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SAGU - Unified Open Management System for Educational Institutions (Extended Abstract)

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Abstract

SAGU is a portuguese acronym for "Sistema Aberto de Gestão Unificada", which translates in English to "Unified Open Management System". SAGU was originally designed to automate all of the relationship that happens between a student and his/her Educational Institution. This relationship happens in the academic, financial and administrative levels, and SAGU has subsystems - modules - dedicated to all of these levels. Being a modular, open system, SAGU can be tailored to fit the needs of any Educational Institution. It uses PHP³ and PostgreSQL⁴ and it's server runs on a GNU/Linux operating system. The client is any graphical browser, such as Netscape, Konqueror or even Internet Explorer, running on any operating system. This way, the system administrator or IT manager is free to decide upon any available client platform. SAGU is licensed under the GNU/GPL⁵.

Extended Abstract

A Brief History of SAGU

Univates is a University Center, an Educational Institution very similar to Community Colleges in the United States. It is located in Lajeado, the most important city of Vale do Taquari (Taquari River Valley), a region that comprises 36 cities and 300 thousand inhabitants. Lajeado is located 120 Km away from Porto Alegre, the capital of the State of Rio Grande do Sul, in Brazil.

By the end of 1999, the fast paced growth of the University was not being supported by the existing administrative system, which was based on proprietary software. A decision needed to be made on what new system Univates should migrate its operations to.

In August 1999, Univates' IT manager and a technical consultant visited the San Jose Linux World Conference and Expo, and as Free Software was not completely news to Univates (GNU/Linux has been used since 1997), the pair researched for free software development tools that could be used to build a new administrative system. The PHP language seemed to be the natural option for a quick database system development, although it was not possible to find any reference of a system using PHP that could handle the financial and academic data of more then two thousand University students at that time.

Back in Brazil, Univates put together a team to start working on PHP and MySQL in order to build a prototype system that would handle the entrance exam system (called Vestibular). As MySQL⁶ was not ready to provide database transaction support at that time, PostgreSQL was used. As no one at Univates had previous experience with any free-

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 - 3 <http://www.php.net>
 - 4 <http://www.postgresql.org>
 - 5 <http://www.gnu.org>
 - 6 <http://www.mysql.com>

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software database implementation, it was decided the system being developed would be database independent, and a database abstraction layer was one of the first pieces of code developed.

In early 2000, the entrance exam student data was processed by the new, free software based system at the same time it was processed by the existing one.

Although there was no intention to run performance comparison tests, it was very noticeable that while the old system classified almost 2,500 student candidates for about 20 different courses in three hours, running on a Pentium II 450 Mhz with 512 Mbytes of memory, the new system, running on a much smaller system (Pentium 200 Mhz, with 64Mbytes of memory) did the same thing in less than 5 minutes. Even recognizing that more tests should have been executed in order to produce accurate performance data, the Univates development team felt they were on the right track. With the proof of concept achieved by the "Vestibular Prototype" the IT department got the Rector approval to build the whole system, now named SAGU, which is a portuguese acronym for Unified Open Management System (Sistema Aberto de Gestão Unificada).

Original Design Goals

The complete development started with the following requirements:

- **Database independence:** As the developers had no previous experience, and there was no local success history, on PostgreSQL, it should be easy to plug in any other SQL database if needed.
- **Web Interface:** At the same time SAGU was being developed, Univates started migrating the desktop operating system from proprietary software to GNU/Linux, so the users should have the same SAGU client interface, given their desktop was able to run any popular browser. Also, if the system was to be remotely accessed, the interface should also be based on a web browser.
- **Modularity:** All of Univates business needs should be divided into comprehensive modules. This would ease the development and allow someone else who would like to use the system to build it only with the desired modules.
- **Free Software:** As SAGU was being built using only free software, the system itself would be free software, released under the GNU/GPL.

SAGU Modules

SAGU went live in July of 2000, and today automates the relationship of more than five thousand active students - plus eight thousand historical student records - within Univates. It comprises the following main modules:

- **Vestibular:** Handles the entrance exam process, where the students have their first contact with the Educational Institution. Provides grade classification, classroom distribution, different enrollment options and an Internet enrollment system.
- **Academic System:** divided into the Graduation, High School and Extension modules. It handles the student classes, grades, teachers assigned to given classes, classroom distribution, class schedule, etc.
- **Financial and Accounting System:** The account receivables system, which handles the payments due by the students and provides several accounting reports. It also provides interfaces to external accounting systems. This system also handles student credits and insurances.
- **Human Resources:** Interfaces with the external payroll system and verifies existing relationships when assigning a teacher to a class or allows a student or employee to borrow books from the institution's library.
- **Generic Reporting Tool:** As users are always asking for different kinds of reports, SAGU has it's own reporting tool, used to create all sorts of Postscript documents, using the psLib (also developed by the SAGU Team), a very handy library used to generate Postscript documents on-the-fly.

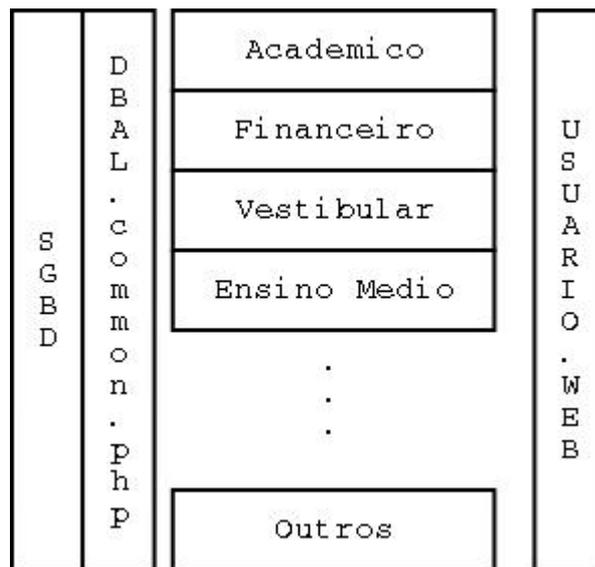
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SAGU2 Design Goals

One of the things that allowed SAGU's fast development was the almost full adoption of the ER (Entity-Relationship) database model of the previous system. It allowed the system to go live less than six months after the development started. The downside of it is that the ER model can be understood quite easily by the ones involved with the project since the beginning, but it is almost cryptic for anyone who wishes to understand the business logic by only looking at it. This makes it difficult for new developers to contribute to the project, and does not ease new database business constructions. With that in mind, SAGU developers came up with a road map for SAGU2.

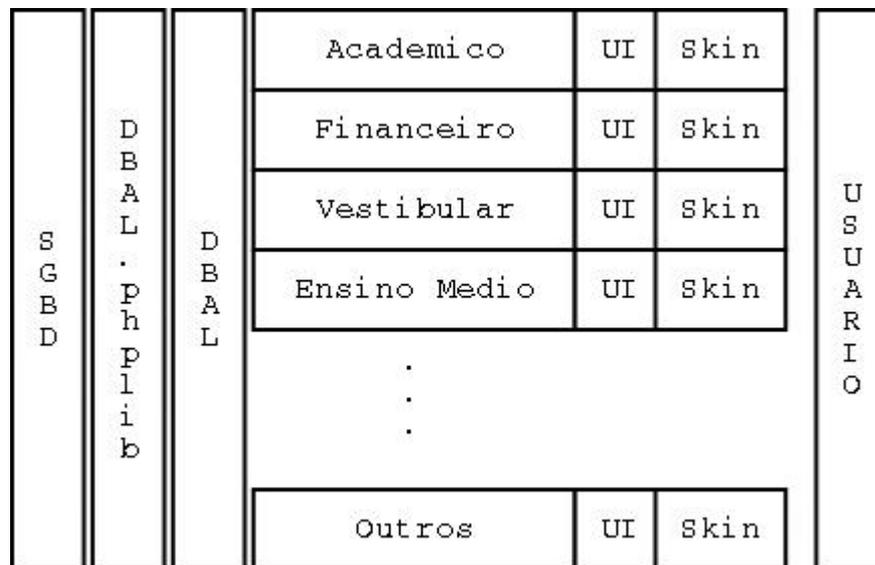
- System documentation must be clear, reflecting the business logic rather than the database, and must be dynamically created at the same time the development happens.
- Business logic must be independent from the database and user interface, allowing the developer and database analyst functions to be as independent as possible.
- The web interface must be built by a web designer who doesn't necessarily need to know PHP programming or SQL databases.

This new road map is already being used to develop SAGU-Workflow (in portuguese, SAGU-Protocolo). Bellow is an illustration that represents the today structure of SAGU:



The DBAL (Database abstraction layer) which consists in the program, common.php, is what allows SAGU to be connected to different kinds of databases. All the modules, however, are responsible at the same time for business logic and user interface. The illustration bellow shows the new architecture in which SAGU2 is being built:

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Here, along with the DBAL, which is still responsible for database abstraction, there is a DBI, which consists of database interface objects that will be made available for the business logic programmers. This way, these programmers won't need to know SQL in order to develop applications, they will only use the ready made objects when connecting to the database. The business logic programmers may still define what functions will be available to the users' interface (UI), and another programmer may construct these UI's on any desired structure (Web,text, or GTK, for instance). For Web browser interfaces, a designer will be able to define different kinds of skins (or themes), customizing the system accordingly to the user preferences or some other Educational Institution interface standards.

Development Infrastructure

In order to help coordinate the work of SAGU and other free software developers, Univates uses SourceForge⁷ software, customized into what is called CodigoAberto.ORG⁸, a web site hosting several development tools such as CVS (Concurrent Versions System) for version control, Mailman for managing mailing lists, PHPMyExplorer file management and several other tools for task assignment, bug tracking and others. Univates made CodigoAberto.ORG also available to anyone who wishes to develop free software and by the time this text was written the site was hosting more than 30 projects with more than 300 registered developers.

One of the most important development tools produced by the SAGU development team, integrated with the other CodigoAberto.ORG tools is SAGU-CVS, which eases CVS files check in and out.

Important Spin-offs

While SAGU was being developed, several programs used within it gained a life of their own. All of them have made available for the free software community and obtained the highest download rates in sites such as PHPClasses⁹.

- PsLib¹⁰: a library for creating Postscript documents. It is used within SAGU's Generic Reporting Tool and today has development contributions from Germany and the US.
- Dbf2sql¹¹: classes for .DBF (Clipper, dBase) database conversion into SQL inserts.
- Sql2txt¹²: classes that allow the easy conversion of SQL queries into text format that are to be imported into desktop

7 <http://sourceforge.net>

8 <http://codigoaberto.org.br>

9 <http://phpclasses.upperdesign.com>

10 <http://pslib.codigoaberto.org.br>

11 <http://dbf2sql.codigoaberto.org.br>

12 <http://sql2txt.codigoaberto.org.br>

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spreadsheets, for instance.

- SAGUDiet¹³: a SAGU implementation being developed by volunteers to run stand-alone in very small computers that can be donated to small public and community children schools.

Conclusion

Although SAGU was originally developed to be a system to be used by Educational Institutions, it's database transactional, easy to interface main structure allows several integrated management systems to be developed. It is a proven, intensive database-driven PHP solution being evaluated now to be used by several Universities in Brazil. The development team believes SAGU will become a free software standard for Educational Institutions administration in Brazil.

¹³ <http://sagudiet.codigoaberto.org.br>