

Toyota's "Open Strategy" of Connected Vehicle

June 21, 2018

Ken-ichi MURATA

Project General Manager
– Connected Strategy,
Connected Company,

Masato ENDO

Project Manager
– Intellectual Property,
Advanced R&D and
Engineering Company,

Toyota Motor Corporation

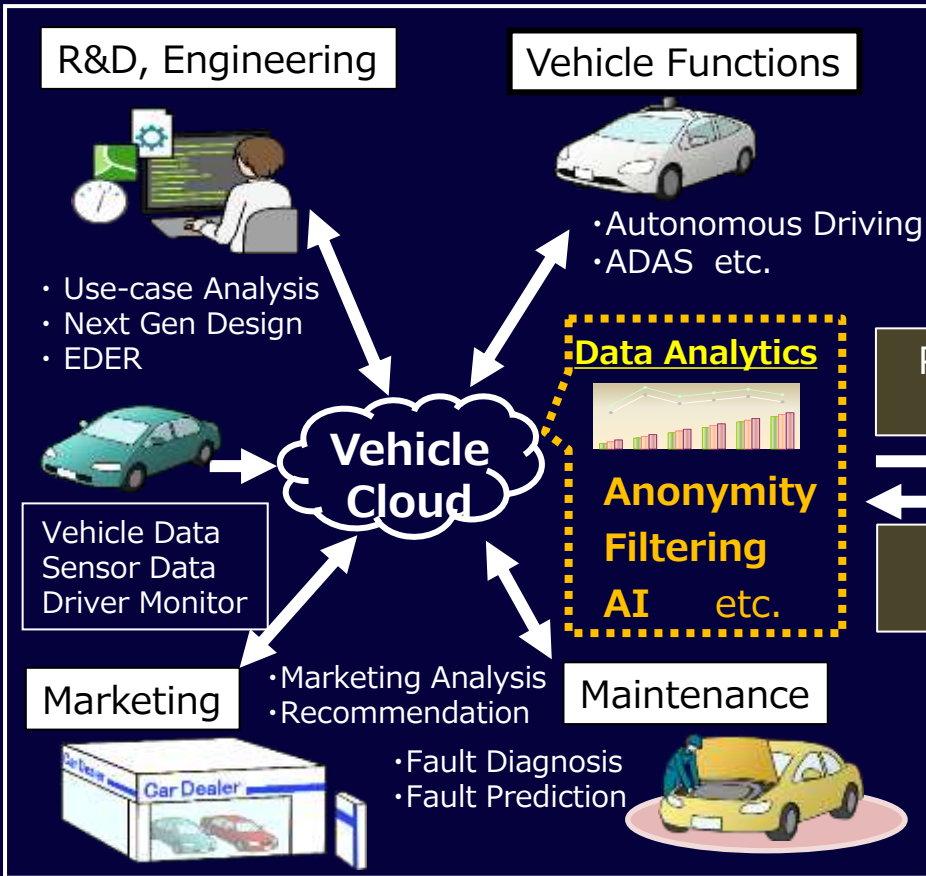


Agenda

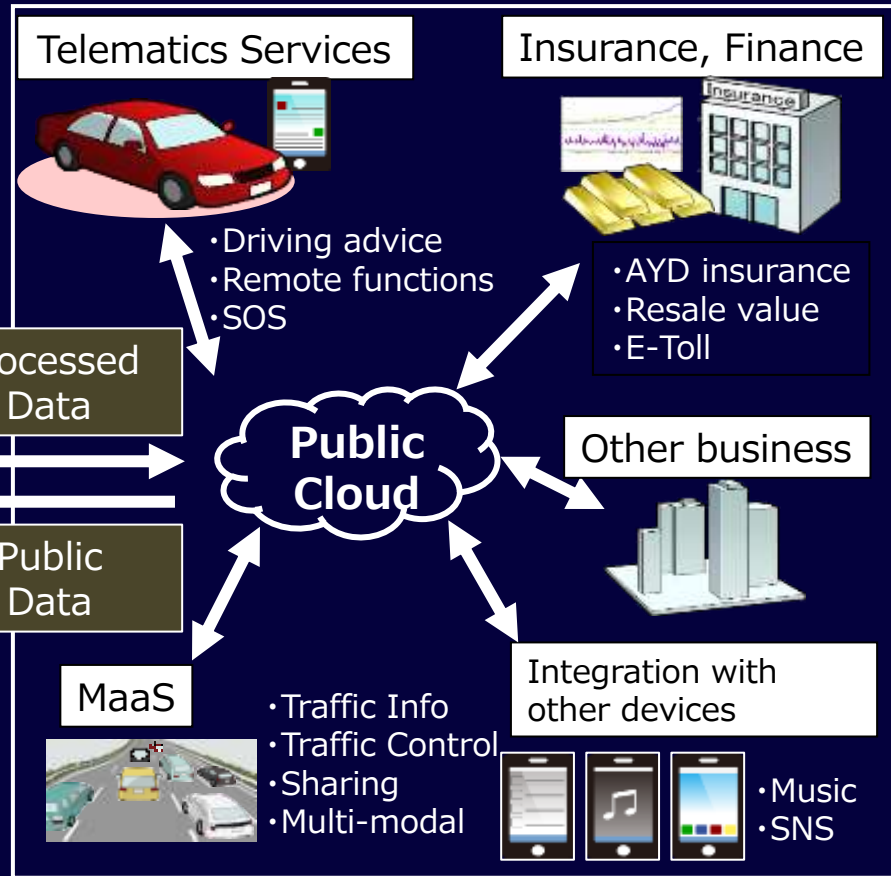
1. Toyota's contribution to open activities **for technical** challenges
2. Toyota's contribution to open activities **for non-technical** challenges

Data Flow of Connected Vehicle

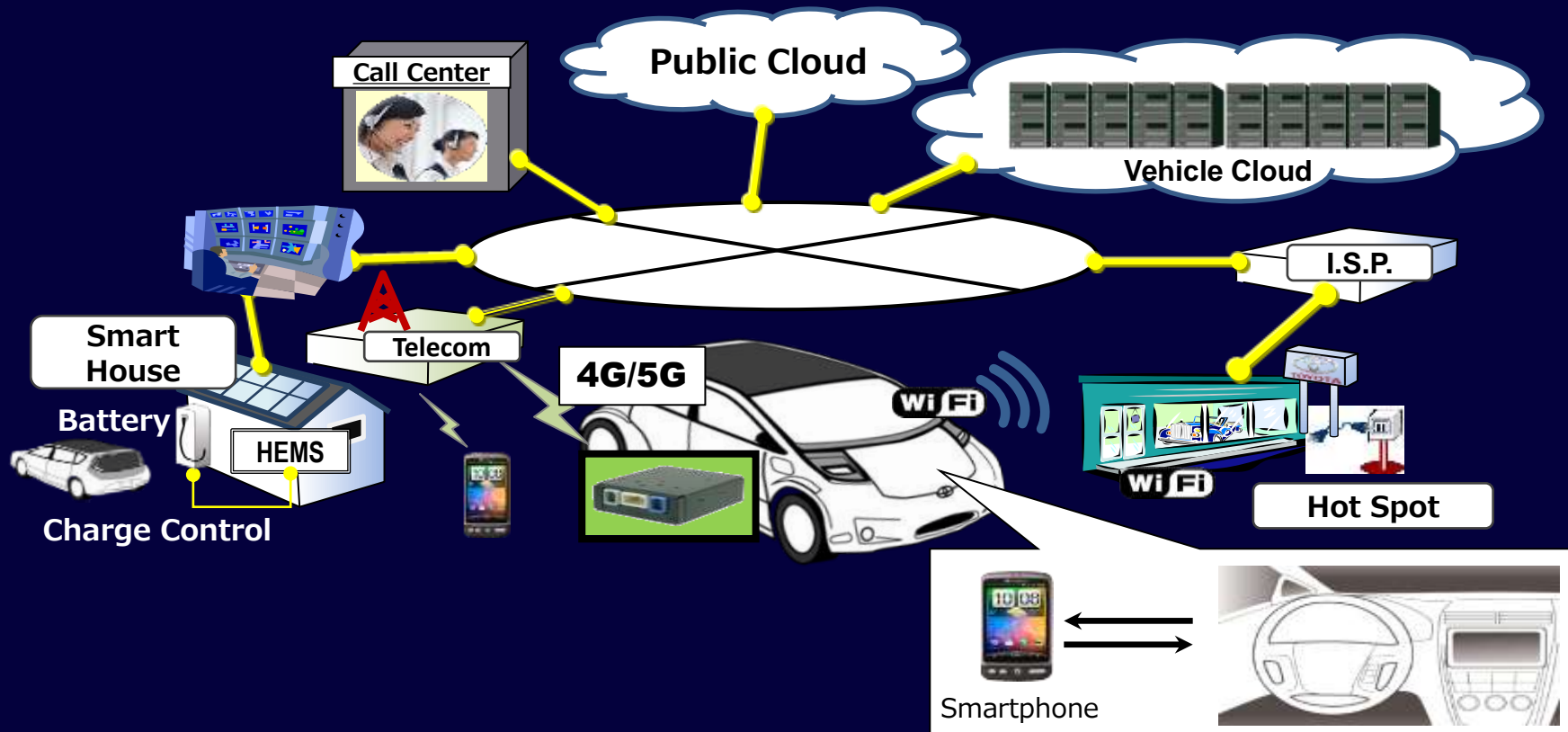
Automotive Business



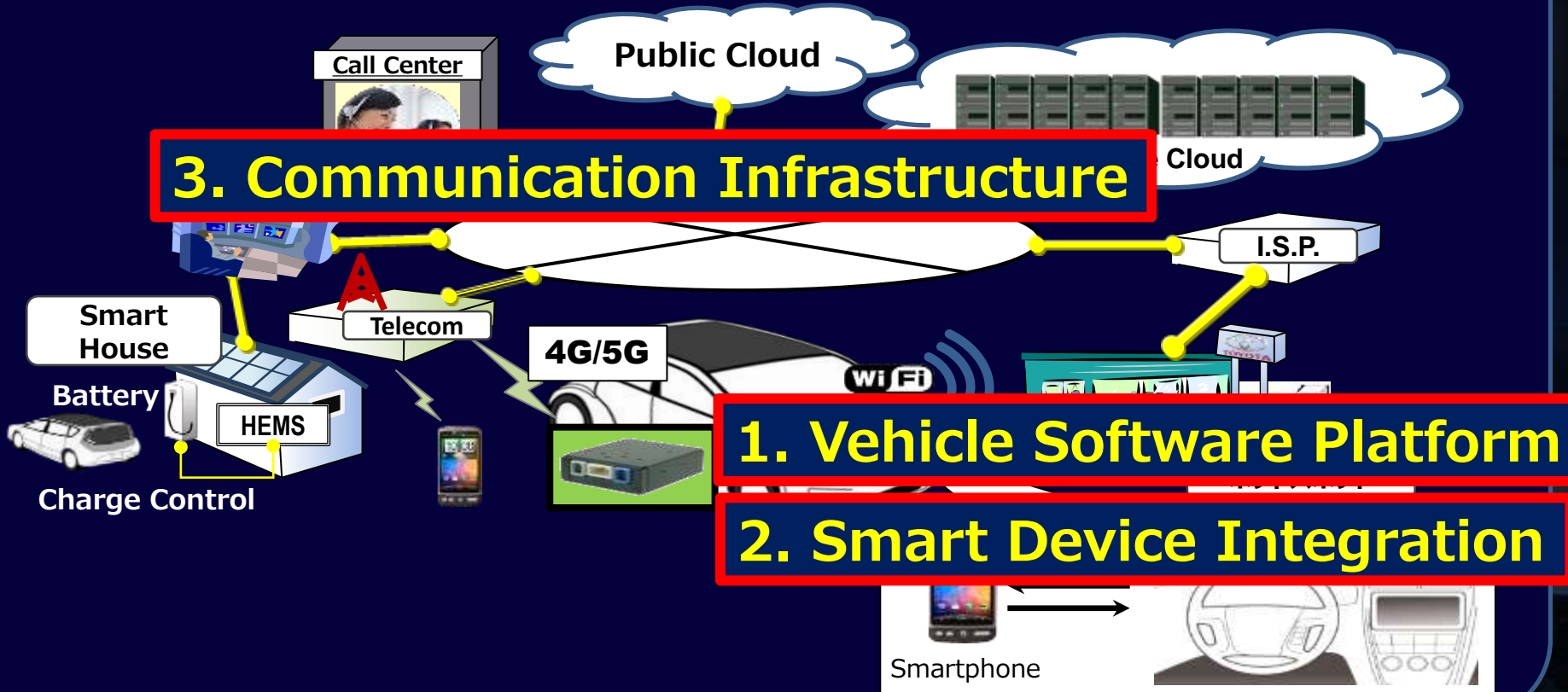
Non-Automotive Business



Overall system structure



Issues on Technologies



AGL : Automotive Grade Linux

2012

2013

2014

2015

2016

2017

2018



Input Requirements

Requirement Spec. v1.0



Contributing Code to AGL UCB

AGL UCB 1.0

AGL UCB 2.0/3.0

AGL UCB 4.0/5.0

Deploy IVI system base on the AGL specification from 2017 Toyota Camry



System development aligned with AGL

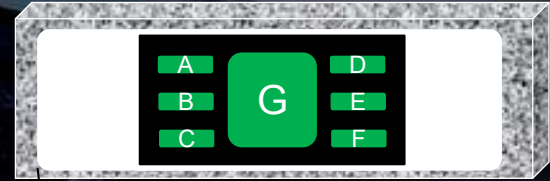
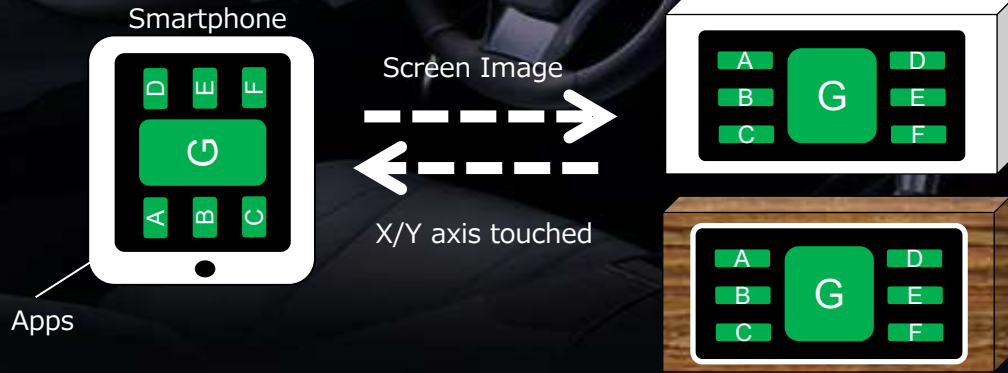
Contribute to establishment of AGL



SDL : Smart Device Link

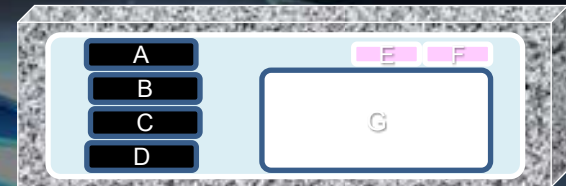
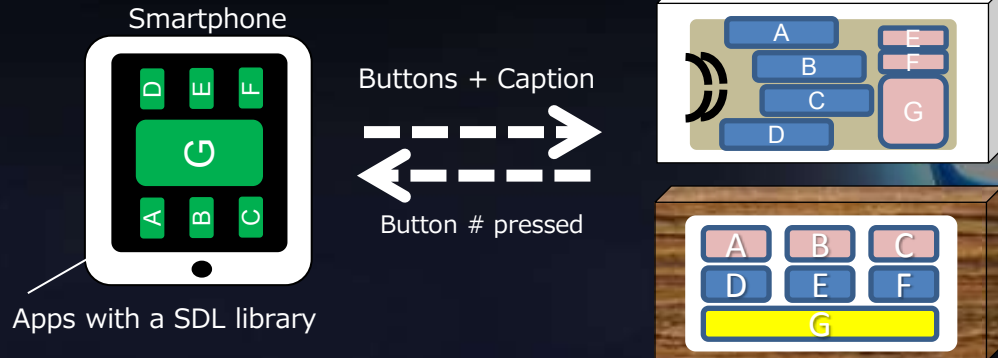


1. Mirroring



The IVI system only show the screen image sent from the smartphone.

2. SDL(Smart Device Link)



Contributing API spec and Open Source of the libraries.

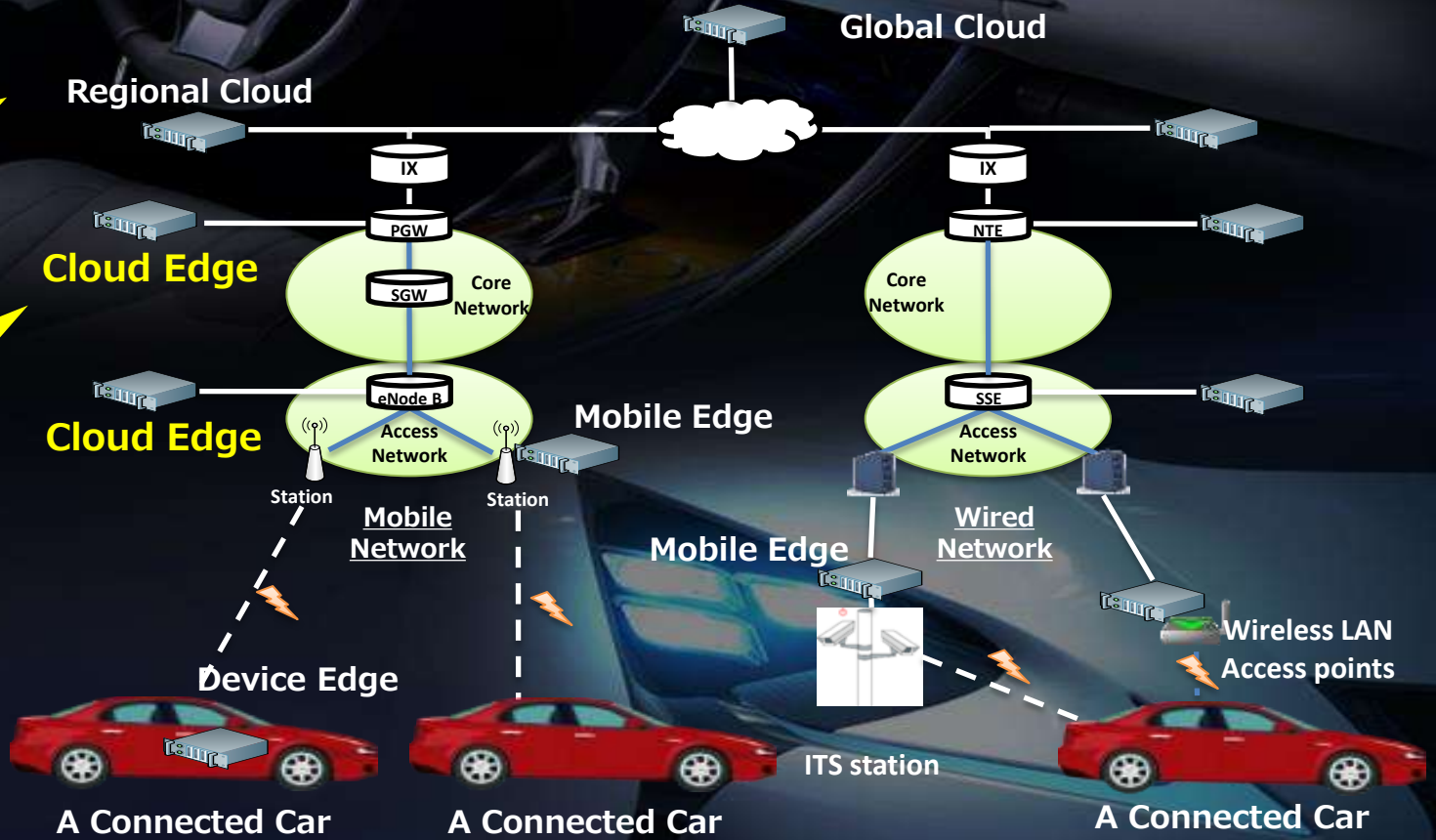
AECC: Automotive Edge Computing Consortium



Contributing to establish the consortium

Contributing requirements from Car OEM viewpoint

Contributing system requirements and standardization



Issues on Non-Technologies

To reduce OSS copyright risks

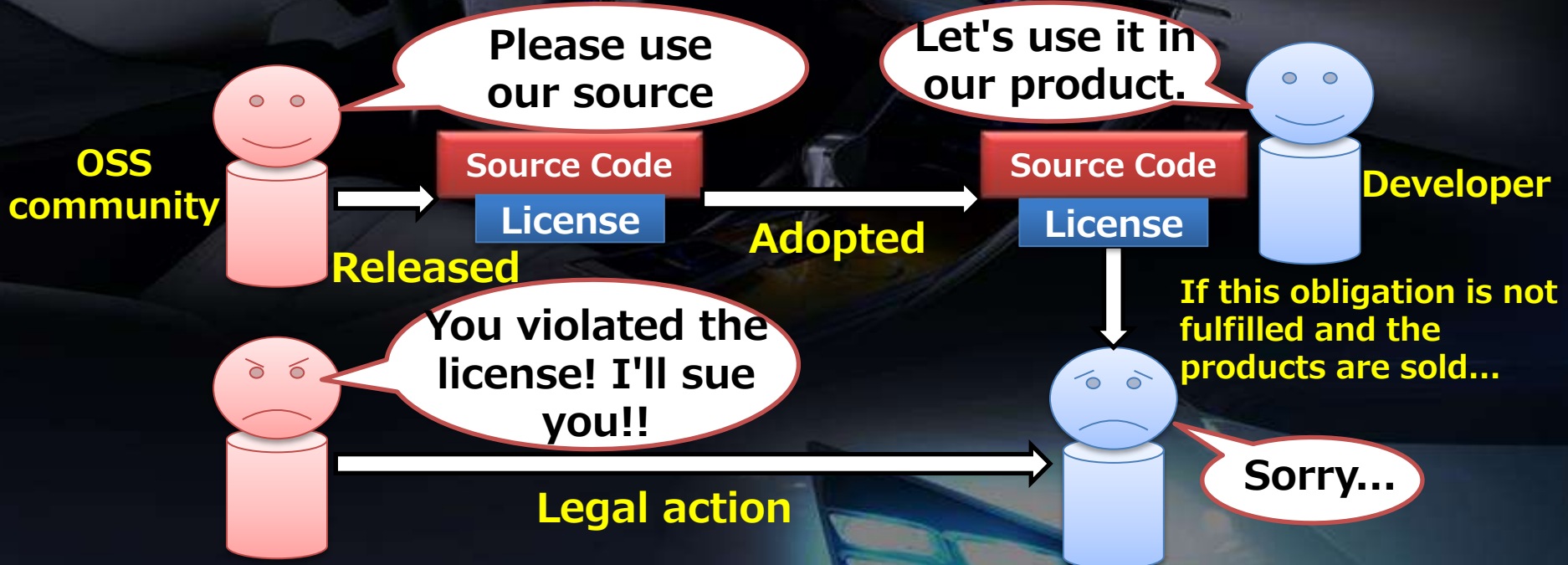
To reduce OSS patent risks



**Hybrid
strategy!**

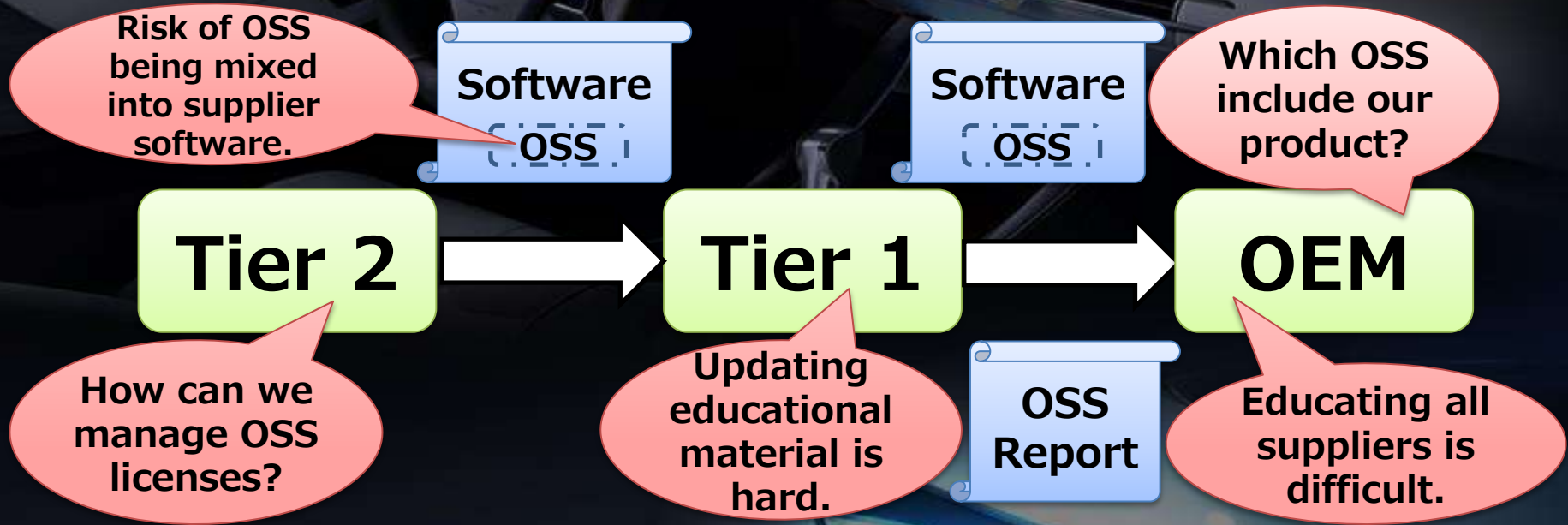
- We are working together with the communities to reduce OSS legal risks for customers and developers.
- TOYOTA is the first corporation to become a top level member in both OpenChain Project and OIN.

OSS Copyright Risks



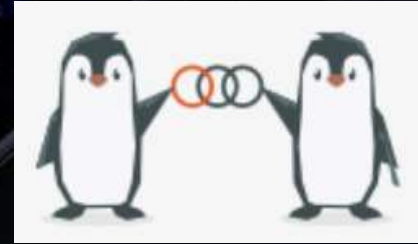
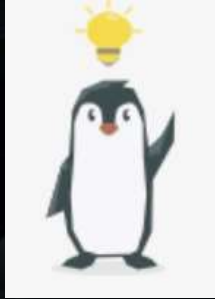
**If the obligations prescribed in the license are not fulfilled
⇒ The license is invalidated and there is the possibility of
legal action for copyright infringement.**

OSS Copyright Risks in the Supply Chain



Mixing OSS in the supply chain may cause unknown copyright risks. A company with no or weak OSS governance system may cause risks to the whole supply chain.

OpenChain Project



Platinum members:

Qualcomm/SIEMENS/HARMAN/WIND RIVER/Adobe/ARM/HPE
CISCO/GitHub/Western Digital/**TOYOTA**/HITACHI/Sony/Comcast

- OpenChain is a project of Linux Foundation that aims to create and distribute standards for OSS compliance.
- TOYOTA is the first Automaker and the first Japanese company became platinum member of OpenChain.

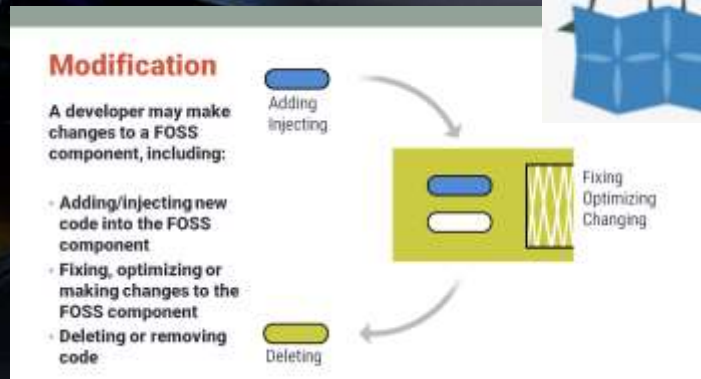
Major output of the project

Specification

1) Introduction	3
2) Definitions.....	4
3) Requirements.....	5
Goal 1: Know Your FOSS Responsibilities.....	5
Goal 2: Assign Responsibility for Achieving Compliance	7
Goal 3: Review and Approve FOSS Content.....	8
Goal 4: Deliver FOSS Content Documentation and Artifacts	9
Goal 5: Understand FOSS Community Engagement	10
Goal 6: Certify Adherence to OpenChain Requirements.....	11
Appendix I: Language Translations.....	12



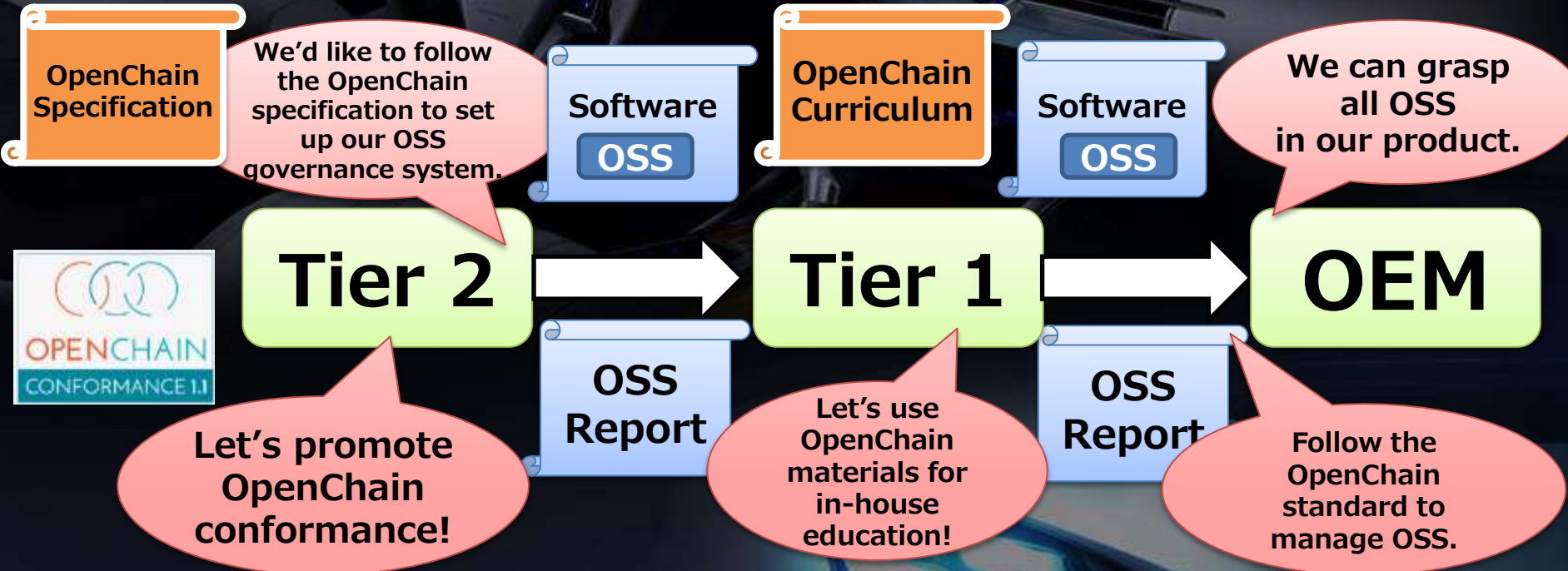
Curriculum



Self-Certify



Pros of applying OpenChain to the Supply Chain



OpenChain materials will provide strong OSS governance throughout the whole supply chain!

OpenChain Japan Work Group

<Members>

Over **25** companies

TOYOTA/HITACHI/Sony/Panasonic/TOSHIBA/NEC/FUJITSU/RICOH/
MITSUBISHI ELECTRIC/DENSO/DENSO TEN/AISIN AW/Pioneer/RENESAS...

<Mission>

To help Japanese and Asian engineers so engineers can use OSS safely

<Activities>

- Promoting OSS compliance in Japan and Asia
- Solving issues which are unique to Japan
- Sharing information



TOYOTA, HITACHI and Sony formed the Japanese Work Group last December and have already initiated OSS compliance activities in Japan and elsewhere in Asia.

OSS Patent Risks



- Some Linux users have been involved in patent infringement cases.
- There are over 300,000 OSS-related patents!!

Even if we use open source, it is challenging to avoid litigation completely. However, understanding all OSS-related patents would be a difficult challenge.

OSS Patent Risks

openinventionnetwork[®]

+2400

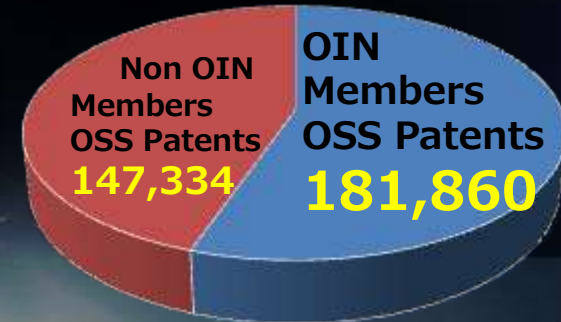
**PARTICIPANTS
FROM START-UPS
TO LARGE CORPORATIONS**

Board members:

Google/IBM/NEC/PHILIPS/Red Hat/Sony/SUSE/TOYOTA

+3M

**PATENTS AND
APPLICATIONS OWNED
BY OIN LICENSEES**



All members agree to mutually cross license, exclusively to use in the Linux System, their patents which are directly related to the function described in the OIN Linux System definition.

TOYOTA's Mission as a Board Member (1)

Board Members

Google/IBM/NEC/PHILIPS/Red Hat/SONY/SUSE/TOYOTA

openinventionnetwork

Linux System Definition



- To reduce AGL patent risks, TOYOTA is trying to include AGL into revised OIN Linux System definition.
- The OIN board is scheduled to approve AGL inclusion in OIN Linux System Definition by "Summer 2018"!!

TOYOTA's Mission as a Board Member (2)

European OEMs

DAIMLER/VOLVO

U.S. OEMs

Ford/GENERAL MOTORS

Japanese OEMs

HONDA/MAZDA/SUBARU/TOYOTA

Korean OEMs

HYUNDAI/KIA

Chinese OEMs

BYD/FOTON/GAC MOTOR

Over ten OEMs and many suppliers already became members of the OIN, and more OEMs may join OIN in the near future.

Welcome new Automotive Member!!



YAMAHA

Revs Your Heart

**Today we're pleased to announce that
IWATA oriented automaker Joined OIN!!**

TOYOTA's Open Strategy

Find solutions with
the community!

Technical
Issues



openinventionnetwork

Promoting
Issues



Compliance
Issues

IP
Issues

We'll continue to have activities with OSS community to develop "better" software society.

Vehicle demo: AGL HMI-FW using vehicle information

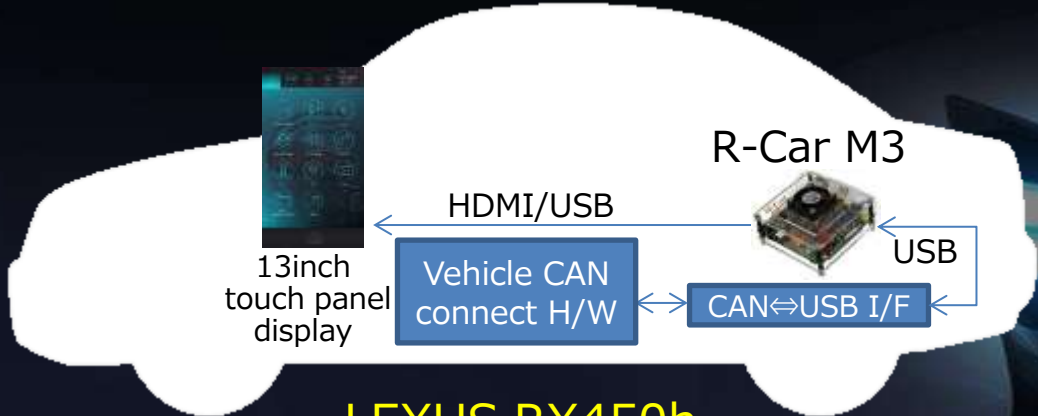
This demo is expanded CES 2018's AGL demo

Adding vehicle device control on AGL via CAN

- Get CAN data in real time
- Operate the door windows and the side mirrors

Changing display mode for safer driving by the vehicle condition

- Cover the screen of the movie



LEXUS RX450h



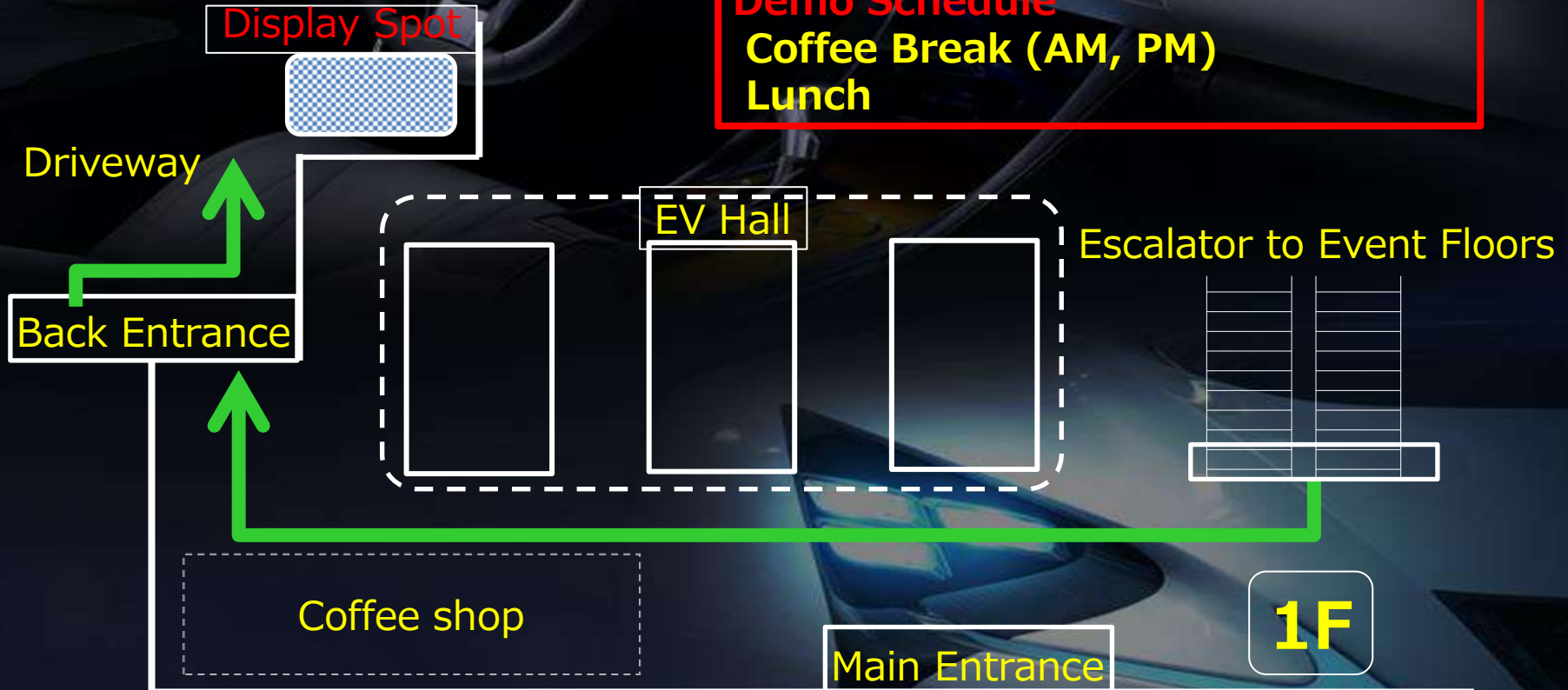
Structure of interface software

Demo location information

Demo Schedule

Coffee Break (AM, PM)

Lunch



Display Spot

Driveway

Back Entrance

EV Hall

Escalator to Event Floors

Coffee shop

Main Entrance

1F