



# Autonomous response for security and resiliency

Sebastien Dupont - CETIC

The Claridge – Brussels, Belgium | 10-11 May 2023

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From Cloud to Edge to IoT**

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# Motivation

Raise in attacks targeting **cyber physical systems**

ex. Ukraine, 2022 – **energy grid blackout** attempt by Industroyer2 malware

Convergence of IT and OT increases attack surfaces

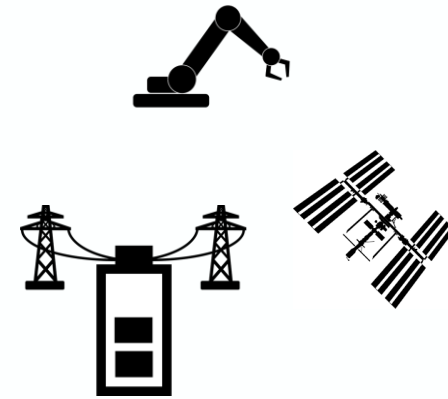
→ Need for **cyber resilient infrastructures**

Cloud/Edge/IoT challenges:

- real time, limited connectivity, heterogeneity, updates, ...

Standards and regulations

- NIS2, CRA, GDPR 
- ISO/IEC 27001, ISO/IEC 25010, ... 



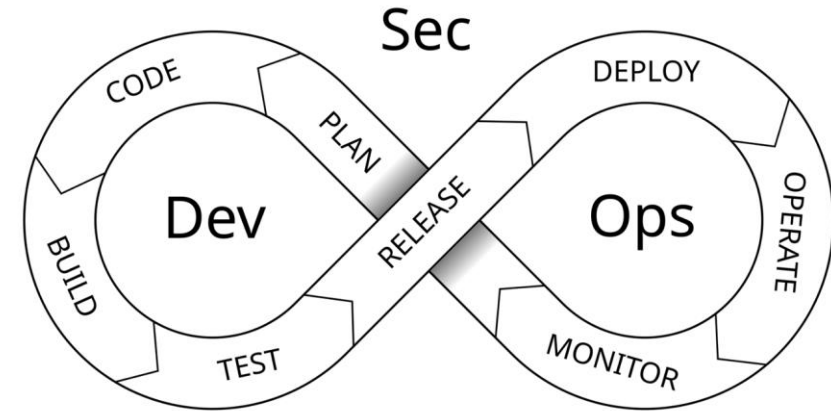
# Autonomous response for security & resilience

**Self-healing** Cloud-Edge-IoT continuum

**Security “By Design”**, risk-based

## Automation:

- penetration testing
- chaos engineering
- load testing
- DevSecOps
- AI & human in the loop



Quality, speed, security



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# The machine economy will be open source! (or will not be)

Gaël Blondelle – Eclipse Foundation

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# Open Source innovation drives the industry

IoT &  
Edge Computing



Machine  
Learning & AI



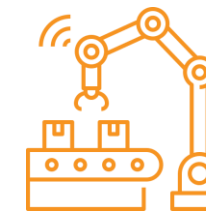
Cloud



Distributed Ledger  
Technologies



Industrie 4.0

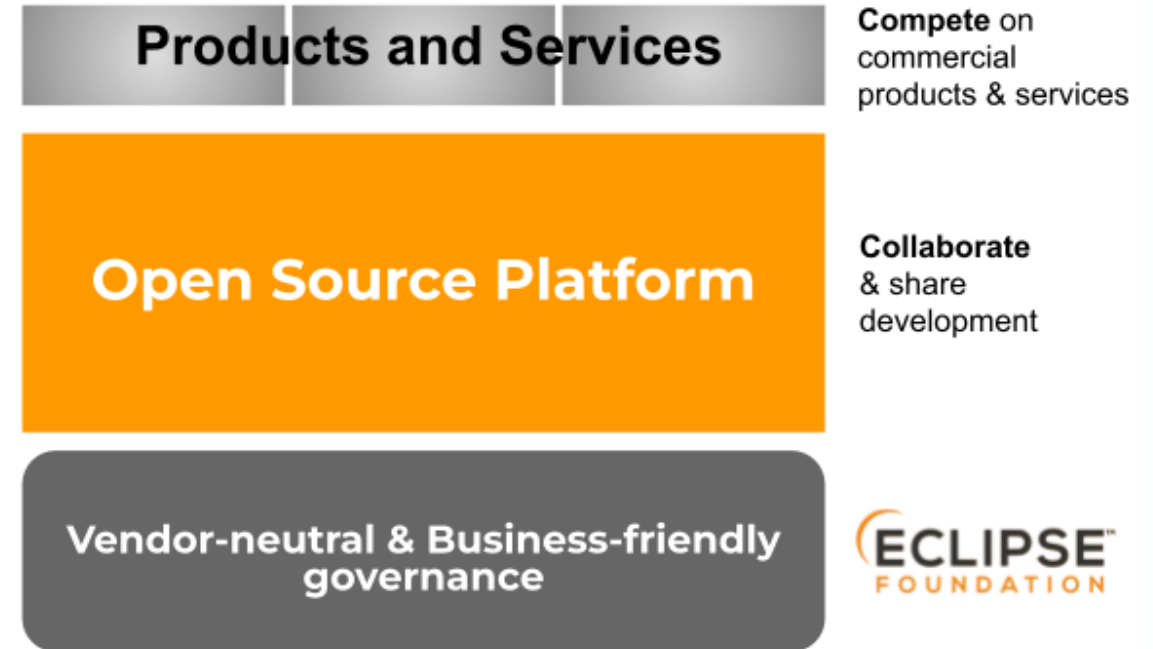
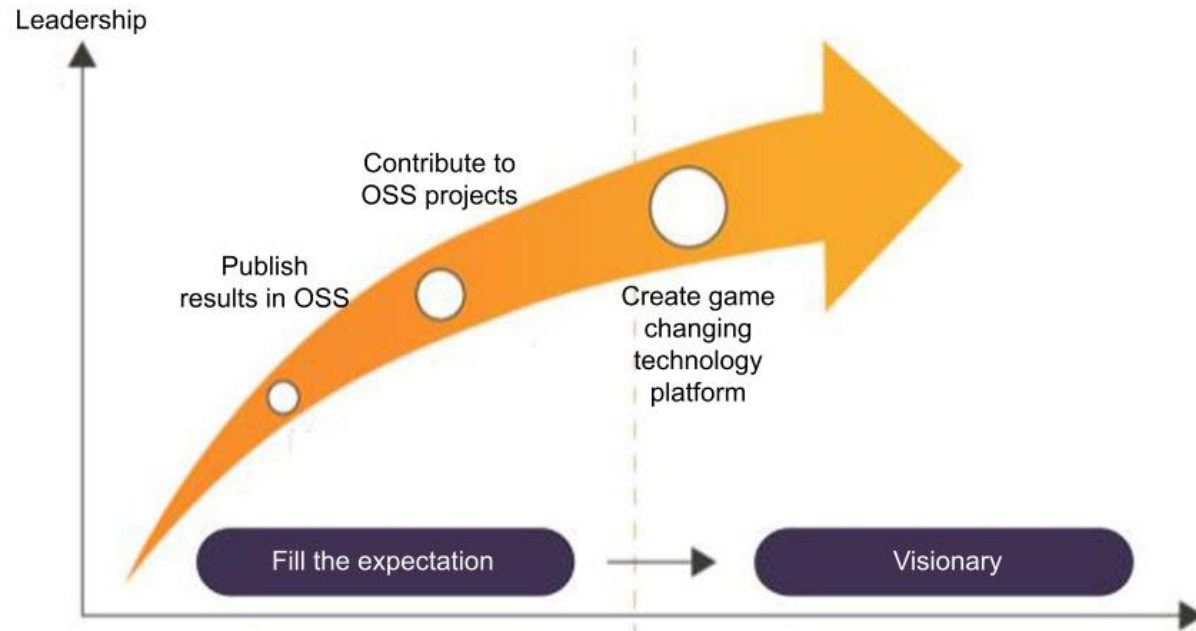


Industry trends are being lead by open source innovation

.....Mostly

# Open Source is good Open Source platform is better

Photo by [Romain HUNEAU](#) on [Unsplash](#)



Leverage open source superpowers with a « **code first** » approach and an « **architecture of participation** »

Open Source best practices enable **collaboration** and **exploitation**





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## Your contacts if needed

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# Challenges towards effective support of Computing Continuum use cases

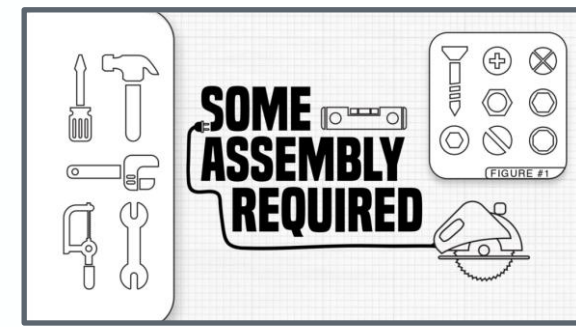
Manolis Marazakis – FORTH (Greece)

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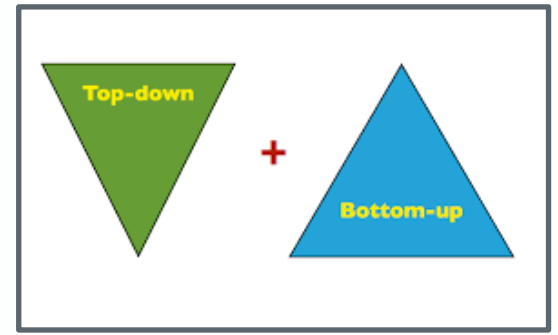
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# Vision of Computing Continuum (CC)



- Combining real-time data with complex models and data analytics to monitor and manage systems of interest
  - How to combine simulations, AI/ML, data-driven analytics ?
  - How to allocate a suitable set of infrastructure components to run the application workflow, in a dynamic and adaptive manner ?
  - Demanding requirements at application, middleware, system levels
- Current status: Several separate software stacks optimised for different goals
  - specific to the target infrastructure
  - eg. physical simulation, ML/AI-driven modelling and inference, data processing and analysis
- Increasing need for integrated software ecosystems which combine current "island" solutions and bridge the gaps between them
  - Support the entire lifecycle of CC use cases, including initial modelling, programming, deployment, execution, optimisation, as well as monitoring and control
  - Establish and manage trust over time when sharing systems, software and data
  - Support for reproducibility of workflow results

# Research Challenges



- Software interoperability and composability enhancements
  - Facilitate integration of HPC, AI/ML and data analytics processing, including hybrid applications such as AI-enabled simulations.
    - Diversity of existing software stacks and execution platforms → use of distributed and dynamically allocated resources
- Federated usage of compute, storage and communication resources
  - Widely distributed, dynamically changing, and heterogeneous infrastructure
    - Operating autonomously under the purview of independent authorities
    - Combination of technical and organizational concerns
  - Identity & Access Management (IAM)
  - Interoperable resource allocation and accounting
  - Scheduling/orchestration and monitoring middleware at large scale
  - Security assurances regarding platforms, interconnects, and data



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**Thank you for your attention.**

*How close or how far are we from being able to support the Computing Continuum vision ?*

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# A Paradigm-Shift for the IoT-Edge-Cloud Continuum

Panagiotis Kokkinos, Emmanouel Varvarigos  
Institute of Communication and Computer Systems (ICCS), Greece

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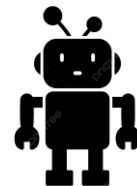
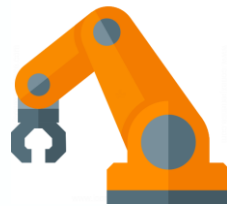
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# A paradigm shift

- Today, several technological challenges are addressed in order to build the IoT-Edge-Cloud continuum
  - Software and algorithms
  - Hardware-accelerated devices
  - High Performance Computing (HPC)
- Beyond that we believe that a paradigm shift is also required in the way we utilize these technologies

# Edge infrastructure deployability

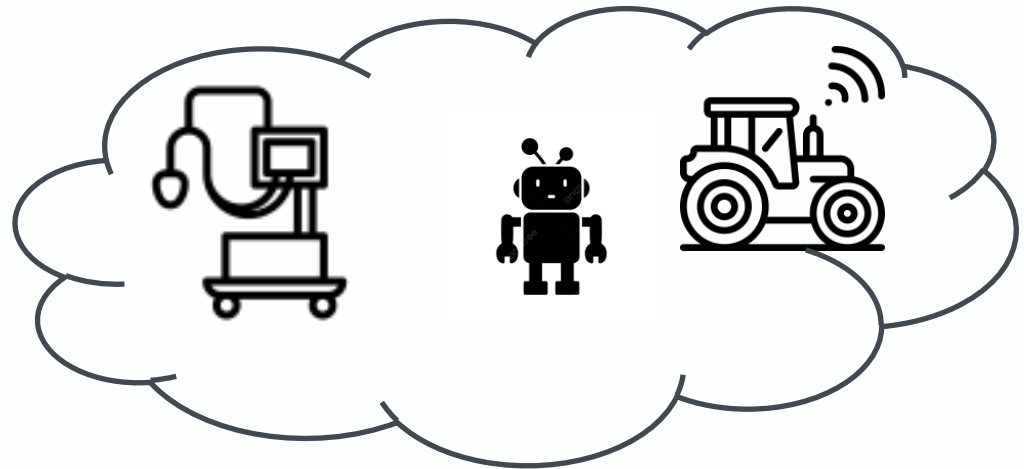
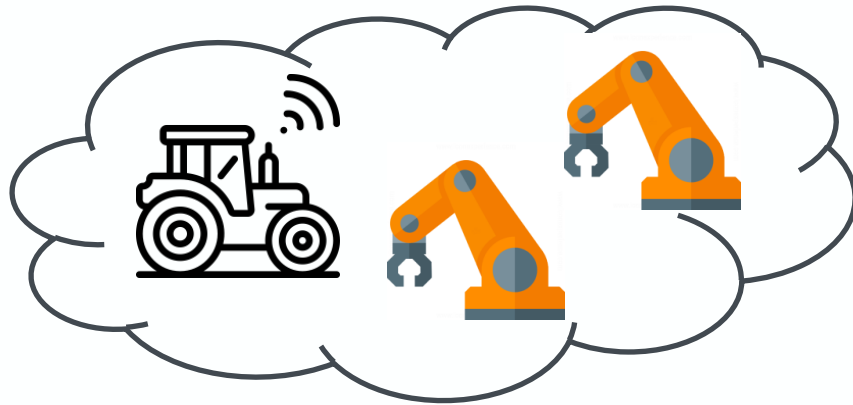
- In order to provide the anticipated edge services the deployment of edge sites needs to be massive
- This can be accomplished through edge disaggregated whiteboxes that are build from on off-the-shelf hardware, modular open-source software and open APIs
- Enable greater transparency and control over the edge infrastructures



Edge whiteboxes: Open software & hardware technologies

# Business Aspects of Edge

- There are no real incentives, mainly in terms of return of investment, for deploying new edge infrastructures
- Support edge resource sharing and federations and transform edge resources to a marketable entity, like in the energy sector





# Edge Operation

- Build edge infrastructures so as to accommodate any kind and any volume of processing and storage tasks that today are served by cloud resources
- Edge infrastructures should be ready for the scenario where the cloud resources are not available at all or it is not efficient or desired to use them
- Support development of applications from third-party developers
- This can be achieved through:
  - shared data from IoT devices
  - shared edge resources
  - shared processing mechanisms/algorithms



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# Swarm Robotics is the Next Frontier in Cloud-to-Edge-to-IoT Research

Thomas Watteyne – Inria

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# Swarm Robotics is the Next Frontier in Cloud-to-Edge-to-IoT Research

## motivation

- massive community in Europe of IoT researchers: protocols design, standardization, implementation, experimentation

## state-of-the-art

- End of cycle: protocols are standardized, commercial solutions are on the shelf
- The low-power wireless aspect of (Industrial) IoT is solved. **What is the next frontier?**

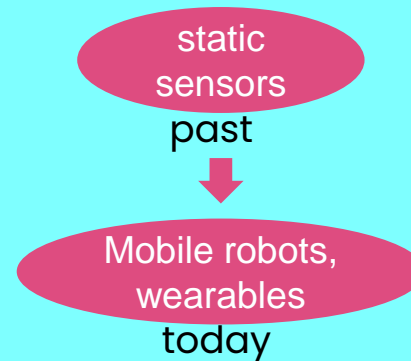
- Time Synchronized Channel Hopping (TSCH) is de-facto standard for Industrial (IEEE802.15.4e, 6TiSCH, ISA100.11a, BLE, ...)
- 100,000's TSCH networks running today
- Ideal for process monitoring.



## Grand Challenge

Define the next research cycle for the low-power wireless research communication to enable new mobile swarm applications

Integration of digital and physical worlds



drone-assisted search and rescue

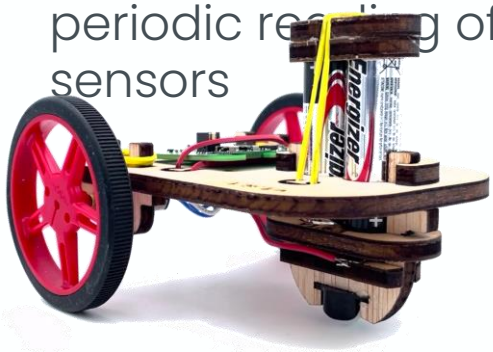


AGV ↔ worker collision avoidance

## Scientific Objectives

1. Supporting Mobility in Industrial IoT
2. Wireless Control Loops and Latency Predictability
3. Constrained Localization

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# Thomas Watteyne

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# Pattern-based, low-code Application and Platform Engineering Automation

George Kousiouris- H2020 PHYSICS & Harokopio University of Athens

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# Current Status and Challenges in Software Engineering

- Technical Challenges
  - Gap of Application Evolution vs Platforms/Services
  - Highly distributed and liquid environment: Execution substrate volatility
    - Cloud/edge continuum: Dynamic and altering formation of resources
    - Higher needs for agility, dynamic adjustment, adaptation & orchestration
  - Higher application risks from distributed models (Microservices, serverless)
  - Difficulties to adapt to constantly changing architectures
- Societal Challenges
  - Gaps in IT personnel
  - Openness and strategic autonomy considerations due to
    - Geopolitical tensions
    - Differences in privacy vision (EU-US)
    - Data sovereignty and regulations
      - Need for more automated means for compliance adaptation and checking
  - AI-based advances
    - Can streamline typical processes but not generate synthesis, combinations and integrations

# Research Topics

- Next Generation Application Design frameworks
  - Low code
    - Reduce learning curve and entry point for IT practitioners
    - Enhance synthesis: critical differentiator from AI
  - Pattern-based embedded implementations
    - Abstracted app design
      - Template&parameter-based
    - Ready-made, reusable solutions for intelligent and integrated combinations
      - Cloud-native by design, enforcing aspects such as high availability, legal compliance etc
      - Speed up app development and adaptation
    - AI-driven adaptation to current conditions targeting pattern parameter setting
- Next Generation Platform Engineering Automation
  - Pattern-based view on platform level blocks
    - Data sharing service primitives, IaC pattern templates, DevOps patterns, Federated constructs and dynamic onboarding, resource setup automation, configuration and management





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# Computing Continuum: A co-habitation of domain-specific vertical solutions?

Claudio de Majo, John Favaro, Maria Giuffrida – Trust-IT Services

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# The computing continuum and heterogeneity

The computing continuum is a new societal force and a heterogeneous environment where different devices and systems interact and operate together



INTERNET OF THINGS



EDGE COMPUTING

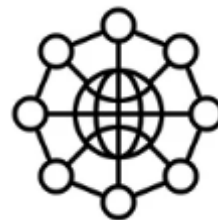


CLOUD COMPUTING

Heterogeneity must be addressed to guarantee efficiency and security and tackle challenges:



Data management



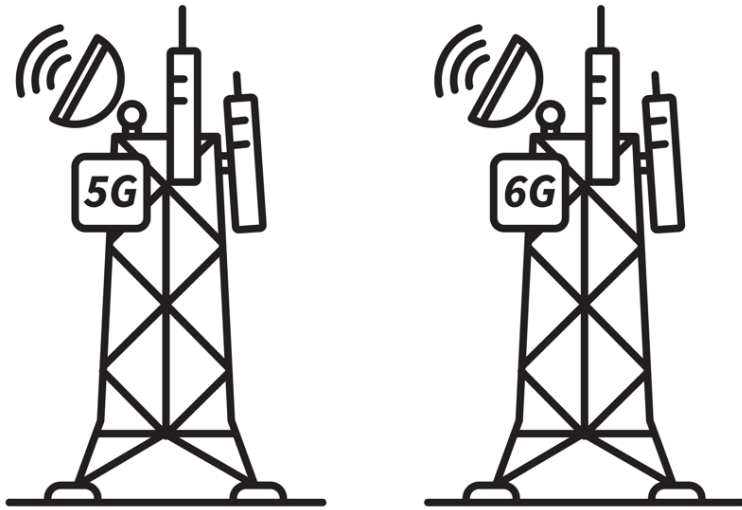
IoT 5G-cloud imbalance



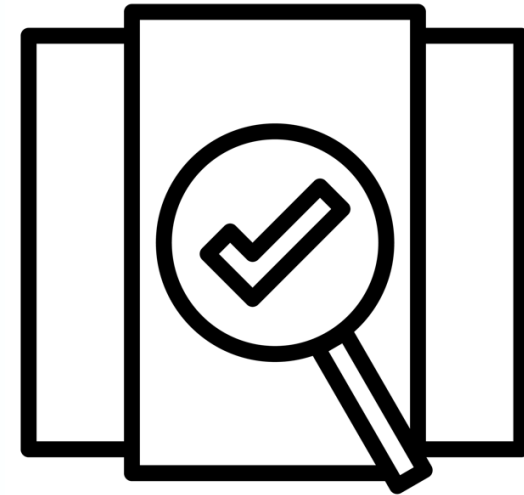
AI ethical questions

# 5G/6G technologies and standardisation efforts

5G/6G technologies and standardisation efforts should be jointly leveraged to turn the computing continuum into an effective co-habitation of domain-specific vertical solutions enabling cross-sectoral exchange and semantic interoperability.



5G/6G technologies can improve the performance of the computing continuum through innovations such as low-latency and synchronisation



Standardisation processes tackling arising technical challenges can provide the interoperability and scalability required to realise the full potential of CEI applications



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# Thank you for your attention!

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# Efficient, secure and trustable computing continuum: automation and data processing

Matija Cankar – XLAB d.o.o.

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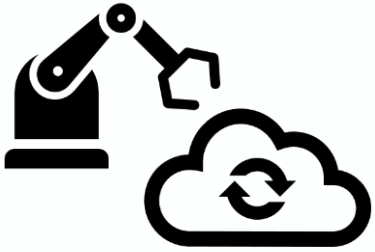
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# Continuum: Trust your creation (XLAB)



**Challenge #1: The need for efficient data processing and storage.**



*Devices and services generate massive amounts of data. We need to address the optimisation of processing with **automation**, **machine learning** and leverage **platform engineering** (future **DevOps**) approaches.*

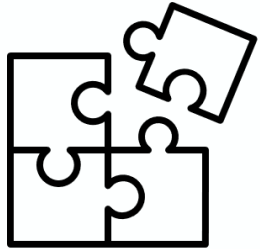
**Challenge #2: The need for effective security and privacy measures.**



*Gain the **trust** in hardware, development of infrastructure (Infrastructure as Code), application deployment and lifecycle management. **Automation** of steps can allow us to investigate the process beforehand (shift security left) and put **security and privacy** on the next level.*

# Data: trust and share (XLAB)

## Challenge #3: The need for standardization and interoperability in the Cloud continuum domain



*Systems must work together **seamlessly**. Standards and protocols can help – we welcome them – but are slow. Meta-systems and Meta-services, can tie things together and help standards to appear in de-facto way, e.g. Meta-orchestrator of Gaia-X.*

## Challenge #4: Data governance for privacy and security.



Data management must be **safe, trustable**.

Data governance and sharing must be **easy and reliable**.

*The systems for data sensitivity check, data cleaning and data sharing with retention are a must to create a **real data market continuum**.*





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