



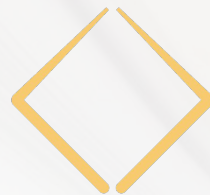
This project has received funding from the European Union's Horizon 2020 research and innovation program through grant agreement 801101.



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**MAESTRO**  
DATA ORCHESTRATION

# Middleware for memory and data-awareness in workflows

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# Motivation

- HPC and HPDA workloads are more and more I/O-intensive
- Performance bottlenecks are usually in the memory and storage systems
- Reducing and minimising data movement is very hard in general
- The HPC software stack was designed in a different era, to solve a different problem

**The Maestro consortium is building a middleware library that characterises application data, reasons about how to load and store that data, assesses the cost of moving it and automates data movement across diverse memory systems**



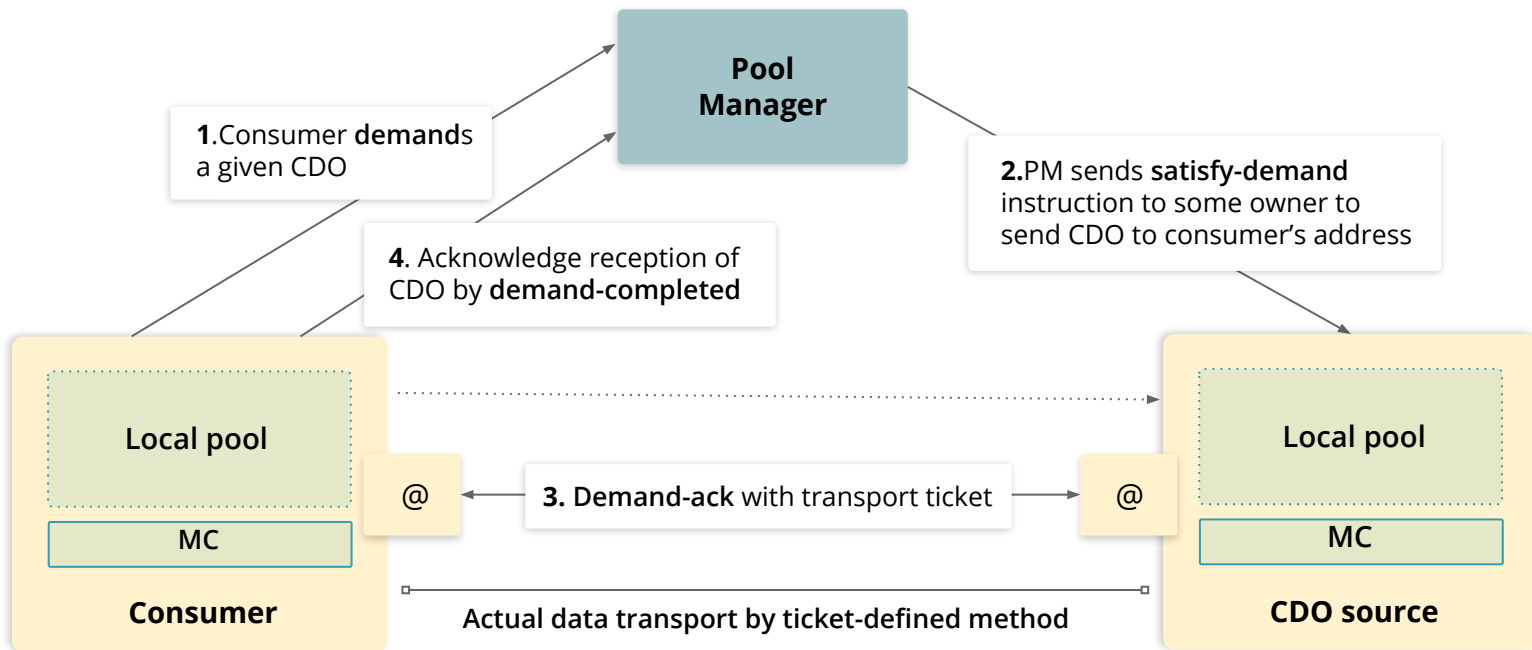
**DATA AWARENESS**



**MEMORY AWARENESS**

# Flexible Data Store and Transport

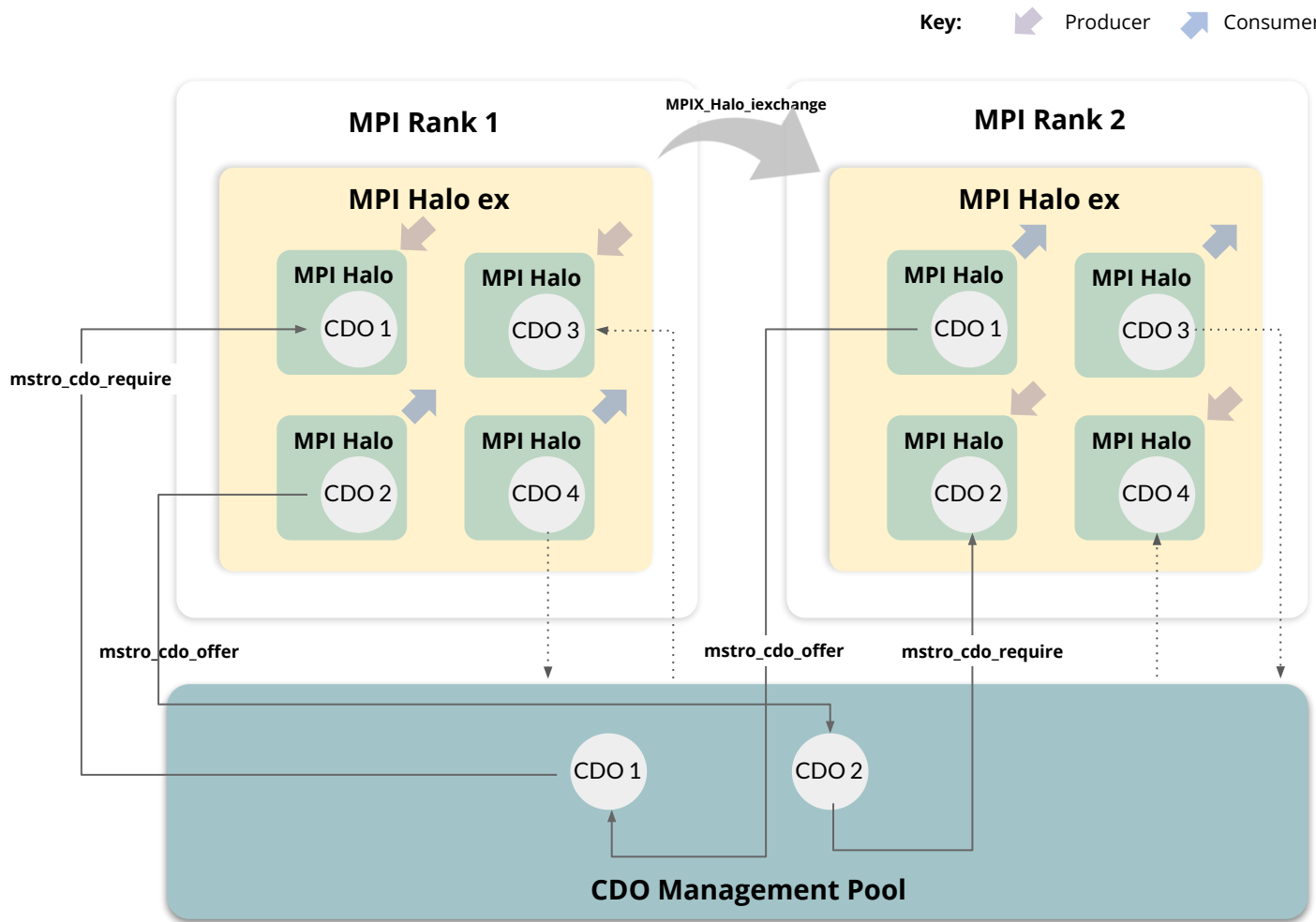
**CDO (Core Data Object)** it is at the heart of Maestro's design and is used to encapsulate data and meta-data.



CDO creation benchmark shows performance of **>50,000 CDO/s** using **20 nodes**

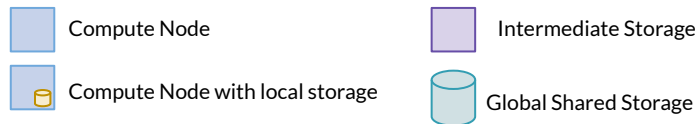
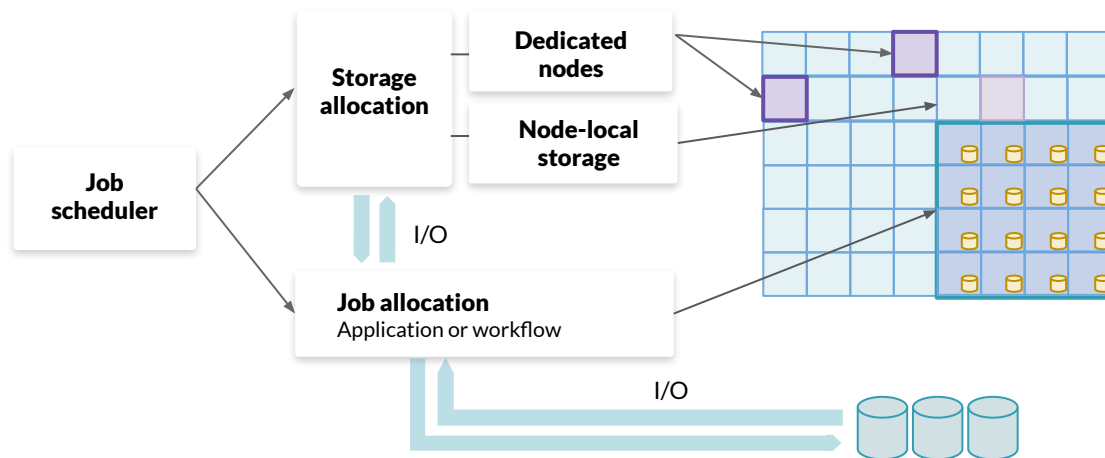
# MPI Halo exchange process

To demonstrate data transport capabilities, test its robustness and explore performance, we implemented MPI\_Halo, an MPI abstraction for halo exchanges, on top of Maestro as shown in the figure here. To test this version of MPI\_Halo we used the mini-app Hydro.



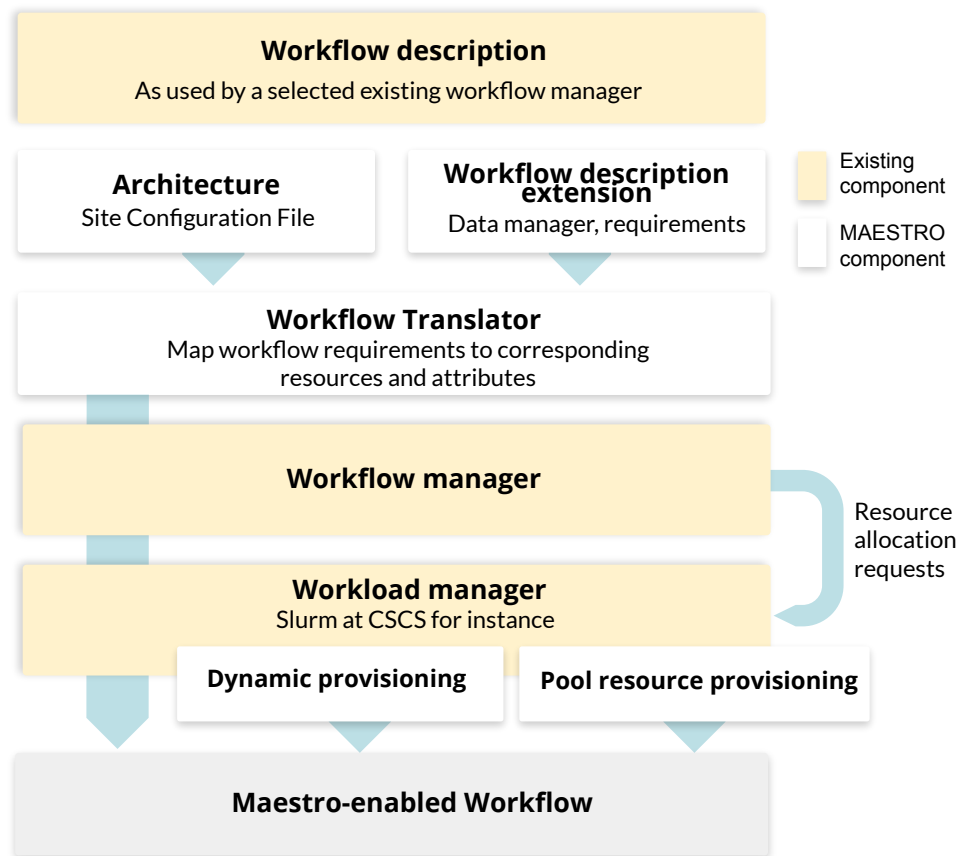
# Dynamic resource provisioning mechanism

Within the Maestro project a solution has been developed that allows to provide access to dedicated storage resources through an dynamically deployed data manager



# Workflow execution framework

- Efficient workflow execution relies on **efficient data exchange and data-aware scheduling**
- **Maestro approach**
  - Foresee extension of workflow description
  - Maestro Workflow Translator creates updated workflow description
  - Maestro Pool supports smart data transport and placement
  - Maestro Dynamic Provisioning allows adding storage resources dynamically







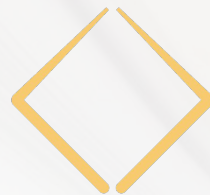
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