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Research on Non-Standard Business Optimization of Insurance Companies Under Computer Big Data

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Abstract: - This article mainly describes a lightweight framework based on J2EE (Struts+ Spring+ Hibernate). Then the paper puts forward the design and implementation scheme of the electric power enterprise insurance system based on J2EE. The technical architecture, function model, data model, information security mechanism and test specification of the system are emphatically described. The goal is to use this architecture to increase program reusability and reduce engineering complexity. The NP method is used to screen the customers in the insurance system, so as to improve the effectiveness of customer relationship management. Finally, the feasibility of the proposed algorithm is verified by computer simulation. This method can not only ensure that probability 1 converges to the optimal solution, but also improve the efficiency of customer feature selection.

Keywords: J2EE; Struts; Spring; Hibernate; Insurance Computer System; Nested Segmentation Algorithm; Characteristic Selection; Pattern Recognition.

I. INTRODUCTION

After the 1980s, with the rapid development of computer technology, the insurance industry has gradually had the prototype of computer business system. In the development and implementation of the commercial insurance public insurance data warehouse, the operating system of the department has been continuously improved, and the data exchange and processing center has been built. How can people meet the needs of more and more insurance companies for the analysis and prediction of various queries, statistics and statements? How can enterprises effectively avoid and solve operational risks? How can people make better use of this information for operational and managerial purposes? How can insurance companies use these big data to plan their own development blueprint and seize market advantage. And this is exactly the problem that our insurance industry faces in the process of development [1]. As China's insurance market is a highly competitive and dangerous industry, its requirements for economic benefits have been changed from relying on short-term gains to achieving the maximum profits through appropriate strategy selection, and the success or failure of this decision will have an important impact on the survival of the company [2]. After years of using computerized business systems, insurance companies have accumulated huge amounts of historical data, which are their most valuable assets. In order to convert massive data into effective data, people need a set of appropriate analysis methods.

At present, China's insurance industry generally adopts the way of data warehouse, and after entering the WTO, foreign insurance companies with strong strength have also entered this field [3]. This requires the domestic insurance enterprises to accelerate the development in order to survive in the increasingly fierce market environment. In order to better conduct the research of business decision-making, many domestic insurance companies have begun or are carrying out the construction of commercial data warehouse [4]. Enterprise insurance is the most fundamental protection provided by the state and enterprises for the active and retired people. It is an inevitable trend to strengthen the work of the insurance industry, especially information technology, to carry out fine management of enterprises and improve operations and services [5]. Under the traditional power industry management mode, various insurance institutions usually have their own information systems, in different systems, there is not smooth information flow, there is a large number of repeated data input phenomenon, so the consistency of commercial data is difficult to be guaranteed, resulting in low efficiency. How to unify the different individual information systems, realize the unified management of the insured and the insured, and develop the integrated software that can integrate the information of various insurance is particularly important [6]. This paper discusses the problems that should be paid attention to in the integrated insurance system of industrial construction enterprises in China.

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II. INSURANCE SYSTEM SOFTWARE TECHNICAL ARCHITECTURE

Under the background of the rapid development of information technology, a lightweight J2EE solution (SSH) based on Spring architecture and integrating Strus and Hibernate is proposed according to the characteristics of power grid enterprises and their actual work needs [7]. The SSH three-tier architecture is a freely available framework comprising three distinct layers: the presentation tier, the business logic tier, and the data access tier. Here, the client does not engage directly with the database; rather, it communicates solely via the linkage between the front-end components and the intermediate layer, which subsequently interfaces with the database through the application server..

A. Introduction to Struts

Struts is an MVC architecture established on the SunJ2EE platform, which takes Servlet and JSP as the core, and can adapt to the needs of various applications [8]. Struts integrates servlets, JSPS, custom tags and related information in a unified architecture, which greatly shorters the development cycle of the system.

B. Introduction to Hibernate

Hibernate is an open source object-oriented mapping architecture that provides Java developers with an object-based approach to database manipulation through the simple packaging of JDBC. Whether it is a Java client or a Web application, Hibernate can be used for JDBC.

C. Introduction to Spring

Spring architecture is a hierarchical architecture, including 7 modules, the most critical is the Spring kernel container, which defines the creation, configuration and management of beans, the key component is the Bean Factory, which uses the method of reverse control to separate the configuration and dependency of the application. Spring framework introduces an innovative abstraction for data retrieval, featuring an uncluttered and effective JDBC design that markedlyenhances performance and mitigates the risk of errors. The data access paradigm within Spring is further enriched through its incorporation of Hibernate alongside other object-relational mapping techniques, as cited in reference [9]. Moreover, Spring facilitates enterprise-level transaction management, exemplified by its declarative transaction control for plain Java objects (POJOs). This empowers developers to create software without the intricacies inherent to Enterprise JavaBeans (EJB), while still benefiting from the vital services traditionally linked with EJBs..

III. DESIGN OF INSURANCE INTEGRATED MANAGEMENT SYSTEM

A. Functional model design

The insurance system consists of 12 main functional modules, which are: daily affairs management, organization personnel management, role authority management, system management, basic pension management, enterprise annuity management, supplementary medical management, four insurance management, commercial enterprise annuity management, local insurance management, comprehensive report display, log management, etc. The relationship between logic modules is shown in Figure 1 (the picture is quoted in Model-Software Components), each business function will be embodied in the logic module, and the system function is only summarized by taking basic old-age management as an example.

Collecting, storing and analyzing the collected information of social pension funds based on the three-level management of provincial, municipal and county companies has the following parts: (1) providing the information reported by each unit: (1) employee addition, reduction, transfer, file modification, employee supplementary payment, retirement approval, retirement change, confirmation and reporting. It can print, export, text, etc.(2) Data summary: Provide report functions of various departments such as employee addition, reduction, adjustment, file change, and renewal. You can do spreadsheet output and output. (3) The declaration of payment basis includes the addition, deletion, modification and inquiry of the payment basis of employees of each unit. (4) Payment basis query includes the payment basis query to the employees of each company and the output of Excel documents. (5) Employee payment declaration includes the addition, modification, deletion and inquiry of the employee payment basis. (6) Changing the "Retirement Declaration" includes inquiring and revising the retirement situation of employees of the unit. (7) "Modification of retirement Documents" includes the inquiry and modification of the "retirement documents" of the employees of the unit. (8) Information on receipt of information, including receipt of active files, contribution basis, retirement files, retirement pension. (9) The

output of the form includes the output of intra-provincial migration form, inter-provincial migration form, retirement approval form, total wage report form, total wage declaration form, statements, etc.

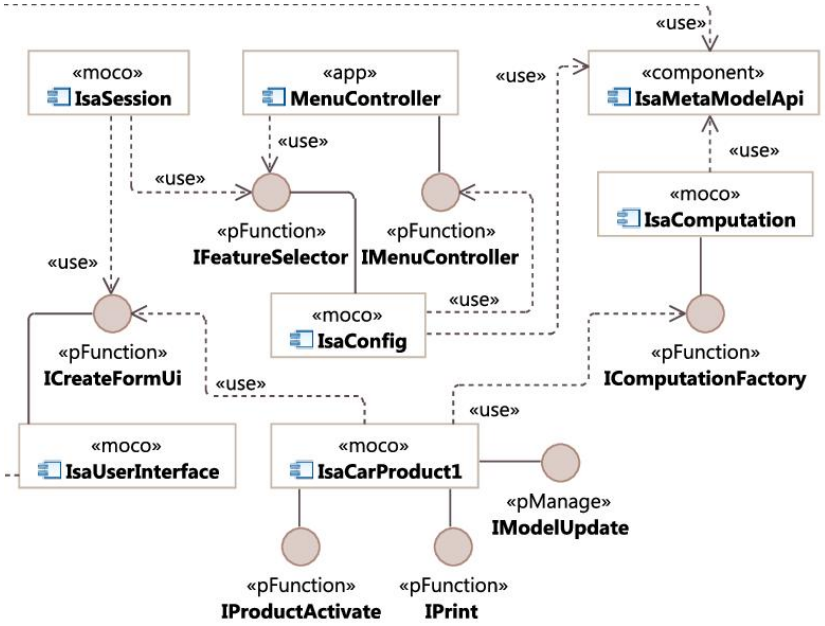

Fig.1 Logical module relationship of insurance system

B. Data warehouse technology

Compared with relational databases, current data warehouses do not have rigorous mathematical principles, but tend to be more practical applications [10]. From the engineering characteristics of data warehouse, from the technical point of view, its workflow can be divided into three parts: data extraction, storage and management, and data performance.

a. Data Extraction

Data extraction is the door through which data is imported into the data warehouse. It can be realized only after extraction processing [11]. Among them, several aspects of connection, replication, increment, transformation, scheduling, monitoring and so on are studied.

b. Storage and management

The presentation of data in data warehouse is also different. The primary problem facing data warehouses is how to effectively store and manage massive data, whose scale far exceeds that of conventional transactions, and will accumulate over time, so only relational databases can be qualified for this task. Secondly, because other data processing platforms have not realized the most basic general query function, this paper studies the multidimensional information processing method based on data warehouse [12]. Theoretically, the optimization for data support includes database indexing mechanism, query optimization, join strategy, data sorting, sampling and so on. However, in the data warehouse, there are highly inconsistent data between the various tables, and the optimal path obtained by the general query optimizer may not be the best, so how to convert the general relational database into the service suitable for the data warehouse still needs a lot of work.

c. Data display

The data representation is the "front" of the data warehouse, and its functions include multidimensional analysis, mathematical statistics and data mining. Mathematical statistics use statistics on data to verify assumptions about something in order to make decisions. Data mining is to actively seek and discover the laws behind the data.

C. Data model design

Because Hibernate is used as the O/RMapping tool, the method of generating Java classes -> Generating -> Modifying Hibernate configuration files -> generating a database table structure is used in the process of designing the database [13]. Developers design Java classes based on the business model, Hibernate configuration files can be generated based on the Java class, and it can be modified locally. Figure 2 shows the

database design approach (image cited in Using Hierarchies, Aggregates and Statistical models to discover Knowledge from Distributed Databases).

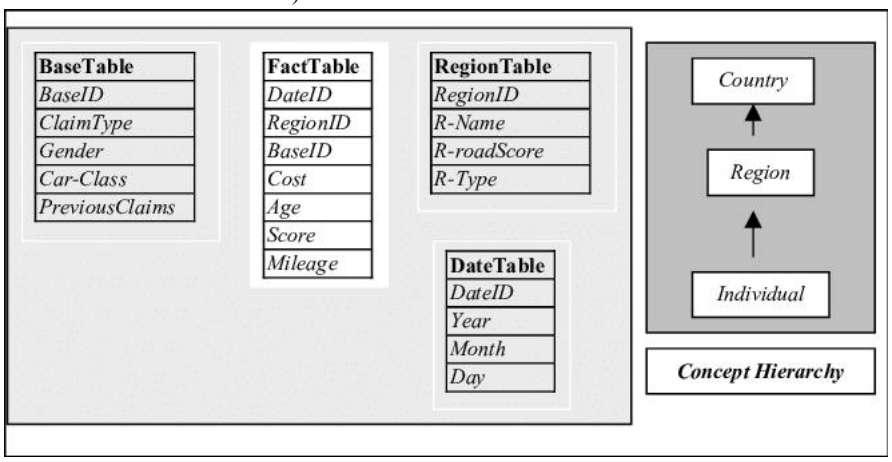

Fig.2 Database design approach

Eclipse+ Nitrox is used to write Java classes, create and change Hibernate profiles, and create data tables for them. In the data storage architecture, a database table is used to save the records of the province's power grid company. The main reasons are as follows: (1) The report should summarize the data of each unit. (2) The maximum number of data, estimated to be no more than 15,000 per cell and no more than 15,000,000 for 10 years, is acceptable for DB2 databases. (3) A retrieval method based on indexation is proposed. It can speed up the speed of retrieval. For the application scenario of the comprehensive security system, the clustering method of the middle layer is adopted to ensure that the operation efficiency of the system will not be affected when the system is accessed at the same time on a large scale. However, Hibernate needs to disable the caching mechanism of non-cluster classes.

a. Analysis of power insurance business

The insurance business process is very complicated, different from the general financial services industry, such as banks [14]. The basic procedures of insurance service include: insurance, underwriting, modification, reinstatement, loss reporting, transfer, charge, payment, claim settlement, contract termination. Figure 3 shows the Business Process for this insurance (the picture is referenced to Business Process).

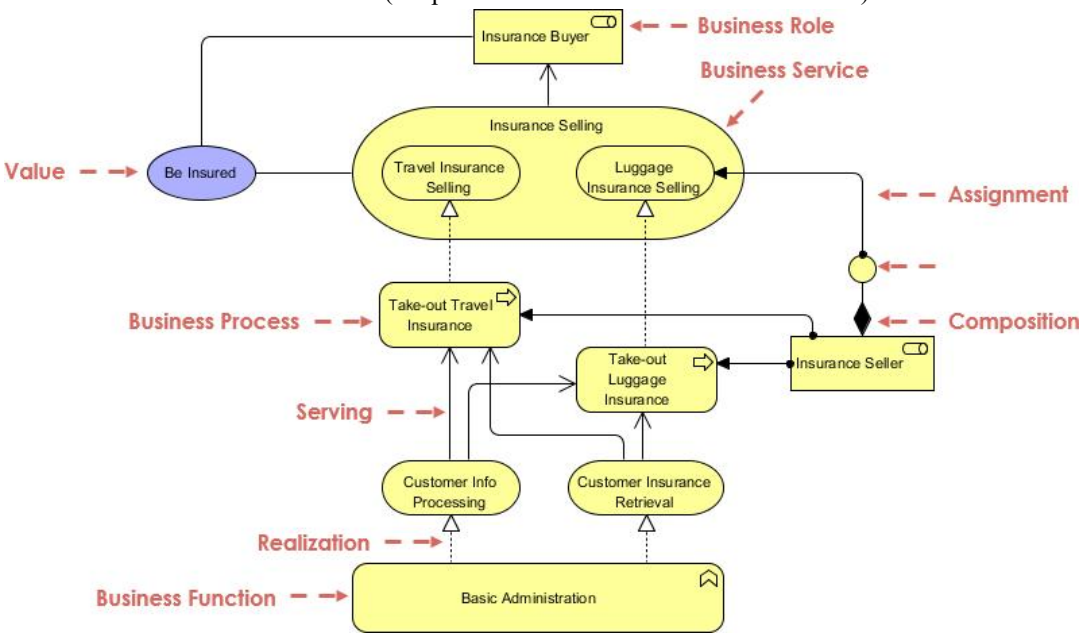

Fig.3 Insurance business process

During the life cycle of the policy, there may be situations such as correction, restitution, loss reporting, transfer, charges, payments, claims, contract termination, etc. Therefore, the content of the policy needs to be adjusted accordingly, and the data information in the corresponding business database should also be adjusted accordingly. This database operation can be summarized into some relatively simple operations, such as adding records, deleting records, modifying records, and querying information. Because the commercial database has the

characteristics of high frequency of data change and fast speed of data update, it is difficult to manage it reasonably.

The system strictly controls the user's permissions, the system first sets various permission groups, sets different permissions for various tasks, and can give each user the operation permissions of each task, if the user is not authorized, then the operation menu corresponding to the task will not appear in front of the user at all, such as: The insured personnel only set up an underwriting management authority, but there is no claim management authority, therefore, the insured personnel even claims management options do not see, naturally can not carry out the various functions of claims management; In addition, in order to access business data, the system also sets up different kinds of data authorization such as individuals, branch offices, branch offices, head offices, etc., which can set different access rights according to different users, such as: Employees of different branches can see the business data of their own branch, but can not see the business data of other branches, but the staff of the head office should let them browse the business data of each branch, and the staff of the branch can only see the business data of their own branch, but can not see the business data of other branches [15]. This can be achieved by setting the level of user access to the data. Through the full control of the user's authorization, the whole system is more secure and reliable, thus ensuring the stability and efficient work of the entire network and the security of data. the system administration process is shown in Figure 4 (image cited in blockchain for automotive: An insight towards the IPFS Blockchain-based auto insurance sector).

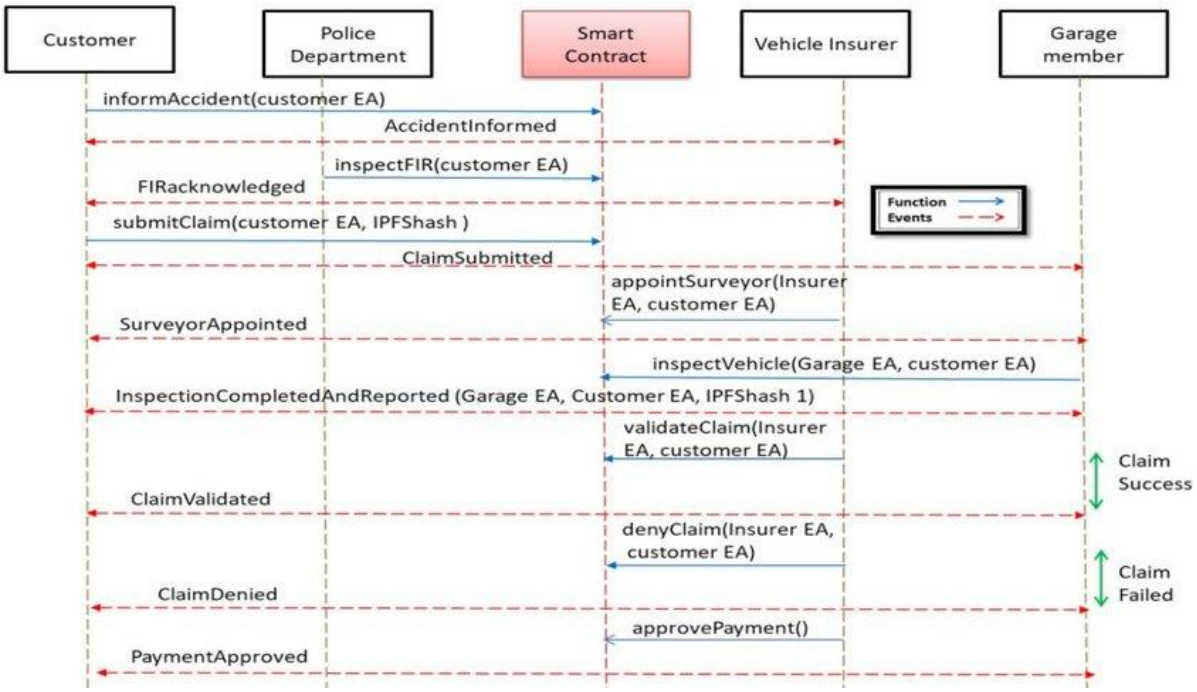

Fig.4 System management process

b. Data Environment Analysis

The microcomputer business system of China Power Supply Company consists of three business databases: marketing business database, direct selling business database and "old business" database. The so-called market operation is the insurance operation of individuals; Direct sales are conducted as a team [16]. The so-called "old business" is that before 1996, it was manually entered into a database without the use of computers. The enterprise sales database and the direct sales enterprise database have the same library and table structure, but the fields and meanings used are different. The "old business" database is structurally very different from the other two. The purpose of data warehouse is to integrate the above three different types of data to form a unified data warehouse. The integration process is shown in Figure 5 (image cited in IT Solutions for Insurance Industry).

The marketing operation database, the direct selling business database and the "old business" database are both relatively independent and interrelated. For example, if a customer bought a policy before 1996, his "old business" will have his personal data in its database; Then, he bought a sales insurance, in the sales system, there will be relevant information [17]. This is very common in OLTP, but not in OLTP. Therefore, when conducting customer relevance analysis, CRM needs to treat the two as one. This requires effective identification and integration of user data. In this case, the insurance company will establish a unique subscriber number for each customer. The user number is generated based on the user's identification code. This method can easily unify the

data of 3 commercial databases. Through the integration of the intermediate library, an intermediate library is established, and all the business activities of the enterprise are analyzed comprehensively.

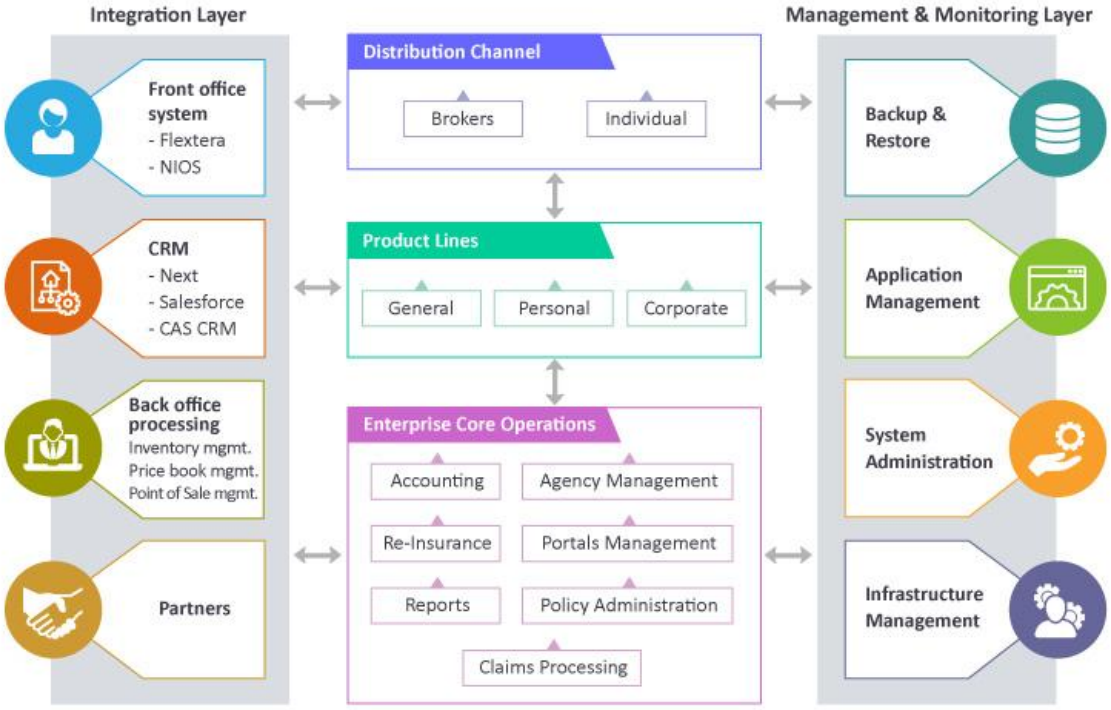

Fig.5 Insurance business data integration process

D. Information security mechanism

The architecture for the B/S architecture, through the application server for unified access to the database, do not need each client can be connected to the database, so you can eliminate the client through the system for direct access to the risk. In terms of operators, the method uses two methods of "user name + password", and the password is saved by password. For insured self-examinations, use Social Security number + ID number for verification [18]. After the system is put into use on the unified integrated platform of the provincial company, no additional authentication will be required. In this paper, an identity-based authorization management method is proposed. Firstly, by classifying different types of users and authorizing them accordingly, the unification of users and roles is finally realized. A user can have more than one type of character, and if a user has more than one character at the same time, the right to use it is the sum of all character uses. The data that the user can manipulate is determined according to the user's unit, and only when the user's permission is permitted, the user can manipulate the data of its unit, and can see the data of its unit or its sub-unit in the report. For the key functions in the system, the user's actions to the system are recorded in the form of log, which is convenient for future query and analysis, has a certain ability to prevent denial, and can also be recovered in the case of error. When HTTPS is used for encrypted transmission, you can ensure that no leakage occurs during transmission. Figure 6 shows the Secure encryption transmission mode of the insurance system (the picture is quoted in the Secure secondary utilization system of genomic data using quantum secure cloud).

The purpose of identifying enterprise customers and prospects is to find a customer who has a high life value (CLV) and can form and maintain a customer relationship with the company, so as to help customer maintenance and customer management, so as to improve the effectiveness of CRM implementation. In order to accurately identify customers, people must take some representative customers as samples, and extract the most efficient combination of customer characteristics, so as to achieve the distinction standard [19]. However, the basic feature vector of customers is a high-dimensional one. In terms of population and geography, customers themselves have characteristics such as name, age, gender, nationality, address, etc. On the purchase behavior, it shows the characteristics of purchase frequency, purchase period and purchase amount. When the number of samples is small, the use of massive features to classify the classifier has shortcomings in computational complexity and classification effect. Feature selection refers to the screening of the mass data according to the object to be measured, so as to achieve the dimensionality reduction processing of the image, and measure its effectiveness by

the divisibility criterion. The process of customer identification classification algorithm is shown in Figure 7 (image cited in Measuring and Improving User Experience Through Artificial Intelligence-Aided Design).

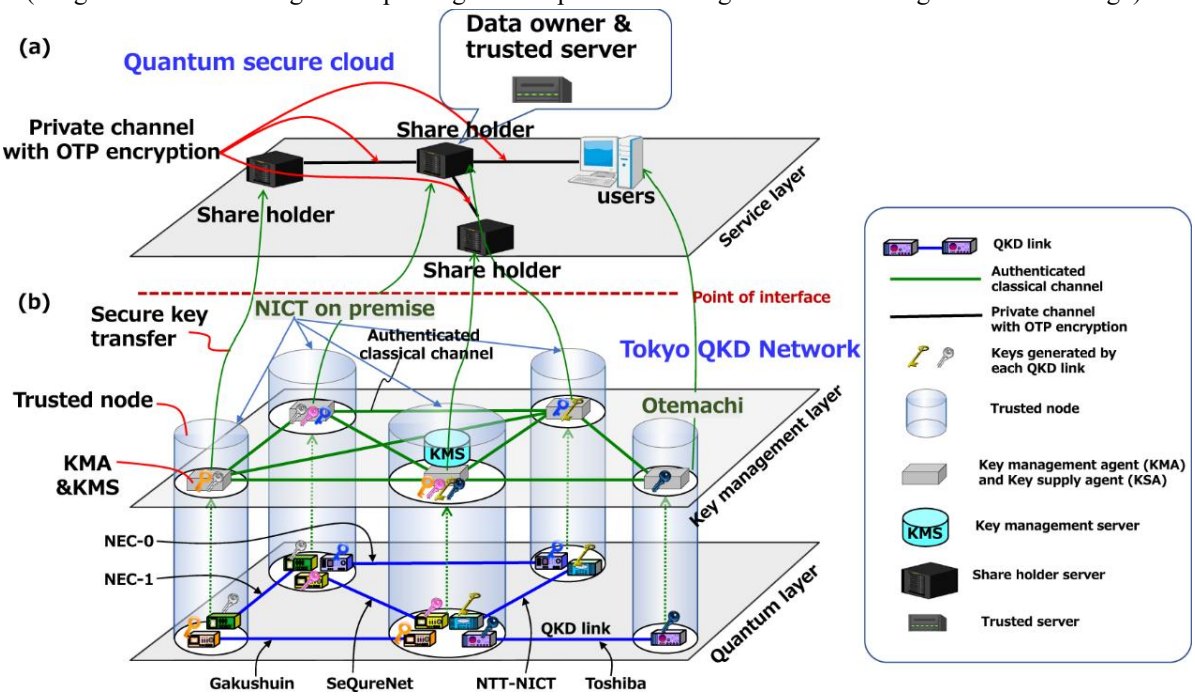

Fig.6 Security encryption transmission mode of the insurance system

IV. THE SELECTION OF CUSTOMER IDENTIFICATION FEATURES

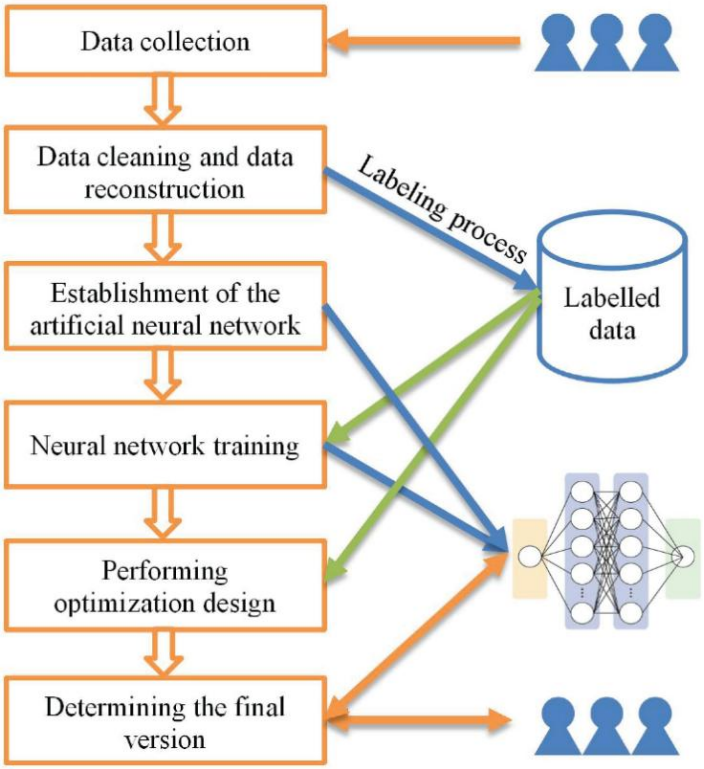

Fig.7 Process of customer identification and classification algorithm

A. Selection of customer characteristics based on separable criteria

The location of the customer in the feature space is not the same, so that the customer can be distinguished. If the space between two partitions is large enough, the separability of the class division can be improved. Classes are divided using the category interval within a class. Let $u_k^{(i)}, u_l^{(j)}$ be the s dimensional customer feature vector in class λ_i and Class λ_j sample customers respectively, and $\xi(u_k^{(i)}, u_l^{(j)})$ be the distance between these two

vectors [20]. The number of sample customers in class z, λ_i and the number of samples in class λ_j are respectively n_i, n_j. The prior probabilities are respectively P_i, P_j.

$$Gs(u) = \frac{1}{2}\sum_{i=1}^{z} P_i \sum_{j=1}^{z} P_j \frac{1}{n_i n_j} \cdot \sum_{k=1}^{n_i}\sum_{l=1}^{n_j} \xi(u_k^{(i)}, u_l^{(j)}) \tag{1}$$

When the distance between two vectors is in Euclidean distance form

$$\xi(u_k^{(i)}, u_l^{(j)}) = (u_k^{(i)} - u_l^{(j)})^T (u_k^{(i)} - u_l^{(j)}) \tag{2}$$

The average distance is

$$Gs(u) = tr(R_\lambda + R_\varepsilon)$$

$$R_\lambda = \sum_{i=1}^{z} P_i \frac{1}{n_i} \sum_{k=1}^{n_i} (u_k^{(i)} - v_i)(u_k^{(i)} - v_i)^T \tag{3}$$

The inter-class is

$$R_\varepsilon = \sum_{i=1}^{z} P_i (v_i - v)(v_i - v)^T \tag{4}$$

v_i is the mean vector of Class i sample customers and v is the lumped mean vector of all classes of samples. combine

$$v_i = \frac{1}{n_i}\sum_{k=1}^{n_i} u_k^{(i)}, v = \sum_{i=1}^{z} P_i v_i \tag{5}$$

The criteria are used because the customer is expected to identify results with as little intra-class dispersion as possible and as much inter-class dispersion as possible

$$G = tr(R_\lambda^{-1} R_\varepsilon) \tag{6}$$

B. Optimization of customer feature selection

If the customers of the same category in the sample are clustered together in feature selection while the customers of different categories are far away from each other, the customers are most easily identified [21]. The problem of customer feature selection is to select effective s features from the S dimensional original features of the obtained sample customers so that all kinds of sample customers can be separated as far as possible. Suppose the original feature vector of the customer is u_S, then the optimization problem of customer feature selection can be expressed as

$$Max\ z = G(u)$$

$$s.t \begin{cases} |u| = s \\ u \subset u_S \end{cases}$$

In formula (1), P_i is the prior i customers, which is the number of training customer samples: $P_i = \frac{n_i}{n}$.

The number of possible combinations of s features from S original features of the customer is $Z_S^s = \frac{S!}{(S-s)!s!}$, which is similar to the Traveling salesman problem (TSP). When the original feature vector dimension is high, the exhaustion method is too large to be realized. It is very meaningful to adopt some practical methods to achieve the accuracy of customer identification.

V. REALIZATION OF POWER INSURANCE BUSINESS DATA WAREHOUSE

In the process of online, the precision of the view in the data warehouse is very important. Online maintenance includes two key links: one is to modify the original data, and the other is to update it accordingly [22]. The data in trajectory database is modified by using database triggering technology. Although there are other ways to track changes to data in a database, such as viewing a database log file, a database trigger is the most appropriate way. Trigger program is a mechanism set in the database, its principle is very simple, that is, all

the events in the database that cause the table content to change, such as insert, delete, update, etc., will automatically perform the corresponding action. The experimental results show that the trigger can realize many different types of SQL statements, and can realize the modification of the data in the database well, and only need a small amount of database system resources. You can create a trigger by creating a trigger declaration. The SQL declaration is triggered as a trigger operation in a database table, and the SQL declaration is started in the database, as shown in Figure 8 (the image is referenced in the Data Mining Implementation Process).

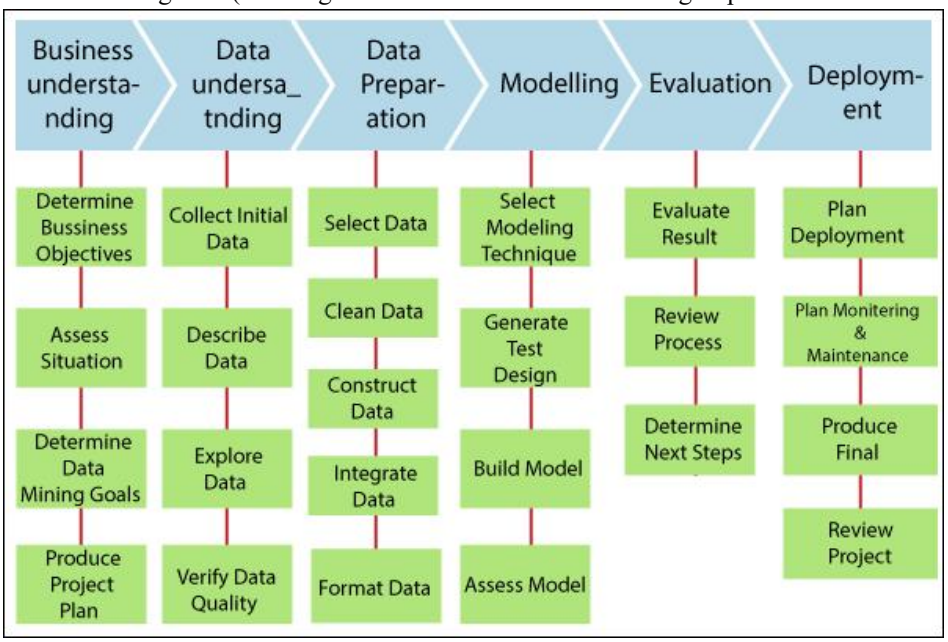

Fig.8 Database implementation process

The update of the data is mainly to prepare the data and load the data, this process often consumes a lot of system resources, so its implementation is often after the end of the work. Because there is no access at night, the current data warehouse needs to be automatically upgraded. Because the insurance company's data is stored on a Unix server, this can be done using Informix ESQL/C. Meta Cube is an OLAP online analysis and processing software with multidimensional data as its core [23]. The method finds the data set that meets the requirement from the database and parses it. Meta Cube is a standard SQL that works perfectly with Microsoft Excel and can be searched on the Web. Meta Cube can give full play to the various selection and analysis functions of relational databases, and integrate powerful and flexible query methods with relational databases, making it suitable for arbitrary queries and preset queries. ActiveX is a data display control component based on Informix metacube API, which supports network mode data warehouse and realizes report browsing, multi-dimensional online analysis and so on.

Insurance companies have many branches, and the distribution is very scattered, and many of the grass-roots branch staff can only operate through text terminals. It is necessary to make full use of 4GL language to access the data warehouse of the text terminal to achieve the purpose of making full use of the database.

4GLG1 is an advanced database access language that allows direct control of the screen. Before, if it was in a commercial database ranking, it would take at least ten minutes to complete, but with a data warehouse, the process is less than ten seconds. This allows rankings that can only be completed at the end of the month to be done at any time, greatly increasing the availability of data.

VI. SYSTEM TEST

The testing work of the project is divided into three stages: 1) The performance of each functional component is tested by manual and programming methods. The design of the test program focuses on the business logic layer, which needs to be realized by the programmer himself and carried out simultaneously with the coding program. 2) In the software development process, in the software development stage, the software development unit will carry out software development for the software and software development for the product. System testing focuses on the functionality of the system, the documents submitted, and the execution of the functionality. Conduct independent testing of tests, write test plans, test cases, test reports. In the process of testing, the normal data and illegal data are tested by manual detection method. The data saving module is easier to use, but the correctness of the data is also important. 3) In the actual application, Loader Runner and Jmeter software are used

to simulate the actual application scenario and test its indicators. The performance test is also stress tested to get the maximum operating load that the system can withstand. Figure 9 shows the system interface.

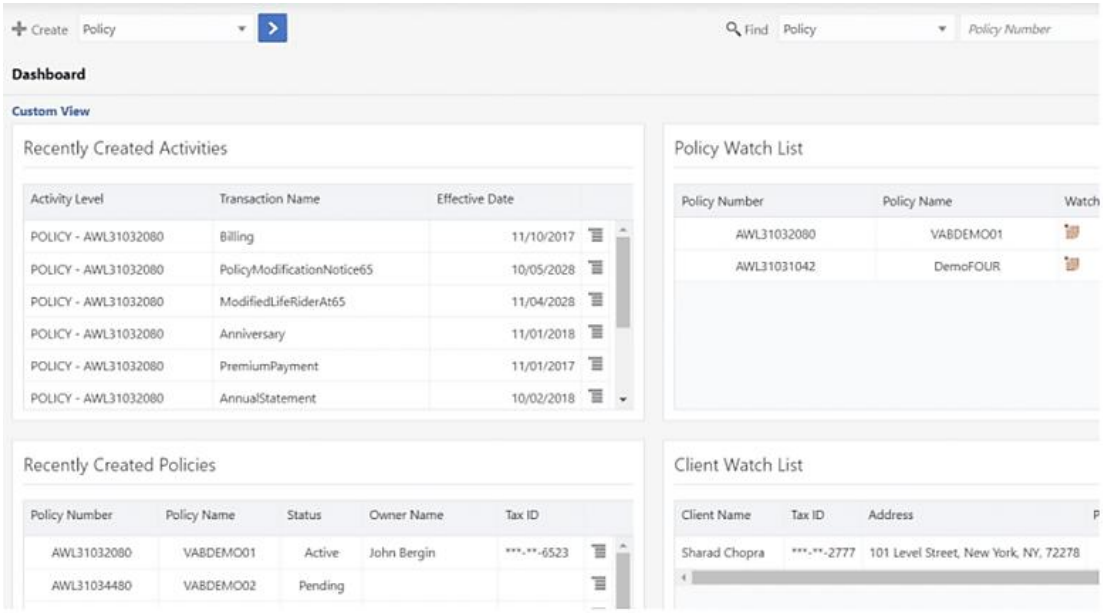

Fig.9 System part interface

VII. CLOSING REMARKS

The effectiveness of the proposed method is confirmed by the actual deployment of the system in a real world environment. The project was not only developed successfully, but also rigorously tested within the regulatory framework used by the company. This practical application demonstrates the robustness and applicability of the method in an operating environment, underscoring its potential to improve process efficiency and reliability. In addition, the system can be adapted to similar regulatory environments, thus providing a scalable solution for insurance regulation in various sectors.

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