Design and Implementation of System Management with Multiple Access Channels on Wired and Wireless Networks

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Abstract. Server administrator of large scale distributed server must confirm whether server system normally operate by real time and it must check on a failure to occur in a server quickly. Administrator must always wait in a network in case of existing management system to have been connected to a wired network at the place where access is possible. Therefore, it is necessary that the system management used a network to use wired and wireless at the same time. This way can improve promptness of server management, reliability, safety. Also, This way lets you maximize efficiency of server management and minimize management manpower and reduces server management cost and decreases system construction cost and can efficiently manage a server failure. For all these things, this paper studies a multi-connection way of a compunction management system with interface of wired and wireless access channel.

1 Introduction

It is hard to forecast system failure on a characteristic of the Internet previously. A wired server management system cannot respond a system failure quickly, and there is a limit.[6] Therefore, it is necessary that the system uses wired and wireless access channel, and can manage various computers in remote site at the same time. This way is not concerned about time and a space to administrator and provides the environment that can concentrate to system management work safely.

The purpose of this paper extends a Web-based server management system currently implemented in a wired network with a wireless network-based mobile system, and it
is design and to implement[4]. In case of Web-based system, administrator can do system management in all places connected Internet[7]. Therefore, it can expect synergy effect if Web-based system connects with a wireless network. In order to efficiently implement a wireless management system, A system is composed of an agent system that every sub-network was installed[2] and a management system to manage multi-agent[5]. In distributed network environment, it implemented the management system that connected domain and an information inquiry function of management agents, performance, resources, a monitoring function of traffic, a report function and so on to wired and wireless service with a design.

This paper is organized as follows. Section 2 mentions Web-based system and wired and wireless connection technology on related study, and Section 3 explains the system architecture which used the technology, Section 4 explaining a figure of a system to have been implemented. Finally, Section 5 presents a conclusion.

## 2 Related works

### 2.1 Necessity of Web-based system management

In a viewpoint of a Web-based system, difference of Application-based system and Web-based system is as follows. First, Because Web works on the Internet, as for the user, system management is possible in all places connected Internet. Also, It is possible to reduce a load of a system as installing a small-sized agent module in a system as much as possible. On the other hand, an application-based system needs the process that you must install in a relevant system. And because the administrator must do system management in application of the relevant system that is not the Internet, the mobility of system management is limited. Also, when management system need an expansion, as for the Web-based system, an upgrade about a management system is possible through a network without a need of special program reinstall. Thus, it is composed so that most systems operate Web of the Internet with a base recently while a merit of a Web-based system is discussed.

<table>
<thead>
<tr>
<th>Table 1. Application-based / Web-based system comparison</th>
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<tbody>
<tr>
<td><strong>Location</strong></td>
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<tr>
<td>States</td>
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<tr>
<td>Installation</td>
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<td><strong>Expansibility</strong></td>
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2.2 Wired accessed technology

There are Web and Java technology in wired accessed technology. First of all, at Web technology, the World Wide Web (WWW) was developed for the purpose of efficient share of data and study results of an exorbitant quantity got in a European Organization for Nuclea Research. Web compares in the existing Internet service that serviced a menu approach and it is achieved a hypertext and provides exorbitant convenience to document utilization.

Also, Web technology used consistent user interface, and was integrated a lot of service. And Web composes a document with a hypertext, can easily approach by another detailed information. The Internet that is active as share of information or a provider is available for general users. Web lets you look as a lot of server do entire layout equally, and it looks like operated in one server. In this way, Web can prevent a excessively heavy load of server providing information.

Java can easily use in a different system environmental. And it is a development language to be suitable in object for portability to produce excellent programs. There are Java applet, Java servlet, JSP in Java components. Java applet inserts a Java program in a HTML document and can express a static page on a more dynamic page. Java servlet is concept of applet operating in server. Whenever a HTTP request comes from web browser as CGI script, Java servlet makes answer information of server. JSP gives dynamic contents function to Web site and on-line application.

2.3 Wireless accessed technology

WML and WML script are basic languages to compose WAP contents. VB script or Java script and concept are similar to HTML on general wired Internet, and the structure and meaning have a simpler form. WML is a Markup language to have been based on a XML language. It was developed for user interface for the unit that WML provided contents, and performance was limited like a cellular phone or a pager. WML script was developed to a WAP architecture appropriately with a ECMA script (ECMA262) based.

Characteristics of WML are as follows. WML provides the user interface which improved, plays in order to be able to efficiently use a terminal, control the unit that a terminal and a terminal are surrounding and reduces size of necessary bandwidth in order to send data between a communication company and users.

A main function of WML is four followings. A text and an image are displayed. WML composes Deck/Card, connects to a movement between Card, and lets a voice channel coexist with data channel. WML supports a text and an image basically and can play various handwriting and layout. All information in WML consists of set of Deck and Card, but Card is dialogue performed between terminals with a user. For example, Card selects in a menu, or it is to input a text. Basically, a user takes the information that oneself wants by a movement between Card, or provided it. This Card gather, and it is achieved Deck. Deck is same as a HTML page. WML manages that moves between Card and Deck state, and can treat an each event to occur in a terminal. Also, WML supports a function to connect Deck to specific Card directly like HTML4 and defined the application interface which did in order to be able to talk.
Design and Implementation of System

3. System architecture

3.1 Total system architecture

This system is based on client/server model. Administrator is reported state about managed agent systems through Web interface accessed to the central web server and mobile interface. Administrator carries out system management with a base in the report which analyzed resources state and performance of server. The system is composed of a management agent, analysis server system and a remote client system greatly. A management agent is installed in each Linux system and transmits status information of a relevant system with a collection. Analysis server system analyzes status information about the managed object which got through an agent. And a remote client system carries out direct management operation with wireless access channel through web browser and mobile appliances. An basic operational process of a total system about system management is as follows.
Fig. 1. A total system configuration

① Administrator asks server for service through web browser as Internet Explorer and application loaded by mobile appliances.
② A remote client system classifies a request of a user by service and interprets it, and runs a service module requested.
③ If it is got a service request from a remote client, analysis server system communicates an information request to a relevant agent through socket.
④ A management agent applies the service that received a request of server to a system and delivers the relevant results to management server again.
⑤ A management server approaches DB as necessary and modifies data and passes the results that analyzed it to a remote client system.
⑥ A remote client system processes the analysis results and looks with a Text-based information form to mobile appliances user with graph or a form of a table to a web browser user after dealing.

An analysis server reports it to the client system that it collects data about operation of a management agent according to schedule. These report information marks it in a remote client system so that administrator can check a situation about operation of a management agent by real time.
3.2 Wireless access channel structure

Wireless access channel provides interface for monitoring information of management agent systems managed through analysis server system in this system. The request of a wireless client passes through the WAP gateway of mobile communication, and transmits HTTP request of an URL form to WAP application server. WAP application server transmits WAP page information of a WML form to a WAP gateway without a request for a management agent with the contents that saved service is possible. Transmitted WAP page information passes through a WAP gateway, and the encoding works with a form of binary WML, and is provided to a wireless client. If a request is necessary for a management agent, it uses a TCP socket to communicate between management agent and WAP application server. Information collected by a request of a wireless client is processed into a primary through analysis server system. Processed information are transformed into an appropriate form in wireless accessed channel service through an application level message protocol converter to provide in analysis server. The last processed management information are provided to a wireless client through protocol conversion and data encoding process, and passes through the WAP gateway of mobile communication.

3.3 The structure of managed agent

A management agent is installed in each Linux system and carries out self-system analysis function by the management request and reports it analysis server system. There are a communication module, a message processing module, an environmental setting module, system communications module, an analysis module, backup daemon in details functional module. An explanation about modules is as follows.
1) A communication module is a module for communication between remote client system and management agents. This does the message communication which used a socket basically. The port number for a socket generation is saved in configuration file (Configuration.ini), and it is set when the first agent executing
2) A message processing module is a module to take charge of a generation and elimination about message entities for communication. It generates message to follow which requests information, or report. And it takes charge of message elimination about the unnecessary information
3) An environmental setting module saves the port numbers for execution of an agent environmental setting information in a setting file, and modifies this as necessary, and provides smooth operation about a system.
4) An system communications module takes charge of the role that has got necessary information from a relevant agent system when there are a request of system user management, system assets management, a system network management and software management from analysis server.
5) An analysis module takes charge of general control activity for a management agent to operate analysis about message, judgment about a process situation, work allotment about necessary modules without error as backbone of information processing exactly.
6) Backup daemon is daemon operating separately. It carries out backup according to the schedule that was set up after checking the file which set up a backup schedule.

3.4 Analysis server structure

This system is to support easy management about Linux systems on a Web with a base with Java technology. The largest characteristics of this system are based on

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Web, and administrator does not go to a relevant system directly but uses internet browser in distant PC, and it is possible a grasp the management present situation. Also, it is for a comparative analysis of management systems to have been easy with statistical information about a lot of systems through group management by customer company. In order to establish these systems, management server processes the information that collected in the Linux server system which is the each management object and must provide it through web server. An explanation about a module is as follows.

1) A communication module is a module for communication between remote client system and management agents. This does the message communication which used a socket basically.
2) A report management module generates a report in a HTML document to order a report of administrator, and to save.
3) A message processing module is a module to take charge of a generation and elimination about message entities for communication.
4) An environmental setting module saves necessary configuration file in an operation of server, and modifies this as necessary, and provides smooth operation about a system.
5) An error process module copes the time that an error generated. It records an error situation by a log so that administrator provides a function to easily check a situation.
6) An analysis module takes charge of general control activity for a management agent to operate analysis about message, judgment about a process situation, work allotment about necessary modules without error as backbone of information processing exactly.
7) A group management module manages management agents belonging to groups and the group which differentiated the systems that are managed object by property. And it carries out a function to append the management object to a group, to delete, to save detailed information about a system and to change. These groups and agent information save into DB. Also, a group module finds out statistical information of a system by group.
8) A real-time agent fault management module operates with an individual thread. It confirms the fault present situation about all agents which analysis server system manages through message polling periodically. Even if these agents fault information does not have a request of a remote client, a report is performed. Therefore, it provides a dynamic agent management function to administrator.

3.5 Message structure

<table>
<thead>
<tr>
<th>Main Type</th>
<th>Sub Type</th>
<th>Status</th>
<th>Data</th>
</tr>
</thead>
</table>

**Fig. 4.** Message format

In order to communicate between server system and management agents smoothly, a management system defines a new message class and exchanges information.
It is possible transmission with the message object through ObjectInputStream, ObjectOutputStream of Java communication between systems. It defines serialVersionUID to transmit the message object and prevents message transfer fault phenomenon by object serialization. Transmission fault phenomenon is incorrect recognition and detection impossibility error problem about message. An explanation about message format is as follows.

1) MAINTYPE marks contents about subject transmitting message. It is a field referred to for the first time to analyze message.
2) SUBTYPE shows details type of each message. Also, it is used as a tangible distribution ruler about management as an indication item and a report.
3) STATUS includes answer back code about request message. And it shows the success right or wrong about a request.
4) DATA is the Vector which message contents are included in. Contents about request information are included in case of general message. And a case of error message includes error information about a relevant error situation

4. Implementation

4.1 Analysis server implementation

Analysis server system delivers the management request from a remote client system to the Linux systems that are managed object. And it reports all analysis present situations about a request item to wired and wireless channel administrator. Also, it checks up/down state of management agents periodically and provides information about a fault situation to administrator.

A real-time agent fault management modular detailed explanation of Fig. 4. is as follows. It operates with an individual thread, and confirms the fault present situation about all agents which analysis server system manages through message polling periodically. Even if agent fault information does not have a request of a remote client, a report works. Therefore, it provides a dynamic agent management function to administrator.

Analysis server system is composed of NMServer and NMWorker. NMServer uses a server socket and manages connection from a lot of remote clients. NMWorker lets you connect a client to an agent.

While server system is started, it sets up basic environment variables through configuration file(Configuration.ini) located in server, and generates a server socket. Also, it activates a real-time agent fault management module with a new thread and then, communicates with a remote client through other channel that came for NMServer. ClientComm takes charge of this role. It does message polling on all registration agents saved in DB according to schedule , and judges activation state of agent daemon after that and reports it to administrator.
If a request about connection reaches a server socket from a client, NMServer sets up new connection about an accessed client. Then, it saves this information in the self-FIFO queue which it generated. These works hold simultaneous accessed management for server smoothly. If connection is set up with a client, NMWorker generates stream. Then, it waits for message receipt from a client. If management information message is received, server analyzes type about this, and judges whether it is with server related message cognition agent related message.

### 4.2 Management agent implementation

If a management information request from server comes, management agent acquires information about an agent system, and the agent daemon respond to server after processing. When agent runs at the first time, AgentComm class generates a server socket for message receipt from server and sets up basic environment variables through configuration file (Configuration.ini) located in an agent. Then it generates Backup Demon for a backup file generation, and message receipt wait state works. If request message reaches, an agent analyzes message and discriminates between management request information. After judging system user management, system asset management, a system network management, contents about software management, each class acquires suitable information from an agent system through system communications module. It is reported to server through a socket after information is summarized by the information that administrator wants, and it was generated message format. The backup daemon is made together when agent daemon is generated. Backup daemon backs up an important file of the system that administrator set up periodically. If backup daemon begins, first of all, it reads the file which information about a backup setting file(bkfile.log) and all checks location information about a setting file. The period of backup is possible with a week, one month every day. This uses a daycount, monthcount variable and is categorized. If it is matched to inspect each file, backup daemon backs up a file and renews a backup information file. Backup daemon waits with sleep state all day after having increased daycount and monthcount if a process about all setting files is over.

### 4.3 Web client implementation

A Web client system operates in web browser of a client. It uses a socket and accesses analysis server system. When initialization works, Web client system gets a customer company and agent list information from server and materializes a tree and an icon map format. In order to judge operation state of an agent, Web client system generates separately ping thred and generates another channel connected server. This ping thred shows the agent up/down state through communication with server periodically by real time.
If a system is initialized, response wait state for a management command from administrator works. If administrator request a information. It is dealt according to each module by a kind after judges what kind of request a remote client is.

A basic instruction process takes charge of a summarization in a ControlManager class. This class controls general process stream as distributes a command to each module. And it controls a command and integrate results. Besides, TeleManager class takes charge of an agent communication with a client system, and RuntimeManager exchanges real-time information between an agent and a client system. If administrator asks for a report, PrintManager class reads a web page from server after generating a web page obeying the results and creates output environment. Also, if real-time information of a system becomes a request, it newly generates real-time thred and exchanges a message with server and shows dynamic real-time information. But, if an event occurs as page conversion, relevant real-time thred terminates. User interface used a Swing class of Java. And each function implement to reduce a load of a system with using thred as much as possible. The main screen implement with the single class (InterMain) which was not a union of a lot of classes. This reduces a waste of load waiting time along frequent loading of the page that an event generated. Each functional class is commonly implemented one. If necessary work has real-time monitoring, thred generates.

4.4 WAP client implementation

WAP client system monitors a WAP page. And a WAP page generated with Java technology, is transmitted from WAP server to a wireless client in a WML page form. Because a wireless client had inferior hardware resource, WAP client system implemented works such as processing and a generation of monitoring information in WAP server.

Therefore, it was designed so that the maximum can reduce processing work of a client. During resources state monitoring in a monitoring menu of a management agent, if it is abnormal state, WAP client system can make telephone connection a personal contact point of input management agent administrator.

Fig. 5. Management agent selection menu
5. Conclusion

Currently there is many server management software of a group unit by a development of a wired network and importance increase of server. But a system management responsible person can be placed in the environment that is hard to approach system management software through wired networks technically. Therefore, a system to approach through a mobile device with a Web-based management system implemented in the existing wired network has enough meaning.

This paper shares the economic side with the technical side and can forecast the expected result. In the technical side, it expects a system management technical elevation in remote site through a wired network and a wireless communication network. And it expects real-time performance measure, establishing the correct server capacity plan that used data, working together of a server management and wired and wireless access technology. In the economic side, using an integrated function and reducing management system construction cost. And maximization of management efficiency, the integrated operation with minimum manpower, efficient management of company computer resources and the business efficiency maximization that used a wireless communication network are.

There are a lot of problems to port a management system to have been already implemented with various mobile devices. This paper presents design structure of inferior input/output interface of a mobile device, business definition along a characteristic, implementation, a development direction of study.

References

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