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Implementation and Experience with the Terminal Registration System with Web Interface

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ABSTRACT

The cost of operation and management are growing rapidly in proportion to the increase of the number of network terminals connected to the network. We hope to improve the quality of network service, but it is difficult because of reasons such as manpower and budget limitations. The number of staff members in our information processing center decreased when the organization was restructured in October 2003.

To address this situation, we implemented a new network terminal registration system with a web interface. On our campus, users have to register the MAC address to get the DHCP IP address for their personal computers. Prior to the new terminal registration system, it took several days to register them. However, the network terminal registration procedure is now fully automated for DHCP where users can connect their personal computers to the network in a few minutes. The network terminal registration for a fixed IP address is almost automated and reduced in the operation time. As a result, we decreased the staff member's workload and improved the throughput time to register a new network terminal.

The system also contains detailed information including the update status of anti-virus software of each computer in a network terminal database. This approach improves the security of our network system. In this paper, we describe the system structure, facility, user interface, and some experience with the system.

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Categories and Subject Descriptors

K.6.1 [Management of Computing and Information Systems]: Project and People Management - *Systems development*.

K.6.4 [Management of Computing and Information Systems]: System Management - *Centralization/decentralization*.

General Terms

Management, Design, Performance

Keywords

Terminal registration, networking, DHCP, web-based, personal computing, system configuration, static IP address.

1. INTRODUCTION

The Ministry of Education (the Ministry of Education, Culture, Sports, Science, and Technology at present) planned to reduce the number of universities in Japan since 2001. As a result, Kyushu Institute of Design (KID) and Kyushu University were integrated into a new Kyushu University in October 2003. Both universities are located in Fukuoka City. KID had the Information Processing Center (IPC) for itself. However, the IPC of KID became a branch of the Computing and Communication Center of Kyushu University. The staff members of IPC were reduced from two official administrators and three technical staff members to only three technical staff members at that time.

The technical staff members now belong to the Information Management Office (IMO) in the Faculty of Design, Kyushu University. We were forced to manage the additional jobs with less staff members. We tried to reduce the administrative work and improve the service for users. For that purpose, we simplified the procedure to register network terminals from paper base to a web interface. It improved the ease of usage and the time for network terminal registration [2].

Technical staff members registered a network terminal by updating configuration files for DHCP and/or DNS by hand while they were receiving e-mail sent through web interface from users. They were expected to register new network terminals carefully. It is a simple process, but must be done without fail. It requires some time to complete the terminal registration. Only one technical staff member could do it well. When the technical staff member was absent from the office, the terminal registration was delayed till he returned back to the office.

Research we conducted proposed a method to reduce the time and cost for network terminal management with a web interface [1,3,4]. These systems do not give the guarantee against errors because administrators operate the system by hand. In this paper, we describe the system which makes it possible to register a new network terminal automatically for DHCP and almost automatically for static IP. It reduces the time, cost, and errors to register a network terminal. It also gives someone whom may not be proficient at networking the ability to register a new network terminal.

2. SYSTEM DESIGN

2.1 System Configuration

We used the network terminal registration system with the web interface just after our university integration. Prior to the new system, a user submitted the request for a new network terminal registration via a web interface, but the data was sent to technical staff members by e-mail. They received the e-mail for the request, and then began to register a new network terminal by hand. In our new network terminal registration system, we tried to make the procedure for network terminal registration as automatic as possible.

Figure 1 shows the system configuration. Table 1 shows the hardware resources used for the system. We used an Apache server, PHP, and PostgreSQL for the server as shown in Table 2. The server system is located far from the servers for DHCP and DNS.

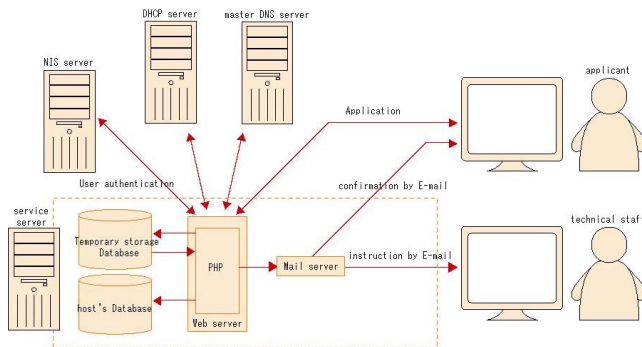


Figure 1. System Configuration

Table 1. Hardware for the server

CPU	Pentium III 500MHz
Memory	256MB
Hard disk	8GB
NIC	100BASE-TX

Table 2. Software for the server

OS	Fedora Core 1
WWW server	apache_2.0.47-10
Database server	PostgreSQL_7.3.4-2
MTA	sendmail-8.12.10-1.1.1
cron	crontabs-1.10-5

2.2 User Interface

Only teachers and administrative staff members can apply for a new network terminal registration. Figure 2 shows the screen for user authentication. The system authenticates a user with a username and password authorized by IMO and distinguishes the kinds of users. We prepared the following figures in English for this paper. The real screens are displayed in Japanese. As a result, the design in the following Figures is slightly different from those in operation.

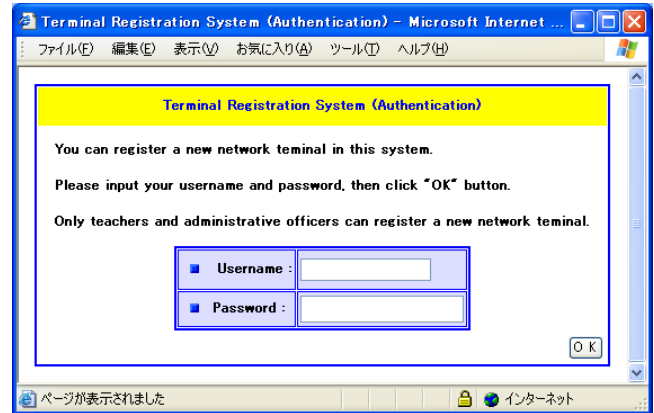


Figure 2. Screen for user authentication

After the user passes the authentication, a screen as shown in Figure 3 is displayed. In the screen, the user can select three functions such as a new terminal registration, a list of the users' network terminals, and an option to update the user's information. After the user selects the first function, the screen to register a new network terminal is displayed as shown in Figure 4. User name, status, affiliate, building, phone number, etcetera are automatically displayed in this screen based on a database we adopted to maintain user information. In the previous system, it was difficult to display such data on the screen because of the lack of a database. Users can update the information by selecting the third function in Figure 3.

Information inputted by users is maintained in the database and used for later management and administration of users and network terminals. It is possible for us to list all network terminals now. It was impossible to list the network terminals before.

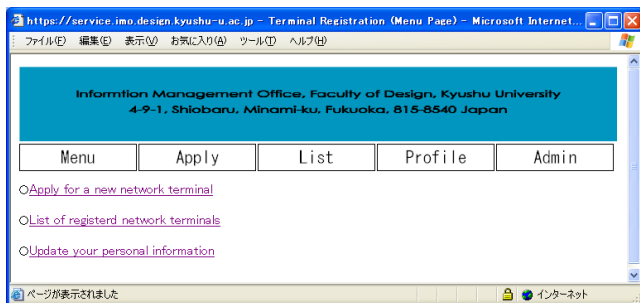


Figure 3. Menu for users



Figure 4. Screen for new network terminal registration

2.3 Administrator interface

Static and DHCP IP address types are available on our campus. We have faced difficulties in assigning static IP addresses for new network terminals on our campus because the number of network terminals is increasing rapidly. IMO assigns DHCP address for clients of Windows, Mac, and etcetera as much as possible.

The setup for both IP address types is different. The procedure to set up configuration files for a DHCP address is fully automated in a new system, so the administrator does not have to do anything for a DHCP address. However, we could not fully automate the procedure for static IP address because IMO has its own policy to assign static IP address. It is not easy to translate the policy to a procedure.

First, the system displays the list of network terminals that IP addresses are not yet assigned. A technical staff member selects one network terminal from the list. After that, the system displays the list of suitable static IP address to be allocated for the network terminal. The technical staff member selects one static IP address from the list. These simple steps are all the technical staff member is expected to do.

3. SYSTEM IMPLEMENTATION

We are using two types of IP address, static and dynamic IP on our campus. We have to change the procedure to register a new network terminal according to the types of IP address.

3.1 DHCP address

There are six DHCP servers corresponding to VLAN for the departments, office, and other units. The system has to specify the particular DHCP server according to the sub-domain requested by a user. The system retrieves the configuration file of a specified DHCP server and appends the necessary definition into the configuration file, then uploads the configuration file to the specified DHCP server. This is not a simple process because the DHCP servers are different for each VLAN. Figure 5 shows the total control flow for DHCP address.

The detail is as follows;

1. Recognize VLAN from sub-domain
2. Specify the particular DHCP server
3. Download the configuration file
4. Back up the configuration file and prepare a new configuration file according to the user request
5. Upload the new configuration file to DHCP server
6. Back up the current configuration file and replace the configuration file with a new file in the DHCP server
7. Restart the DHCP server

We use the cron system to restart the DHCP server in the remote DHCP server now because it was not easy to execute a command as ROOT from another computer. However, it is not good with response time. We are planning to replace the mechanism with SSH and SUDO command to execute the same job from our server simultaneously.

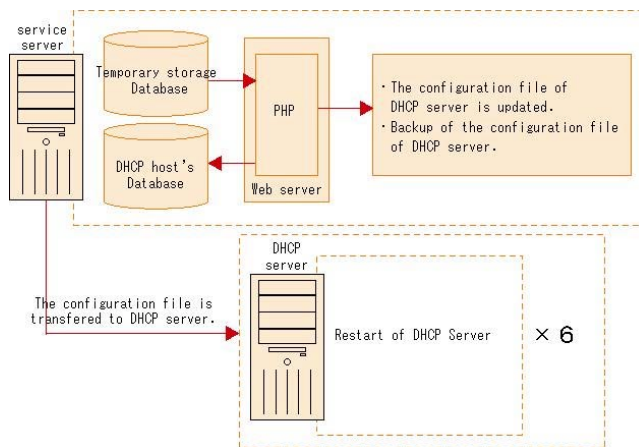


Figure 5. Total Flow for DHCP address

The process for DHCP is done automatically. The administrator does nothing to register a new network terminal for DHCP. A new network terminal usually becomes available in a few minutes. After the process is done, an e-mail is sent to the user and staff members to notify it.

3.2 Static IP Address

The system updates the configuration file in the DNS server in this case. We only have one DNS server. Therefore, the process is easier than the case of DHCP and it is almost automated. When a user applies for a static IP address, an e-mail is sent to the technical staff members. It contains the URL to display the list of network hosts that have unassigned static IP addresses. The technical staff member accesses the URL and selects one network terminal to assign a static IP address. After a technical staff member selects one IP address, the remaining process is done automatically. Figure 6 shows the total control flow for static IP address.

The details are as follows;

1. Download the configuration file from the DNS server
2. Back up the configuration file and appends a new terminal definition in the configuration file
3. Upload a new configuration file to the DNS server
4. Back up the current configuration file and replace it with a new configuration file in the DNS server.
5. Restart the DNS server.

We implemented this function for static IP addresses, but it may not be necessary because the numbers of request for static IP address are not large per month. Additional work is required to set up the configuration for e-mail and/or the firewall in many static IP address. The work load does not reduce much in total. The technical staff member wants to make certain the process of assigning the static IP address is according to the policy.

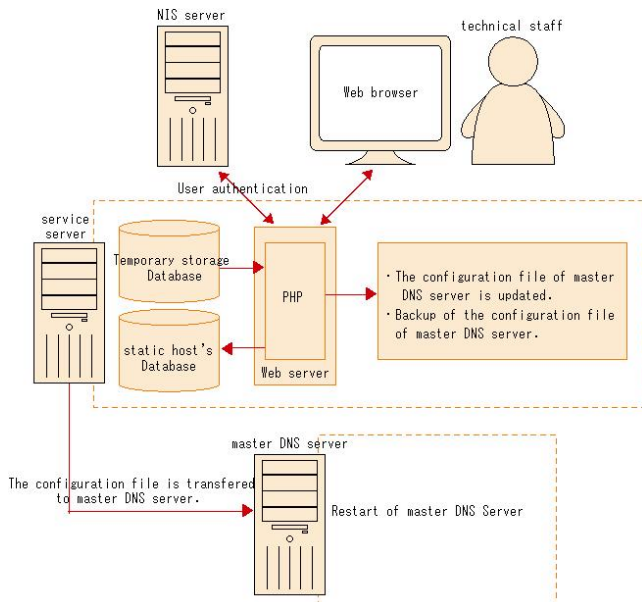


Figure 6. Total flow for static IP address

4. SECURITY

4.1 Anti-Virus software

IMO purchased 1000 licenses in 2003 of Virus Buster from Trend Micro to protect personal Windows computers against viruses on our campus. Software is distributed to each user free of charge. We guess that the recent number of personal computers using Virus Buster is almost 800. However, in the past we had no way to count the precise number of Windows computers and to confirm how well pattern files were updated for Virus Busters on our campus.

We can find the server for Virus Buster of Trend Micro with TCPDUMP command. We have been recording all TCP headers in the line between our gateway and the upper in another campus. We can retrieve the communication traffic between Windows computers and the server for pattern files of Trend Micro from the records of the TCP header.

The system updates a date field in the database to record that a Windows computer updated the pattern file for Virus Buster directly using the static IP address. Using the DHCP address, the system searches the MAC address from the IP address via a combination of the IP address and the MAC address in the DHCP server. We know the current status of updates for virus pattern files comprehensively. Figure 7 shows the list of network terminals for one user and it contains the last day when pattern files for Virus Busters were updated on the right fields on the screen.

Figure 8 shows the recent status of updating the pattern files for Virus Busters on our campus. There are more than 2000 network terminals on our campus, but we do not know the precise number of network terminals using Windows. We know that more than 500 personal computers updated the pattern files for Virus Busters on June 2, 2006.

No.	Hostname	IP address	Subdomain	MAC address	Final update of VB
1	apple	133.5.123.92/32	aid	0007407e937	
2	cosmos	133.5.123.20/32	aid		
3	h-mas1	133.5.123.100/32	aid	00c091263463	
4	h-pw1	133.5.123.102/32	aid	005004395c28	
5	flab	133.5.123.104/32	aid	00042389da10	
6	fserver	133.5.123.94/32	aid	0090997ea8c6	
7	knight	133.5.123.96/32	aid	00909925ed10	
8	lemon	133.5.123.103/32	aid	00901e1012c8	
9	ladit	133.5.123.89/32	aid	008045139401	2006-06-12
10	oil	133.5.112.62/32	adwa	000456b242da	
11	rose	133.5.123.101/32	aid	0080452b93cb	2006-06-12
12	tomato	133.5.123.92/32	aid	000039d4f8a8	
13	yane	133.5.123.90/32	aid	000180350fce	
14	twice	133.5.123.99/32	aid	00022d89e728	2006-06-12

No.	MAC address	Subdomain	Final update of VB
1	0040ca2a9ae4	aid	
2	0001804c420a	aid	
3	00105a7696a9	aid	
4	000a7932d957	aid	
5	08005a39115b	aid	
6	00018026e415	aid	
7	0004235917c6	aid	
8	0040ca2795bb	aid	

Figure 7. List of network terminal for one user

4.2 Network Terminal Search

The system maintains all the network terminal information in the database. We can get information for a particular network terminal.

nal when necessary. Figure 9 shows the sample screen for the result of host search. The key parameters are IP address, username, building, host name, sub-domain, and MAC address. We can find the detailed information quickly when a Windows computer is attacking other computers because of virus infection or when some network terminal is facing network troubles.

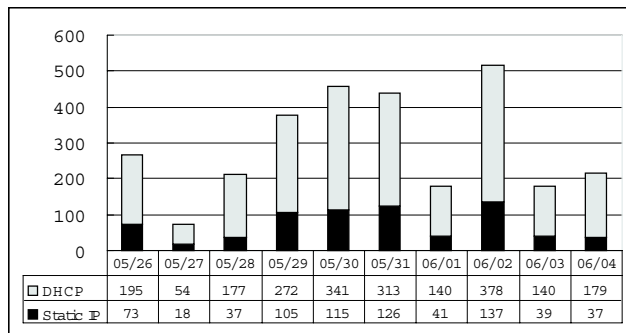


Figure 8. Recent status of updating pattern files

Network Terminal Information	
IP address	133.5.123.99/32
User name	fujimura
Host name	wise
Subdomain	aid
MAC address	00-02-2d-89-e7-28
Building	5号館
Floor	6階
Room	藤村教室室
Machine name	FMV
OS name	windows XP
mac address	00-02-2d-89-e7-28
Windows update	
final update of Virus buster pattern file	2006-06-12
Registered date	2003-10-16
Last updated	
Remarks	

Figure 9. Sample Result of Host Search

5. CONCLUSION

We implemented the network terminal registration system with a web interface. It makes it possible for non-technical staff members to register a new network terminal and reduces the time and cost to register a new network terminal. It also provides enough information about a particular network terminal such as host name, username, building, phone number, sub-domain, MAC address, and etcetera. We can get useful information quickly if we are facing network troubles.

We succeeded in specifying the communication traffic between Windows computers on our campus and the outside server for pattern files of Virus Busters. It makes it possible to know whether each Windows computer updates the pattern files or not. It can be adaptable for other virus software. It is also adaptable to Windows Update and we succeeded in detecting such communication traffic for a trial.

We implemented the system in March 2006. We have had some difficulties in operating the system because the synchronization of network terminal data between the old system and the new one. We do not have sufficient data for network terminals in the old system as much as the new system requires. We are planning to gather the necessary data to operate the new terminal registration system as soon as possible.

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