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Research on the Application of Cloud Computing in Enterprise Credit Rating System

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Abstract: At present, in the context of the "Internet+" era, cloud computing has become the basic equipment in the era of digital economy, and the increasing improvement of the big data ecosystem has laid an important foundation for the development of cloud computing, and cloud computing has also catalyzed the rapid development of big data in the application field. This paper is based on the application of cloud computing to enterprise credit rating system, that is, the collection of enterprise information and behavior information through a distributed platform; The collected data is modeled and verified through the big data mining platform; Provide cloud desktops for credit rating applications through virtualization technology; Through the exploration of credit rating theory and credit rating model development. At the same time, combined with the related technology and theoretical knowledge of cloud computing, a credit rating solution model for cloud computing is found. The cloud computing application of the credit rating system was initially realized through VMware software.

Keywords: Cloud Computing; Credit Rating; Big Data.

1. Introduction

With the rapid development of the global economy and the intensification of corporate competition, corporate credit ratings have become crucial. However, there are still many problems in the traditional enterprise credit rating, such as the limitations of incomplete information processing and opaque data, the inability to effectively use the multi-source and multi-dimensional nature of data in the information age, and the lack of comprehensive consideration of the credit problem of enterprises from the perspective of the overall situation. However, with the rapid development of cloud computing technology, the enterprise credit rating system based on cloud computing came into being, providing enterprises with powerful computing and storage capabilities, and making data analysis and management more efficient and flexible with the advantages of cloud service platforms. The financial data analysis and management platform based on cloud computing technology realizes the comprehensive collection, rapid processing and real-time monitoring of financial data with the help of the computing and storage resources of cloud service providers. With data collection, data processing, and data monitoring and management as the core, the platform realizes data source access and data conversion and cleaning through the application SAAS, PAAS, IAAS, analyzes data using advanced machine learning and data visualization tools, and implements data monitoring, alerting, and anomaly detection. In addition, the platform also applies association rule mining and stream computing technology to further improve the accuracy of data processing and monitoring efficiency. Through real-time data monitoring and alert mechanism, the platform can detect potential risks and anomalies in time, help enterprises take timely measures to avoid financial risks, and provide strong support for the development and competition of enterprises.

2. Overview of Cloud Computing Architecture

2.1. The Overall Technical Architecture of Cloud Computing

Figure 1 shows the overall technical architecture of the cloud computer.

Cloud Infrastructure Service (IaaS): A pool of resources provided by the system. Cloud Platform as a Service (PaaS): The operating environment. Cloud Software as a Service (SaaS): Application software at the top of cloud computing.

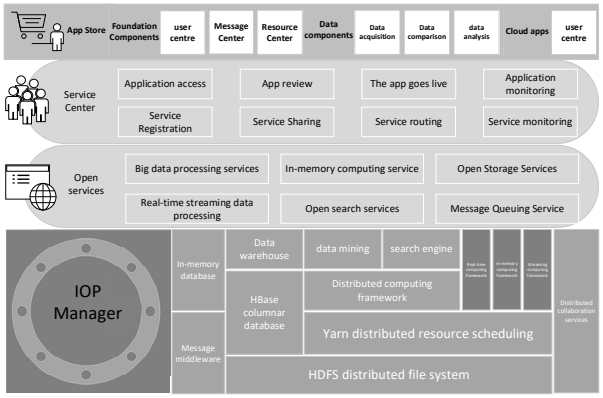


Figure 1. Cloud computing service architecture

(1) IOP Manager is the nerve center of the Yunhai IOP platform, which is responsible for the automatic installation, deployment, parameter configuration, monitoring and management of big data components and application suites, and coordinated resource scheduling.

(2) Yunhai IOP takes the Hadoop ecosystem as the main line, mainly through the construction of large-scale distributed storage and computing clusters, to achieve efficient analysis and utilization of massive data. The platform has deeply integrated, optimized, and adapted the development of various open source components, so that all kinds of components can work together efficiently and stably.

(3) Yunhai IOP provides a variety of elastic cloud service suites, and assists third-party applications to "go to the cloud" through the service center, which is a bridge between upper-layer applications and platform resources. The app store has a range of built-in features, including a user center, message push, and general data integration software. These features help customers reduce the cost of developing and launching third-party applications and improve development efficiency.

2.2. Cloud Computing Security System

Cloud computing technology is developed based on big data and can process massive amounts of information, but information security has always been a concern for people. Especially for financial institutions, they are more concerned about the security of information, so safe and reliable cloud computing technology has a wide range of significance.

(1) Autonomous controllable cloud core equipment.

Autonomy is a prerequisite for safety. Only by mastering the core and key technologies can we not be controlled by others, can we ensure the sustainable development of the industry, and can we avoid the safety of building on the "beach".

(2) Build a trusted cloud infrastructure platform.

Trustworthiness is the foundation of security. Cloud computing trusted technology is based on innovation, so build a trusted chain from the underlying firmware to the last application, so as to ensure the security and trustworthiness of cloud computing.

(3) Provide elastic cloud security pool services.

Pooling is the direction of security, just like the evolution of computing devices and storage devices into computing pools and storage pools, and the provision of computing services and storage services. Security devices are also evolving to security pools to provide users with intelligent, linked, and easy-to-use security services.

2.3. One-stop Cloud Desktop Architecture

Among them, cloud computing can provide cloud desktop services in virtualization processing. In the traditional personal computer office environment, due to the problems of PC hardware is easily damaged, system operation failures, and software needs to be updated cumbersomely, it will bring great workload and IT operation and maintenance costs to management. Cloud desktops can be deployed by personal computer desktop data centers to achieve unified management and control of desktop desktops, and also provide users with access to cloud desktops, making business development more flexible. Only the desktop virtualization, server virtualization, and storage virtualization technologies of cloud desktops are required to quickly build a desktop cloud.

The one-stop desktop cloud solution can effectively improve deployment efficiency and simplify desktop O&M. At the same time, it can also ensure the security of information, so as to realize mobile work.

3. Demand Analysis of Corporate Credit Rating

3.1. Business Processes

The system adopts the idea of task flow to design business processes, mainly including: subject rating, debt rating, financial early warning rating, and rating review.

(1) The general process of credit rating

The general process of credit rating generally requires preliminary evaluation, review, approval and many other links, but with the detailed differentiation of rating objects, the assets of different types of customers, different risk levels and different risk exposure sizes are also the main constraints and obstacles raised when the existing rating system is fully automated online processing.

Therefore, it is necessary to combine complex business rules with workflow alerting through the introduction of "workflow alerting" to realize the independent maintenance of complex rules and the dynamic adjustment of the approval process, and to meet the automation, transparency and standardization of the system in order to meet the requirements of the rating system for the approval process and authoritative control.

In the rating process built on top of the workflow engine:

1) Analyze the evaluation model matched by the personnel system to evaluate the qualitative and quantitative parts, and evaluate them regularly after completion. During the rating process, credit analysts can run material information references, financial analysis, industry comparisons and other analysis methods, manually adjust the model rating, sign manual adjustment opinions, and write word rating reports until submitted for approval.

2) After the analyst initiates the internal review, the system generates the rating task in the task column of the approver by communicating the task. Approvers can directly click the link to enter the review page, express review opinions and manually modify the rating results, junior approvers can return, submit or directly approve the completed operations, and senior or final approvers can return or complete the approval.

(2) Early warning rating process and tracking rating process

In addition to the general process, the credit rating also includes the early warning rating process and the tracking rating process, generally speaking, the early warning rating process is as follows:

1) The analyst sets the relevant financial early warning indicators and the value range of the indicators, and when the system imports new financial statements, the system automatically calculates the relevant indicator values, and determines whether the early warning rating is triggered, and if so, the rating is carried out according to the general rating process;

2) The analyst sets the relevant news event level, and then the system triggers the warning rating when there is serious negative news or information;

The tracking rating process is the rating formed after the end of the credit rating, after the expiration of the validity period or after the relevant settings are triggered, which is collectively referred to as the tracking rating.

4. The Overall Structure of the Credit Rating System

4.1. System Logic Architecture Design

As can be seen in Figure 2, in general, the entire rating business can be subdivided into three major functional groups: data framework, business framework and model framework.

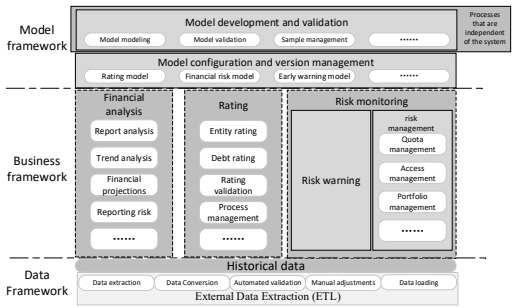


Figure 2. System logic structure diagram

4.2. Data Architecture Design

(1) External data extraction

The process of external data ETL is divided into three stages: data collection, data correction, and data use, as shown in Figure 3.

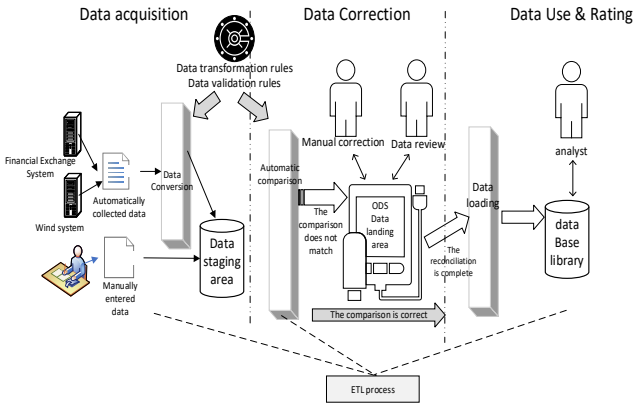


Figure 3. system ETL process diagram

(2) Data collection

This process mainly completes the process of loading external data to the data staging area of the database.

(3) Data Correction

The system needs to verify the externally collected data by the system automatically comparing the data verification rules set by the module.

(4) Use of Data

After the data is compared and corrected and loaded into the basic database, it is in a temporary state (not yet effective), and such data cannot be used for rating, financial analysis (viewable), to prevent artificial adjustment of the data.

(5) Historical data management

Ratings only reflect the relative order of credit risk, and if risk is to be priced and actively managed (e.g., stress testing, portfolio allocation, etc.), the absolute value of risk should be determined, such as probability of default, default correlation, default loss ratio, etc. Financial institutions need to strictly manage historical data to ensure that the data is not modified and that the data is consistent with each other, so as to provide a basis for future calibration of risk parameters.

4.3. System Physical Topology

The credit rating system is uniformly installed and deployed on the credit rating server, and all the functions of the credit rating system are provided through WEB services.

Users of various roles can log in to the credit rating system through the internal network using their personal work computers, and use the credit rating system according to the permission settings of each role. The physical topology is shown in Figure 4.

Structure Description:

The database and web application of the credit rating system are installed and deployed on the credit rating server.

The credit rating system regularly extracts the new data of the day from the database of the intermediary machine through direct connection to the database, and imports it into the corresponding receiving table of the credit rating system.

The structure of this receiving table is the same as that of the data table of Caihui, and after receiving the data, the data will be transferred to the business table of the credit rating system through the background program of the credit rating system.

The credit rating system provides data to downstream systems through a direct connection to the database

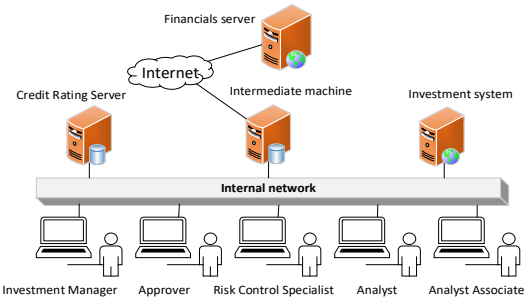


Figure 4. system physical topology

4.4. System Functional Architecture Design

The credit rating management system includes six parts: personal workbench, financial analysis, credit rating, portfolio management, business model maintenance, daily business maintenance, and system management.

The personal workbench includes three management modules: My Tasks, Task Tracking, and My Customers

Financial analysis includes nine management analysis modules, including financial statements, financial ratios, cash flow structure, trend analysis, financial forecasting, report risk, scenario analysis, early warning setting, and peer comparison.

The credit rating includes three functional modules: entity rating, debt rating, and other debts guaranteed by the company

Business model management and maintenance is divided into rating model maintenance, financial diagnosis model maintenance, important wind reference management, and other parameter management.

The other two functional modules of the system are daily business maintenance and system management.

5. Detailed Design of Credit Rating System

5.1. Design of Main Rating Module

(1) Function introduction

Principal rating refers to an analyst's internal rating of a selected company using a pre-defined rating model.

After the analyst selects a company to be rated according to the module provided by the workbench, the financial information of the company can be viewed from the financial analysis module, including all historical financial statements, and financial forecasts can be made based on the historical financial statements.

Once you have reviewed your company's financial information, you can use the Entity Rating module to rate the

company internally. When rating, you need to select a rated model that has been set, and the system will automatically call the rating model to rate the company's financial data, which is the quantitative part. For the qualitative part, the analyst needs to choose according to the actual situation when rating. After the selection is complete, the rating model is automatically invoked through the "Calculate Rating" function for rating.

(2) Class diagrams

When an entity is rated, the entity rating class is called through the company class to read the information about the entity rating class. and call the rating model class for rating.

(3) Activity Sheet

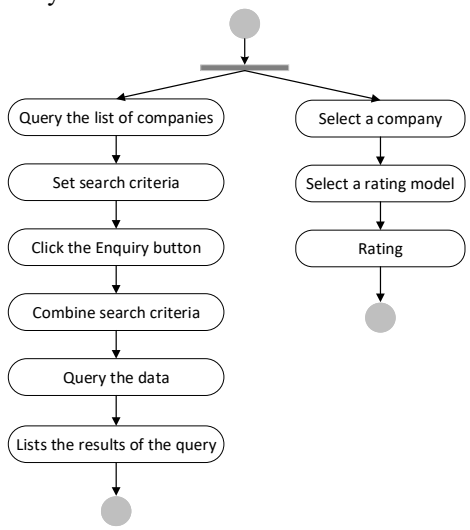


Figure 5. the chart of main rating activity

When rating an entity, the analyst needs to query the companies that need to be rated, and then query the company information table by setting the corresponding query conditions to query the corresponding company list. After querying the list of companies, select the companies that need to be rated, you can carry out various financial analysis and processing, and then select the corresponding rating model to rate the company.

(4) Sequence diagram

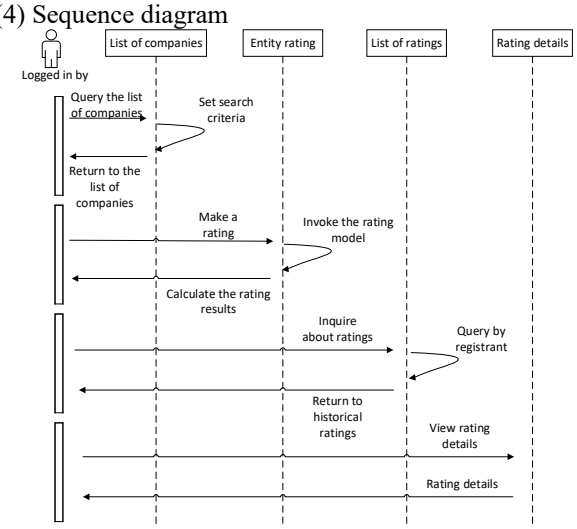


Figure 6. Main rating sequence chart

In Figure 6, the analyst sets the query conditions to query the list of companies, selects the company to be rated, and calls the rating model, and the rating model calculates the rating result according to the rating method set in the model and the relevant information of the company. Analysts can also query the company's historical rating data, and select a historical rating to view the historical rating details.

(5) Algorithms and pseudocodes

The rating model of the subject rating is configurable and can be configured according to different industries and rating models. A large number of qualitative and quantitative indicators are involved in the algorithm and processing of the model to support the rating operation. The following are the main algorithms and scoring rules involved:

Key indicators

Working capital (10,000 yuan): current assets - current liabilities

Cash flow after capital expenditure (10,000 yuan): cash flow after debt repayment + increase (decrease) in short-term borrowings + difference in financing and utilization of non-current assets

Scoring Rules:

Discrete scoring, cycling from 1 to the number of fraction segments, finds the first cut-off point value less than or equal to R, and its corresponding score is the final score.

Pseudo-code of the main indicator algorithm:

Coef=12/Mnths {Proportion of reporting period (not displayed) = 12/Number of months in reporting period} v_Coef:=12/v_fin_period;

Turnover = PL101/10000 * Coef{Net operating income (10,000 yuan) = net operating income at the end of the period * 12 / number of months in the statement period / 10,000}

Oprt_prft = PL300/10000 * Coef {Operating profit (10,000 yuan) = ending operating profit * 12 / number of months in the statement period / 10000}

Tot_Asst=BS001/10000 {Total assets (10,000 yuan) = total assets at the end of the period / 10,000}

Wrkg_Cptl= (BS100- BS300)/10000 {Working capital (10,000 yuan) = (total current assets - total current liabilities)/ 10,000}

5.2. Interface Design

The data interface part provides the function of storing and restoring data in the selected data management system for objects that need to be stored for a long time in the system.

The data interface section involves three storage locations: an external database, an intermediate transformation database, and a system database. The data included include company information, debt information, financial information, mortgage guarantee information, external rating information and other data information on which the rating is based.

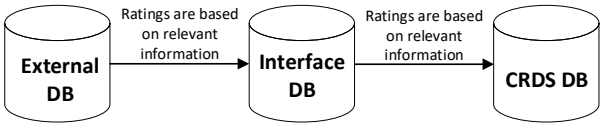


Figure 7. Interface Design

The daily interface operation with Caihui is as follows:

The system automatically executes the background storage, extracts data from the database of the financial exchange front-end machine to the intermediate database, and the extraction of the data is incremental, and the corresponding data is added according to the update time of the financial exchange data.

Then, the background storage procedure is executed, and the new business data is automatically operated according to the corresponding business logic (for specific business logic, please refer to the attached "Credit Rating and Financial

Exchange Data Interface Description LS" document), and the new data is added or updated to the business data table of the credit rating database.

In the credit rating database, the database link statement to the financial exchange front-end machine is as follows:

EXEC sp_addlinkedserver

@server='finchina', -- The alias of the financial exchange database that was accessed

@srvproduct=' ',

@provider='SQLOLEDB',

@datasrc= '10.2.2.54,1433' -- The IP address and port number of the server where the database is accessed

EXEC sp_addlinkedsrvlogin

'finchina', -- The alias of the database being accessed

'false',

NULL,

'CRDS',-- The account number of the database provided by a commercial bank

'crds@hlic' -- The password provided by a firm to access the database

5.3. System Operation

In terms of performance test, with the concurrent virtual user data as 100, the transaction response time in the test process is less than 10 seconds, and the CPU, memory, and disk are also calculated according to the principle of 3-12 times the number of concurrent users and the number of online users, which can fully support 300-500 people online at the same time.

6. Summary

The new technology of cloud computing is following the development of Internet finance and big data, and when our economic growth slows down, some industries, especially small and medium-sized enterprises, have been seriously impacted, many enterprises have gone bankrupt, the non-performing rate of banks has risen sharply, and financial risks have followed.

This paper draws on cloud computing technology, from the data collection, model construction, system deployment, risk early warning to the application of credit rating, adopts the idea of cloud architecture, conducts research, and finds that the application of cloud computing technology in the field of credit rating is feasible, meaningful and promoting, and has innovative and promotion value. After that, the author used the virtualization software VMware to carry out the initial implementation of the credit rating system. Finally, through the research on the construction of the financing platform for small and medium-sized enterprises in a province, the role of cloud computing technology for credit rating is empirically verified.

Although it has a role in promoting credit rating or the construction of financing platforms, it still faces many problems. First, data locking and data security. Data is the core secret of all enterprises involved, so no enterprise wants its data to be seen by others, and this problem has always been the core problem.

Of course, there are also problems such as testing in large distributed systems. The author's view is that although such problems cannot be ignored, the solution is still bearable. In any case, it is expected that in the next few years, cloud services may become one of the options considered by most IT companies.

Acknowledgments

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