2nd Phase SIP-adus /

Study on Intellectual Property Management Strategy

Yokohama National University

YNU YOKOHAMA National University Technova Inc.

Study objectives

- Propose intellectual property management tactics concerning standardization for SIP-adus; particularly for,
  - a safety evaluation environment in cyberspace
  - an architecture for geographical data for automated driving
- Study competitive business models and related issues to enhance data sharing and utilization in the autonomous driving industry

Study team & Advisory Panel

Study Team

Name	Affiliations
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Seiji Manabe	Professor, IAS, YNU
Tohru Yoshioka-Kobayashi	IAS, YNU & Assistant Professor, Hitotsubashi University
Masahito Itoshisa	Advisor & Associate Professor, Hosei University

Advisory Panel

Name	Affiliations
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Masao Ueki	Chairman, StarPatents LLP
Manabu Eto	Professor, Hitotsubashi University
Kenji Suganuma	Senior advisor, Denso Inc.
Masahiro Serizawa	Executive Specialist, NEC Corp.
Yuji Toda	General Manager, Hitachi Ltd.
Toshifumi Futamata	Visiting Researcher, The University of Tokyo
Shogo Matsunaga	Partner Attorney at Law, Sonderhoff & Einsel Law and Patent Office
Fumihiko Moriya	Head, Nokia Technologies Japan

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Intellectual property management for building a safety evaluation environment in cyberspace

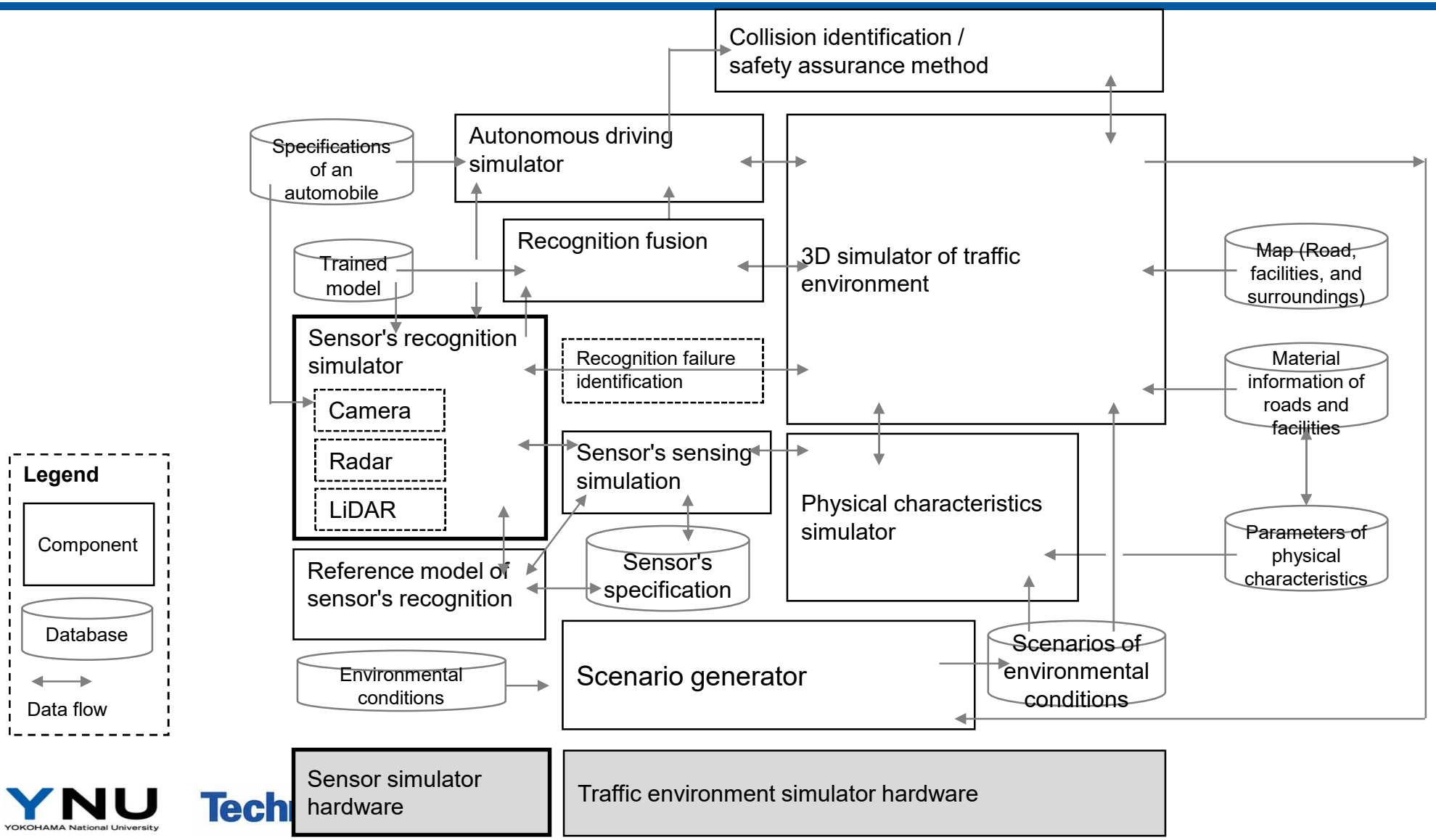
Frameworks

- As a system product:
  - Multiple components constitute the system
  - Expected complicated standardization and IP landscape with many stakeholders
  - Need to identify the system's architecture and competitors
- As a software product:
  - Need to consider IP and standardization strategy specific to IT
  - Need to focus on interfaces between components

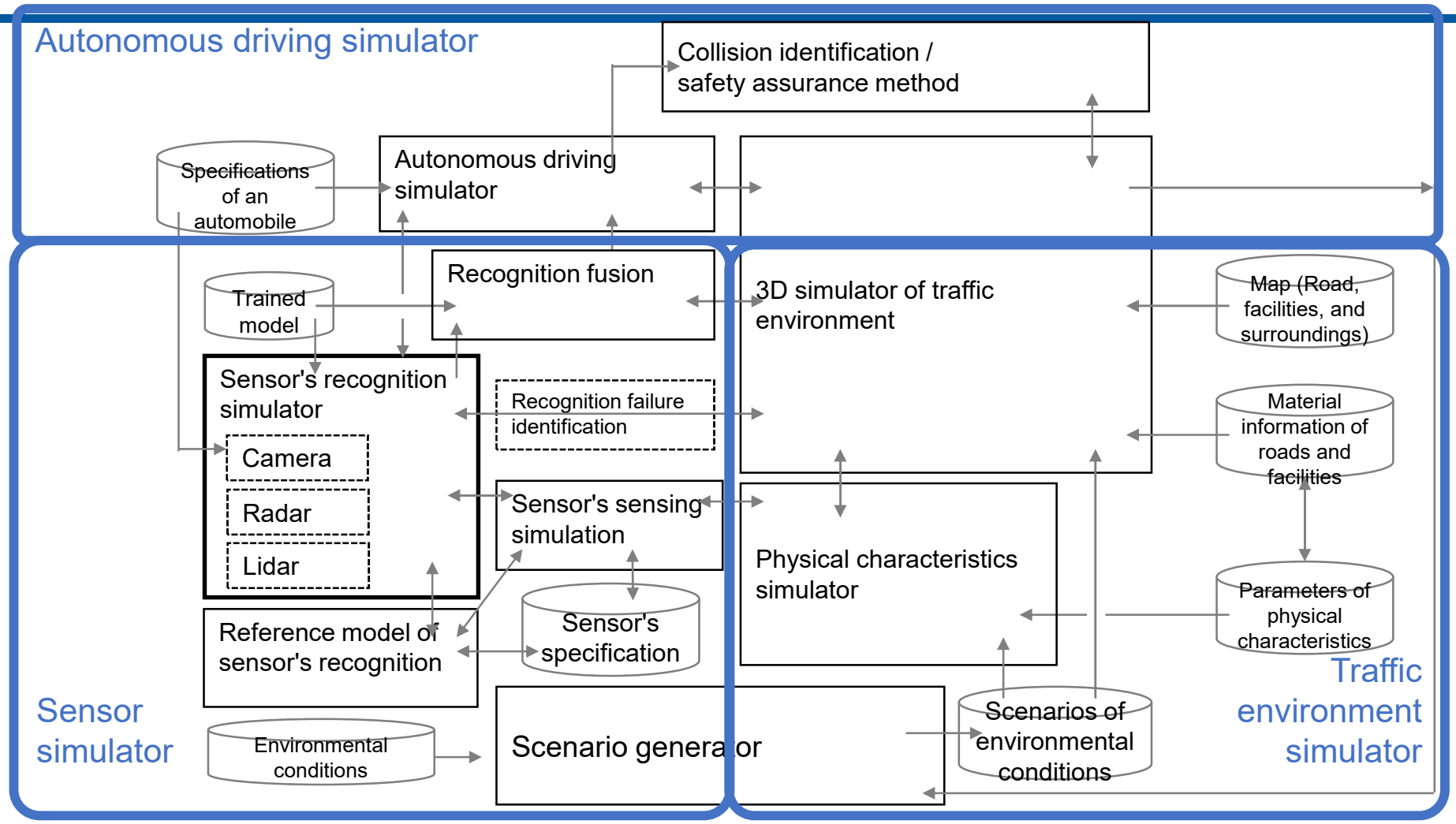
Methodology

- Interview survey (including a field work)
  - Total 10 times
- Literature survey
- Patent survey
- Discussion within study team and advisory panel
  - 3 times discussion with the advisory panel

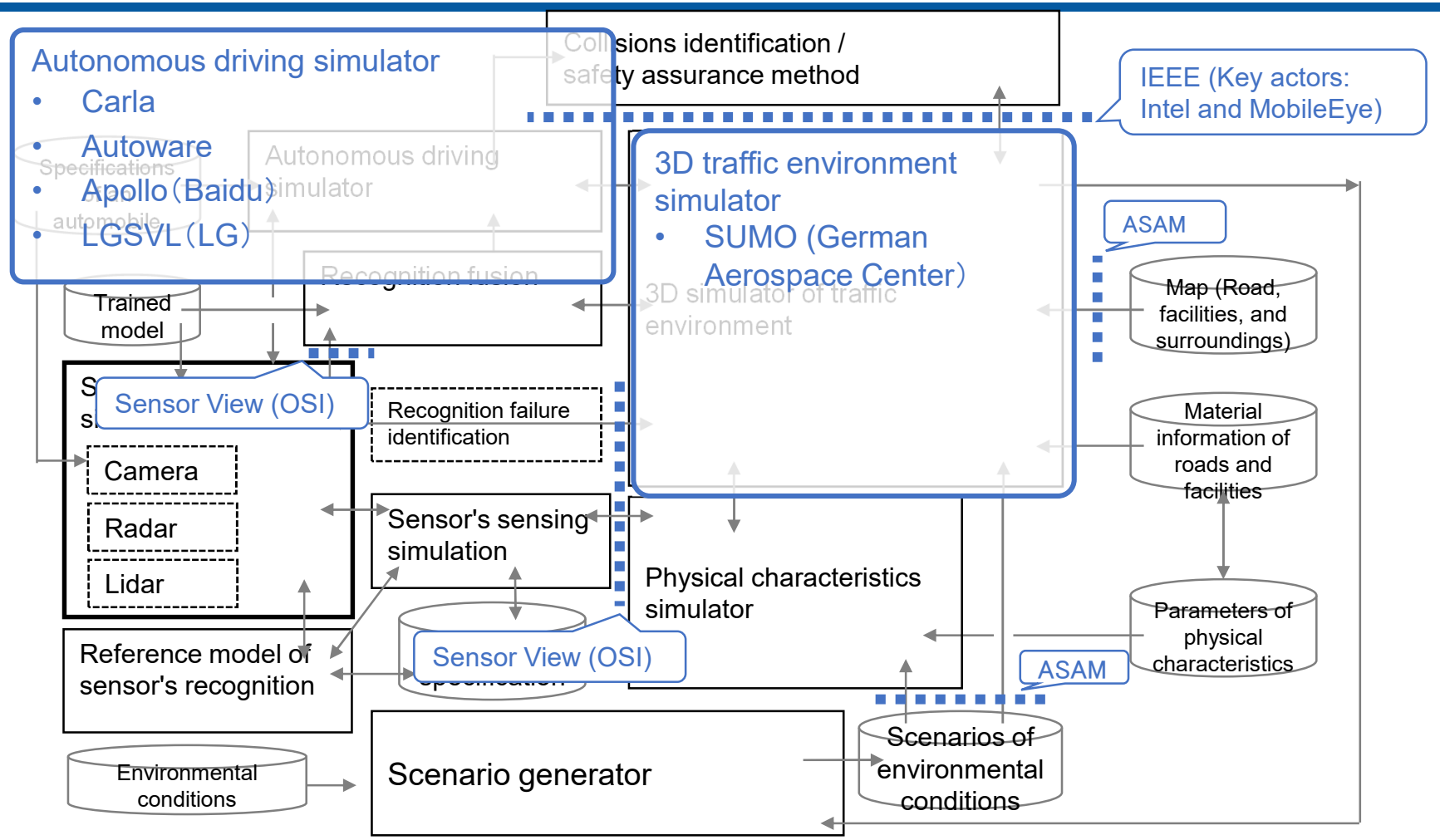
Result: Architecture



Result: Key components in the architecture

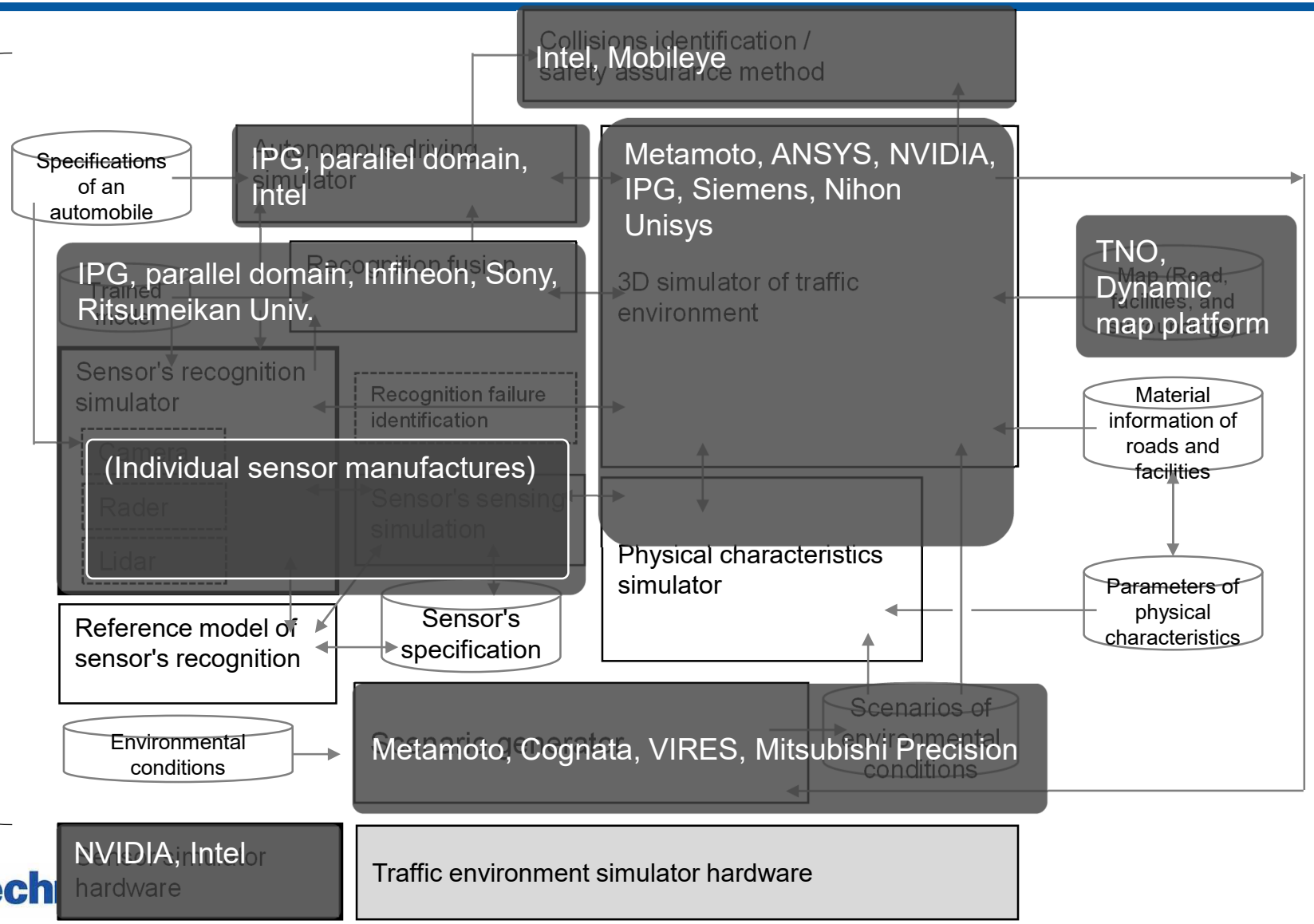


Result: Major standards and platforms



Result: Major players

Ford
Baidu
Toyota Motor
dSPACE
Google



Result: Major patent applicants

Traffic environment simulation

Rank	Japan	U.S.	Europe	China	Korea
1	TOYOTA MOTOR CO. LTD. (JP)	Baidu USA LLC (US)	FORD GLOBAL TECH LLC (US)	BAIDU USA LLC (US)	LG ELECTRONICS INC.(KR)
2	HONDA MOTOR CO. LTD. (JP)	TOYOTA MOTOR CO. LTD. (JP)	BOSCH GMBH ROBERT (DE)	HONDA MOTOR CO. LTD. (JP)	SAMSUNG ELECTRONICS CO., LTD.(KR)
3	YAMMER POWER TECHNOLOGY CO. LTD. (JP)	LG ELECTRONICS INC. (KR)	VOLKSWAGEN AG (DE)	TOYOTA MOTOR CO. LTD. (JP)	HYUNDAI MOTOR COMPANY (KR)

Sensor simulation

Rank	Japan	U.S.	Europe	China	Korea
1	DENSO INC. (JP)	LG ELECTRONICS INC. (KR)	FORD GLOBAL TECH LLC (US)	FORD GLOBAL TECH LLC (US)	SAMSUNG ELECTRONICS CO., LTD. (KR)
2	CANON INC. (JP)	SAMSUNG ELECTRONICS CO., LTD. (KR)	BOSCH GMBH ROBERT (DE)	SAMSUNG ELECTRONICS CO LTD (KR)	LG ELECTRONICS INC. (KR)
3	CAPCOM CO. LTD. (JP)	Ford Global Technologies, LLC (US)	LG ELECTRONICS INC (KR)	WGR CO LTD (JP)	HYUNDAI MOTOR COMPANY (KR)

Result: Major patent applicants

Autonomous driving simulator

Rank	Japan	U.S.	Europe	China	Korea
1	HONDA MOTOR CO. LTD. (JP)	Uber Technologies, Inc. (US)	FORD GLOBAL TECH LLC (US)	BAIDU USA LLC (US)	HYUNDAI MOTOR COMPANY (KR)
2	TOYOTA MOTOR CO. LTD. (JP)	Baidu USA LLC (US)	GM GLOBAL TECH OPERATIONS LLC (US)	FORD GLOBAL TECH LLC (US)	LG ELECTRONICS INC. (KR)
3	KUBOTA CORP.（JP)	GM GLOBAL TECHNOLOGY OPERATIONS LLC (US)	BOSCH GMBH ROBERT (DE)	GM GLOBAL TECH OPERATIONS LLC (US)	BAIDU USA LLC (US)

Interface between key components

Rank	Japan	U.S.	Europe	China	Korea
1	HONDA MOTOR CO. LTD. (JP)	INTEL CORPORATION (US)	GOOGLE LLC (US)	APPLE INC (US)	SAMSUNG ELECTRONICS CO., LTD. (KR)
2	GOOGLE LLC (US)	Samsung Electronics Co., Ltd. (KR)	BOSCH GMBH ROBERT (DE)	SAMSUNG ELECTRONICS CO LTD (KR)	LG ELECTRONICS INC. (KR)
3	APPLE INC. (US)	Google Inc. (US)	SAMSUNG ELECTRONICS CO LTD (KR)	FORD GLOBAL TECH LLC (US)	GOOGLE LLC (US)

Result: Patents from potential competitors

	IPG	NVIDIA	ANSYS	metamoto	dSPACE
Traffic environment simulation	No	Yes	No	No	Yes
Sensor simulation	No	Yes	No	No	No
Autonomous driving simulator	No	No	No	No	No
Whole system	No	No	No	Yes	Yes
Characteristics	No patent filing	Many patent filings	No patent filing	Only one patent filing, but covers whole system	Limited patent filings, but they cover traffic environment simulator and whole system

Result: Landscape of intellectual property

- Following players are potentially influential from the perspective of patents/other forms of IPs
  - Simulation software vendors: metamoto, dSPACE
  - Automobile OEMs: Ford, Toyota Motor
  - Emerging IT-based automobile OEMs: Google, Baidu
  - Semiconductor manufacturer: Intel, NVIDIA
  - Electric appliance manufacturer: LG, Samsung

Discussion on business environment

- We expect a further modularization
  - because many players in different industries have incentives to foster multiple types of modularizations on their own
- Existing simulation platforms have an advantage to some extent
  - because some of above-mentioned players have motives to use these platforms

Discussion on business environment

- Semiconductor manufacturers have strong motives to develop safety evaluation environment in cyberspace...
  - because a sensor simulator shares some functions with actual sensing system, and
  - safety assurance of sensing directly links with their semiconductor sales:
  - particularly sales of players who are not advantageous in telecommunication chipset
- We conclude that the strength of DIVP is in its physical simulation module

Business scenarios: Overview

- Survey results lead three scenarios:
  1. Integral scenario: All components are internally developed. They have limited interoperability with other standardized systems or modules.
  2. Physical characteristics simulator concentration scenario: The consortium mainly develops physical characteristics simulator and related modules. These modules have interoperability with widely diffused modules.
  3. Sensor simulator concentration scenario: The consortium mainly develops a sensor simulator. This module consists a part of add-ins of widely diffused safety assurance systems

Business scenarios: IP/Standardization tactics

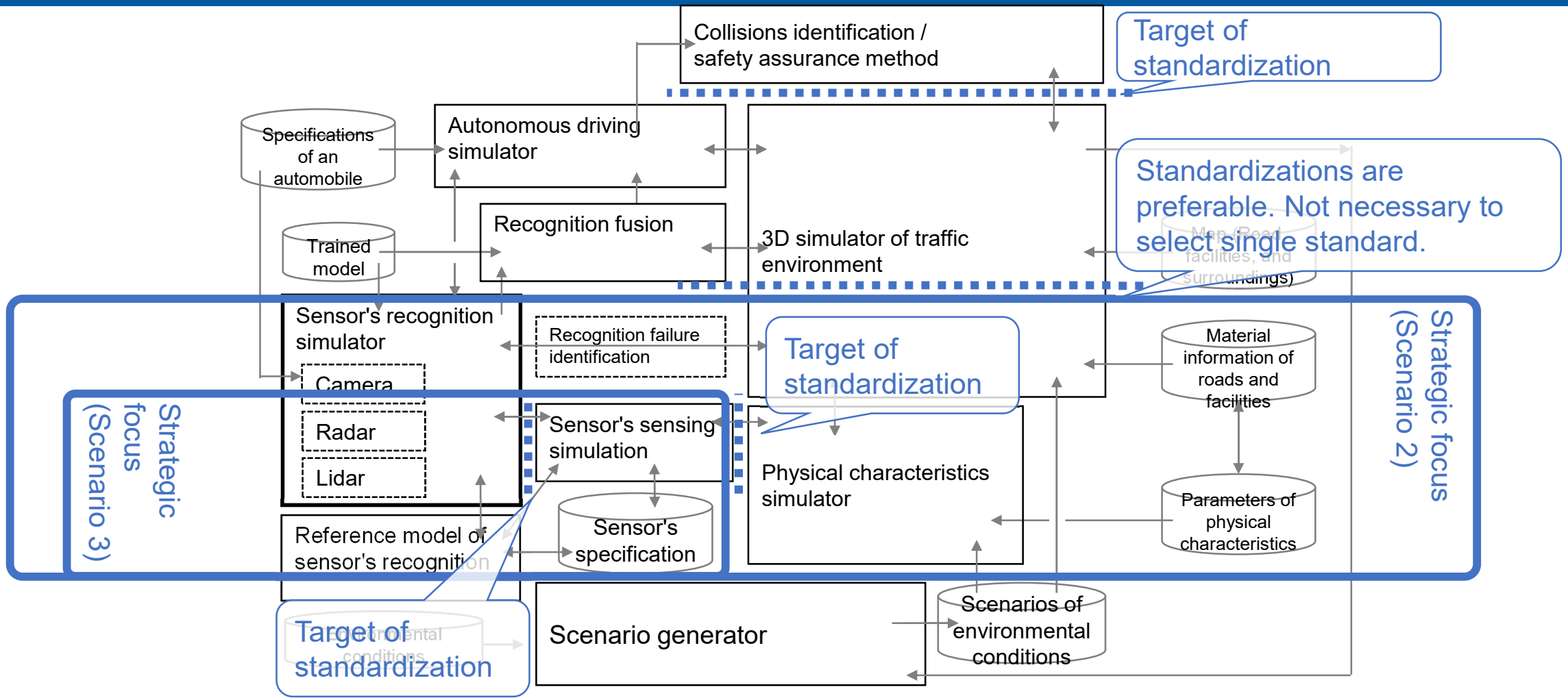
Scenarios	IP tactics	Standardization tactics
1: Integral	● Emphasis on patents regarding interfaces between key modules	● Not necessary
2: Physical characteristics simulator concentration	● Emphasis on IP protections (including those as trade secrets) of concentrated modules	● Emphasis on standardization of safety assurance criteria ● Multiple standards are acceptable between a traffic environment simulator and a physical characteristics simulator
3: Sensor simulator concentration	● Emphasis on IP protections of reference models	● (Same as above)

Business scenarios: Pros/Cons

Scenarios	Pros	Cons
1: Integral	● The platform provides a one-stop solution for OEMs ● OEMs and sensor suppliers can ask customization	● The platform will not absorb the latest modules developed by competitors ● The platform may remain as an uncompetitive independent system
2: Physical characteristics simulator concentration	● The platform provides adequate benefit to every players	● The platform will not absorb a part of the latest modules developed by competitors ● The module may remain as a minor one
3: Sensor simulator concentration	● The platform vendors can concentrate on their competitive module(s)	● Questions remains in their profitability

Strategic focus

Conclusion: Preferable scenarios and a corresponding architectural map



Surveys and research on design and creation of an architecture for automated driving and driver assistance

Frameworks

- Study from three perspectives:
  1. Intellectual property perspective: What kinds of contract templates (and their guidelines) should be prepared?
  2. Data sharing & utilization promotion perspective: What types of incentives should be provided?
  3. SIP-project perspective: How societal benefits are obtained from the platform (as semi-public goods)

Methodology

- Interview survey (including a field work)
  - Total 6 times
- Literature survey
- Patent survey
- Discussion within study team and advisory panel
  - 3 times discussion with the advisory panel

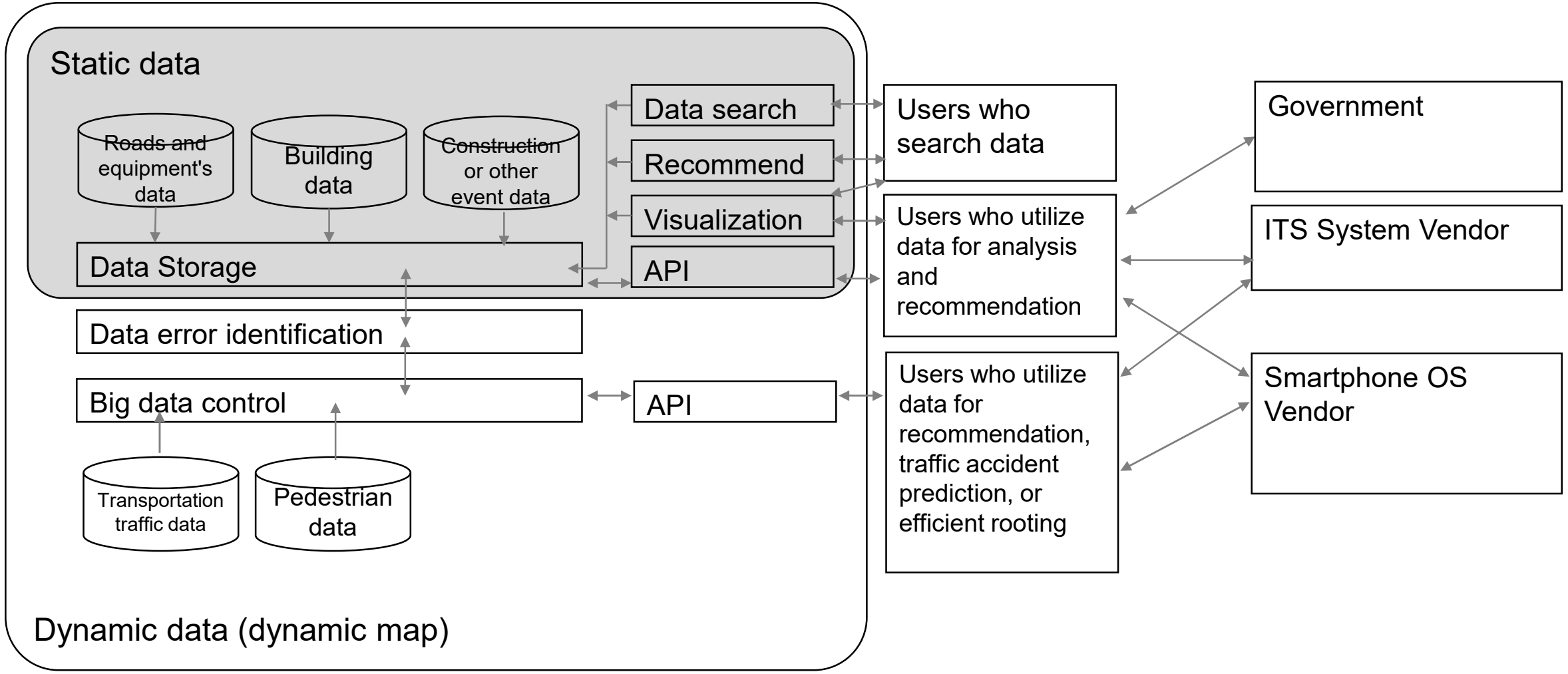
Patents regarding transportation traffic data use

	Usage	Applicants	Patent filing (or grant) numbers	Name of inventions
Dynamic data	**Rooting**	Toyota Motor	JP5908724	Rooting to the best available cross-sections
		China Mobile	CN103905991A	Traffic jam prediction
		Xiaomi	EP3096265A2	Traffic accident recognition
		Google	EP2947608A1	Efficient root suggestion
		Blackberry	EP2343694B1	Estimated arrival time announcement
	Risk prediction	Navteq	EP2159777A2	Traffic obstacles recognition
	Recommend	Volvo	US10704915B2	Personalized infotainment selection
		Ford	DE102012220244A1	Personalized advertisement
		Intel	US20150317687	Personalized advertisement
Static	**Risk prediction**	Toshiba	JP6045846B2	Traffic accident prediction
	Recommend	Bosch	DE102012211189A1	Automobile's condition evaluation by comparison between actual driving and estimated driving

Major patent applicants

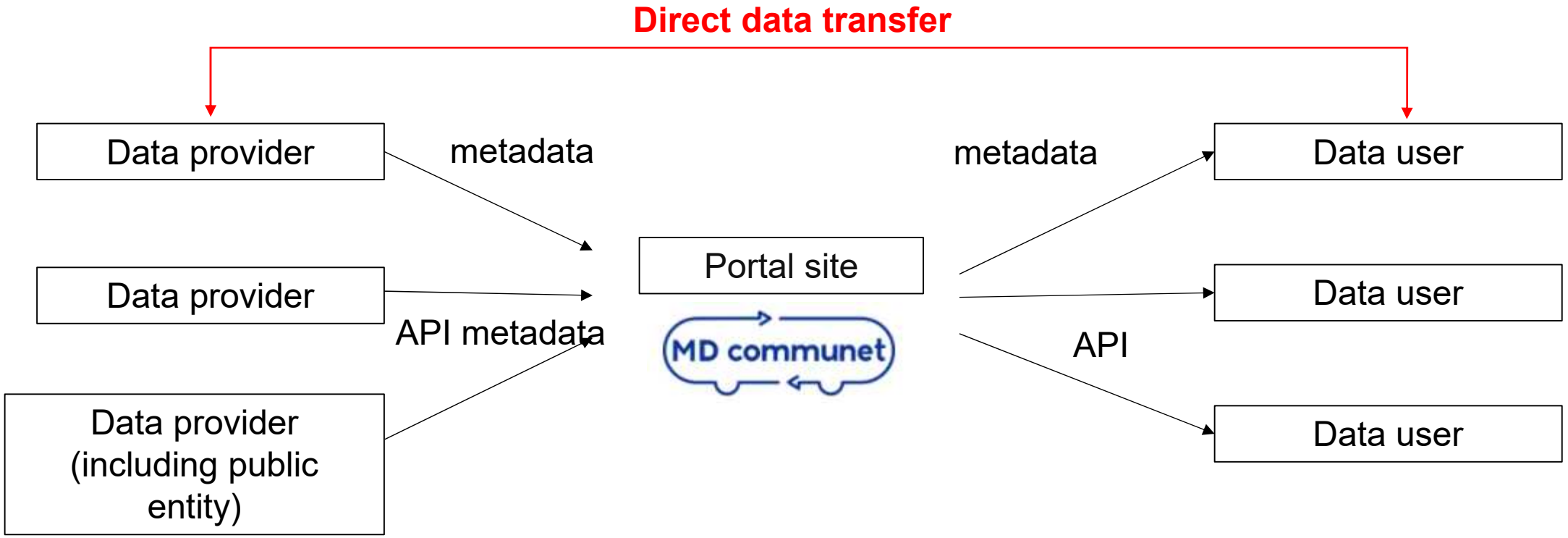
Rank	Japan	U.S.	Europe	China	Korea
1	Toyota Motor Corp. (JP)	International Business Machines Corporation (US)	MICROSOFT TECHNOLOGY LICENSING LLC (US)	STATE GRID CORP CHINA	SAMSUNG ELECTRONICS CO., LTD.
2	Mitsubishi Electric Co. Ltd. (JP)	GOOGLE INC. (US)	GOOGLE INC (US)	ALIBABA GROUP HOLDING LTD	ELECTRONICS AND TELECOMMUNICATIONS RESEARCH INSTITUTE
3	Aisin AW Co. Ltd. (JP)	Microsoft Technology Licensing, LLC (US)	HERE GLOBAL BV (NL)	BAIDU ONLINE NETWORK TECHNOLOGY BEIJING CO LTD	GOOGLE LLC (US)
4	Pioneer Corp. (JP)	Oracle International Corporation (US)	BOSCH GMBH ROBERT (DE)	TENCENT TECH SHENZHEN CO LTD	NAVER CORPORATION
5	Toyota Mapmaster Inc. (JP)	HERE Global B.V. (NL)	ORACLE INT CORP (US)	HUAWEI TECH CO LTD	ALIBABA GROUP HOLDING LTD (KY)
6	Fujitsu Ltd. (JP)	Apple Inc. (US)	PALANTIR TECHNOLOGIES INC (US)	BEIJING BAIDU NETCOM SCI & TEC	SK PLANET CO., LTD.
7	Yahoo Japan Corp. (JP)	Facebook, Inc. (US)	HUAWEI TECH CO LTD (CN)	MICROSOFT TECHNOLOGY LICENSING LLC	FACEBOOK INC (US)
8	ZENRIN-Datacom Co. Ltd. (JP)	MICROSOFT CORPORATION (US)	SAMSUNG ELECTRONICS CO LTD (KR)	UNIV ZHEJIANG	HYUNDAI MOTOR COMPANY
9	Alpine Electronics, Inc. (JP)	Wal-Mart Stores, Inc. (US)	APPLE INC (US)	BEIJING GRIDSUM TECHNOLOGY CO	MICROSOFT TECHNOLOGY LICENSING LLC (US)
10	Gurunavi, Inc. (JP)	SAP SE (DE)	IBM (US)	BEIJING JINGDONG SHANGKE INFORMATION TECHNOLOGY CO LTD	KOREA UNIVERSITY RESEARCH AND BUSINESS FOUNDATION

Architecture



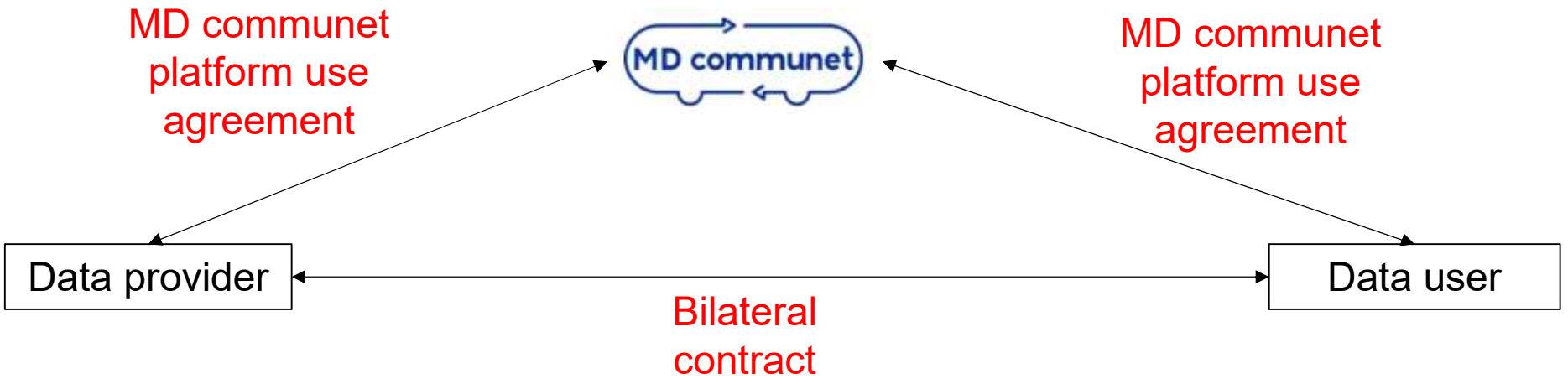
Current situation of MD communet

- MD communet emphasize in data collection other than their business development



Contractual arrangement in MD communet

- “MD communet's platform use agreement” only govern basic issues between data providers and users, and remaining issues are open to bilateral contract between them



Issue of current MD communet

- Issues in data sharing
  - Clarification of ownership of data and its subject matters
  - Data quality (reliability and "freshness"), and prevention of illegal use
  - Liability for accident, and rules for secondary data
- Issues in the expansion of its user base
  - Economic: Incentive design for data providers
  - Technical: Measures against growing volume of data and dynamic data

Current IP-related issues

- A position of MD communet operator
  - "The platform should prioritize data provider. MD communet should not control contract between providers and users."
- A position of Dynamic Map Platform Co., Ltd.
  - "The platform should not control contract between providers and users."
  - "We concern risks of illegal use, unintentional data transfer to competitors, and cost-return performance."

Issues in enhancement of data sharing and utilization

- Necessity of the expansion of the data platform
  - Appropriate incentive designs, balancing between competitors, and management of conflict of interest
- Effective operation of the data platform
  - Data search function, indexing, data quality, pricing, data fusion, standardization, API
- Monetization of the data platform
  - Anti-copycat measures, and consideration of business models of both data providers and users
- Necessity of the adequate measures against growing volume of data and security issues

Different motives by actors: Data providers

	Data provider: Data seller (as primary business)	Data provider: Data seller (as side business)	Data provider: Neighbor business player	Data provider: Public sector
Income structure	Royalty or revenue from data	Royalty or revenue from data, or data-sharing originated collaboration	Data-originated neighbor business expansion	Public funds or fees from nonprofit activities
Examples	Map data supplier	OEMs with big cruising data	Taxi service provider who intended to appeal their taxi service quality by disclosing real-time taxi conditions	Nonprofit organization for traffic accident news broadcasting
Key interest	Revenue from data	Cost for data sharing	Ripple effect from data-sharing	Cost for data sharing

Different motives by actors: Data users

	Data integration consultancy	Data user: Data analytics consultancy	Data user: General users
Income structure	Royalty or revenue from processed data, or fee from data utilization consultation	Fee from data analytics	Business efficiency improvement by data analytics
Examples	Data consultancy	Data or marketing consultancy	Logistics service provider who improve their business by data analytics
Key interest	Royalty or fee of data or consultation Note: Easiness for use of data is negatively evaluated by these actors	Royalty or fee of data or consultation Note: Easiness for use of data is negatively evaluated by these actors	Royalty or fee of data, and easiness for use of data

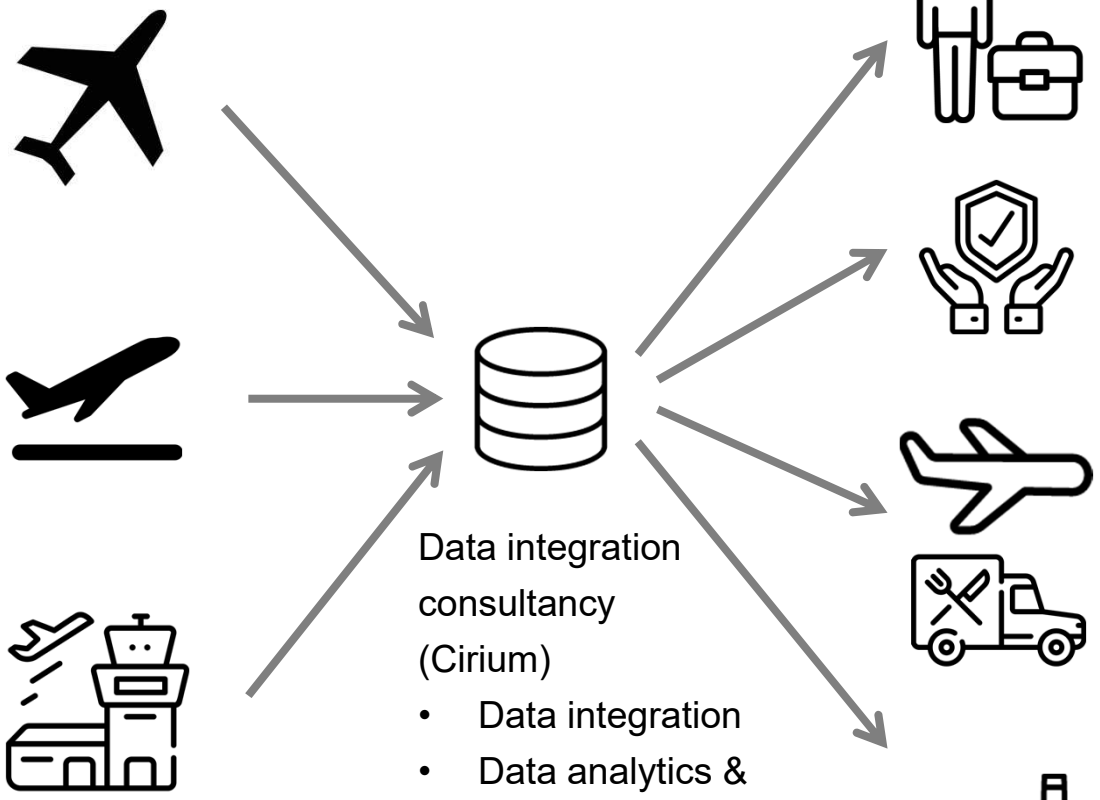
Business model of data integration consultancy

Case: Cirium

Airline operator
- Flight schedule
- Delay info.

Airport authority
- Airport weather info.

Traffic control authority
- Air traffic info.



Data integration consultancy (Cirium)
- Data integration
- Data analytics & consultation

- To passengers: Provide delay info.
- To agencies: Provide delay forecast
- To insurance company: Provide evidence for travel insurance
- To airline operators: Suggest the best flight and fleet maintenance schedule
- To catering or fuel service providers: Suggest the best logistics plan
- To fleet manufacturers: Provide potential demand for new fleets
- To fleet leasing companies: Suggest the best leasing plan

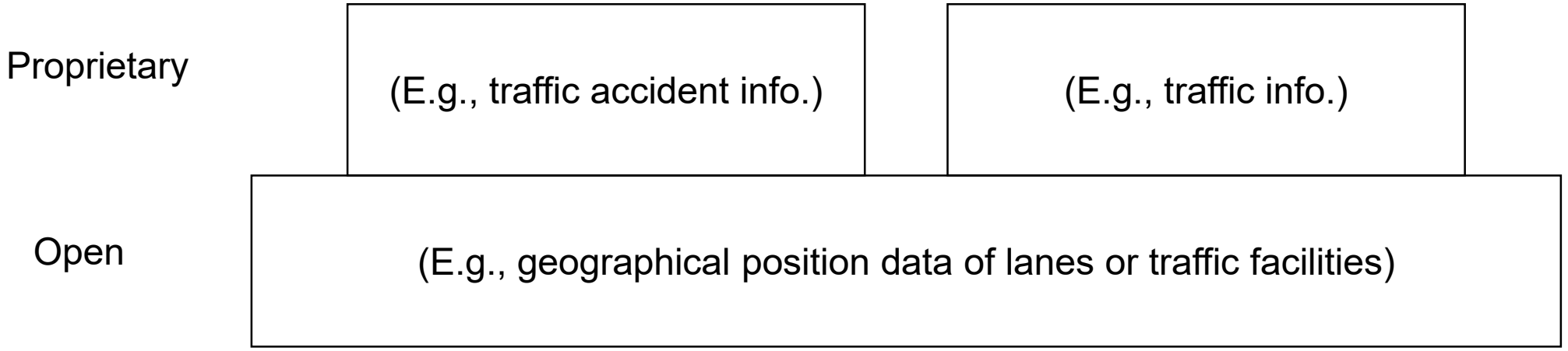
(References)
- Travel Voice (2019/6/25)
- Cirium Web site

Conditions to enhance data sharing and utilization

- Incentives for data providers
  - Conditional sharing (or refusal of sharing with competitors), and secrecy of data acquisition process
  - Grant-back terms to processed data, royalty payment, and related auditing
- Incentives for data users
  - Data quality assurance
  - Meta data disclosure and standardized data format

Two contractual arrangements to enhance data sharing and utilization

- Proprietary utilization: Data providers individually set conditions for data use
- Open utilization: The consortium prepares a sets of contractual arrangements
  - Note: Need to consider the antitrust law
- Both arrangements can co-exist (see below)



Open-oriented contractual arrangements found in other industries

- Creative Commons (CC) License
  - Promote utilization and secondary use of copyrighted work
  - Provide selected contractual arrangements

- Open-Source Software (OSS) License
  - Promote diffusion and secondary use of software (or codes)
  - Permit use of copyrights and patents as long as the users comply with conditions of OSS license

SIP as a “semi-public” project

- Competition with GAFA and BAT
  - Need to develop a basis in which every player has little obstacles in data-sharing and business activities
- Model contractual arrangements or contract templates
  - Data Trading Alliance
  - AI Data Consortium
  - METI, Contract Guidelines on Utilization of AI and Data
- Collaboration between private and public sectors
  - Public data sharing, legal development, and social consensus building
- Starting from a small goal to direct a great goal

Hypothetical scenarios and associating issues

- Data provider prioritized scenario:
  - Data process and secondary use by users, actions against violations of conditions for data use, data security, and proprietary use of data
- Data user prioritized scenario:
  - Format of data catalog, easiness of data processing and/or use

- Common issues for both providers and users
  - Data quality assurance, provider-user matching