# SIGMA CLOUD: FROM AN ON-PREMISE SOLUTION TO A CLOUD ONE FOR SIGMA CONSORTIUM

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**Keywords**
Sigma, CRIS, SIS, CLOUD.

## 1. Abstract

SIGMA Gestión Universitaria is a nonprofit consortium established in 1996 by a group of 8 top level Spanish Public Universities to provide technological solutions to their needs for managing academics, learning, research and organization processes. SIGMA represents 20% of the students in the Spanish university system. The consortium's objective has evolved towards the continuous technological modernization of university management through the development of IT solutions aimed at automating the administrative processes and, as a result, guaranteeing their effectiveness.

So in 1996 the 8 universities that created SIGMA were trying to sum their efforts in a unique SIS & CRIS solution core. The project let develop fully functionality software with their entire specific casuistic and in terms of costs were affordable for all of them.

Nowadays as the price of storage and bandwidth continues to drop fast, Cloud-Based services are becoming more and more attractive and are affordable to small and medium-sized businesses which are seeking to reduce licensing costs, avoid recruiting IT staff and focus fully on their core responsibility–growing the business.

The concept of the cloud is a simple one: a service provider processes, manages or stores customer data in a remote data center either as a substitute for, or as a supplement to, customers' on-premises infrastructure.

## 2. SIGMA GESTIÓN UniversitAria Consortium

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**Figure 1: SIGMA consortium**

The consortium's objective has evolved towards the continuous technological modernization of university management through the development of IT solutions aimed at automating the administrative processes and, as a result, guaranteeing their effectiveness.

Technology and innovation are the backbone of the services and solutions provided, based on a highly open source development and deployment platform for J2EE certified application servers compliant on a multi-tier and high performance proven open architecture.

Internationalization is also one of SIGMA's top priorities. For years, SIGMA has established relationships with other European universitity consortiums. Lately, SIGMA has open new strategic areas of interest such as SaaS, BI, eLearning and Mobile. SIGMA focuses the development and support of two main suites of solutions:

## 3. SIGMA Student Information System

The European Higher Education Area (EHEA) was created to construct the Europe of Knowledge and place it at the international forefront, in order to benefit mobility and employment opportunities, and also to unify higher education studies in the EU. Since then, one of the main priorities of SIGMA [1] has been the adaptation of its products and services to the requirements of the EHEA, thus assisting the universities in the group as they go through this important transformation process.

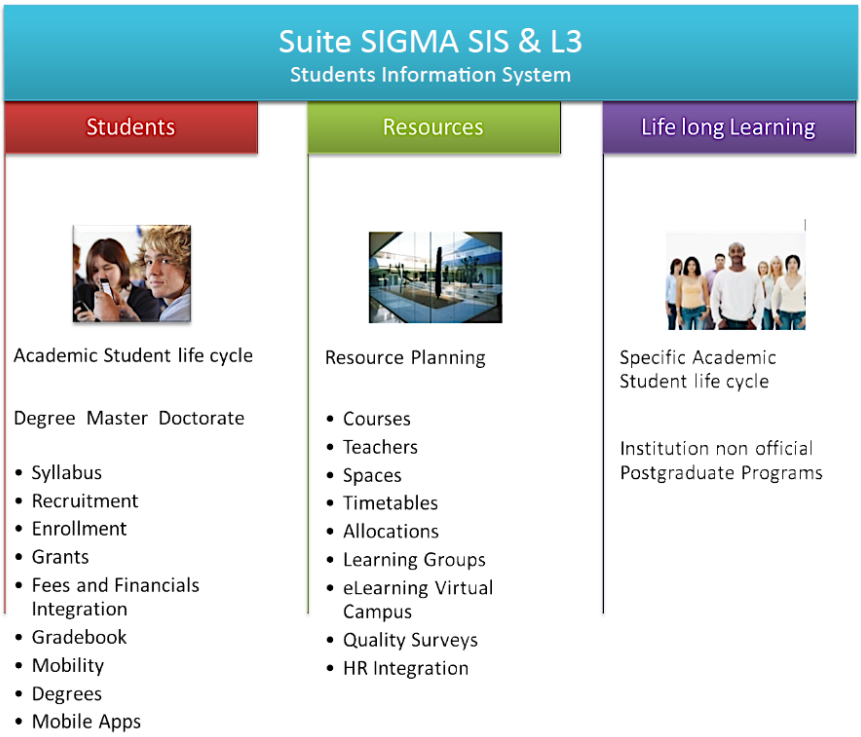


**Figure2: Suite SIGMA Students Information System**

## 4. SIGMA Current Research Information System

The European Research Area (ERA) [2] was created to facilitate the mobility of researchers, attract the best world researchers and coordinate the national and regional programs. Since then, SIGMA [1] has incorporated in its products - adaptations and new functionalities to support the scientific activity as well as its promotion, and has aligned its SIGMA CRIS Research Project with the ERA requirements.

Sigma is also aware of the new research trends (mobile devices, EuroCRIS Common European Research Information Format – CERIF [3] initiative, unique author identifier studies (i.eiraLIS [4]), altmetrics [5], …) through continuous studies and the experience provided by the joint collaboration with the universities that compose the consortium.

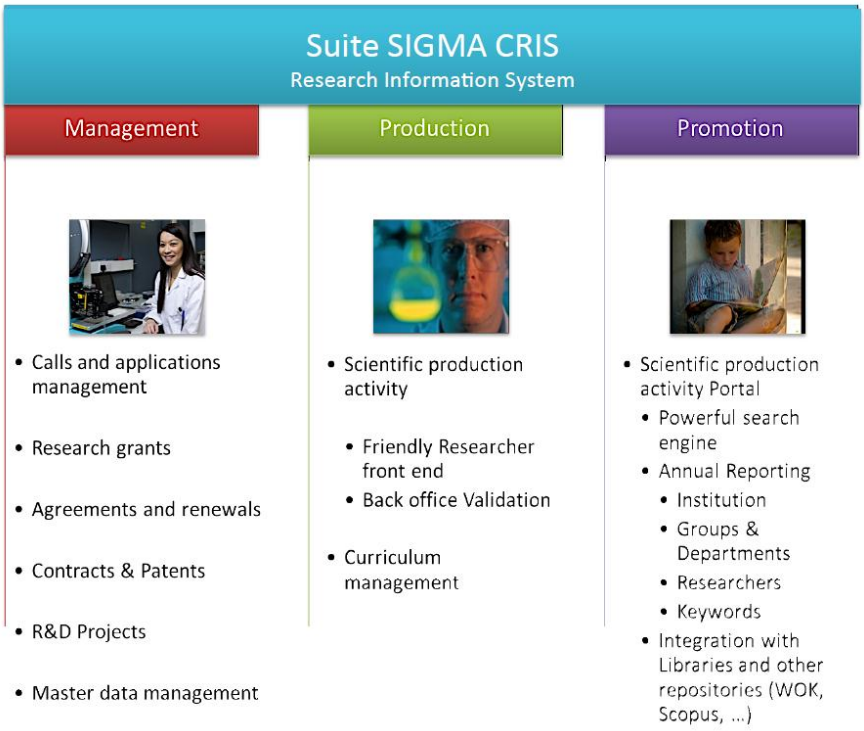


**Figure 3: Suite SIGMA Current Research Information System**

## 5. From and On-Premise solution to the CLOUD

Traditionally we were focused on the development and distribution of software for our clients that were installed on their own in their own systems, which means that in the 90s we had to compile the software for different platforms from several vendors such as SUN, HP or DEC.

One first step that SIGMA face with in the early 90's was to unified all the platforms in only one, in order to earn time and efforts in the development side.

In the middle of 90's SIGMA consortium decided to migrated to Java the SIS and CRIS solution. We achieved a significant milestone; we optimized the software engineering and development process, returning a cost reduction by minimizing points of failure because of the platforms unification.

Due to the European crisis the market for large Spanish public universities was in a situation that did not offer many opportunities for us to enlarge our clients.

In this context, we find out that our suites SIGMA Student Information System and Research Information System solutions that were designed with a very wide functional coverage, suitable for the needs of large universities, but we had a big drawback, anyone who would like to use SIGMA SIS or CRIS solutions should buy the necessary infrastructure and invest on licenses that were not cheap. This made difficult for us to enlarge our number of clients.

In order to offer to the markets a more competitive solution, we decided to offer our software solutions as a service model.

Software as a Service (SaaS) model had a number of advantages:

- Less or no initial investment in infrastructure and licences for the possible new costumer.
- Reduced costs, because it's paid for use.
- The customer does not require dedicated staff to maintenance the software nor infrastructure.
- Support more agile and fast. The application bugs have a direct treatment and the solution was put into service more quickly than in in-house facilities.
- The client could focus their efforts on the core business.
- Increased availability and data security, having infrastructure that, despite being shared, is more powerful and secure.

Our objective was that SIGMA solutions could be addressed to relatively small private colleges but of great reputation and large centres attached to public universities. All of them, on budget and human resources, not eligible for a suite like SIS VEGA but yet with a SaaS solution could become part of the community of users of SIGMA.

The SIGMA approach for the new clients, required a review of the organization of the software offered to universities, so as to define lighter suites to be used by higher education colleges and centres, more process-oriented and focused on the end user, who would have also a more specialized and nearer support from SIGMA.

The main technical milestone was to convert an On-Premise software developed for ages to a multitenant once. After this change in our SIS and CRIS solutions we were able to reduce the costs dramatically because not only we implement a platform shared by multiple clients (multi-tenant), where the infrastructure and licences costs were divided by all the clients, but also share the same software version in a single environment to reduce administration costs. The same infrastructure, and with once software deploy could serve multiple clients, each clients with its own environment, configuration, data, and look&feel.

After that we had an oriented to a service solution for SIS and CRIS suites, we set up our SaaS journey with our first client in 2011 the Institut Quimic de Sarria (IQS).

**Figure 4: SaaS costumers evolve**

Since early 2011 the service provided by SIGMA has gone through several phases during which it has matured both the solution core and the service delivery, so that it can address the large universities market.

SIGMA is now offering its software suites in a complete SaaS model to some medium-big universities, based on the same business and service premises as described above. Likewise, the integration of new services in the SaaS model, such as Business Intelligence, eLearning or mobile apps, allows the SIGMA SaaS clients to enter in a continuous integration model to use this new services is an easy way.

That opportunities with medium-big institutions furthermore the assimilation of several small centres attached to large universities is consolidating the service model in 2013 and expecting to grow in 2014.

After gaining experience in SaaS service, in early 2014 we defined the SaaS model for those universities that belongs to SIGMA consortium. But in this case, we upgrade our SaaS solution to a cloud one.

A cloud means that applications that run on the cloud take advantage of the flexibility of the computing power available. The computers are set up to work together so that it appears as if the applications were running on one particular machine. This flexibility is a major advantage of cloud computing, allowing the user to use as much or as little of the cloud resources as they want at short notice, without any assigning any specific hardware for the job in advance.

So that, the idea behind for our universities of the consortium was that they should continue deciding the evolution of SIGMA SIS & CRIS solution, which modules have to be update or deployed at the platform and which not, as if the infrastructure was On-Premise. But the infrastructure and the database were allocated at SIGMA

## 6. Project and methodology

Early in 2014 one of the SIGMA universities asked us to design a migration project of their SIS and CRIS environments to the SIGMA SaaS model.

The project was divided in the following phases:

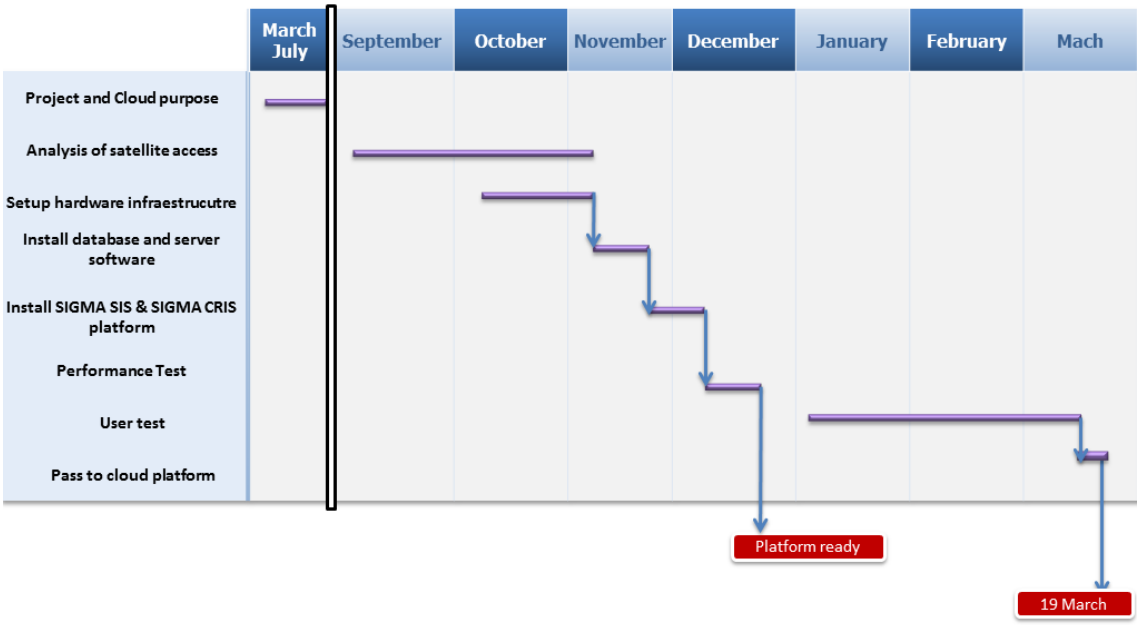


**Figure 3: Project plan**

### Project and cloud purpose

The first part was to develop a document which specifies what services SIGMA SaaS could offer and how we thought that the interaction should be. This document was built together SIGMA and the university Staff, notice that each SIGMA university are owners of the complete SIS and CRIS solutions even the company. The main roles involved in this project were:

University staff

Technological vice-rector, the CIO, the responsible of hardware and communications and the responsible of the SIS at the university

SIGMA staff

The CIO, the responsible of hardware and communications, and the university consultant

The result of this study was a document which defines the SaaS model purpose. And it was presented to the university to obtain its approval.

## Analysis of the satellites access

On premise systems usually has a layer of extra services that the IT department has developed over time. In addition, is common to be used to access to the database by direct SQL queries or by automatized scripts.

A critical point in the transition to SaaS is the analysis of the different types of access and the resolution of each of them. In our case these kinds of services were:

- Satellite applications accessed via an API well-known
- Satellite applications accessed through direct connection to the database
- Shortcuts to the base of automatic / manual data

### Satellite applications accessed via API

In this case, the shift to SaaS model has no impact. A web-based service for data from external systems architecture allows changes without impacting system components.

### Satellite applications accessed through direct connection to the database

The university may have developed applications that access data itself and some SIS system interchangeably, these applications are those we call satellites.

To avoid changing the application we decided to use links to the remote tables so that the satellite data applications continue accessing by the same way despite some of the tables of the schema were remote.

In this scenario the big deal was to achieve the same performance as if the satellite applications were on premise. This was a huge goal to achieve. In fact the access that has poor performance where those which the same query mix data from both schemas the client's one and the remote one.

We try different choices (build views from the remote table on the client side, study changing the queries, adjust the VPN from client to SaaS CPD. At the end we decided to set up a dedicated communication line between Sigma SaaS infrastructure and the CPD of the university. This line has response time as if was local network extends.

The database replication was dismissed by costs of extra infrastructure and licensing involved.

### Direct access to the database

In order to let the ICT department the access to the database as it was on premise, the database users were defined with the minimum permissions and all their actions are audit.

Note that in the SIGMA consortium universities own the software and database. Therefore it is lawful to have access to their data freely, but controlled to guarantee service.

Once solved the communication needs and demonstrate its performance to the university the follow task involved only SIGMA staff. We build the platform. The project continued by creating a fully operational environment. And in early January 2015 the SaaS platform was completely built. It was given to the university to be tested by the ICT department and end-users mainly.

Again we defined a test plan that it lasted 2 month. The objective of this end-user test was in on hand that the end-users get confident with the new platform and service. An on the other hand test all the main activities before the pass to the SaaS model in the production environment.

Finally the end-users decided to migrate to the platform on mid-March 2015.

Nowadays SIGMA is offering a for the entire SIGMA universities consortium a Private cloud solution.

## 7. REFERENCES


SIGMA Technological innovation for universities

http://gestionuniversitariasigma.com/index.php/en/

European Research Area http://erc.europa.eu/

EuroCRIS – CERIF initiative http://www.eurocris.org/Index.php?page=CERIFreleases&t=1

IraLIS – International Registry for Authors http://www.iralis.org/

Altmetrics – A manifesto: http://altmetrics.org/manifesto/

Institut Químic de Sarrià: http://www.iqs.edu/en/


## 8. AUTHORS' BIOGRAPHIES

Jordi Cuní was born in 1976 in Barcelona Spain. Computer Science degree at Universitat Oberta de Catalunya (2006 – 2012), Computer and Software Engineer at Universitat Autònoma de Barcelona (1997 – 2000).

He works for SIGMA since 2000, being the current Manager of Architecture Area and Software quality assurance Area. He leads a development team counting on 7 people for those areas.

His role focuses mainly on maintenance and develop the own Sigma framework in order to increase the productivity, define the methodology among the different areas and establish the software development tools for the rest of the company. At last but not least his area takes part on technical and performance support for our customers and helps them in the migration projects of their back-end resources. Previously, he had been project management for developing SIGMA's area for 5 years. His main efforts was focused on develop software solutions on resource planning necessities, stock management of static and mobile resources and physical and on-line surveys.