Students Management System

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Abstract
Nowadays technology is everyplace, but a lot of processes are supported on paper yet. In spite of the cost of it, this way make imposible the effienct analysis ot amounts of data, that actually have a enormous potencially but aren't used because the people that manage this haven't appropieate tools or knowlegment about it.

Responsability

Everything that is writed and explained here comes from opinion and own experience of the author and don't represent a correct or exactly way that do things. All decisions can be discussed and obviously it may not represent the best decision.

Contents

1 Introduction

1.1 What about it?

The idea behind of the develop ot this software isn't only to do a good tool for educational centers, is also an excuse to research and learn about a lot of technologies and patterns but above all it's about how to do software, clean, simple and easily readable sotware.

This software has been thinked to help a lot of teachers in their work, but which is exactly the problem? And how it will help?

Until a few years ago the digitalization of education was something imposible to think, the cost of equipments and the digital illiteracy did imposible to think in to do things of another way. The only computers that we could see was inside the 'Computer room', where students learnd to use a simple text processor, received a simple notions of internet of websites, mail system or storage devices, isn't bad to start, but we don't talk about this. And what about teachers? Maybe a few of computers in some rooms or office allow them send mails, maybe build a simple website or offers some resource to the students (in the better case). As we can imagine, the paper was the mainly support of all about management of the center.

If we think about proccesses in a scholar center we can't imagine the amount of paper that is necesary to registry all about students, teachers, subjects, relationships between them and the rest of work. And the worst of this is that every three months and every year the most of this documents, papers, records, etc, need be redo, because the mayority of this relations will change and will be necesary record all.

Can you imagine the amout of papers, time and efforce is necesary to do this? We will talk more about this after.

So now all peple have a smarphone, the hardware is really cheap (laptops, tablets, etc...) and open a website for a inexperted person is very easy, and almos free, in some clicks. There are alot of system and tools about e-learning like Moodle, Chamilio , etc that allows manage a lot of thigs like classroom, activities, exams, ect... all had been listen somethimes about it but they have an specific domain and are builded to an specific way.

This area is more or less knowled for the mayority of new teachers and schooll stuff. Many center uses some tools like this to do a lot of tasks, but in spite of it, there are another a lo of tool much very heavy that is following hand made.arises

1.2 Why to build a new tool?

But is really necesary build to zero a new tool for do this. Well, if we want, could reuse some preexisintg tool, maybe adding some module to do all things that we detect that fault, but this present a lot of problem, that are closely related with the architecture and liceses of this software. Because of this, is putted a lot of effor in this project in the opennes of code and architecture, beause this is that make possible that the platform can be change, evolutionate in many forks and feedback herself.

1.3 Domain of the problem

The idea to build SMS arises from the need of a managment system for a specific educational center in Granada, that mainly speed up all their internall management, avoid the spend of printed paper and save huge amounts of time. Beside this they want a system that was helpful for making better management decisions, in marking paths for future improvements.To achieve that the system would need as core a subsystem of relationships managment, teachers that imparts class to students, students that are enrollments in subjects and in groups or courses, and a long etcetera. This only as the base of the system, because with this would only be modeled the kind of relations that the center have. A part of this and like the minimal requirements the center need that the sistem provide a simple way to do their most heavy and paper, time and money cost, the attendance contros (we can start to see some requirements that the system would have). Appart of this but related they need a system to save marks related with students and disciplinary notes. Only this three things done digitally may be a small internal revolution.

1.3.1 Minimal requirements

The managers of the center can't have a precise idea about which must be the functions of the sofware. They have a clear idea about what kind of process in their daily work there are the most heavy and consume more paper, that are which they want to digitalice, but they haven't think about navbars, icons, colors palettes, designe of user interfaces or something like this. They have abstract ideas that will need dimensioning and shaping but which in synthesis offer the minimun system requirements.

General needs

How is talking about software, it will need run in somewhere, and they what to be cheap and easy to run. And at first there aren't any prerequirements. Maybe they preffer that this can run in devices like smartphones, tablets, laptops, but they don't have a good technical knowlements and is indiferents that be a native app, a web app or some strange artefact. For other hand exists an essential requirements, must be run in any devide for the same person, independently of the machine where it be (sometimes in laptop and sometimes in smartphone, for example).

Management System

As we can imagine, a center have a lot of differents kind of relationships, and as obligatory part of the system it must be offer a simple way to do this. Teachers imparts subjects to group of students (called classes), students are enrolled in subjects, and so on. These cases of use and all it can see below will be revised as *User Stories* in detail later.

Attendance Controls

One of most importat proccess to digitaly, the amount of data tha is saved on papper and also imposible to manage before and much less do it an analysis. They need a simple way, a simple interface to do this that allow this save time (doing it, analysis and mangement it), paper and effort.

Class Controls

A part of manage of classrooms they must offers a say to follow the students evolution in class, behaviour, positives and negativss and another lot of things like paper save, time and effort as section above.

Marks

As another of proccess that more paper consumes is the marks management. They want a system that simplity the proccess of insertion, analysis and management. Without any specially idea in mind are open to any good user interface that simplify this.

Disciplinary Notes

It also must provide a management of this kind of notes, in which a bad behaviour of a studnet is saved, managed and fully reported to the specific users inside of app, as tutors, pedagogue, etc, for example.

Simple and advance reports

Another part interesting for they is improve the reports that they obtains from their data. The on paper support do this almost imposible to big scale, an a important feature must be do this posible. Advanced reports about a lot of kind of items, like students, state of subjects, marks, etc, in seconds with some cliks. This will improve the take of decisions and will do better meetings with better decisions based on good and crontastable data.

Autonomic Official System Connection

The national system of education in which this center is framed have a diferents informatic reginal system. In this case, in Andalucia, where the certer is it called SENECA (other

Feature	classDojo	TeacherKit	A+	iDoceo	Additio	SMS
Attendance	✓	✓	✓	✓	✓	✓
Discipline	|	✓	✓	✓	✓	✓
Attitude	|	✓	✓	✓	✓	✓
Marks	✗	✓	✓	✓	✓	✓
Competencias	✗	✗	✗	✓	✓	✓
Rubrics	✗	✗	✗	✓	✓	✓
Message	✓	✓	✓	✗	✗	✓
patters	✗	✗	✗	✓	✓	✓
reports	✗	✓	✓	|	✓	✓
analysis	|	✓	|	|	|	✓
models and predictions	✗	✗	✗	✗	✗	✓
Centralizate and jerarqy	✗	|	✗	✗	✗	✓
Total	58.3%	80.5%	72.2%	72.2%	80.5%	99%

Table 1.1: Features

in other places of the country). All public and semipublic educaitonal centers need save data in this systems necessarily, and this haven't a simple public API where connet us. They must be done dirty way, making a maxed mode way to simplify the download and download of data that minify the interaction with the official system.

1.4 The cost of non-digitalization

here will be the exlanation of the use of papper and time of a teacher.

1.5 State of Art

As part of the research process has been analyses some aplications that (although isn't a directly competition) represent the actual state of art about the kind of sofware we are talking about.

Feature	classDojo	TeacherKit	A+	iDoceo	Additio	SMS
Personalization	✗	✗	✗	✗	✗	✗
Good UI	|	✓	✓	✓	✓	✓
Buena UX	|	✓	✓	✓	✓	✓
Price	✗	✓	✓	✓	✓	✓
Performance	✗	✗	✗	✓	✓	✓
Scalable	✗	✗	✗	✓	✓	✓
Data control	✓	✓	✓	✗	|	✓
Multiplatform	✗	✗	✗	✓	✓	✓
Centralized	✗	✓	✓	|	✓	✓
Total	44.4%	50.0%	16.6%	16.6%	44.4%	99%

Table 1.2: Architecture and design

2 Designe Decisions

Nowadays we can build almost any kind of software with a lot of differents language from which to choose, but as if that were not enough there are also a lot of architectures that are possible to follow, and beside of this it will necesary choose where deploy our software, or how doc it, or how magane our work team, etc. A lot of options that it will necesary to choose and that can make the difference between the success or failure of our project. So, what about of these decisions in this project? Take a look about it.

2.1 Kind of software

Based of informal requirements was thinked that the best option must be a **web app** for a lot of reasons. First of all because is the simplest way to offer an app that can run in almost any device (with a *simple*[1] browser).

2.2 Architecture

2.2.1 Why microservices?

Much more that the trend in the develop of apps, all of change of paradigm inspired in distributed system, now over http and focussed (especially) in web apps as a consequence of the multiple benefits to this kind of sofwate.

Language agnostic, scalable, size ajustables, independently, the system splited in litle pieces with this boundaries ...

2.2.2 Why polyglot database?

With the mircroservices approach the system will be some very differents database to do some diferents things. So, in general we can see our backend like a black box when the data persists in a polyglot database. That means that the data is save in differents ways, using diferetns formats and diferents driver to manage this. There are a group of data that it need saved with certain relations, due to its nature, so a relational database seem perfect to do this, but this kind of databases (like MySQL) can been slowly or too heavy for other tasks of kind of processes, like data analysis.

[1] Actually a browser is one of the more complex pieces of software, but here is labeled as simple because is a software that the mayority of device like smartphones, tablet, etc, have by default and for the most non technical people isn't a complex software, nothing could be further from the truth.

2.2.3 Repository Strategie

2.3 Languages and frameworks

2.4 Deploy scenarios

Google App Engine, Amazon Web Services, Microsoft Azure, IBM BlueMix, Heroku, CloudFoundry, etc...

Realizar comparativa y justificar muy bien la eleccion.

2.5 Documentation

2.6 Methodology and planification.

Eleccion de metodologias agiles basadas en Scrum para la gestion del equipo y en historias de usuario para el modelado del sistema.

2.6.0.1 ds

2.7 License

2.7.1 Licencia y enfoque

3 Architecture Modeling

En base a los requisitos funcionales del sistema, se ha modelado la arquitectura en base a ciertos subsistemas o microservicio
2

3.1 General Patterns

en microservicios, entre ellos el basado en una API GATEWAY que es el adoptado por nosotros.

3.2 Evolution

En muchas ocasiones lo mÃąs interesante de un desarrollo, la fase propia

En este caso se pierden las conclusiones y decisiones tomadas por el equipo de desarrollo que les han llevado a toma una u otra decisi Por eso se intentarÃą reflejar lo mÃąs fielmente posible como ha sido el proceso que ha llevado el sistema al su fase de entrega final.

3.2.1 First Phase

Servicios bÃąsicos y no demasiado estandard

3.2.2 Second Phase

Los microservicios bÃąsicos

3.2.3 Third Phase

La arquitectura final

3.2.4 Not closed final state

Estado final pero por supuesto no cerrado al cambio ni a la ampliac con los servicios que faltarÃŋan o que no estan aÃžn externalizados.

4 Core

Talking about SPIKES in all sections that is needed, como UIKIT en la UI, endpoints en la APIG, ndb, mongo, etc, etc...

4.1 APIGmS

4.1.1 Introduction

As has been comment before, the pattern choose to this microservices based app architecture is API Gateway, this offers a lot of benefits, but also some drawbacks. The mainly idea is to have a service working like as the gateway of the service, so the back-end becomes in a black box where all inside is behind of this service, transparent to the customers of this.

So, this service works basically like a dispatcher, it receives the calls from user interface and decide where send the request.

4.1.2 Spikes

To build this services was tryed some diferents approach. Like almost in every modules, the same functionality can be writed for may ways. So, in this case specially (a service thinkied to run in GAE) the platform offer us a speciall way to do this, better than standard, according to them.

4.1.3 Testing and docs

As is a dispatcher, the testing strategie isn't like others. Don't have sense write (be automatic or not) a lot of test that redo the same checks only using another port (in local) or url (in production). To do this easier, a simple strategie is execute the same test that are executed over the microservices isolated from the APIGmS, exactly the same.How do this? The tests writed uses a url that included a port of execution (because

all servies using the same url in local) so if we want to know if the response is equal from APIGmS we only need change the port of execution. So, for example if the tests suite to serviceA runing over localhost:8003 the test that check this service throught APIGmS (must be exactly the same behaviour) will use localhost:8001.

The tool used to do all test (except for the UI) is the python framework PyTest allow easily, writing scenarios. This technique allow repeat all test first over the service and after from the distpacher (showing all result as well).

Besides of this, the service can have functions of modules that need be tested independently, these need a specific tests.

On the other had with docs something similar happens, don't have sense write a doc defining the behaviour of all sections of api gateway if this doc already exists in each service. It's redundant and complex to mantain. Because of this a simple approach is link the docs to services docs, so the task of write it relegate to them.
As is saided the tool Sphinx is used to build the doc of the service. That basically inspect the code files mixing this with all the files that we write (pure doc) to show this as a web based documetnation (easy to read and understand).

4.2 TDBmS

4.2.1 Introduction

This mService offers the managment of the teaching of the center. This means that persist in a relational database all relations between teachers, students, subjects, etc, and all resource availables to make this posible throuhg an api.

This like the rest offers his resource throuhg an api writed in Flask (follow the same architecture that all).
The engine to save all these relations is MySQL, for many reasons, mainly because is the best known engine and in which it has some experience and also because GCP offers as a cloud product Google Cloud SQL Databases. Until recently only offerts MySQL but now (since March of 2017) they offer also PostgreSQL.

4.2.2 User stories

As base of requirements process have been used user stories.

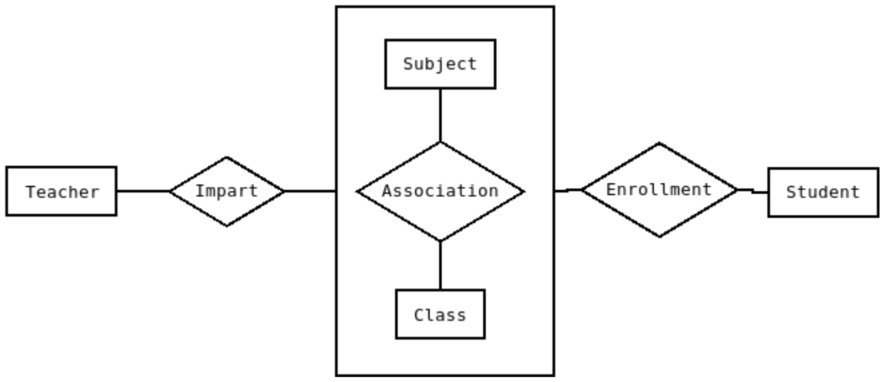
#**1**
Me as manager, I want save subjects, teachers, students and classes.

#**2**
Me as manager, I want can relate teachers with subjects.

4.2.3 Design

4.2.3.1 E/R designe

Based on user histories and the domain of the problem the designe done based of this entity relation diagram:



The design follow some details that the domain presents, that is related (at least the more significantly) below:

4.2.3.2 Access Library

In the old version it was a little ORM that offers simple methods to access data transform this in SQL raw sencentes. Now this library is only a wraper of the SQLAlchemy to keep apart the apirest of the service to the database access layer.

4.2.3.3 mService API

4.2.4 Stones and evolution

4.2.4.1 Way to access to raw data

While at firs of develop the mainly strategie to follow was write all by cero, finally the point of view has been changed to follow the use of standard tools and avoid reinvent the wheel.

So, if in the first stages of the project the acces to raw data through the engine was hand made, using an own simple library that worked like as simple ORM, the evolution of it and especially the problems found and the unmaintainability of code have made that now the approach turned to use a good tool as ORM like SQLAlchemy.

The changes in the specifications of the api while the develop and the maintaince of the performance of the queries when is writed hand made in raw SQL isn't a good idea. Before the develop of this mService it easy to understand that only in few projects is justified the use of raw sql sencences and drivers whiout ORM (by easy that it was).

4.2.4.2 Delete items strategy

dfasdf

4.2.4.3 Item's metadata.

4.2.4.4 Input / Output convention

All in JSON except the values with NULL in the input and in the output.

4.2.4.5 How to save the deleted items.

In the way to develop the microservice we have the question, we want to save the deleted items? For one hand we could want to know

4.2.4.6 Optional subjects, the “class” Table.

In the domain of the problem can be exists optative subjects and is needed search a way to implement this because has a specific details that aren’t like the rest.

The details. The studies plan forces in certain courses to select one or several optional subjects. For example, if a student has enrollment in 2ÂžESO (independently of the group, A, B...) the law and consequently the studies plan force to the student to choose between some optional subjects. So, maybe this subjects exists only in this optional case as “ rare subjects” but in other cases this are only normal subjects but that in this course are offer like optional.

A simple example of this is French subject, it in some courses like 3ESO and 4ESO is obligatory but it in Bachiller (the upper level) is optional because the students can be select if they want make the final exam with this second language or select another like English or Greek or Latin p.e.

To obtain this we decide develop a simple solution without change the original database logic schema. So, how we have an entity that save the classes and it have three attributes, course, word and level mainly we going to add three more to this special cases, optative, groupNumber and subgroupNumber. Like this special cases haven’t word param when they have value word don’t have and when the item have word (A, B, C...) then don’t have this special attributes.

Maybe this don’t be the best solution, but is a simple in the point of develop.

Obviously like we can’t have two autoincrement values in the same table definition in MySQL we will need control this programatically, but is something that we can assume to get our goal easily.

Problema:

La misma ventaja que nos ofrece UNIQUE para el caso de los eliminados ahora nos muerde aquÃŋ. Mientras que allÃŋ beneficiaba porque esta clausula no incluye a los item que tengan campos a null y permite que no de conflicto en este caso si insertamos un grupo optativo obviamente deberÃą tener el camo word a null y si es asÃŋ podemos tener exactamente dos grupos iguales sinque de conflicto.

course

1 <null> ESO 1 1 1 0

1 <null> ESO 1 1 1 0

Sin dar conflicto, lo que no puede ser.

estÃą a null o no para le resto de los procedimientos.

Por esta razon decidimos usar el mismo campo word, con una nomenclatura especial, ya que no se va a ser usada para los grupos generales que indique que se trata de un grupo optativo y ademÃąs especifique el grupo y el subgrupo, en concreto:

OPT_n_m
donde n serÃą el nÃžmero del grupo (que habrÃą que incrementar prograticamente a mano) y m el nÃžmero del subgrupo que tambińe habrÃą que incrementar a mano en caso de que se creen mÃąs.
Esto siempre a falta de un mejor solucion que se adopte en iteraciones posteriores.
Y en la api nosotros siempre preferimos explÃŋcito a implicito.
Requisitos:

1. Ya que todo se controla desde mysql pero no existe forma de hacerlo automatico vamos a crear unos disparadores para la inserccion y la eliminacion para mantener la consistencia de los datos. Cuando se introduce un nuevo grupo optativo se debe comprobar que existe el anterior tanto en grupo como en subgrupo para que no exista el subgrupo 4 sin el 3 o el dos. De la misma manera no se podrÃąn eliminar un grupo 4 si el 2 aÃžn existe.

API definition @app.route('/entities/<string:kind>', methods=['POST'])
Para realizar la introduccion de un estudiante al sistema usamos
el re.
No podemos introducir un usuario que no tenga datos, al menos
deberÃą pasarse el dato nombre que es Ãžniquo mÃŋnimo que debe
existir para el tipo alumno.
Cuando se pide una lista de elementos y la peticin se realiza correctamente pero no se devuelve nada porque no existen items de ese recurso se envÃŋa un 204 Success without content.
Importante: Muchos de los detalles de control de consistencia no pueden relegarse a la UI, ya que aunque en ella no se deben permitir ciertas acciones por la logica del sistema, la api no debe permitir su realizacin aunque se haga de forma manual sin los conectores de la UI.
Por eso no solo la seguridad sino el control de la consistencia debe
estar presente de la mejor forma posible en todas las acciones que contra esta un usuario puede hacer.

User histories El microservicio de Base de Datos acota el dominio de la gestin docente dentro del sistema, quizs se le cambie el nombre a TmS teachingMicroService.
A travÃľs de este microservicio podemos realizar todas las acciones relativas a.
Este microservicio se basa en una base de datos.
I like

4.3 SCmS

4.3.1 Introduction

Students Control micro Service or SCmS is the service that provide the resources to make posible tasks like .... .

All of this working independently to the rest of the system with her own database.

4.3.2 First Iteration

Like in every scenarios we can divide the domain of the problem in some services, but in this

case and like first iteration it has been decided leave toguether all the issues thar are related with the students controls.

4.3.3 Designe

4.3.3.1 Arquitecture

4.3.3.2 Languages and tools

4.3.4 Testing strategy

4.3.5 Deploy

4.4 AmS

4.4.1 About

Analytics micro Service or AmS.

4.4.2 First Iteration

4.4.3 Designe

4.4.3.1 Arquitecture

4.4.3.2 Languages and tools

4.4.4 Testing strategy

4.4.5 Deploy

4.5 UImS

4.5.1 Scope

4.5.2 UX basic strategy issue

Explicacin del problema.

4.5.2.1 All in one

Cuando todo se trata como un boque al que se le procesan las diferencias.

4.5.2.2 All live mode

Donde por cada accin se realiza una llamada a la api y no existen los botones guardar, incluso cuando se escribe texto en los campos se estÃą realizando el guardado.

4.5.2.3 Mixed mode

Donde la seccion de datos propios de la entidad se procesa de forma tradicional y las relaciones se actualizan conforme se manipulan. Esta es la que finalmente optamos por usar.

4.6 External Services

Conclusiones de por quÃľ se han usado ciertas cosas y por que no otras

4.6.1 Pub / Sub pattern

4.6.2 Firebase

4.6.3 Third Party DataBases

Por que nos hemos quedado con las que usamos y porque no usamos otras.

5 Future Plans

5.1 Features

5.2 Architecture

Image of all microservices in their final state

5.3 Technologies

6 Retrospective

Solo ahora que va acabando el proyecto es posible ver todos los problemas que se han tenido y la forma de ponerles solucin de una forma + amplia, viendo donde se cometieron erroes y cuales han sido los beneficios y cuellos de botella del desarrollo del proyecto.

6.1 DRY

Comentar algunas de las cosas en las que se ha caido, como el escribir cosas desde cero cuando habÃŋas soluciones o cosas parecidas ya hechas.

La validacin de envÃŋos en las apis, los ORMs, la documentacin, el testing, etc, etc...

6.2 KISS

6.3 The heaven of frameworks

Existen un monn de frameworks distintos para hacer lo mismo, cada uno en su lenguaje, y cada uno con sus detalles. ahora que terminamos el proyecto, evaluamos los beneficios y problemas que hemos encontrado en unos y otros, atendiendo entre otras cosas a la demanda y uso d elos mismos, desde el nÃžmero de oportunidades laborales, el nÃžmero de preguntas en stackoverflow .

6.4 Community

el contacto con la comunidad, deberÃŋa de haber sido mucho mayor y previo, (comunidades profesionales)

6.5 The strategie

Los problemas de la planificacin, las virtudes de hacer algo as, lo aprendido con las historias de usuario y como es muy dificil abordar un problema de este tamao solo, la dificultad de encontrar colaboradores, etc, etc...

6.6 DevOps and storms in the cloud

Conocimientos, lugares donde desplegar, infrastructura de google, los problemas que se han encontrado, como diferencia esto de un despliegue en otro sitio (en cuanto a curvas de aprendizaje).

7 Resources

7.1 Articles

1. http://blog.zachbjornson.com/2015/12/29/cloud-storage-performance.html
2. http://googlecloudplatform.blogspot.com.es/2015/12/the-next-generation-of-managed-MySQL-offerings-on-Cloud-SQL.html

7.2 Communities

1. https://plus.google.com/+googlecloudplatform/posts
2. https://plus.google.com/+AngularjsEspa%C3%B1ol/posts

7.3 Technologies

1. https://material.angularjs.org/

7.4 Books

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