HORIZON-CL4-2022-DATA-01-04/01/05

HORIZON-CL4-2022-DATA-01-04

1. What are you looking for?

- data market/ data economy enablers
- technologies, solutions, frameworks that facilitate the collection, sharing, storing, processing, **trading** and re-using of data
- practical and scalable solutions for handling large amounts of transactions while minimizing energy consumption
- development and demonstration of practical and mature end-to-end systems

HORIZON-CL4-2022-DATA-01-04

2. What do you NOT want?

- duplicates of privacy-preserving technologies and data platforms already funded under H2020
- project proposals lacking energy-efficiency as a design principle
- theoretic/ research projects – this is an IA topic with TRL 7 by the end of project

HORIZON-CL4-2022-DATA-01-04 topic evolution

3. Is this new or has it been called before?

- privacy-preserving technologies and data platforms have been addressed in H2020 (ICT-18-2016, ICT-13-2018-19) – but this is the first time we specifically address data trading
- link to the Digital Europe programme: actions are expected to support the deployment of the Common European Data Spaces

HORIZON-CL4-2022-DATA-01-04 topic evolution

4. Current project portfolio *(if relevant)*

Examples of Data Platforms (IA) ICT-13-2019:

DATA VAULTS (Personal data vaults),
PIMCITY (Building the next generation personal data platforms)

Examples of privacy-preserving technology projects (RIA) ICT-13-2018:

MOSAICrOWN (Multi-Owner data Sharing for Analytics and Integration respecting Confidentiality and Owner control)
Safe-DEED (Safe Data Enabled Economic Development)
MUSKETEER (Machine learning to augment shared knowledge in federated privacy-preserving scenarios)

5. Who are the types of main stakeholders that are addressed?

6. Is there a key group of actors (eg. Partnership or other) driving this?

HORIZON-CL4-2022-DATA-01-04
key actors

5. Who are the types of main stakeholders that are addressed?

- data technology developers, data providers, data brokers, data users, data subjects (citizens)

6. Is there a key group of actors (eg. Partnership or other) driving this?

- this topic implements the co-programmed European Partnership on Artificial Intelligence, Data and Robotics

HORIZON-CL4-2022-DATA-01-04

7. Are there any additional/ background documents?

- Communication: A European strategy for data (February 2020, defines the concept of Data Spaces)
- The "Data Governance Act": Proposal for a Regulation on European Data Governance
- Towards a European-Governed Data Sharing Space (BDVA position paper, November 2020)
- The Digital Europe programme

Future Outlook

8. Do you have information about future trends, emerging initiatives, roadmaps, key players in this area?

- the Digital Europe programme will support the operations, deployment and coordination of the Common European Data Spaces in key domains of society and economy (health, cultural heritage, environment, mobility…)
- tight link between the "data spaces" topics of Horizon Europe and the actual Data Spaces in Digital Europe will have to be established

Upcoming events/ information days

9. Please list upcoming information days and other events of relevance to this area

- Info Day on Horizon Europe Cluster 4, Destination 3 (29.11-01.12.2021)

HORIZON-CL4-2022-DATA-01-01

1. What are you looking for?

- technologies for data assets that are beyond reach of existing technologies in terms of volume, velocity, variety.
- precise and timely analytics, prediction, simulation and visualisation
- responsible and trustworthy technologies

HORIZON-CL4-2022-DATA-01-01

2. What do you NOT want?

- solutions for data contexts that can already be handled by existing technologies
- proposals that don’t specify their performance goals or don’t explain how they will monitor their progress towards those goals
- visualization tools that are not usable by a typical end user of data analtyics

HORIZON-CL4-2022-DATA-01-01 – topic evolution

3. Is this new or has it been called before?

While data technologies aren't entirely new, we are now looking for extreme* data technologies

**data that exhibits one of the following characteristics to the extent that they cannot be handled by 2022 technologies*

- increasing volume, speed, variety; complexity/diversity/multilinguality of data; the dispersed data sources; sparse/missing/insufficient data/extreme variations in values

HORIZON-CL4-2022-DATA-01-01– topic evolution

4. Current project portfolio: representative examples (non exhaustive)

- https://daphne-eu.github.io
- https://everest-h2020.eu
- https://www.marvel-project.eu/

Work Programme topic – Key actors

5. Who are the types of main stakeholders that are addressed?

Data technology & software developers, data producers & users, data brokers, AI developers, standardization organizations

6. Is there a key group of actors (eg. Partnership or other) driving this?

- *Big Data Value PPP (H2020 partnership)*
- *European Partnership on AI, data and robotics (Horizon Europe partnership, just launched)*

Work Programme topic

6. Are there any additional / background documents?

Communication: A European strategy for data (February 2020, defines the concept of Data Spaces)

Proposal for a Regulation on European Data Governance (The "Data Governance Act")

Towards a European-Governed Data Sharing Space (BDVA position paper, November 2020)

The Digital Europe programme (expected publication/launch in autumn 2021)

Future Outlook

7. Do you have information about future trends, emerging initiatives, roadmaps, type of stakeholders in this area?

   - Not applicable.

Upcoming events / information days

8. Please list upcoming information days and other events of relevance to this area

Info Day on Horizon Europe Cluster 4, Destination 3 (29.11 – 01.12.2021)*

* Cluster 4 - Digital, Industry & Space | European Commission (europa.eu)

HORIZON-CL4-2022-DATA-01-05

1. What are you looking for?

- Tools to provide better technologies and solutions for data mining of large, constantly growing amounts and varieties of data.
- Solutions to provide ground-breaking advances in the performance, speed and/or accuracy as well as use-fulness of data discovery, collection, mining, filtering and processing in view of coping with “extreme data”.
- These solutions should enable accurate, green and fair AI systems where quality of data is of utmost impor-tance.

HORIZON-CL4-2022-DATA-01-05

2. What do you NOT want?

Anything theoretical or unrealistic/non-functional

HORIZON-CL4-2022-DATA-01-05 – topic evolution

3. Is this new or has it been called before?

While data mining isn't entirely new, we are now looking for extreme* data mining solutions.

**data that exhibits one of the following characteristics.*

- increasing volume, speed, variety; complexity/diversity/multilinguality of data; the dispersed data sources; sparse/missing/insufficient data/extreme variations in values

HORIZON-CL4-2022-DATA-01-05– topic evolution

4. Current project portfolio

(not applicable)

Work Programme topic – Key actors

5. Who are the types of main stakeholders that are addressed?

Data technology & software developers, data producers & users, data brokers, AI developers, standardization organizations

6. Is there a key group of actors (eg. Partnership or other) driving this?

- *Big Data Value PPP (H2020 partnership)*
- *European Partnership on AI, data and robotics (Horizon Europe partnership, just launched)*

Work Programme topic

6. Are there any additional / background documents?

Communication: A European strategy for data (February 2020, defines the concept of Data Spaces)

Proposal for a Regulation on European Data Governance (The "Data Governance Act")

Towards a European-Governed Data Sharing Space (BDVA position paper, November 2020)

The Digital Europe programme (expected publication/launch in autumn 2021)

Future Outlook

7. Do you have information about future trends, emerging initiatives, roadmaps, type of stakeholders in this area?

   - Not applicable.

Upcoming events / information days

8. Please list upcoming information days and other events of relevance to this area

Info Day on Horizon Europe Cluster 4, Destination 3 (29.11 – 01.12.2021)*

* Cluster 4 - Digital, Industry & Space | European Commission (europa.eu)

HORIZON-CL4-2022-DATA-01-02/03

A European Data Strategy

EU Data Strategy

Cloud actions:
- Cloud Rulebook
- Co-Investments in cloud-to-edge services, cloud federation and marketplaces.

Data actions:
- New legislation (Data Governance Act & Data Act)
- Co-investments in EU data spaces

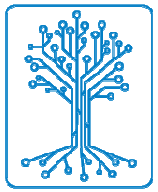
DEP

IPCEI* on Next Generation Cloud
*(*Important Project of Common European Interest)*

EUROPEAN ALLIANCE FOR INDUSTRIAL DATA, EDGE AND CLOUD

Coordination

Federation & interoperability standards



GAIA-X

Use cases; technical architecture

European Common Data spaces

European Commission

European Industrial Technology Roadmap for the Next Generation Cloud-Edge Offerings

Priority areas for EU joint investments efforts revolve around three pillars:

1. **Becoming the leader in domains that will shape European cloud and edge offerings on the global market, focusing on climate-neutrality, cybersecurity, trustworthy data exchange and interoperability**

   ➢ **Strong role for R&I**

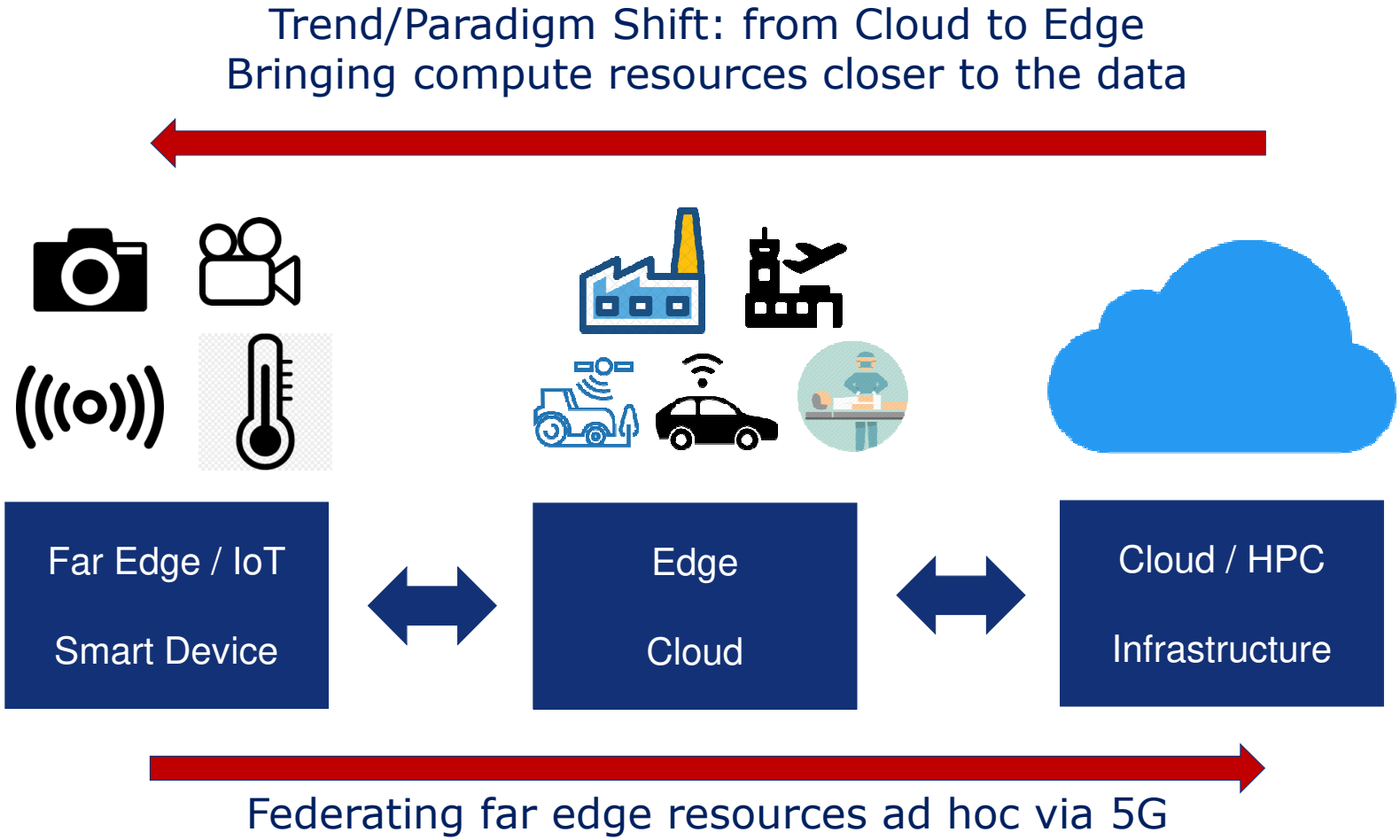
2. *Renewing and expanding infrastructure foundations across Europe*, including an increased density of edge and cloud facilities across the continent, backed by network and interconnectivity services that will enable innovative use cases at scale

3. Enabling sovereign and sector-specific services to end-users, providing businesses with trusted options that match global standards in terms of price and resilience.

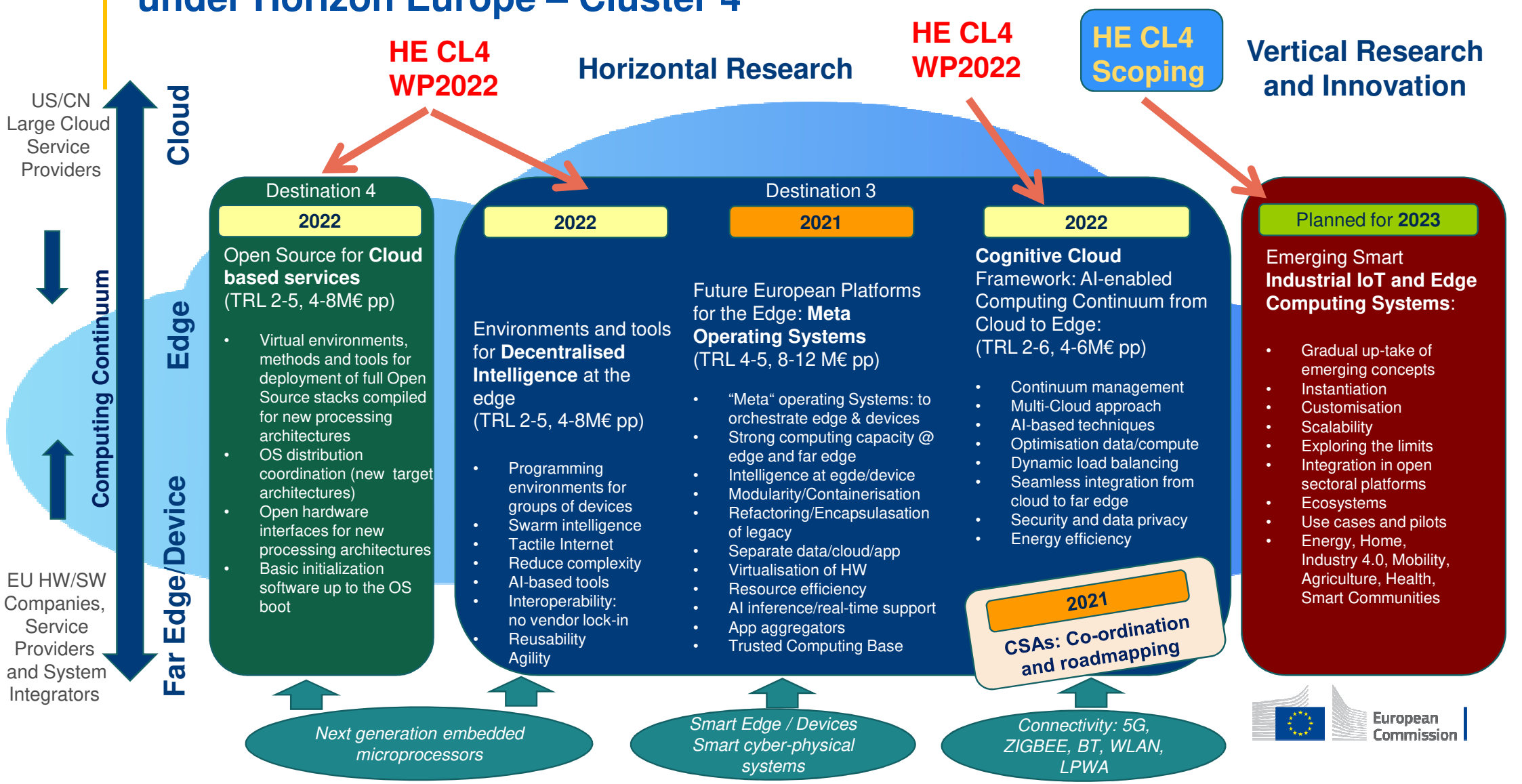
Report following the CEO Roundtable "Shaping the Next Generation Cloud Supply for Europe" that took place on 16 December 2020

European Commission

Cloud-Edge-IoT Orchestration



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



Section:
From Cloud to Edge to IoT for European Data

Horizontal Coordination

RIA:

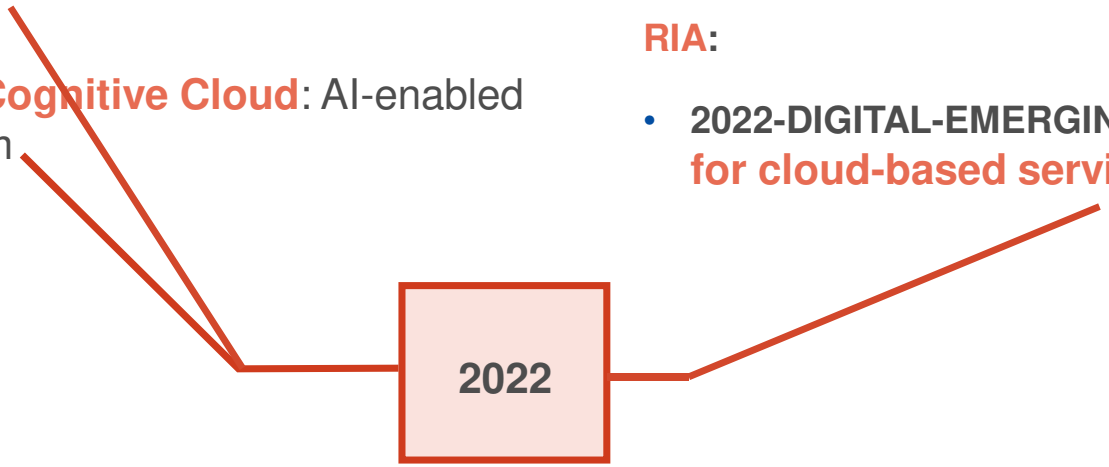
- **DATA-2021-01-05**: Edge Operating System
- **DATA-2022-01-03**: **Programming Environments** and Tools for Decentralised Intelligence
- **DATA-2022-01-02**: **Cognitive Cloud**: AI-enabled computing continuum

CSA:

- **DATA-2021-01-07**: Coordination and Support of the 'Cloud-Edge-IoT' domain
- **DATA-2021-01-08**: Roadmap for next generation computing and systems

RIA:

- **2022-DIGITAL-EMERGING-01-26**: **Open source for cloud-based services**



European Commission

Cloud Topic Evolution

FP7

- "Software & services and Cloud computing"
  - Total EU contribution: €351.5 million
  - Number of projects: 95 (s/w and cloud)
  - Average per project: €3.7 million/project

H2020

- "Advanced Cloud Infrastructures and Services"
- "Cloud Computing"
- "Cloud Computing: towards a smart cloud computing continuum"
- "International collaboration with Japan, Korea and Brazil"
  - Total EU contribution: € 195 million
  - Number of projects: 59
  - Average per project: €3.8 million/project

HE

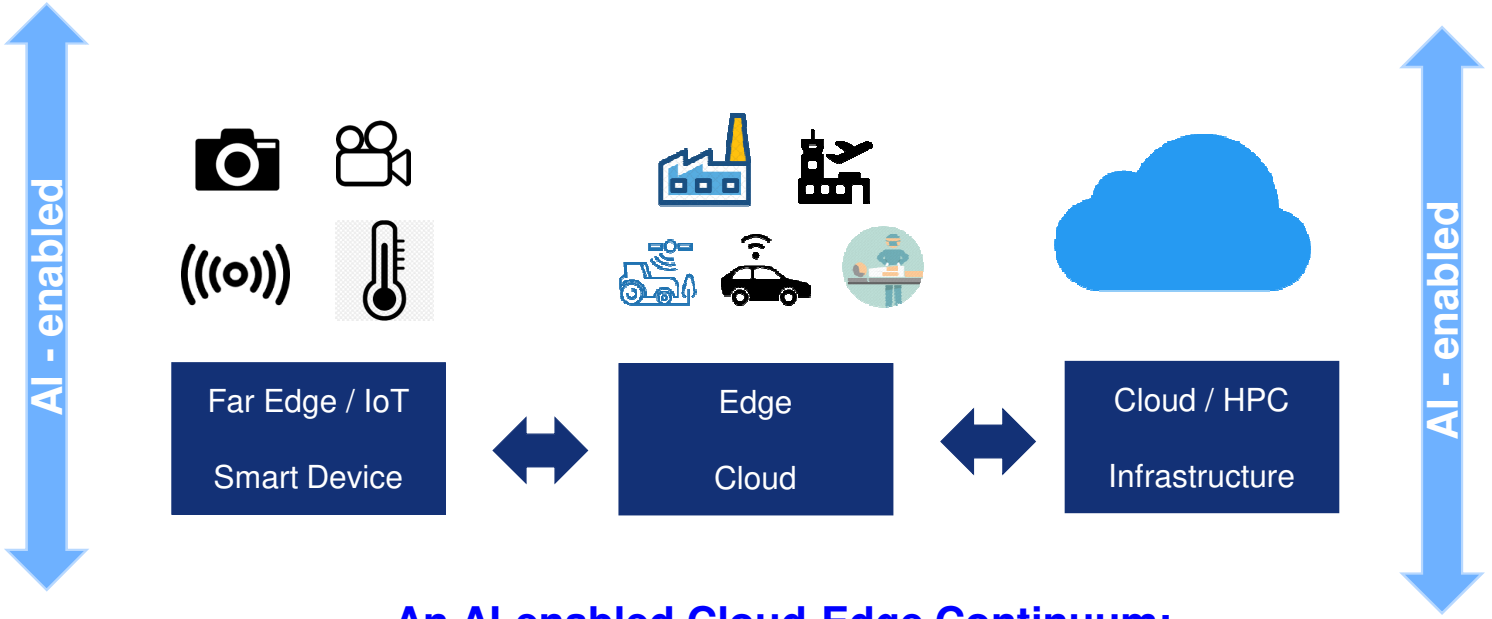
2022 Topic:

- HORIZON-CL4-2022-DATA-01-02: Cognitive Cloud: AI-enabled computing continuum from Cloud to Edge
  - Total EU contribution: €50 million

Paradigm Shift: Cloud – Edge – IoT

R&I on the next generation Cloud-to-Edge-to-IoT technologies

Trend/Paradigm Shift: from Cloud to Edge
Bringing compute resources closer to the data
→ Cloud research still IMPORTANT!



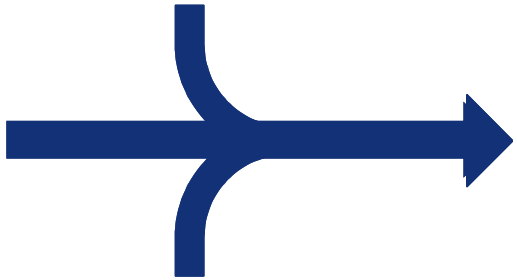
An AI-enabled Cloud-Edge Continuum:
Seamless, transparent and trustworthy integration of diverse computing and data environments spanning from core cloud to edge

From H2020 to HE WP2021-22

Preparation process

Internal consultation

Independent experts
(e.g., Jeffery, Schubert, Juan Ferrer)



HE WP2021-2022 on Cognitive Cloud

Other sources
(e.g. Future Cloud Cluster Roadmap, NESSI position paper, H-CLOUD)

COGNITIVE CLOUD
AI-enabled Computing Continuum from Cloud to Edge

AI and Cloud

Artificial Intelligence will transform current clouds into Cognitive Clouds

Applying AI-techniques:
- **dynamic load balancing**
- **optimise energy efficiency**
- **balanced data traffic and**
- **high, distributed, reliable throughput from cloud to edge**
- **etc.**

The **Cognitive Cloud** will **interface with all the layers in the computing continuum layers** and will respond and **adapt intelligently** to changes in application behaviour and data variability **offering automatic deployment, mobility and adaptability of services from cloud to edge.**

Application developers will be empowered with **greater control** over **network, computing and data infrastructures and services**, and the end-user will benefit from seamless access to a continuous service environment

European Commission

HORIZON-CL4-2022-DATA-01-02:
Cognitive Cloud: AI-enabled computing continuum from Cloud to Edge

- **Type of Action**: Research and Innovation Action (RIA)

Opening: 23 November 2021	**Deadline: 5 April 2022**
Budget: EUR 50 million	**EU contribution per project**: EUR 4 – 6 million

- **Technology Readiness:** Level Activities are expected to start at TRL 2 and achieve TRL 5 by the end of the project

HE WP2021-22:

https://ec.europa.eu/info/funding-tenders/opportunities/docs/2021-2027/horizon/wp-call/2021-2022/wp-7-digital-industry-and-space_horizon-2021-2022_en.pdf

European Commission

COGNITIVE CLOUD

AI-enabled Computing Continuum from Cloud to Edge

Scope:

- Highly innovative **cloud management** layer making the **best application of artificial intelligence techniques and AI models** with **automatic adaptation** to the **computing resources** (i.e., connectivity, computing & storage) in cloud and edge to optimize where data are being processed (e.g. very close to the user at the edge, or in centralized capacities in the cloud).
- **Seamless, transparent and trustworthy integration of diverse computing and data environments** spanning from core cloud to edge, in an AI-enabled computing continuum.
- **Automatic adaptation** to the growing complexity of requirements and the exponential increase of data driven by IoT deployment across sectors, users and contexts while achieving optimal use of resources, **holistic security and data privacy and credibility**.
- **Interoperability** challenges among computing and data platform providers should be addressed and **cloud federation approaches** (based on **open standards, interoperability models and open platforms**) should be considered where appropriate.

COGNITIVE CLOUD

AI-enabled Computing Continuum from Cloud to Edge

Expected Outcome:

- A new **AI-enabled** Cloud framework that will **automatically adapt** to the growing complexity and data deluge by integrating **seamlessly** and **securely** diverse computing and data environments, spanning from core cloud to edge.
- This framework will **respond and adapt intelligently** to changes in application behaviour and data variability offering automatic deployment, mobility and adaptability of services from cloud to edge.
- The Cognitive Cloud will **interface with all the layers in the computing continuum plane** and will learn through the monitoring and management of resources deployed on Cloud/Edge.
- Applying AI-techniques will cater for **dynamic load balancing** to **optimise energy efficiency** and maintaining **balanced data traffic** and **high, distributed, reliable throughput from cloud to edge** according to the application needs and the underlying infrastructures.
- Application developers will be empowered with **greater control** over **network, computing and data infrastructures and services**, and the end-user will benefit from seamless access to a continuous service environment

HORIZON-CL4-2022-DATA-01-02:
Cognitive Cloud: AI-enabled computing continuum from Cloud to Edge

What are we looking for?

- Development of **generic and advanced cloud technologies, mechanisms, techniques, etc.** ➡ **Research in cloud technologies! not in AI**
- The proposals should **demonstrate the applicability and viability of the proposed technological solutions** across multiple application domains.
- **Beyond State-of-the-art**, not incremental type of research

What do we NOT want?

- Using existing Cloud technologies as an enabler for research in other domains (e.g., AI, IoT, BigData, etc.)
- Any User Application development using existing Cloud technologies

European Commission

Information about European Cloud Research and Cloud projects

Cloud CSAs:

- H-CLOUD https://www.h-cloud.eu/
- Hub4CLOUD https://www.h-cloud.eu/ict_40-projects/hub4cloud/

Technology Drivers for Edge Computing

Energy Footprint

- Real-time decision making
- Automation & safety

Analytics Performance

- Lightweight OS on resource restricted environments as Edge
- Integration of AI/ML

Open Architectures

- Vendor Lock-in
- Regain market shares in data economy

Security & Privacy

- Keep data close to source

Network Evolution

- Mesh topology / 5G

Latency

- Real-time decision making
- Automation & safety

Decreasing HW/sensor costs

- New functionalities, sensing, control
- Reduces complexities of distributed installations and unit cost economics

European Commission

HORIZON-CL4-2022-DATA-01-03:
Programming tools for decentralised intelligence and swarms

➢ **Type of Action: Research and Innovation Action (RIA)**

Opening: 23 November 2021	Deadline: 05 April 2022
Budget: EUR 40 million	**EU contribution per project**: EUR 4-8 million

➢**Scope:**

- To develop **agile and secure architectures**,
→ dynamic programming environments and tools for the compute continuum from the device and edge perspective

- Energy-efficient, lightweight AI-based approaches, tools for decentralised device and edge intelligence, innovative mesh architectures with mixed topologies to support concepts like tactile internet and swarm intelligence.

- Shift from programming environments for individual devices to dynamic groups of devices like swarms.

- Proof of concept or prototype implementations should validate the concepts in at **least 3 application areas** like for example automated driving, health, farming, smart factories, utilities, cities and communities, logistics, buildings.

WP2022 – HE-CL4 - HORIZON-CL4-2022-DATA-01-03:

Programming tools for decentralised intelligence and swarms (RIA)

- **Agile and secure architectures for collaborative 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 the complexity of programming and maintenance.
- **Dynamic open environments and tools**,
  - E.g. SDKs which stimulate open architectures and interfaces, interoperability and avoiding vendor lock-in, open source where appropriate.
- **Reinforced Europe's position in the market of next generation smart systems**
  - E.g. systems**,** sensors and devices integrated in an evolving Internet of Things and cyber-physical ecosystems with strong capacities at the edge.

European Commission

HORIZON-CL4-2022-DATA-01-03:

Programming tools for decentralised intelligence and swarms

What are we looking for?

- New decentralized architectures for smart nodes,
  → **Swarm Intelligence**
- Programming tools for decentralized intelligent nodes
  → **Open source, where applicable**
- The proposals should **demonstrate the applicability and validation of the proposed concepts** in at least 3 application domains
  → **Contribution to SDGs**

What do we NOT want?

- **Proprietary technology** development → need to consider open interfaces and standards, where applicable build on open source projects
- **Narrowly focused scope** → need interdisciplinary proposals SW-HW-network
  → need to connect different dots IoT, EPI, cloud, ARTEMIS, KDT , SNS..

European Commission

HORIZON-CL4-2022-DATA-01-03:

Programming tools for decentralised intelligence and swarms

What are we looking for?

- New decentralized architectures for smart nodes**,**
  → **Swarm Intelligence**
- Programming tools for decentralized intelligent nodes
  → **Open source, where app**
- The proposals should **demonstrate the applicability and va**
  concepts in at least 3 application domains
  → **. Contribution to SDG**

Research orientations include actionable data streams, contextual interaction and data fusion between the users and the objects as well as. analytical model distribution, delocalized computation and new mesh architectures.

Concepts relying on smart sensor networks, new generations of embedded processors, and operating systems for the edge **with seamless federation of object identities (IDs)** and distributed operation of a large number of heterogeneous IoT devices and smart systems to achieve higher **resilience, security and trust in embedded AI applications**.

What do we NOT want?

- **Proprietary technology** development → need to consider open interfaces and standards, where applicable build on open source projects
- **Narrowly focused scope** → need interdisciplinary proposals SW-HW-network
  → need to connect different dots IoT, EPI, cloud, ARTEMIS, KDT , SNS..

European Commission

HORIZON-CL4-2021-DATA-01- (both topics)

Future Outlook:

- Portal for projects, open calls and events: www.NGIOT.eu
- Study *Economic Potential of Far Edge Computing in the Future Smart IoT* launched on 06/07/2021 → Portal Shaping Europe's Digital Future
- Roadmap published by the Alliance on Industrial Data and Cloud

Please list upcoming information days and other events of relevance to this area

- Workshop Autonomy in the Computing Continuum on 11/11/2021 see https://www.ngiot.eu/event/ec-virtual-event-digital-autonomy-in-the-computing-continuum/?instance_id=193 // Report to follow
- *InfoDay – planned end January for Matchmaking t.b.c.*

European Commission