Open data interface for ERP/MES integration

Deliverable 5.1

MUWO

MULTI-METHOD WORKSPACE FOR HIGHLY SCALABLE PRODUCTION LINES

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Abstract	This deliverable provides a description of the mechanisms used to establish communication between ERP/MES and the tools developed in MUWO
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Function	Name	Entity
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Reviewer		

Executive summary

The tools developed in MUWO use as input data that can be retrieved from machines, but also information from information systems such as ERP (Enterprise Resource Planning) and MES (Manufacturing Execution System). For this, it is necessary to establish communication with these systems.

This deliverable outlines the communication mechanisms between the information systems of use case providers and MUWO, with a focus on optimizing data exchange for production orders, stock and operational plans. The document is structured into three sections, each dedicated to a specific use case, in which details regarding the development of interfaces for ERP/MES integration, API creation, library usage, data models and security aspects are provided.

Partner contributions record

#	Entity	Contributor on Phase 1	Date of Contribution1	Contributor on Phase 2	Date of Contribution2
1	Accuro	X	19/09/2023		
2	ACD	X			
3	Alpata	X			
4	Evosoft	X			
5	Inovasyon	X			
6	ISEP				
7	Progim	X			
8	SisTrade	X	14/05/2023		

Changes record

Version	Date	Entity	Description of Changes
V0.1	31/03/2023	ACCURO	Creation of the document template, ToC and guidelines for partners to follow.
V0.2	14/05/2023	SISTRADE	IDEPA's ERP integration
V0.3	19/09/2023	ACCURO	Contributions to § 2.3 regarding ERP integration in UC3.
V1.0	22/11/2023	ACCURO	Final editing and formatting.

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1. Introduction

1.1. Document objectives and scope

This deliverable aims to illustrate how the communication between the information systems of the suppliers of the use cases and MUWO is done so that they can feed each other with data on orders, stock and optimized plans to reduce time and costs.

1.2. Document structure

For each use case, different interfaces have been developed to obtain information from company information systems such as ERP, MES or WMS. Therefore, the document is divided into three sections, one for each use case, in which it is presented how the interfaces have been developed to exchange information between the ERP/MES system and MUWO, taking into account factors such as the creation of APIS -if the ERP/MES system providers do not have one or it is not suitable for what is needed-, the libraries that have been used in the development, data models, or security aspects to restrict access to outsiders and avoid compromising the system.

2. Interface for ERP/MES integration

2.1. UC1 – IDEPA's use case (Portugal)

2.1.1. ERP integration description

IDEPA is a valued customer of Sistrade and uses the Sistrade ERP software to cover all company requirements, benefiting from its comprehensive features and functionalities to streamline their operations effectively. This includes accounting, general ledger, payroll, commercial management, production, materials, suppler management, CRM, business intelligence, scheduling, and other key ERP or MIS features. Considering this information, IDEPA contains valuable information that can be used to feed both EHMS platform and its algorithms.

IDEPA is currently sending data to ISEP and Sistrade via an API with varied information. This data will be evaluated by both ISEP and Sistrade algorithms so that it may be processed and used to provide relevant insight (Table 1).

Table 1 - ERP API Endpoints

Endpoint	Description
/HumanResources	Returns data from the HumanResources Table
/MachineBuffers	Returns data from the MachineBuffers Table
/MachinesExecPlan	Returns all data from the MachinesExecPlan Table
/MachinesExecPlan?ReleaseTimeInicio='yyy-MM-dd'&ReleaseTimeFim='yyyy-MM-dd'	Returns all data between the records within the dates passed as parameters for ReleaseTime
/MachinesExecPlan?EndProcessingTimeInicio='yyy-MM-dd'&EndProcessingTimeFim='yyy-MM-dd'	Returns all data between the records within the dates passed as parameters for EndProcessingTime
/MachinesExecPlan?ReleaseTimeInicio='yyy-MM-dd'&ReleaseTimeFim='yyy-MM-dd'&EndProcessingTimeInicio='yyy-MM-dd'&EndProcessingTimeFim='yyy-MM-dd'	Returns all data between the records within the dates passed as parameters for ReleaseTime and EndProcessingTime

/MalfunctionsLog	Returns all data from the MalfunctionsLog Table
/MalfunctionsLog?Resource=Machine	Returns all data from the MalfunctionsLog Table containing the Machine passed as a parameter
/MalfunctionsLog?Type=Type	Returns all data from the MalfunctionsLog Table containing the Type passed as a parameter
/MalfunctionsLog?DateTimeInicio='yyy-MM-dd'&DateTimeFim='yyy-MM-dd'	Returns all data between the records within the dates passed as parameters for DateTime
/MalfunctionsLog?DateTimeInicio='yyy-MM-dd'&DateTimeFim='yyy-MM-dd'&Resource=Machine	Returns all data between the records within the dates passed as parameters for DateTime and where the Resource is the Machine passed as a parameter
/Operations	Returns data from the Operations Table
/Products	Returns all data from the Products Table
/Products?ProductType=ProductType	Returns all data from the Product Table containing the ProductType passed as a parameter
/Products?Code='Code'	Returns all data from the Products Table containing the code passed as a parameter
/Resources	Returns data from the Resources Table
/Routings?DataInicio=&DataFim=	Returns data from the Routings Table
/SchedMaint	Returns all data from the SchedMaint Table
/SchedMaint?Machine=Machine	Returns all data from the SchedMaint Table containing the Machine passed as a parameter
/SchedMaint?StartTimeInicio='yyy-MM-dd'&StartTimeFim='yyy-MM-dd'	Returns all data between the records within the dates passed as parameters
/SchedMaint?StartTimeInicio='yyy-MM-dd'&StartTimeFim='yyy-MM-dd&Machine=Machine	Returns all data between the records within the dates passed as parameters and where the Machine is the Machine passed as a parameter
/Schedules	Returns data from the Schedules Table
/Tasks	Returns all data from the SchedMaint Table

/Tasks?Operation=Operation	Returns all data containing the Operation passed as a parameter
/TecProdPlan	Returns all data from the TecProdPlan Table
/TecProdPlan?ReleaseDateInicio='yyy-MM-dd'&ReleaseDateFim='yyyy-MM-dd'	Returns all data between the records within the dates passed as parameters for ReleaseDate
/TecProdPlan?DueDateInicio='yyy-MM-dd'&DueDateFim='yyy-MM-dd'	Returns all data between the records within the dates passed as parameters for DueDate
/TecProdPlan?ReleaseDateInicio='yyy-MM-dd'&ReleaseDateFim='yyy-MM-dd'&DueDateInicio='yyy-MM-dd'&DueDateFim='yyy-MM-dd'	Returns all data between the records within the dates passed as parameters for ReleaseTime and EndProcessingTime
/UrdProdPlan	Returns data from the UrdProdPlan Table
/UrdProdPlan	Returns all data from the UrdProdPlan Table
/UrdProdPlan?ReleaseDateInicio='yyy-MM-dd'&ReleaseDateFim='yyyy-MM-dd'	Returns all data between the records within the dates passed as parameters for ReleaseDate
/Planeamento	Returns all data from the Planeamento Table
/WIP	Returns all data from the WIP Table
/WIP?OperationStartTimeInicio='yyy-MM-dd'&OperationStartTimeFim='yyyy-MM-dd'	Returns all data between the records within the dates passed as parameters for OperationStartTime
/WIP?Resource='Resource'	Returns all data with the Resource passed as a parameter

2.1.2. EHMS integration description

In addition, Sistrade has developed another API, responsible for sending sensor and environment data to ISEP, enabling the usage of this information as input for the predictive AI-based models (predictive maintenance and predictive quality).

Table 2 - Loom's API Endpoints

EndPoint	Description
/Loom9/TemperatureCuttingTool	Get Temperature Cutting Tool data
/Loom9/Inductive	Get Inductive data
/Loom9/AlarmGreen	Get Alarm Green data
/Loom9/AlarmOrange	Get Alarm Orange data
/Loom9/AlarmRed	Get Alarm Red data
/Loom9/TemperaturePowerCabinet	Get Temperature Power Cabinet data
/Loom10/Humidity	Get Humidity data
/Loom10/Temperature	Get temperature data
/Loom10/TemperatureCuttingTool	Get temperature cutting tool data
/Loom10/Inductive	Get Inductive data
/Loom10/PowerMeter	Get Power Meter data
/Loom10/TemperaturePowerCabinet	Get Temperature Power Cabinet data
/Loom11/TemperatureCuttingTool	Get Temperature Cutting Tool data
/Loom11/Inductive	Get Inductive data
/Loom11/AlarmGreen	Get Alarm Green data
/Loom11/AlarmOrange	Get Alarm Orange data
/Loom11/AlarmRed	Get Alarm Red data
/Loom11/TemperaturePowerCabinet	Get Temperature Power Cabinet data
/Loom12/TemperatureCuttingTool	Get Temperature Cutting Tool data
/Loom12/Inductive	Get Inductive data
/Loom12/PowerMeter	Get Power Meter data
/Loom12/AlarmGreen	Get Alarm Green data
/Loom12/AlarmOrange	Get Alarm Orange data
/Loom12/AlarmRed	Get Alarm Red data
/Loom12/TemperaturePowerCabinet	Get Temperature Power Cabinet data

2.2. UC2 – GTF Rotor cell operation (Turkey)

ERP (Enterprise Resource Planning) and MES (Manufacturing Execution System) integration is done to provide management and analysis of production data, costs and performance. ERP and MES in a unique way that should be integrated as the following steps:

- *Identify the connection points:* Determine which data needs to be shared between the ERP and MES systems and how it will be transferred.
- *Data modelling:* Decide on the structure and format of the data to be shared.
- *Data transfer:* Establish a method for transferring data between the ERP and MES systems, typically using an API (Application Programming Interface). Although it is typically provided via API, an intermediate database is usually created when database access is provided. A service running in the background writes the data sent by the ERP system to the database of the MES system and vice versa.
- *Testing:* Conduct tests to ensure that the integration is working correctly.
- *Review and optimize:* Monitor the performance of the integration and make any necessary optimizations.
- *Continuous improvement:* Make any necessary changes to the integration to keep it running smoothly and improve it over time.

In order to achieve a successful integration of ERP and MES, it is important to correctly implement the data modelling, data transfer, and continuous improvement steps. Additionally, the integration should be tailored to the specific needs and production structure of the business.

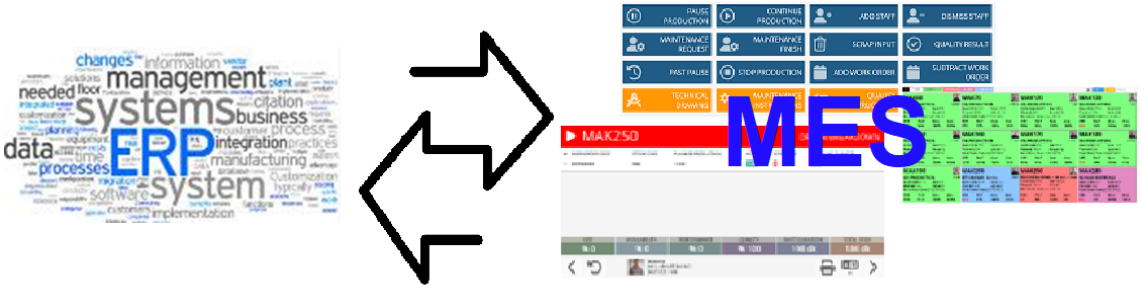

Figure 1. Integration between ERP and MES systems

2.3. UC3 – ALBERO's use case (Spain)

The ERP has a fixed data structure, a series of tables and elements linked to each other that make it possible to quickly obtain the precise information for each OF (Fabrication orders) or order. With this premise, the information is obtained from the ERP DSP 2000, pointing to the necessary tables. The great complexity of tables and elements needs to be reduced to a series of data necessary for the extraction of OF for subsequent analysis and treatment. The ERP has a My SQL database from which information can be extracted or entered according to established basic guidelines. This information must be extracted in an orderly manner to give logic to the data.

Once the connection is established with the server on which the ERP data is located, requests are launched against the database. These requests seek to extract all the necessary information to be able to sort and classify all the OFs with the AI algorithm.

For the correct extraction of information from the server, an analysis of the available data has been carried out, a mapping of all the existing tables in the System, searching only for the variables necessary for the AI algorithm. After a first mapping of the data, it has been possible to reduce the number of tables from a quantity greater than 500 to an approximate total of 5 tables, of which not all the columns registered in the ERP are used. Once the tables are defined, the service points only to the necessary tables, reducing the search spectrum and streamlining the process. This process of searching for information within the server where the ERP is hosted has a system for detecting new entities. This functionality allows the service to search for information on the server only when new records are added. Allowing greater operational agility and lower use of resources. The service shares the information obtained from the server with the AI algorithm.

Figure 2. Data flow

Figure 2 shows the flow of information and the orientation that follows previously explained. It starts from the server where the ERP is hosted, when a new record or a set of new records is entered, the service is activated by capturing data. This data is housed in an intermediate database to which the AI

algorithm has access. Data already processed is marked so that it does not have to be processed again. Once the information reaches the algorithm, it orders the OFs to optimize the productive process.