Technical and economic approach

Crop traceability system

Ref: 2022.ACC.Bonnysa.01

INDEX

1. Introduction

Now...

Starting point

1. Introduction

Current situation

At Bonnysa, the entire process of growing its plants is controlled. From the planting of the seed, the grafting of the rootstock and variety to its development of the plant, so that they can count on the most suitable and high quality products with a 100% balanced structure.

In the Greenhouses, they have agricultural technology that allows them to achieve the best possible planting conditions for all their products. In this way, they achieve a perfect temperature and humidity, localized ferti-irrigation, fertilizer control, sunlight and of course, the irrigation system to avoid wasting water. During the harvest and selection, all its agricultural operators select the tomatoes, vegetables and fruits that they know will pass the subsequent internal quality controls with a high percentage of probability. Thanks to a strict selection protocol, at Bonnysa we only have the products that give the highest quality and flavour to your meals.

Bonnysa has multiple greenhouses and they need a lot of control in their systems, in addition to a lot of flexibility, not only of quality, but also of costs. In addition, having the option to perform a backward audit of food products

Current situation

Different activities are carried out in the field through tablets with tag readers that allow the digitization of the production processes by uploading the information to the central servers:

Worker QR / Crop Line QR	Crop harvesting - entry into the warehouse for quality control, prior to packaging	QR of Pallets – No. of boxes/ kg
		

Starting point

Based on the above, Bonnysa needs to implement a universal solution for all its crops in the group.

In this solution, it seeks to integrate three fundamental aspects of its business:

- Attendance control
- Production Control
- Information traceability

Starting point

Bonnysa, as part of its digital transformation, aims to create a traceability system that allows identifying and tracing the complete information available from its collection processes to the food processing part.

The aim is to create a new solution that allows us to face the new challenges that have arisen by being able to manage large amounts of data from the field in an agile way, as well as to be able to create new functions including disruptive technologies such as blockchain.

2. Objectives

Document and project...

2. Objectives

Project Objective

Bonnysa needs to homogenize the systems that allow traceability of origin in order to produce it, as well as to measure the production of its workers. Control, manage and supervise each of the business operations in an optimal way:

- Know how many containers are collected by each worker. The worker will choose their name from the workers in the list and link it to the container they have filled.

- Know in real time, who harvested, how much, when and where they did it (plot/row). Tracing all transactions through Blockchain ensuring that the information is 100% truthful and no one can modify it.

- Locate every action taken in the field, track quality issues, and provide corrective guidance to the specific worker to prevent future errors.

2. Objectives

Project Objective

Control and monitor:

- Real-time "targeting" for different work areas in different geographical locations
- Measurement of plot production per tonne-per-hectare/tonne-per-crop.
- Ability to compare workplaces.
- Effective control of individual activities instead of side activities.
- Identical management and monitoring capabilities across the entire managerial framework.
- Manage to collect and analyze agronomic data:
- Quantities harvested according to location in the plot/row
- Up-to-date logistical information that enables assessment of post-harvest fruit handling (sorting and packing).

Enable information analysis and alerts.

- Worker performance.
- Find problems in real time and be able to correct them in the field.
- Know the results of the harvest at the end of the day.

2. Objetives

Document objetives

Propose a technological solution to Bonnysa that meets the high-level requirements provided, outlining the general architecture of the applications that will form the solution, as well as the methodology for its development and planning.

The solution will consist of several components:

Web-based information management and real-time consultation platform, adaptable to different device screen sizes.

Android mobile application for field use.

1.Attendance control system to streamline worker entry and exit processes.

2.Ability to record each worker’s work breakdown, specifying which production lines or tasks they were engaged in and when.

3.Identification of appropriate devices and technology to automate this process, such as RFID cards, NFC, etc.

4.API system to facilitate data exchange and interoperability with other Bonnysa systems.

3. Scope

Project...

What software solution?

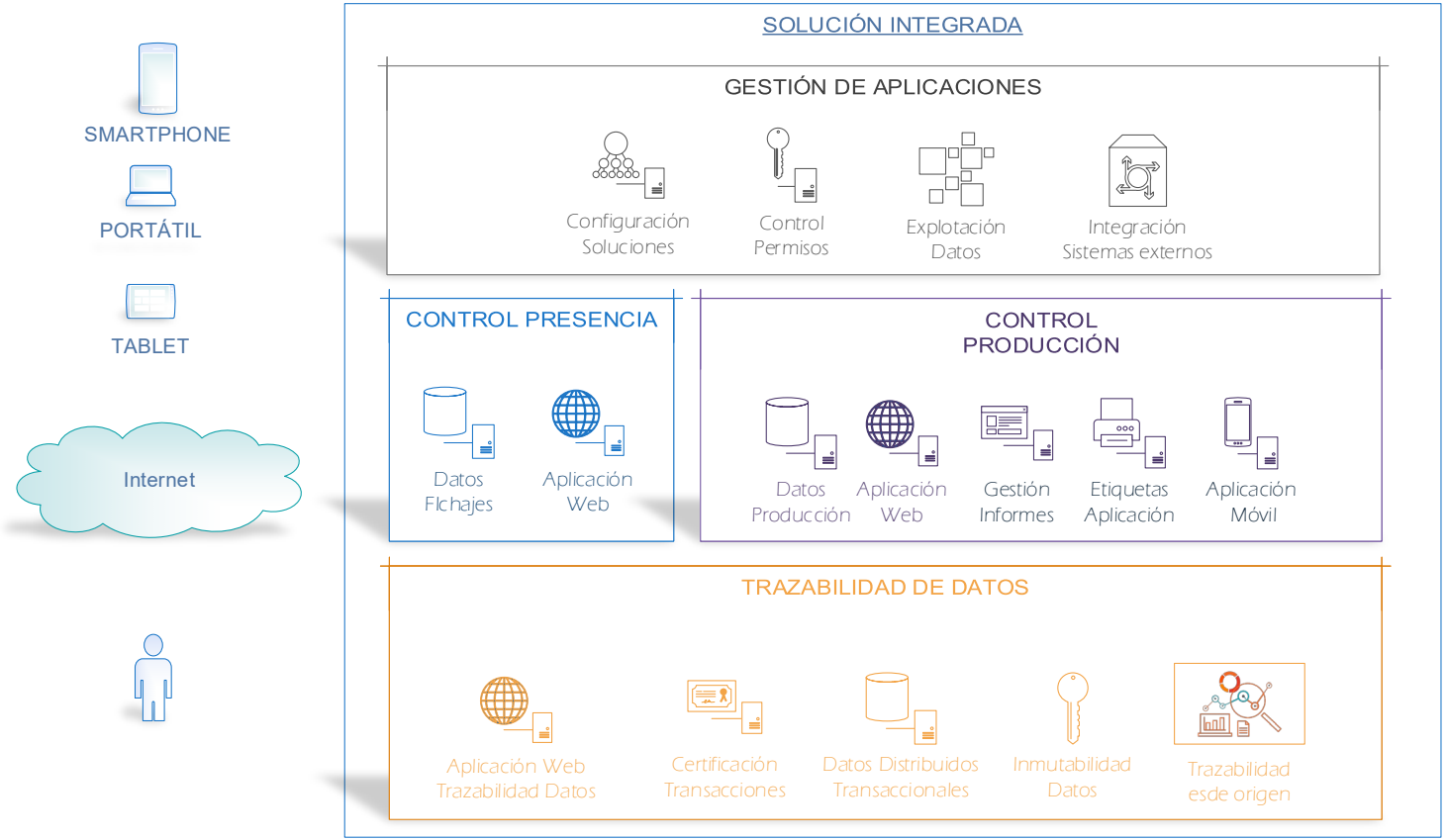
Solution

A solution will be developed that will allow the integration of different software applications, with centralized access to each of them through a flexible permission control system.

It will be based on a web application from where you can control user permissions and access the rest of the applications.

Users who need to access any of the systems independently can do so through the corresponding url or application

Solution - Architecture



Web application– Production Control

The web platform will allow the unified management of information regarding production tasks through different sections adapted to each type of information, among which will be:

- Worker/group management
- Sector/Group/History Management
- Management of Cultural Tasks
- Device Management
- Managing the working day
- Data / harvest / time management
- Sticker Management
- Quality Management

Web Application – Production Control

Different entities will be processed to allow the production processes necessary for the operation tasks both in the field and in the control or management of information and data verification:

- Same
- Crops
- Crops
- Gangs
- Workers/Groups....

- Tasks / Types of work
- Tags
- Locations
- Greenhouses / Corridors
- Types of plants
- Times

Web Application - Activities

The platform will allow, among others, to include the different activities to be carried out:

Select Worker (Group Name)	
Administrative	B. Branch
B. Stand	Order
B. Detail	Machinist
B. Mimosa	Pinche
Irrigation	Etc.

Select Agrotechnical Operations	
Cutting plants	Irrigation
Clean litters	Treatment
Putting on hangers	Crop cleaning
Plant	Cut Threads
Band	Wetering

Web Application – Reports

The platform will allow you to export generic pdf and Excel reports or configured adapted to Bonnysa's needs and plan recurring shipments of them, among them will be:

- Summary Activities / Last Day of Work
- Daily Farm Overview: With Options for Disaggregation by Kilos, Costs, and Workers
- Summaries by location
- Attendance Summary
- Harvest Summary: Scans, Kg/hour
- Weekly Summaries
- Quality Control
- Scanning/harvester/timing control
- Individual statistics: Including the kgs each worker has collected and locations

Web App – Charts & Dashboard

There will be control graphs associated with the information displayed with different levels of aggregation indicating information intended for command management or for decision-making of the type:

- Workers per group
- Workers by sector
- Industry information on map
- Production per hour
- Harvester Monitoring
- Harvesting group monitoring
- Harvesting of the sector

...

Mobile App – Field - Production Control

As part of the production control, and intended for use in the field, a mobile app will be made that will allow the tasks and times of workers and groups to be recorded on the different farms / greenhouses / corridors.

The application will be installed on tablets with a built-in reader that will allow readings of the different Datamatrix / QR / barcode labels.

On the Tablet it will be possible to associate and account for jobs to workers. Both the jobs and the quantities collected and the location where they are carried out will be associated by reading pre-designed labels so that the work on the app is very agile.

Mobile app- Production Control

The platform will have a main menu for use in the field where you can choose the function to be performed:

- Worker
- Agrotechnical Operations
- Location
- Greenhouse
- Plant Types
- Switch users
- Location options
- Scanning Options
- Configuration
- Delete Saved Data
- Management Tools

Mobile App - How It Works

It will usually be used by a crew manager who will associate:

- Jobs for the different workers
- Location of Work
- Weight in case of pickup
- Pallets and destination of the goods

Mobile App - Data

The app will use different web services / APIs that will allow the resident information to be obtained in a centralized database.
The exchange of information will be done securely through secure connection protocols, using https and json web tokens.

The information will be shared with the web application for information consultation and can be viewed in real time.

After receiving coverage or connection and through a layer of server services, the pending download and upload operations will be carried out, allowing an optimal user experience.

Mobile App – Offline Operation

The app will manage the data locally offline so that it works in areas with low coverage is optimal.

After receiving connectivity and through a layer of connectivity services with the central server, the pending download and upload operations will be carried out, allowing an optimal user experience, recording for each worker the breakdown of their working day: on which of the lines they have been working or on which tasks, and when.

Production Control

In general, the mixed Web-Mobile solution will allow Bonnysa to meet the general and particular needs set out by Bonnysa:

- Define different levels: Area (large crops), greenhouse, m2 and how many plants it has, line.
- Reusable worker/line barcodes
- The terminal registers by means of QR: personnel, doors of the greenhouses, streets, etc.
- Distribution of personnel by TASKS and STREETS, having information on the time that each one is dedicating to a task and the number of plants they treat. Greenhouse/Hour of People/Result Obtained
- Definition of operations that improve processes, such as checkout information.

...

Time & Attendance Solution

Accuro's presence control application will be adapted so that it can be integrated with different applications available to Bonnysa.

Accuro's timekeeping solution is very flexible and has great possibilities for adaptation:

- Customizable forms in various formats
- Multi-company
- Multi-calendar
- Configurable absences
- Signing automation
- Control reports to users and administrators
- Allows compliance with applicable regulations
- Adaptable for RFID clocking in – mobile devices / pcs

Time & Attendance Solution

It will allow when integrated with the production control web application:

- Be able to record for each worker the breakdown of their working day: which of the lines they have been working on or on which tasks, and when.
- To be able to find the right devices and technology to provide that automation. RFID cards, NFC, etc.

The solution can be integrated with the current LABOR MENTOR ERP as well as other payroll or human resources management applications

General characteristics of the solution

In general terms, the solution offered by Accuro will allow Bonnysa to:

- Exit a SaaS model
- BONNYSA's own model that can be used in all your crops
- Integration with any platform / Timekeeping / Labor / BI
- Cover current functionality FULLY
- Reuse the barcode system
- Reuse of the current model and adaptation made to different crops
- Resolution of PROBLEMS and improvements compared to the current solution such as Pallet Traceability (Now only the area from which a Pallet comes is known)

Information Traceability Solution

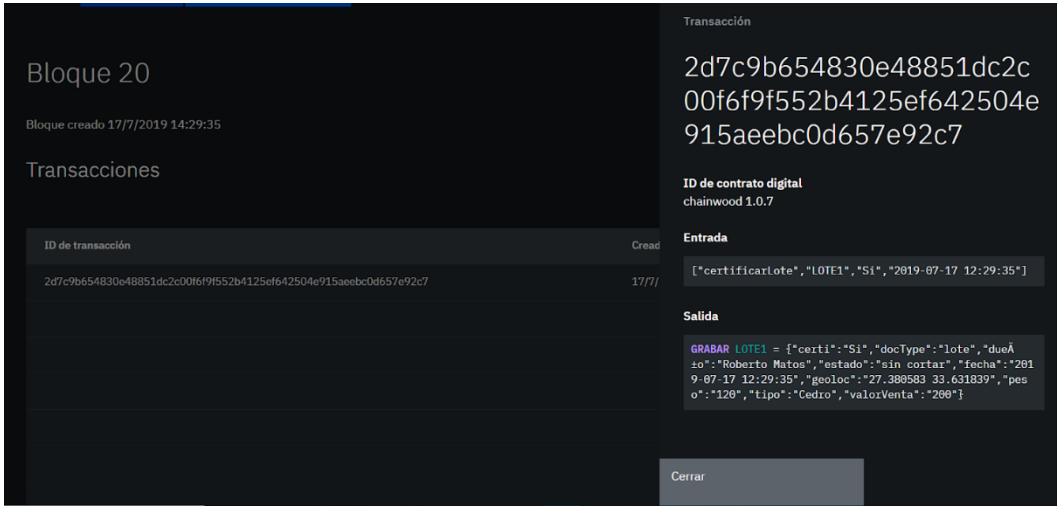
The platform will allow you to control the entire process of growing your plants by tracing the information back to the source.

In addition, on the traceability solution, ACCURO will apply Blockchain technology to the process that goes from the harvest of the crop, to the entry into the warehouse for quality control, prior to packaging.

In this way, it will be guaranteed that, in the event of a bad batch, it will be known what line of work it was and on what date to prevent other batches with the same undesirable quality from leaving.

Information Traceability Solution

There will be a web platform from which to verify each of the transactions carried out during the production control processes in order to ensure the traceability of the operations and link the data of the products with their location of origin and characteristics of the harvest.



Information Traceability Solution

Blockchain technology is essential when it comes to giving veracity to the information that the platform will show when the user requests information on the traceability of a raw material or product.

It is important to mention that due to the current state of maturity of this technology, it is not feasible to store large amounts of information on the blockchain due to its high cost and that is why offchain data will be combined with on-chain data to create a system that is capable of certifying that the data in the database has not been corrupted.

Specifically, the information related to each asset to be traced will be stored in a SQL database and the digital fingerprint of each record in the database will be the information that is stored in the blockchain.

Information Traceability Solution

Every time a transaction is made that adds, modifies or deletes information related to the traceability of an asset, a blockchain service will be consumed that will execute a Smart Contract and store the new digital fingerprint of that asset or its hash on the blockchain.

In order to verify on the blockchain that the database record has not been maliciously modified, the blockchain will be called to verify that the fingerprint of the database record and the one stored in the blockchain match. If this were the case, it would mean that the database record has not been modified by third parties. This information can be checked on the blockchain through the application's graphical interface or through the block explorer implemented on the blockchain itself.

BLOCK CHAIN
CADENA AGROALIMENTARIA

More detailed requirements to be defined

The proposed solution refers to the solution offered at the macro level. A more detailed catalogue of requirements will be made to allow adaptation to all the processes that Bonnysa requires during the early stages of development in order to determine, among others, the following aspects:

- Devices and technology suitable for this automation. RFID cards, NFC, etc.
- Reusable labelling
- External Systems Integration and Sizing Entities: labor / power BI

...

Web Application - Technology

The technological platform that will be used to carry out the developments regarding the website will be:

- ASP.Net Core Framework
- Angular
- Sql Server
- C#
- IIS
- Drupal
- WordPress

Web Application - Technology

Some of the characteristics for which we chose .Net technologies for the realization of the project are the following:

- Unify scheduling models
- Simplify development even more
- Provides a Robust and Secure Execution Environment
- It is independent of the programming language
- Interoperability with existing code
- Simplifies application installation and management
- It is extensible

The great development experience of the personnel involved

Web Application – Frontend Technology

Features and benefits of using Angular:

- Angular extends HTML by adding functionality and allowing you to create powerful dynamic templates.
- It is possible to use TypeScript but it is not mandatory.
- Framework that includes a large number of options and functionalities as standard that libraries do not normally include.
- Reusable code
- PWA Applications
- Opensource

Web App – Content Management

Features and advantages of using content management systems such as Drupal or Wordpress:

- Easy of use by having a friendly graphical interface and simplified content management.
- Speed in development with the use of predefined templates and themes.
- Personalization of content with the use of plugins or custom modules.
- Security by having regular updates and security extensions.
- User management with roles, groups and permissions that are integrated with a secure and robust authentication system.
- Multilingualism.

Database Storage - Technologies

Some of the features for which we chose the Microsoft Sql Server relational database management system:

MICROSOFT SQL SERVER FEATURES

- Transaction Support
- Scalability, stability and security
- Supports stored procedures
- It also includes a powerful graphical management environment, which allows the use of DDL and DML commands graphically. It allows you to work in client-server mode, where the information and data are hosted on the server and the terminals or clients of the network only access the information

The great development experience of the personnel involved

Mobile App Technologies

The technological platform that will be used to make the mobile application will be Android, developing it natively using Google's own libraries:

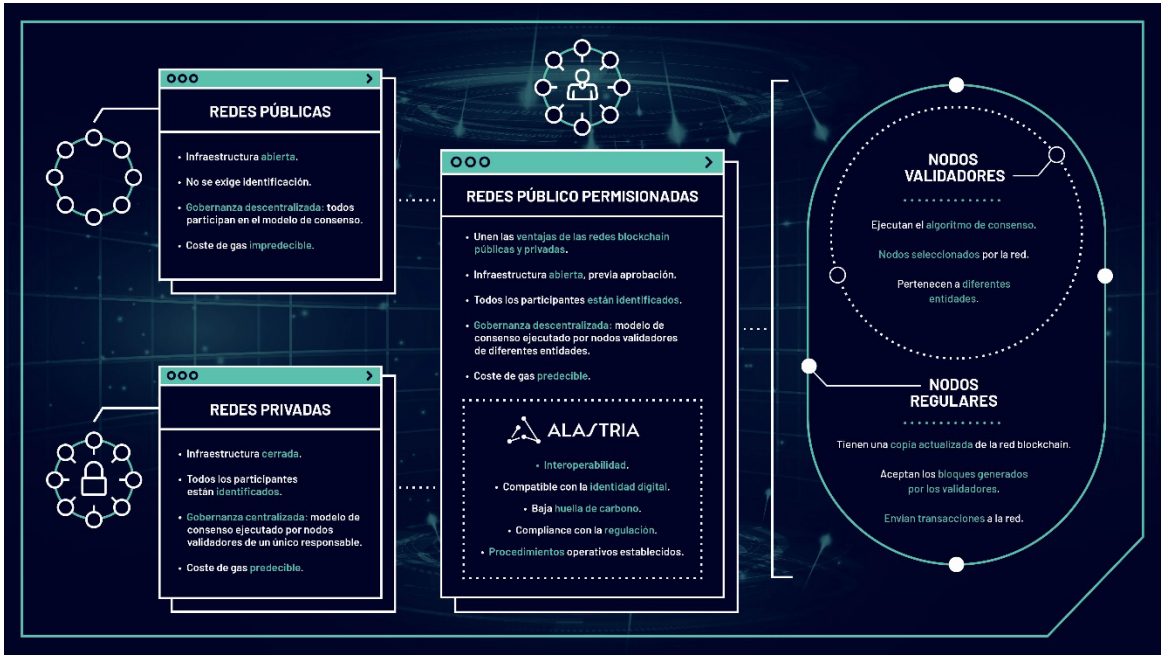
- Android SDK
- Kotlin

Technologies - Blockchain

Blockchain application based on Hyperledger.
Encryption of inter-node communications (TLS) and enabling an intermediate layer of events to update the information that is being plotted in the system.

Technologies – Blockchain - Alastria

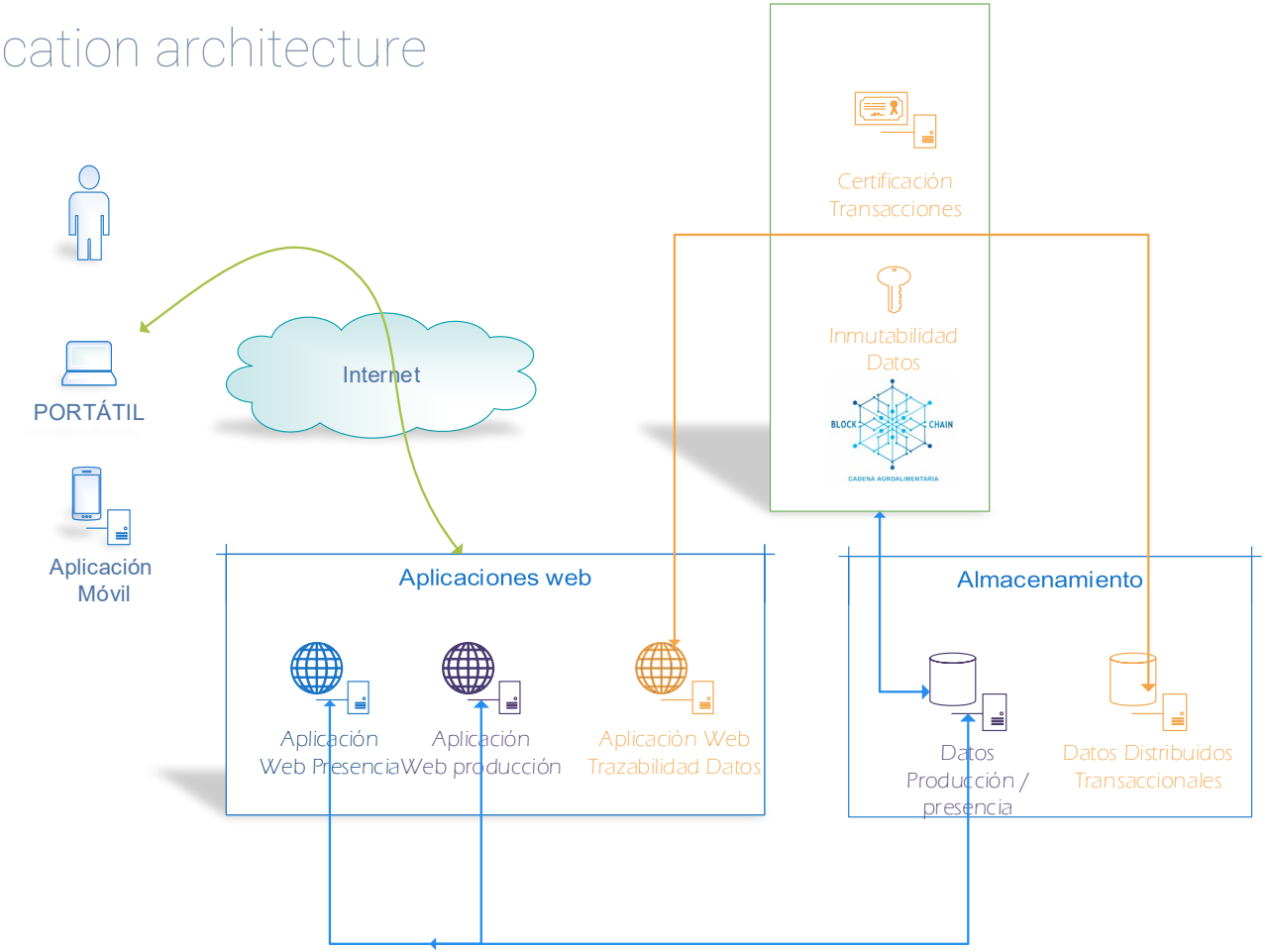
One of the largest public-permissioned and multi-sector Blockchain platforms in the world, which brings together companies, academia and public administrations with a common purpose: the promotion of decentralized technologies.



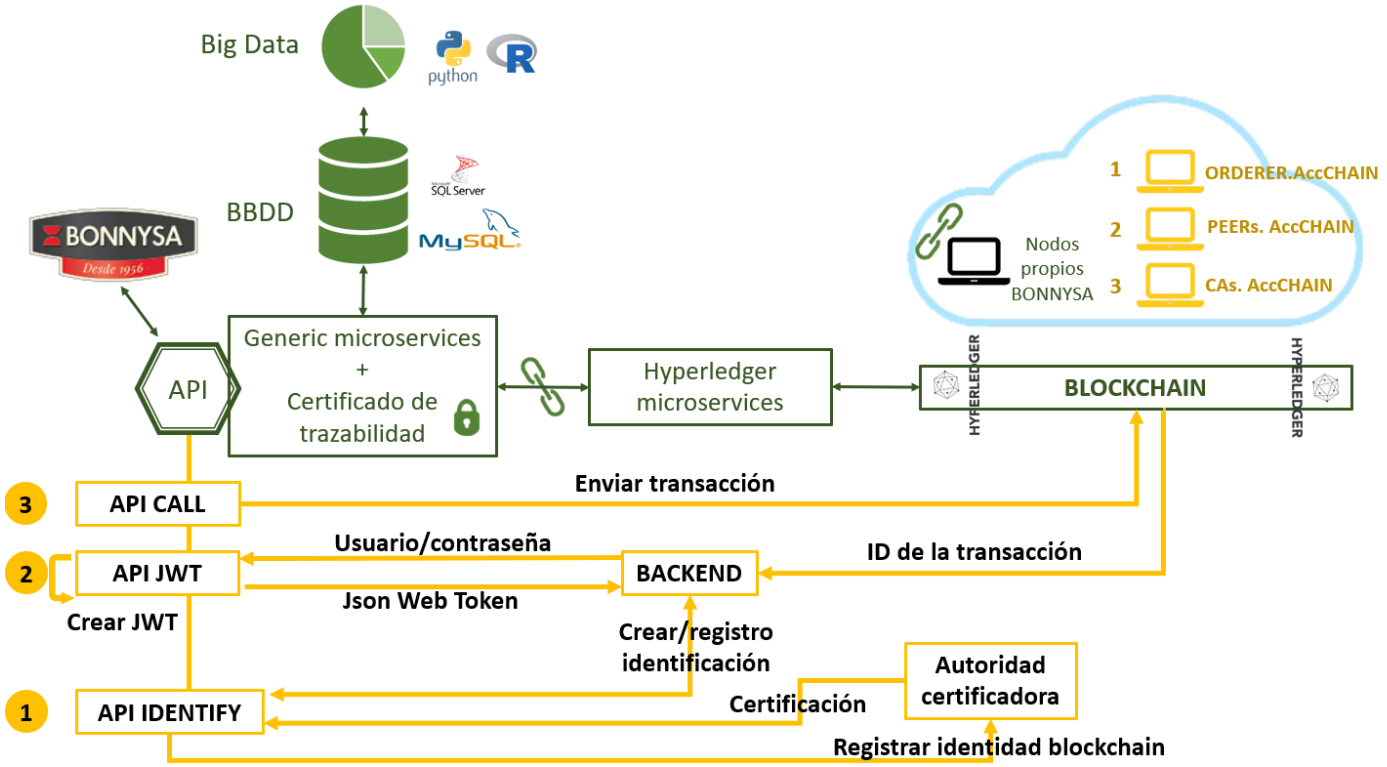
4. Architecture

Software Architecture

Application architecture



Blockchain Architecture



System Architecture