Internet Development in the USA and Thailand

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Abstract
The Internet was started in 1969 as a project of the US Department of Defense called ARPAnet which linked computer at universities and research laboratories within the USA. By 1995, the Internet is the largest computer network in the world, covering 105 countries and serving over 64 million users. Some Thai professors and students in the USA from 1969 got to use the Internet but when they returned to Thailand prior to 1987, they could not afford to pay for long distant telephone calls to connect to the Internet in the USA. Internet in Thailand started in 1987 and by 1995, the number of users has reached over 45,000 and growing very rapidly. It appears Internet will become very important for the national and social development of Thailand. Therefore, to provide information for those who are interested in the Internet, this paper presents a brief account of Internet development in the USA and Thailand.

1. Introduction
In Thailand in 1995, the word "Internet" appears in the news, either newspapers, magazines, radio and television, almost every day. The number of Internet users has reached over 45,000 and the trend shows that it may grow up exponentially. Therefore, it is highly desirable that a brief account of the development of Internet should be provided for those who are interested in learning about the Internet. Since the Internet started in the United States of America, the picture would not be completed without also including an account of Internet development in the USA. Therefore, this paper presents a brief account of Internet development in the USA,
Internet development in Thailand, Internet at Assumption University and Internet at KSC.

2. Internet in the USA.

In 1957, President Kennedy of the US responded to the USSR launching of Sputnik by setting up Advanced Research Project Agency (ARPA) to try to be ahead of the USSR. One of the major achievements of the project was the birth of the Internet in 1962 when Paul Barran announced his idea for "Distributed Communications Network" using packet switching.

In 1967, a version of the packet-switching network was presented to the Association for Computing Machinery (acm) Symposium on Operating System Principles. The senior author of this paper was Director of Graduate Studies in Computer Science at the University of Missouri in the USA at that time. Like most of Computer Scientists in the US at that time, he read and discussed the paper with his colleagues but none realized that it would become very important.

In 1969, the US Department of Defense (DOD) commissioned ARPANET for networking research and subsequently the first Internet node was established at the University of California at Los Angeles (UCLA). In 1970, ARPANET hosts started using Network Control Protocol (NCP). By 1971, there were only 15 nodes and 23 hosts.

In 1971, the first E-mail program for a distributed network was invented by Ray Tomlinson. In 1973, Internet became international with ARPANET establishing connections to England and Norway. In 1974, Robert Metcalfe wrote his Ph.D. dissertation proposing Ethernet. Then Vint Cerf and Bob Kahn wrote a paper "A Protocol for Packet-Network Intercommunications" outlining Transmission Control Protocol (TCP). By that time, the Internet has only 64 hosts. In 1976, AT&T Bell Labs developed Unix-to-UniX Copy Program (UUCP). Then Usenet was established using UUCP between Duke University and University of North Carolina by Tom Truscott and Steve Bellovin.

In 1982, the network by ARPANET got the first reference as "Internet" with TCP/IP widely accepted. At this time, the Internet has only 235 hosts. In the same year, a similar network was started outside the USA and this network was called Eunet (European Unix Network).

In 1983, the University of Wisconsin developed "Name Servers". On January 1983, all remaining NCP's were switched to TCP/IP. In the same year, the University of California at Berkeley released Unix 4.2 incorporating TCP/IP. The number of Unix hosts was increased to about 500. In 1984, Domain Name Server (DNS) was introduced. The number of Internet hosts doubled to about 1,000. The first Asian UUCP network was established in Japan by the name of
JUNET (Japan Unix Network).

In 1986, NSFNET was created by the US National Science Foundation with a backbone speed of only 56 Kbps. The NSF also established five supercomputing center connected by NSFNET and that promoted the popularity of the network. The number of hosts increased to about 2,000 in February and 5,000 by November of the same year.

In 1987, Merit network who managed the NSFNET backbone joined hands with IBM and MCI to establish Advanced Network and Service (ANS). The number of hosts increased to about 20,000 in 1987, and about 100,000 in 1989. NSFNET backbone was upgraded to T1 (1.544 Mbps) in 1989. In the same year, Ohio State University established relay between CompuServe and the Internet.

In 1990, ARPANET ceased to exit. In the same year, Mitch Kapor founded the Electronic Frontier Foundation. In 1991, the Commercial Internet eXchange (CIX) association was established. In the same year, Wide Area Information Service (WAIS) was released. The University of Minnesota released Gopher. The National Research and Education Network (NREN) was established in the US. The number of Internet hosts became 376,000 in January 1991, and 617,000 in October 1991.

In 1993, the US National Information Infrastructure Act was passed. In the same year, business and the media discovered the Internet. The number of host became about 2,000,000.

The Internet celebrated its 25 anniversary in 1994, Mosaic and Netscape became very popular. World Wide Web and Gopher were widely used. The US Senate and House established Internet Servers. The Internet Shopping Malls were established. Advertising through the Internet were used by law and many other firms. The number of Internet hosts reached 3,000,000.

In 1995, NSF decommissioned NSFNET and shifted funding to the VBNS (Very-High-Speed Backbone Network Service). The number of Internet hosts was about 4,000,000 at the beginning of the year and became about 6.4 million by the middle of the year. Assuming an average of ten users per host, the number of Internet users became about 64 million.

3. Internet in Thailand

Some Thai professors, students and visitors to the United States of America had been given Internet addresses but when they returned to Thailand, not many continued to use their addresses because of the high cost of international telephone connection. In 1987, the Asian Institute of Technology (AIT) in Thailand entered into an agreement with the Department of Computer Science at the University of Melbourne in Australia to operate Internet email service on a regular basis. The Australian node would call AIT
three times a day to send and collect mail.

AIT charged 200 baht (about US $8) per month for up to 15,000 characters transferred (counting both in and out messages combined) plus one baht for every additional 50 characters. One of the problems was the inability to control incoming mail, especially the lengthy Call for Papers, list of reference, etc. which was not asked for, and had to be paid for because they had automatically entered the mailbox. This problem was later solved when the rate was changed to a fixed amount per month rather than varying with the number of characters. Another problem was that during the connection to Australia, usually three times a day at 02:30, 15:30 and 19:30, users were requested not to call the only dial-in number with the only modem available at that time.

In 1988, Prince of Songkhla University in the southern part of Thailand established an Internet node connected to Melbourne University a few times a day. Two dial-in telephone numbers were made available from 09:00 in the morning till 19:00 in the evening.

In 1991, Digital Equipment (Thailand) Ltd. acquired an Internet address for internal and research-related usage. No dial-in number was made available and user had to user to use the machine at the company.

A major breakthrough occurred in 1991 when Chulalongkorn University became Internet gateway in Thailand. After sufficient testing, full operation was started in July 1992 with a 9600 bits per second (bps.) leased line to Virginia, U.S.A. and later upgrades to 64 Kbps line. The fees for the leased line with 25% educational discount from the Communications Authority of Thailand (CAT) were about 5.2 million baht per year (about US$ 468,000). Initially only one telephone line was made available but by 1993 twenty lines were accessible. The all day, all night and full Internet service at Chulalongkorn University were obviously much better than the email-only at AIT. Instead of waiting a day or so for the message to be routed through Australia, one could communicate as many times a day as necessary and desirable. One could use the "talk" command to enter into interactive communication. When calls for papers were received from the network, one could ask for and obtain clarification right way.

All major Internet players such as NECTEC, ABAC, KMITL, etc., became active in 1992. In January 1992, the National Electronics and Computer Technology Center (NECTEC) established the NECTEC E-mail Work Group (NWG). In February 1992, NWG established a network named ThaiSarn (Thai Social/scientific, Academic and Research Network) with a machine donated by IBM, two dial-in telephone lines available 24 hours a day for NWG connections. UUCP (UNIX-UNIX Copy) was made hourly with Thammasat University and Prince of Songkhla University, and international connection with
Australia through AIT three times a day. The service was later upgraded to include six
dial-in telephone lines and 24 hours per day
international connection through
Chulalongkorn University. Then in
September 1993, NECTEC became the
second gateway from Thailand and it was
connected to Virginia, U.S.A. by a 64 Kbps
leased line.

In January 1992, Thammasat
University (TU) Information Processing
Institute for Education and Development
(IPIED) also registered as an Internet node.
One dial-in telephone number was made
available 24 hours a day.

The Faculty of Engineering at King
Mongkut's Institute of Technology
Ladkrabang started experimenting with
Internet in mid 1992 connected to
Thammasat. At the beginning, only about 40
users were approved. Later the Computer
Research and Service Center which serves all
the faculties established a central node for
Ladkrabang. By October 1993, about 500
Internet addresses had been given.

Prince of Songkla University and AIT
joined ThaiSam in 1992 but AIT later
installed a direct leased line to Chulalongkorn
University. An account of Internet at
Assumption University will be given in
Section 4 of this paper.

4. Internet at Assumption
University and KSC ComNet

As of September 1995, Assumption
University (AU) and KSC Commercial
Internet Co.,Ltd. (KSC ComNet) have the
largest Internet system in Thailand. Three
SunSparc 1000 computers with 640 Mb of
main memory and 123 Gb of disk space, 56
sets of Sun Sparc Classic and several hundred
sets of micro-computers. The computers are
connected through campus network with the
speed of 100 million bits per second. For
telecommunication, 520 telephone lines are
available for dial-in at up to 28.8 Kbps, and a
total of 2,000 lines have been requested.

The Internet project at Assumption
University was started soon after AIT
spearheaded Thailand connection to the
Internet in 1987. The senior author of this
paper was the President of AIT Alumni
Association and got Internet account at 200
baht per month. Since he was also the
Honorary Vice President of Assumption
University, his Internet fees at AIT as well
as the costs of the computer and modem
were paid for by Assumption University.

After several years of usage of
Internet through AIT, the authors were
convinced that the system should be made
available to the whole university. Therefore,
in August 1993 they proposed to AU Board
of Trustees and got approval to implement
the Internet project by setting up an Internet network called AuNet. The purposes of AuNet include the followings:

1. To educate the students, faculty and staff member on the concepts of local and international networking.
2. To prepare the students to enter into information society where networking will be the norm rather than the exception.
3. To provide full Internet access to all students, faculty and staff members for their personal and educational usages.

On the financial side, the Board of Trustees approved the proposal to let the students pay for the project. The Board decreed that Internet knowledge and experience become a requirement for graduation in any and all educational programs at AU. Each undergraduate student is charged US $4 per month and graduate student US $8 per month. All the income is earmarked for the development and maintenance of the project.

The Internet Institute of Assumption University was established with the senoir author as the Chairman of the Board. The institute consists of three centers, namely, AuNet in charge of providing services to students, staff, and faculty; Network Research Center (NRC) in charge of research; and Knowledge Service Center (KSC) in charge of providing knowledge and distance learning through the Internet.

On the nineteenth day of January 1995, Her Royal Highness Princess Maha Chakri Sirindhorn graciously presided over the opening ceremony of the International Internet Gateway at Assumption University. This international gateway may be considered the third international Internet gateway from Thailand or the first private-sector international Internet gateway from Thailand. The two earlier gateways are in the government sector.

Another major Internet breakthrough in Thailand occurred at the end of 1994 when the Communications Authority of Thailand (CAT) entered into joint venture agreements with two organizations, namely, NECTEC and Internet Knowledge Service Center Co., Ltd. (KSC), to offer commercial Internet in Thailand for the first time. For flexibility in operation, it was agreed that each joint venture be made a private company in order to avoid the red tape and bureaucracy associated with government agencies. However, the joint venture with NECTEC which was supposed to become a private company named Internet Thailand Co., Ltd. could not get approval from the Ministry of Commerce to be a private company unless an approval is given by the cabinet of Thailand. The approval was not given because parliament was dissolved. Therefore, NECTEC was allowed to operate commercial
Internet on a trial basis for one year, under what is called "Internet Thailand Project" and not Internet Thailand Co., Ltd.

In December 1994, a private company was registered as KSC Commercial Internet Co., Ltd. (KSC ComNet) and subsequently CAT got 32% shares in KSC ComNet free of charge. The other 3% shares are to be sold to CAT employees, and 65% goes to Internet KSC Co., Ltd. Assumption University agreed to serve as the incubator for KSC ComNet for a period of not more than two years.

The registered purpose of the KSC Commercial Internet Co., Ltd. is to do Telecommunication business including offering commercial Internet. Later in 1995, Jasmine International Public Co., Ltd. became a joint venture with Internet KSC Co., Ltd.

As of July 1995, there are ten related companies in the KSC group (as shown in Figure 1), namely, Internet KSC Co., Ltd., KSC Commercial Internet Co., Ltd., Telecom KSC Co., Ltd., Internet Shopping Mall Co., Ltd., On-Line Advertising Co., Ltd., KSC Electronic Data Interchange Co., Ltd., KSC Communications Co., Ltd., KSC Technology Transfer Co., Ltd., KSC Multimedia Co., Ltd. and KSC International Co. Ltd.

Internet KSC is the mother company holding shares in all the other nine companies. Telecom KSC sells telecom equipment and software such as computers, modems, telecom software, etc. Internet Shopping Mall operates electronic commerce. On-Line Advertising is the ad agency for ads on the Internet. KSC EDI offers Internet EDI, factory automation and office automation. KSC Comm offers teleconference, video-on-demand, etc. KSC Tech provides training, seminar, etc. KSC Multimedia offers multimedia, Internet fax, Internet pager, etc. KSC International handles International business.

In November 1995, the second Network Operation Center (NOC) in addition to the existing one at Assumption University will be established at Laksi Plaza. The two NOC's will be connected to CAT at Bangrak in a triangular fashion as shown in Figure 2. If a connection between any two points is broken, the other part of the triangle can serve as a backup. KSC has also requested CAT to provide another gateway, e.g. through Nonthaburi, in addition to Bangrak.

The Internet connection form Thailand, especially those related to KSC, is shown in Figure 3. The Internet Nodes at KSC are shown in Figure 4. The approximate numbers of Internet users in Thailand is shown in Table 1.

5. Concluding Remarks

In the last year, Thailand has made a big jump forward as far as Internet is concerned. The authors have been invited to give a lecture on Internet in Thailand in Singapore and Hong Kong in September 1995. The presenters before the authors have
talked about Internet in South East Asia and they ranked Thailand almost at the bottom of the table. After the authors gave the talk and answered questions, the audience agreed to move Thailand to be number one or two at the top of the Internet table for South East Asia. However, there was a question why members of different Internet service providers in Thailand cannot communicate directly and have to go through the United States. The authors explained that their Internet system would be ready and willing to connect to other system in Thailand and, as a matter of fact, they have made proposal to the Communications Authority of Thailand (CAT) for CAT to require that all Internet service providers in Thailand be connected to each other through CAT. It is hoped that all parties concerned would try their best to cooperate in research, development and applications of the Internet for the benefit of Thailand.
KSC Group of Companies
Internet Nodes at KSC ComNet and Related Organizations
Triangular Internet Connection by KSC ComNet
Table 1. Approximate Numbers of Internet Users in Thailand in 1995

<table>
<thead>
<tr>
<th>Organizations</th>
<th>Sample Internet Node Names</th>
<th>Number Of Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Asia Credit Co., Ltd.</td>
<td>malisa.acl.co.th</td>
<td>50</td>
</tr>
<tr>
<td>- Asian Institute of Tech.</td>
<td>ait.ac.th</td>
<td>1,000</td>
</tr>
<tr>
<td>- Assumption University</td>
<td>abac.au.ac.th au.edu ksc.net.th ksc.co.th comnet.ksc.net ksc.net th.com th.org th.edu ac.ac.th</td>
<td>25,000</td>
</tr>
<tr>
<td>- Assumption College</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Bangkok University</td>
<td>bu.ac.th bu.edu</td>
<td>500</td>
</tr>
<tr>
<td>- Chiangmai University</td>
<td>cmu.chiangmai.ac.th</td>
<td>1,000</td>
</tr>
<tr>
<td>- Chulalongkorn University</td>
<td>chula.ac.th</td>
<td>3,000</td>
</tr>
<tr>
<td>- Digital Equipment Corp. (Thailand)</td>
<td>dech.co.th</td>
<td>50</td>
</tr>
<tr>
<td>- Hewlett-Packard (Thailand)</td>
<td>hpth.co.th</td>
<td>50</td>
</tr>
<tr>
<td>- Kasetsart University</td>
<td>nontri.kuac.th</td>
<td>1,000</td>
</tr>
<tr>
<td>- Kasem bundit University</td>
<td>kb.ac.th</td>
<td>50</td>
</tr>
<tr>
<td>- Khon Kaen University</td>
<td>kku.ac.th</td>
<td>1,000</td>
</tr>
<tr>
<td>- King Mongkut’s Institute of Technology Ladkrabang</td>
<td>kmitl.ac.th</td>
<td>1,000</td>
</tr>
<tr>
<td>- King Mongkut’s Institute of Technology North Bangkok</td>
<td>kmitnb.ac.th</td>
<td>1,000</td>
</tr>
<tr>
<td>- Mahidol university</td>
<td>mahidol.ac.th</td>
<td>1,000</td>
</tr>
<tr>
<td>- Ministry of Public Health</td>
<td>moph.go.th</td>
<td>200</td>
</tr>
<tr>
<td>- National Electronic and Computer Technology Center and Internet Thailand Project</td>
<td>nwg.nectec.or.th inet.co.th</td>
<td>3,000</td>
</tr>
<tr>
<td>- Police department</td>
<td>police.go.th</td>
<td>100</td>
</tr>
<tr>
<td>- Prince of Songkhla University</td>
<td>psu.ac.th</td>
<td>1,000</td>
</tr>
<tr>
<td>- Ramkhamhaeng University</td>
<td>ru.ac.th</td>
<td>1,000</td>
</tr>
<tr>
<td>- Royal Palace</td>
<td>(unpublished)</td>
<td>50</td>
</tr>
<tr>
<td>- Thailand Information Access Center</td>
<td>tiac.nstda.or.th</td>
<td>10</td>
</tr>
<tr>
<td>- Thammasat University</td>
<td>tu.ac.th</td>
<td>1,000</td>
</tr>
<tr>
<td>- Others</td>
<td></td>
<td>3,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>45,510</strong></td>
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