RELATIONAL DATABASE SUPPORT FOR ENTERPRISE PRODUCT DEVELOPMENT USING OPEN SOURCE SOFTWARE

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Abstract: *The software acquisition cost is today a very important problem for all Information Technology Department in the enterprise. After it takes different software products, in many cases, the IT enterprise employees observe than these products become unnecessary in short time. The Open Source Software represents a solution for the enterprise because it can be taking free (e. g. Internet download), tested, modified improved and redistributed. We present in this paper an example of this software implement for a relational database development in the enterprise.*

Key words: *Enterprise, open source software, relational databases, middleware.*

1. INTRODUCTION

For survival, whether organizations are composed of one or many enterprise (holding) or organizations are small, medium or large, it is necessary to learning from the past, supervised the present and planning the future. For this, the enterprises continuous implement IT strategies & architectures to improve manufacture, research, products quality, sales, and service and to control costs. All enterprises have a local area network, an intranet or/and Internet, servers and workstations for operations, administration and management who work together for the same objective: profits. The enterprises uses Internet or Internet technologies to attract, retain and cultivate relationships with customers, streamline supply-chain, manufacturing, and procurement systems and automate corporate processes to deliver the right products and services to customers quickly and cost-effectively, also to capture, explore, analyze, and automate corporate processes information on customers and company operations in order to provide better business decisions.

New enterprise model architecture using Intranet/Internet/Extranet infrastructure and technologies is present in Fig. 1 [1] in a general aspect. In this way are dignify the customer – company (Business to Customer), company - supplier (Business to Business) and internal company (Intra-Business) relations [2].

As a result of a new product development paradigm, there is a greater need for software tools to effectively support the formal representation, collect and exchange of product information during the product development stage [3].

In the enterprise is very easy to obtain many important dates and information's requested to be know in the products development process as well as another specifics enterprise internal and external processes (Fig. 2) [4] unless employees used different (specialized) updated database as well as [5]:

- Materials Database for materials, raw materials and equipment structured by producers   for Technical & Manufacturing Department, Material Supply and Commercial   Departments;
- Codes, Standards & Technical Specifications Database for all applicable technical documentations;
- Laws in Force Database for Legal Department and Management Team;
- Competitors Product Database for Marketing and Research Development Departments;
- Employees Database for Human Resources Department and Management Team.

The quick access to dates does reduce, among others, the projects duration because for finalized one project is imperative to work with a big and diversified and structured quantity of dates and information's. Generally, the information's have a sources variety. Regarding customers, for example, if make information providing classification has [4]:

- Solicited, quantitative, structured dates – corporate under customer requirements check studies form, other producer's products tender analysis, etc. This information's are practical because identify the enterprise market place and set off his chink and strong point. Marketing Department obtains these dates type.
- Unsolicited, quantitative, structured dates – corporate under reports form and are receiving from different
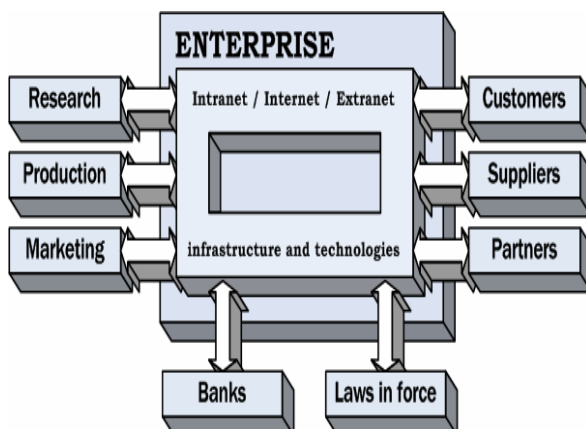

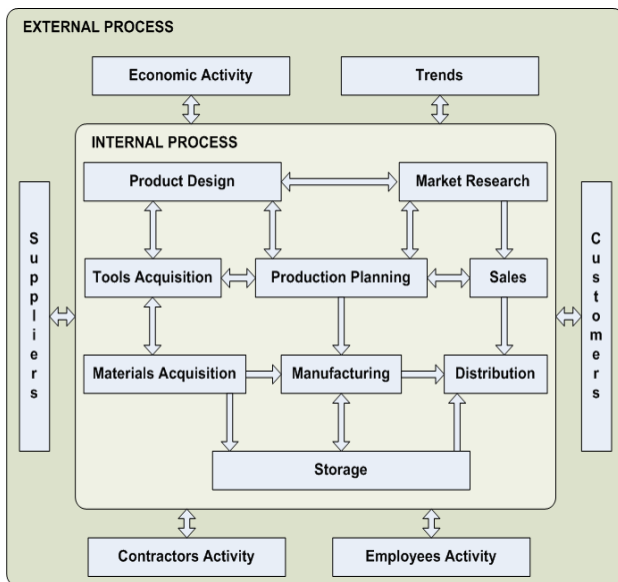**Fig. 1.** New enterprise model architecture.

Fig. 2. Internal and external enterprise processes.

governmental agencies such as governing rules or standards. Important is than these dates must be respected.

- Solicited, structured dates - acquired by through group's agency corporate with meetings among or with different organizations manager or expert's occasion, for positive/negative aspects identification, or for corporate actual and future products trends. It is recommended to records these meetings for revision so as to ideas extraction in a structured forms.

- Solicited, quantitative, random dates - issued dates from achieved survey based on customer's visits and from discussions with different in domain consultants.

- Unsolicited dates – these dates derived from enterprise agents, service points, training programs, shows, different specialized reviews, enterprise employees, and so on.

All these dates must be collected structured and processed and then tables form integrated in a database for extract the requested, qualitative dates.

Considering facile information's organization and recovering significance it's recommended to stock these in databases. In the last time the databases much growing and brings users a big profit. Just these reason majority database systems are expensive commercial applications and their documentation is hardly accessible. Therefore will be present in these pages a databases development method using Open Source Software products at the enterprise level. Certainly, implementation of this method at enterprises level depends of a lot of factors such as: the enterprise management team decisions, the IT personal number (especial programmers and analysts programmers number as well as of their training level), future strategies, projects priority, etc.

2. OPEN SOURCE SOFTWARE DEFINITION

Open Source is a software type characterized by free public access to source code in Open Source License conditions. Open Source Initiative, a non-profit corporation dedicated to managing and promoting the *Open Source Definition* give the open Source definition [6]:

Open source doesn't just mean access to the source code. The distribution terms of open-source software must comply with the following criteria:

Free Redistribution

The license shall not restrict any party from selling or giving away the software as a component of an aggregate software distribution containing programs from several different sources. The license shall not require a royalty or other fee for such sale.

Source Code

The program must include source code, and must allow distribution in source code as well as compiled form. Where some form of a product is not distributed with source code, there must be a well-publicized means of obtaining the source code for no more than a reasonable reproduction cost–preferably, downloading via the Internet without charge. The source code must be the preferred form in which a programmer would modify the program. Deliberately obfuscated source code is not allowed. Intermediate forms such as the output of a preprocessor or translator are not allowed.

Derived Works

The license must allow modifications and derived works, and must allow them to be distributed under the same terms as the license of the original software.

Integrity of the Author's Source Code

The license may restrict source-code from being distributed in modified form *only* if the license allows the distribution of "patch files" with the source code for the purpose of modifying the program at build time. The license must explicitly permit distribution of software built from modified source code. The license may require derived works to carry a different name or version number from the original software.

No Discrimination against Persons or Groups

The license must not discriminate against any person or group of persons.

No Discrimination against Fields of Endeavor

The license must not restrict anyone from making use of the program in a specific field of endeavor. For example, it may not restrict the program from being used in a business, or from being used for genetic research.

Distribution of License

The rights attached to the program must apply to all to whom the program is redistributed without the need for execution of an additional license by those parties.

License Must Not Be Specific to a Product

The rights attached to the program must not depend on the program's being part of a particular software distribution. If the program is extracted from that distribution and used or distributed within the terms of the program's license, all parties to whom the program is redistributed should have the same rights as those that are granted in conjunction with the original software distribution.

License Must Not Restrict Other Software

The license must not place restrictions on other software that is distributed along with the licensed software. For example, the license must not insist that all other

programs distributed on the same medium must be open-source software.

License Must Be Technology-Neutral

No provision of the license may be predicated on any individual technology or style of interface.

3. RELATIONAL DATABASES

A database is a structured data files. For added, accessed and processed database information's is necessary to have a database administration system. (E.g. Oracle, MySQL, PostgreSQL, Interbase). PostgreSQL is an object-relational database management system developed at the University of California at Berkeley Computer Science Department. A Relational Database Management System (RDBMS) is a complex software program [7], the purpose of which is to store, manage and retrieve data as quickly and reliably as possible. PostgreSQL used a BSD (Fig. 3) license (Berkeley Software Distribution).
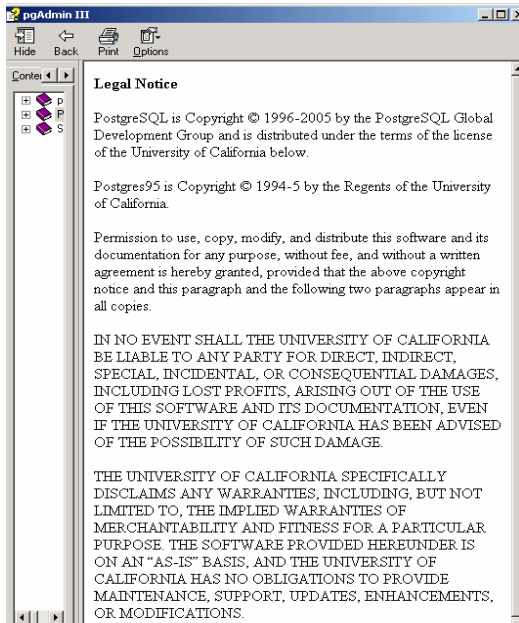

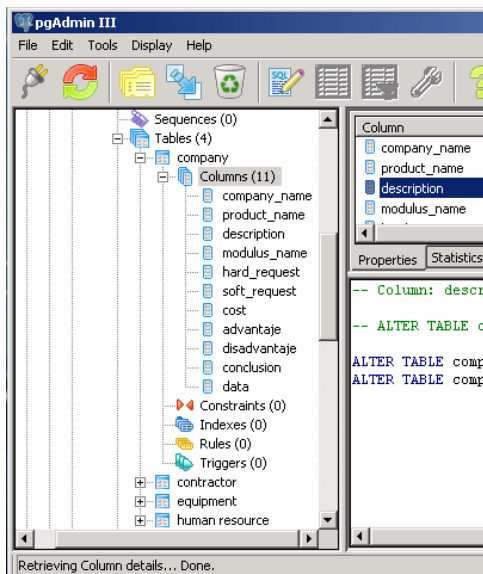
Fig. 3. PostgreSQL *License*.

Fig. 4. PostgreSQL *Company* table.

It is necessary just to keep the copyright and license information in the source code (it is imperative to mention *"This product includes software developed by the University of California, Berkeley and its contributors"*). This license has OSI certification. BSD license, technical support and public source property make PostgeSQL a very popular software product between enterprises who want to have a database because don't exist price cost, producer dependence or license agreements modification. PostgreSQL use the SQL language (Structured Querry Language, the most prevalent standardized language for database interrogation). For example, we created a table for software products evidence (Fig. 4).

SQL standard language is very accessible in the Linux medium because this language has a simple interface. SQL language under PostgreSQL accept SQL instructions such as created, erased from database, created, modified and erased from tables, modified, inserted and erased of recordings, recordings selection from different table and different base from database.

PostgreSQL uses a client/server model. A PostgreSQL session consists of the following co-operating processes [8]:

• A server process, which manages the database files, accepts connections to the database from client applications, and performs actions on the database on behalf of the clients.

• The user's client applications that want to perform database operations. Client applications can be much diversified: a client could be a text-oriented tool, a graphical application, a web server that accessed the database to display web pages or a specialized database maintenance tool.

4. MIDDLEWARE AND INTERFACES

A language who can translate the browser request, to process these request, to interact with software on server for requests satisfy and to server indicate exactly which need to send back to user's browser it is necessary to have. These languages, which work with the server and can execute these, are middleware. In the middleware languages class we have ASP, Perl, PHP and ColdFusion. PHP (Hypertext Pre-processor) program is Open Source, server-side, web scripting software. You can use, modify and redistribute free this product. PHP is a scripting language specialized for application developing through code integration in the HTML document. PHP syntax derived from C, Java and Perl. The difference between PHP and other similar product, such as JavaScript is then PHP is executing on the server when JavaScript is execute on the user computer.

An example of the dates issue from the *Company* table using PHP language is Fig. 5

All PostgreSQL features are support by graphical interface of PgAdmin III, interface who makes administration to be very easy. PgAdmin III is Free Software under the Artistic License (approved by OSI) and is designed to satisfy all users' requirements, from simple SQL queries writing to complex databases developing.

A HTTP (HyperText Transport Protocol) server for application rolling is request. Good choice is Apache because of flexibility, portability, safety and extensibil

```php
<?php
$db=pg_pconnect("host=... port=... user=...
password=... dbname=...");
if (!$db) {
        print("Connection Failed.");
        exit;
}
$company_name=$_GET['company_name'];
$data=$_GET['data_'];
$query= "SELECT * FROM company WHERE
\" company_name \" = '$ company_name ';";
$result=pg_query($db, $query);
$num=pg_numrows($result);
pg_close();
echo "<b><center>Database Output</center></
b><br><br>";
$i=0;
while ($i < $num) {
$ company_name Result =
pg_result($result,$i,"company_name");
...    ...    ...
$dataResult = pg_result($result,$i,"data");
echo "<b> Company name:$company_name </b><BR>
        ...    ...    ...
            Others information:$data<BR>";
++$i;
}
?>
```

Fig. 5. Example of the dates issue from the *Company* table using PHP language.

Fig. 6. Apache license.

ity. Apache has Apache Software License. This license is similar with BSD License but is forbidden to put the name *Apache* in derived products (Fig. 6) without Apache Software Foundation accord.

PHP and Apache for Linux is used. To apply the Apache License to your work, it's necessary [6] to attach the following boilerplate notice, with the fields enclosed by brackets "[]" replaced with your own identifying information. The text should be enclosed in the appropriate comment syntax for the file format. It's also recommended that a file or class name and description of purpose be included on the same "printed page" as the copyright notice for easier identification within third-party archives.

The interfaces with users and administrators are indicating to be simple to used, friendly, attractive, without many graphical pictures or animations because these does loading operation to be slower.

For the forms realized it can be used different language as HTML (HyperText Markup Language), CSS (Cascading Style Sheets) or JavaScript. Easy to used is HTML (Fig. 7) because this language can be edited in any text editor software and integrated the PHP script.

```html
<html>
<body>
<center>
<table width=500 border=0 CELLPADDING=1 CELLSPACING=
<tr><th>
<form action="insert.php" method="post">Company name
Product name:</th><th><input type="text" name="nume_
Product description:
</th><th><input type="text" name="um_prez"></th></tr
Modulus name:
</th><th><input type="text" name="um_exam"></th></tr
Hard - requirement:
</th><th><input type="text" name="doc_exam"></th></t
Soft - requirement:
</th><th><input type="text" name="spec"></th></tr><t
Acquisition cost:
</th><th><input type="radio" name="clasa" value="sma
Acquisition advantaje:
</th><th><input type="text" name="um_data_obt"></th>
Acquisition disadvantaje:
</th><th><input type="text" name="doc_um_data_obt"><
Conclusion:
</th><th><input type="text" name="dom_arma"></th></t
Others information:
</th><th><input type="text" name="data_echiv"></th><
<tr><td colspan=2 align=right><br>
<input type="Submit" value="Submit"><br></td></tr>
</form></table>
</body>
```

Fig. 7. Form for Company table administration using HTML language.

The most used HTML editors are Notepad for Windows and Pico for Linux. HTML is one of fundamental first WWW (World Wide Web) fundamental elements and describe primary format in which documents are distributed and visualized on the Web. Between his advantages specify the platform independence, hypertext links and documents conformation. HTML documents are ASCII Format documents and can be created with anything texts editor. HiperText is to say that any word, phrase, picture or any document element seen by user can make reference to another document.

This property facilitates navigation between multiple documents or internal same documents. The strict documents structure admits their conversion from a format in another as well as databases formed by these query.

5. DATABASES STORAGE

If, in the enterprise, we have many databases, appear the storage dates, protection dates and loosing date's problems.

A solution is to create and to implement own Data Center (Fig. 8) [9] based on multiple storage solution determine by used applications.

A Data Center (Fig. 9) admits all authorized user access, dates backup and restore, and dates procurements in complete destruction case. The storage data system will be protecting with dates loosing or partial/total destruction default.

In the modern data centers resources are used efficient by all users, because accessing possibilities, multiple storage system emerging in different locations. Every department's employees can find minimum packages of data, necessary to start their part. For have good result from the beginning is good for each department to have a
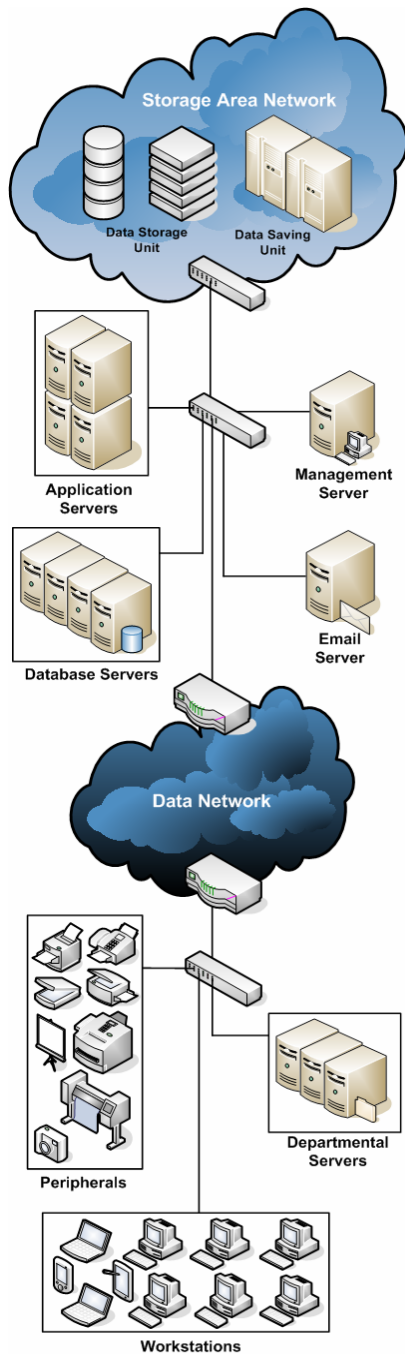
Fig. 8. Data Center general view.

Fig. 9. Data Center general architecture.

database administrator who make permanent database update, based on the dates provide from enterprise inside or outside.

The databases project finalization success depends of interdepartmental team co-operation, relation's work and of communications quality between database project co-ordinators and management team [10]. It is recommended than management team to know from the beginning what are the costs (human and material) and how much will be during the project.

Generally, to realize and to implement a database project are requisite a period within few months and few years.

6. CONCLUSIONS

Here it was describe few Open Source Software products and an implementation method. Database developing using these method request an application server and a database server (Fig. 10) [11].

Application sever are responsible of communication with users. Usual steeps in users working process with databases are the following (Fig. 11):

1. User makes a request for certain dates (e.g. a special form, a rapport or a situation).

2. Application server receives the request, locate the files and give request to PHP for processing.

3. PHP starts processing, make connection with database and send the request.

4. Database server receives the request, processing and sent to PHP the result.

5. PHP returns to application server the result.
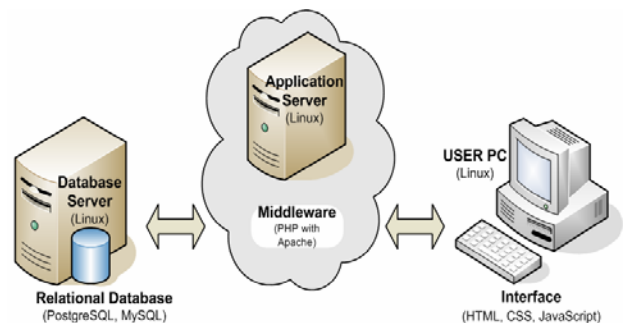
6. Applications server sent to user the result.

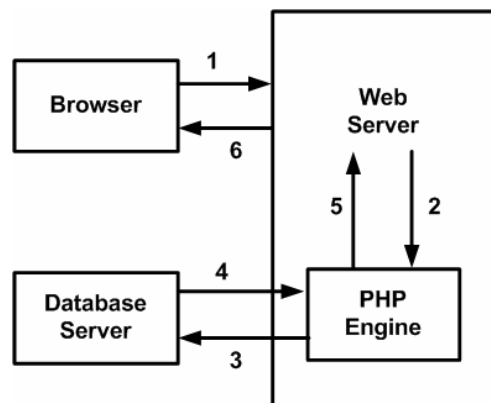**Fig. 10.** Databases general architecture using Open Source Software.

Fig. 11. The databases working process steps.

Must be known than open source products aren't in all cases better then commercial software. There is software Open Source who excels any commercial alternative as performance, but there is inferior software to comparative commercial software. Open source software with free sources is a good option these products having a remarkable quality because of fact then often these projects get together distinguished programmers and everything is public, open and anybody can come. Sources access and modified possibility is a great advantage even if very rarely somebody makes these modifications. Certainly, in the actual market the price makes the rules. Enterprise software solution is influence by shrift, medium or long-term calculation. Decision can be take consequence a comparative analysis.

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