SIP-adus
-Mobility bringing everyone a smile-

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Program Director, Cabinet Office

<Translated Version>

SIP 戦略的イノベーション創造プログラム
Cross-ministerial Strategic Innovation Promotion Program

Outline of the SIP-adus

Steering Committee for SIP Automated Driving Research Project

Chairman: Program Director Mr.Kuzumaki (Toyota)
Membership: Ministries and agencies concerned with ITS, automobile manufacturers, academic experts, automobile-related organizations, etc.

System Implementation Working Group

[I] Development and validation of the automated driving system
[II] Development of base technologies to reduce traffic accident fatalities and congestion

Map Structuring Task Force

Surveys and studies on the enhancement of map data

International Cooperation Working Group

[III] Building of international cooperation

HMI Task Force

Surveys and studies on HMI (Human Machine Interface)

Next Generation Transport Working Group*

[IV] Development toward realization of next-generation transport

*Also serves as Working Group 4 of the promotion conference for CSTI's "Task Force on Science, Technology, and Innovation for the 2020 Tokyo Olympic and Paralympic Games"

Large Scale Field Operational Test Task Force

Study of the content, locations, and size of large-scale field operational tests

> R&D for the SIP -adus
> FY2014: Approx. 2.535 billion yen
> FY2015: Approx. 2.358 billion yen
> FY2016: Approx. 2.713 billion yen
>
> R&D was promoted under the leadership of the Program Director and in cooperation with ministries and agencies concerned (NPA, MIC, METI, MLIT)

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Outline of the R&D Plan: Objectives

JAMA's Automated Driving Vision
The Automated Driving Technology Framework
JAMA 一般社団法人 日本自動車工業会

Automated driving level — Driver assistance — Partial automation — Conditional automation — High automation — Full automation

Congested environment (urban area) — Complex
Ordinary road
Applicable area
Expressway
Parking lot — Simple

Urban area ("last one mile")
Intersection passage (right/left turn)
Automated driving on arterial roads
Emergency vehicle stop (deadman)
Obstacle avoidance
Lane-keeping assistance
Congestion tracking
Turning off
Merging
Convoy traveling
ACC
Single lane
Automated lane-changing
Parking assistance
Automated parking
Fully automated parking

Autonomous system (recognition of surroundings with sensors) → Cooperative system (enhancement of environmental recognition)

Environmental recognition through vehicle-to-vehicle communication and vehicle-to-infrastructure communication

Automated driving type

(1) Practical application of a high-end semi-automated driving system (Level 2) by 2020

(2) Clarification of functional expandability requirements and priority for next step and scheduling of its deployment

Accelerate and realize the development of digital infrastructure by leveraging the large-scale field operational tests.

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3

SIP-adus R&D Fields

Vehicle

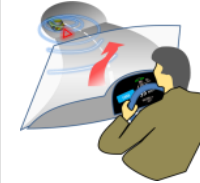|		
Recognition	Judgement	Operation
Maps, ITS info, sensors	Control, artificial intelligence	Hydraulics, electric motor

HMI*

Human Machine Interface

Harmony with people

Enhanced

- **localization**
- **Surrounding environment recognition**

Are important for the automated driving system

Dynamic map

High-definition digital map

ITS information

On-board sensor

GNSS

Camera

LIDAR
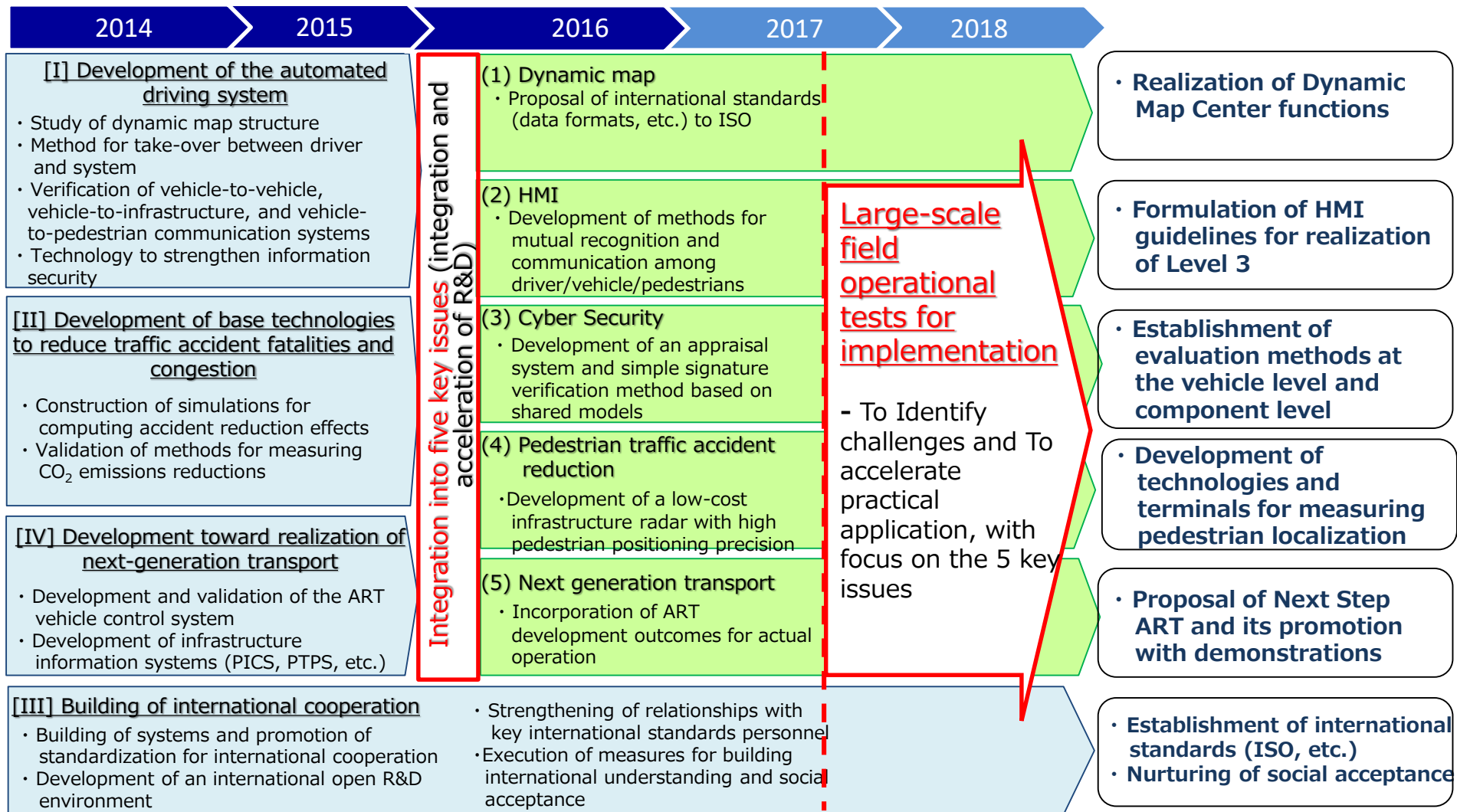
Radar
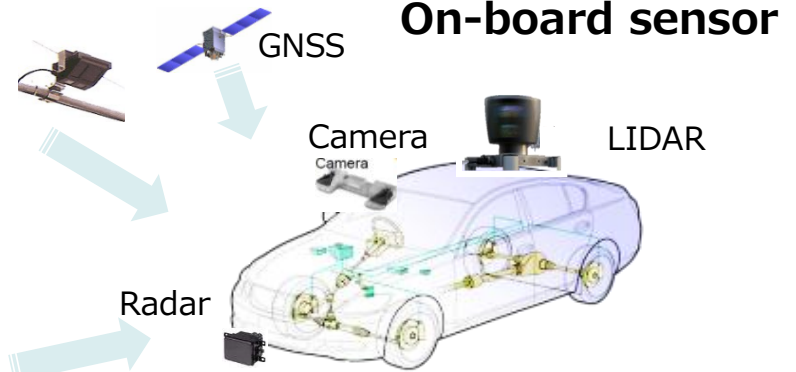
Base technologies — Cyber Security, simulation, database, etc.

Red text: Area of cooperation undertaken at SIP

Promoting R&D focused on topics for collaborative industry-academia-government collaboration at SIP

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Overall Schedule and Final Output Goals

2014	2015	2016	2017	2018

Integration into five key issues (integration and acceleration of R&D)

[I] Development of the automated driving system
- Study of dynamic map structure
- Method for take-over between driver and system
- Verification of vehicle-to-vehicle, vehicle-to-infrastructure, and vehicle-to-pedestrian communication systems
- Technology to strengthen information security

[II] Development of base technologies to reduce traffic accident fatalities and congestion
- Construction of simulations for computing accident reduction effects
- Validation of methods for measuring CO_2 emissions reductions

[IV] Development toward realization of next-generation transport
- Development and validation of the ART vehicle control system
- Development of infrastructure information systems (PICS, PTPS, etc.)

[III] Building of international cooperation
- Building of systems and promotion of standardization for international cooperation
- Development of an international open R&D environment

(1) Dynamic map
- Proposal of international standards (data formats, etc.) to ISO

(2) HMI
- Development of methods for mutual recognition and communication among driver/vehicle/pedestrians

(3) Cyber Security
- Development of an appraisal system and simple signature verification method based on shared models

(4) Pedestrian traffic accident reduction
- Development of a low-cost infrastructure radar with high pedestrian positioning precision

(5) Next generation transport
- Incorporation of ART development outcomes for actual operation

- Strengthening of relationships with key international standards personnel
- Execution of measures for building international understanding and social acceptance

Large-scale field operational tests for implementation

- To Identify challenges and To accelerate practical application, with focus on the 5 key issues

- **Realization of Dynamic Map Center functions**

- **Formulation of HMI guidelines for realization of Level 3**

- **Establishment of evaluation methods at the vehicle level and component level**

- **Development of technologies and terminals for measuring pedestrian localization**

- **Proposal of Next Step ART and its promotion with demonstrations**

- **Establishment of international standards (ISO, etc.)**
- **Nurturing of social acceptance**

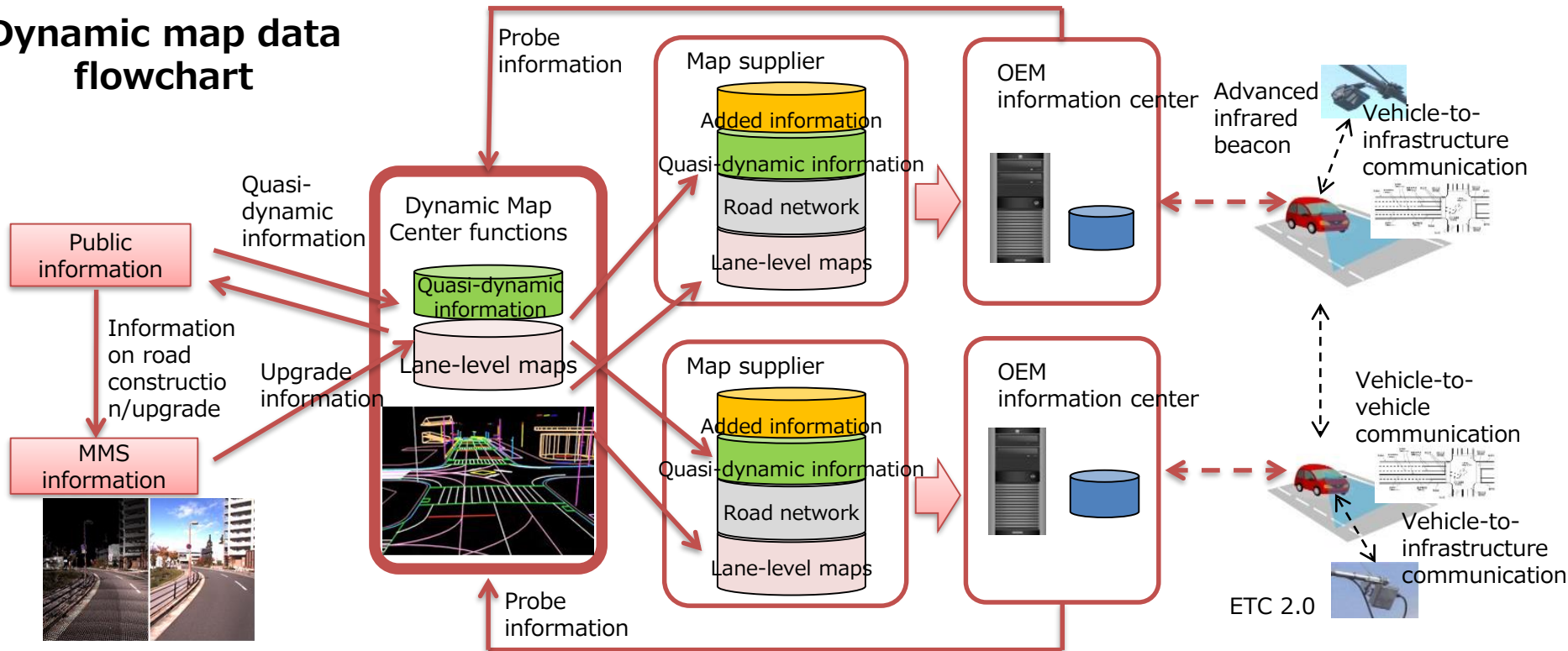***Linked with SIP's "Maintenance of Cyber Security in Important Infrastructure, etc."**

Reinforcement and promotion of i) development, ii) field operational tests, and iii) international cooperation, with focus on the 5 key issues

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Progress with the Dynamic Maps

Ultimate goal: **Realization/commercialization of Dynamic Map Center functions and standardization**
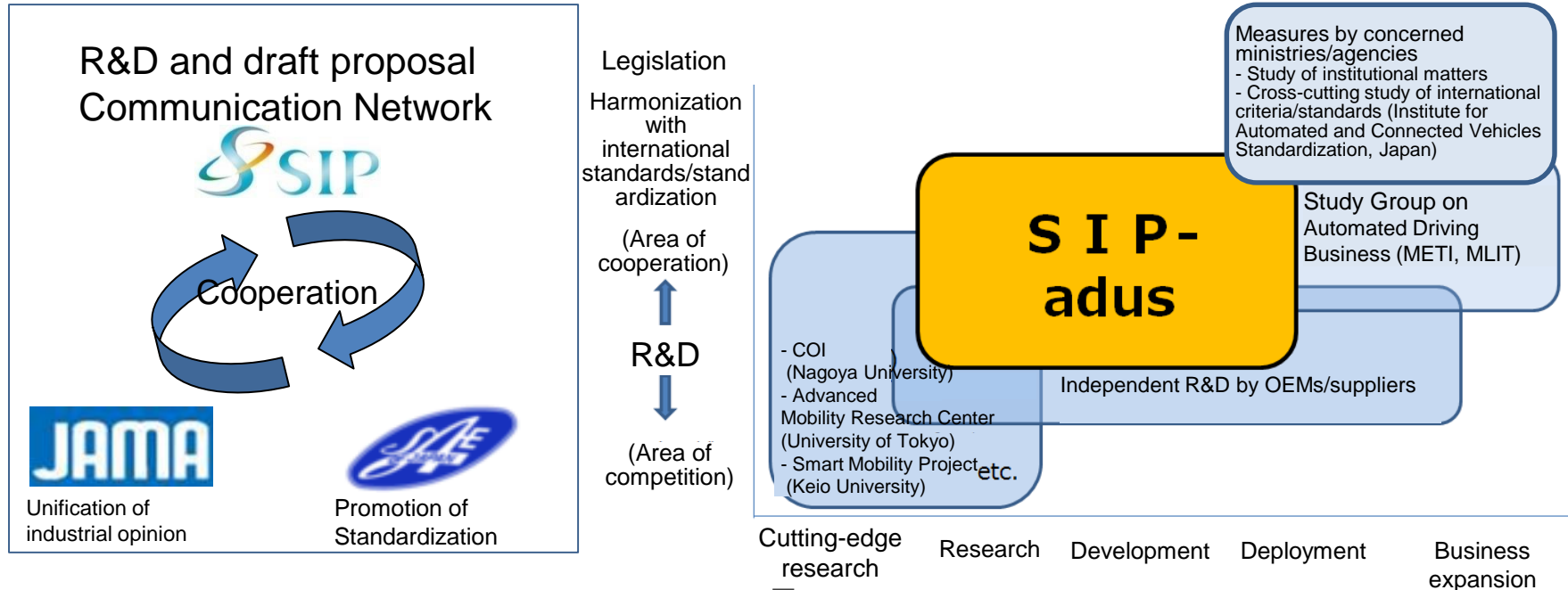
Dynamic map data flowchart

- **Establishment of Dynamic Map Planning Co., Ltd. (DMP)** → Start of study toward becoming a business company
- Preparation of high-precision 3D maps covering approximately 300 km (of a total of 600 km) for use in large-scale field operational tests
- Cooperation and discussion with concerned organizations (JARTIC, etc.) for tying with existing quasi-dynamic information
- Finalization of static map specifications, **proposal to ISO/TC204/WG3**, and beginning of standardization work

# Cooperation with Organizations and Projects Concerned

・(1) Addition of committee members from the Society of Automotive Engineers of Japan (JSAE) and Japan Automobile Manufacturers Association (JAMA) (2) Organization of **liaison meetings among SIP-adus, JAMA, and JSAE →**

Acceleration of standardization through sharing of usage cases, etc.

・Promotion of **mutually-complementary development** through collaboration with COI (Nagoya University), the Study Group on Automated Driving Business (MLIT, METI), and others

・Launch of **independent workshops** for automated driving in ITS Japan and the Japan Electronics and Information Technology Industries Association (JEITA)

・Start of cooperation with the European Automobile Manufacturers' Association (ACEA) and Japan Automobile Importers Association (JAIA) → Announcement of participation in large-scale field operational tests

・Cooperation in SIP's infrastructure maintenance, disaster preparedness and mitigation, and cyber security through dynamic maps

R&D and draft proposal
Communication Network

SIP

Cooperation

JAMA

Unification of industrial opinion

Promotion of Standardization

Legislation

Harmonization with international standards/standardization

(Area of cooperation)

R&D

(Area of competition)

Measures by concerned ministries/agencies
- Study of institutional matters
- Cross-cutting study of international criteria/standards (Institute for Automated and Connected Vehicles Standardization, Japan)

Study Group on Automated Driving Business (METI, MLIT)

SIP-adus

- COI (Nagoya University)
- Advanced Mobility Research Center (University of Tokyo)
- Smart Mobility Project (Keio University) etc.

Independent R&D by OEMs/suppliers

Cutting-edge research | Research | Development | Deployment | Business expansion

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International Cooperation

・Establishment of an **SIP contact point for six key international cooperation themes** and continuous participation in international conferences in the US and Europe and teleconferences → Formation of a US-Europe-Japan network centered on SIP

- Dynamic Map
- Connected Vehicles
- Human Factors
- Impact Assessment
- Next Generation Transport
- Cyber Security
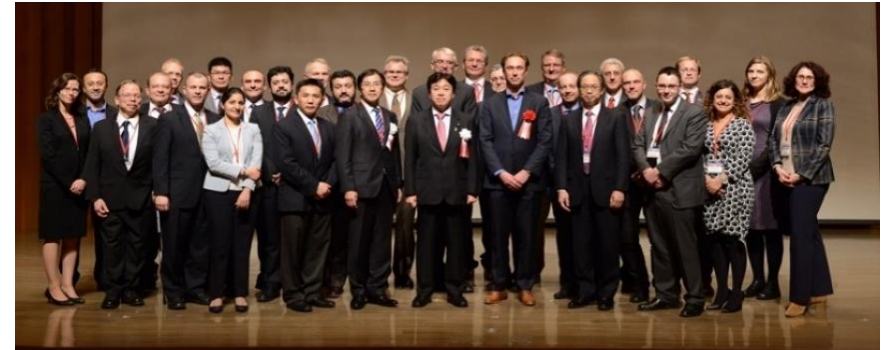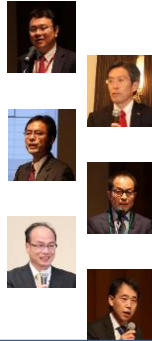
◇ **Third SIP-adus Workshop 2016**

SIP-adus: Innovation of Automated Driving for Universal Services

Dates: November 15 to 17, 2016   Venue: Tokyo International Exchange Center

Participants: 61 speakers (**34 from outside Japan**), including Yosuke Tsuruho, Minister of State for Science and Technology Policy; Finland's Minister of Transport and Communications; and Dr. Kazuo Kyuma, full-time member of the Council for Science, Technology and Innovation 425 total participants (**50 from outside Japan**)

Content: Recognition of the work of the sessions and subcommittee for discussion among experts (Breakout WS)

→ **Europe decided to hold a similar international conference** on automated driving (April 3, 4)

◇ **Joint Japan-Germany statement on promoting R&D on automated driving system technology**

German Minister of Education and Research Wanka and Japanese Minister of State for Science and Technology Policy Tsuruho signed and announced the joint statement in Berlin, Germany, on January 12, 2017. Discussions are planned for future German participation in the large-scale field operational tests.
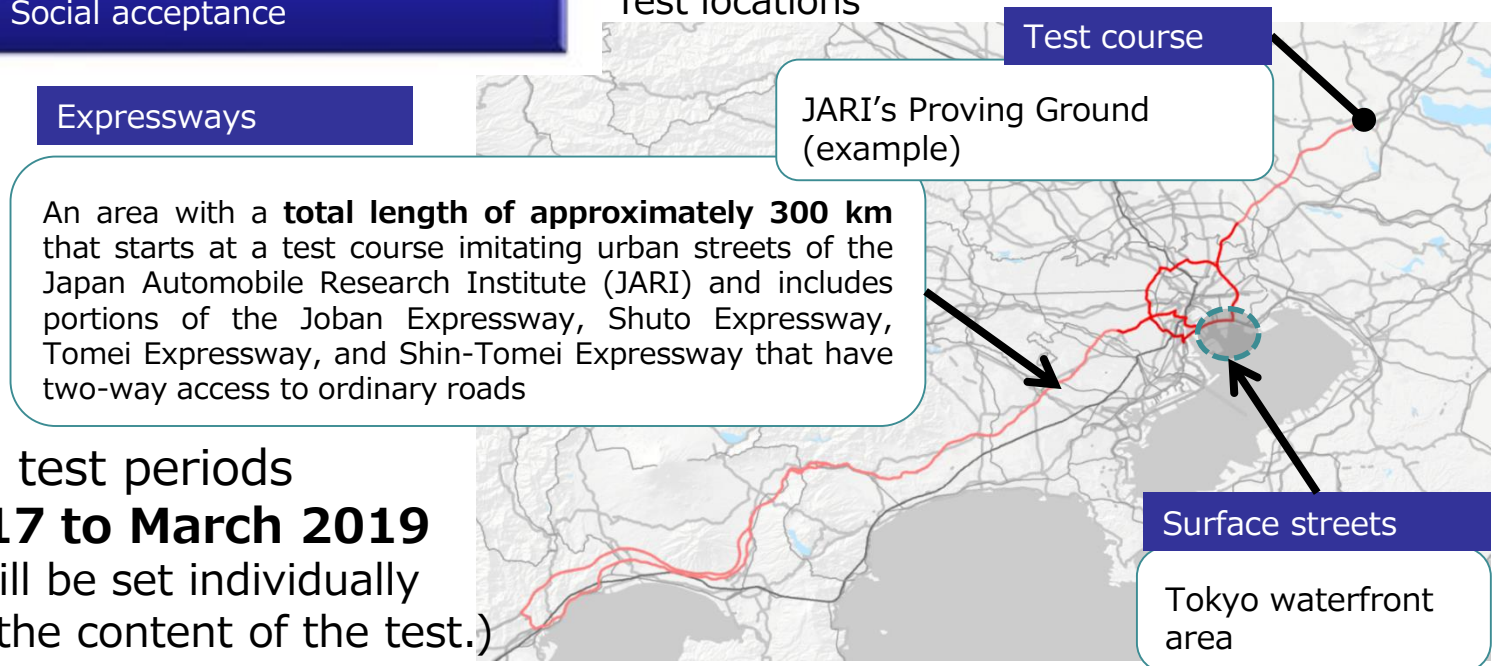
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Large-Scale Field Operational Tests

- Activation of research/technical development
- Evaluation/issue identification with more objectives
- Focus on deployment
- International cooperation and coordination
- Social acceptance

· To Provide **opportunities for open discussion** through large-scale operational tests on public roads, to promote international standardization and R&D with focus on the 5 key issues, and to hold social acceptance-building events

Envisioned participants
· Domestic and **foreign OEM/suppliers**
· Universities/research institutes
· Concerned ministries and agencies/journalists/members of the general public

Test locations

Test course

JARI's Proving Ground (example)

Expressways

An area with a **total length of approximately 300 km** that starts at a test course imitating urban streets of the Japan Automobile Research Institute (JARI) and includes portions of the Joban Expressway, Shuto Expressway, Tomei Expressway, and Shin-Tomei Expressway that have two-way access to ordinary roads

Surface streets

Tokyo waterfront area
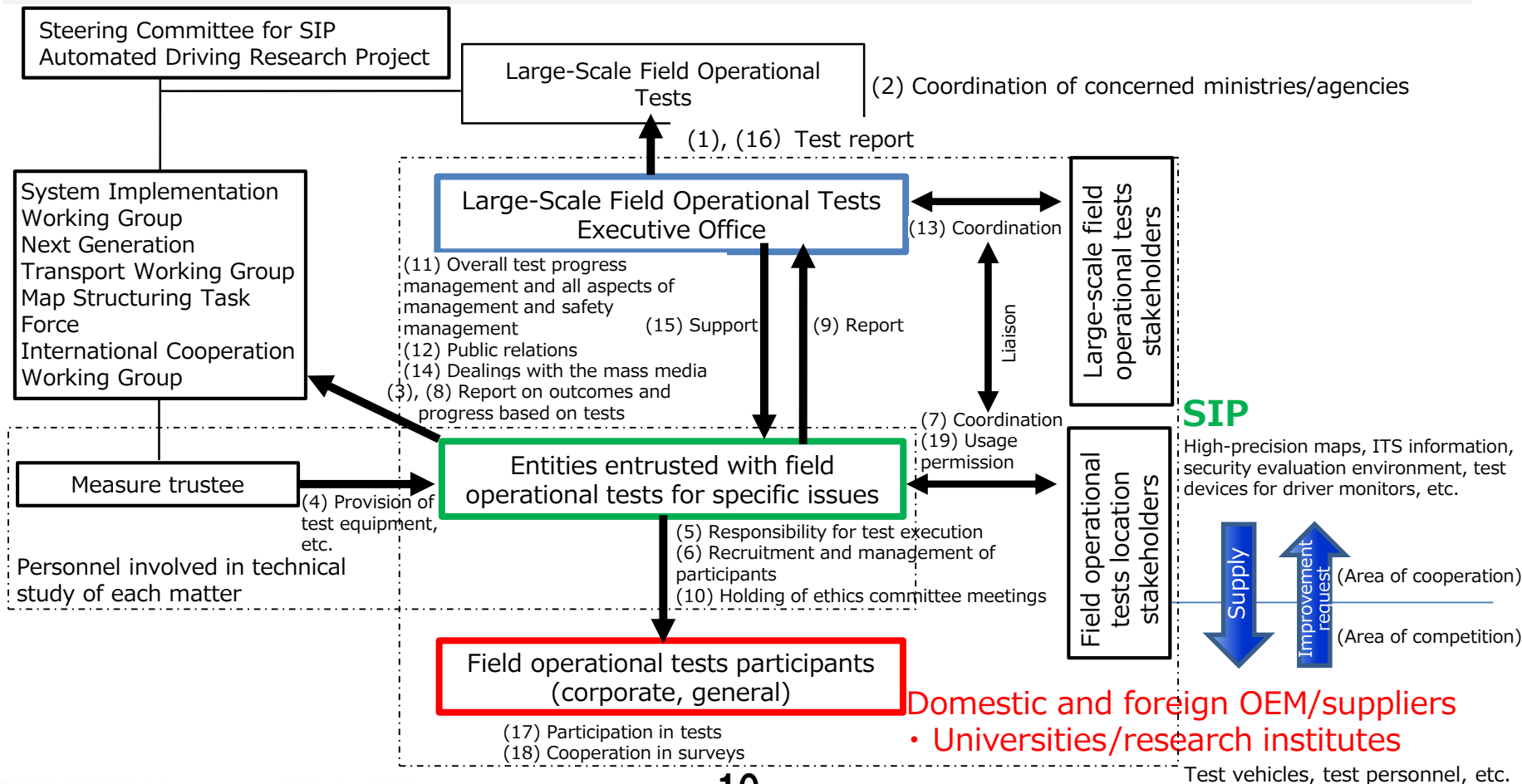
Duration and test periods
Autumn 2017 to March 2019
Test periods will be set individually depending on the content of the test.)

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Field Operational Tests and Safety Management Scheme

・ High-precision maps and test environments are provided by SIP, and test vehicles and test personnel are provided by participants (OEM, suppliers, universities, research institutes).
・ The Large-Scale Field Operational Tests Executive Office has cross-cutting authority and oversees progress and safety management for all aspects of the tests.
・ The tests will be in compliance with the "guidelines for field operational tests of automated driving systems on public roads" (National Police Agency).
・ Test organizers plan to purchase insurance that covers the costs of investigations into accident causes and first response costs.
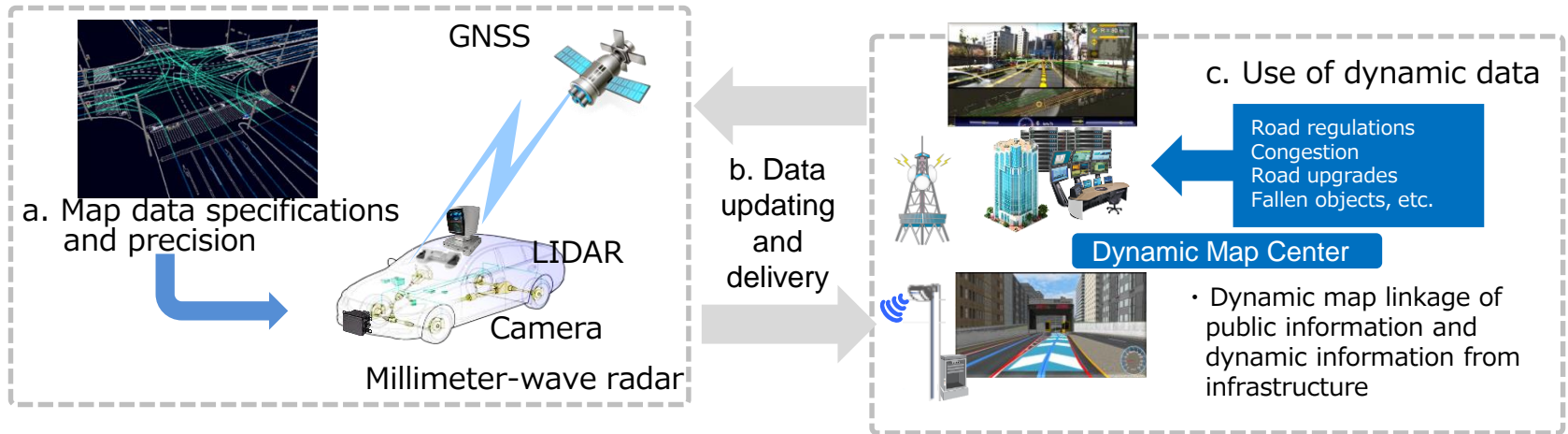
Steering Committee for SIP Automated Driving Research Project

Large-Scale Field Operational Tests

(2) Coordination of concerned ministries/agencies

(1), (16) Test report

System Implementation Working Group
Next Generation Transport Working Group
Map Structuring Task Force
International Cooperation Working Group

Large-Scale Field Operational Tests Executive Office

(13) Coordination

Large-scale field operational tests stakeholders

(11) Overall test progress management and all aspects of management and safety management
(12) Public relations
(14) Dealings with the mass media
(3), (8) Report on outcomes and progress based on tests

(15) Support   (9) Report

Liaison

Measure trustee

(4) Provision of test equipment, etc.

Entities entrusted with field operational tests for specific issues

(7) Coordination
(19) Usage permission

SIP

High-precision maps, ITS information, security evaluation environment, test devices for driver monitors, etc.

Field operational tests location stakeholders

Personnel involved in technical study of each matter

(5) Responsibility for test execution
(6) Recruitment and management of participants
(10) Holding of ethics committee meetings

Supply

Improvement request

(Area of cooperation)

(Area of competition)

Field operational tests participants (corporate, general)

(17) Participation in tests
(18) Cooperation in surveys

Domestic and foreign OEM/suppliers
・ Universities/research institutes

Test vehicles, test personnel, etc.

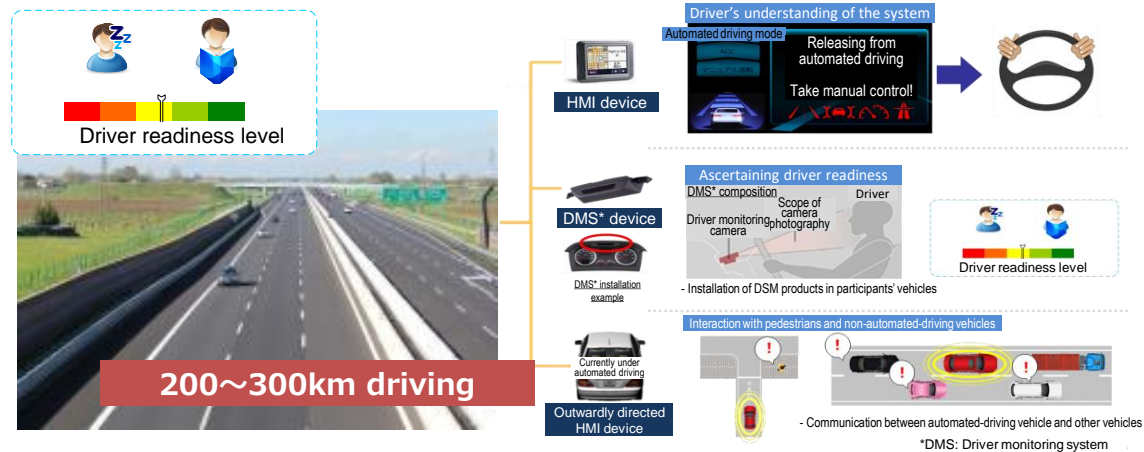# Content of the Field Operational Tests (Example)

Dynamic maps

a. Validation of the specifications and precision of high-precision 3D map data
b. Validation of the data update and delivery systems
c. Validation of the quasi-dynamic information specifications for vehicle control and driver assistance

- standardization
- Start of commercialization-based services

GNSS

a. Map data specifications and precision

LIDAR

Camera

Millimeter-wave radar

b. Data updating and delivery

c. Use of dynamic data

Road regulations
Congestion
Road upgrades
Fallen objects, etc.

Dynamic Map Center

· Dynamic map linkage of public information and dynamic information from infrastructure
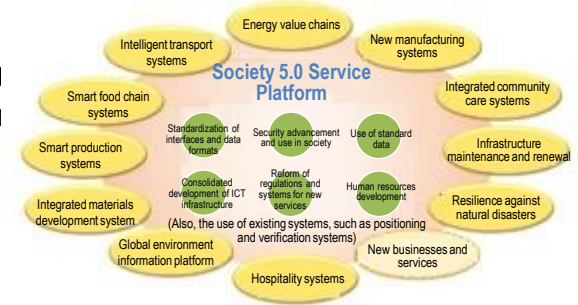
HMI

a. Clarification of the time required for transfer from automated driving to manual driving based on the definition of "readiness"
b. Development of a driving behavior database to promote HMI R&D and standardization

Driver readiness level

200～300km driving

HMI device

Driver's understanding of the system
Automated driving mode
Releasing from automated driving
Take manual control!

DMS* device

DMS* installation example

Ascertaining driver readiness
DMS* composition
Scope of camera photography
Driver monitoring camera
Driver

Driver readiness level

- Installation of DSM products in participants' vehicles

Currently under automated driving

Outwardly directed HMI device

Interaction with pedestrians and non-automated-driving vehicles

- Communication between automated-driving vehicle and other vehicles
*DMS: Driver monitoring system

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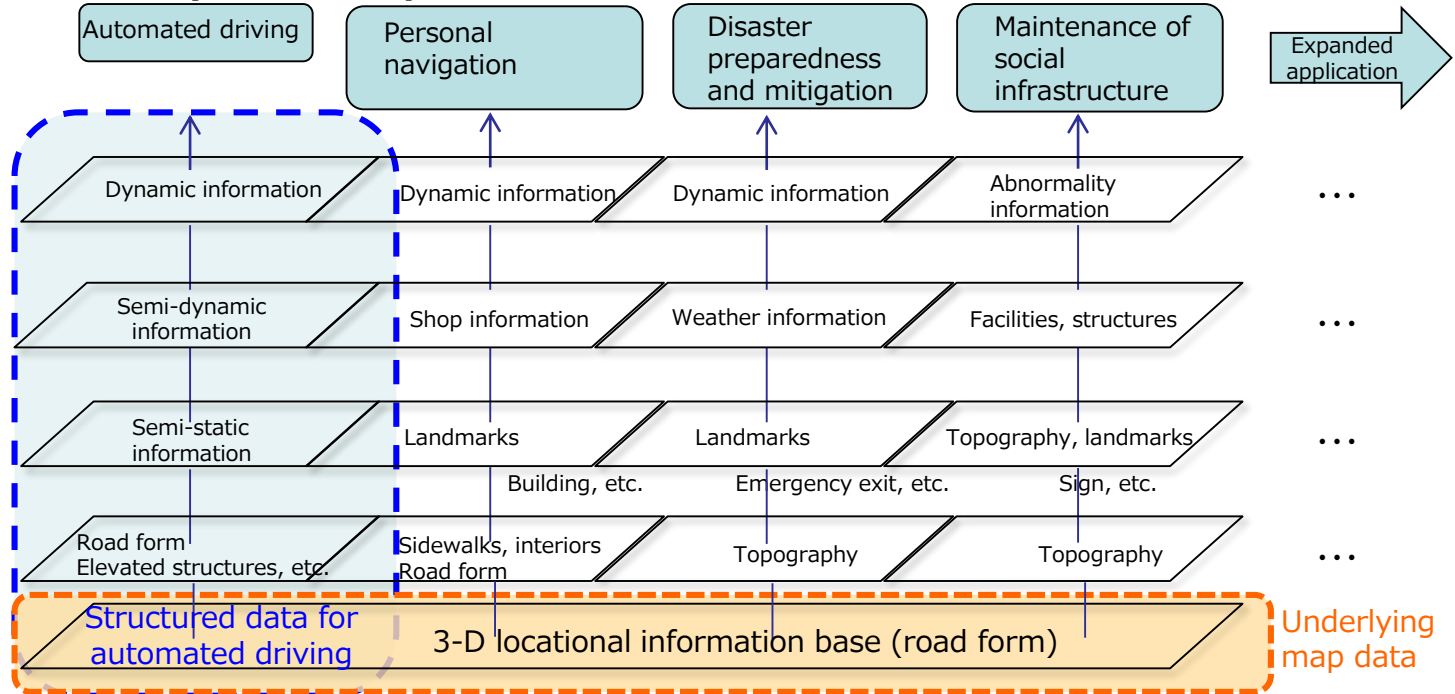Cross-ministerial Strategic Innovation Promotion Program

Toward Realization of "Society 5.0"

Society 5.0: A "Super Smart Society"
(Fifth Science and Technology Basic Plan)
 (1) **Sophisticated integration of cyberspace with physical space**
 (2) Simultaneous pursuit of economic development and resolution of social cha...
 (3) Realization of a human-centered society that permits a high quality of life

Society 5.0 Service Platform

Energy value chains
Intelligent transport systems
New manufacturing systems
Smart food chain systems
Integrated community care systems
Smart production systems
Standardization of interfaces and data formats
Security advancement and use in society
Use of standard data
Infrastructure maintenance and renewal
Integrated materials development system
Consolidated development of ICT infrastructure
Reform of regulations and systems for new services
Human resources development
Resilience against natural disasters
(Also, the use of existing systems, such as positioning and verification systems)
Global environment information platform
New businesses and services
Hospitality systems

Multipurpose use of dynamic maps

Automated driving	Personal navigation	Disaster preparedness and mitigation	Maintenance of social infrastructure	Expanded application
Dynamic information	Dynamic information	Dynamic information	Abnormality information	...
Semi-dynamic information	Shop information	Weather information	Facilities, structures	...
Semi-static information	Landmarks	Landmarks	Topography, landmarks	...
	Building, etc.	Emergency exit, etc.	Sign, etc.	
Road form Elevated structures, etc.	Sidewalks, interiors Road form	Topography	Topography	...

Structured data for automated driving | 3-D locational information base (road form)

Underlying map data

Promotion of multipurpose use for the realization of Society 5.0 and commercialization of dynamic maps

◆ **Promoting multipurpose use of dynamic maps**

・ Modeling and proposal of travel support services utilizing traffic information that is based on dynamic maps

・ Cooperation in SIP's infrastructure management and disaster preparedness/mitigation, and validation of the usefulness of dynamic maps

・ Building of a record of use by public institutions

・ Pursuit of cost reduction

・ Building of a service platform for the safe and stress-free exchange of the wide variety of geospatial data possessed by the public and private sectors.

ART Information Center
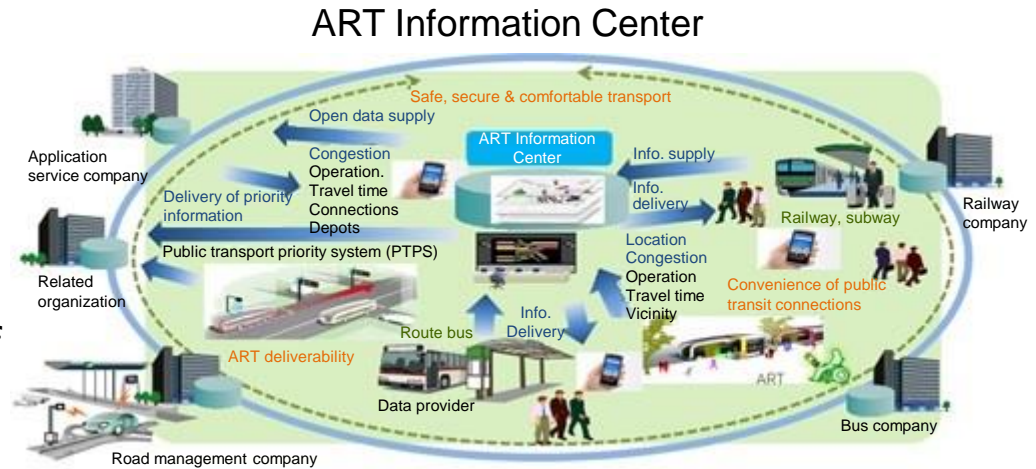
Service platform
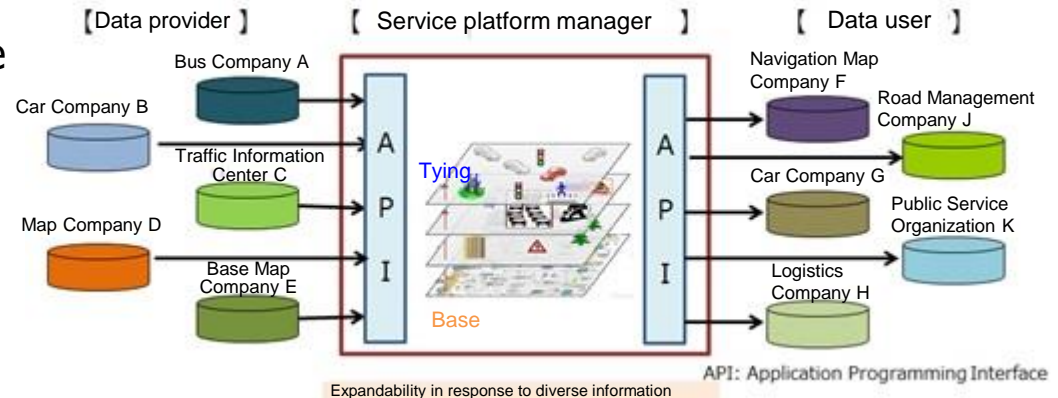
Mobility bringing everyone a smile!

Thank you for your kind attention.