Application Development Center for Multimedia Applications on Broadband Testbed Network

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Abstract: This paper describes the system and network configurations of the Application Development Center for multimedia applications on Korean broadband testbed network. The center is primarily used for developing networked multimedia services funded by the Korean Ministry of Information and Communications. The center is equipped with ATM switch, multimedia workstations and PCs. More than 180 applications for the broadband testbed network are under development. Several examples will be presented in detail.

1. Introduction

The Korean broadband testbed network is employed to test the validity of technologies and to confirm and evaluate the processes and outputs of application services and relevant technology developments in promoting the Korea Information Infrastructure(KII).[1]

The functions of the testbed network are classified into three categories: (1) Providing the environment to test and evaluate the applications and technologies for the KII. (2) Finding the problems occurred during constructing the KII and implementing the applications, and finding the solutions for the problems. (3) Gaining the experiences of technologies for constructing and operating the KII.

Necessary technologies in the first stage of the KII will be developed and secured through undertaking various pilot projects such as the application and technology development on broadband testbed network. The main purposes are to ensure the effective utilization of the KII and to encourage the private sector including academic and industries to develop novel ideas and to participate in technology development actively.

The proposals for developing applications for the testbed network are selected through open competition. The areas of the applications are not limited if they are original and can be worked on the high speed information communication network.

The application development centers are built to give opportunity to test and evaluate the outputs of the applications of the pilot projects. Two centers are built to serve in February 1996: one is at Seoul National University in Seoul and the other is at Chungnam National University in Taejon. They are sponsored by the Korean Ministry of Information and Communications, and LG Electronics Co., Ltd. Other two sites are to open in March are located at KAIST at Seoul and Taejon campuses, funded by the Korean Ministry of Information and Communications, and IBM Korea.

2. The Application Development Center [2]

2.1 The Testbed Network

The plan of the Korean government for constructing the high speed public information networks, called the New Korea Net-Public, aims to provide universal multimedia information and telecommunication services by facilitating wide-area, two-way, and digital telecommunications. The New Korea Net-Public will be established by the year 2015 through interconnecting companies, households, etc., via optical fiber cables.

For successful implementation of the plan, the construction of cabling of optical fiber and the development of services are executed in parallel. Most of all, the services should be attractive to public making the public awareness enhancement. For this reason, the application and technology development pilot projects by Korean government were started in 1995. 186 teams have been selected and funded to take part in the projects, by developing various applications for the broadband testbed network. The total annual budget for the applications development was 7.8 billion in 1995 Won. The broadband testbed network and the application development centers were also constructed, as explained in the previous section.

The organizational structure of for the promotion of the testbed network is depicted in Figure 1.

The Korea Information Infrastructure Task Force(KIITF) in the Korean Ministry of Information and Communications is the supervisory organization of the overall program. Its roles are: (1) drafting the basic action plans for the testbed network and application development center, (2) promoting the technology and user adaptation standards related to the testbed network, and (3) supporting for the effective

operation of the testbed network.

If KIITF is mainly charged with planning, then the High Speed Communication Network Management Division in Korea Telecom(KT) takes exclusive charge of the program. Its roles are: (1) drafting and implementing the detail plans for establishing the testbed network and operating it, (2) managing the users of the testbed network, (3) set-up the application development centers for the testbed network and operating them, (4) making the technology and user adaptation standards related to the testbed network, and applying them practically, and finally (5) organizing the steering committee of the testbed network.

The user committees are assumed to perform the following tasks; (1) to propose some improvements or advances for the testbed network to steering committee, (2) To develop technologies related to high speed information communication network and evaluate them, and (3) to make the equipments improved and more convenient for the users of the testbed network.

Finally, the steering committee's roles are: (1) evaluating the proposals for the testbed network operation, (2) managing the cooperation among the members.

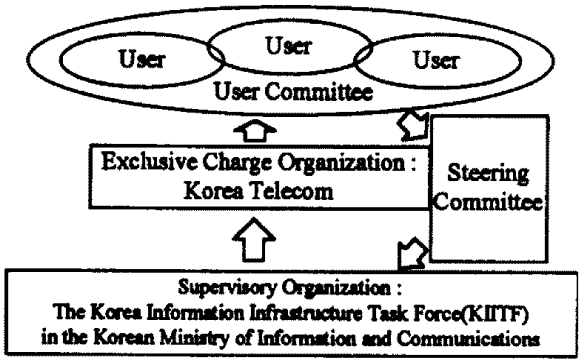


Figure 1. The Organizational Structure to promote the testbed network

The plan to setup the broadband testbed network is separated into three stages. The first stage is between 1995 and 1997. The 2.5 Gbps optical fiber transmission link between Seoul and Taejon will be established and upgraded. The ATM switching system will be installed to facilitate the huge information interchange, providing 2~155 Mbps access speed for each subscriber. Various trial services such as circuit-switched services and private leased line services are provided in this stage. The application development centers will be built to provide the excellent development environment for any users who find it hard to get access to the optical fiber transmission network or to purchase the equipments necessary for the information-superhighway-related technology development and test. In this period, ten centers will be established in total: five centers in Seoul, two centers in Taejon, one in Pusan, one in Taegu, and one in Kwangju. The initial testbed network configuration is depicted in Figure 2.

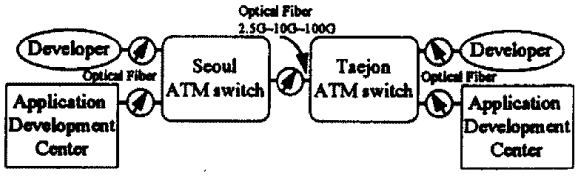


Figure 2. Testbed Network Configuration(1996)

In the second stage(1998~2002), the access speed will be upgraded to 622 Mbps, as the testbed backbone links will employ more advanced transmission and switching technologies. The access will become available throughout the nation in this stage. In the third stage(2003~2010) of the testbed network, the backbone link speed is expected to exceed 1 Tbps.

2.2 The Application Development Center

The application development center occupies 70 m^2 approximately. It is equipped with one ATM switch, one ATM-LAN Hub, one server computer, three Unix workstations, two Windows NT workstations, and seven multimedia PCs. The MPEG-I video and audio real-time encoder, high quality VCR, LDP, camcorders and CD-ROM writer are also set up for developing the contents of multimedia data. For playback and demonstration of the finished multimedia data, the large-screen TV set and MPEG-II decoder are also in place.

The network configuration of the application development center at Seoul National University is depicted in Figure 3. The same equipments with the same configuration are installed at Chungnam National University in Taejon. The equipments are sponsored by LG Electronics Co., Ltd.

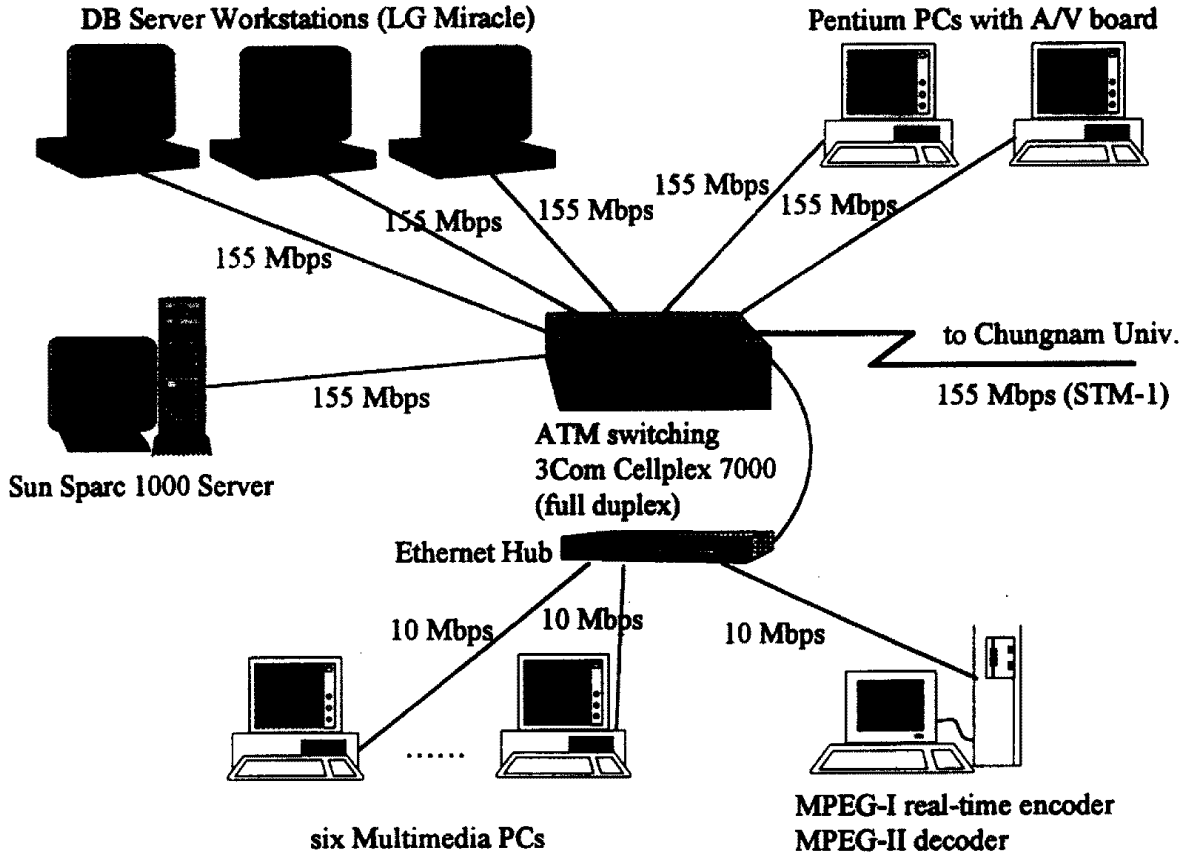


Figure 3. Testbed Network Configuration at Seoul National University

Installed softwares include, for the client-server application environment, the popular Data Base Management Systems(UniSQL, ORACLE, INFORMIX, SYBASE, and Object Store).

Currently the centers are heavily used by development teams from all over the country. Three or four teams are scheduled to use each center every day. For year 1995, the number of applications was 33 in education field, 64 in living area, 32 in medical area, 29 in office usage area, and 28 in software tools.

As typical examples, three applications are presented in next section.

3. Typical applications

3.1 Software Rent On Demand over High Speed Network [3]

This application is now under development at Chung Ang University.

This application is based on the idea that large computer programs can be transferred in a short time if the high speed network is in place. A new category of applications for the high speed network, called Game On Demand or Program On Demand, is envisaged under this project.

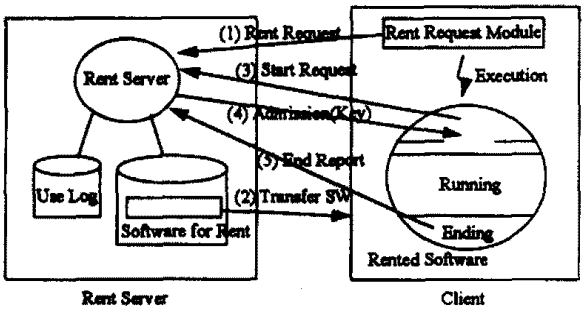
What is peculiar in this project is that it is assumed that a program is transferred and used by the requester on a usage basis. This software(program) is therefore rent to a client, and is not sold. Consequently, the application needs precise management of program transfer and usage. The client is requested to pay according to the usage(time or frequency). This application is called Software Rent On Demand over the high speed information communication network.

The main technical issue here is software rent and management technology. The software management controls the software usage of rented. The control of execution of rented software needs different technology than the current software copy protection technology. Also, the impact on the execution performance of the rented software, and the traffic amount between the rent server and client should be minimized. This problem is solved by employing a key. The rented software can not be executed without proper key that rent server provides. And the illegal use of rented software is thus prohibited. The rent

server receives the use request and end report from clients and calculates the charge by the usage time. If the client's request is for a new software that the client does not possess, then the rent server transfers the software at first. Otherwise, that is, if the requested software already exists in the client side, then the software would be executed without program transfer from server to client.

The conceptual operation of the proposed scheme is depicted in Figure 4.

Under this approach, the rented software resides on the client system permanently, once it is transferred from the server. At each execution, the client needs a specific key from the server. The network traffic is thus minimized.



Operating Sequence:(1)->(2)->...(5)

Figure 4. Software Rent Management Method

Alternative to the above approach to transfer the software each time a client requests it, and to prohibit the permanent storing of the software on local disk. This can only be achieved by proper assistance from the client's local OS(or by modification in the program structure). This scheme is not considered because of its large bandwidth requirement and local OS credibility problem.

3.2 Internet Security System [4]

This project, conducted at Seoul National University, is to develop security architecture for the Unix hosts connected by high speed network. The main elements(see Figure 5) are Network Communication Supervisor Program, Security Diagnostic Program, Firewall and Network Communication Protection Program, and Log-file Checking Program. All programs reside in security system that each host maintains.

The Network Communication Supervisor Program logs every communication events occurred in each host and stores its records in other system or peripheral system for safety reasons. It works like open software Etherscan, and Snoop[5]. The Security Diagnostic Program in each host provides easy-to-use user interface to the security-unaware general users. Hangul dictionary is added in password security diagnostic program to filter Hangul words and names. It also supervises the shell user, controls the use of su, finger, rlogin, rsh, and tftp. The Firewall and Network Communication Protection Program performs selective access the network by the users. New cipher algorithms of data exchanged through network are developed in this project, which are based on DES, Hangul DES, and Public-Key Cryptography. The Log-file Checking Program is to find out security violation events from the log file and produces analysis reports and possible solutions on those events.

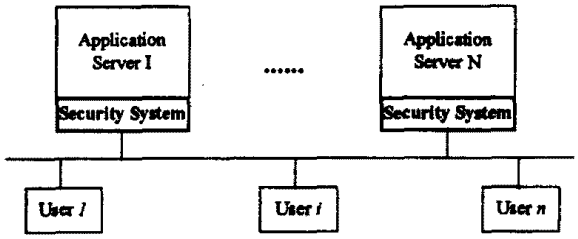


Figure 5. Security System Architecture

The proposed security system provides the B1 level functions of DoD TCSEC(Department of Defense Trusted Computer System Evaluation Criteria), such as authentication information protection, interactive authentication, discretionary access control, audit, and mandatory access control.

3.3 ClipNet : A Large-Scale Distributed Multimedia Retrieval Network Service [6]

The system and network architecture for ClipNet, a wide-area distributed network service for multimedia retrieval, investigated by Seoul National University, are presented here. In ClipNet, a client's request to a multimedia clip (a clip is an autonomous information object in video, audio, mixed media, etc.) is handled by an array of distributed clip servers each having different multimedia clip databases.

ClipNet is used by two different groups of users; clip providers and clip users. Clip providers can be individuals or industries, public or private. ClipNet provides easy clip registration, modification, distribution, and deletion for clip providers. The new informations are automatically propagated to the concerned servers for clip and link consistency over the corresponding domain. Clip users view the clips through a browser in the client system.

ClipNet is operated on top of the wide-area broadband network, and is composed of client systems with browsers, clip servers, directory servers, and link servers (see Figure 6).

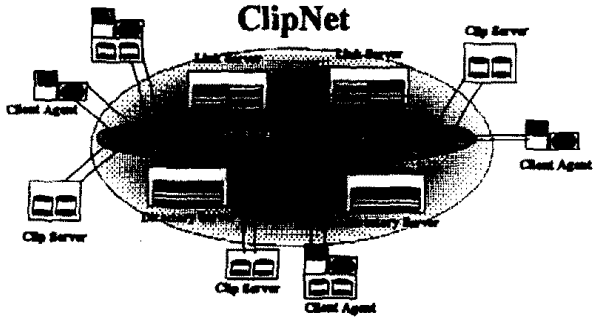


Figure 6. The global ClipNet architecture

Each clip is characterized by unique clip identifier, data type, links, search indexes, creator, applicable operations, version number, etc. One clip can be stored in a number of servers, and the search engine located in the client's system retrieves the requested clips from the costwise nearest servers. To locate the nearest server, the search engine usually consults one directory server in its domain. The directory server is capable of identifying the clip server to fulfill the retrieval request by comparing the indexes and the routing tables. In our architecture, link servers are defined to keep the informations on the hypermedia links in the clips.

The browser is located within the client system handling the retrieval request by the clip user. The request is transferred to the search engine or the agent subsystem which is a part of the browser.

The directory server locates the clip that matches the query issued by the browser, and notifies the result to the clip server and the client for further processing.

The clip server manages clip database. A clip server communicates its clip list to one or more directory servers. The same clip can be stored in several clip servers, and the client's request is handled by the clip server selected by the directory server which received the request.

Clips can have hypermedia links to other clips. To accommodate frequent update and migration of clips, link informations are separately handled by the link servers. The link server stores all the necessary informations of the links contained in the clips that are listed in the directory servers under its control. By doing in this way, clips are not affected by the changes in the links, for example update of the destination clips.

Internet and its primary application, World-Wide Web, demonstrated that the browsing multimedia information over the network could become the killer application of the emerging globally connected information infrastructure. The present services are, however, inadequate to support massive users and massive informations. The primary reason of the poor service is the lack of directory service. Clients should know exactly the identifier of the information and its location in order to issue a retrieval request to the network. In some cases, the retrieved information may not be the one he wants, and the network browsing can turn into a very time-consuming task.

Hypermedia links are heavily used in the network browsing. Because of the very dynamic nature of Internet publishing, links often lead to old or unavailable informations. Searching for the correct site, in this case, is also very tedious or even impossible. The proposed Clipnet architecture is a new networking approach to solve the two above problems.

4. Concluding Remarks

For the successful development and test of new application projects running over the New Korea Net(Korean version of Information Superhighway), Korean Ministry of Information and Communications put into place Application Development Centers equipped with excellent computing and network facilities, to be used freely by the application developers. This paper gave an overview of the government plans, and system and network configuration of the Application Development Centers, along with three typical undergoing development projects.

The first-year demonstration research projects running on top of the broadband testbed network will end in April 1996. For the second year period, new projects will be added, as the budget is expected to increase. It is highly hoped that the centers become birthplaces of many exciting and popular new services in the coming information era.

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This work has been supported by research contract with Korean Ministry of Information and Communications(MIC). The authors would like to thank MIC for providing text and information on their plans on Korea Information Infrastructure.