Deployment of Smart Mobility in Korea

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Contents

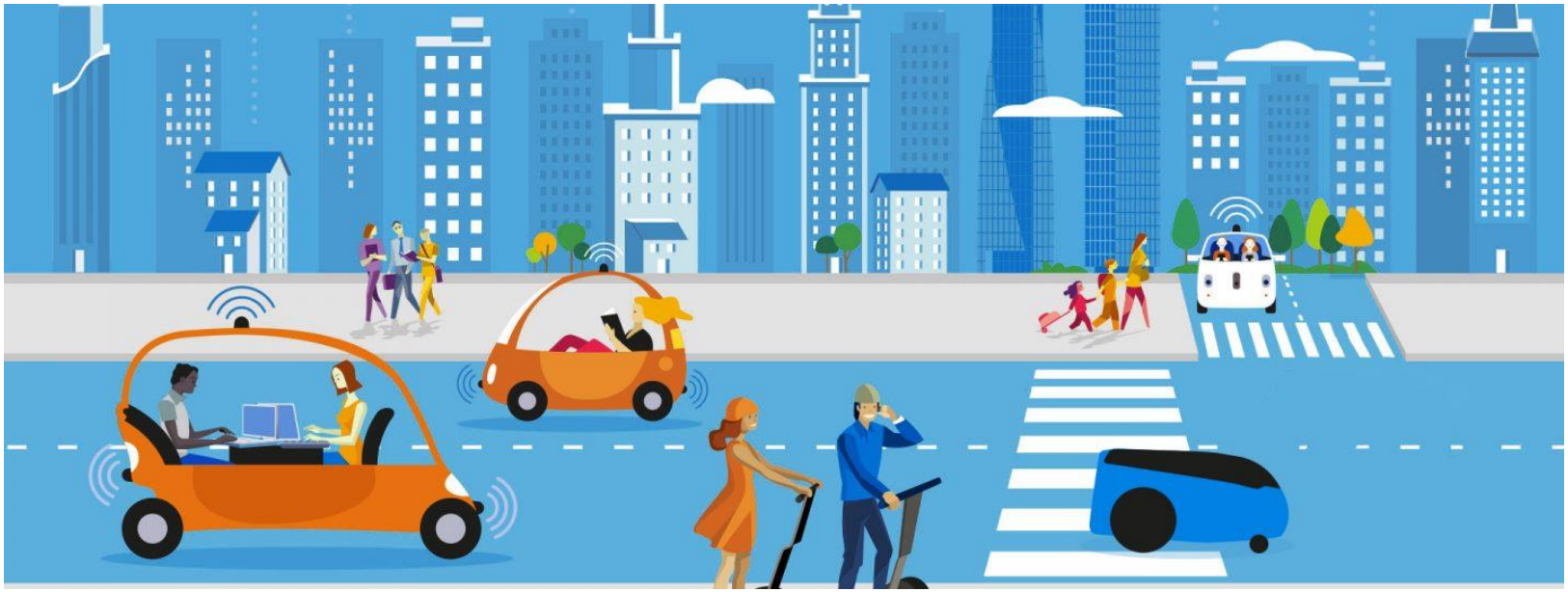
1. Smart Mobility

Transportation and the Traffic Problem

- Transportation System
  - Individually-owned cars
  - Public transportation systems
- Traffic Problem
  - Road traffic has become a huge social problem, as urbanization and populations have increased
  - Air pollutions in cities have been a social problem
  - Many solutions for solving traffic problems have been applied

Smart Mobility

- A new and revolutionary way of thinking about how we get around
  - one way is to try to make transportation systems be cleaner, safer, and more efficient
  - another way is to make mobility revolutions in the society such as zero emissions, zero accidents, and zero ownerships



Source: Urban-hub.com

Smart Mobility

- The concepts of smart mobility includes a wide range of modes of transportation
  - Kick scooters, bicycles, buses, subways, taxis, autonomous vehicles, walking, and so on
- Users have option to own or share

Source: iberdrola.com

Key Principles of Smart Mobility

- Flexibility
  - multiple modes of transportation allow travelers to choose which ones work best for a given circumstance
- Efficiency
  - the trip gets the travelers to their destination with minimal disruption and in as little time as possible
- Integration
  - the full route is planned door-to-door, regardless of which modes of transportation are used
- Clean technology
  - transportation moves away from pollution-causing vehicles to zero-emission ones
- Safety
  - fatalities and injuries are reduced drastically

Smart Mobility in A City

Scope for Mobility Revolution

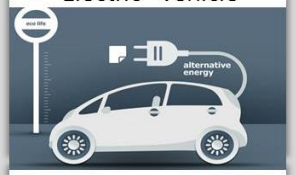
Automation

- Autonomous

- Drone

Electrification

- Electric Vehicle



Integration

- Shared Transport

- Integrated

Tools

AI

IoT

Big-data

Cloud

Solution

Safety

Traffic

Environment

Impact on Transportation System

Reduced Traffic Congestion

- Traffic congestion/road investment will decrease due to increased road capacity followed by automation and integration.

Increased Mobility

- As driving becomes unnecessary, productivity on the road and mobility of the mobility-impaired will improve.

Reduced Traffic Accidents

- Number of traffic accidents will decrease as human factors are eliminated. (80 ~ 90% caused by human factors)

Introduction of New Services

- Various new services such as car-sharing and automated taxi/bus will be introduced.

Changes in City Structure

- City structure and land value will change due to the changes in transportation behavior such as decreased demand for parking in residential and commercial areas.

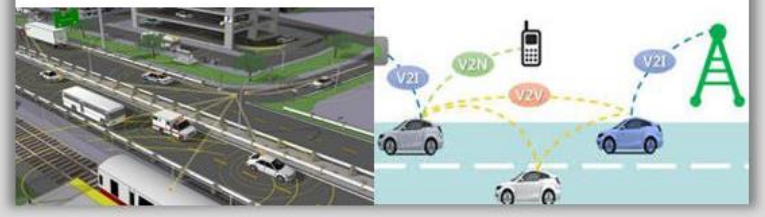
Reduced Driving Job Industry

- By 2040, AVs will take up 7 ~ 24 % of the driving job industry.

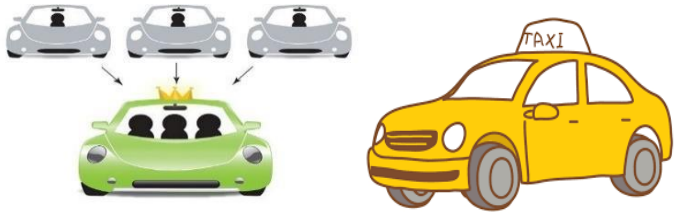
Policy Issues

Roles in Land and Transport Area

- Selecting core strategy b/w technology and transport system
- e.g. : relation b/w AV and infrastructure

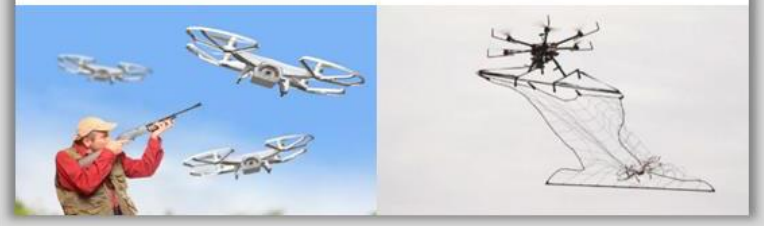


- **Barriers to enter into new market due to opposition from old industries**
- **e.g. : carpool app vs. taxi**



Regulation Issue

- Regulations relatively stricter than advanced countries make it difficult to introduce innovative services.
- e.g. : flight zone and time in drone



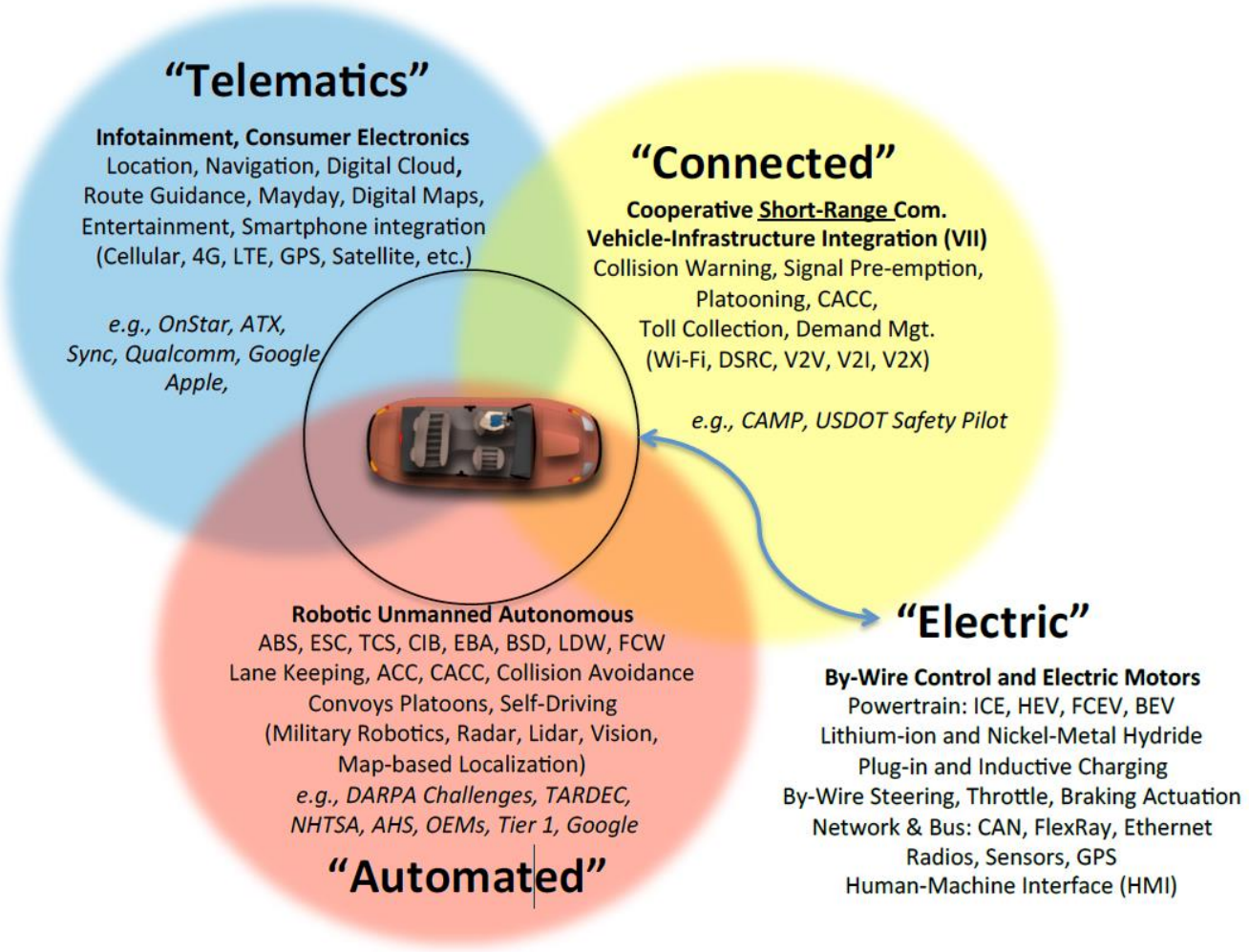
Data-Sharing Issue

- Public use of data can be undermined due to privatization and commercialization of data such as transport pass data, base station data.
- Transport card data and cell phone location date cannot be used for public purpose due to privatization
- However, the data are produce by citizens

2. New Technologies

Challenge in Automotive

- Connected, automated, and electric functions in future vehicles



Source: Steven Underwood, Automated, Connected, and Electric Vehicle Systems

Challenge in Transport

Electrification

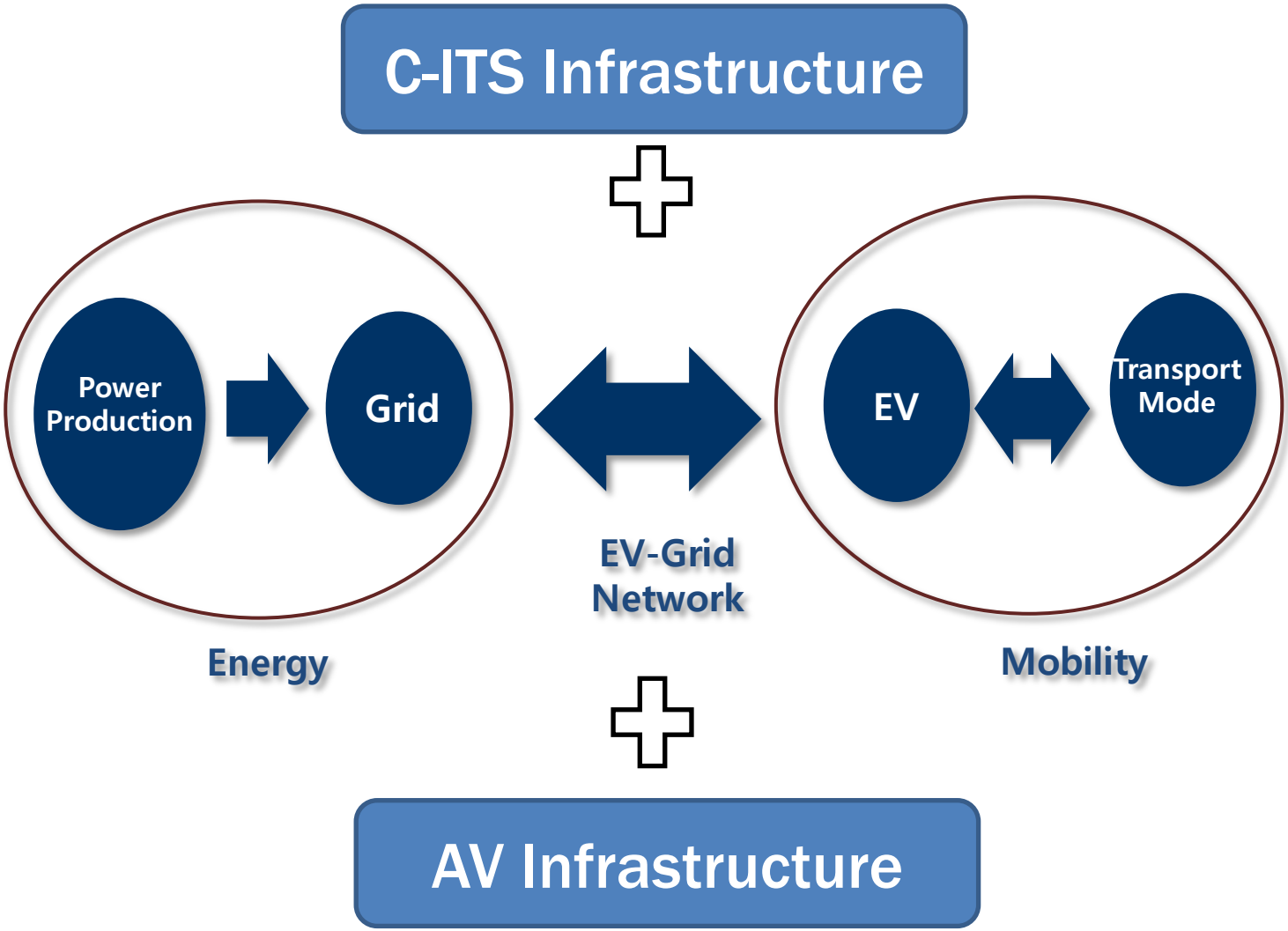
Automation

Mobility Integration

Big Data

Challenge in Infrastructure

- New infrastructure and connection



Challenge in Public Transit Service from Electric Bus

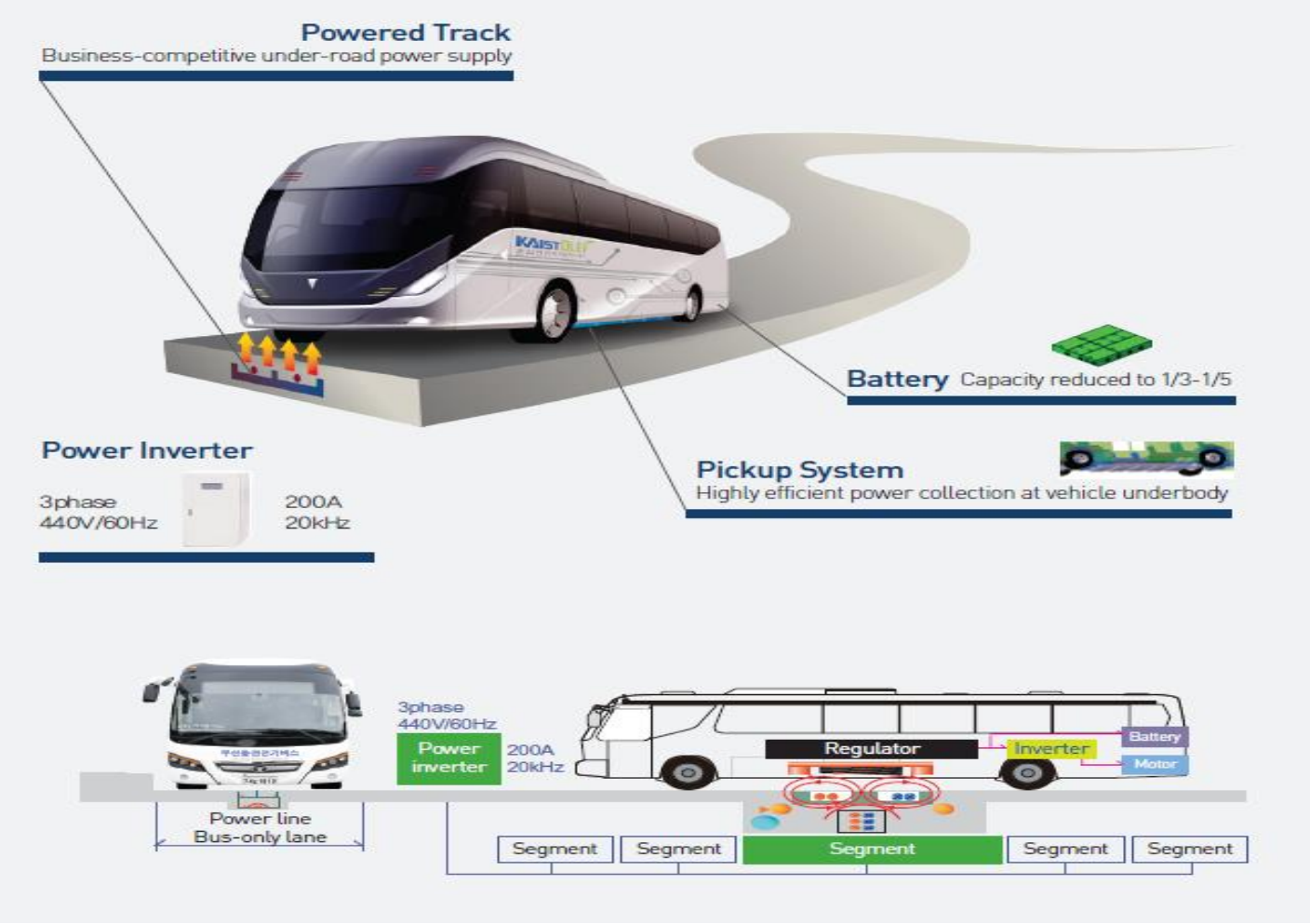
- Started developing electric buses to reduce 30% of the country's greenhouse-gas emissions by 2020
- Funded national R&D projects to develop electric buses and recently implemented them in three major cities
  - Plug-in electric bus
  - Wireless electric bus
  - Battery swiping electric bus

Plug-in Electric Bus

- Tested in downtown of Seoul city

Wireless Electric Bus

- Tested in Daejeon and Gumi cities



Battery Swapping Electric Bus

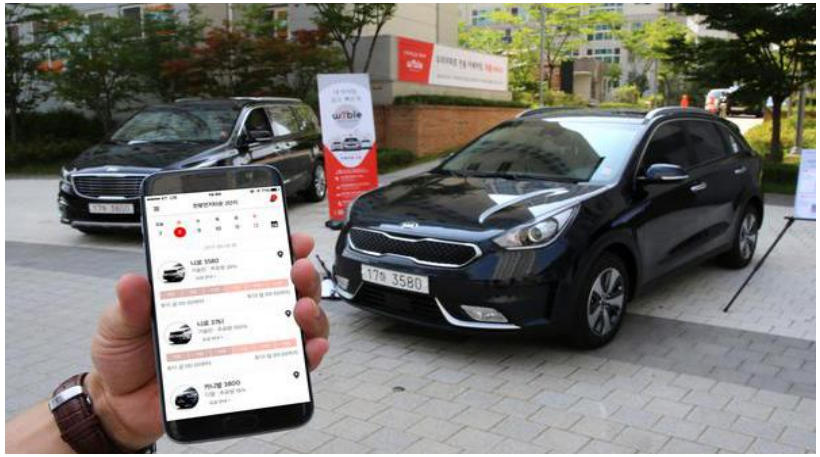
- Tested in Pohang city and has been running in Jeju

New Mobility as a Service

Automated Taxi

Electric Bus & Automated Shuttle

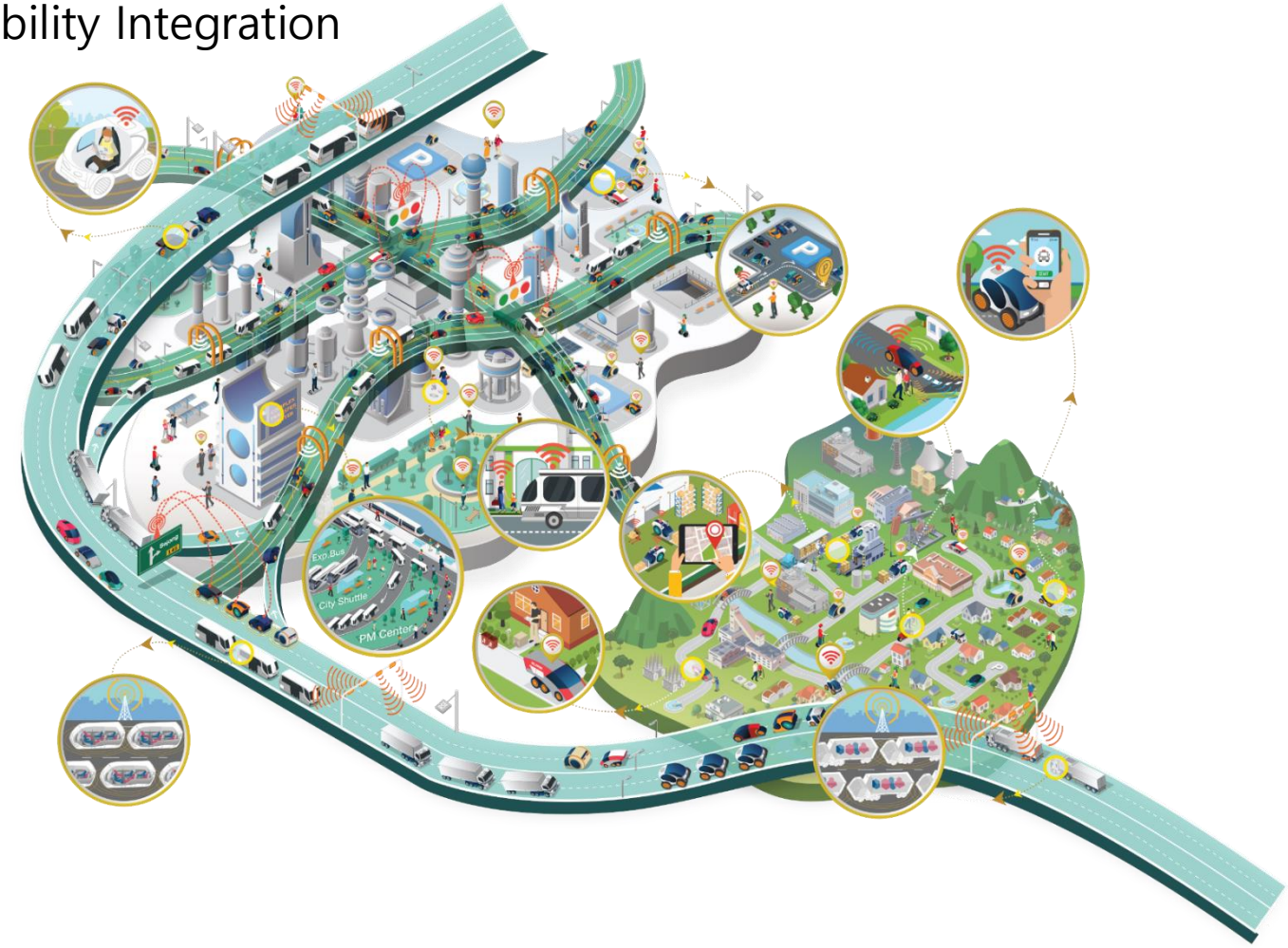
Car Sharing



3. Deployment of Smart Mobility

Direction for Smart Mobility

- Mobility Electrification
- Mobility Automation
- Mobility Integration



Mobility Electrification

- Various transport vehicles have been introduced


[Upright type]


[e-Bicycle]


[e-Motorcycle]


[Smart-Mobility]


[EV, FCEV, Hybrid]


[Automated e-Shuttle]

EasyMile

- Model (Year) : EZ10 (2015)
- Max speed : 40km/h
- No. of seats : 6
- Travel distance : 80km
- Travel time : 12hours
- Systems : Lidar, Camera, GPS

IBM-Watson IoT

- Model (Year) : Olli (2016)
- Max speed : 58km/h
- No. of seats : 6
- Travel distance : 3.48km/kWh
- Travel time : -
- Systems : Lidar, Camera, GPS

2getthere

- Model (Year) : ParkShuttle (2005)
- Max speed : 36km/h
- No. of seats : 12
- Travel distance : 75km
- Travel time : 6hours
- Systems : Detector

WEpods

- Model (Year) : WEpod (2015)
- Max speed : 40km/h
- No. of seats : 6
- Travel distance : 100km
- Travel time : -
- Systems : EZ10 + Radar, Laser

Navya

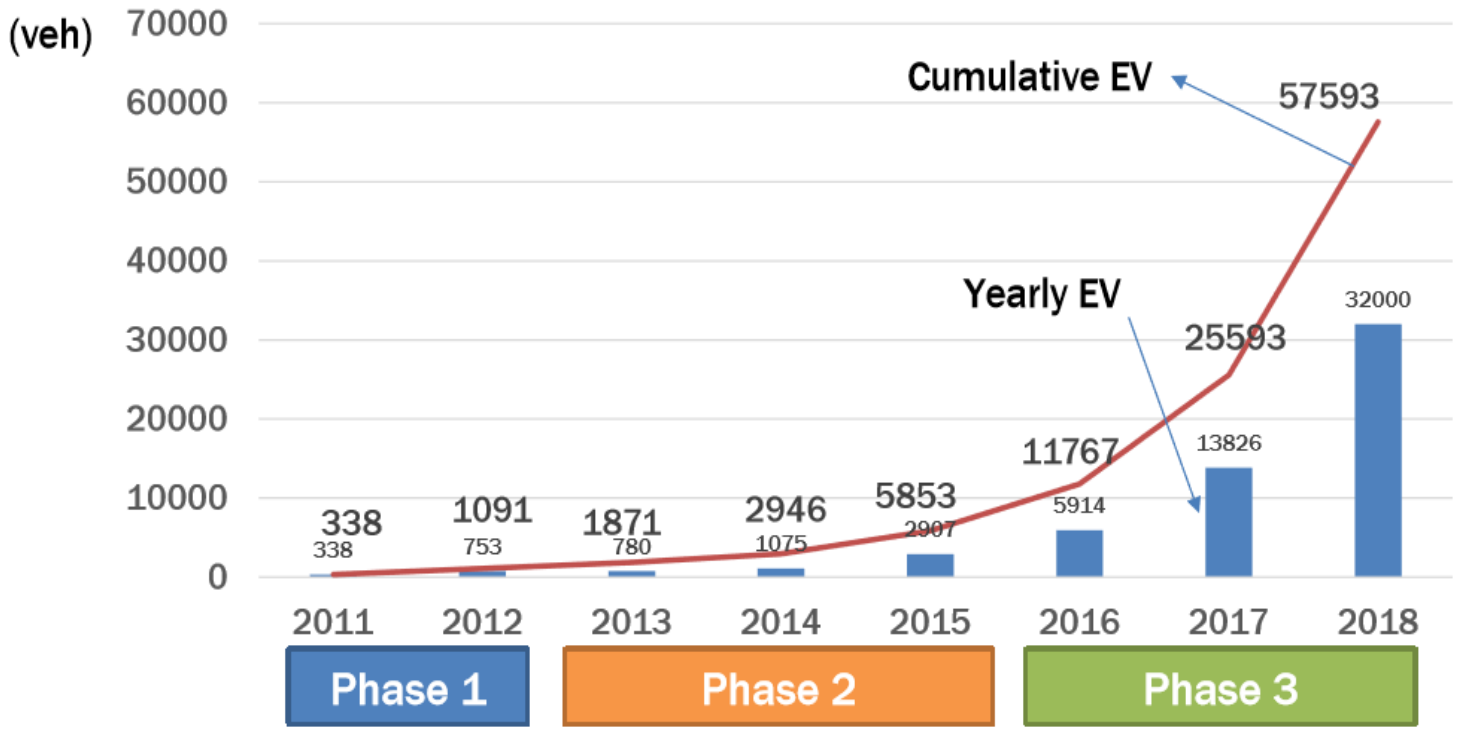
- Model (Year) : Arma (2015)
- Max speed : 45km/h
- No. of seats : 11
- Travel distance : -
- Travel time : 13hours
- Systems : Camera, Laser, GPS

Robosoft

- Model (Year) : robuCITY (2014)
- Max speed : 32km/h
- No. of seats : 6
- Travel distance : -
- Travel time : -
- Systems : Lidar, Camera, GPS

Electric vehicles

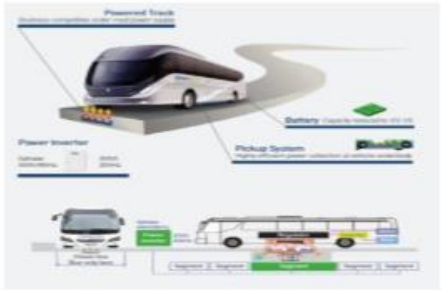
- Registered EVs
  - Increased rapidly since 2016
  - Because of improved EV performance, subsidy, and charging infrastructure



	2011	2012	2013	2014	2015	2016	2017	2018
# of OEM	5	4	4	6	6	6	5	9
# of EV Models	5	4	4	6	6	7	6	22

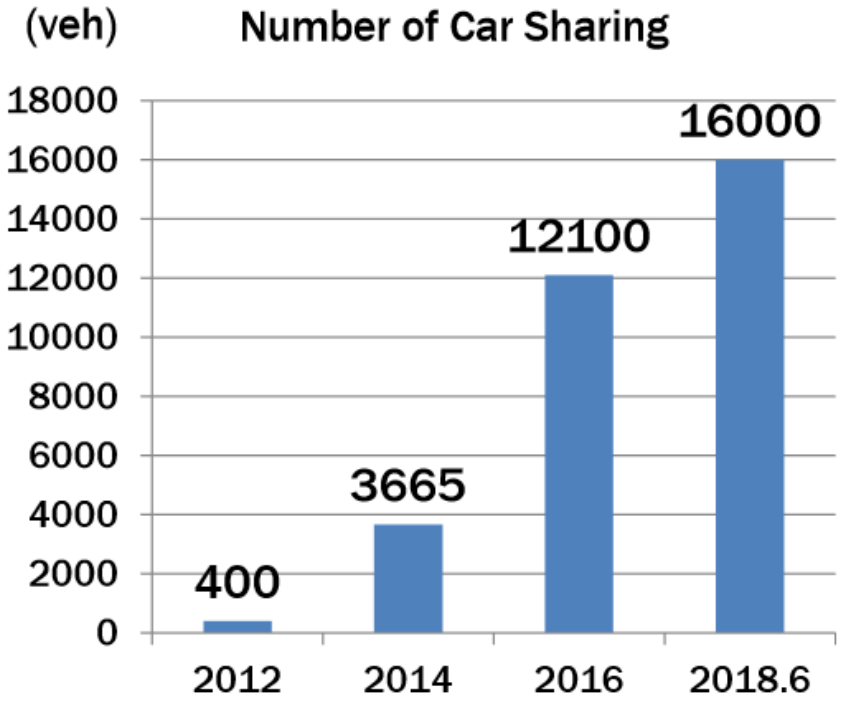
Electric vehicles

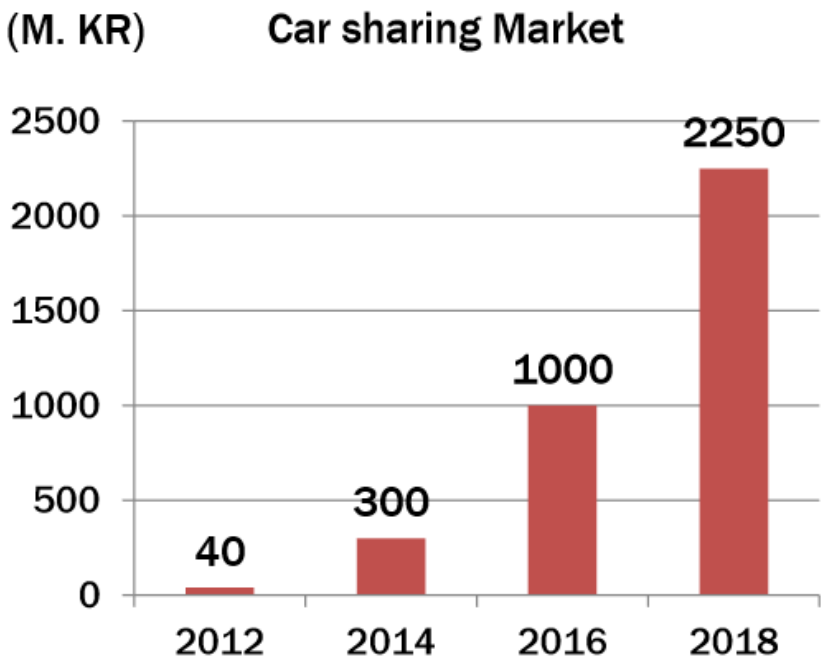
- Electric Buses
  - 3 types of electric buses



New Business in EV

- Car sharing business
  - Main business model proposed for EV
  - Emerging mobility market in Korea





Automated Driving System




Level	기존	2015	2016	2017	2018	2019	2020	2022	2024	2026	2028	2030
Level5 Full Automation												
Level4 High Automation												
Level3 Conditional Automation												
Level2 Partial Automation												
Level1 Driver Assistance	ACC, S&G, PA, LKA											
Level0 Driver Assistance & ADAS beyond human Capability to act	LCA, PDC, LDW, FCW, Emergency brake, ABS, ESC, DSR											

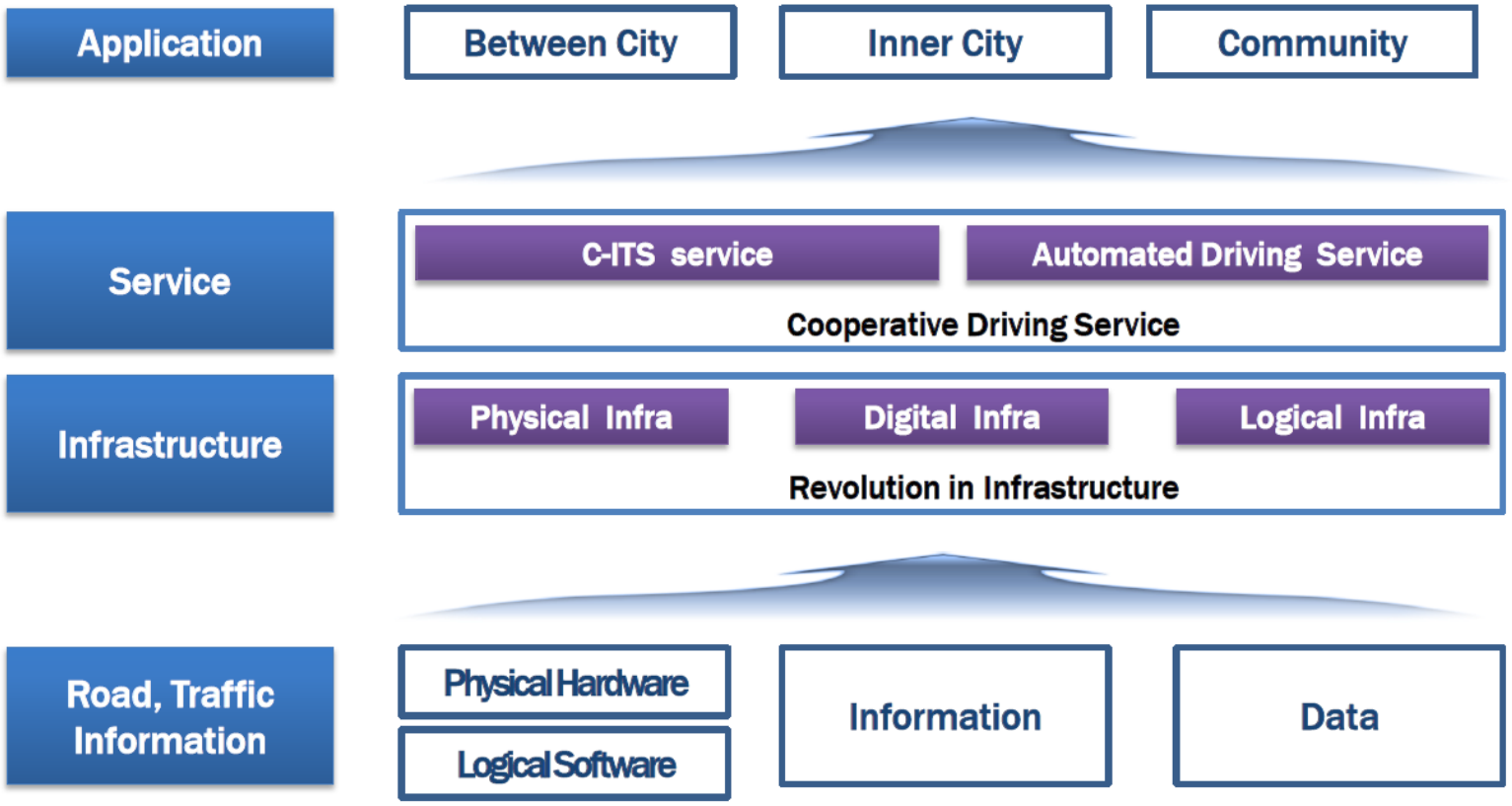
Policy for Mobility Automation

- Connected & Automated Driving

Source: Ministry of land and transportation, Autonomous Vehicle Policy of Korea, 2016.5

Automated Driving Infrastructure

- Digitalized infrastructure for AV



K-city for Mobility Automation

- K-city has been built for testing automated vehicle safety functions

C-ITS Pilot Deployment

- Deployed in a road section of 18km between Sejong and Dajeon
  - Tested for 15 scenarios
  - 3,000 drivers

Categories	Services	Road Types			Time			Tech.
		Free-way	N-road	U-road	'14	'15	'16	
Cooperative Traffic Management	Location-based vehicle data collection	O	O	O	O	O	O	V2I
	Location-based traffic information provision	O	O	O	O	O	O	
	Smart tolling with multi-lanes and non-stop	O				O	O	
Safe Driving Support	Road hazard zone driving	O	O	O		O	O	
	Road surface-weather information	O	O	O		O	O	
	Work zone driving	O	O	O		O	O	
Intersection Driving Support	Signal information provision		O	O			O	
	Intersection collision prevention		O	O			O	
Public Transp. Commercial Vehicles	Public transp. Management	O	O	O		O	O	
	Commercial vehicle management		O	O			O	
Transportation poor	School/Silver zone warning		O	O			O	
	Pedestrian collision prevention		O	O			O	
Designed Tested Services	Car Crash Prevention	O	O	O			O	V2V
	Emergency vehicle priority	O	O	O			O	
	Emergency call	O	O	O			O	

C-ITS Pilot Deployment

- 15 Services in Korea

01. Prove Data Collection

Location based probe data collection

02. Location Base Traveler Information Service

Location based traveler information service such as VMS (12V)

03. Smart Tolling (Multi Lane Free Flow Tolling)

Multi lane free flow toll collection based on DSRC (WAVE)

04. Road Hazard Warning

Radar detector recognizes obstacies on the road then broadcasting warning messages via RSE

05. RWIS (Road Weather Information System)

Microscopic road weather & surface condition information service via RSE

06. Work Zone Warning

Broadcasting work zone warning via 12V, V2V

07. Red Light Violation Warning

Detecting red light violation cars then broadcasting caution warning

08. Right Turn Assist

Notifies a driver who is attempting to make a right turn when it is not safe to proceed

09. Bus Management

Fleets monitoring system via DSRC collecting locations and violating conditions

10. School Bus Warning

Broadcasting boarding or alighting condition from the school bus

11. School Zone Safety

Alerting school zone and advising recommended speed

12. Pedestrain Warning

Warns a driver when pedestrians are near a crosswalk

13. FCW / EEBL

Warns a driver when the front vehicle makes hard breaking or stopping

14. EV Approaching Warning

The emergency vehicle broadcasts its conditions for priority

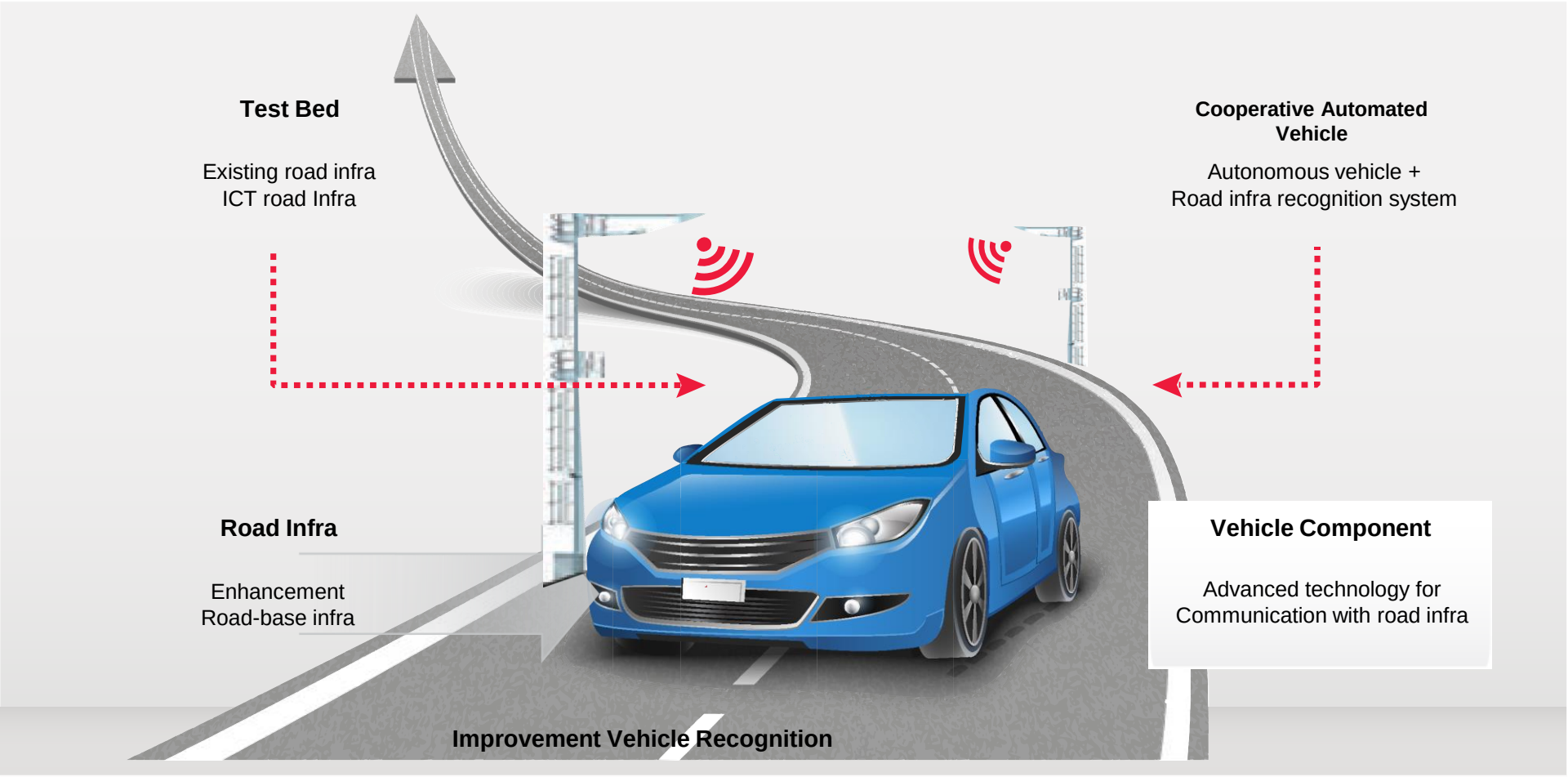
15. Emergency Warning

The broken car broadcasts its conditions to prevent secondary accidents

Source : Ministry of land and transportation, Introduction of Korean ITS

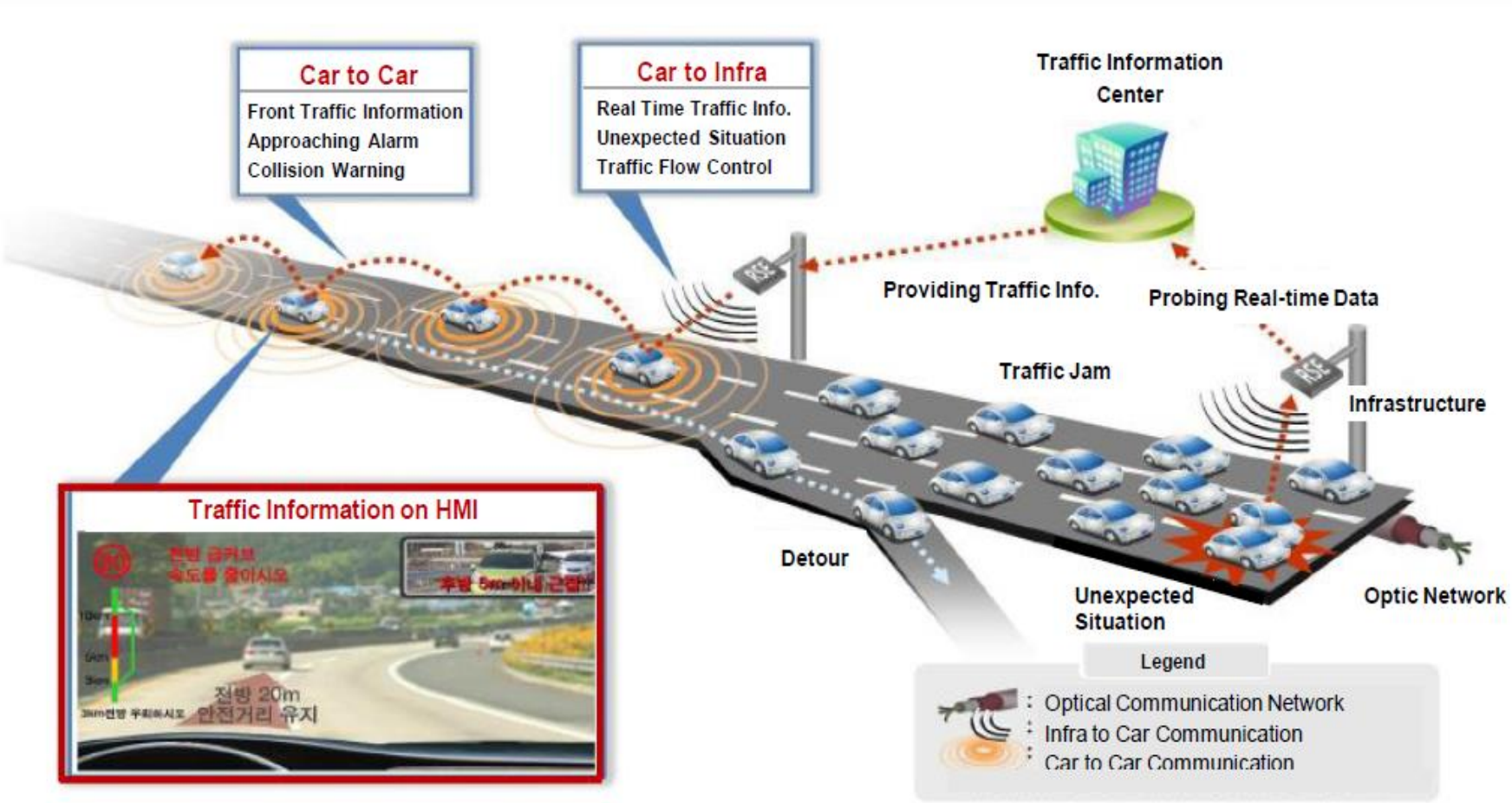
Cooperative Automated Driving Roadway System

- R&D Projects for automated driving systems



Cooperative Automated Driving Roadway System

- V2V, V2I, V2P Wireless Communications + Intelligent Transport Systems



Mobility Integration

“ Integrated Mobility ”

Mobility Service based on ICT technologies

On-demand, Door-to-Door Service

(Frost & Sullivan, 2016)

Intermodal Transportation

+

ICT Technology

e.g., wireless Comm., smart devices, (Big) data mining

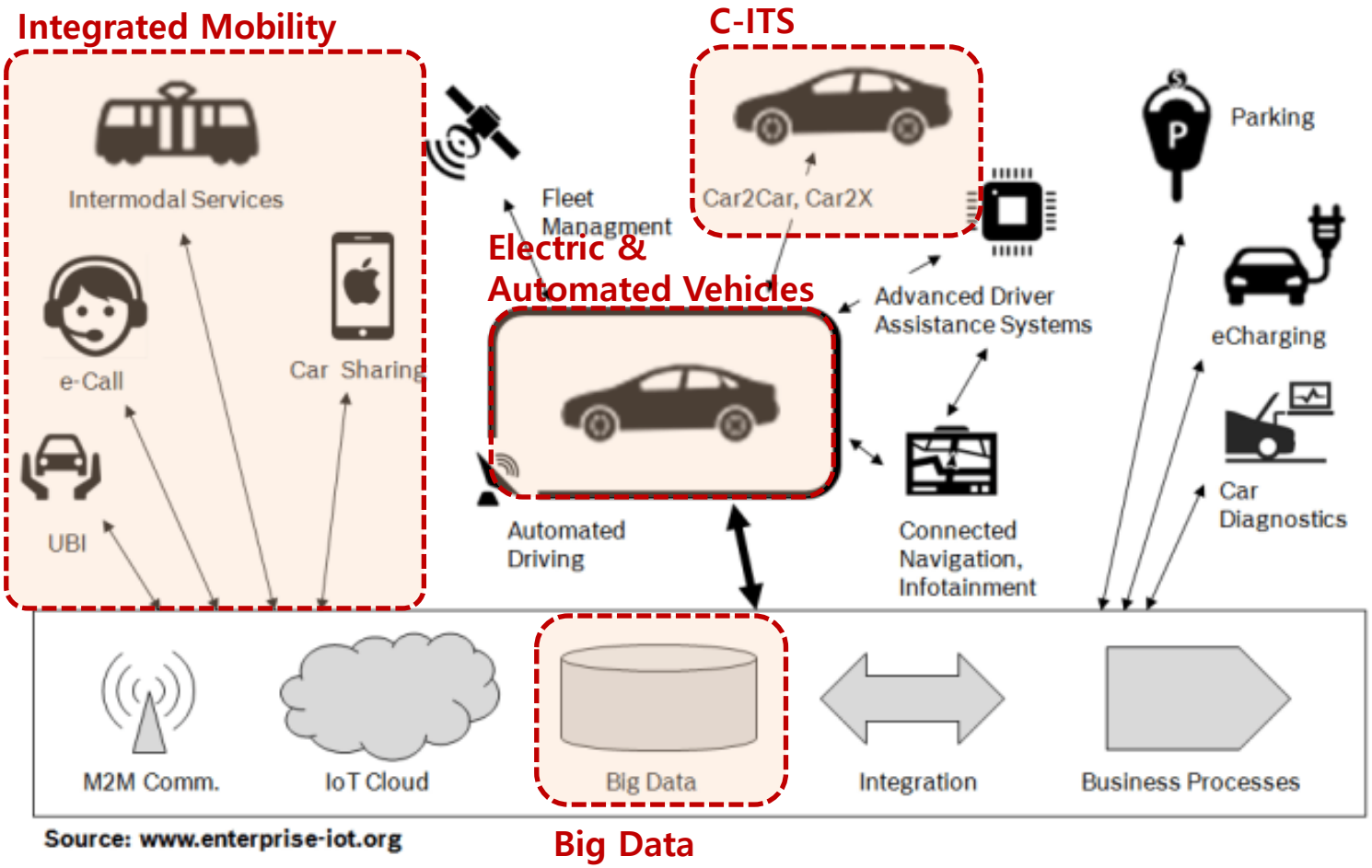
+

New Mobility System

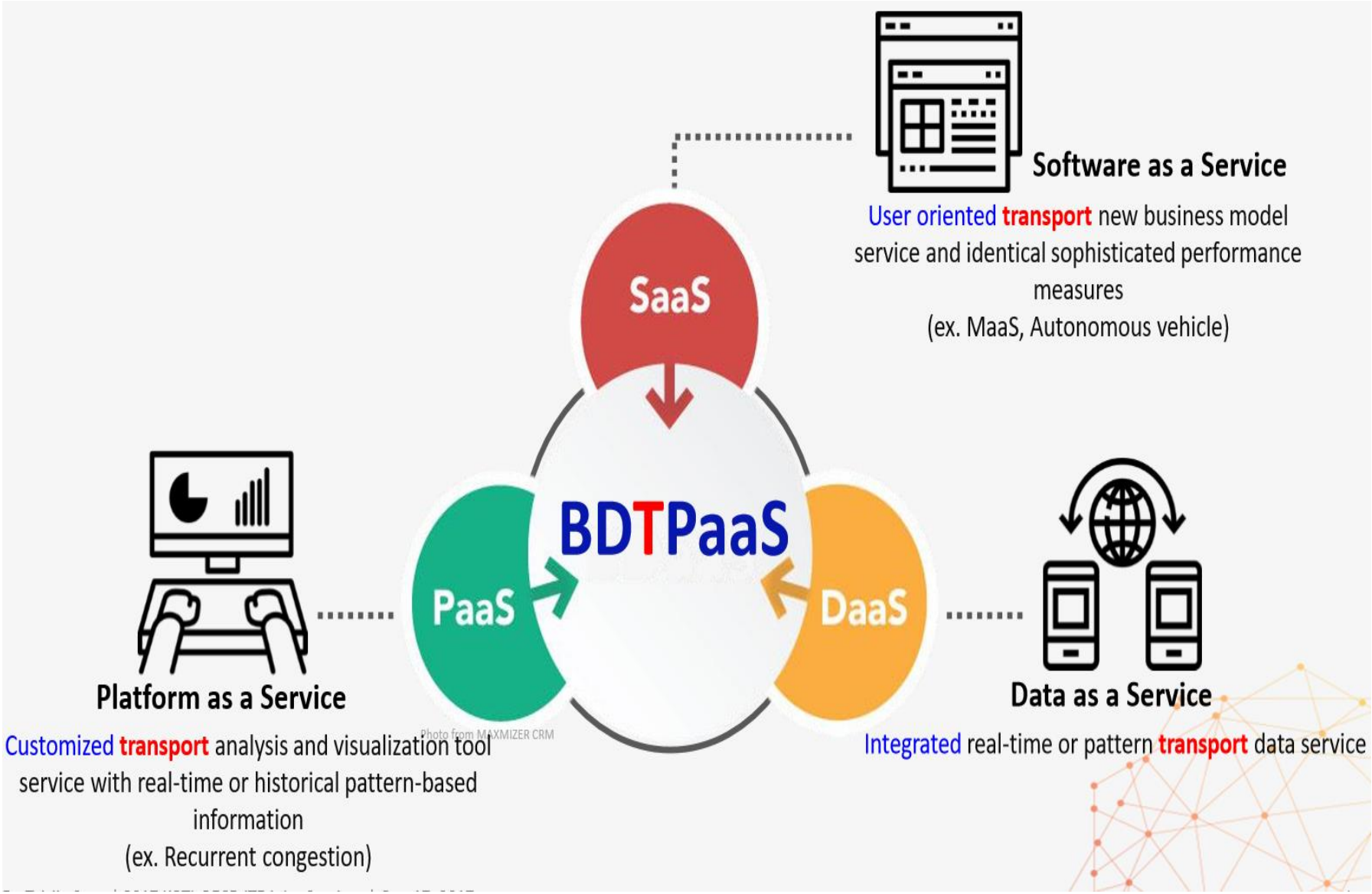
e.g., e-Mobility, AV

Core Components

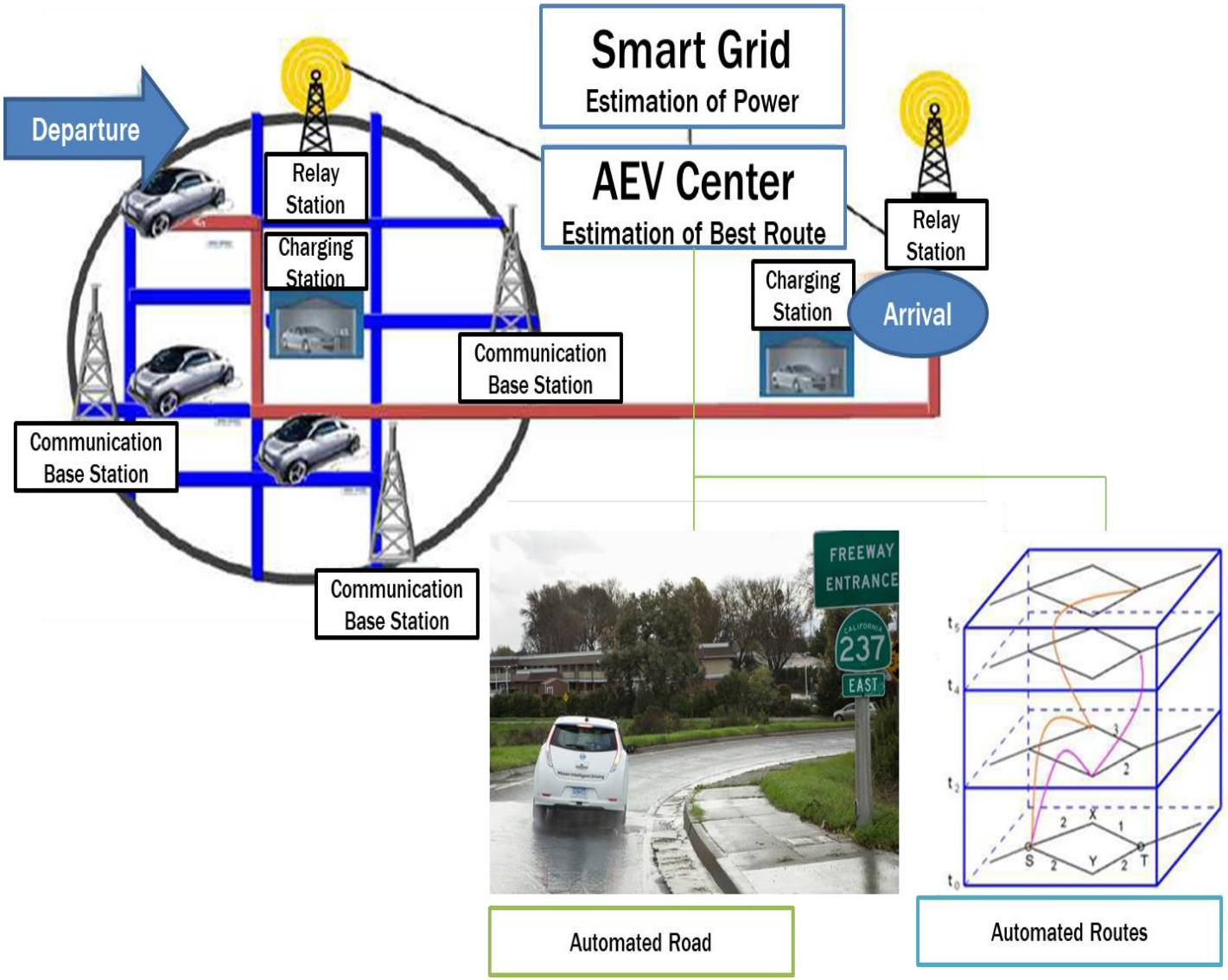
- Cooperation and integration for smart mobility



New Platform for Mobility



System Integration for New Mobility



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