A Cloud Data Center Operation and Maintenance Management Process for the Research Institution based on Improved ITIL

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Abstract. The concept of ITIL management process is introduced in this paper. According to actual practices in the scientific research institutions and role-based access control theory, an improved model of ITIL is designed. When used in scientific research institutions, cloud data center operation and maintenance management, the model has achieved good results and provides new ideas for enhancing the level of informatization construction in the scientific research institutions.

Introduction

The human society is moving towards the information age from the industrialization era, under the background of the rapid development of informationization of scientific research institutions. With big data, cloud computing technology, the construction of scientific research data center has become scientific the inevitable choice for the research institutions of information infrastructure and information technology infrastructure that supports environment construction. How to combine programming characteristics of scientific research institutions and scientific management system with mechanism, to ensure the safety of the data center of the scientific research institutions, operation efficiency, realization of due profits? Ii is a topic worthy of further study. Now, the concept of ITIL management process is introduced in this paper. According to actual practices in the scientific research institutions and role-based access control theory, an improved model of ITIL is designed. When used in scientific research institutions, cloud data center operation and maintenance management, the model has achieved good results and provides new ideas for enhancing the level of informatization construction in the scientific research institutions.

ITIL management system

ITIL(IT Infrastructure Library) is the international IT service management model, released first by the British government in the 90s of the 20th century. After nearly 20 years of exploration and practice, the model has formed a set of IT service management serving as best guidance in practice. The model is an objective, rigorous, quantitative standards and specifications [1, 2].

The core of ITIL is "service management", including 10 processes and a management function. Usually according to their functions and service objects, ITIL can divide these processes and functions into two packets: "service supporter" and "service provider"[3]. "Service supporter" process groups include operation and maintenance management platform related to IT, event management, problem management, configuration management, change management, release management, one management functions and five processes; "service providers" process groups include five processes: management service level management, financial management for it services, management ability, IT services and continuous management and availability management. The difference between the traditional IT management mode and the IT service management mode is shown in table 1.

Tab.1. The difference between the traditional IT management mode
and the IT service management model

Traditional IT management mode	IT service management model
based on technique	based on process
Fire brigade	forethought
react passively	react actively
centralized operation, independently completed unit	distributed operation, appropriate use of outsourcing
Isolated and scattered	Integrated, within enterprise
unrepeatable, implicit responsibility	repeatable, explicit responsibility
no regular process	most practical process
in the view of the operation and maintenance management department	in the view of the business unit
for specific operations	for business

Cloud data center operation and maintenance management core process design based on improved ITIL

Because of the particularity of scientific research institutions, there are some differences between the cloud data center operation and maintenance management and traditional IT service management. Therefore it is advisable that we improve the ITIL process based on role-based access control theory, and integrate the three modules: ITIL Service support processes of the operation and maintenance management services, incident management, problem management, which constitute the basic framework of scientific research institutions cloud data center operation management by the relationships among the three role-based access control theories.

Role-based access control theory

The core idea of the role-based access control is to link the access to the role, by assigning the appropriate role to the user, to achieve the logical separation of the user and access permission. Role is set up by a variety of task requirements. When the user and the specific one or more roles are connected, the system not only can add, delete roles, but also set the authority limits of the role. In this way, the security of the application of RBAC is put on a natural level close to the organizational structure.

The standard NIST RBAC model is composed of four parts: core RBAC, RBAC Hierarchal, constraint RBAC in static duty separation (static separation of duty, SSD) and dynamic separation of duty (dynamic separation of duty, DSD). The core RBAC is the most basic model; RBAC Hierarchal, on the foundation of basic model, joins the concept of role hierarchy, and defines the inheritance relationship between the characters; constraint RBAC embodies the certain roles that cannot be served by the same user. Therefore, it could put constrains on the user granted role or access permissions.

As RBAC model has improved the ITIL process, the roles are designated and programed uniformly by the administrator, in order to facilitate the administrator management and to support template role. For users of the same rights, they only need to copy the user role templates, which can enable them to obtain the same permissions. So it does not include the RBAC Hierarchal section, nor supports the static separation of responsibilities under the inheritance relationship. The model used in this paper is shown in Figure 1.
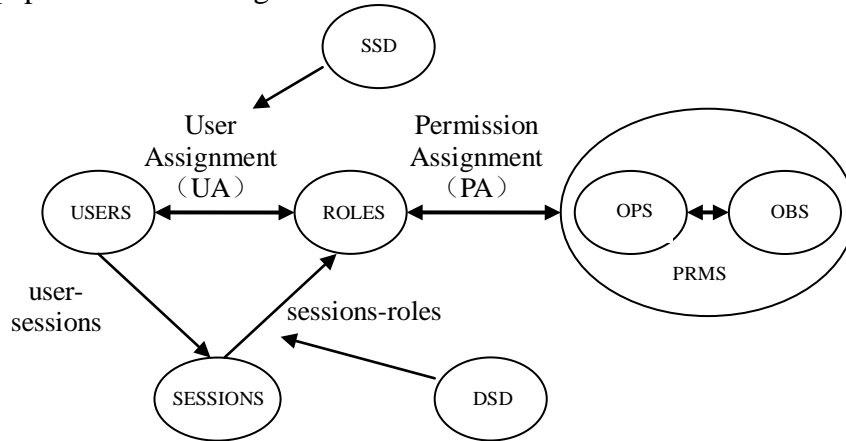

Fig.1. RBAC Model

Operation and maintenance management service desk

The operation mode of operation and maintenance management service station mainly has three types: distributed, centralized and virtual. According to the numbers of the research subordinate units and the inter-regional typicality of business systems deployment, the distributed operation and maintenance management services should be selected. Its advantages are: according to the specific circumstances of each subordinate units, we could carry out personalized deployment and provide localized IT operation and maintenance services to meet the user's personalized needs.

Distributed operation and maintenance service desk management use distributed deployment, centralized management "mode of operation, relying on scientific research institutions within the network independent operation. Data center is located in the center of management, responsible for the centralized management, access to all subordinate units of the operation and maintenance management. Service station and the subordinate unit of operation and maintenance managers can see only local operation and maintenance service desk management. Operation and maintenance management service desk set up a shared directory, for storing all subordinate units shared documents, convenient to exchange information between the units, sharing. Operation mode of operation and maintenance management service station is shown in figure 2.

Operation and maintenance management service station, as the technical point of contact between the user and the maintenance management, its function is to accept, forward and process user messages submitted by telephone, mail, online service request in the running process of the platform to monitor alarm and emergent events. Staff in the service processing course first resort to the knowledge base and the configuration management database, to check the records, on the basis of the existing solution pretreatment, such as operation and maintenance management service. If station staff evaluates that the incidence can be resolved independently, the officer should document, and confirm with the customer that the scheme is feasible. If it is feasible, feedback should be given and the solution should be made into knowledge entry. If not resolved, the incidence would be upgraded up to event flow procedures. Service request is transferred to first line support, waiting for the completion   of the process by the support personnel. Finally, the feedback will be returned to the operation and maintenance management service station, and the operation and maintenance management service station will inform the progression of the customer service requests and consult with the user to confirm scheme.
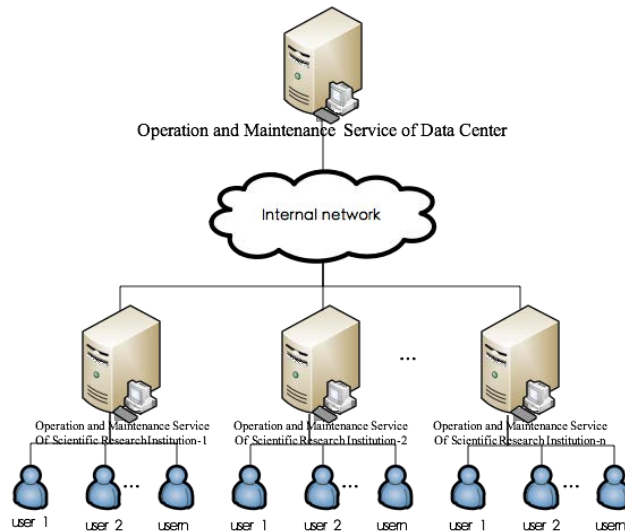
Fig.2. Operation mode of operation and maintenance management service station

Event management module

Because of the particularity of scientific research institutions, there are some differences between the cloud data center operation and maintenance management and traditional IT service management [4, 5]. Therefore it is advisable that we improve the ITIL process based on role-based access control theory, and integrate the three modules: ITIL Service support processes of the operation and maintenance management services, incident management, problem management, which constitute the basic framework of scientific research institutions cloud data center operation management by the relationships among the three role-based access control theories.

Event is an activity that is not consistent with the IT service standard, which causes or may cause service interruptions or service degradation. Event management module is designed to quickly resolve such activities, and to avoid its adverse impact on the business.

The purpose of the introduction of the event management process is not to identify the root cause of the event, but to define the scope of service level and business priorities to shorten the IT business interruption time as far as possible and to improve the availability of services. Priority event is set in accordance with the service level with business priorities range. It is an important index to measure the incident management and the level of priority decision event by priority process rules and event processing time [6].

The event management module contains the following:

1. Event receiving and recording: this step is responsible for receiving and recording all the IT events reported by the user or system.

2. Event classification and initial support: events can be divided into different categories of declaration, fault, alarm, consulting and all events are classified according to their characteristics and setting priorities.

3. Investigation and diagnosis: if frontline support staff are unable to independently solve the event, they can turn to operation management departments for knowledge base of long-term accumulation formation, diagnostic tools, online information resources etc in order to further analyze the event.

4. Solution and recovery: line or second line operation and maintenance support personnel to deal with the event, and then return the event feedback to the service management platform. By the service management platform, the staff inform the user and confirm situation with users.

5. Emergency and event escalation: if an event is defined as an emergency, the service management platform should immediately submit his request to the frontline service personnel, and report to the professional event management unit and to related management layer. The corresponding management unit should decide on how the event should be   properly handled to

ensure high time-efficiency to work out the solution.

Problem management module

The problem is the deep root of one or more existing or hidden events. Problem management is concerned with how to find the root cause of the event, rather than simply providing repair services. The goal of problem management is to reduce the number of events that affect the normal operation of the information system, so as to avoid the repetition of the root causes of similar incidents, and to change the mode of operation and maintenance management.

The problem management module mainly includes the following contents:

1 Issue registration: service management platform will transfer the unsolved problems within event management platform to problem management process, and the basic information of the incident will be submitted to the problem management process.

2 Classification of problems: the personnel in charge of implementation and management would classify issues based on the collected events. According to the priority of events and event type, level, occurrence frequency is classified, staff should determine the impact level on the business system events after event management communication, and further confirm event priority.

3 Research and diagnosis of problems: after receiving the application, the problem is analyzed according to the professional category, by the designated professionals to the incident.

4 Assess the impact and scope of risk.

5 Distribute processing results and reports.

Conclusion

In order to meet the real needs of scientific research institutions of information change, a number of units have been built to build data centers based on big data and cloud computing technology. In order to make full use of its economic benefits, it needs a scientific and effective operation and maintenance management. Referring to the successful practice of ITIL in the field of IT service management, the proposed improved ITIL model, the design and implementation of scientific research institutions in cloud data center operation and maintenance management framework and process, are effective ways to promote the scientific research ability of scientific research institutions.

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