An Advanced Vehicle Gateway with Data Collecting Vehicle Domain Service

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Overview

- Background
- Definition and scope
- Data interface and service variations
- Smart traffic services and VDS
- Smart city information model by systematic approach
- Schedule and status

Background

- ▪ Spread of Information and Communication Technologies

  - Recently information and the communication technology evolved with the explosive spread of smartphones drastically.

  - The communication speeded up, cameras and the sensing devices became high definition and as for the CPU, an expressway became high-performance. The spread and increased production of these devices accelerated the cost reduction.

- ▪ Expected evolution of vehicle ICT

  - The introduction of these to vehicles are expected by the generalized information and communication technology and spread of cost reduced devices.

  - Particularly, the introduction of the information and communication technology about driving movement will be expected to complement a conventional incomplete domain, and to realize safer, more effective and multifunctional driving.

Definition of VDS

▪ Definition of Vehicle Domain System

- Data collection server service implemented in vehicle
- Data collecting application, to get safety or function relevant information from driving group partners around the server vehicle by itself without additional infrastructure data service.

Driving group partners
- Vehicles
- Walkers
- Bikes

Partner application

Communication channel

Vehicle server

VDS application
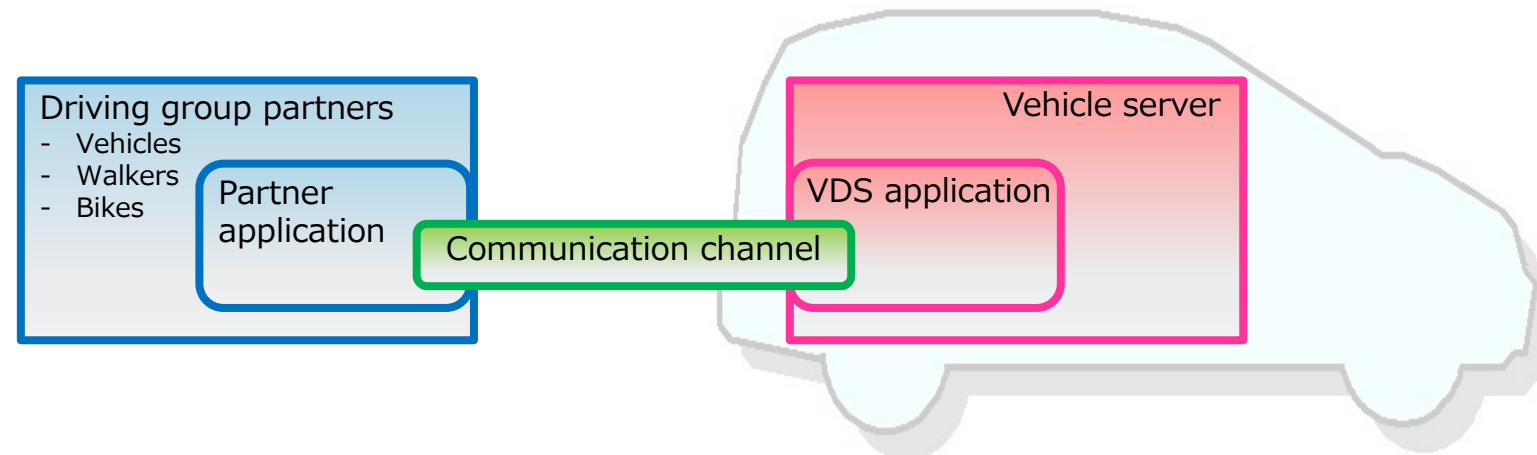
VDS function overview

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Actors within vehicle domain

- Basic actors of vehicle domain

- In the vehicle domain area, there are various traffic participants. They are registered as actors of vehicle domain.

- Domain vehicles are most typical actors.

- The other traffic participants, such as walkers and bicycles are also within the vehicle domain. They are registered as domain participants.

Domain vehicle 2

Domain participants 1

Domain participants 2

Vehicle domain

Master vehicle

Domain vehicle 3

Domain vehicle 1

Domain participants 3

Actors of vehicle domain

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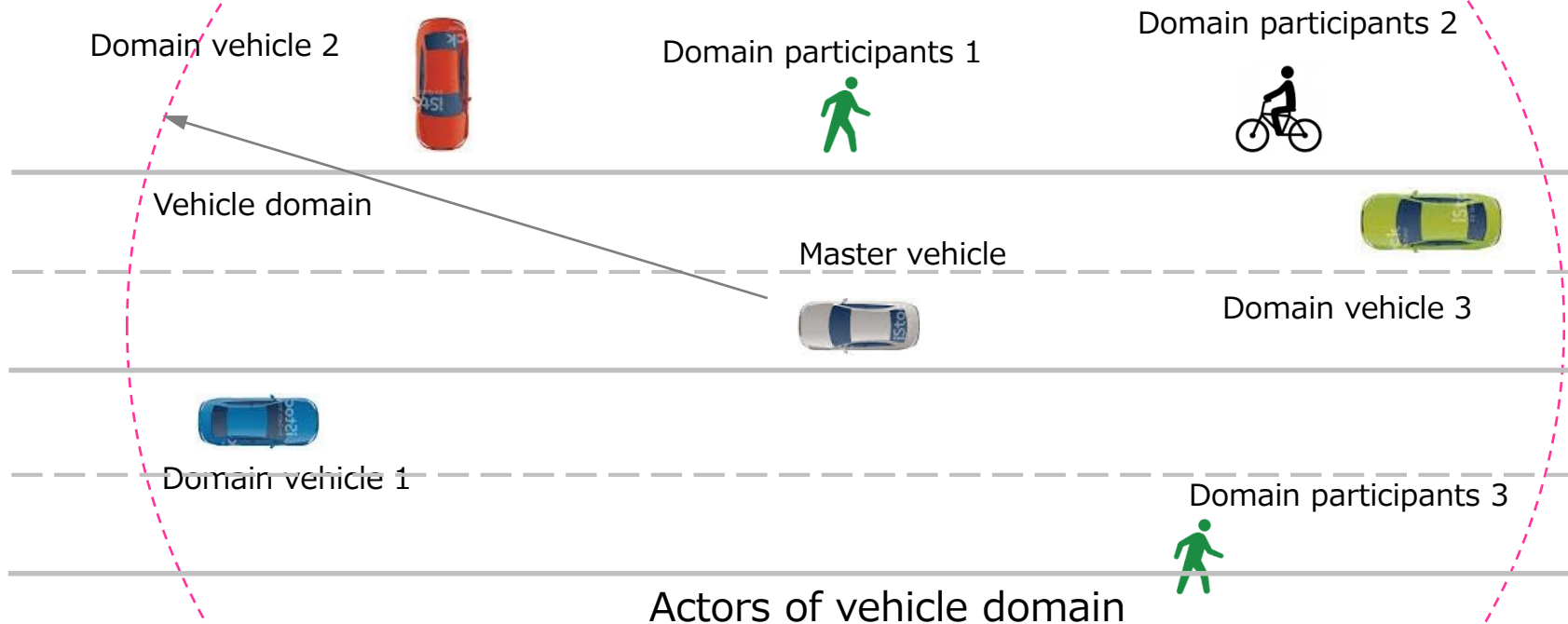
Supplemental actors in vehicle domain

- Sensors in vehicle domain

- In order to complete the map of domain actors, silent participants shall be covered. They will be captured by domain sensor participants and reported to master vehicle.
- Typical domain sensor is the other side of the most intelligent domain vehicle.
- The actor of exclusive sensors could exist.

Domain vehicle 2

Domain participants 1

Domain participants 2

Domain sensor 2

Vehicle domain

Master vehicle

Domain vehicle 3

Domain sensor 1

Domain vehicle 1

Domain participants 3

Actors of vehicle domain

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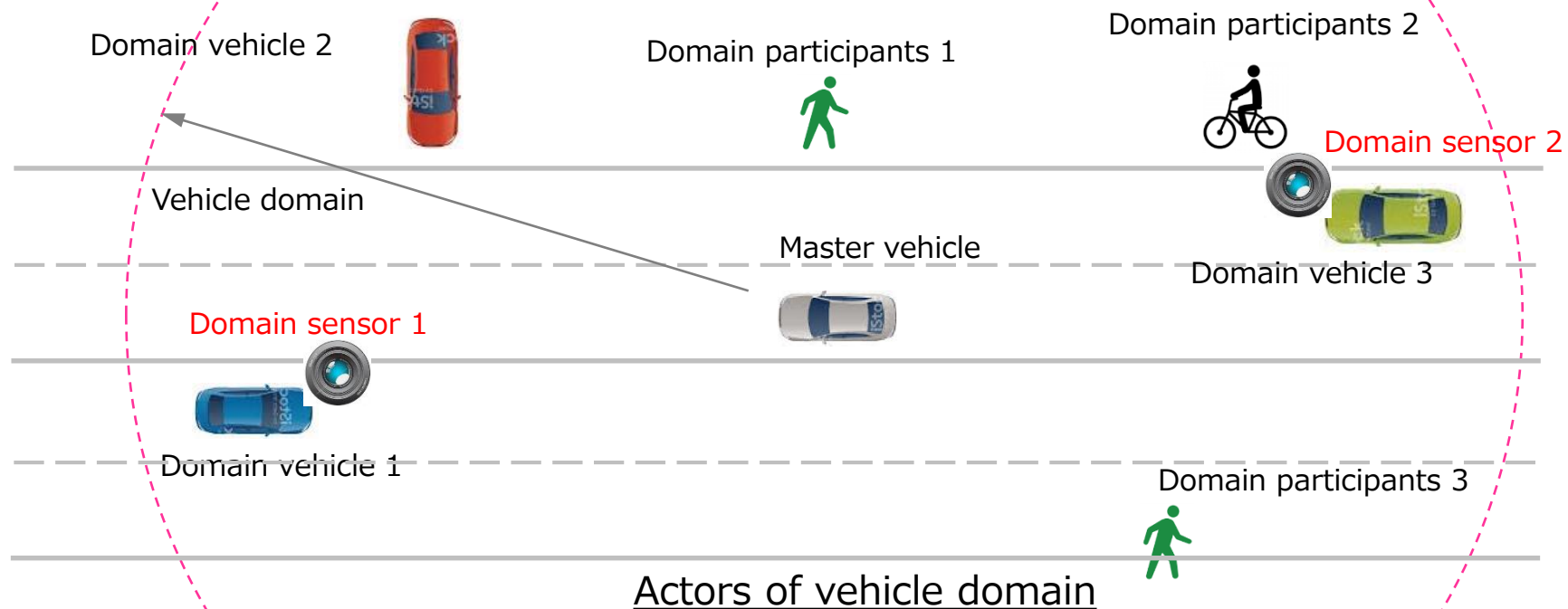
# Data calibration by master time synchronization

- **Reporting data shall be calibrated by time synchronization**
- Master vehicle generates the domain master time for data synchronization. It will request the calibrated data based on synchronized time to all actors.

Vehicle domain

Master vehicle

Domain vehicle 2
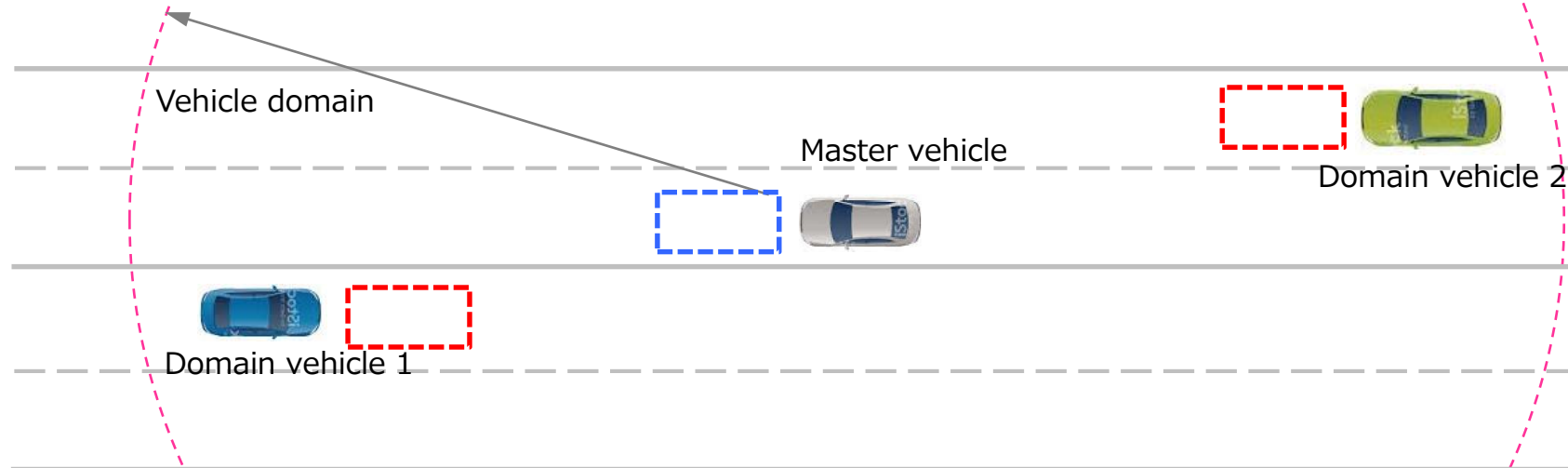
Domain vehicle 1

Data calibration by VDS master time synchronization

Driving maneuver within operation domain

▪ Vehicle domain for driving maneuver have two areas

- It consists of preparation and operation domain.
- Vehicle domain system shall define only the method of data exchange and negotiation sequences.

Vehicle domain

Operation

Preparation   Master vehicle

Domain vehicle

Typical driving maneuver example of lane change

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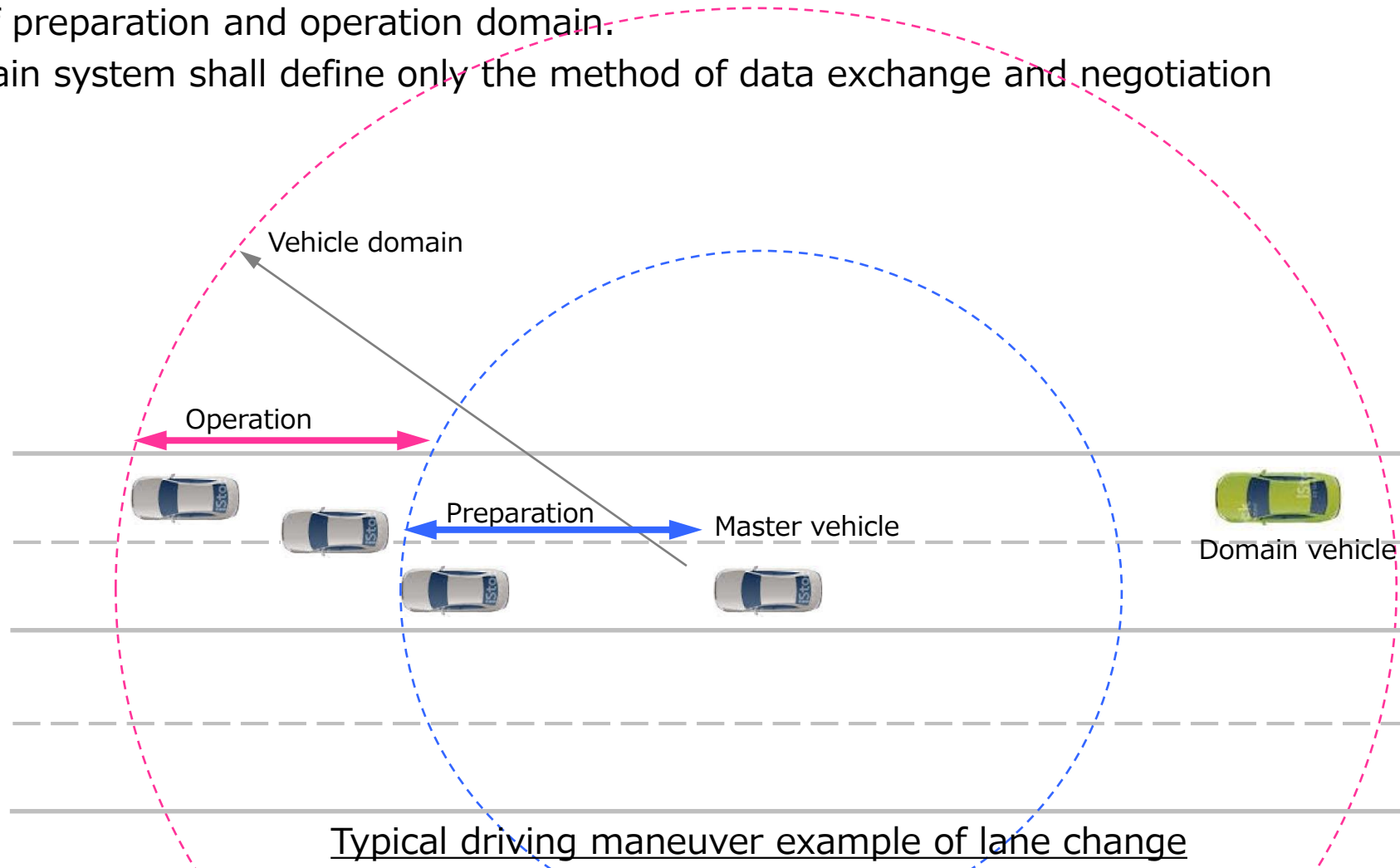
Reference time generation in operation domain

▪ Master vehicle generates reference time

- In order to collect data within operation domain, master vehicle generates reference time steps for data synchronization.

Vehicle domain

Synchronization Time Steps

Master vehicle

Domain vehicle

Typical driving maneuver example of lane change

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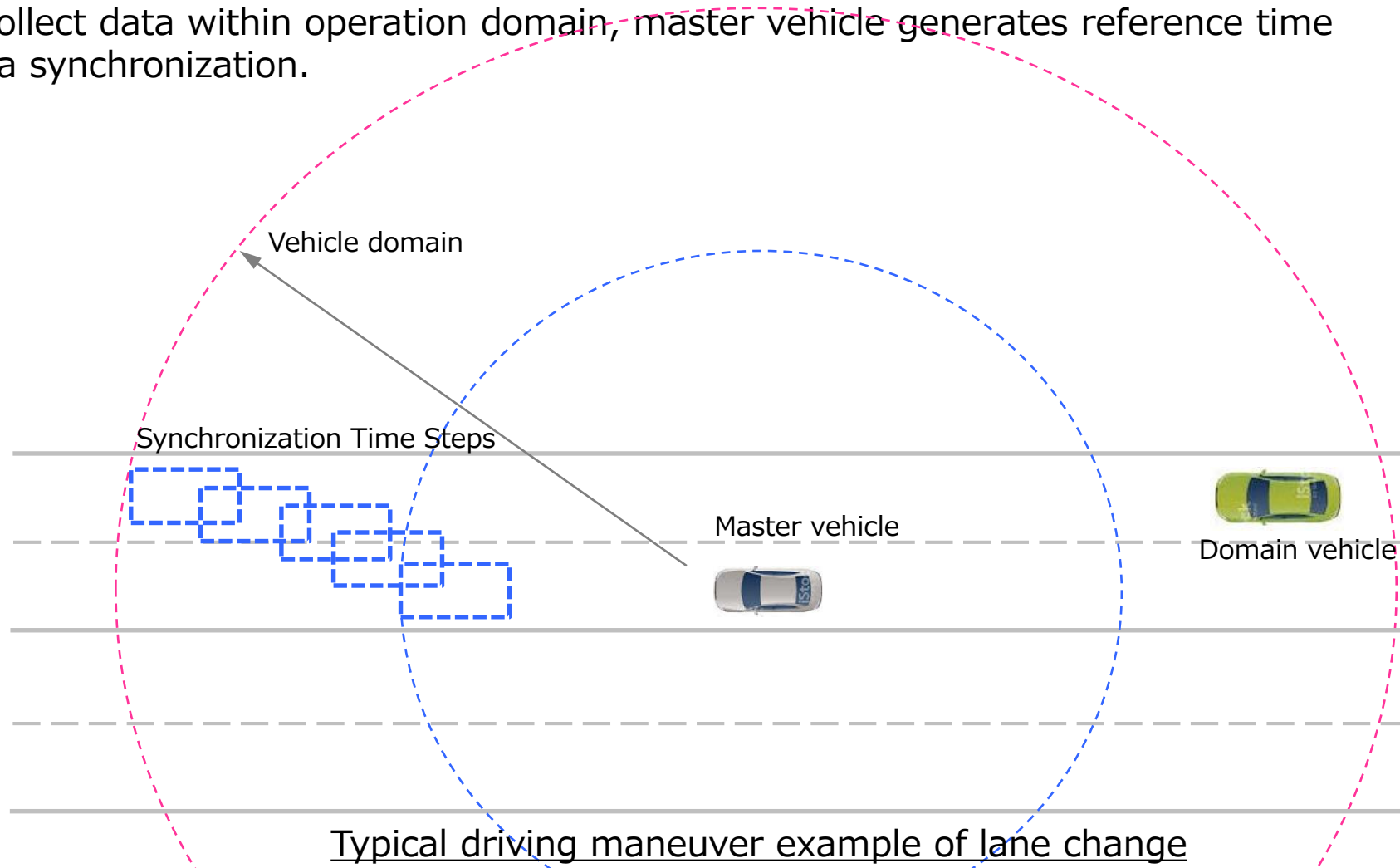
Calibrated data collection of driving maneuver

- **Master vehicle collects the calibrated data**
- Master vehicle requests relevant data for maneuver negotiation to target domain vehicle with generated reference stepped time.
- Domain vehicle will report the calibrated data.
- Maneuver plan will be adjusted with target domain vehicle, if necessary.

Vehicle domain

Synchronization request

Synchronized response

Master vehicle

Domain vehicle
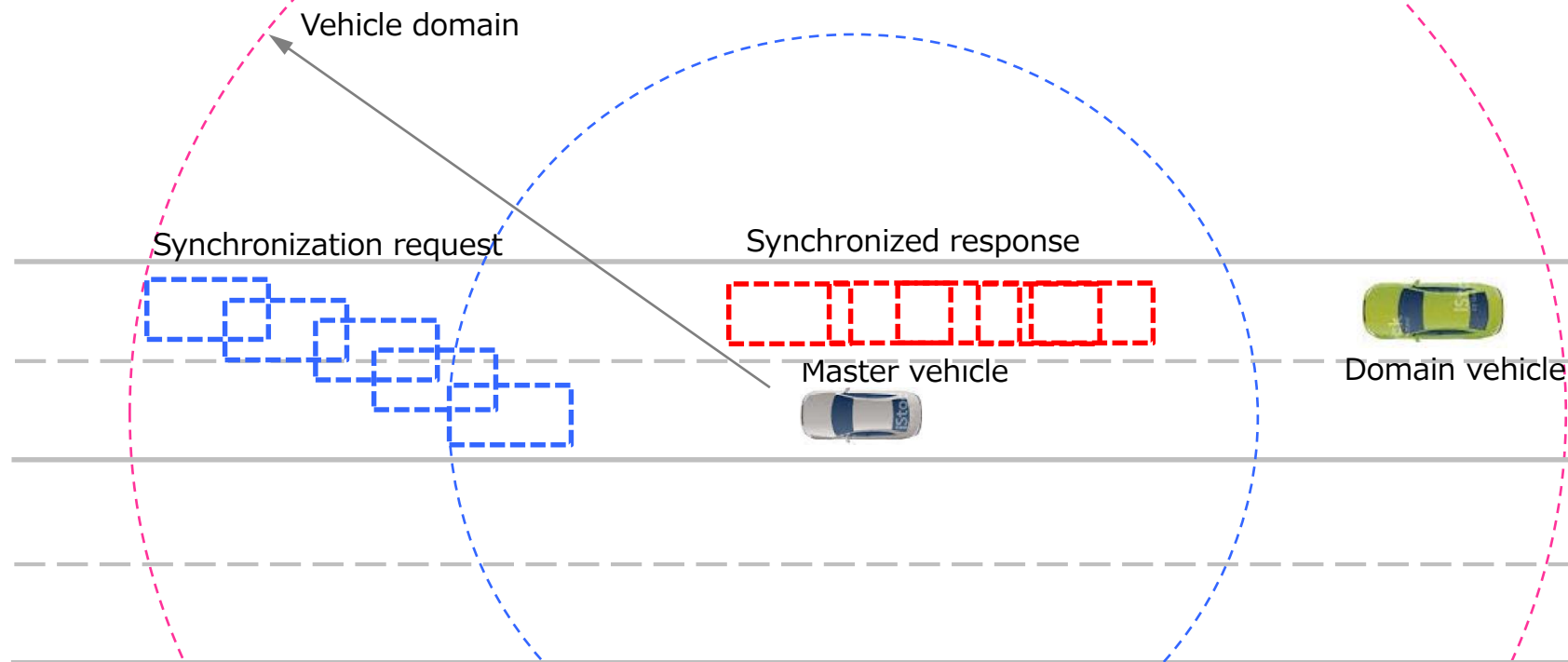
Typical calibrated response for driving maneuver negotiation

Smart city information exchanges modeled by systematic approach

- **Systematic approach will generalize the functions in smart city.**
  - Whole of explicit functions and implicit rules are generalized to be modeled.
  - Modeling will be performed in use case definitions.

- **Use cases are located on geography and classified on business.**
  - Geographical scale covers from home to country.
  - Business domain covers from customer to centralized management.

Introduction of smart traffic architecture model proposal

- Definition of Smart Traffic Architecture Model proposal
- Horizontal axis; customer, commercial&consumer, business, public and central traffic manager
- Vertical axis; home, town&street, city, state&intercity and country
- Various business use cases will be located in each business domain.

Function / Area	Traffic manager	Public	Business	Commercial /Consumer	Customer
Country	Local Dynamic Map Server				
State / Inter-city	Smart City Traffic Manager		Logistics Transport Manager		ITS Information Service
City	Traffic Operator	Bus Monitor Manager LRT Monitor Manager		TAXI Management	
Town / Street	Traffic Monitor		Baggage Delivery Food Delivery	Car sharing Service	OEM Telematics
Home					

VDS allocation in smart traffic architecture model

▪ Vehicle domain service is located in STAMp

- VDS will be located from home to city on geographical and customer to public in business
- VDS will be connected explicitly or implicitly with other services

Function / Area	Traffic manager	Public	Business	Commercial /Consumer	Customer
Country	Local Dynamic Map Server				
State / Inter-city	Smart City Traffic Manager		Logistics Transport Manager		ITS Information Service
City	Traffic Operator	Bus Monitor Manager		TAXI	
Town / Street	Traffic Monitor	LR? Ma			
Home			Food Delivery		

Vehicle Domain Service

Advanced gateway functions enabled by VDS

- ▪ VDS as network services

  - VDS will collect information of all actors within its vehicle domain.
  - VDS will complete the instant actors map of vehicle domain.
  - VDS will issue the traffic monitor report including instant actors' map to be used other domain actors.

- ▪ VDS as advanced gateway

  - VDS is one of independent service space generated by VD service function.
  - At the same time, VDS will connects itself to other business domain networks in smart traffic.
  - Various services information will go through VDS connection.

ISO 23239 project status

- ## NWIP and AWI

- Discussion started in 7th ISO TC 22 / SC 31 data communication plenary meeting at VDA, Berlin in September 2017.
- NWIP was submitted to ISO-CS in November 2017.
- The proposal was approved in January 2018.

- ## New project and working group allocation

- The new project was started as ISO 23239, vehicle domain service.
- It was allocated under ISO TC 22 / SC 31 as the new WG 8.

- ## Liaison and harmonization

- Potential harmonization are under discussion with SAE and ISO TC 204 / WG3.
- Appreciated harmonization with ITU-T SG16 are in preparation.

Documents structure and development schedule

- ▪ Part 1:General system requirements and use case definitions
  - AWI: 2018-01~
  - WD is under development, CD will be expected in 2019-01~.

- ▪ Part 2:Application layer and sequence requirements
  - PWI: ~2018-10, NWIP: ~2019-06

- ▪ Part 3:Network and transport layer requirements
  - PWI: ~2018-10, NWIP: ~2019-06

- ▪ Part 4:Physical and data link layer requirements
  - PWI: ~2018-10, NWIP: ~2019-12

- ▪ Part 5:Conformance tests for data collection interfaces
  - PWI: ~2019-12, NWIP: 2020-06

The End

Thank you for attention!