High Speed Supercomputer Network in Korea

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ABSTRACT: *The SSC(SERI Supercomputer Center) has started and developed the KREONet, one of five government supported National Backbone Information Systems, for sharing the supercomputing resources and the worldwide latest R&D information of Science and Technology. In this paper, the status of supercomputer networking and the strategy of network design for high-speed technology in Korea are discussed.*

1 Introduction

There are 6 supercomputer centers in Korea. Among them, only the SSC (SERI Supercomputer Center) gets fund from Korean government for providing the universities and research institutes in Korea with services such as sharing the supercomputing resources and the worldwide latest R&D information of Science and Technology.

Organization	Location	System (GFLOPS)	Installation Date	KREONet site
SERI Supercomputer Center	Taejon	CRAY C916/16512 (16)	Nov., 1993	Yes
Samsung Research Institute Supercomputer Center	Kihung	CRAY Y-MP 4E/464 (1.3)	Feb., 1992	No
Korea Defence Institute Supercomputer Center	Taejon	CRAY Y-MP 2E32 (0.6)	Mar., 1992	Yes
Kia Motor Co Supercomputer Center	Sohari	CRAY Y-MP 4/116 (0.5)	Nov., 1990	No
Kyoungpook University Supercomputer Center	Taegu	CRAY Y-MP EL/1-512 (0.13)	May, 1993	Yes
Hyundae Motor Co Supercomputer Center	Woolsan	CRAY Y-MP 4E/464 (1.3)	June, 1993	No

Figure 1: The Status of Supercomputer Centers in Korea

SSC, the nonprofit research institute, is thought to be the representative of Korean Supercomputer Centers for its openness to the academic and research institute sites, and the highest supercomputing power with stablized network user service in Korea.

The reputation has been started since 1988 for the first supercomputer in Korea, CRAY-2S, installation at SERI to improve R&D environment of academic and research institute sites. After this installation at SERI, there have been five supercomputer centers at some of companies and universities for their own R&D requirements.

SSC also started the project called KREONet (Korea Research Environment Open Network) in 1988. In 1987, Korea started National Backbone Information System (NBIS) project for the five major backbone networks as follows:

- Government Administrative Network
- Bank and Financial Network
- National Defence Network
- National Security Network
- Educational and research Network

Under the plan of Education and Research Network, KREONet launched in 1988.

The major objectives of KREONet are:

1. High speed Science & Technology Backbone Networking
2. Sharing of Supercomputer, Software and Interent Resources
3. Providing and Distributing R&D related Information

The high speed supercomputing network in SERI was started from the high speed local area network to KREONet, one of five major NBISs, which has more than 115 academic and research institute sites for the most effective utilization of Cray C916/16512 computing and Internet services.

KREONet lab (dept. of Research Computer Network) in the SSC is responsible for KREONet project. KREONet project is divided into the following three development phases:

- Phase 1, (1988-1991): Construction of testbed for KREONet and basic service
- Phase 2, (1992-1996): Expansion and stabilization of KREONet and Service
- Phase 3, (1997-2001): Construction of high speed research and information network

In this paper, the status and plan for high speed supercomputer networking in SSC are discussed.

2 Status of High Speed Supercomputer Networking in SSC

2.1 Network Configuration

The SSC high speed supercomputer network can be divided into three hierarchical parts:

- SERI High Speed Local Area Supercomputer Network: Cray C916/16512 system is connected to channel switch box and this box is connected to brouter which is directly connected to FDDI. There are four FDDIs in SSC. Among them, three FDDIs are in Taejon and one FDDI is in Seoul. And SSC has a Hyperchannel and a HIPPI segments.
- KREONet Domestic National Supercomputer Backbone Network: SSC is connected to KREONet by one of FDDI routers in SSC. There are 15 regional network centers of KREONet from 56 Kbps to T1 speed.
- KREONet International Supercomputer Network: KREONet has two international links to U.S.A. and Europe.

The following figures are about these networks with links speed.

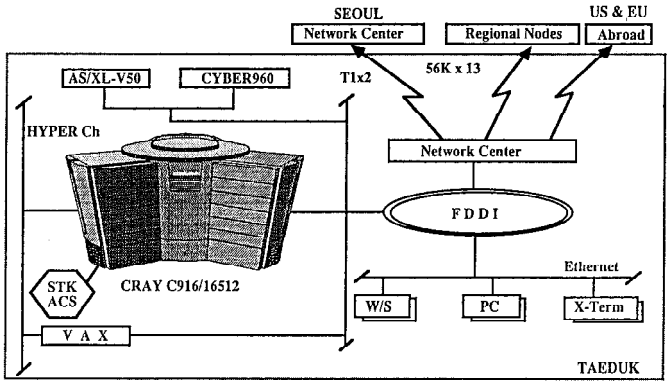

Figure 2: SERI High Speed Local Area Network

Among more than 115 KREONet sites, there are 100 Mbps speed sites such as KAIST (Korea Advanced Institute of Science and Technology) and KORDIC (Korea Research & Development Institute Center). And KARI (Korea Aerospace Research Instirute) and KBSC (Korea Basic Science Center) are in process of 100 Mbps enhancement.

KREONet International Supercomputer Network has links to U.S.A. and E.U. From June, 1991, KREONet started U.S.A. link with NSFNET/CERFNET(56K) and in July, 1994 this link changed to ICMNET/NSFNET(256K). KREONet also has had a link to E.U. with ULCC (University of London Computer Center)/EuropaNET(64K) since September, 1994. The international link to Japan is in process for opening in July, 1995 with IMNET/Japan.

2.2 Network Access

The KREONet access consists of mamny kinds of connections as follows:

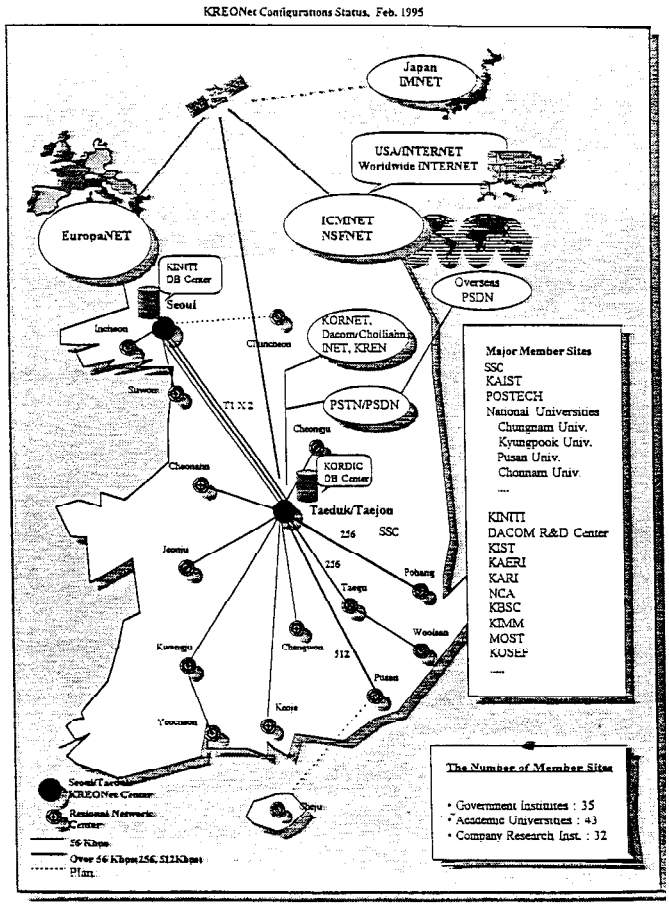

Figure 3: KREONet Domestic National Backbone & Internatio Supercomputer Network

- Router-to-Router T1 Speed (Digital 1.544 Mbps with LAN interconnection)
- Router-to_Router 56 Kbps (Digital 56 Kbps with LAN interconnection)
- Gateway-to-Gateway 56 Kbps (Digital 56 Kbps with hosts, workstation)
- Gateway-to-Gateway 9.5 Kbps (Analog 9.6 Kbps with hosts, workstation)
- Terminal-to-Server Leased line (Analog leased line 1.2 to 9.6 Kbps PC, Terminal)
- Terminal-to-Server Public Telephone and Data Networks (PC, Terminal)

2.3 Network Architecture

The Network Architecture of KREONet is shown in the figure 4.

KREONet is typical kind of heterogeneous network. The network hardware is consists of many kinds of equipments from dial-up modem to ATM router, Hyperchannel, and HIPPI because of the user's requirements. The protocol used in KREONet is TCP/IP with 18 B-Class and 707 C-Class IP

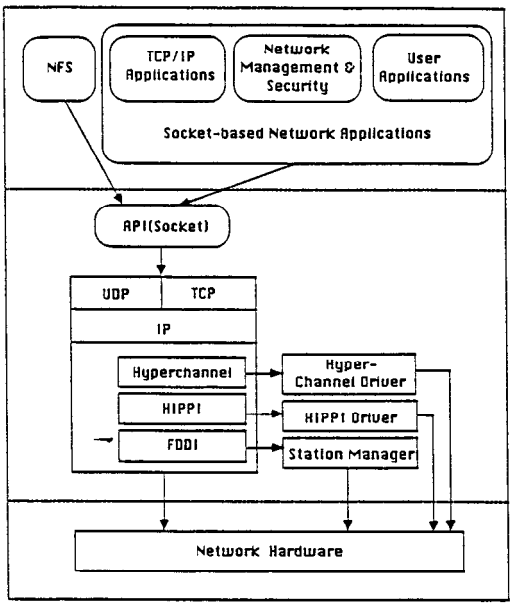

Figure 4: Status of KREONet Network Architecture

addresses. The KREONet's Autonomous Number is 1237 and the routing protocols in KREONet are BGP4 for external routing and IGRP for internal routing.

2.4 Network Services

The functional supercomputer network services are as follows:

- Network Operation: Administration of KREONet Operation facilities, supporting technical problems of member sites, operation of domestic/international links, routing, and domain name.
- Network Information: R&D related information tools-Gopher, Web/Netscape, NIC Help, Online menu-development, Anonymous FTP server administration, Internet USENET service Administration, Internet Conferencing System Maintainence.
- Network Management: Development of Network Management program, statistic of network usage traffic report, future backbone system analysis and consulting.
- Network Security: Consulting and fix Internet security problems, handle Internet security incidents, developing security tools, domestic/international security related activities.
- Network Engineering: Research very high speed network technology and advance network services

2.5 Network Usage

The usage of KREONet in 1994 is shown in the figure 5.

From the figure 5, the average monthly KREONet usage in 1994 is about 100 Giga bytes. The percentage of usage by subscriber group is 34% from research institutes, 42% from universities, and 24% from company's research institutes. And the traffic distribution is 85% in domestic, 11% in U.S.A. link, and 4% in EU link (this one begins since September, 1994).

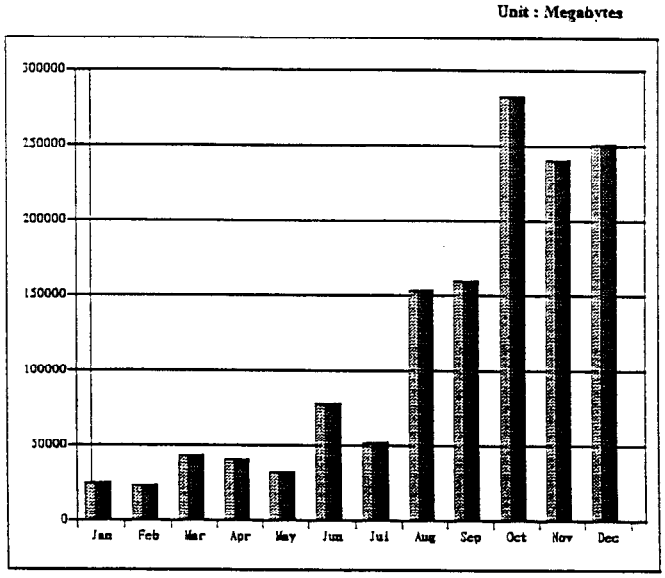

Figure 5: The usage of KREONet by month in 1994

From these data, we guess that SSC CRAY users use KREONet more than the other KREONet users. For example, the total number of FTP sessions in Feb., 1995 from CRAY users is 19,017.

3 Plan: Strategy, Policy, and Technology

3.1 The Users' Requirements Analysis

1. The five RSCs (Regional Supercomputer Centers) at Seoul, Taejon, Kwangju, Pusan, Taegu-Pohang Science Towns sould be in consideration for optimizing and improving the utilization of regional supercomputer resources through high speed network service. The five RSCs will be integrated by NationalMetaCenter.
2. National Information Super Highway (NISH) project in Korea has something to do with KREONet project. For instance, the domestic optical fiber networking will help enhancing the link speed at the 3rd phase of KREONet. KREONet also participates in SOFTECH2015 (Software Technology for 2015) project, one of major NISH projects, that is for R&D in the fields of high speed information network and high performance computing services.
3. Buliding the high speed network testbed in Taeduk Science Town which is located in Taejon should be in consideration for testing many kinds of supercomputing R&D products and high speed advanced multimedia R&D information services of science and technology.
4. KREONet has plans to speed-up the international links of ICMNET/NSFNET, EuropaNET and future IMNET/Japan for implementing Global MetaCenter with National MetaCenter in Korea.
5. Making high speed supercomputer network user environment model by referencing the SSC user monitor reports for implementing the user-oriented network service.

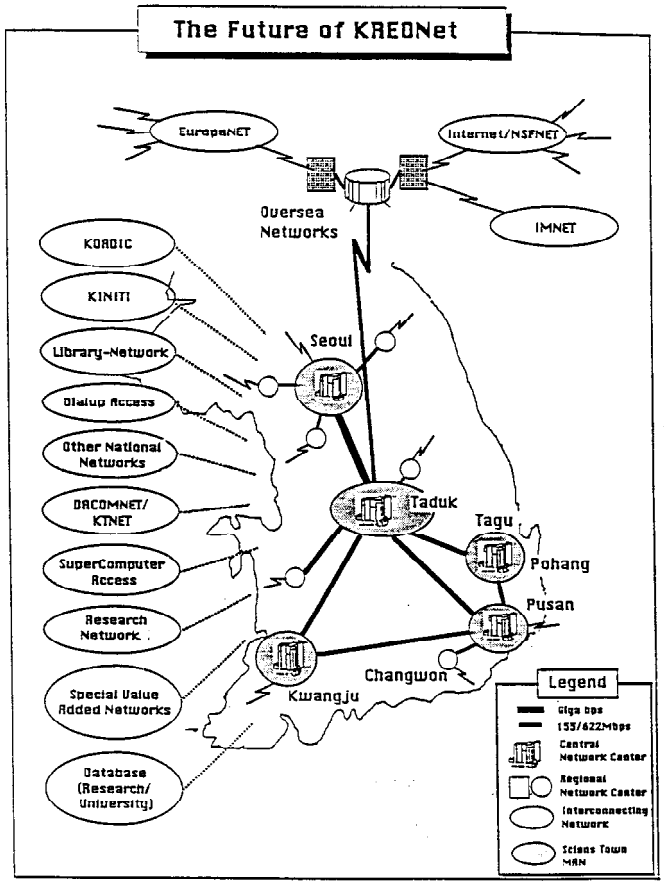

Figure 6: The Phase 3 of KREONet(1997-2001)

3.2 The Policies for High Speed Supercomputer Networking

3.2.1 National Policy

MOST (Ministery of Science and Technology) in Korea has plans for the activation of science and technology with KOSEF (Korea Science & Engineering Foundation) and KBSC (Korea Basic Science Center). Among the plans, KREONet invloves in building RSCs for supercomputing resources sharing and information service which will include ERC (Engineering Research Center), SRC (Science Research Center) and RRC (Regional Research Center).

3.2.2 International Cooperation Policy

The major international cooperation includes high speed networking with oversea supercomputer centers, exchanging experts each other, and international R&D project cooperation.

3.3 High Speed Supercomputer Network Services

1. Definition: Those are not in conventional Internet services such as e-mail, anonymous ftp, archie, gopher, etc but the hypermedia and multimedia service with supercomputing applications.
2. The presumed High-speed Network Service Model is Virtual & Real Workspace Service and this service covers the following:
   - T3D-based applications,
   - Application Software Packages,
   - Virtual Reality User Interface Kits,
   - OSF/DCE DFS (Distributed File System),
   - NationalMetaCenter/GlobalMetaCenter,
   - and the integrated Internet services.

3.4 Network Architecture and Technical Aspects

The Network architecture and its technical components are under consideration, and at present, ATM, HIPPI, and UltraNet is seriously considered as the main technology for Phase 3 of KREONet.

4 Conclusion

4.1 What Should We Do?

1. Constructing the development task force for high speed supercomputer network user interface software.
2. Providing the R&D supercomputer and multimedia services by constructing the Giga bit level national networks.
3. Constructing the supercomputer standard organization for user terminal, high speed networking, and network services.

4.2 How To Do. (Is CUG Mission?)

4. Based upon the international cooperation, CUG needs to initiate Global Supercomputer Networking project for worldwide Global MetaCenter.
5. For the '4.1 What Should We Do?', CUG needs to establish the following sub-groups:
   - Standards for User Environment of high speed supercomputer network sub-group
   - Development of User Interface Software for high speed supercomputer network sub-group
   - Global Supercomputer Networking sub-group

References

[1] B. Leiner, Critical Issues in High Bandwidth Networking, RFC1077, Gigabit Working Group, Nov. 1988.

[2] Craig Patridge, Gigabit Networking, Addison-Wesley Publishing Company, 1994.

[3] High-Performance Parallel Interface, Internet, 1994. 9.

[4] HPCC, FY 1995 Implementation Plan, 1995.

[5] I. Chlamtac, Design and Analysis of Very High-Speed Network Architectures, IEEE Transaction of Comm., Vol. 36, No. 3, pp. 252-262, Mar, 1988.

[6] NREN, Computer Science and Telecommunication Board, Realizing the Information Future, 1994.

[7] RACE, Commission Of The European Communities, 1994.

[8] Annual High Speed Network Workshop Proceedings 1991-1995, Korea Information Science Academic Society, January 1991-1995.

[9] Annual Winter Computer Communication Workshop Proceedings 1991-1995, Korea Information Science Academic Society, January 1991-1995.