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Data Management and Exchange between a Meta-Orchestration Platform and Data Spaces

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## **Distributed Applications in the Computing Continuum**

- Development of edge and cloud computing orchestration platforms, aiming to manage applications across the entire computing continuum.
- Need to reduce the distance and the latency between the data generation and the application execution points.
- Optimal provision of the application in terms of energy consumption and cost, while achieving high performance.



Source: https://digital-strategy.ec.europa.eu/en/policies/iot-investing



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## **Data Management Challenges**

- Need to manage data flows considering constraints related to data locality.
- Need to develop efficient distributed management approaches considering local and global data aggregation and processing.
- Need to support semantic alignment of the collected data for data openness, re-use and interoperability purposes.
- The considered data may regard different type of information, including consumption of compute and network resources, Quality of Service (QoS) metrics, distributed traces and logs.



#### **Meta-orchestration platforms** System of Systems Approach Emergence of meta-orchestration platforms. Multiple orchestration modules, each one of responsible for the manage What you can mechanisms at a local or global level. control Synergetic Meta-Orchestration Specified by the application requirements Requires learning **Cloud Computing** Computing-continuum resources Computing-continuum resources Infrastructure Markov Blanket what you are capabilities responsible for ations actions IoT to Edge to Cloud metrics Edge Computing Continuum Infrastructure Ð System Set of of state Causality Adaptation IoT and Edge computing Set ( Software Stack IoT Devices Resources Ouality Cost

S. Dustdar, V. C. Pujol and P. K. Donta, "On Distributed Computing Continuum Systems," in IEEE Transactions on Knowledge and Data Engineering, vol. 35, no. 4, pp. 4092-4105, 1 April 2023, doi: 10.1109/TKDE.2022.3142856.

#### Fusion of different type of signals

## **Modern Observability Stacks**

#### Data and ML Models Sharing





#### Integrated solution based on open-source observability stacks



## **NEPHELE IoT Software Stack (VOStack)**









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## **NEPHELE Meta-Orchestration Platform**





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## Interlinkage between the Meta-Orchestration Framework and Data Spaces



#### Insights

- The sharing and re-use of such data can boost the development of effective ٠ and reliable orchestration systems, as well as innovative loT applications and analysis services.
- Extensions in Data Space connectors can be implemented to validate and ٠ evaluate the proposed approach.

#### **Barriers and Opportunities**

- Openness and semantic alignment of the collected data are considered as enablers for their adoption and exploitation.
- Need to develop efficient distributed management approaches considering ٠ local and global data aggregation and processing.
- Motives to data producers to share their data (data monetization). ٠
- New business models for data sharing and exploitation in the computing continuum.

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# Thank you

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