第 XXXII 部

Asian Internet Interconnection Initiatives

第32部
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第1章 Introduction

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 has not 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 in 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, 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 in 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

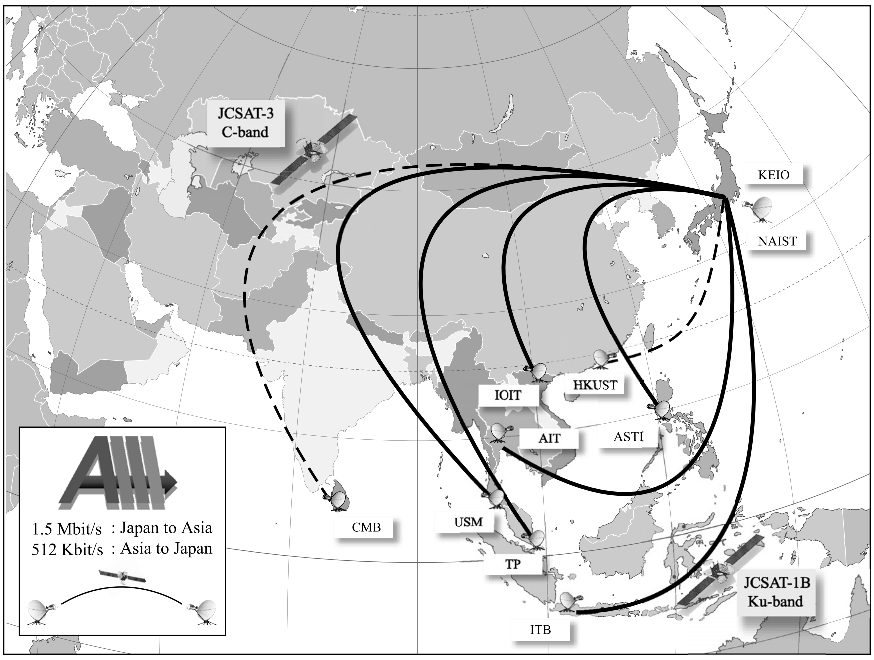

Fig. 1.1. The AI^3 testbed network

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.

In this report, we mention our activity in this year with our partners who use AI3 network also together. We firstly describe report of each partners. Then we describe activity of WGs which are research groups inside AI3 and some experiments in this year.

第 2 章　Site Updates

2.1 SFC

2.1.1 Introduction

We have the hub station of AI^3 and research team in Keio University Shonan Fujisawa Campus (SFC). After AI^3 stopped the Ku-band operation, Ku-band partners such as ITB and AIT started to use C-band satellite links. Now Universiti Sains Malaysia (USM), Advanced Science and Technology Institute in Philippine (ASTI), Temasek Poly in Singapore (TP), Institute Of Information Technology in Vietnam (IOIT), The National University of Laos (NUOL), Institut Teknologi Bandung in Indonessia (ITB), and Asian Institute of Technology in Thailand (AIT) are connected to SFC using bidirectional satellite links. SFC and NAIST are connected using a 3 Mbps terrestrial link and a VLAN through WIDE network. SFC also has a Unidirectional Links (UDL feed and two Receive-Only (RO) stations) which have satellite facility only for receiving data traffic. Almost 20 RO stations are connected to AI[3] UDL.

SFC has several upstream connectivities to the Internet. WIDE network provides AI[3] full transit for both IPv4 and IPv6, and APAN provides us an IPv4 transit to R&D networks and a full IPv6 transit. We have an IPv6 connectivity to NSPIXP6 in Tokyo, and we establish private peerings with several ASes there. We actively monitor and measure the AI[3] traffic at SFC.

SFC also provides some important network services, such as WWW cache, CPU server, secondary DNS, and multicast for SOI-Asia lectures.

2.1.2 Operation

Bandwidth re-allocation

AI[3] reallocated the bandwidth of C-band satellite links on 1 November 2004. Figure 2.1 shows the new bandwidth allocation. After this re-allocation, we use an additional frequency band of 2.0 Mbps and reserve 11 Mbps for UDL. We assigned the bandwidth for new satellite links for SFC-ITB, and SFC-AIT and several 128 kbps links for new partners. The bandwidth of SFC-USM, SFC-TP, SFC-ASTI, SFC-IOIT were changed from 1.5 Mbps/0.5 Mbps asymmetric to 0.5 Mbps symmetric.

Operational activities and troubles

April, 2004

SFC-ITB C-band bidirectional link became operational. The bandwidth from SFC to ITB was set to 512 kbps, and ITB to SFC was set to 1500 kbps.

May 27, 2004

A new terrestrial link between SFC and NAIST was installed. SFC and NAIST had been connected using a VLAN through WIDE before this installation, and the stability had been an operational issue. We achieved a stable connectivity with this link, and the link enables us to have connectivity redundancies between SFC and NAIST.

June, 2004

Connected to NSPIXP6. Our IPv6 BGP router is n6-gate.AI[3].net.

June, 2004

A partner's broken satellite modem transmitted a wrong carrier to the UDL frequency. UDL transmission was stopped for a while.

August 4, 2004

A satellite router, sfc-sat.AI[3].net, broke down because of a hardware failure.

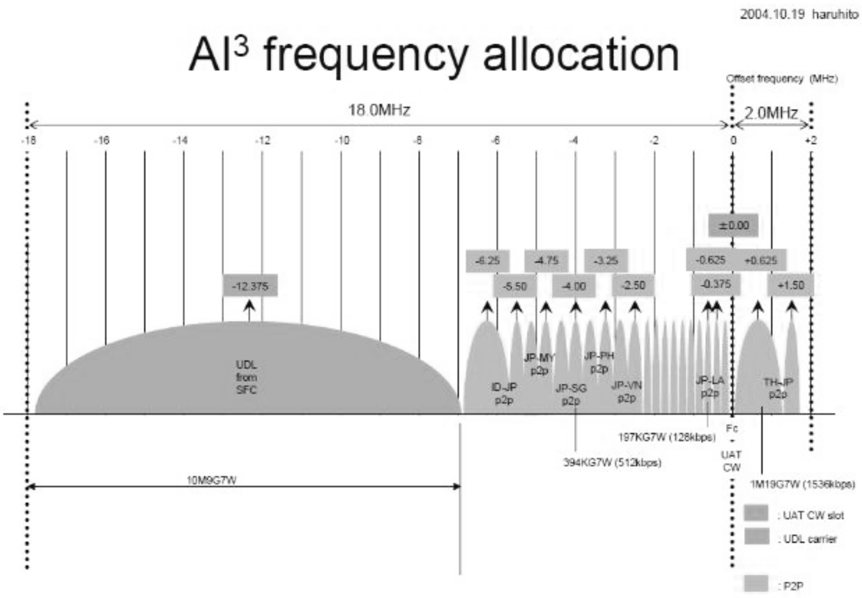

Fig. 2.1. New spectrum bandwidth allocation

August 5, 2004

Stopped a BGP peering between cisco1.fujisawa.wide.ad.jp (WIDE) and sfc-gate.AI^3.net (AI^3) because the former had an interface problem. We established another peering to WIDE using other routers (foundry1.fujisawa.wide.ad.jp and sfc-apan-gate.AI^3.net).

August 9, 2004

AIT started to connect to SFC using a C-band bi-directional satellite link. The bandwidth from SFC to AIT was set to 512 kbps, and AIT to SFC was set to 1500 kbps.

September 1, 2004

Policy routing and a QoS mechanism were installed on AI^3 UDL.

November 9, 2004

Recovered the BGP peering between cisco1.fujisawa.wide.ad.jp and sfc-gate.AI^3.net. The interface problem of cisco1.fujisawa.wide.ad.jp was solved.

November, 2004

Allocated IPv4 and IPv6 addresses for new SOI-Asia partners. New SOI-Asia partner networks were constructed from the end of 2004 to the beginning of 2005.

December 5, 2004

Another satellite router, sfc-sat2.AI^3.net experienced a network interface failure. We stopped using quad ethernet cards and started to use VLAN pseudo-interfaces on FreeBSD because our router needs to have many interfaces to connect all bi-directional satellite links.

December 27, 2004

The SFC earth station was suspended by a power failure. The failure is followed by some hardware problems and a mis-pointing of the satellite dish. SFC earth station resumed operations 2 days later.

December 31, 2004

SFC suspended transmission for several hours due to heavy snow.

2.1.3 Developing tools

We developed several tools in this term to support our network operations. These tools display the status and the usage of our satellite links, and they enable us to find the issues of our network easily. Another important function of these tools is to provide simple interfaces and comprehensive information to AI^3 network operators. AI^3 network is distributed to many countries and organizations, and it requires coordination and cooperation between the operators.

MRTG Index

The "MRTG-Index" is a type of IndexMaker of MRTG (Multi-Router Traffic Grapher). MRTG is one of the most useful software for collecting any types of data using SNMP, especially link usage. There are many MRTG graphs in many servers in AI^3, hence they create a manageability problem. It is hard for operators to manage many of such graphs and web pages, although the link usage data and equipment parameters must be monitored.

The MRTG-Index provides the index of MRTGs per category and group using a simple configuration. For example, the daily graphs of all satellite links are shown on an index page. Multiple categories can be managed easily using it. All MRTG-Index requirement is just a list of the

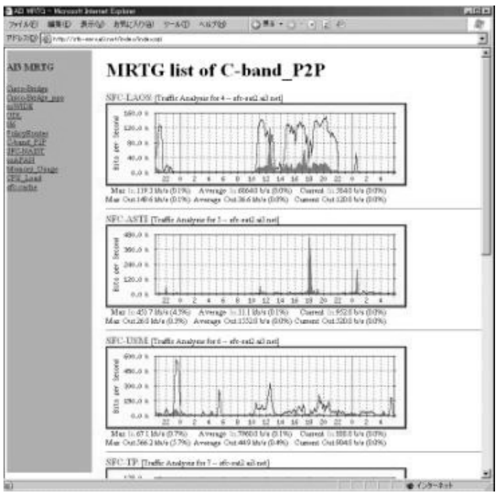

Fig. 2.2. MRTG Index

MRTG URLs and their descriptions per category. Figure 2.2 shows a sample screen of MRTG-Index page.

Looking Glass

Figure 2.3 shows an original looking glass for AI^3 operation. This looking glass enables network operators on each site to check the status of the other sites quickly. All routers on a network with UDL are asymmetric by nature, so it is hard to understand the status of the network and to debug some troubles by monitoring only from one side.

On AI^3, return connectivities from RO sites to the UDL feed in SFC are provided by each RO site's upstream ISPs. Therefore the network performance of an RO site depends on the status of both UDL and the return connectivity of the RO site. Our looking glass provides not only some basic network command such as ping and traceroute, but also TCP/UDP performance estimation from UDL feed to RO sites. A common looking glass in all AI^3 sites enabled us to well understand the network conditions and find the sources of some troubles quickly.

Fig. 2.3. Looking Glass

Packet Loss Ratio

AI^3 network was designed with the consideration of the most efficient usage of our spectrum bandwidth. But that does not mean that all satellite links have enough bandwidth because our network traffic is increasing even though our spectrum bandwidth does not. Our satellite link bandwidth was allocated according to its usage. For this reason, packet losses happen by the lack of satellite link bandwidth. Packet losses decrease the performance of TCP and applications, hence they must be monitored and used as a consideration for bandwidth reallocations. We are monitoring packet losses by sending 5 ping packets each minute from SFC to the other end of each satellite link, and the results are visualized using graph. Figure 2.4 and Figure 2.5 show the screenshots of this tool.

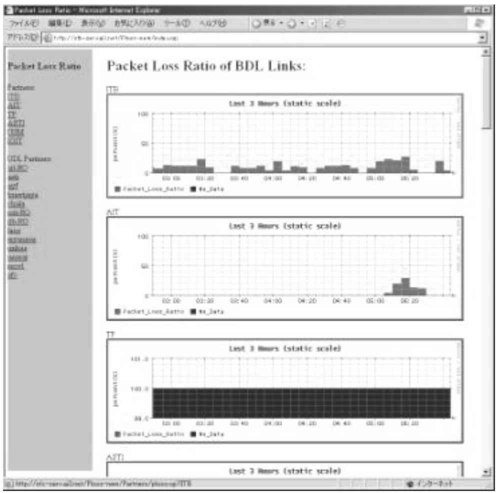

Fig. 2.4. Packet Loss Ratio

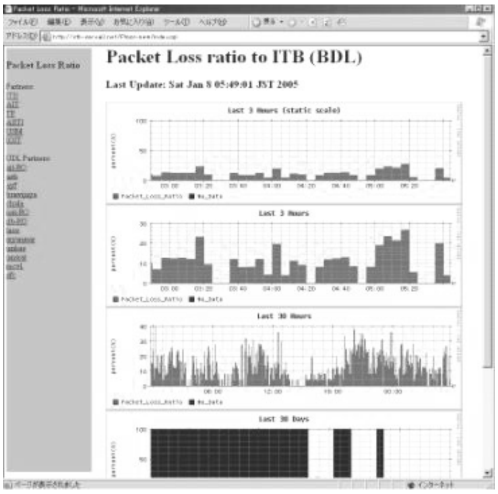

Fig. 2.5. Packet Loss Ratio2

2.2 NAIST

2.2.1 Introduction

NAIST is an institute university in Japan. NAIST and SFC are AI^3 sites located in Japan and operate our network and have some experiments on our network. It plays some important roles such as providing DNS and WEB services. Currently, we have missed satellite link on NAIST on Apr, 2004 because of termination of using satellite link on Ku-band which is frequency of the satellite link.

2.2.2 Operations

NAIST 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.

1. DNS server
   We provide AI^3 primary DNS system. It contains many records not only for Japanese sites but also for foreign partner's. Therefore many partners refer it as their DNS server.
2. WEB server
   The web server is named www.AI^3.net. It is used to inform our results and to share the operator's information. For example, We can check whether NAIST network system is going well or not on our Multi Router Traffic Grapher page.
3. Mail server (and Mailing List service)
   We have mail and Mailing List server. We can easily share various of information about our activity such as operational topics, progress of our projects and so on.

2.2.3 Research Topic

A research topics is now proceeding in NAIST. It is about worm traffic detection on AI^3 network for support operation. We are defining some indexes which describe characteristics of traffic, such as scattering of access destination, homogeneity of traffic flows and so on. We would shut such malicious traffic out with our detecting system. Currently we are going to define benchmark indexes more and check the effectiveness against worm traffic. This research is just proceeding. And no paper have been published yet.

2.3 ITB

2.3.1 Introduction

This report will give some summary of ITB's network activity, which is using AI^3's C Band link Internet connectivity. See Figure 2.6.

General Information and History

Institut Teknologi Bandung (ITB), was founded on March 2, 1959. The present ITB main campus is the site of earlier engineering schools in Indonesia. Although these institutions of higher learning had their own individual characteristics and missions, they left influence on developments leading to the establishment of ITB.

In 1920, Technische Hogeschool (TH) was established in Bandung, which for a short time, in the middle forties, became Kogyo Daigaku. Not long after the birth of the Republic of Indonesia in 1945, the campus housed the Technical Faculty (including a Fine Arts Department) of Universitas Indonesia, with the head office in Jakarta. In the early fifties, Faculty of Mathematics and Natural Sciences, also part of Universitas Indonesia, was established on the campus.

In 1959, the present lnstitut Teknologi Bandung was founded by the Indonesian government as an institution of higher learning of science, technology, and fine arts, with a mission of education, research, and service to the community.

Government Decree No. 155/2000 pertaining to The Decision on ITB as Legal Enterprise (Badan Hukum) has opened a new path for ITB to become autonomous. The status of autonomy implies a freedom for the institution to manage its own business in an effective and efficient way, and to be fully responsible for the planning and implementation of all program and activity, and the quality control for the attainment of its institutional objective. The institution has also freedom in deciding their measures and taking calculated risks in facing tight competition and intense pressures.

Location

Bandung, with a population of approximately one and a half million, lies in the mountainous area of West Java, at an altitude of 770 meters. The ITB main campus, to the north of the town centre, and its other campuses, cover a total area of 770,000 square meters.

Address

Office: Jl. Tamansari 64 Bandung 40116,
Campus: Jl. Ganesha 10, Bandung 40132
Indonesia
Tel and Fax +62-22-2500935

2.3.2 Research

IPv6

On the end of July 2004, we presented about various IPv6 topic on NICE2004 (National Internet Conference and Education). List of presentation can be seen as follow:

- IPv6 Reverse DNS using BIND-9 by Anthony Fajri (undergraduate student at ITB)
- IPv6 at ITB by Dikshie Fauzie (graduate student at ITB)
- KAME IPv6 Stack for BSD by Dikshie Fauzie (graduate student at ITB)
- IPv6 Applications of End Users by Affan Basalamah (research assistant at AI^3 ITB)
- IPv6 Deployment Aspect by Wahyu Hidayat (research assistant at AI^3 ITB)

All of presentations are based on our research and experiment at ITB. We also did some measurement on RR (SOI-Router) to see IPv6 traffic using aguri. Preliminary results can be seen on:
`http://167.205.8.2/~dikshie/aguri-v6-rr/2004/`

Current status:

- 42 subnets has been deployed and still increasing.
- On October 2004 we changed our topology:
  - our main IPv6 routers sits on top of backbone routers (Cisco catalyst 6000 series) which dont support IPv6.
  - formerly we used to connect those PC routers using tunnel IPv6 over IPv4 to build IPv6 backbone (leaf subnets connect natively though).
  - now we interconnect backbone routers on L2 (instead of IPv4) which can be reached by our IPv6 routers.
  - the same way we applied to form our new IPv6 backbone thus our PC routers do not depend on IPv4 anymore.
- Multicast deployment
  - use pim6sd on backbone routers (3 from kame-snap and 1 from ports).
  - after changing the topology, Bootstrap Router (BSR) mechanism worked well and stable.
  - on July new implementation available which is pim6sm from XORP.
- Stability and performance
  - only FreeBSD-4.x and FreeBSD-5.x from recent kame-snap which can run ospf6d properly.
  - stability issue occurs on some stub subnet (runs on Linux) which causing many LSAs messages.
  - netperf shows that IPv6 forwarding/ throughput still lag behind IPv4. We are waiting IPv6 fast forwarding.
  - XORP pim6sm served well but some issue regarding with linklocal not supported and mainly affecting RIB made us to choose pim6sd for stable deployment.
  - only FreeBSD4 (both kame-snap and stable) which can run stable enough when forwarding heavy multicast traffic (higher than 6 Mbps).

DNS

As we know APNIC and ISC has been operated new F root server in Indonesia operated by APJII (Indonesia Internet Service Provider Association).

We measure dns request delay using dnsprobe from MAWI of WIDE Project. The result is on: `http://167.205.8.2/~dikshie/f-root`. This result also presented by George Michaelson of APNIC on 18th APNIC meeting in Fiji (`http://www.apnic.net/meetings/18/docs/sigs/dns/dns-pres-michaelson-roots.pdf`).

2.3.3 Operation of DNS

Introduction

ITB has three DNS server which are ns1.itb.ac.id, ns2.itb.ac.id, and ns3.itb.ac.id. All servers using FreeBSD-4.x, BIND-9.3.0, and IPv6 enabled.

Progress and Problems

- lame delegations are reduced
- no recursive client problems in 2004
- new problem was caused by worm

Reverse

- Reverse IPv4 and IPv6 are important
- All usable IP Addresses (IPv4 and IPv6) must have reverse
- By using reverse, tracing to trouble computer become easier and faster
- Reverse format used in ITB-net are
  - IPv4: in.addr.arpa
  - IPv6: ip6.arpa

Reverse configuration example:

```
;db.2001:d30:3:0002 @ ns2.itb.ac.id
$TTL 3d ;
@  IN SOA 2.0.0.0.3.0.0.0.0.3.d.0.1.0.0.2.ip6.arpa.
   dnsadm.itb.ac.id. (
      2004041100  ; Serial number (YYYYMMddhh)
      24h         ; Refresh time
      30m         ; Retry time
      2d          ; Expire time
      3d          ; Default TTL (bind 8 ignores this,
      bind 9 needs it)
)

      IN  NS  ns2.itb.ac.id.
      IN  NS  ns3.itb.ac.id.

$ORIGIN 2.0.0.0.3.0.0.0.0.3.d.0.1.0.0.2.ip6.arpa.

; Add your reverse here

*     IN  PTR     client-0002-v6.itb.ac.id.
```

Measurement

We did tcpdump for 2 hours on ns2.itb.ac.id then we got some facts below:

- Top 10 Domains

```
"photos.friendster.com"
"www.symantec.com"
"us.i1.yimg.com"
"mesin-14-18.ms.itb.ac.id"
"157.14.205.167.in-addr.arpa"
"18.14.205.167.in-addr.arpa"
"championzone.net"
"funky.ifs-irc.net"
"85.80.0.26.249.202.in-addr.arpa"
"83.80.0.26.249.202.in-addr.arpa"
```

- DNS Type

```
Query count: 528937
0"0" 428
"SRV" 745
"TXT" 5493
"ANY" 8387
"SOA" 11971
"MX" 29722
"AAAA" 48315
"A6" 89081
"PTR" 114725
"A" 219608
```

2.3.4 UDLR

Current configuration is shown in Figure 2.6.

Bandwidth usage is shown in Figure 2.7.

Previously, throughput with the previous dvb card was very slow and we suspected failure of the card. Finally, the throughput was recovered after changing the card by new one.

We are also did traffic measurement using aguri on RR (SOI-Router). Preliminary result:
`http://167.205.8.2/~dikshie/aguri-v6-rr/`
`http://167.205.8.2/~dikshie/aguri-v4-rr/`

2.3.5 Worm

Until now, on the Cisco Catalyst 6000, policy routing of netbios packet seems to have better effect rather than blocking the netbios packet. The method of policy routing is to forward the

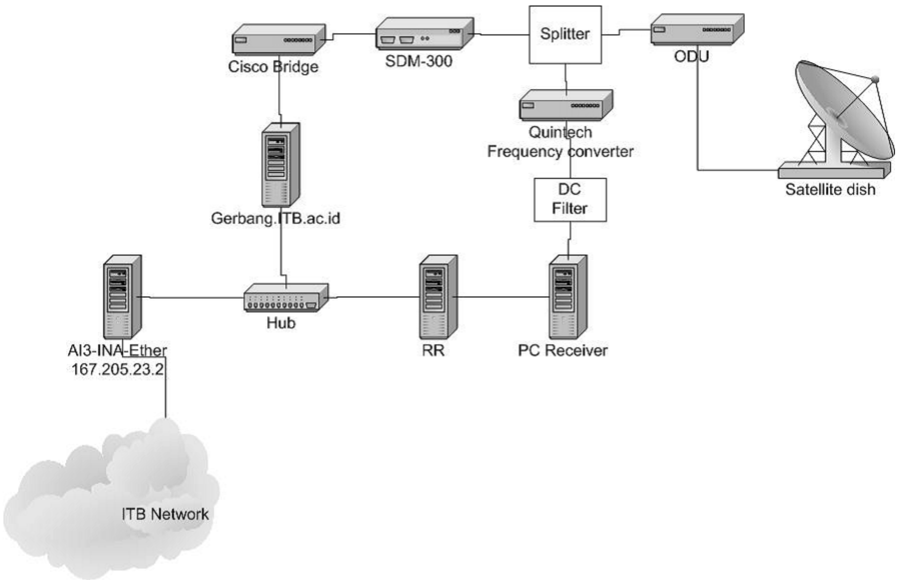

Fig. 2.6. Hardware and Topology

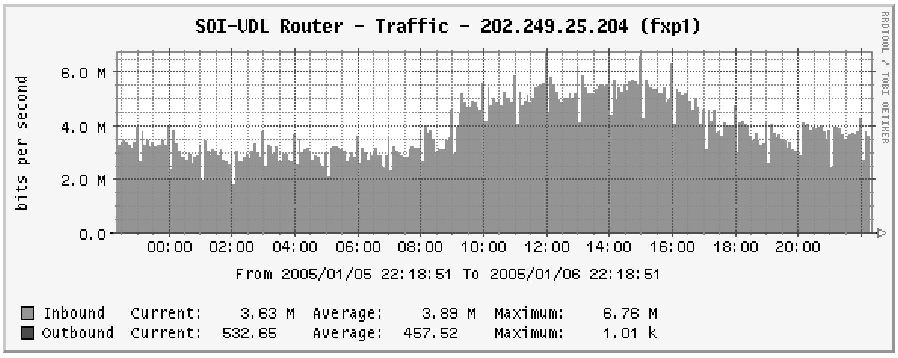

Fig. 2.7. Bandwidth Utilization

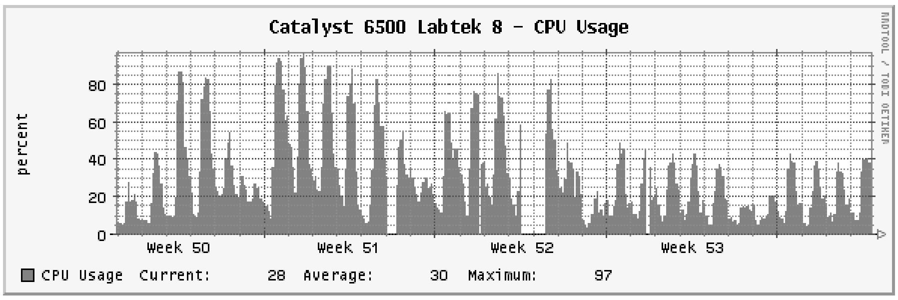

Fig. 2.8. CPU Load Cisco Catalyst 6000 Series

netbios packet to the Cisco Null Interface. The effects are about:

- CPU load: By using routing policy, CPU load is decrease from 100% to 60% in peak time. This is shown in Figure 2.8.
- Packet delay

We also setup a RBL system `http://rbl.itb.ac.id`. This system does:

- automatic virus detection and IP address logging by examine:
  - email: from the email antivirus log
  - netbios worm: from the cisco catalyst 6000 IP traffic log
- SMTP access blocking from the infected PC

to all ITB MX server.

- inform the user of the infected PC by redirect the target website access to the informational web pages. The redirection processing is using squidguard from Squid http proxy.

2.3.6 Email

There is no major changes for email operation system. We still use transparent redirection to the antivirus server for the smtp packet. The only change from last year is the using of new Antivirus and Antispam system and the temporal performance could be seen at `http://students.itb.ac.id/~hadi/`

2.3.7 Cache and HTTP

We have 4 proxy cache server to handle all ITB and some institutions connected to us. Now we have cache5.itb.ac.id runs on FreeBSD IA64 arch. We used to connect with parent to SFC. After evaluating the additional delay, we choose direct connection.

From mid-December 2004 until 3 January 2005, some website which have broken PMTU was not able to access from ITB site using UDL link. From our investigation with help from Husni and Abas (Unibraw) and some trial and error process, we found that we can access those websites by changing the MTU of the cache server interfaces to about 1452 bytes.

2.3.8 Research Plan on 2005

- F root and I root server measurement and analysis
- One way delay measurement on UDLR using owamp
- Large scale multicast

2.4 USM

2.4.1 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 512 kbps 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 through 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.

2.4.2 Operation

1. Bandwidth change in downlink.
   USM downlink spectrum was reallocated so that it uses less bandwidth, which is 512 kbps. The remaining bandwidth (1.5 Mbps − 512 kbps) is assign to UDL downlink.
2. Installation of new TVRO dish.
   Installation of new 3.0 Meter TVRO dish to join UDL network is in the progress. Expected to finish by beginning of February.
3. Alternative BGP route for IPv6 BGP. USM create an tunnel to create a secondary BGP link to AI^3 IPv6 network. Details can be found at IPv6-WG.
4. Distance education. USM new VSAT earth station launching ceremony. Invited AI^3 chairman Prof. Suguru Yamaguchi to give a opening talk using VC over satellite. Participate by TP from Singapore, USM from Malaysia and also NAIST from Japan.

2.4.3 Research Activities

We are researching about ULE encapsulator for IP over DVB MPEG2-TS traffic. This is a collaboration project between KEIO university and USM. Prototype is expected to release by the end of January 2005.

2.4.4 Paper published in 2004

"Experiences with the NS Simulator," Proceedings NS-2 Network Simulation Workshop, Universiti Putra Malaysiam, 23 Oct. 2004.

2.5 ASTI

2.5.1 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.

The Department of Science and Technology provided a five-year funding to ASTI for the Philippine Research, Education and Government Information Network (PREGINET) project, in response to the need to have a national research and education network in the Philippines that will connect academe and research organizations in the country to facilitate collaborative activities. PREGINET was established in June 2000 and now connects more than ninety (90) 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.

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. Figure 2.9 shows the network diagram of the DOST-ASTI PREGINET connection to the AI^3 network.

For 2004, ASTI-PREGINET continued with its various initiatives in IPv6, Multimedia over IP, Network Measurements, as well as participated in the activities of AI^3. The Philippines, through ASTI, hosted the AI^3 Autumn 2004 Meeting and SOI-Asia Meeting held at the University of San Carlos (Talamban Campus) in Cebu, Philippines on October 5 to 8, 2004. A total of 38 foreign delegates and 70 local participants participated the meeting.

Among the 2004 highlights of ASTI-PREGINET activities/projects supported and enabled by the AI^3 link are:

2.5.2 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 and on the establishment of 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 the funding 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.

A technical talk on IPv6 was also conducted for the PREGINET partner institutions during the 1st Philippine Research and Education Network Symposium held in Cebu City last May 24–25, 2004.

2.5.3 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 videoconferencing, videostreaming, video-on-demand, and voice over IP. ASTI-PREGINET participated in the annual global videoconferencing event Megaconference VI held on December 9. Technology was central to the event as thousands of participants gathered simultaneously from all continents of the world using advanced networks. All in all, 372 sites participated, with an estimated audience of around 3,000.

New applications, such as Access Grid and Virtual Classroom (VCLASS) System, 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, telemedicine and bioinformatics, disaster mitigation.

Testbeds on IP Multicast and Access Grid were set-up. The multicast testbed is being used to evaluated MBONE tools such as VIC, RAT, SDR, NTE and WBD, for possible deployment over PREGINET. The team will continue to conduct a series of deployment activities on the multimedia over IP applications. The pilot sites identified for the deployment of IP multicast conferencing include Bicol University (BU), UP Open University (UPOU), and Benguet State University (BSU).

ASTI-PREGINET team also collaborates with the National Computer Center (NCC) on the use of the IP Multicast technology for the delivery of online trainings and courses over PREGINET, which is organized by NCC's National Computer Institute in cooperation with the different state universities and colleges nationwide.

Research activities on Access Grid have been undertaken. ASTI became the first "certified" Access Grid Node in the Philippines. With the set-up of the AG node in ASTI, it is now possible to experience collaborative environments with the international research community.

As part of the implementation of the Access Grid, several tests were conducted to evaluate the multicast connection of PREGINET network to the international R&E networks. With the establishment of an Access Grid testbed, ASTI-PREGINET was able to connect and join the Access Grid lobby of Argonne National Laboratory in USA, WestGrid in Canada. ASTI-PREGINET participates through testings and evaluation of Access Grid set-up with AARNet/Grangenet of the University of Queensland, Australia, the Asia-Pacific Access Grid lobby.

ASTI was one of the more than 50 sites that participated in the SC Global 2004 on November 9 to 11 through the Access Grid. SC Global 2004, the world's leading conference on high performance computing, networking and storage were held in Pittsburgh, USA. The Philippines was a special mention during the opening of the SC Global 2004, being a "certified and connected" AG node. It is the country's first time to participate in this global conference.

ASTI-PREGINET team is also scheduled to deploy applications that will enhance distance education initiatives such as the Virtual Classroom (VCLASS) System. A VCLASS testbed was set-up and ongoing testings are conducted in collaboration with AIT, Thailand in order to prepare for the deployment of said system.

A seminar/workshop on the VCLASS System was conducted with the faculty and staff of Benguet State University (BSU) and with the participants from other academic institutions in Cordillera Administrative Region (CAR) who were invited by BSU. A demonstration on VCLASS was likewise conducted for the PREGINET partner institutions during the 1st Philippine Research and Education Network Symposium held in Cebu City last May 24–25, 2004.

ASTI-PREGINET's possible partner on the deployment of the VLCASS System includes Benguet State University, Bicol University, and Saint Louis University in Baguio.

2.5.4 Network Measurements

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-PREGINET has developed NetMon, 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. NetMon Beta v.1.0 was launched during the 1st Philippine Research and Education Network Symposium held in Cebu City last May 24–25, 2004. Technical talk Netmon's features and a demonstration on its installation procedure was likewise conducted during the symposium.

ASTI-PREGINET has also developed a scalable Network Management system, which was named “Pawikan”, in response to the unavailability of open-source software that could properly manage the growing PREGINET network. As part of the research and development efforts of DOST-ASTI, Pawikan aims to be used in the nationwide PREGINET network and also to the commercial companies such as the big telecommunication companies (telco) in the Philippines which requires a scalable and efficient network management system. As a distributed network management framework, Pawikan is composed of many features such as automatic network discovery, topology mapping, distributed data synchronization, fast data collector, and web-based user interface.

The Pawikan Network Management System was presented at the ECE 2004 Conference and AI^3 2004 Autumn Meeting and generated a lot of interest. The ASTI-PREGINET team has already deployed the Pawikan server, in addition to the current MRTG/Weathermap System, and it has been uploaded to the DOST sourceport.

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

2.5.5 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.

ASTI-PREGINET collaborates with University of the Philippines-Manila College of Medicine, DENR and other partner institutions for the adoption of the Digital Content System as the platform to build repository of their digitized publications and multimedia files.

A workshop on digital Content System for the faculty and staff of Benguet State University (BSU) and other academic institutions in Cordillera Administrative Region (CAR) was co-organized by ASTI-PREGINET with BSU. A demonstration on the system was also conducted for the PREGINET partner institutions nationwide during the 1st Philippine Research and Education Network Symposium held in Cebu City last May 24–25, 2004.

The Commission on Higher Education (CHED) also works with ASTI-PREGINET for the conduct of the Digital Content System Workshop for the staff of CHED's Zonal Research Centers. CHED considers the use of the system as platform for the different zonal research centers to share their respective research data and/or output.

2.5.6 SOI-Asia

DOST-ASTI and PREGINET partner institutions participate in the activities of SOI-Asia through lectures, tutorials, and interactive discussions. DOST-ASTI is also promoting to PREGINET partner institutions the activities of SOI-Asia. The University of San Carlos—Talamban Campus is one of the major universities in the Philippines that signified its interest to become part of SOI-Asia, and has submitted its application.

DOST-ASTI and PREGINET plans to participate in a series of lectures that will again be conducted by SOI-Asia, which will start in July or August 2005.

2.5.7 Papers Published/Presented for 2004

- "Pawikan: A Scalable Network Management System for Small, Medium and Large-Scale Networks" presented at: (1) ECE Conference 2004, Mapua Institute of Technology, Philippines, on November 26, 2004; and (2) AI^3 Autumn 2004 Meeting, University of San Carlos—Talamban Campus, Philippines, on October 7, 2004
- Access Grid Technology: "Building Collaborative Environments" presented at the AI^3 Autumn 2004 Meeting, University of San Carlos—Talamban Campus, Philippines, on October 7, 2004
- "Network Management Utilizing Open

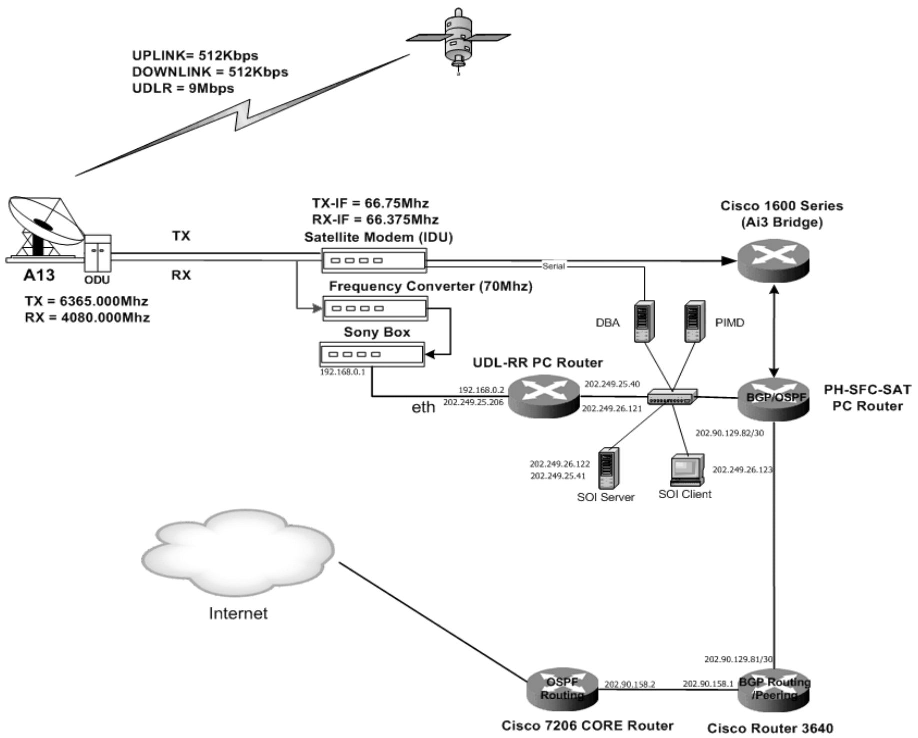

Fig. 2.9. Network Diagram of the DOST-ASTI PREGINET Connection to the AI^3 Network

Source" presented at the Open Source Conference, EDSA Shangri-la, Philippines, on August 19, 2004

2.5.8 Other Matters

Infrastructure Problem Encountered

ASTI experienced an infrastructure problem on its satellite setup on the later part of the year. Our staff, with the help of a JSAT representative, diagnosed the ODU equipment of ASTI. The recommendation was to recrimp the connectors on the cables. After resolving that issue, another problem was seen on the IDU, which was transmitting spurious signals. It was eventually resolved by changing the bandwidth on the IDU due to the reallocation of Wishnet.

第 3 章 Researches

3.1 IPv6 WG

3.1.1 Introduction

The objectives of this working group are to obtain accomplished IPv6 technology, to solve any problems related to IPv6 on our environment, and to contribute to the promotion of IPv6 in Asia. We AI^3 have tried to deploy native IPv6 network in SE Asia for years. Last year, we started to use own sTLA address space, and it enabled us to operate our network autonomously. This year, our network was expanded on each site. Now we are operating a large scale and geographically distributed IPv6 network among 25 organizations.

3.1.2 Current topics

Deployment and operation of IPv6 network is a continual task of this group. Related to that, we describe technical documents and guidelines for ourselves, new comers, and other people who are interested in IPv6. Information sharing is supported by blogs and presentations on AI^3 meeting. Moreover we have some research topics such as evaluating IPv6 multihop satellite network. Below list shows our current activities.

- Operation of IPv6 network on AI^3
  - Constructing stable and serviceable IPv6 network.
  - Activating usage of IPv6 in AI^3. Moving it from experimental use to commodity use.
- Sharing operational and technical information
  - Sharing experience and knowledge related to IPv6
  - Reporting our activities each other.
- Research about 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.

3.1.3 Operation

On this term, we had three operational topics mainly.

DNS delegation

DNS delegation was required for activating our IPv6 network on each site. Because IPv6 enabled servers can be accessed by IPv6 only if dns service returned its IPv6 address to clients. And the second reason is that many organizations are enabling IPv6 on thier campus network with IPv6 address space allocated by AI^3. Thus name spaces related to IPv6 had to be managed on each site.

BGP peering

sTLA address space enabled us autonomous IPv6 routing. That should be implemented by BGP4+. On this term, we peered with AS2500 (WIDE) and AS7660 (APAN) who provide us full IPv6 transit. Also we achieved private peering with AS17815 (USM), AS290 (NetWorld+Interop), AS6447 (OPENTRANSIT), and AS5511 (ROUTE-VIEW Project).

Expantion of our network to many UDL sites

After SOI-Asia workshop on summer of 2004, many UDL sites joined to AI^3 IPv6 network. That meant that many routers which belongs to each organization would join to a single ospfv3 cloud. So we defined a rule about OSPFv3 router-ID to prevent conflictions among them.

3.1.4 Information Sharing

presentations

Information sharing was supported by blogs and presentations on AI^3 meeting. On AI^3 meeting in Cebu from 2004/10/6 to 8, we had three presentations; they were Deployment IPv6 Multicast using PIM-SM (From Wahyu Hidayat, wahyu@dns.math.itb.ac.id), IPv6 Activity in Brawijaya University (From Achmad Basuki, abas@brawijaya.ac.id), and Activity on NSPIXP6 (From Shunsuke Fujieda sirokuma@sfc.wide.ad.jp)

documents

Many documents about operational guidelines and activities were published on the web, especially using blog. There are three sites which were constructed for information sharing on AI^3. They are "AI^3 IPv6 operational notes" (`http://sfc-cpu.AI3.net/~sirokuma/blog`), "Weblog of ITB Campus" (`http://weblog.IPv6.itb.ac.id`), and "UB-IPv6 PROGRAM" (`http://IPv6.brawijaya.ac.id`). Below list shows documents posted on "AI^3 IPv6 operational notes".

1. named.conf of ns2.AI^3.net (2004.02.14)
2. BGP-configuration-memo (2004.02.14)
   About recommended filters for IBGP and EBGP, and special addresses for IBGP peerings.
3. Enabling IPv6 in UDL site (2004.02.15)
   Guideline about enabling IPv6 on UDL site, from UNiBRAW
4. sfc-sat2 configuration (2004.02.15)
   zebra, ospfd, ospf6d, and bgpd configuration of sfc-sat2.AI^3.net (satellite router on SFC)
5. sfc-gate configuration (2004.02.15)
   zebra, ospfd, ospf6d, and bgpd configuration of sfc-gate.AI^3.net (External router via WIDE on SFC)
6. USM BGP.conf (2004.02.20)
   About configuration of bgpd on USM.
7. EBGP Router (2004.02.25)
   QandA about appropriate BGP configuration on USM.
8. Source code of Dancing rabbit (2004.03.23)
   On top page of 'AI^3 IPv6 operational notes', some rabbits dance if you accessed it with IPv6.
9. Malang Meeting Room (2004.04.14)
   An announcement that Malang Meeting Room was IPv6 available.
10. Zebra and OSPF6d configuration guide (2004.05.12)
    Minimal and secure configuration guide of zebra and ospf6d.
11. The way to support ip6.int and ip6.arpa in a zone file (2004.05.16)
    A configuration guideline for supporting IPv6 reverse dns zones.
12. AI^3 has joined NSPIXP6 (2004.06.08)
    Announcement of starting our router operation on NSPIXP6
13. Current Peering status on NSPIXP6 (2004.08.05)
    Until that time, AI^3 had peered with 2500 (WIDE, 2004/06/03), 5511 (ROUTE-VIEW Project, 2004/06/15), 290 (NetWorld+Interop 2004/06/23), 6447 (OPENTRANSIT 2004/07/03), and 7660 (APAN 2004/08/04).
14. v6.AI^3.net was created! (2004.09.16)
    An IPv6 address "v6.AI^3.net" appeared for a target on ping6. Now AI^3 IPv6 registry (WWW page) can be accessed with that name, also.
15. Named configuration samples (2004.10.20)
    Bind configuration samples from UNIBRAW and SFC.

16. Peering address of BGP4+ (2004.11.17)
    Why we should use global address for EBGP peering was described.
17. Some trivial errors on redistributing static routes (2004.12.24)
    On configuration of zebra daemons.
18. IPv6 Tunneling and configuration guide of BGP4+ (2004.12.26)
    Practical guide of bgp4+ configuration and IPv6 over IPv4 tunneling using gif interface on Freebsd. It was written after an actual developing work between USM and SFC.

Especially 3, 10, 15, 17, and 18 were well documented and described with detail.

3.1.5 AI^3 IPv6 Registry

On this term, we assigned new IPv6 address spaces to 7 organizations. SOI-Asia workshop required their own address space for training of IPv6 network, and they actually constructed an IPv6 network which was close to an environment of Receive-Only site. Other new organizations are all new SOI-Asia partners and their networks are under construction. Totally, AI^3 has assigned IPv6 address spaces to 25 organizations and 25 POPs by now.

3.2 Report of UWB Interference Study onto C Band signal from Geo-Stationary satellite

3.2.1 Background

This report is a result of experiment from Temasek Poly Univ. in Singapore as our partner. A study was conducted during 2003–2004 by Infocomm Development Authority (IDA), the regulatory body from Singapore, in collaboration with Temasek Polytechnic, to study the effect of interference from UWB signals onto a downlink signal from a C Band Geostationary satellite.

Table 3.1. 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 (Institute 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
SOI-Asia Workshop	2001:0D30:0013::/48
PSU (Prince of Songkla University)	2001:0D30:0014::/48
CRMA (Chulachomklao Royal Military Academy)	2001:0D30:0015::/48
MUST (Mongolian University of Science and Technology)	2001:0D30:0016::/48
ITC (Institute of Technology of Cambodia)	2001:0D30:0017::/48
BUET (Bangladesh University of Engineering and Technology)	2001:0D30:0018::/48
TU (Tribhuvan University)	2001:0D30:0019::/48

Table 3.2. 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
SOI-Asia Workshop	2001:0D30:0113::/48
PSU (Prince of Songkla University)	2001:0D30:0114::/48
CRMA (Chulachomklao Royal Military Academy)	2001:0D30:0115::/48
MUST (Mongolian University of Science and Technology)	2001:0D30:0116::/48
ITC (Institute of Technology of Cambodia)	2001:0D30:0117::/48
BUET (Bangladesh University of Engineering and Technology)	2001:0D30:0118::/48
TU (Tribhuvan University)	2001:0D30:0119::/48

3.2.2 Scenario of experiment

The equipment set up for the experiment is given in Figure 3.1.

UWB transmitters were configured with a certain combination of pulse repetition frequency (PRF), dithering and polarity settings, collectively described as "signal characteristics". Around 30 or so sets of signal characteristics were used. In tests involving more than 1 UWB transmitter, all UWB transmitters used the same settings.

At each UWB signal power setting, the BER was recorded to study the interference effects.

For each satellite mode, each type of UWB system, each of the UWB transmitters and a given set of signal characteristics, the satellite transmitter was set to transmit at two different power levels. The first power level was such that the signal strength of the satellite downlink signal would be at the threshold (i.e. receiver sensitivity) level

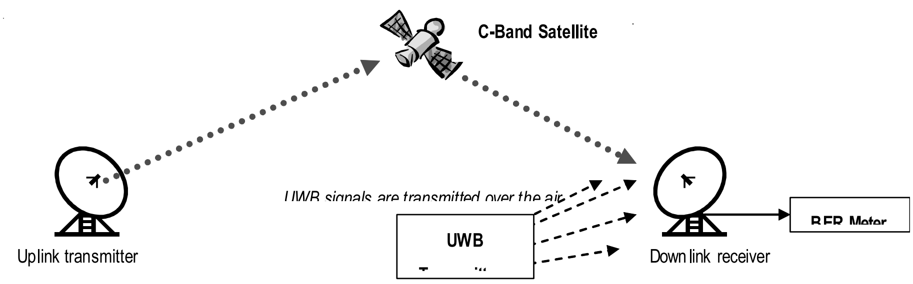

Fig. 3.1. Equipment Setup

specified by the relevant international standard at the input of the satellite receiver. The second power level would be such that the signal strength of the satellite downlink signal would be at the threshold level of the receiver used in the experiment at the input of the receiver. The second power level was lower than the first, since actual receivers often perform better than what the international standards mandate.

3.2.3 Results

IDA had done extensive field measurements and carried out detailed analysis. It was found that a C/I ratio of 14 dB is required for coexistence. After deliberations,

"IDA recommends a value of C/I = 11 dB, recognizing that a conservative choice of code rates and the use of Reed Solomon coding can significantly increase the robustness of a satellite link against UWB interference"

These results were presented in an International Seminar on UWB held in Singapore in May 2004.