



DISTRIBUTED COMPUTING

Seminar - BonÀrea IT - Technology in BonÀrea (Past and present)

Marc Cervera Rosell - 47980320C

Academic course 2022 - 2023

Bachelor's degree in computer engineering

Contents

Introduction	1
Activity questions	2
Question 1	2
Unibasic	2
Visual Basic	3
ASP/PHP	4
jQuery/Bootstrap	4
Polymer	5
SPA/PWA	5
Java/JAKARTAEE	6
Microprofile	6
Docker/Kubernetes	7
WAF	7
SOC/SIEM	7
SQL Server	7
MySQL/MariaDB/InfluxDB/MongoDB/Redis/IndexedDB/Universe	8
Elastic search/apache lucene - apache solar	9
Queues	9
Saga pattern	10
Question 2	10
Question 3	14
Question 4	15
Question 5	15
Question 6	15
Question 7	16
Conclusions	16

List of Figures

1	BonÀrea IT's logo	2
2	Example of Unibasic's code	3
3	Visual Basic's starting layout	3
4	jQuery code example	5
5	SPA/PWA schema	6
6	Jakarta's logo	6
7	Microprofile's logo	6
8	WAF's logo	7
9	SQL server's logo	8
10	From left to right and from up to down. Logos of: MySQL, MariaDB, influxDB, mongoDB, redis, indexedDB and universe.	9
11	From left to right. Apache lunar and apache solr.	9
12	Saga pattern according to a BonÀrea's order	10
13	Apps' server	14
14	From left to right: Docker's logo and Kubernetes' logo	14

Introduction

On November 23rd, Sergio Trujillo, a BonÀrea worker, came to the distributed computing class to speak about his job in the company. BonÀrea has a vast experience in the agri-food sector. The company develops all the necessary livestock, industrial and commercial activities to arrive to the consumer with no intermediaries.

From 1959, the company has been incorporating in the productive, business and commercial structure all the necessary elements to perform a vertical integration and, in this way, close the complete productive circle of the meat product. This company, however, has more business lines, such are; animal feeding, agricultural services, energy, finances, insurances, consultant, communications, and supermarkets. Also, has some social actions as BonÀrea foundation assistance and BonÀrea foundation sport.

Under the slogan “innovation is our breath”, BonÀrea has always bet on technology and tried to keep it in mind in all the productive cycle. Starting with the digitalization of the primary sector, going through the industrial activities and finally with the distribution of their products. This is possible thanks to a team formed by more than 200 professionals distributed in different areas inside the company.

Under the slogan “innovation is our breath”, BonÀrea always has bet on technology and tried to keep it in mind in all the productive cycle. Starting with the digitalization of the primary sector, going through the industrial activities and finally with the distribution of their products. This is possible thanks to a team formed by more than 200 professionals distributed in different areas inside the company.

Referring to the technological development, the company has always bet for its own personal, by providing all kinds of formations and giving the chance of having a professional development inside an area where, historically, always has had shortcomings and challenges. The BonÀrea’s technological area is segmented in 8 different subareas: App development, Big data, E-commerce, ERP solutions, AI, industry 5.0, cybersecurity and systems.

The first computer, arrived to the company in 1969. From then until nowadays, the company developers have written thousands of code lines and the company data centres have processed millions of data and petitions to make all the services have an optimum stability. All of this is achieved analysing and monitoring all the data 24 hours a day, 7 days a week. In the following image, the BonÀrea IT’s logo can be seen.



Figure 1: BonÀrea IT's logo

Activity questions

Question 1

What main technologies do they use and for what purpose do each of them?

Unibasic

UniBasic is an interactive Business BASIC development language that operates on a wide range of Unix-based systems. This technology is currently used as a database. → BonÀrea uses this technology for the boxes.

The boxes are open-air centres where you can collect your food purchase. There are available fridges and freezers.

The biggest disadvantage, it's that Unibasic uses as many licences as open terminals.

The biggest disadvantages of Visual basic are that the client have to install libraries and software, and uses as many licenses as open terminals.

ASP/PHP

These two technologies are programming languages that adapt well, specially, to the web developing. The main difference between them is that ASP is property of Microsoft and PHP has a free software license. → BonÀrea used these two technologies to build the webpage in the past.

Let's see an example of PHP code:

Let's begin with the server side:

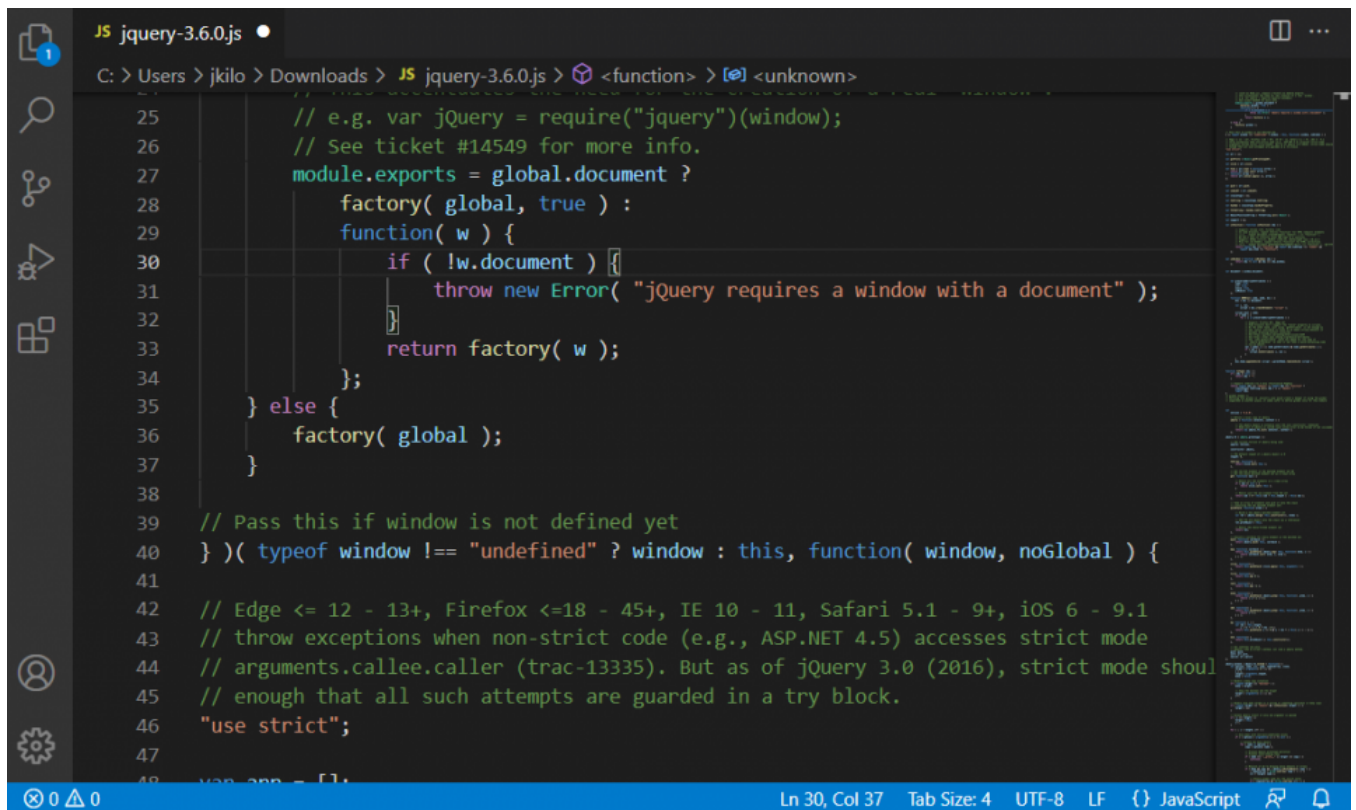
```
<html>
  <head>
    <tittle>PHP Test</tittle>
  </head>
  <body>
    <?php echo '<p>Hello World</p>'; ?>
  </body>
</html>
```

The biggest disadvantage of using this technologies are that each request opens and closes independent connections to the DB and the full page is sent on each query.

While it's that using the browser as the terminal provides more security, it's hard to control the external components and devices and there are differences between browsers.

jQuery/Bootstrap

With the advent of web 2.0, jQuery was one of the most widely used libraries to facilitate DOM management and make AJAX calls. → BonÀrea used this technology to build the webpage in the past.

A screenshot of a code editor with a dark theme. The editor shows the jQuery 3.6.0.js file. The code is written in JavaScript and includes comments explaining various features and browser compatibility. The code is organized into a factory function that checks for the presence of a window and document object. The status bar at the bottom indicates the current line is 30, column 37, and the file is UTF-8 encoded.

```
25 // e.g. var jQuery = require("jquery")(window);
26 // See ticket #14549 for more info.
27 module.exports = global.document ?
28   factory( global, true ) :
29   function( w ) {
30     if ( !w.document ) {
31       throw new Error( "jQuery requires a window with a document" );
32     }
33     return factory( w );
34   };
35 } else {
36   factory( global );
37 }
38
39 // Pass this if window is not defined yet
40 } )( typeof window !== "undefined" ? window : this, function( window, noGlobal ) {
41
42 // Edge <= 12 - 13+, Firefox <=18 - 45+, IE 10 - 11, Safari 5.1 - 9+, iOS 6 - 9.1
43 // throw exceptions when non-strict code (e.g., ASP.NET 4.5) accesses strict mode
44 // arguments.callee.caller (trac-13335). But as of jQuery 3.0 (2016), strict mode should
45 // be enough that all such attempts are guarded in a try block.
46 "use strict";
47
48 var _jQuery = {};
```

Figure 4: jQuery code example

Polymer

Polymer is an open-source JavaScript library for web applications using web components.

→ BonÀrea used this technology to built his page. Polymer became obsolete.

SPA/PWA

PWA is understood as a progressive web app. It is a mobile app in a browser that has gradually become an alternative to native apps. The term PWA was coined originally by Google, which established a checklist to define what creates a PWA. PWA is built from web technologies that are quite similar to us, like HTML, JavaScript, and CSS.

SPA stands for a single-page application. It is a web application in which its content is dynamically loaded without reloading the page.

In SPA, when you open one page, all HTML and CSS are loaded instantly. Then, when you move around this site, only the updated data is loaded; the page is not necessary to reload. This is the reason why the user experience becomes smoother without wasting time waiting for loading.

So, BonÀrea uses these technologies to create his website.

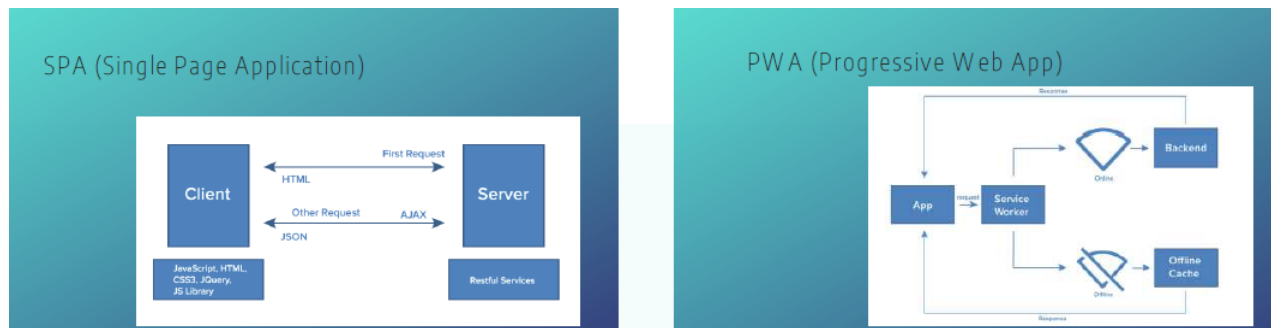


Figure 5: SPA/PWA schema

Java/JAKARTAEE

These technologies are used to code all the backend.

JakartaEE is the new equivalent of JavaEE. This means that the company has to migrate from JavaEE to JakartaEE. JavaEE (JakartaEE now) provided a lot of tools to work efficiently and in an ordered way.



Figure 6: Jakarta's logo

Microprofile

This technology is currently used to update dependencies from *javax* to *jakarta*.



Figure 7: Microprofile's logo

Docker/Kubernetes

BonÀrea uses these technologies to create the structure the software structure through code.

WAF

This technology is the most recent implementation speaking of security.



Figure 8: WAF's logo

SOC/SIEM

This technology is used by the company for security issues. Concretely, is used for ensuring the security of the information and reviewing alerts that will detect an attack.

SQL Server

SQL Server, is used for the data integration to the business intelligence systems.



Figure 9: SQL server's logo

MySQL/MariaDB/InfluxDB/MongoDB/Redis/IndexedDB/Universe

All of these technologies are databases.

Except MongoDB, the other ones are SQL or SQL-like databases. MongoDB is a non relational database and is used as a support to provide more velocity.

Redis is used as a caché. Redis is a key-value DB and the where the "value" values are JSON.

InfluxDB is used in the company to manage the the operational technology of the company and is very similar to SQL.

Universe is the database that contains approximately the 90% of the code that the workers codify and have codified all over the years. It's a multivalue database and is used by BonÀre since the 70's.

Finally, IndexedDB, is a database that is integrated inside the browsers.



Figure 10: From left to right and from up to down. Logos of: MySQL, MariaDB, influxDB, mongoDB, redis, indexedDB and universe.

Elastic search/apache lucene - apache solr

These technologies are search engines and are used by the company because they provide many options to improve the obtained results.



Figure 11: From left to right. Apache lucene and apache solr.

Queues

Actually, queues are not a technology. Actually are a data-structure that are integrated inside different technologies. In this section, appear messaging brokers such as RabbitMQ, Kafka and ActiveMQ. These technologies are messaging brokers. So, are intermediary computer programs that translate a message from the formal messaging protocol of the sender to the

formal messaging protocol of the receiver.

Message brokers are elements in telecommunication or computer networks where software applications communicate by exchanging formally-defined messages.[1] Message brokers are a building block of message-oriented middleware (MOM) but are typically not a replacement for traditional middleware like MOM and remote procedure call (RPC).

One thing to highlight of Kafka, is that is less flexible than RabbitMQ but has the advantage that the messages are persistent and we can retrieve them.

Saga pattern

The Saga design pattern is a way to manage data consistency across microservices in distributed transaction scenarios. A saga is a sequence of transactions that updates each service and publishes a message or event to trigger the next transaction step. If a step fails, the saga executes compensating transactions that counteract the preceding transactions.

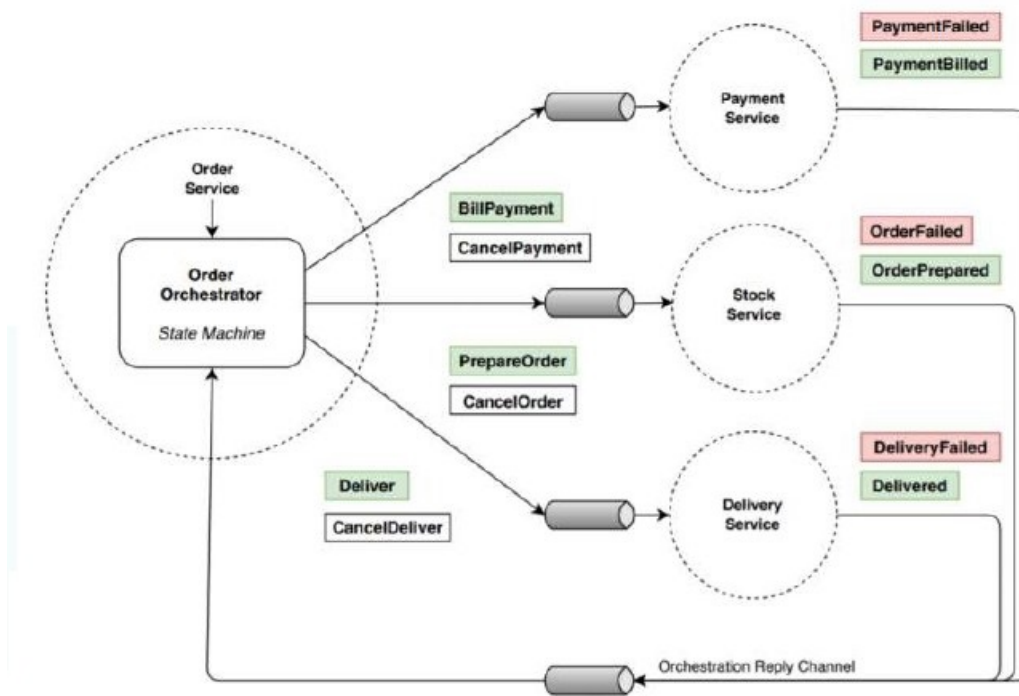


Figure 12: Saga pattern according to a BonÀrea's order

Question 2

Which criteria have they followed to choose the development technologies? Efficiency, performance, standarizartion, open systems, or does it respond to an

integration with old systems?

To answer the second question of this activity, all the technologies will be listed identifying the reason why they were chosen.

- Java
 - Standard.
 - Efficient.
 - Solid. → Has no weaknesses nor security gaps.
- Kubernetes
 - Efficient
 - * Allow working with multiple dockers.
 - * Allow saving the dockers logs.
 - * And more!
- WAF
 - Protective shield.
 - Detect the action of automated attacks.
 - App level (layer 7s) control.
- Unibasic
 - Fast.
 - Long term.
- ASP/PHP
 - Easy.

- On premise (No cloud)
 - Data protection.
 - Unrestricted access.
 - Own maintenance.
- MariaDB/MySQL
 - Replication between instances is very spontaneous.
 - GNU license.
 - Fast.
 - Easy integration with a wide variety of software tools.
- SQL server
 - Data security.
 - Frequent/Standard.
- InfluxDB
 - SQL-like language for queries.
 - Low latency (nearly real time).
 - OSS license.
- MongoDB
 - No schema predefined → Flexibility.
 - No need extra format conversion.
 - SSPL license (Almost OSS license).
- Redis
 - Provides services continuously.
 - Can withstand failures.
 - Fast.
 - Clients can be implemented in all the popular programming languages.
- Apache lucene and Apache Solar

- Elastic search.
 - * Provide many options to improve the obtained results.
- Universe
 - Provides a user interface (Command line).
 - Programming in Unibasic.
 - * In the previous section, it has been explained that the origins of the company are based on this language.
 - Long term. → The company has a lot of years of experience and self-developed resources.
- Queues
 - Allow decoupling.
 - It's fault tolerant.
 - Allow broadcasting.
 - Flow control.
 - Load balancing. → Load balancing is the process of distributing a set of tasks over a set of resources (computing units), with the aim of making their overall processing more efficient. Load balancing can optimize the response time and avoid unevenly overloading some compute nodes while other compute nodes are left idle.
- JavaEE/Jakarta
 - GNU license.
 - Is developen un Java, hence, complies with the Java properties.
 - Simplified architecture.
 - Freedom of choice in servers, tools, and components.
 - Integration with existing information systems.
 - Scalability to meet demand variations.
 - Flexible security model(J2EE).

Question 3

What software architecture is commonly used in BonÀrea? (Comment if it's a specific design for each application or if there exist a general architecture design).

The main architecture of the company is the virtual servers. They have +500 virtual machines, +1 petabyte of storage, +8 terabytes of RAM and +1 petahertz of processing power. They have an applications' server that follows the following scheme:

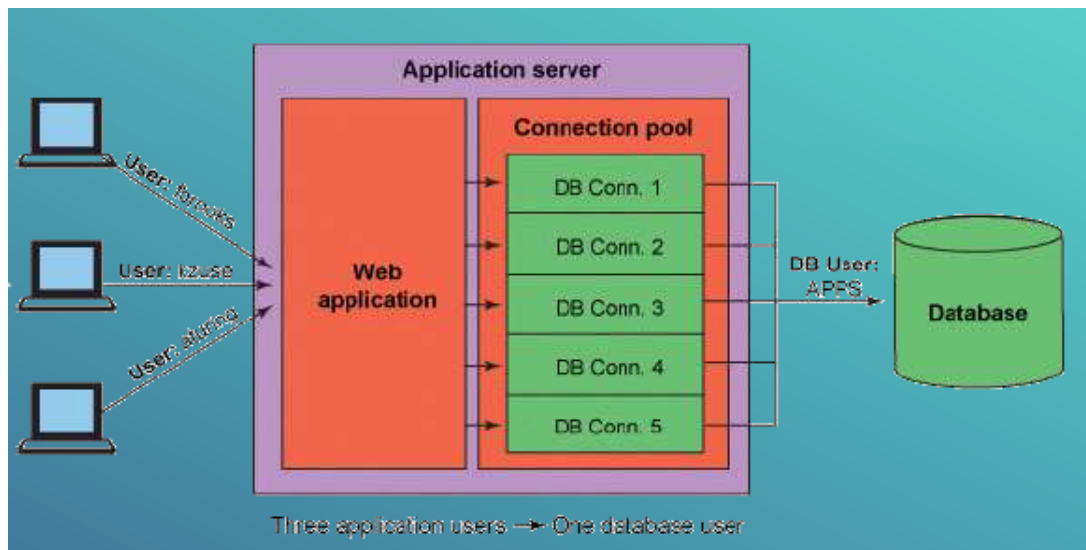


Figure 13: Apps' server

They use Dockers too, to build the structure of a program through code, and finally they use Kubernetes.



Figure 14: From left to right: Docker's logo and Kubernetes' logo

Question 4

What paradigms of those seen in classroom can you identify that are used on the solutions provided by the lecturer on that company? Discuss about if there has been an evolution or if there are paradigms that have not changed over time.

During the lecture, I was able to identify four different programming paradigms. These paradigms are:

1. Message-oriented.
2. Service-oriented.
3. Object-oriented.

Question 5

This company have many different business areas. In most cases it is necessary and important for the company to share these data. How do they solve the sharing of data and/or integration of different applications?

Until 2016 this aspect was not taken in consideration. In 2016 BonÀrea created the "Direcció general". With the creation of this department, the company became centralized, speaking in terms of billing. A couple of years later, they realized that this was not a perfect system, and they decided to decentralize the company again. But this time, it was not a total decentralization. Nowadays, the company performs a hybrid system in terms of billing. Now the question is. How can a worker of the company know what is being done in another department? The answer is easy, a worker can know it through BonÀrea IT.

Question 6

Regarding the concepts seen in class, how do they address aspects such as availability, accessibility, transparency, openness, scalability, fault tolerance? How do they deal with security aspects?

In terms of security, they use CVE to identify, define and catalog publicly disclosed cybersecurity vulnerabilities. They are forming the users through basic cybersecurity courses. Themselves are sending fishing emails and if the user falls into the trap, the company sends that user to the course.

Previously, I've commented about virtual servers. Virtual servers provide a cost reduction, scalability, personalization, easy maintenance and an easy data recovery.

In terms of data sharing, they started passing the data with 3+1/2-inch floppy disks. Later they changed the system and they were sharing data via telephone. The third data sharing improvement was sharing the data via internet (only 1 time per day) and now, they're sharing data via internet but they're sharing it in real time.

BonÀrea is currently renewing the communications ring with a fiber speed of 40 Gb/s x2. In such a way that if one side of the ring goes down, the other side keeps on. It's true, the fact that if one side of the ring goes down, the speed is reduced to 40Gb/s.

The network of the company has approximately 10.000 network ports with 150 subnetworks. —> The management of the entire system requires the control and the monitorization of all the resources (VLAN).

Using queues, BonÀrea achieves concepts as failures tolerance, decoupling, broadcasting, flux control and load balancing.

The data sharing among the business areas is performed with web services.

Question 7

What about the future trends in tools and software development in the company?

The company is focused in target all the technology in web services.

Conclusions

The lecturer claimed that BonÀrea bets for technology, but I don't agree at 100%. I don't agree because they're using technology that is completely obsolete. Two examples of this are that they are using Unibasic and Rocket Universe.

In the other side, they're trying to renew his technologies day to day, but in the BonÀrea's case will cost a couple of years because they have many code to renovate. For example, the lecturer assured that the company used JavaEE but they're now migrating the JavaEE code to Jakarta. The speaker assured that more than the 90% of the companie's code is written in Rocket Universe. In my opinion they should do an extra effort to migrate that code to more modern technologies.

Apart from my conclusions about the conference, I think that is an interesting activity to know how the company has evolved from his origins to now.

It is also interesting to know which technologies were used before those we use today. For example, in my case, I've never listened nothing about Unibasic.