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Developing Grid-based E-finance Portals for Intelligent Decision Making

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E-finance is rapidly transforming and evolving toward more dynamic, flexible and automated solutions. This paper describes a conceptual model with dynamic multi-level workflows corresponding to a multi-layer Grid architecture, for multi-aspect analysis in building an e-finance portal on the Wisdom Web. The application and research demonstrate that mining-grid centric three-layer Grid architecture is effective for developing intelligent risk management and decision making financial systems.

1. Introduction

This paper concentrates on how to develop an mining-grid centric e-finance portal (MGCFP), not only for supplying effective online financial services for both retail and corporate customers, but also for intelligent risk management and decision making for financial enterprises and partners.

In this paper, we demonstrate MGCFP with three levels of dynamic workflows, namely data-flow, mining-flow, and knowledge-flow, corresponding to the Grid with three layers called data-grid, mining-grid, and knowledge-grid, respectively, for deploying and managing data mining agents for multi-aspect analysis in distributed, multiple data sources, and for dynamically organizing financial services for intelligent risk management and decision making.

2. Related Work

Traditional integrated financial enterprises, which exclusively distribute self-developed products via proprietary channels and fulfill all transaction and support services in-house, are no longer adequate for the changing demands of the environment. The challenge Web-based financial intermediaries faces is the transformation to profitability by expanding their relationship through the cross-selling of products and services. A new approach to system architecture is needed that reduces the complexity and costs of coupling information systems as well as increases flexibility to accommodate change.

Real-time integration of disparate data and applications is a key challenge faced by the financial services industry today [Pan 04]. The main challenge of Grid computing is the complete integration of heterogeneous computing systems and data resources with the aim of providing a global computing space through the use of standard protocols. Although most of Grid projects have focused on resource sharing in the distributed environment, researchers are beginning to touch about how to employ knowledge processing on the Grid [Curcin 02].

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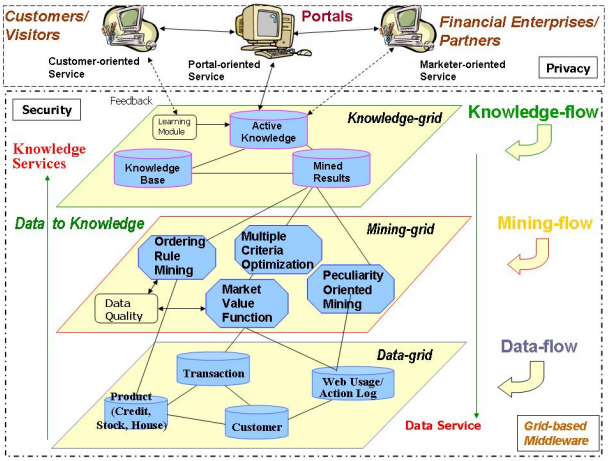

Figure 1: **The architecture of mining-grid centric e-finance portal (MGCFP)**

3. System Architecture

Figure 1 shows the architecture of mining-grid centric e-finance portal (MGCFP) that has been developing by us. The MGCFP consists of following primary applications, such as banking, investment, insurances, mortgage and loans, wealth management as a set of integrated financial services.

The architecture comprises a distributed, multi-tired, service-oriented, component-based solution that offers a high degree of modularity. The solution is available on the open industry standard platforms J2EE. The portal enable the financial enterprise to have a common infrastructure that encapsulates business rules, back-end connectivity logic and transaction behavior, enabling banks to write-once, deploy-everywhere, across channels. The solution ensures a unified view of customer interactions to both the customers and the enterprises.

3.1 Data-grid vs. Data Warehouse

Most e-finance information system is based on data warehouse. Using the popular definition of a data warehouse as a collection of subject-oriented, integrated, time variant, non-volatile data in support of management decisions. Along with the strengths of the data warehouse architecture are many limitations.

Therefore, we need a new distributed, flexible infrastructure to develop e-finance portal. As the huge and multiple

data sources are coupled with and geographic distribution of data, users, systems, resources, and services in the typical types of enterprises, Grid platform is an ideal middleware or platform for e-finance portals development.

3.2 Mining-grid vs. OLAP

E-finance portal is not simply about cheap transaction platform, although that will become more and more important. There is a whole range of all types of risk - credit, liquidity, interest rate risk and market risk - that need to be taken into account. In some ways, the Internet may heighten these risks. From the top-down perspective, different data mining methods are deployed on the mining-grid as agents for mining services. On the mining-grid, different mining methods work just like agents, that is to say, they are working in an autonomic, distributed-cooperative mode.

3.3 Knowledge-grid for Knowledge Management

In general, several kinds of rules and hypotheses can be mined from different data sources by multi-aspect mining. The results cannot be utilized for knowledge services until they are combined and refined into more general ones to form *active knowledge*, by meta-learning and reasoning. Distributed Web inference engines on the knowledge-grid will employ such active knowledge with various related knowledge sources together to implement knowledge services and business intelligence activities [Tomita 04, Zhong 04].

4. Security Concerns

Operational risk, including security risk, is of course one of the more frequently mentioned risks in connection with electronic banking. Security is not a new risk. We are all familiar with the various security issues that banks are facing on a day-today basis, e.g. robberies, thefts of ATM machines, frauds. However, banking transactions over the Internet do pose new issues.

Given the open nature of the Internet, transaction security is likely to emerge as the biggest concern among the e-finance's customers (actual and potential). Since transaction risk would create a significant barrier to market acceptance, its management and control are crucial for business reputation and the promotion of consumer confidence as well as operational efficiency [Liao 03]. The customers must be assured that the confidentiality in their transactions must be maintained.

5. A Case Study: Credit Card Risk Management

In this section, we present a case study on credit card analysis for demonstrating how to use the model proposed above in an e-finance portal.

Credit card transactions continue to grow in number, taking an ever-larger share of the e-finance system and leading to a higher rate of stolen account numbers and subsequent losses by banks [Chan 99]. Large-scale data mining techniques can improve on the sate of the art in commercial practice. Scalable techniques to analyze massive amounts of transaction data that efficiently compute fraud detectors in a timely manner is an important problem, especially for e-finance.

Data mining for credit card portfolio management decisions is to classify the different cardholder behaviors in terms of their payment to the credit card companies, such as banks and mortgage loan firms. In realty, the common categories of the credit card variables are balance, purchase, payment and cash advance. Some credit card company may consider residence state category and job security as special variables. In the case of FDC (First Data Corporation), there are 38 original variables from the common variables over the past seven months. Then, a set of 65-80 derived variables is internally generated from the 38 variables to perform the precise data mining.

6. Conclusions

The paper presented a conceptual model with dynamic multi-level workflows corresponding to a multi-layer Grid architecture, for multi-aspect analysis in distributed, multiple data sources, and for dynamically organizing status-based financial services. It is clear that the value of e-finance technology cannot be fully realized unless we streamline all the interrelated processes and services in the marketplace effectively [Fan 00]. We illustrate how to use the multi-layer Grid conceptual model for building an e-finance portal. The most common challenges are how to deploy and use multiple data sources on the Grid and how to represent and learn the complex relationships between them. In the future, Web-based financial intermediaries will succeed by offering seamless integration of finance and business processes.

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