Data monitoring and runtime process optimization

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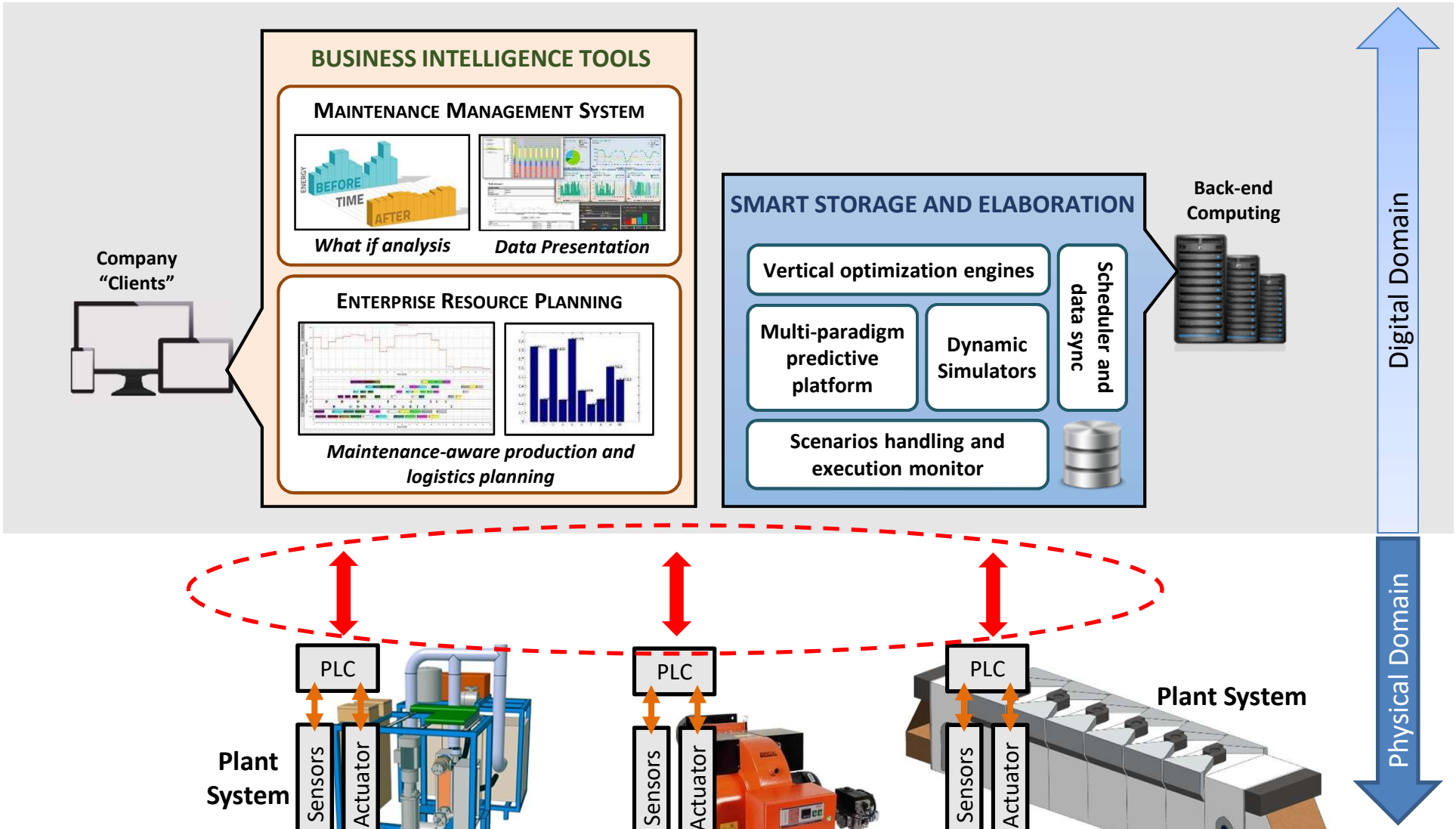
Synesis & role within I-ThERM

SYNESIS is a private-public Consortium whose main shareholders are private Italian and German SMEs, and whose public shareholders are Italian and German RTD Institutions: the Italian National Research Council (CNR) and the German Fraunhofer Gesellschaft (FhG).

MISSION Synesis represents the new frontier of Technology Transfer in the industrial automation domain: bridging the gap between research and industry by mastering competences of both worlds

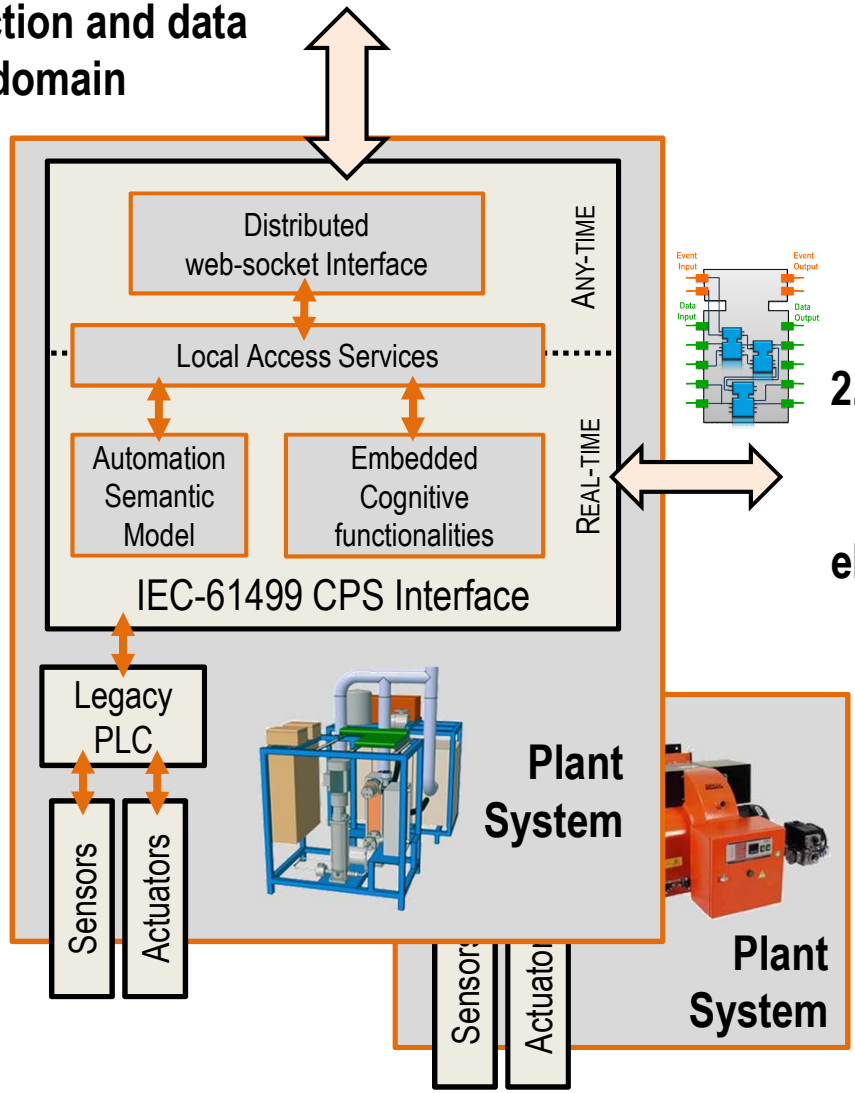
INDUSTRIAL SECTORS Research and Industrial initiatives for manufacturing technology innovation are focused on the concept of **Sustainable Automation**, merging seamlessly advanced control technologies with energy efficiency and low environmental impact.

Connection and supervision needs



Communication, monitoring and supervisory control: high-level requirements

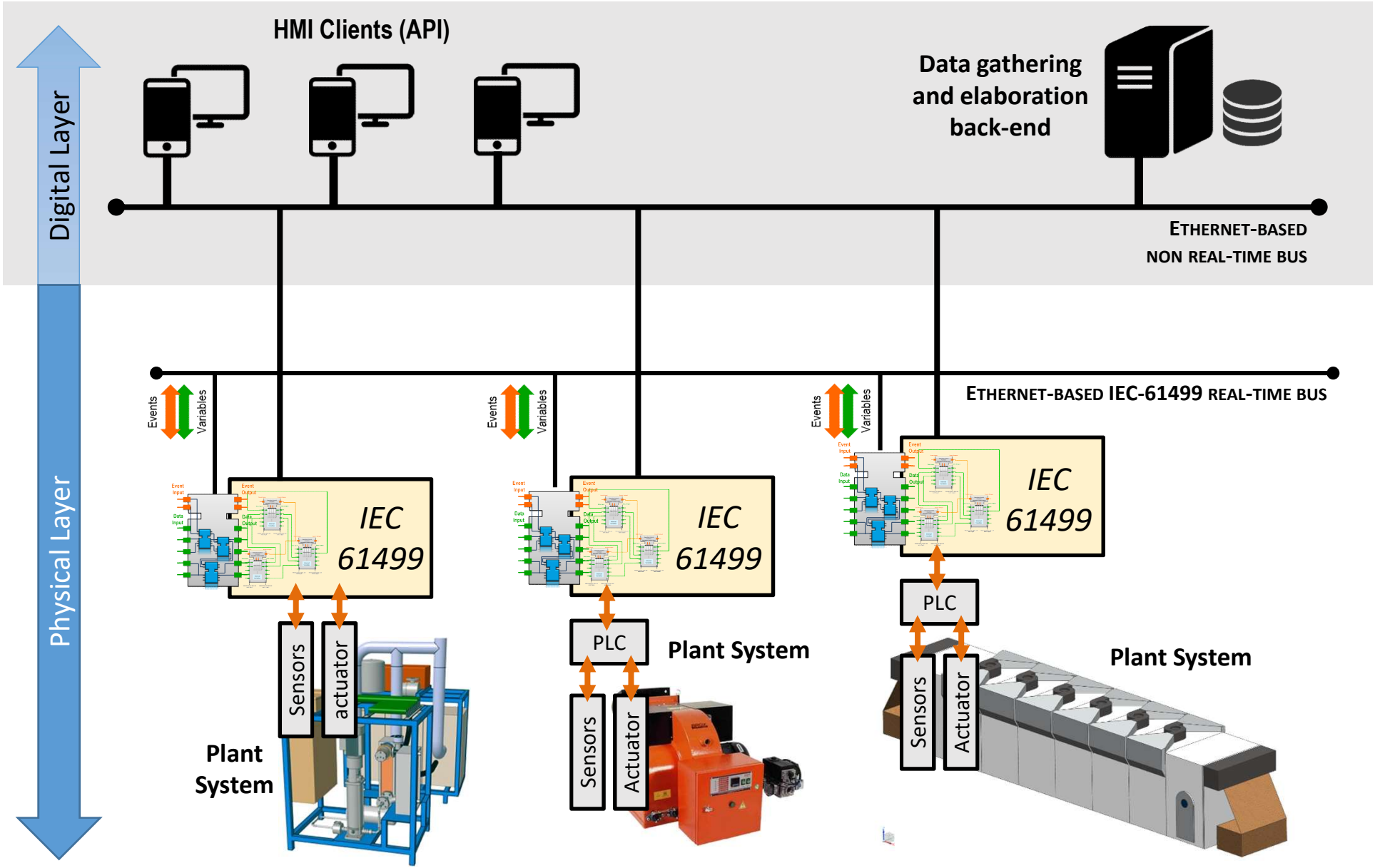
3. Full-duplex and event-based interface to enable seamless connection and data streams with ICT domain



2. IEC-61149 real-time communication to enable distributed elaboration of signals

1. Connection between a middleware node and PLC through standard interfaces (OPC-UA, Modbus, etc.)

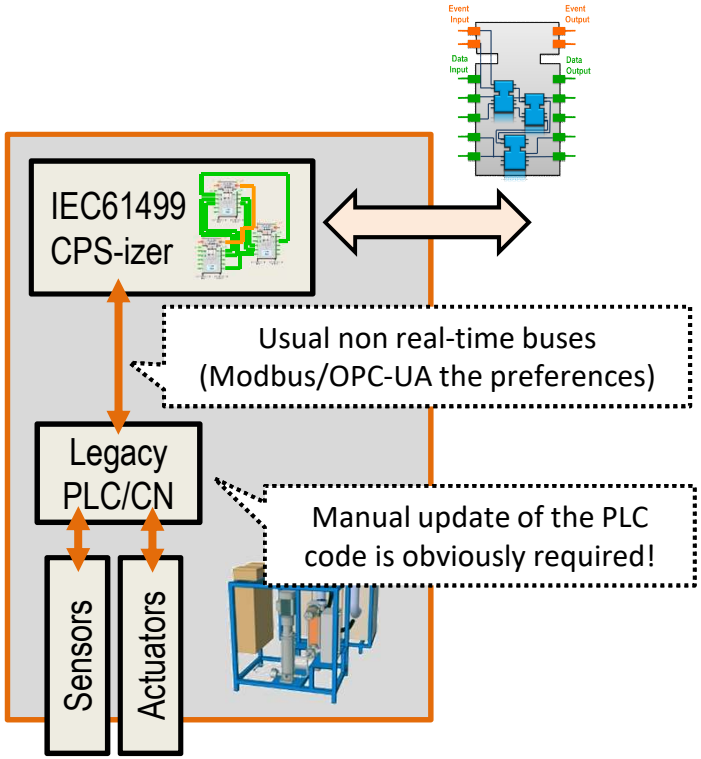
Communication, monitoring and supervisory control middleware: functional architecture



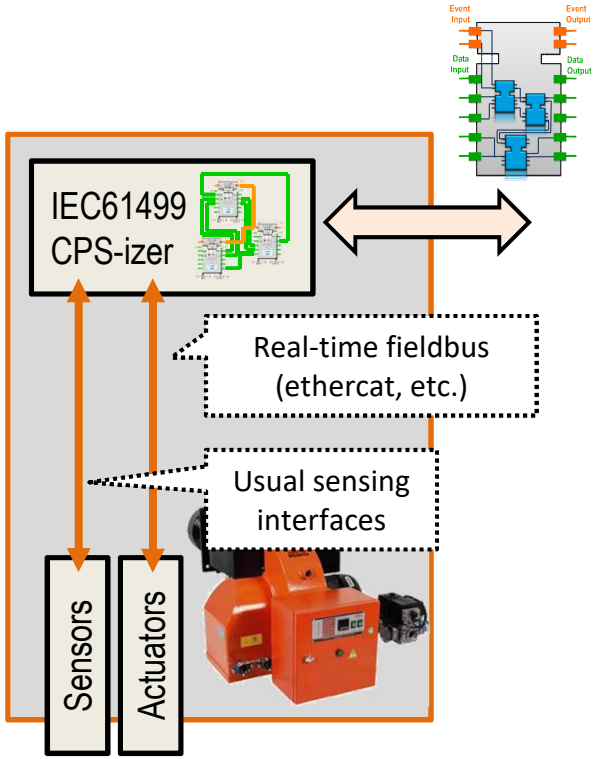
Use-case scenarios and technical focus

Interfacing with the plant systems

First scenario:
Communication with existing PLC (+CN) topology



Second scenario:
Direct interfacing to new sensors and/or currently non-controlled devices



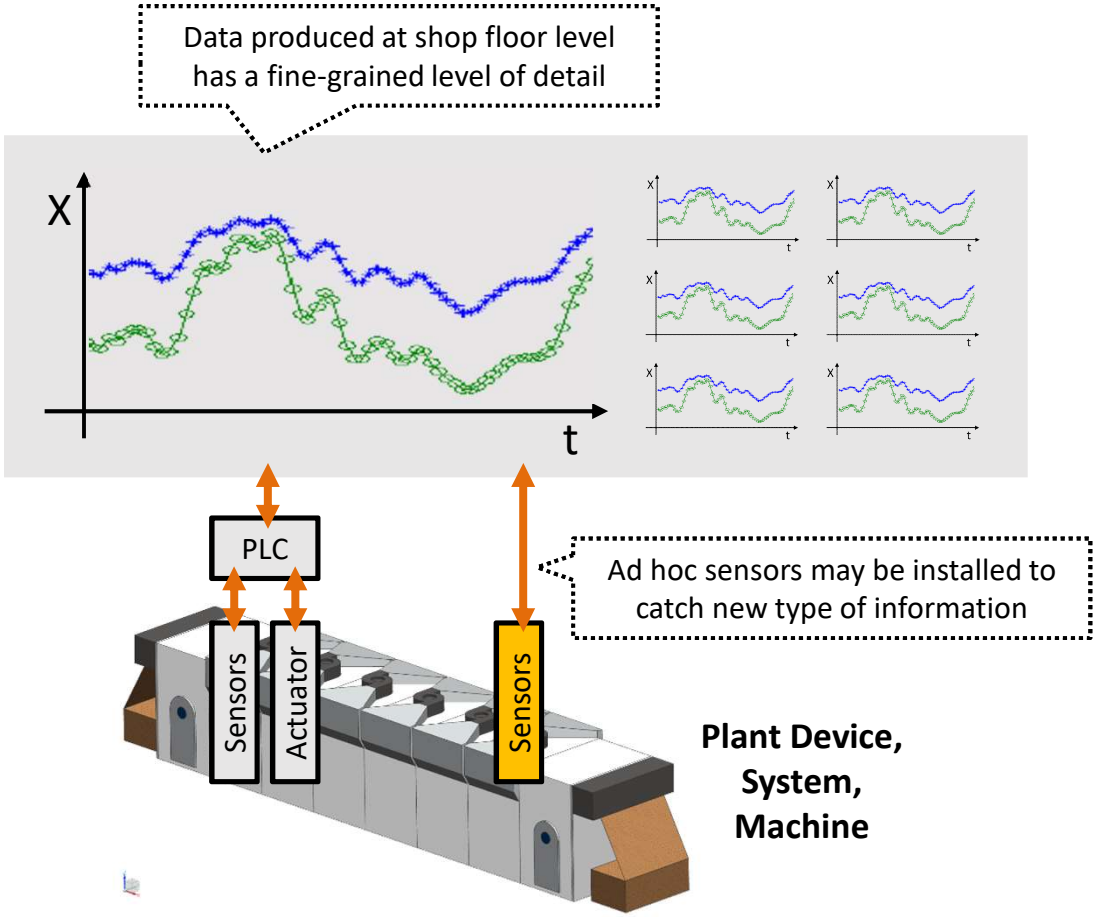
All Nodes are IEC-61499 networked elements

Use-case scenarios and technical focus

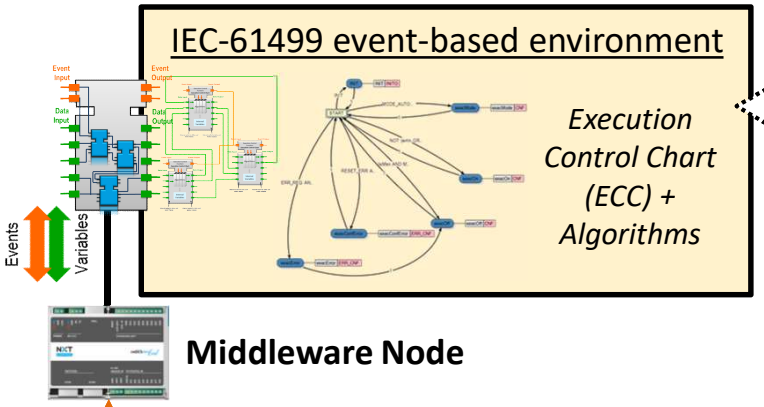
I-ThERM

Issue-1: bandwidth on the communication bus

Issue-2: raw data does not have contextual information



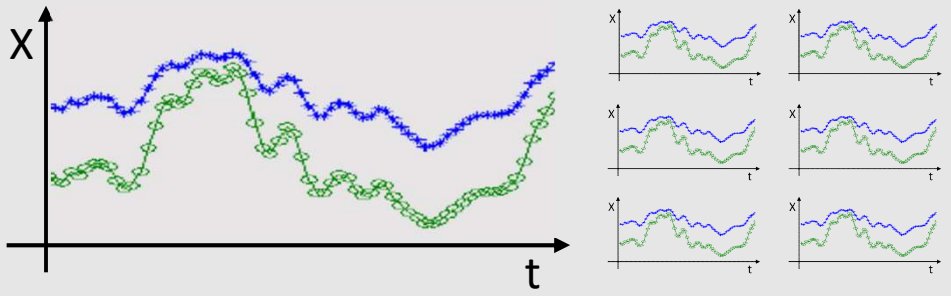
Use-case scenarios and technical focus



The node is programmed through IEC-61499 to implement a simplified state machine describing the current condition of the mechatronic system. Its evolution is triggered directly by the events generated by the PLC

Middleware Node

Specific "events" at machine level can be communicated by the PLC by exposing internal variables



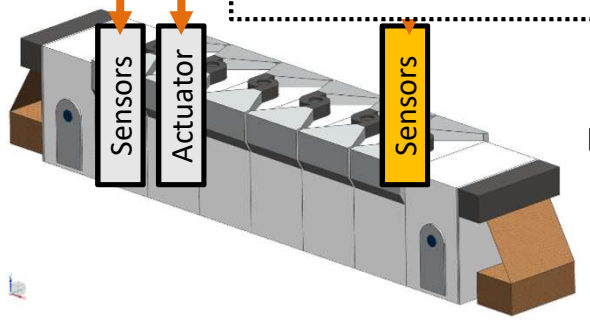
(Event-1, t1) | (Event-2, t2) | (Event-3, t3)

$P_{1,1}$	$P_{2,1}$	$P_{3,1}$
$P_{1,2}$	$P_{2,2}$	$P_{3,2}$
$P_{1,3}$	$P_{2,3}$	$P_{3,3}$

Events are time-stamped and can be further characterized by a set of parameters

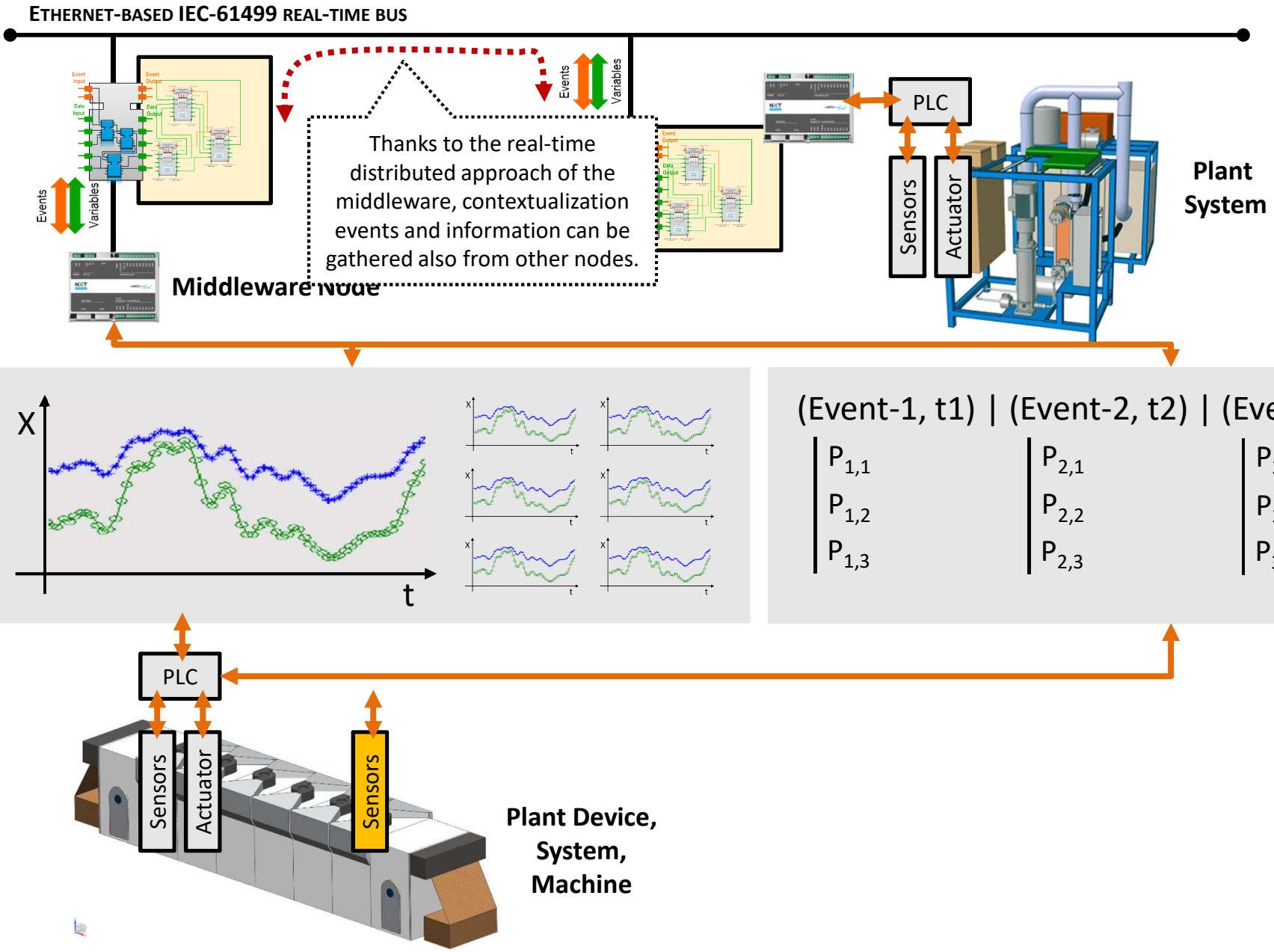
PLC

The PLC, governing the machine, has additional information about its "status"

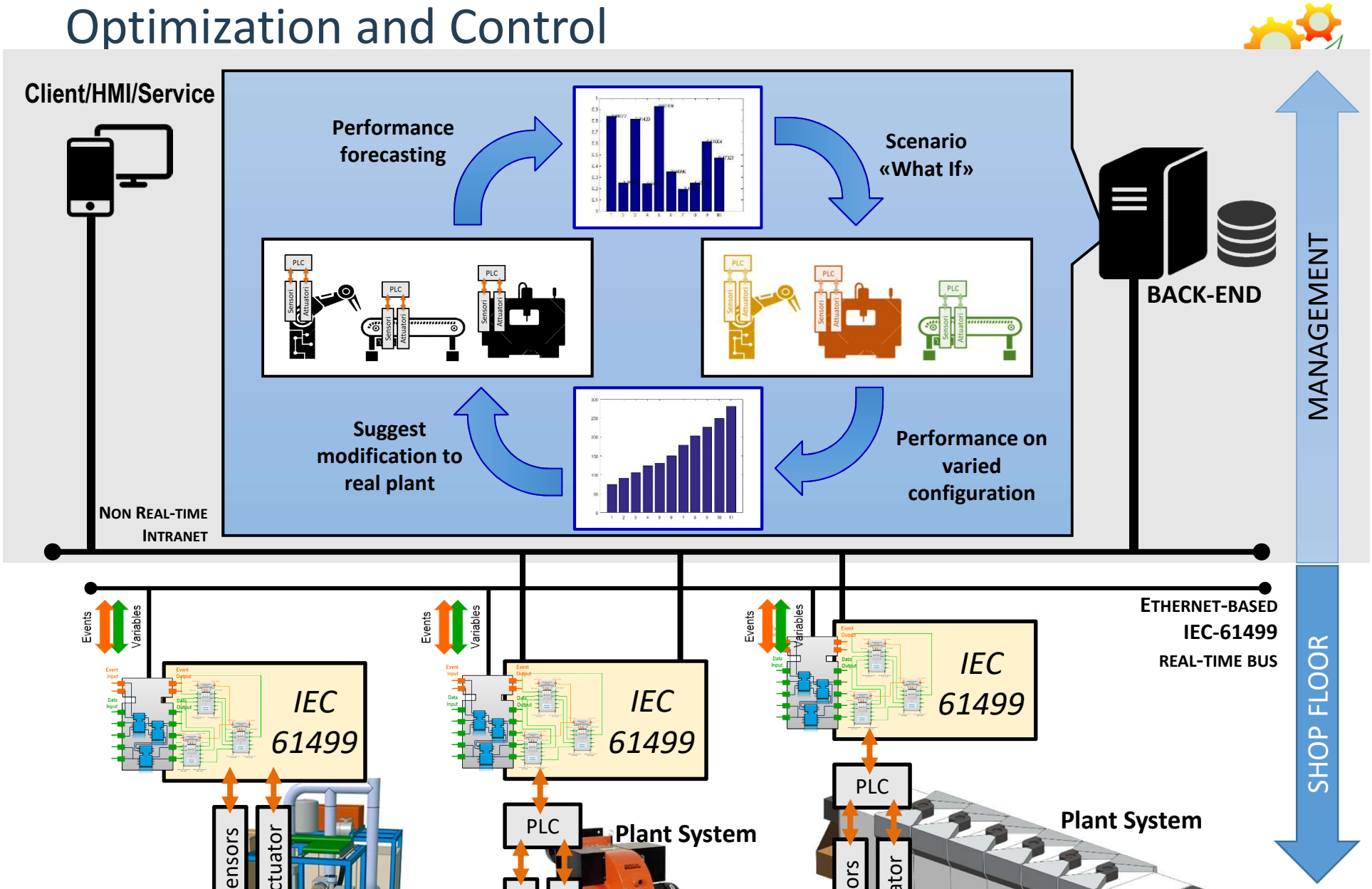


Plant Device, System, Machine

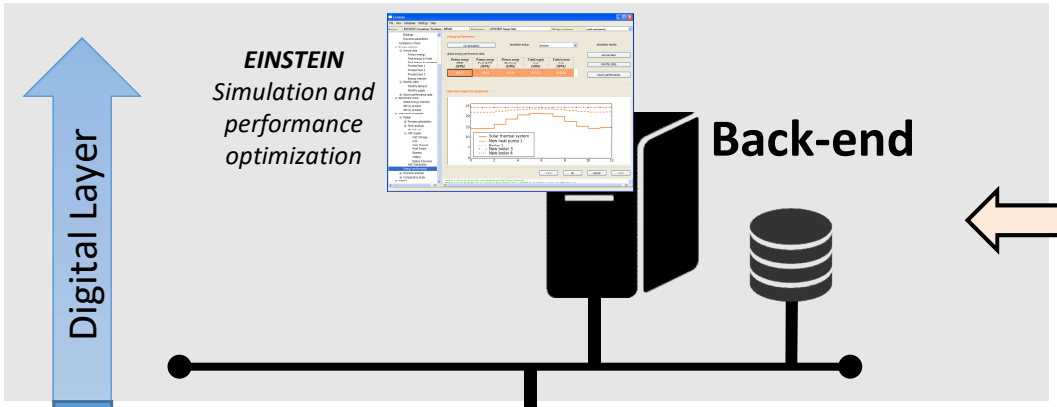
Use-case scenarios and technical focus



Optimization and Control



I-ThERM Demo - Heat pipe economiser
ARLUY (WP7)



Data Monitoring & Model Synchronization

Process Simulation & Optimization

Closing the control loop through the Simulation