

Design of Service Control Subsystem of Cloud Computing Operation and Maintenance Platform

Zhang Pengcheng

Computer College of Huanggang Normal University, Huanggang 438000, China

zhangpengcheng@126.com

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Abstract: Design and implement the service control subsystem of the cloud computing operation and maintenance platform to provide a reliable platform for users to operate and manage cloud services. The research content includes the design and implementation of the cloud computing operation platform and the user's interactive channel. Based on the analysis of relevant research status at home and abroad and related implementation technology research, the component-oriented bus platform architecture is determined. In this paper, we decided to use the active MQ messaging middleware, platform service control subsystem to build a distributed publish/subscribe control bus to control and schedule the various components in the platform. In front of the system, this article provides users with a Web client based on the Web2.0 concept, and implements the CLI (Line Interface Command) command line interface based on the Python scripting language. The Service Control Center is implemented through the REST-based Wink Apache component, which responds to requests from front-end users and controls the system to run and maintain the various components of the workbench through the control bus.

1. Introduction

With the development of virtualization and network technology, people have entered a new era, the "computing cloud" era. Applications are no longer installed locally, but are deployed in the cloud and data is stored in the cloud. Users can use the browser to remotely calculate and process data and the results displayed on the client, which we call a cloud computing model. Cloud computing is a kind of distributed computing, which effectively calculates utility computing, grid computing, grid computing, parallel computing (parallel computing, virtualization, virtualization), load balancing, network storage, etc. The crystallization of the development of traditional computer network storage technology and network technology. It is based on network technology to build a system with huge computing power and low price through the integration of distributed computers, as well as software as a service (software as a service), platform as a service (platform as a service) and infrastructure as a service (infrastructure The service business model [1] delivers cloud computing and powerful cloud services to users. In short, cloud computing is controlled and managed according to unified resources to a large number of distributed servers, in order to meet the needs of large-scale computing users. It can be paid according to the resource requirements of the cloud computing service.

2. Cloud computing related introduction

2.1 Development status of cloud computing

The concept of cloud computing as early as Google company made clear before it has existed, and by the close attention of the major companies. At the same time, more and more enterprises to join the study of cloud computing, Microsoft, Amazon, IBM and other well-known companies have invested considerable resources and energy in the research and development of cloud computing platform. In recent years[2], the industry's strong push, cloud computing has become a hot. Cloud

computing in accordance with its service type can be divided into three levels of service: the software that is service (SaaS), the platform is the service (PaaS) and the infrastructure is the service (IaaS). SaaS software as a service provider, software developers through the deployment of its software products on the server and to provide services to the outside of its software products into service products exposed. The user can enjoy the service provided by the browser terminal via the Internet. Service operators according to the amount of resources used by the user, the use of long and other factors to calculate the need to pay the cost of how much. SaaS service users in this service model can enjoy the most convenient is hardware equipment of all support services run by service providers to make arrangements for, all of the service operation and maintenance work are by the service provider is responsible for, and for users as long as there is a can access internet terminal equipment, you can anytime[3], anywhere to enjoy the service providers to provide services. A schematic diagram of cloud computing is shown in Figure 1:



Fig. 1. Schematic diagram of cloud computing.

2.2 PaaS technology analysis

In this mode, the user saves a lot of hardware facilities and related maintenance personnel expenses, which only need to spend a certain amount of service charges can be used. In this way, the various software and hardware and maintenance resources needed by the service developer can easily be obtained through the Internet terminal, and it is an extremely efficient service provider. Especially for service development enterprises in the initial stage, SaaS is a kind of economic application and development prospects of the way. The salesforce.com is to provide this kind of service is the most famous companies, domestic Kingdee provides online accounting, online supply chain products also belong to this kind of product. SaaS will be applied to the operation and maintenance environment and development platform as a service for developers to use[4]. The platform of this kind of service is usually distributed, and the provider is the user to build a distributed operation platform, hardware facilities, development environment and so on. Users can develop and debug applications in the development platform provided by SaaS, will eventually be deployed through the test application on the platform, and through the Internet to the end user service. Currently in the level of popular products are Azure Heroku, Windows, Store App, Foundry Cloud, etc.. Which Foundry PaaS as the first open source SaaS Cloud platform, won the industry favor. In addition GAE company's Google, Salesforce's multi tenant platform, as well as the development of the eight hundred passenger 800App is also the level of highly competitive products. IaaS will many distributed server cluster, and formed by the unit in charge according to quantity, outward provides infrastructure services. Server cluster the computing and storage functions are virtualization became independent of the resource pool, and according to the needs of the industry users to way for a fee to provide the corresponding virtual computing resources and storage resources. Currently Amazon's IBM, EC2's blue cloud and other services provided by all belong to the SaaS level. PaaS schematic diagram shown in Figure 2:

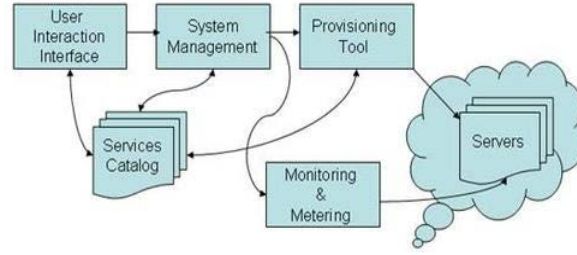


Fig. 2. Schematic diagram of PaaS.

2.3 Introduction and analysis of DEA Technology

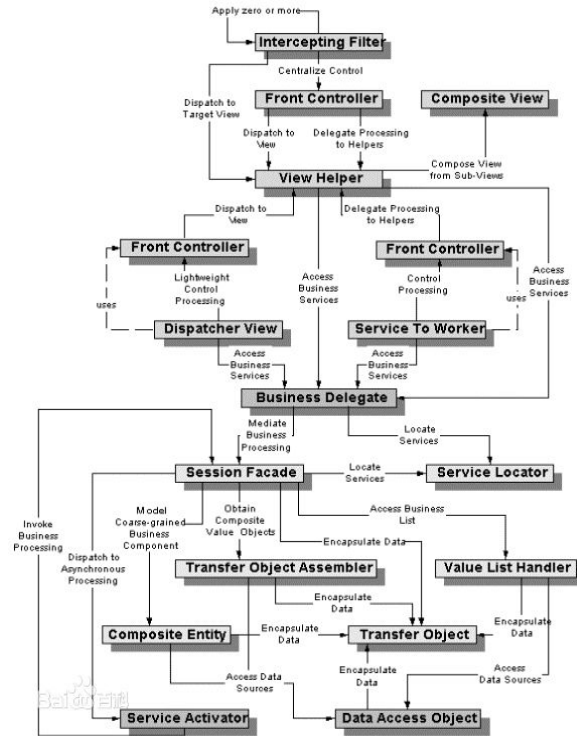


Fig. 3. Schematic diagram of DEA structure.

DEA is a platform for the application of the engine. It will be the application of the package and some of the configuration files through the App Staging package, such as the start stop script, etc., after the package of compressed package called Droplet. Foundry Cloud will store the Droplet in the file system. When Controller Cloud sent to the application deployment instructions, dea.rb script will handle these requests, and from the file system to retrieve and copy the corresponding Droplet, then extract it and run the start and stop script. DEA copy number according to the number of users on the number of instances of demand, how many examples, DEA will be copied how many copies. The control bus role of the system is acted by the Nats module, which is the channel of message passing. NATS based on publish subscribe message mechanism to achieve, is a lightweight message bus[5]. Foundry Cloud platform as a distributed module of the system, the reason to be able to perfect the module's self discovery and error detection, it is due to the existence of NATS. Each component of the platform will subscribe to the NATS according to the demand, or will own the information through its release. For example health manager has been added to the platform, it will release a topic in NATs, the name for healthmanager.start news, contain configuration information of health manager, for example UUID, IP address, port, and so on. Based on the above analysis, we can know that the project is located in the cloud computing platform for the component of the bus architecture type, designed to provide users with a reliable application of the cloud operating environment. However, whether it is an application oriented bus architecture or a component based bus architecture, the current industry uses a message bus based on publish and

subscribe mechanism. The advantage of this mechanism is that it can realize the asynchronous communication between different modules and improve the throughput of the system. Therefore, the cloud computing platform service control subsystem of the project will also use the message bus architecture based on the publish and subscribe mechanism to realize the information interaction among the components in the platform. The component oriented bus runs inside the cloud computing operation platform, and it is the hub of communication between the various components of the platform. The architecture type of operation and maintenance platform[6], the bus is often in the form of modules, and provides the interface for each module in the platform. Using this bus architecture of cloud computing platform for the operation and maintenance are usually in order to provide the service runtime environment based, platform operation and maintenance according to user needs for the deployment of its application to construct corresponding operation environment, with the convenience of the user application of cloud deployment. The schematic diagram of DEA structure is shown in Figure 3:

2.4 System requirements analysis

Information service query contains the following information, service of basic information, the service binding information, virtual machine instances running status information, service versioning information. The basic information of the service includes the service name, category, operation status, and access to the address and other information. Service binding information records the service binding Service and App information, and its binding relationship to expand the way to show the way. In the results of the binding information[7], the binding can be added and removed. The virtual machine running state feedback the running state of the operation of the service of the virtual machine instance. With a service according to the different requirements of its performance, by the number of different virtual machine bearing operation, so by the information to be able to view the current size of the virtual machine and state. Each App has its current version of the code, the user can see the current version number of the App running through the service information query, and can re upload the package to complete the version of the update. Template package in the app details to view the results, the user first enters the app details page view app in the topological map of the bound, through input template name, the user can be app the topology preservation as a template. After the template is saved, it will be displayed in the template list. Users can choose to view the list of templates to view, the system will be the template details of the topology shown. After viewing and confirm the template is correct, the user can be a key deployment of the template. System will be based on the template topology of each node will be the corresponding Service and App one by one to deploy, and after the completion of the deployment of the Service and App in accordance with the association of the topology of the automatic binding.

3. The overall design of the system

3.1 Cloud computing platform architecture design

Interactive operation between user and the system in two ways. One is through the web client, submitted to the browser to interact, another is via the command line terminal, in the CLI to enter the command line to interact. No matter which way the request is submitted, all requests are sent to the service control center for processing by API HTTP in REST request mode. The service control center receives the request from the client, and then it is converted into the specific instruction to the control bus according to the service logic, which is delivered to each function module for processing. The processing result of each component in the operation and maintenance platform is also sent to the control bus, which is transmitted back to the service control center. For example, you need to add a virtual machine in order to improve the operation ability for their application on a cloud platform. The request will be via either the client sends to the service control center, next service control center will be the request is split into a number of command, first of all to bus to send commands to the control, from the directory service and the registered server get the relevant information to the user information and the application, and to determine whether the application

can also expand the virtual machine. If the judge showed that users can continue to add, then the service control center will add virtual machine command bus to send to the control, the command will be received by the infrastructure service module, and according to the command of the specific information for the application of the expansion of a new virtual machine[8].

3.2 System module division

Based on the overall analysis of the cloud computing platform architecture, this paper divides the service control subsystem of the operation and maintenance platform, and determines the specific functions of the system. Cloud computing operation platform control bus and its related components can be divided into 4 modules, according to the order from the front to the back end, which are Web client module, CLI module, service control center and control bus. (1) Web client module Web client module is the system and the user is located in the browser's interactive platform, users can click on the page to view, deploy and maintain their own applications. The module can be divided into the following 3 sub modules: upload control module: the module is responsible for receiving and processing the user Shang Chuanyuan program compression package request. After receiving the users to upload compressed package, the module and the Hadoop distributed file system (HDFS) establish connection and upload files, after the success will return a file in HDFS URL address, to facilitate the calling of the other modules. Page display module: This module is responsible for displaying the information needs of all users in the page, such as a list of the information of the user to deploy an application or service[9], user applications running in the virtual machine state, the binding information between applications and services, a user package application template information. Page control module: the module is responsible for the control and loading of the contents of the page, as well as the processing of all user management and maintenance requests. Including the application of the deployment and delete, application version of the update, application and service binding, the package and deployment of a set of applications that have been bound to each other, and so on.

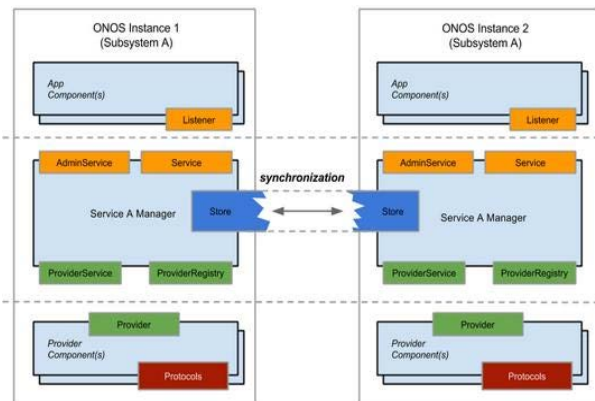


Fig. 4. System architecture diagram.

3.3 Research on control bus message mode

Polling is a request mode based on request / reply mode, the request to the server to send a request, the server immediately after receiving the request to return the response information and close the connection. This request advantages is the first, it does not need to maintain and server has been linked, so resource occupied relatively long connection to less, followed by such way of developers are relatively easy to achieve. In view of the above advantages, the old version of the cloud platform using the polling method can transfer messages between the various components, but this polling model has a drawback is that the requester to regularly send the request, and the request most is useless, it will cause the waste of network bandwidth and server resources. This kind of consumption may not be exposed in the case of fewer users, but once the operation and maintenance platform for access to a large number of user nodes, there will be a series of problems such as insufficient resources. Subscribers to one or more categories of news to subscribe and receive only the subscription message, without the need to know exactly what kind of publication of

news. So this model can not only realizes the issue and subscribers in the structure of decoupling, can also realize their decoupling in time. At the same time, released a subscription model through the parallel operation, message buffer, based on tree or network transmission mode, for the system provides better opportunities for scalable, so that the system has better can be enlarged and dynamic network topology. Considering concurrency and task set size cluster performance in many aspects factors, and control bus of the message queue AMQP correlative protocols support, in order to ensure the performance of message platform hub module, this paper decides the control bus message publish / subscribe mechanism with third party message middleware to implement. In this paper, the function and performance of the most popular message oriented middleware are deeply studied and compared, and finally the implementation scheme of the control bus is finally determined. Can be seen from the figure MQ Zero throughput per second for 15625 more advantage, MQ Active to 11562 times, MQ Rabbit for the 4926 relatively poor. Zero MQ is ideal from the aspects of performance, however, considering from function, zero MQ does not support message persistence. This means that once a server failure, MQ zero will lose all the data, which is obviously system should not occur. Therefore, from many aspects such as persistence, processing speed, cluster difficulty and so on, finally, this paper decided to choose MQ Active which has a superior comprehensive performance as the implementation plan[10].

3.4 Overall design of control bus based on MQ Active

In distributed publish subscribe message queue support, platform for the operation and maintenance of the components according to the need to subscribe to the required monitoring of the topic (topic) can also be in the completion of a number of operations on the corresponding topic news release, to subscribe to a notification the topic of each component of the response. For example, users of your application virtual machine number was adjusted, the directive will be the CLI or portal is transmitted to the service control center, in the module will be on the judgment of the number of users of the virtual machine and the maximum information, if the user to add a virtual machine, the service control center will be to a “virtual machine” topic released a message, this message will be to subscribe to it infrastructure monitoring module, the module will this request accordingly, add a new virtual machine. The so-called rest (representational state transfer) is in the network service provider as resources. Each resource can be distributed in different location of the network can be identified by the URI, and rest of the client can be by a URI of resources of the call. REST architecture, the application of the characterization of the obtained will lead to changes in its state, with the continuous characterization of the acquisition, and its state is constantly changing. In summary, restful architecture cache the response speed to the application to provide a guarantee, at the same time it context free also makes restful architecture objects more independent, and therefore more easily extended. Compared to other HTTP based RESTful protocol architecture, its coupling is smaller, and it does not need to rely on other modules to find resources, which also reflects its good compatibility. The many advantages of REST make it play an important role in the development of Web application. After the completion of the completion of the master and slave nodes to carry out the Broker cluster. Will local principal broker nodes are connected to another node of main and standby broker, because two nodes appear at the same time the probability of failure is very small. Therefore[11], by the broker nodes only need to connect the other end of the main broker can satisfy the needs.

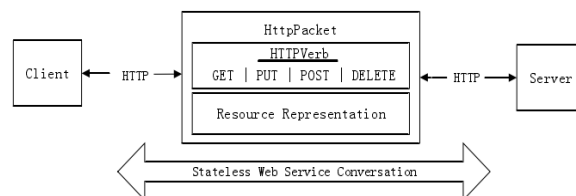


Fig. 5. Web style REST service architecture.

4. Implementation and testing of the system

4.1 Design and implementation of control bus

Control bus implementation consists of two parts, a part is the distributed message middleware Protection Agency, as the control bus to build a distributed runtime environment; another part is for other components of the system call interface, including news release interface and subscription interface, and between them the transfer medium definition. Distributed message bus construction includes three aspects. The first part is building the database backup nodes; the second part is building the master-slave back-up (master slave nodes. The third part is building on news of the cluster agent (broker) cluster. The following will detail the construction process of each part. Database backup is able to ensure that the message is not lost in any case, while it is convenient for the message synchronization of the master and slave nodes. MQ Active database connection with the backup Java database connection (Data Base Connectivity Java), referred to as JDBC. Through in activemq.xml file in the configuration, for different types of active MQ configuration database as a backup dB. In this paper, the use of MySQL database as a support, and the role of broker cluster is load balancing, can guarantee the information of each node in the active MQ cluster to accumulation, and improve overall cluster capacity. Its configuration is still completed in activemq.xml, mainly in the broker tag to complete the configuration of the network connector Connector network. By specifying the URI of the network connector, such as setting a URI for “static: (tcp://9.119.148.122: m62001)”, is when the broker message congestion occurs, the redundant messages will be routed to 9.119.148.122 this server active MQ message queue, up to the load balancing.

4.2 Control bus interface design

The control bus interface can be divided into two modules, respectively is the publisher and subscriber interface interface. Figure in addition to define the release and the consumer interface and Abstract class and the realization of the class also defines the A as transmission media event class, by the event object to transfer messages and message specific response operation. The publisher interface defines the produce method that the publisher object needs to implement, and the method is responsible for publishing the message to the message queue corresponding to the Topic. The interface implementation class is Abstract publisher, the basic properties of the class definition of the news release, including released the topic name topic, and publishers to point to a URL to the two variables, and they get method and the object's constructor. Subscriber interface implementation and release interface similar and different is in the general definition of interface is responsible for receiving messages consume method. In the implementation of the interface to the Abstract class Subscriber Abstract, as well as the same definition of the topic and URL two properties are responsible for the preservation of the subscription and request IP information. The construction method, prepare method and destroy method in MQSubscriber Active are the same as those of the publisher, and the difference is that the consume method. In the consume method. Through the set the message listener method for a subscriber set a listener, so when the publisher released the topic of news, starting the listener in the corresponding methods. Therefore in the call to consume method, need to pass an event handler interface types of objects, the interface defined subscriber to deal with news on the event method, so as to realize the message response[12].

5. Conclusion

This paper design and realize the a cloud computing platform for the operation and maintenance service control subsystem, provided reliable, loose coupling, easy to expand and highly platform and for cloud computing operation and maintenance platform for future research to provide an environment for the operation of cloud services for users. Firstly, this paper analyzes the characteristics of the two common cloud computing operation and maintenance platform, and determines the architecture of the system based on the current situation of domestic and foreign

research in this field. Next, based on the system's function and performance requirements, the overall design of the service control subsystem is carried out, and the implementation techniques of each module are compared and studied. At last, this paper introduces the detailed design of each module and illustrates the realization of the specific details, as well as the results of the system test to sum up. Based on the above research, design and implementation, this paper obtains the following results and conclusions: (1) through the analysis of the current cloud computing platform for the operation and maintenance of two bus architecture style, the establishment of the released subscription message mechanism for the formation of the control bus architecture based on. (2) research and comparison of the functions and performance characteristics of rabbit MQ, active MQ, zero MQ, by testing the message oriented middleware unit time throughput, draws the conclusion: active MQ in terms of function and performance is more balanced, the cluster characteristics more suitable for distributed cloud computing architecture. Finally, this paper determines the implementation of MQ Active as a distributed control bus technology program. (3) based on active MQ cluster characteristics, the architecture of the cluster were optimized. Design a simple, suitable and meet the performance requirements of distributed control bus architecture, to solve the problem of message congestion and caused by the faults of message loss.

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References

- [1] Tharam Dillon, Chen Wu, Elizabeth Changt. Cloud computing: issues and challenges. International Conference on Advanced Information Networking and Applications. 2010.
- [2] Bhardwaj S, Jain L, Jain S. Cloud computing: A study of infrastructure as a service (IAAS). International Journal of engineering and information Technology. 2010.
- [3] Snyder B., Bosanac D, Davies R. ActiveMQ in Action. Journal of Women s Health. 2011.
- [4] Evangelinos C, Hill C N. Cloud computing for parallel scientific hpc applications: feasibility of running coupled atmosphere- ocean climate models on amazon's EC2. Ratio. 2008.
- [5] R Henjes, D Schlosser, M Menth, V Himmler. Throughput Performance of the ActiveMQ JMS Server. Kommunikation in Verteilten Systemen (Kivs) . 2007.
- [6] Leonard Richardson, Sam Ruby. RESTful Web Services. Journal of Women s Health. 2008.
- [7] Guccione S A, Levi D, Sundararajan P. JBits: A java-based interface for reconfigurable computing. the Second Annual Military and Aerospace Applications of Programmable Devices and Technologies Conference (MAPLD) . 1999.
- [8] MF Sanner. Python: a programming language for software integration and development. Journal of Molecular Graphics and Modelling. 1999.
- [9] Fleming, J. Web navigation. Journal of Women s Health. 1998.
- [10] Li J, Humphrey M, Agarwal D, et al. science in the cloud: A modis satellite data reprojection and reduction pipeline in the windows azure platform. Parallel & Distributed Processing (IPDPS), 2010 IEEE International Symposium on. 2010.
- [11] Yao Ke. The realization and optimization of the database connection strategy based on [J]. And the optimization of the ODBC-JDBC computer development and should be in use, 2015, 24 (7): 34-38.
- [12] Tian al. JSP database connection technology of [J]. Tianjin occupation colleges joint journal, 2014, 9 (5): 50-54.