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NEC

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Advances and challenges in remote configuration of connected cars

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Orchestrating a brighter world

NEC brings together and integrates technology and expertise to create the ICT-enabled society of tomorrow.
We collaborate closely with partners and customers around the world, orchestrating each project to ensure all its parts are fine-tuned to local needs.

Every day, our innovative solutions for society contribute to greater safety, security, efficiency and equality, and enable people to live brighter lives.

Content

1. Self-introduction
2. Motivation: The connected car
   1. The vehicular target system
   2. Software-car and the need for up-to-date software
3. Remote configuration
   1. Car gateway
   2. Software OTA
   3. OTA client/server architecture
4. Car gateway (Proof of Concept)
   1. Architecture
   2. Challenges
5. Conclusions

1. Self-introduction

1. 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

2. Motivation

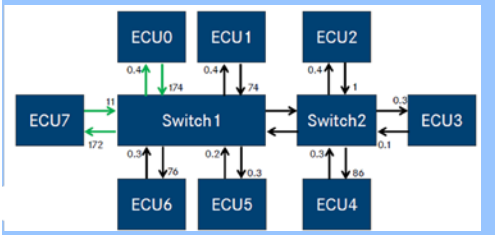
The connected car

The vehicular target system

Automotive networks: CAN, FlexRay, LIN, MOST, Ethernet

Power Train
- Engine control
- HEV/EV motor
- transmission

Chassis
- Steering/EPS
- Brake/ABS
- Chassis control



ECU Ethernet

Networking
- CAN
- LIN
- FlexRay
- Ethernet
- AVB/TSN
- Bluetooth

Safety
- Airbag
- Safety control

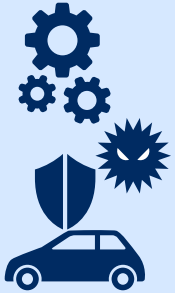
ADAS
- Collision warning
- Parking assistant

IVI
- Car audio
- Connectivity
- Navigation
- Entertainment
- ITS/GPS

Software-car and the need for up-to-date software

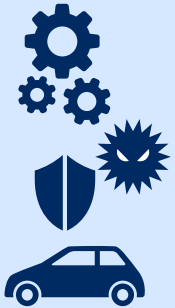
I) Automotive service

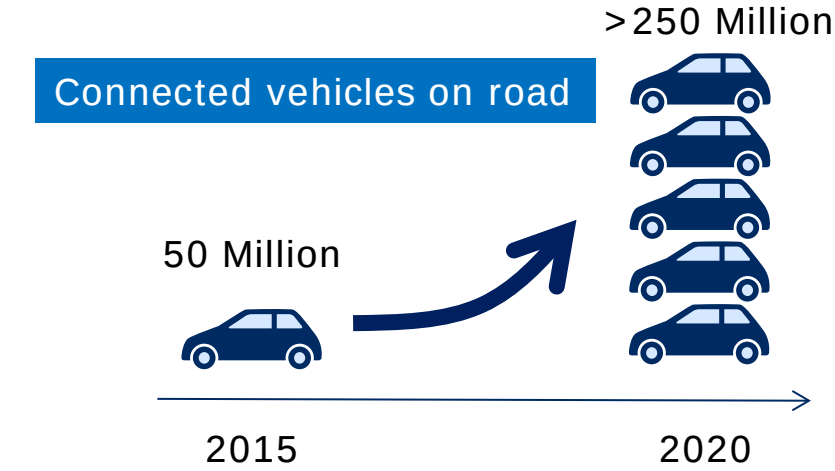
- Over-the-air (OTA)
- Secure OTA
- Firmware OTA (FOTA)
- Service platform

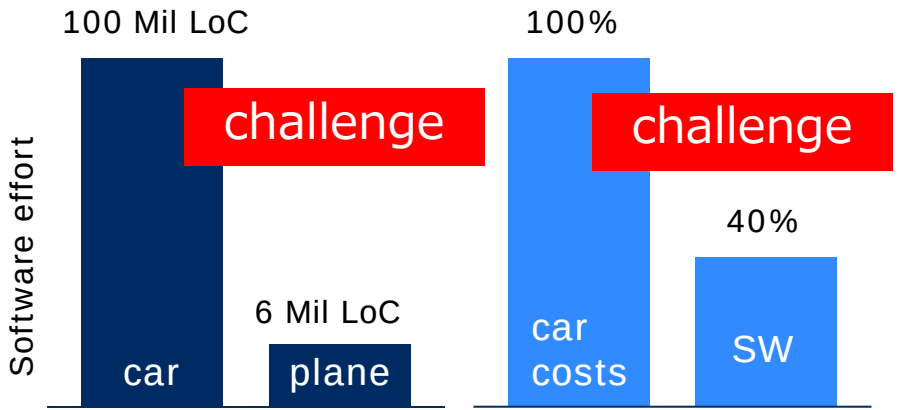


II) Automotive IoT access

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

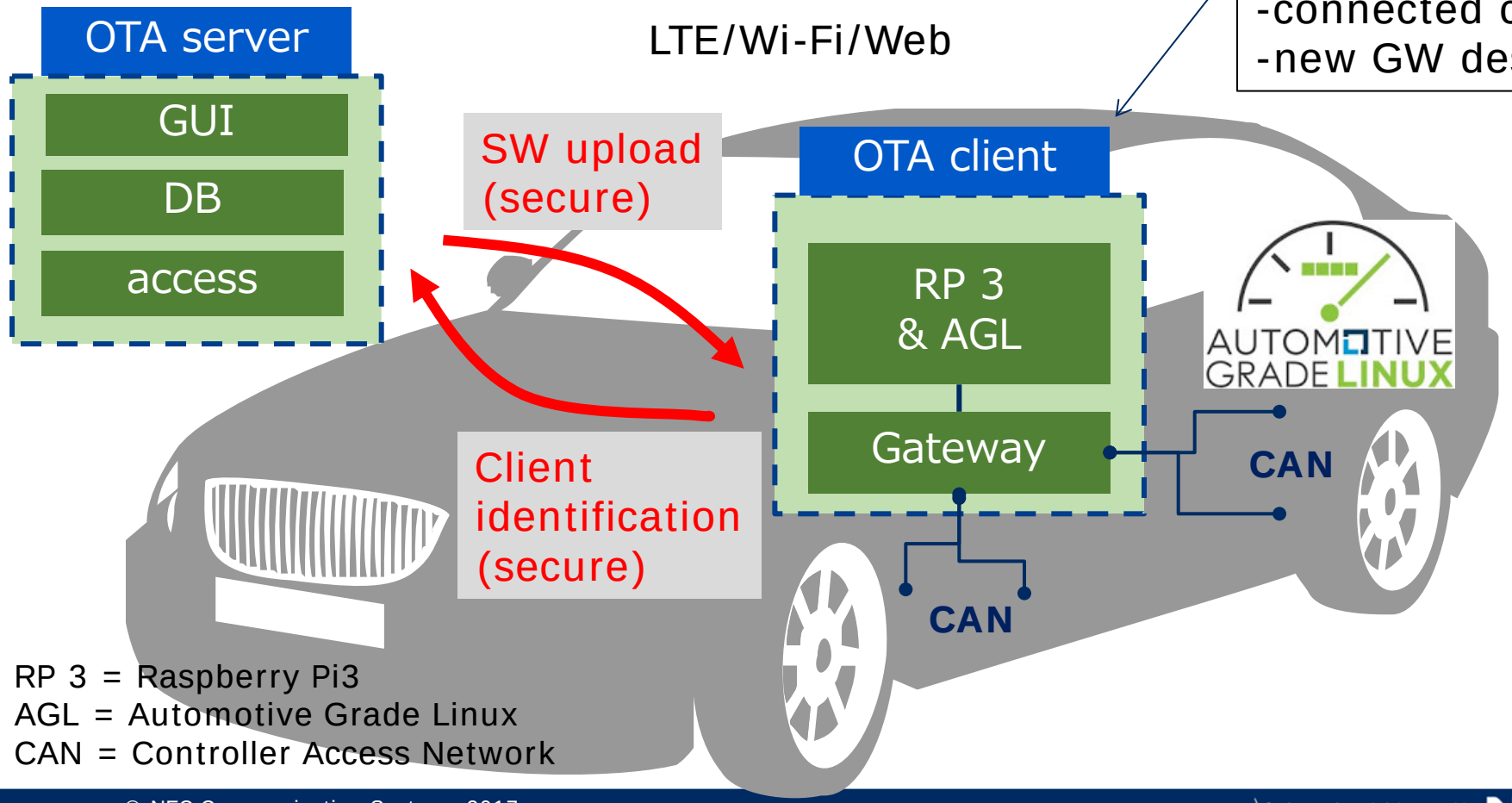






3. Remote configuration

The car gateway



RP 3 = Raspberry Pi3
AGL = Automotive Grade Linux
CAN = Controller Access Network

Software OTA (SOTA)

Update strategies

- Master/Slave
- Bootloader
- Secure roll-back
- Secure home/public WLAN/LTE

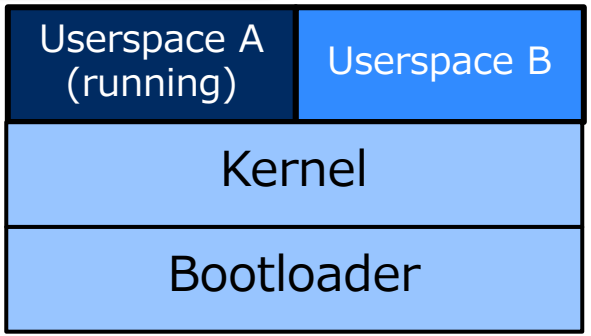
Watching Automotive Grade Linux (AGL)

- Implementation of OTA features
- Implementation of security features
- Open source/collaboration

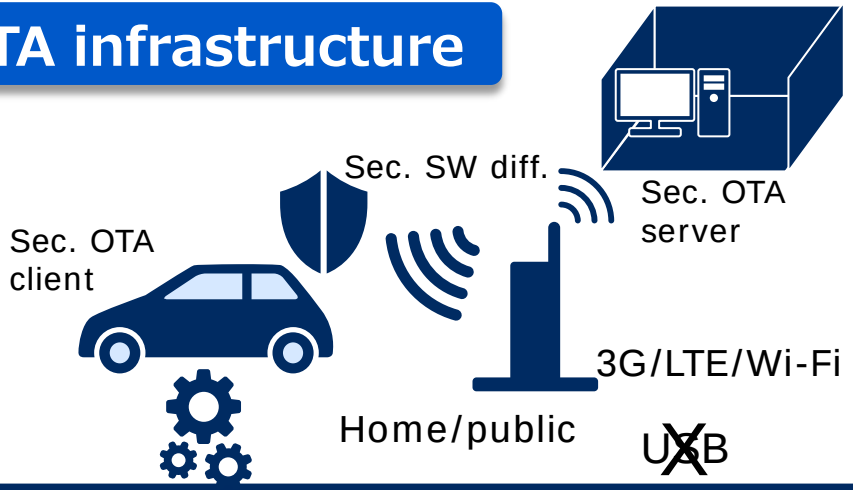
PoC

- Remote configuration setup
- Security features
- Presentation to car OEMs

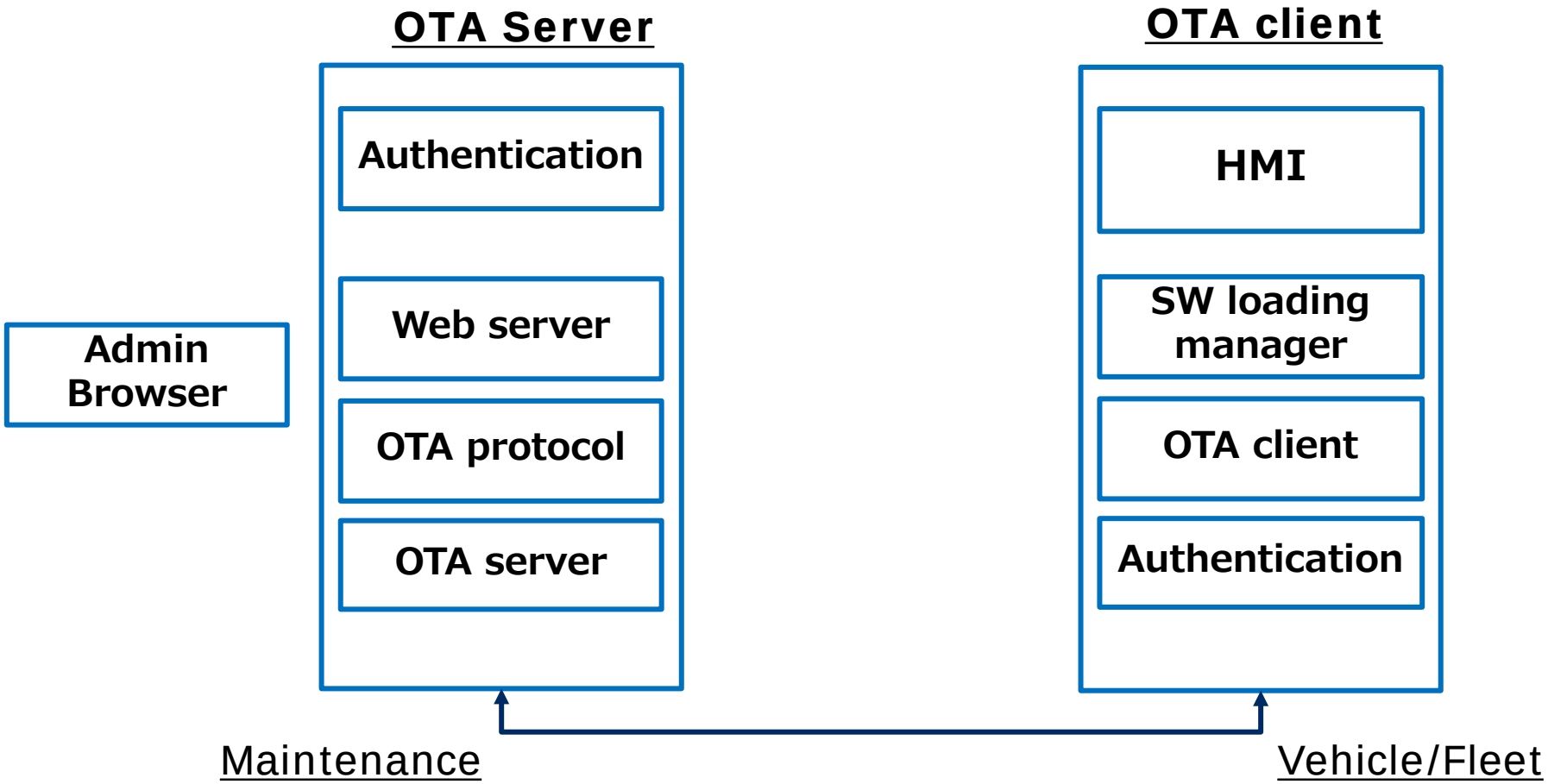
OTA strategies



SOTA infrastructure



OTA client/server architecture

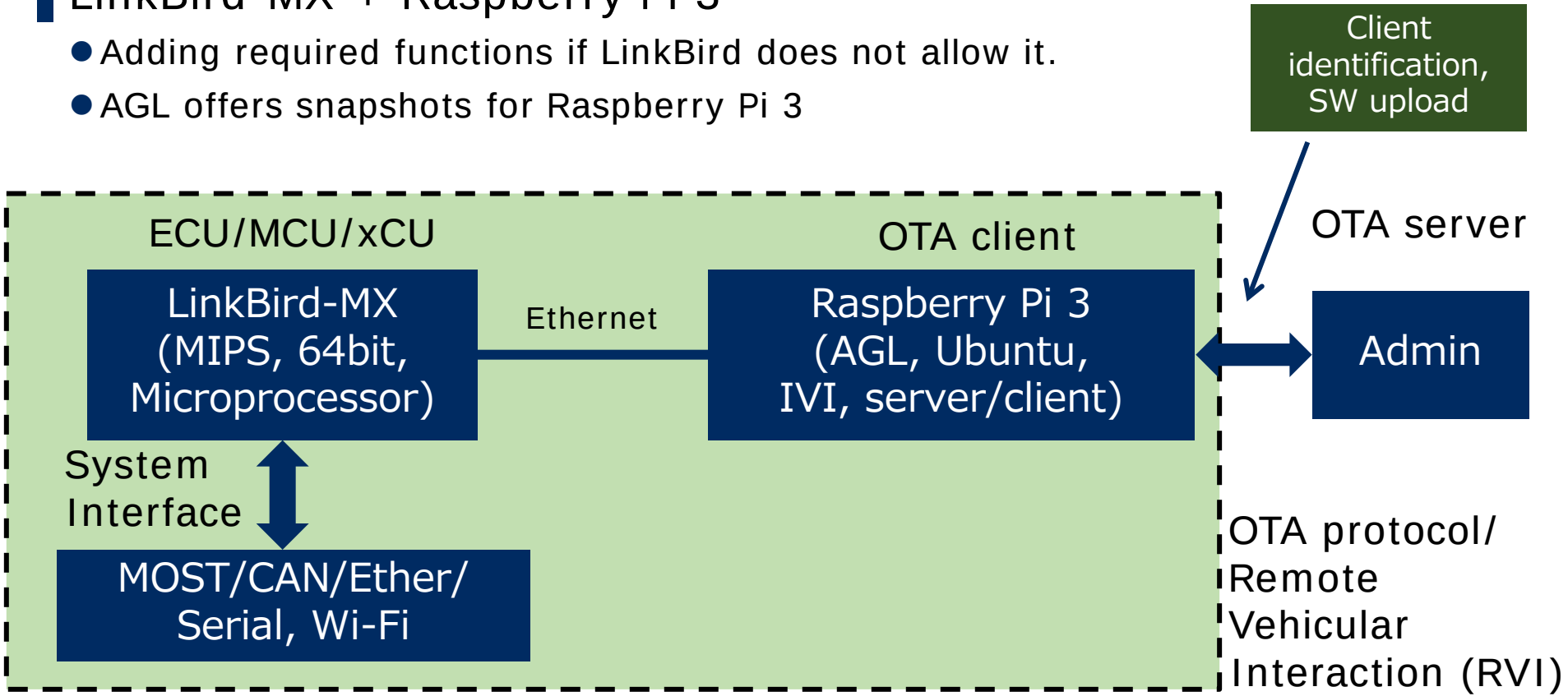


4. Car Gateway (Proof of Concept)

Gateway architecture (OTA client)

LinkBird-MX + Raspberry Pi 3

- Adding required functions if LinkBird does not allow it.
- AGL offers snapshots for Raspberry Pi 3



SW platform: Automotive Grade Linux (AGL)

Car software:

EU | AUTOSAR | Japan

GENIVI | AGL

One platform for
all ECUs, OTA, services

Open source

AUTOMOTIVE GRADE LINUX

Supporter:

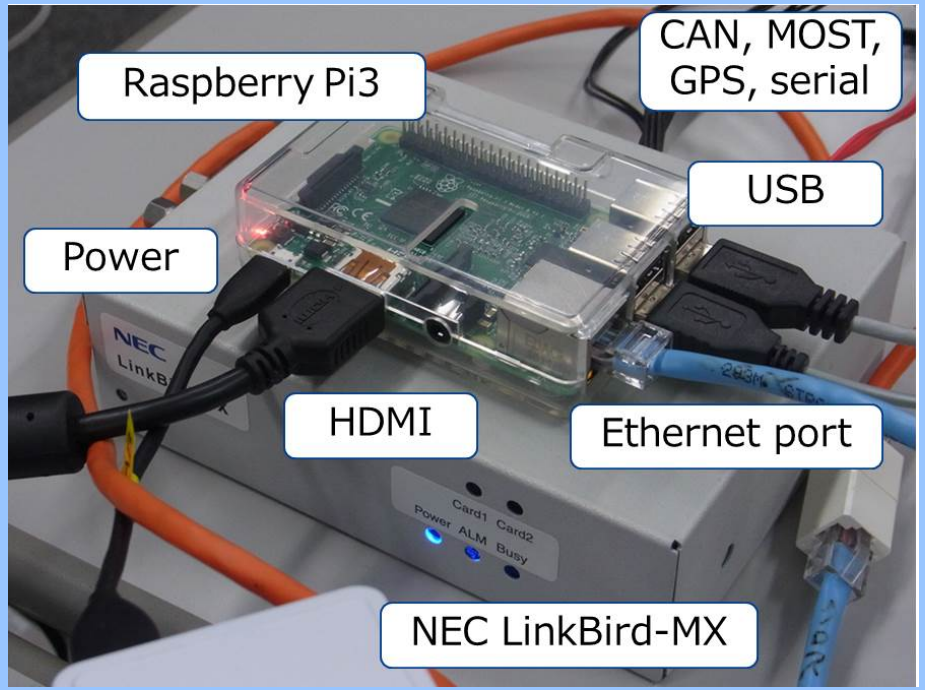
Japanese OEM, car maker

Tizen OS
+
GENIVI

AGL 2.0
(Blowfish)

Since Oct. 2016

AGL Raspberry Pi 3 support



Automotive Grade Linux (AGL) - Advantages

AGL

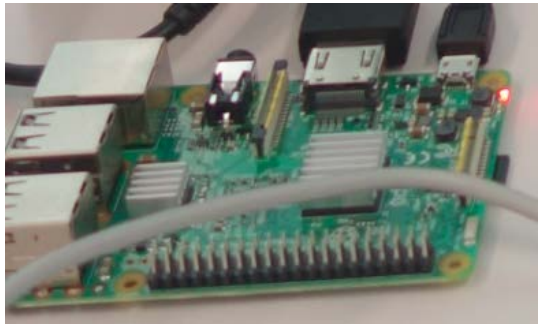
- An open source Linux distribution for car OEMs
- Has many supporters
  - Toyota, Honda, Mazda
  - Denso
  - Fujitsu
  - Panasonic
- Open source of core features
  - Communication
  - IVI
  - Browser
- Allows distinct implementations
  - Competitive
  - Less time-consuming

https://www.automotivelinux.org/

Automotive Linux Summit (ALS 2016)

PoC with AGL software

HDMI



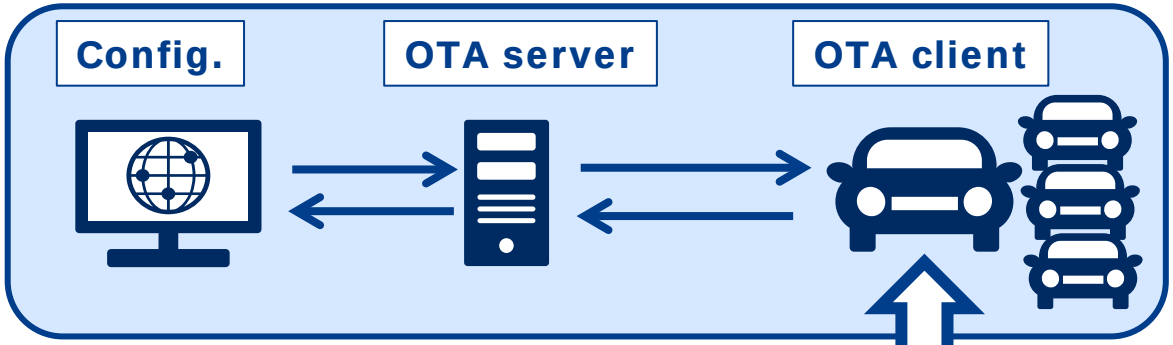
RP3

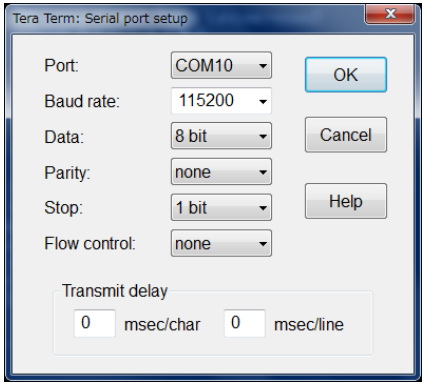
Dashboard

HVAC

RP3=Raspberry Pi3
AGL=Automotive Grade Linux
HVAC=Heating Ventilation and Air-Conditioning

Remote configuration: OTA client/server communication





Terra-term

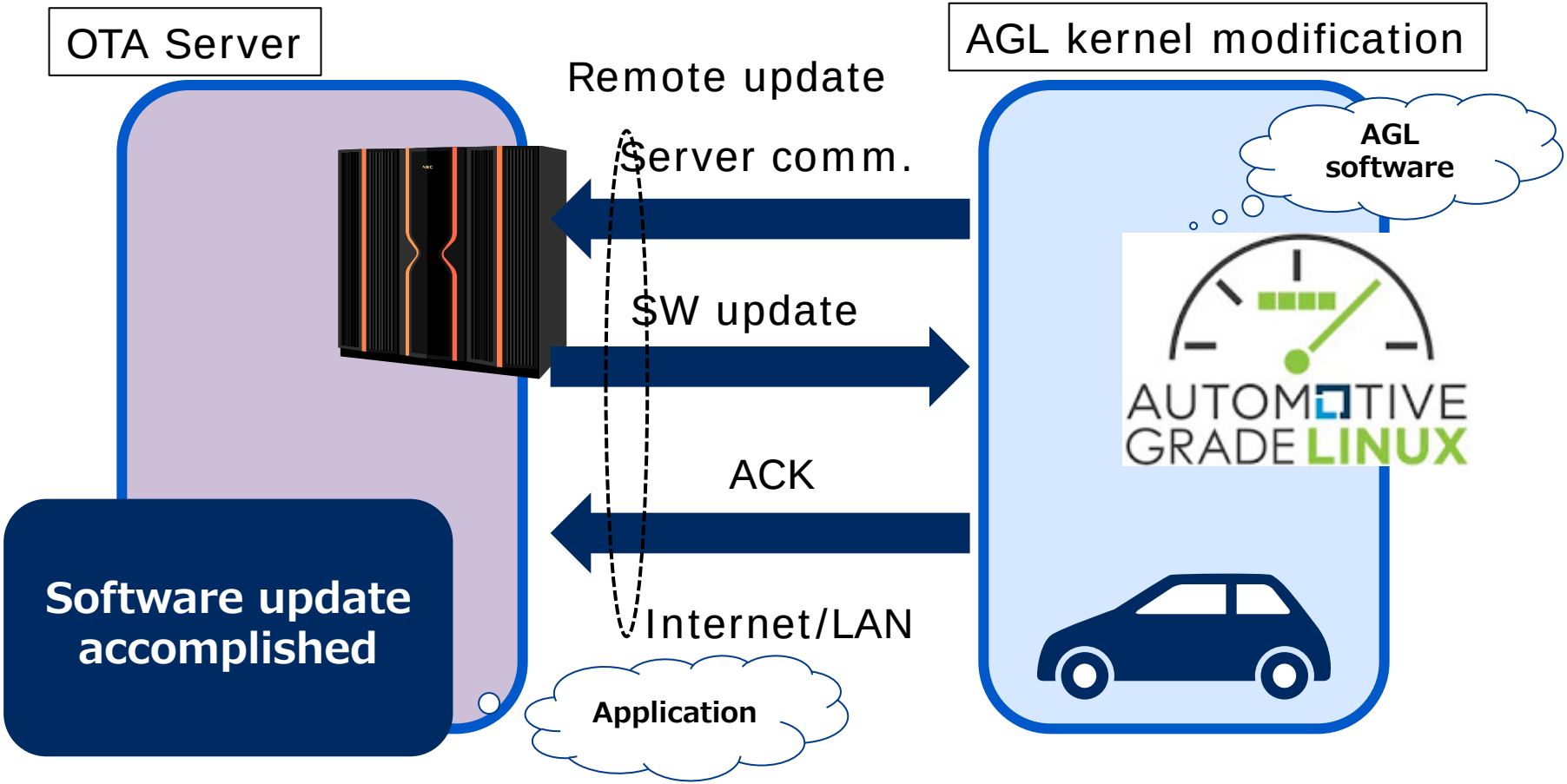
OTA client (RP3)

RP3=Raspberry Pi3

```
Image Name: Linux-4.4.16
Image Type: ARM Linux Kernel
Checksum ..OK
Loading Kernel ..OK
Starting kernel ..
Automotive Grade Linux 3.0.0
Raspberrypi3 login:__
```

Kernel messages

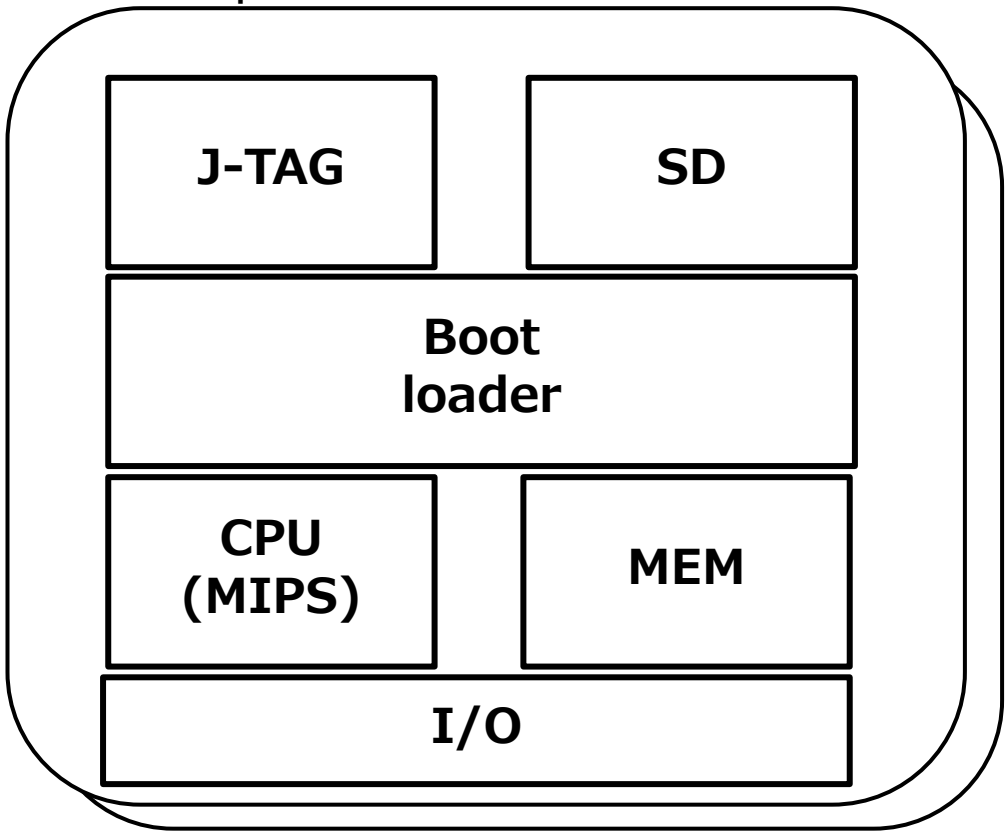
OTA and remote OTA server communication



Challenges in remote configuration: HW/SW dependencies

- There may be dependencies given by the target platform architecture
- CPU/MIPS
- Kernel version
- Outdated drivers/libraries
- Boot-loader
- Hardware interfaces
- (J-TAG/boot-loader/flashing).
- Need for entire HW/SW sources/knowledge when using OTA.

Example architecture:



OTA prototype realization - Discussion

Software

- AGL is helpful to realize remote configuration of hardware components.
- Clear strategy in case of SW roll-back is required.
- Specification of API /client GUI need further development.

Hardware

- Significant slow-down in project realization when HW dependencies exist.
- GW hardware is different and need different remote update strategies.
- Deep understanding of the hardware architecture is essential and all source code need to be available, e.g., boot-loader, kernel updates, etc.

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.

- Automotive Grade Linux aims to modernize and prepare the connected car with flexible, scalable and secure remote configuration.
  - AGL supports OTA and remote configuration of IVI systems.

- Open source projects will help the adoption of OTA technology in automotive markets.
  - However, a strong hardware/software dependency can be challenging.

Thank you!

Questions & Answers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