



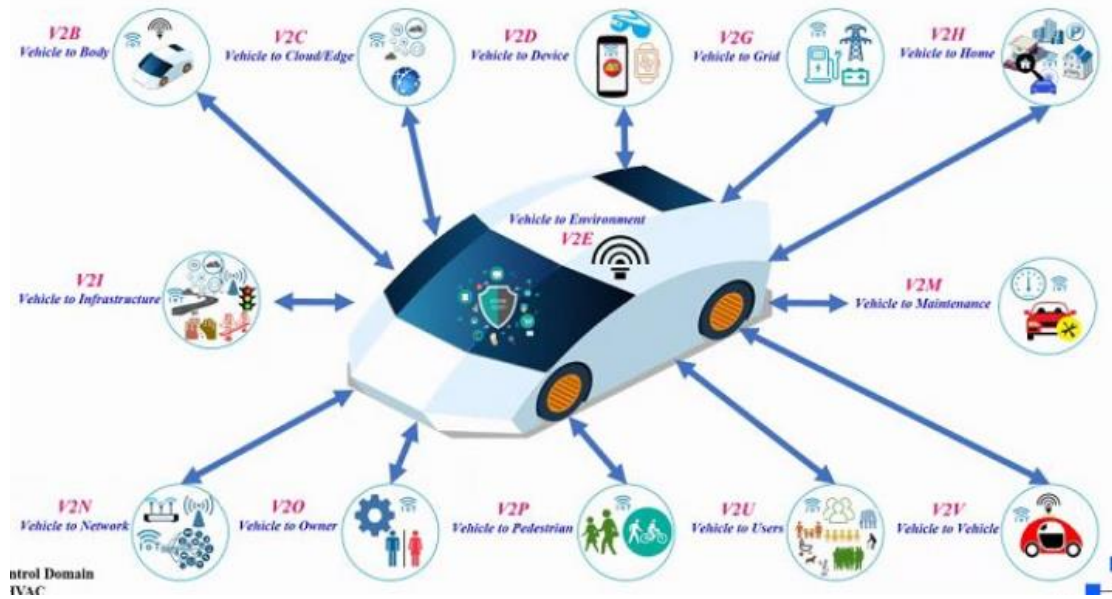
# NEXT GENERATION IOT AND CAR OPERATING SYSTEMS: A EUROPEAN PERSPECTIVE

Workshop: Safety, Research & Innovation  
The Autonomous, Wien, 29 September 2021

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# Next generation „edge“ operating systems for the car



- Current EU leadership
  - used by 90% of OEMs
  - offering a fair market place
- Next generation operating systems
  - connected, autonomous & green vehicles
  - mobility services & apps
  - US technology leadership: Tesla, Google, ...
  - Fierce competition:
    - VW.OS, MB.OS, BMW.OS
    - TeslaOS, Apple Car OS, Bosch
    - International alliances with AWS, MS, Google, Baidu, ...

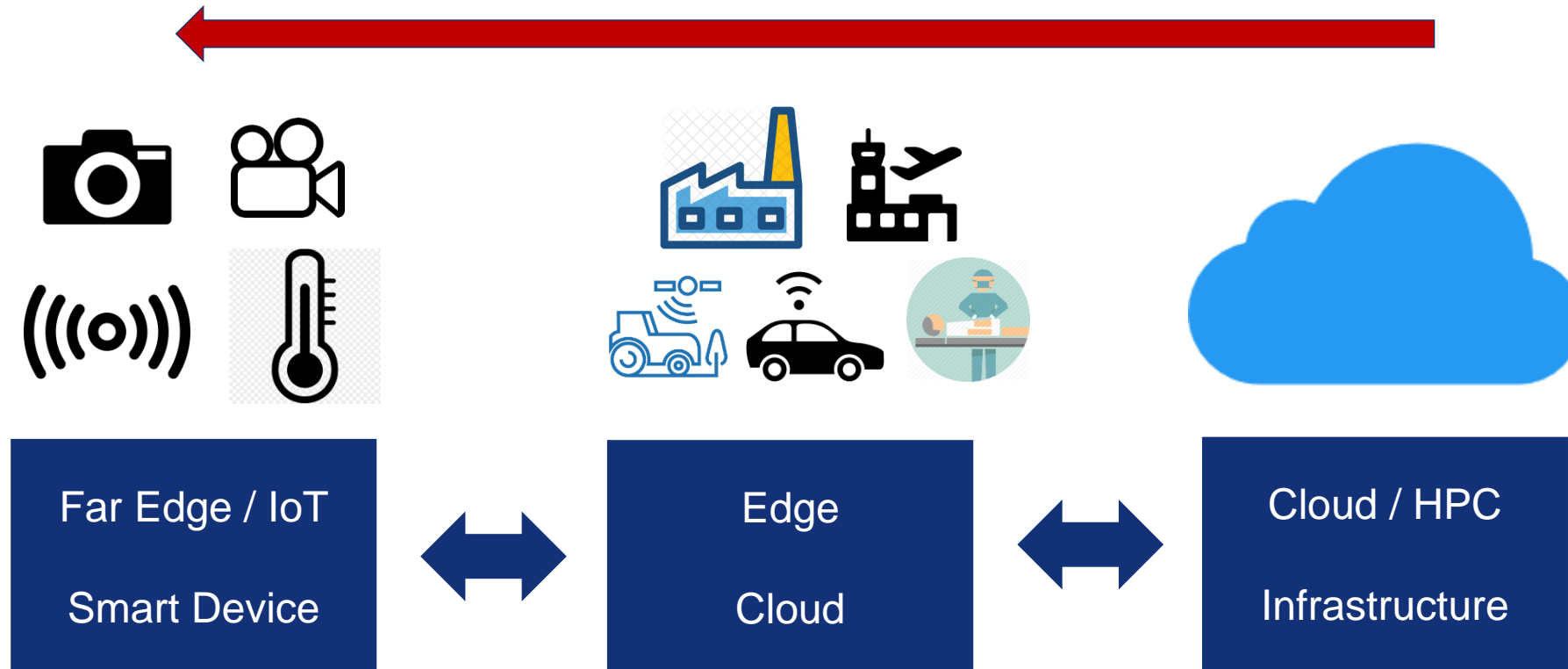
- EU actors must join forces to compete globally
  - meta operating system / interoperability framework
  - orchestrate HW, SW, dataspace, services
  - open platform approach – not proprietary
  - open and fair marketplace
  - scale through EU alliances: across value chains/competition
- Integrated with EV-charging Infrastructure
  - optimise use and production of renewable energy
  - bundling services across sectors, e.g. smart home



Source: Berylls Strategy Advisors

# A Digital Perspective: Paradigm shift from Cloud to Edge to IoT

Trend/Paradigm Shift: from Cloud to Edge  
Bringing compute resources closer to the data



Federating far edge resources ad hoc via wireless (5G, mesh)  
to provide cloud resources close to the edge

# **A 5-yr innovation perspective:** Building the Foundation for the next generation of Cloud-Edge-IoT platforms

- Today 80% to 20% processing on cloud versus edge – reverse in 5 years?
- Beyond cloud-edge service provisioning:
  - incorporating the power of the IoT and its far edge devices and system in a compute continuum
  - bringing computing power to where the data is
  - (Artificial) Intelligence at the edge and far edge – decentralised and swarm intelligence
  - enabling real-time processing: convergence IoT and cyberphysical systems
- Exploiting EU Strengths – application and system engineering competences
  - Cloud computing services: largely general purpose and application agnostic
  - Edge and Far Edge computing must be strongly customised towards the application
- **A new opportunity for European industry:**
  - **next generation of IoT and edge computing**
  - **next generation of industrial platforms and ecosystems**
- Prepare for it NOW:
  - Complement deployment and infrastructure measures (DIGITAL, CEF2, RRF, national funding)
  - Complement R&I of the KDT and SNS Joint Undertakings
  - by ~ 150M€ under HE for developing/piloting next generation Cloud-Edge-IoT

# Use Cases underpinning the trend Cloud-Edge-IOT

Carbon Footprint



Safety



Security



Privacy

Optimisation of resources:  
storage – network – computing centres



Synchronisation  
Digital Twins



Energy Consumption



Environmental Footprint



from

2020



80%

Centralised computing facilities



20%

Smart connected objects

to

2025



20%

Centralised computing facilities



80%

Smart connected objects

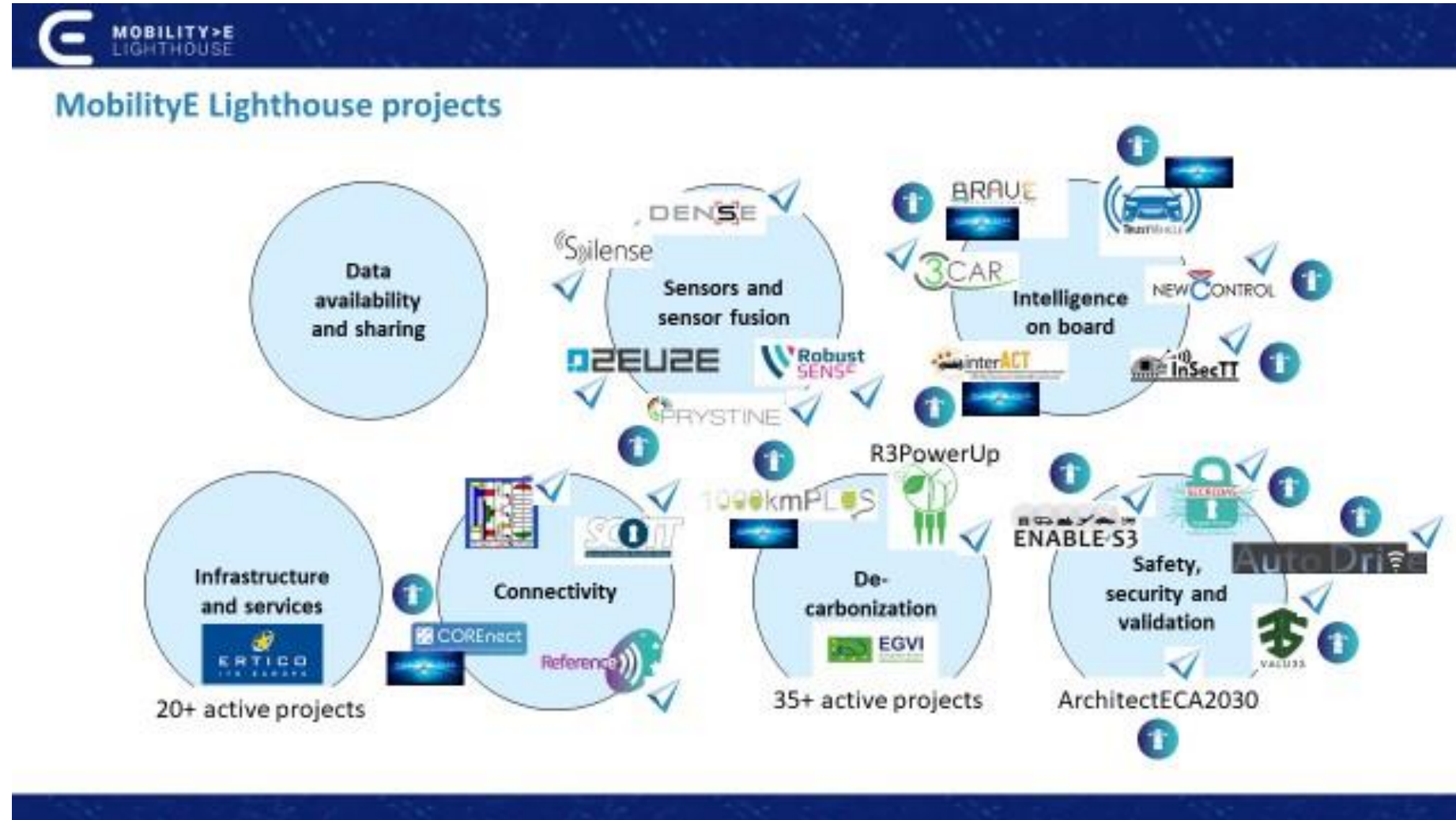


European Commission



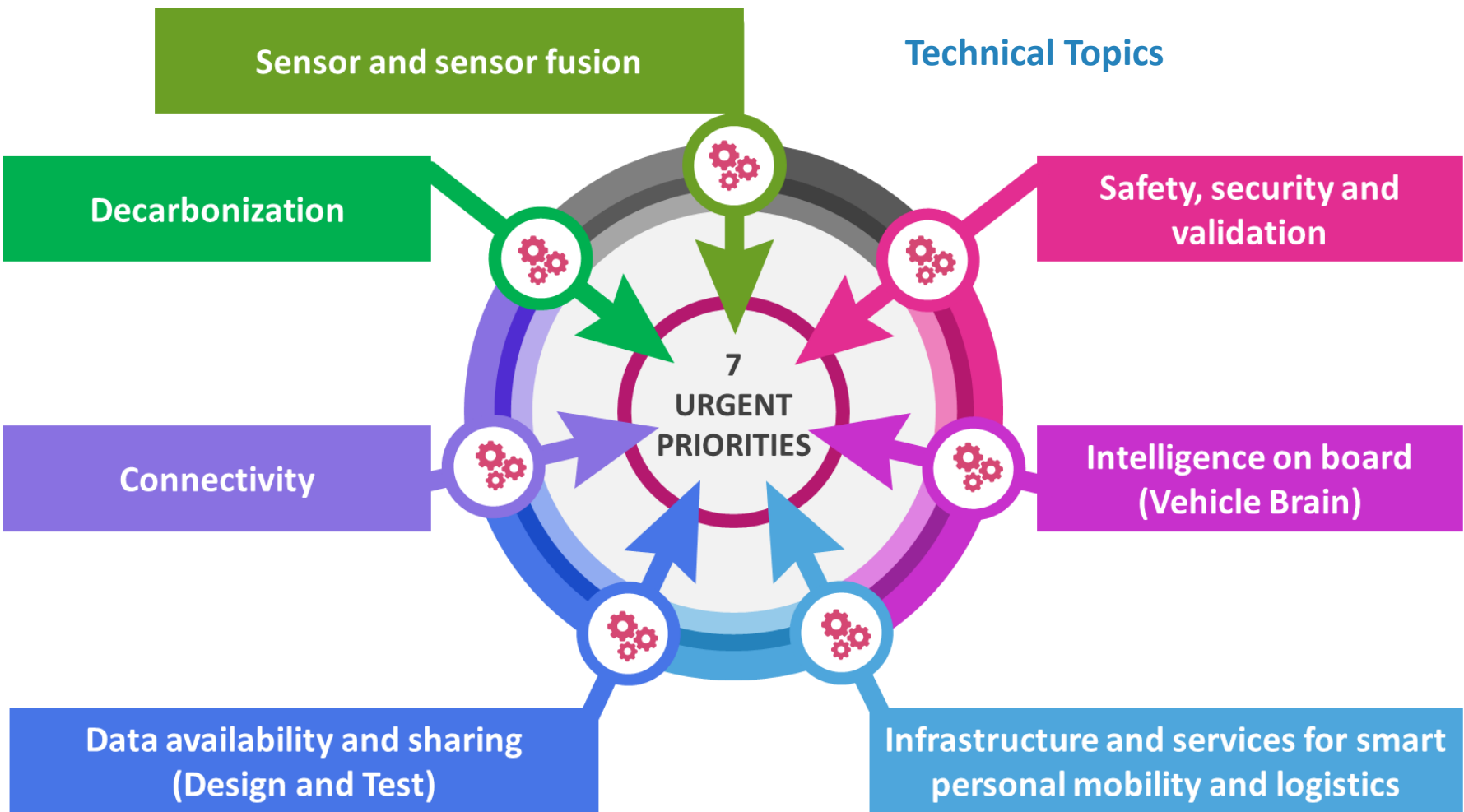
# An automotive perspective:

Some Reflection from the Mobility.E Lighthouse of the ECSEL JU



courtesy of the ECSEL JU

## Trend scouting - continuous research topic prioritization



## Automotive Intelligence and Market Trends



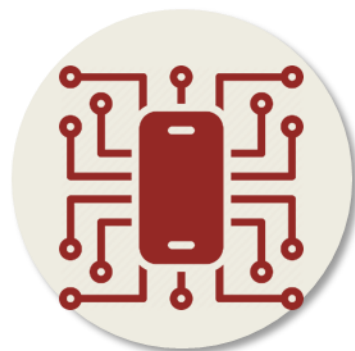
### Electrification

*The electrification of power train and transition to fully electric vehicle platforms. Expanding charging network infrastructures and reducing the time it takes to recharge a vehicle and using new edge/cloud platforms for scheduling and optimization.*



### Automation

*Ability for vehicles to safely operate with less, and no input from the driver. Full autonomy and intelligent connectivity will provide greater productivity and less congestion (resulting in less pollution).*



### Digitalization

*Digital transformation of the mobility applications and services through a radical rethinking of how stakeholders uses mobility in pursuit of new revenue streams, new business models and ecosystems.*



### Decarbonization

*Decarbonization means the reduction of carbon and the conversion to an economic system that sustainably reduces and compensates the emissions of CO<sub>2</sub>, with the long-term goal to create a CO<sub>2</sub>-free global economy.*

Decentralization

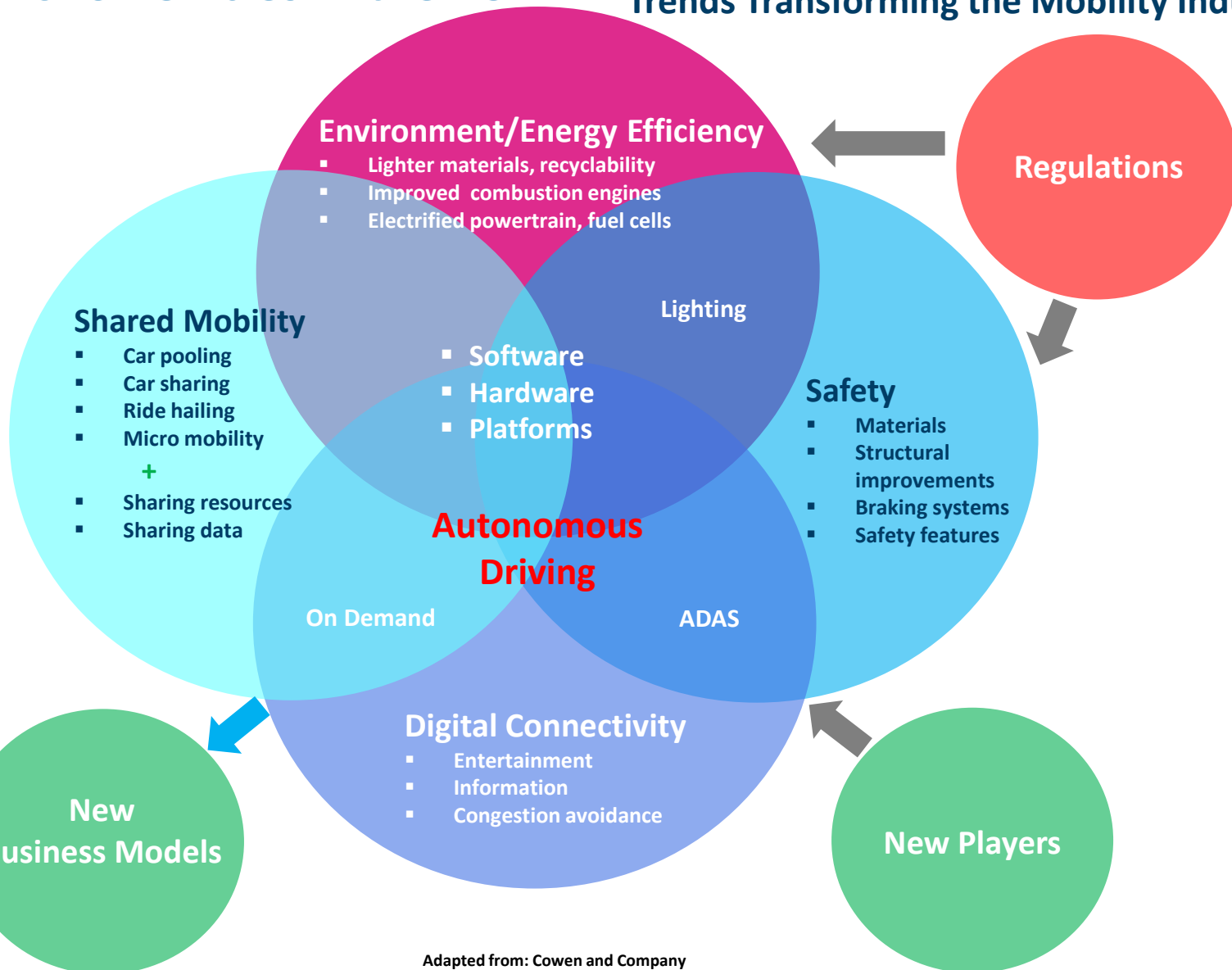
Standardization



# ECAS Vehicles in the EU

## Trends Transforming the Mobility Industry

ECAS = Electric – Connected – Autonomous - Shared



### BENEFITS OF SELF-DRIVING IN THE EU

The infographic illustrates the benefits of self-driving cars in the EU, centered around a car with various icons connected to it:

- Safer roads**: Represented by two cars communicating.
- Protection of the environment**: Represented by a globe.
- Better accessibility**: Represented by a person in a wheelchair.
- Economic growth**: Represented by a bar chart with an upward arrow.
- New jobs**: Represented by a briefcase with a checkmark.

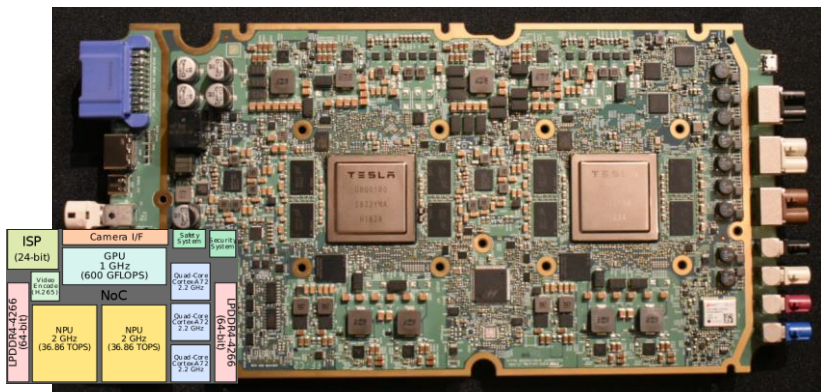
Sources: EPRS, European Commission  
europarl.eu

# Key enablers - Platforms

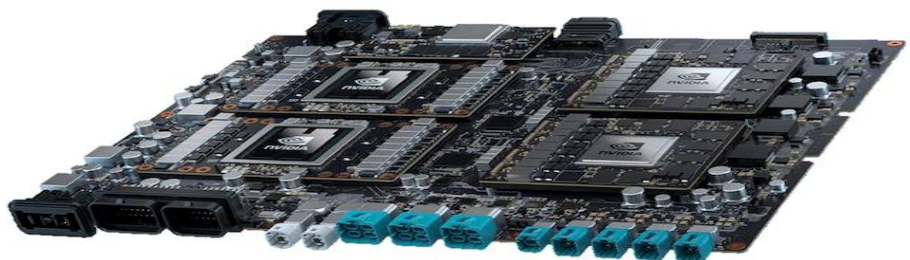
Terabytes of data per hour for autonomous vehicles

## Tesla

### Full Self Driving Compute (FSD) Platform



## NVIDIA DRIVE ROBOTAXI Platform

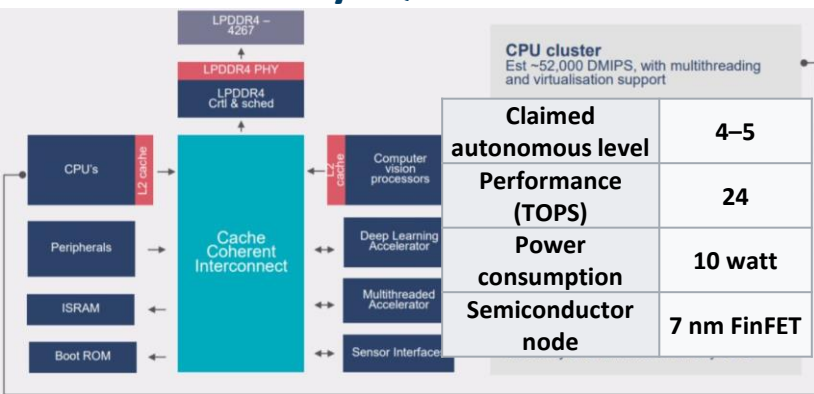


## Qualcomm

### Snapdragon Ride Platform



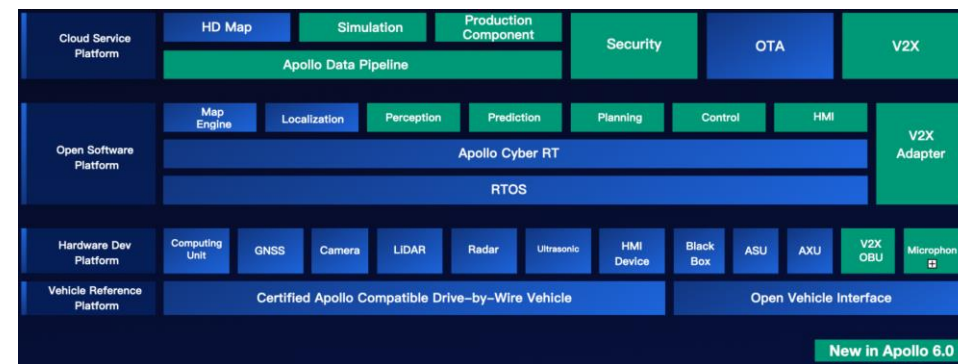
## Intel – Mobileye Platform EyeQ5 SoC



## Visteon Platform



## BAIDU Apollo Open Platform



Need for European SW/HW/Connectivity platforms for mobility

## Two European Strengths

- Automotive and industrial value chain
- Telecom infrastructure and standardization

### Connected Vehicles – Urgent Priorities

- Performance, efficiency, reliability
- High-speed/low-power components
- Adaptability, configurability, and multi-networks
- Connectivity continuum redundancy
- Reliability of connectivity



Source: Hexa-X, H2020

Opportunities for strategically exploiting the strengths for connected vehicles

# Two major opportunities for R&I

- **Key Digital Technologies JU**

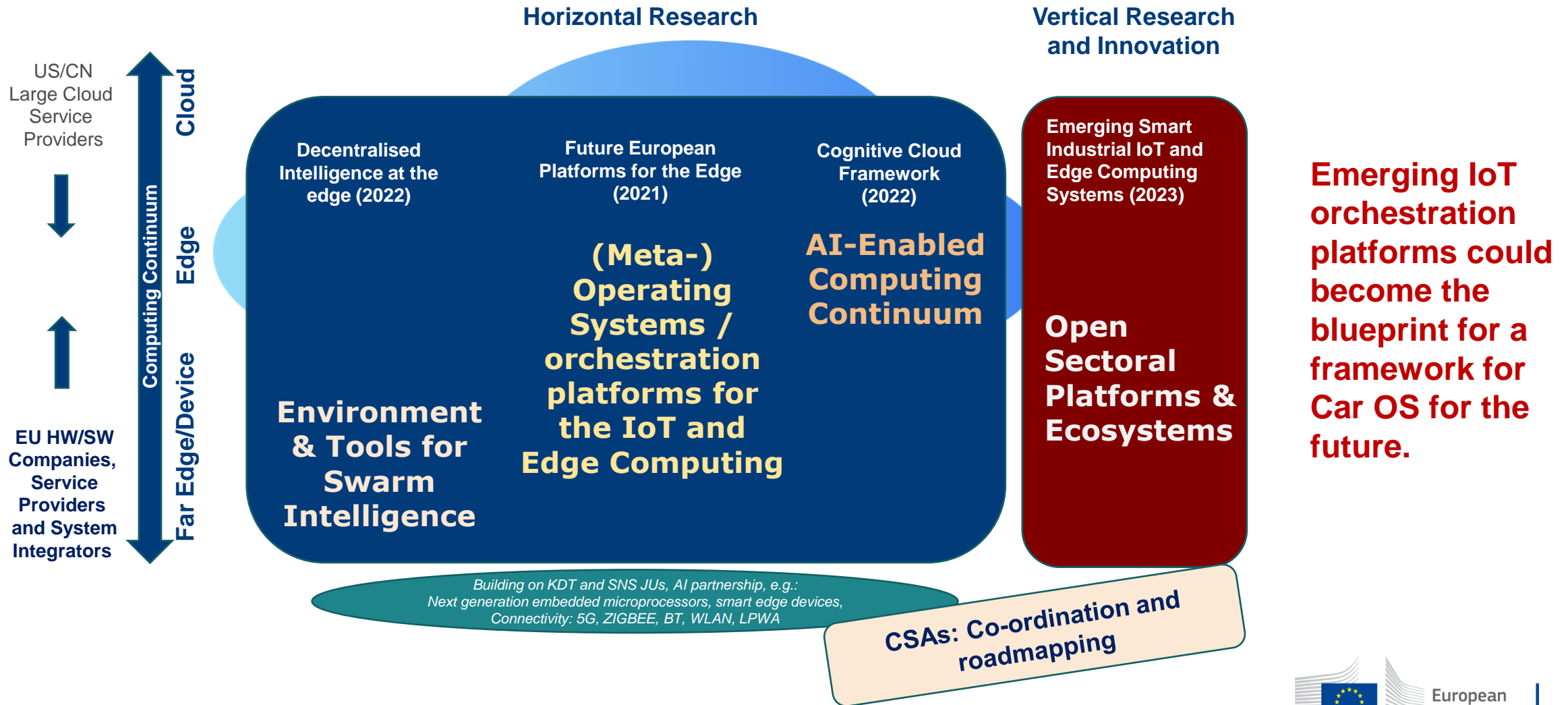
- Call-2021 for KDT expected to be launched in December 2021, deadline in April 2022, selected projects to be launched before end 2022
- This is tentative, depending on the launch of the KDT JU, please see <https://www.ecsel.eu/> for updates

- **Horizon Europe Cluster 4: Digital, Industry and Space**

- Destination 3: World leading data and computing technologies  
Area: From Cloud to Edge to IoT to European data
- **2021 Calls Closing 21 October 2021**

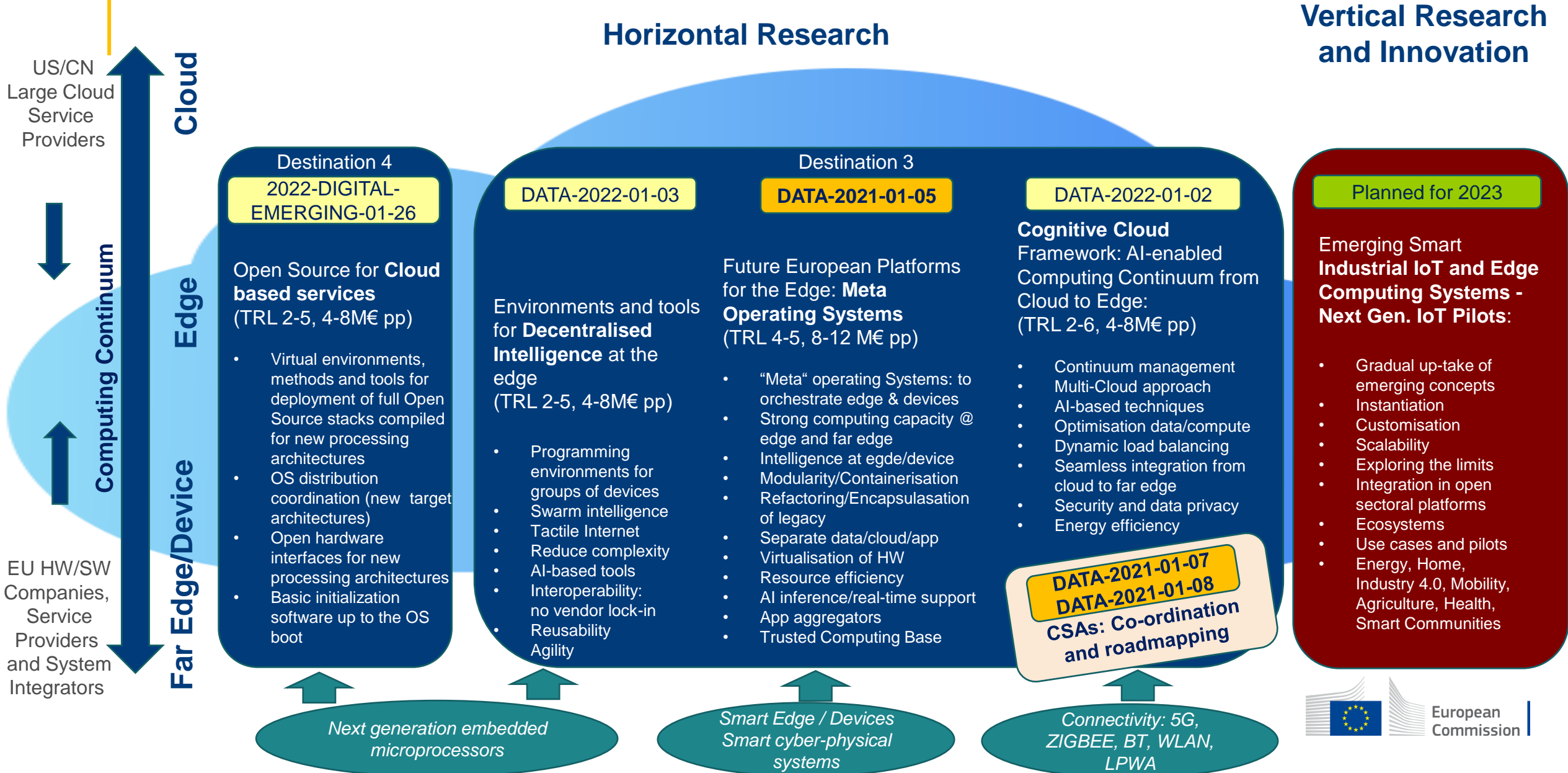


# A coherent EU R&I Agenda → From Cloud to Edge to IoT





# A coherent EU Research Agenda from Cloud to Edge to IoT under Horizon Europe – Cluster 4



# Conclusions

- Europe has been in the lead for the system architecture of cars for a long time
  - the AUTOSAR (Automotive Open System Architecture)
  - strong support through EU programmes
- This legacy architecture is not sufficient anymore
  - with the emergence of connected, automated / autonomous, and clean vehicles
  - with a new dimension of driver-assistant and mobility services
- Car manufacturers need to redefine on-board car architecture and links to the outside world
  - taking stock of advances in digital technologies such as Computing , AI, and the IoT
  - building a next generation of “operating systems” for cars
- A new level of collaboration is required
  - traditional collaboration between automotive manufacturers and suppliers
  - but also with digital companies including chip suppliers and platform companies
- Overcome fragmentation
  - many un-coordinated efforts on new car operating systems by car manufacturers with digital platform companies
  - could pre-competitive EU R&I help to achieve a common next generation framework for digital car architectures?
  - interoperable, addressing the requirements for autonomous, electric and connected vehicles
  - Building on the next generation of digital technologies
  - creating an equal level playing field for OEMs, suppliers and digital technology and service providers

# Relevant Information

- **ECSEL Joint Undertaking:** <https://www.ecsel.eu/>
- **Fireside Chat on Next Generation IoT and Edge Computing**, Meeting of 11 high level experts, 9 Mar 2021 – Report: [www.ngiot.eu](http://www.ngiot.eu)
- **Next Next Generation IoT and Edge Computing Strategy Forum**, Public open virtual meeting, 22 April 2021 – Report: [www.ngiot.eu](http://www.ngiot.eu)
- **HORIZON Europe InfoDays Cluster 4 on 29-30 June 2021**
  - **Topic recordings:** [From Cloud to Edge to IoT](http://www.horizon-europe-infodays2021.eu/event/cluster-4-digital-industry-space)  
<https://www.horizon-europe-infodays2021.eu/event/cluster-4-digital-industry-space>