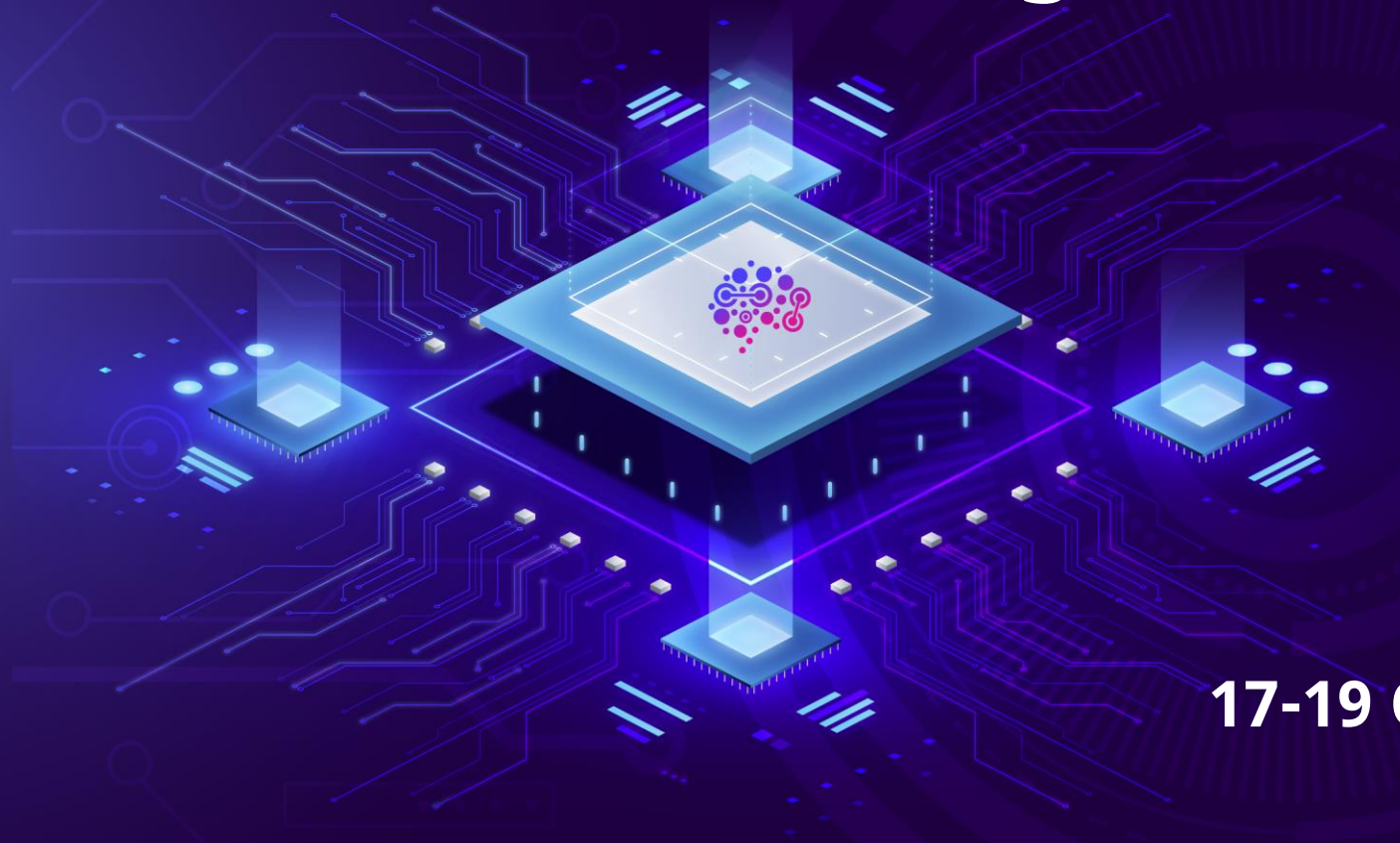
EDGE AI

European Conference on EDGE AI Technologies and Applications - EEAI



Advancing emerging edge AI technologies and driving next generation intelligent applications.

17-19 October 2023, Athens, Greece

European Conference on EDGE AI Technologies and Applications - EEAI

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

Mohammed Abuteir , TTTech

17-19 October 2023 Athens, Greece

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Project Overview

- **Funding**: KDT Call 2022 – RIA
- **Coordinator**: TTTech Auto GmbH
- **Duration**: 36 months (May 2022 – April 2025)
- **Partners**: 47 from 9 countries (EU+Turkey)
- **Use Cases**: 13
- **Project size**:
  - Total: ~ 37 Mio EUR / ~20 Mio EUR Funding

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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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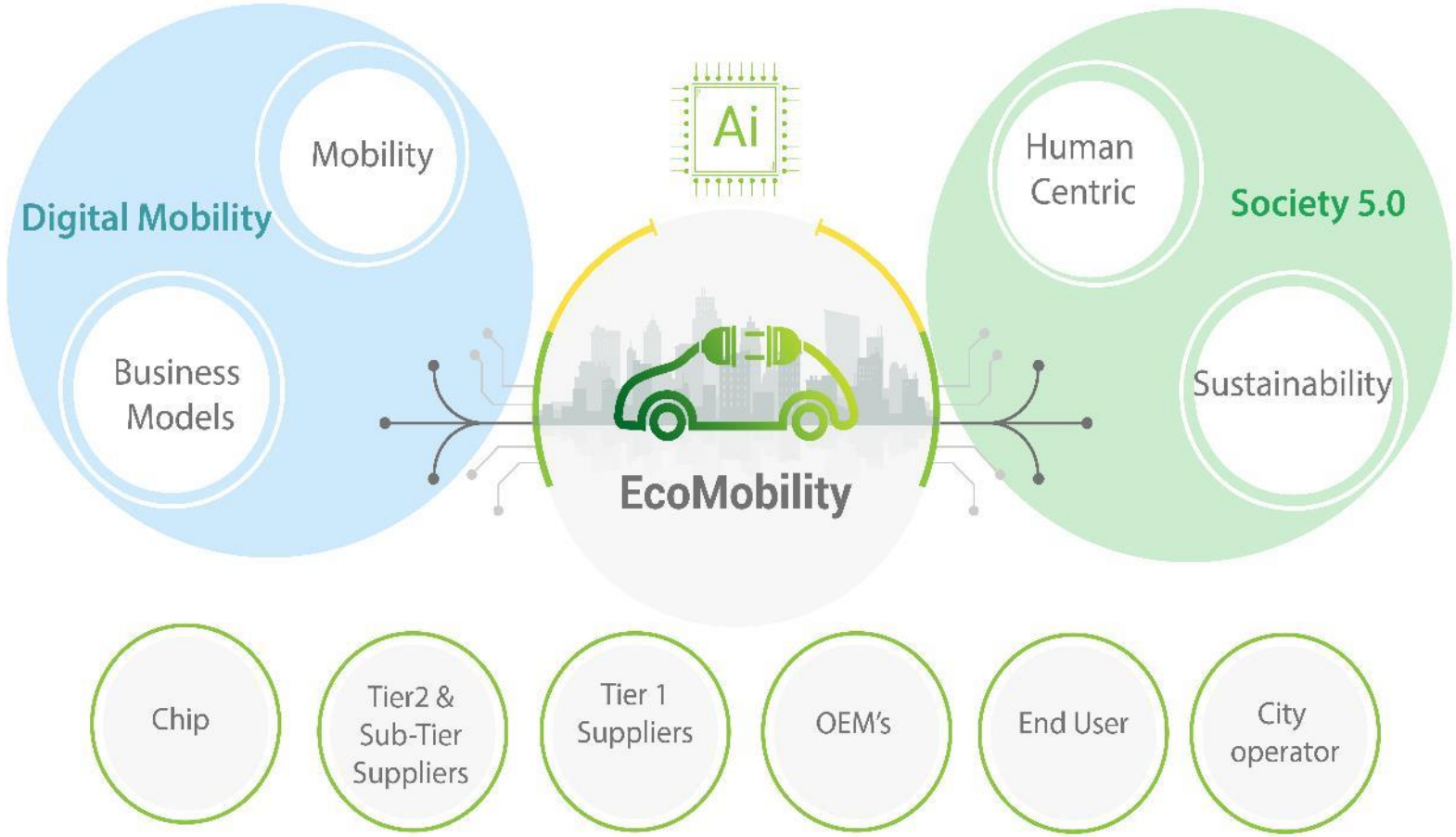
EcoMoblitiy



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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.

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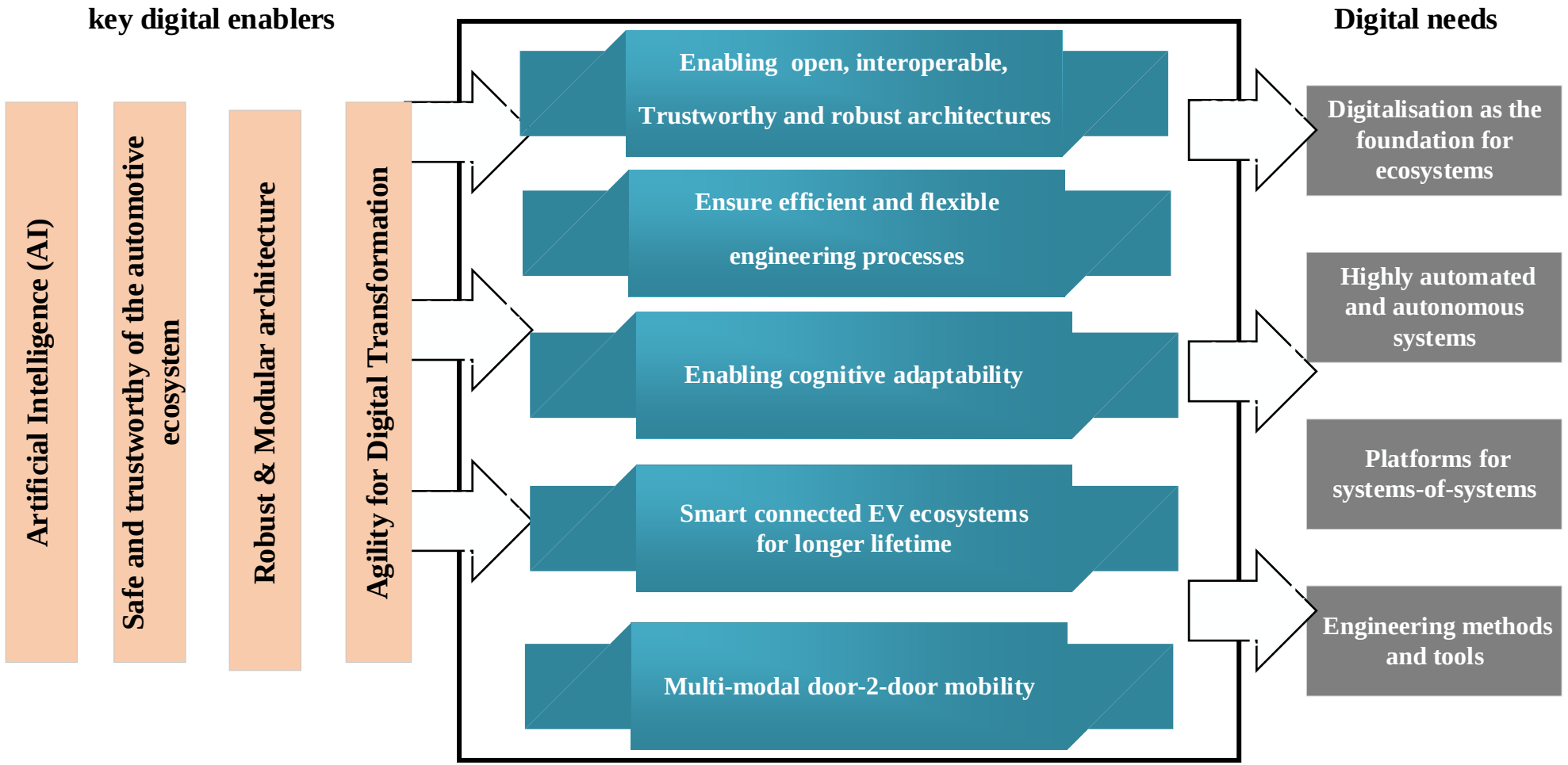
Technology Research challenges



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Objectives

- **Obj. 1:** to enable continuous and robust optimization of well adapted design methods and value chains to achieve digital mobility, enhance reliability, safety and security of future electrical vehicles
- **Obj. 2:** to develop on-board intelligent, trustworthy electronic components and systems for the next generation automated driving (SAE Levels 3+) .
- **Obj. 3:** to develop intelligent connectivity mechanisms and architectures for safer, greener, and more efficient road mobility.
- **Obj. 4:** To develop a connected smart battery management system with cloud-based Artificial Intelligent (AI) services and enhanced hardware capabilities for increased battery lifetime and reliability.
- **Obj. 5:** To develop a multimodal transport system for goods and passengers aiming to a more sustainable and efficient transport through smart city solutions, with upgraded and resilient physical and digital infrastructures for smarter vehicles and operations, for optimised system-wide transport network efficiency
- **Obj. 6:** To provide market intelligence on how to strengthen the European electrified vehicles industry, to enhance user acceptance, and to ensure Europe`s leadership in the field.

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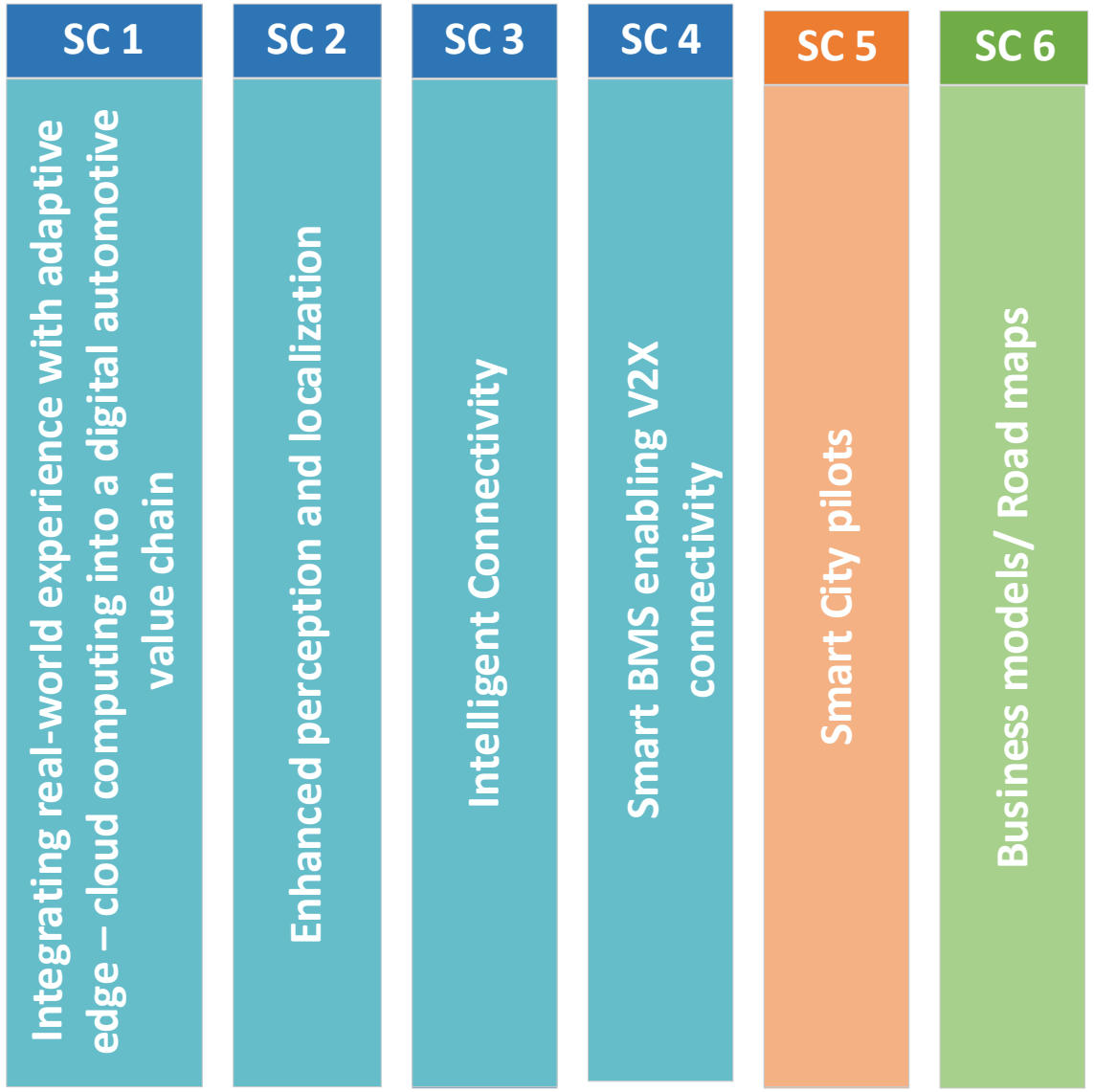
supply chain



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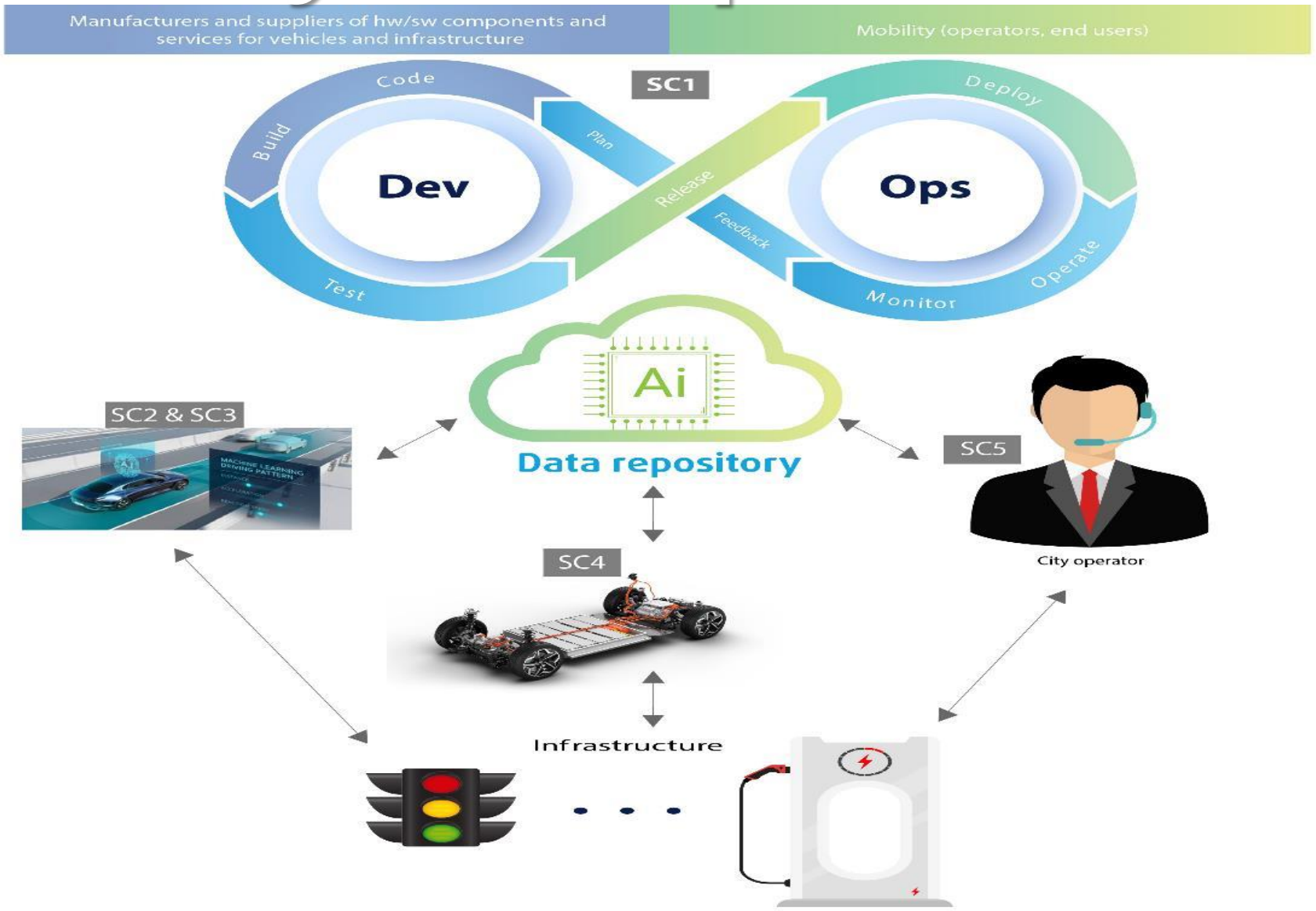
EcoMobility concept



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

SC 1

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

Short development cycles

Incomplete requirements

Automotive SPICE

Safety ISO 26262

Security ISO 21434

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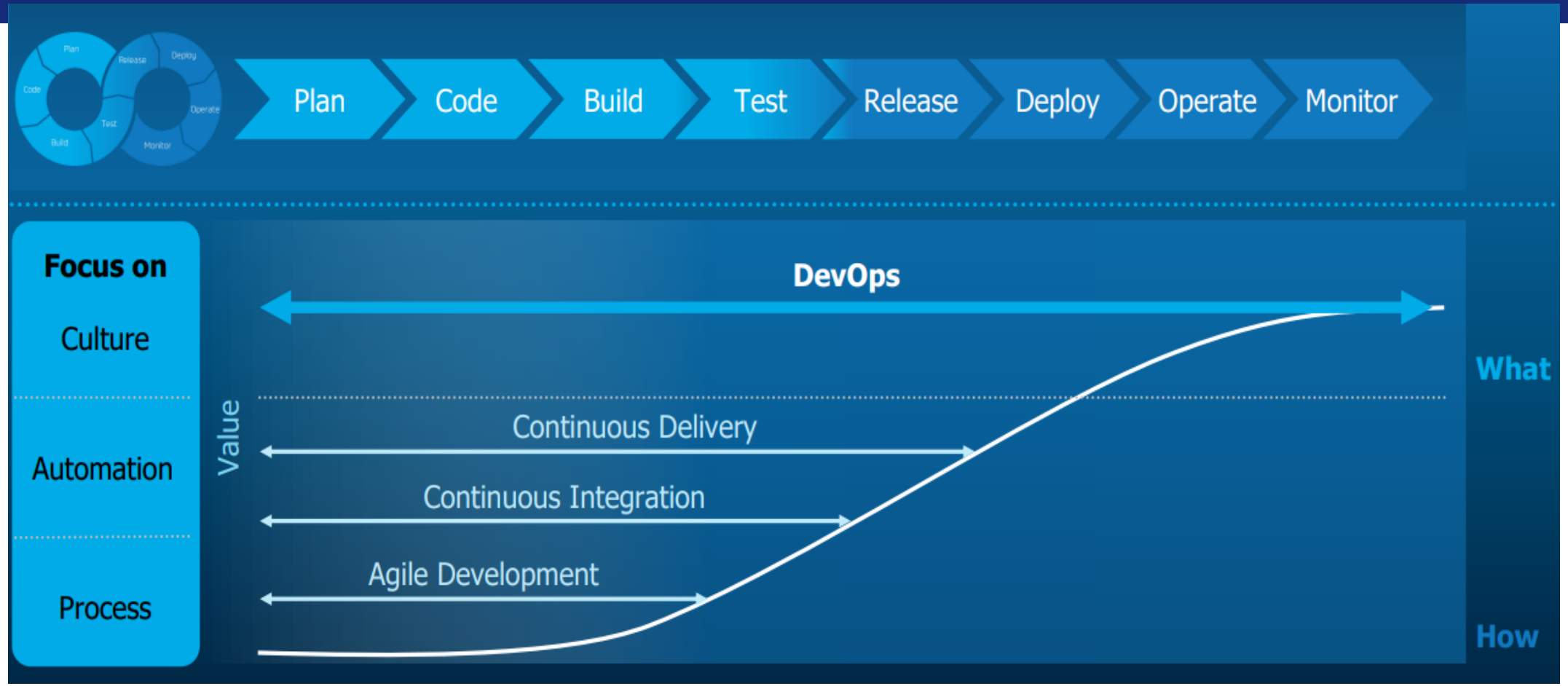
SC 1

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



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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).

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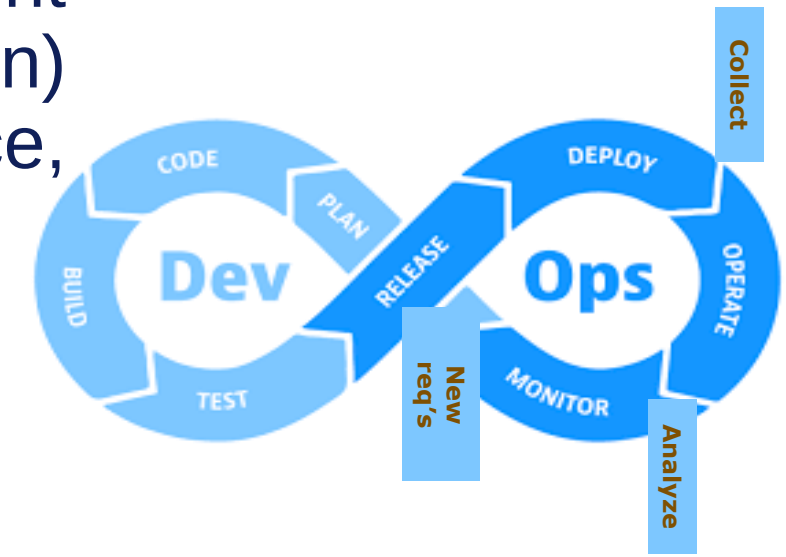
Mission

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).



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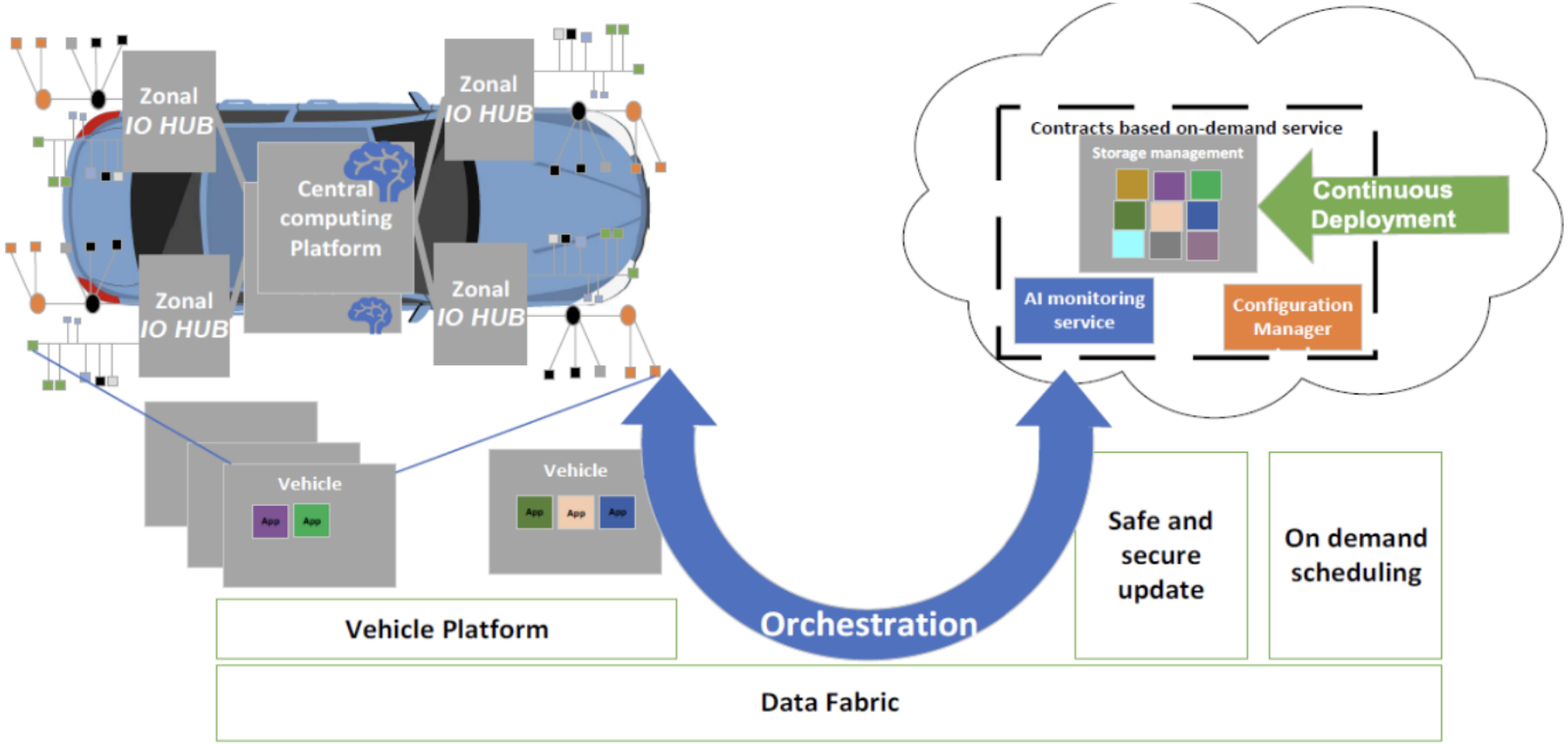
Modular and smart vehicle E/E architecture

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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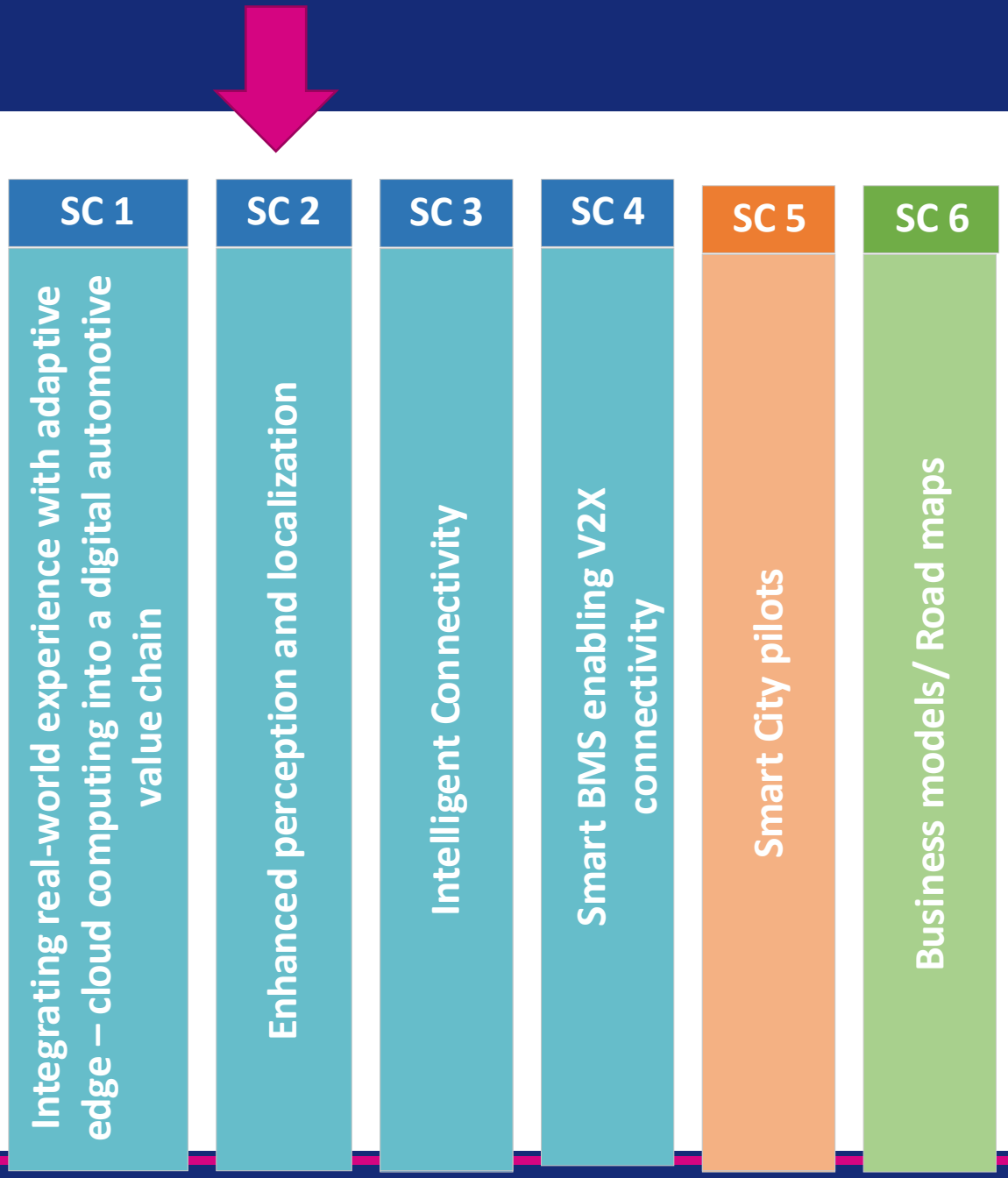

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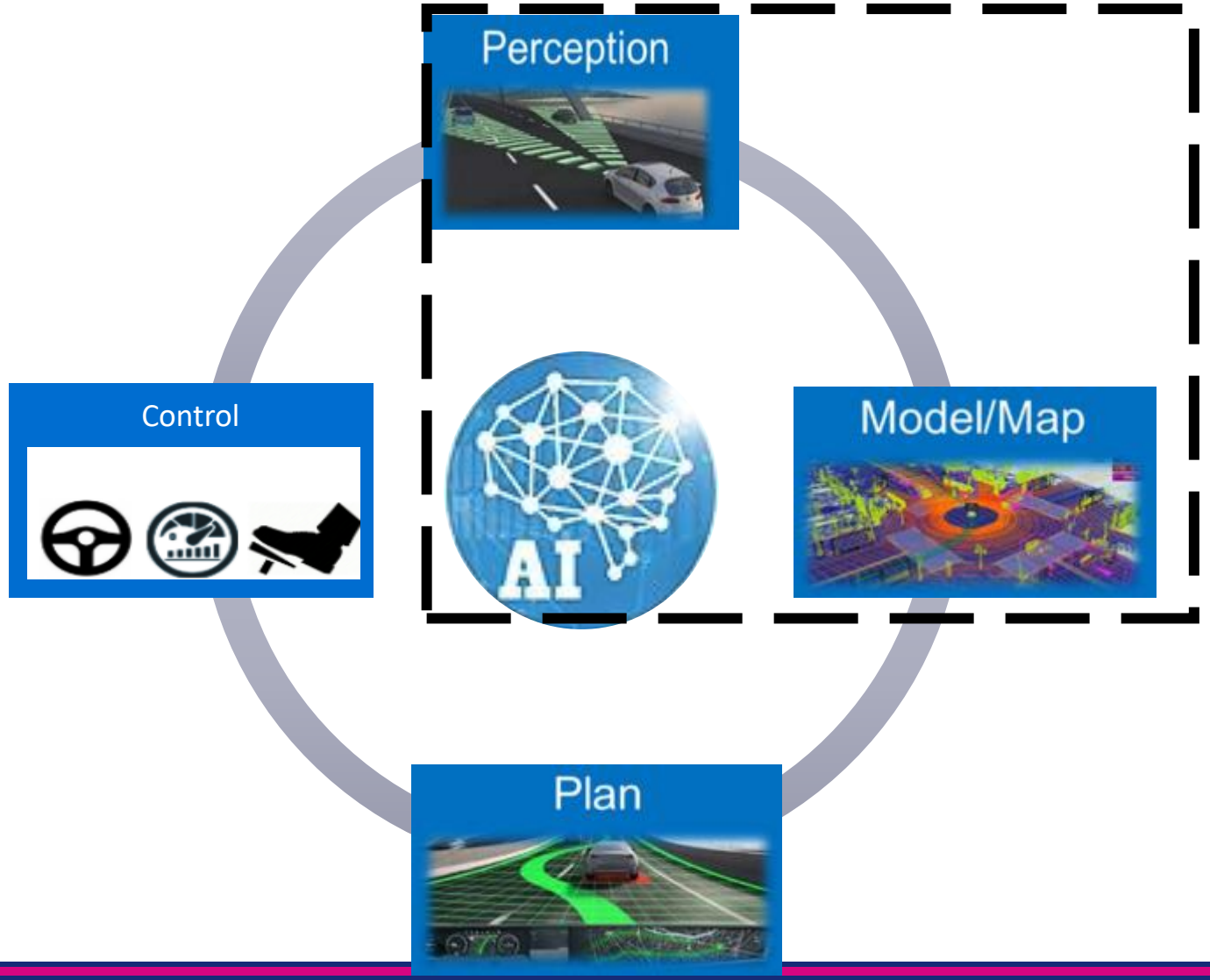
SC2 Enhanced perception and localization - intelligent embedded sensor systems

SC 2

Enhanced perception and localization



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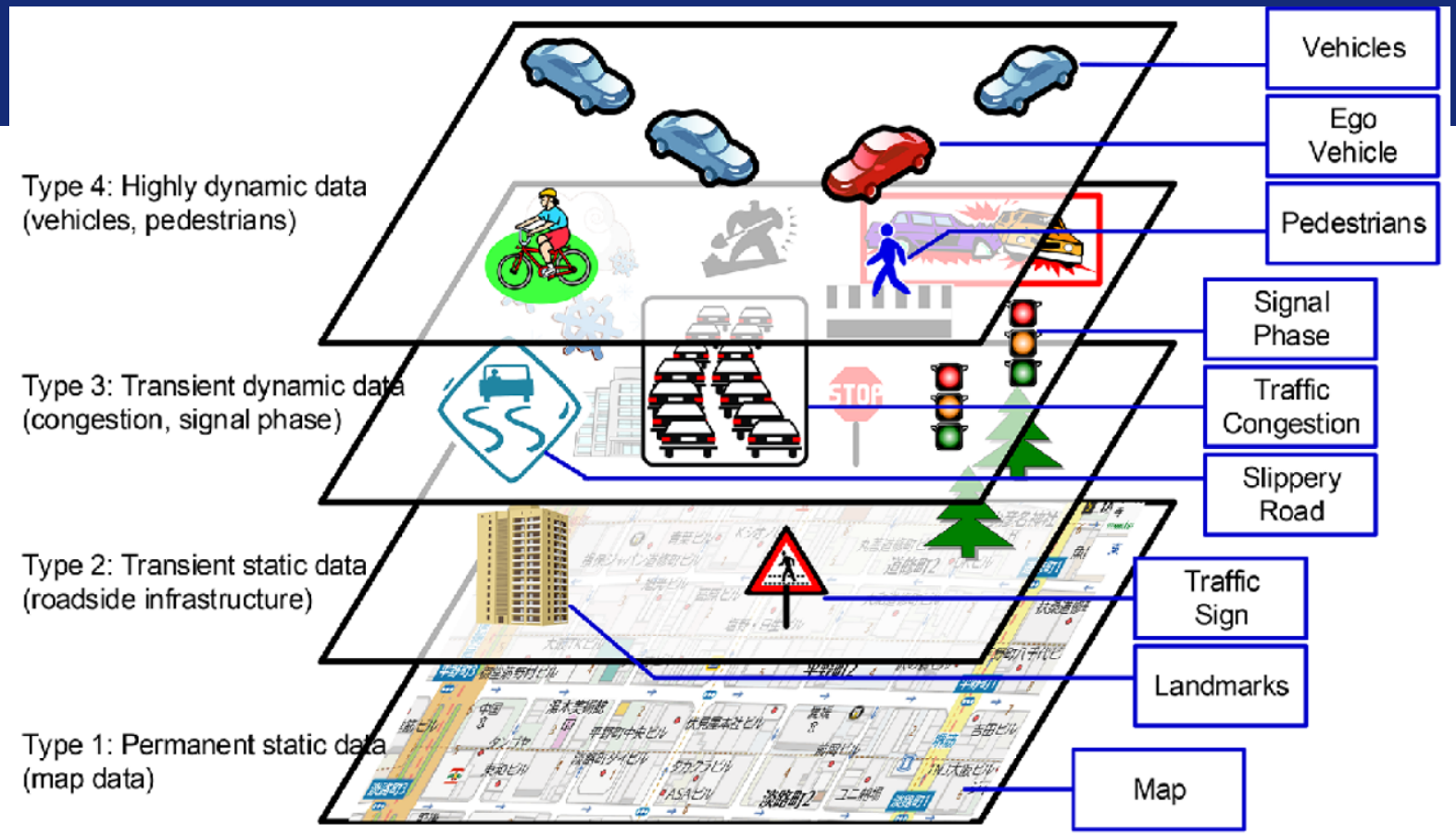
Vision



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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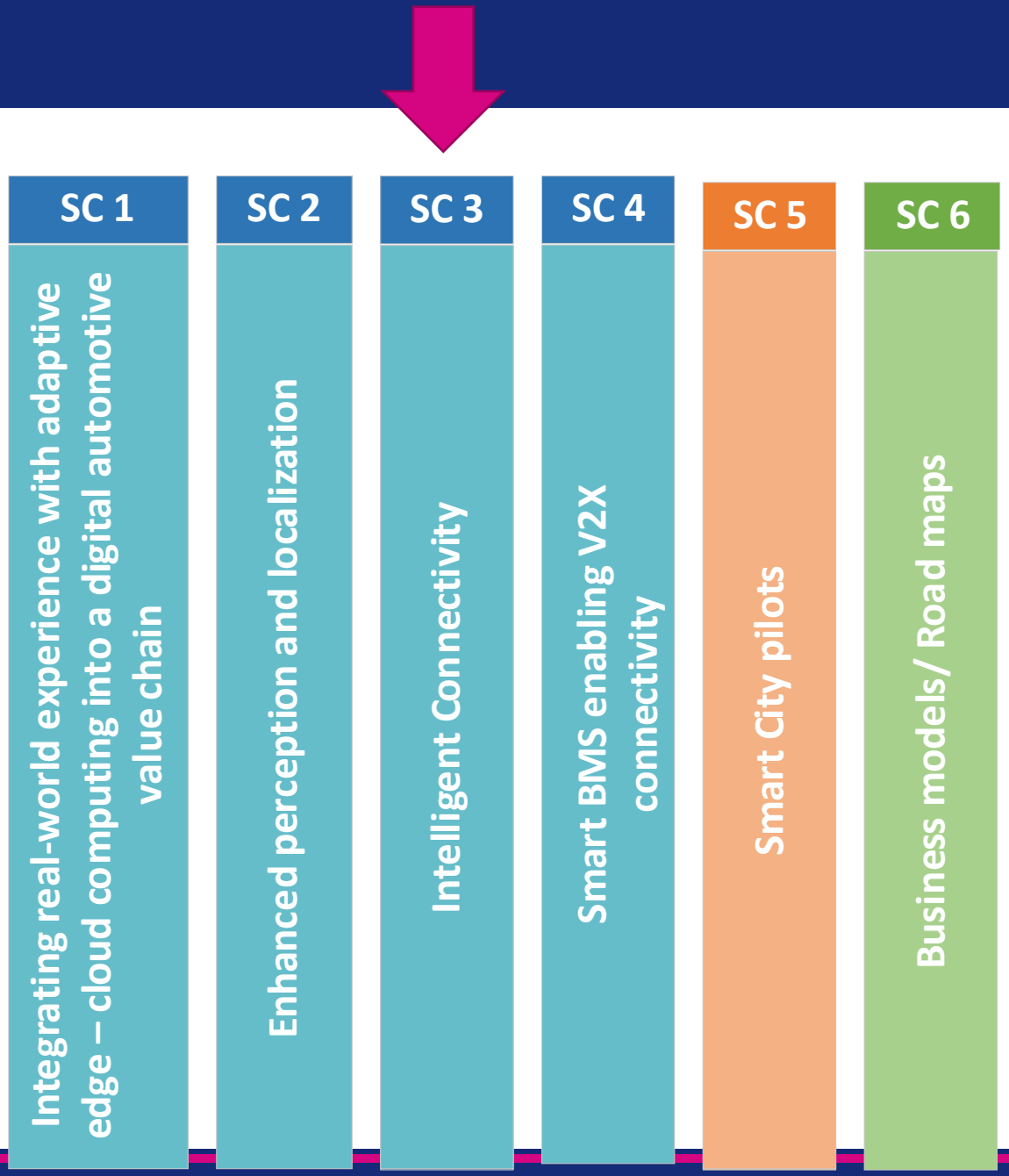

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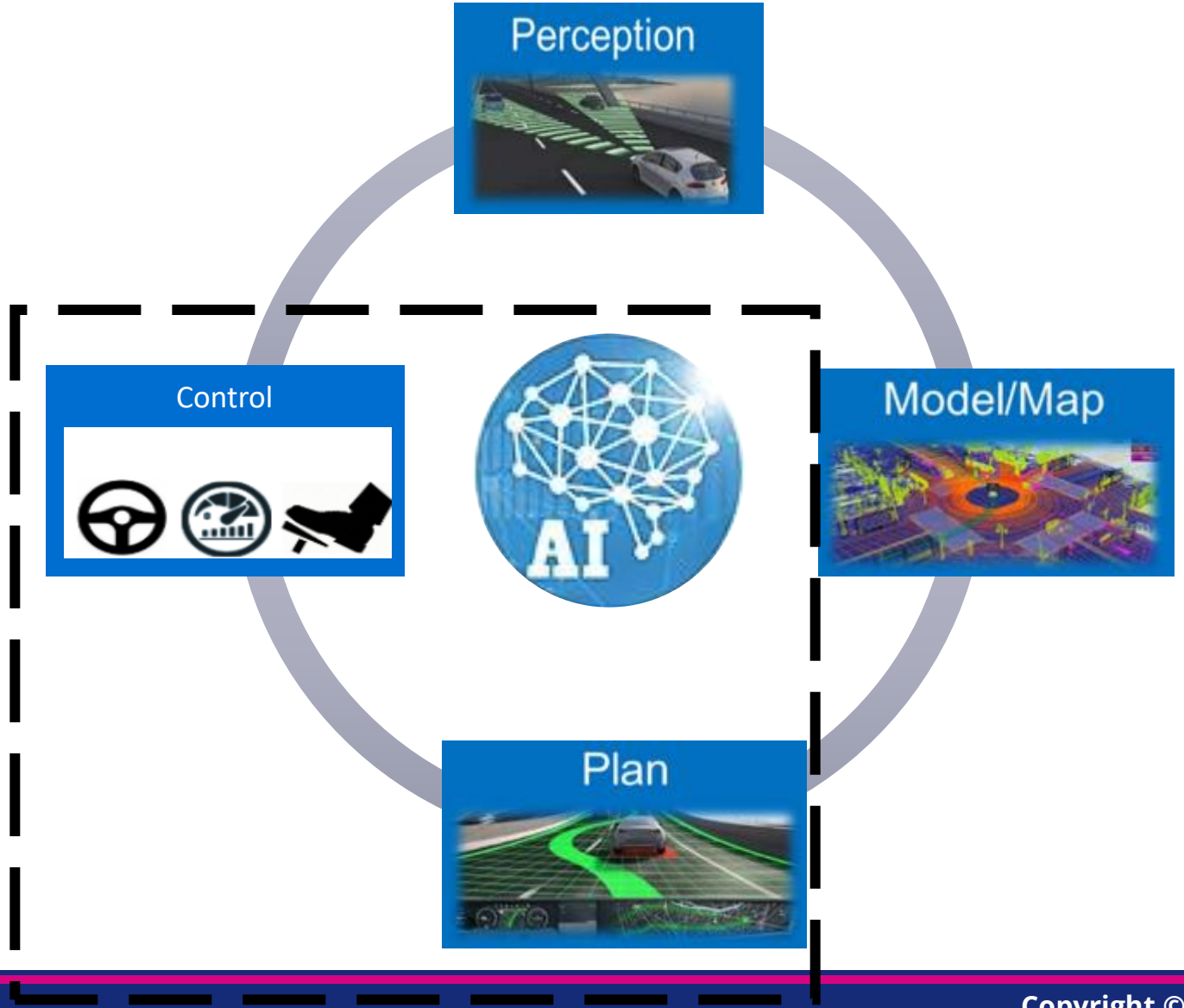
SC3 Intelligent Connectivity

SC 3

Intelligent Connectivity



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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**

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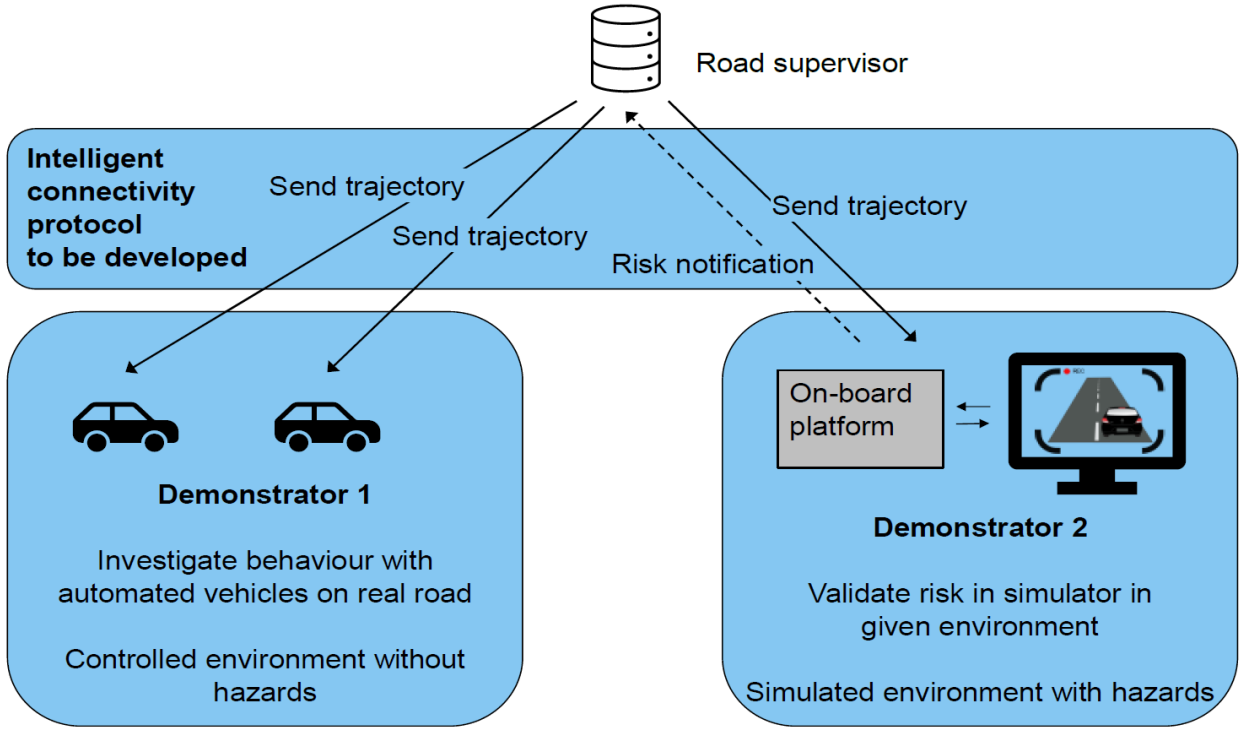
Main outcome

- **Collaborative control for automated driving**
- **Integrated supervisor architectures for risk monitoring**
- **Environmental model**



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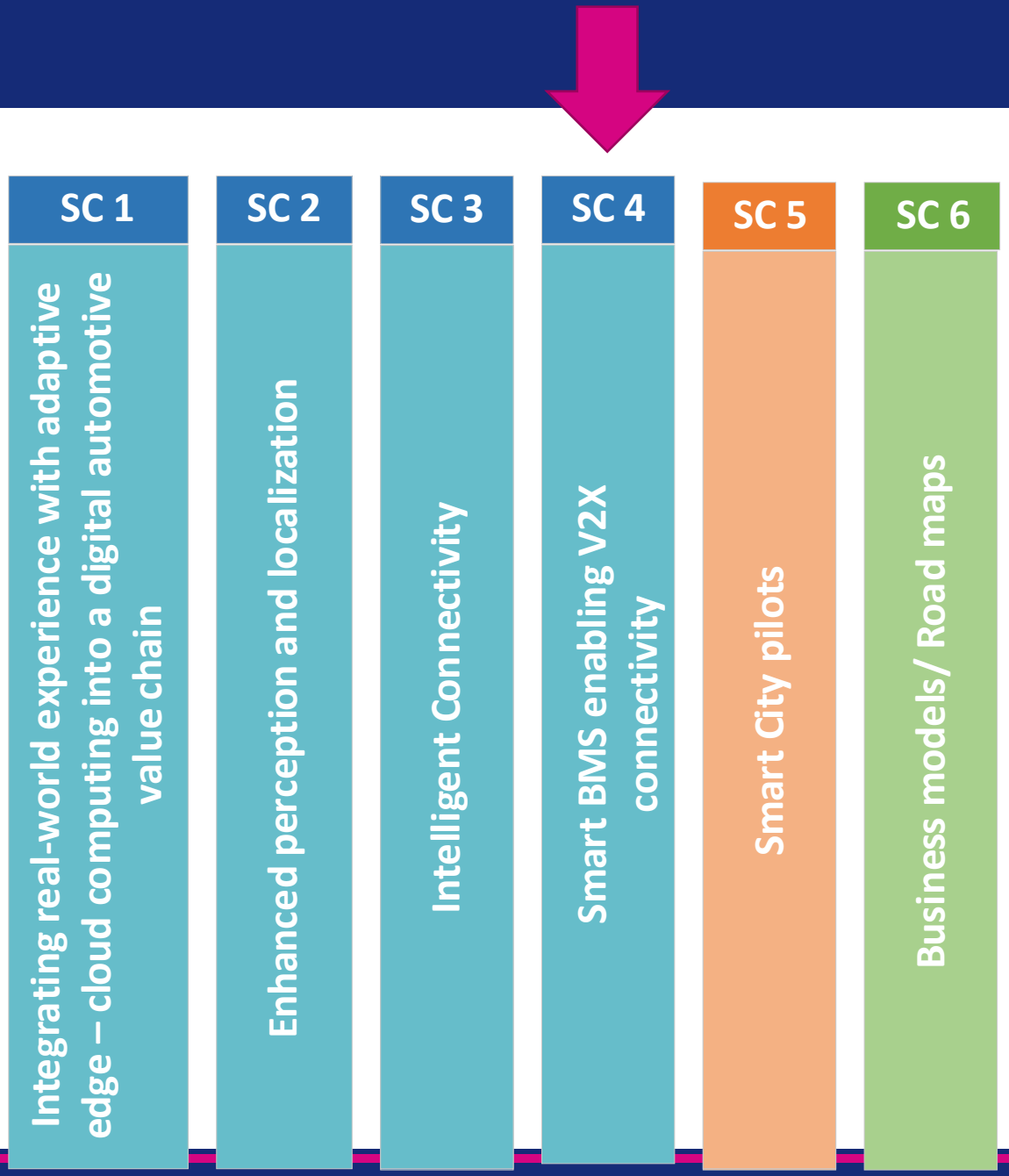

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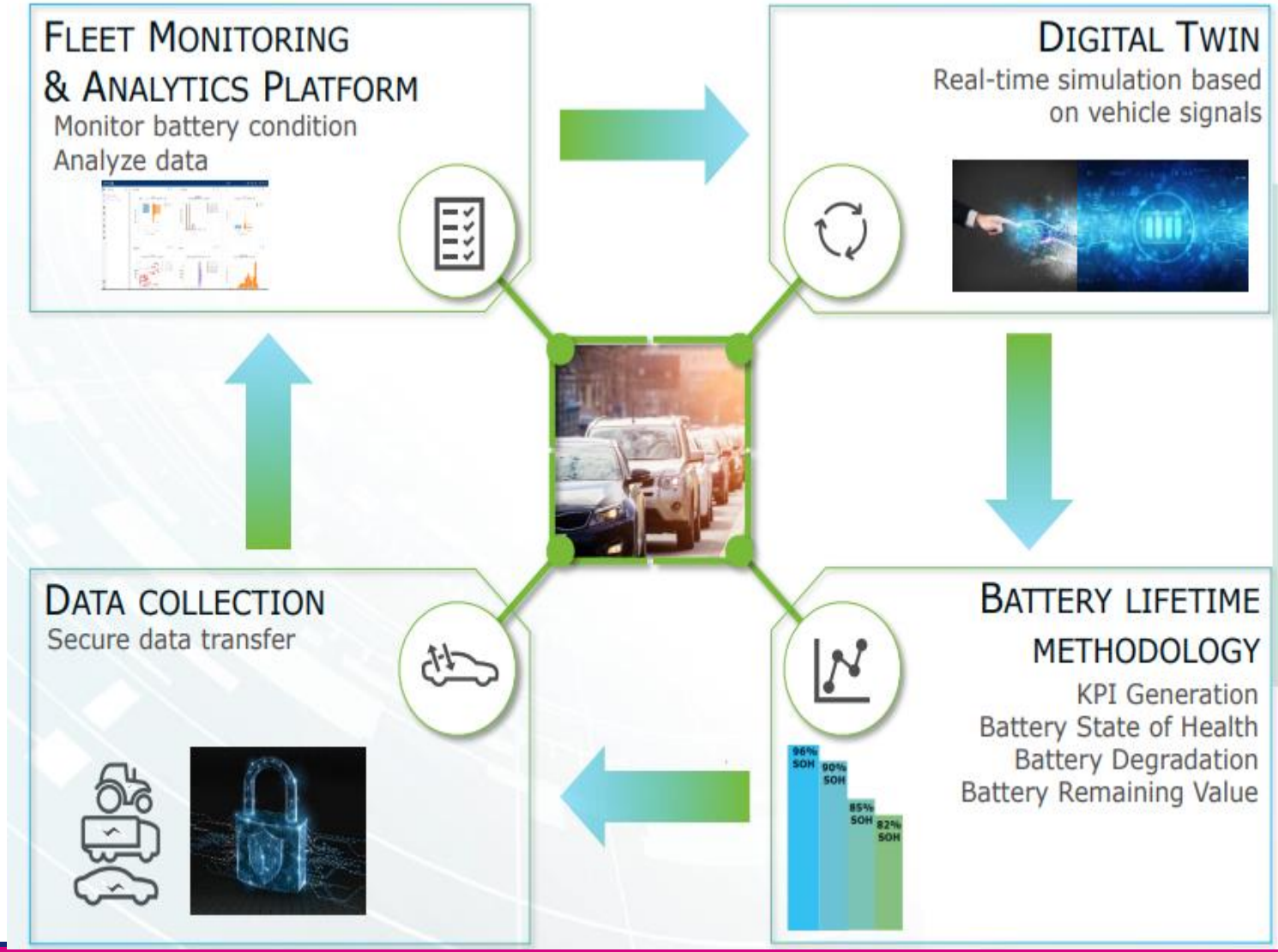
SC4 – Smart BMS with enhanced data management and connectivity

SC 4

Smart BMS enabling V2X connectivity



- ✓ 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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SC 4

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%

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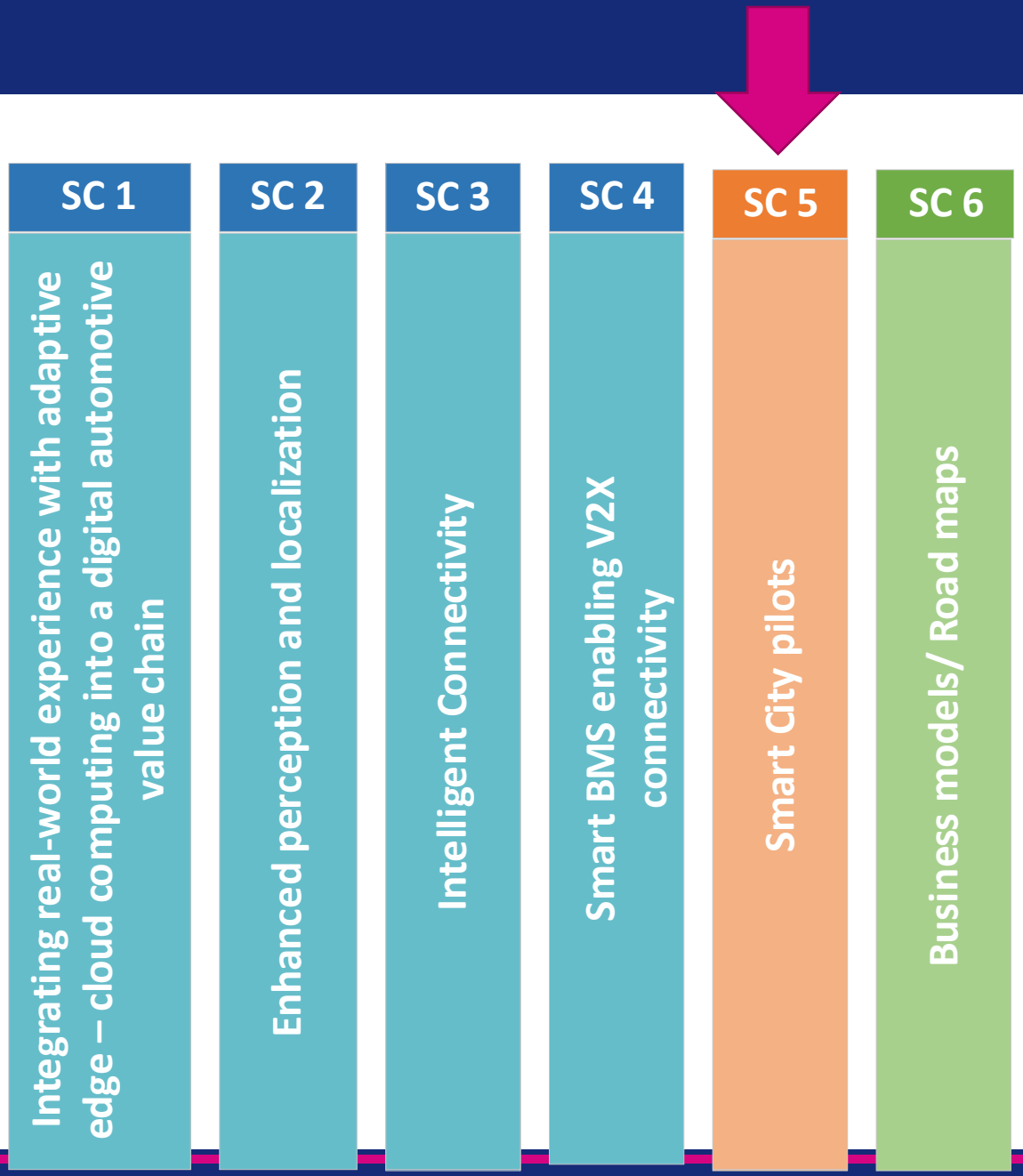

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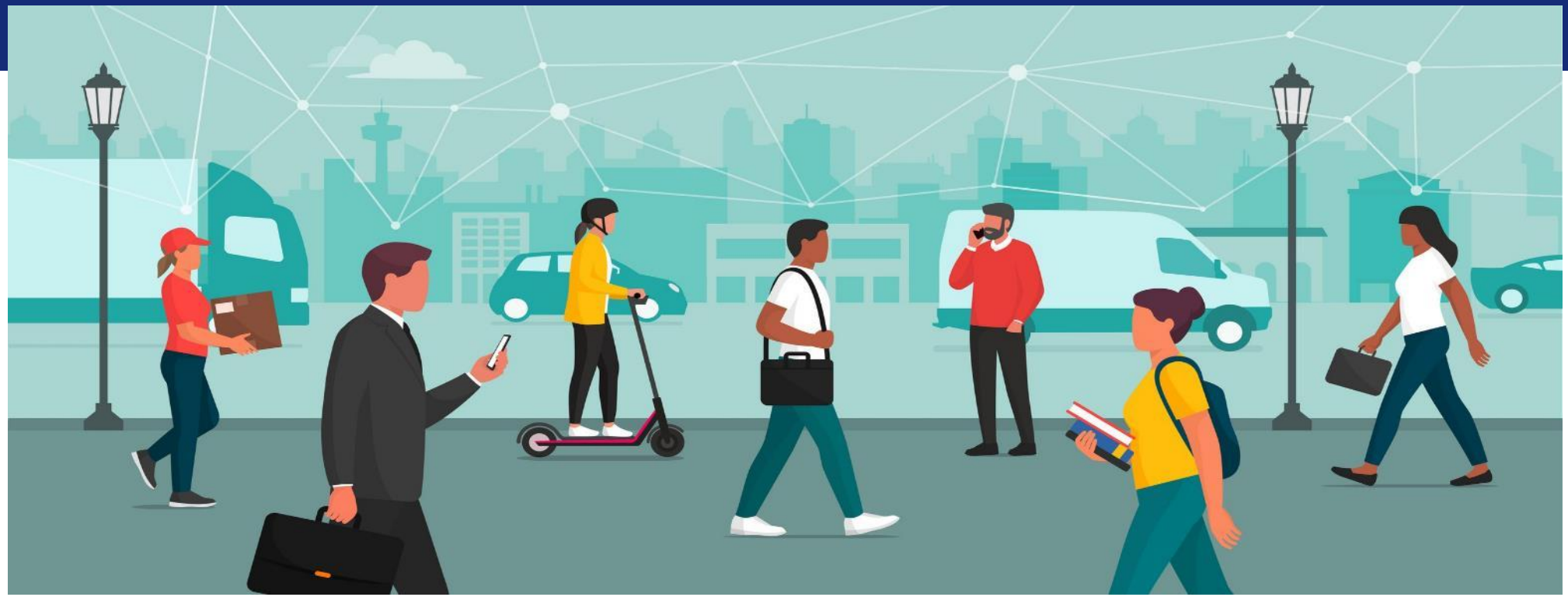
SC 5

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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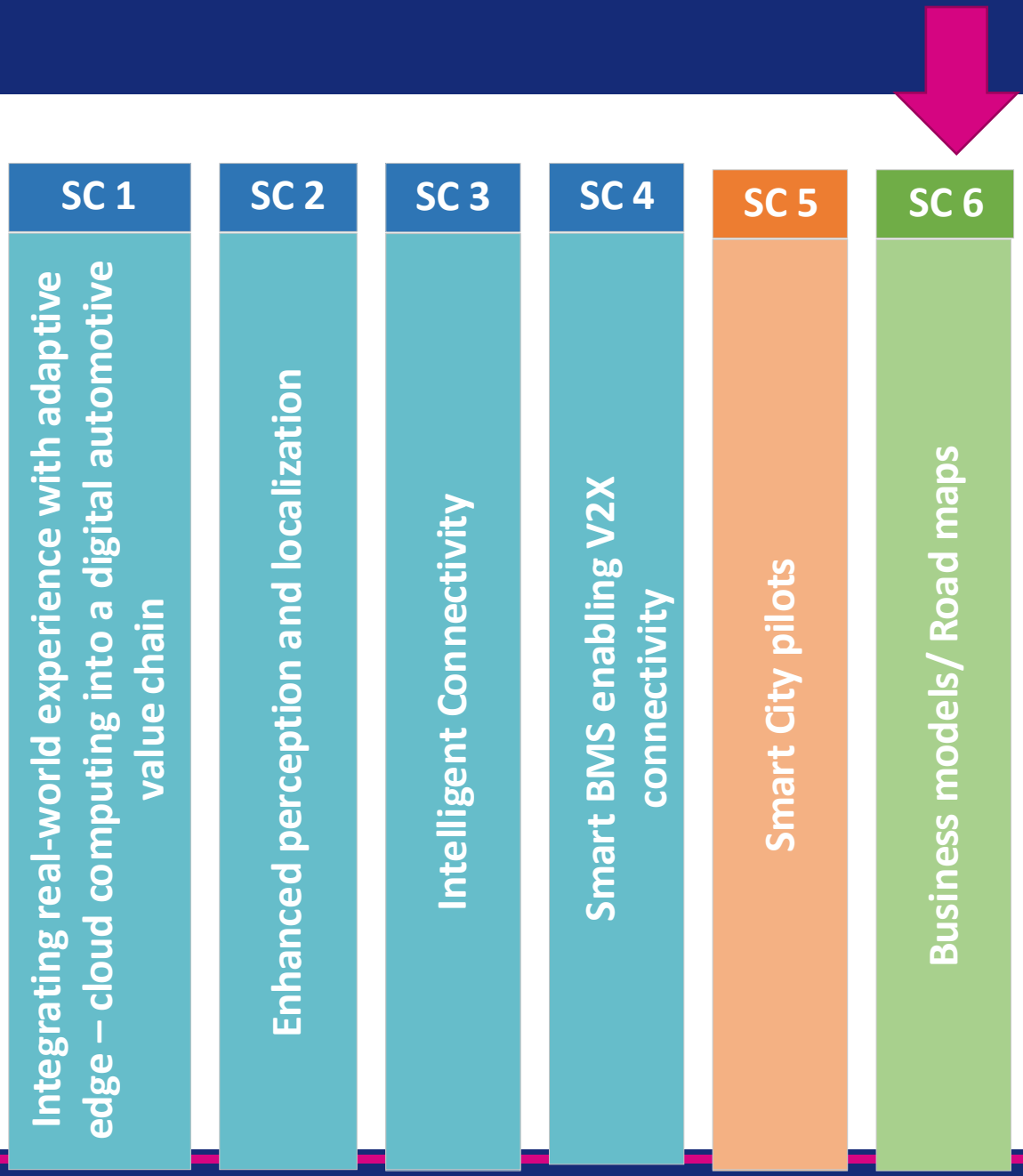

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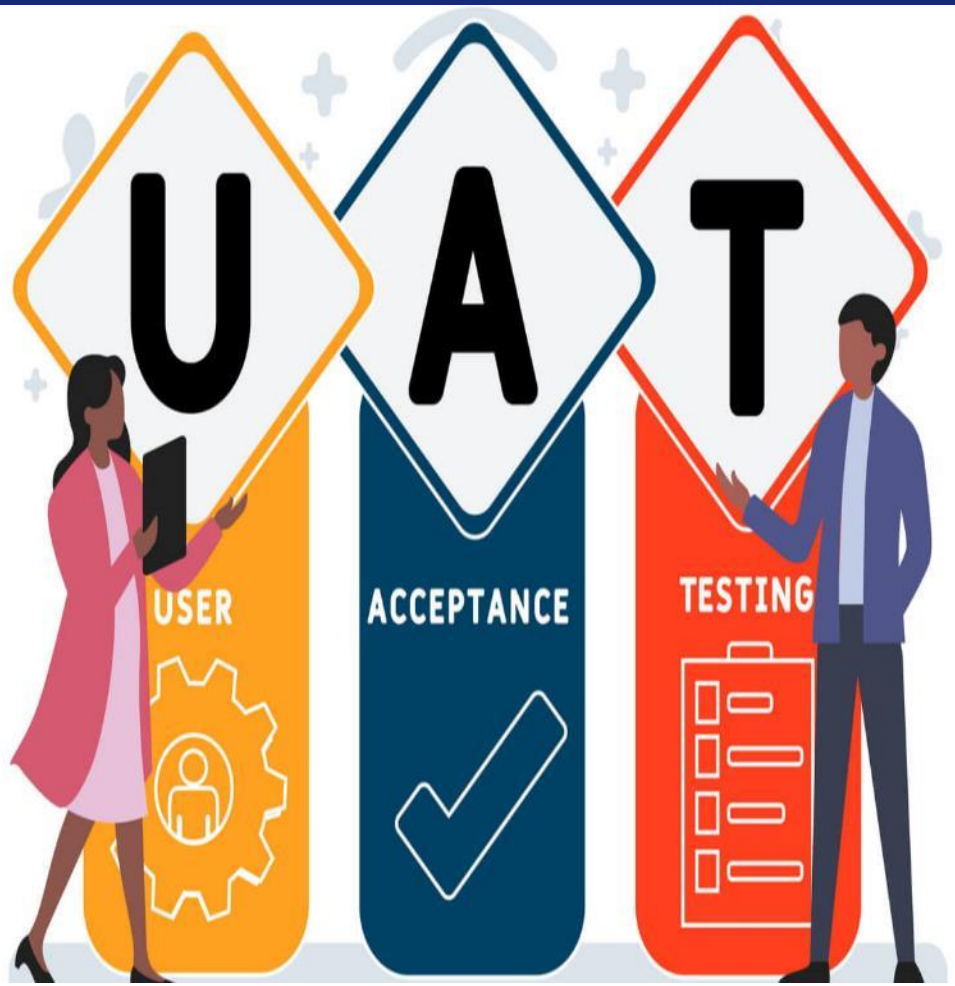

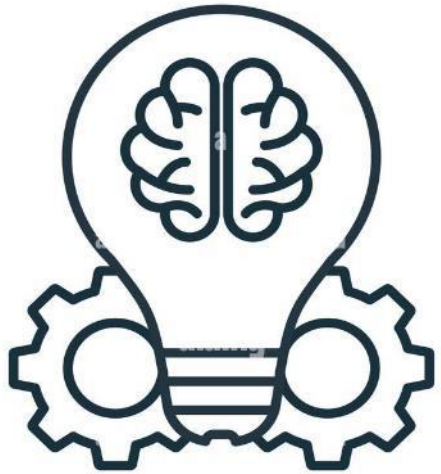

BUSINESS INTELLIGENCE

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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.

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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.

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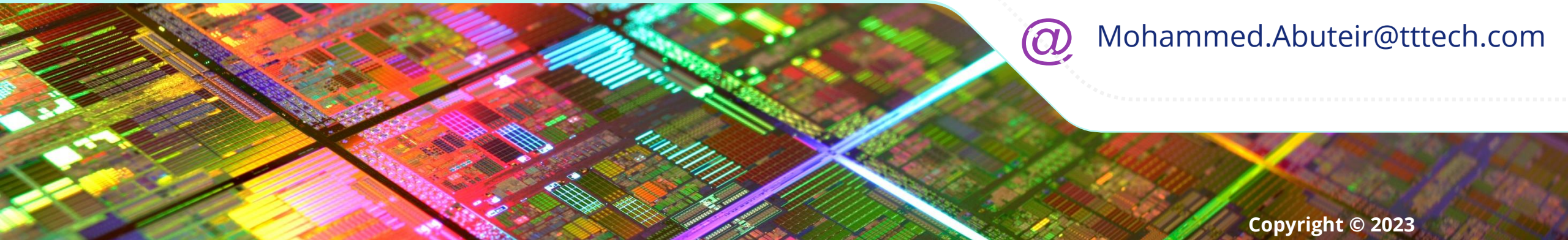
EDGE AI

Thank You

For your attention



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