Research of Distributed Software Resource Sharing in Cloud Manufacturing System

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Abstract

The concept of cloud manufacturing is introduced and the importance of software resource sharing is elaborated. In cloud manufacturing system, server-based architecture is the best solution to provide solutions to address the application of the software resource requirements for small and medium enterprises (SMEs). And the virtualization technology which have developed and mature will provide a strong technical support for it. The system through deploy Citrix's XenApp application servers to achieve application virtualization. On this basis, the distributed software resource sharing platform which mainly for small and medium company had being developed.

Keywords: Cloud Manufacturing, Software Resource Sharing, Small and Medium Enterprises.

1. Introduction

Cloud manufacturing is a computing and service-oriented manufacturing model developed from existing advanced manufacturing models (e.g., ASP, AM, NM, MGrid) enterprise information technologies under the support of cloud computing, Internet of Things (IoT), virtualization and service-oriented technologies, and advanced computing technologies.

In CMfg system, various manufacturing resources and abilities can be intelligently sensed and connected into wider internet, and automatically managed and controlled using IoT technologies (e.g., RFID, wired and wireless sensor network, embedded system). Then the manufacturing resources and abilities are virtualized and encapsulated into different manufacturing cloud services (MCSs), that can be accessed, invoked, and deployed based on knowledge by using virtualization technologies, service-oriented technologies, and cloud computing technologies. The MCSs are classified and aggregated according to specific rules and algorithms, and different kinds of manufacturing clouds are constructed. Different users can search and invoke the qualified MCSs from related manufacturing cloud according to their needs, and assemble them to be a virtual manufacturing environment or solution to complete their manufacturing task involved in the whole life cycle of manufacturing processes under the support of cloud computing, service-oriented technologies, and advanced computing technologies[1-2].

Facing the increasing fierce market competition and continuing upgrade of the economic globalization, more and more enterprises present the trend of the distributional position, the organizational groups and the professional internal division, and the cooperation between enterprises become more and more close, more and more enterprises adopt the way of cross-region, cross border and cross department and cross enterprise to work. This makes that the distribution of enterprise resource tend to be scattered, while the scheduling and management of enterprise resource tend to be unified and integrated, ensuring that the allocation of enterprise resources are reasonable and effective. Software resources are indispensable tool during the process of modern enterprise production and operation. Using the technology of software sharing can greatly expanded area that a software can visit, to make it become possible that providing a necessary foundation to make full use of the software resources and distribute the software resources in different enterprises, in different areas reasonable. So Software resources sharing have three main aspects[3-8]:

1) The inter-enterprise software resources sharing;
2) The software resources sharing between enterprises;
3) providing ASP (SaaS) model of software resources.

2. Requirement Analysis

In our country, medium-sized and small enterprises accounted for more than ninety percent of the total number of enterprises, the total output value of medium-sized and small enterprises accounted for more than two-thirds gross national product (GNP), and the employees absorbed by medium-sized and small enterprises accounted for over 80% of the total number of employees in enterprises, the business scope of the medium-sized and small enterprises is throughout every aspect of the life of national. The operation and development of the medium-sized and small enterprises play a important role in national economy. Along with the development of our society, various industries are gradually connecting with the world, and the world economic globalization has continued to deepen, so far the medium-sized and small enterprises in China already have a lot of chances to rush out and head to the world, and at the same time, the medium-sized and small enterprises in China are also the receiving strong impact from overseas enterprises. The medium-sized and small enterprises in China already have a lot of chances to rush out and head to the world, and at the same time, the medium-sized and small enterprises in China are also the receiving strong impact from overseas enterprises. The medium-sized and small enterprises’ survival and development in china are facing the great opportunities and challenges, and to seize the opportunity and overcome the challenge, they must adopt and master more advanced and scientific operation management style and production services technology. Enterprise informationization is a important strategy for enterprises to improve the resource allocation efficiency and effectiveness, it is a kind of effective means to comprehensive improve the strength and competitiveness of the enterprise. But relative to large enterprises, according to the reasons of economic strength and the historical development and so on, the informationization degree of the medium-sized and small enterprises is still relatively poor, many enterprises' informationization almost have just started, in many cases even because of the strength, scale, inadequate infrastructure, etc. these various kinds of reasons, they can’t be informationized. For the small and medium size manufacturing enterprises at a disadvantage in the process of manufacturing informationization, adopting ASP (SaaS) model to provide the professional informationized software and services will be able to improve the level of enterprise informationization in a specialized and socialized way, and it has the advantages of convenient use, effective fast, low cost, etc.

3. Key Technology of Software Resource Sharing

To realize the sharing of software resources as mentioned before, the key is to solve the problems of cross-regional, cross-platform remote access to the application software. Aiming at this issue, it mainly has two solutions: one is to develop the application software based on the web, make itself has the ability to be across-region and across-platform accessed; the other is to adopt relevant network transport protocols and technologies of software virtualization to deploy the existing application software to the Web, etc. common platforms.

3.1. Software technologies based on Web

The application of Web, because of its easy access for users and dispense with excellent characteristics of installation and maintenance, etc., it has embedded all aspects of social life with the rapid development of the Internet. The design of application software’s that based on the Web has extended to every field, such as product design and manufacture process, from the original information distribution field; there has appeared the technology of product design. PDM manufacturing management and so on which were based on the web.

3.2. Technology based on the Agent, CORBA and Web encapsulation

Encapsulation technology can integrate software and hardware resources distributed in each enterprise into the system, and it is an important means that to realize resource sharing and use of software remotely. At present, the hot spot in researching is the encapsulation based on Agent, and encapsulation based on CORBA and Web.
Agent is a computer system in certain environment. It can achieve its goals independently, and control their own behaviors and internal states under no interference from other Agent and any person. In the distributed system, agent are used to encapsulate existed software system, and provide network interfaces, and make it possible that users of an area can transparently use other areas’ resources. CORBA is a distributed object calculation standard which was formulated by OMG; its purpose is to share information and resource under distributed heterogeneous environment. CORBA defines the function and agreement of ORB, the core of OMG, and IDL of a group of description object model. ORB provides transfer request and basic mechanism of response for software modules based on OMG object technology, thus realize the application system’s using, transplant and interoperate under distributed heterogeneous environment.

3.3. Windows terminal services technology

Windows terminal services make various clients connect to the same terminal server at the same time by using relevant agreement, once establishes the connection between the client and the server, the operation, configuration, data storage of software and the communication between other settings will all operate in server, the server then called terminal server. Using the Windows terminal services has three important characteristics:

1). Rapidly and intensively deploy the application program. Terminal server provide for convenient way quickly deployment application programs based on the Windows, especially important to those application programs which is too expensive, constant updating, frequent using and hard to manage. When the application software has managed by terminal server (or managed by geographically dispersed terminal server cluster), each user can spend a small fee to operate the latest version of application software.

2). Low bandwidth to access data. Terminal server greatly reduces the network bandwidth to remote data access. The efficiency to remote access and operate large quantities of data is very high by using the terminal server to operate the application program in limited connection of bandwidth (such as dialing and sharing WAN connection), because it only transmit the screen display of data on the network not the data itself.

3). “Windows anywhere”. Visit current application program through any equipment (including under drive hardware and non Windows desktop), terminal services can help users to improve the productivity greatly. And, because the terminal services can make “Windows anywhere” to update equipments, such as Pocket PC, and bringing additional processing power.

Currently, Citrix and Microsoft are the main service providers of Windows terminal. The main product of Citrix is XenApp, and the main product of Microsoft is Windows Server. XenApp and Windows .NET Server all support access to the terminal server through browsers, which greatly expand the application scope of Windows terminal. Besides, Citrix is the original developer of terminal serviced components in Windows Server system; it has unique technological advantage in developing the application based on Windows terminal services.

4. System Design and Environment Development

System is based on Citrix XenApp[9-16]. It through Citrix XenApp Web Interface SDK achieves the function of Software Resource Sharing. and added the function of soft management, user management, user permission of using soft management, fetch certificate of soft access for the user of owe permission, generate ICA file of access soft, make user can using corresponding soft. Through this way, the software resource sharing can be achieved over enterprise and area and it will not affect the running of the enterprise internal.

4.1 Architecture of software resource sharing platform

Software resource sharing platform is based on Citrix XenApp. Through re-development the Web interface SDK, embed it to website of this platform for realizing freeing and opening software sharing. This platform provides two kinds of services: software publishing and software using, all other services are assistants of the two services. Platform is running as ASP model. It provides software supply agent service for software provider and provides software online using service for software user. Architecture
of this platform as Figure.1, it can divided to platform layer, software management layer, the detailed explain as follow:

**Figure.1.** Architecture of software resource sharing platform

Platform interface layer (web interface layer): is user interface of the platform which provides access through Web browser.

User, soft management layer: management all registered user of this platform and all software which be shared in this platform. Which include relevant information and running status of software, and user permission, using status of user to software, and the way of using, buying a software.

Application software server layer (XenApp server layer): provide running, management, maintenance of Application software. This layer is management by provider of software resource themselves in general, that can make enterprise of software owner can’t be limited by platform and others. If some software owner not enough technology to manage it, technician of software sharing platform can provide technology support.

### 4.2 Environment Development

This system based on Windows 7 flat, use VMware virtual machine to simulate various kinds of distributed server platform of Windows Server 2003, etc., and use Microsoft's terminal technology to set up Citrix XenApp application software server to realize. Table.1 is development environment list.

**Table.1.** Development environment

<table>
<thead>
<tr>
<th>Item</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>operation system</td>
<td>Window 7, Windows Server 2003</td>
</tr>
<tr>
<td>development language</td>
<td>C#</td>
</tr>
<tr>
<td>script framework</td>
<td>JQuery</td>
</tr>
<tr>
<td>development tool</td>
<td>Visual Studio 2010 Express</td>
</tr>
<tr>
<td>data base</td>
<td>Sql Server 2008 Express</td>
</tr>
<tr>
<td>Web server</td>
<td>IIS6/7</td>
</tr>
<tr>
<td>software serve</td>
<td>Citrix XenApp5</td>
</tr>
</tbody>
</table>
The installation of operating system, Visual Studio 2010 Express, Sql Server 2008 Express.IIS is according to default way, next we will mainly describe the establishment of Citrix XenApp Server environment.

Citrix server establishment is the key step in the software sharing. The install deployment list is shown as Table.2:

<table>
<thead>
<tr>
<th>Computer</th>
<th>Description</th>
<th>Installed component</th>
<th>Network setting</th>
</tr>
</thead>
</table>
| hnie_pc   | test and developed entity mainframe installed chrX_1 and chrX2 these two virtual machine | Windows7
VMware7 |                                 |
| chrX_1    | Terminal service authorize server, Citrix certificate server, Xen App5 server | Windows 2003 sp2 .net framework 2.0/3.5.IIS6.ASP.NET.Terminal Services
Citrix Licensing Server | IP:192.168.231.128 |
| chrX2     | Xen App5 server                                                              | Windows 2003 sp2 .net framework 2.0/3.5.IIS6.ASP.NET.Terminal Services | IP:192.168.231.129 |

Now, we should deploy Citrix server environment. First of all, newly built a virtual machine in VMwarer, choose Microsoft Windows for customer operating system, use the default way to configure. System information is shown in Fig.2.

And then in the virtual machine install Windows 2003 server edition, playing, and install the dot sp2 Framework asp.net 3.5 S and KB961118 and KB956572 patch. In the installation of KB961118, it is prior to installation DotNet3.5, at first. After installation, the system upgrading to the latest security stable state.

Next, install required components of deploying XenApp, including terminal services (XenApp operation needs), IIS server, ASP.NET (Web Interface needs). Click into the start menu, control panel, add or remove programs, add or remove Windows components. Selecte application program server, terminal server and terminal server authorization in figure 3.2 and click on the corresponding detail information button of the application program server, choose Asp.net, then choose the next step according to the default configuration.

5. The Use of Software in Software sharing system
The use of software is the key function of this system; its main work is for users to access the corresponding application server according to users’ authorities to get software using certificate and product the relevant ICA file. Pass the identified ICA file to users to let users’ client plug to analyze and link to access the server software. It needs to make a dynamic management and access to the software resource of every application server distributed in different areas.

System first keeps the detailed information of user, software, and software position, the use relationship between users and software, and certificate. When the user chooses to use software, the system will judge user’s authority to software at first, if the user has the using authority to the software; it can choose to use this software. After the user choosing to use this software, the system will search and access the XenApp server address and some related Farm information where the software resources stand. If it isn’t out of order and after finding the server, the system will get the software information and access token for users according to the saved login name and login command for users, and then use these data’s to product the needed disposable ICA file to access the software.

A successful software used process is shown as Figure.3:

Figure.3. Software using flow
After users get and open the ICA file to access the software, the installed XenApp Client plug-in can use the ICA files link to the corresponding after ica documents for the XenApp plug-in can use the ica documents connected to the corresponding XenApp server and use the software. When the ICA file has been used once, its access token will be void automatically. If the users want to use the ICA file again, the system will request users to input the user name and password of login software.

6. Conclusion

This paper introduces several ways of key technology to realize the software resource sharing platform:
1) Based on the Web technology, rewrite the relevant industry software, take Web page as the user’s interface, make the application software directly can best to realize the software sharing, the amount of mission at that time is large, and limited to the computing capacity of the Web and the related speed of networking protocol and its stability, so the control is very difficult, technology is also very difficult to realize and its broad application is also has a lot of limit.
2) Technology based on the terminal services use the gradually mature virtualization technology to realize the virtualization of software, not need to rewrite the application software, now, with the support of Microsoft, Sijie, Weirui,etc, its development is fast and gradually mature, it must be widely used in the future.
3) The technologies based on Agent and CORBA are advanced and powerful, but the cost is too much, and not has a widely application, so it is not obviously superior to general software resource sharing.

This paper mainly and priority studies the XenApp technology based on terminal services of Sijie company. But because of the limited time and energy, there are a lot of problems need deep researches, the following problems are important to be solved:
1) The support of better browsers: the system is to deploy local softwares to the Web platform through certain means, use through the Web, after all, it has a big difference with the primary Web software, it needs the support of the browser plug, and the user experience is often sharp declined by the effect of the browser’s security function, so in order to better access to the platform to use the software in the browser, system need to provide better browser support to bring better user experience.
2) More elaborate access management: the software and hardware cost of different software, the characteristics of resource and human consumption in operation and maintenance, users’ different means to use software, different time, these decide the system must has extremely sophisticated management to the use of software. Including the exact beginning and ending time of software connection and using, provide detail information and process of resource consumption in the midway.
3) Faster software resources search and connection: the software resources of system are distributed in remote areas, the locating of software and the using authentication are need to proceed in the remote servers, users’ eventually using of software are also need to proceed connect to remote servers, it is very easy to lead to slow speed, so we must prepare optimize working to speed up the searching and connecting speed.

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