Research and Design of the Three-tier Distributed Network Management System Based on COM / COM + and DNA

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Abstract

Considered on the distributed network management system’s demand of high distributives, extensibility and reusability, a framework model of Three-tier distributed network management system based on COM/COM+ and DNA is proposed, which adopts software component technology and N-tier application software framework design idea. We also give the concrete design plan of each layer of this model. Finally, we discuss the internal running process of each layer in the distributed network management system’s framework model.

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1. Introduction

With the development of component-based software technology, most of large-scale software systems turn to distributed architecture. This system is based on the characteristics of organizing the system’s framework and commercial logical structure by local component, the system will submit the calculation to the nodes of network server to perform. At present, the computer application has been turned from the traditional centralized application to distributed application which based on network. So it is natural that use distributed technology to network management.

COM is the component interface normal pushed out by Microsoft. In principle, these components can be established in any environment, but the existing COM components generally depend on the Microsoft environment. The components that can be used in UNIX, Macintosh operating system are very few. With the continuous development of COM technology which is promoted by the Internet technology, Microsoft also introduced a COM-based DCOM / COM +. The appearance of these technologies makes communication between the components and the client program or the components themselves is possible under the distributed network environment.
The multi-layer distributed network management system discussed in this paper is based on COM standard and is designed under N-tier Application software framework design idea. The component of distributed network management system is independent application based on the level of binary code and with a specific function. While deploy these components, you can both deployed them on the same computer or distribute them on different places of a large-scale network. In short, the components can complete a particular function and is part of distributed network management system. The components exchange information by standard interface, by doing this not only simplifies the date exchange but also makes it easily for components to be distributed on different hosts, also provides a scalable interface for the system. Since the interface is built on the level of binary code, compiled code components can be linked directly to the client software, without having to rewrite or re-write client software.

2. System architecture model design

The main tasks of Network Management System:

2.1. Collecting the operating parameters and status information of a variety of network equipment and facilities, showing them to network manager and accepting the handling of network manager.

2.2. Send control index such as changing the working operators or working status to network equipments according to the operator’s instructions or the handle result of the above data.

2.3. Monitoring the implementation of the directive to ensure that the network equipment and facilities are worked normally as network management System requirement.

According to N-tier Application software framework design idea, the entire system is divided into three tiers: client layer, network management and data layer. Corresponding to Windows DNA (Distributed internet Application Architecture) of the FORM +, COM + and STORAGE + layer. As shown in Figure 1.

![The architecture of three-layer network management system](image_url)
3. System working procedure

3.1. The design of client layer and the procedure of client access the network by Web browser.

The main task of client layer is to display the necessary information for network management to network manager, and accept their query of operating, and send the query to network management layer. This part mainly realized display foundation based on web.

As customer-based user network manager can be any web browser; the browser can be run under any operating system. The procedure that customers use a browser to access the network management layer is shown in Figure 2, concrete steps are as follows:

1. Network manager provide URL of web pages (often URL contains embedded DNS), and communicate with the DNS server to find the target network management layer business logic object by DNS.
2. Network manager use SSL to prove their identity to complete the certification process.
3. After certification, network manager get web pages in some styles. These pages reflect the net status of that time. After completion of the corresponding operation network manager submit request to the Web server software (IIS), and accept Operational control ASP through HTTP.
4. The JavaScript or VBScript program in ASP script loaded by IIS will distribute each request to network component object.
5. After network management orders were submitted to the Component Object, object access the database through the OLE DB / ADO, and submitted service through COM + Services and DTC.
6. Finally, submitted the command has been completed through MSMQ (Microsoft Message Queuing).

3.2. Network management design and the procedure of the network manage layer in response to customer calls.

Network management is the core of the whole distributed network management system, responsible for specific business logic, including configuration management, fault management, performance management, security management and systems management. Configuration management is responsible for network equipment as well as network configuration information; fault management responsible for detecting and dealing with a variety of network faults; performance management is responsible for the
analysis and monitoring of the system and network performance; security management responsible for
the safety of network and network management system itself; systems management provide their
management services for managing network management system.

The whole network management layer is realized by two COM components: network component and
adapter components, Each COM component corresponds to specific business logic. We realize all
network management modulates of this system in the form of components object of network components.
Clients can complete the interface configuration management, fault management, performance
management, security management and system management functions by calling the interface of
component object. Finally through Adapter components turn the specific operate request on equipment to
device-related command and passed to the equipment. Components and adaptive control devices
communicate through SNMP, or user-defined protocol interface. In addition, the layer can also be
provided an interface to third-party billing system to achieve a billing management function.

The process Network management in response to customer calls is shown in Figure 3, specific steps
are as follows:

1. In order to response to the request of client layer net manager send by HTTP, windows server run
ASP page, so that produce the calling of creating component object. For DCOM client, it needs
component object identifier CLSID_A, the identifier IID_A of interface to be access, and remote
machine name as parameters to call COM library function to produce the call of creating component
object.
2. COM of Windows server find CLSID_A in the COM + catalog at run time, if the component is not
configured yet, then information about this class are stored in the registry, if the components are
confined components, then RegDB have many useful information about this components. Have
information about this component, COM can create object at run time, and make sure that the object
instance is belong to correct process. COM also create proper environment for this object at run
time. Finally client gets the interface pointer pIA of this component object.
3. Client get function provided by this interface through network component object interface pointer
pIA, can also do any jump among different interface by function Query Interface ( ), to get the
function of other interface. The database stored the topology information of the entire network; it
can associate the network component to complete network management function correctly.
4. Network component is client compared to interface Adaptation Component, as procedure 1)--3)you
can get the interface pointer of interface adapter component object, and transmit request to interface
adapter component object. Under the associate of interface adapter component object complete the
function that turns the request produced by network component objects into specific equipment-related orders.

- Through SNMP protocol or user defined protocol interface transmit specific equipment-related orders to the managed network equipment, control the managed equipment to complete the network managers’ operation, and at the same time update the database.

3.3. Data layer design and the procedure that network layer access to date layer

The data layer is mainly composed of a variety of databases, including the management information database MIB, events database and database systems. Management information database store network management information; Events database store network fault events and information relating to the incident; database system responsible for the storage of information about data management systems, such as network topology, the system administrators’ manage the log and so on.

Each database is managed by the database management system. As the COM+ integrates DTC (Distributed Transaction Coordination), in addition to supporting a separate operation in the affairs of the DBMS, but also realize cross-DBMS affairs and operations will not affect the consistency of the data.

Network management components equivalent to the client of data layer, the operation of network management layer to access the data as follows:

- Network management components requests to data management components for database operations.
- Network management layer components call OLE DB / ADO / ODBC interface API when necessary.
- OLE DB / ADO / ODBC are responsible for DBMS access or other data sources.
- DBMS or other data source complete the update of database in the support of the COM+ Distributed Transaction co-processor

4. Discussion about system security

As the network management system related to the distributed environment and network operations, the system security must be taken into account. Distributed security is composed by several different services, of which the most important is the authentication, authorization, data integrity and data of the private .COM+ allows set up these options for configured components by management method. Just by the adoption of a simple configuration can be set up on COM+ application of certification services, data integrity and data-private options. In the distributed network management system, the role can be assigned as needed, once the role has been well defined, for the purview of each role can be defined through the management method.

5. Summary and outlook

The distributed network management system can extend the network management functions dynamically without the need of changes to the client code, only need to add new components and exposed the components interface the client, so the system has good scalability. As the components designed in accordance with standard COM, it can be easily integrated into third-party components software; the system also has a good reusability. However, it also has shortcomings in many areas, especially the cross-platform identity and security need to be further improve and enhance in the future. Through the above discussion we can get a consensus that, regardless of whether on the Windows platform to develop application, the application is expected to be multi-layered, with component-based, and can be visit by Web, so undoubtedly the choice is the most Safe.
References


