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#### Università di Pisa



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# Data-aware service placement in the Cloud-IoT continuum

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#### Context





### **Considered Problem**



Where to **place** application services onto infrastructure nodes?

How to **route traffic** between them in a contextand QoS-aware manner?



#### **Related Work**<sup>[1,2]</sup>



Software, Hardware, IoT



Latency, Bandwidth





Security (only a few) Routing

[1] Salaht et al., "An overview of service placement problem in fog and edge computing", CSUR, 2020[2] Brogi et al., "How to place your apps in the fog: State of the art and open challenges", SPE, 2020



### Objective

- Devise a declarative modelling of Cloud-IoT infrastructures and multi-service applications, to determine eligible *application placements* and *data traffic routings* across Cloud-IoT resources in a context-, QoS-, and **data-aware** manner.
- Exploit continuous reasoning to speed-up decision making at runtime.
- Implement and assess the proposed solution in a **Prolog** open-source tool.





## **Continuous Reasoning**

- Adapt placement and routing at runtime.
- Triggered at each infrastructure/application change.
- Partial re-deployment, focusing only on suffering services.
- **Speed-up** the whole placement and routing search process.

























5/7





#### **Experimental Results**





Exhaustive

Continuous Reasoning

Search

6 / 7



### **Conclusions and next steps**

#### **Progress w.r.t the state-of-the-art:**

- data-aware modelling of data services and IoT devices
- joint placement of both data and services
- security requirements
- runtime adaptation (via continuous reasoning)

#### Limitations and future work:

- extend the model to account for serverless/FaaS
- multi-objective optimisation (evaluate the goodness of a solution)
- further management decision (scalability, undeploy, MELs)
- validate placement and routing solutions on real testbeds,
- increase prototype usability (e.g. user-friendly tools)



## THANK YOU FOR YOUR ATTENTION!





