#HorizonEU

HORIZON-CL4-2023-DATA-01:

Collaboration between European Commission and NSF across the computing continuum

JAN KOMAREK

Policy officer

DG CONNECT/E4
European Commission

Research and Innovation

EU/US joint effort on the continuum of computing: **HiPEAC**

- The European Commission and the U.S. National Science Foundation seek to catalyse **long-term research collaborations** that draw upon complementary expertise from the European and American computer and network systems research communities **to enable robust systems that operate across the *computing continuum***
- Main actors are **HiPEAC** (Marc Duranton, Tullio Vardanega), **EC** (Max Lemke, Jan Komarek), **NSF** (Jason Hallstrom, Gurdip Singh)
- First outputs
  - A **Joint White Paper**, which motivates the problem and its landscape, and outlooks future directions: will be included in the HiPEAC vision 2023 volume
  - Two **joint online workshops** 14 November 2022 and **Workshop #2 Programmatic focus**: 16 November 2022

EU/US joint effort on the continuum of computing: technical challenges

- **Infrastructure heterogeneity**: the need for unifying functional and non-functional abstractions for specifying, implementing, and reasoning about resource-rich networks of edge nodes and cloud data-centres
- **Everything-as-a-service**: the need for highly efficient service-based implementation workflows across the continuum for more intelligent utilization of underlying infrastructures
- **Dynamic provisioning and migration**: the need to align application demand with resource availability, to limit sensitive data transmission, to minimize energy consumption, carbon emission, operating costs, across time, latency, and resource budgets dimensions
- **Intelligent orchestration**: the need to juggle multi-objective criteria spanning functional and non-functional performance, privacy, security, energy, operation costs within a dynamic economic and environmental context, using “natural” configuration interfaces and learning-based services for higher ease of control and mastering by humans

EU/US joint effort on the continuum of computing: envisioned technical directions

- Unifying specification and programming language abstractions for heterogeneous systems operating across the compute continuum, including support for both functional and non-functional concerns
  - E.g., declarative privacy constraints
- Operating system, middleware, and runtime services for executing across the compute continuum
- Resource disaggregation, federation, and scheduling across the compute continuum
  - Including compute, memory, network, sensors, actuators
- Collective perception of aggregate performance, resource utilization, and operating environment
  - E.g., differential energy costs
- Specification-based, resource-aware service discovery, provisioning, migration, and orchestration across the compute continuum
- AI-assisted service provisioning, migration, and orchestration based on multi-objective optimization, i.e., autonomous infrastructure and service management
  - E.g., performance, privacy, security, energy, emissions)
- Ensuring trust across the compute continuum, including novel attack models and corresponding security and privacy patterns
  - In the face of dynamic provisioning and migration

From Cloud to Edge to IoT for European Data – HORIZON-CL4-2023-DATA-01-07: Collaboration with NSF on fundamental research on new concepts for distributed computing and swarm intelligence (CSA)

The total indicative budget for the topic is EUR 1.00 million.

Scope:

- Develop mutual interest of the EC and US National Science Foundation (NSF) in collaborating on longer-term **fundamental research on new concepts for distributed computing and swarm intelligence**.
- Common workshops for exchange of research results organised through the CSA HIPEAC (of HORIZON-CL4-2021-DATA-01-08: Roadmap for next generation computing and systems technologies)
- **NSF would provide supplement of funding for to drive joint research.**
- **EC matching/reinforcing of on-going work streams in projects (~ 100 Mill €)** especially linked to the topics *Programming tools for decentralised intelligence and swarms / Intelligence*

Expected Outcome:

- **Support structure** for secretarial services, networking including travel, research exchange and fellowship programmes, promotion and brokerage events
- networking events and vision workshops for the academic and industrial computing community
- Yearly common workshops for exchange of research results organised in close collaboration with the HIPEAC CSA + NSF.
- **Joint Vision for design of a trustful evolution at the edge, towards a spatial web or Metaverse**
- Trigger **research community amid strong competition from Asia**

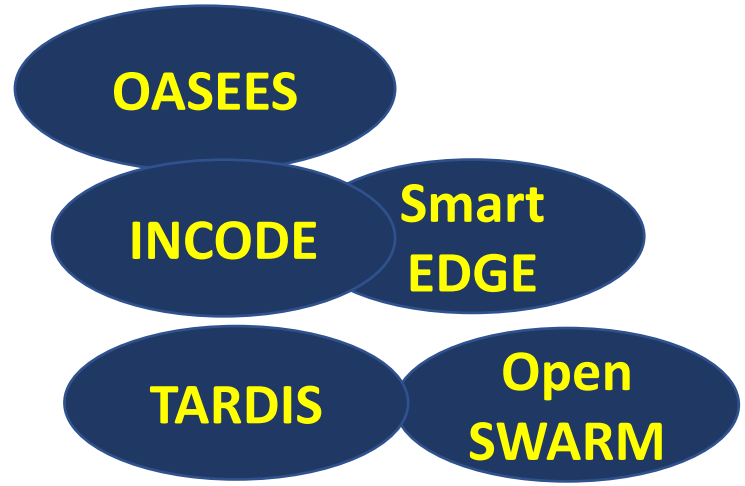
Swarm Initiatives launched on 1 January 2023

Programming Tools and Methods

- Emerging concepts for smart edge-connected nodes with decentralized intelligence and
- Dynamic groups of nodes across the device-edge-cloud continuum aiming at Swarm Intelligence, methods for node and system abstraction for collaborative IoT.

Good Coverage, with aspects

SW Engineering aspects linked to behaviour-based, energy-aware, deep reinforced learning SW developments, exploiting in-network computing via 5G, integrating lightweight AI with IoT nodes based on constrained and heterogeneous nodes



	Automated driving	Health	Farming	Smart factories	Utilities	Cities and communities	Logistics	Buildings
INCODE			x	x	x		x	
OASEES				x	x		x	x
OpenSwarm		x				x		
SMARTEDGE	x	x		x		x		
TaRDIS				x	x			x

European Commission

Thank you for your attention.

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