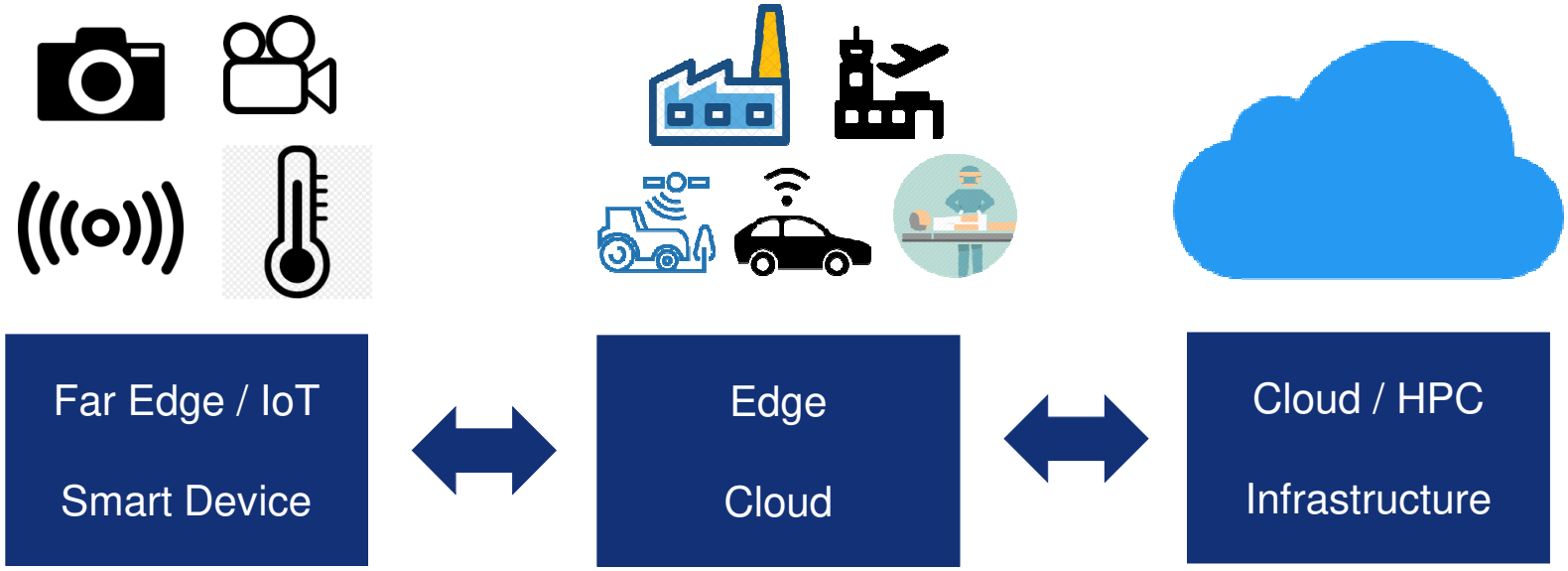
Cloud-Edge-IoT Orchestration

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



Federating far edge resources ad hoc via wireless (e.g. 5G)
to provide cloud resources close to the edge

Section:
From Cloud to Edge to IoT for European Data

RIA:

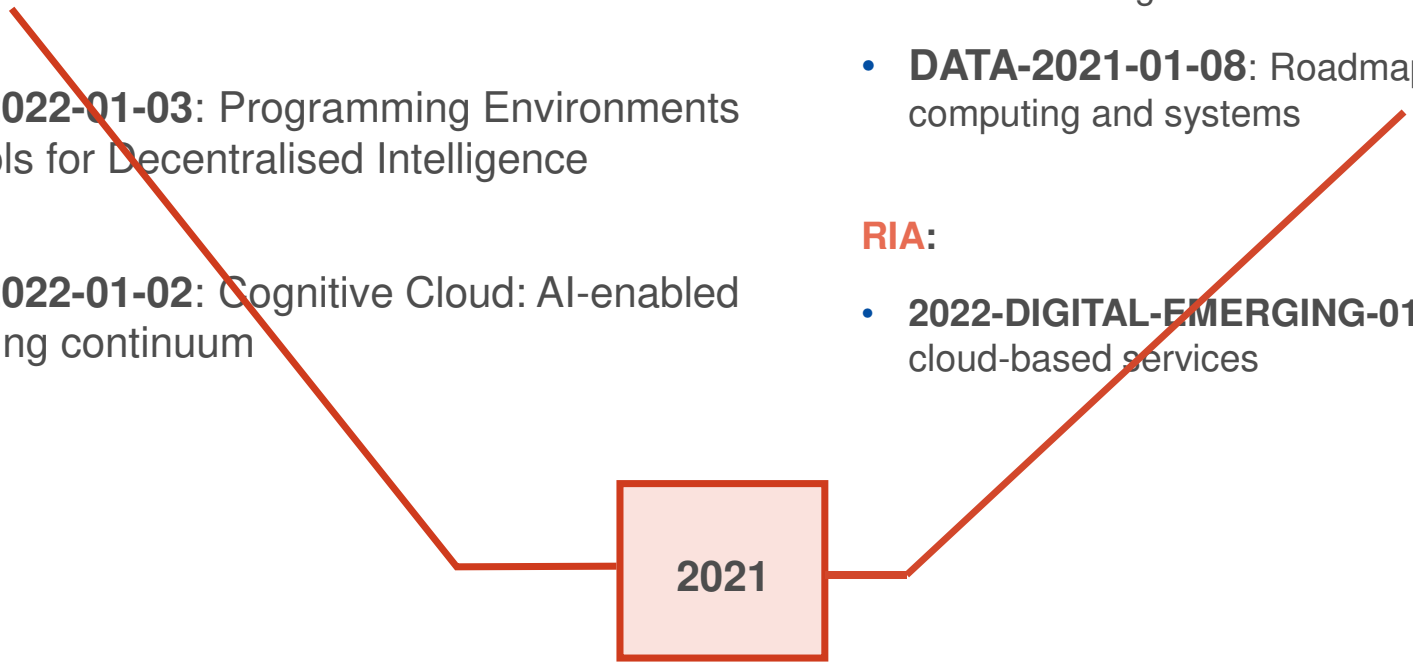
- **DATA-2021-01-05**: Edge Operating System
- **DATA-2022-01-03**: Programming Environments and Tools for Decentralised Intelligence
- **DATA-2022-01-02**: Cognitive Cloud: AI-enabled computing continuum

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



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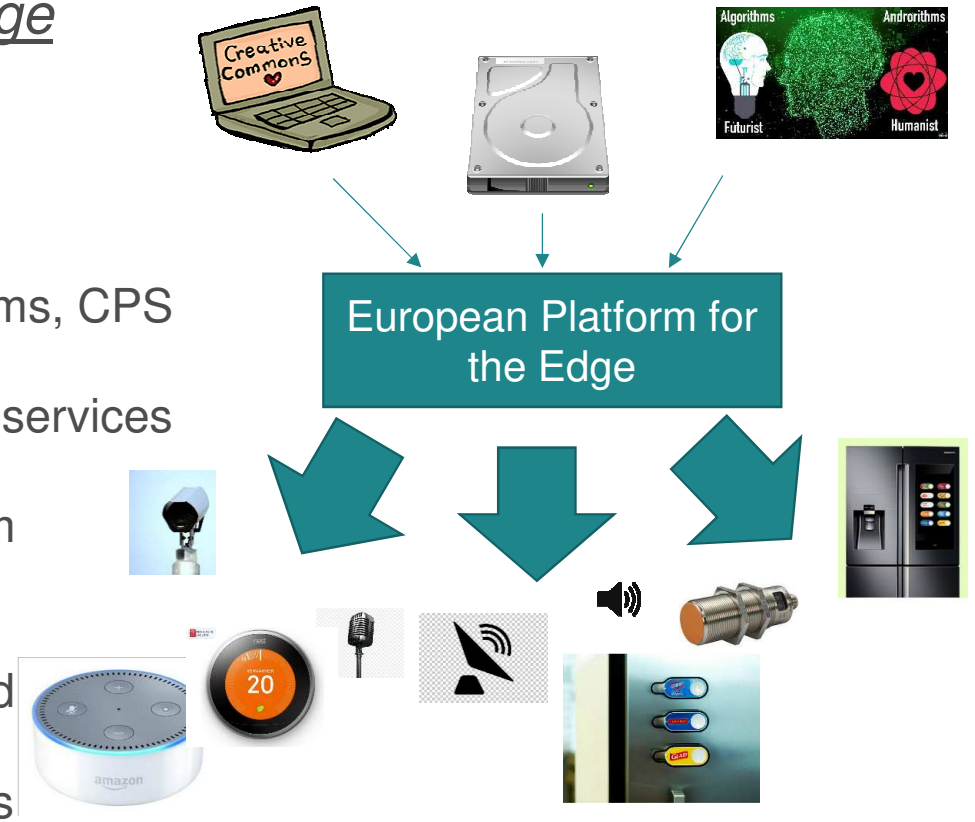
What are we looking for?

A Meta Operating Systems for the Edge From Cloud to Edge to IoT:

➢ Key elements

- Bring together IoT, AI, distributed systems, CPS
- Optimize operation of IoT systems and services
- Optimize the CO2 footprint, benefit from the use of renewable
- Orchestration across device-edge-cloud
- Validation in at least 3 different domains



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HORIZON-CL4-2021-DATA-01-05:
Future European platforms for the Edge: Meta Operating Systems

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

Opening: 22 June 2021	Deadline: 21 October 2021
Budget: EUR 54 million	**EU contribution per project**: EUR 8 – 12 million

- **Scope: addressing R&I and strengthen EU's supply and value chains:** develop meta operating systems for the edge; (*) integrating relevant elements of computing, connectivity, IoT, AI and cybersecurity, (*) enable cloud and edge computing orchestrations by bringing computation, data and intelligence closer to where the data is produced (sensors and devices); (*) by which data volume, variety, interoperability, and velocity should be handled efficiently and securely.
  Validation through proof of concept or prototype implementations for at least 3 different applications in domains such as mobility, logistics, manufacturing, energy and other utilities, buildings or farming
  .

https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/cluster-4-digital-industry-and-space_en

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HORIZON-CL4-2021-DATA-01-05:
Future European platforms for the Edge: Meta Operating Systems

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

Opening: 22 June 2021	Deadline: 21 October 2021
Budget: EUR 54 million	**EU contribution per project**: EUR 8 – 12 million

- **Expected Outcome**: Proposals are expected to contribute to (all) of the following expected outcomes:
  * **Next generation of higher-level (meta) operating systems** for the smart Internet of Things supported by advanced concepts such as ad-hoc clouds, time-triggered IoT, and decentralized intelligence .
  * **European Autonomy in data processing at the edge** by building open platforms + open APIs
  * Achieve **Trust in meta operating systems in industrial ecosystems** by open standards and open source

- **Cascading Grants**: The maximum amount to be granted to each third party is EUR 150.000 in order to allow third parties to support industry, in particular SMEs, in take-up of emerging edge topologies, for populating and validating relevant use cases through experiments
  * Market Perspective: Emergence of an open edge **ecosystem including midcaps, SMEs and start-ups** including business models to foster the up-take of an edge operating system,

- **https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/cluster-4-digital-industry-and-space_en**

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HORIZON-CL4-2021-DATA-01-05

What do we NOT want?

- Pure technology push → need to consider validation in selected application context
- Low profile projects → looking for strategic projects to pave the way for a European Strategic Agenda
- Proprietary technology development → need to consider open interfaces and standards, where applicable build on open source projects
- Narrowly focused scope
  → need to connect different dots IoT, EPI, cloud, ARTEMIS, KDT , SNS..
- Static work plan execution
  → build an open ecosystem and make strategic use of Cascading funds
- Simplistic dissemination activities: non-targeted, academic communication

HORIZON-CL4-2021-DATA-01-05

Are these new topics?

- **Up-stream R&I to kickstart a new strategic initiative under Horizon Europe CL4 – Destination 3**
- **Building on Cluster H2020-ICT-56 on Next Generation of IoT**
  → coordinated by the CSA EU-IOT – eu-iot.eu
- **Direct follow-up of the European Data Strategy**
  → complementing legislative proposals , e.g. DMA, DGA, Data Act
  → new public-private partnerships like GAIA-X or Alliance on Industrial data and cloud
  → bridge to related SRIAs in ECSEL/Artemis, EPI, SNS JU, KDT JU
- **Coupling different sectors at the edge to allow reduction of GHG emission**

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HORIZON-CL4-2021-DATA-01-05 – Key Actors

Who are the types of main stakeholders that are addressed?

- Industrial IoT/Systems Value chain: Data, AI technology providers, sensor-IoT device manufacturers, distributed computation experts, connectivity, standardisation
- Existing digital platforms (IoT, FIWARE, ..) , relevant open source communities,
- Academia, key industrial demand side, system integrators SMEs, start-ups ,

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

- Alliance AIOTI, GAIA-X, Alliance of Industrial Data & Cloud, BDVA, 5G PPP, ARTEMIS IA

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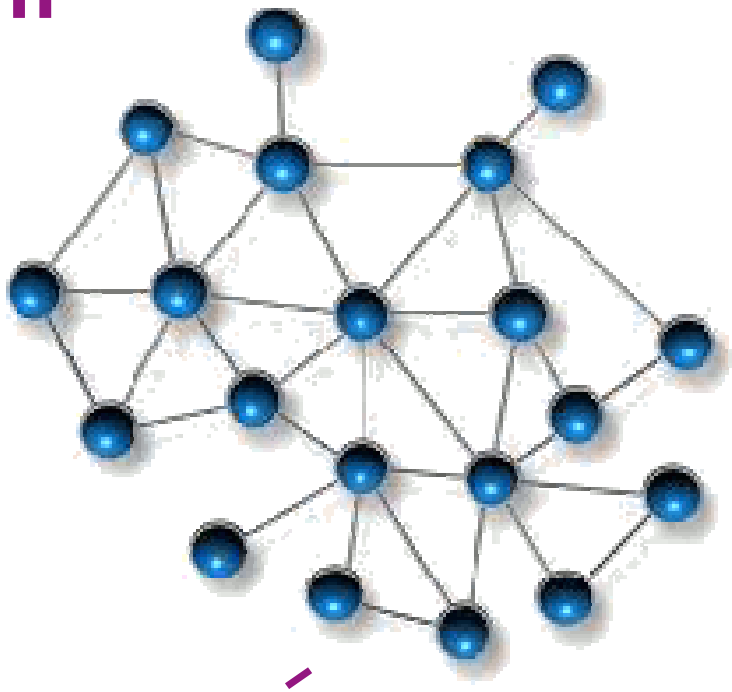
Lessons learned Strategic Forum

- **Computing Continuum**:
  - Cloud – EDGE – 5G/IoT – HW Devices

- **Partnering to grow the opportunity**, Accelerate adoption
  → Fierce competition from Internet giants
  → Multivendor partnerships, alliances

- **System Integration Platforms**
  → a must for interoperability and open standards
  → avoiding fragmentation (e.g. data flow, verticals)



System Platforms	Ecosystem & Alliances	Visionary Concepts
Reference Architecture Cloud-Native Systems A Meta OS SW Over The Air …	Open Standards & APIs Open Source like Eclipse, Linux, etc. Trust & Trustworthiness …	Decentralised Intelligence Distributed Computing Swarm Intelligence Virtualisation …

:
Event Report Next Generation IoT and Edge Computing

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HORIZON-CL4-2021-DATA-01-07

CSAs for the 'Cloud-Edge-IoT' domain

Scope

There is an explicit need for two CSAs *as they must address the topic from two different but complimentary perspectives and target groups – the supply and the demand side***.**

- **coordinate with the evolution of the computing continuum** and
  - support the delivery of interdisciplinary-based new services and applications on top of the cloud-edge-IoT enabled data layer
  - the potential to generate vast opportunities for entire ecosystems and avoid vendor-lock in at the edge.

- to coordinate, build constituency, and analyse the needs for **advanced smart IoT and edge computing nodes and systems**
  - in terms of performance, price, energy footprint, real-time capability, security and trust (leveraging cybersecurity activities in Cluster 3),
  - needed degree of customisation, synchronisation of digital twins etc. – existing or emerging solutions, as well as to identify gaps.
  - an analysis of cross cutting aspects like open standards, open source, and synergies across sectors

HORIZON-CL4-2021-DATA-01-08

Roadmap for next generation computing and systems technologies

Scope

CSA: support the European Commission and the European computing constituency by providing to them annually updated roadmaps for research and innovation related to computing

- **Overarching and building the bridge across Destinations 3, 4 and KDT**
  - *building the bridge between Destinations 3 (heading "From Cloud to Edge to IoT for European Data"), Destination 4 ("Ultra Low Power Processors"), as well as the Joint Undertakings on Key Digital Technologies, Smart Networks and Services, and high-performance computing (HPC).*

- **builds on the achievements and structures established by the HIPEAC project *)**
  - think tank of all renowned European research centres on computing "at large" and their key experts, covering academic visions and industrial perspectives

***) www.hipeac.net/**

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HORIZON-CL4-2021-DATA-01-07

What do we NOT want?

- Generic domain knowledge: → need to support a Strategic Vision
- Carrying out R&D, scientific papers as outcome // tons of deliverables
- Newcomers in CSA actions → track record in community buildings and stakeholder mobilisation
- Large consortia: → need of a powerful but lean consortium
- Simplistic, standard dissemination activities: need professional approach
- Closed club → need to open up target communities to interdisciplinary topics

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HORIZON-CL4-2021-DATA-01-05

Are there any additional / background documents?

- **Communications**:
  → European Data Strategy, Update Industrial Strategy, EC Strategic Foresight

- **Position Papers and Event Reports**
  → Alliance AIOTI Strategic Foresight : IoT and Edge Computing Convergence
  → Fireside Chat on Next Generation IoT and Edge Computing, Meeting of 11 high level experts, 9 Mar 2021 – **Fireside report published**.
  → Next Next Generation **IoT and Edge Computing Strategy Forum**, Public open virtual meeting, 22 April 2021 – www.ngiot.eu

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

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

➢ *‚From Cloud to Edge to IoT'* **Brokerage Event**, 07 July2021
→ https://horizon-europe-cloud-edge-iot.b2match.io/ *-- ON-GOING -*

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HORIZON-CL4-2021-DATA-01-05

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 to be published by the Alliance on Industrial Data and Cloud

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

- White paper & roadmap workshop by NGIoT (after summer)
- IoT Week 30/08-03/09/2021 (virtual) – https://IoTWeek.org
- Edge Standardisation workshop on 13-14 September 2021 (virtual) see ngiot.eu/events

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