

ARQSI PROJECT ENGLISH

1 Preamble

The 2019/2020 edition of Project Laboratory Lab 5 (LAPR5) from ISEP Computer Engineering Degree will operate in a Project Based Learning (PBL) mode functioning as a single project integrating all 5th semester course units (UC). It is performed during the semester at the same time by all the curricular units: ALGAV, ARQSI, ASIST, SGRAI and GESTA. For the realization of the project will be formed working groups common to all UC. Note that at the end of LAPR5 it is not intended to get 5 separate projects, but rather an integrated solution, a system, comprising several modules. The rules outlined in this work methodology document are master lines that cover the main existing scenarios. Situations other than those mentioned in this document should be submitted to the LAPR5 RUC, which together with the RUCs of the remaining UCs will decide how to proceed in these scenarios. Although LAPR5 runs on the PBL model with the 5th semester UCs, it is important to stress that project implementation has to highlight the good practices gained over the previous four semesters and that the application of these best practices will be part of the final project evaluation criteria.

2 System Develop

The startup companz MyOwnCutlery.com aims to market itself with a digital platform where everyone can order and make their own cutlery (knives, forks, spoons, etc.). To do so, it will create a production unit and a set of information systems to manage its customers' order production. Customers will be able to register on MyOwnCutlery.com, order the parts they desire and track the status of their order while it is being manufactured.

2.1 Context of application

NOTE: The system requested here is a simplification of what is a real production management system. Simplifications are assumed to make the project workable within the framework of the LEI semester, so they should pay attention to the simplifications and assumptions described. The type of plant where the system will be deployed manufactures products that follow linear manufacturing processes along a production line, as shown in the example in Figure 1.

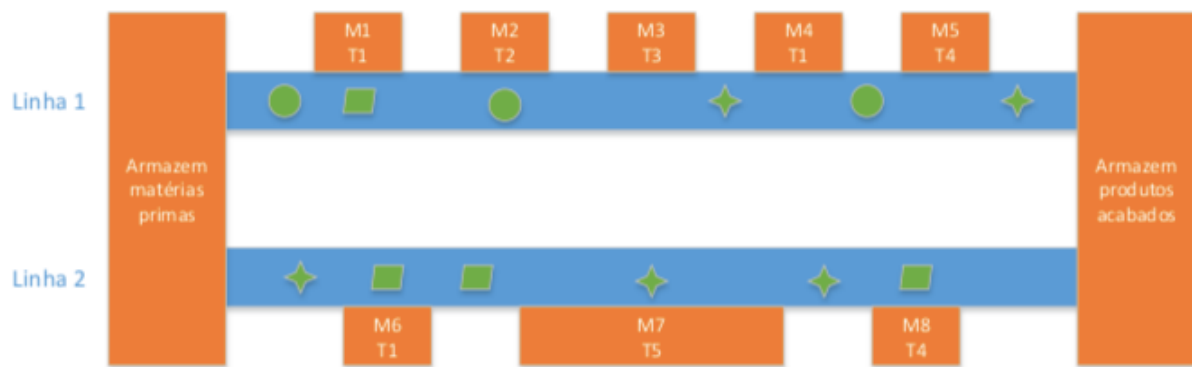


Figure 1. Factory Example

In this example we show two production lines with various equipment (machines) along each line (the lines denoted blue and the equipment orange). Each piece of equipment is of a particular type and allows one or more factory operations to be carried out, for example a bending machine allows folding materials while a milling machine allows milling (roughing) materials. It is assumed:

- Although each machine can perform one or more operations or the same operation, but with different tools (eg drilling with 5 mm drill or 22 mm drill), within this project the [operation, tool] pair is considered as a separate operation. In other words, drilling with a 5mm drill bit is an option while drilling with a 7mm drill bit is another separate operation.

Table 1. Example machines and their capabilities

Tipo de máquina	Operações que pode executar	Máquinas no exemplo
T1	op1	M1, M4, M6
T2	op2	M2
T3	op3	M3
T4	op4	M5, M8
T5	op2, op3	M7

The products (denoted by the green symbols) circulate on the production line and are worked on each machine according to its manufacturing plan. In the example 3 types of products are shown, each with a different manufacturing plan (Figure 2).



Figura 2. Planos de fabrico de cada produto exemplo

Due to their manufacturing plan, “round green” parts cannot be manufactured on line 2 as there is no machine capable of performing the second op1 operation on this line. Taking factory orders into account, manufacturing orders will usually be generated by grouping multiple orders, for example, a single 100-item manufacturing order can satisfy two orders for that item. The manufacturing orders are then planned for a given day to meet the delivery deadline.

	Dia	xx/yy/zzzz	
	Linha 1		
		OF-20	
		OF-32	
		OF-21	
		OF-43	
		OF-19	
		OF-23	
	Linha 2		
		OF-40	
		OF-33	
		OF-18	
		OF-05	
		OF-51	
		OF-22	

It is assumed:

- An order generates a work order and a work order only concerns one order (they have a one-to-one relationship).
- The deadline for completion of an OF is the delivery date indicated by the customer in the order of 3 days decreased.
- Each customer will have a priority (1 to 5) managed by an autonomous process. For simplification of the current scope, priority will be assigned randomly upon client registration. Manufacturing orders to be executed on a given day will generate the factory production plan for that day, indicating which line and which machines to use in accordance with the manufacturing plan of the ordered products.

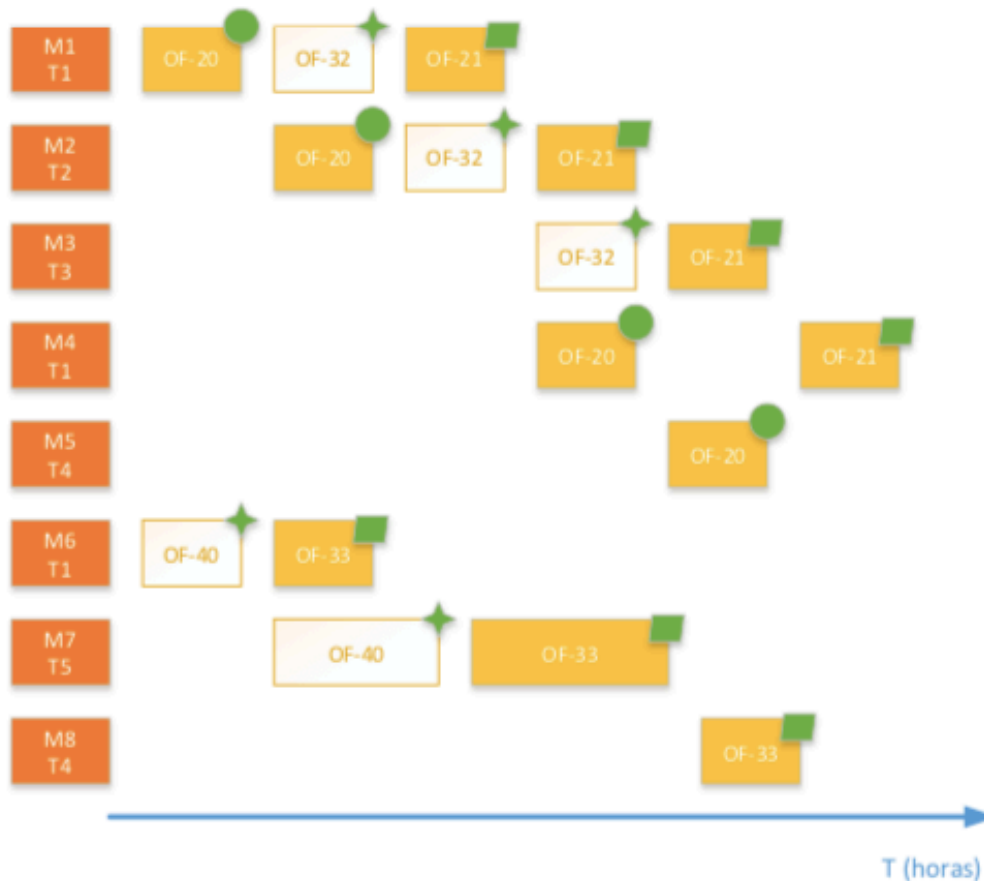


Figura 4. Extracto de Plano de produção para um dado dia

The following simplifications are assumed:

- A manufacturing order cannot be interrupted or divided
- An OF only enters a production line when the previous OF is complete. Can overlap of the same OF on different machines as they are OF for N products. That is, once an operation is completed, the product under construction may proceed to the next machine / operation instead of completing a batch associated with a machine / operation before moving on to the next machine / operation.
- Setup times (eg tool change) occur between two OFs, but on the same machine there is no setup time during the OF execution.

2.2 Terminology

In the simplified scope of this project we will use the following definitions:

- Production line - sequential organization of machines and their means of transport between machines
- Equipment - synonym for Machine
- Machine - productive equipment capable of performing manufacturing plan operations with a view to produce a product. A machine is of a certain type which defines what its features.
- Machine Type - characterization of the capabilities (what operations you can perform) of a

set of machines

- Operation - one of the capabilities of a machine type, eg drilling
- Manufacturing plan - sequence of operations required to produce a product
- Product - one of the items that the factory is able to produce according to its manufacturing plan
- Customer - person or company that purchases factory products
- Order - A customer's purchase intention for a certain quantity of a particular product
- Manufacturing order - instruction for the factory to produce certain quantities of a given product
- Production plan - sequence of manufacturing orders and allocation to each production line in time to satisfy factory orders

2.3 Overview

It is intended to develop a support system for various management activities of a production unit (factory), whose main modules and information flows are represented in the diagram of Error! Reference source not found.

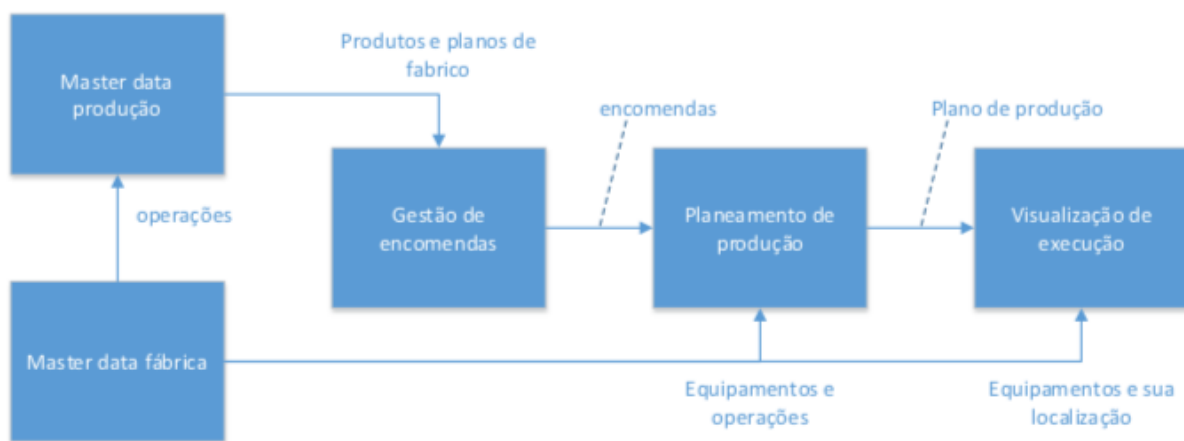


Figura 5. Visão geral

The system should consist of a Single Page Application (SPA) web application that allows authorized users to access the different application modules, as well as a set of services that implement the business rules components necessary for the application to function. web. Generally speaking, the main features of each module are as follows:

- Master data factory - allows the management of information related to equipment (machines) in the factory, such as their identification, make, model, location, capabilities (operations that can be performed and their characteristics, eg duration). This information is defined and managed in this module and is consumed by the master data production, production planning and execution visualization modules.
- Master data production - allows the management of information related to the products that the factory produces, and their manufacturing plans. This information is managed in this module and consumed by the order management module.
- Order management - registration of users (customers) and management of their orders with

data processing in accordance with the RGPD. The information managed in this module is consumed by the production planning module.

- Production Planning - Based on existing orders, generates the factory production plan for a given day, taking into account various optimization criteria, such as executing all orders faster, minimizing backlog or No of customers with late orders. The plane generated by this module is consumed by the execution visualization module.
- Execution visualization - allows the 3D visualization of the plant (equipment) as well as the animation of the production plan.

Although not within the current scope of the project, consideration should be given in the solution architecture to the future extension for mobile applications for Order Management and Execution Visualization.

The solution should address three types of users:

1.
 - ■ Data administrators * - use the master factory data and master data production modules.
 - ■ Customer * - Register and use the order management module.
 - ■ Production Manager * - Uses the production planning and execution visualization module.

Under the current project, user administration can be done directly through the database and no user management module is required.

2.4 Description of infrastructure

In addition to the functional modules, the operation of systems, definition of business continuity plans, network architecture and server operation where the system is installed must be taken into account. All equipment is connected to a computer infrastructure. There are, not shown in Figure 1, two load balancing servers, where the applications, services and databases are installed and are in charge of storing information. There are also two failover servers that distribute addresses to all systems and are responsible for system and user authentication (DHCP, DNS (if applicable) and server authentication, and eventually a Kerberos server). The integrity of the information that systems access must be audited and verified. Each system can only access the data that concerns it. In addition and in view of the need to know and the need to know all information should be protected from improper access. That is, the principle of minimizing access to what is absolutely essential for each user / application, creating tunnels for information transfer, assessing data and application integrity, and encrypting and encrypting / minimizing data.

2.5 Privacy and Data Protection

Since the order management module is exterior facing, special attention must be paid to the privacy and data protection in light of the RGPD. This requires the system to comply with current legislation and, in particular, to provide legal information and to inform the user upon registration, as well as to allow access and cancellation of his account in legally permitted cases and conditions.

