Applied Mechanics and Materials Vols. 571-572 (2014) pp 567-571
Online available since 2014/Jun/10 at www.scientific.net

doi:10.4028/www.scientific.net/AMM.571-572.567

The selection and study of HA cluster software design

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Keywords: HA; The Shared disk type; Database monitoring

Abstract. With the rapid spread of network communication technology, the demand of reliability of the network service system is higher and higher for various industries. Any service failure will bring huge loss to the enterprise or individuals. So HA cluster system is increasingly favored by people as an important means of disaster. In this context, this paper analyzed the characteristics and role of HA cluster and the existing HA cluster software. Finally, in terms of optimization of the cluster mode scheme, disk filter way and the monitoring mode program, the corresponding software design scheme selection was put forward.

Introduction

As the development of the PLA General Armament Department test information system, more and more information was stored in the information system. In the test task system, providing continuous service has become the key to the success. For example, in the recent launch of chang'e 3 task, the whole process of taking off, entering the transfer orbit, lunar orbit, and soft landing takes more than 10 days. During this period the real-time acquisition and storage of chang'e 3 relevant information ensures the landing and the success of the follow-up missions. In the execution of the entire system, it will cause immeasurable loss once a machine failure or overload downtime happens. HA[1] cluster is an effective disaster recover system[2] in order to avoid this kind of circumstance.

Analysis of HA Cluster Software and the Demand

High availability software establishes the backup machine to take over the mechanism to realize the disaster based on cluster running status monitoring. Because of great practical value and market value, the clustering software has been diversely developed. The focus of our research direction is how to design a suitable software for the PLA General Armament Department to meet such high demand with high reliability. This study is based on local service and aims at high-level users, to ensure its business running without perturbation. The goal of this design is to control the outage recovery time within minute level, and the design scheme will be described in the following part.

Clustering software study has been used widely abroad, and the technology is more mature. For example, NC company has introduced Express Cluster series based on Windows NT and LifeKeeper2.0. The former provides a complete fault tolerance, and provides data, applications, and the high availability of the communication resource, protection of resources, including volume, IP, file sharing LAN management server and applications. The latter supports multiple operating system platforms, with high scalability, on the image type cluster. It only needs adding a shared storage device type to be converted into sharing cluster, and it can real-time monitor every part of the whole system. In addition, the NASDAQ company software First Watch Dr. Legato Co - Backup Server double-machine fault-tolerant software also has fairly good reputation in the industry.

In recent years, with the increase of the cluster software requirements in China, there have been multiple agencies to carry out the related research, such as Shanghai ding software r&d LanderCluster-DN and LanderCluster-MN cluster software. It can not only implement automatic application resource switch on the application of flexible monitoring function, but also supports more

than double node smooth extension for convenient integration of existing resources. While the Data Ware Howe company provides a safe and reliable system service with multi-level complete equivalence monitor switch, and can build the remote online maintenance mode through double-machine fault-tolerant software Beijing days air Huaxing company launched HA cluster software disaster by reorganization of network resources, and thus suitable for multiple platforms and multiple point of remote and local cluster [3].

The Selection and Research of the Software Design Scheme

As shown in Fig. 1，to design suitable for the PLA General Armament Department test information system software of HA cluster software needs to consider several aspects. This paper explains cluster mode, the monitoring mode, the disk filter way and the CLI extensions. Cluster mode is responsible for the deployment system and monitoring resources; The monitoring mode is the core part of HA cluster, can find out the abnormity of the database and the service and take effective measures combining with cluster mode; The disk filter protects data management in the operating system level; CLI [4] command line interface provides users with interface to carry out the instructions and directly affects the usability of the software.

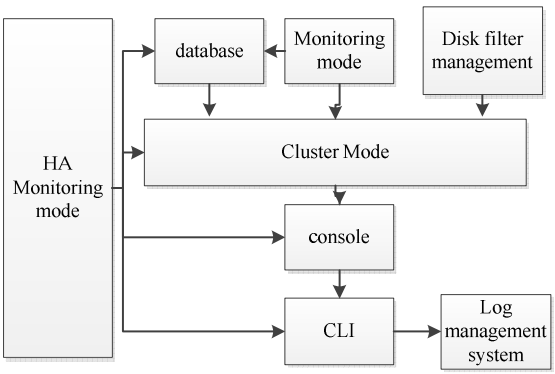

Fig. 1． HA cluster structure diagram of software design

Cluster Mode Scheme. Cluster mode is made up of the cluster of multiple servers and monitoring resources, including the shared disk, applications, IP, services and accessibility of the Shared disk, the state of application and service, IP connectivity monitoring.

Cluster mode sets the mutex attribute between group and group and stand-by priority of the backup in the group. One way is the double backup mode, another is single activation modes. As shown in Fig. 2, it only arranges two backup state server in the group which need to be monitored; The latter is shown in Fig. 3, it arranges two machines in the need to monitoring group, one of them is active, the other is in the backup state. In the event of failure, it will chose the one without mutex attribute or the highest priority for machines to take over the service.

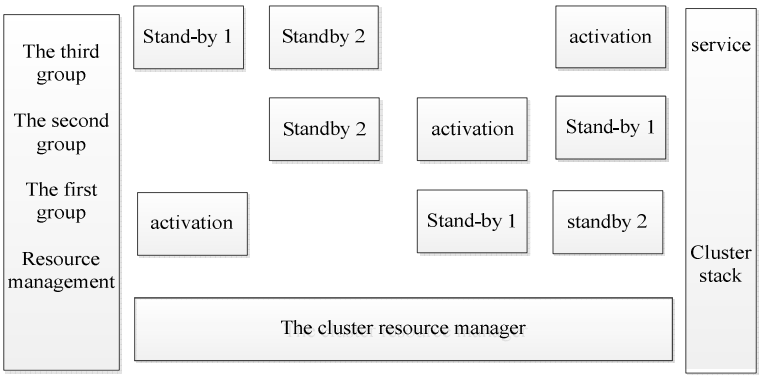

Fig. 2. Dual standby cluster pattern sketch

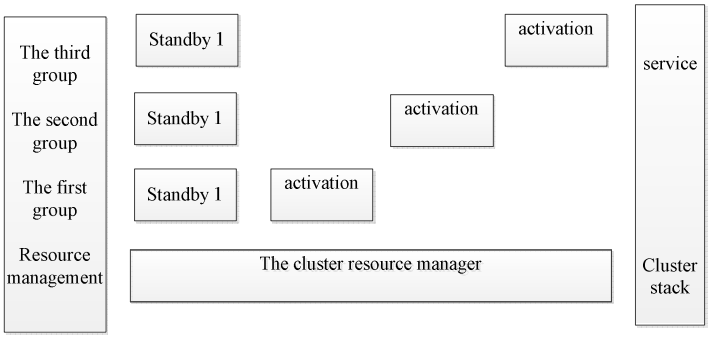

Fig. 3 Single activation cluster pattern sketch

In terms of implementation, the single activation mode in information management of cluster is simpler, but the whole cluster is prone to the single point of failure, because there is only one preparation machine, which is suitable for the simple cluster. When double machine exist mutex attribute between group and group, it can achieve multiple failure group switch at the same time. It is not only suitable for dealing with a single point of failure type applications，but also be applied to complex applications, so the double machine cluster mode is chosen.

Disk Filter Way. Shared disk access is cluster software commonly used methods. Shared disk in the system can adopt two ways, one way is to format the file system, another is based on the bare plate. For the format of the file system, if A, B two points connect to Shared disk at the same time it will make two nodes due to error data inconsistency easily.

In order to reduce the risk and limit the shared disk access, it can through the following three ways:

a) Limiting the connection between the operating system software and the target shared disk. In connecting disk at the same time, point A as the main point, it will refuse point B to access to the disk. During failover, it first connects the target shared disk resources, then switch to other resources accordingly.

b) Using the disk filter driver to control the disk access. This method makes all Shared disks on each node connected and filters the shared disk through the access channel. At this time the only active points have access permissions.

c) Using the file system filter driver to control the disk access. This method makes the backup system cannot to access the shared disk partition. The file system filter driver is based on the logical volume of local file system, then puts all the filtered manager I/O request to determine the stack instance.

Although the software method is simple, it limits availability greatly due to not unified user version. File filter driver implementation difficulty is smaller, but it will restrict user access to the disk. Considering decided to use the second way, this way the realization of the difficulty in contrast will be larger, but can effectively realize the limitation on the disk access safely.

CLI function expansion method. CLI is the command line terminal interface, he realize function is consistent with the graphical user interface GUI, which is a complement to a GUI application. General CLI command line before execution will expand to meet the execution needs. It extending the functions can be used in two ways.

In the first way, CLI and GUI package the basic judgment in the command request, as shown in Fig. 4. It before performing each step operating parameter validation, once found parameter input error will warn you, and after the complete parameter determination will continue to execute corresponding command response to end. This method conforms to the conventional thinking, can greatly improve user interface friendly. This method conforms to the conventional thinking and can greatly improve user interface friendly.

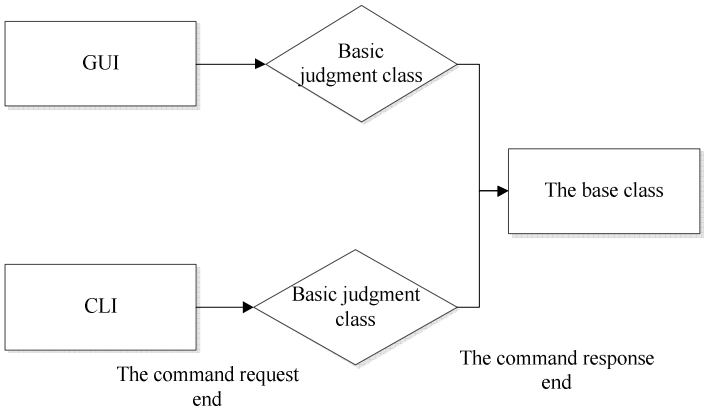

Fig. 4. Command request the basic judgment class

The second way is that GUI packages basic judgment class in the command response end, as shown in Fig. 5. After user inputting all the instruction, it will pass parameters to the command response end to be sentenced. Once it is wrong, GUI will prompt the user has inputting errors. This way malpractice is to reduce the friendly user interface and the errors can only hint at the last execution.

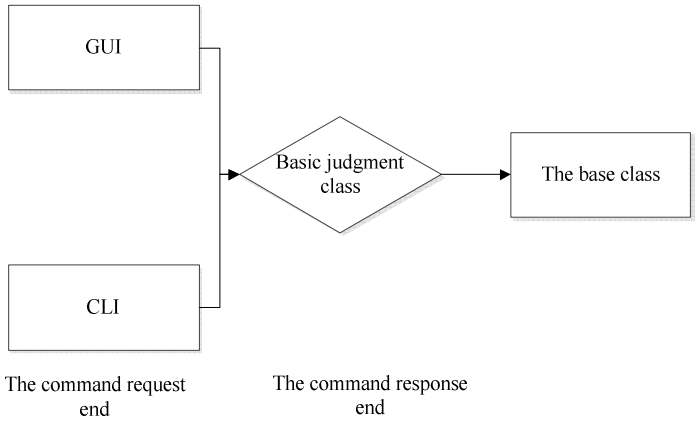

Fig. 5. The basic judgment of the command response

The second way is chosen considering the development difficulty, it can be in as far as possible to reduce damage to the user interface friendly and increase the generality of the interface, witch reduces the construction and makes the interface more simple.

Monitoring Mode Program. Monitoring mode is the core part of the software design including database and application monitoring mode monitor mode, which is effective means to make the software failure data alerts.

Database monitoring mode. Such as PostgreSQL，SQL Server，database operation mode is made up of a series of services, database instance and database to monitor an instance[5]. The protection of database protection is through the establishment of the database instance and combing database service and monitoring service. Database monitoring mode can be used in two ways: one is to join the service monitoring and script resource combination. The second is reading and writing the database testing regularly，which in service monitoring and implementation based on script resource more effective monitoring data.

Although the first way avoids the development of database monitoring module functions, but may not realize the deep monitoring database. Taking into account the development needs facing the high-end users, systems need high reliability monitoring database, so the second mode with high availability becomes a better choice.

Application monitoring mode. According to the software module division to achieve two processes correspond, respectively, HA monitoring process and the software process. HA plays a central role in monitoring the process of the entire software system, which is responsible for the overall work. As shown in Fig. 6, Through the heartbeat technology to monitor and control system software in the running state, once found the problem it will timely use of standby application. This method is suitable for different resources and environment. HA monitor mode using an independent monitoring mode, reducing contact with other applications, reducing dependency and improve stability. It makes sure that HA switching time can be minute level and the process cannot affect the system[6].

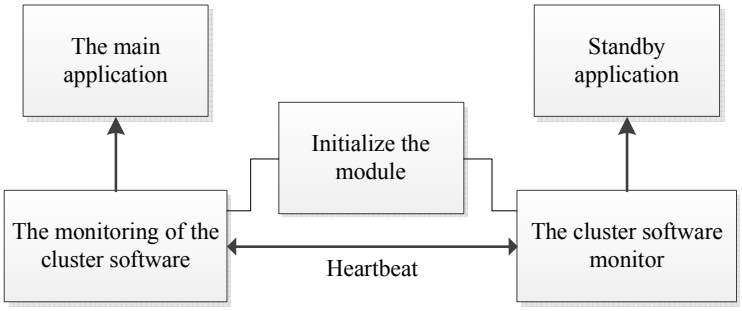

Fig. 6. The application of monitoring mode

Conclusions

The security and reliability of the PLA General Armament Department test information system and the measurement and control system influence the results of the weapon and aerospace task directly. The HA cluster software has some advantages, such as simplifying the cluster mode, high reliability of the database synchronization monitoring, friendly designing and high compatibility of the command execution end, and so on. Through combining with the actual demand of the PLA General Armament Department design effectively, the HA cluster software is able to narrow down the recovery time for minutes. Therefore, the disaster recovery platform, which is based on the clustering technological construction of the testing communication network, can provide an important barrier for data integrity and business continuity of the PLA General Armament Department testing information system. In the next step, the overall design of the high availability clustering software will be explored to realize the requirements of the complex system and business.

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Computers and Information Processing Technologies I
10.4028/www.scientific.net/AMM.571-572

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10.4028/www.scientific.net/AMM.571-572.567