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Asian Internet Interconnection Initiatives

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Asian Internet Interconnection Initiatives

第 1 章 Introduction

1.1 about AI^3

The Internet has become a critical and dependable infrastructure for today's society. Various kinds of services are provided on the Internet and many people haven't been able to imagine their daily life without the Internet. Since this penetration process has taken almost 5 years and more even for developed countries, it is quite natural for us to estimate that such penetration process in developing countries takes longer years than we experienced in developed countries. In fact, many developing countries are now struggle to develop the Internet infrastructure; however, still limited number of people in such countries can utilize the Internet without any difficulties. Their governments in many developing countries are now encouraging its industries as well as other domestic communities to cope with this issue called "digital divide" or "equal access," but few countries have improved this situation. As its results, this situation has caused stagnation in various kinds of activities.

In order to give solutions for this issue in the international context, many challenges have been conducted since mid 1990's. For example, Internet Society has been working actively on human resource development through organizing Networking Training Workshop (NTW) since 1992. The workshop gathers people who are involved to the Internet development from various fields and provides in-depth training on how to develop the Internet. This workshop contributed the Internet development especially in Latin America and African countries. As another challenge,

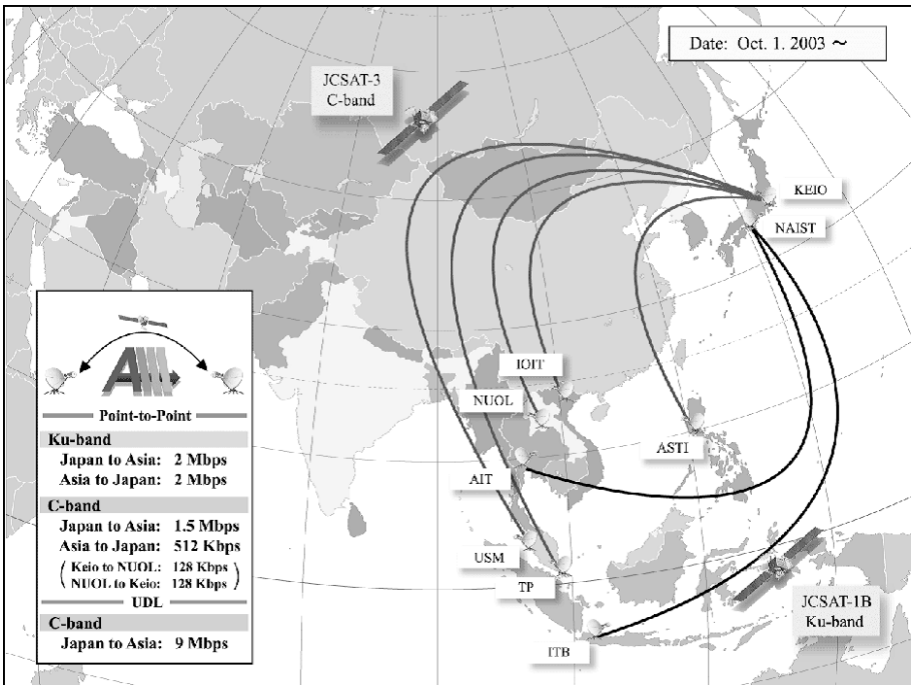

Fig. 1.1. AI^3 network

many international donor programs such as JICA of Japan have been working aggressively on the Internet development in various countries. Of course, there has been tremendous commercial investment for the Internet development.

With these activities, however, there is still big gap between developed and developing countries in terms of the Internet development. Especially for Asian countries, this penetration process has more difficulties because of broader diversity of economic development, existence of tremendous number of languages in Asia, geographical and climatic variety from small tropical islands in Pacific Ocean, monsoon region in South East Asia, desert in Central Asia, and to northern icy rural areas. In mid 1990's, leaders involved to the Internet development in Asia concluded that more active participation to the Internet development was highly required.

With this situation in mid 1990's, our project called Asian Internet Interconnection Initiatives, or AI^3 (ei-tripl-ai) in short, has been established in 1995, in order to work for the Internet development in Asian region. When we started this project, we set some assumptions on what is required to accelerate the deployment process of the Internet: (1) a testbed network as a live demonstration and also as a technical showcase of the Internet technology is required because it always can persuade many people of the potential and possibility for the power of the Internet, (2) research for adapting and localizing the Internet to the region should be conducted simultaneously with the deployment, because the Internet is aiming to be an infrastructure for our society, and (3) human resource development locally in the region is vital for rapid deployment of the Internet because the human resource development process can reproduce more evangelists, supporters and participants for the Internet deployment.

With these assumptions, the AI^3 project decided to start as a research consortium of leading research groups in universities in Asia. Because universities are in charge of human resource development, less restricted to have a testbed network, and a base of research activities, we expect we can find out there many researchers who are working actively on the Internet technologies.

In our 7 years activities, AI^3 testbed network has been built to connect 16 universities in 10 countries in this region and still expanding. This network has been working on 24/7 basis and turned to be its communication infrastructure for members of this AI^3 project. In this report, we summarize the AI^3 project and its achievements in both Internet development and our R&D process using AI^3 satellite Internet infrastructure in Asia.

1.2 Infrastructure

1.2.1 L2 design

When we started the AI^3 project in mid 1990's, we could get fiber optical infrastructure in Japan, however, legacy PSTN was only a major infrastructure available in many Asian countries. Therefore, the biggest issue was to find out the way to install the Internet infrastructure for members in Asia even when there was few terrestrial communication infrastructures developed. The solution we delivered was to build up our international Internet testbed network using communication satellites.

The advantages on use of communication satellite as our L2 technology is trivial; we don't have to expect terrestrial infrastructure around project's members to hook up to the Internet. What we need for installation of the Internet is to construct satellite earth station; therefore, nothing but stable and enough electricity to activate equipments for the satellite earth station is required.

As technology transfer and equal partnership are important for international collaboration, the AI^3 project made a project framework about AI^3 partnership. This framework defines that purchasing VSAT earth station, obtaining appropriate licenses from the local authorities and

anything coordinated locally must be completed by each partner in each country. On the other hand, the AI^3 project provides satellite circuits (bandwidth on transponders) and related technical information to all the partners. Within this framework, AI^3 partners were invited from Asian countries, and the groups who indeed needed the AI^3 project were selected.

In the preparation process of each earth station, the AI^3 project provides the minimum requirement concerning station equipment such as frequency and polarization, satellite modem, antenna and HPA (High Power Amplifier), and so on. Along with such minimum requirement, AI^3 partners set up their earth stations which were fitted for this requirement considering procurement, cost, maintenance and operation in their local circumstances.

Consequently, each earth station has been set up using the different RF unit. Through this process, we found that there were various regulations to start satellite communication in Asian countries. The required licenses from the local authorities were for wireless communication, location of earth station, import permissions of wireless devices and etc. Obtaining the licenses was much hard for AI^3 partners in some cases, however, they finally accomplished this task in every way. From the aspect of human resource development, AI^3 partners got a complete *know-how* at the initial stage.

Since the early stage of the AI^3 project, Ku band transponder on the communication satellite JCSAT-3 operated by JSAT Inc. has been utilized and Ku band VSAT earth stations were installed at the member sites listed in the upper part of Table 1.1. These installations were done around 1996. At that moment, there were many hope and hype on usage of Ku band satellite communication channel for the Internet, because there were few experiments using Ku band so far and Ku band has bigger rain degradation effect than C band which is quite popular for digital communication in tropical region. Therefore, several experiments to confirm usability of Ku band satellite communication channel in tropical area, where heavy rain is quite popular, were conducted right after our installation. Furthermore, when we started this project, there was no other large scale satellite Internet infrastructure, we developed several tools and systems to operate our infrastructure to be merged to ordinary Internet environment.

In 1999, we had an opportunity to expand our activities to more countries in Asia. At the time, we started to use C band transponder on JCSAT-3 and added 5 more universities listed in the lower part of Table 1.1. These universities added to our C band infrastructure are relatively strong in terms of technology development in this region. Our network is mapped into geographical location, though two of them are not in operation due to some operational difficulties at HKUST station and our planning link to CMB before installation.

With two transponders, both Ku and C bands,

Table 1.1. partners connected via bi-directional link on both Ku and C band

Members	Country	Abbrev.
Ku band		
Nara Institute of Sci. and Tech.	Japan	NAIST
Institute of Technology Bandung	Indonesia	ITB
Asian Institute of Technology	Thailand	AIT
C band		
Keio University	Japan	KEIO
Temasek Polytechnic	Singapore	TP
University Sains Malaysia	Malaysia	USM
Advanced Sci. and Tech. Institute	Philippines	ASTI
Institute of Information Technology	Vietnam	IOIT

we installed two hub stations in Japan to span our links to our member sites, and set up broadband transit link between these stations using nation wide ATM network called JGN in Japan.

1.2.2 L3 design

Our network can be considered a transit network connecting multiple AS resides on member sites. We operate our own AS for our project itself and our network exchanges traffic comes to/from our member AS. In this sense, our network can be considered a distributed L3 internet exchange scattered over South East Asian region.

For global Internet connectivity, APAN TRANSPAC link as well as WIDE Internet operated by WIDE Project can be used. This broadband backbone connectivity to the Internet can facilitate conducting several experiments with other members in our AI^3 project as well as research groups in Internet2 and others. Especially for APAN, our network is fully integrated to their APAN infrastructure.

1.2.3 UDL

Major achievement in our project is UDLR which stands for Uni-Directional Link Routing.

In our original design of VSAT earth station, each station had to obtain appropriate license from authorities to receive and transmit signals from/to the communication satellite, however, license for transmitting signal normally requires us to have long and complicated process as described earlier. Moreover, VSAT earth station with transmitting capability requires expensive equipment. These characteristics of VSAT earth station made our licensing process troublesome in many cases, so that we consider the licensing process as the hardest part for member site set up in our project.

On the other hand, receive only earth station is quite popular in Asian countries especially for TV broadcasting, and in many cases there is no requirement to obtain licenses for building receive-only earth stations. Furthermore, the receive-only station is inexpensive. If we can use receive-only station for Internet connectivity, installation of our gateway at our member site can be done more easily.

Around 1998, the bases of UDL routing technology was developed. A single satellite channel is shared among UDL receivers. The “feed” station transmits IP datagram to the satellite channel as L1 broadcast, and each UDL receiver selectively receives and forwards IP datagram bound

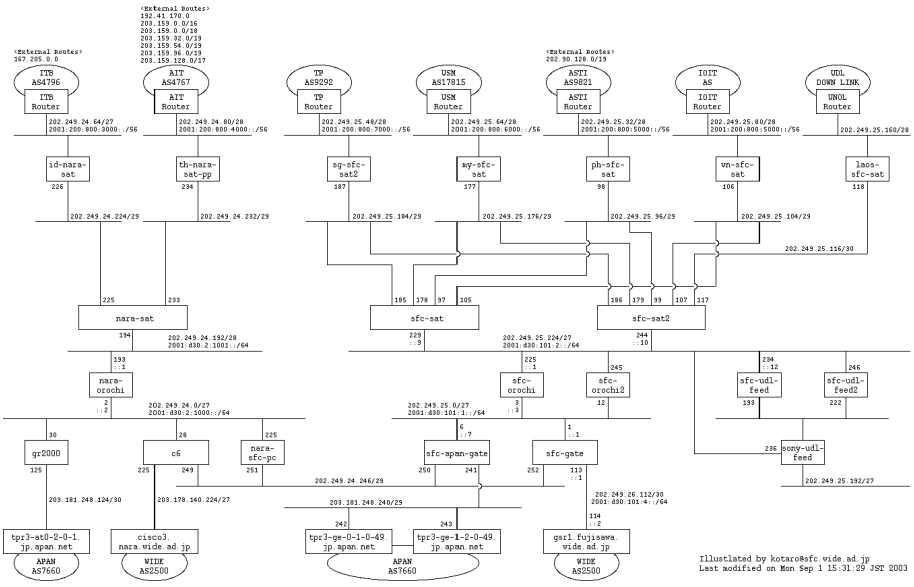

Fig. 1.2. AI^3 network topology

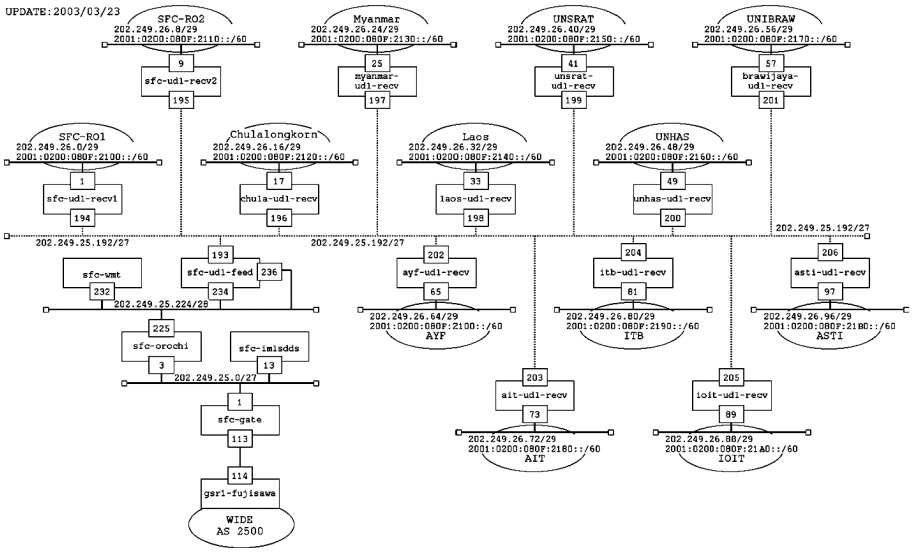

Fig. 1.3. AI^3 UDL network

Table 1.2. partners using UDL

Members	Country	Abbrev.
Keio University	Japan	KEIO
Chulalongkorn University	Thailand	CHULA
Asian Institute of Technology	Thailand	AIT
National University of Laos, Laos	Laos	NUOL
University of Computer Studies, Yangon	Myanmar	UCSY
Brawijaya University	Indonesia	UNIBRAW
Sam Ratulangi University	Indonesia	UNSRAT
Hasanuddin University	Indonesia	UNHAS
Institute of Technology Bandung	Indonesia	ITB
Asian Youth Fellowship	Malaysia	AFY
Institute of Information Technology	Vietnam	IOIT
Advanced Sci. and Tech. Institute	Philippines	ASTI

for the network connected to the receiver. For uplink from UDL receiver sites to the Internet, terrestrial link from the site to the Internet is utilized. Of course, many Internet protocols have an assumption that each link in the Internet should be bidirectional, so that the UDL receivers and the "feed" station need to handle routing control to make UDL working consistently with other connected networks.

This mechanism is well fit to both communication satellite and many usage of the Internet. Since a single communication satellite can be considered as an amplifier to receive signals from an earth station and retransmit to covered area of its transponder, the nature of the communication via satellite is broadcast. With UDL routing technology, we have to share bandwidth available on the satellite with other members, but theoretically we can use the entire single transponder which can serve us up to 30 Mbps bandwidth as one way link. Currently we are providing 6 Mbps for UDL sites, and it is quite enough for carrying multimedia traffic such as traffic for distance education using video conferencing mechanism and other ordinary Internet applications.

In UDL configuration, we have to use terrestrial link as its uplink to the Internet and available bandwidth on the terrestrial links are around 64 kbps in many cases in our AI^3 project. However, since many usage of the Internet is still

Table 1.3. Chairs of AI^3

Chairman:	Jun Murai,	Keio University
Secretariat General:	Hidetaka Izumiyama,	Wishnet Inc.
Chair of Directors:	Suguru Yamaguchi,	NAIST

Table 1.4. WG Chairs

UDL wg:	Hidetaka Izumiyama,	Wishnet Inc.
	Wan Tat Chee,	USM
DBA wg:	Haruhito Watanabe,	Wishnet Inc.
Multicast wg:	Kanchana Kanchanasut,	AIT
IPv6 wg:	Shunsuke Fujieda,	Keio University
	Tommy Tai Wee Fatt,	TP
	Wan Tat Chee,	USM
Netmon wg:	Kotaro Kataoka,	Keio Univ
	Yan Adikusuma,	NAIST
Multimedia wg:	Sureswaran Ramadass,	USM
	Tan Chen Wei,	USM

along with client server model, clients reside in a UDL receiver site have to transmit data destined for application servers on the Internet but its bandwidth consumption is quite limited. In our experiments, 64 kbps uplink is enough for ordinary usage in many cases. With this UDL technology, we are now connecting 8 more universities in Malaysia, Indonesia, Laos, and Myanmar as shown as Table 1.2.

All the members in our project are listed above.

1.3 Organization

As the growth of our AI^3 organization, we changed our organization structure. Then we prepared working groups as research group. We introduce about the new structure in this section.

1.3.1 Overview of AI^3

Established in 1995, AI^3 (Asian Internet Interconnection Initiatives) is a project aiming for implementation of research and development activities for infrastructure and architecture technology for Internet, evaluation tests in experimental environment, and rollout/deployment of Internet in Asia Pacific Region.

Since its formation of AI^3, Internet environment using satellite line has been built and in operation.

Phase 1 (1996–1998): Conducted research on Internet backbone with use of Ku Band in Asia Pacific Region and built the testbed network connecting Japan, Indonesia, Thailand and Hong Kong. The evaluation results showed that Ku Band with wider range of rain attenuation parameter is applicable for the Internet backbone even in Asia Pacific Region with heavy rainfall.

Phase 2 (1999–2001): C-Band was utilized to expand the service coverage area. We welcomed additional research partners based in Singapore, The Philippines, Malaysia, and Vietnam, and assessed the practicality of satellite line based Internet environment in wider area.

Phase 3 (2002–2003): Taking advantage of broadcasting capabilities of satellite line, application of unidirectional broadcast line was developed. Designed the UDLR protocol to utilize unidirectional satellite line on Internet and implemented experimental study on providing platform base for distance education in this environment.

Since October 2003, this network environment has been utilized as testbed for research and development activities for IPv6 satellite line based Internet infrastructure technology and its standardization initiatives as well as for education/personnel development purposes in Asia.

1.3.2 Organization of AI^3

Reorganization of AI^3 took place in June 2003 and our current organizational structure is as

Table 1.5. Country Representative

Indonesia:	Intan Ahmad,	ITB
Thailand:	Kanchana Kanchanasut,	AIT
Singapore:	Tommy Tai Wee Fatt,	TP
Malaysia:	Sureswaran Ramadass,	USM
The Philippines:	Denis F. Villorente,	ASTI
Vietnam:	Tran Ba Thai,	IOIT

Table 1.6. Taskforce Chairs

Network Operation:	Husni,	Wisnhet Inc.
Information Management and Web:	Hidetaka Izumiyama,	Wishnet Inc.
Human Resources Development:	Suguru Yamaguchi,	NAIST

follows:

Directors are appointed in following 4 categories:

a. Research Working Group (WG) Chairs as Table 1.4
b. Country Representatives as Table 1.5
c. Taskforce Chair(s) as Table 1.6
d. Liaison SOI ASIA Project: Keiko Okawa, Keio University

第 2 章 Site updates

Our network is spread over Asian area. We have 8 partners now. We show update information from each site.

2.1 Asian Institute of Technology (AIT)

2.1.1 Introduction

AIT is a partner of AI^3 project in Thailand. AIT is an international graduate institution of higher learning with a mission to develop highly qualified and committed professionals. We have satellite station which is connected with NAIST, JAPAN through Ku-band satellites.

2.1.2 On a technical side:

- Change of the IP numbering for Ku Band, in order to free some IP addresses for other purposes, the subnet allocated for AIT was reduced from a block of 32 addresses to a block of 16 addresses. This renumbering was carried out in coordination with ITB and NAIST.
- Change of bandwidth on the satellite link, uplink was increased from 512 kbps to 2 mbps, down link was changed from 1.5 mbps to 2 mbps. The change was carried out seamlessly, in coordination with NAIST and JSAT satellite control center.

2.1.3 Events:

- SOI ASIA Operators Workshop 2003 Spring
  AIT hosted the SOI ASIA Operators Workshop 2003 Spring on Feb. 17–24, 2003.
- SOI Asia Project — Realtime ASEAN Interaction
  IT Networking for Human Resources Development and Cooperation in ASEAN
  The Video Conference was conducted on 20 February 2003 by the University of Computer Studies, Yangon (UCSY) of Myanmar, Keio University from Japan and AIT.
- Meeting over internet for the ministry of finance of Japan and Thailand, AIT hosted two meetings where higher officers of both ministries could communicate with each other over internet.
  The remarkable point of the meeting was that, due to bandwidth reservation, a very high quality could be achieved. So forth, meeting participants could chat freely while completely forgetting the technology being used. Since the very beginning, the

conversation become as natural as it could have been over a phone communication.

- School of Internet (SOI-ASIA) Courses and Special Lectures

  AIT joined the following SOI-ASIA courses and special lectures
  - Advanced Internet Technology during January 2003
  - Code Division Multiple Access (CDMA) by Prof. Masao Nakagawa on 9 October 2003
  - Internet Technology by Prof. Suguru Yamaguchi on 9 October 2003
  - Advanced Topics for Fisheries and Marine Science II "Fish Diseases and Health Management" on 29 October 2003 and 13 November 2003
- AIT/Internet2 Workshop, AIT broadcasted the workshop over AI^3 link during 18–20 May 2003.
- Nobel Laureates and Eminent Persons Lectures, AIT broadcasted lectures over SOI-Asia in November and December 2003.

2.2 Advanced Science and Technology Institute (ASTI)

Introduction

The Advanced Science and Technology Institute (ASTI) became a partner of the Asian Internet Interconnection Initiative (AI^3) in August 1999. It established its earth station and became part of the AI^3 network on March 3, 2000.

With our experience as an AI^3 partner and because of the need to have a national research and education network in the Philippines, connecting academe and research organizations in the country to facilitate collaborative activities, ASTI proposed and obtained funding from the Department of Science and Technology for the Philippine Research, Education and Government Information Network (PREGINET) project. PREGINET was established in June 2000 and now connects more than eighty (80) academe, research and government institutions in the Philippines. Organizations connected to PREGINET use the AI^3 link of ASTI to connect to research and education networks outside of the Philippines.

Among the activities and projects supported and enabled by the AI^3 link include:

2.2.1 IPv6

ASTI, through PREGINET, is pursuing the adoption of IPv6 in the Philippines by gaining competency in the technology, advocacy and building partnerships with government, research and academic institutions as well as ISPs and Telecommunications Providers. The ASTI-PREGINET IPv6 team conducts IPv6 R&D activities, deployment, demonstrations, tutorials and workshops.

The team's research and development activities were focused on IPv6 deployment, transition mechanisms and IPv6-enabling network services. The team also conducted research on IPv6-enabled traffic monitoring as well as establishing a testbed for Mobile IPv6. ASTI, through the PREGINET network, is also connected to M6bone via an IPv6-over-IPv6 tunnel where tests on IPv6 Multicast were conducted.

In terms of IPv6 deployment, ASTI established IPv6 networks in selected partner institutions in the Philippines. A total of eight (8) IPv6 links were established which include three (3) academic institutions, which will be conducting research and development on IPv6, and five (5) network service providers that are conducting testbed deployment. In addition, ASTI received from APNIC the first IPv6 address block in the Philippines in 2003. ASTI is now in a transition phase to move its IPv6 network towards the new block and working on peering arrangements between AI^3 and APAN.

In-partnership with Pan-Asia ICT Networking programme, ASTI undertook the "Building a Philippine IPv6 Network Project". Through thefunding from IDRC/AMIC, ASTI was able to deploy IPv6 PC Routers to one institute in each of the three geographic areas of the country (Luzon, Visayas, Mindanao). The strategy is to make

these institutions the "lead" agents for IPv6 adoption in their respective areas. The project also funded the development of informational materials about IPv6 and enabling IPv6 for the most common operating systems and network services. More information on this is available for viewing or downloading at the ASTI IPv6 website (http://www.ipv6.asti.dost.gov.ph). The project started on November 15, 2002 and officially ended last September 15, 2003.

The ASTI-PREGINET group also conducted three (3) IPv6 workshops in 2003, which were attended by almost two hundred (200) participants from the academe, government, and the industry, particularly the network service providers. These workshops were conducted with the University of the Philippines (UP), Asia Pacific College (APC), Technology Management Society of the Philippines (TMSP), Philippine Long Distance Telephone Company (PLDT), and several PREGINET partner institutions in the country. Some support and funding from the Pan-Asia ICT Networking program and some local sponsors were used to fund the workshops.

Last November 25, 2003, UP, PLDT, TMSP and ASTI co-organized a local IPv6 forum, with invited speakers such as Dr. Jun Murai of Keio University, Bill Manning of Information Sciences Institute, and Yves Poppe of Teleglobe of Canada. The forum presented ideas on IPv6 applications, operations, and possible business models that companies can use in adopting IPv6. The event was attended by industry players from the ICT sector and representatives from the academe and from the government, particularly from the regulatory and advisory bodies on ICT.

2.2.2 Multimedia over IP Technologies and Applications

The ASTI-PREGINET team also undertakes R&D on Multimedia over IP technologies and applications. These technologies and applications that are deployed over PREGINET include video-conferencing, videostreaming, video-on-demand, and voice over IP. New applications, such as Access Grid and Integrated Virtual Learning Environment, have been evaluated and tested for deployment over the PREGINET network. The applications deployed over PREGINET are used to facilitate coordination and research collaboration among connected institutions in such areas as agriculture, distance learning, bioinformatics, and disaster mitigation.

Testbeds on IP Multicast and Access Grip are in the process of being set-up. The multicast testbed is being used to evaluate MBONE tools such as VIC, RAT, SDR, NTE and WBD, for possible deployment over PREGINET. A series of deployment activities on the multimedia over IP applications is scheduled this year. The pilot sites identified for the deployment of IP multicast conferencing include Bicol University (BU), UP Open University (UPOU), and Central Visayas Information Sharing Network (CVISNET).

Research activities on Access Grid were also started in 2003. The initial phase of the implementation of the Access Grid initiative includes the conduct of several tests to evaluate the multicast connection of PREGINET network to the international R&E networks. The Access Grid initiative was also presented in the AI^3 meeting in Vietnam last October 2003. During the meeting, an Access Grid Technical Working Group was created to facilitate the implementation and deployment of Access Grid over the AI^3 network.

This year, the ASTI-PREGINET team is also scheduled to deploy applications that will enhance distance education initiatives such as the Integrated Virtual Learning Environment. Ongoing evaluation on the technologies and tools for this application are being conducted.

2.2.3 Network Management and Monitoring

ASTI-PREGINET team also conducts research and development on new tools to monitor and manage a network. To maintain the health and availability of the PREGINET network, ASTI developed a web-based network monitoring

system. ASTI has shared information on network monitoring tools with the administrators of PREGINET partner institutions and with other researchers abroad.

The team has developed an integrated, web-based network monitoring tool that monitors various types of network devices and systems, and manages the performance of a network. The tool automatically notifies network administrators on detected network problems and allows network administrators to resolve network problems. It is now currently in the testing stage of its development.

2.2.4 Digital Content System

ASTI-PREGINET team has developed and set-up a digital content system capable of handling digitized documents. The system is made available for use by PREGINET partner institutions over the network. Documents that can be uploaded and stored easily include theses, dissertations, researches, journals, and other publications, even audio and video files of trainings, seminars, and workshops. It also serves to enhance collaborative intellectual activities.

2.2.5 SOI-Asia

DOST-ASTI and PREGINET partner institutions participate in the activities of SOI-Asia through lectures, tutorials, and interactive discussions. Last 2003, PREGINET participated in SOI activities on "Interactive Discussion on Distance Education" and on "Realtime ASEAN Interaction on IT Networking for Human Resources Development and Cooperation in ASEAN". DOST-ASTI is also promoting to PREGINET partner institutions, including the UP Open University, the activities of SOI-Asia. The team also plans to develop a website dedicated to all the activities and participation in the SOI-Asia project.

2.2.6 Papers Published for 2003

- "Characterization, Analysis and Visualization of Traffic in the AI^3 Satellite-based Research Network Testbed" presented at the SAINT 2003 Conference in Florida, USA last January 2003.
- "Deployment of IP Multicast over the Philippine Research, Education and Government Information Network (PREGINET)" presented at the National ECE Conference last November 2003 in Cebu City, Philippines.
- "Mapping Cybergeography of the Internet Architecture, Implementation and Future Applications of Internet Mapping" presented at the National ECE Conference last November 2003 in Cebu City, Philippines.

PREGINET's connection to the AI^3 network facilitates Philippine's access to information and enhances interaction between the local R&E institutions with other international R&E networks. Researchers in the country were provided with the opportunity to gain operational experience in satellite-based and next-generation networking technologies and applications as the Philippines establishes and expands its own R&E network. Attachment A shows the network diagram of the DOST-ASTI PREGINET connection to the AI^3 network.

2.3 Institute of Information Technology (IOIT)

2.3.1 Institute of Information Technology

- Establishment:

  1976: Institute of Computer Science and Cybernetics (ICSC).

  1989: ICSC was renamed Institute of Informatics (IOI).

  1993: IOI, Center for System and Management Research and Center of Applied Mathematics merged into Institute of Information Technology (IOIT).
- Staff:

  There are 200 people. Among them, 60 Dr. Sc. and Ph.D, 16 Prof. and Ass. Prof.
- The functions:

  Carrying out the studies of basic problems of informatics, mathematical and technical

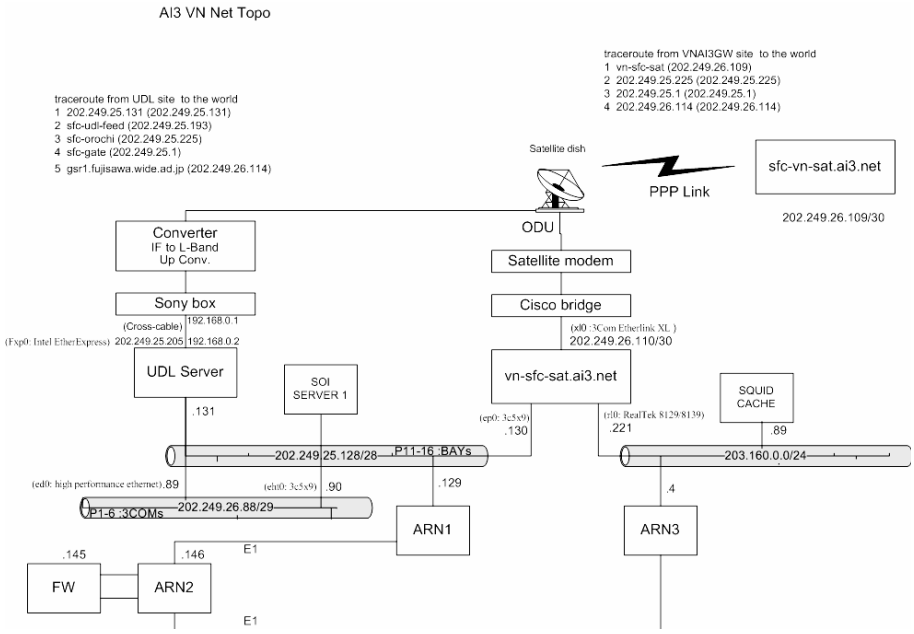

Fig. 2.1. IPv4 network topology

aspects of IOIT, the application of IOIT in socio-economic systems and industrial manufacturing processes. Design and development of IOIT products, especially software. Development of IOIT applications in different sectors, transfer of technologies in the field of IOIT, technical consulting in some of governmental IOIT projects in administration as well as in other sectors of economics. Training of scientific researchers on IOIT. International cooperation in IOIT.

- Main facilities:

  Institute's LAN has been served as NCST's Campus Network Center, basing on switched Ethernet on Fiber Optics and Twisted-Pairs and serving nearly 400 PCs, SUN Workstations, Digital Alpha Servers, interconnected by Netware, Windows NT, UNIX using TCP/IP. Platforms are heterogeneous, including Windows and UNIX, various databases and different tools for developing integrated database systems, information management systems and other software packages. IOIT is one of the first four Internet Service Providers (ISP) in Vietnam, providing services for E-mail, FTP, Telnet and World Wide Web (WWW). The Institute has a key-laboratory for Networking Technology and Multimedia.

- Major R&D Activities

  Computer Science: Artificial intelligence, Pattern recognition and Image processing, Programming languages, Parallel processing, Information cryptography.

  Software Engineering: Distributed database, computer graphic, software engineering methodology, system analysis and design, multimedia, geographical information systems, management information systems.

  Technical Informatics: Networking, informatics on telecommunication, system support.

  Industrial Automation: Advanced control technologies, modern control theory, robotics, embedded control, PC based control systems.

  Mathematical Aspects of IT: Mathematical modeling, numerical methods, computational statistics.

  IT for Socio-Economic Systems: Economic models, economic system analysis, analysis, design and implementation of computerized information system for socio-economic activities.

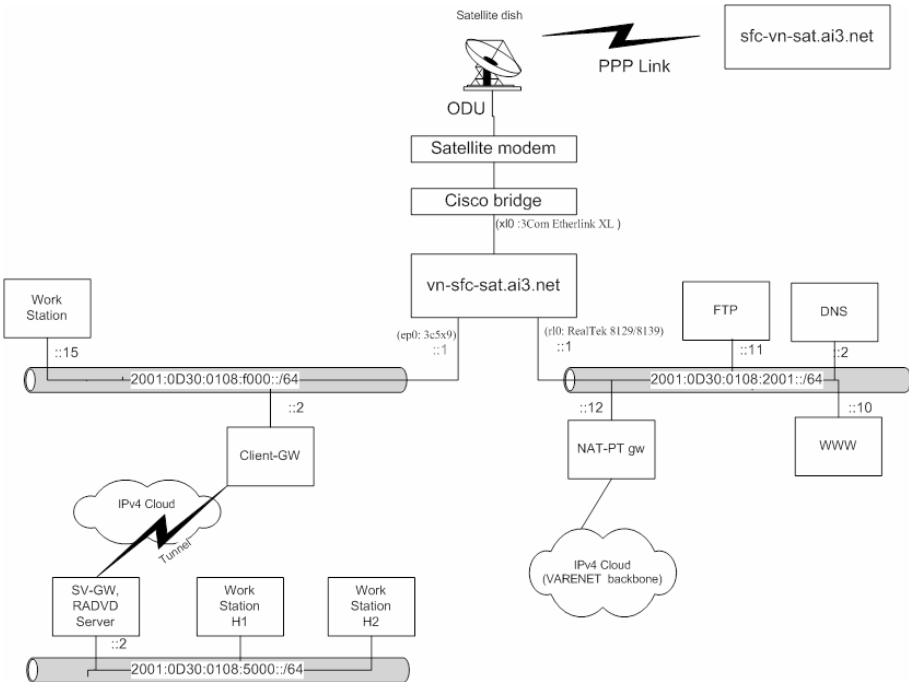

Fig. 2.2. IPv6 network topology

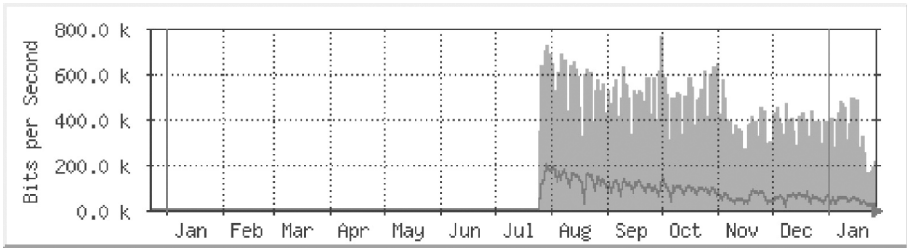

Fig. 2.3. C-Band Bandwidth utilization — year 2003

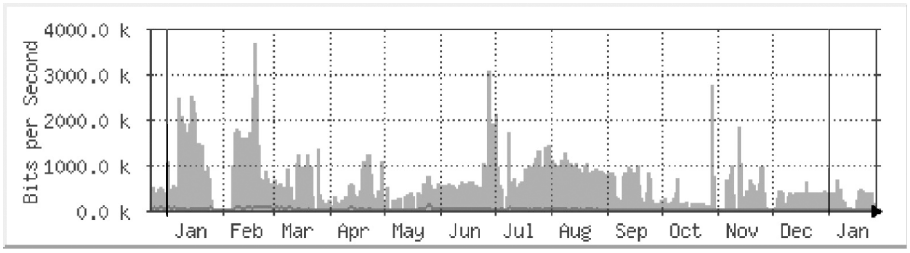

Fig. 2.4. UDL bandwidth utilization — year 2003

2.3.2 Network Topology

We have some graphs in this section. Figure 2.1 shows IPv4 network topology with IOIT. We also have IPv6 testbed network as Figure 2.2. We are researching about IPv6 technology and applications on the testbed. In addition, we can see network statistics in 2003 from Figure 2.3 and Figure 2.4.

2.4 Research

- IP6 to IPv4 transition mechanisms: NAT-PT, tunneling

  Description: NAT-PT gateway allows IPv6 only network to access services in IPv4 only network and vice versa. It is represented as Figure 2.5

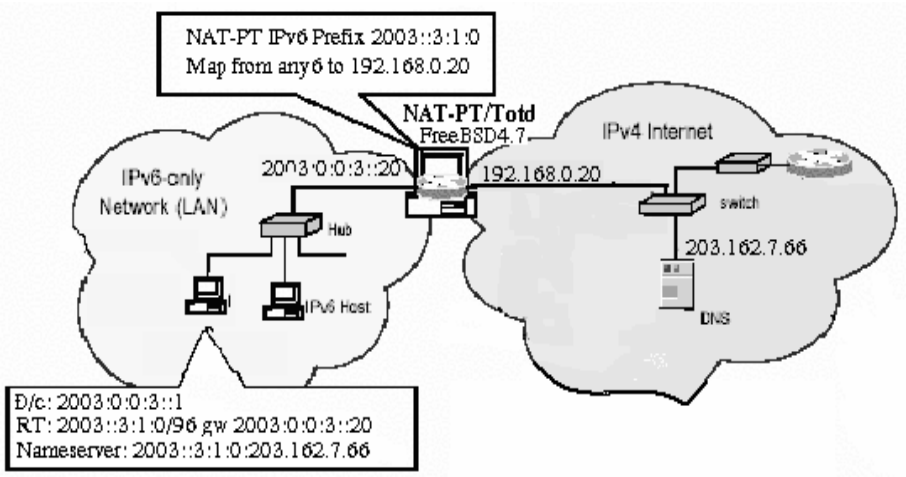

Fig. 2.5. NAT-PT experiment

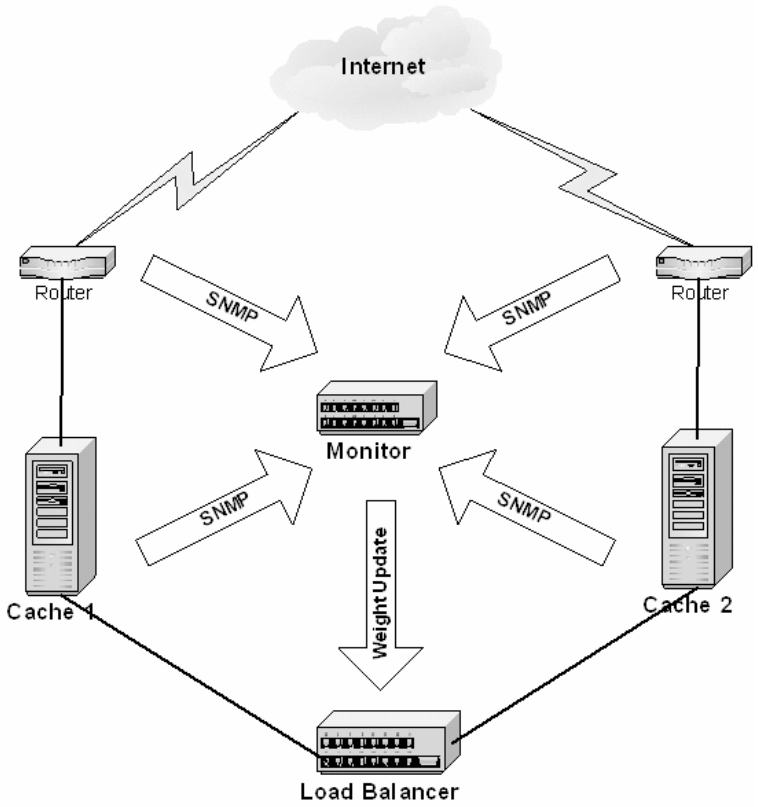

Fig. 2.6. Load balancing scheme

Configuration: NAT-PT gateway
- Intel P4, 256 MB RAM
- FreeBSD 4.7 later
- KAME's NAT-PT patch
- Totd

• Adaptive load balancing: keepalived, snmp, linux virtual server Description: The Load balancer distributes HTTP requests to different cache servers. Each cache server connects to different Internet link. The weight of distributed requests will be determined by calculating average load for each link and will be updated dynamically (See as Figure 2.6).

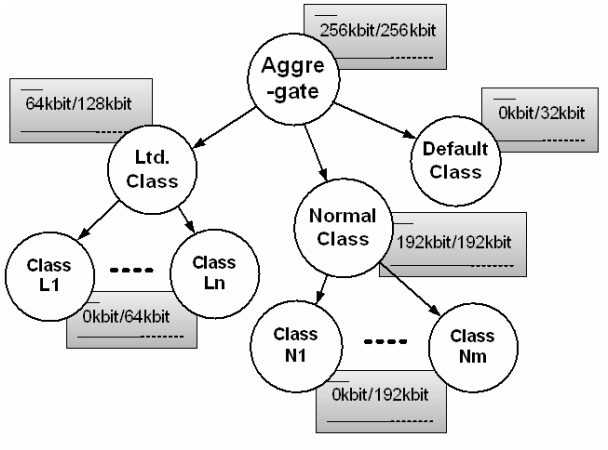

Fig. 2.7. Traffic shaping scheme

Table 2.1. Operation activities

Number	Date/Time	Task	Status
1.	25 Jun 2003	IPv4 address renumbering	Done
2.	3 Nov 2003	IPv6 address renumbering	Done
3.	14 Nov 2003	UAT report	Done
4.	20 Nov 2003	DBA client installation	Done

Configuration:

- Loadbalancer: RedHat Linux 9.0, linux virtual server, keepalived, snmp
- Monitor: RedHat Linux, snmp
- Cache server: RedHat Linux, squid

• Traffic shaping on Linux

And also, we propose traffic shaping mechanism on Linux (See Figure 2.7). It can contain many policies about traffic characteristics.

Description: A Linux gateway manages bandwidth using HTB (Hierarchical Token Bucket) queue mechanism

Operation activities

AI^3-VN 2003 operation was smooth administratively and technically, including hosting AI^3 Autumn Meeting in Danang, Vietnam 2–4/Oct/2003.

2.5 ITB

2.5.1 Introduction

This report will give some summary of ITB's network activity, which is using AI^3 Internet connectivity for both Ku and C-Band links.

2.5.2 Operation

• Renumbering

- IPv4 renumbering was done on August 2003
  - ∗ NAIST-ITB Sat from 202.249.24.228/30 to 202.249.24.224/29
  - ∗ ITB NOC from 202.249.24.64/27 to 202.249.24.64/28
- IPv6 renumbering was done on November 2nd 2003
  - ∗ ITB-POP from 2001:200:800:3000::/64 to 2001:d30:103::/48
  - ∗ ITB-ORG from 2001:200:830::/48 to 2001:d30:3::/48

• AI^3 Satellite Bandwidth Allocation change

- Ku-Band

  On October 10th 2003, we finished the UAT process.
  - ∗ uplink changed from 1536 kbps to 2048 kbps
  - ∗ downlink stayed at 2048 kbps
- C-Band On November 14th 2003, we finished change the receiving parameters on

sony box (RO site). Change receiving UDL (shared) from 6600 kbps to 9690 kbps.

- DNS Operating 3 main name servers, they are:
  - ns1.itb.ac.id
    IPv4 Address: 167.205.23.1 and 202.249.24.65
    IPv6 Address: 2001:d30:3:0:250:baff:fecb:9fcf and 2001:d30:103:3000:202:44ff:fe16:58e1
  - ns2.itb.ac.id
    IPv4 Address: 167.205.22.123
    IPv6 Address: 2001:d30:3:1:200:21ff:fee0:6d2e
  - ns3.itb.ac.id
    IPv4 Address: 167.205.64.158 and 167.205.30.114

  Successfully upgrade to BIND 9.2 (ns2 using 9.2.3 RC3), ns2 using BIND-9.2.3-RC3, we are ready to serve IPv6 transport.
  Domain and reverse handled by ITB's dns server are shown on Table 2.2.
  Known Problems and troubleshooting:
  - Missing other domain.
    just wait until the missing domain can be resolved
  - Lame Server.
    block dns server that cause lame server
  - Quota reached for recursive client.
    block dns server that cause recursive client
    increase recursive parameter
    upgrade ns1.itb.ac.id

  TODO:
  - IPv6 reverse delegation.
    2001:d30:3//48 and 2001:d30:103::/48 reverse is handled by ns1.itb.ac.id
    reverse for IPv6 subnet will be delegated to ns2 and ns3
- SMTP
  - Operating 3 MX servers (mx1, mx2, and mx3.itb.ac.id), each using Postfix 2.0.7 with tls+ipv6-1.13-pf-2.0.7.patch
  - mx-out.itb.ac.id
    load balancing server using cisco catalyst 6500 (not IPv6 compliant)
    provide outgoing SMTP for 167.205.0.0/16
  - filtered by RBL
    - sbl.spamhaus.org (transfer zone)
    - relays.ordb.org
  - filtered by regex
    ftp://ftp.worldless.net/pub/postfix/
  - migrate mailing-list from ezmlm to mailman 2.1.3
- Cache Operation
  - Running 4 servers (cache1-cache3.itb.ac.id, ganesha.itb.ac.id):
    - 2 servers for internal users (approx. 3000)
    - 1 server for other institutions connect to ITB (via IEEE 802.11 wavelan and others)
    - 1 server for dial-up users
  - Each configured as:
    - Parent to sfc-cache.ai3.net:8080
    - Sibling to the other server
  - 1 server running squid-ipv6 (2.5 devel):
    - Obtain additional http traffic from UDL (and others configured to parent from it)
    - IPv6 users

Table 2.2. List of Domain That ITB's nameserver Handle by

domain itb.ac.id	domain stsi-bdg.ac.id
reverse 167.205/16	domain att.ac.id
reverse 202.249.24.64/28	domain unpas.ac.id
reverse 202.249.26.80/29	domain ukm.ac.id
domain itb.ai3.net	domain stt-sfb.ac.id
domain itb.edu	domain sttt.ac.id
domain itb.net.id	domain pedc.ac.id
domain ganeca.net	domain p3gt.ac.id
domain unsoed.ac.id	domain ikip-bdg.ac.id
domain itsb.ac.id	domain lpkig.ac.id
domain ikip-manado.ac.id	domain freebsd.or.id

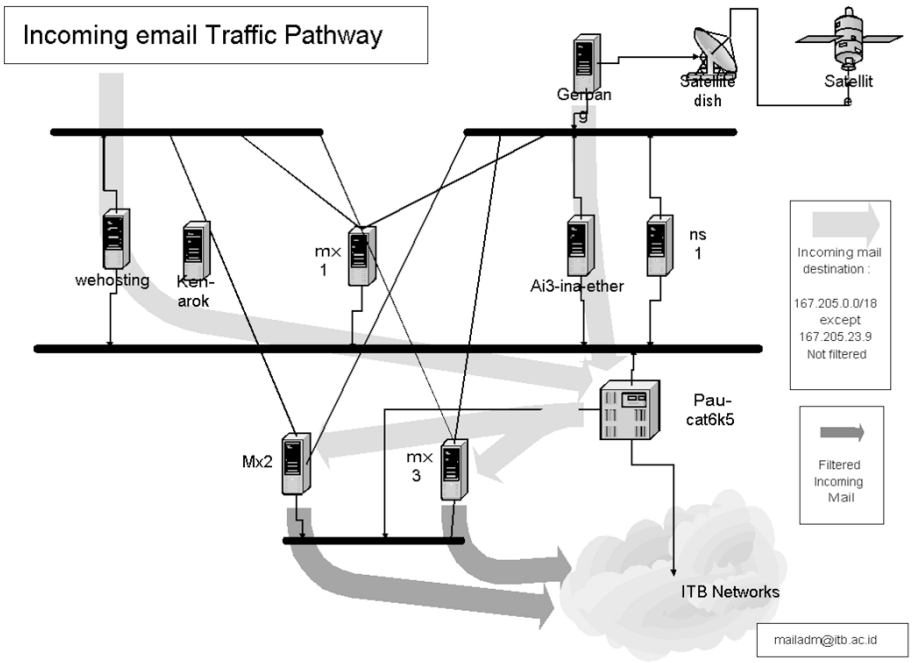

Fig. 2.8. ITB's SMTP Schema

∗ On-demand special request

– Policy routing (by husni):

∗ http port 8080 (from sfc-cache to ITB)

∗ http port 80 (from direct-Internet to ITB)

• Traffic Utilization

– Available connection:

∗ 2 Mbps (KU) +6 Mbps (C/shared) downlink

∗ 1.5 Mbps (KU) uplink

– Major permitted services: http, http proxy (8080), smtp, dns, ftp, irc, telnet, ssh, cvs

– Traffic classification/prioritization:

∗ control = (routing + icmp)

∗ interactive = (dns + telnet + ssh)

∗ http

∗ smtp

∗ non interactive = (ftp + cvs + rsync)

– Average bandwidth spent:

∗ 700Kbps (KU) uplink and 1.3 Mbps (KU) downlink

∗ 2.5 Mbps (C) downlink, including 512 Kbps multicast from sfc-wmt

– Monitoring tools:

∗ Daily summarization

· netman, http://netman.itb.ac.id

· mrtg

∗ Real-time monitoring (1 second)

· altqstat, part of altq

· ttt, part of tele traffic tapper

– reference

`http://www.ai3.net/op/mrtg/sat/nara-sat.ai3.net_1.html`

`http://soi-asia-netmon.ai3.net/host/detail-if?if_id=8`

• School of Internet ITB as member of AI^3 has been involved in SOI-ASIA project. ITB has got a lot of benefits from SOI-ASIA courses for human resources development. The courses that has been carried by ITB can be shown on Table 2.3.

– On June 2003 we got new audio equipment generously provided by School of Internet Asia Project. So ITB began to use that new audio equipment for next lectures and events

– The participants in SOI-ASIA lectures at ITB very variations, On Advanced Internet

Table 2.3. List of Courses That ITB has been Taken

11 November 2002– 23 January 2003	Advanced Internet Technology: Grid computing, Multicast Measurement and Analysis IPv6 infrastructure Architecture TCP/IP congestion control Security, Satellite and Internet Mobility and routing technology
2 July 2003	Interactive discussion on "Interactive Distance Education"
8 October 2003– 9 October 2003	The Future of Indonesian Technology: CDMA and IT
29 October 2003– 13 November 2003	Fish Management and Health Management: Diseases problem in prawn farming Genetic linkage maps and QLTS associated with viral disease resistance in fish Diseases problems in fish farming Immunological control for fish diseases

Fig. 2.9. SOI Class Room at ITB

Technology lectures, we have many participant, but on Fisheries lecture we have only one participant

– ITB has been established SOI working group, chaired by Mr Jaka Sembing, MEng. So, ITB now have formal organization to carry on SOI lectures

– On March 2004, we plan to give lecture on Biotechnology and Bioinformatics (first quarter).

One of pictures on ITB's SOI classroom is shown on Figure 2.9.

2.5.3 Research Activity

- IPv6
  - Objective
    - Part of our contribution in AI^3 community to be active, especially on network research and deployment
    - To become one of the pioneers in our country which has been deploying and operating IPv6 network:
      - Gain more experience, and use it later for network research and academic purposes
      - Share and help our local ISP how to deploy and populating IPv6 network

2.6 Milestone

- On 02 February 2003 began change old scenario (tunneling networks) with Itojun-san's suggestion (vlan trunking)
  - Base on problem that existing subnets defined on vlans on our backbone-routers, but they currently don't support IPv6 (cisco catalyst 6000 series, MSFC1)
  - Attach a PC-router with its physical-interface configured as trunk (and receive every vlan)
  - Configured vlan interfaces to existing vlans, and deploy IPv6 subnets
  - Status: succeed deploying 4 main routers on west, north, dan south campus. These are running freebsd4, freebsd5, openbsd33,and netbsd161, all of them using kame-snap kernel, and interconnected using tunneled-links
- At the same time we begun to interconnect IPv6 subnets with IGP using zebra routing daemon
  - Redistributing old prefix 2001:200:830::/44, and at (02/11) change to new AI^3 sTLA segment with prefix 2001:d30:3::/48

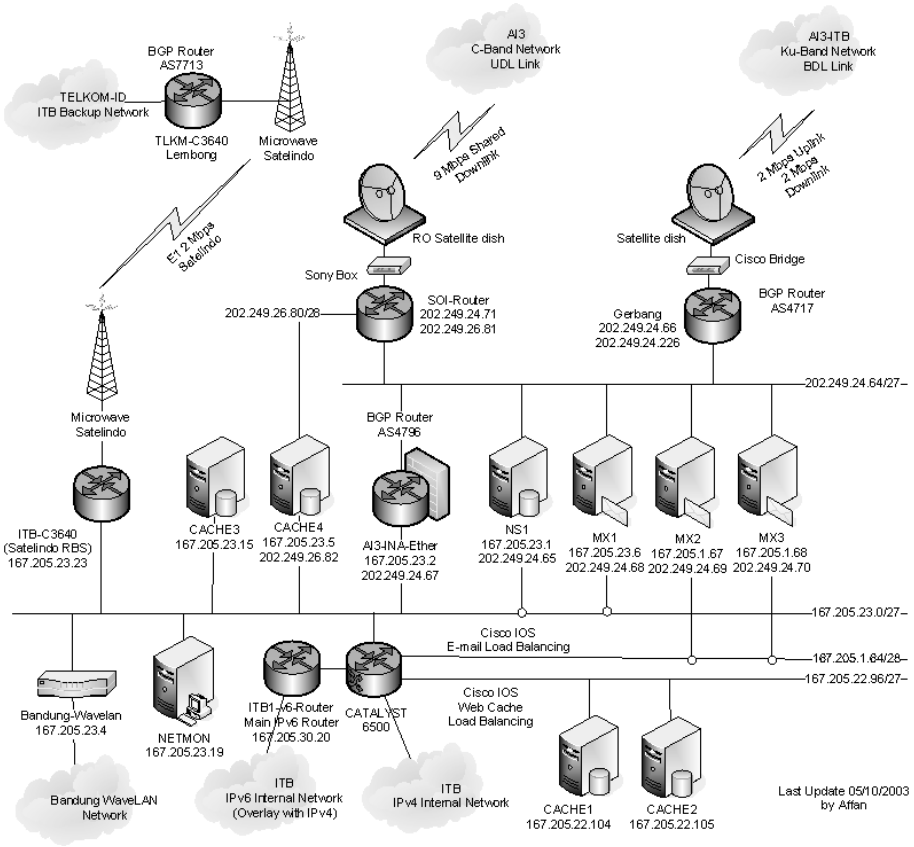

Fig. 2.10. Our NOC Diagram for IPv6

- Unicast routing mainly deployed using OSPFv3 (ospf6d implementation), and only a few using RIPng (only for certain leaf-subnets)
- Status: currently 19 router (vary from freebsd2-freebsd5, openbsd, netbsd, and Linux) participating on OSPFv3 and connecting 25 IPv6 subnets with native connectivity

• On 25 June 2003 Began to deploy Multicast routing using PIM6-SM (pim6sd implementation) on every router
- Not too success, as the tested applications (vic, rat, videolan) don't work the same way as they do on IPv4 networks
- Still having problems with RP selection

• TODO
- Deploy to every IPv4 subnets (250 routing entries) using unified backbone topology
- Providing more dual-stack services for local communities
- Populating IPv6 DNS Resource Records for IPv6 nodes, obtain sTLA from APNIC
- Achieve stability for IPv6 routing, especially on multicast routing
- More research topics and papers

Our IPv6 NOC diagram is shown on Figure 2.10.

• AVIST Project

On the end of October 2003, ITB was invited by Asian Institute of Technology (AIT) for training course in VCLASS for Asian Virtual Institute of Technology (AVIST) technical support. ITB send mr Mohamad Dikshie Fauzie to complied with that training.

AVIST is ASEAN virtual class organization model, it was endorsed by ASEAN Sub-Committee on Infrastructure and Resource Development (ASEAN SCIRD) and ASEAN Committee for Science and Technology (COST). The main purpose of setting up AVIST is to contribute to the development of science and technology human resources in ASEAN countries through the provision of vocational training, and continuing professional educational opportunities to various Science and Technology sectors by leveraging on the innovative use of information and communication technologies such satellite, internet as well as web-based courses and programmes. The five days training agenda can be shown on Table 2.4.

ITB has been setting up vclass software on http://mawar.comlabs.itb.ac.id and AVIST project and vclass software has been presented on E-Learning seminar on 11 December 2003 at ITB campus. Upon completion of the training, the trainee organizations will mandatory become AVIST technical support or national dissemination centers via mirror

Table 2.4. Five Days Training Agenda

27 October 2003
Opening Ceremony
Introduction to VClass
Students learning functions
Basic web server
Practice on video streaming
28 October 2003
VClass authoring tools installation and practice
VClass authoring tools usage and practice
Making class on demand I
Making class on demand II
29 October 2003
Course management
Practice on course management
Class management
Student tracking and evaluation
30 October 2003
Registry functions
Administration functions
Advanced video streaming and vclass integration
Practice on real time classroom on internet setup
31 October 2003
System installation
VClass installation and maintenance
Summary
Closing Ceremony

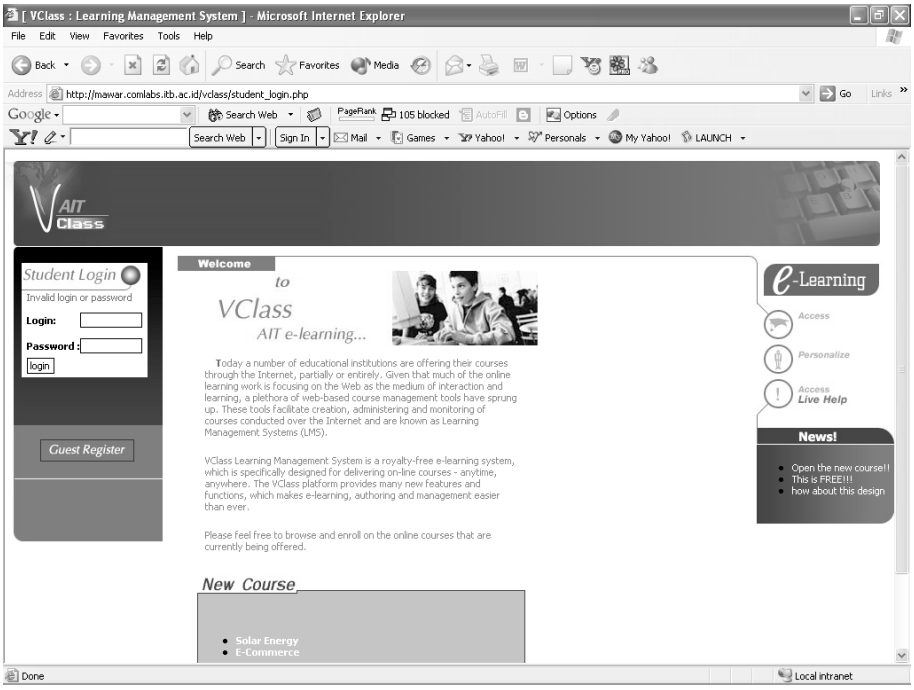

Fig. 2.11. Students Login Screenshot

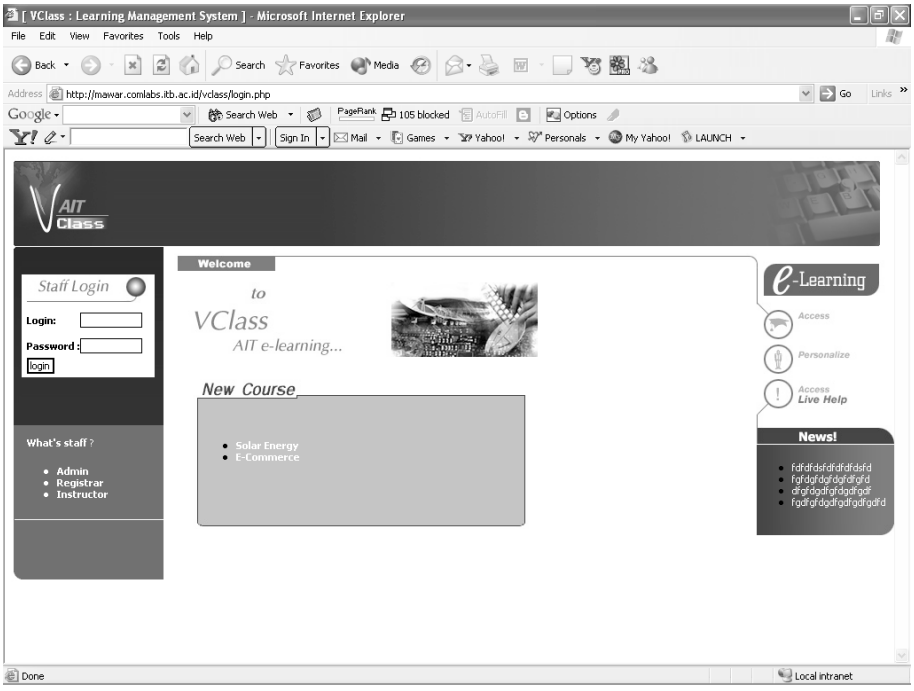

Fig. 2.12. Staff Login Screenshot

sites establishment to carry AVIST materials for local access using VClass platform developed by DEC/AIT. Screenshots of VClass software are shown on Figures 2.11 and 2.12.

2.7 TP

2.7.1 Introduction

The Satellite Internet Competency Unit (SICU) from the School of Engineering, Temasek

Polytechnic, operates and maintains the Satellite Network Operations Center (NOC) to the AI^3 in Singapore. In addition, we also have separate satellite connectivity to USM in Malaysia, via the MeaSat2 satellite. Primarily, we conduct satellite-internet related projects with our partners, both local and overseas.

2.7.2 Activities For The Year 2003

1. QoS (Quality of Service) over Dynamically Assigned TDMA Satellite Network This is a collaboration project with USM and NTU, with funding support from our government agency, Singaren, using the satellite link provided by Binariang over the MEASAT2 satellite. A presentation on this project was made during the APAN 2003 Conference, held at Fukuoka, Japan, on 23 Jan 2003. In addition, the interim results of the experiments were also shared with other interested partners during the Singaren Broadband 21 Symposium held in Singapore on 15 March 2003.
2. Study of UWB Interference on Fixed Satellite Downlink System
   This is a collaboration project with our regulatory body, IDA (Infocomm Development Authority), to look into the possible interference on satellite system due to Ultra-Wideband Emission. The field tests were conducted using the satellite downlink from MeaSat2 satellite, with a number of UWB devices emitting near the receiving satellite dish.
3. Tutorial Presentation on "ATM over Satellite" at SAINT2003
   SICU presented a topic on "ATM over Satellite" at SAINT2003 workshop on 27–31 January 2003.
4. Distance Education
   A Distance education has been conducted at Oct 2003 involving TP from Singapore, ASTI from Philippines and USM from Malaysia. A full Bidirectional video conference with document sharing was carried out.
5. Mitigation of Rainfade on Satellite Link
   A collaboration with Nanyang Technological University (NTU), our local partner, to look into ways to mitigate the effect of rainfade on satellite transmission.
6. JAXA Visit
   JAXA has visited TP to explore possible collaboration with them on the WINDS experiment using their experimental Ka-band satellite, which will be launched in 2005.

2.8 University Sains Malaysia (USM)

2.8.1 Introduction

Currently Network Research Group from School Of Computer Science, Universiti Sains Malaysia hosts the AI^3 Malaysia Network Operation Center (NOC). We are allocated bandwidth of 1.5 Mbps down link and 512 Kbps uplink by the AI^3. Also, we own AS 17815 for our native IPv6 network. Our native IPv6 network links to other native IPv6 network on the Internet thru AI^3 native IPv6 network.

Research collaborations are being done with other partner such as Temasek Polytechnics at Singapore and ASTI at Philippines. Basically our research activities focus on these topics

IPv6 over satellite. Video Conferencing over satellite. QoS issue IPv4 and IPv6 traffic for satellite links. Distance Education. IP over DVB-s.

2.8.2 Operation

1. QoS (Quality of Service) over Dynamically Assigned TDMA Satellite Network USM has collaborated with Temasek Polytech to research on this topic using the secondary link of both institutions. Satellite bandwidth was provided by Binariang using MEASAT2 satellite. This project ends at 30th September 2003.
2. QoS of IPv6 Traffic Over Satellite Link
   This project aims to look into the performance of IPv6 traffic on satellite link environment. The result of the study has been presented at AI^3 Meeting at Tokyo.

3. Distance Education

   A Distance education has been conducted at Oct 2003 involving TP from Singapore, ASTI from Philippines and USM from Malaysia. A full Bidirectional video conference with document sharing was carried out.

4. IPv6 Workshop

   An IPv6 workshop was conducted for research communities in Malaysia. The aim is to promote IPv6 awareness amongst Malaysian research community.

5. Fix for Osprey card to run MCSv5.

   Most of the UDL partners in AIII uses Osprey video capture card for SOI-ASIA video conference. MCS was found not compatible with this card. A program has been developed to change the setting of the card so that it will be compatible with MCS.

6. Installation Of VoIP equipment and DBA client

   DBA client and VoIP equipment were installed and configured by Mr. Watanabe Haruhito on November.

7. IPv6 Address Renumbering

   IPv6 address renumbering has been done. New address is as follow

   AIII-MY NOC: 2001:0D30:0006::/48

   USM Pop: 2001:0D30:0106::/48

2.8.3 Research Activities

- Unidirectional Full Mesh Satellite Link using IP over DVB-s.

  The aim for this project is to setup a unidirectional full mesh satellite network using the low cost DVB equipment. Driver development for linux kernel 2.4 is still in progress.

  Paper published in 2003:

  "Deployment of UDL Mesh Satellite Networks using DVB-S Technology," Proceedings Asia Pacific Conference on Communications 2003 (APCC 2003), Penang, Malaysia, Sep. 21-24, 2003.

- Connecting IPv4 Islands in IPv6 Internet.

  This project will look into the idea of connecting IPv4 islands in IPv6 Internet using existing and new migration protocols (e.g., 4to6 and 6to4).

2.9 SFC

SFC is the hub-station of AI^3 C-band network. USM, ASTI, TP, IOIT and NUOL are connected to SFC using bi-directional satellite link. SFC also has a UDL feeder, and it transits all UDL traffic to partners. SFC has connections to APAN and WIDE, which are the upstream AS of AI^3. Besides that, SFC and NAIST are connected by wide-area Ethernet. SFC site has several important machines, WWW-cache server, shared-CPU-server, secondary DNS server, and SOI machines.

2.9.1 Bandwidth Re-allocation

AI^3 modified the bandwidth allocation of C-band satellite links on 14th November 2003. On this modification, the carrier assignment of the UDL was changed and its bandwidth was increased from 6 Mbps to 9 Mbps. The carrier assignment of the Vietnam links and the Laos links were changed without changing their bandwidth. Figure 2.13 shows the new carrier assignment of C-band satellite links.

AI^3partner sites and SOI-ASIA partner sites changed their satellite link configuration for the new bandwidth allocation. SFC carried out some measurements to check the spurious radiation by the UDL bandwidth increase. AI^3 partner sites passed their uplink access tests with the satellite control center of JSAT, and the bandwidth allocation was completed on that day. Because SOI-ASIA partner sites are receive-only, we confirmed the recovery of UDL connectivity by the report of receiving carrier status at each SOI-ASIA partner site.

2.10 Monitoring of UDL Traffic

In this year, SFC monitored the traffic on the UDL. The Figure 2.14 is all traffic of the UDL partners for a half year. Brawijaya University and ITB are using the UDL heavily. The traffic to

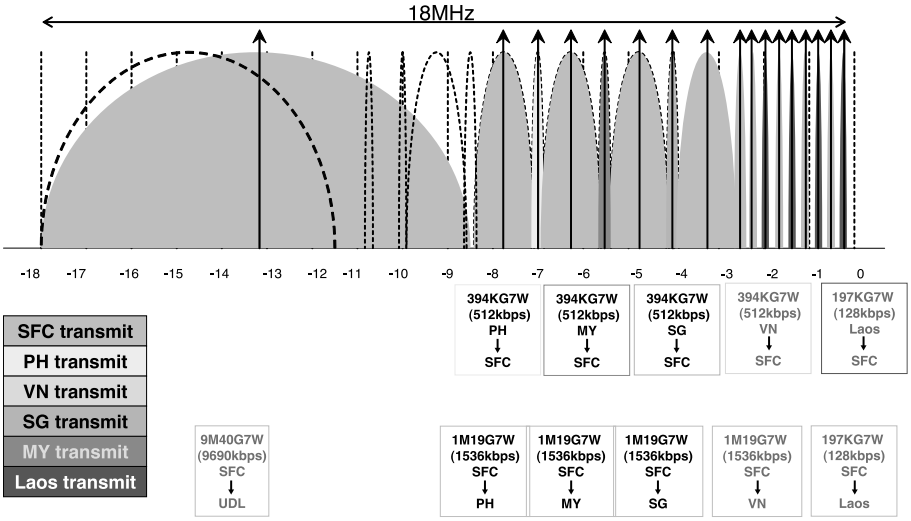

Fig. 2.13. C-band Carrier Assignment

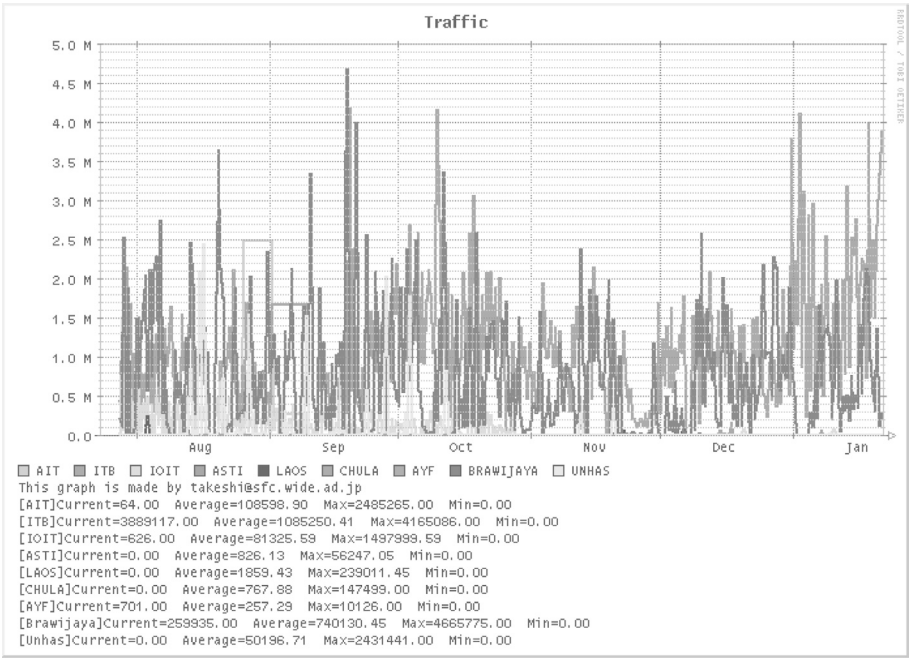

Fig. 2.14. ALL UDL partners Traffic

Brawijaya is destined to its UDL site segment, while AI^3 policy routing mechanism route some traffic to ITB via UDL.

Figure 2.15 is the traffic measurement classified by the purpose. The lowest bar in the graph means the traffic related to SOI-ASIA, which is multicast traffic to groups 233.18.109.1–233.18.109.5. The middle bar is the policy routing traffic. Policy routing load balances the traffic to ITB and AIT between the bi-directional satellite link and UDL because their traffic sometimes beyond the limit of bi-directional link. In such partners, the traffic for the P2P link go through the UDL by the policy routing software. We monitor only the traffic which go through the UDL by the policy routing software. The top bar in the graph is the commodity traffic to the UDL partners. The traffic on UDL increases steadily, thus we use priority queuing when it is over the limit. SOI-ASIA related traffic takes the highest

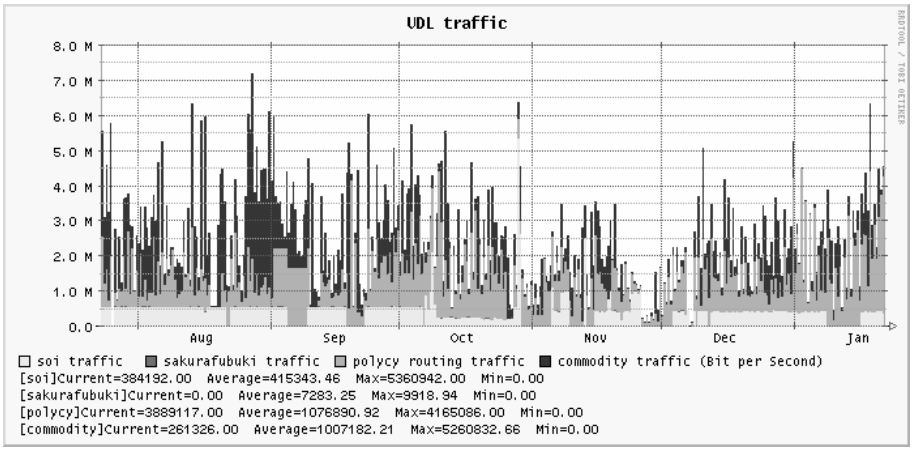

Fig. 2.15. Policy based UDL Traffic

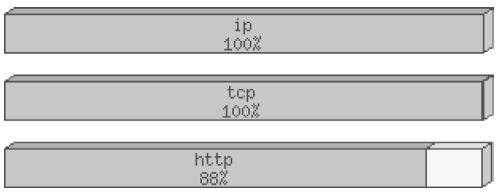

Fig. 2.16. the protocol distribution for Brawijaya University

priority, and policy-routed traffic is the second priority.

We are monitoring the protocols of the traffic to UDL partners everyday. Figure 2.16 is the result of Brawijaya at 10/9. Now, most of the UDL partners use the bandwidth for HTTP access, and some of them use Squid web-cache.

2.10.1 Operation Topic

January 17, 2003

IP tunneling connection between SFC and NAIST was established. This link is for redundancy of connectivity between SFC and NAIST.

January 18, 2003

BGP peering with USM (AS17815) established. AI^3 provided transit connectivity through SFC site.

February 20, 2003

Stopped redistributing BGP routes to ospf on sfc-apan-gate and gr2000. All Backbone routers were connected by IBGP (IBGP hack operation started). AI^3 had two route-reflectors. One is sfc-gate in SFC and the other is gr2000 in NAIST.

March 11, 2003

Researched in the utilization of ip addresses at all subnets in AI^3. The result was discussed at AI^3 meeting in June 2003.

march 24, 2003

SFC-GATE broke down. The machine hardware was changed to another one as short-term solution.

June 19, 2003

There was AI^3 meeting in Tokyo and discussion about new ipv4 address assignment policy. Some sites returned /27 and got /28, and all bi-directional satellite links assigned /29 for backup router to connect in both side. Then ipv4 address renumbering schedule was fixed.

July 19, 2003

New Advisory from cisco came, so we upgraded IOS on some routers.

July 23, 2003

IPv4 address renumbering on each satellite link was done.

August 18, 2003

The sfc-gate was replaced to new hardware, and the sfc-sat2 which is the main router connected to satellite link was installed. They have RAID-1 backup system and more ethernet ports than old one. Both of sfc-sat and sfc-sat2 connects to all C-band partners for redundancy.

August, 2003

The UDL Partner NUOL was connected with bi-directional satellite link of 128 kbps. Because there was no available terrestrial link from NUOL to SFC.

August, 2003

SFC and NAIST renumbered ipv6 addresses.

January, 2004

The sfc-gate and gr2000 were configured as IPv6 route-reflector.

In progress

Now, we are in preparation of the IPv6 BGP peering with Partners, and DNS delegation of subdomains and reverse dns from AI^3 to partners.

2.11 NAIST

2.11.1 about NAIST

NAIST is an advanced institute in Japan. NAIST is one of the two AI^3 sites located in Japan besides with SFC site. It plays transit network such as transferring any traffic between partners and provide DNS and WWW services.

2.11.2 Network

NAIST AI^3 site has two satellite links with Indonesia (ID) and Thailand (TH) on Ku-band. It provides connectivity to the Internet for each foreign site. And it also has ground link to Keio Univ. (SFC). Sometimes our network is used for transmitting Remote Education Program provided by WIDE SOI group from SFC. At the time, our network is used for transferring the program from SFC site to partners in foreign country.

Our links are upgraded to 2 Mbps one in order to traffic gain in this year.

1. For ID link
   Ku-band on JCSAT-1b, 2 Mbps bandwidth is assigned as uplink from NAIST and 2 Mbps one as downlink.
2. For TH link
   Ku-band on JCSAT-1b, we use 2 Mbps bandwidth as uplink to AIT and 2 Mbps one as downlink.
3. On the ground link
   The connection between NAIST and SFC use 100 Mbps Ethernet-VLAN.

2.11.3 Services

NAIST site provides Web, DNS, Mail and Mailing List services for AI^3 network. Besides, we provide many functions for informing our project and sharing information each other as well as maintaining our network.

2.11.4 Research

- Against Worm traffic
  One of our members is involved in researching Intrusion Detection System (IDS) on AI^3 network against worm program. Recently there are a lot of evil programs which try to copy itself to network nodes and having some evil roles for DoS attack and trojan victim. And it is well-known issue that sometimes the traffic from worm exhausts almost network bandwidth. In our research, we think we can detect the traffic by analyzing of traffic flow specification on distributed traffic monitoring mechanism (currently we are focusing on distributed IDS as the mechanism). We can find much information to see flow source and destination on distributed sensor.
- Monitoring System Integration
  And also we have another research topic related to monitoring scheme. Hw suggested a way to use network information, which come from some monitoring scheme such as snmp, satellite modem probe and other hand-made programs, as uniformalized information. It will give us various applications about not

only monitoring but also notification and controls. More information is on Netmon WG.

第 3 章 WG activities

We have many working groups in our organization. Each WG has its own purpose and research topic. In this chapter, we describe about WG activity in AI^3.

3.1 DBA WG

3.1.1 Objective

In this working group we are developing Dynamic Bandwidth Allocation System — DBA System —.

Satellite communication can provide connectivity to wide area. Recently data communication activities like the Internet using satellite link are becoming more popular. Satellite communication, which can reach wide area geographically, is good to connect many different places.

Satellite links have limited bandwidth, for satellite communications to work we have to assign a certain bandwidth to each earth station. Currently, we use satellite links with fixed bandwidth assignment. If we use satellite link for communications like the Internet, some channels might experience congestion while some channels do not. To improve the usage of all channels we need a dynamic bandwidth assignment function based on the traffic.

Furthermore, to enable dynamic bandwidth assignment, we need to remotely control earth station.

In this WG we are trying to solve the problems that arise when we want to use dynamic bandwidth assignment for the Internet-like satellite-based communication. We design and implement a system to perform earth station remote control through the Internet. Also we design and implement a dynamic bandwidth assignment based on the real-time traffic. We are evaluating this system using a test bed network.

3.1.2 Research

signaling We are designing the signaling protocol among the earth stations, for earth station remote control. This signaling should be efficient and perfectly reliable, for smooth and safety operation. The signaling is a core technology of DBA system.

traffic monitoring In order to do the dynamic bandwidth allocation based on the real traffic, we need to analyze the traffic information. We have many kinds of traffic monitoring tools and analyzing tools in the world, but we do not know what kind of traffic information we need and which tool we should use for this purpose. We are researching what information we need, and how we collect them.

QoS In order to maximize the convenience of satellite Internet, we should combine DBA system and QoS system. The DBA system can change the bandwidth of the link and it provides final solution for network congestion. However, changing the bandwidth is "heavy work" — we have to change the all earth station configuration on the network and we will get some "down time" while changing the bandwidth. If we combine DBA and QoS, we can solve small congestion problem by QoS, without using DBA. It improves the convenience of satellite Internet. We are researching how we combine DBA and QoS.

human interface (visualization) In order to decide the "best bandwidth assignment", DBA system should provide good interface for the administrator. If administrator can get the current network status through the good GUI interface, it contributes to the decision making of "best bandwidth assignment". We need to research about what good interface is, what kinds of information the administrator needs and does not need.

3.1.3 Current status

June 2003 Establishment of this WG, and started designing/implementing the signaling protocol.

November 2003 Completion of designing/implementing. We got an approval from JSAT Corp., for implementation of using this signaling protocol on the real satellite Internet.

December 2003 Installation of the signaling system to AI^3 network, and started operation. Started a researching about traffic monitoring.

January 2004 Started a researching about QoS.

3.2 IPv6 WG

3.2.1 Objective

The purpose of IPv6-wg is to obtain enhanced ipv6 technology, discover the problems we face in future, and contribute to the promotion of ipv6 in Asia. *AI*^{3} has tried to deploy native IPv6 network in the Asia for years. To develop large scale IPv6 network, we started the operation with sTLA address space, this year. This is the first trial of sTLA management at the Asian scale. And we will activate the utilization of ipv6 in AI^3, and try to shift our commodity traffic to ipv6.

We also tackle any problems we face through our activity by developing new technologies. One of the main research topics is developping technology for IPv6 multihop satellite network. Current IPv6-WG is formed by old IPv6-WG and IPv6-Multihop-WG. They were combined at October 2003.

3.2.2 Research

- To study large scale IPv6 network operation technology. The routing technology, server configuration, and services which help our operation.
- To activate the use of IPv6 in AI^3, from experimental use to commodity use.
- IPv6 multihop satellite network
  - To evaluate and recommend the optimal routing methodology for IPv6 traffic in a multihop satellite system.
  - To study the performance of IPv6 traffic due to the effects of multiple satellite hops.
  - Utilize IPv6 multihop satellite network as the core network for IPv4 stub networks, and study the performance.

3.2.3 Developing IPv6 multihop satellite network

- Activities

  Link status

  MEASAT 2 transponder bandwidth reassignment by Binariang to new allocation of 2 MHz. Currently awaiting signing of new Lease Agreement between USM and Binariang to reactivate link (lease expired Dec. 2003). When reactivated, link will be initially between Temasek Polytechnic and USM using FDMA P2P link until TDMA IF-converters are available. Expected completion end Jan. 2004.

  IPv4 IP over MPE-TS encapsulator for Linux

  User space daemon development in progress. Prototype expected in April 2004, providing IP transmission over DVB-S stream.

  UDL Mesh ARP module

  Linux kernel module in progress.

- Paper "Deployment of UDL Mesh Satellite Networks using DVB-S Technology", Proceedings Asia Pacific Conference on Communications 2003 (APCC 2003), Penang, Malaysia, Sep. 21-24, 2003.

3.2.4 IPv6 network operation activity

This year, we took sTLA address space from APNIC. Our new address space is 2001:d30::/32. We renumbered our network from old address (2001:200:800::/40) to new one. The current topic of operation is to start IPv6 BGP peering, and to complete dns delegation of reverse dns of ipv6 address space.

February 21, 2003

Sent application for sTLA address space to APNIC.

April 7, 2003

Acquired ipv6 sTLA address space from APNIC.

April 21, 2003

Started to construct AI^3 IPv6 address registry, and discussion about address allocation policy.

September 6, 2003

JSAT has connected to AI^3 with ipv6 using IPv4 tunneling. AI^3 assigned 2001:d30:11::/48 to JSAT.

October 31, 2003

Brawijaya University connected to AI^3 with ipv6 on UDL.

November, 2003

Making ipv6 BGP peering policy between AI^3 and Partners.

November 17, 2003

Checked that all old ipv6 address had been cleared in AI^3.

November 22, 2003

Stopped the announcement of 2001:200:800::/40 to WIDE.

In progress

DNS delegation for some zones is under work. BGP4+ peering between AI^3 and partners is under work. In USM, multihoming will be activated between USM and Temasek Polytechnic, when MEASAT 2 link is reestablished.

3.2.5 AI^3 IPv6 Registry

Following is the regulation and policy of our IPv6 registry. All Line are excerpts from web page (http://sfc-cpu.ai3.net/v6/).

- Overview AI^3 Registry has the main goal of deploying IPv6 at a larger scale by using satellite networks all over Asia. We will try to delegate address space to organizations, for specific use within the Internet infrastructure they operate. Assigning without duplication, we will track a variety of information attached and/or related to the IPv6 prefixes. Then, we would like to disclose enough information about our IPv6 allocation service unless it violates privacy over the net. Thus, our aim is to provide any organizations/partners in Asia with IPv6 connectivity.

  The following is the necessary conditions for the use of our IPv6 address space. We assign a /48 IPv6 prefix to only those who fulfill all the conditions set forth below.

  Delegation of a /48 IPv6 prefix

  We will assign 2002:0D30:xxxx::/48. No less or no more than /48 per request is to be assigned from our Registry.

  No commercial use

  Please make sure NOT to use it commercially.

  No sub-organization

  Any address spaces assigned by AI^3 Registry to an organization are used within the Internet infrastructure of the organization you operate. That is, do NOT sub-assign the address space assigned by AI^3 Registry to your sub-organization or other parties.

  Accordance with our Operational Notes

  Please review our Operational Notes.

  Year Report to be submitted

  Please submit report about your network. The format of the report should be text or html. As for the details, please refer to our Report format.

- A List of IPv6 address assigned from AI^3 registry
- How to assign /48 IPv6 prefix

  This section describes how AI^3 assign /48 IPv6 prefix. Figure 3.1 is AI^3 TLA allocated by APNIC. Figure 3.2 is AI^3 TLA internal structure.

  3

  FP (Format Prefix - the very first 3 bits). i.e., FP “001” (binary digits) means global address.

Table 3.1. A List of Organization

NetName	IPv6addr
SFC (Keio University Shonan Fujisawa Campus)	2001:0D30:0001::/48
NAIST (Nara Institute of Science and Technology)	2001:0D30:0002::/48
ITB (Institut Teknologi Bandung)	2001:0D30:0003::/48
AIT (Asian Institute of Technology)	2001:0D30:0004::/48
TP (Temasek Poly)	2001:0D30:0005::/48
USM (University of Science Malaysia)	2001:0D30:0006::/48
ASTI (Advanced Science and Technology Institute)	2001:0D30:0007::/48
IOIT (Institute of Information Technology)	2001:0D30:0008::/48
UCL (University of Colombo)	2001:0D30:0009::/48
Myanmar (University of Computer Studies)	2001:0D30:000a::/48
Chulalongkorn (Chulalongkorn University)	2001:0D30:000b::/48
Laos (National University of Laos)	2001:0D30:000c::/48
AYF (Asian Youth Fellowship)	2001:0D30:000d::/48
UNSRAT (Sam Ratulangi University)	2001:0D30:000e::/48
UNIBRAW (Brawijaya University)	2001:0D30:000f::/48
UNHAS (Hasanuddin University)	2001:0D30:0010::/48
JSAT (JSAT Co.)	2001:0D30:0011::/48
WishNet (WishNet Co.)	2001:0D30:0012::/48

Table 3.2. A List of POPs

POPName	IPv6addr
SFC (Keio University Shonan Fujisawa Campus)	2001:0D30:0101::/48
NAIST (Nara Institute of Science and Technology)	2001:0D30:0102::/48
ITB (Institute Teknologi Bandung)	2001:0D30:0103::/48
AIT (Asian Institute of Technology)	2001:0D30:0104::/48
TP (Temasek Poly)	2001:0D30:0105::/48
USM (University of Science Malaysia)	2001:0D30:0106::/48
ASTI (Advanced Science and Technology Institute)	2001:0D30:0107::/48
IOIT (Institute of Information Technology)	2001:0D30:0108::/48
UCL (University of Colombo)	2001:0D30:0109::/48
SFC-RO1 (SFC Receive Only Site1)	2001:0D30:010a::/48
SFC-RO2 (SFC Receive Only Site2)	2001:0D30:010b::/48
Myanmar (University of Computer Studies)	2001:0D30:010c::/48
Chulalongkorn (Chulalongkorn University)	2001:0D30:010d::/48
Laos (National University of Laos)	2001:0D30:010e::/48
AYF (Asian Youth Fellowship)	2001:0D30:010f::/48
UNSRAT (Sam Ratulangi University)	2001:0D30:0110::/48
UNIBRAW (Brawijaya University)	2001:0D30:0111::/48
UNHAS (Hasanuddin University)	2001:0D30:0112::/48

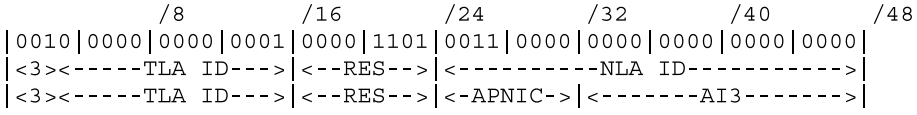

Fig. 3.1. /32 structure

TLA ID

Top Level Aggregator ID. 13 bits in length.

RES

Reserved bits. 8 bits in length.

NLA ID

Next Level Aggregator. 16 bits in length.

RRRR

Reserved bits. 4 bits in length. “0000” is

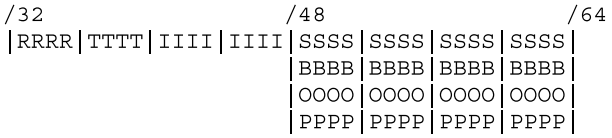

Fig. 3.2. AI^3 TLA internal structure

for the first allocation (April, 2003).

TTTT

Type ID. 4 bits in length. "0000" is for O (ORG), and "0001" is for B (Backbone) and P (POP).

IIII

Index ID for ORG and POP. 8 bits in length. If Index ID is filled, Type ID (TTTT) will increase.

SSSS

SLA ID. 16 bits in length. Used in site (POP, ORG) at whose disposal.

OOOO

Organization is 2001:0D30:00yy::/48. "yy" is sequentially increased as assignment is processed. Prefix for each organizations joined to AI^3 are reserved.

BBBB

Backbone is 2001:0D30:0100::/48. Backbone is a special case of POP.

PPPP

POP is 'Point of Presence' and that means 'A Part of AI^3 network'. POP is 2001:0D30:01xx::/48. "xx" is sequentially increased as assignment is processed.

3.3 Multimedia WG

3.3.1 Objective

The goal of this working group is to

1. Study and optimize interactive multimedia distant education using on different satellite environment.
2. Modify and optimize MCS to run on UDLR satellite network.
3. Performance study on real time multimedia application on UDL-Mesh satellite network.

3.3.2 Current Status

1. I distance seminar has been conducted involving TP (SG), ASTI (PH) and USM (MY) using existing AI^3 bdl satellite network. Full bidirectional video conference and document sharing was able to run smoothly using MCSv5 video conferencing software.
2. A fixed for Osprey video capture card has been developed. Osprey card are widely used by UDL SOI-ASIA partner.
3. Will test MCSv5 video conference and document sharing on UDL satellite network once SOI members are ready.

3.4 Netmon WG

3.4.1 Objective

The objective of Netmon WG is to establish and develop methods on network monitoring that support stable and effective operation of the AI^3 network. The outline of activities in the Netmon WG is:

- Define the object that should be monitored,
- Implement the monitoring system and subsystems,
- Utilize and evaluate the monitoring system suite.

3.4.2 Research

- Monitoring System Integration

  In the AI^3 network, several monitoring systems are working independently in each partner site. Then, the monitored status in each site is not shared on the whole AI^3 network. Assuming that monitoring systems consist of a probe module, a user interface, a data base, there are several approaches to integrate those subsystems. In this research, we investigate and discuss a suitable approach

for integrating monitoring systems on the distributed network.

- Operational Information Classification
  Satellite links have many operational parameters compared with other data links used on the Internet. Also, the availability of such operational parameters is different between satellite links.
  In order to efficiently monitor the data link layer of a distributed satellite network, we classify operational information of satellite data link and organize the information that is essential beyond independency of satellite links.

3.4.3 Current Status

Netmon WG is organizing the operational information of satellite data link, and defining it on a MIB (Managed Information Base), that is called "SAT-MIB". At the same time, we're implementing the SNMP agents to adopt the SAT-MIB onto every earth stations on the whole AI^3 network. We will evaluate our MIB through the AI^3 network operation.

3.5 UDL WG

3.5.1 Objective

The objectives of UDL wg initiatives are to 1) define standard protocol for IPv6 over MPEG-TS, 2) develop software for IPv6 transmission over UDL, and 3) to use it on AI^3 network as AI^3 de facto standard.

Wishnet Inc and USM were the active members of UDL wg in 2003. At USM, a study on application of UDL was conducted with a topology of multiple UDLs on Mesh each of which is connected by 1 hop. Wishnet Inc. worked on protocol to carry IPv4/IPv6 over MPEG-TS packet in DVB (Digital Video Broadcasting) environment which is commonly used for digital satellite broadcasting.

To achieve the objectives, UDL wg has shared the information on hardware (IP encapsulate/decapsulate PCI board) as well as software/driver within AI^3.

3.5.2 Research

During the course of 2003, research environment as Table 3.3 was implemented:

In 2004, we are planning to conduct interconnectivity test using the software developed by each party and implement standardization efforts.

3.5.3 Paper

Reference (published in 2003): "Deployment of UDL Mesh Satellite Networks using DVB-S Technology," Proceedings Asia Pacific Conference on Communications 2003 (APCC 2003), Penang, Malaysia, Sep. 21–24, 2003.

Table 3.3. UDL WG Research Environment

OS:	Linux 2.4
Transmit PCI Board: Receive PCI Board: DVB Modulator:	Computer Module, DVB Master FD TechnoTrend, TT-PCline Newtech, NTC2177