The Methodology、 Meta-Synthetic Integrated Environment and Data Accessing Service of Stratagem Research

Wei Jicai, Ren Tingguang, Zhang Jing

***Abstract*:** The stratagem-research(SR) methodology was brought forward and constructed in this paper, under the guidance of the combination of qualitative and quantitative methods, the meta-synthetic integrated environment of SR was designed. and then, the data accessing service is designed to meet the needs of searching and utilizing various data in the meta-synthetic integrated environment of stratagem research (SR) and meanwhile data fuzzy mining engine is supposed to refine the collected data to make them useful for the stratagem research. Also, for accessing and utilizing database, data accessing API is designed, which provides a uniform interface for all data accessing requests and with mapping function gets all data address and accessing transparent.

Key words: Stratagem-research, Methodology, Meta-Synthetic Integration environment , Data Accessing Service.

I. Introduction

STRATEGIC issues bearing on the overall situation is the strategy decision-making procedure. To a country, it relates to national security and interests. Strategic issues related to political, economic, military, diplomatic factors, etc., is a kind of typical complex system. Traditional research approaches could not fully meet the requirements of modern strategic study. It is difficult of them to understand and analyze stratagem development and transformation principles. This requires the introduction of new ways and means, which was set and called as strategic research methodology in this paper, to help develop strategic decision-making, and to evaluate strategy projects. At the same time, high-level decision makers could engage in strategic thought and ability training, during which the qualitative and quantitative analysis environment would be provided to support decision-making.

Firstly, the Strategic Research Methodology(SRM) was proposed and established. Furthermore, under the guidance of SRM, the Meta-Synthetic Integrated Environment of SR (MSIESR) was designed and implemented to deal with the stratagem research difficulties. Then, under the meta-synthetic integrated environment of stratagem research[1],[2], relevant data, information and knowledge in different formats involving politics, economics, military or diplomacy need to be adopted to support the work of stratagem research. These data, information and knowledge may come from different sources, with some from the simulation system or the comprehensive evaluation system under the meta-synthetic integrated environment of stratagem research, others from internet or various circles of the society. In order to make these data, information and knowledge more efficient and accessible for the stratagem research, we are supposed to figure out the potential correlations among them for the strategic decision makers or researchers and extract from them the useful elements so as to provide some useful knowledge for the decision support and studies. Additionally, to make all of the applied systems (like simulation system, the evaluation system, etc.) under the meta-synthetic integrated environment more accessible to users, user interface and data accessing API are designed, coupled with data mapping, to get all data address and data accessing practices transparent. For the sake of these applications, data accessing service in the meta-synthetic integrated environment of stratagem research is designed

II. Stratagem Research Methodology

Any country or region would carry out the strategic research from its own development needs based on the geopolitical, economic forms, geographical environment, military power, ideological and other factors comprehensively[3],[4]. Because the strategic issues are of wide research field, many influencing factors, and great information quantity, stratagem research would relate to many complex models, qualitative and quantitative combination analysis, and high authority[5]. Then the conclusion could be drawn that the SR is a kind of typical complex systems. The complexity is mainly manifested in four aspects, the hierarchy, emergence, non-linear, and adaptation[6].

Strategic Research Methodology (SRM) is to solve the problem of strategic studies. SRM would be of various methods, theory, and the mutual relationships between methods or theory. It would realize the organic combination of theoretical approaches with the overall concept of strategic research. When establish and utilize the strategic research methodology some principles should be kept, as follows.

A. Research Dynamically and Integrated

Strategic research should be used dynamically, based on the system characteristics, carried out from an overall perspective. It is necessary to focus on strategic research in the various components. Furthermore, we should pay attention to the interaction between them and the results generated by the overall effects, so as to embody the emergence of the system fully.

B. Embody the Hierarchy

Strategic research methodology should be adapted to different levels of strategic studies and form a set of standardized methods. Furthermore, of different levels for a variety of related methods, and realize the organic integration.

C. Combine the Qualitative and Quantitative Methods

The complexity cause the strategic research must adopt a combination of qualitative and quantitative methods. At the same time, strategic research focus on macro-planning, so the methods should be supplemented by qualitative mainly and quantitative partly.

Summarily, to use strategic research methodology effectively, it is necessary to construct a special environment for strategic research. The environment should reflect the strategic course of the study, groups of intellectual acts, the overall use of effects and dynamics of implementation capacity, while providing quantitative analysis of assessment tools, which constitute the work of a group decision-making model, decision-makers and stakeholders could complete the strategic research mission in the environment.

III. The Meta-Synthetic Integrated Environment of Stratagem Research

The Meta-Synthetic Integrated Environment of Stratagem Research (MSIESR) is an integrated environment for collaborative work. According to the different stages of strategic studies, different research methods are introduced to fulfill different corresponding strategic research. In the functional sense, MSIESR should support different strategies research problems and have the ability to collaborate the whole process of research. From the software appliance perspective, each tool or system has the flexibility and reorganization, and could be used to customize mission constitutes a research-oriented software environment flexibly.

A. Description of MSIESR

The combination of qualitative and quantitative methods is the fundamental nature of MSIESR. According to MSIESR, the human knowledge and judgments would be characterized and be combined with the quantitative models and data, so as to achieve the inter-conversion between qualitative knowledge and quantitative data. It is necessary of MSIESR not only to take advantage of computer to solve structural problems, but also to utilize the intelligence of people (experts) to solve the unstructured problems, i.e. the computer deal with quantitative and qualitative analysis of experts together. Therefore, the MSIESR is not only a computer and network-based software environment, but also could be used by the analysis users, the research users and the game users. Focused to solve the strategic research missions at different stages and from different levels, the environment-related data, information, model and knowledge would be used to complete the strategic research work.

B. Construction of MSIESR

The construction structure of MSIESR is shown in Figure 1. The Architecture includes the software tools and subsystems (such as simulation systems, gaming systems, video conferencing systems, etc.). The Technical Standards regulates the software standards, interface standards and data standards. Execution based on the architecture and technical standards, organizes and takes advantage of the related tools, software and data to complete the study mission. Network and Computer is the basic physical environment of MSIESR. And the Fundamental Resources include all kinds of resources for the strategic research, such as data, model, etc, and the variety of resources produced during the course of the research.

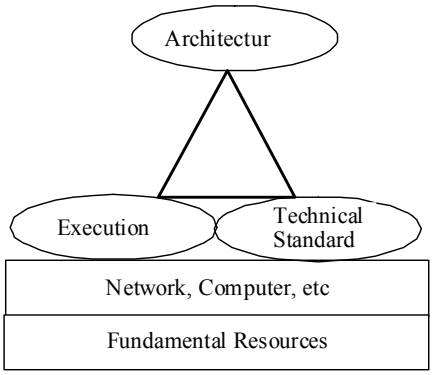

Figure 1 Construction of MSIESR

C. Architecture of MSIESR

The architecture of MSIESR is composed of the user, the software pipeline, the integrated management, the discussion and gaming environment, the video conferencing system, the simulation systems, the simulation development system, the service layer and the corresponding database, as shown in Figure 2.

User. There are three categories of User of MSIESR, including the Red side, Blue side and the Director. The red side, blue side are on behalf of different interest groups. And the director side would complete the process of discussions with the deduction supervision, information communication and convicted. When Users use MSIESR, they could finish various missions, such as adversarial argumentation seminars, deduction and argument, etc., not only under the auspices of the director, but also on the behalf of one simple side, red or blue side, individually.

Software Pipeline. Fulfill the task of transmission the variety of integrated information in MSIESR.

Integrated Management. The integrated management completes all the software asset management functions, such as software installation, deployment and setting, run-time status monitoring and control, etc. It should be of online help function, the security management and audit, the user management and so on, either. And it's also of the ability to carry out the unified management of resource.

Discussion and Gaming Environment. The discussion and gaming environment adopts the thought of "people-in-the loop and human-centered", in order to support the strategic studies experts group with a virtual research environment., in which the experts could get several tools available to support information retrieval. Then expert groups could realize the experience and knowledge sharing. Thus, the experience, knowledge, and judgement，could be combined with the data, models and methods among the environment, which cause that the study of strategic issues is no longer a single, stand-alone or time-limited

discussion, but a kind of continuous interaction and mutual co-ordination process.

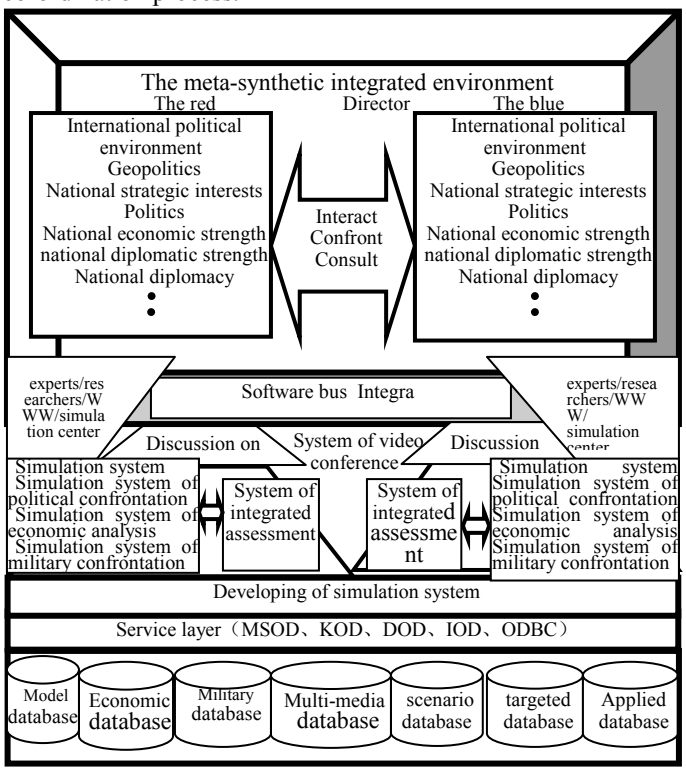

Figure 2. The Schematic Diagram of the Meta-synthetic Integrated Environment of Stratagem Research

Video Conferencing System. Video conferencing system would support the network's video conferencing environment. User could control the number of video and display customized manner with the software manners.

Simulation Systems. Simulation System completes the quantitative analysis and support during the course of study, such as military confrontation simulation system for military combat forces assessment, the, economic analysis system for the completion of a country or a region's economic situation in a certain period of time. Simulation Development System. Simulation System Development Environment complete the process of proof required for study at all levels of the development of simulation systems. The simulation systems could not only be centralized, but also be distributed or parallel. When developing these simulation systems, the operational control manners could be determined at the same time.

Service Layer. Service layer would provide the underlying services, including MSOD (Modeling and Simulation On Demand), KOD (Knowledge On Demand), DOD (Database On demand), IOD (Information On Demand) and ODBC and other service functions.

Database. It would support a variety of databases and realize the function for the data storage.

D. Execution of MSIESR

The execution MSIESR reflects the basic steps and methods of strategic studies. Based on the research mission, the research process would be determined, the tasks could be decomposed, and the research process would be implemented. Concretely, the transaction could be divided into six steps.

Step 1, choose research methods.

Step 2, prepare the software environment.

Step 3, develop the demonstration systems.

Step 4, prepare data.

Step 5, execute system.

Step 6, assess comprehensively.

Among them, research methods choosing is based on research problem in MSIESR and selects the appropriate research methods, such as the simulation methods, the discussion methods and confrontation deduction methods. The software environment preparing is based on the method chosen by MSIESR at step 1, and organizes all the available software related to the corresponding task in MSIESR according to the Integrated Management. The demonstration systems' developing is based on research tasks and takes advantage of the Simulation Development System to develop the proper system. Data preparation is to get all the data related to argumentation ready. And the system execution is to run mission-related system and save the results. The comprehensive assessment is the final step in the feasibility studies, through the demonstration of data analysis and synthesis, the relevant measures and suggestions would be proposed.

E. Application of MSIESR

When dealing with the actual stratagem analysis problem, researches could take advantage of MSIESR and follow the steps described in section *D*. According to the relevant requirements and background, it's not restricted of users to choose all the six steps above. Users could just select the necessary and steps.

IV. The Structure of Data Accessing Service System

Data accessing service is one part of the Database on Demand (DOD) under the meta-synthetic integrated environment of stratagem research (see Figure 2), and the other part is resource accessing service. The resource accessing service, based on the resources from the internet, is to do the preliminary data mining, the results of which will be stored in the target databases; while the data accessing service, directly facing users under the meta-synthetic integrated environment of stratagem research, not only conducts deep data mining and searching on basis of the target databases but also provides the access interface to the applied systems.

On basis of data collecting and mining, it establishes a low-level database through data fuzzy mining to furnish the applied systems under the meta-synthetic integrated environment of stratagem research with data accessing service. The structure of the data accessing service system can be seen in Figure 3.

It mainly consists of user interface, the data accessing service and the corresponding database layer within Database on Demand (DOD). Through the data mining in target data resources, it provides all the users, environments and the applied systems of the stratagem research with necessary data, information and knowledge, and also provides a uniform

interface for searching, collecting, classifying and accessing data.

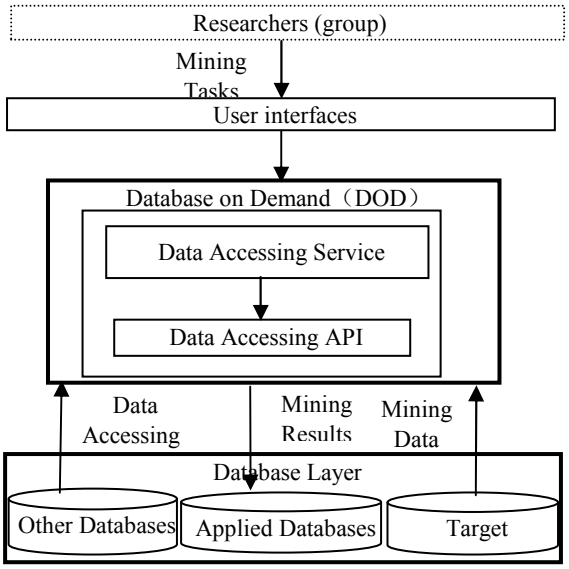

Figure 3. The Schematic Diagram of the Structure of Data Accessing Service System

A. User Interface

User interface provides users with a software interface on which they choose whatever services they want. It has two functions, one is re-mining the data and information on the internet after the preliminary mining to form the corresponding database in accordance with the needs of the stratagem research; and the other function is providing the data accessing API for the meta-synthetic integrated environment of stratagem research, the applied system and the comprehensive evaluation system.

B. Data Accessing Service

The data fuzzy mining engine within the data accessing service serves to do further classification and deep mining upon the collected data to make them more applicable for the stratagem research. Data accessing API provides a uniform interface for data accessing practices and with mapping function gets all data address and accessing transparent. Through the management of metadata in the resource database and the resource-to-resource mapping, data accessing service maps every resource request as the operation of low-level databases, making the resources transparent to users and the addresses of the application programs. The database accessing interface transfers the received accessing requests to be database accessing requests according to the recorded information in the meta-database and gets finally the accessing practice realized through the accessing engine in the databases.

C. Database Layer

Database layer includes all the databases under the meta-synthetic integrated environment of stratagem research and consists of several data accessing servers in the local area network (LAN).

V. Data Mining Procedures and the Algorithms

Data mining is an essential part in accomplishing the data accessing service under the meta-synthetic integrated environment of stratagem research, and consequently the next-up come the introduction of data mining procedures and the algorithms.

A. Data Mining Procedures

The data mining under the meta-synthetic integrated environment of stratagem research may be divided into three steps, the first of which is to use the available search engines from the internet to widely search and roughly classify relative resources there to form the corresponding database; then to preprocess these resources with the data searching and mining engine to get target databases which make data ready for the data fuzzy mining engine; and finally to refine the data from the target databases with the data fuzzy mining engine according to specific needs of the stratagem research to form the applied databases as required. The abovementioned databases are a collection of databases located at several data accessing servers in the LAN, which can be seen in Figure4.

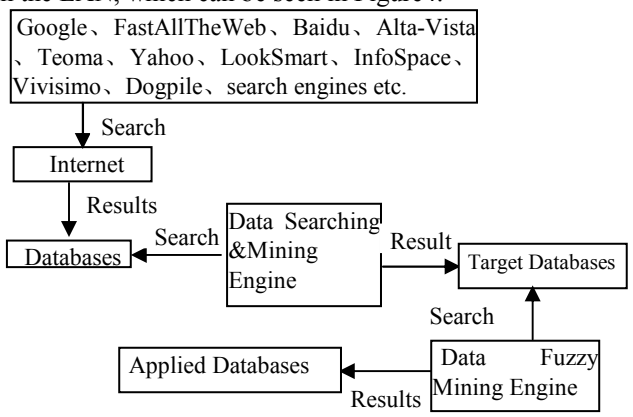

Figure4. The Schematic Diagram of Data Mining Procedures under the Meta-synthetic Integrated Environment of Stratagem Research

B. Algorithms of Data Fuzzy Mining Engine

With the target databases from the data searching and mining engine plus the needs of the stratagem research, fuzzy data space is established to do deep mining upon the data, information and knowledge and re-classify the data according to the application needs. Then in accordance with the established data association rules, a decision tree is adopted to do the deep data mining to for the appropriate data pool as required by decision support studies. The “appropriate” here means being capable of providing information support and new statistical rules and associations for the strategic decision-making studies. The data mining provides every model of the meta-synthetic integrated environment with the necessary data[7],[8], preprocess the anomalism of the data being used and meanwhile get the abnormal data generated by the models explicitly marked and processed[9],[10],[11].

According to the above introduction, the conjured algorithms of the data fuzzy mining engine are as follows;

（1）Begin;

（2）Enter: the domain name, time and the server name;
（3）Enter the name of the applied databases and the problem domain;
（4）Enter the fuzzy matching precision and seeds
（5）Calculate the matched seeds according to the fuzzy matching precision and seeds;
（6）Establish the fuzzy matching space database;
（7）Search and identify
If there is any data in the searched database identical to the matched seeds
Record the information of the data pool;
Extract the data;
Add to the fuzzy matching space database;
Else if there is not any data identical to the matched data
Calculate the similarity coefficient according to the entered seeds;
Produce new seeds according to the similarity coefficient;
There is some data identical to the matched seeds in the searched database
Record the information of the data pool;
Extract the data;
Add to the fuzzy matching space database;
Else
End the searching and identifying
Go to (12)
End if
（8）Go back to the results, and display data formats and sizes;
（9）Process the fuzzy matching space database;
（10）Convert the data formats;
（11）Generate the applied databases;
（12）End.

VI. Software System Designing

Software system designing of data accessing service is mainly conducted in data accessing service and databases."

A. Data Accessing Service Designing

Through the management of metadata in the resource database and the resource-to-resource mapping, data accessing service maps every resource request as the operation of low-level databases, making the resources transparent to users and the addresses of the application programs. The database accessing interface transfers the received accessing requests to be database accessing requests according to the recorded information in the meta-database and gets the database accessing requests and data accessing respectively based on SQL and information catalogue finally realized through the accessing engine in the databases. The designing may can be seen in Figure 5.

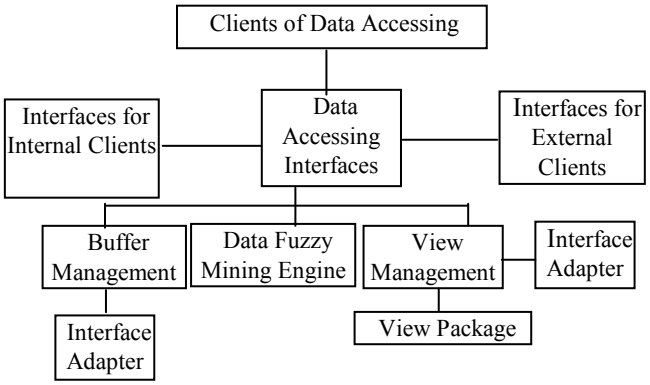

Figure 5. The Schematic Diagram of the Structure of Data Accessing Service

Data accessing service, mainly based on the characteristics and the structure of resource database, establishes control interfaces correspondingly to the low-level data, which facilitates the accessing and operation by callers on the various low-level resources and protects them from being directly utilized by other unwanted requests. It provides basic databases with such functions as searching, deleting, amending and inserting and is able to send the results of the data accessing back to the callers in form of a result collection and save the field values of blob and bfile as local files. It is also equipped with an abnormality treatment mechanism which sends back the error information at the time of database accessing request errors or operation failure to resource databases and then provides some instructive operational tips. Additionally, it also provides an affair handling mechanism dedicated to backspacing and submitting operations within the applicable scope. To be more specific, it starts submission only after the data maintenance of the resource databases has been completed, but if abnormality appears in the operational process, it will backspace to the original state.

B. Database Designing

Database designing is the foundation of data accessing service, which can be simply illustrated via database logical data model (see Figure 6).

In Figure 6, **DATASOURCEINFO** stores the basic information of data source; **DATABASE_DETAIL** conserves the connection information of database-file data source; **XMLFILE_DETAIL** saves the connection information of XML-file data source; **COLUMNSET** stores the basic information of tables, views and services; **TABLEINFO** has the details of tables in source bases; **TABLE_COLUMN** saves the basic information of columns of the tables in source bases; **VIEWINFO** stores the details of views and services in source bases; **VIEW_COLUMN** has the field information of views in source bases; **INSTANCE** stores the instances in the views and serivices; **CATEGORY** conserves the basic information of domains in source bases; **CONSTRAINTS** saves the basic information of constraints; **FOREIGNKEY** has the details of constraints of foreign keys; **FUNCTION** stores the information of functions for searching views and services in source bases;

FUNCTION_INSTANCE means the contingency tables of functions and instances, which means to describe the instances relating to the functions.

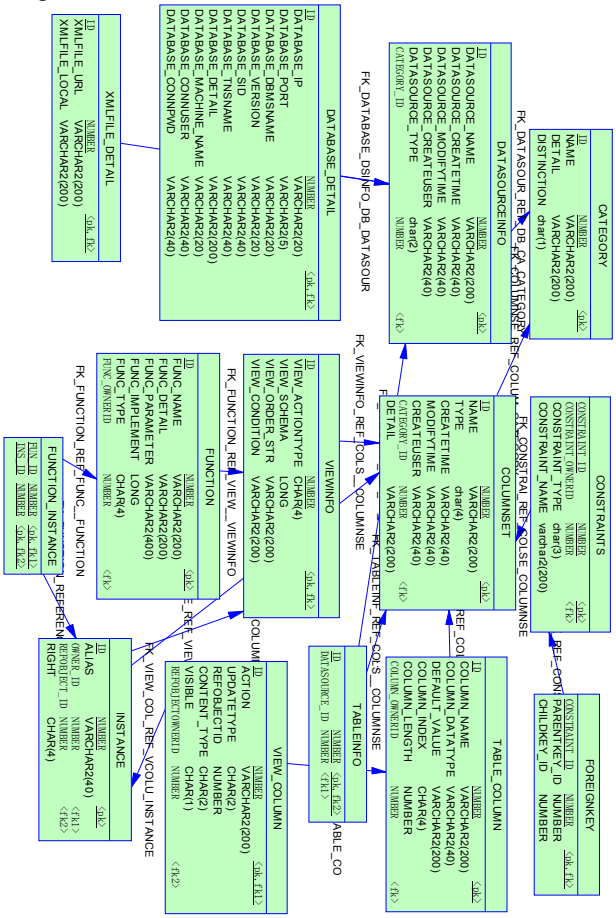

Figure6. The Schematic Diagram of the Database Logical Data Model

VII. Realization of Database Accessing Service

A. The Application Flows of Data Accessing Service

The structure of software for data accessing service is based on the framework of C/S and its basic application flows can be seen in Figure7.

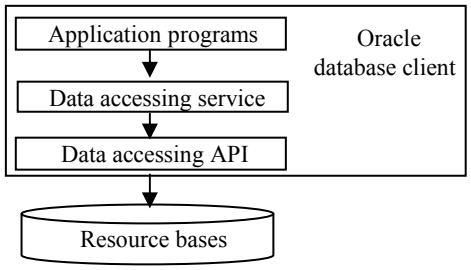

Figure 7. The Schematic Diagram of the Application Flows of Data Accessing Service

B. The Realization of Database Accessing Service

For the sake of good expandability and maintainability, the data accessing service adopts a hierarchical structure which, on basis of the metadata accessing interface and via the metadata information from the information catalogue, transfers users' requests to be SQL commands and then calls the data accessing engine through the accessing interface on basis of SQL to realize the low-level data accessing. The running interface of data accessing on basis of SQL can be seen in Figure 8[12],[13],[14],[15].

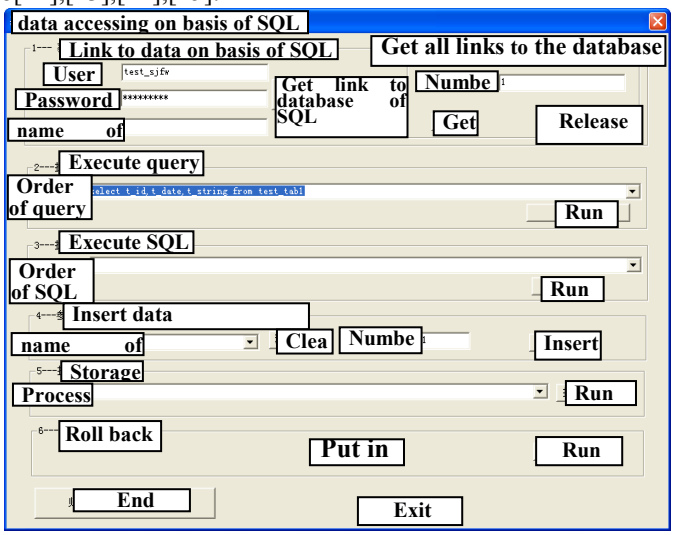

Figure 8. The Running Interface of Data Accessing on basis of SQL

C. The Flow Graph of Data Accessing

The flow graph of data accessing service can be seen in Figure9.

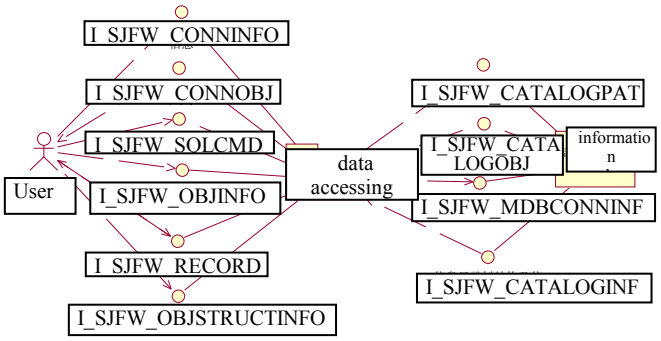

Figure9. The Flow Graph of Data Accessing

Here, I_SJFW_CONNINFO refers to the relative information of resource database/information catalogue that users set to connect via the interfaces of data accessing service. I_SJFW_CONNOBJ means the connection objectives to which data accessing service return after users finish setting the connection information of resource database/information catalogue for the sake of accessing to target databases. I_SJFW_SQLCMD refers to users' accessing commands to databases, including searching commands and non-searching commands. I_SJFW_OBJINFO means the objective names and condition information of databases to be accessed by users, including data searching, deleting and amending. I_SJFW_RECORD is the resource database record where data accessing interfaces return for searching in compliance with users' accessing requests, or means that users update or insert the records into the resource database by resetting the resource

database record and calling relevant interfaces. I_SJFW_OBJSTRUCTINFO refers to the structure information of database objectives users expect to set up or amend via interface setting and then call relevant interfaces to get it done. I_SJFW_CATALOGPATH means the path by which users set to obtain relevant information catalogue objectives. And I_SJFW_CATALOGOBJ means the information catalogue objectives to which information catalogue service returns after users set the path. I_SJFW_MDBCONNINFO is the connection information to information catalogue metadatabase through which users manage to connect the metadatabase and obtain more information of catalogue objectives by information catalogue service. I_SJFW_CATALOGINFO means that users obtain the tree structure of the catalogue and the details of objectives through information catalogue after connecting the information catalogue metadatabase. I_SJFW_ACCESSUSER refers to the user names only with which data accessing service may obtain privilege information through security service interfaces. I_SJFW_PRIVILEGEINFO means the privilege information the security service interfaces send back to designated users, including the objectives the users have privilege to access and the types of the privileges.

There are two ways for data accessing, one is based on SQL, and the other on information catalogue. The following part will be all about the application flows based on SQL, which is a part of data searching with the data fuzzy mining engine and there are in total eight steps (see Figure10).

1. to get the global object ISJFW_DMCatalogMng*;
2. to get the connection objective to databases ISJFW_Connection ;
3. to get the objective executing database operation ISJFW_Command*;
4. to set and execute accessing commands;
5. to obtain error information;
6. ergodic search throughout the result collection;
7. the release after the execution;
8. The release after all accessing operations.

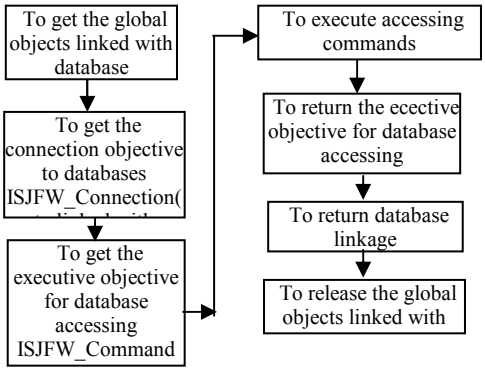

Figure10. The Application Flows Based on SQL

Data accessing based on information catalogue can be seen in Figure11.

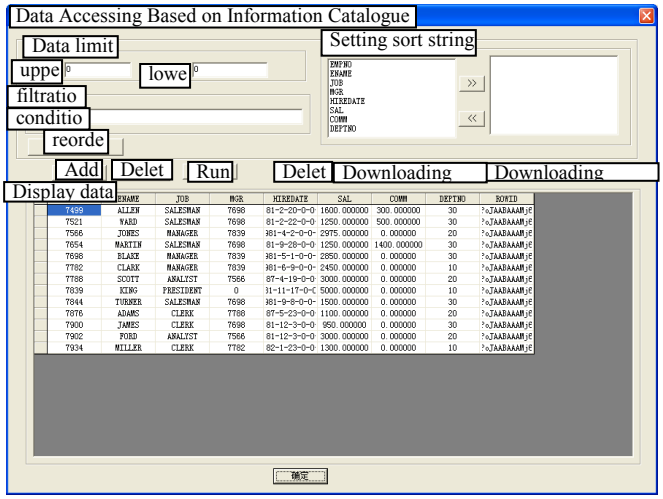

Figure 11. Data Accessing Based on Information Catalogue

VIII. Conclusion

By analyzing the characteristics of strategic studies, combined with computer technology, simulation technology, software engineering, network technology, according to the different stages during the strategic research, the strategic research methodology was established. And the strategic research integrated environment, MSIESR, was proposed, designed. Base of the MSIESR, to design the data accessing service. The Data accessing service directly faces users and the application systems under the meta-synthetic integrated environment of stratagem research. It is supposed to not only realize deep data mining so as to provide the stratagem research with valuable information but satisfy users' searching requests for all resources in the environment and set up data accessing API for the application systems. Consequently, to improve the efficiency of data accessing, during the process of designing and realizing, parameter wiring is provided here to speed up the data insert, and approaches to performing the stored procedure are adopted for the convenience of direct calling[10],[11].

For the sake of good expandability and availability, data accessing service, in accordance with the metadata information of the corresponding resource database provided by information catalogue service, realizes a set of accessing interfaces based on objectives which may not be take the way of SQL commands but instead add, delete, amend and search the data of databases registered in the information catalogue service. And the metadata of accessing objectives are also provided to users via the interfaces, which helps realize the connection of metadata and data information and maximize the amount of information about the accessing objectives users can get when calling the interfaces.

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Wei Jicai, The birth place is Shan Dong Province China and birth date is 1973.1. The educational background was system engineer, system simulation and modeling and awarded Doctor degree in 2003. The major field of study is Complex Systems Simulation in the Science and Technology on Complex Systems Simulation Laboratory.

Weijic2000@yahoo.com.cn
Address: Post Box.9702#19, Beijing China, 100101
Beijing Institute of System Engineer
Science and Technology on Complex Systems Simulation Laboratory China
Tel +86 13611209303 Wei Ji-cai

Ren Tingguang, The birth place is Si Chuan Province China and birth date is 1974.5. The educational background was system engineer and awarded Doctor degree in 2007. The major field of study is Complex Systems Simulation in the Science and Technology on Complex Systems Simulation Laboratory.

Address: Post Box.9702#19, Beijing China, 100101
Beijing Institute of System Engineer
Science and Technology on Complex Systems Simulation Laboratory China

Zhang Jing, The birth place is He Bei Province China and birth date is 1978.7. The educational background was system engineer and awarded Doctor degree in 2004. The major field of study is Complex Systems Simulation in the Science and Technology on Complex Systems Simulation Laboratory.

Address: Post Box.9702#19, Beijing China, 100101
Beijing Institute of System Engineer
Science and Technology on Complex Systems Simulation Laboratory China