EcoMobility: Intelligent, Safe and secure connected Electrical Mobility solutions: Towards European Green Deal and Seamless Mobility

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Challenges and needs

Transforming the Automotive Industry: Rapidly advancing technologies and changing consumer preferences are reshaping the automotive industry towards sustainable digital mobility.

- **Complex Transformation:** The automotive industry faces a complex transformation driven by evolving technology, changing preferences, and sustainability demands.
- **Collaborative Ecosystem:** Success hinges on collaboration across the mobility ecosystem, requiring innovative business models and efficient door-to-door mobility solutions.
- **Software Dominance:** Software-driven innovations, including full automation, introduce complexity, demanding a stable digital value chain.
- **Diverse Vehicles:** From e-bikes to cars, diverse vehicles will exchange data, necessitating robust infrastructures.
- **Safety Imperative:** Ensuring safety, especially for vulnerable road users, is paramount, given their significant share of road fatalities
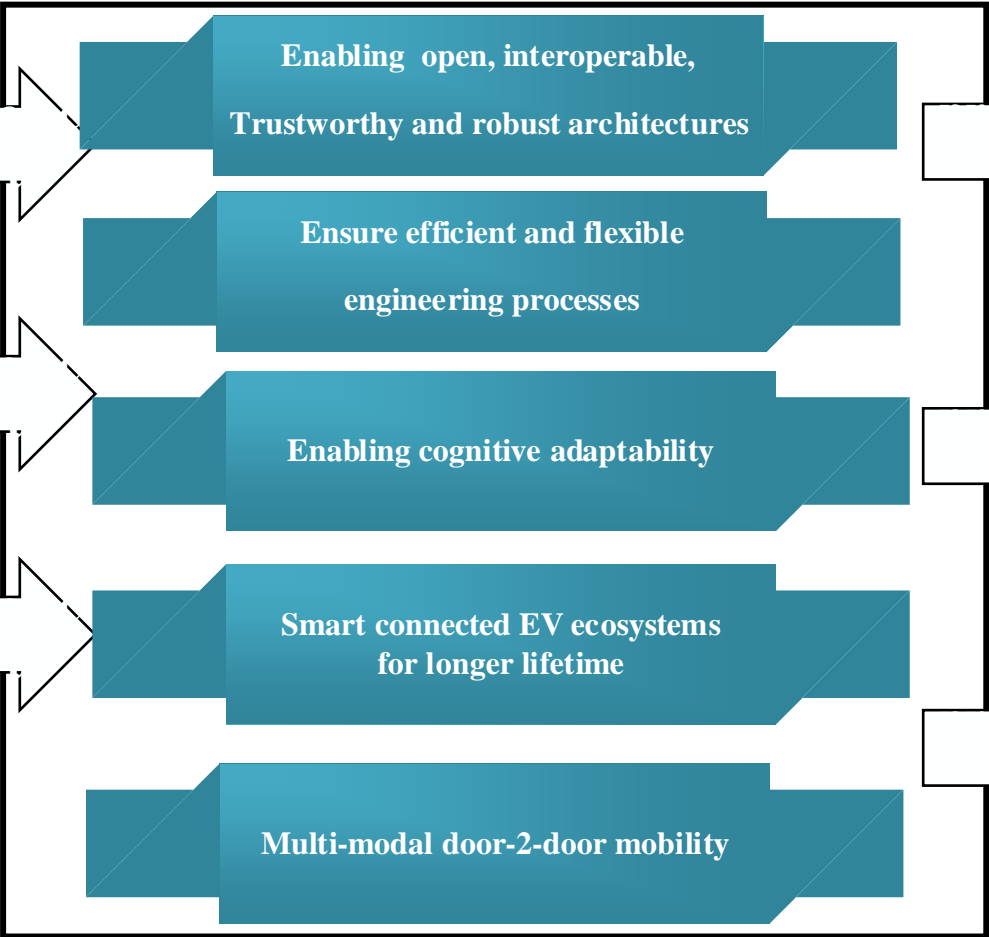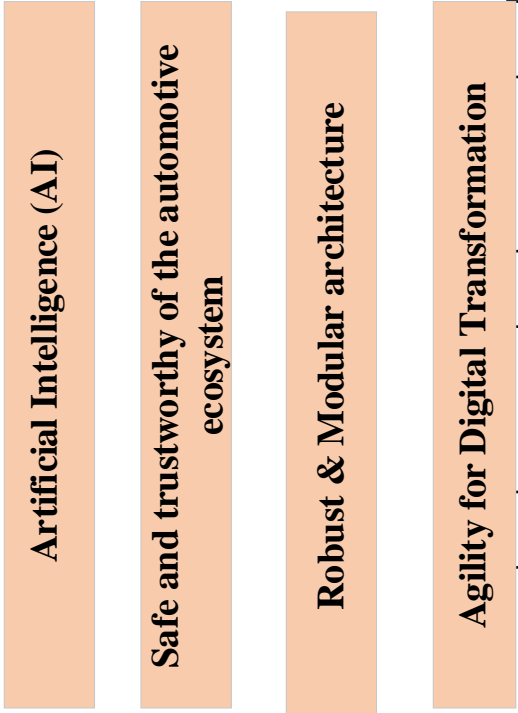
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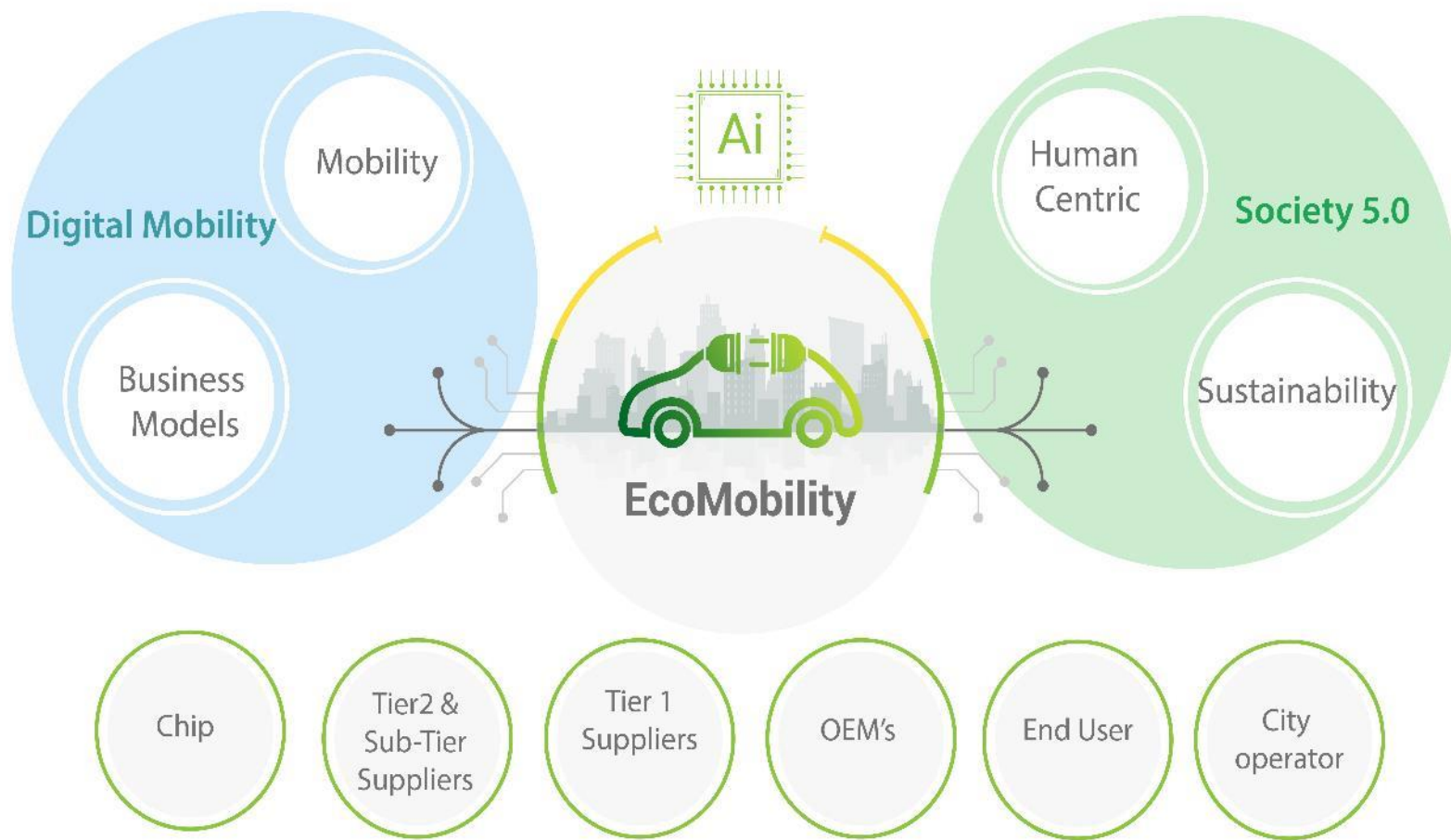
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Main Vision

- EcoMobility aims to **promote the transition of European industries and cities from isolated and rigid transportation methods to a service-oriented, interconnected mobility ecosystem**. This will be achieved by **facilitating the sharing of data and services** among involved stakeholders.

- The main vision is to reach **a sustainable value chain and enable technologies for door-to-door mobility of people and goods**. This will be achieved based **on customized autonomous vehicles integrated with an agile life cycle management system**. This system will allow continuous evolution of services, resulting in improved safety, security, efficiency, and ecology.
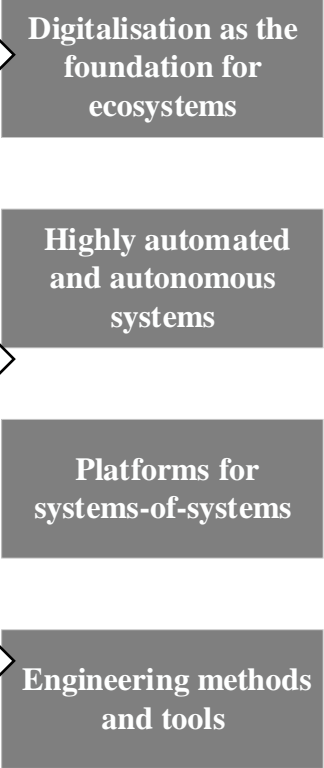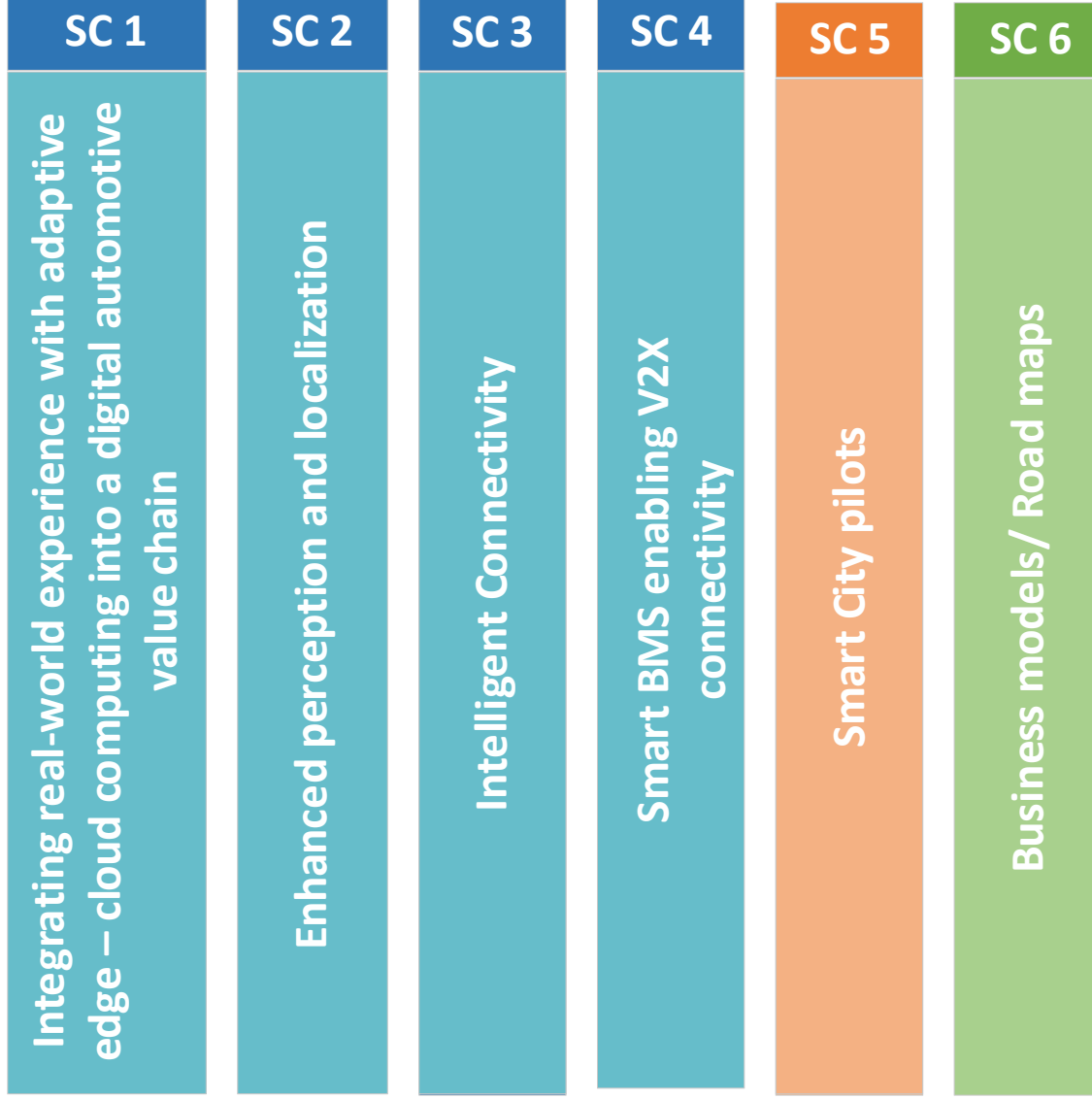
Technology Research challenges

key digital enablers

Digital needs

Artificial Intelligence (AI)

Safe and trustworthy of the automotive ecosystem

Robust & Modular architecture

Agility for Digital Transformation

Enabling open, interoperable, Trustworthy and robust architectures

Ensure efficient and flexible engineering processes

Enabling cognitive adaptability

Smart connected EV ecosystems for longer lifetime

Multi-modal door-2-door mobility

Digitalisation as the foundation for ecosystems

Highly automated and autonomous systems

Platforms for systems-of-systems

Engineering methods and tools

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AI

SC 1 — Integrating real-world experience with adaptive edge – cloud computing into a digital automotive value chain

SC 2 — Enhanced perception and localization

SC 3 — Intelligent Connectivity

SC 4 — Smart BMS enabling V2X connectivity

SC 5 — Smart City pilots

SC 6 — Business models / Road maps

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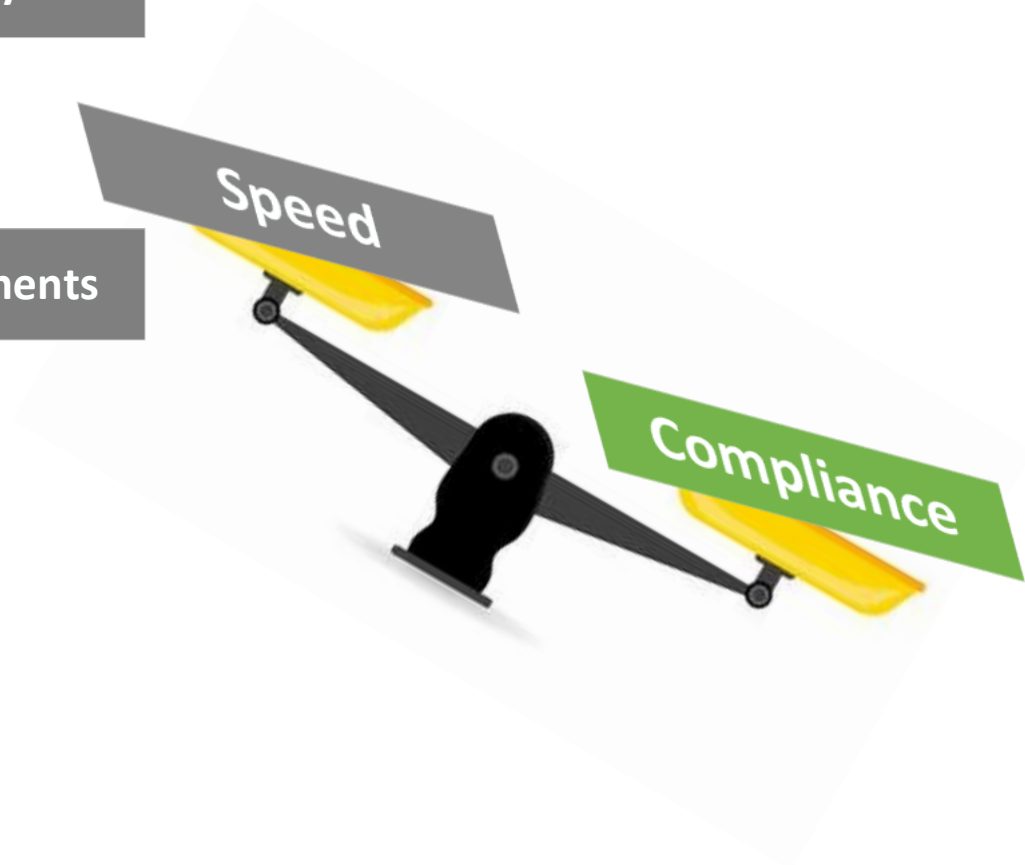
SC 5 — Smart City pilots

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SC1 – Integrating real-world experience with adaptive edge – cloud computing into a digital automotive value chain

Short development cycles

Incomplete requirements

Speed

Compliance
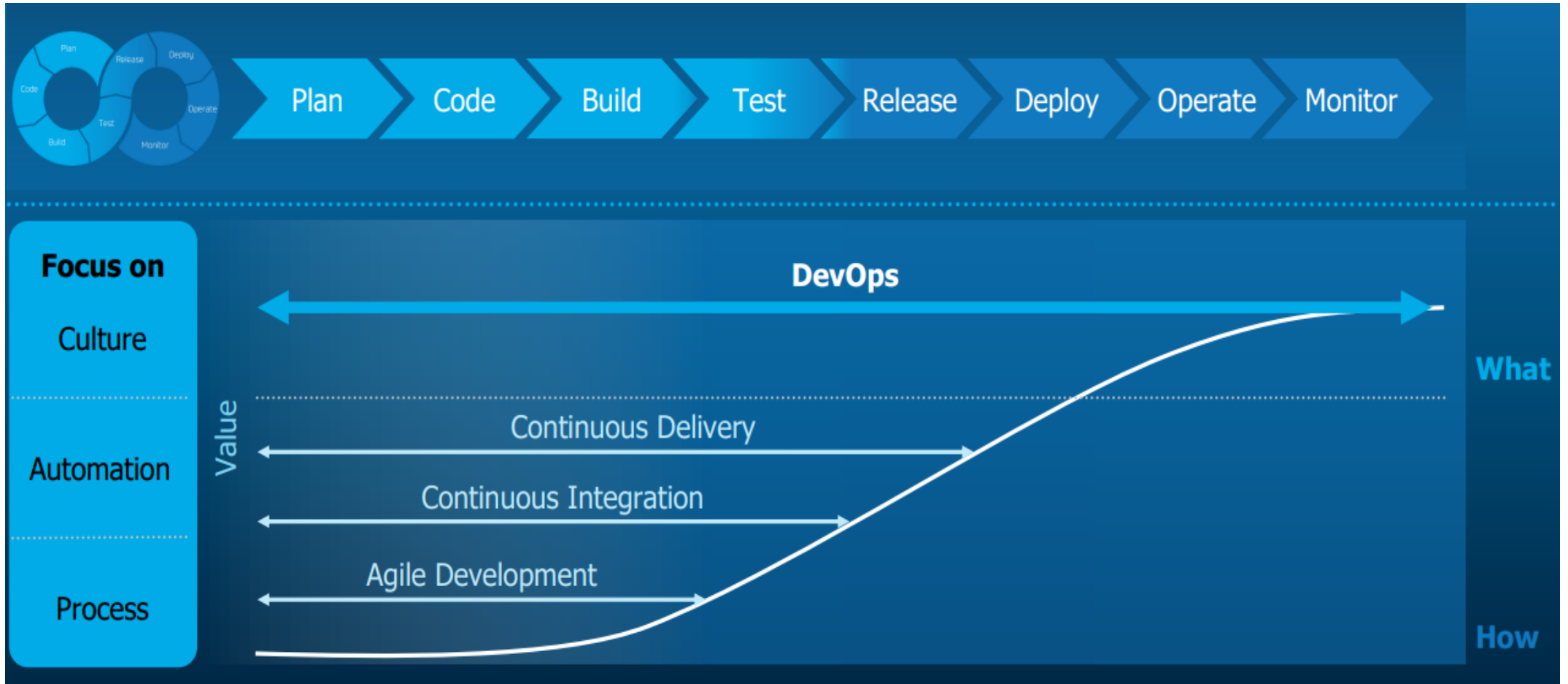
Automotive SPICE

Safety ISO 26262

Security ISO 21434

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SC 1 goals

The SC1 goals is to apply the benefits of DevOps (e.g., fast innovation, user-centric approach, ongoing improvements) to the V-process, which is well established and widely recognized in the automotive industry for providing functional safety. Continuous post-deployment systems improvement will allow

(i)   to identify system flaws, erroneous, and missing functionality during operation,

(ii) to improve automated vehicles in operation quickly, and

(iii) to perform physical V&V for systems in operation (not available at site).
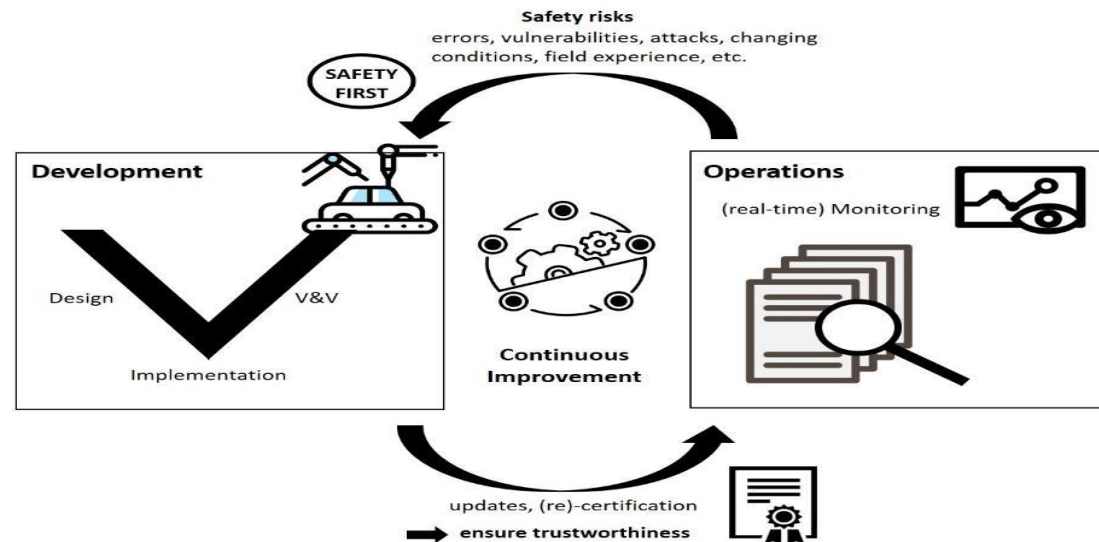
Mission

The goal of this SC is to investigate and prototype methods and tools that:

- allow for real-world experience gathering,

- pre-processing data,

- transform data into actionable information,

- bridge the gap between pre-deployment (development, verification and V&V, production) and post-deployment (operation, maintenance, and EOL).
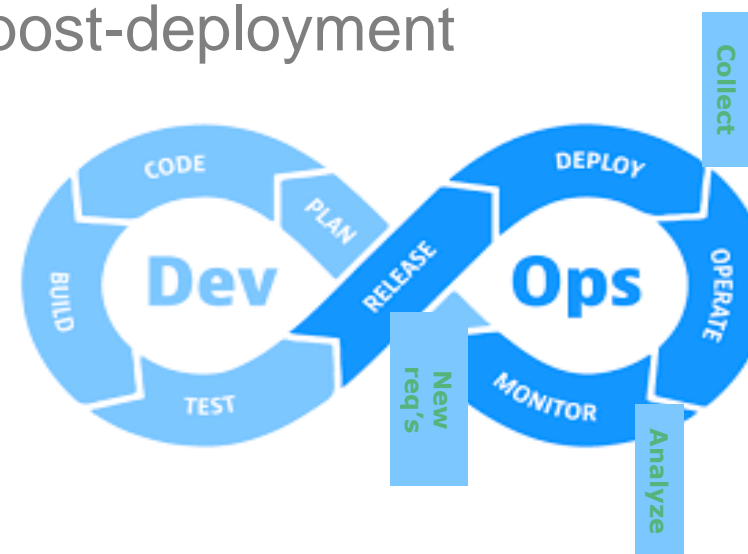
Modular and smart vehicle E/E architecture

we will develop a new dynamic and adaptive dependable E/E architecture that enables safe and secure on-demand service offerings using contract-based design and ensures a continuous integration / continuous delivery of application updates.

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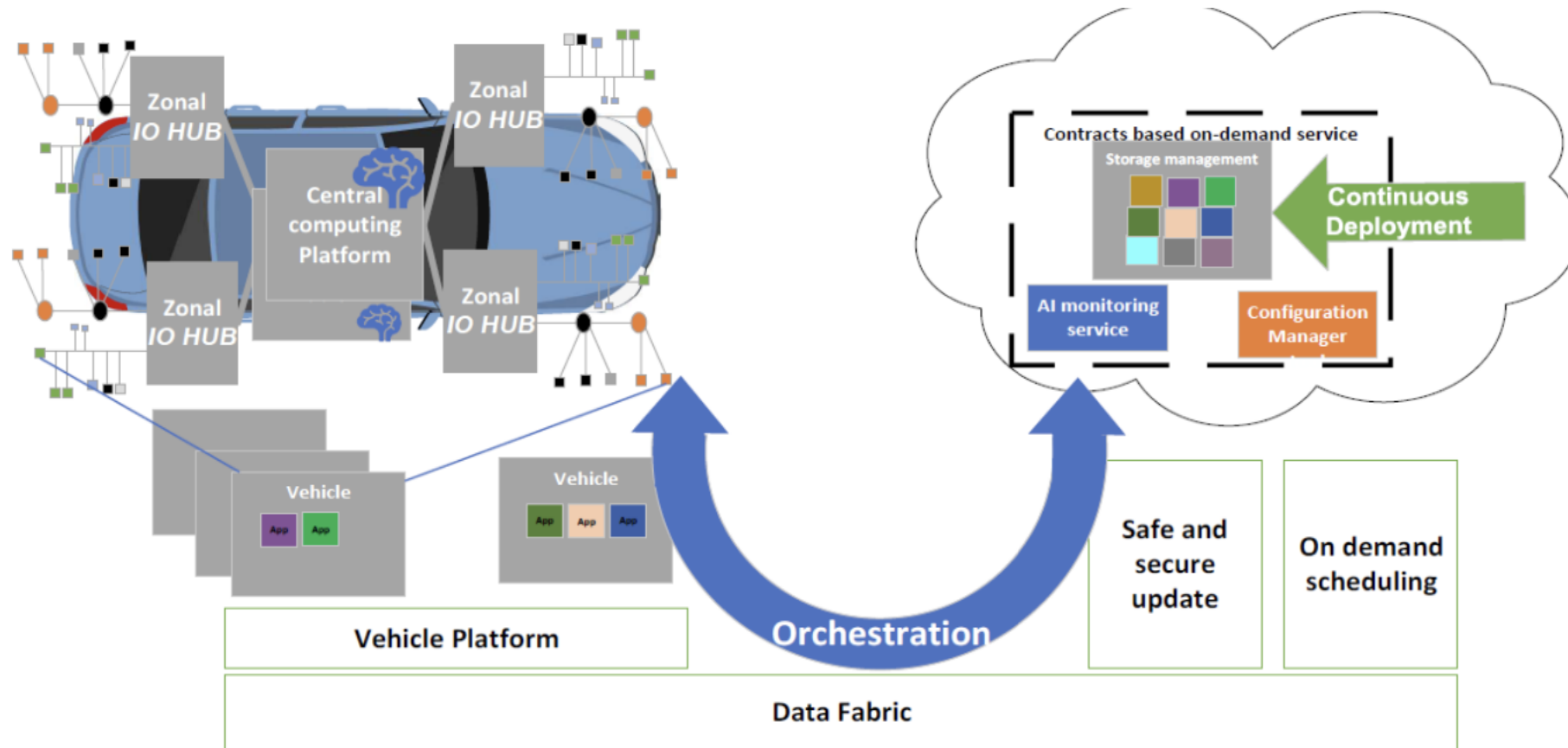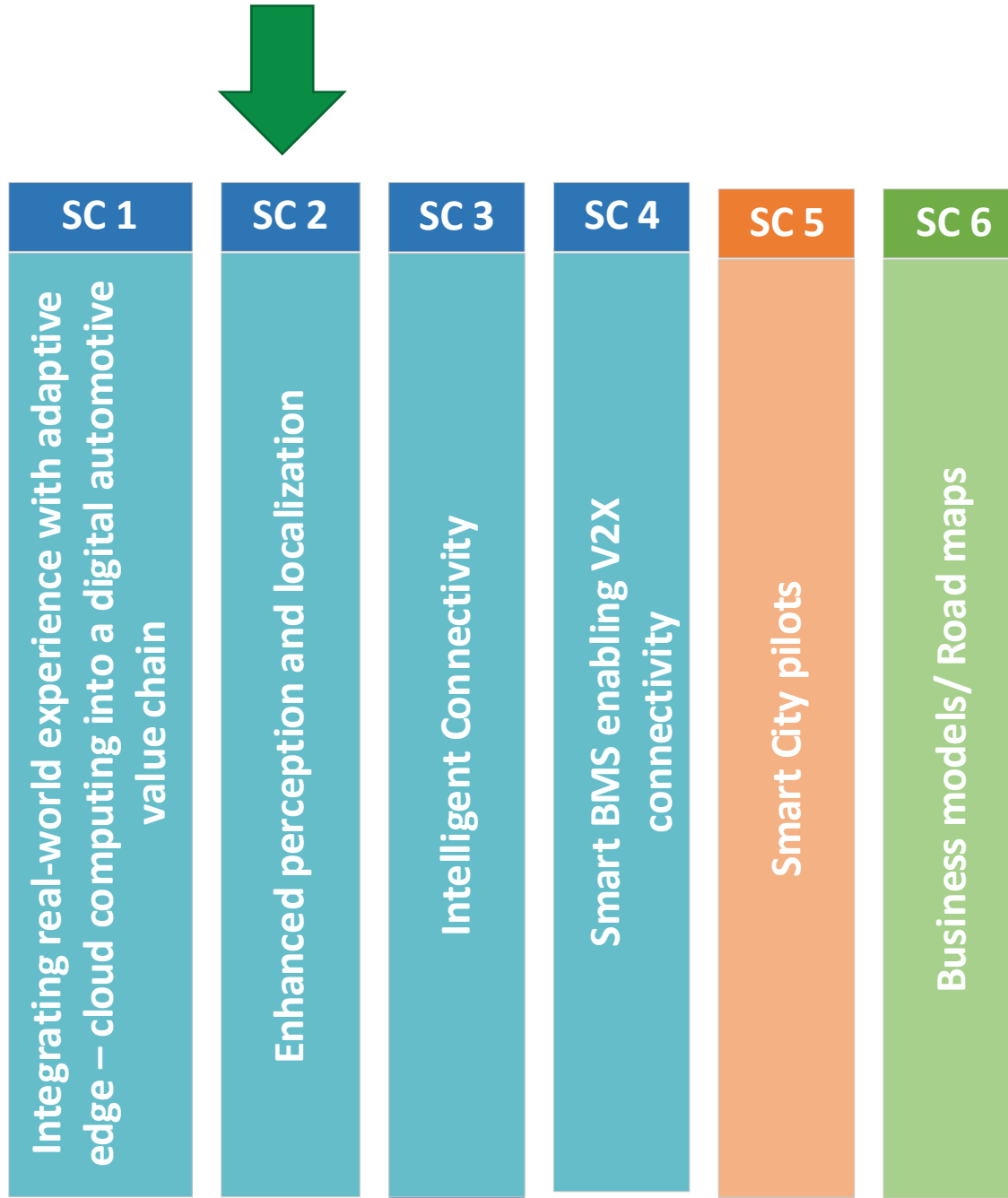
SC2 Enhanced perception and localization - intelligent embedded sensor systems

Enhanced perception and localization

Vision

Type 4: Highly dynamic data (vehicles, pedestrians)

Type 3: Transient dynamic data (congestion, signal phase)

Type 2: Transient static data (roadside infrastructure)

Type 1: Permanent static data (map data)

Vehicles
Ego Vehicle
Pedestrians
Signal Phase
Traffic Congestion
Slippery Road
Traffic Sign
Landmarks
Map
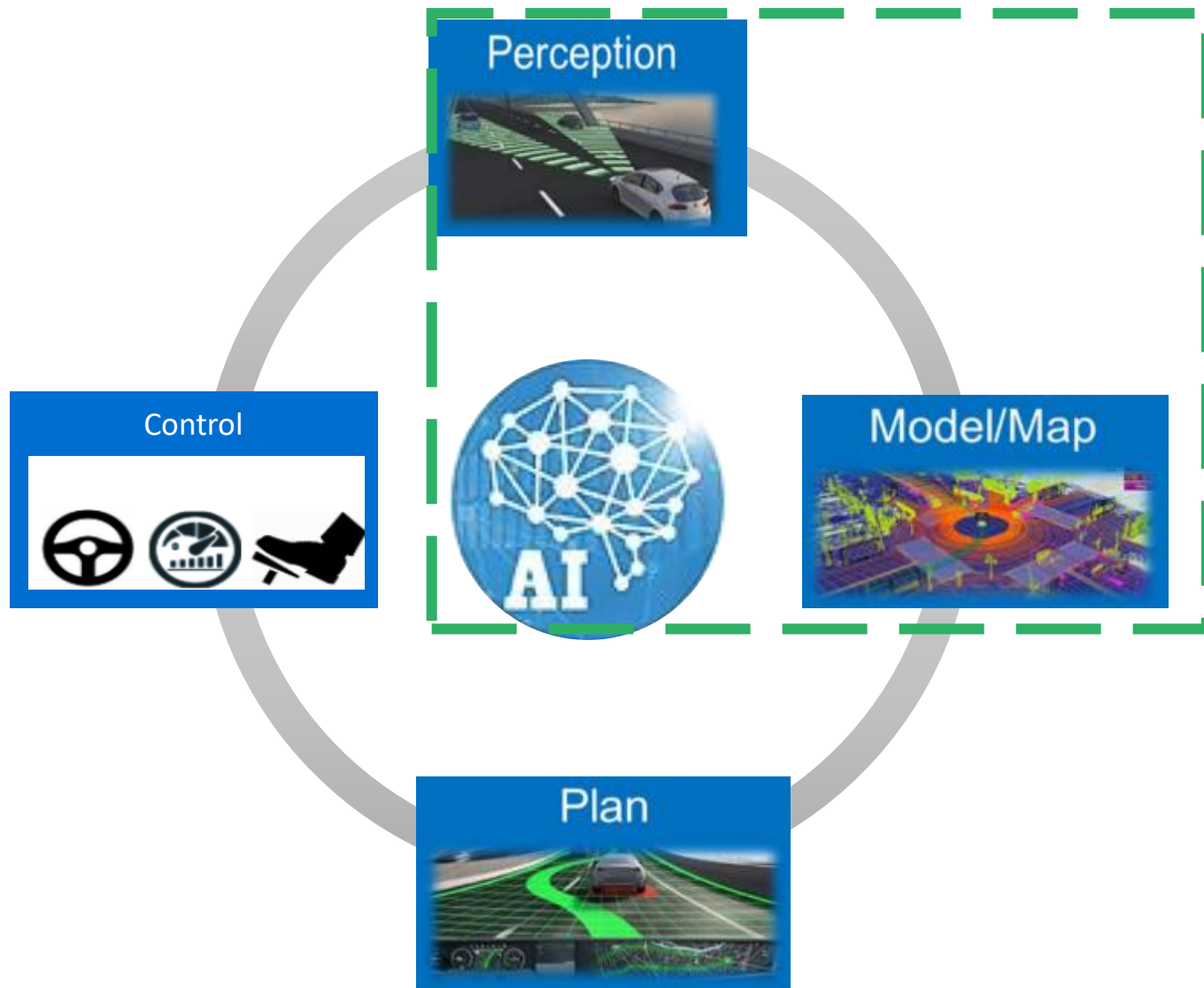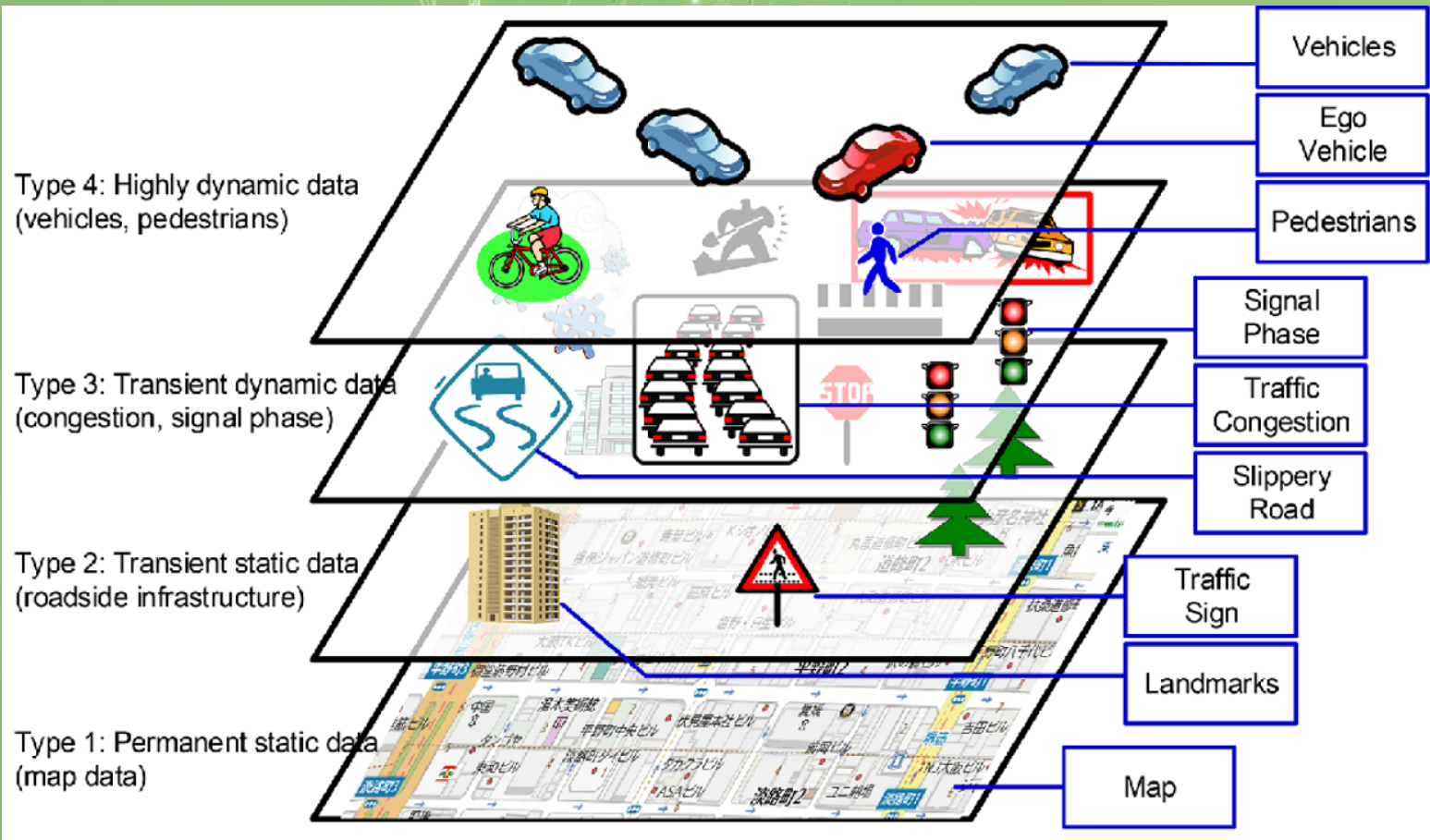
Use fused information from **maps and perception sensors** of multiple sources for reliable and precise localization as an enabler for new and improved ADAS/AD systems. Sensors can be part of **vehicles** or the **infrastructure**.

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Enhanced perception and localization

- Shared **situational awareness** for sharing object detection between vehicles, including a corresponding protocol

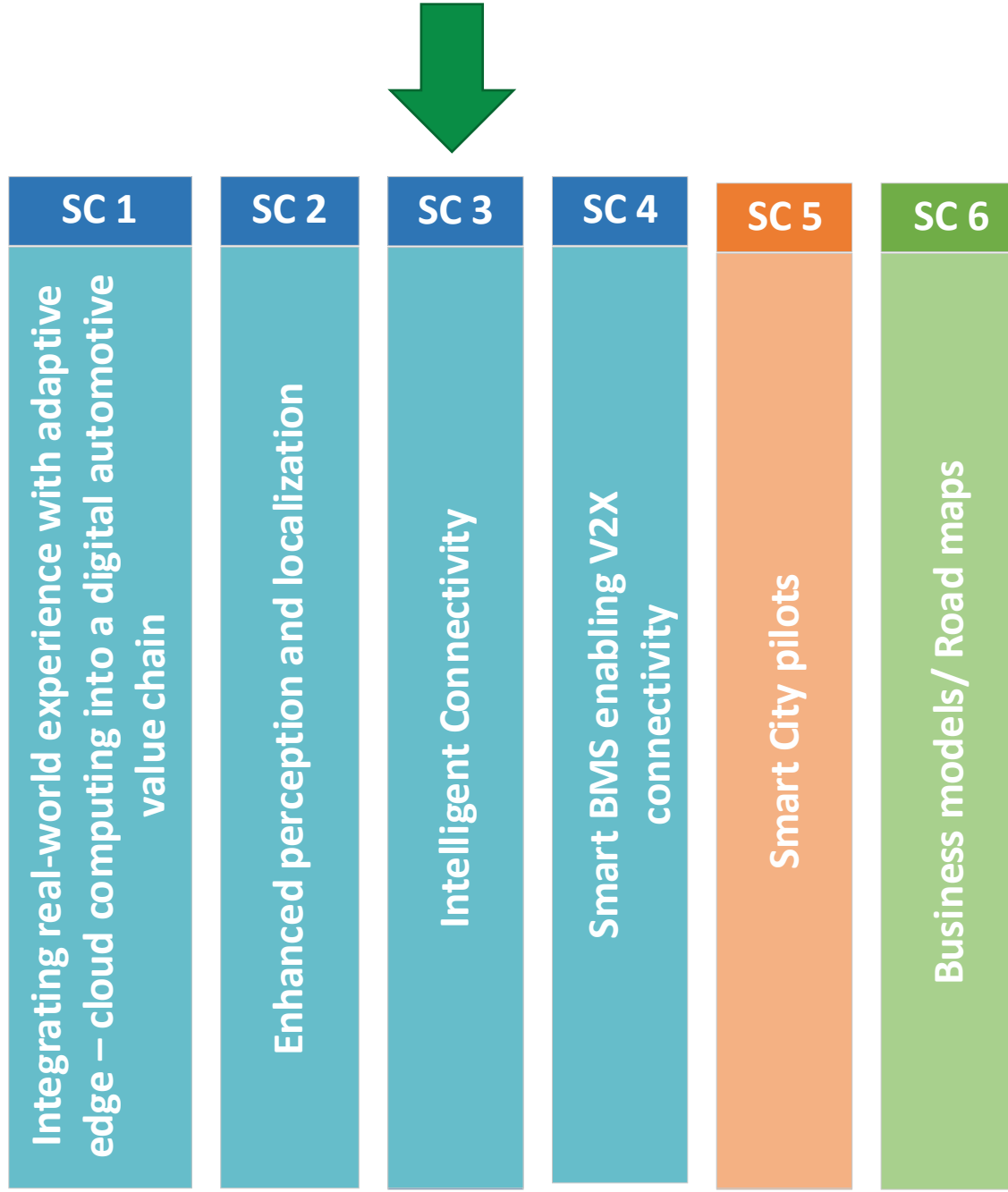- **Object detection, tracking, and collision prediction** for next-generation automotive imaging radar increasing the number of object classes (10x) that can be detected reliably and their spatial resolution.

- **Map-based lane-level localization** using radar detections increasing the robustness and accuracy of automotive-grade vehicle localization.

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SC3 Intelligent Connectivity

Perception

Control

Model/Map

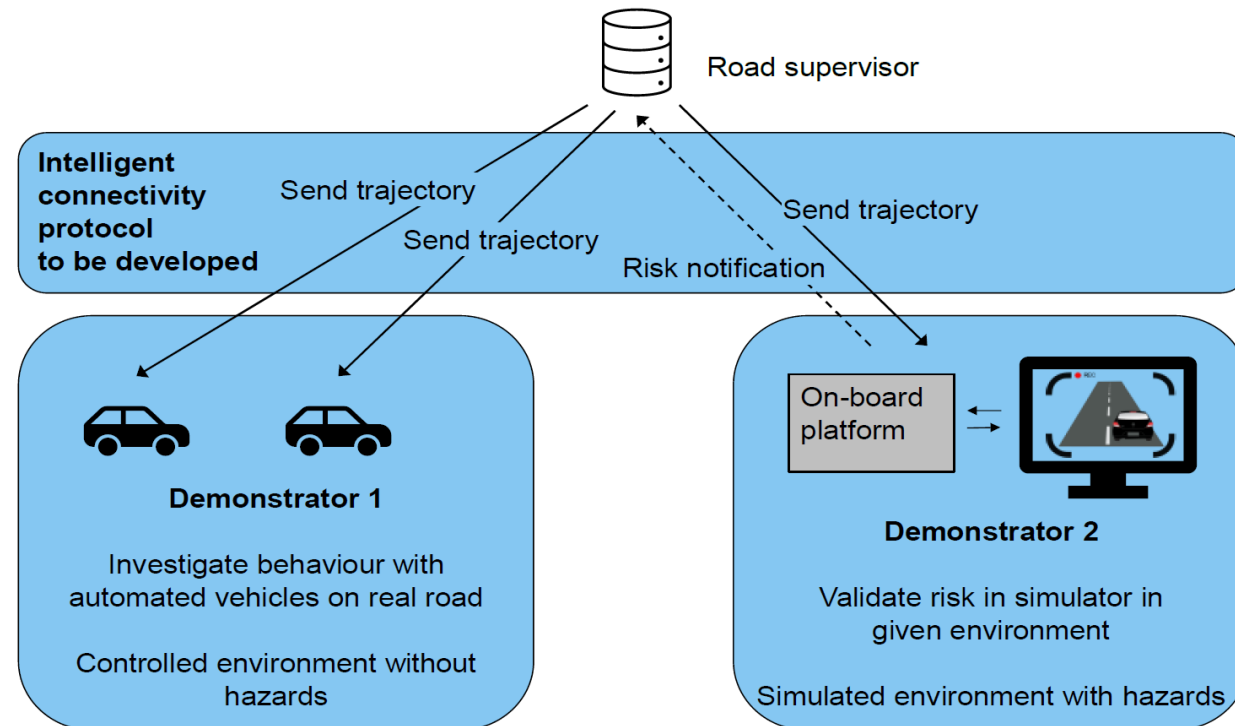Plan

AI

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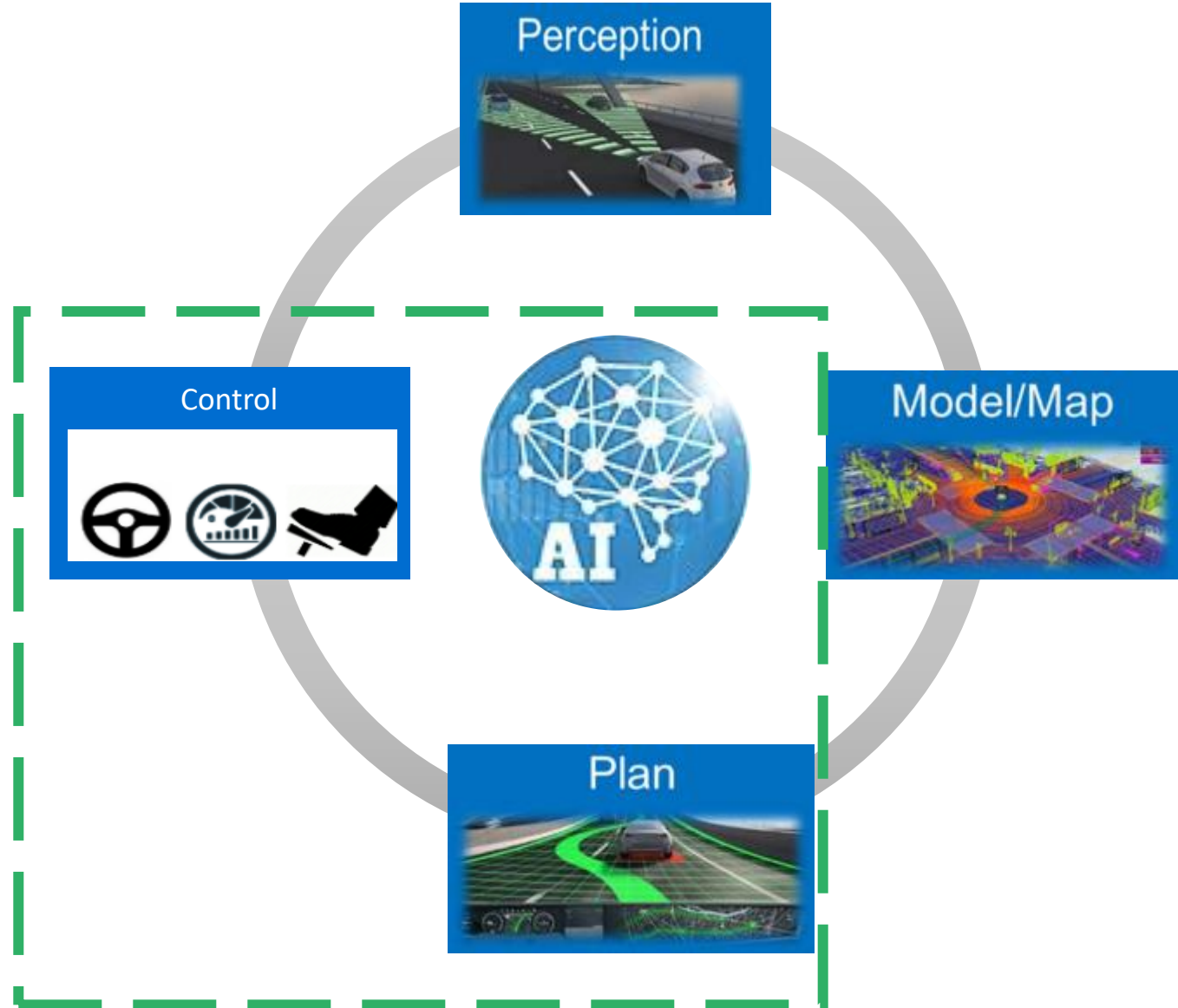
SC3 Intelligent Connectivity - Vision

- Rethinking of today's de-centralized driving behavior
  - **now**: every **vehicle** makes its **decision independently** in road traffic
  - **future**: vehicle actions **coordinated by higher authority** that has better overview of the situation on the road (comparable to air traffic management)

- Preconditions for a Supervised trajectory management system
  - increasing number of **SAE Level 4 & Level 5** vehicles expected on roads
  - availability of reliable low latency **communication (5G, C-V2X)**
  - improved and affordable **localization** solutions
  - introduction of high-performance **edge computing**

Main outcome

Intelligent Connectivity

- **Collaborative control for automated driving**

- **Integrated supervisor architectures for risk monitoring**

- **Environmental model**

Road supervisor

Intelligent connectivity protocol to be developed

Send trajectory

Send trajectory

Send trajectory

Risk notification

Demonstrator 1

Investigate behaviour with automated vehicles on real road

Controlled environment without hazards

On-board platform

Demonstrator 2

Validate risk in simulator in given environment

Simulated environment with hazards

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10/23/2023

SC4 – Smart BMS with enhanced data management and connectivity

Smart BMS enabling V2X connectivity

FLEET MONITORING & ANALYTICS PLATFORM
Monitor battery condition
Analyze data

DIGITAL TWIN
Real-time simulation based on vehicle signals

DATA COLLECTION
Secure data transfer

BATTERY LIFETIME METHODOLOGY
KPI Generation
Battery State of Health
Battery Degradation
Battery Remaining Value
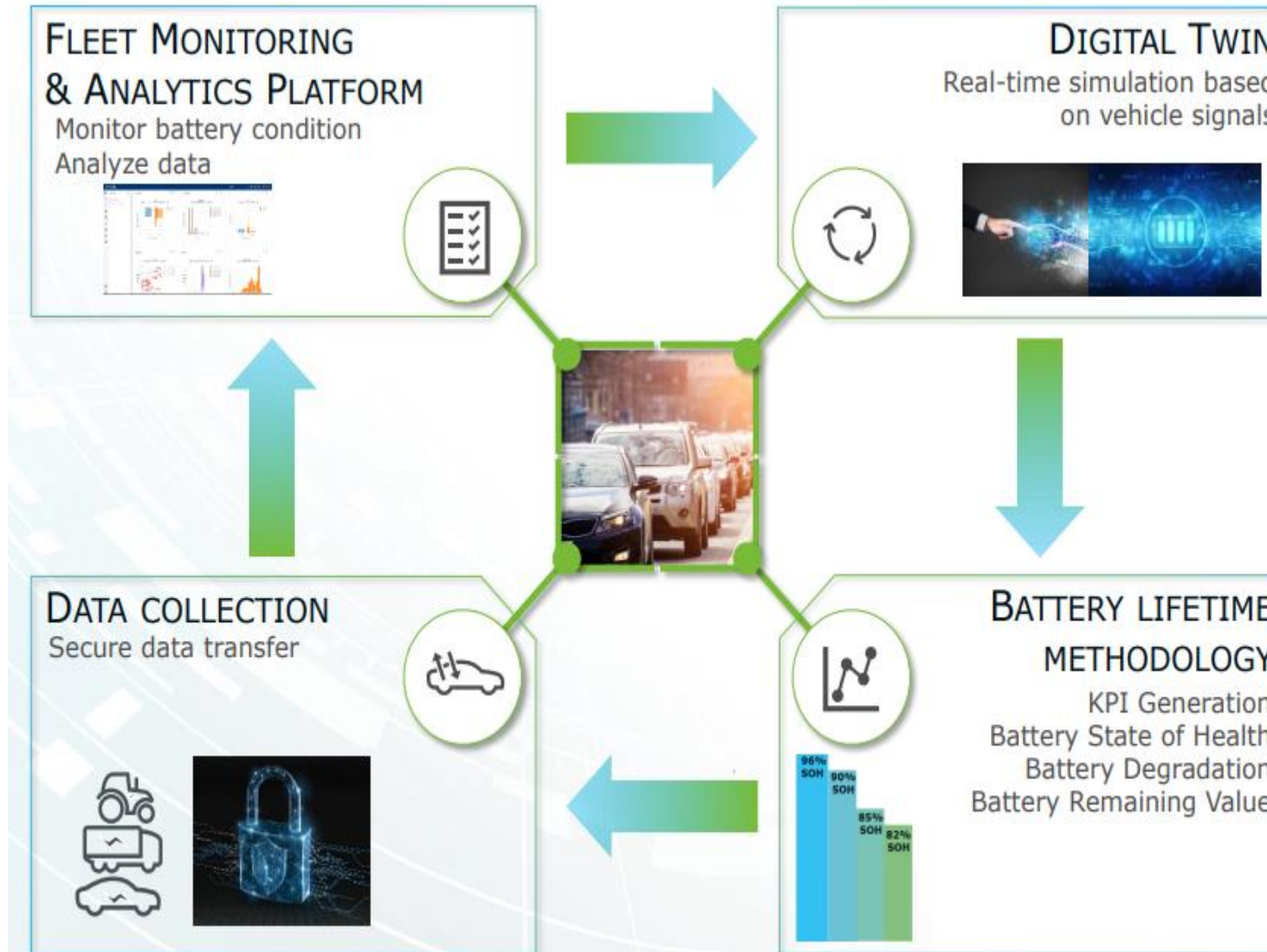
✓ Improve **battery value** & profitability

✓ Optimize **charging strategy**

✓ Increase **workshop efficiency**

✓ Reduce **total cost of ownership**

✓ Optimize **warranty** claim process

✓ Cost-efficient battery **replacements**

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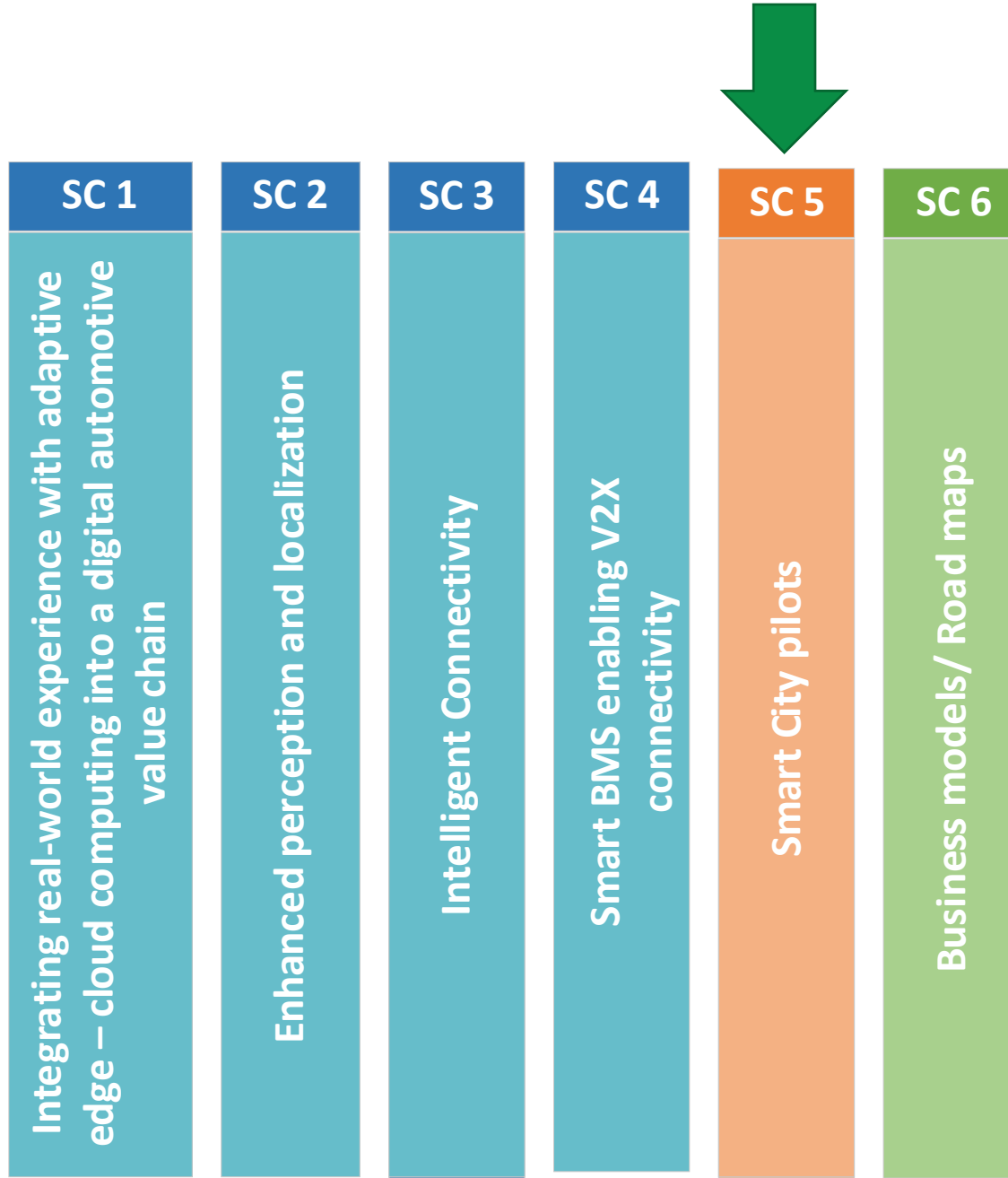**Smart BMS enabling V2X connectivity**

- **Safe and secure multicore processor and supply system**

- **Model-based and AI-based BMS**

- **GaN-based active balancing circuits**

- **Multi-axial mission synthesis and vibration testing** for battery systems

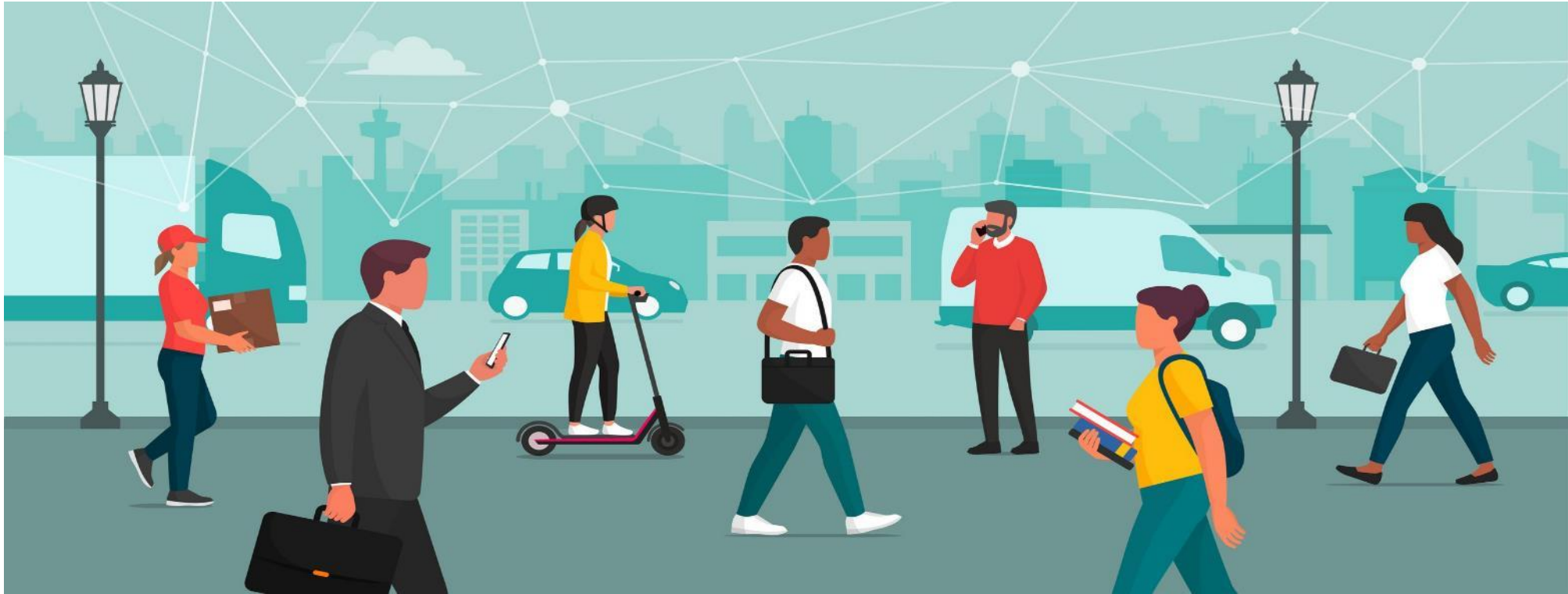- Smart integrated **battery sensors**

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Key Performance Indicators

- Increasing the **lifetime** of the battery system up to 15%
- Increasing the **driving range** of the EV up to 5%
- Increasing the **reliability** of the battery up to 15%

High Temperatures   Overcharging   Deep Discharges   High Discharges
© EnergySage

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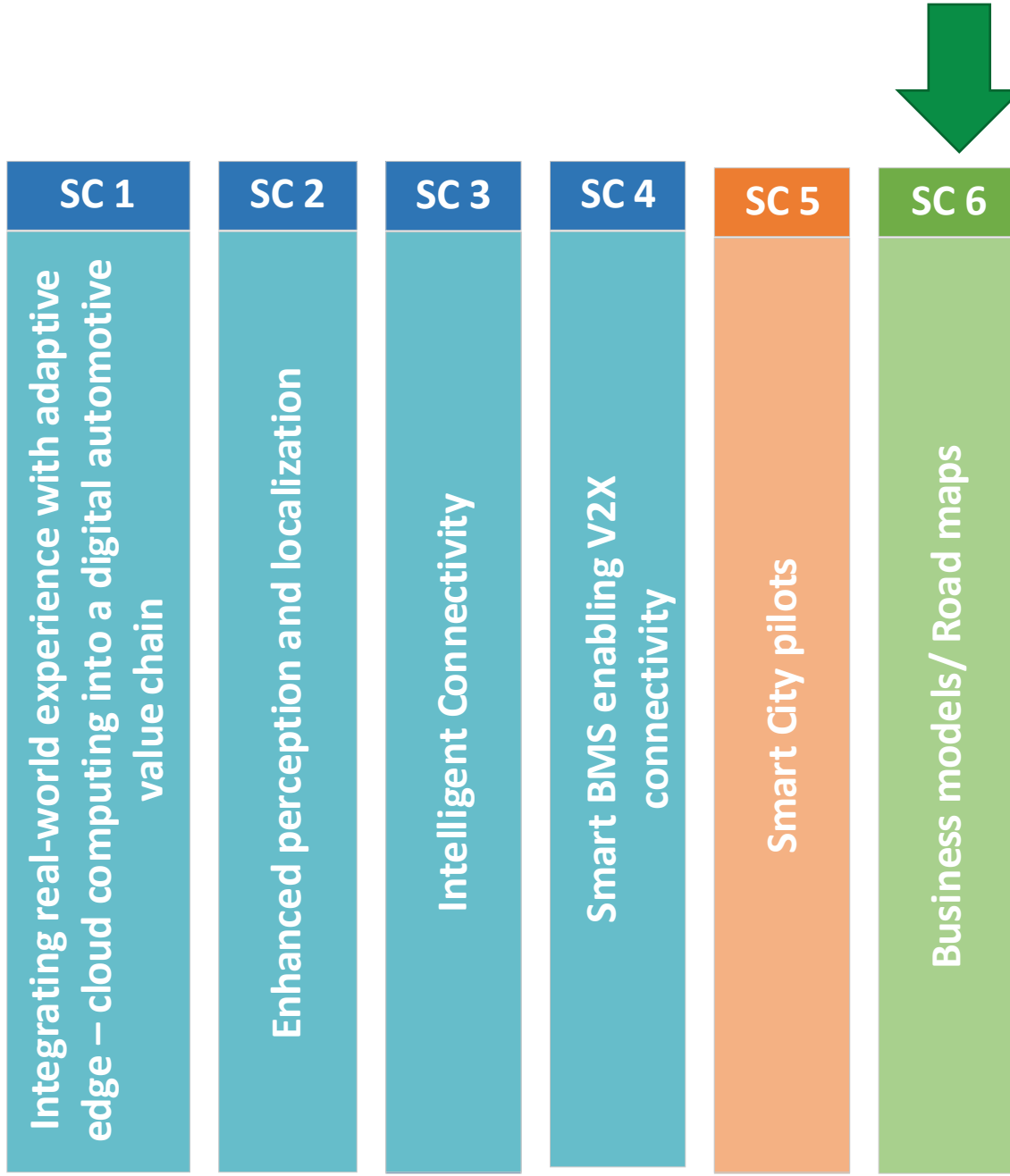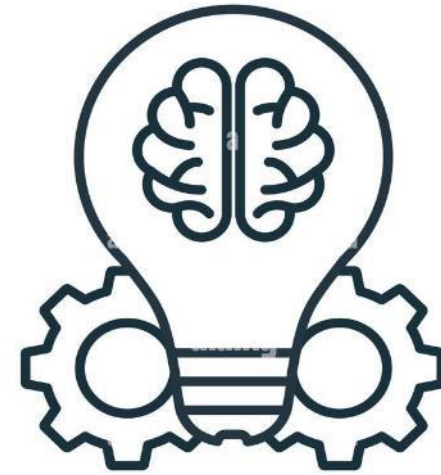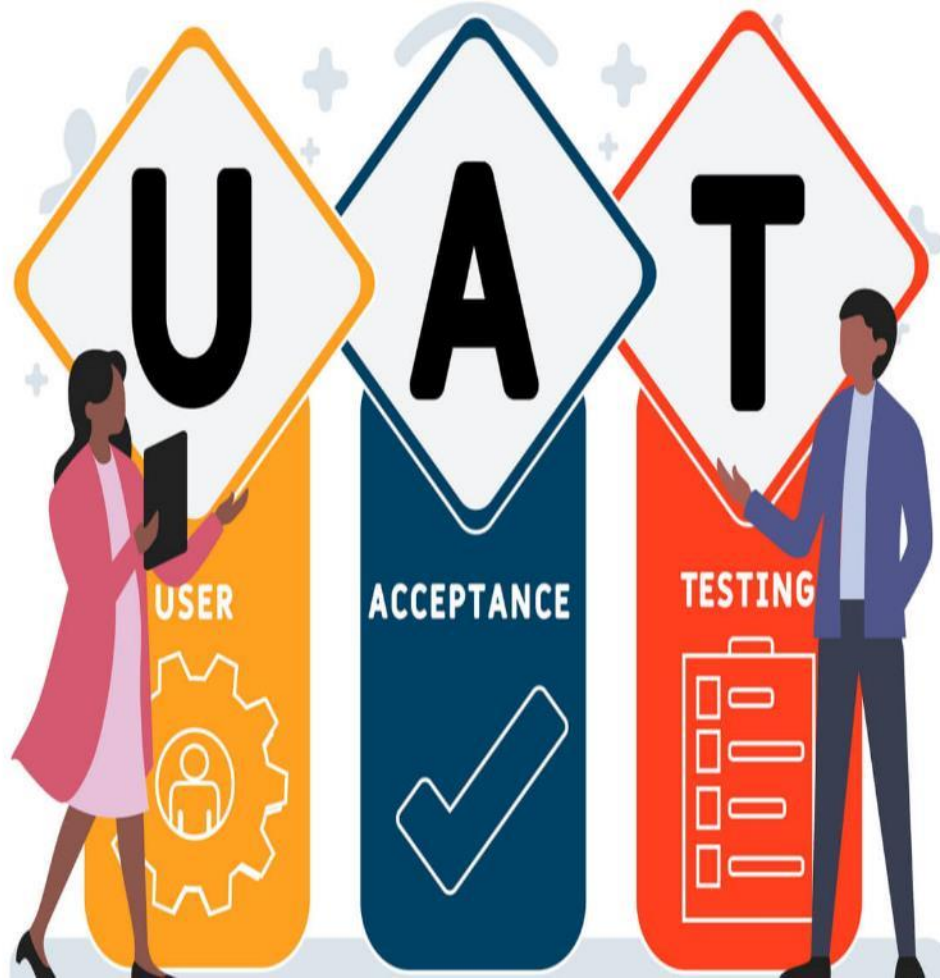| SC 1	SC 2	SC 3	SC 4	SC 5	SC 6
Integrating real-world experience with adaptive edge – cloud computing into a digital automotive value chain	Enhanced perception and localization	Intelligent Connectivity	Smart BMS enabling V2X connectivity	Smart City pilots	Business models / Road maps

Smart City pilots

- **Smart mobility with Multi-modal autonomous & tele-operated transport on land and sea'**
- **AI for efficient door 2 door transportation**
- **Smart city and users in the loop.**

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SC 5

Smart City pilots

- Traffic management models based on digital twins

- Filtering and sending data securely and in real time in the smart city

- Development of C-V2X communication with 5G infrastructure and modems

- Generation of high-definition digital cartography of urban areas from merged information flows

- Define and implement a Mathematical end-user trust model as a function of as a function of f{fairness | transparency | explainability | responsibility | accountability | safety | security | privacy | robustness | reliability | acceptance}

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Business models/ Road maps

USER ACCEPTANCE TESTING

BUSINESS INTELLIGENCE

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Project Aspirations

- Our project aims to establish a domain model across six supply chains.

- We are committed to implementing state-of-the-art (SOTA) and cutting-edge digital enablers.

- Our expertise will be harnessed to empower all phases of the highly automated vehicle life cycle.

- We envision showcasing, 13 demonstrators that will cover each aspect of this life cycle.

- we plan to develop a comprehensive market analysis and a detailed business plan.
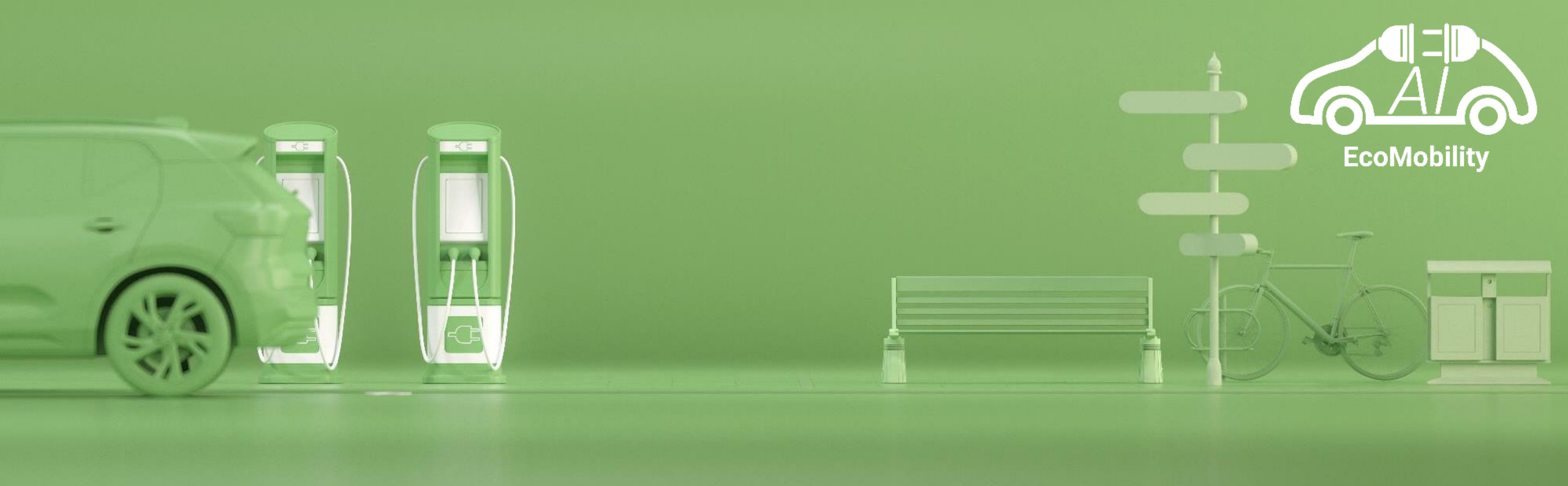
LIFETIME EXTENSION AND MOBILITY CLUSTER

This cluster aims to innovate and collaborate for a greener future, where products, technologies and infrastructure last longer, enhancing quality of life in Europe's cities and beyond.

ARCHIMEDES

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ArchitectECA2030

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The project has been accepted for funding within the Key Digital Technologies Joint Undertaking (KDT JU), a public-private partnership in collaboration with the Horizon Europe (HORIZON) Framework Programme and National Authorities under grant agreement number **101112306**

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KDT JU

KEY DIGITAL
TECHNOLOGIES
JOINT UNDERTAKING