

# A PORTAL SYSTEM AND ITS APPLICATION BASED ON DACS WEB SERVICE

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## ABSTRACT

*DACS (Destination Addressing Control System) Scheme is developed as a new network management scheme. DACS Scheme performs the network management and services efficiently by communication control of client computers. Through the communication control, a whole network is managed. In the network with DACS Scheme, new network services and information systems are realized. As examples of those, we have developed a new portal system and DACS Web Service. DACS Web Service is a network service for realizing a portal system where each user can create the customized Web page as Personal Portal freely and easily. We show the proposed portal system and its application based on DACS Web Service.*

## KEYWORDS

*Personal Portal, DACS Scheme, Web Service, CGI*

## 1. INTRODUCTION

We have developed DACS (Destination Addressing Control System) Scheme as a new network management scheme. The basic principle of DACS Scheme is that, a whole network system is managed through communication control of a client (a client computer) in a user unit [1]. Moreover, functional extension is done in the form of communication control by a user unit, which also coexists with communication control by a client computer unit in users group [2]. In addition, secure DACS Scheme was proposed to solve a security problem of the network [3]. In the network with DACS Scheme, we think that a lot of new network services and new information systems will be realized. As examples of those, we have developed a new Portal System and DACS Web Service as a web service. The word of “Web Service” means the network service which is provided to users through Web Server. Moreover, though the word of “Portal” often indicates Web page for information searching [4] [5] such as Google and Yahoo, the word of “Personal Portal” used in here is different from the above “Portal”. Here, “Personal Portal” indicates the entrance where each user can acquire his/her interested information on the network, and can display the different information for respective individual users on Web Browser dynamically by using the program such as CGI [6].

DACS Web Service is a new network service for realizing a portal system where each user can create the customized Web page as personal portal freely and easily. DACS Web Service is realized by extending two kinds of functions of Web Service realized on the network introducing DACS Scheme. The first function of Web Service is that, data which is stored in database dispersed on the network can be used efficiently [7]. The second function of Web Service is that, data which is stored in document medium such as PDF file and simple text file

can be used efficiently. By using both functions, when each different user inputs same URL on Web Browser, the different information for each user is searched and extracted from database or document medium, and it is displayed on Web Browser in respective contents. By implementing various kinds of URL into a static HTML file, each user can create and customize Personal Portal freely and easily. That is, by letting these two kinds of functions of Web Service coexist, the Web Service which a user can use information on the network regardless of information storage form is realized [8].

In the network without DACS Web Service, Web pages are often used as communication means other than E-mails and telephones. Static Web pages are often used as a communication mean for the unspecified number of users. But, they are unsuitable to communicate among respective individual users for respective purposes or interests. As another communication mean, Personal Portal realized by Web Service which can change the contents of Web page by a user unit dynamically, is proposed. Then, the Personal Portal is suitable to communicate among respective individual users for respective purposes or interests. To display the necessary information for individual user on Web Browser, that information is searched and extracted from databases on the network, and notified to each user by the program such as CGI. When each database is distributed on the network, the program to extract the information from each database, will be large-scaled and complicated. Because the program is introduced by a system administrator and can't be changed by a user freely, Web page as Personal Portal is not always useful for each user. By use of DACS Web Service, these problems are solved. We explain the content of research on Portal System by DACS Web Service as a whole.

## 2. Issue on Mechanism of Existing Personal Portal

So far, various researches have been studied on Personal Portal [9] [10] [11]. In addition, it is possible to realize Personal Portal by a commercial product. In both cases, basic mechanism, which is processed in the sequence is shown from (1) to (9) in Fig. 1. A characteristic of this mechanism is the next two processing on Web Server.

- (a) User authentication is performed by user information at the processing of between (5) and (6) in Fig.1.
- (b) Information related to user is searched and extracted from data which is accumulated beforehand by the processing of (6) and (7) in Fig.1.

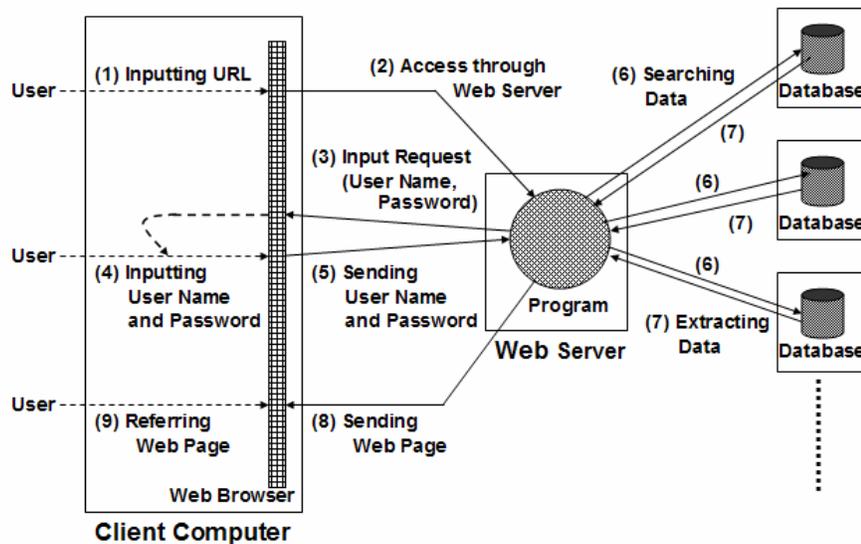


Figure 1. Mechanism of Existing Personal Portal

Processing of (a) is necessary to perform processing of (b) and becomes essential so that Web Service premises anonymous user. Web page as Personal Portal is generated by the program such as CGI on the Web Server. Because the program is introduced by system administrator and can't usually be changed by a user, the Personal Portal can't always be easy to use for each user, or be customized for personal use. Therefore, to solve these problems, we realized a new Portal System and DACS Web Service as a new network service. That Portal System is realized by the synopsis of DACS Scheme first. Then, we explain DACS Web Service and the new Portal System.

### 3. Synopsis of Existing DACS Scheme

#### 3.1. Functions of DACS Scheme

First, summary of DACS Scheme is explained. Fig.2 and Fig.3 show the functions of the network services by DACS Scheme. At the timing of the (a) or (b) as shown in the following, DACS rules (rules defined by user unit) are distributed from DACS Server to DACS Client.

- (a) At the time of user's logging in the client
- (b) At the time of a delivery indication from the system administrator

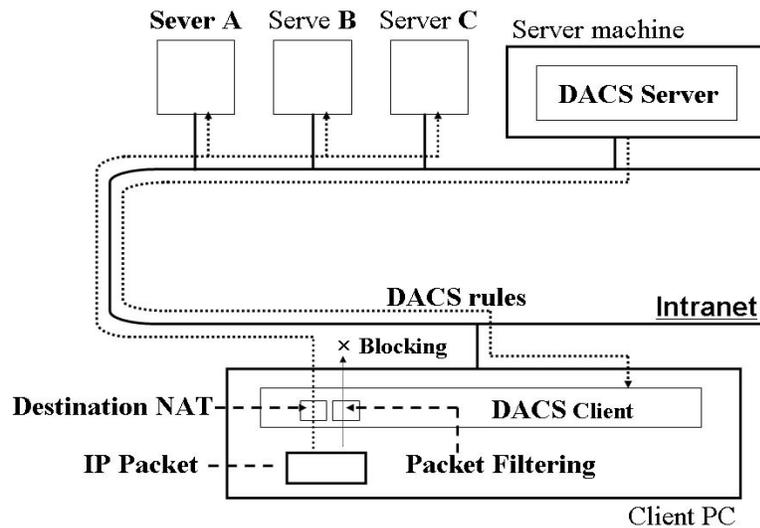


Figure 2. Function of DACS Scheme (1)

According to distributed DACS rules, DACS Client performs (1) or (2) or (3) operation as shown in the following. Then, communication control of the client is performed for every login user.

- (1) Destination information on IP Packet, which is sent from application program, is changed by Destination NAT.
- (2) Packet from the client, which is sent from the application program to the outside of the client, is blocked by packet filtering mechanism.
- (3) Communication between a client and a network server is supported by VPN with the port forward function of SSH [12], after the destination of the communication is changed to localhost (127.0.0.1) by the function of (1).

An example of the case (1) is shown in Fig.2. In Fig.2, the system administrator can distribute a communication of the login user to the specified server among server A, B or C. Moreover, the case (2) is added. When the system administrator wants to forbid user to use MUA (Mail User Agent), it will be performed by blocking IP Packet with the specific destination information.



as a communicating server. By using this function, the transparent use of a client machine as a characteristic of the DACS Scheme is maintained. The transparent use of a client machine means that even if the configuration of the network servers is changed, the client machine can be used continuously without changing its setups. The communication control for this function is performed with DACS SControl by the function of SSH. By using these two functions, VPN communication or no VPN communication for each network service can be selected for each user. When no VPN communication is selected, the communication control is performed by the DACS Control, as shown in (d) of Fig.4. When VPN communication is selected, the destination of the communication is changed by the DACS Control to localhost. Then, the port number is changed to the number assigned for each communication. Subsequently, the communicating server is decided and VPN communication is performed by the DACS SControl, as shown in (g) of Fig.4. In the DACS rules applied to the DACS Control, localhost is indicated as the destination of communication. In the DACS rules applied to the DACS SControl, the network server is indicated as the destination of communication. Thereafter, by changing the content of the DACS rules applied to the DACS Control and the DACS SControl, the control between VPN communication and no VPN communication is distinguished.

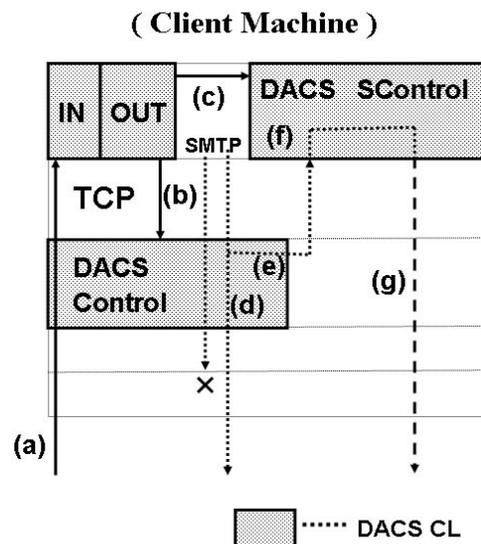


Figure 4. Layer setting of DACS Scheme

### 3.2. Network Services Corresponding to DACS Scheme

On the network introducing DACS Scheme, when a correspondence list of a client's IP address and user name logging in that client is passed to the network server, it becomes possible to identify which user is sending the communication from a client. As the result, it becomes possible for a program on the network server to perform different processing for every each user.

### 3.3. Two Kinds of Functions of Web Service Based on DACS Scheme

Two kinds of functions of Web Services based on DACS Scheme are described, here. At First, the function to use data from database is developed. To realize this function, DACS Scheme needs to be extended, and the program on Web Server needs to be implemented in correspondence to the extended DACS Scheme as shown in Fig.5.

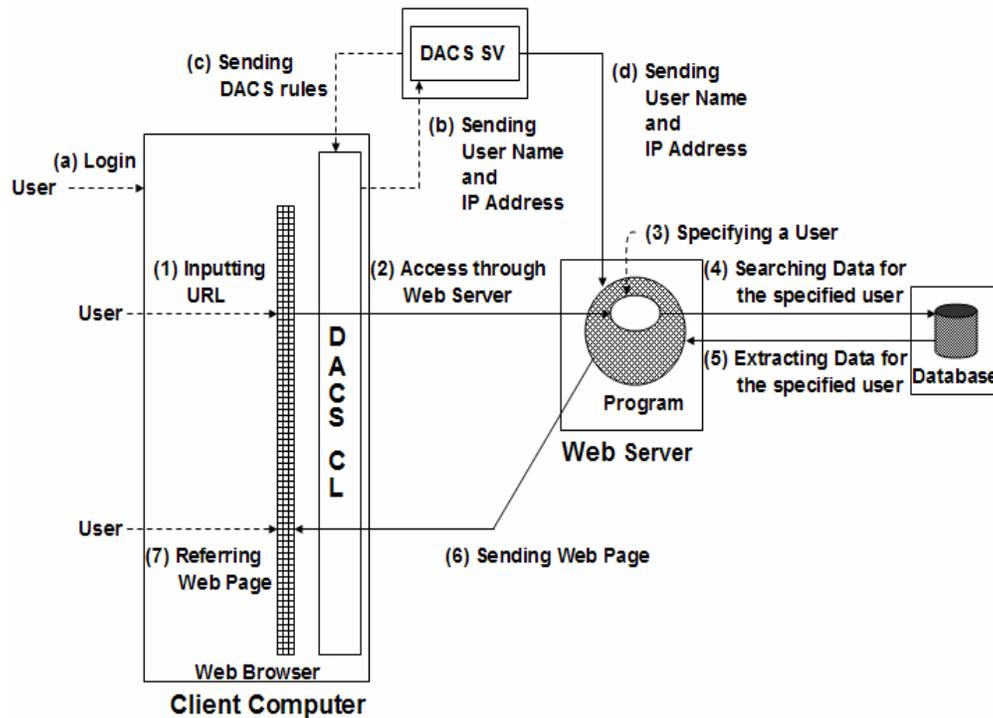


Figure 5. Function Using Data from Database

In the network with DACS Scheme, after a user's logging in a client (a), user name and IP address are sent to DACS SV (b). Then, DACS rules are sent back to DACS CL (c). Moreover, user name and IP address are sent to the program on Web Server. Then, the server side program on Web Server can identify the user by checking the login information and the source IP address from the client, and can change the processing of the program every user. When each different user accesses the program with same URL, different information for each user can be searched and extracted from database, and be displayed on Web Browser. Through the processing from (1) to (7), this new function is performed.

Next, the function to use data from document medium is developed for the respective user. In the network with DACS scheme, different IP address and TCP port can be assigned for one host name by a user unit. Therefore, different document medium with same file name on different Web Server can be referred for each user by inputting same URL to Web Browser. When this principle is combined with the function of virtual host which is equipped as Web Server, it is possible to use Web Server as shown in Fig.6.

By the function of virtual host, multiple groups of socket (IP address and TCP port) can be assigned for one Web Server. The referred document can be changed every socket. First, in Document root of Web Server in Fig.6, directories (Dir A,B,C,D,...) are prepared for each user. By the function of virtual host, each directory is connected to each socket as one pair. By changing TCP port number (3000,3001,3002,...) for one IP address (192.168.1.1), sockets corresponding to each directory are prepared. Next, movement on this mechanism is described. One user inputs one URL to Web Browser. When the URL is inputted by User A, the file in Dir A which is connected to the socket (192.168.1.1:3000) is referred. Equally, when by User B, the file in Dir B which is connected to the socket (192.168.1.1:3001) is referred. When by User C, the file in Dir C which is connected to the socket (192.168.1.1:3002) is referred. When the

document medium with same name exists in each directory (Dir A,B,C...), each user can see different contents by inputting same URL to Web Browser. For information sender, because it is possible to notify information to the specific user by uploading document medium to the predetermined directory, information usage becomes largely wide. Because information sender can describe the content of document medium easily and freely, it is possible to communicate the information with much expressive power and impact.

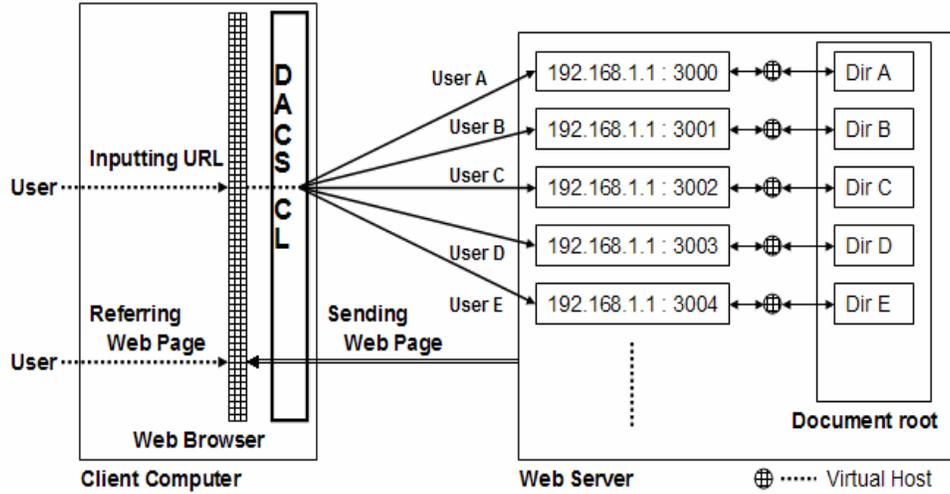


Figure 6. Function Using Data from Document Medium

### 3.4. System Configuration to Realize Personal Portal

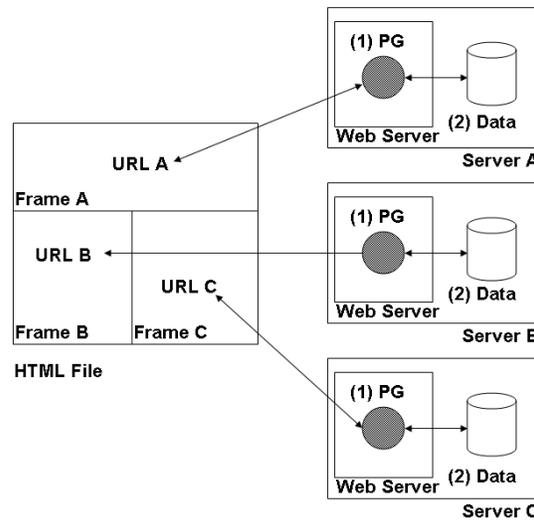


Figure 7. System Configuration of Type 1

By using the function to use data from database, the system configuration of Type 1 is enabled as shown in Fig.7. Server A-C which has programs based on DACS Scheme as shown in (1) of Fig.7, and data in database as shown in (2) of Fig.7 respectively. In DACS Scheme, information

related to each user is displayed on Web Browser by only inputting the URL. The following mechanism is built based on this principle. One window of Web Browser is divided into some frames. For example, it is divided into three frames (Frame A-C). The static HTML file with each URL (URLA-C) in each frame is created for displaying Web page as Personal Portal. The static HTML File is put on Web Server or on the client. When the static HTML file is opened through Web Browser, information extracted from each server is distributed on Web Browser. URL corresponding to each server is only incorporated in the static HTML file. Thus, when the static Web page is created, user can create the customized Web page as Personal Portal easily.

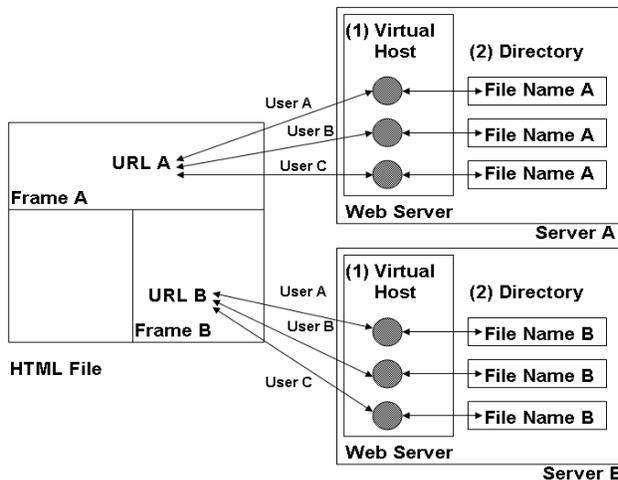


Figure 8. System Configuration of Type 2

As shown in Fig.8, the system configuration of Type 2 can be realized by using the function to use data from document medium. Each URL (URL A,B) is prepared. URL and the kind of information which can be seen after inputting the URL to Web Browser are notified to users. For example, URL for acquiring an issue in one classroom and URL for communicating from office to each individual user is enumerated as a kind of URL. By inputting URL to Web Browser, the file with same name (File Name A or B) is referred.

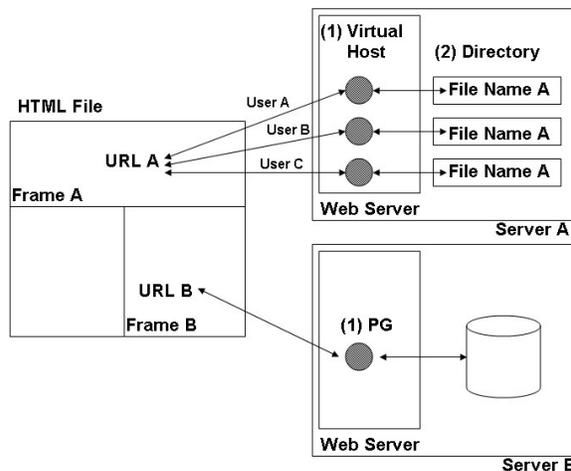


Figure 9. Web Service by Two Functions

As shown in Fig.9, the Web Service which a user can use information on the network regardless of information storage form is realized.

#### 4. New System Based on DACS Portal

Network based on DACS Scheme, can present different contents on the Web page by the dynamic function of static documents. Then, the entrance of information extraction

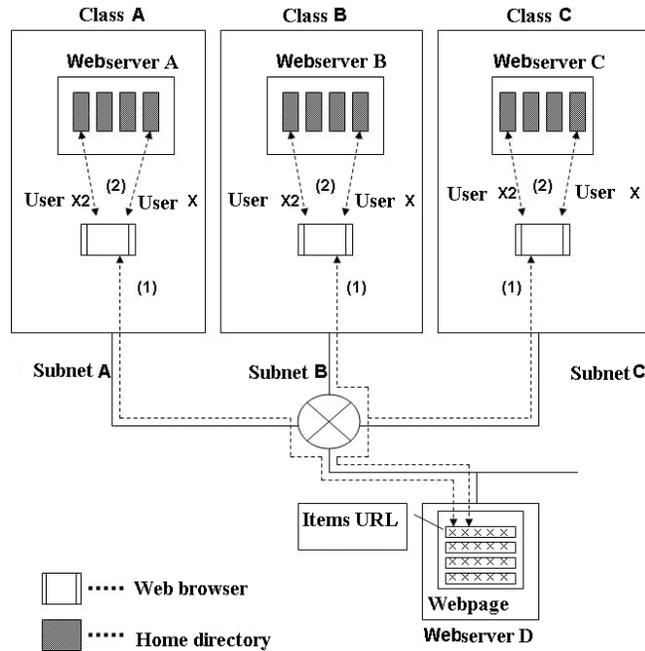


Figure 10. Distribution System on DACS Portal

is called DACS Portal here. The content of the DACS portal is as follows. First, a URL having a specific function is published on a static Web page, and the page is opened on the Web server that can be accessed from all places on the network. In the network introducing the DACS Scheme, by the dynamic display function of static documents, access control to the page is performed for each user. When a student clicks the URL in order to communicate in the laboratory, the student who belongs to the laboratory can see the displayed data on the Web browser, while other students cannot see it. Then, when a student clicks the URL for personal contacts, the student can view different information for each user. The DACS portal is the entrance by the static Web page where each student can acquire the information on himself/herself.

The new distribution system based on this DACS Portal is shown in Fig.10. For the evaluation of the proposed distribution system, an experimental system was constructed as shown in Fig.10. Each Web server (Web server A, B ,C...) is located in each classroom (Classroom A, B ,C...), the access from the common network is intercepted by the filtering mechanism located on the gateway of the classroom's network. The Web server that publishes the Web page as the DACS portal is located on the common network that becomes accessible from any classroom. Next, the content and operation of this system is explained. First, a student connects a client machine to the classroom's network. A teacher starts the system, and

distributes a document for each user to the folder in the home directory. Next, the teacher notifies the student the item name on the Web page as the DACS portal. The student can easily acquire the document only by clicking that URL of that item. The processes of the system at that time are as follows. When the target item is clicked, the name resolution for the domain name in the URL is performed. At this point, the common IP address is notified to the client machine, and the IP address of the extended Web server is not notified. Subsequently, by the function of the DACS CL on the client machine, the common IP address is changed to the IP address of each Web server. As a result, the document is sent to the user. When a client machine is outside the classroom's network, DACS rules required for changing the destination from the common IP address to that of the Web server is not assigned to the client machine. Because the communication between the Web browser and the Web server is not performed, the user cannot acquire the document. Therefore, only when the client machine is in the same classroom with the Web server, the user can acquire the document.

Thereafter, the communication in (2) of Fig. 9 was changed to the VPN communication by the function of the DACS Scheme. As a result, regardless of whether the communication occurs in the classroom's network or outside, the Web server can reject the communication from the client machine that does not have the DACS CL. In other words, only when the client machine is connected to the classroom's network and has the DACS Client, the user can access the Web server. So, it becomes unnecessary for a system administrator to locate the filtering mechanism on the gateway of the classroom's network and to change the network configuration.

In addition, although it is not directly improved by applying the DACS portal, DASC Scheme is a method of managing the setting information in one place. It becomes easy for the system administrator to manage the setting information.

For the evaluation of the proposed distribution system based on DACS Scheme, an experimental system was constructed as shown in Fig.11. In Fig.11, the conventional distribution system and the proposed distributed system are connected the experimental network with client. To prove that the proposed Distribution System is more convenient for the user than the conventional Distribution System, the result of the theory evaluation and the proving experiment are explained. In the experiment, an accurate judgment that removed "User's subjectivity" as much as possible was executed. After extracting an individual operational process by actually operating both systems, the comparisons were done theoretically done as much as possible. Thereafter, about the parts that cannot be theoretically compared, the judgment that was not based on "User's subjectivity" (the judgment based on questionnaire survey) was executed.

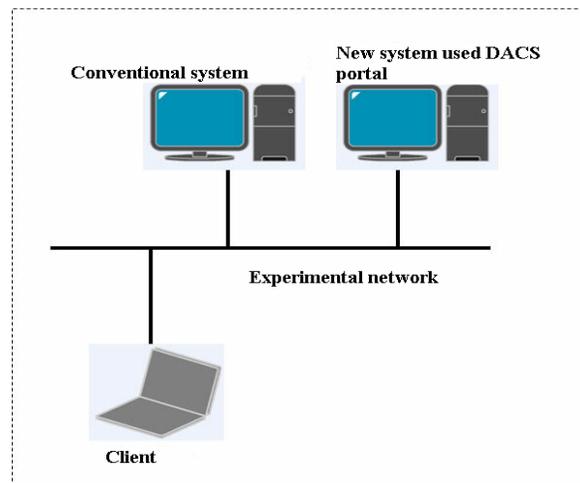


Figure 11. Experimental Environment

#### 4.1. Theoretical Comparison

Comparison of operational processes is theoretically carried out as shown in Table 1, in which operations before files extraction and those of files extraction, are compared.

First, the part of "Operations before file extraction" was examined. The processes from (1) to (3) are common for both systems and they do not differ. Though the processes of (4) and (5) are more necessary in the conventional Distribution System, they are not necessary in the proposed Distribution System.

Table 1. Comparison of systems

|                                   | Conventional system   | Dis. Sys. used DACS portal  |
|-----------------------------------|---|---|
| Operations before file extraction | (1)Log in client<br>(2)Start browser<br>(3)Input URL<br>(4)Log in System<br>(5)Access to directory                  | (1)Log in client<br>(2)Start browser<br>(3)Input URL for DACS portal  |
| Operations of file extraction     | (6)Extraction obj. file<br><br>( Searching method)<br>(a)Watching<br>(b)Change file order<br>(c)Search by file name | (4)Click item on portal page<br><br>(Searching method)<br>(a)Watching |

Then, process (6) of "Operations of file extraction" was examined. In the conventional Distribution System, a file list in the folder of home directory was displayed on the screen of the client machine in the operation to process (5). On the other hand, in the proposed Distribution System, the Web page as a personal portal that publishes the items linked with the file is displayed on the Web browser. After process (5), in the conventional Distribution System, the user searches the target file and acquires it. The searching method is some methods from (a) to (c) in Fig.12. When the files increase, the method (c) is the best simple method. In the proposed Distribution System, the user can obviously find the item of the target file in publishing only a minimum item in the Web page. It is thought that the proposed Distribution System is more convenient for the user. However, because this judgment was based on "User's subjectivity", the experiment described in the next paragraph was executed.

#### 4.2. Operational Process Experiments of File Extraction

After 75 files were stored in the folder of the home directory in both systems, the processes of both systems are executed just before process of (6). Thereafter, 20 users operated the following two operational processes, and answered the questionnaire survey.

Operation 1: The target file is searched and acquired directly from the folder of the home directory in the existing Distribution System.

Operation 2: The target file is searched and acquired by clicking the indicated item of the Web page in the extended Distribution System.

In the questionnaire survey, the user selected one of the following three choices.

Choice 1: Operation 1 is easier to use than Operation 2.

Choice 2: Operation 2 is easier to use than Operation 1.

Choice 3: Operation 1 and Operation 2 are the same levels on easiness to use.

In the total result, one user selected Choice 1, and seventeen users selected Choice 2. Two users selected Choice 3. By the result of the theory evaluation and the proving experiment, it was proven that the extended Distribution System was more convenient for the user than the existing one. The proposed system was agreed to be better, simple and easy system by most students.

## 5. Conclusion

This paper proposes DACS Web Service to realize the customized personal portal, which is based on DACS Scheme as a network management one. The DACS Web Service is realized by integrating two types of web service functions. By using the DACS Web Service, data dispersed on the network in a database or in a document medium can be used efficiently as a personal portal. It is shown that the proposed portal system is managed by DACS communication control by users or clients, easily. Further, the portal system applied to the educational site is shown.

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