

EU Cloud Edge IoT.eu

The European Cloud, Edge & IoT Continuum

Decentralised Intelligence and Swarms - What is at stake?

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Funded by
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Let's talk about Swarms & Intelligence



• *What is it you want to solve ?*

? From nature

to

Systems ?

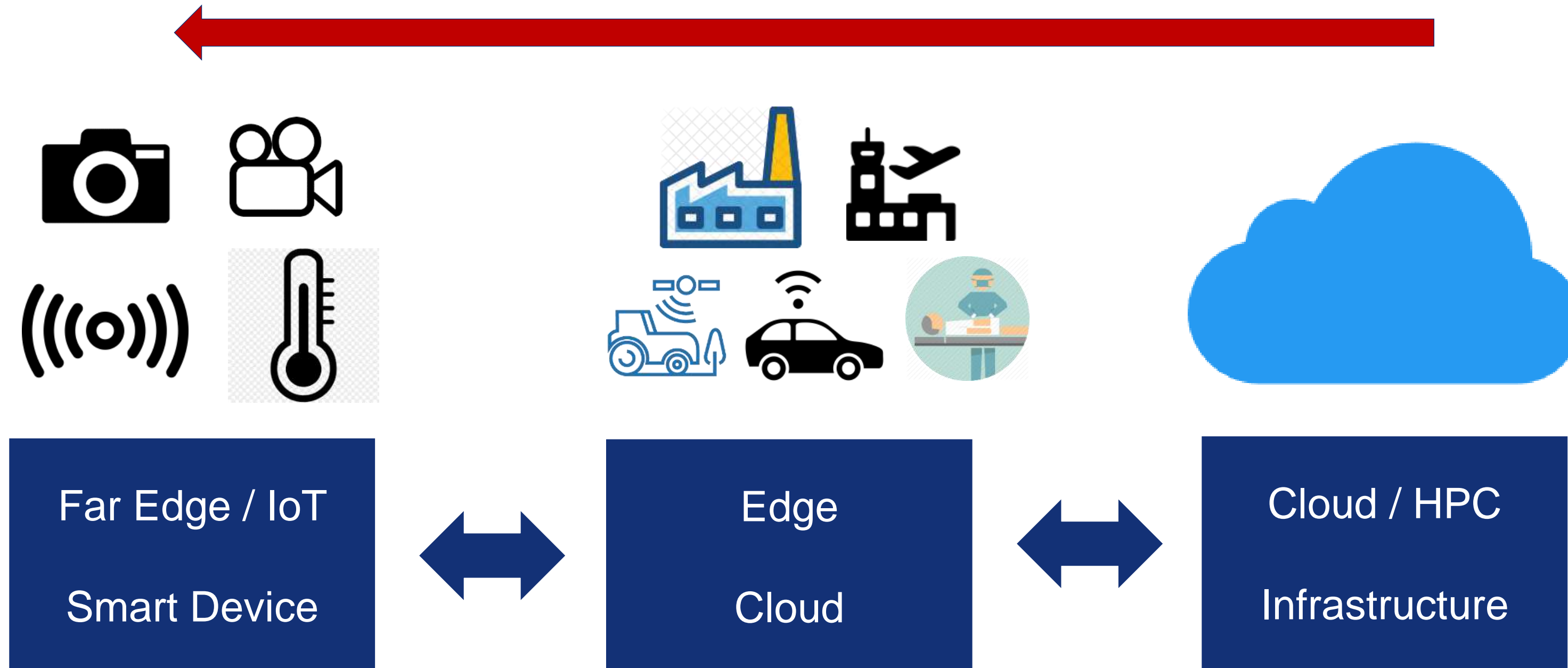
• *What is it you want to tell people?*

• *Where do we have applications today?*



Cloud-Edge-IoT Orchestration

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



Federating far edge resources ad hoc via 5G
to provide cloud resources close to the edge

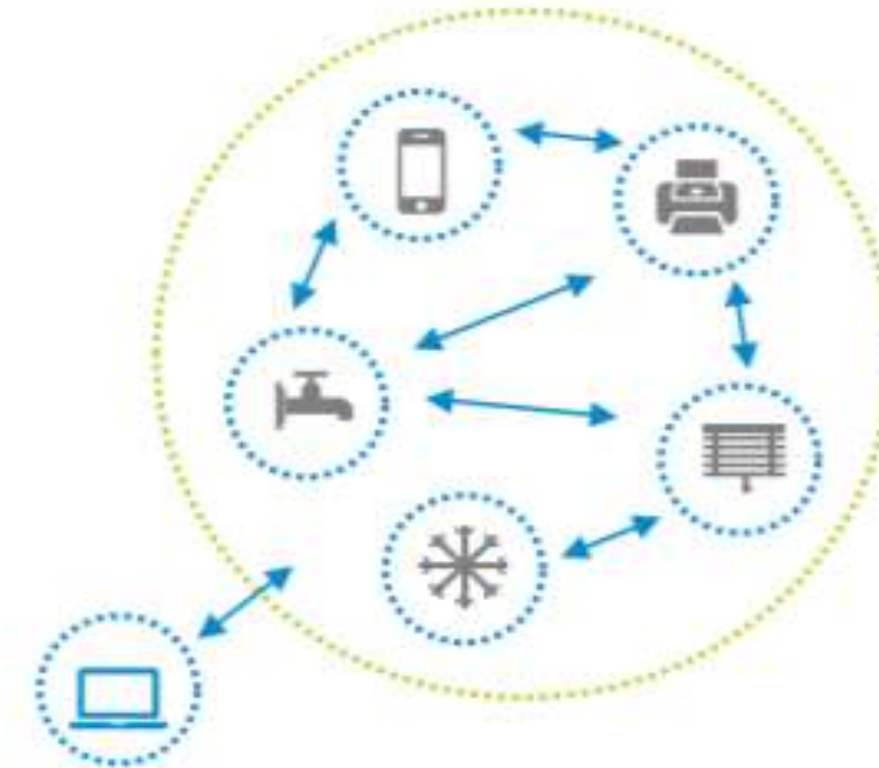
Evolving Edge - IoT Topologies

Today:



- Rely on clouds and gateways
- No universal language
- Expensive to implement and expand
- Doesn't allow for future use cases

Future:

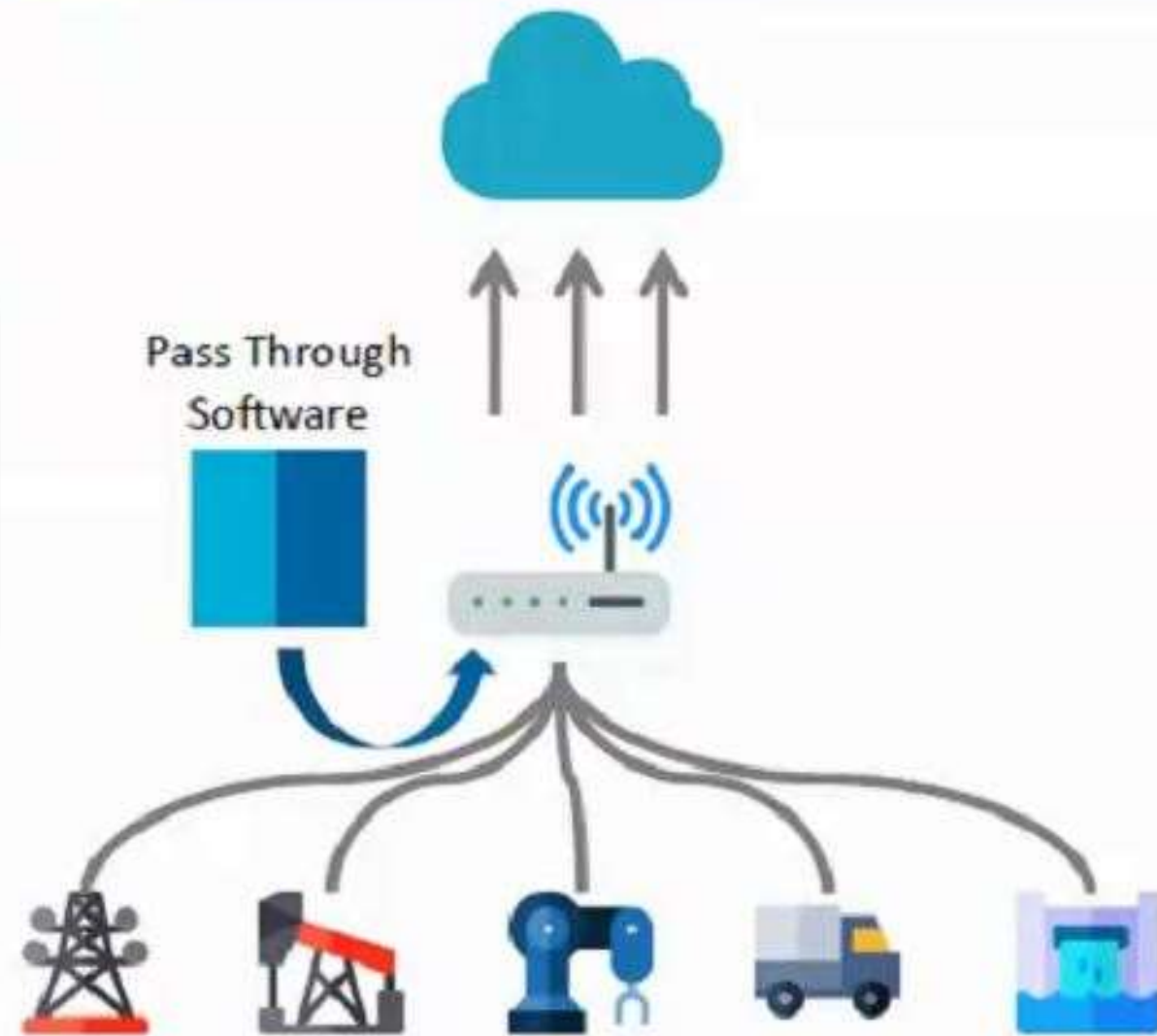


- Direct communication between devices
- Every Use Case possible
- Easy to expand
- Secure

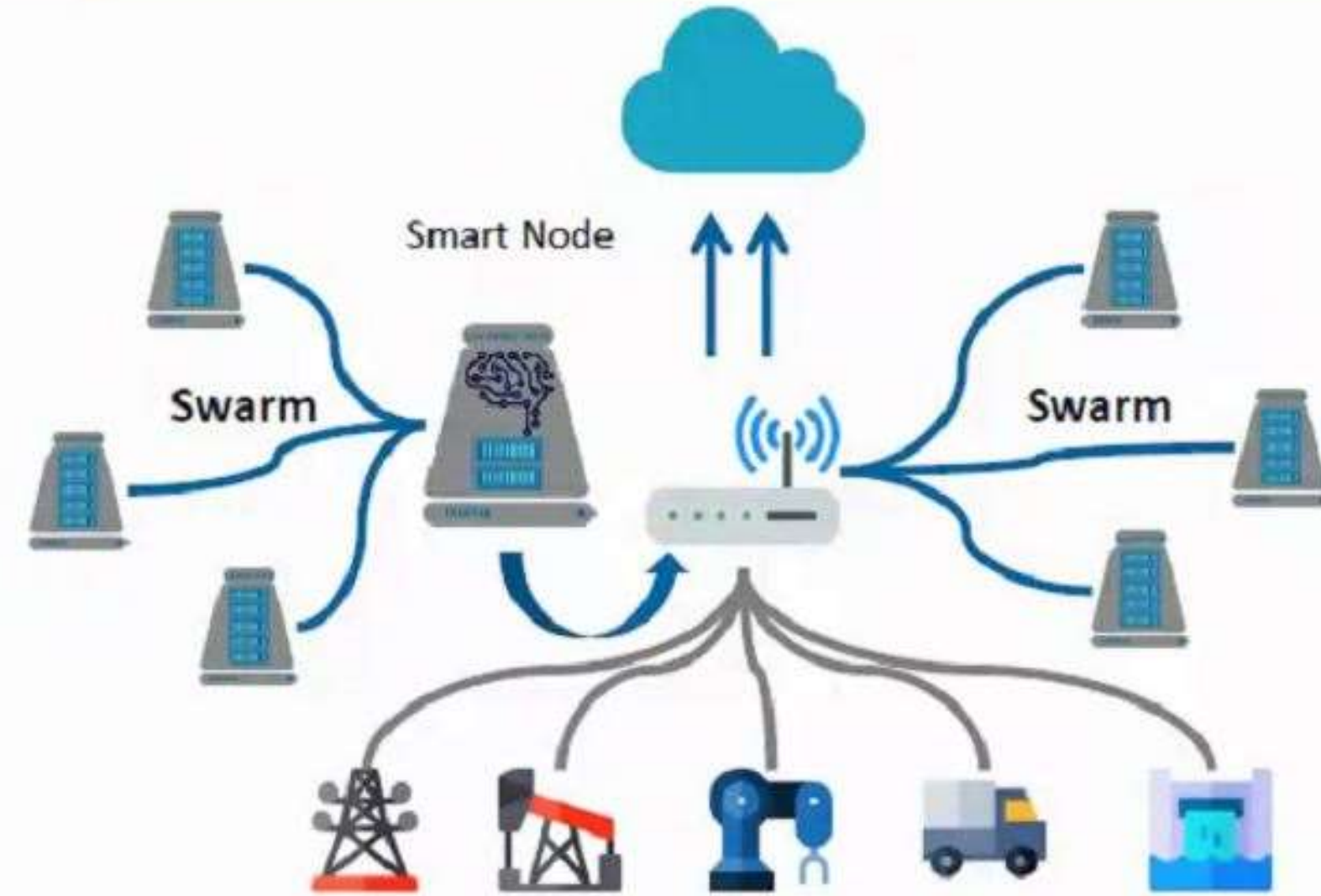
From Cloud-based IoT Devices and Services

...moving towards fully decentralized processing

Industrial IoT in the Cloud



Cloud continuum to the Edge



**Collaborative Smart Node software on the Edge: advanced processing close to field assets
Less data overhead to the cloud, increased resiliency, better latency**

Swarms? → *starting with mesh interaction*

The Energy Data Mesh



Building up decentralised intelligence // Power at the edge // Distributed Computing // new mesh communication

Target: Programming Environments

→ *for Decentralised Intelligence & Swarm*

**CPS,
Digital
Twins,
Agents**

**5G,
communications**

**Smart
RTE**

**37 M€
in 2022**

AI-IOT
(e.g. nodes, mesh)

**Swarm
Computation
Paradigms**

*Covering high-level abstractions of functional and non-function properties
as well as discovery mechanisms, device identity management*

Path from today's examples to new opportunities

- a. A drone software platform to operate 5300 drones simultaneously.
 - b. An orchestration software to operate fleets of objects
- **A programming environment** for safe, robust, efficient programming and fast deployment and operation
 - **From concept implementation towards real life pilots** towards acceptance
 - Supported by **real-time simulation models** / building on advances in SW tools, e.g. GenAI
 - Identification of **emerging standards** like ISO23374 based on ETSI TS 103 882 for digital twins
 - **Open interfaces** enabling vendor-independent and exploitable across different use cases.



Programming tools for decentralised intelligence and swarms (RIA)

- Agile and secure architectures for collaborative smart nodes
 - **Smart nodes with decentralised or swarm intelligence**, which build on European strengths in embedded sensors and devices and wireless communication, both non-cellular and mobile 5G networks.

- Programming environments for smart edge-connected nodes

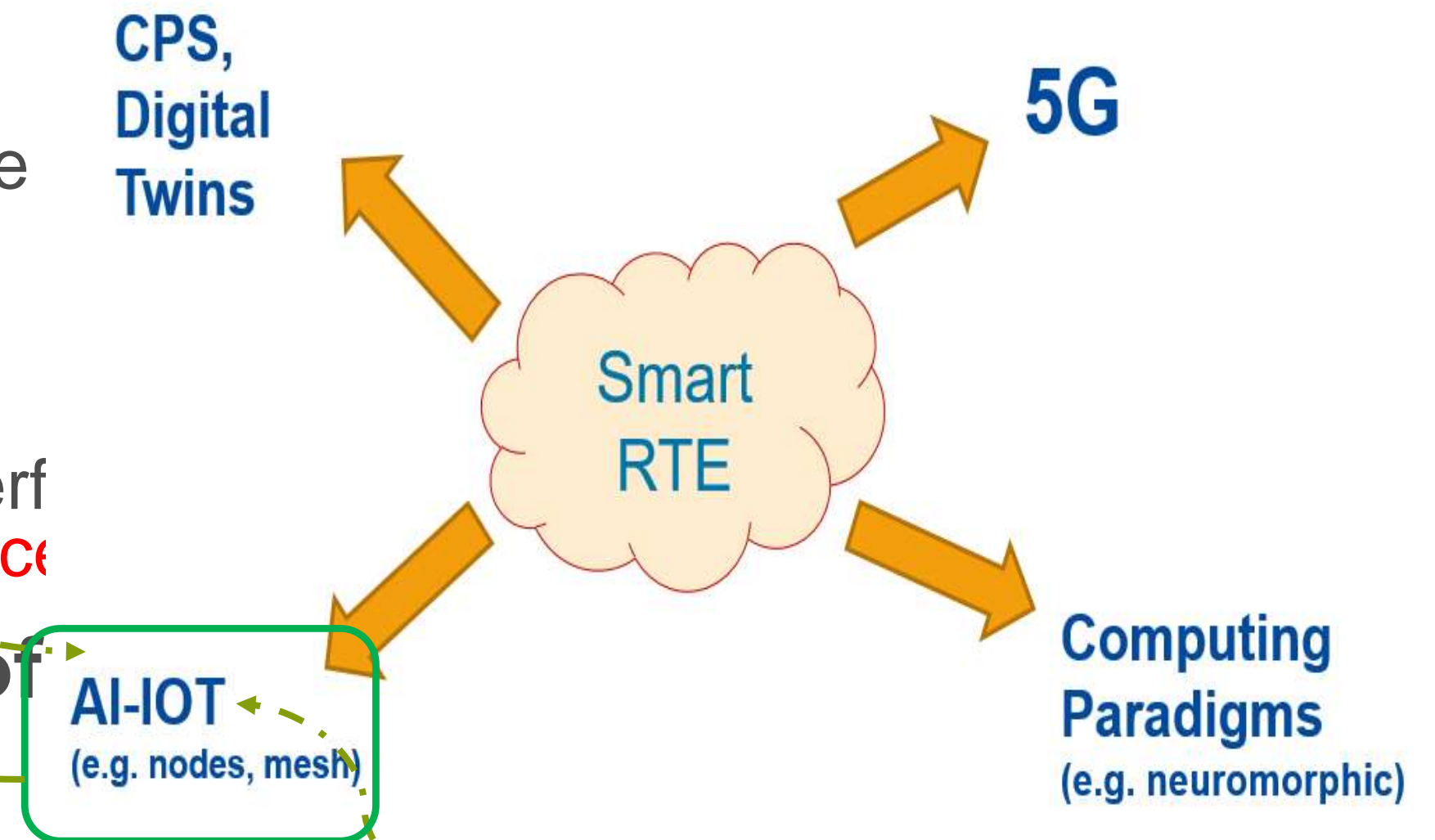
- .. and dynamic groups of nodes across the device-edge-cloud continuum, which reduce and maintenance.

- Dynamic open environments and tools,

- E.g. SDKs which stimulate open architectures and interop interoperability and avoiding vendor lock-in, open source

- Reinforced Europe's position in the market of systems

- E.g. systems, sensors and devices integrated in an evolving Internet of Things and cyber-physical ecosystems with strong capacities at the edge.



Key Swarm Cluster assets:

→ Grouping of Use cases & Infrastructure validation

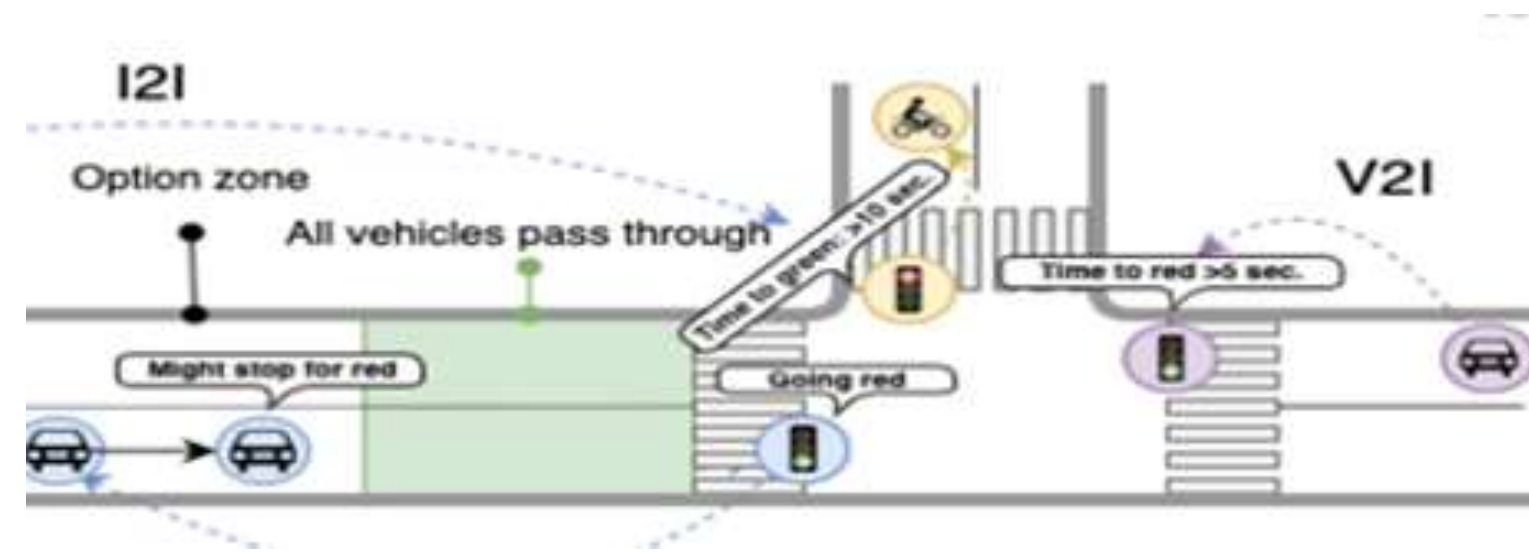
Manufacturing:

Context-aware safety



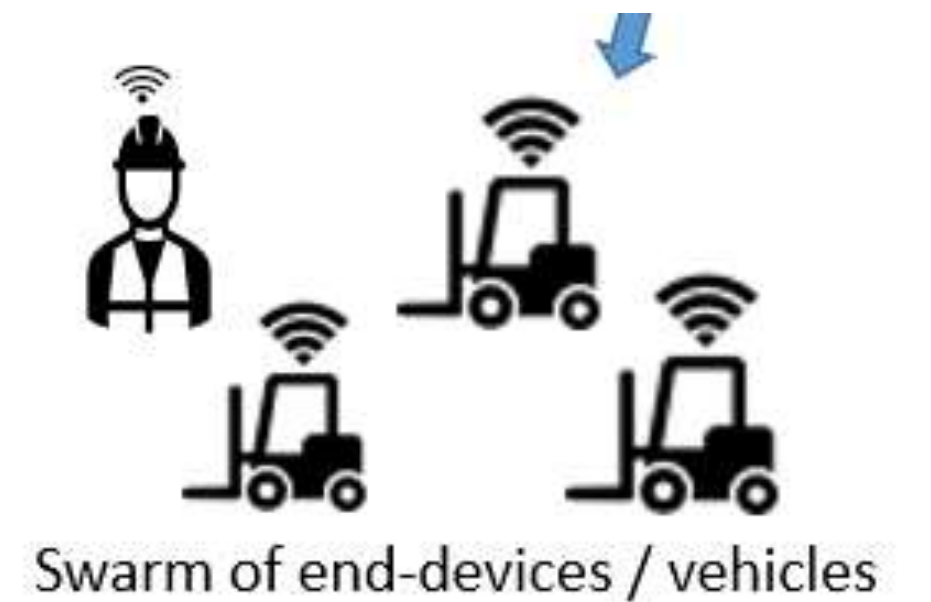
Smart Traffic:

intelligent crossing optimizing traffic flow



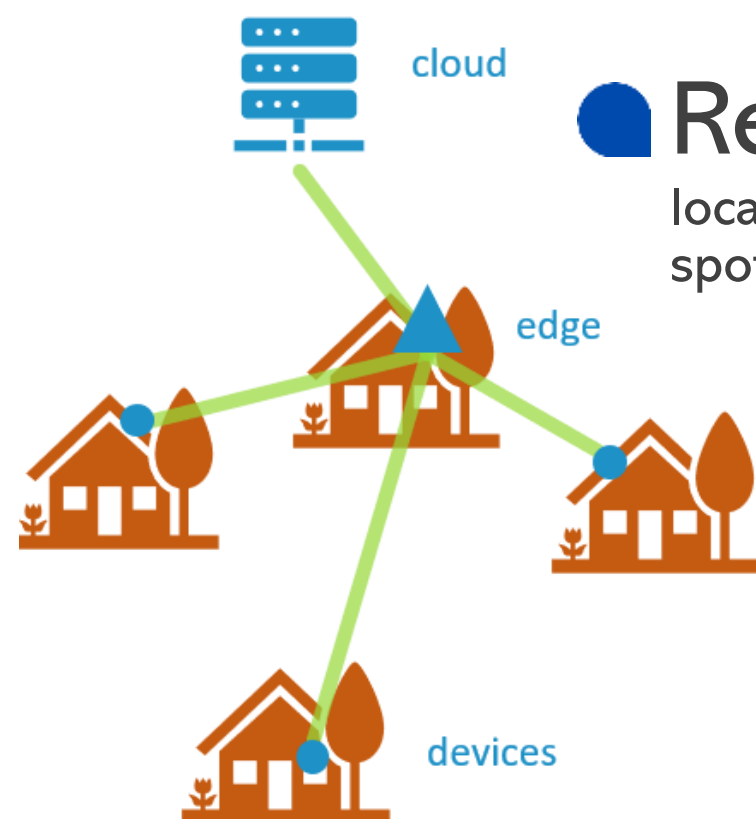
Logistics:

Asset coordination on the spot



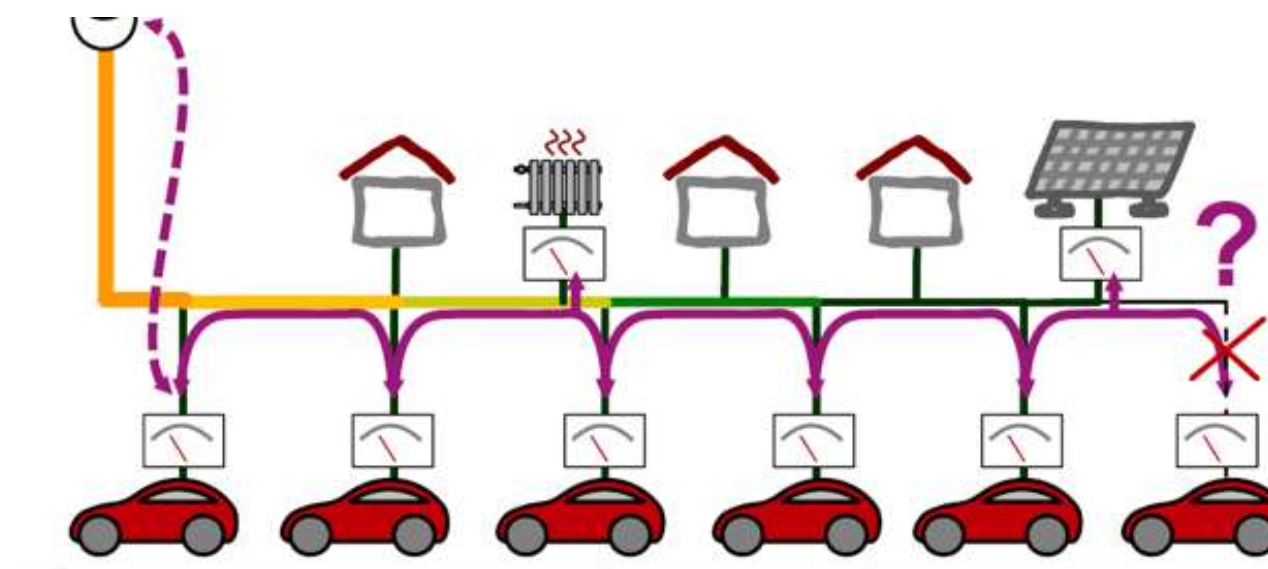
Renewable energy:

localised Activation of resources on the spot



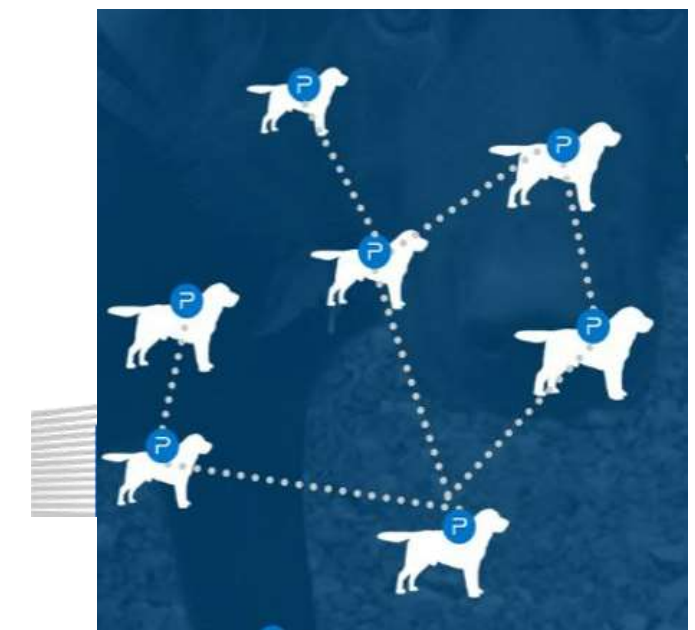
EV Charging:

localized active Peak Shaving



Emergency / Rescue services:

Highly responsive resource coordination





Strategic Liaisons



Open Source
Engagement



Architecture



Ecosystem
Engagement



Market and Sectors



Communications

What do we want to get out of the cluster?

- **Communicate**
 - Story Telling of Swarm Computing / Decentralised Intelligence
- **Integrate:** Common Tool Integration Platform
- **Share:** Sharing of infrastructure for tool validation
- **Vision:** Future vision / reflection of emerging technologies

Related Background



- **Commission Internet of Things:**

- [The next generation Internet of Things | Shaping Europe's digital future \(europa.eu\)](https://europa.eu)

Position Papers and Event Reports

- Alliance AIOTI Strategic Foresight : [IoT and Edge Computing Convergence](#)

- Next Generation [IoT and Edge Computing Strategy Forum](#),

- **EU Portal** – [Building the European Cloud, Edge & IoT Continuum](#)

- HIPEAC Vision <https://www.hipeac.net/vision/#/latest/>

- ARTEMIS SRIA - <https://artemis-ia.eu/>