This research was supported by the Ministry of Land, Infrastructure, and Transport(MOLIT, KOREA)
[Project ID : 19TLRP-B146733-02, Project Name : Connected and Automated Public Transport Innovation(National R&D Project)].

Building Cooperative Automated Public Transportation System and HD map

New Mobility TF, ICT R&D Center
SK Telecom

Partner for New Possibilities

Content

Project Overview - Background

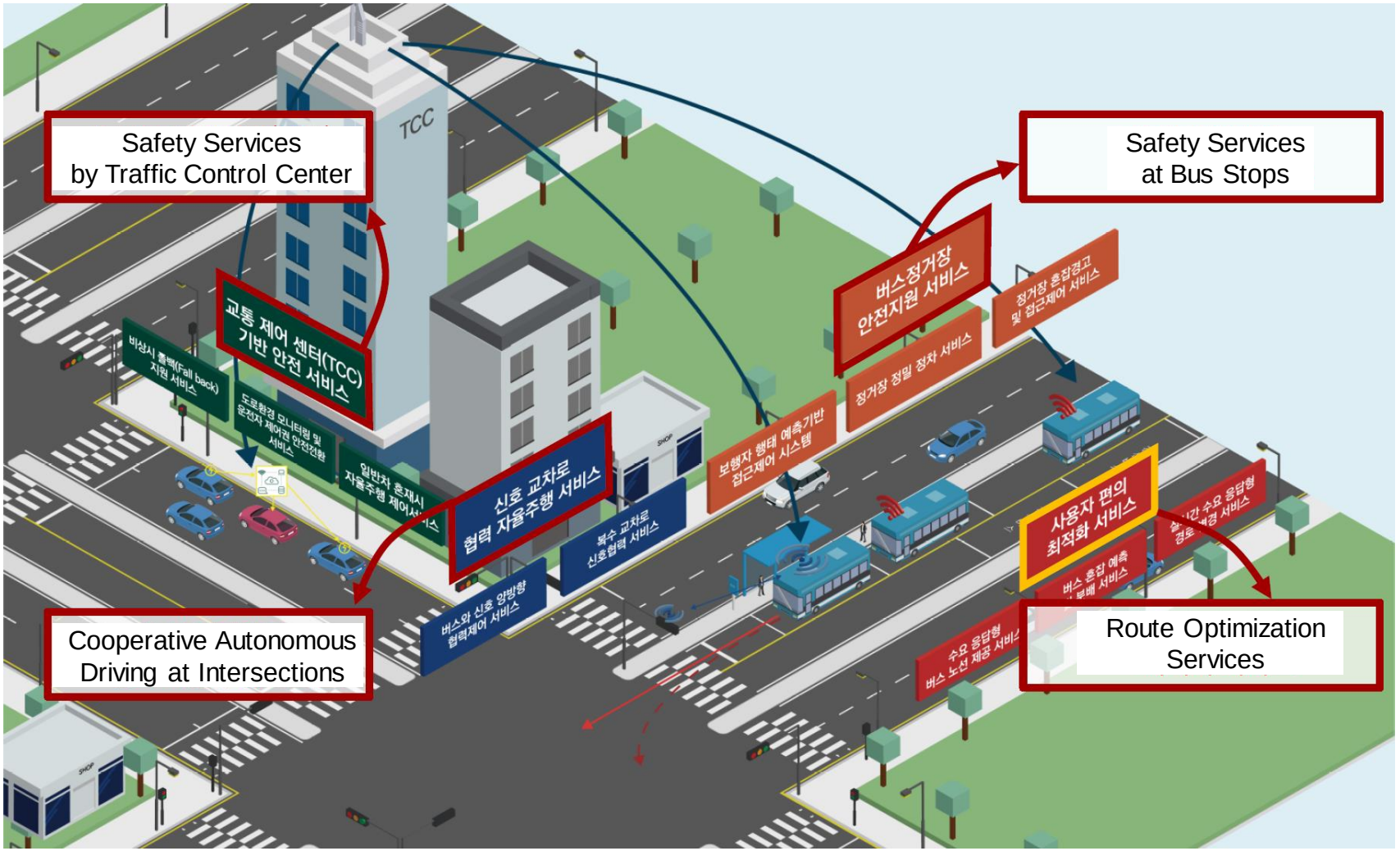
○ Autonomous driving for Public Transportation

Private vehicles	Public Transportation
Something, Everywhere	Everything, Somewhere
Diversity in vehicle technology levels and road conditions	Homogeneous vehicles and restricted road conditions
Various requirements for infrastructure to deal with different types of vehicles	Fixed requirements for infrastructure, tightly coupled with the target vehicles
Individuals are responsible for maintenance and operation	TNC (Transportation and Network Company) is responsible for maintenance and operation

-> Autonomous driving will be commercialized sooner for public transportation.

Project Overview – Target services

○ 4 categories, 11 services



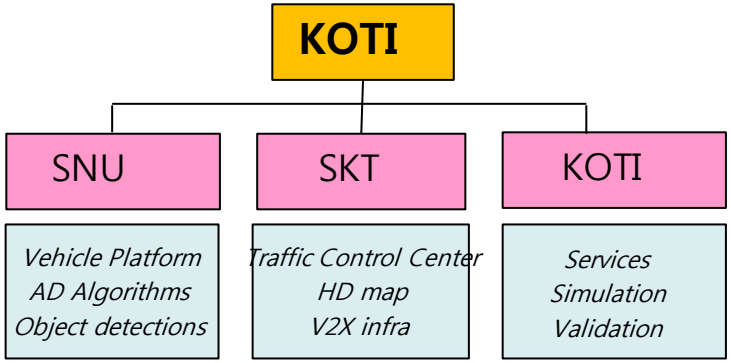
Project Overview - Organization

○ Project of MOLIT Ministry of Land, Infrastructure and Transport

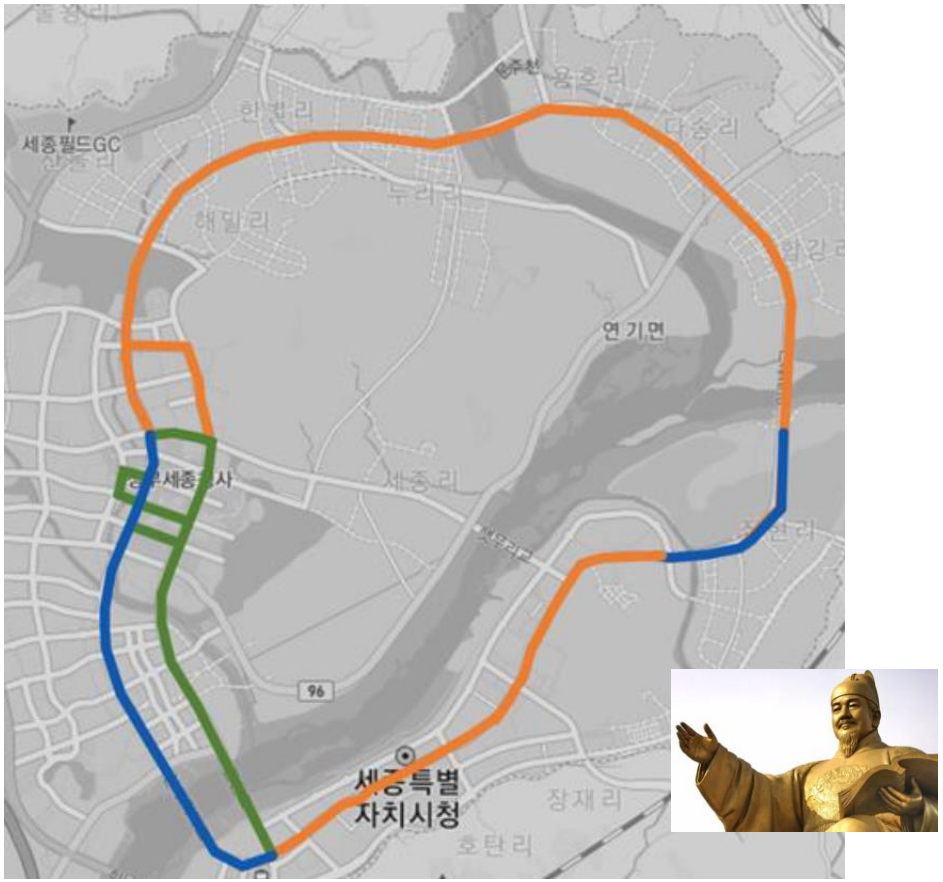
○ Period: 2018.5 ~ 2021.12

○ Resource: $31M ($24M from gov)

○ Organization



* KOTI (KOrea Transport Institute)
* SNU (Seoul National University)
* SKT (SK Telecom)



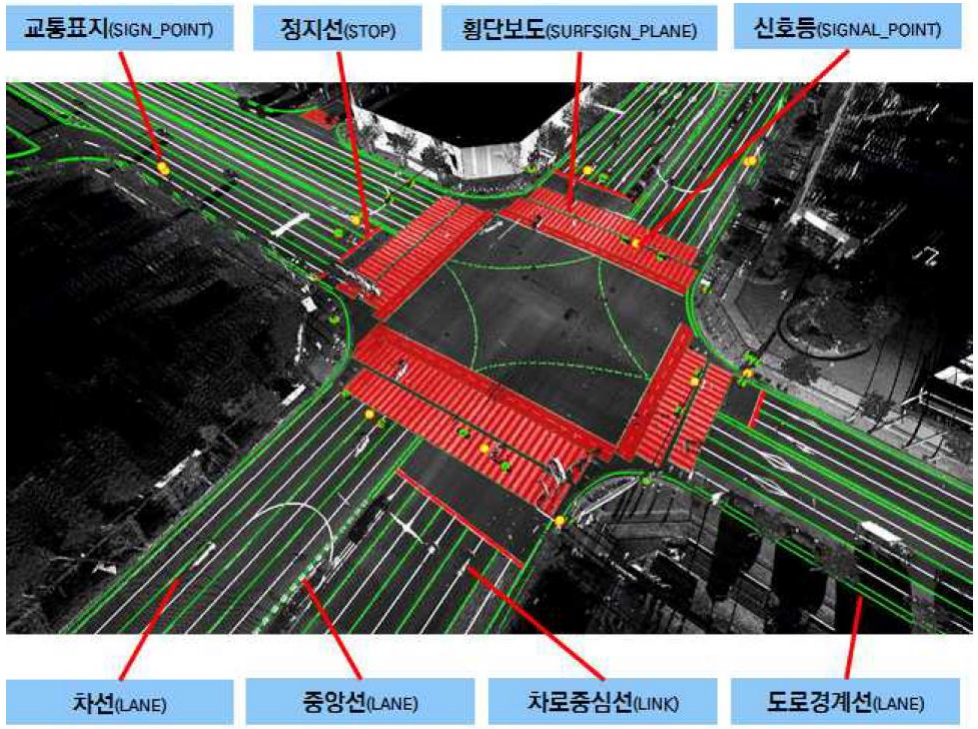
Service Area: SEJONG, the administrative capital

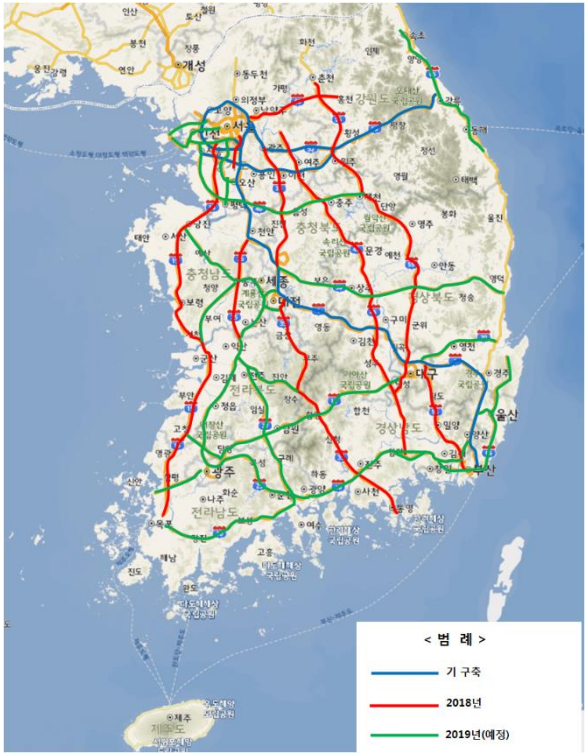
Bus-only road, w/ existing C-ITS infra (5km)
Normal road, w/ existing C-ITS infra (5km)
Bus-only road, new infra to be installed (24km)

HD map service (1/3)

○ Korean HD Map standard

- Developed by 'National Geographic Information Institute (NGII)'
- Format: Shape (shp, shx, sbx, sbn, dbf, prj)
- Data included: Lane, Stop, Link, Sign point, Signal point, Surface sign point, Surface sign line, Surface sign plan, No autonomous driving, etc



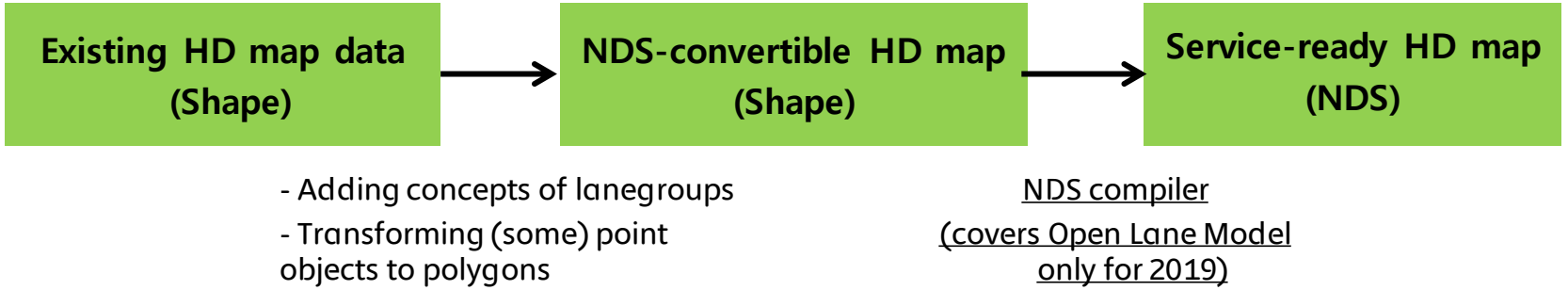


HD map service (2/3)

○ Korean HD Map standard – Issues

- The standard does provide HD map features, but the focus is visualization
  - — Not enough VOC from the users, such as OEM and tier-1
- Missing concepts necessary for efficient processing in vehicle, such as
  - — Tiling and versioning
  - — Service interface
  - — Efficient geometry encoding
  - — Serialization framework
  - — Attribute interoperability

- Solution – Two-phased database preparation



HD map service (3/3)

○ HD Map Update

- Freshness is the key issue for usefulness of HD map
- Crowdsourcing road data collection and updating in server is essential

Data Flow

Understanding Environment

Road Observation Data Creation

- Perception & Localization
- 3D Environment Modeling

Crowd-sourced Data Updates

Update Map Contents

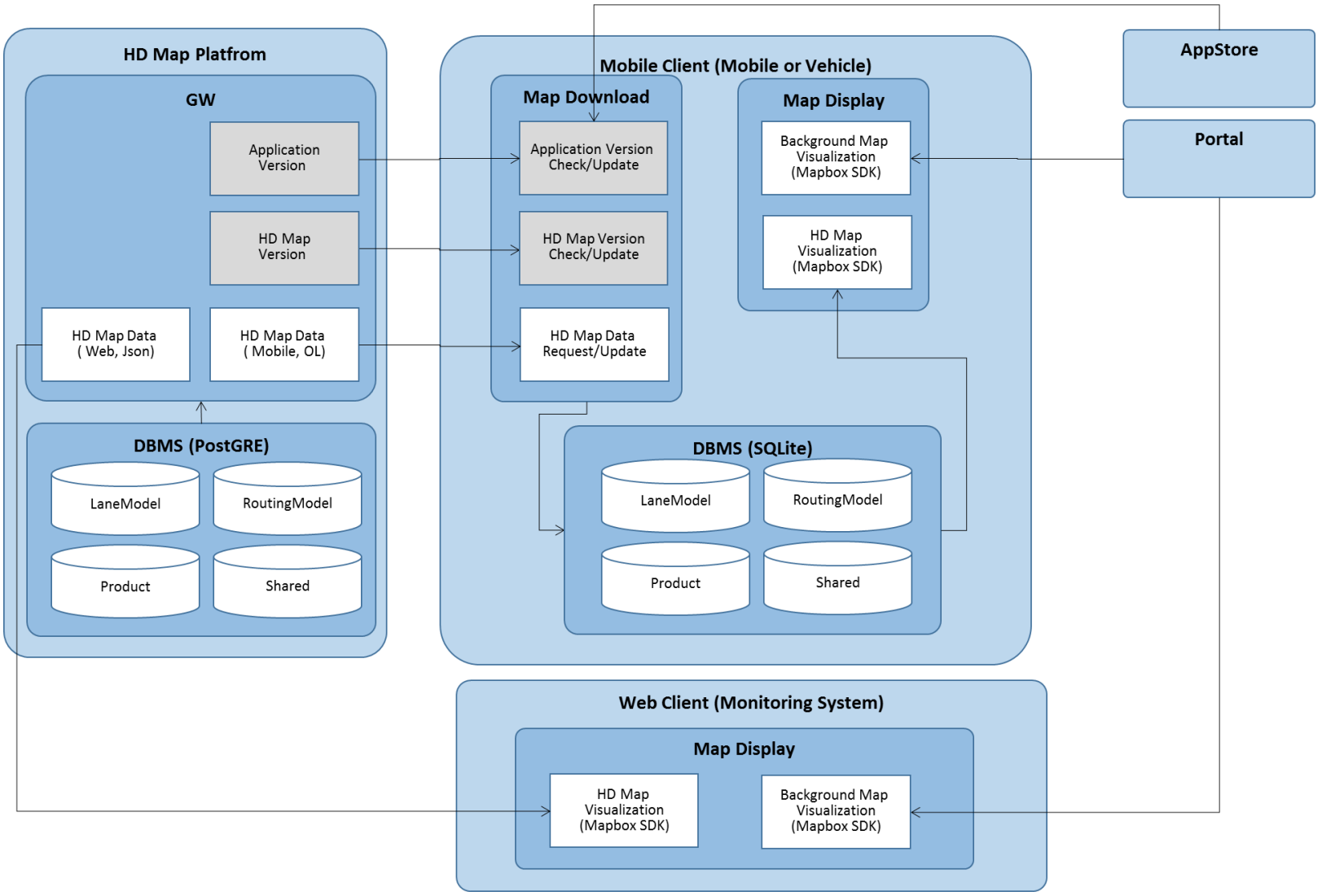
- Aggregation & Align
- Verify, Change detection, Update

Service and Platform

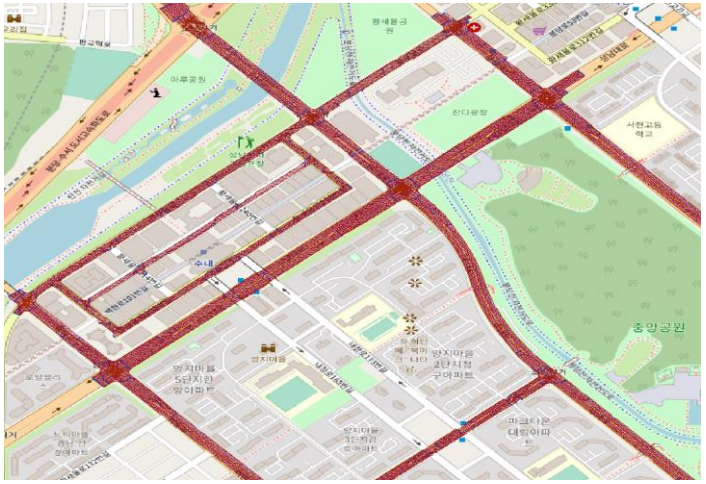
Deliver & Publish

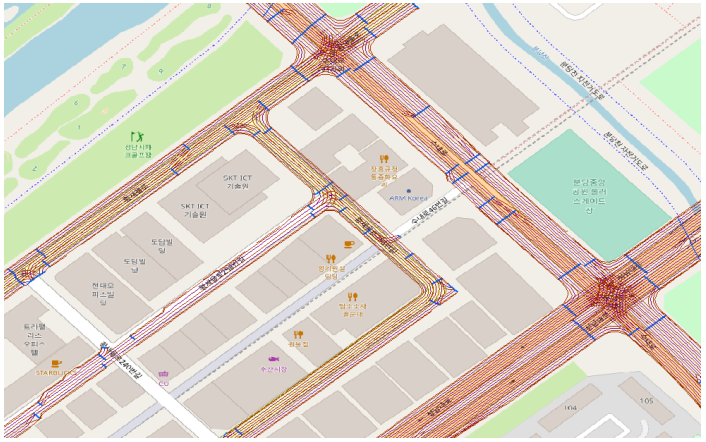
- Data layers & API
- Visualization

Development - Architecture



Development - Visualization





HD map DB

Mobile client (in dev)

Conclusion

◯ Issues

- Steep learning curve – large specification, many levels of referencing, high complexity of SDK libraries, etc
- Not enough sample data, especially for Open Lane Model
- Map viewer missing for Open Lane Model
- Lack of API-level interface definition and example use cases
- SQLite is inadequate for providing services to multiple users

◯ Future work

- The first trial with a few basic scenarios will be conducted at the end of 2019
- Full HD map services, including update by crowdsourcing, will be demonstrated in 2020
- In 2021, optimization and standardization will be done

Other HD map projects in Korea

○ New committee for standardization of HD map

- OEMs (including Hyundai) and service companies (including all three MNOs and major OTTs) have made an MOU in 2019 to make a new Korean HD map standards
- Adopting (and extending) existing standard is an option, too

○ Seoul C-ITS project

- C-ITS infra for Seoul, the capital of Korea, is in development by the consortium led by SK Telecom
- The scope includes HD map, Map update by crowdsourcing, Traffic control system, V2X on 5G/Wave, etc

○ Incheon Free Economic Zone (IFEZ)

- Incheon, where Seoul-Incheon International Airport is, and SK telecom made an MOU to build HD map for the whole area of IFEZ (132.9km^2)
- 5G N/W and Dynamic Data Platform will enable real-time change detection of road data and road conditions