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CONVERGING

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DELIVERABLE

D4.2 – CONVERGING Big Data Pipeline and hybrid digital twins

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Executive Summary

This deliverable (D4.2) describes the ongoing development and implementation work in Work Package 4, Big Data Pipeline. It covers the work developed in WP4 until the month 30th (February 2025) of the project, extending the work presented in D4.1 delivered on month 18th (February 2024) of the project.

To achieve the objectives of WP4 towards the development of the Big Data Pipeline and related modules, the work has been undertaken in the following tasks:

- **Data at Rest (DAR) module** led by AIMEN (Task 4.1)
- **Data In Motion (DIM) module** led by INTRA (Task 4.2)
- **AI Digital Twin (AIDT) module** led by VIS (Task 4.3)
- **Integration and Communication Architecture** led by INTRA (Task 4.4)

The Data At Rest (DAR) module is a transverse module that uses an architecture based on microservices for online processing, providing seamless data sharing between modules and facilitating data analysis. In its final version, presented in this deliverable, the DAR module has been deployed in two key components: the Data Framework and the Asset Administration Shell (AAS) Framework. The deliverable presents the functionalities provided to support the modules, the design, architecture, and technologies integrated into its development.

The Data In Motion (DIM) module is responsible for the data exchange between the different HRC (Human-Robot Collaboration) agents in real-time. DIM captures, fuses, processes, and sinks information. DIM takes advantage of the Open Flow knowledge repository and information model and connects with the DAR module as part of the CONVERGING Big Data Pipeline. The final architecture, as well as the functionalities and technologies deployed, is presented in this deliverable.

The AI Digital Twin (AIDT) module is developed on top of Visual Components 4.0, which accelerates the deployment of the Digital Twin for the pilot cases, including virtual representation of the shop floor, simulation libraries, integration with planning modules, and communication with ML/AI frameworks. During this period, the work developed, and detailed in this deliverable, has been focused on the simulation library development to match CONVERGING requirements, the improvements in the simulation and virtualization engines, and the development in the AI/ML. The work in the integration process is also presented.

The deliverable is finalized with the Integration and Communication architecture within the CONVERGING project. CONVERGING architecture is modular and reconfigurable, which serves as the backbone for connectivity and interaction among production resources, software, and modules. The work developed towards architecture development and implementation and the tools and methodologies are presented as well as the functionalities of the current version.

While in the case of the DAR and the DIM modules the final versions have been delivered, continuing its implementation in each of the pilots, the AIDT and the Integration and Communication Architecture will continue their development until the month 36 (August 2025) of the project and the final results will be presented in D4.3.