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Modern technologies for data storage, organization and managing in CRM systems

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Abstract. In our study we intend to emphasize the main targeted objectives for the implementation of CRM type platforms. According to these objectives, in order to provide the functionality of CRM platforms, we will make a reference to the prime methods of collecting and organizing information: databases, data warehouses, data centers from Cloud Computing field. As a representative procedure of handling information we will exemplify the OLAP technique which is implemented by means of SQL Server Analysis Service software instrument. Finally, we will try to look over some of the Cloud Computing based CRM platforms and how the OLAP techniques can be applied to them.

Keywords: Business Intelligence, Cloud Computing, CRM, Data Centers, OLAP.

1. Introduction

The new information and communication technologies play an important part in focusing organizational strategies on the satisfaction of clients` needs and demands. The integrated approach of technologies, equipment and organizational knowledge in the systems for customer relationship management leads to a sustainable development of relationships between a company and its clients. So we could say that the incorporation of strategy for the customer relationship management, based on the new technologies, is imposed as a necessity in the current context, where attracting and keeping customers require orientation to market and to its needs.

Taking right decisions in real time regarding transactions is essential in the process of understanding what happens in any economic enterprise. Cloud Computing based CRM platforms must have analytical and interactive abilities in order to allow the makers of decisions to have a deeper perspective on the conducted activities, necessary for fast and documented identification of market changing conditions and for generating a response reaction according with those transformations. Analyzing Cloud Computing

based CRM systems helps the companies to obtain an increased profitability through streamlining the functional systems and the decisional capacities in order to improve activities and to increase the profit. In this context, Cloud Computing based CRM platforms which are endowed with Business Intelligence instruments are seen as being the key to any marketing analysis.

2. Targeted objectives by implementation of CRM platforms

The main objective of investment in CRM is represented by the automation of salesforce, the design of separate applications for CRM based on its own data. Current tendencies in customer relationship management consist in the idea of supporting the CRM platforms through data warehouses. Lately, data warehouses are found in data centers which are basically elements of Cloud Computing paradigm.

Following the implementation of data warehouses resulted higher amounts of data which are delivered in time and with a superior quality according to the objectives of business- improving services and keeping customers.

The targeted effects remain unchanged under the influence of CRM implementation, being subscribed to the general objectives on organizational level: getting new clients, building up strong loyalty relations, sales and post- sale services.

Both `business-to-business` and `business-to-customer` companies are interested in improving the loyalty relation with clients as a main purpose. Contrary, while the B2B companies intend to attract new clients, the B2C companies try to increase the customer satisfaction level.

In order to keep up with the accomplishment of these important priorities, the CRM Cloud Computing solutions are predominantly used by organizations of all size. Over 50% of big and medium organizations in North America and Europe have already implemented this technology and they are investing more and more in order to upgrade their CRM systems.

3. Databases, data warehouses and data centers for CRM platforms

One of the most important activity for marketing department or for the customer relationship management from any economic entity is the one of analysis of customers collected data. Some authors believe that economically, such an analysis can be accomplished through many steps:

- Marketing analysis;
- Market analysis through its segmentation;
- Using and combining marketing techniques;
- Observing the market and competitions' activities.

For the accuracy of marketing analysis, the interrogated collection of data must be as wide as possible and the analysis techniques must be fast, with an increased efficiency. In general, specialized CRM platforms are used as we pictured in a previous section. These contain guides, procedures, processes and strategies which give to the economic entities the ability to group interactions with customers and also the ability to

store all information about them. Slowly, economic realities led to shaping a brand new Business Intelligence concept which contains economic and informational notions and principles and suitable modern technologies.

Many authors define in an intrinsic way Business Intelligence. They consider that BI includes characteristics which are linked to the ability of collecting, processing and recording data which will provide information in time for customers and according with their requests. Some published studies picture the existence of the following components for Business Intelligence:

– Data sources - Are, in general, operational databases, data with a specific historical background, and data from different sources. They can also be relational databases or other data sources matching the applications. Some of them contain information that is structured as worksheets, charts or simple multimedia files;
– Data warehouses - Data warehouses are defined as data collections that are orientated towards integrated, timeless, historical and persistent subjects which are meant to support the process of managerial substantiation. Data warehouses have operational and external data in order to sustain the substantiation of decisions;

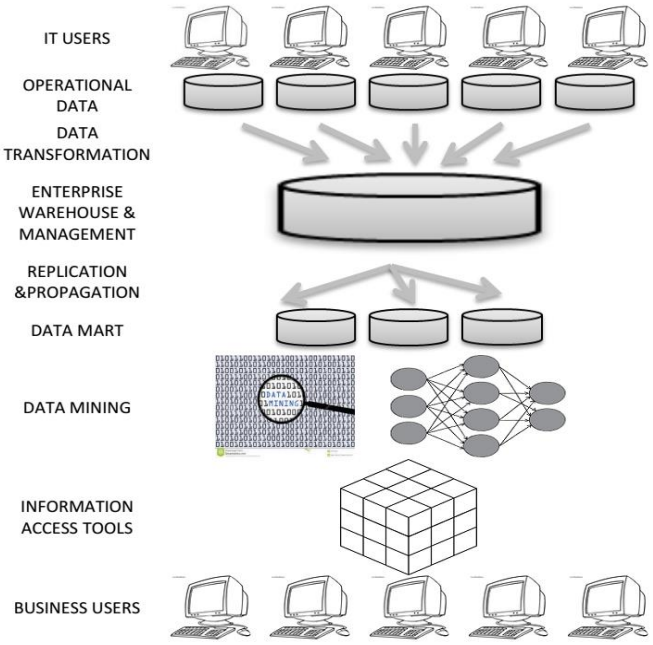

Fig. 1. Data warehouse architecture. Source: Khan A., Ehsanb E., Mirzac E., Sarward S., Integration between Customer Relationship Management (CRM) and Data Warehousing, 2011

– Mc Donell estimates that exist the following advantages of data warehouses: provide a single convincing data source for the business, offer clear relevant information in

time for making decisions regarding the business, the architecture of the data warehouse is scalable and extensible for the entire organization. In a personal acceptation, a data warehouse is a data collection which comprise a large period of time, well arranged on subjects and domains of interest, with an architecture that is adaptable to requests and capable to provide clear and exact information, given in real time for the assistance and the substantiation of the managerial decision;

– Data centers - A data center is a collection of subjects from a certain area which is meant to serve a specialized department such as financial, marketing or customer relationship management one. There is an independent data center suitable for the department which is many times used for giving information about customer. The right naming is Independent Data Mart- IDM. Inside the department it also exists a DDM- Dependent Data Mart- a subgenre of the data center where data is organized according to a set of requires.

Interrogations and reporting instruments- OLAP technique (On Line Analytical Processing) supplies a multidimensional synthesized image of data and it is used in reporting, analysis, modeling and planning with the purpose of improving the business. OLAP technique and its technologies can be used in working with data warehouses, data centers which serve intelligent informational systems. Some authors say that OLAP technique uses multidimensional data warehouses predominantly made of historical or external data which is originated in different organizations. OLAP technique permits a multidimensional modeling of data through the OLAP cube, a multidimensional structure, a hypercube that allows the complex aspects of phenomes being modeled.

Through a personal perception, OLAP technique represents a multidimensional analysis instrument of the big efficient data collections in real time, with increased accuracy which allows, thanks to the dimensional structural cube, complex modeling of any economic phenomenon. The newest software instruments make this technique one of the most used for the substantiation of economic analysis, that being easily extrapolated in the Cloud Computing area. One of this software is provided by Microsoft, SSAS- SQL SERVER ANALYSIS SERVICE.

New studies picture multidimensional analysis which can be obtained with the aid of the transferred information in SQL SERVER database. Those way managers can identify precisely the position of products when they develop strategies for value management or for calculation of clients' profit. Data transfer from an operational database integrated in CRM system of SQL SERVER gives the possibility of a diagrams' view.

Multidimensional analysis is achieved by using the instruments made available by Microsoft Excel- pivot tables. According to the known purpose, an analysis' cube is made that ensuring sales approach on two segmentation criteria: educational level and age. With the aid of Excel program, the cubes' dimension is divided in rows and columns considering the pivot, the amount of invoiced values.

4. OLAP technique extension in Cloud Computing area

In previous sections we proved that OLAP technique is a major component of Business Intelligence systems, which is used especially in data warehouses and data centers area. We aim to find out how extensive OLAP technique is and if it is according

to the new Cloud Computing technologies. Recent studies identify the next components of OLAP technique into Business Intelligence systems: a graphic component- an user interface which contains an extensive library with graphic reporting instruments, a component used for data analysis which includes predictive scripts, reports, interrogations and data examples, a component for OLAP cubes storage which consists in multidimensional data, extracted from data warehouses, a component for the process of data that is extracted from the data warehouses in order to integrate it in OLAP cubes, a data warehouses matching component, a component with a role in obtaining storage and process of external data, an IT infrastructure matching component.

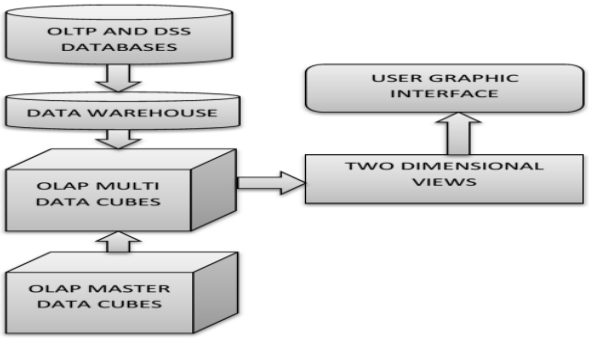

Fig. 2. Graphic for BI and OLAP. Source: Al-Agrabi H., Liu L., Hill R., Antonopoulos N Future of business intelligence in the Cloud, 2015

The previous picture indicates the existence of two OLAP cubes: a multidimensional OLAP data cube and a master OLAP data cube. The master cube has the aim of controlling the relationships between bi-dimensional data and multidimensional data cube. The data is included in online processing and transformed into tables. In return, these are included in databases which can be accessed by the final users.

Within the process of adopting the specific Business Intelligence systems to Cloud Computing we have to keep in mind the following aspects: adapting the Business Intelligence applications' standards to the Cloud Computing architecture standards, the introduction of a simultaneous data system that has a role in uniform delivery of interrogations and of some response times forms to all data servers, an architecture which is designed for the matrix distribution of interrogations.

There are architectural patterns of the mentioned directions. They cover the following elements: hardware resources for processing, storage and networks, software resources which consist in operational systems, data interrogations, data centers which consist in relational or multidimensional databases, data warehouses instruments, specific Business Intelligence instruments, application sets for data reading and analysis.

5. OLAP multi-cube CLOUD space

According to the previous experiences we will emphasis the modality in which the OLAP technology can be applied in the Cloud Computing space, more exactly we will show how a multi-cube can be built in an experimental data base center. The cube dimensions will be formed taking over data from the 3 created cubes connected to the central data cloud computing servers.

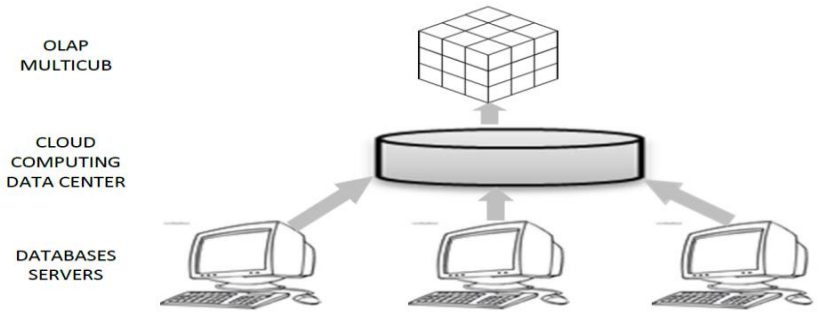

Fig. 3. OLAP multi-cube in a Database Center

To generate the cube model we will assume that we have to take decisions at a fundamental level of a company that acts in customer relationship management domain. Therefore, we will have to prioritize projects or stop projects depending on incomes that they will generate. For this, we will need the data stored on different servers of the regional departments of the company to be stored in corresponding data bases. We will need a data base that contains information about potential projects or projects that are already developing. This will be named: PROJECTS DB and contains the following head tables: clients, project list and project locations. It will be followed by SUPPLIERS DB and it is composed by the following tables: requests, offers received and orders placed. Another relevant data base in our model is MATERIALS DB that contains information about the necessary materials regarding the proper developing of the project. The tables included in this data base are: Acquisitions Demands, materials list, materials, producers.

The model we proposed is applicable, but indicative. The databases` structure can be modified regarding the company` activity, organigram, IT existing platform, etc. With the proposed model we try to simulate the real decisional activity. The existing data bases from the regional servers will be undertaken with Microsoft SQL Server software and elaborated with Microsoft Visual Studio.

In what concerns the data base structure, these are related as follows: in the PROJECTS DB, the relations are established in the tabs: Client ID and Location ID; in the SUPPLIERS DB, the tabs of connection between tables are: ID Request and ID Offer; in the data base MATERIALS DB the tabs of connection are: ID Acquisition, ID material and ID producer. The data base structure is illustrated in **Fig. 4** and **Fig. 5**

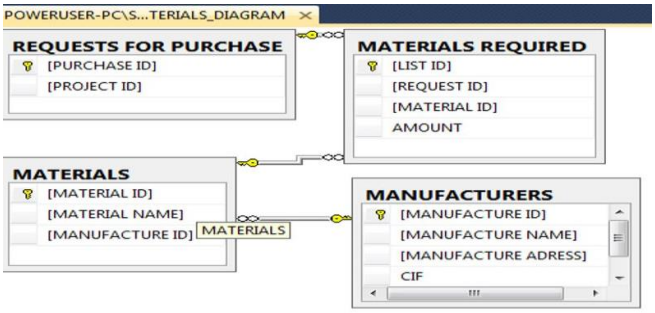

Fig. 4. MATERIALS data base structure - imported in the Center of DATA
Source: Microsoft SQL SERVER 2014

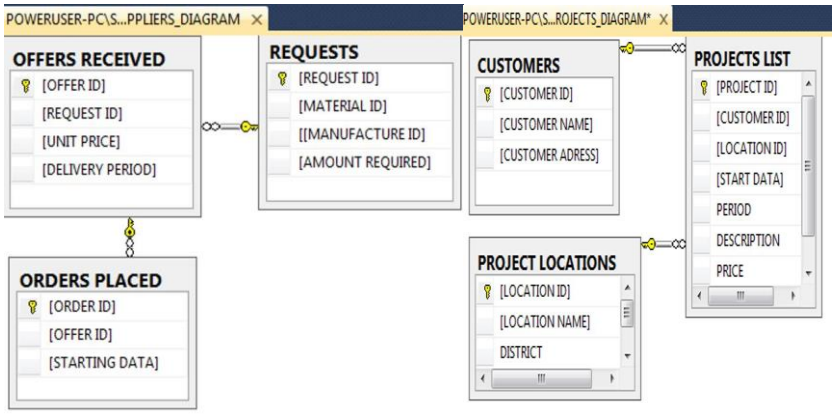

Fig. 5. Projects DB and Suppliers DB structures imported in the Center of DATA
Source: Microsoft SQL SERVER 2014

The existing data from the databases will be aggregated and used for developing the following cubes: PROJECTS, SUPPLIERS and MATERIALS. The information that we are willing to obtain from the 3 cubes are: the necessary amount of materials for the good evolution of the projects, total value of the acquisitions of materials and the total value of the projects.

The measurements of the cubes are: quantity, price per unit and total price. The three cubes will finally generate a multi-cube that will help us to calculate the total profit of the company.

To create the cubes, we used Microsoft Visual Studio and Cube Wizard. We selected the database assigned to the cube, then we introduced the created dimensions using the tables and we introduced the measures as we previously showed. The cubes structure is illustrated in fig. 6. For generating the multi-cube we will use the wizard through the option Mining Structures, stating that the database sources can be found within the existing cubes.

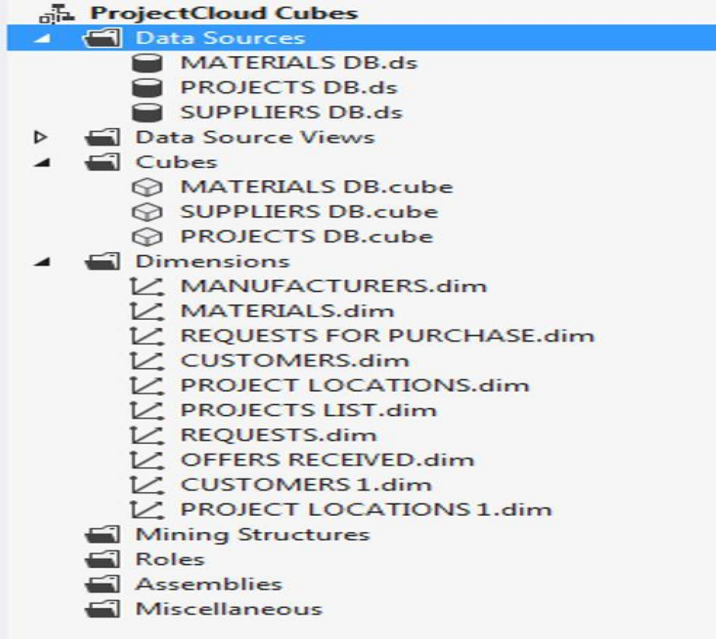

Fig. 6 Cubes structures created in Microsoft Visual Studio

6. The classification of CRM platforms that are using Cloud Computing technology; Forthcoming research directions

There are many types of Cloud Computing based CRM platforms which have to be taken into consideration: platforms that are designed for big and medium companies and specialized platforms.

CRM platforms designed for big companies- These platforms are made for enterprises with an income which is bigger than one billion dollars a year or with 1000 or more employees. These offer an entire range of functionalities which can serve to some numerous population users and have multidimensional and multilingual support. Some examples are: SAP CRM, Oracle Siebel CRM, Oracle CRM On Demand, Oracle E-Business Suite CRM, Oracle PeopleSoft Enterprise CRM, Microsoft Dynamics CRM, Pegasystems Customer Process Manager, RightNow CX, Salesforce.com, Chordiant Software CX Suite, Sword Ciboodle.

CRM platforms designs for medium companies- These platforms are made for enterprises that have an income which is less than one billion dollars and/or less than

1000 employees. These offer limited and simpler functionalities and capacities of CRM systems comparing to the platforms that are designed for companies' market. Some examples of such companies are: SAP Business All-in-One CRM, CDC Software Pivotal, Oracle CRM On Demand, Microsoft Dynamics CRM, FrontRange Solutions, GoldMine Enterprise Edition, Maximizer CRM, NetSuite, RightNow CX, SageCRM, Sage SalesLogix, Sugar Enterprise.

Specialized CRM platforms- These software solutions offer ample functionalities and capacities for both big and medium companies. Specialized CRM platforms are available for the automation of marketing, customers' services, customers' analysis and customer data management for specific industries such as sciences and telecommunications. There are five types of specialized CRM platforms: analysis platforms, customer data management, customer services platforms, marketing automation platforms, industry specific platforms. Some examples of such CRM platforms are presented on types as the following:

- Analysis platforms: SPSS Predictive Analytics;
- Customer data management: SAP NetWeaver MDM, Oracle Customer Hub, SAS DataFlux CDI Solution, IBM Initiate Master Data Service:, IBM InfoSphere MDM Server, D&B Purisma's Purisma Data Hub, Siperian MDM Hub, Sun Master Data Management Suite;
- Customer services platforms: Consona CRM, eGain Service, Genesys Telecommunications Labs' CIM Platform, InQuira Customer Experience Platform, KANA Suite, LivePerson's Enterprise Platform, nGen Customer Interaction Mgmt. Suite, Numara FootPrints for eService, Parature Customer Service;
- Marketing automation platforms: Alterian Marketing Suite, Aprimo Enterprise, Infor CRM Epiphany, SAS Customer Intelligence Platform, Teradata Customer Management, Unica's Affinium Marketing Management
- Industry specific platforms: Amdocs CES Customer Management (telecommunications), Veeva VBioPharma (sciences), StayinFront CRM (sciences), Cegedim Dendrite (sciences).

Regarding banking area, the main suppliers of Cloud Computing platforms which are adapted to financial and banking services particularities are: Salesforce.com, Microsoft, Oracle, IBM şi Pegasystems.

In the forthcoming article we aim to identify how the named platforms use Business Intelligence instruments. We aim to define a taxonomy for implementation of Business Intelligence systems in Cloud Computing, including configuration aspects, to create a methodology which allows organizations to develop their own applications for data storage and managing, a methodology for data storage in Cloud, for developing applications in Cloud Computing.

7. Conclusions

In our study we tried to penetrate a fascinating customer analysis data area, the area of Business Intelligence according to the latest technological tendencies and to the CRM platforms for Cloud Computing. In order to achieve our goals, we defined the

basic concepts, we tried redefining some of them through our perception and we pictured the way the OLAP technology is applied to data analysis. We made a classification of Cloud Computing based CRM platforms and we aim to have as future research directions the exact nomination of Business Intelligence components which are integrated in these systems and the possibilities of developing and improving them.

We appreciate that one of this paper strength is represented by the development of the concepts: Business Intelligence, CRM and Cloud Computing, strongly related one to another. We tried to develop these concepts by analyzing the data about clients. To achieve a correct analysis, in real time about the client, we have to use modern technologies in order to aggregate information. Therefore, we considered that it is very important to emphasis how data can be aggregate in Cloud Computing or in data centers of Cloud Computing, using the OLAP technology. The main difficulty we have faced in our research, and definitely a weak point of the paper, was the lack of real data. We propose ourselves in the future that all the models that we developed in this paper, both theoretically and conceptual, to implement them effectively, using real data.

Nevertheless, in the future research we will test, in order to obtain compared results, the functionality of the Cloud Computing platforms, classified previously.

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