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Asian Internet Interconnection Initiatives

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第 1 章 Introduction

The Internet has become a critical and dependable infrastructure for today's society. This was clearly seen when an earthquake in Taiwan on 26 December 2006 knocked out several undersea cables off Taiwan. Some Asian countries, including Taiwan, Singapore, Thailand, Philippines, and Indonesia, were severely affected. However, satellite connectivities were not affected by this disaster. Thus we can see this as a role of satellite Internet today, in addition to providing connectivities where terrestrial links are still scarce.

Asian Internet Interconnection Initiatives, or AI^3 (*ei-triple-ai*)[6] in short, was 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.

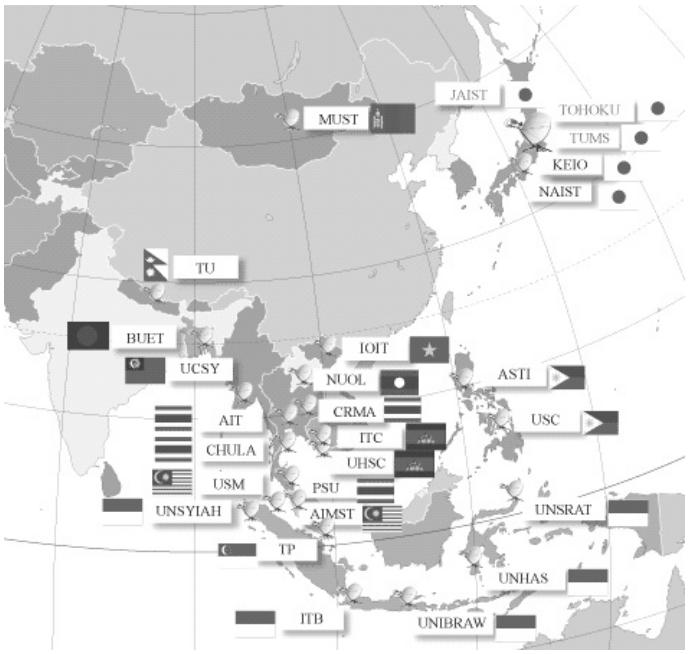

Fig. 1.1. AI^3 partners

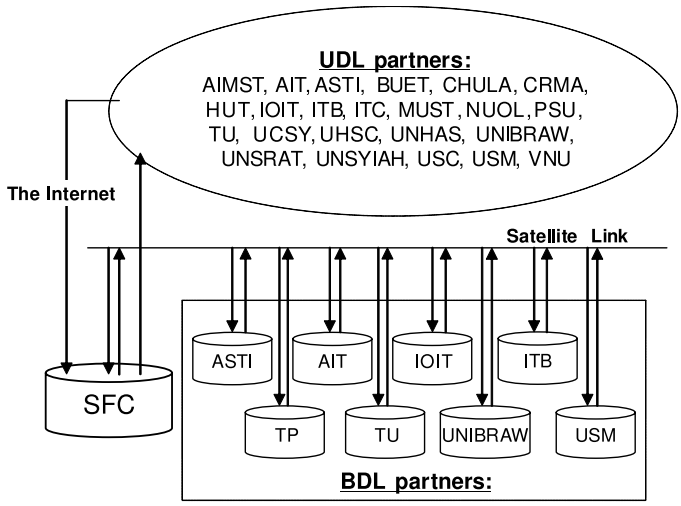

Fig. 1.2. AI^3 satellite topology

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. Our decision and achievements are recorded on papers[103, 104].

In our 12 years of activities, AI^3 has been an international research consortium of 29 organizations in 13 Asian countries as shown in Figure 1.1. This network has been working on 24/7 basis and turned to be its communication infrastructure for members of this AI^3 project. Recently, we are not only focus on conducting satellite research activity but also conducting IPv6 research activity. Our partners include Japan, Indonesia, the Philippines, Singapore, Vietnam, Malaysia, Thailand, Cambodia, Laos, Nepal, Myanmar, Bangladesh, and Mongolia. We aim to contribute to developing a communications infrastructure as well as human resources in these regions through the project. In this report, we describe all conducted activities in 2008.

Figure 1.2 shows the satellite-network topology. The earth station at SFC transmits signals between BDL partners and to UDL partners. The UDL frequency can simultaneously transmit aggregated traffic to many partners. Satellite links are shared by both BDL and UDL signal transmissions. We are developing UDLR technology[29] in this environment.

第 2 章　Research Activities

In terms of research activities in AI^3 working group, several papers have been published and accepted for publication.

Kamolphiwong et al.[55] introduced some enhancements of interactive distance learning (IDL) applications which support SIP-based conference scenarios. The system have been deployed in e-learning scenarios when interactive communications are needed, for example, class scheduled learning and class mate group finding. In addition, other rich features can be added to such scenarios, e.g. sharing on-line objects and documents in real-time, virtual interactive white-board, and multimedia recorder.

Ang et al.[8] introduced a method to improve the efficiency of IP packets transmission over satellite communication system using RObust Header Compression (ROHC). This research presented a study of performance characteristics of ROHC over DVB-S via an actual satellite link.

Kanchanasut et al.[56] described experiences for

a collaborative project, called ANGKOR. This research conducted real-life experiments on setting up remote teaching and learning in medical sciences, which comprises of rich media contents with mandatory interactive sessions. Based upon the experimental results from this project, this research proposed a framework for a remote classroom system over heterogeneous network environment.

Watanabe[95] described the activities of the AI^3 project in SFC. Using satellite links, this project gives contributions to the society by: developing Internet technologies using satellite links, operating an Internet infrastructure for southeast Asian region including a multicast network, and distance education.

Basu et al.[14] presented an educational development that extends the boundary of traditional distance learning approach to incorporate compute laboratory for live IT hand-on lessons for learners in developing countries. Computer virtualization technology and large-scale computing laboratory are integrated to provide laboratory environments for region-wide learners.

Mikawa et al.[66] presented the first sustainable education collaboration architecture that interconnects universities to build multilateral learning environment to foster students to become cosmopolitans. The proposed approach is taken from technical and administrative aspect to enable effective and sustainable education collaborations among the universities. This research is unique that it pursues how to sustain the education collaboration region-wide by integrating the three aspects: distance education system, guideline development and operator development, while other work focuses on only one or two components.

Kataoka et al.[57] proposed a network architecture for a large-scale UDL that: (1) decreases the traffic load of LLTM at the upstream network of the UDL, (2) coordinates the data link layer and network layer of receivers without communications via UDL, and (3) enables neighbor discovery for direct communication between receivers via a bi-directional link that is used as a return path for LLTM. Simulation results showed that the proposed architecture reduces by more than 90% the control messages to be sent via UDL compared with IPv6 stateless address autoconfiguration on the existing network architecture.

第 3 章 Meetings

AI^3 leads to held biannual meetings with partners sites. This chapter reports arguments in the meetings.

3.1 Nepal Meeting

AI^3 and SOI Asia Project held a joint meeting from June 1 to June 2 2009 in Kathmandu, Nepal, hosted by Tribhuvan University. The joint meeting discussed the operation and research activities. Due to the swine flu scare and the security situations in Kathmandu, this meeting was shorter and attended by less participants than usual. Nevertheless, this meeting discusses several key issues in AI^3:

- bandwidth resource management,
- ULE box development status,
- network security,
- relation and collaborations with other RENs in the region.

3.2 Penang Meeting

The fall meeting in 2009 was held from November 29 to December 1 2009 at the Universiti of Sains Malaysia in Penang, Malaysia. The meeting discussed operation and research activities. Delegates from Keio SFC, Nara Institute of Science and Technologies (NAIST), ASTI, Universiti Sains Malaysia (USM), Institut Teknologi Bandung (ITB), Brawijaya University, and Tribhuvan University, as well as from SOI Asia partners attended the meetings. The

meeting discussed the following items:

- ULE box development status and deployment plan,
- ConnectUs initiative,
- relation and collaborations with other RENS in the region,
- future directions.

The following are the details of the discussions in the meeting.

3.2.1 ULE box development status and deployment

The AI^3 UDL has been using UDLR feed and receiver products from UDCast for about five years and many sites already got broken UDL receiver boxes. AI^3 has been developing its own UDLR feed and receiver products using Linux and off-the-shelf DVB cards with the cooperation from a partner organization: Universiti Sains Malaysia. This development is expected to minimize the maintenance costs and time, as well as to conform with the ULE encapsulation standard. The UDLR feed and receivers' development is ready by mid 2009, and this meeting decided to deploy the ULE box in December 2009.

3.2.2 ConnectUs initiative

ConnectUs is an initiative in AI^3 Project to expand the IPv6 Multicast network further beyond the satellite link using terrestrial wireless network. The two candidate technologies for this initiative are DVB-T and Wi-Fi mesh network. We have decided to look further into the possibilities of using both technologies to provide IPv6 Multicast connectivity.

3.2.3 REN relations

We plan to push IPv6 Multicast to RENs in the region, especially to TEIN3 and other RENs connected to TEIN3. TEIN3 has agreed that AI^3 and SOI Asia can use its network for our activities, including distance education. We also plan to push the use of DokoDemo SOI Asia to RENs.

3.2.4 Future directions

This meeting also addressed the need to have a roadmap of the future 5–10 years. Discussions in the meeting for the future of the project include:

- Delay/Disruption Tolerant Network,
- IPv6 Multicast over terrestrial wireless network,
- outreach activities, including publishing a book on our experience in satellite Internet,
- RO sites at TEIN3 landing sites, and
- continuous update in understanding of who our costumers are.