Introduction

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Introduction

What

Equipment Integration is the process of building an interface between a machine and an external application. The interface may have different goals, such as control, process monitorization or gather process information. In order to have this link between what is the machine domain and the external application domain, there needs to be middle man brokering the interface. This middle man must retrieve and interpret the machine and application information and if needed apply transformations in order to make the two systems understand each other.

```
graph LR
    A(Retrieve) --> B(Interpret)
    B --> C(Transform)
    C --> D(Send)
    D --> A
```

Why

Equipment Integration is a vital part of retrieving and using information of a shop floor, making it relevant for:

- Capturing and using information from the shop floor, not as a single event but as an event that is part of a known productive flow.
- Enrichment of production data through transformation and contextualization.
- Enhancement of quality and reliability of shop floor information by:
  - Reducing manual inputs that bring human error.
  - Enabling automatic validation of complex recipes used in equipment.
  - Allowing finer control over production equipment and over the complete productive process.

How

To implement a model of equipment integration on a productive environment, it is important to recognize that each integration is a separate problem to be analyzed and handled. In most situations, even using equipment acquired from the same supplier may have variations.

There is, however, a generalized framework on how to approach and solve equipment integration problems.

Problem mapping

```
flowchart LR
    A(Understand the conditions the data is generated) --> B(Know the communication protocol)
    B --> C(Retrieve and interpret important information)
    C --> D(Transform and adapt the data)
    D --> E(Send data to destination)
```

Step	Description

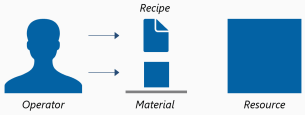
	Step	Description
1	Understand the conditions the data is generated	- Understand the operational process that will trigger the event/data generation - Map the content of the information contained in the generated data ✎ Requires close contact with the stakeholders at the shop floor level to properly interpret the information later
2	Understand the communication protocol	- Be acquainted with the convention that controls and allows a connection, communication and data transfer between two systems - Know how the machine communicates and why
3	Retrieve and interpret important information	- Know the structure in which the data is provided - Understand and interpret the data that will be vitally relevant to solve the problem ✎ Not all data is important data, assess what is relevant for your use case
4	Transform and adapt the data	- Perform data processing - Harness the information and harmonize it, prior to sending it to the final receiver (whether it is the MES or any other system) to know how to process the available data - Know how to deliver it allowing optimized retrieval
5	Send data to destination	- Send the information to an external application. This application can for example store the data, use it to control the equipment or for any other purpose you wish

Real world scenario

A very quick example of a real world scenario of a production process on the shop floor, presented in two alternative viewpoints, one using manual processes and another one with a fully integrated solution:

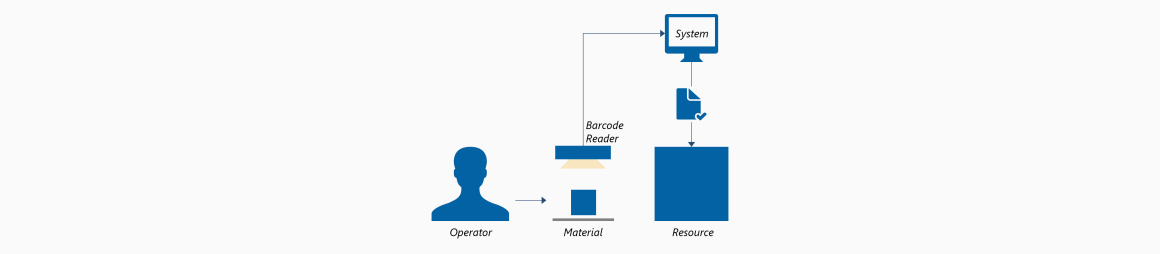
Without Equipment Integration

- The operator
  - Places a Material in the Resource entry port for processing.
  - Scans a barcode from the Material to indicate that the Material is going to start processing on the Resource.
  - Manually reviews the Product information to determine which specific Recipe will be used. This is a visual and manual process, prone to errors and delays.
  - Accesses the Resource manually to select the recipe to use for the current Material, ensuring that the proper Material is being processed in the proper Resource with the proper Recipe through manual processes and self-validation.



With Equipment Integration

- The operator or conveyor places a Material in the Resource for processing
- A barcode reader placed in the entry port detects the presence of the Material, automatically reads the barcode and notifies the system of the presence of the Material about to be processed
- The system receives and interprets the barcode information, automatically resolving the Product that the Material is representing and subsequently which Recipe should used for the Material, sending the Recipe ID to be loaded in the Resource which now knows exactly which Recipe to be used without any human interaction.



This example illustrates the machine domain and the domain of process configuration (which knows the barcode and the recipe to use). The role of equipment integration is to interact and interface with these two systems to generate value.

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