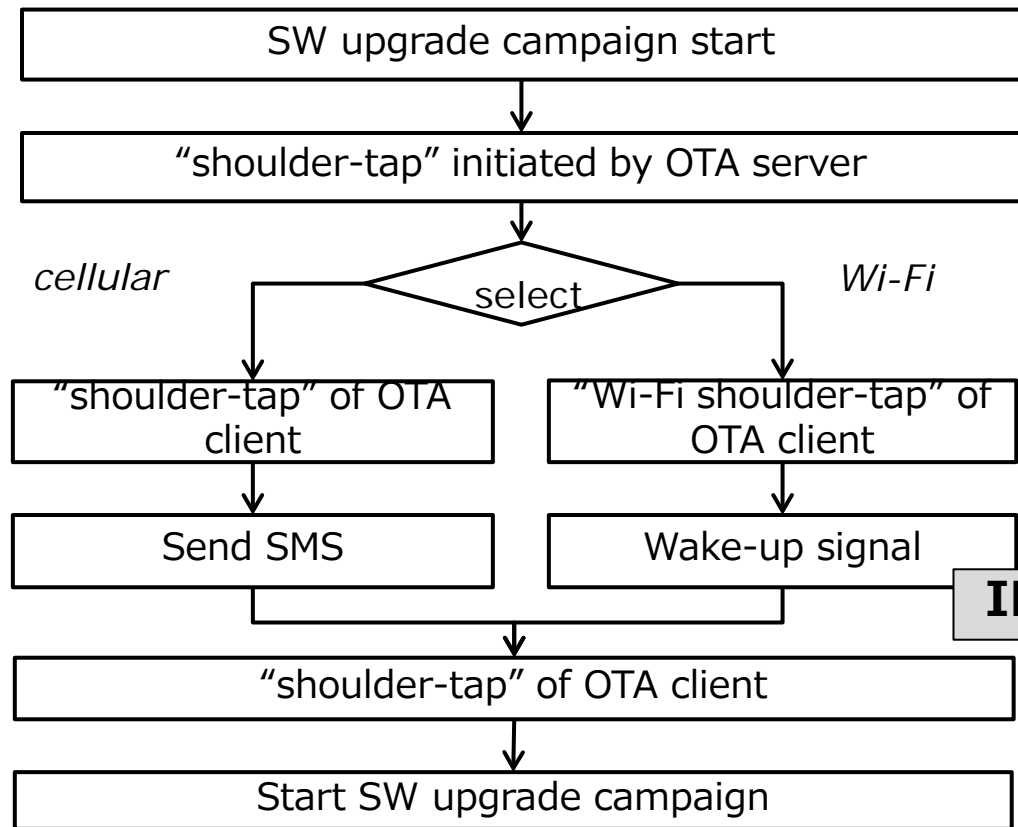
Current OTA



Proposed OOD



Example (shoulder-tap algorithm)



The vehicle should be located inside the trusted zone, stationary, not used, to start the SW upgrade.

IEEE 802.11ba

Implementation example (ROD/location/access service)

ECU type	OEM (engineer)	Garage (mechanics)	Owner (driver)	Location
Class 1 (uncritical)	O	O	O	Home, work
Class 2	O	O	X	Garage, maintenance
Class 3 (most critical)	O	X	X	Car assembly line

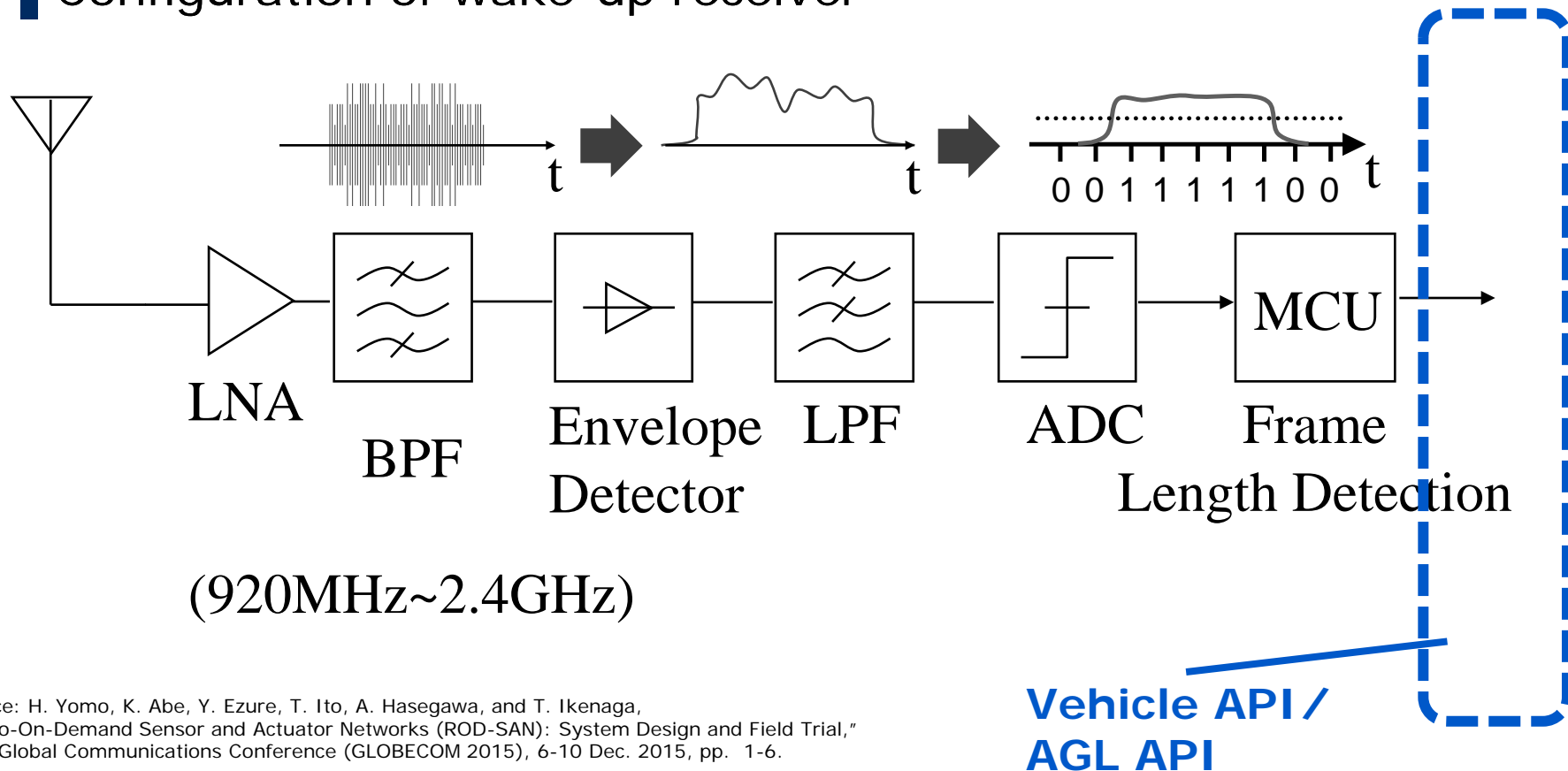


**Model/type
access**

**Single
vehicle**

WuRx (Wake-up Receiver)

Configuration of wake-up receiver

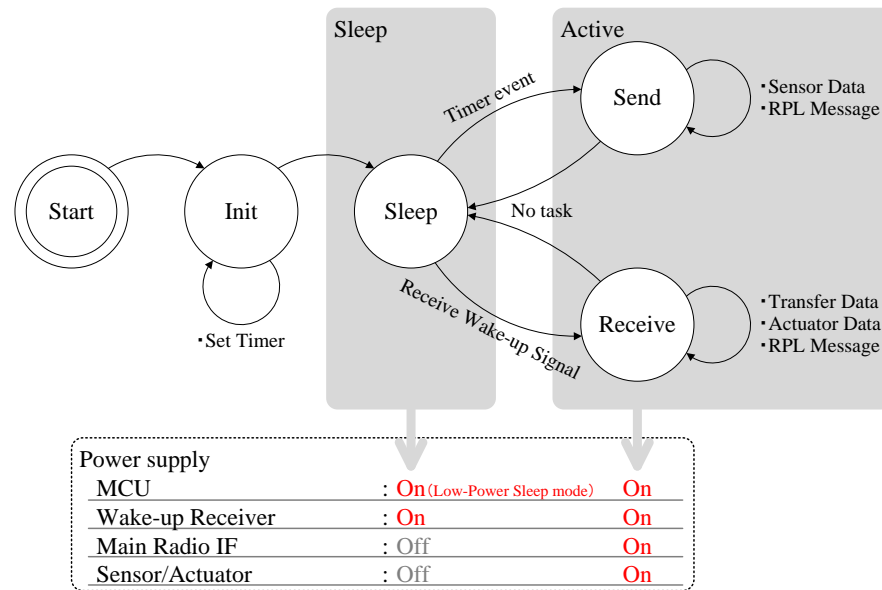
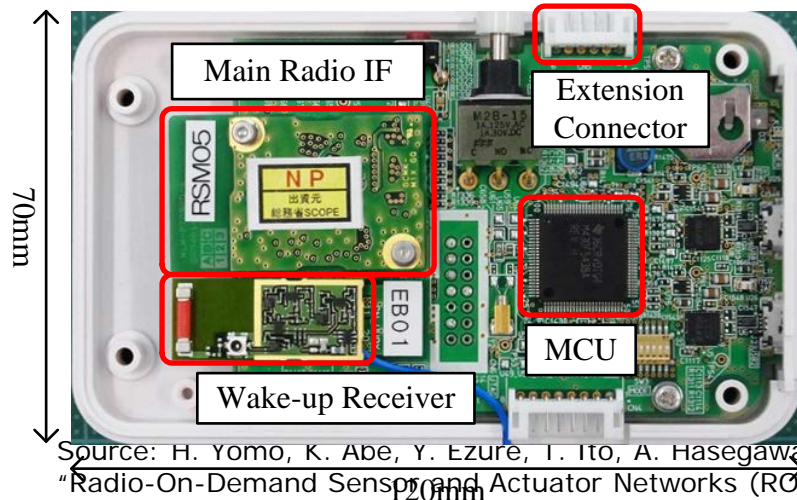


Source: H. Yomo, K. Abe, Y. Ezure, T. Ito, A. Hasegawa, and T. Ikenaga, "Radio-On-Demand Sensor and Actuator Networks (ROD-SAN): System Design and Field Trial," IEEE Global Communications Conference (GLOBECOM 2015), 6-10 Dec. 2015, pp. 1-6.

Wake-up / OTA configuration

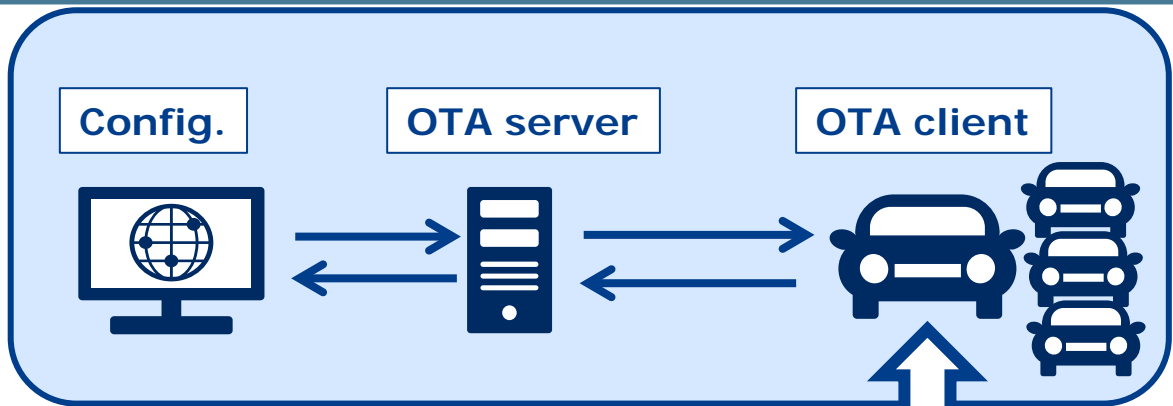
Wake-up ID

- Unicast Wake-up ID in function of MAC address
- Unique Broadcast Wake-up ID
 - Mainly used for sending control information (e.g. route maintenance)



Source: H. Yomo, K. Abe, Y. Ezure, T. Ito, A. Hasegawa, and T. Ikenaga,
"Radio-On-Demand Sensor and Actuator Networks (ROD-SAN): System Design and Field Trial,"
IEEE Global Communications Conference (GLOBECOM 2015), 6-10 Dec. 2015, pp. 1-6.

Remote configuration: OTA client/server communication



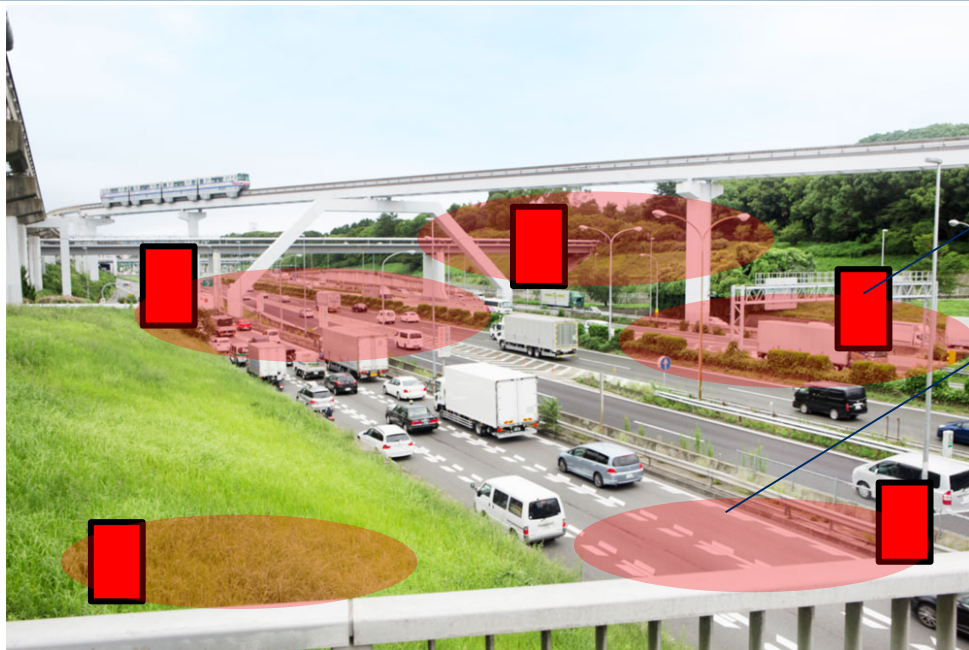
OTA client (RP3)



OOD client

RP3=Raspberry Pi3

Use case scenarios (secure SW download, etc.)



OOD AP

Trusted zone

Trusted zone

OOD AP



5. Conclusions

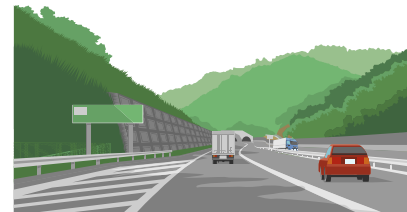
Conclusions

There is an increased need for connected vehicles and remote configuration of car software.

- Increased of software recall can be solved by over-the-air (OTA) communication.

OTA strategies have been already realized with AGL. However, current developments suggest a stronger involvement of sensors.

Sensor information can be utilized to secure OTA services. We have proposed an OTA-On-Demand (OOD) service and realized the setup with AGL.



Thank you!

Questions & Answers

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