The 12th Japan ITS Promotion Forum

Automated Driving Systems

Dynamic Map

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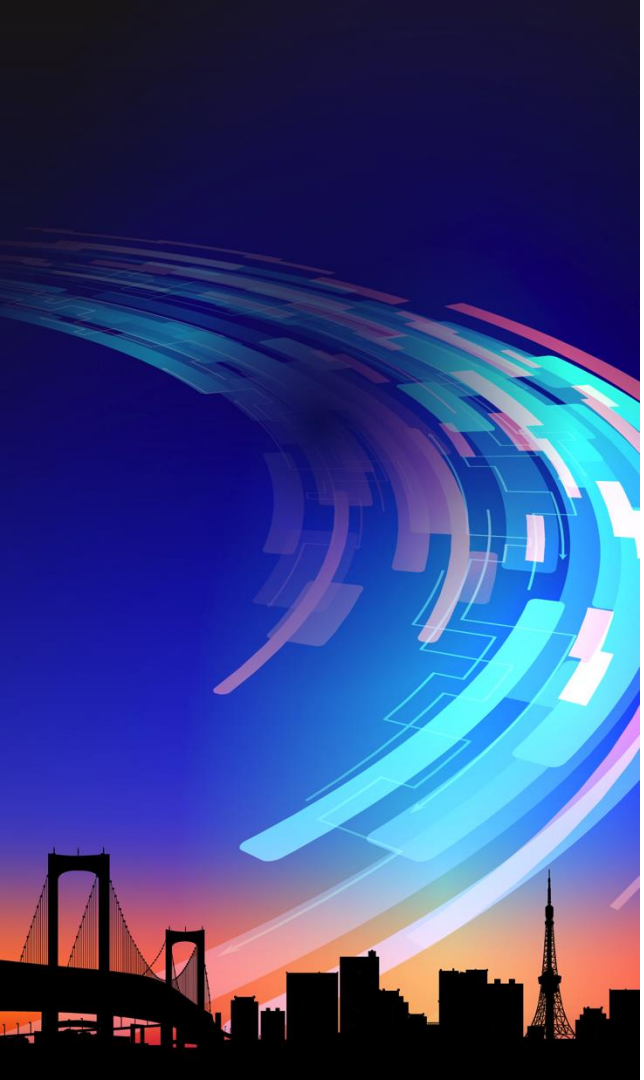
the University of Tokyo

<Translated Version>

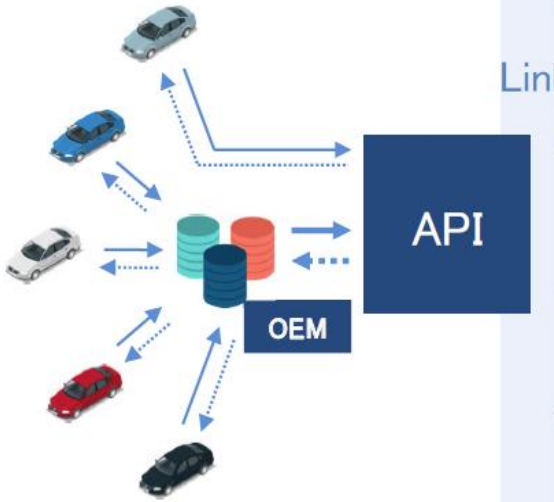
SIP

Cabinet Office



1. What is “Dynamic Map”?

Dynamic Map



API : Application Program Interface

Dynamic Data

Movement of Vehicles, Status of Pedestrians, Traffic Signals etc.

Semi-dynamic Data

Accidents, Traffic Jams, Detailed Weather etc.

Semi-static Data

Traffic Regulation, Road Construction, Weather etc.

Static Data
=High Definition 3D Map

Road, Lane, 3D Shape of Structures etc.

Combine various data

Digital Mapping

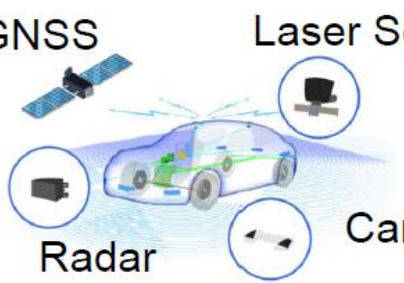
Various Uses

Platform

3D Common Platform Data

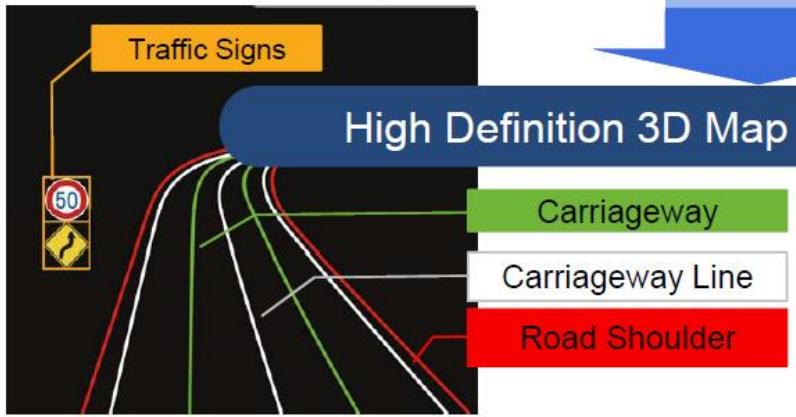
Point Clouds, Graphics, Probe Data etc.

Example of Application: Vehicle Position Detection

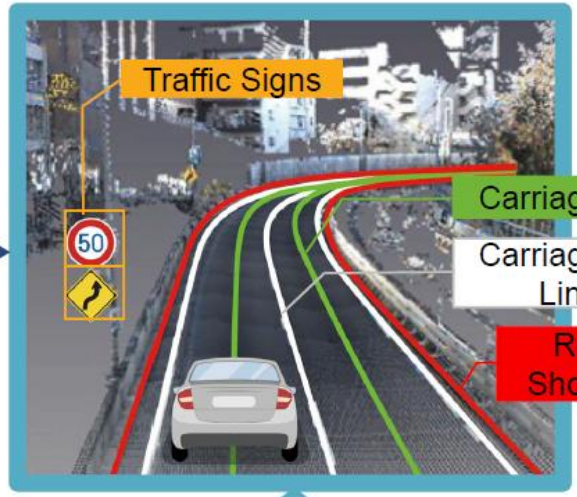


Sensed Data

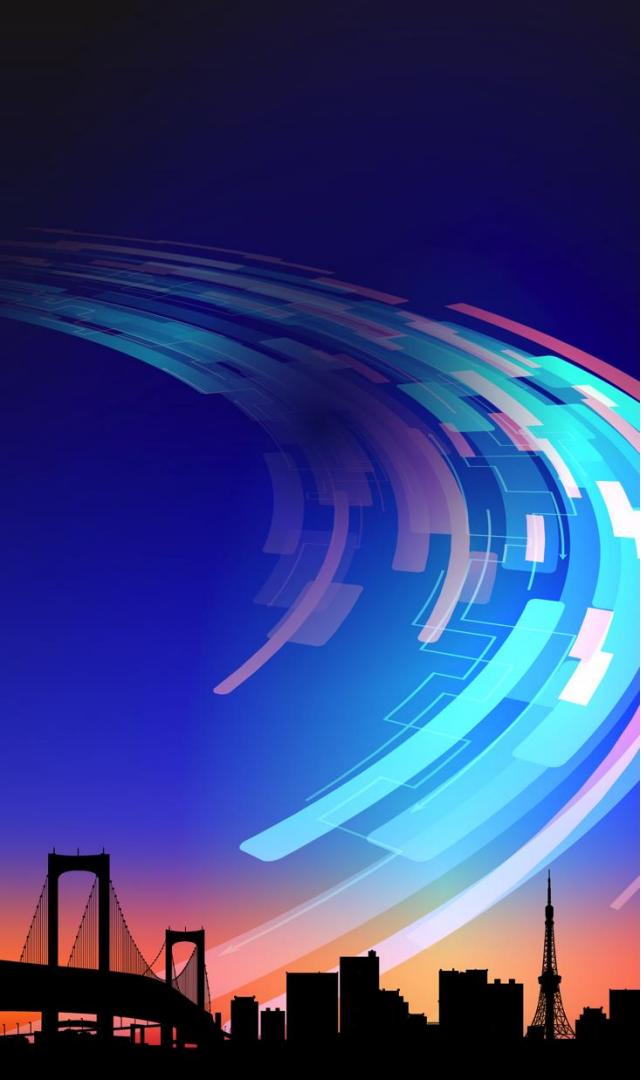
Compare to estimate the position



High Definition 3D Map



Estimate the position of the vehicle



2. Specification and Prototyping

Dynamic Map Data Structure and Scope for Cooperation

Dynamic map

Dynamic information
(nearby vehicles, pedestrians, signal information, etc.)

Location reference method

Semi-dynamic information
(accident information, traffic congestion information, short range weather information, etc.)

Semi-static information
(traffic restriction information, road construction information, long range weather information, etc.)

* Traffic congestion information
* Road construction restriction information
* Traffic restriction information, etc.

Distribution of the above information is currently being coordinated

Navigation map

Static information
(road surface information, lane information, etc.)

Collaborative area
(features used by many OEMs)

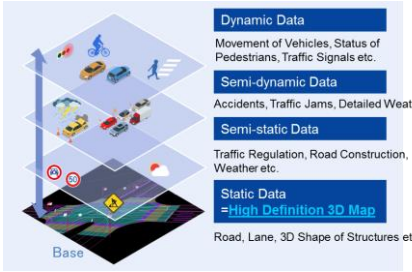
Basic maps supplied by SIP adus

* Road shoulder
* Center line
* Lane line
* Lane edge
* Stop line
* Pedestrian crossing
* Road marking
* Traffic signal
* Road sign
* Carriageway link
* Lane link
* Intersection lane link
* Area-formed intersection
* CRP node

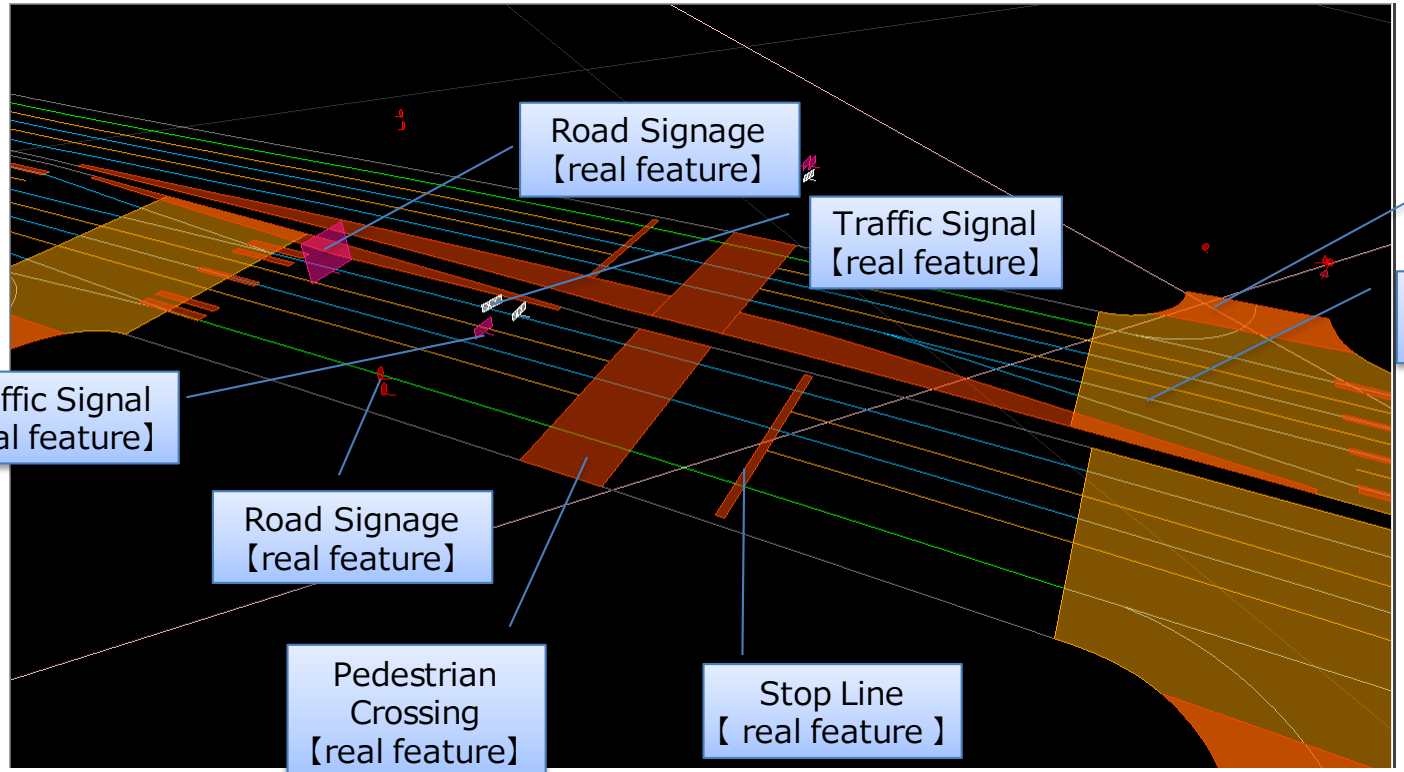
14 features

Competitive area
(features designed by individual OEMS for product differentiation purposes)

Additional data prepared by test participants based on test contents and functions to be implemented



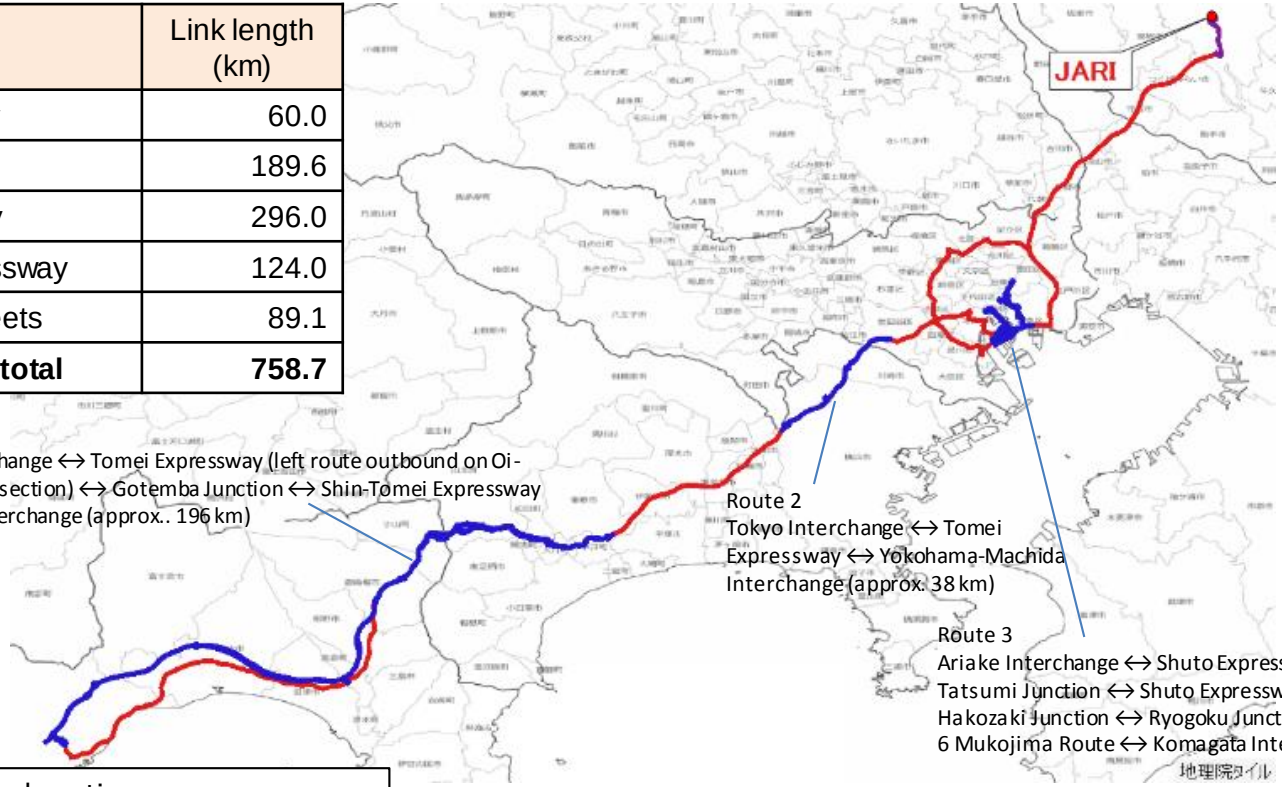
Sample Expression



Legend
: Lane Link [Virtual feature]
: Carriageway Link [Virtual feature]
: Carriageway Line [real feature]
: Intersection Area [Virtual feature]
: Road Marking (instruction) [real feature]
: Road Shoulder [real feature]

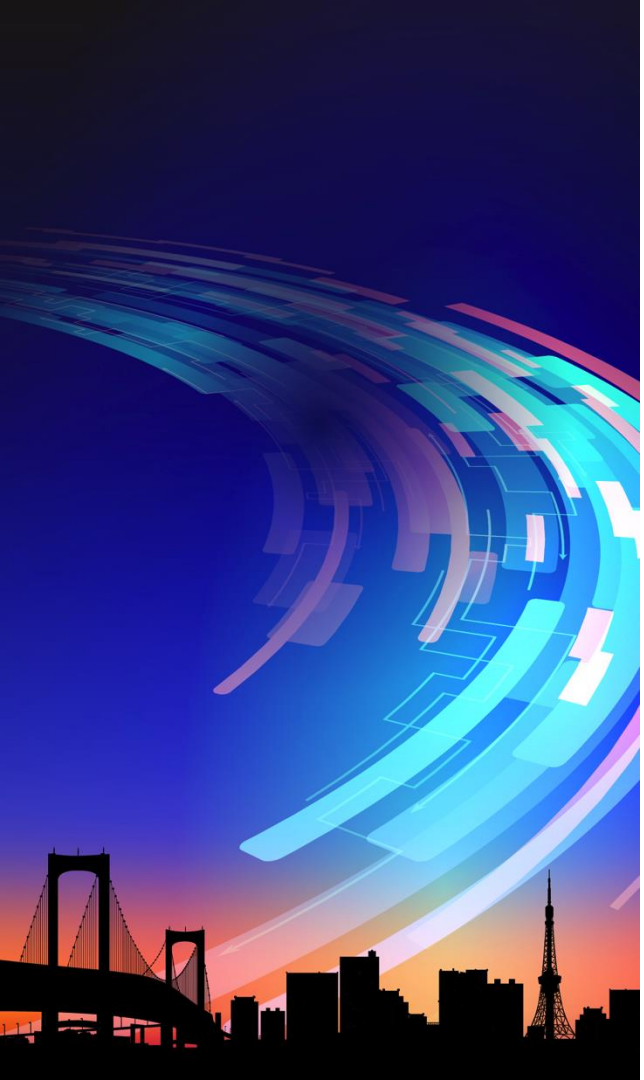
Scope of Static Map Trial

Route	Link length (km)
Joban Expressway	60.0
Shuto Expressway	189.6
Tomei-Expressway	296.0
Shin-Tomei Expressway	124.0
Surface streets	89.1
Trial section total	**758.7**



Explanation
- FY2016 section
- FY2017 section

Activities to ensure conformity with public surveys and achieve multipurpose application will continue together with the trials.

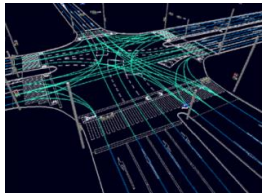


3. Large-Scale Field Operational Tests

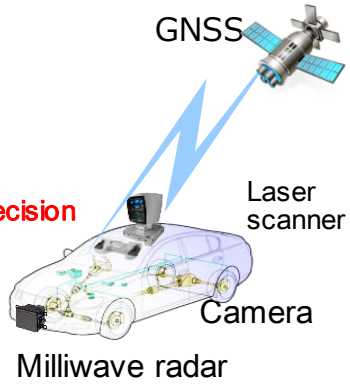
Positioning of the Dynamic Map Field Operational Tests

Test details

a. Validation of specifications and precision of static, high-accuracy 3D map data
b. Validation of data updating and distribution systems
c. Validation of linkage of dynamic data delivered from infrastructure, etc.



a. Specifications and precision of map data

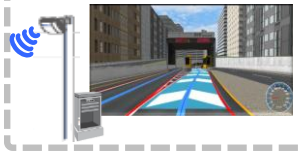


b. Updating and distribution of data

c. Use of dynamic data

- Information on road regulations
- Information on traffic congestion
- Road update information
- Information on falling objects, etc.

Functions of the Dynamic Map Center



・Linking of dynamic data from public information and infrastructure with the dynamic map

Objectives

- Confirmation of and agreement on final specifications toward practical implementation of the dynamic map
- Promoting standardization activities
- Promoting R&D on use of the dynamic map and development of applications

Benefits of participation

- Participation in opportunities to table desired features and proposals toward practical implementation of the dynamic map
- Participation in examining details of proposals for standardizations
- Acceleration of R&D at participating companies

＊ Dynamic Map Field Operational Test Briefing (Material created by NEDO)

Field Operational Test Participants

Daihatsu Motor Co., Ltd.
Continental Automotive Corporation
Meiji Logitech Co., Ltd.
Toyota Motor Corporation
Pioneer Corporation
Suzuki Motor Corporation
BMW
Honda R&D Co., Ltd.
Alpine Electronics, Inc.
Volkswagen Group
Calsonic Kansei Corporation
Mazda Motor Corporation
Mitsubishi Electric Corporation
Mercedes-Benz Japan
Omron Corporation
Subaru Corporation
Robert Bosch GmbH
Nissan Motor Co., Ltd.
ZMP Inc.
Saitama Institute of Technology
Nagoya University

Total: 21 Organizations

*As of October 3, 2017 Participants in the Dynamic Map or HMI tests
**Additional recruitment took place in January 2018.

Schedule and Progress

- Static maps for 758.7 km have been provided to participants
- Tested more than 90 days/route in October and November

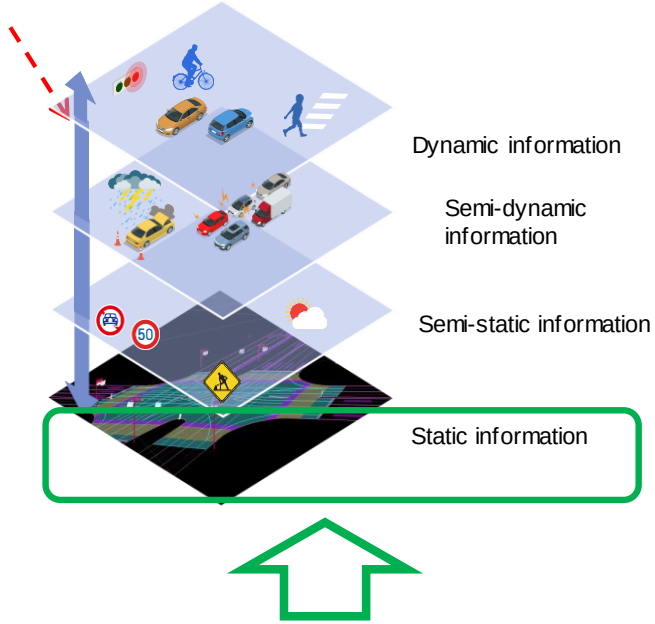
Main item	Sub-item	Supplied data, tools, etc	Classification	2017						2018											
				7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Supply and evaluation of dynamic map data and tools	Static high-precision 3D map data	Static high definition 3D map data (304 km) + Viewer	Supply																		
			Evaluation																		
		Static high definition 3D map data (758.7 km) + Viewer + API (Step 1)	Supply																		
			Evaluation																		
		Static high definition 3D map data (updated data)	Supply																		
			Evaluation																		
		Static high definition 3D map data (updated data: incorporation of improvement requests, etc.)	Supply																		
			Evaluation																		
	Semi-static / Semi-dynamic information	Semi-static / Semi-dynamic information + Viewer + API (Step 2)	Supply																		
			Evaluation																		
	Dynamic information	Dynamic information	Supply																		
			Evaluation																		
Document submittal	Preparation/updating of test plans		Submittal of first version																		
			Submittal of updated version																		
	Application for use of outcomes / license agreement for map data relating to the dynamic map field operational test		Application for use of outcomes																		
			License agreement																		
Meeting	Dynamic Map Field Operational Test Working Group																				

Requests for improvement of evaluation of features and attributes and map data, etc.

Incorporation of opinions

Test Process for Static Information Updates and Delivery

Location reference method



Study of the update scope and conditions for this portion

(1) Study of use cases

Types of road condition changes, etc.

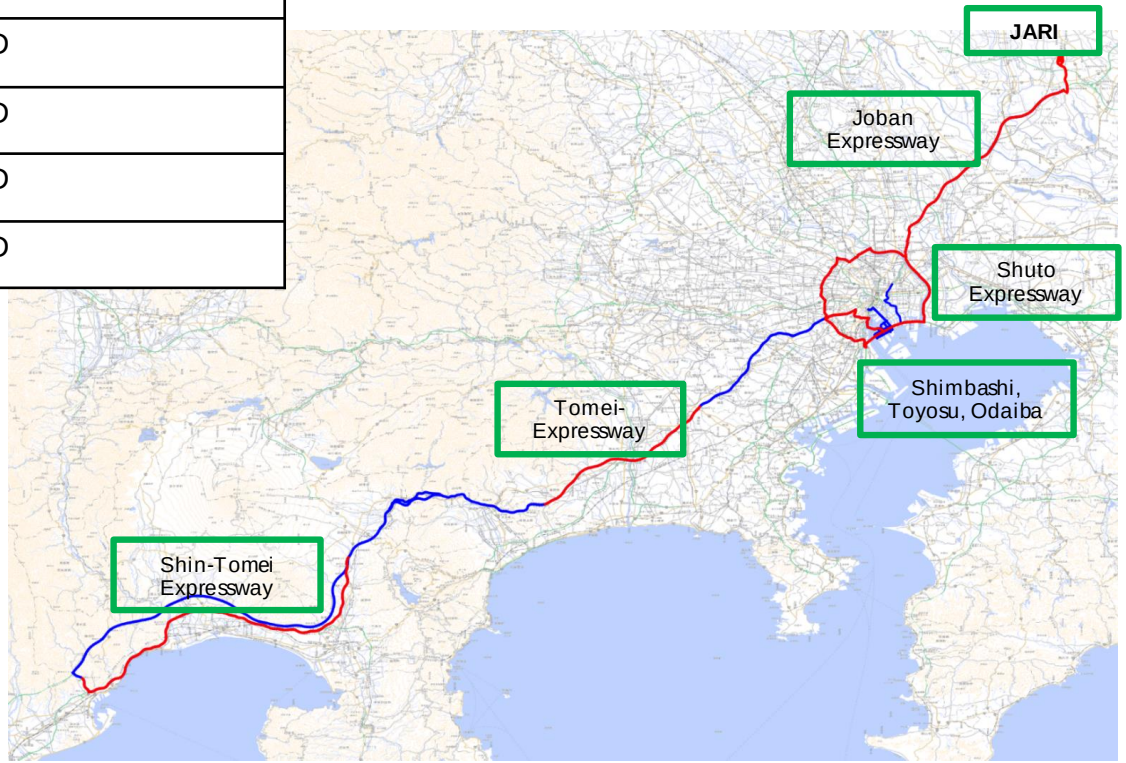
(2) Arrangement of matters requiring updates

Update units, frequency, etc.

(3) Study of update rules, information to be added to high definition 3D maps, etc.

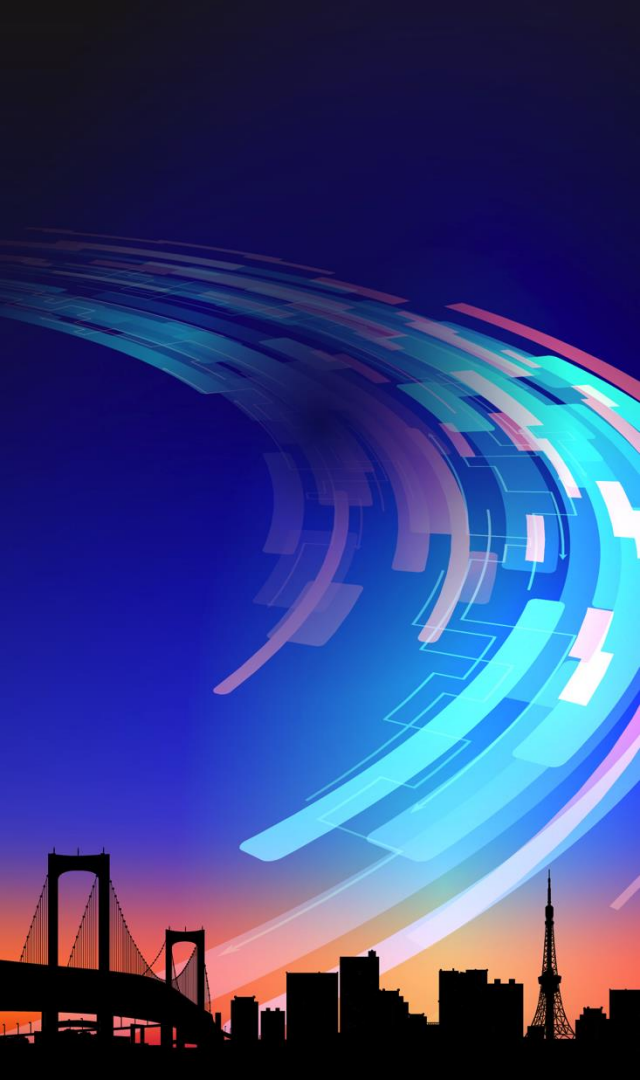
*More than 9,600 road signs, traffic signals, and road markings exist in the section provided in September (approx. 300km).

Dynamic map	**Test area (candidate)**
Dynamic information	TBD
Semi-dynamic information	TBD
Semi-static information	TBD
Static information (update)	TBD



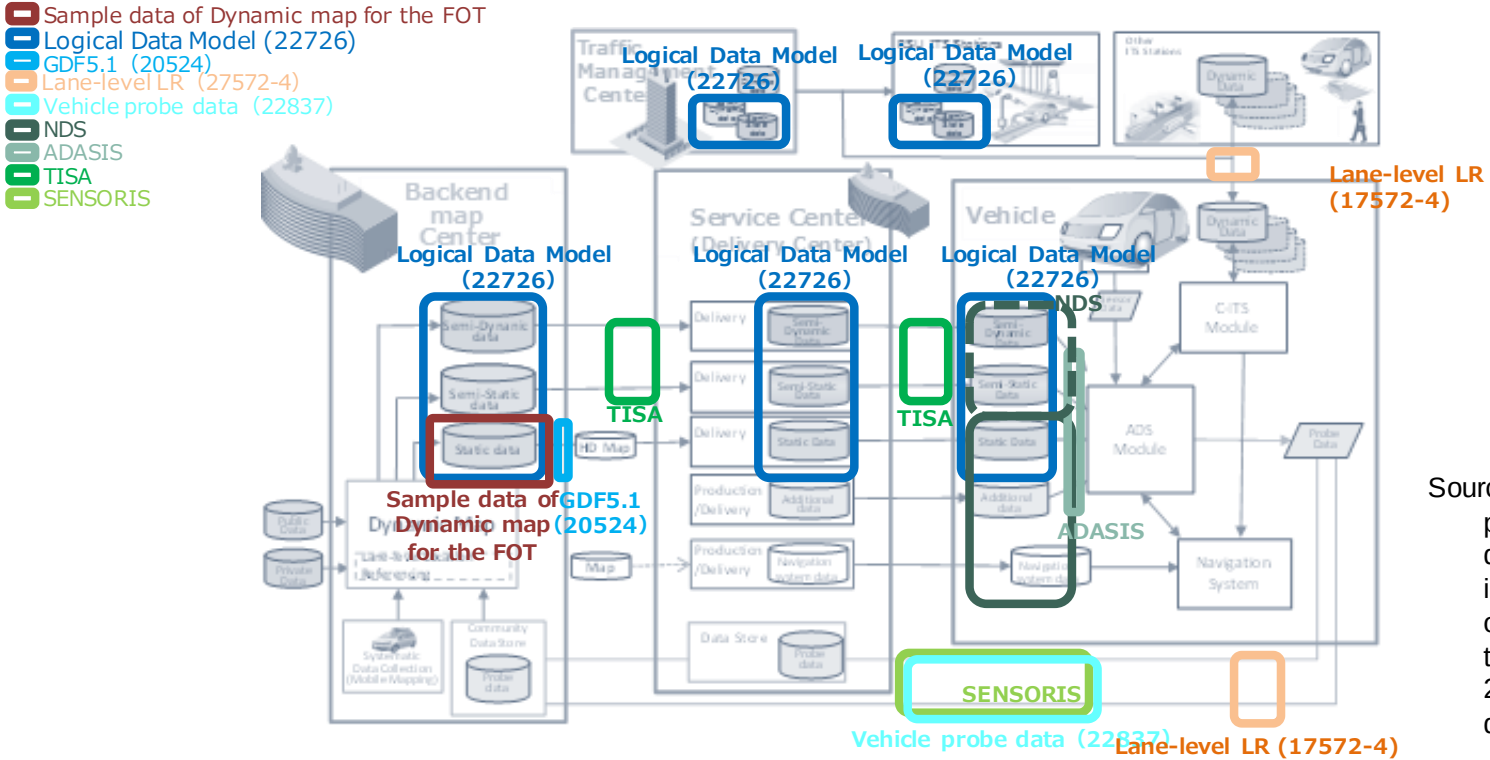
Explanation:
Blue line: Zone supplied in September
Red line: Zone supplied in December

A reduced-shade map of the Geospatial Information Authority of Japan is used as the base map.



4 Standardizations and International Cooperations

- Thus far, Japan has led standardization activities in ISO/TC204/WG3.
- Beginning this fiscal year, Japan will actively participate in activities aimed at industry standards.



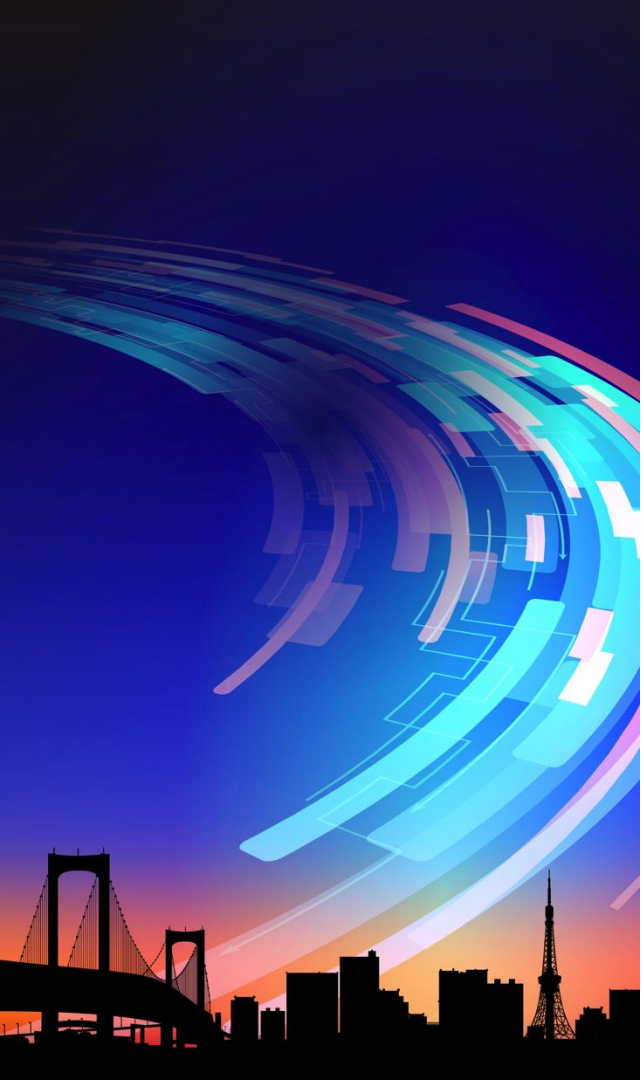
Source: Overall diagram prepared based on discussions with European industrial standards organizations and others at the SIP-adus Workshop 2017 (currently under discussion)

Standardization/International Cooperation Topics of FY2017

- Promotion of items in ISO/TC204/WG3
  - GDF5.1 CD20524-1, NP20524-2
  - Lane-level location referencing method: NP17572-4
  - Map data model for automated driving: PWI22726, others

- Promotion of dialogue and cooperation with domestic and overseas bodies using SIP-adus workshops and other opportunities
  - DMP, JAMA, JASPAR
  - Tri-lateral meetings: ART-WG, OADF, NDS, ADASIS, SENSORIS, TN-ITS, TISA, etc.

- Systems for future discussions
  - Establishment of a small body to discuss standardization strategies in Japan under the Dynamic Map Task Force
  - Formal participation in OADF as SIP-adus
  - Support for the holding of an OADF joint meeting with ISO/TC204/WG3 (January 2018), etc.



5. Looking Ahead

Looking Ahead

- Taking the dynamic maps to the demonstration and actual development phase
  - DMP launched for the static map.
  - Static to dynamic information will be linked in field operational tests.
  - Based on the results of the field operational tests, steps will be taken toward actualizing a platform that links and uses various forms of information.

- Further advancement of standardizations and international cooperations
  - Proposals for standardizations and cooperations based on the test results.
  - Aggressive diffusion of information to ensure consistency with various similar activities overseas in order to prevent Japan's being passed by.

- Toward effective and high-quality development, expansion and maintenance
  - Development for ordinal roads and overseas regions.
  - Toward study of technical development and frameworks for effective and high-quality development and maintenance.


Thank you
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