Revealing mutual Relationships between Truck Platooning and Smart Hyperconnected Physical Internet Systems

Session: Autonomous Road Transport & Logistics Operations

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Agenda

- Rationale for the paper
- Truck platooning worldwide
- Connecting Austria in a nutshell
- Connecting Austria initial results
- Conclusions and recommendations

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Logistics motivation / Relationships between Truck Platooning and Smart Hyperconnected Physical Internet Systems

- **Vision of PI** = sustainable logistics networks
- The role of **connectivity** is essential for **global value chains** and **logistics** will be **key** for maintaining **sustainable transport** solutions.
- **Connectivity and sustainability** are **two** essential **aspects** of **truck platooning**, one of the **first close-to-market applications** for semi-automated freight transport.
- **Paper-contribution: relationships between truck PI and truck platooning**

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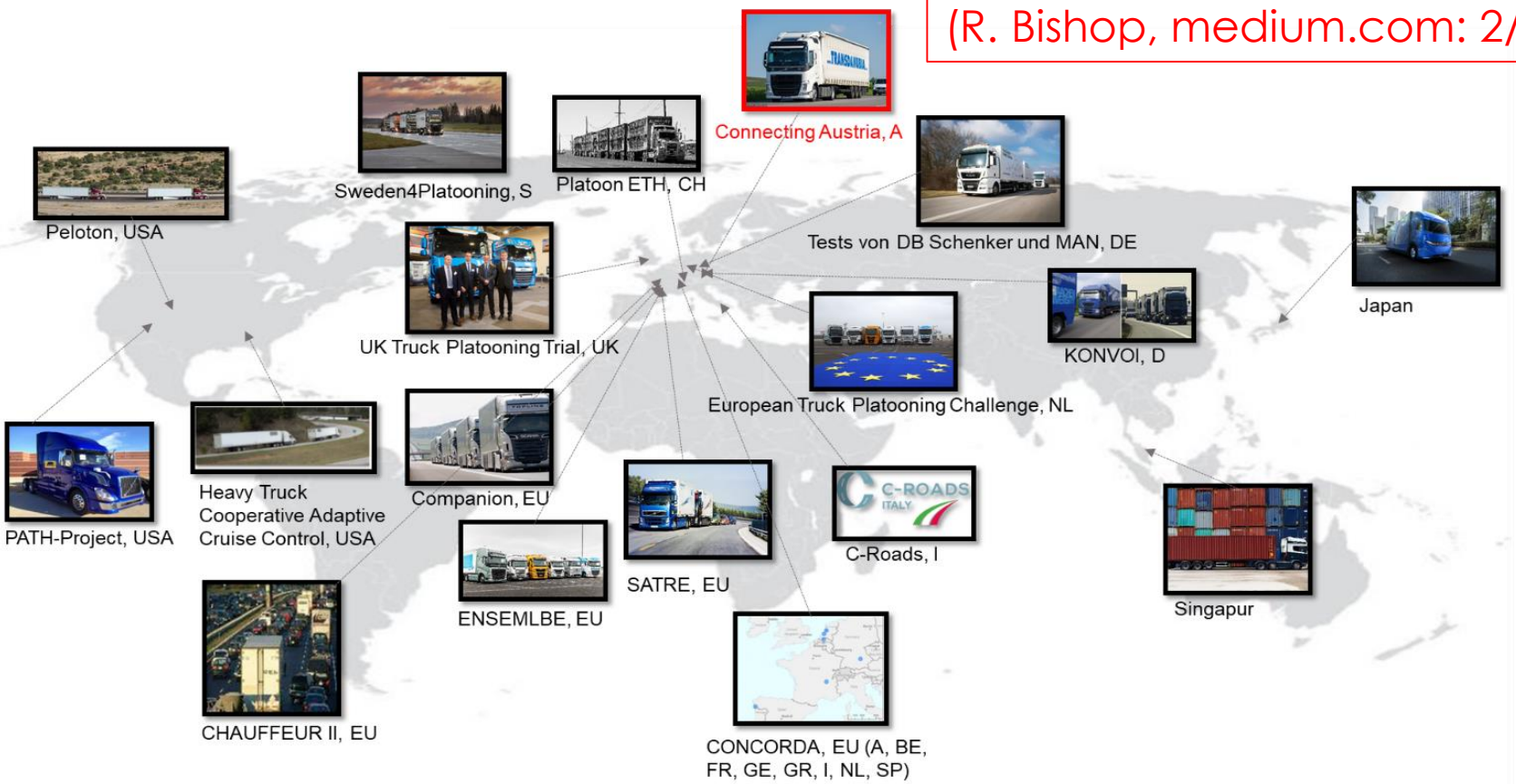
Truck platooning worldwide

Connecting Austria mentioned as 1/11current active truck platooning projects worldwide (R. Bishop, medium.com: 2/4/2019),



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In a nutshell

- The **Austrian national lighthouse project Connecting Austria** brings technology leaders and end-users together to demonstrate and evaluate four use cases for **semiautomated and energy-efficient truck platoons**.
- Key **objective** is an **evidence-based evaluation of energy-efficient truck platoons** as a pre-requisite for **next steps in deploying truck platooning** in Austria and Europe.
- How can **cooperative infrastructure** communication support the **deployment** of truck platooning?

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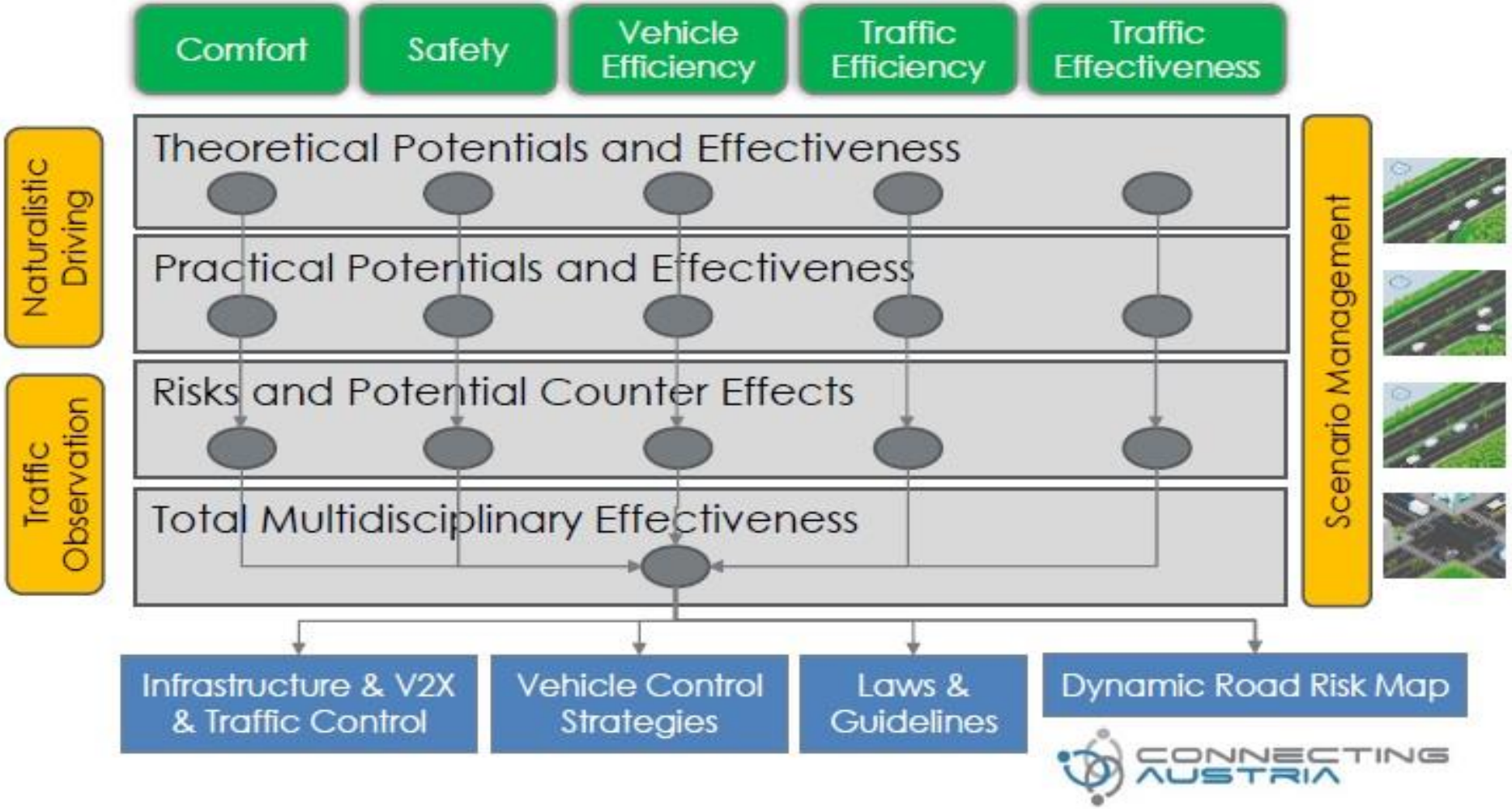
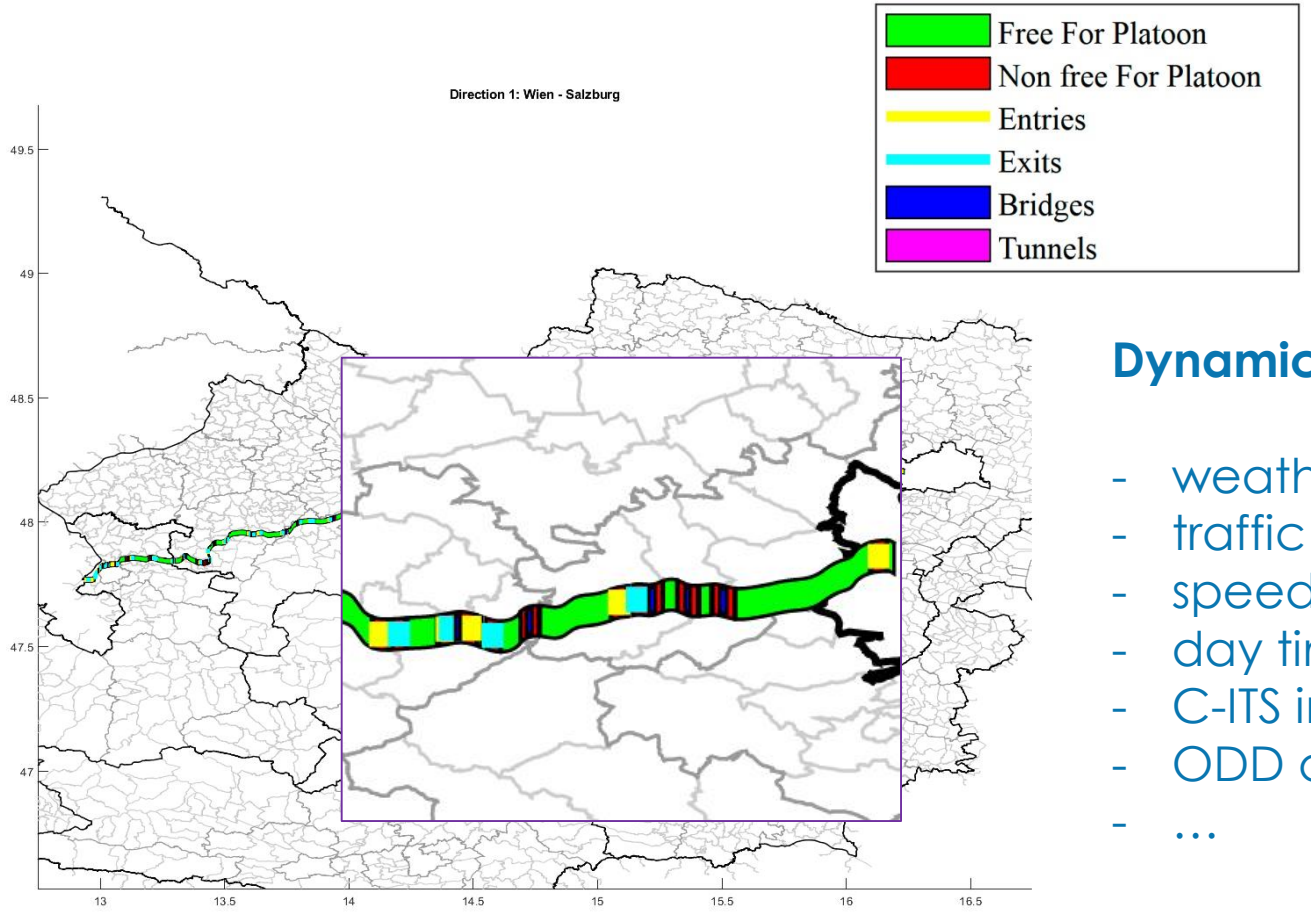
R&D Approach / Procedures



Which Austrian road sections are ready or candidates for future operation under platooning modes? C-ITS based dynamic risk-rated map



Dynamic – due to different:

- weather conditions
- traffic density
- speed
- day times
- C-ITS infrastructure avaialble
- ODD and ISAD levels
- …

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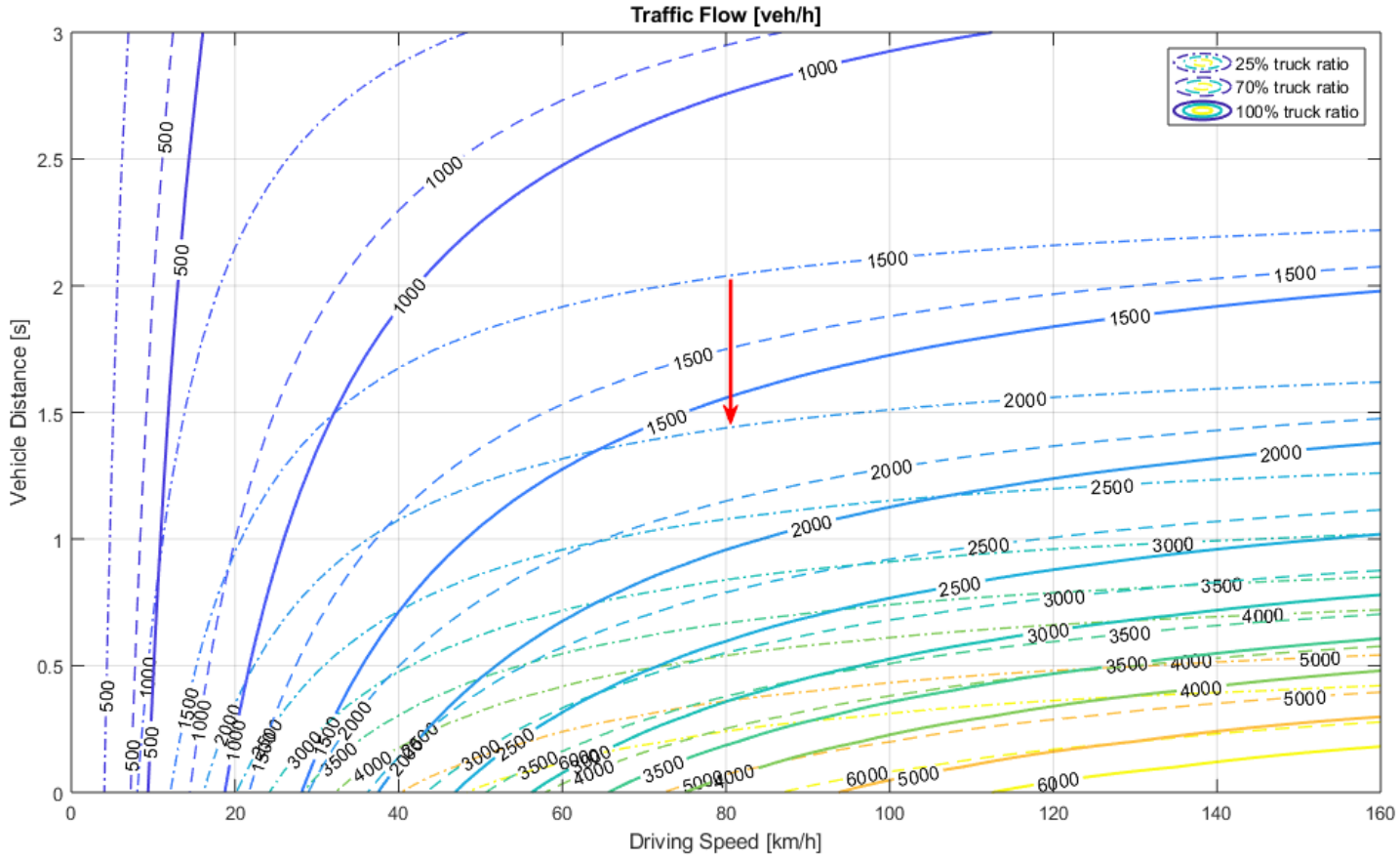
What is the (theoretical/practical) traffic-efficiency potential of truck platooning (ANDATA, 2018)



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Connectivity & Sustainability

Connectivity

(1) technical connectivity, e.g. V2V communication and I2V communication supported by the different technologies (e.g. WLAN ITS G5, 5G), or

(2) organizational/individual connectivity, e.g. multi fleet platooning

Sustainability

(1) environmental sustainability

(2) economic sustainability and

(3) social sustainability.

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First results: organizational/individual connectivity

- **Long-term vision** and goal for logistics operators is **multibrand and multifleet ad-hoc platooning**
- **Potential for cost savings** motivates logisitics providers to invest in truck platooning
- **Trust is key for connectivity** (between **drivers** within the platoon; between **logistics** operators; between truck **manufacturers**)
- **Standardisation processes** for V2V communication are necessary and are already ongoing (ENSEMBLE)
- **Infrastructure operators** invest heavily in research and infrastructre investment for fostering platooning with (I2V) comunication
- **Technology acceptance** seems to be very high – perceived ease of use and perceived usefulness(EDDI project)
- **Drivers' trust** in technical system is very high

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First results: technical connectivity

- **V2V communication** – works very good (EDDI project, WLAN ITS-G5, 35.000 km on public roads, no accident, 98% availability, drivers felt safe, no neurophysiological stress measured)
- **I2V communication (**WLAN ITS G5): Platooning-related use cases defined and harmonized with road operator
  - UC1.02: Platoon support information for automated vehicles
  - UC1.03: Situation based distance gap for automated vehicles
  - UC4.01: GNSS correction data
- **Successful C-ITS demo** in Austria (VW, ASFINAG – Austrian road operator)

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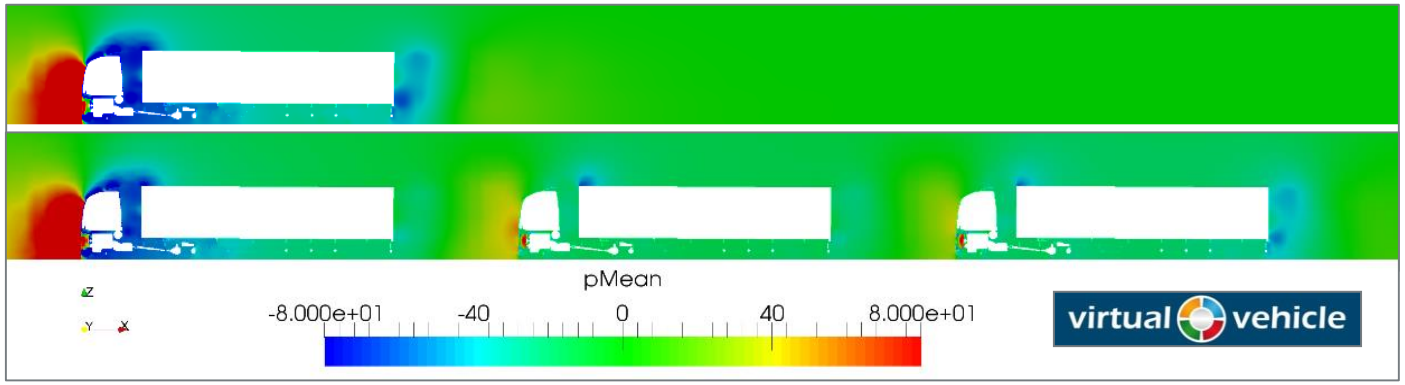
First results: Environmental sustainability

- Environmental sustainability: theoretical savings potential up to 10%; average 5% (platoon of three trucks) demo-testing; 4% EDDI (with restrictions)



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First results: Economic sustainability

- Actual fuel savings are **directly linked to the economic sustainability** for fleet operators.
- **Fleet operators require means to evaluate the impact** of truck platooning for their company on their routes with their customers and to take informed decisions when adopting truck platooning.
- **Relevant acceptance criteria** such as **trust** among drivers**, reduction of workload**, **trust** in the system, system safety & security are relevant for decision makers.
- **Maximum economic** potential with multi-fleet ad-hoc platooning**?** European harmonization (V2V communication – e.g. ENSEMBLE project) and I2V communication - is necessary.

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First results: Social sustainability

- **Truck drivers acceptance** of platooning is **quite high** after the project (EDDI)
- **No neurophysiological stress measured** due to platooning
- Platooning could **improve attractiveness** of truck driver **jobs**
- **Guidelines** for determining **situations in which platooning is feasible** on certain roads (e.g. depending on weather, traffic situation and road type) are **required** for decision makers (e.g. road operators, politicians, law).

Conclusions and recommendations (I)

- Truck platooning deployment faces **many opportunities and challenges**
- Expected **benefits** from logistics and society **tends to be high**
- In order to deploy truck platooning successfully, **collaboration** among diverse stakeholders will be crucial.
- Truck platooning system providers will need to ensure **technical connectivity as well as system safety & security** between diverse truck platooning systems.

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Conclusions and recommendations (II)

- **Fleet operators** will need to **collaborate** to gain fuel and cost savings.
- **Truck drivers** will need to **collaborate** to drive safely in a semi-automated platoon.
- **Truck platooning system developers, road authorities, and governmental institutions** will need to develop **guidelines** for determining situations in which platooning is feasible on Austrian roads (e.g. depending on weather, traffic situation and road type).
- **Learn** from **already provided exceptions** for testing on public roads to easily extend test areas
- **More** experience based on **driven km in real world traffic** with platoons
- **Cross-boarder truck platooning field tests** to learn and to foster the acceptance of truck platooning as one of the first semi-automated driving function

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Ongoing and future work in Connecting Austria develops guidelines for energy efficient and semi-automated truck platooning for Austria aiming at finally revealing mutual Relationships between Truck Platooning and Smart Hyperconnected Physical Internet Systems.

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www.connecting-austria.at

Appendix

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administered by FFG Promoting Innovation.
co-financed by bmvit Federal Ministry for Transport, Innovation and Technology

13 Project partners

ANDATA ARTIFICIAL INTELLIGENCE LABS
AC AUTOMOBIL CLUSTER
business upper austria
BOKU
CNL
HiTec marketing
IESTA
TU WIEN TECHNISCHE UNIVERSITÄT WIEN
INSTITUT FÜR MECHANIK UND MECHATRONIK Mechanics & Mechatronics
KFV
FH OBERÖSTERREICH
LOGISTIKUM CHALLENGE ACCEPTED
scch software competence center hagenberg
SIEMENS Ingenuity for life
swarco SWARCO FUTURIT Verkehrssignalsysteme Ges.m.b.H.
TRANSDANUBIA
virtual vehicle

Project data

- Duration: 36 months
- Project start: 01/01/2018
- Project budget: 4.3 MEuro
- Project funding (bmvit): 2.5 MEuro
- www.connecting-austria.at
- Project Leader: Dr. Wolfgang Schildorfer, wolfgang.schildorfer@fh-steyr.at

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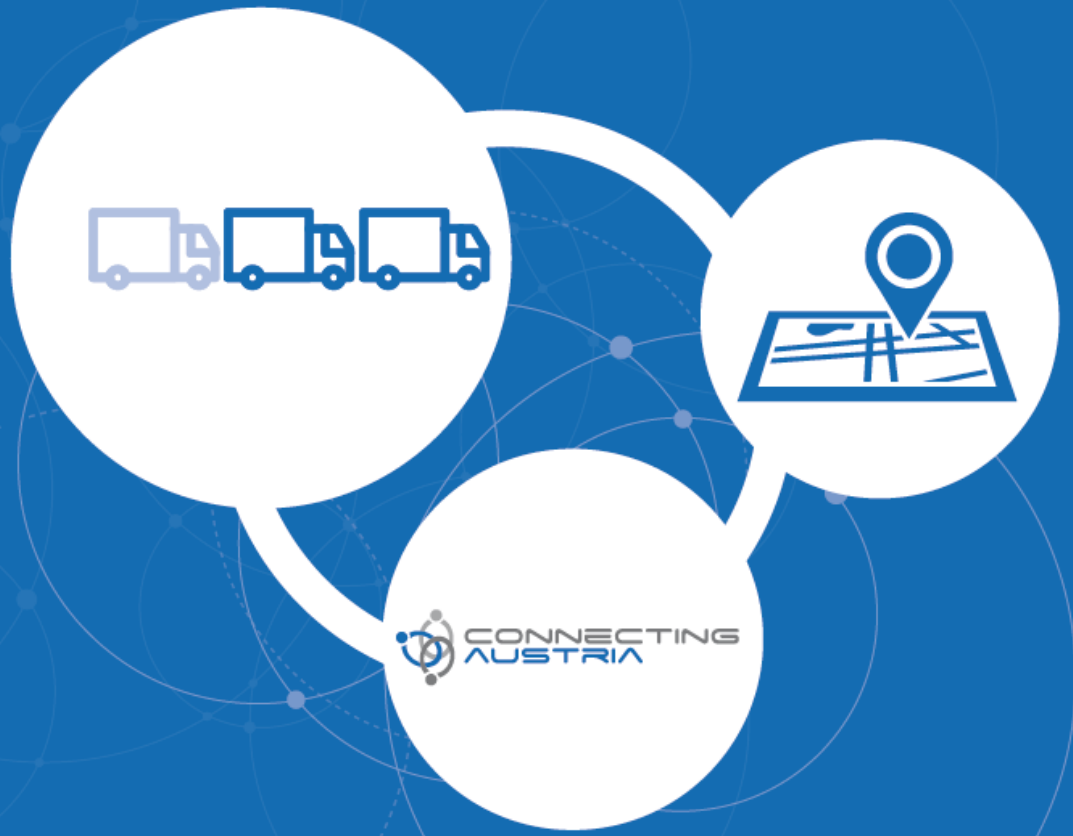
1 Truck Platoon

2 Platoon ⇄ Entire traffic



3

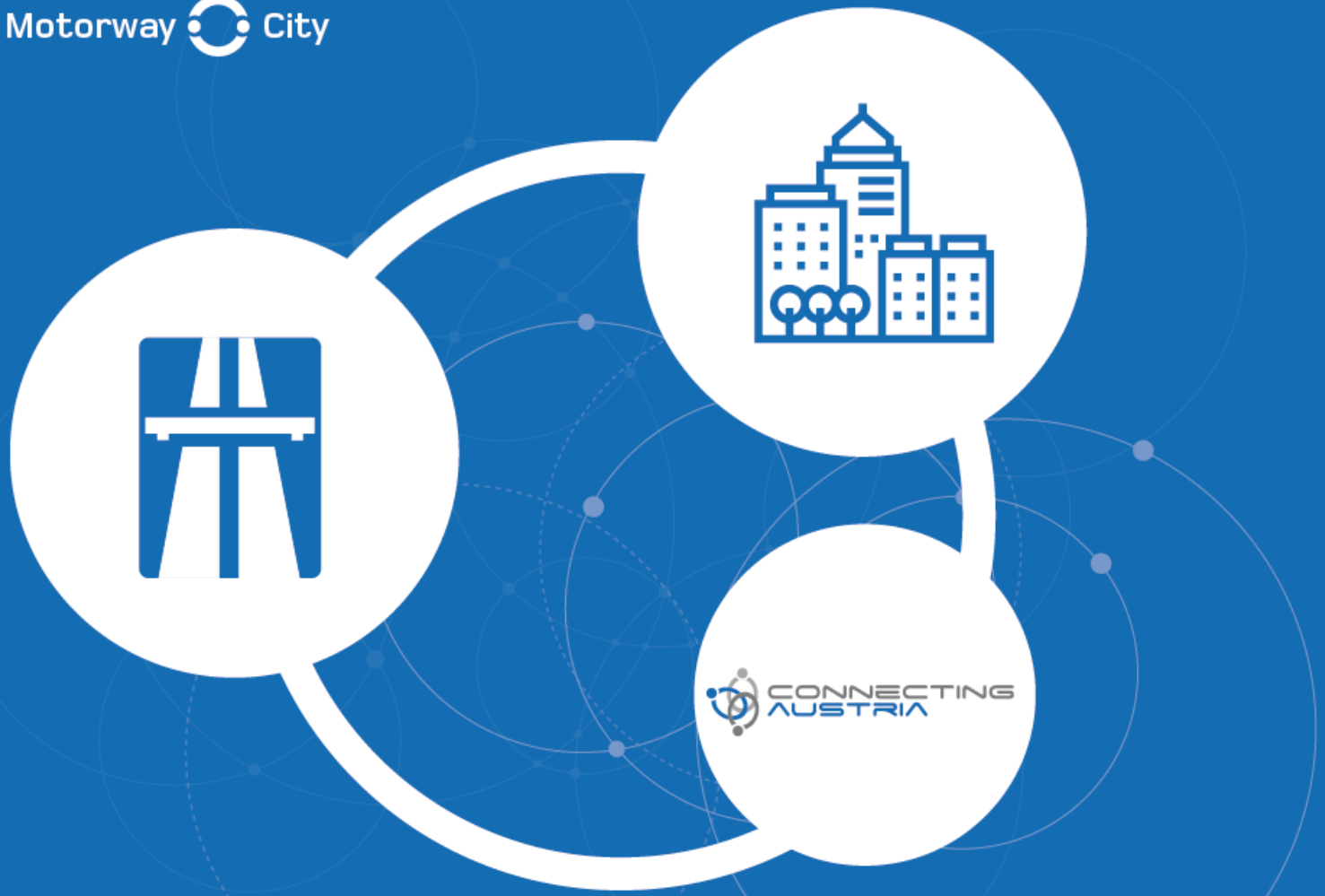
Security Efficiency Effectiveness

4

Infrastructure technology Automotive technology

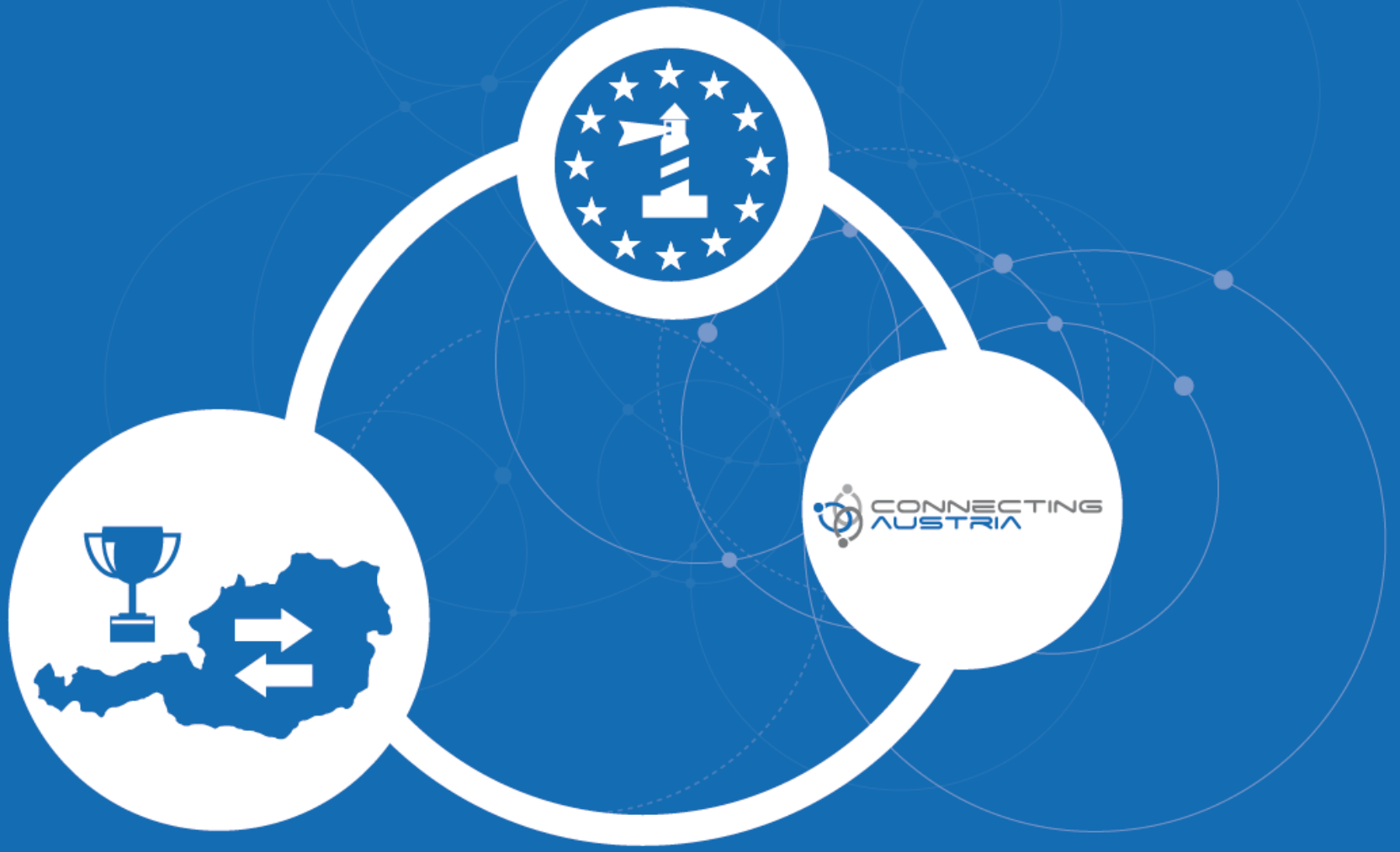
5

Motorway City



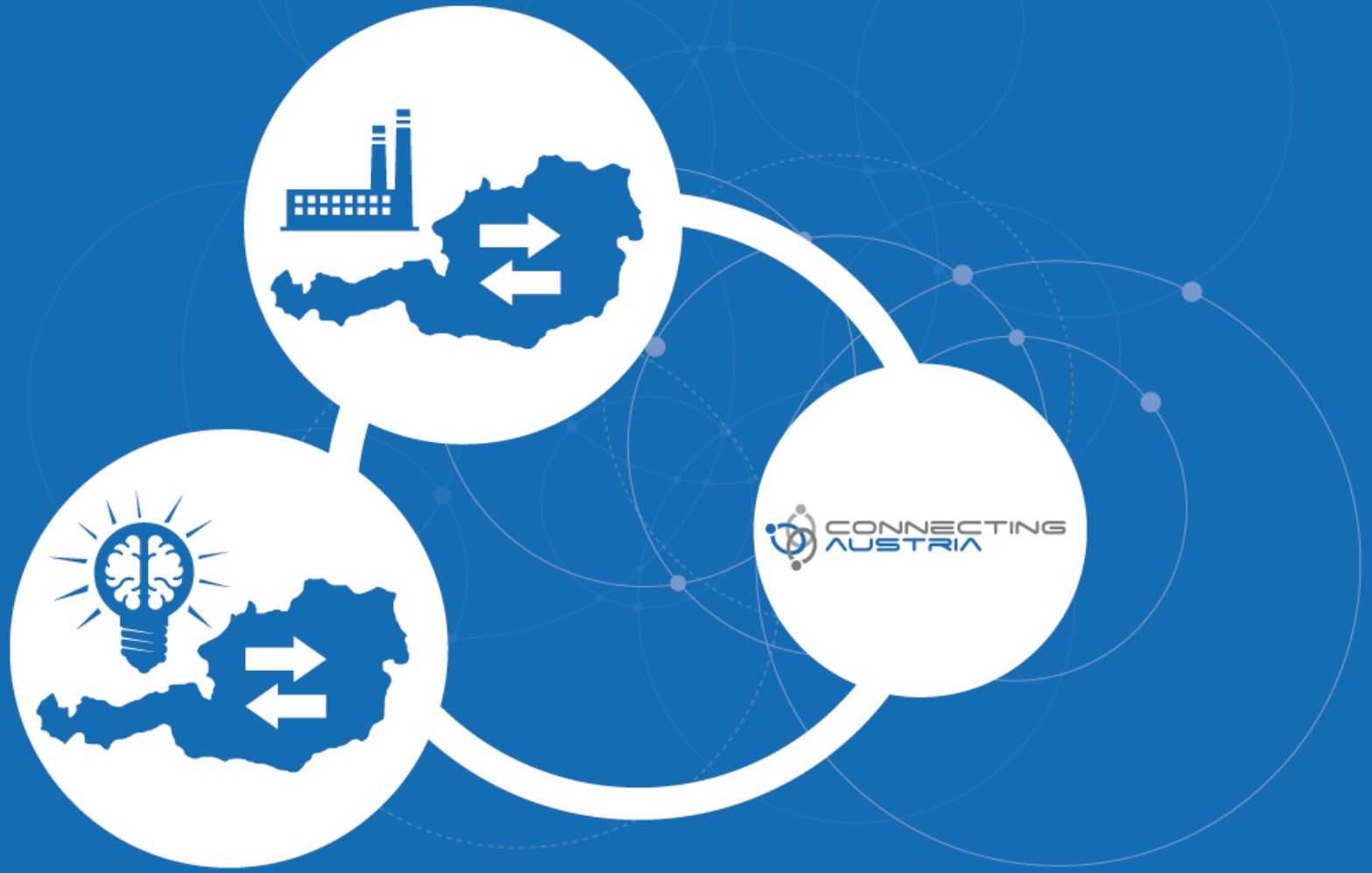
6

Sustainable Austrian excellence in mobility
European flagship projects with international visibility

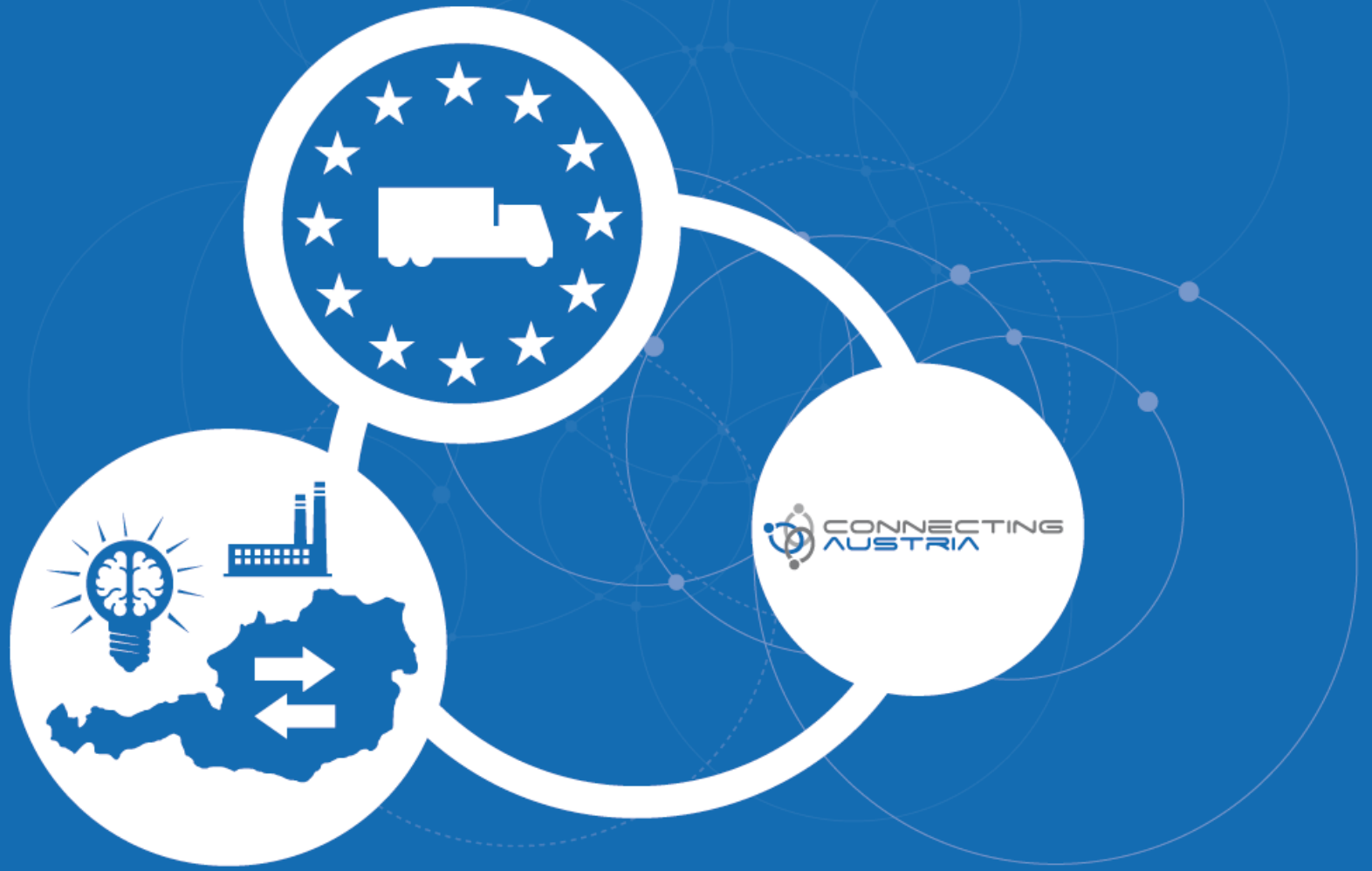


7

Austrian industry and logistics
Austrian leading research in the field of energy-efficient, semi-automated freight traffic to strengthen their competitiveness

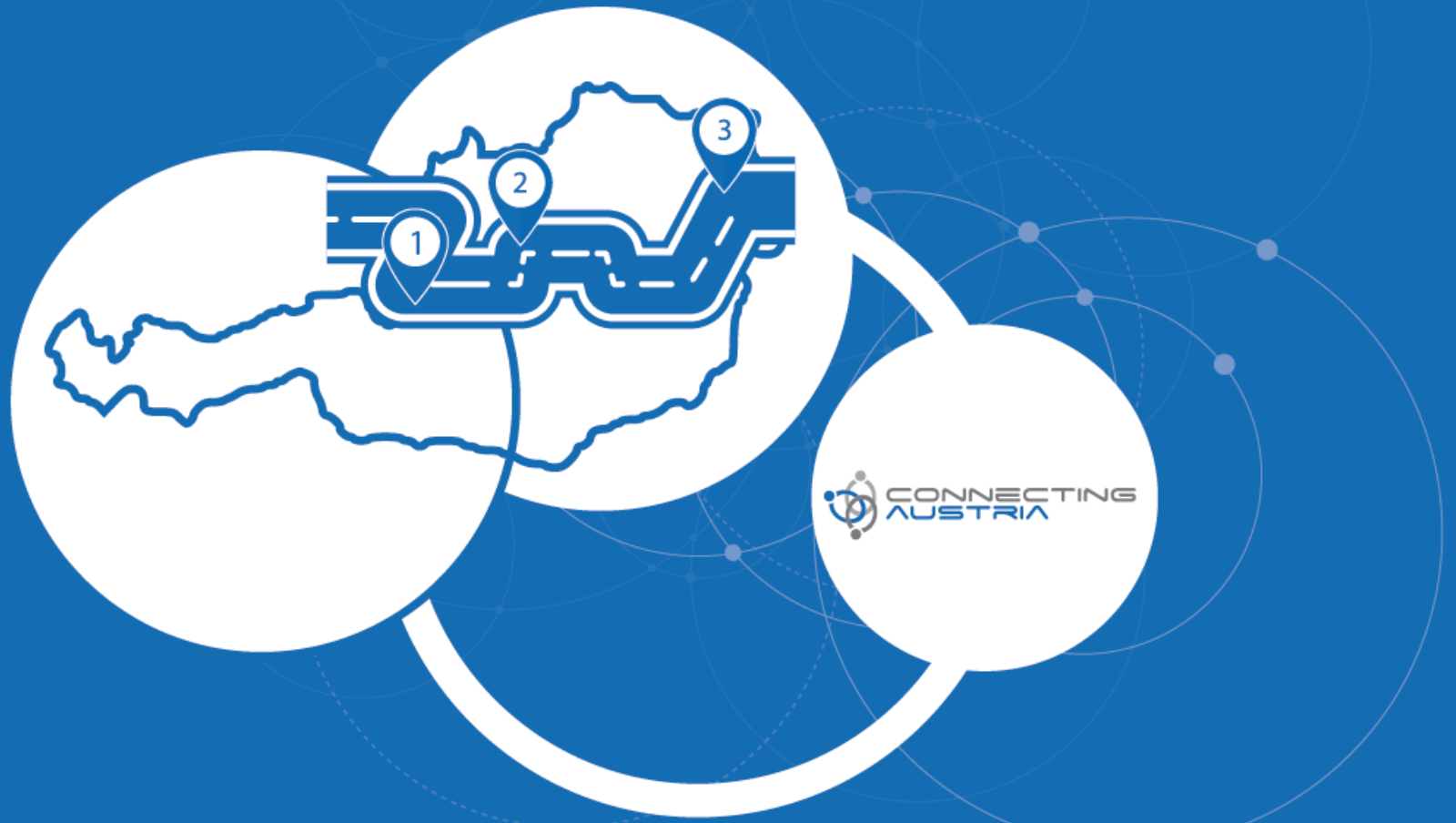


8 Challenges of international freight traffic
Solutions of Austrian industries and logistics



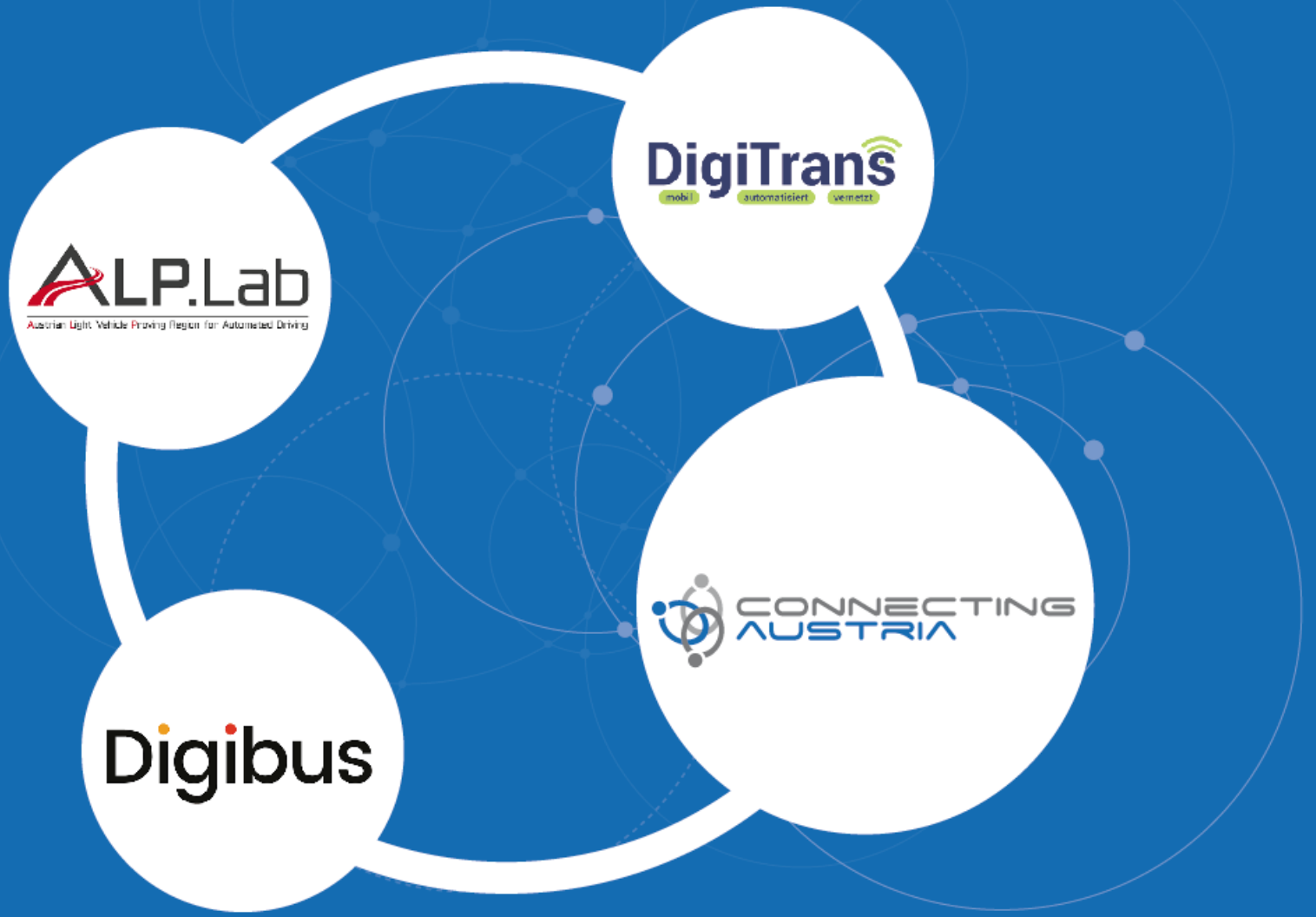
9

The geographic connection between the western and the eastern part of Austria.



10 Projects Alp.Lab Connecting Austria DigiBus DigiTrans

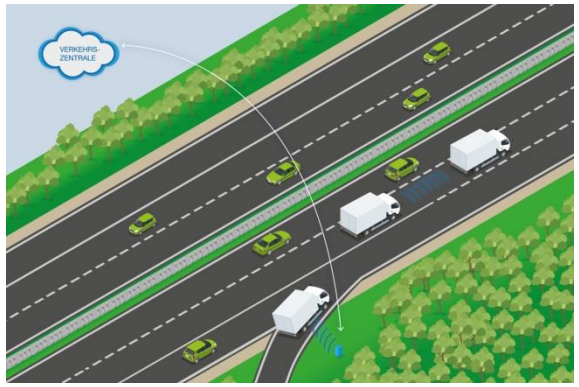
via common project partners



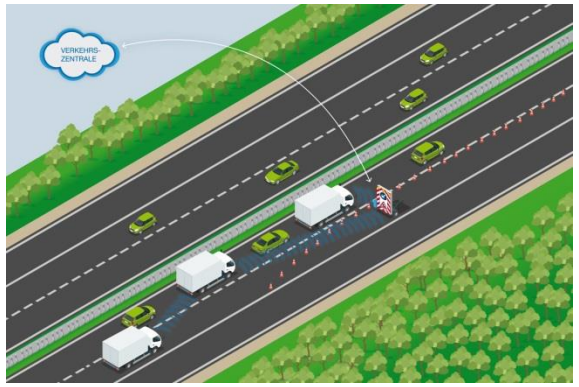
Main research question

- **Main research question**: What is needed to **safely and efficiently set up** a **semi-automated platoon (L1)**, to **maintain** a platoon and to **go back** to a regular transport mode?
- How can **cooperative infrastructure** support the deployment of truck platooning?
- Project's **unique contribution**: **specific focus on infrastructure issues** and on **parameterized traffic perspectives**

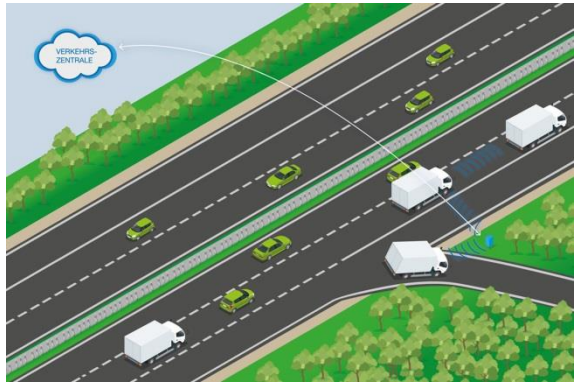
4 Use Cases



UC1: Trucks entering the motorway



UC2: Truck platoon approaching a hazardous location



UC3: Truck platoon leaving the motorway

UC4: Truck platoon crossing an intersection

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EDDI project (Germany)

2019-05-10 · Truck

Platooning in the logistics industry: Researchers see great potential in real operations after tests

Successful completion of pilot project run by DB Schenker, MAN Truck & Bus and Fresenius University of Applied Sciences

Operating electronically linked trucks on German motorways is safe, technically reliable and easily applicable in the routine of a logistics company. These are the key results of the world's first field test with truck platoons in real logistics operations, which the project partners presented in Berlin today.

As part of a research project sponsored by the Federal Ministry of Transport and Digital Infrastructure (BMVI), professional drivers drove two electronically linked

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