Sustainable mobility
by technology convergence

Synergies for the transformation towards the autonomous vehicle eco-system

THE | AUTONOMOUS

Autonomous Conference, Vienna
14.09.2023 14:15-16:15

TTTech

KDT JU
KEY DIGITAL TECHNOLOGIES JOINT UNDERTAKING

ECSEL Joint Undertaking

FFG Forschung wirkt.

is project is funded by the European Union

Input from Europe´s Funded Electromobility research projects

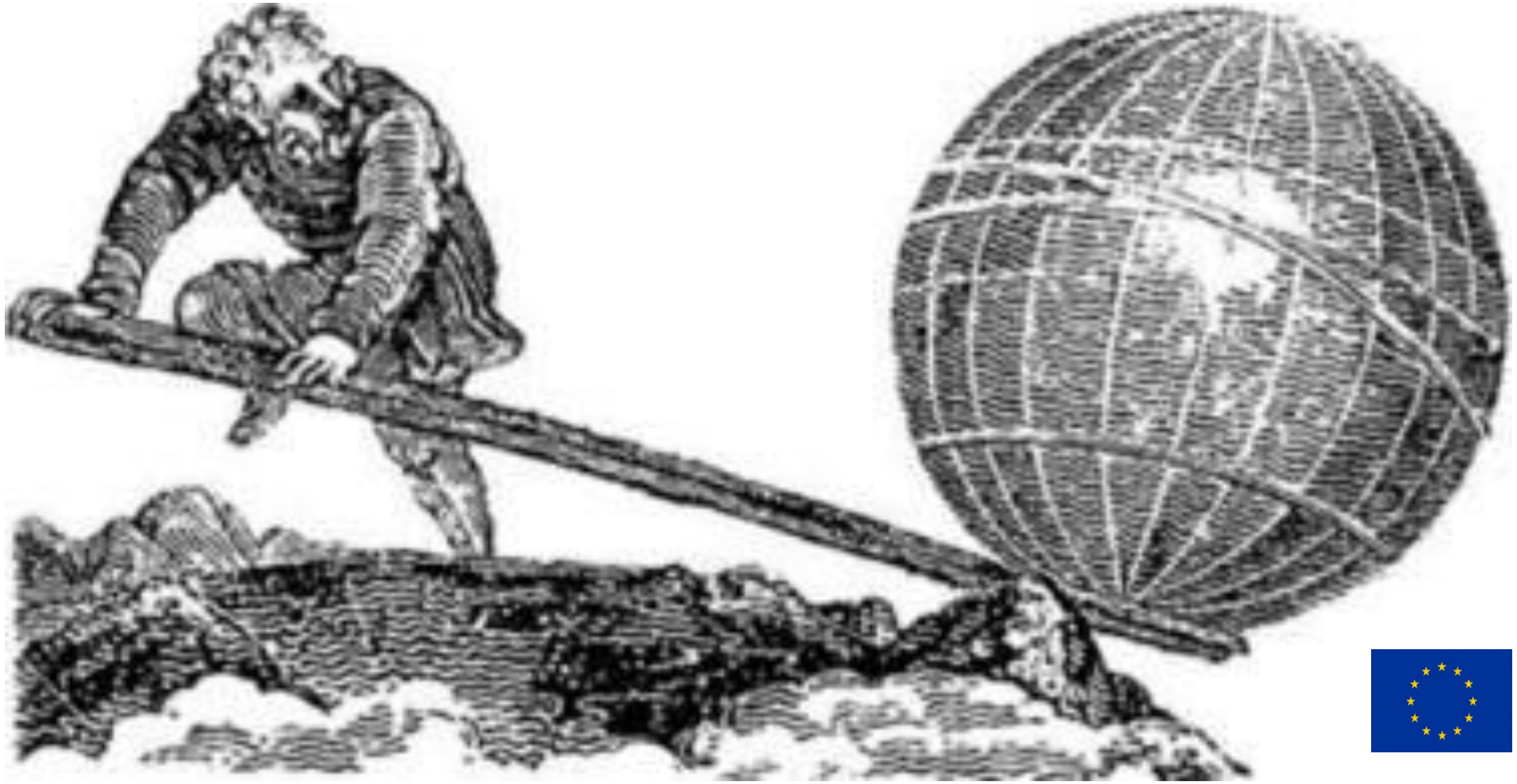
Today´s contradictions

Reiner John, AVL List, Austria
et. all

Presentation V1.0

How to implemented the challenge

Mega trends
Technologies
Society
Impact



KDT JU
KEY DIGITAL
TECHNOLOGIES
JOINT UNDERTAKING

Emergence: the solution comes from system

The collaborative individuum knew´s nothing about the bridge

internet

internet

internet

internet

Trustfully Collaboration in complex, complicated and chaotic systems

ECSEL / KDT European funded projects in the ECO system of mobility, infrastructure & energy

ECO Design, Efficiency, Material substitution, reduce yield losses	Carbon debt visibility, environment impact bill, supply chain resources	**Components and data for cyclic economy**

ECA 2030 — clean → connected → collaborative — Society 5.0 — Mobility 5.0 — Sustainability,

www.mobilitye.eu

MOBILITY>E LIGHTHOUSE

EGVI European Green Vehicles Initiative

2009 **E3Car**
2010 **Castor**
2012 **Motorbrain**
2014 **3CCAR**
2016 **AutoDrive**
2019 **Architect**

Standardization
Life time monitoring
Certification framework

Fail-aware
Fail operational
Complexity
Redundancy
Multiphase
Multi-propulsion
Functional Integration
Efficiency

Electric Car

New Control

Prystine

2017 2018

Sensors & platforms

Complexity explosion

2022 **Archimedes** Sustainability
2022 **A-IQ Ready** Emergence
2020 **AI4CSM** Connected shared Mobility
2018 **AI4DI** Platform for cross-cutting requirements
AI for cloud to edge
Multi-domain

Fleets
Vehicle in Traffic
Emergence
Cyclic economy
Green Deal
Ecosystems

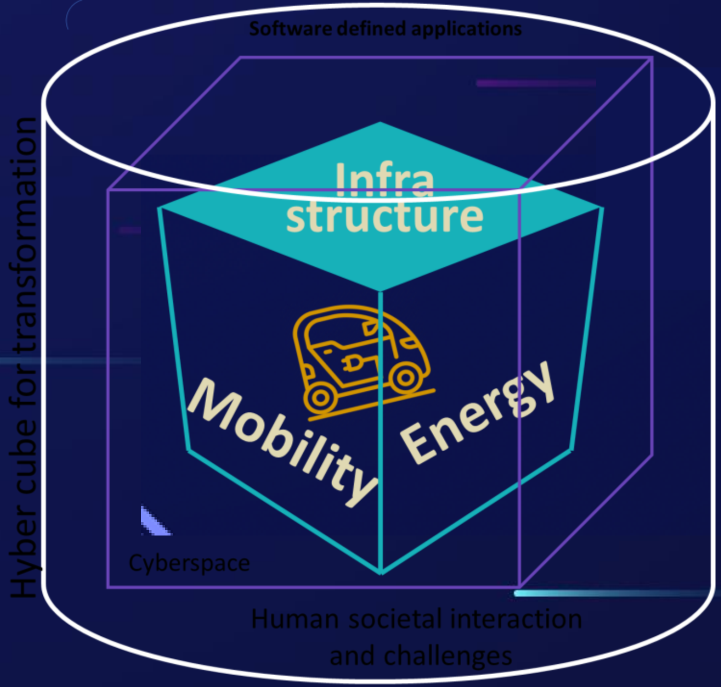
Complexity solved by trustable AI

Quantum encryption
Quantum sensor
Quantum computing

Scalable embedded Intelligence for Edge and edge/cloud operation

Propulsion | **Perception** | **Connectivity** | **L3, L4, L5 Control** | Autonomous | Digitalization

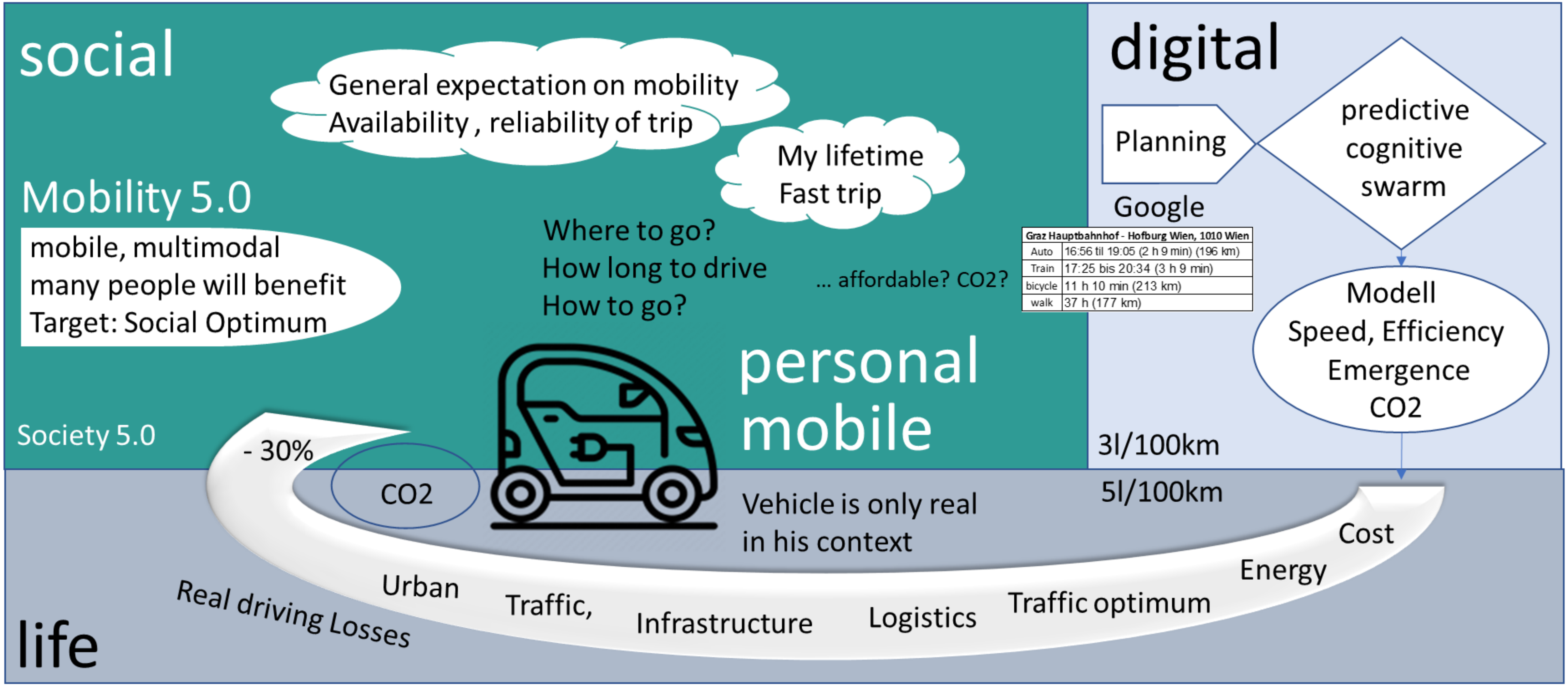
FFG Forschung wirkt.



Human friendly
goods and services

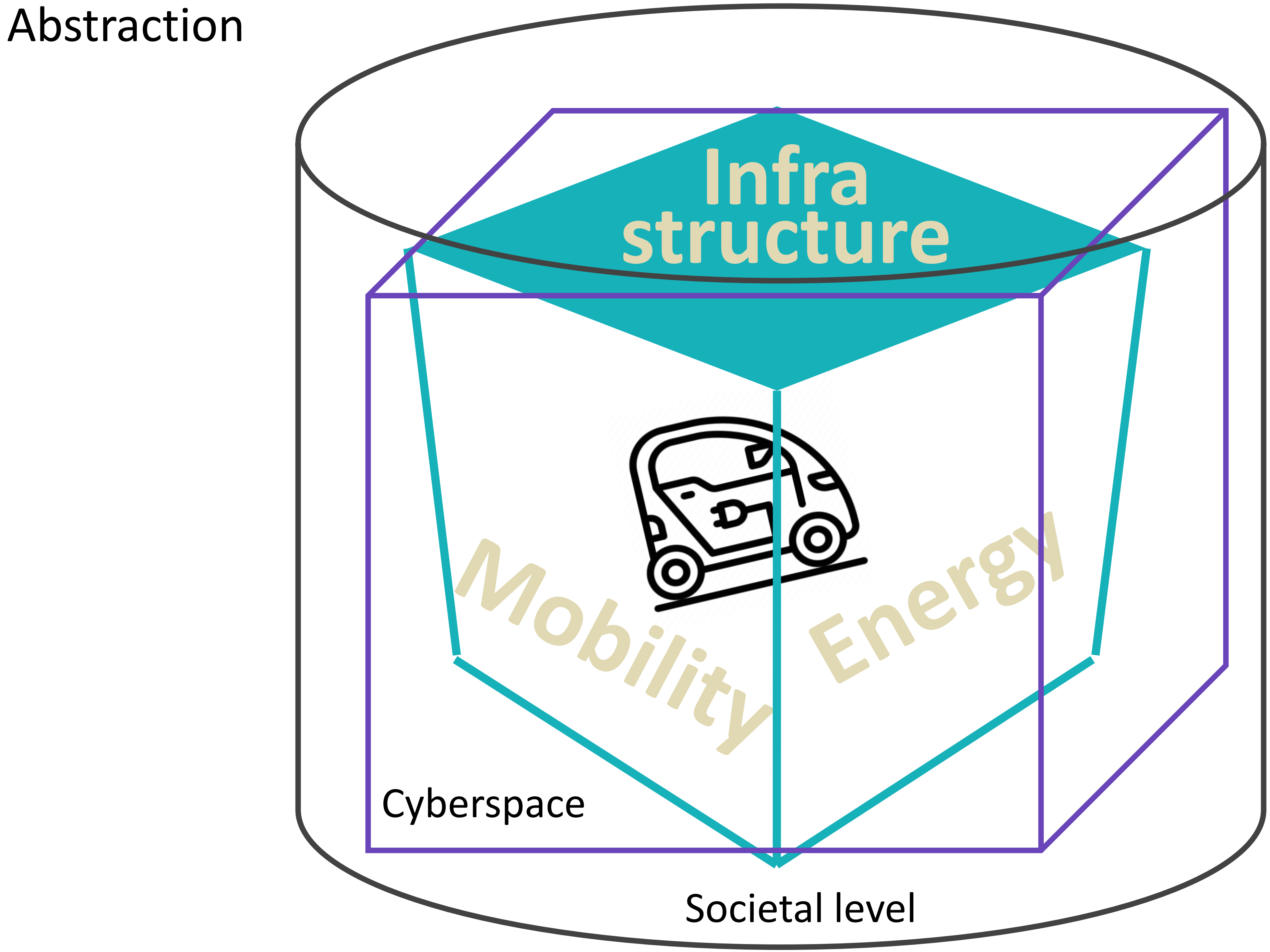
Driving, connected assets, digital twin

The individual human will choose his way of mobility, technology will minimize emissions, optimized by extrinsic intelligence and efficiency from electric, connected, automated and shared mobility



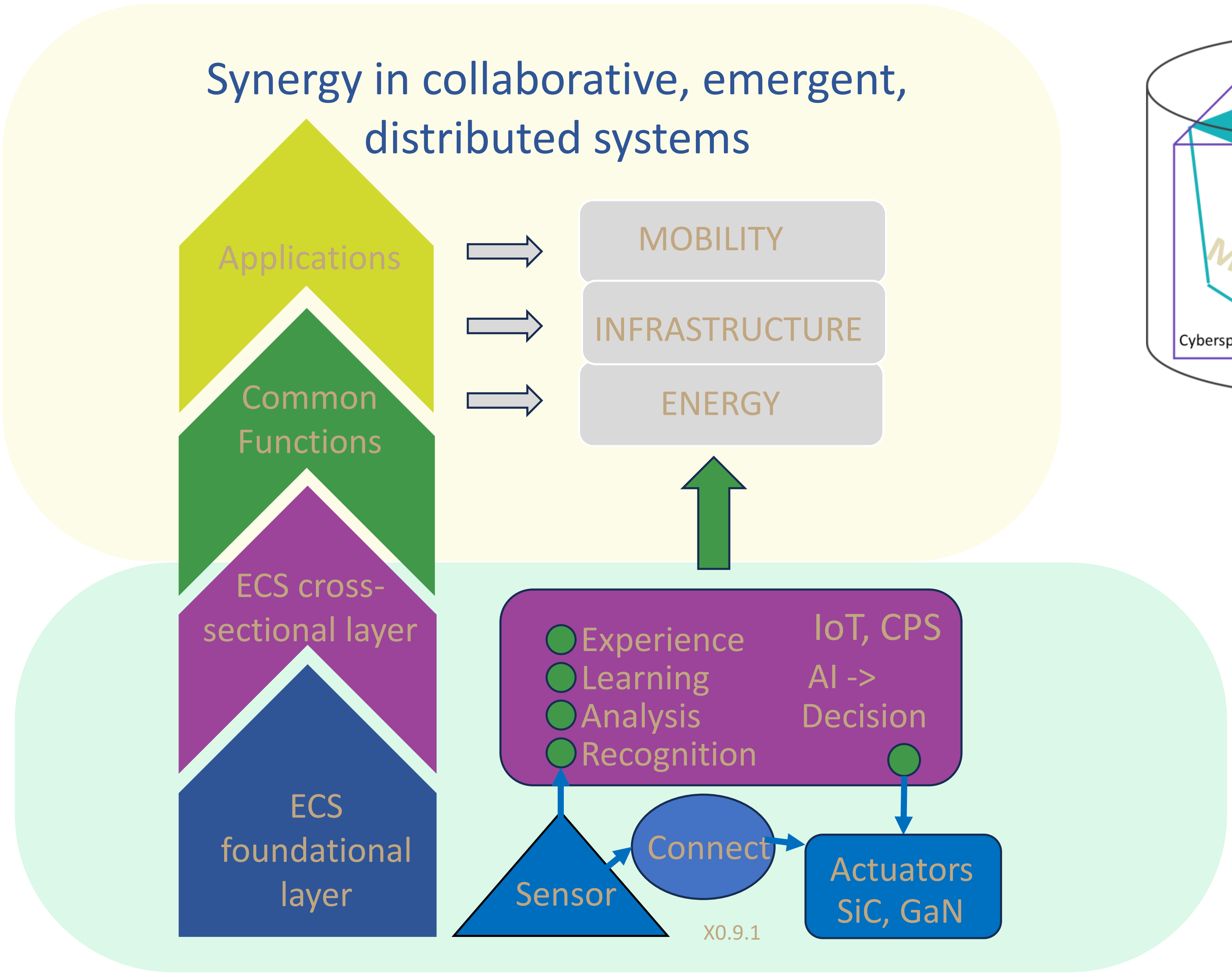
Industry 5.0 and Society 5.0: fair use of resources in the sense of a social optimum for the needs of all people in the society.

Franz Zieher, Reiner John

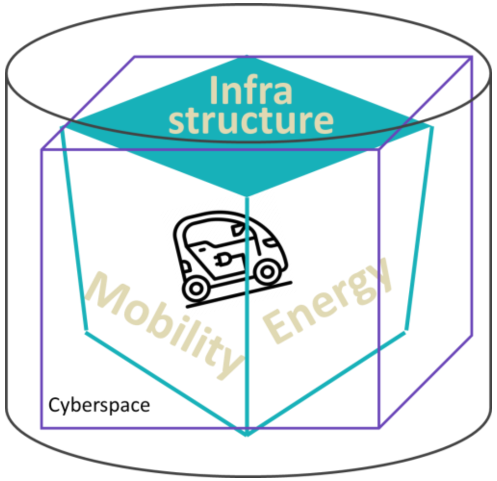


Abstraction
Infra
structure
Mobility
Energy
Cyberspace
Societal level

Sematics

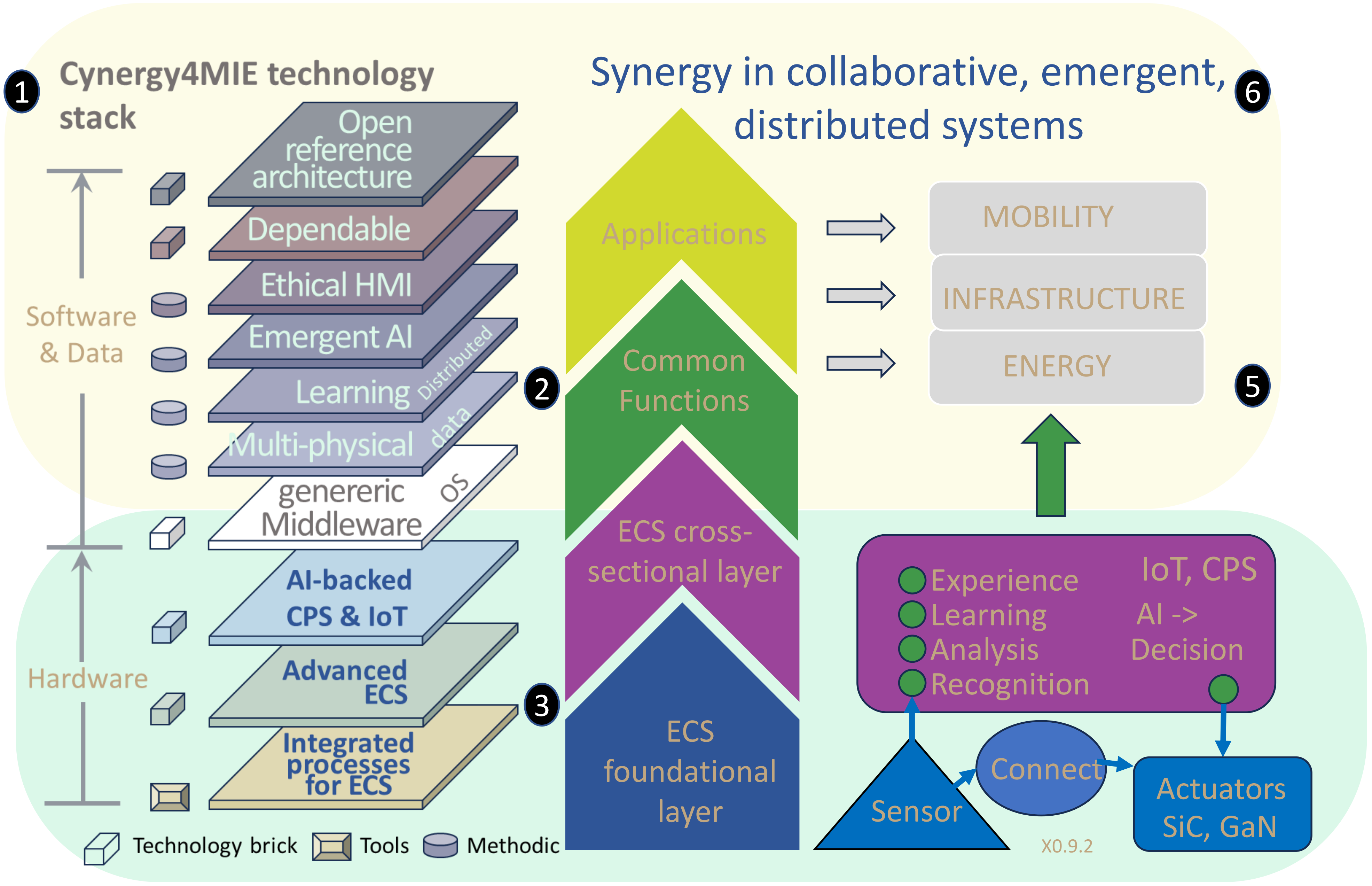


Synergy in collaborative, emergent, distributed systems
Applications
Common Functions
ECS cross-sectional layer
ECS foundational layer
MOBILITY
INFRASTRUCTURE
ENERGY
Experience
Learning
Analysis
Recognition
IoT, CPS
AI -> Decision
Sensor
Connect
Actuators SiC, GaN
X0.9.1



Infra structure
Mobility
Energy
Cyberspace

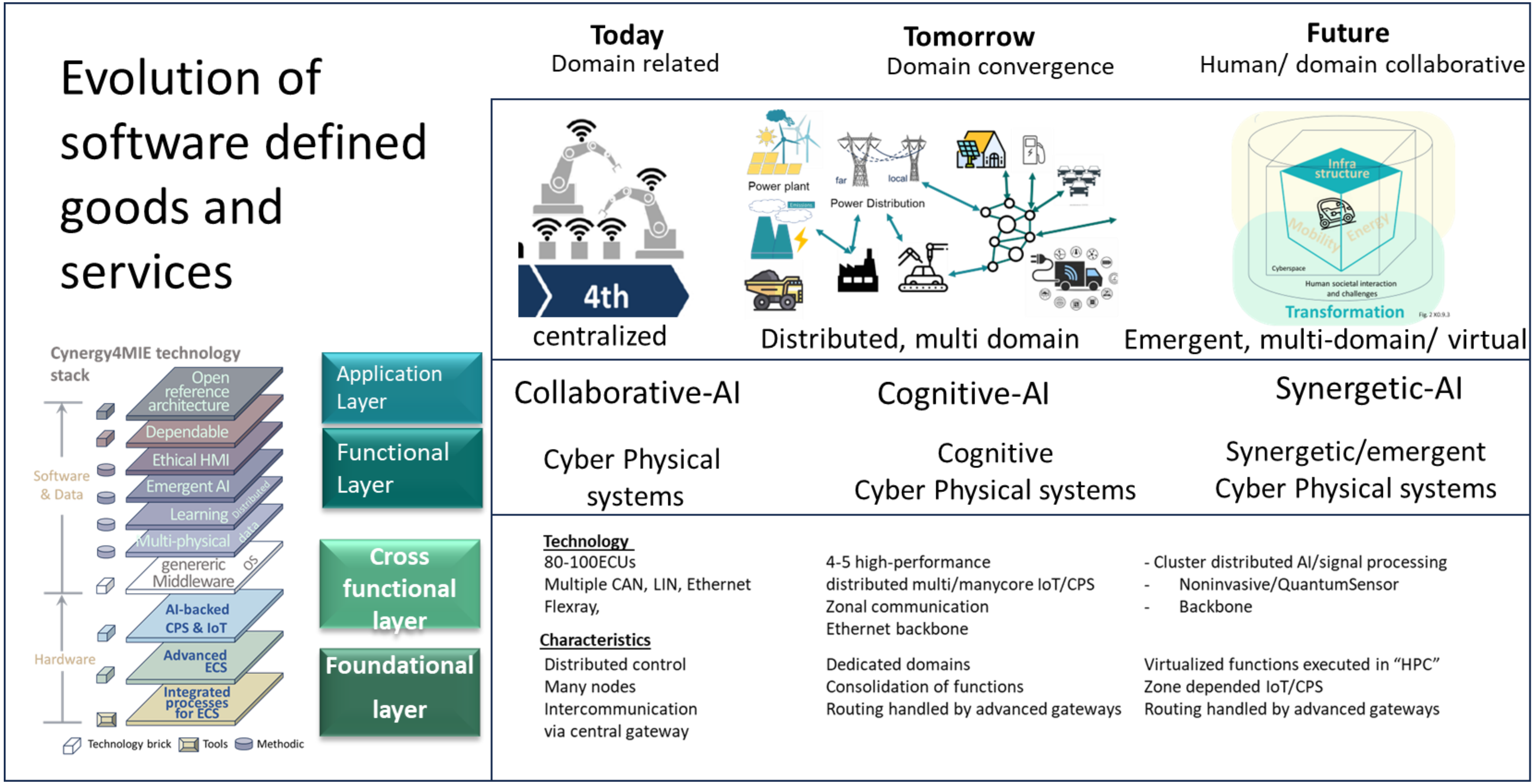
Technology stack



Where to go?

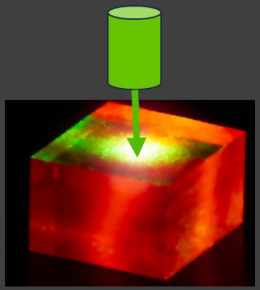
Software defined systems

Advanced Hardware

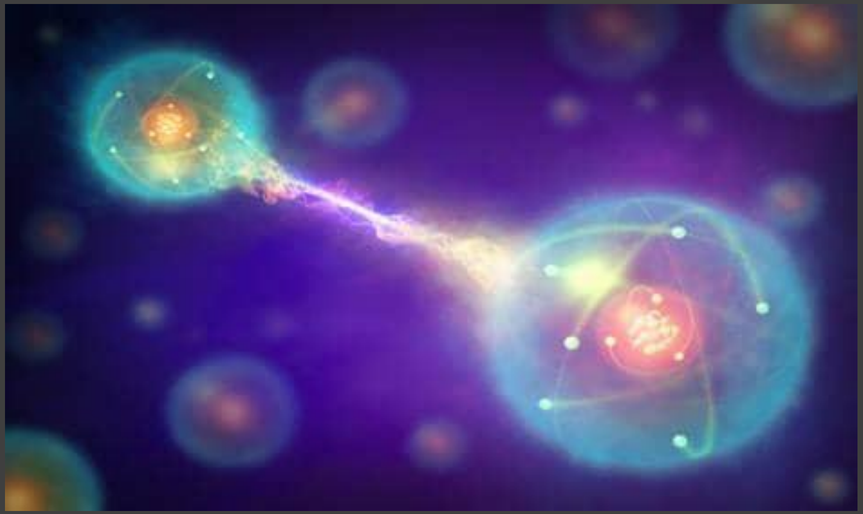


- Products and services become more human centric
- Ethical behavior from human Machine interaction
- Stack oriented Design and adaption make them affordable and flexible to build

A-IQ Ready



Quantum correlations and advantages



X0.2

Entanglement // Verschränkung

AI-READY: enabling different application through quantum sensor technology (1/4)

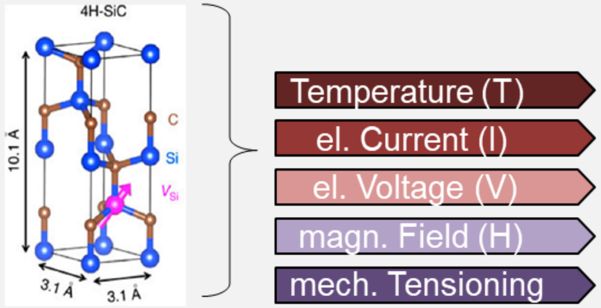
The proposal is to **connect SC3, SC4 and SC6** by **leveraging on the quantum sensor technology**.

In fact **the same QS technology** will be **integrated** into **different processing platforms** thus enabling **different applications** in **different SCs**

Quantum-sensors

highest precision & sensitivity for multi-physical characterisation to optimize systems on the edge

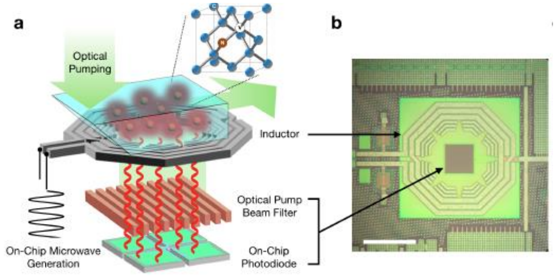
Quantum Sensor for multi modal, multi-physical, multi-scale measurements



Multi feature extraction for models

SC6

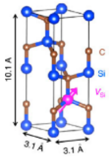
Development of the QS, HW interface and toolbox



FAU, EDI, I&M

SC3

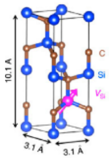
QS for detection of magnetic field orientation on UGV



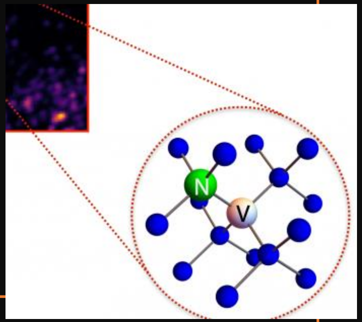
VIF, MUL, FAU, AIT, OTH, EDI I&M, UNIMORE

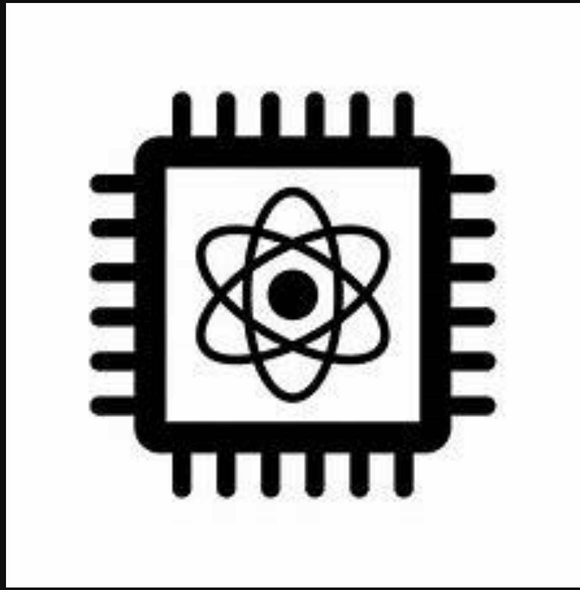
SC4

E-motor equipped with the quantum flux sensor



MBAG, HSO, AVL, BUT, I&M, UNIMORE



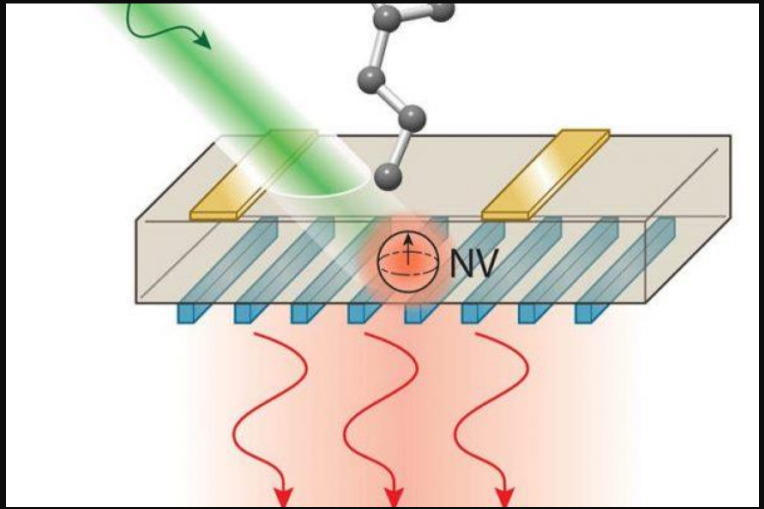


Quantum sensing

Quantum sensing makes use of the unique and counter-intuitive properties of matter and light when it is governed by quantum physics, such as quantization of energy levels, particle-wave duality, coherent superposition, and entanglement, to make precision sensors and measurements.

Applications of quantum sensors

range from medicine to navigation, security, materials science, and even astrophysics.



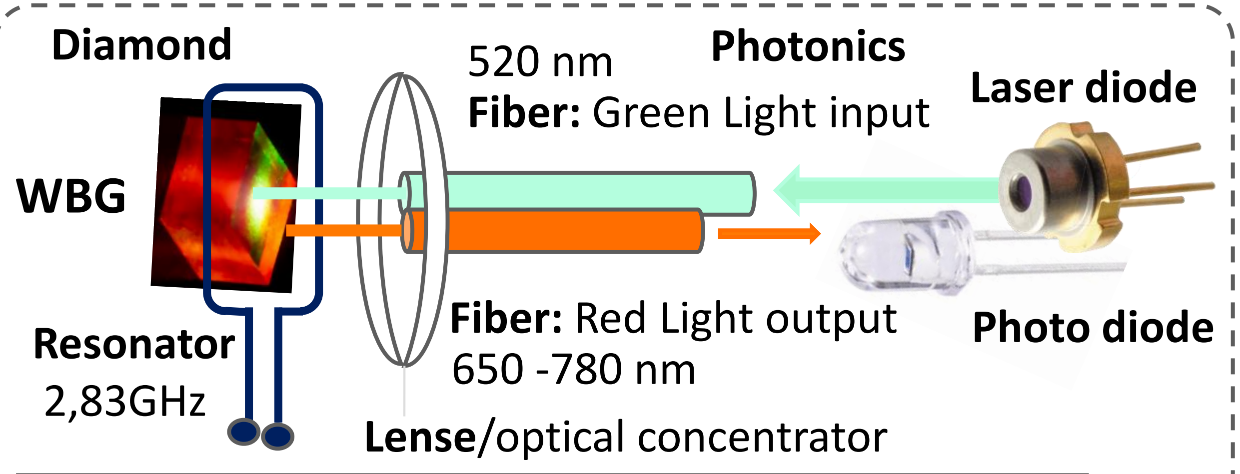
Primary challenges

in quantum sensing is to protect the quantum system that is being used as a measurement device from the deleterious effects of interacting with its surrounding environment, while remaining sensitive to the target signal.

Quantum sensing research spans

from Chemistry, Physics, and Engineering science

First ever made integrated Q sensor magnetic field



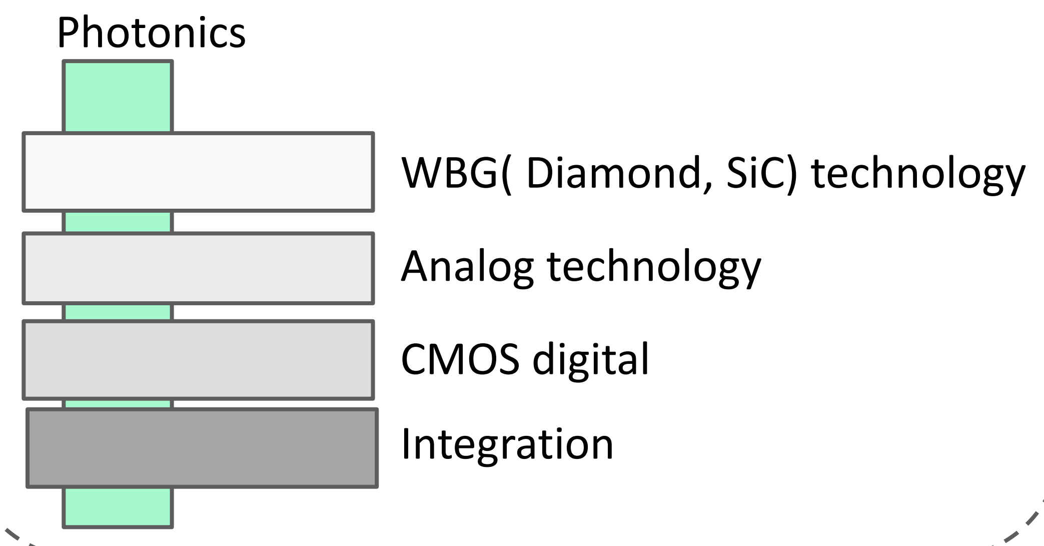
Analog
MW-source, MW-amplifier
IQ-mixer, Photodetector
Lock-in amplifier, ADCs/DACs

CMOS Digital
Hardware control and timing
Signal processing
User interface

Figure 5 x0.9

More out top technologies

Integration of 5 Foundation layer (SRIA 1.1 – 1.3)



More than Moore -> functionality

Use the strength of Europe's semiconductor technologies

Semiconductor content ->
new semiconductor are the key to the new world

SiC , GaN -> High innovation

Example: Real-time torque sensing allows to monitor true power transfer, which is crucial for drive control systems, especially in terms of efficiency and safety improvement

mmWave sensor

Current limitations:
Robustness against electromagnetic interferences, vibrations and limited installation space.

New:
New concept for torque measurement using tunable millimeter-wave metamaterials together with a continuous wave radar chip as read out.

Enjoy the way to a sustainable world build by trust and collaboration.

We owe it to the planet

Helmut List

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