

REIHE INFORMATIK

33/95

**Perspectives on the Development
of the China Internet**

Franklin F. Kuo and Xing Li

Universität Mannheim

Praktische Informatik IV

L15,16

D-68131 Mannheim, Germany

PERSPECTIVES ON THE DEVELOPMENT OF CHINA'S INTERNET

by

Franklin F. Kuo,
University of Mannheim
Kuo@pi4.informatik.uni-mannheim.de

Xing Li,
Tsinghua University and CERNET
Xing@cernet.edu.cn

1. Introduction

In recent years, China's economy has been growing at annual rates exceeding 10%. Its telecommunications infrastructure has been expanding at even higher rates - in some cities and provinces, growth rates of 50 to 100% per year have been reported. In similar fashion, the growth of China's TCP/IP Internet has been equally strong. Starting from a single satellite connection in mid 1994, there are over 1000 hosts registered in China today. Despite this, the growth of China's Internet still pales in comparison with the spectacular growth of the Internet in the West. In this paper, we will examine the history of China's Internet, and discuss current issues and problems which impede the rapid development of the Internet in China.

2. Recent History of China's Internet

Until 1993, China's connections to the global Internet were through several e-mail relays in Germany and British Columbia. In most cases, funding for the relays was provided through the assistance of the German and Canadian governments. China's first computer network connection with the outside was the China Academic Network (CANET) which was established in 1988. CANET, with dozens of China's education and research organizations as members, was able to exchange email with the Internet by using X.25 technology via a gateway in Karlsruhe University, Germany. In 1990, CANET registered the top domain "cn" in the InterNic. In the same year, the China Research Network (CRN) was established. This network also used X.25

links to exchange information with the outside world via RARE. There are now more than ten research entities connected by CRN.

In 1993, the Institute of High Energy Physics (IHEP) of the Chinese Academy of Sciences established a link to the Internet through the Stanford Linear Accelerator Center (SLAC). This link enabled a small number of Chinese academics and researchers to communicate directly through the Internet. Since funding for this link was limited to high energy physics research, the link provided only limited access to Internet information resources. Meanwhile within China, the Ministry of Posts and Telecommunications (MPT) was developing an X.25 wide area network called at various times, CNPac, ChinaPac, and ChinaNet. Although the span of this network was nationwide, with switches in hundreds of cities, this network was little used because of its low speeds, inadequate service support, and high tariffs. Not unlike PTTs in the rest of the world, China's MPT pushed X.25 networking while ignoring the burgeoning TCP/IP Internet that was being developed by the world's academic/research community

China's first full link to the Internet was inaugurated in May 1994 by the National Computing and Networking Facility of China (NCFC) project, jointly supported by China's State Planning Commission and the World Bank. Originally the goals of the project was for the establishment of a supercomputer center and three campus computer networks, i.e. the Chinese Academy of Science Network (CASnet), Tsinghua University Network (TUnet) and Peking University Network (PUnet). Upon the completion of the three campus networks in 1992, it was decided to expand the project's scope to initiate a full Internet connection. After more than a year's delay, a 64 kB/s satellite connection to the CIX (Commercial Internet eXchange) was established, and China became a full-fledged member of the Global Internet.

3. The Current Situation of the China Internet

Since May of 1994, a number of other Chinese universities and research institutes have established e-mail or even full Internet links. As of October 1995, there are over eight satellite links of 64, 128, or 256 kB/s to the outside Internet. Two major computer networks have emerged in China. The first is the China Education and Research Network (CERNET), and the other is the MPT commercial TCP/IP network, called ChinaNet.

3.1 CERNET

In December 1993, the China Education and Research Network (CERNET) project was begun. Under the funding of the Chinese government, and managed by the State Education Commission, the main objective of the CERNET project is to establish a nationwide computer network infrastructure to support education and research in and among universities, institutes and schools in China. Its specific aims are as follows:

- (1) Establish a nationwide backbone which connects eight regional networks and connect them to the global Internet.
- (2) Set up a national network center.
- (3) Set up ten regional network nodes.
- (4) Adopt TCP/IP as the network protocol and establish network management systems
- (5) Provide Internet applications and develop China's information resources and applications.

CERNET will use the MPT digital data network (DDN) as the basic communications carrier. DDN's data rates range from 64 Kbps to 2.048 Mbps (E1). MPT's public data network (X.25) will be used as the backup channel.

CERNET will have one to four links to the global Internet, each with a data transmission rate greater than or equal to 64 Kbps. The first link is to the United States with a trunk speed of 128 Kbps (256 Kpbs in the near future). Future linkups will be to the Asia Pacific Region and Europe.

In the past year, there has been consistent progress in the implementation of CERNET. All ten regional nodes have been

established and as of this writing there are fifteen Chinese universities with full CERNET connections. If one recalls the remarkable development of the US NSFNET in the early years of its existence, one would find many parallels in the development of CERNET.

3.2 the MPT's ChinaNet

In recent months, China has witnessed many commercial Internet initiatives. Foremost among these is the commercial Internet access project initiated by the Ministry of Post and Telecommunications. Through its new TCP/IP network, renamed ChinaNet, the MPT has decided to become a commercial Internet Service Provider (ISP). It has commissioned two satellite ports to the Internet, one to be located in Beijing and the other in Shanghai. Another link to the southern city of Guangzhou is planned for operation by the end of 1995. Originally, the MPT wanted to link its X.25 public data network to these gateways, as well as providing leased line connections via its DDN service. At the present time, it appears that the MPT has decided to provide full TCP/IP access service throughout China, and is planning to build a nationwide Internet backbone. In addition, other commercial companies in China are planning to offer various value-added Internet services. Most of these companies are joint ventures between government entities and private enterprises. Whether these companies are planning to be ISPs, to compete with the MPT, remains to be seen. In any event, commercial activities dealing with the emerging Internet in China are growing at an extremely fast pace. This coupled with the Hong Kong ISPs' promotional activities in China, make the Internet business extremely competitive.

3.3 The PRC Government's Plans

During the past two years, the PRC government has done extensive planning for the Ninth Five Year Plan, which would guide China's economic development during the the 1996 - 2000 period. Prominent within these plans are the so-called *Golden Projects* which would lead to technological modernization of China's governmental, commercial, and educational infrastructures. There are eight such projects, with such names as:

- *Golden Bridge*, which aims to link the economic information networks of China's provinces and cities;

- *Golden Card*, which aims to develop an electronic credit-card payment system;
- *Golden Intellectual*, whose goals are to develop educational and scientific computer networks.

It appears that all eight Golden Projects will depend upon the use of nationwide computer networks to move and process data. From a technical standpoint, these Golden Projects are quite different, however. Some of them concentrate on the application layer, while others are actually physical or link level projects. Moreover, not all of them involve TCP/IP networks. For example, The Golden Bridge Project calls for the development of a nationwide VSAT (Very Small Aperture Terminal) satellite communications network to link to different regional networks. The Golden Intellectual Project includes the CERNET and the Chinese Academy of Sciences networks. It remains to be seen what role the China Internet will play in each of the Golden Projects. Very few of the Golden Projects will be fully funded by the government. Each project will be the responsibility of a particular ministry or state council. These ministries are in constant discussions with local or foreign corporations for joint ventures to develop the necessary technological infrastructure to support the projects. There does not appear to be close coordination between the various ministries and councils managing the projects. Since funding is tight, not all of the projects will be able to attain their stated goals.

3.3.1 China's NII

The PRC government has recently recognized the importance of planning for China's National Information Infrastructure (NII). Rather than designating a particular ministry, such as the Ministry of Electronics to take the lead in developing plans for China's NII, the government recently created an inter-agency task force under the name "Joint Conference for the Informatization of the National Economy" (the name sounds less unwieldy in Chinese). Since various ministries are vying for the responsibility of coordinating the development of the China Internet, the Joint Conference has assumed that responsibility.

As of October 1995, the Joint Conference has not issued a policy paper on the government's role in the promotion and development of China's Internet. As a policy organization, the Joint Conference will be able to settle disputes among the various ministries, but it is unlikely that it will be able control and disburse the necessary

funding to fuel the growth of the China Internet. The Golden Projects could possibly contribute to the growth of China's NII, but it does not appear that their specific goals are sufficiently rationalized at this time.

4. Problems and Issues

4.1 Technical Issues

There appears to be few technical difficulties in the development of China's Internet. The most up-to-date protocols, procedures, hardware, software, and other necessary technologies are readily available from the West. Because of the scramble to implement Internet nodes, the major technical problems seem to arise from the scarcity of qualified systems personnel needed to install, maintain, and operate the Internet nodes.

4.2 Economic Issues

In terms of economics, China's Internet is facing many difficulties. The primary difficulty is the high cost of doing business with the Ministry of Posts and Telecommunications. The MPT has the responsibility of developing and maintaining China's telecommunications infrastructure, both for voice and for data communications. To improve and upgrade this infrastructure requires vast amounts of investment capital every year. With China firmly committed to a market economy, a profitable payback to these investments is needed. Up to this time, the MPT's investments in its data communications infrastructure have been highly unprofitable. Thus the MPT has been forced to charge high rates for its data communications services. Since most of China's ISPs are required to use the MPT data communications infrastructure, they are at the mercy of the MPT's high tariff rates. The high rates are also because the MPT has hitherto enjoyed a monopoly situation. In 1994, the PRC government created a competitor to MPT by chartering a joint venture of several other ministries to set up a "Second Network" called *Unicom Corporation*. With little investment money of its own, *Unicom* has been slow in getting started, and it could take years before Unicom can truly be regarded as a competitor to the MPT. The problem of high Internet rates is compounded by the fact that many of China's academic networks are also trying to offer fee-based Internet access, seemingly in competition to the MPT's commercial Internet access service. With no strong policy guidance from above, the MPT naturally favors its own ISP service

over that of others, in terms of favorable tariffs, installation schedules and maintenance.

Because it is very expensive to use the Internet today in China, its growth will be severely constrained as compared to the Internet in the US, where increasing competition among the data carriers will produce not only lower costs, but newer technology and better service.

4.3 Political Issues

Nearly all the current ISPs in China today are state-owned enterprises whose sponsors are the various ministries and state councils. For example, CERNET is backed by the State Council on Education (somewhat akin to a Ministry of Education). The Chinese Academy of Sciences network is sponsored by the State Council on Science and Technology. The Ministry of Posts and Telecommunications is offering a commercial internet service, but so are other networks sponsored by other government entities.

Since the financial stakes in China's Internet are potentially very large, there is a lot of competition between the various networks and sponsors for control of the development of China's Internet. Without a national strategy for China's NII, there is little guidance from above to control and coordinate the plans of the various competing entities. Duplicative efforts abound in China's Internet. There are now at least eight separate satellite gateways to the outside Internet, with speeds of 64-, 128-, or 256 kB/s. If some of the competing entities could pool their resources, they could share one or more E-1 gateways of 2.048 MB/s at little or no extra cost. Fairness policies for sharing, however, need to be addressed. There is currently no wideband E-1 or E-3 backbone in China, although there are various plans for these in the future.

A coordinated national strategy could call for the implementation of several high speed backbones, linked by neutral Internet Exchange (IX) points and Network Access Points (NAPs). Under such an architecture, all the ISPs in China could access the backbone structure, which could be cost-shared by all entities on an equitable basis.

A coordinated national strategy should define the specific missions of the various competing entities today, so that each ISP would have an area of primary responsibility such as education, research, government, commerce, and information services.

Finally, a coordinated national strategy could identify total financial support needed for the development of the Internet, and allocate this budget among the various ISPs, including the MPT, to allow for favorable tariff rates for educational, research, and governmental users.

4.4 Social Issues

4.4.1 Localization

The Internet represents Western technology. Most of its information resources are in English. In order for the Internet to be of maximum usefulness in the China, the information resources need to be available in the Chinese language. So far, aside from Chinese versions of e-mail and some Chinese Web homepages, there is little evidence of efforts towards localization. CERNET has launched some localization projects and it recognizes that if China's Internet is to be widely used, most of its information resources must be in Chinese. Without localization Chinese Internet users will have to do business in English, which would certainly limit the Internet's use, and make the Internet seem like a high-tech form of Western colonialism.

A national strategy for China's NII must include plans and funding for localization of China's Internet resources.

4.4.2 Human Resources

In the push to implement Internet technology in China, human resources, in terms of trained Internet specialists, have been stretched to the limit. Most of the current ISPs in China have few trained systems specialists needed to install, operate, and maintain Internet hardware and software. There needs to be better training for ISP personnel..

It is important to note that one of the primary goals of the CERNET project is to train Internet specialists. Although learning on the job is somewhat inefficient, it is one way to train the large numbers of specialists that are needed to run China's Internet of tomorrow. A possible source of help could be from the West. If Western universities could send Internet-knowledgeable students to China for academic exchanges, these students could be of significant assistance in the expansion of the Internet in China.

5. Future of China's Internet

Is there a bright future for China's Internet? With over 1.1 billion population, China's Internet could become the world's largest in the 21st century. How fast it will grow depends on how the Chinese government and the leaders of China's Internet business resolve the current difficulties outlined in the previous sections.

The authors of this article have no specific solutions to offer. However, we believe that the set of core principles enunciated by the G7 nations for their "Global Information Infrastructure" or GII, could be useful in laying out plans for China's own NII and for its Internet development. These core principles are:

- o Promotion of dynamic competition
- o Encouragement of private investment
- o Defining an adaptable regulatory framework
- o Provision of universal access to networks and services
- o Promotion of equality of opportunity for citizens
- o Promotion of diversity of content, including cultural and linguistic diversity
- o Recognition of the necessity of worldwide cooperation

Although these are general principles, their implementation, with special attention to China's unique circumstances, would be important steps in the attainment of China's national information infrastructure.