



Sharing Resources and Services in the FLUIDOS Continuum: the REAR Protocol

FLUIDOS @AIOTI Days

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Many resources in the computing continuum

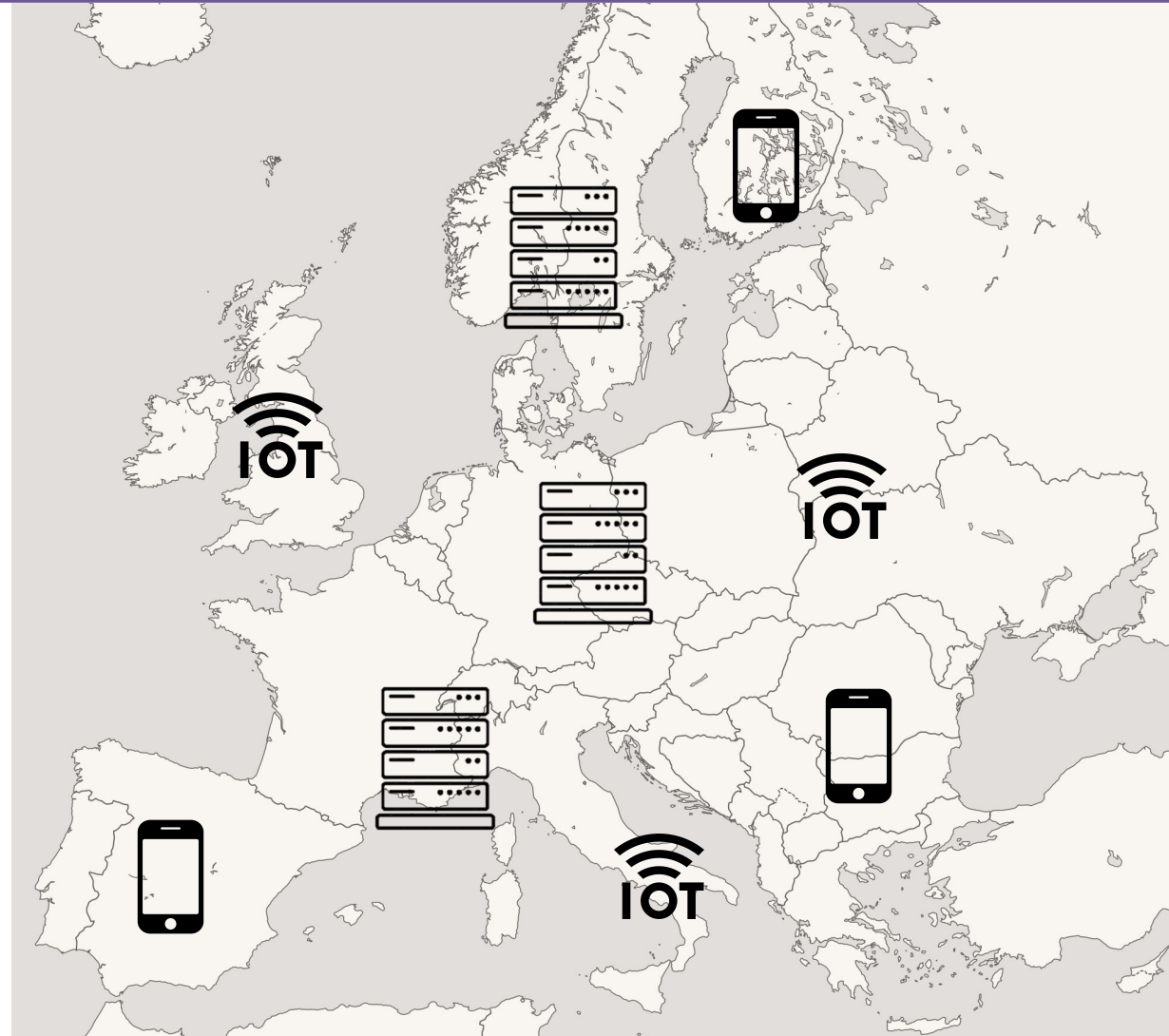


Which are their characteristics?

Can I reserve some of them?

Can I sign a contract?

Can I setup a virtual cluster with Ligo?



The REAR protocol



REAR (REsource Advertisement and Reservation) addresses four key objectives:

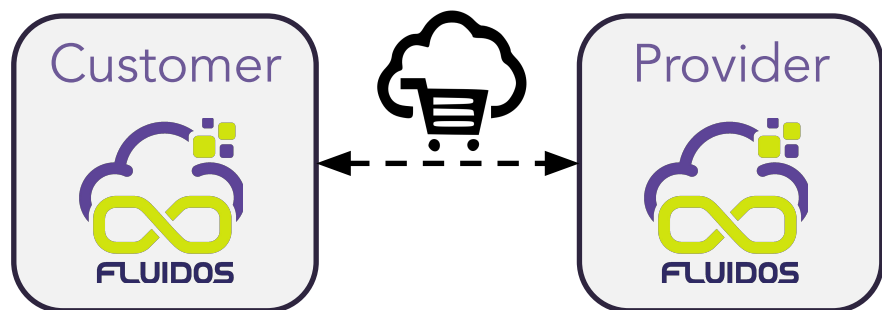
- **Standardization:** it defines **common interfaces and messages** for resource advertisement and reservation to promote interoperability and compatibility across heterogeneous computing environments.
- **Extensibility:** it allows participating parties to enrich the resource description with **arbitrary data**, such as internal energy metrics, latency considerations, cost models, and more, to **optimize resource allocation** and utilization.
- **Decentralization:** no need for a single server that knows everything, although a brokering-based model is also supported.
- **Security and Trust:** it incorporates mechanisms for **authentication**, **authorization**, and **secure communication** to ensure the integrity and confidentiality of resource transactions, and it provides information about the **security capabilities** of the selected domain.



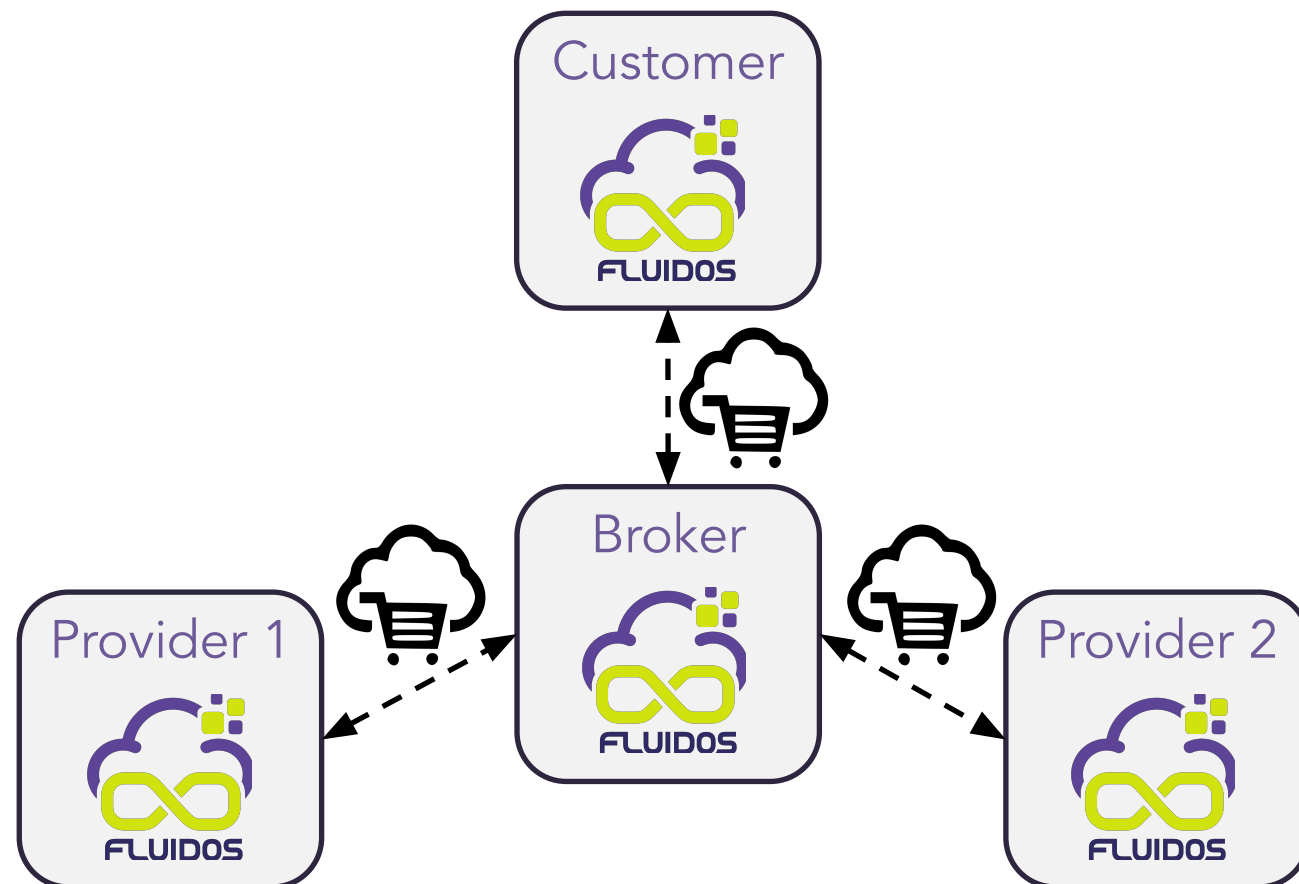
REAR interactions between clusters



HORIZONTAL INTERACTION (direct)



VERTICAL INTERACTION (indirect, through broker)



REAR data models



- The problem of advertising and reserving resources is rather general and can apply to many contexts
 - When looking for specific type of VM (e.g., CPU, RAM)
 - When looking for a specific Kubernetes cluster (e.g., number of nodes, availability of GPUs)
 - ...
- REAR data models are used to define different types of resources advertised in the continuum, each one with its own characteristics
- Currently, 5 types of resource are defined

K8SSLICE

A Kubernetes cluster

VM

A Virtual Machine

SERVICE

An application, consumable at a given address:port

SENSOR

A hardware device (e.g., sensor) exporting data in a specific format

DATA

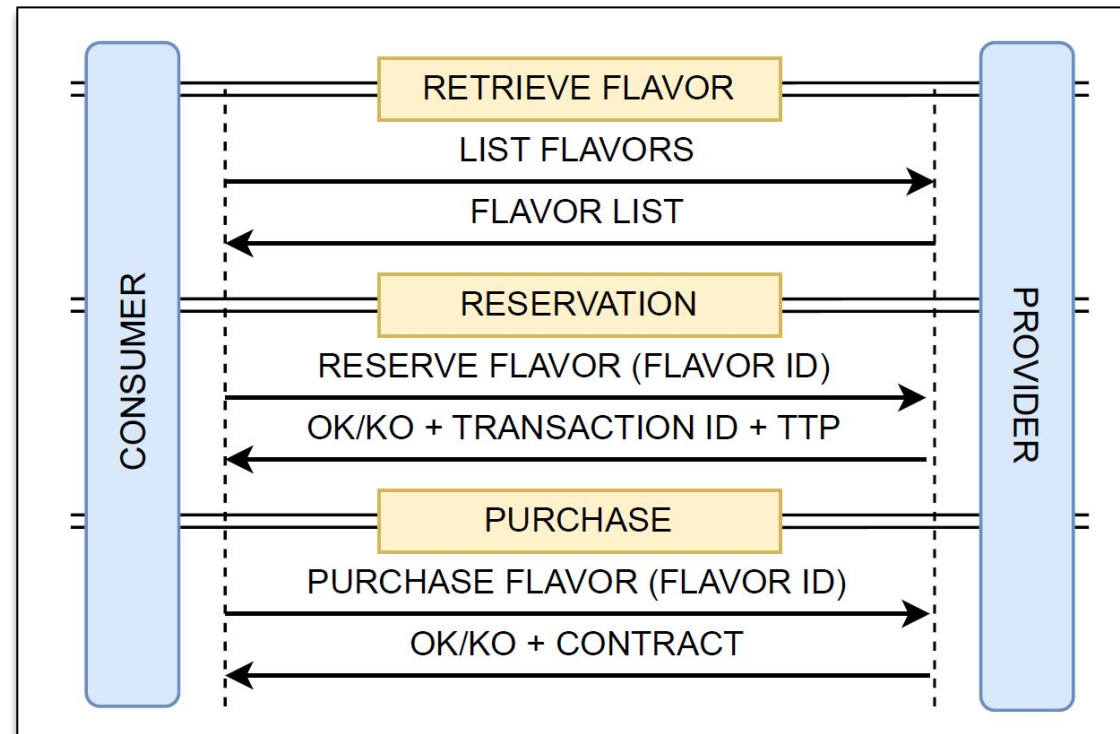
A data structure that can be consumed (e.g., a volume)



REAR workflow



- REAR defines several messages for the advertisement/reservation of resources in the continuum, which can be classified as either required or optional:
- REQUIRED
 - LIST FLAVORS
 - RESERVE FLAVOR
 - PURCHASE FLAVOR
- OPTIONAL
 - SUBSCRIBE FLAVOR
 - WITHDRAW FLAVOR



Discussion



- Wide range of applicability
 - In the **IoT-edge-cloud continuum** addressed by FLUIDOS
 - By a customer that needs to **buy a VM/K8s cluster/etc.** from one of the many existing providers (e.g., hyperscalers)
 - By new actors that would like to implement a **brokering model** to cloud resources
 - By a **telco** that need to acquire computing resources for one of its customers currently on a foreign operator (roaming)
 - REAR represents a nice companion for the Camara project (<https://camaraproject.org/>)
 - Etc.
- Availability
 - Specs: <https://github.com/fluidos-project/REAR>
 - Code: <https://github.com/fluidos-project/node>
 - Paper: <https://doi.org/10.1109/NetSoft60951.2024.10588885>



Conclusions



- **Extensible protocol**, supporting several types of resource and use cases, also beyond our project.
- **Standardized interface** for messages and data models, and **open-source** implementation available.
- **Interoperability** and compatibility is provided across different computing environments and different actors.
- **Decentralized**, no single point of failure, no single point of control.
- **Built-in security**, ensuring the integrity and confidentiality of resources, and provides information about the security characteristics of the target domain.





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