A DESIGN OF MULTI-HETEROGENEOUS SYSTEM USING SOA AND RFID MIDDLEWARE PLATFORM

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Abstract:

The commercial exchanged procedure among enterprises is complicated, and adopting information system of each other is mostly different. The circulation of each other’s information and merger of the workflow are a complicated problem, for instance: trades, orders, stocks up etc., include a lot of trade files and goods information among them. Under the environment of global commercial competition, how electronic enterprises improve the competition advantage to shorten the information exchanges, it is a problem that is worth paying attention and solution. The purposes of this research is to decrease in the labor processing time and reduce data loose hard error, and to provide business more flexible services for a speedy response to demand, and to solve the problem of information multi-heterogeneous system.

The RFID middleware platform of this research read 1 transaction of information only needed the shortest time of 0.11 seconds within completed distribution and construction in the experiments. Comparison with Savi pointed out that the records of goods read 1 transaction of information from bar code needed about 2 seconds; we can save the time up to 94%. The practical expression was informed that this research provides the solution can effectively reduce operating time and the problem of information in multi-heterogeneous systems.

Keywords:
Web Services; XML; SOA; RFID Middleware

1. Preface

1.1. Research Motivation

The progressing greatly in science and technology and the development of Internet network, e-commerce has already become important media engaged in the conduct of business. In order to overcome the question of linking up of the heterogeneous information system between enterprises, there already have many kinds of specifications of electronic information exchange based on XML, reducing the operation cost while information sharing. Though XML can offer an information sharing specification of stepping the platform, but the construction of the materials still needs to consume a lot of manpower and time.

The organization develops with the information system, the materials are more and more miscellaneous, but these materials are usually the important information of the organization. It is an important topic to convey the materials to the back end system effectively. Between traditional application program and application program (Application to Application), the materials are solved through Middleware structure, are erupted simultaneously and exhibited various kinds of application software of Application Server; so, using the structural design solution of Middleware becomes an extremely important technology of RFID. The combination of RFID Middleware and Web Service can save the goods trading time and their circulation of the standard materials over item by item even more.

1.2. Research purpose

This research purpose is by setting up the goal of Service Oriented Architecture (SOA) of network service platform. We can utilize the Extensible Markup Language (XML) to be the information exchange form, and combine Web Services technology to abolish the obstacle of communicating with (Application-to-Application). We can cooperate with EPCglobal standard, realize commercial procedure automation, supports the innovation of the commercial way, let the system have malleability of prolonging even more, and make use of it by reflecting the demand faster. So, in the development of RFID Middleware, the Service Oriented Architecture as the foundation, we offer a more flexible and more elastic service to enterprises, and can enable the supply chain with the complete automation of information transfer among companies. It reaches the goal reflecting the demand immediately that the traditional enterprise's e-commerce has not been reached.
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1. Produce suitable for RFID channel into the intermediary software research model of distribution industry's data transfer.
2. Probe into difference between the data transfer of channel RFID combine Web Service and transmitted with the traditional artificial file keying and mails.
3. Probe into the application of RFID, Web Service and XML.
4. Research the analysis result and offer relevant units to consult, to help the research in the future and to make some contribution to the whole industry.

2. Literature

2.1. RFID middleware

To RFID intermediary software according to Forrester Research (RFID Middleware) Role define, it acts the part of intermediary between RFID Tag and application program, and should include the following functions [3]:

1. Data filtering and aggregation:
   When the Tag reads the mistake or the burdensome data, middleware should responsible to revise the mistake to correct. In case of a large amount of trade, RFID middleware must offer the buffer capacity to filter and assemble by dealing with the huge data.

2. Data routing and integration:
   Some companies have such systems as SCM, ERP or CRM, etc. It hopes Middleware can offer the ability that routes send and combine of the data, in order to enable the manufacturer to pass RFID more efficient operation.

3. Process Management:
   Middleware is responsible for monitoring data and arrival of materials through customizes work. That is to say, it can set up and monitor the administrative system of stocks, when the system stock is lower or already out of more stock, it must supplement the necessary products again through this software.

   As shown in Figure 1, its main structure and function are explained as the followings:

   Figure 1. Structure of RFID middleware

2.2. Web service

2.2.1. Structure of SOA

Service-oriented architecture is a method to construct dispersing type systematic application program. It uses the application program function will take the service transmission for the end-user or other services. It uses the opening standard, to carry on with the software resources alternately and uses the expression standard way [11].

   Explanations clearly of Figure 2 building for SOA deploy and structure.

   1. Service provider - Turn function to service, mainly provided service interface by software assets that serve for managing the specific task. It may be enterprise's entity or the service interface of the subsystem that can utilize again.
   2. Clients or Service requester - Use and serve, look for the service offered by the Service broker, and relatively use relevant services.
   3. Service broker - Offer users to find binding information needed (Yellow Page in the directory). Also can be a service provider.
   4. SOA infrastructure - Connect consumer with supplier together in reliable way with controlling effectively.

   Figure 2. SOA structure chart [2]

2.2.2. Impact on enterprises and information system of SOA structure

SOA Become the hot issue of IT industry in recent years. American research institution Gartner Group has pointed out, when enterprises facing quickly change with the highly competitive environment, must set up strong IT structure, to quickly response various kinds of contingent commercial
In order to succeed using SOA it has two important points: 1. Understand the new rules. 2. Plans to change the application program construction way.

Since the technology of such Web Services as XML, SOAP, WSDL, UDDI, etc., appears on the market, it imagines space broader and more limitless, therefore, has created the rise of SOA concept as shown in Figure 3. Idea and foundation of SOA, to put it briefly, focus on setting up various kinds of Services, with the description clearly of each service function, with clearly define of IO (Input/Output) interface, under linking and combining different services, to form different application systems; And because of the change of demand, and contact different application between each service, fully worthy of waving benefit of sharing.

Because it is inseparable that rise of SOA and Web Services relevant technology become standard trends, so Web Services and realization of SOA of structure often put together. But, the realization of SOA structure is not limited to Web Services; There are also prevailed of CORBA, or DCOM that Microsoft pursued or RMI and JNDI in JAVA can realize SOA structure. But, when platform providers such as Microsoft, Sun or IBM, promotes develops Web Services tool one after another, even the application system's provider such as SAP, Seibel or PeopleSoft, also promotes the Web service orientation as the new generation application system, irrefutable Web Services realizes SOA as the optimal path [4].

Figure 3. Service enablement technologies

Conceptually, SOA is like a software technology such as object oriented or software component, use small spare part to combine into an application system. But what SOA emphasized is how to issue, combine and using loose relation of each other application system function component in the network [5]. Web Services is a main interface standard that can be used for realizing SOA in the present technology and integrating and procedure enterprise system and commercial procedure electrification through Web Services, also combine the procedure of customer or manufacturer into enterprise procedure to raise coordination operation degree. Also we can expose to other enterprise partners with their own competitive procedure.

In summary, our research proposes new structure to combine RFID Middleware and SOA as a platform for data using among enterprises.

3. Research approach and steps

3.1. Research approach

The construction of the information system is different from generally, because the information system combine with organization operation procedure oftenly. In order to smoothly combine old system with new technology, this research combines RFID and cooperates with XML for data exchange, reduces the time of trade files exchanges between enterprises and improves the using of information.

The traditional file needs to be repaired manually. It consumes a lot of time oftenly, and problems such as accuracy may happen often (for instance of data key-in mistakes), the manpower load (such as examining data correctly) and uncertainty (if the mail is postponed) [6]. So, through the electronic data exchange can solve the information-sharing problem. The production of the intermediary platform adds the development of extension mark language (XML), utilize the design structure of across platform, derived out the information exchange platforms. The electronic files of every industry must define these information in the intermediary platform to finish the task that the data exchange rapidly. Exchanged problems faced from the heterogeneous systematic data in the past, can be solved easily under SOA structure.

According to the document, traditional middleware doesn't support link from several distributed application system server to database. For example, ODBC client/server middleware originally designs to links single resource to the database server [12]. But in the networks nowadays need a kind of new middleware to deal and transmit large amount of instant information at the same time. RFID middleware acts the role between RFID label and application program, the main purpose is to set up a standard that can communicate with each other. It is different from the past that the same type of server can only corresponds with the same software and realizes the combine of systematic procedure let the system more elastic. And, how RFID middleware assemble, filtering and guarantee the data read with effective content which are sent to the database are all important subjects of RFID middleware. We will sum up for the following several items:

1. Need harmony and offer proper interface to different application system of manufacturer.
Offering an open and elastic system structure.
Make the software function interface that RFID hardware manufacturer needed to offer.
Reach the basic function of middleware that Auto ID stipulates; strengthen the interface function of the card-reading machine.

To solve the efficiency of the service of the software after channeling RFID, this research regards designing the application program interface as the concept, developing dealing of intermediary platform of Reader information, and making the data read by front reader which can be transform and transmit through this intermediary platform. For example: ERP (Enterprise Resource Planning), WMS (Warehouse Management Systems) for the application system or database of the back end system and utilize XML to combine Web Server technology and make the product information among enterprises, and let the information system have malleability of prolonging even more.

According to Temara Petroff’s research pointed out, the upgrades of information system can be divided into the following three strategies [7]:

1. Using package to replace the original system.
2. Merge the original system and the development again.
3. Construct a new information system.

This research will use the second kind of strategy; combine various types of reading devices and link procedures offered on the market. We offer combine and coordinate sharing with the task in the platform, offer different kinds of reader device with a communication method, and produce an interfaces after integrating. We let the user easily reach the several task from different system in a single interface and inject a new motive to information system that will not affect the operation of old system.

3.2. Research steps

In according with the above-mentioned methods proposed, we propose the following steps:

1. Analyzed present situation traded between upper and lower enterprise, collect relevant documents and procedure, analyze after gathering.
2. Analyses RFID development present situation and relevant documents, which are collected, probing into RFID may be applied to the way in which the data flow inside enterprises.
3. Consult relevant documents, analyze the operation idea and procedure that passes in and out of the goods among enterprises, propose that RFID can be applied to the model structure of the goods and information transmission among enterprises.
4. Through making and constructing the pro system.
5. Compare the cost of channeling RFID and Web Service technology and possible benefit; appraise the feasibility channeled into Web Service.
6. Via analysis result made into a conclusion and proposes relevant suggestions.

3.3. System structure

This research designed systematic structure is summed up as the following several parts, the systematic structure is as shown Figure 4:

1. RFID Reader and Intermediary Platform (Middleware) Combination.
2. The data analyzed that read by RFID Reader
   By the original information that Tag reads, need to analyze to enrich its value, this stage will use XML for transformation of data form to let the data can effectively link with back end database.
3. Effectively stores the data in the back end database
   We want to make the data read and put in order to become useful, so need to completely store data on database, increase data completion and usefulness.
4. Merge of RFID intermediary platform and existing application system
   When information has already been process completely, need to consider how to combine with the system in operation. We utilize XML file to data that the application system need to convey to every application system through Web Service, application system only need to process XML file to take out the data and store, and can solve the source problem of the data and consistency of maintaining the data.

3.4. System simulation

This RFID middleware selecting Windows 2000 Professional and above version as operating system, Visual Studio .NET 2005 C#, Net Framework 2.0 as system development tool, SQL Server Develop version as database system tool to build up a intermediary platform for communicator of RFID and back end database.
4. Analyzing and discussion

4.1. RFID technology can improve visibility and ability tracking

The traditional logistics centre still depends on the investment of a large amount of manpower, using information system or the new technology as the supporting work. The RFID system makes the visibility of supplying chain greatly improve, make the goods in any parts of supply chain can be tracked immediately, and reduce the manually mistake at the same time [9].

4.2. The advantage of using web service [10]

1. Adopt WSDL and describe interfaces abstractly, enable the construction of Web Service to across the platform or procedure language.
2. Enterprises may face organizing integrate and or altering the commercial mode, use Web Service to make the change of enterprise's application program easier.
3. Serve oriented design function make software applied extensive, and increase software service business opportunity.

5. Results

The RFID middleware platform of this research read 1 transaction of information only needed the shortest time of 0.11 seconds within completed distribution and construction in the experiments. Comparison with Savi pointed out that the records of goods read 1 transaction of information from bar needed about 2 seconds; we can save the time up to 94%. The practical expression was informed that this research provides the solution can effectively reduce operating time and the problem of information in multi- heterogeneous systems.

6. Conclusion

Enterprise structure integration can be the connector between strategy and system, make strategy goal, procedure improvement and systematic structure can be combined, and solve effectively because the demand of the software is indeterminate, failures and risk caused [8]. Have advantages than EDI, HTML through Web Service, mainly regard XML as the information transmission foundation, and can cross over the fire wall and have distributed objects characteristic [1]. But, RFID middleware is not merely designed to one company or one manufacturer, it is the merger platform that cooperates with every reading device manufacturer, through this platform, if the manufacturer increased RFID equipment, that needn't be limited to intermediary's software again is improper.

This research focus on difficulty of integration of traditional B2B information, with the insertion of RFID, we develop a RFID intermediary platform combined with Web Service where users needed to react when emergency occurs. We use Web Service modules advantage to let the user's demand of change can be realized on the intermediary platform directly. The multiple design labels and reading devices in enterprise will not be the problem of the development, cooperate with strategy and products integrating, and reach the anticipated benefit development helpful to RFID.

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