

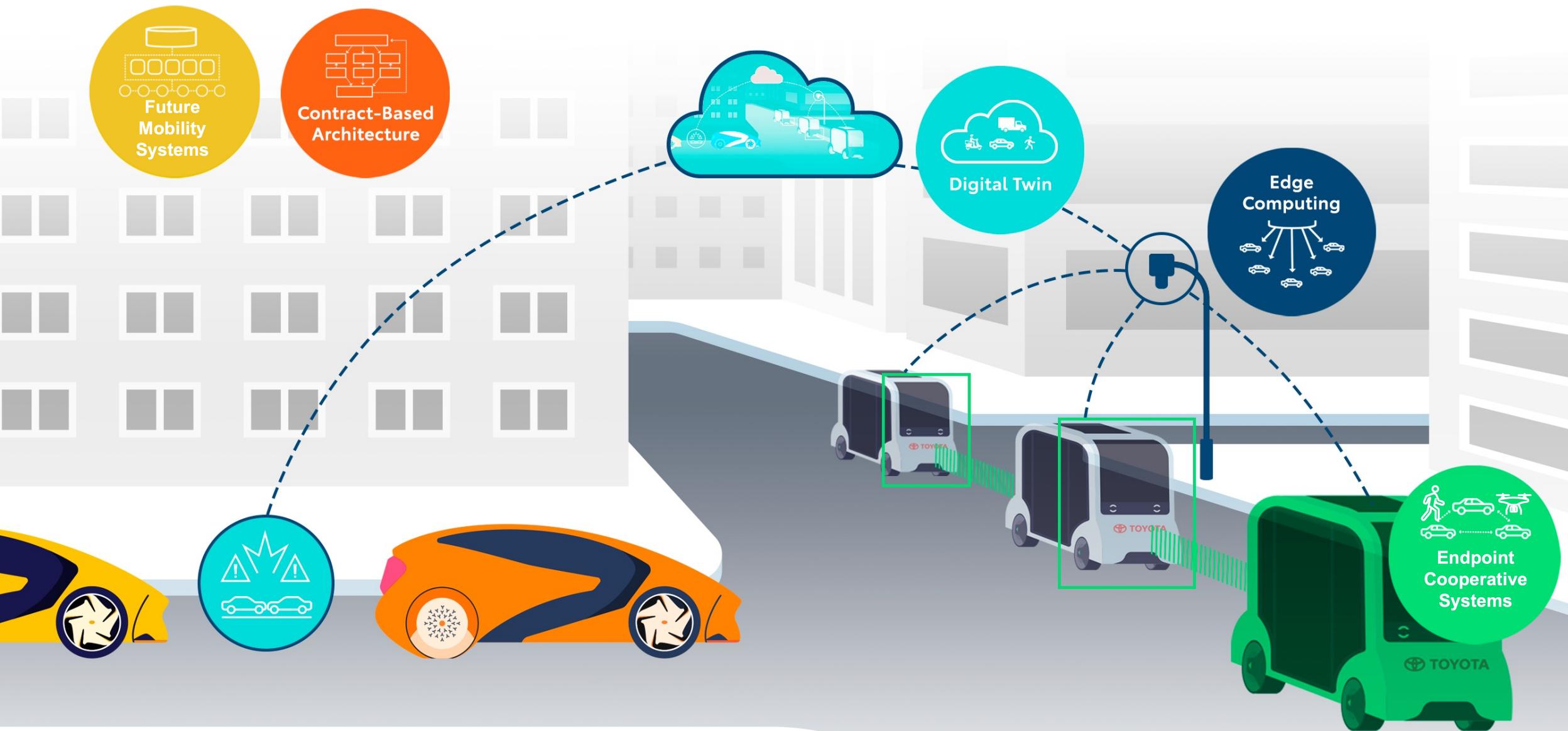
The Connected World

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5 Building Blocks towards End-to-End Connected Society ...



Future Mobility Systems

Purpose

Conduct applied research to define future mobility E2E connected system requirements & architecture

E2E System Requirements & Architecture

Cloud Layer



Mobility Service (Cloud)



ML

OTA Update

ML Models

E2E Integrated Testbed & PoCs

Revise

MSPF 2025+ Architecture

Cloud Components
Edge Components
Vehicle Components
API Components
...

Edge Layer

Emerging Services



Mobility Service (Edge)

High Def. Map

Cruise Assist



Mobility Service (Edge)

Emerging Services

High Def. Map

Telematics

Access Network

Vehicle Layer

Vehicle System

Connected Vehicle

DCM

Connected Vehicle

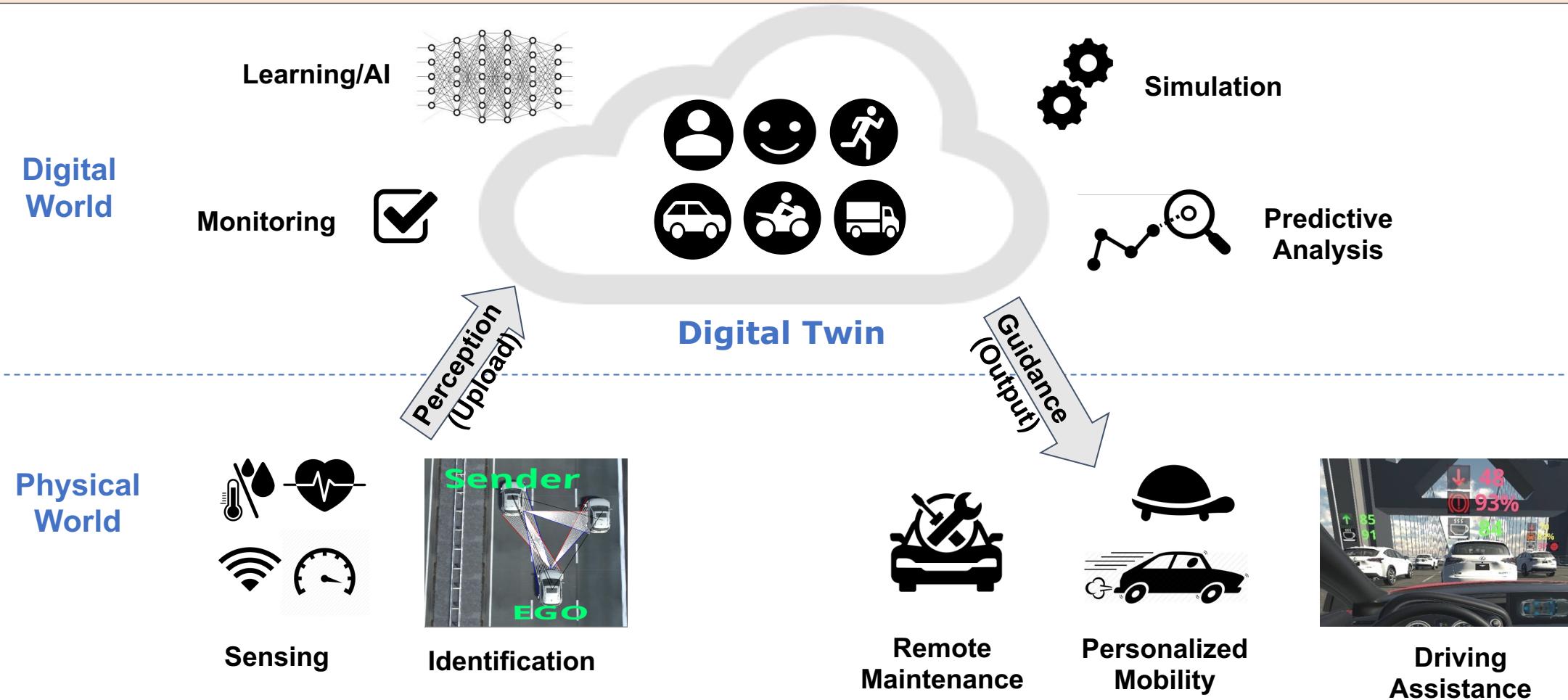
Connected Vehicle

DCM

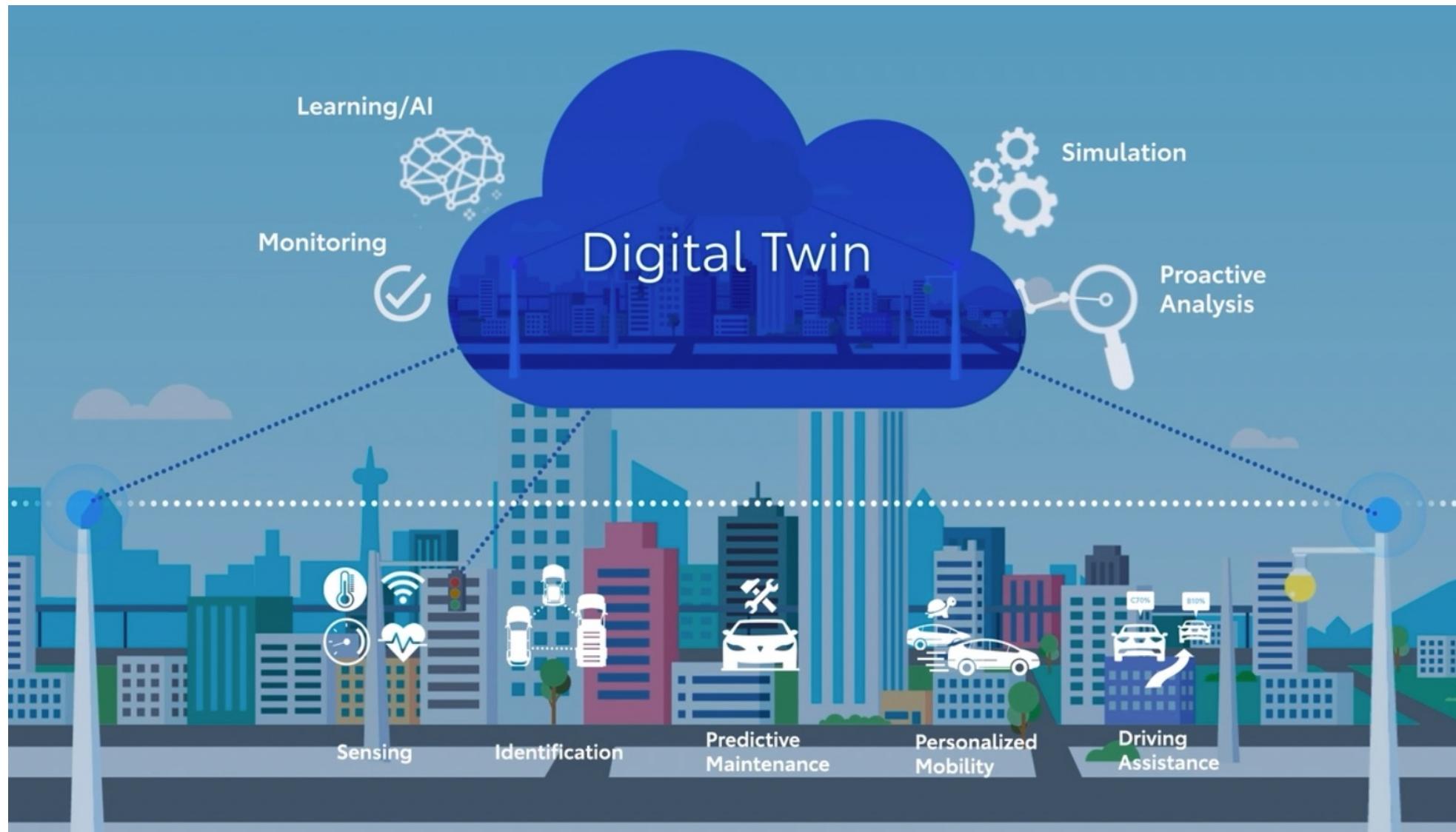
Digital Twin (also popular term “Cyber-Physical System”)

Purpose

Creating a digital footprint of car & human behavior for safer driving and future mobility platform services



Digital Twin Promotional Video



Personalized Adaptive Cruise Control + Edge/Cloud

Background

- Drivers **manually change** the adaptive cruise control gap setting
- 38% of drivers change the gap setting

Goal

- Design Personalized-ACC (P-ACC) to satisfy personal driving experience.

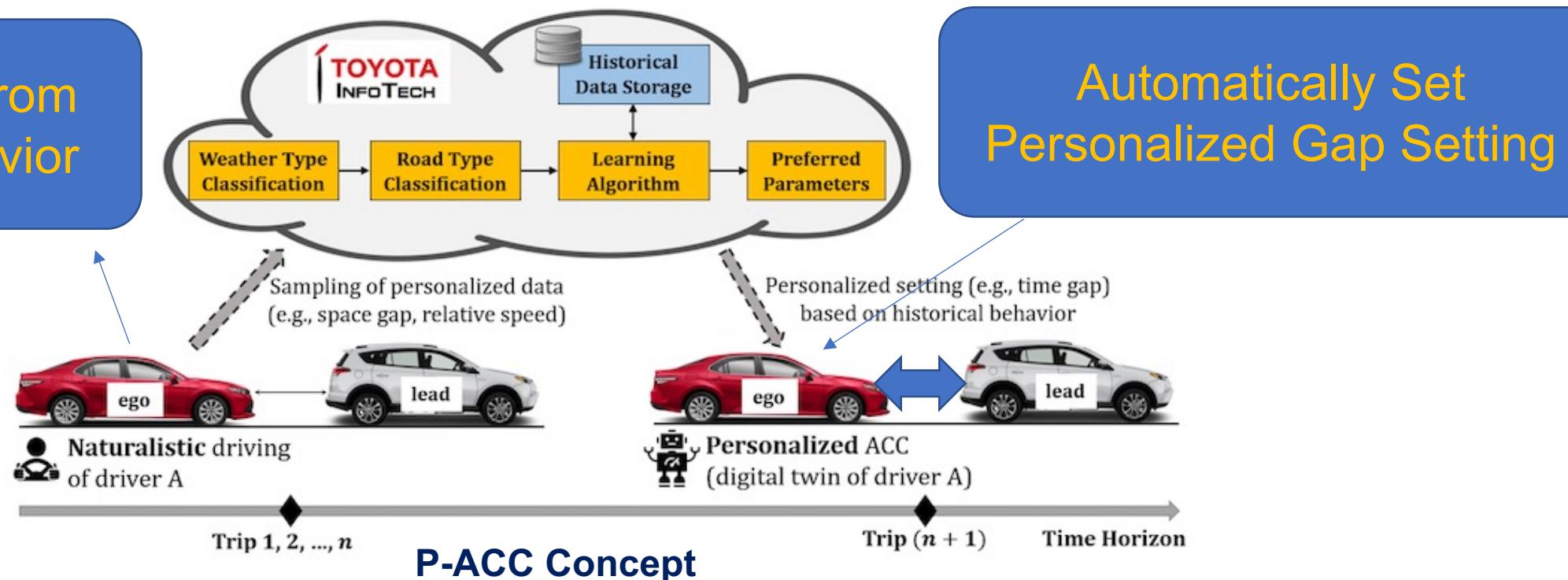
Methods

- Utilize Digital Twin Framework for car & human behavior
- Learn personal driving gap preference from driving data
- Applies the personalized setting to the actual vehicle accordingly

Accomplishment

- Vehicle-CCC Integration & Tested in ACM test track
- Product intercept targeting for TSS4/5

Learning from Past Behavior



Edge/Cloud + P-ACC Real-World Vehicle Demo

**Generate bulk data in
simulation**

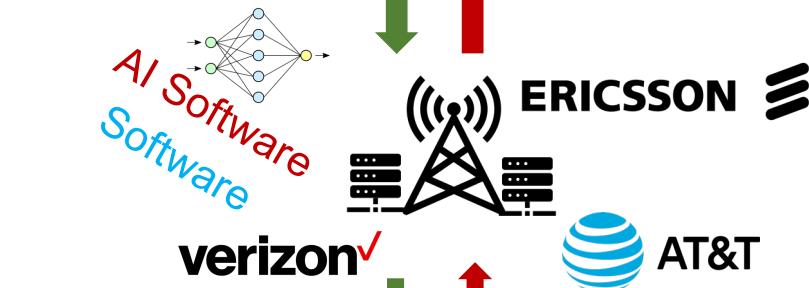


Contract Based Architecture ≈ Security

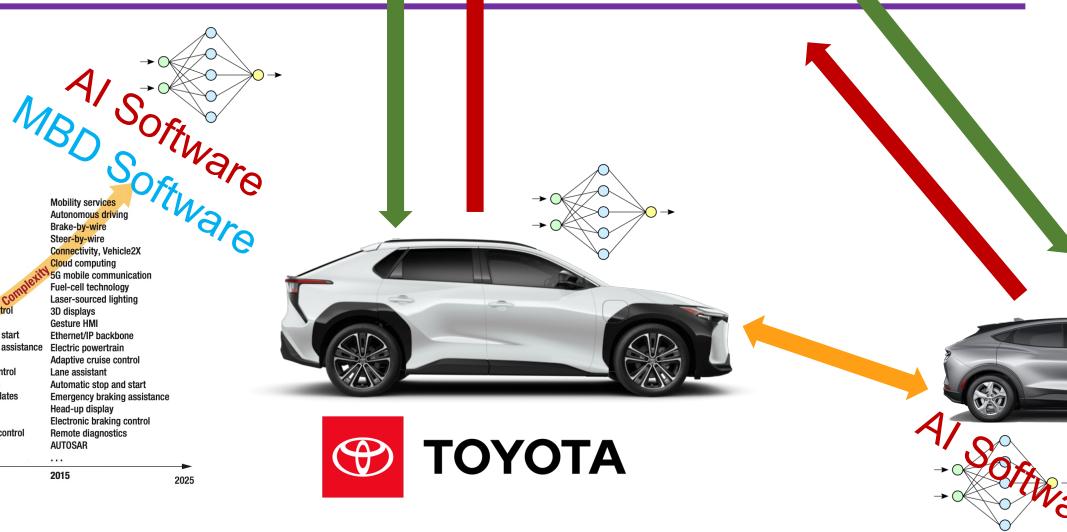
Cloud Layer



Edge Layer



Vehicle Layer



- Managing complexity of ever-growing and distributed mobility software
- Promoting openness among heterogeneous systems
- Hiding proprietary information while fostering cooperation with other systems

Problem

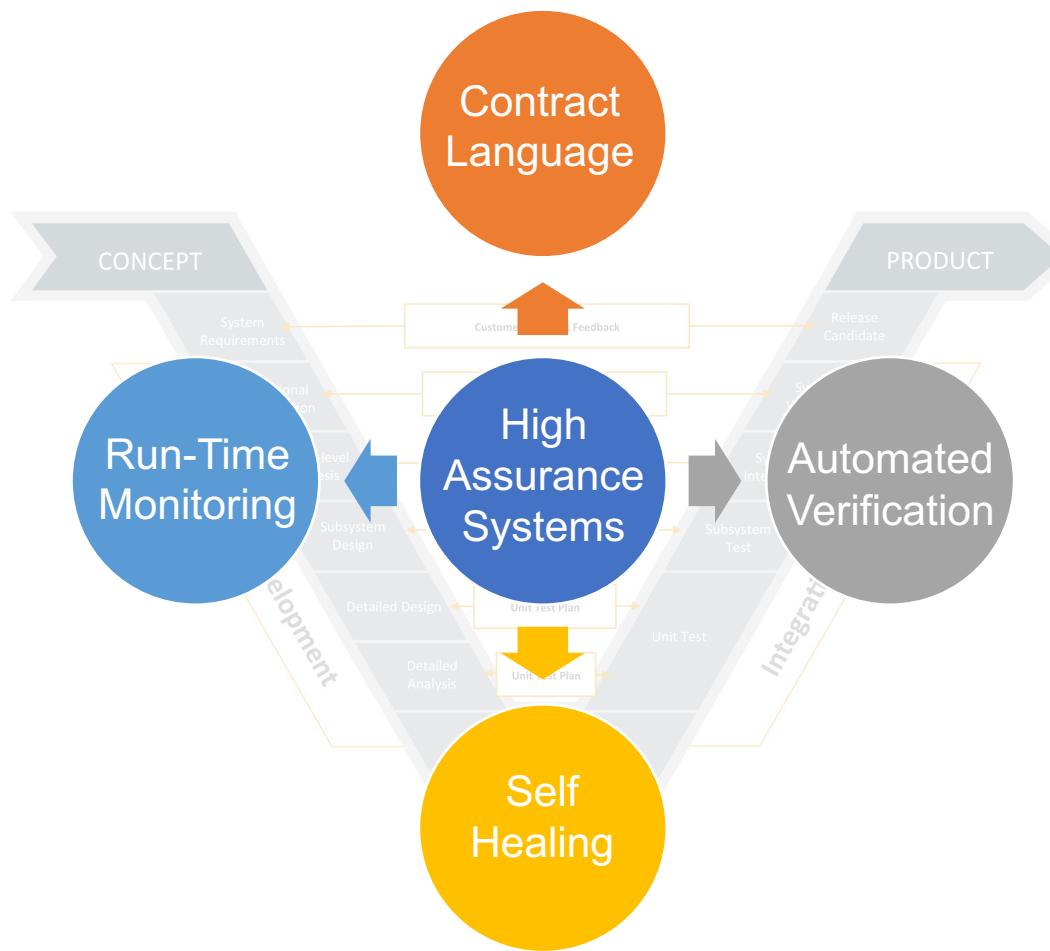
How can we **formally design a connected eco-system** composed of multiple '**intelligent**' and '**connected**' components or sub-systems with high quality assurance **and Security**?



Contract Based Architecture

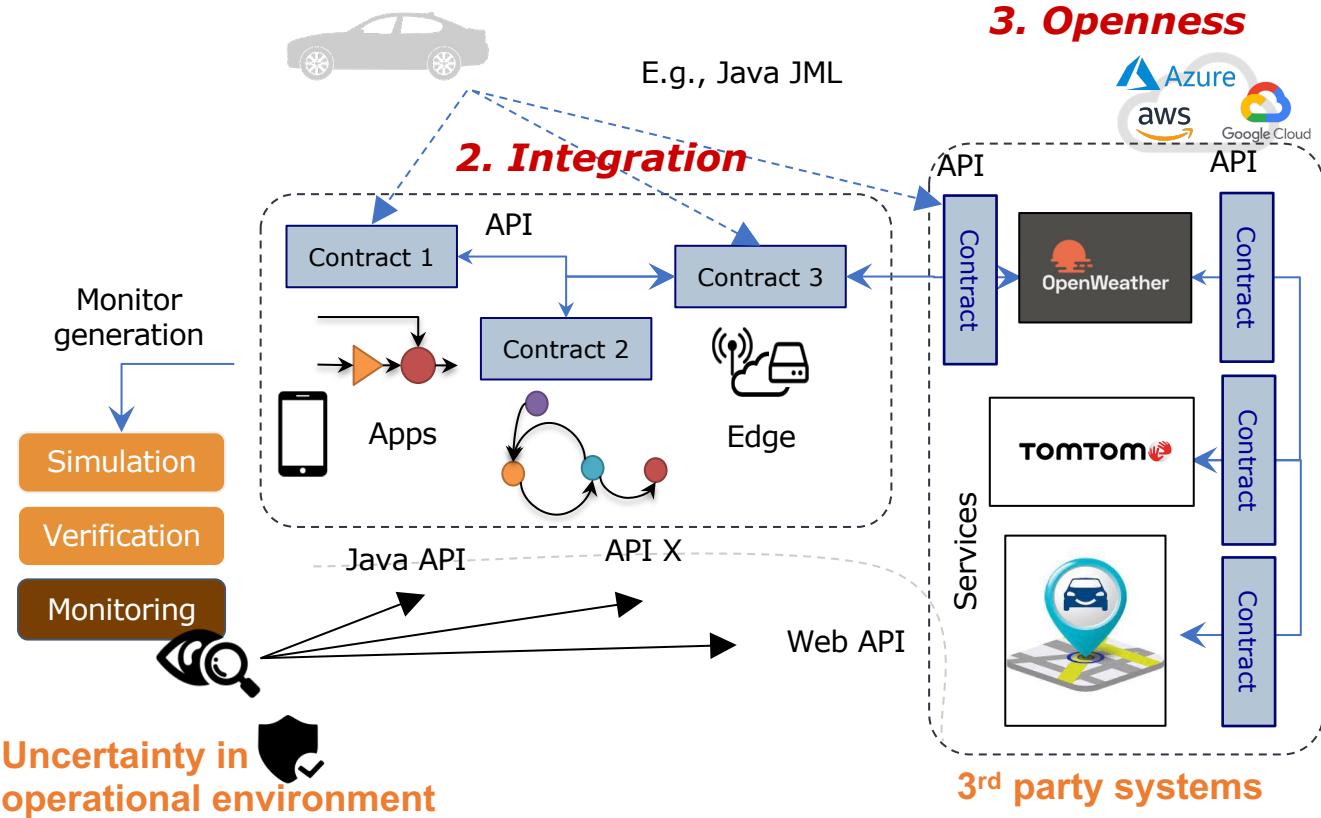
Purpose

Contribute to specification, design and integration of the distributed system by hiding complexity

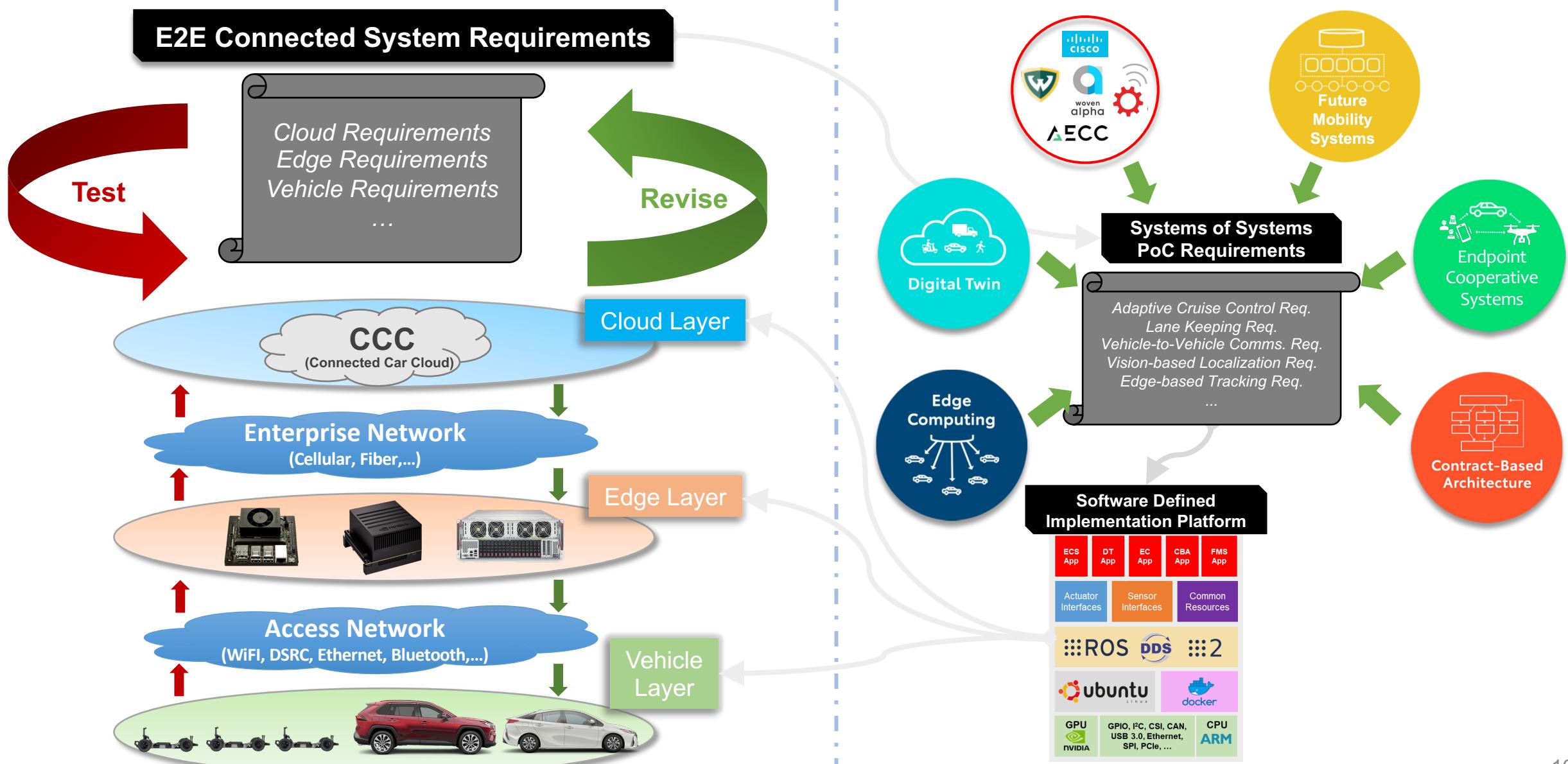


1. Complexity

Requirements: Performance, Functional, Safety, Security



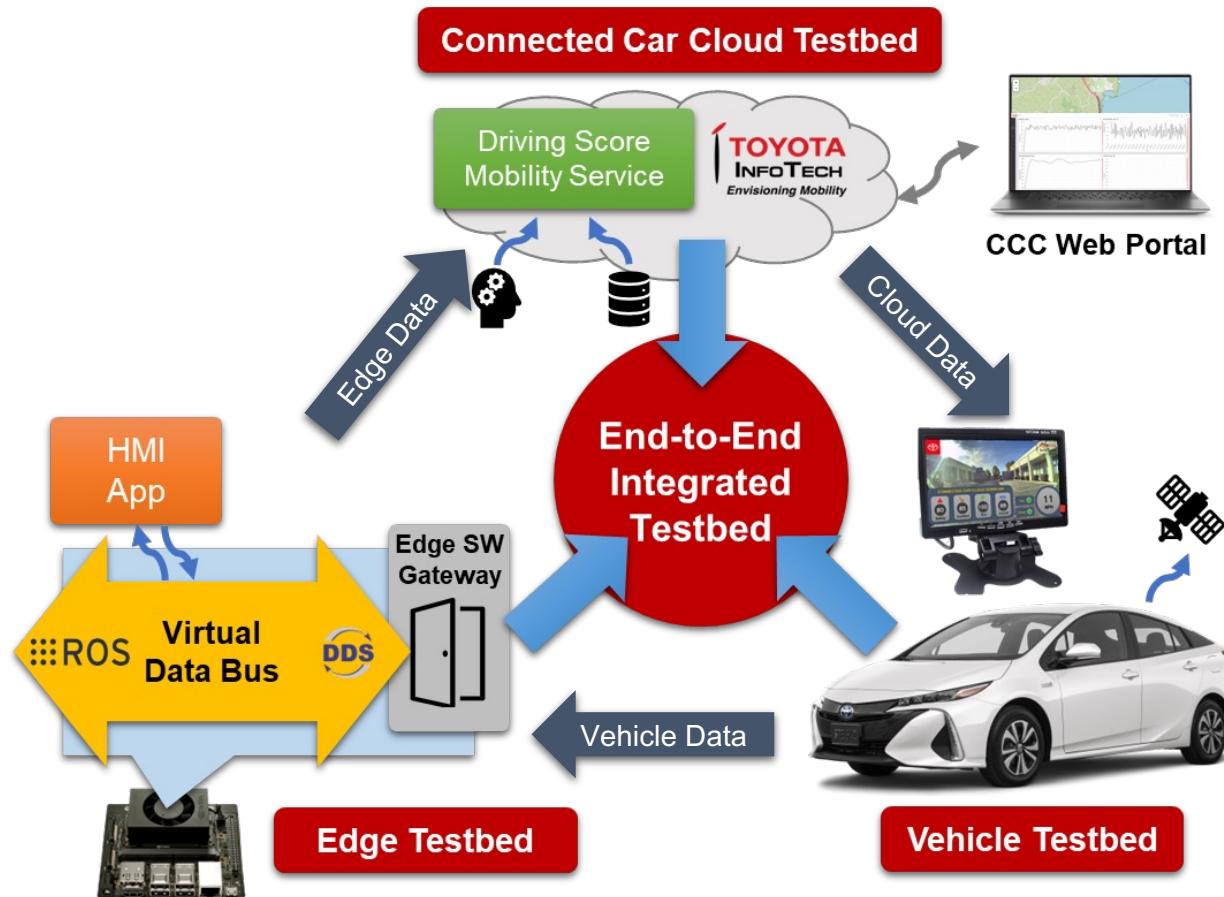
End-to-End (E2E) Connected Testbed



E2E Testbed: Vehicle-Edge-Cloud Integration

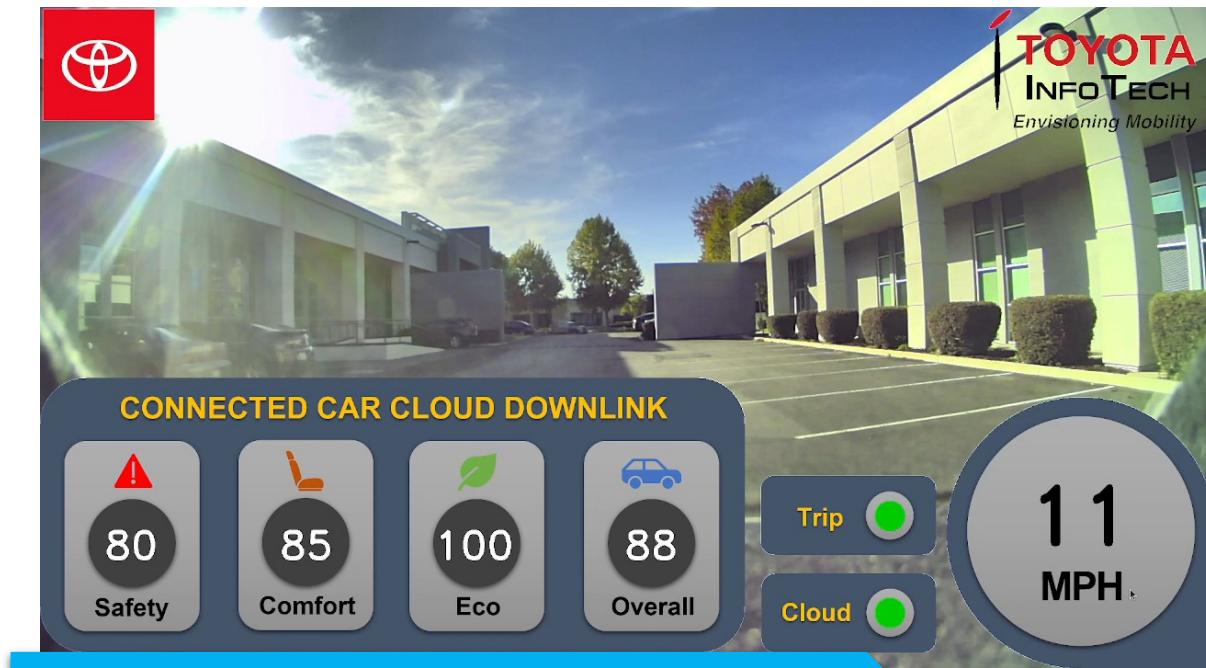
Purpose

Integration of R&D test vehicles with Connected Car Cloud (CCC) through HW/SW Edge Gateway



Vehicle-Edge-Cloud Testbed Architecture

Cloud Driving Score Proof of Concept

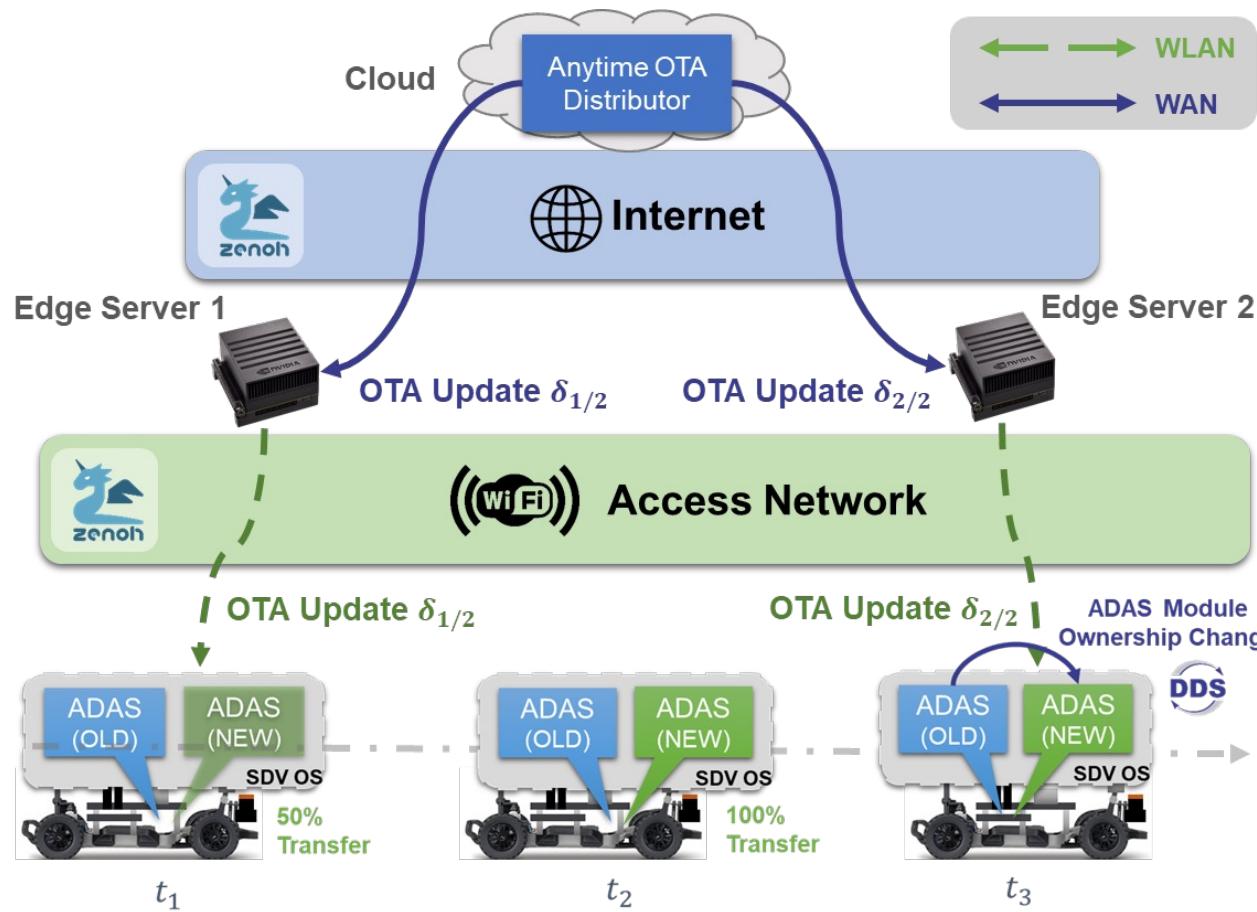


Software defined architecture implemented with industrial middleware allows for design and implementation of functions distributed over Vehicle Edge Cloud Components

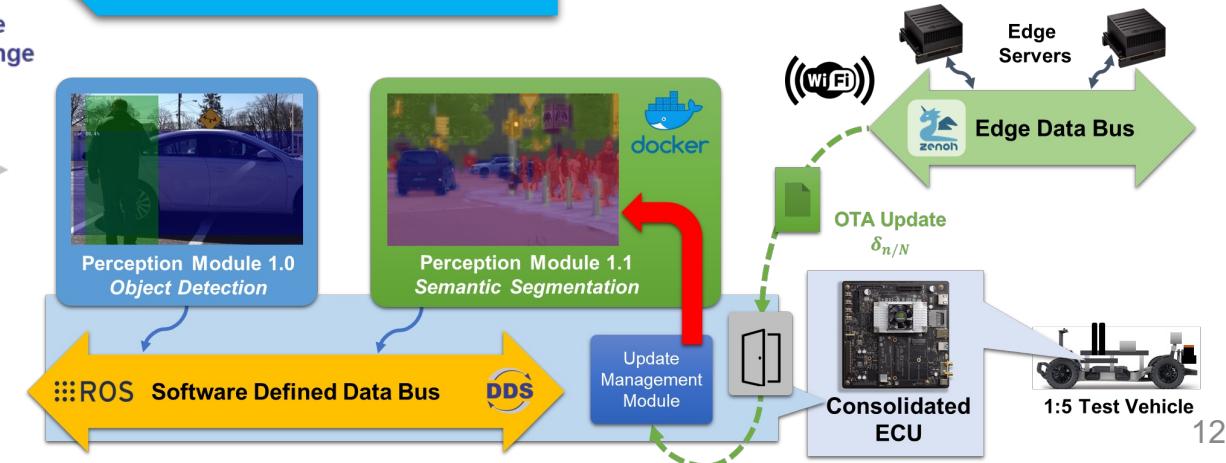
E2E Testbed: Anytime OTA Update

Purpose

Demonstrate systems integration of Anytime OTA update for ADAS with End-to-End Integrated Testbed



Anytime OTA Vehicle-Edge-Cloud Architecture



Edge Computing (EC)

Purpose

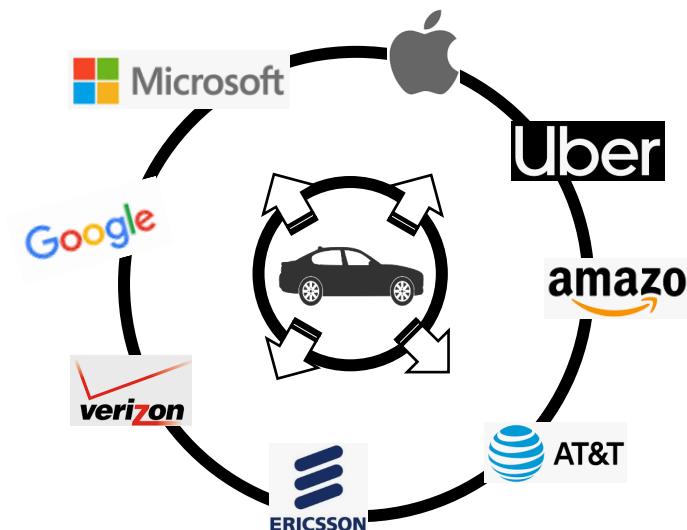
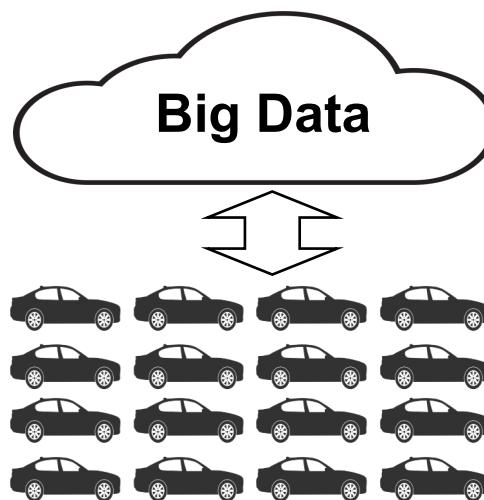
Developing edge computing technology to enable end-to-end connected mobility services

1. Background: Computing Paradigm Shift

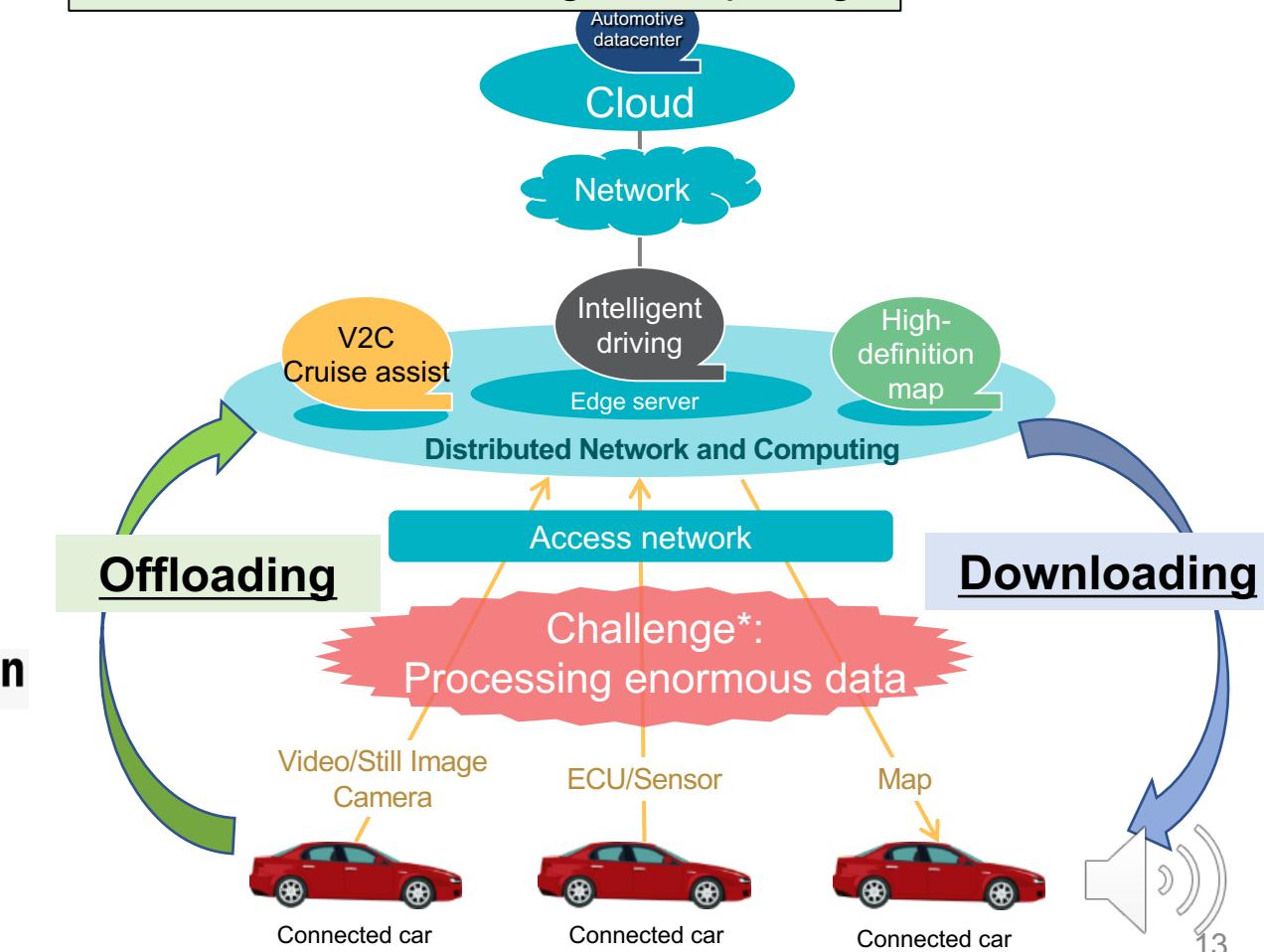


- *Connectivity*
- *Smart Infrastructure Support*
- *Diverse End Devices*

2. Issue: Big Data and Open System



3. Research Area: Edge Computing



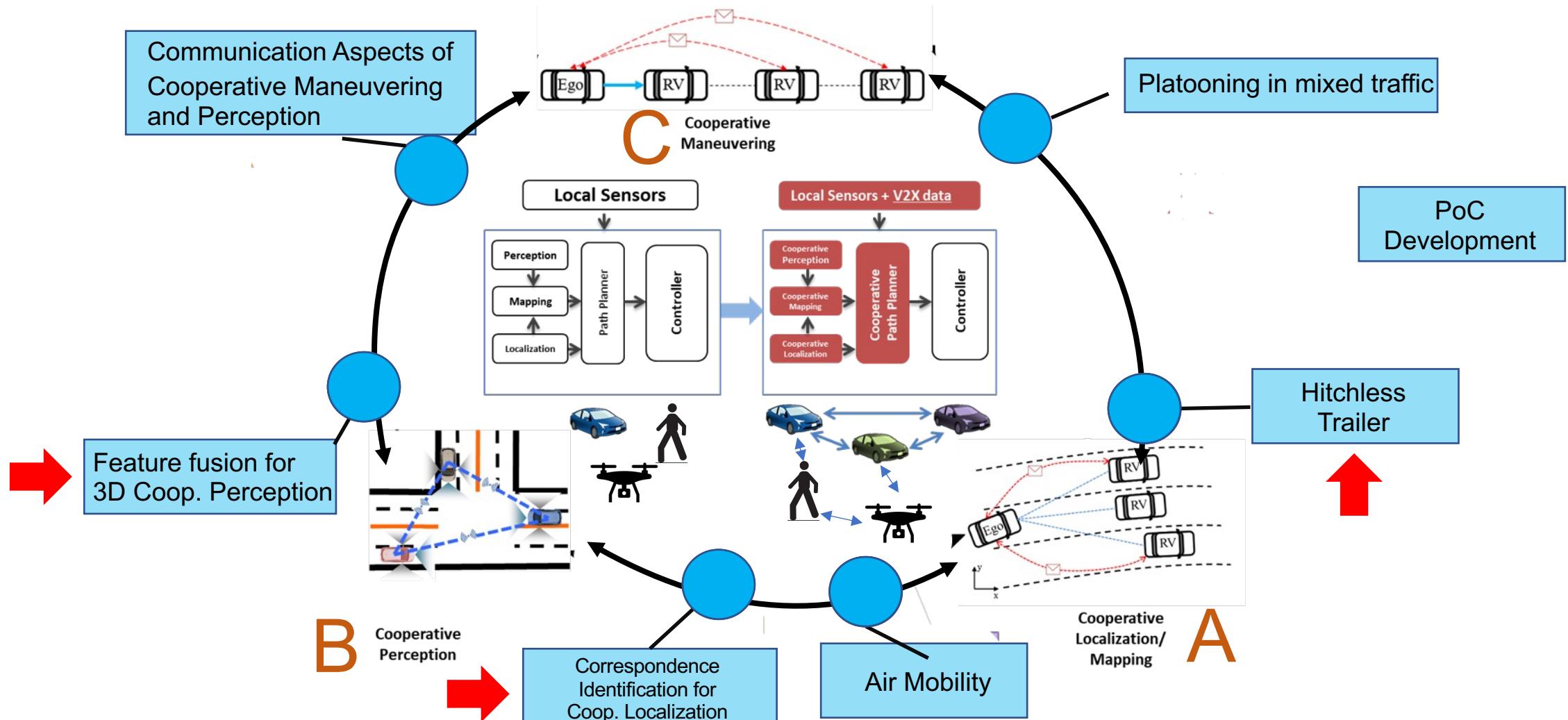
Edge Computing (EC) Video



Endpoint Cooperative System

Purpose

Develop cooperative solutions for connected ground and air traffic participants



Questions for You???

- What challenges do you see in creating a connected world?
- What “security” challenges do you see in the IoT world with millions/billions of connected devices?
- Which is your favorite car company? What are they doing better for you than others?
- What did you learn (if anything) from this presentation?
- What kinds of topics would you like to see in the future?