Study on the Design of CRM-Oriented Synthetic Decision Support System

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Abstract—With the popularization of E-commerce in recent years, Customer Relationship Management (CRM) has gained much attention. Many companies have initiated projects to improve on customer orientation and plan the implementation of CRM systems. Among the desired benefits are increased customer satisfaction and retention by providing personalized products and value added services. With the aid of data warehouse, data mining and OLAP technology, businesses can formulate specific strategies for different customer bases more precisely. This paper presents a model and investigates the use of computational intelligent techniques for CRM. These techniques allow the complex functions of relating customer behaviour to intema1 business processes to be learned more easily and the industry expertise and experience from business managers to be integrated into the modeling framework directly. Hence they can be used in the CRM framework to enhance the creation of targeted strategies for specific customer bases.

Keywords—Customer Relationship Management (CRM), Decision Support System (DSS) , Data Warehouse (DW) , Data Mining (DM) , On-Line Analytical Processing (OLAP)

I. INTRODUCTION

Building and maintaining customer relationships is neither new nor necessary tied to the use of information technology. Nonetheless, the use of customer relationship management (CRM) systems is becoming increasingly important to improve customer lifetime value [1][2]. By providing information on customer data, profiles and history they support an important area of a company's core processes, especially in marketing, sales and service. However, in the fierce competition, for an enterprise, CRM should use the advanced information communication technology to pass the customer information to the enterprise, also should analyze and process this information to support the strategic decision-making of the production and operation of enterprises [3]. Therefore, introduction of decision support into the CRM in enterprise is very necessary.

II. CUSTOMER RELATIONSHIP MANAGEMENT (CRM)

A. Definition of CRM

Customer Relationship Management (CRM) is a strategy used to learn more about customers' needs and behaviors in order to develop stronger relationships with them [4]. After all, good customer relationships are at the heart of business success. There are many technological components to CRM. The more useful way to think about CRM is as a process that will help bring together lots of pieces of information about customers, sales, marketing effectiveness, responsiveness and market trends [5]. The idea of CRM is that it helps businesses using technology and human resources to gain insight into the behavior of customers and the value of those customers.

B. Core Management Idea

CRM is an integrated approach to identifying, acquiring, and retaining customers. By enabling enterprises to manage and coordinate customer interactions across multiple channels, departments, lines of business, and geographies, CRM helps enterprises maximize the value of every customer interaction and drive superior corporate performance [6]. Today's enterprises must manage customer interactions across multiple communications channels including the web, call centers, field sales, and dealers or partner networks. Many enterprises also have multiple lines of business with many overlapping customers. The challenge is to make it easy for customers to do business with the enterprises any way they want at any time, through any channel, in any language or currency and to make customers feel that they are dealing with a single, unified enterprise that recognizes them at every touch point.

III. DECISION SUPPORT SYSTEM (DSS)

DSS is an artificial intelligent human-computer system, which is based on management operational research, cybernetics and behavior science, by way of computer, simulation and information, synthetically using existing data, information and models, assists decision and resolves half structured or unstructured decision problems.

Traditional Decision Support System takes model base system as principal part, and assists decision by quantitative analysis. Model base includes many models, such as mathematics models, data processing models and graphics models. It's the kernel part of DSS. In the early 90's, Decision Support System and Expert System is combined as Intelligent Decision Support System. Expert System assists decision by qualitative analysis, which is combined with Decision Support System, has improved the decision ability farther.

In 90's years, study and development upsurge of Data Warehouse, Online Analytical Processing (OLAP) and Data Mining has started, formed DSS based on Data Warehouse, which is called synthetic DSS. It is a set of solving schemes

based on Data Warehouse, and using OLAP and Data Mining as implementation tools.

A. Data Warehouse (DW)

In the mid-1980s, the concept of data warehouse was proposed by the founder Dr. W.H.Inmon: Data warehouse is "a subject-oriented, integrated, time-variant, nonvolatile collection of data in support of management decisions" [7]. The function of the data warehouse is to provide a general data warehouse environment, by which users can create and maintain their data warehouse in accordance with different needs to finish data analysis and processing and provide preparation for Data Mining (DW) and Online Analytical Processing (OLAP) task.

With the appearance of CRM, the data warehouse seems to obtain a real business justification in a number of enterprises [8]. In CRM system, data are daily growing information and are distributed at different organizational levels, different locations within different types of databases, so the role of data warehouse is very important. It normally contains information about the customer, information gathered via purchase made, surveys, as well as other point of contacts information [9]. With the use of DW, the information of customers, products and services can be easily accessed and suitable for analysis using DM and OLAP.

B. Data Mining (DM)

Generally, data mining is the process of analyzing data from different perspectives and summarizing it into useful information that can be used to increase revenue, cuts costs, or both. Data mining software is one of a number of analytical tools for analyzing data [10][11]. It allows users to analyze data from many different dimensions or angles, categorize it, and summarize the relationships identified. Technically, data mining is the process of finding correlations or patterns among dozens of fields in large relational databases.

In CRM systems, data mining is the core technology. It refers to finding various valuable or disciplinary things from a large amount of data using a variety of models and algorithms. Data mining technology help enterprises manage all stages of the customer life cycle, including gaining new customers, making existing customers create more profits, maintaining valuable customers, and so on. It can help enterprises identify customers' characteristic, which enables enterprises to provide targeted services to customers [12][13]. It therefore provides services for the operation decisions of enterprises.

In the current practice of customer relationship management, data mining technology behaves mainly in the following areas: clustering and classification technology is mainly used for customer segmentation (Grouping) processing, such as the valuable customer group's classification. Correlation analysis technology is mainly used to analyze correlatively a certain customer group under a variety of indexes, such as that whether high-valued customer group is the customer group of high turnover rate or not [14]. Pattern recognition technology is mainly used for the identification of a customer's particular action, such as the identification of customers' calling pattern, the stock transactions, the consumptive preferences of credit cards, and so on. 0-1 planning technology is mainly used for the analysis of

applicability for clients with various marketing methods, which means that according to different customer groups, choose the one which is most likely to gain success and costs least, from e-mails, door-to-door marketing, plane advertising, online marketing, counter marketing, and so on. Forecast technology is mainly used to find out customers' future conduct, such as that in the analysis of customer loss, use neural network to learn various behavior changes before losing customers, then forecast (warn) the possible loss of valuable customers.

C. On-Line Analytical Processing (OLAP)

On-Line Analytical Processing (OLAP) was proposed by E.R.Codd father of relational database in 1993. It is a category of software technology that enables analysts, managers and executives to gain insight into data through fast, consistent, interactive access to a wide variety of possible views of information that has been transformed from raw data to reflect the real dimensionality of the enterprise as understood by the user.

OLAP tools summarize, analyze and process the customer information, improve the numerous data in DW into useful information, and offer an intuitive and easy-to-understand inquiry results to decision makers [15][16][17].

OLAP and data mining is complementary, but their emphasis is different. Data mining is mainly based on artificial intelligence, machine learning, statistics and database technology, is a decision support process. Through analyzing a large number of original data of customers, products and services, it discovers predict customer behavior to help the enterprises' policy makers to adjust marketing strategies to reduce risk and make the correct decision-making, focusing on automatic discovery of hidden patterns in data and useful information [18]. The OLAP will focus on the interaction with enterprises, a very rapid response time to provide the multidimensional data view. Data mining can expand the depth of the OLAP analysis and can find complex and detailed information. Meanwhile, the results of OLAP can provide analytical information, which can as the basis for data mining.

From the discussion above, based on DW, using OLAP and DM as implementation tools, the combination of the three can make the CRM-oriented synthetic decision support system more effective.

IV. MODEL DESIGN OF CRM-ORIENTED DECISION SUPPORT SYSTEM

As mentioned above, CRM has become one of the leading business strategies in today's competitive business environment. It is the information of three business processes including sales, marketing and service; the integration and the automatic processing of the means (such as telephone, fax, network, and E-mail, etc.) used to contact with customers; the processing of the information gathered from the above two and the building of customer intelligence so as to help enterprises making better customer management strategies [19].

A. CCDW (Customer-Center Data Warehouse)

Generally speaking, the integration of customer information and sales analysis needs at least five years or even longer, so the traditional database system is difficult to achieve this

application. Data warehouse technology must be introduced into enterprises to manage the customer information. That is to establish a CCDW (Customer-Center Data Warehouse), which can accomplish the integration and unity of the separated customer information from the enterprises.

In short, CCDW integrates the customer data spreading around the operation system through the methods of extracting, transferring and selecting the customer information related to the calculation of customer analysis indicators (customer value, customer loyalty, customer classification, and so on.). It is the basis of analyzing the whole CRM system [20]. With the introduction of CCDW and combination of data mining and OLAP in CRM, the effectiveness of CRM is greatly enhanced.

B. Structure of the System

In the traditional enterprise's decision support system, database, model base, knowledge base and method base are often independently designed and implemented. So, they are lack of internal consistency and good decision-making ability. In order to solve the above problem, this paper presents a decision support system model with CCDW as its center, with data mining and OLAP as a method. Its overall structure is shown in Fig. 1:
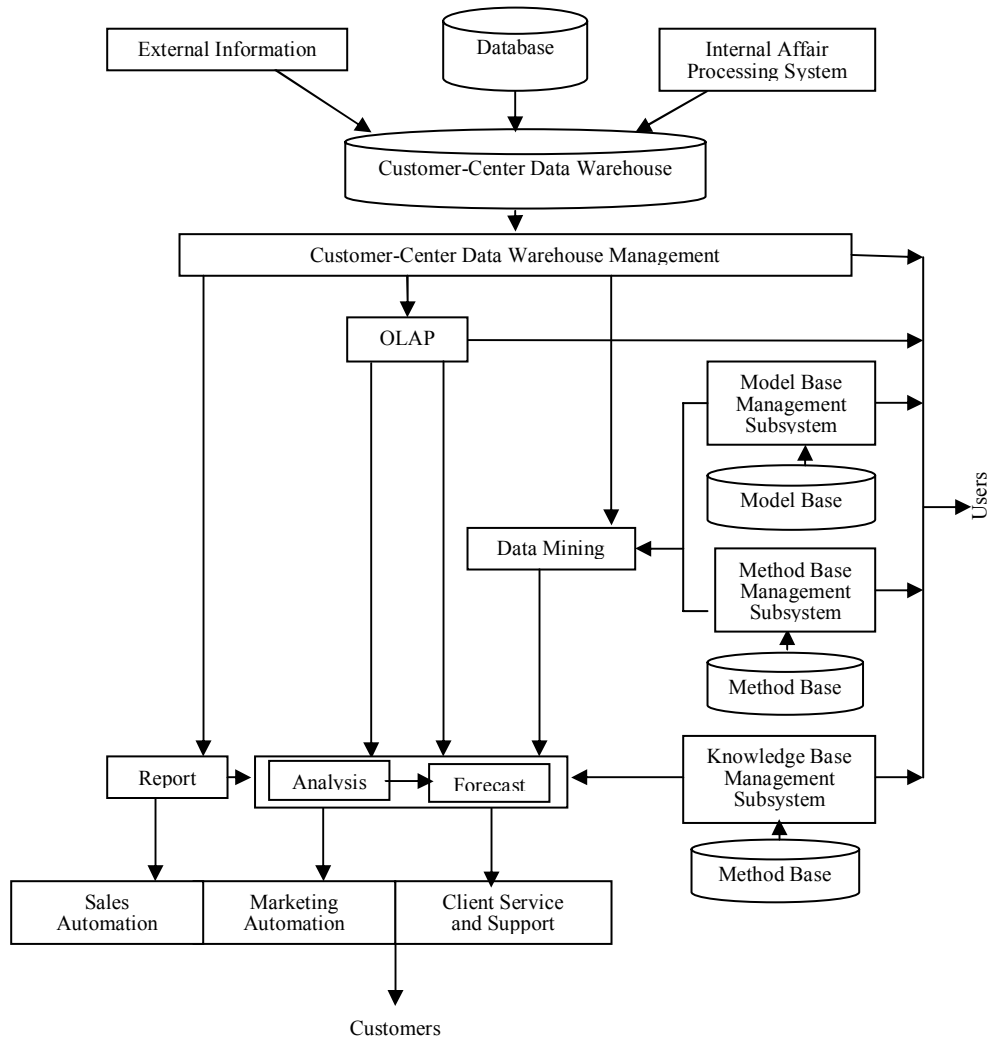

Figure 1. Framework of CRM-oriented DSS

The CRM-oriented synthetic decision support system integrates a great capacity of data concerning sales, services [21], market and operation; uses data warehouse, data mining, OLAP and decision support technology; translates integrated and reliable data into useful and reliable information, then translates the information into knowledge; provides further strategic and technical operation decisions for the whole enterprises; provides an accurate basis for the customer service and the development of new products; enhances the competitiveness of the enterprises [22]. Then the enterprises can concentrate their limited resources to all effectively

selected customers, and at the same time keep long term and effective relationship with these customers.

V. Conclusions

The development of CRM benefits from the development of computer technology, artificial intelligence technology and data-processing technology. CRM uses management and interaction with customers to reduce sales links, lower sales costs, discover new markets and channels, and thereby enhance customer value, customer satisfaction, and customer loyalty. While introducing decision support into CRM is the necessary means of implementing CRM smoothly, improving the efficiency of analysis and decision-making. So, with fierce competition among enterprises increasingly, as well as continuous depth implementation of CRM, this new type of CRM integrated with DSS will be recognized and accepted by more and more enterprises, and will generate tremendous return to the enterprise's investment.

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