Data Warehousing project

Spring 2016 - University of Neuchatel

Professor & Assistant
Kilian Stoffel
&
Fabrizio Albertetti

Group 15

Huong-Giang Clara Le
Matthieu Harbich
Bryan Cornelius
Florent Plomb
Amélie Bui

Table of contents

La Nébuleuse

Data warehouse conception

1 Introduction

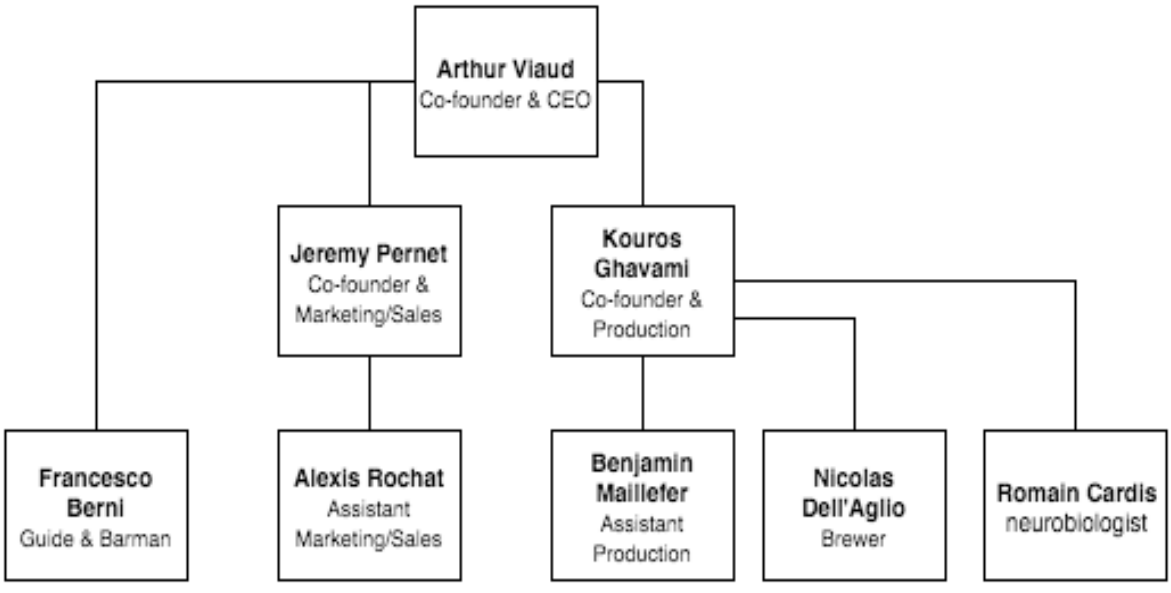
In this project, we attempted to conceptualize a data warehouse based on the case study of La Nébuleuse, a local brewery. Before conceptualizing, we gathered as much information as we could through an interview with the company, to better understand their needs as well as the challenges they faced. With this information, we first developed a Subject Area Model that allowed us to have a structured overview of the brewery most important areas of interest. From then on, we enriched our diagram to create a Business Data Model, always keeping in mind the business questions we had to answer. Finally, we imported the defined model and data into a database, allowing us to answer the business questions we had set at the beginning of the project.

2 Background of the company

La Nébuleuse is a young beer brewing company located in Renens, which was launched in February 2014 by three friends. Their business started in their basement and rapidly, the available space was too small to answer the increasing demand. They needed to find a bigger location and at the end of year 2014, they moved to their actual site in Renens.

Presently, seven employees are working full-time. As for their beer production resources, they have a mixing system of 15 hectolitres and a fermenting capacity of over 400 hectolitres.

Organization



The company is currently composed of eight people, three of them are the co-founders and the remaining five others, are working in different departments such as marketing, sales and production. La Nébuleuse also counts a neurobiologist, who develops the yeast and the incoming beers new flavors.

3 Project goals

In order to define the scope of this project, we had the opportunity to visit the beer brewing factory and to have an interview with the CEO. We discussed several points and in particularly, their current situation and problems they encountered, which need to be solved. Through this discussion we could identify three main challenges:

- **Decentralization of the information**

  As we face a small and young company, La Nébuleuse does not own any centralized information system. On one hand, the data and information are recorded informatically, with the support of excel sheets or via a small application, developed for the the warehouse management, and on the other hand, part of the information is gathered scriptually with simple sheets of paper, that are sometimes sticked on tanks. As a result, we can see that their current way of recording data is not optimal and this could potentially lead to a loss of important information.

- **No traceability of problems**

  La Nébuleuse does not own any program, which can record the source, the nature and the duration of problems. In order to get an efficient and optimized production, it is very important for the company to track the problems and store the history. It would be benefic to have an appropriate global view of the problems, which would be benefic for future improvements.

- **No clear task assignment**

  During rush periods, La Nébuleuse needs to have employees working on a specific task in order to increase their productivity and meet the deadlines. However, no clear task assignment is currently defined, all employees are multitask. With the ongoing organisation, it is delicate to identify the responsible person, when a problem occurs.

Our main goal is to design a Data Model focused on the production & the logistic of the company, in order to optimize and keep a history of each process, to register problems and to centralize the information.

4 Business scenario

4.1 Description of the data found

We mainly collected the data through an interview with the CEO of the company, and partly from the artisanal application developed for the warehouse management. The information found is essentially related to products, steps, problems, machines and waste involved in the production, and the suppliers, orders, warehouse and batches involved in the logistic.

4.2 How the data is collected, maintained, and utilized in the company

The data is essentially used with purpose of following orders, purchases, managing stocks, and keeping a simple traceability of the production.

We were told that a part of the data used is digitalised and that another is scriptural. In addition, they are also using different artisanal applications for different purposes, such as keg management, accounting and

warehouse flows. Consequently, the majority of the data comes from employees, who write information regarding their tasks.

For their warehouse, they have an app which was developed by an engineer friend, that simply manages in and out flows. However, the rest of the logistic and production data is only written (e.g. the monitoring of the different batches). There is no maintaining system and most of the data is not securely saved.

Furthermore, one of the need is to collect, analyse and use anomalies that occurred, in order to prevent them in the future. But nothing is monitored yet.

In conclusion, most of the data is scripturally collected, not saved and maintained and above all, not utilized for optimisation.

4.3 Understanding of the data

As the CEO said, it would be crucial to be able to avoid stock out and technical problems. The ongoing structure of the data and the way they are managed, jeopardise some aspects of the company. In order to reach their goal, a digitalised system which manages the whole data flow is required. Consequently, the brewery would be able to use this information in order to optimize their logistic and production, taking into consideration their growth.

4.4 Some business questions, relative to production & logistic, interesting to this company from your data.

- What are the different ways of producing their beers?
- How much time does the production take for of a chosen kind of beer?
- What is the most popular/profitable product?
- Who are the best customers?
- Who are the strategic suppliers?
- At which threshold is stock out possible?
- Was this technical problem already monitored?
- Could we avoid this problem?
- How many grains/bottles should we procured considering this exceptional order?
- To which batch belongs this beer?
- What is the current stock of a particular raw material?

5 Subject Area Model

To find an answer to these questions, we designed a Subject Area Model that would allow us to solve some of the challenges, this brewery faces. To do that, we began by trying to understand how the business works.

The overall logic is that La Nébuleuse orders its raw materials from suppliers, stores those materials in its warehouse before using it to produce beer. Once the final product is ready, they keep it once again in the warehouse, right before delivering it to their customers.

5.1 Subject Area Description

Order

The 'Orders' subject area concerns all the information related to orders transactions of raw materials, that shift the ownership of materials and product component from a Supplier to La Nébuleuse. It concerns all the information related to orders transactions: suppliers, quantities, materials and the payments.

Raw Materials

The raw materials are all the products which need to be processed and transformed in final products, in order to be sold. A raw material is identified by an identification, its quantity, the unit, its type and its expiration date.

Productions Lines

The "Production Lines" subject area concerns all the information about the production processes and the transformation of raw materials into a finished product. As the production process involves a lot of volatility, it is very important to know the state, the stage and location of each batch being produced at all times. All information concerning the production processes and the state, the stage and the location of each batch of beer. The production process is made of different steps, including the raw materials, the equipments and the workers involved in it. From a step, we can identify the problems and the amount of waste related to.

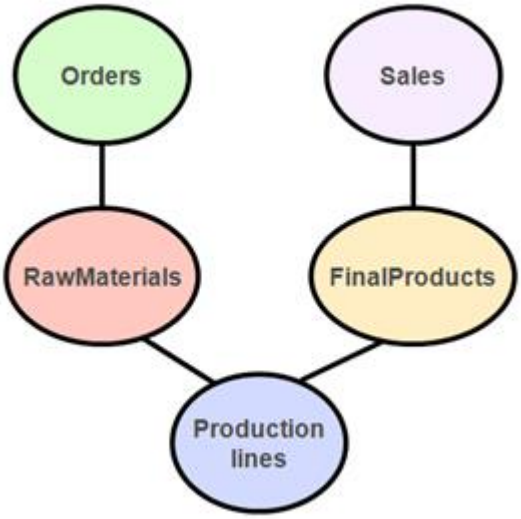
Final Products

This subject area deals with all the products and services realized and offered by La Nébuleuse. More precisely, the beer production and events such as beer testing, which bring another revenue stream.

Sales

This final subject area is about all the information related to the transactions concerning the finished products sold to the clients. The customers, which are separated into two categories; private or business, the quantities sold and the types of product for instance and their payment method.

5.2 Subject Area Model diagram



6 The information of each entity

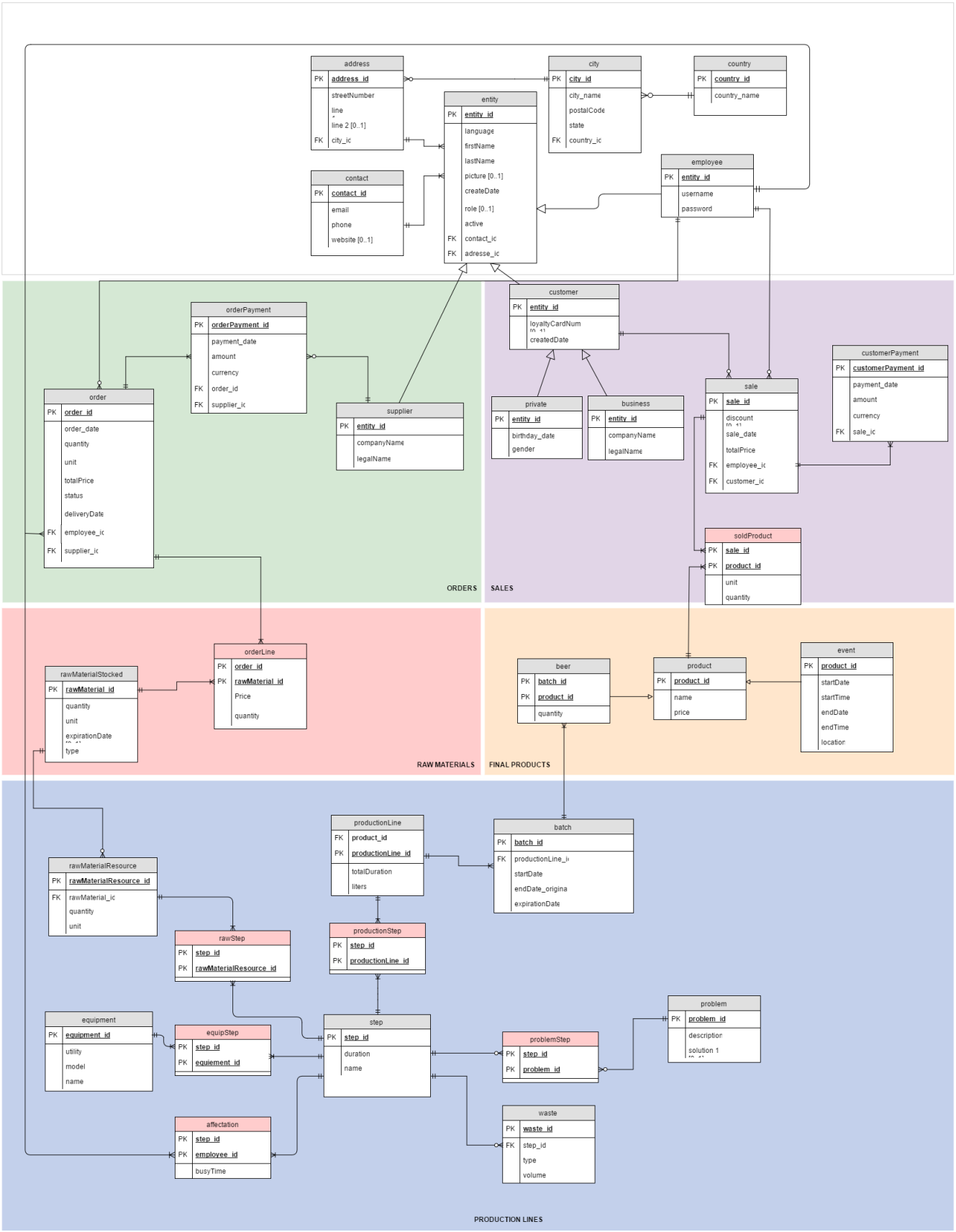
Subject Area	Entity Name	Description	Attributes	Examples
Orders	order	Orders made by La Nébuleuse to their suppliers in order to be able to realize their production	**1. order_id** 2. order_date 3. quantity 4. unit 5. deliveryDate 6. totalPrice 7. status 8. employee_id 9. supplier_id	**1. 6** 2. 15/03/2016 3. 50 4. kg 5. 05/04/2016 6. 50 7. Open 8. 12 9. 13
	supplier	Suppliers to which La Nébuleuse orders raw material, such as hops, wheat, yeast, bottles, cans, keg , etc.	**10. entity_id** 11. companyName 12. legalName	**10. 6** 11. Huzer SA 12. SA
	orderPayment	Information about the payments between La Nébuleuse and the suppliers.	**13. orderPayment_id** 14. paymentDate 15. amount 16. Currency 17. order_id 18. supplier_id	**13. 6** 14. 04/04/2016 15. 500 16. CHF 17. 12 18. 13
Raw materials	rawMaterial	All the raw materials in La Nébuleuse storage.	**19. rawMaterials_id** 20. type 21. quantity	**19. 6** 20. wheat, yeast, bottle, can, keg, hop

			22. unit 23. expirationDate [0..1]	21. 500 22. kg, unit 23. none, 31/12/2016
Production lines	productionLine	The entire process concerning a special variety of beer. A productionLine is made of several steps and has no temporality.	**24. productionLine_id** **25. product_id** 26. Liters 27. totalDuration	**24. 6** **25. 12** 26. Stirling 27. 50
	step	Several steps form a productionLine. A same step can be in different productionLine(s).	**28. step_id** 29. stepName 30. duration	**28.** 6 29. Crush the grains / Add yeast for the fermentation process / Adjust the tank temperature 30. 70 hours
	rawMaterialResource	All the raw materials involved in a recipe production.	**31. rawMateria.._id** 32. type 33. quantity 34. unit	**31. 6** 32. wheat, yeast, bottle, can, keg, hop 33. 500 34. kg, unit
	equipmentResource	All the machinery and equipment included in production	**35. equip…_id** 36. type 37. quantity 38. unit	**35. 6** 36. Machine 1 37. 1 38. unit
	affectation	People included in the production	**39. Step_id** **40. Employee_id** 41. busyTime	**39. 23** **40. 12**
	batch	All information concerning a particular batch. A batch belongs to a particular productionLine, a certain type of beer, and at a particular step of the productionLine process.	**42. batch_id** 43. startDate 44. productionLine_id 45. endDate 46. expirationDate	**41. 12** 42. 21/12/2015 43. 2 44. 23/05/2017 45. 12/08/1018 46. 31/12/2017
	problem	Record of all problems which can occur during any step of the production process.	**47. problem_id** 48. description 49. solution 1 [0..1]	**47. 7** 48. Probleme de .. 49. Cuisson basse temp...
	waste	All unused raw material due	**50. Waste_id** 51. Step_id	**50. 12** 51. 45

		to production	52. Type 53. volume	52. Vegetale 53. 50price
Final products	product	All the different offers of La Nébuleuse, its beers and events.	**54. product_id** 55. Name 56. price	**54. 6** 55. Stirling / Dégustation Automne 2016 56. 3
	beer	final output of the production	**57. Product_id** **58. batch_id** 59. quantity	**57. 4** **58. 2** 59. 456
	event	La Nébuleuse also proposes some events for customers to discover their beers and to create customer experiences	**60. product_id** 61. type 62. startDate 63. startTime 64. endDate 65. endTime 66. location	60. 67 61. guided tour, tasting 62. 05/11/2016 63. 10:00 64. 05/11/2016 65. 14:00 66. Brasserie Renens
Sales	customer	All the people who pay for any product or event proposed by La Nébuleuse	**67. entity_id** 68. createDate 69. LoyaltyCardNum	67. 3 68. 01/01/2016 69. 464HJ
	private	Any private individual	**70. entity_id**	**70. 6**
	business	Corporate customer buying Nébuleuse's products in order to resell them	**71. entity_id** 72. companyName 73. legalName	**71. 6** 72. Zelig 73. Zelig SA.
	sale	Final products and services that have been sold	**74. sale_id** 75. discount 76. sale_date 77. employee_id 78. customer_id	**74. 4** 75. 0.3 76. 04/05/2016 77. 3 78. 5
	soldProduct	Link between final products and the sales	**79. sale_id** **80. Product_id** 81. Unit 82. quantity	**79. 34** **80. 4** 81. Bottle 82. 300
	customerPayment	Invoices of La Nébuleuse's customers	**83. customerPay.._id** 84. payment_date 85. amount 86. currency 87. customer_id 88. sale_id	**83. 45** 84. 04/05/2016 85. 450 86. CHF 87. 4 88. 65.

Other	entity	It is an employee, a customer or a supplier.	**89. entity_id** 90. language 91. firstName 92. lastName 93. picture 94. role 95. active 96. contact_id 97. adresse_id	**89. 45** 90. FR 91. David 92. Hasselof 93. - 94. customer 95. true 96. 12 97. 32
	contact	The different ways of reaching an entity.	**98. contact_id** 99. email 100. phone 101. website	**98. 23** 99. john@doe.com 100. 079717990 101. www..
	address	The address of an entity	**102. address_id** 103. streetNumber 104. line 1 105. line 2 106. city_id	**102. 6** 103. 45 104. Rue du… 105. - 106. 54
	city	The city that is in the address	**107. city_id** 108. city _name 109. postalCode 110. state 111. country_id	**107. 43** 108. Lausanne 109. 1003 110. Vaud 111. 32
	country	The country to which belongs the city	**112. country_id** **113.** country_name	**112. 32** 113. Switzerland
	employee	A person working for the company	**114. entity_id** 115. username 116. password	**114. 6** 115. John 116. 1234

7 A complete Business Data Model (diagram)

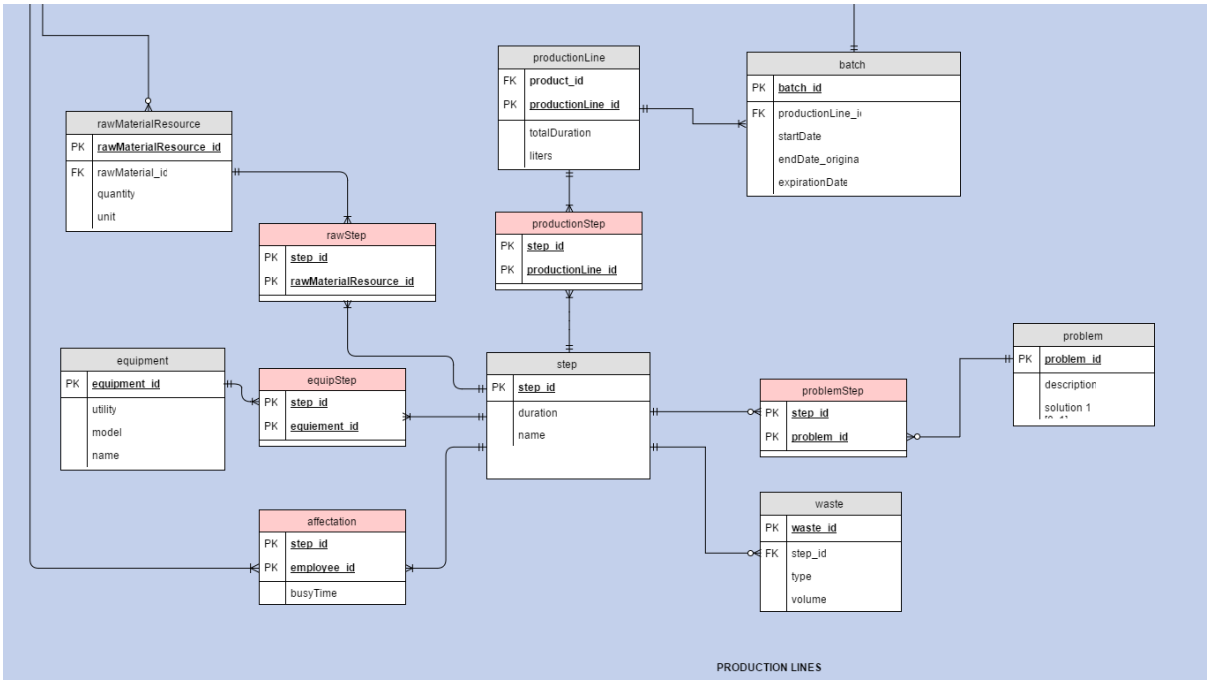


8 Focus on three important parts of the Business Data Model

We will now focus on three parts of our Business Data Model for some clarification and further explanations: the “Production Lines”, “Other” and the “Sales” subject areas.

8.1 Part 1: Production Lines Subject Area

The production phase of beer might be the key and most tricky part of a brewing company. Indeed, the diversity of beers, processes, equipments, problems and possible consequences make the “Production Lines” subject area one of the most complex to design.



La Nébuleuse produces several types of beers and each type needs to go to different kind of process (or recipe). In the model, we can see that through the productionLine entity, each type of beer has its own row in the productionLine table. When producing a new batch of a particular beer, we run a new batch in the corresponding production line.

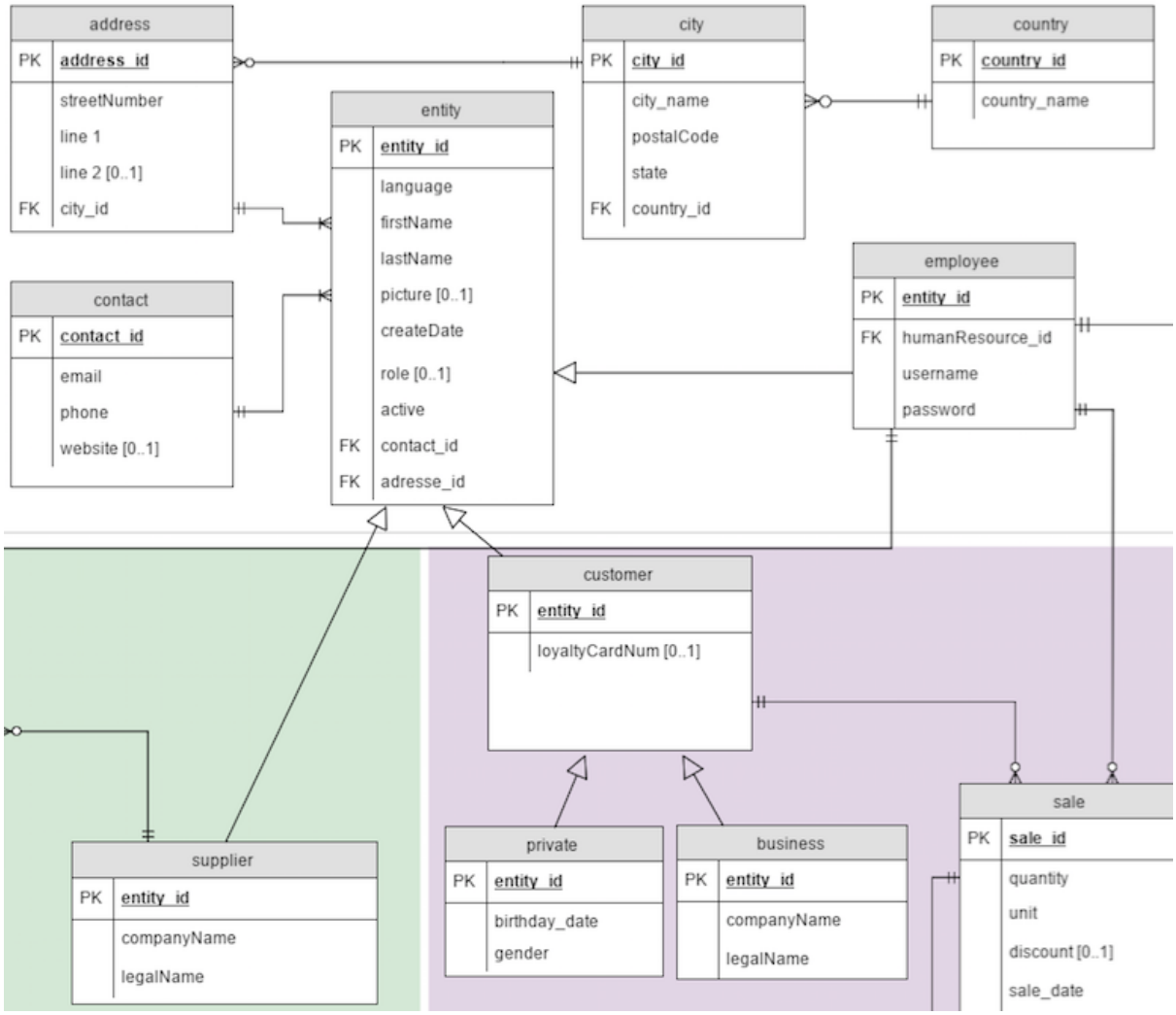
A productionLine is made of several generic steps that need to be performed (step entity), in other words the steps correspond to the recipe instructions. A step is generic and needs resources to be carried out: different types of raw materials (rawMaterialResource entity), equipments and materials (equipment entity) and human resource (employee entity). Each step can then be affected to a certain employee, the problem of no one taking responsibility being solved. It can also produce some waste, demanding La Nébuleuse to organize a way to manage waste.

One of the challenges faced by the company was the retainment of knowledge and of the problems that had occurred in the past. In the Business Data Model, we tried to solve this issue by linking a problem entity to each step. Hence, for any steps, La Nébuleuse has the possibility to keep track of the problems encountered and of the different solutions that were adopted.

8.2 Part 2: “Other” Subject Area

At the top of Business Data Model, we have a “subject area” — a white space — that does not belong to any defined subject area. This space contains all the information concerning different entities and people that all have similar attributes despite their different functions (suppliers, customers, employees).

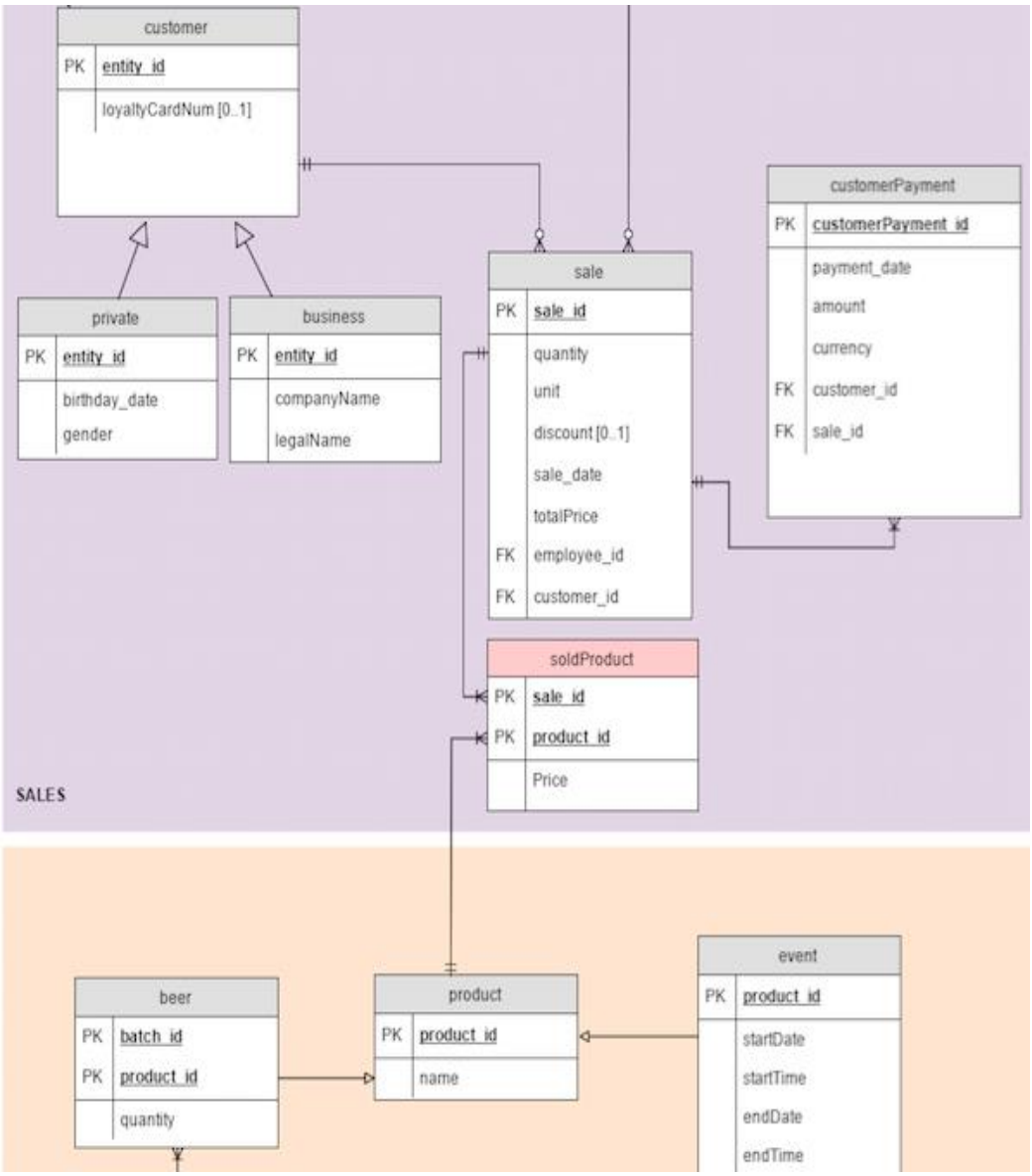
Indeed, all the stakeholders — suppliers, customers or employees — are recorded in the database with their profile information (name, language, picture, etc.), contact information (email, phone number, website) and address. The entities supplier, customer and employee are thus sub-entities of entity.



8.3 Part 3: Sales subject area

The first important aspect is the fact that we wanted to distinguish the private individual customers (private sub-entity) from the corporate ones (business sub-entity). Indeed, those two kinds of customers do not have the same attributes and the sales related to each type have to be distinguished as they consist in different strategies to adopt towards them.

We also separated payment from sale, as we want to anticipate all possible situations, such as the fact that a customer could pay with a partial invoice strategy. As well, we have to notice that a single sale can include several different products at the same time, and that a product can of course appear in several different sales.



9 Develop the model with the following steps

For developing our final Data Model, we decided to use steps 1-4 and 6.

9.1 Step 1: select the data of interest

The data of interest for La Nébuleuse remain in the fact of being able to identify and measure its productivity on the production, client and supplier sides. This aspect is directly linked to the several business questions that we could identify from our discussion with the CEO.

According to what we already have in the Business Data Model, here are our data of interest:

- **Sales**

  It is important for La Nébuleuse to be able to identify the popularity of its products through the client's purchases. One of the business questions was to know, which is the most popular/profitable product. It is also interesting to know who are the important customers, in order to be able to directly target them with specific marketing campaigns or attractive prices for example. The enterprise wants to know the evolution of some financial aspects such as sales. Finally, La Nébuleuse wants to be able to anticipate the need of components involved in the production of a particular beer, considering exceptional large orders.

- **Orders**

  It is essential to optimize their procurement policy, in order to have a better management of the components they do need and when they should order. Therefore, they should be able to track all their payments to proceed to financial analysis.

- **Production** Lines

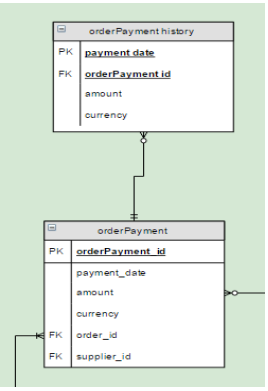
  The interesting data concerning the production lines is the total production line duration, the number of technical problems, the stock out warning threshold, etc. All these aspects should be available in order to measure and optimize the production and to efficiently increase the productivity of La Nébuleuse.

-

Step 2: add time to the key

It is crucial for La Nébuleuse to monitor the history of some data, as the Data Warehouse Data Model is said to be "over-time", unlike the Business Data Model. Consequently, we thought it is important to monitor the incoming and outgoing payments, the sales and the orders and the production batch.

To do that, we added in each entities we enumerated previously, an attribute called: ..._date. Then we linked the entity to a new one having the same title followed by 'history'. This entity is able to record all the time-related transactions. The figure on the right shows how we proceeded for the orderPayment entity.



9.2 Step 3: add derived data

With the purpose of facilitating the access to summarized and crucial information, we added some derived data to our model, which would allow us to avoid the need of time-consuming mathematical operations. Here is a list of derived data which are useful for La Nébuleuse, considering their business needs:

- The number of sales per customer, in order to identify the ranking importance of clients (customer entity)
- The number of orders per supplier, to identify the most important suppliers for the procurement strategy (supplier entity)
- Reordering point (stock out avoidance): A warning should exist in order to avoid the risk of stock out (rawMaterialStock entity)
- The number of problems occurrence per production line and also the total duration of a production line (productionLine entity)

9.3 Step 4: determine granularity level

For La Nébuleuse the level of granularity should be sufficient to:

- Support the current business needs, by providing consistent answers.
- Anticipate the future business needs, considering the fact that is is a fast growing company with several projects planned.
- Avoid complexity.
- Respect the cost policy. Indeed, it is still a volatile company, which should monitor closely and avoid unjustified costs.

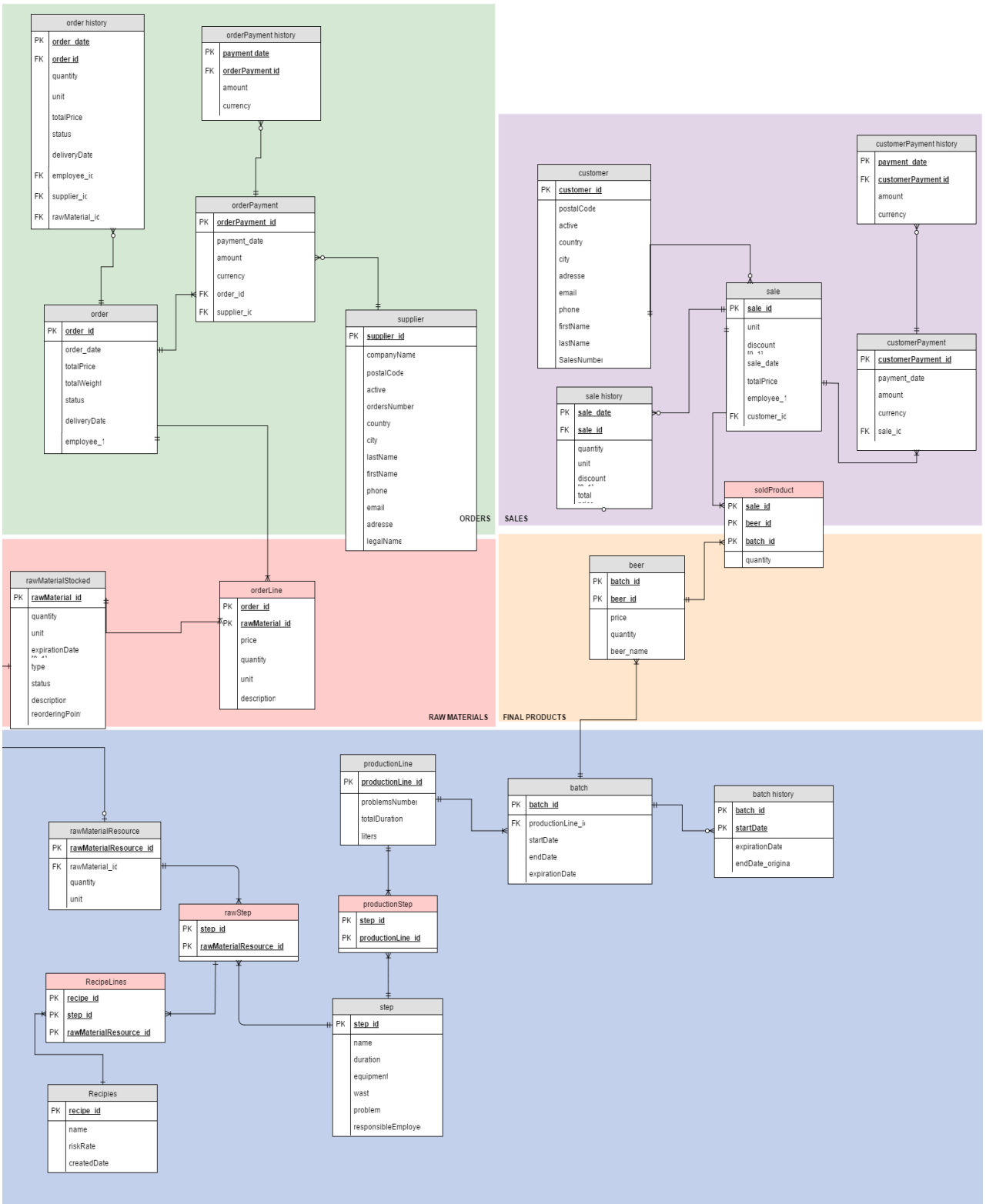
Considering these aspects, the current level of granularity of the Data Warehouse Data Model, is sufficient.

9.4 Step 6: merge entities

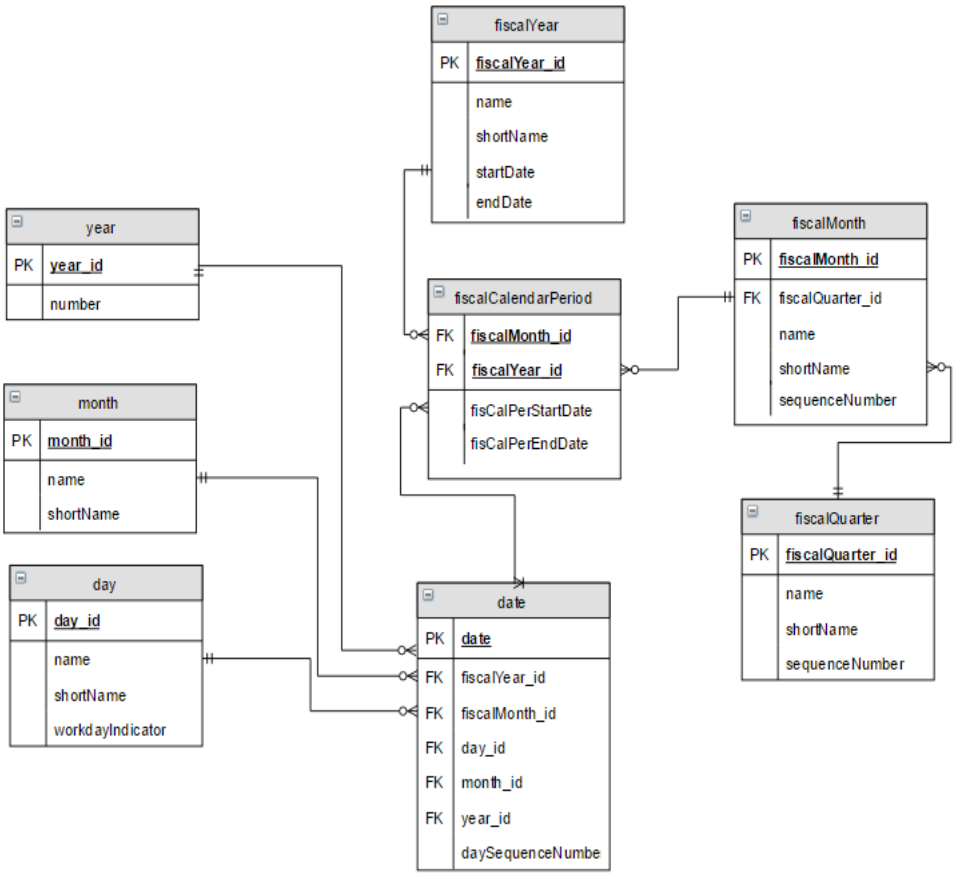
This part was done during the data of interests selection. More precisely:

- We merged address, country, city and their attributes directly in the customer and supplier entities.
- We followed the same approach with equipment, employee affectation, waste and problem, which were directly merged in the entity step.

9.5 Data Warehouse model



10 Add calendar and hierarchies into your model



Even if the company main focus is manufacturing, we selected the 4-5-4 fiscal calendar as we want La Nébuleuse to be able to monitor payments, orders and sales, but also because they are especially proactive during weekends through events, visits, etc. Furthermore, their business is not developed enough in order to have an utility in having a week centric calendar.

The entity “date” is the junction with the calendar and the rest of the Data Warehouse Data Model.

11 Import your data to database (Access, Sqlite, etc)

We decided to choose postgresql with pgAdmin because we are used to work with this environment. Here is an example of the implementation of three tables: Customer payment, Beers and Sold_product, which is a joining table between sale and product with a composed primary keys.

```
CREATE TABLE Customer_payments
(
customer_payment_id int NOT NULL,
payment_date DATE,
amount int,
currency VARCHAR (20),
sale_id int NOT NULL,
PRIMARY KEY (customer_payment_id),
FOREIGN KEY (sale_id) REFERENCES Sales(sale_
);

CREATE TABLE Beers
(
beer_id int NOT NULL UNIQUE,
batch_id int NOT NULL UNIQUE,
quantity VARCHAR (20),
beer_name  VARCHAR (20),
PRIMARY KEY (beer_id,batch_id)
);
```

```
CREATE TABLE Sold_products
(
sale_id int NOT NULL,
payment_date DATE,
amount int,
currency VARCHAR (20),
beer_id int NOT NULL,
batch_id int NOT NULL,
price DECIMAL(5,2),
```

In order to test our model and do queries, we imported random data with a little script in java. The following picture shows an example of how to populate the customers table. We repeated the process for each table.

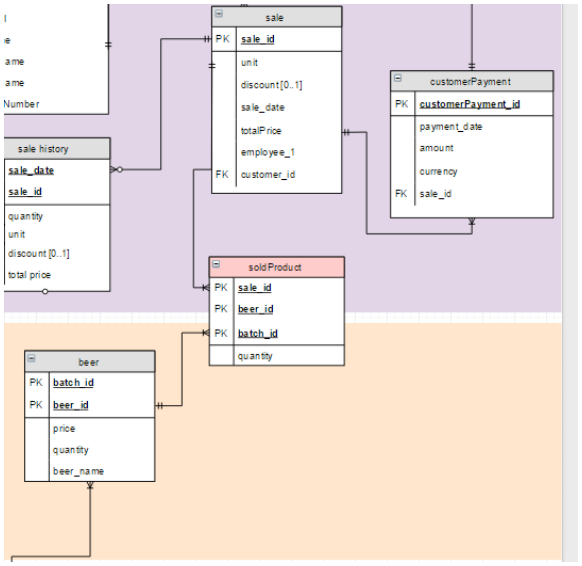
```
    Connection c = null;
    Statement stmt = null;
    try {
        Class.forName("org.postgresql.Driver");
        Connection connection = null;
        PreparedStatement pst = null;

        connection = DriverManager
                .getConnection("jdbc:postgresql://127.0.0.1:5432/neb",
                        "postgres", "1234");
        System.out.println("Opened database successfully");
int counter = 1;
        String fname[] = {"Levi", "Duncan", "Fletcher", "Tyler", "Troy", "K
        String city[] = {"Lausanne", "Genève", "Yverdon", "Neuchatel", "Ber
        Random rdm = new Random();
        do {
            String stm = "INSERT INTO customers"
                    + " (customer_id,firstname,city) "
                    + " VALUES(?,?,?)";
            pst = connection.prepareStatement(stm);
            pst.setInt(1, counter);
            pst.setString(2, fname[counter-1]);
            pst.setString(3, city[rdm.nextInt(6)]);
            pst.executeUpdate();
            counter++;
        } while (counter < 101);

        pst.close();
        connection.close();
    } catch (Exception e) {
        System.err.println(e.getClass().getName() + ": " + e.getMessage());
        System.exit(0);
    }
    System.out.println("Table created successfully");
```

12 Focus on three important parts of the final model

12.1 Example 1 : Favorite Beers (most sold beer)

One interesting thing for La Nébuleuse is to know which beers are the most sold. To do so, we proceed in two steps.

First, we show the quantity sold and the beer name based on the different sales. Then we add a quick query to join sale beers and sold product tables, and then we can see the different orders.



	sale_id integer	quantity integer	beer_name character varying(20)
1	31	193	Grinch
2	11	499	Grinch
3	38	361	Grinch
4	62	175	Stirling
5	59	354	Grinch
6	54	331	Grinch
7	10	235	Stirling
8	95	374	Stirling
9	52	317	Grinch
10	51	357	Grinch
11	98	323	Stirling
12	56	224	Grinch
13	24	200	Grinch
14	63	249	Grinch
15	11	372	Stirling

```
SELECT sold_products.sale_id,sold_products.quantity,beer_name FROM beers
INNER JOIN sold_products ON sold_products.beer_id = beers.beer_id
AND sold products.batch id = beers.batch id;
```

Second, we create an aggregative column of the quantity called totalSold and we join the sold product and the beer table. Then we do a group by beername and order by totalSold. As well, we compute the sales revenue equal to the beer price times the total sold. As a result, we get that the Embuscade beer is the most popular one, followed by the Grinch and Stirling.

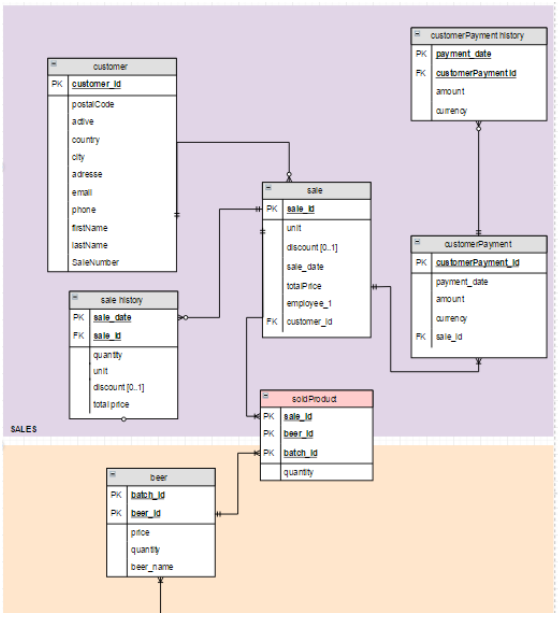
```
SELECT beer_name,sum(sold_products.quantity) AS TotalSold,beers.price,
       SUM(sold_products.quantity*beers.price) as salesRevenue  FROM beers
       INNER JOIN sold_products ON sold_products.beer_id = beers.beer_id
       AND sold_products.batch_id = beers.batch_id
       GROUP BY beer_name,price ORDER BY totalSold DESC ;
```

	beer_name character varying(20)	totalsold bigint	price integer	salesrevenue bigint
1	Embuscade	13194	2	26388
2	Grinch	11800	3	35400
3	Stirling	9648	2	19296

12.2 Example 2: customers ranking

It is also important for La Nébuleuse to see which customers are the most important. So we can do a query on the customer, the sales, the sold_product and beers tables to get a list of the customer purchases and we create a sum of the sold_product times the beers price in order to find the best one. We can see with this example that Lamar is the top customer.

```
SELECT customers.customer_id,firstname,
SUM(sold_products.quantity*beers.price) AS TotalPurchase  FROM customers
INNER JOIN sales ON sales.customer_id = customers.customer_id
INNER JOIN sold_products ON sales.sale_id = sold_products.sale_id
INNER JOIN beers ON beers.beer_id = sold_products.beer_id
GROUP BY customers.customer_id
ORDER BY TotalPurchase DESC
```

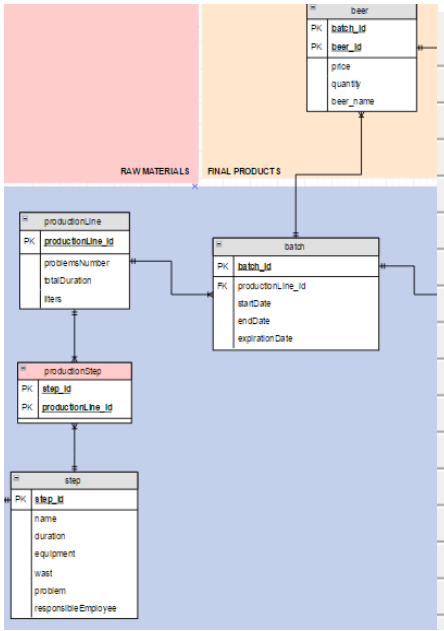


	customer_id integer	firstname character varying(20)	totalpurchase bigint
1	67	Lamar	6252
2	23	James	3456
3	25	Fitzgerald	3379
4	78	Jackson	3372
5	92	Carson	3149
6	39	Ashton	2887
7	82	Slade	2757
8	9	Uriah	2756
9	28	Burton	2711
10	33	Paul	2413
11	30	Leo	2075
12	43	Kenneth	2061
13	94	Connor	2016
14	34	Kevin	1912
15	32	Kirk	1870
16	4	Tyler	1753

12.3 Example 3: Beer Production

As a third example, we will now focus on the beer production, by identifying how long it takes to produce each beer. To do so, we modelize a step table and a production line table. The production of one kind of beer needs several steps and each step has a specific duration.

```
SELECT beers.beer_name,steps.name AS step_name,duration FROM beers
INNER JOIN batchs ON batchs.batch_id = beers.batch_id
INNER JOIN production_lines
ON batchs.production_line_id = production_lines.production_line_id
INNER JOIN production_steps
ON production_lines.production_line_id = production_steps.production_line_id
INNER JOIN steps ON production_steps.step_id = steps.step_id ;
```



	beer_name character varying(20)	step_name character varying(20)	duration integer
1	Stirling	Filtrage	44
2	Stirling	Fermentation	120
3	Stirling	Maltage	33
4	Stirling	Germination	135
5	Stirling	Emboutaillage	35
6	Stirling	Concassage	46
7	Embuscade	Concassage	46
8	Embuscade	Fermentation	120
9	Embuscade	Germination	135
10	Embuscade	Trempage	129
11	Embuscade	Maltage	33
12	Embuscade	Filtrage	44
13	Embuscade	Emboutaillage	35
14	Embuscade	Houblonnage	167
15	Grinch	Maltage	33

And now we can find the total production duration by making the sum of each single duration, group by the beer's name and then we find the duration for each beer.

```
SELECT beers.beer_name,sum(duration) AS totaltime FROM beers
INNER JOIN batchs ON batchs.batch_id = beers.batch_id
INNER JOIN production_lines ON batchs.production_line_id = production_lines.production_line_id
INNER JOIN production_steps ON production_lines.production_line_id = production_steps.production_line_id
INNER JOIN steps ON production_steps.step_id = steps.step_id
GROUP BY beer_name
ORDER BY totaltime DESC
```

	beer_name character varying(20)	totaltime bigint
1	Embuscade	709
2	Grinch	537
3	Stirling	413

13 Conclusion

After having identified the real business needs of La Nébuleuse, we were able to address them proactively by following the project's scope provided by the professor.

At the beginning of this project, we had determined three main challenges that La Nébuleuse is currently facing: the decentralization of the data, the traceability of the problems encountered and the assignment of responsibilities.

With the help of the knowledge acquired during the semester, we deepened our analysis step by step and were able to address those challenges. Moreover, the three intermediary presentations allowed us to step back and to criticize the project progress, by also including the remarks of the professor's assistant.

In conclusion, we think that the Data Warehouse Data Model created is a considerable potential asset that La Nébuleuse could use to not only optimize their production and logistic, but also to support their business development strategy.