

Study and Use of Data Synchronization in the General Equipment

Support Information System Based on SOA

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Abstract: In order to solve the problem of how to keep data consistency among application system in the construction of General Equipment Support Information, based on analyzing the function of SDC(Share data Center), and some research on SOA(Service-oriented architecture) and relevant technologies are done. According to specialty of loose coupling among the application systems and expandability of SDC in the construction of General Equipment Support Information, a solution of data synchronization technology based on SOA is presented. Finally, the equipment's information in the system of Equipment Management is taken as an example to implement data synchronization with other application systems by using SOA technology.

Introduction

Under the influence of information technology new military reform, we have made some achievements in the construction of general equipment support informationization, and have established a series of general equipment support information system. These systems mostly for all units and departments of their business needs, equipment support organs and units at all levels use widely. However, using different technologies and platforms standards of different needs result in a multi system co-exist situation, and the multi system co-exist situation result that the same type data in different systems exist at the same time, data synchronization could not be completed between systems, "data island" emerged. Regardless of the use or maintenance, these data island will make the realization of the unity of the data increase a certain amount of work, resulting in unnecessary waste of resources. Shared data center can solve most of the "data island" problem, guarantee the consistency of similar data in multiple equipment support application systems, reduce the workload of system administrator of data synchronization, and make the data integration between the existing systems possible.

Based on this, this paper will mainly study on how to use service-oriented architecture (SOA) technology to realize data synchronization between shared data center and equipment support application systems, to solve the data integration and sharing problems under the environment of heterogeneous system.

ShareDataCenter

ShareDataCenter (SDC) is a platform for collecting, processing and storing all kinds of shared data and providing information sharing services. Shared data center can provide an integrated data center for the business system, it integrates important and general business data into a database, provides the accurate and consistent data for all other business systems; easy to flow, share and utilize data between the various departments effectively, solve the problem of "data island"; reduce

duplication of data collection, reduce workload and the cost of expenditure; easy to data analysis and provide strong support for the role, and ultimately provide a reliable, uniform data platform to achieve information integrated

In general, the goals of sharing data centers are as follows^[1]: arrange the data of the existing system, clear the garbage data in "Data Island" gradually, and ensure the authority of the data in the share data center. Complete data docking with the existing application system; ensure the interaction between the core data of these systems. Complete data docking between the application system to be built and the existing application system. Provide data support services for future application systems based on business requirements.

Service Oriented Architecture (SOA)

Service Oriented Architecture (service and oriented architecture, SOA) to serve as the basis, to business driven as the core, take the coarse-grained, loosely coupled way to organize application system, to meet the ever-changing business needs inside and outside the enterprise organization flexibly^[2].

SOA structure model

SOA is composed of three parts, the Service Provider, the Service Consumer and the Service Repository; they constitute the SOA's foundation. Its structure model is shown in Figure 1.

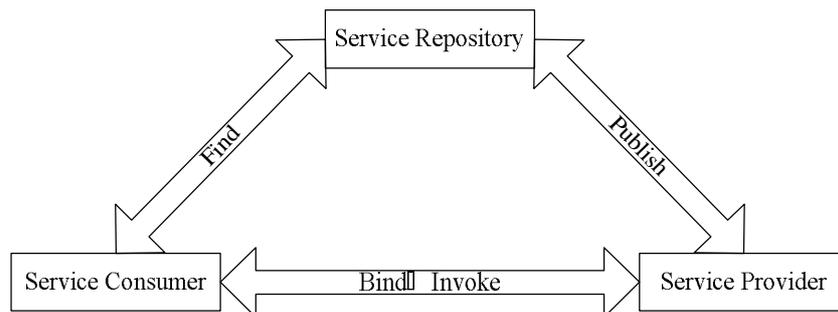


Fig.1 SOA structure

key technologies of SOA

The key technologies of SOA architecture are ESB, JMS, Web Service, etc.

1) Web Service technology. The Web service is a set of open standards for the World Wide Web Consortium (W3C). It is a set of software components based on the XML standards; it can interconnect in a variety of different networks. Web services using WSDL (Web service description language) as the service interface description language, Web Service registration and service search and location based on UDDI (Services Publication and discovery) protocol specification, and using soap (Simple Object Access Protocol) transfer protocol to exchange the information of XML format between the network.

2) ESB technology. Enterprise service bus (ESB) is a product combined with traditional middleware technology, XML, web services technology and soon^[3]. It is a standardized communication infrastructure for connection service, based on open standards, provides a reliable, measurable and highly secure environment for application, and can help the enterprise to design and simulate the business process, control and track each business process, analysis and improve processes and performance^[4]. ESB mainly has the functions of routing function, data type and interface conversion, protocol conversion, event management, security management, etc.

3) JMS technology. Java Message Service (JMS) is a Java Message Service specification proposed by Sun, it is the standard API access to enterprise messaging system, it is a API used to

access the messaging system not depend on a specific manufacturer, it is an interface for supplying application creation, sending, receiving and reading the message, the specific implementation maybe different^[5].JMS use asynchronous communication model: after sending update information to the message platform, the information sender can turn to other work without having to wait for a message from server message platform. The advantages of this asynchronous communication: even there is a network failure or collapse of the server will not cause data inconsistency or lost, the message will be preserved in the server queue until it is finally accepted.

Data synchronization scheme based on Service Oriented Architecture (SOA)

At present, our army general equipment support lack of unified planning and unified standard in policies and regulations, technology system, system development and the allocation of resources, lack of top-level design, the phenomenon of developing independently by various departments and dispersion construction is more common, lead to various system design and distribution in different servers. Since the shared data center needs to be carried out with multiple application systems, the problem of coupling must be considered in the design. It should reduce the coupling between the application system and the shared data center; reduce the possibility of data dependence between the systems as far as possible^[6]. In addition, the application system in the process of system integration cannot be completed in a short time, so it needs to connect the share data center gradually. Data synchronization technology scheme based on SOA is shown in Figure 2.

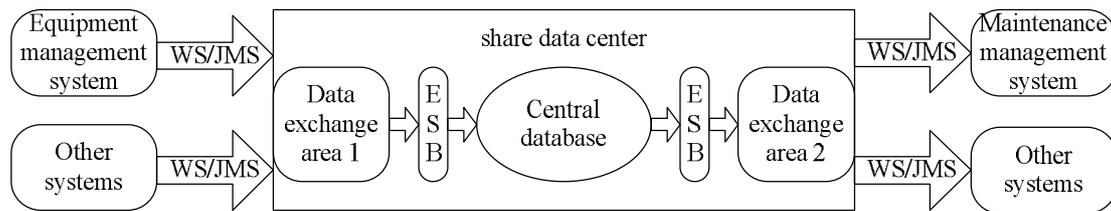


Fig.2 data synchronization technology based on SOA

The central database is used to store the standard data that the general equipment support information system is shared, and the exchange area is used to store the incremental tables corresponding to the data tables of the application systems. ESB is used to control the business data from interface, which is cleaned, stored and finally released to other application system. ESB provides the routing and transmission functions to achieve flexible portfolio business processing. There are two data interfaces, one is data import interface, and the other is data distribution interface. The more complex part is in the data import interface. Since each application system may use different data source to store data, each application system may have its own specific data interfaces.

The whole universal equipment support information system has two kinds of data interface: Web Service real-time interface and JMS asynchronous interface. Such as equipment management system for equipment basic information, since each system are related to the application of this part of the information and need to real-time update, so the basic information of equipment change will be achieved by the Web Service real-time interface. But some information for protection of business systems, such as main business information and proprietary business information, the data throughput is larger, and the requirements of real-time is not so high, so it can use JMS asynchronous interface to achieve.

Data synchronization technology based on Service Oriented Architecture (SOA)

It uses data synchronization technology based on SOA architecture to synchronize the equipment basic data of equipment management system to the center database of shared data center, and then synchronize the data from the central database to other applications of the system.

The process of data synchronization is mainly divided into 3 steps: data import, wash and distribute. After the equipment management system adding or modifying (may be due to equipment allotment or retirement reasons) basic information of equipment, call a shared data center service interface, synchronize the changed data to a central database, and then pushed sent to the equipment maintenance system, equipment management system, ammunition management system, combat readiness management system and other systems. The real-time synchronization is implemented in this way. The ESB uses the Mule service bus as the support, and all service data operations (such as cleaning, storage, distribution) are configured in the Mule service bus.

Data import is importing application system change data to the corresponding incremental table of data exchange area of shared data center. Since many application systems are related to the application of the basic information of the equipment, need real-time update, so the equipment information update will be achieved by the Web Service real-time interface. Data import is implemented by the application system calling shared data center data and synchronizing them into the Web service. Data import configuration in Mule as shown in Figure 3.

```
<inbound>
<cxfinbound-endpoint address="http://<server address>/
services/SynHRData"
serviceClass="dataimport.webservice.ISynHRData"/>
</inbound>
<component
class="dataimport.webservice.impl.SynHRDataImpl"/>
```

Fig.3 data import configuration

The ISynHRData is the interface of data import, and the interface can reduce the coupling degree between systems and improve the scalability of the system. The SynHRDataImpl class is a class of ISynHRData, and its function is to import the required data into the corresponding incremental tables.

Data cleaning is the process of cleaning the temporary data in the corresponding incremental tables of data exchange area and storing the data to the central database. We should establish the rules for cleaning first, dynamically establish the rules by the metadata definition of the business table and the metadata definition of the association table, then set up the storage process according to the cleaning rules, accomplish the cleaning operation of the data transmission. The configuration of data cleaning in Mule is shown in Figure 4.

```
<filtering-router>
<outbound-endpoint address="cxf:http://<server address>/
services/SynHRData">
<custom-filter name="Clean EquipmentData"
class="datacleaning.business.CleanEquipmentDataServiceImpl"/
>
</filtering-router>
```

Fig.4 data cleaning configuration

CleanEquipmentDataServiceImpl is the realization of data cleaning function class. After the data operations finishing the first step data import, it will automatically clean the data of increment table, then store the changed standard data to central database for the data distribution operations.

Data distribution is distributing the standard data in the central database to other application systems which are needed. After equipped basic information updating center database, it will automatically call data distribution service to distribute the data to the data exchange area, this process does not need the data cleaning, just simple data format conversion. And then push the data from the data exchange area to the equipment maintenance system, equipment management system, ammunition management system, combat readiness management system and other systems automatically, in this way to achieve real-time synchronization. Data distribution is similar to the data import process, just exchange the source data end and the destination data end.

The configuration of data distribution in Mule is shown in Figure 5.

```
<filtering-router>
<outbound-endpoint address="cx: http://<server address>/
services/SynHRData">
<custom-filter name="DistributionEquipmentData"
class="datadistribution.business.SendEquipmentDataImpl"/>
</filtering-router>
```

Fig.5 data distribution configuration

SendEquipmentDataImpl class's implementation of the function is to import the basic information of the equipment data into the data exchange area first, and then released to other applications.

Conclusion

Through the discussion of the technology based on SOA data sharing and its application research in general equipment support information system, theoretically realized data synchronization between share data centers and various application systems, solved the "data island" problem in the process of each application system, and also meet real-time data transmission, low coupling and scalability between share data centers and various applications.

The innovation of this paper is to apply the shared data center to the general equipment support information system, discuss its design ideas, propose a data synchronization technology based on SOA, and provide the design idea of development of equipment support information system with good expansibility and high flexibility for the whole army.

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