# *IP TELEPHONY AND THE INTERNET*: CHINA CASE STUDY


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# 1. Introduction

In the latter part of the 1990s, many small computer and ISP outlets across China used the country's network backbone to provide domestic long-distance and international calls to the public, and in some cases at less than half the rate charged by the incumbent, China Telecom. Yet, despite an abundance of network infrastructure, the Ministry of Information Industry (MII), via its leading telecom enterprise, China Telecom, had, until 1998, steadfastly resisted the proliferation of IP Telephony services—implying that such services were not legal and then clamping down on anyone who tried to provide them.[1]

When, however, the prosecution failed and they realized that their position was untenable, China Telecom rapidly embarked upon a dramatic turn-around. Government officials at the MII created a new licensing framework for Internet telephony operators, limited in the first instance to the government-affiliated telecom bodies—China Telecom, China Unicom and Jitong. They also focused the newly licensed carrier, China Netcom, on IP services and they galvanized China Telecom to undertake the largest roll-out of an IP Telephony platform in the world.

Almost overnight the government had swung around from blocking IP Telephony (in much the same way that they had banned callback operators) to rolling it out as a central plank of their emerging telephony, data and Internet agendas.

China's IP Telephony market formally opened on 28 April 1999, with the MII issuing licences to China Telecom, China Unicom, and Jitong to begin six-month periods of trial operation in a total of 26 cities. This was later extended, first into the new year and then for the whole of 2000. In so doing, the legalization of IP Telephony ended what was still effectively a *de facto* long-distance and legal international monopoly held by China Telecom.

China Telecom was the first of the three carriers to launch services in an initial roll-out comprising 25 cities. The network was rated as one of the fastest IP Telephony roll-outs to have taken place, taking just two months. To build a circuit-switched network of comparable size and capacity would have taken 1.5 years and cost three times the amount. Unicom launched its IP Telephony trial in 12 test cities, acquiring nearly 700'000 customers between June and November 1999.Unicom's 12-city trial network reached full capacity in only 80 days instead of the predicted six months. By June 2000, Unicom had recorded 183 million minutes of Voice-over IP (VoIP) use and racked up US$ 21.6 million in sales. By November, the company had established IP Telephony gateways in 104 cities, with service to 160 international locations, and had become focused on IP Telephony to the extent that they were planning to build the world's largest dedicated IP Telephony network.

Similarly, Jitong had, from January to June 2000, registered revenue of US$ 70.8 million from sales of IP phone cards, up from US$ 35 million for June to August 1999. The annual potential revenue was projected at US$ 37 million for 2000 and US$ 2.6 billion by 2004. Ironically, by the start of 2000, with the government ready to open the market to new competing licensees, many inside of the three existing competitors—Unicom, Jitong and Netcom—already questioned the basic business proposition for IP Telephony in the country. Recent China Telecom price revisions meant that all three were looking for replacement revenue streams with long-term growth potential. Nobody doubted the importance of IP services, nor that both voice and data traffic in China would increasingly be IP traffic. However, IP Telephony as a stand-alone business proposition had rapidly become questionable.

## 2. The Internet in China

The first Chinese Internet connection was established by the Chinese Academy of Science (CAS) in 1988, which registered the ".cn" domain name with the Internet Society in 1990.[2] As was the case elsewhere in the world, while the academic community was the first to begin to develop Internet usage in China, it has been the commercial world that has spurred the government to act, and in China, commercialization of the Internet occurred in 1995. However, commercialization of the Internet in China also represented a means for the Ministry of Posts and Telecommunications (MPT) to regain control of a telecommunication service with regard to which it had "missed the boat", regaining the initiative from CAS and attempting to block rival government agencies from exerting control. The MPT, the Ministry of Electronics Industry (MEI), the State Commission of Education (CES), and CAS had, by this time, been struggling to gain control of the registration function for the .cn domain as China's Internet began to significantly expand.

An associated reason for commercializing Internet service was that, after establishment in May 1994, the CAS network was often overloaded. A new system, charging for access at market rates, was seen as a way of relieving congestion on the single existing connection and funding further buildout of the network.[3] Commercialization of Internet services and the introduction of the World Wide Web into China combined to fuel the growth in user numbers (see Figure 1). As was the case elsewhere, China's administration of the Internet was thus forced to evolve rapidly.

The Leading Group on Informatization (LGI), a cross-ministerial coordination group reporting directly to the State Council was responsible for the first attempt to establish regulatory guidelines for Internet development in China: the Interim Regulations [on International Interconnection of Computer Networks], issued in January 1996.[4] The Regulations stated that the LGI was in charge of overseeing the Internet in China and separated networks into Interconnecting Networks (IN)—which connect into the global Internet-and Access Networks (AN)—providing local access to the Internet. The order further specified that four organizations would operate INs:

- the Ministry of Posts and Telecommunications (MPT): ChinaNET;
- the State Education Commission (SEC): CERNET;
- the Ministry of Electronics Industry (MEI): ChinaGBNet; and
- the Chinese Academy of Science (CAS): CSTNet.

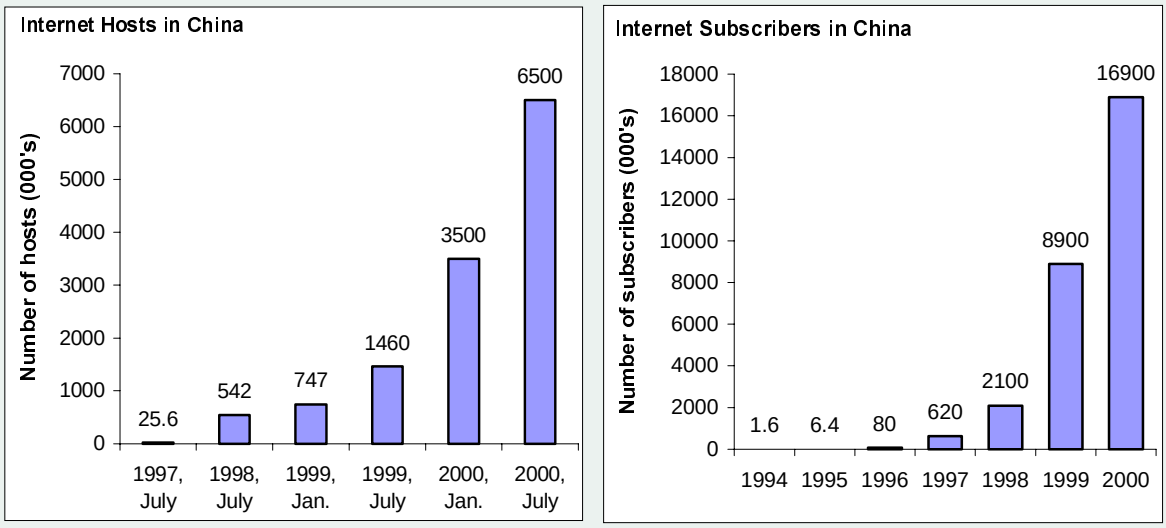
Each of the three bodies other than the MPT chosen to administer INs had to connect to the MPT international gateway if they wished to access international circuits. The MPT therefore, in the interests of national security and orderly administration, was able to maintain its "gateway" position, managing both availability and price of international bandwidth. Subsequently, the Ministry of Public Security (MPS) issued regulations requiring Internet users to register with public security authorities.[5] Users were forbidden to employ the Internet to transmit or receive information that challenged laws or administrative regulations of the State, or endangered national unity.[6] In addition, INs and ANs were required to work with the MPS to prevent and deal with illicit conduct. Given that the MPS had neither the resources nor personnel to effectively track Internet use, it was dependent on the INs and ANs to serve as its agents, and to instil a high level of self-censorship.

The MPS' gain in responsibility came at the loss of the Ministry of Radio, Film and Television (MRFT), which had traditionally controlled mass media in China, but had not yet moved effectively to extend its domain to cover interactive services such as the Web. This jockeying for administrative responsibility grew through the 1990s (Table 1).

Many expected that the Chinese government's regulatory restrictions on the Internet were related to a desire to keep the number of Internet users in China to a linear growth path. After all, it was widely accepted that the Chinese government was not keen to promote widespread access to information.[7] However, constrained Internet development was quite obviously not the case—as the roll-out of the network, the Government Online programme (see below), and the extraordinary growth in subscription levels began to demonstrate. In China, growth, rather than simply control, was the government's primary objective (as had been demonstrated through the early 1990s in basic telecommunications).

Clear evidence of this is, for example, the fact that in 2000 to expand access to the Internet, Chinese authorities have continued to cut the fees that ISPs pay to access telecommunication lines. By December 2000, the fees for a 2-megabyte domestic connection to an international digital line had been reduced to Rmb 100'800 (US$ 12'145) per month (fees have dropped from an original 320'000 renminbi to 220'000 renminbi (US$ 26'579) in late-October 1999) The monthly rental fee for the use of switching stations was 180 yuan per month (down from 600 yuan), and the charges for 12 Kbit/s domestic long-distance digital lines had fallen to 7'610 RMB a month down from 80'000 yuan (down from 431'000 yuan) per month. (Digital data line fees were also reduced by 45 per cent in October 1999.) With this and a number of other promotional measures the stage has been set for an explosion in Internet subscription and usage.

**Figure 1: Internet growth in China**




*Source:* China National Network Information Centre.

## 3. Internet market profile

By July 1997, there were some 25'594 Internet hosts using the .cn national top-level-domain (TLD), according to China's domain name registrar, China National Network Information Center (CNNIC).[8] By July 2000, this had grown to 6.5 million (Figure 1, left-hand side). The number of Internet subscribers was growing even more dramatically. From about 80'000 subscribers in 1996, the market had grown to 2.1 million by the end of 1998 and 16.9 million by the middle of 2000 (Figure 1, right-hand side). The government predicted that there would be at least 20 million Chinese on the Internet in China by the end of 2000 and more than 55 million by 2005. There is good reason to think, however, that these numbers—impressive as they are—are still conservative. Many observers believe that the real number of Internet users in China is significantly higher than the official figures.[9]

While controlled growth was the ideal of the telecommunication authorities, the high Internet subscription rates can most effectively be explained by the competition between the various administrative bodies—initially the MPT and the MEI; later the MII and MOFTEC, the SARFT, and the Propaganda Bureau. The MPT/MII was forced to add bandwidth, lower prices and disperse geographically far faster than it would have been likely to if it were the only agency intent on developing the sector (and hence the only provider).[10]

**Box 1: China's Education and Research Network (CERNET)**

The first IP network connecting China with the outside world was established in 1988 via a gateway at Karlsruhe University, Germany. Through the first few years of the 1990s a number of universities and research institutes established e-mail access through a variety of Internet links. For example, in 1990, the State Planning Commission and the World Bank started a project called the National Computing Facilities of China (NCFC). This project included a supercomputer centre and three campus networks: China Academy of Sciences Network (CASnet), Tsinghua University Network (TUNet) and Peking University Network (PUnet). The construction of these three individual campus networks was completed in 1992. In 1994, a 64 Kbit/s satellite link was established and full Internet access became available to the users of CASnet, TUnet and PUnet. However, there was no nationwide education and research Internet backbone, such that each entity had to arrange its own connection.

Thus, in December 1993, the China Education and Research Network (CERNET) project was started. The CERNET project (<www.cdnet.edu.cn>), funded with Chinese government seed money of Rmb 80 million (US$ 10 million), was the first major Internet development project across China and was placed under the direct management of the Chinese State Education Commission (SEC). Also known as "The Golden Intelligence Project"—one of the manifold government "Golden" networking projects—CERNET has been built to connect regional computer networks with university campuses.

The main objectives upon establishment were to: (a) develop a nationwide IP backbone interconnecting eight regional networks (Table 1) and connect them to the global Internet; (b) set up a national network centre; (c) set up ten regional network nodes; (d) adopt TCP/IP as the network protocol and establish network management systems; (e) provide Internet applications and develop China's information resources and applications.

Ultimately, all campus networks across China are to be interconnected, with each other and then with the Internet. The CERNET centre is in Beijing's Qinghua University. Given China's enormous population, officials expect that CERNET will become the world's largest national education and research network. By 1997, mainland China had 1'075 universities, with more than 390'000 university staff, 94'200 graduate students and 2'184'000 undergraduate students. The distribution of the universities and students corresponding to the eight regional networks along with their IP allocations is shown in Table 1.

Following the roll-out to universities and leading institutes, more than 39'412 middle schools with 55'120'000 students and 160'000 primary schools with 122'000'000 pupils will be connected into CERNET.

*Source:* <www.edu.cn/cernet/intro/index>.

**Table 1: Internet-interested actors in China, 1997**

| Agency | Traditional role | Internet role |
|---|---|---|
| *Ministry of Posts and Telecommunications (MPT)* | Regulator and operator of telephony and data networks | Protect its position as dominant provider of telecommunications |
| *Ministry of Electronics Industry (MEI)* | Manufactured information-technology products | Leverage its decaying manufacturing base and political power to pursue lucrative service industry |
| *Ministry of Radio, Film and Television (MRFT)* | Regulator, producer and operator of mass media | Protect ministry's power and influence as interactive technologies challenge traditional broadcast technologies |
| *Ministry of Public Security (MPS)* | Police of Chinese society | Ensure the Internet is not used to leak State secrets, conduct political subversion or spread pornography or violence |
| *State Education Commission (SEC)* | Policy-maker and administrator for China's education system | Internet support for university and secondary education |
| *Chinese Academy of Sciences (CAS)* | Scientific research policy-maker and host of hundreds of research institutes | Technology transfer; Internet-oriented research and development |
| *Xinhua News Agency* | Monopoly news producer | Leverage and protect monopoly on news |
| *Propaganda Department* | Makes sure that mass media is under the guidance of the Party | Especially concerned with the influence of Western information |
| *State Planning Commission (SPC)* | Controls China's economic resources | Pricing of Internet and telecommunication services; funds for infrastructure |
| *State Economic and Trade Commission (SETC)* | Policy decisions regarding infrastructure and relationships with foreign firms | Foreign investment in China's Internet infrastructure |
| *State Science and Technology Commission (SSTC)* | Policy-making and financing of China's research and development | Internet is a "major focus" |
| *People's Bank of China* | Loans to Chinese firms | Loans to Internet firms |
| *People's Liberation Army* | State Security; also has ties to many manufacturing interests | Security issues; expanding into Internet |
| *Provincial and Municipal Bodies* | Moving away from Central government in pursuit of their own economic development | Develop Internet infrastructure, attract investment through the Internet |

*Source:* Adapted from Foster (1998).

## 4. Internet gatekeepers

The main providers of Internet access to the public are:

- China Public Computer Network (ChinaNet). ChinaNet, run by the operator of China's national public telephone network (China Telecom), is the dominant Internet access provider. Often referred to as the 163 network after the number users dial to gain access to it (see "Going online in Beijing"), ChinaNet is also the effective international gatekeeper by virtue of the fact that all networks must go "through" China Telecom's international telecommunications access.
- China Public Multimedia Network (169 Network). The Multimedia Network, more often known by its dial-up access number, 169, is an attempt by the government to build a China-specific content platform for domestic users. Effectively an America Online style platform, it does not provide direct access to the Internet, but rather creates a Chinese intranet, allowing the government to provide cheaper access and Chinese-language content. (By 2000, the 169 network had proven to be ineffective and was purposefully being rolled into the 163 network—see Box 2.)
- Golden Bridge Network (GBNet). GBNet provides the commercial alternative to ChinaNet. Run by Jitong, a State-owned company formerly linked with the now abolished Ministry of Electronics Industry, GBNet has focused primarily on the corporate market.
- China's Education and Research Network (CERNET). CERNET is the principal academic network. It is centred upon Beijing's prestigious Qinghua University and links together the universities, schools, and education and research institutes. It is still technically distinct from the main public network such that websites which are blocked by the government on ChinaNet (see below) will often be accessible from CERNET.
- China Science and Technology Network (CSTNet). CSTNet is similar to CERNET, but significantly smaller in scale: it connects subsidiaries of the Chinese Academy of Sciences (CAS).

ChinaNet is by far the most important of the four Interconnecting Networks; it is by far the dominant provider and, through China Telecom (and thence the MII) is the only point of public international interconnection. This means it can—ostensibly—control who can set up websites and which websites can be blocked. Although technical means do and will always exist for users with the know-how to find their way to blocked sites, formally this means that China Telecom remains in charge overall of who accesses what on the Internet via the public telephone system.

Of the four Interconnecting Networks (INs), only ChinaNet and GBNet can sell Internet access [on commercial terms] to other Internet service providers (ISPs). (CERNET and CSTNet are limited to only providing access to educational and research institutions.) Because China Telecom owns the vast majority of telecommunications infrastructure in China, this in effect means it is the monopoly supplier. All 150 or so of China's ISPs are small and local, and China Telecom has shown no compunction to date in squeezing as much money from these businesses as possible, with the result that whereas in the Unites States, line rental accounts for only about five per cent of an ISP's costs, in China the average is nearly 50 per cent, down from 80 per cent in 1999.[11]

Even more restrictive is a China Telecom practice of linking line rental to the amount of revenue per line.

Consequently, instead of rental declining with volume, it rises, making an ISP less profitable the more it increases its user base or usage. Given a playing field tilted so steeply against them, most independent ISPs have found it impossible to stay in business without receiving some degree of assistance or lenience from China Telecom. As a result, although China saw a small blossoming of ISPs in 1997 and 1998 (many being small bulletin board service operations which decided to go commercial), many of the companies granted ISP licences have subsequently stopped offering ISP services, or have been incorporated into the ChinaNet framework.

As a consequence, the majority of subscribers, whether companies, organizations or individuals, are connected with ChinaNet, either directly or indirectly. Educational users will, of course, access the Internet via CERNET, and those in the Chinese Academy of Sciences via CSTNet. GBNet, while initially offering Internet access to individuals only, is now being developed principally to service corporate customers.

To support its networking initiatives, China rapidly expanded its broadband communications network in the late 1990s. The government had, since the advent of the "Golden Projects" initiative in the early 1990s, recognized the importance of data transmission. As a result, the government's goal of installing fibre-optic telecommunication lines to major buildings in urban areas and to large villages in rural areas by the end of 2000 meant significant near-term investments. MII authorities expected China to invest US$ 27.1 billion to develop its broadband infrastructure in 2001 alone, with investment expected to reach US$ 24 billion by 2005, of which transmission systems would account for US$ 15 billion, access networks US$ 6 billion, and data communications hardware US$ 3 billion.

What this meant for China was that, by the end of the 1990s, the PRC had invested heavily in China Telecom's ATM network to deliver both voice and data over a national—centralized—communications platform. The MII (and China Telecom) had effectively centralized Internet policy-making and network control under ChinaNet, limited the three other national ISPs (or Interconnecting Networks) to discrete user domains, and funnelled all international access through a few control points. Given this intense streamlining, it had been posited that China Telecom's national ATM network would—given time—duly deliver good Internet service to China's users. Unfortunately for China Telecom, the introduction of the new IP technology had eliminated the luxury of time.[12]

**Box 2: The Ill-fated "169 Network"**

One alternative to ChinaNet's 163 network was China Telecom's 169 network—again named after its dial-up access number. The 169 network, also known as the China Public Multimedia Network, was an attempt to build a China-only internet. Started in 1997, it was run by China Telecom's Data Communications Bureau. Despite its title, it used the same telecom backbone as 163, the public network. Its main distinguishing feature was that all of its content was in Chinese.

It was set up to be difficult to access the network from outside, making it far more secure than the Internet proper, while at the same time allowing users controlled access to the "real" Internet. The network was pushed by the telecommunication authorities as the best home for the country's online government project, a scheme aimed at getting ministries and other State organizations to have an online presence. This project gained widespread acceptance amongst the senior Chinese leadership and government departments which were not yet connected to the 163 network were actively encouraged by the State Council to go online via the 169 network.

Through the 163 network, a subscriber could access global Internet resources and could also be accessed by worldwide Internet subscribers. According to the authorities, "considering the shortage of IP addresses, the threat of information security, the large amount of sexual and reactionary information, vulnerability to the attacks of hackers, and the language barrier (most of the Internet content is in English), the MII had constructed a huge nationwide Intranet—the '169 network'."

However, by 1999 the concept of a China Wide Web, was proving largely ineffective. In early 1999, experts form Runway Technology Co. (a Beijing-based systems integration firm with strong government connections) suggested that the 163 and 169 networks could be interconnected to create a uniform (and unified) platform, access system and database— from which all concerned would benefit. In mid-1999 the suggestion was adopted in the southwestern city of Chongqing, with Chongqing's 163/169 network interconnection becoming the key pilot project for constructing China's national network.

In January 2000, Beijing's 163 and 169 network interconnection project was begun, enlarging capacity to some 90'000 dial-up accounts, 220'000 direct dial-up users, and 2'200 'special line' users. In addition to existing services such as e-mail, www, telnet, and FTP services, the new network provided such services as VoIP, e-commerce, and VPN. Following Beijing, Heilongjiang's interconnection project was completed in March, the Guangdong networks were interconnected in April, Inner Mongolia and Ningxia provinces in June, Shenzhen in July, and Liaoning's networks in September. The network interconnection project will continue to be rolled out across the country.

This was not the first time that a restricted network undertaking promoted by the government had failed. In fact, the 169 network was the latest in a series of ventures aimed at developing Chinese-only versions of the Internet walled off from the rest of the world. Other similar schemes included China Internet Corporation (CIC)[13] and Yinhaiwei.[14]

*Source:* MFC Insight.

**Table 2: Bandwidth: Limited but growing**

*Total bandwidth, million bits per second*

| | January 1999 | July 1999 | January 2000 | July 2000 |
|---|---|---|---|---|
| ChinaNet | 123 | 195 | 291 | 711 |
| GBNet | 8.3 | 18 | 22 | 69 |
| CERNET | 8 | 8 | 8 | 12 |
| CSTNET | 4 | 8 | 10 | 10 |
| UNINET[15] | — | 12 | 20 | 55 |
| CNCNET | — | — | — | 377 |
| **TOTAL** | **143.3** | **241** | **351** | **1'234** |

*Source:* CNNIC.

**Box 3: Going online in Beijing: two easy options**

As an example of how easy it has become to go online in China, we can look to the residents of the capital, Beijing. Here the easiest way of getting onto the Internet is through Beijing Online, operated by Beijing Telecom (which is, of course, a subsidiary of China Telecom, ChinaNet's parent company). By 1999, all one had to do to set up an Internet account was to install Beijing Online's dial-up software, dial 2631, and enter user name 263 and password 263.[16] (By late-2000, the fee for this service was Rmb 2.4/hour.)

By contrast, to get onto the GBNet network requires buying a pre-paid card priced from Rmb 20 (US$ 6.6) for five hours access, to Rmb 4'000 (US$ 723) for 1'000 hours, then going through a procedure similar to that for getting online via 263.[17]

GBNet has certain advantages in that it provides a free e-mail address, usable in most large cities across China, and is often significantly less congested than the ChinaNet network. Of course, GBNet also has its drawbacks. One has to find an outlet that sells the cards, and pay in advance (one can purchase a new pre-paid card or purchase more hours using old account online. There are about 20 outlets that sell the cards, and more than 100 China Commercial Bank agencies also sell the cards). If you run out of credit in the middle of the night, there is little you can do about it.

*Source:* MFC Insight (<www.madeforchina.com/insight>).

# 5. IP Telephony: The government initiative

China's IP Telephony market formally opened on 28 April 1999, with the MII issuing licences to China Telecom, China Unicom, and Jitong to begin six-month periods of operation in a total of 26 cities (Table 3). This was later extended—firstly into the new year, and then indefinitely.[18] In so doing, the legalization of IP Telephony ended what was still effectively a *de facto* long-distance and legal international monopoly held by China Telecom. The opening of the IP Telephony market had been preceded by a substantial amount of "gray market" activity by ISPs, computer shops and local CATV networks. What galvanized the market was a lawsuit brought against the MII by two brothers in the southern Chinese province of Fujian.

## 5.1 The brothers Chen

In 1998, the Chen brothers had begun offering IP phone service through their computer store in Fuzhou city. China Telecom insisted that the brothers had broken the law, and filed a judicial demand to get them arrested. After the police detained the brothers and seized their equipment, the Chens filed suit against China Telecom for the illegal capture of their computer equipment.

The Internet phone service offered by the Chens from their store allowed customers to make international calls at half the rate charged by China Telecom. The brothers pointed out that the only telecommunication regulations which appeared to directly relate to their service were the 1993 "Provisional Arrangement for the Approval and Regulation of Decentralized Telecommunications Services" which had listed the services considered to be telecommunication value-added services, for which a licence was required. Computer services, they reasoned, having not been listed, could not therefore be considered a telecommunication service, and as such fell outside the authority of the MII. While the Chens lost their original hearing at the court of first instance, the Mawei District People's Court, they won on appeal at the Fuzhou Intermediate People's Court. The judge accepted their argument that the activity was not covered by criminal law, and was at most an administrative matter. Local court officials then agreed with the brothers that offering IP Telephony service was not explicitly prohibited under existing administrative rules and regulations.

Reports from the case in the Chinese media said that the appellate court had consulted with Internet "experts" and made its decision on the basis that Internet telephony is technologically different from conventional telephony. While the judge's position was said to be sympathetic because he himself was a wangchong (an Internet worm), it is widely accepted that senior government officials in Beijing countered any overt pressure from the MII and made the court aware of the administrative battle surrounding the Internet. Premier Zhu Rongji's widely-known antipathy for the MII's market dominance had dovetailed with the government's administrative restructuring programme and the leadership's desire to promote economic growth and market competition.

The MII's response was twofold. First it issued a notice of its intent to clarify any regulatory ambiguity regarding IP Telephony (while simultaneously stating that the ministry still had responsibility for all matters to do with telecommunications in China and that IP Telephony was a telecom activity—in short, an assertion that the Fuzhou court was wrong). However, with the gate now opened there was widespread recognition,

even within the ministry, that a ban on IP Telephony would be a difficult position to maintain.

Chinese newspaper editorials began to point out that overseas users would be able to adopt Internet phone technology to make calls to China, while organizations such as foreign companies in China would be able to use Internet Telephony over their networks for outbound calls, using private lines leased from China Telecom. Policing of such set-ups would be virtually impossible. As had been the case prior to the 1993 bout of regulatory liberalization and the eventual introduction of (limited) domestic competition, arguments in favour of cheaper costs and alternative operators for Internet access began to emerge from major users. Organizations such as the Ministry of Foreign Trade and Economic Cooperation (Moftec), began to argue that unless the MII allowed Chinese companies to make international calls at the cheapest rate, then domestic companies would be at a competitive disadvantage. Minister Wu Jichuan and his colleagues found themselves under siege. It began to look as though the gray market activity was to be legitimized and that the IP Telephony market would rapidly become competitive, just as, for example, the paging sector had experienced in the mid-1990s.

The MII's second response therefore turned out to be perfectly in character. In April 1999, they licensed three carriers—all now under the umbrella administrative control of the MII—to conduct a six-month trial of IP Telephony services. They also announced that China Telecom would begin one of the world's fastest large-scale IP Telephony roll-out programmes.

### 5.2 The IP phone trial

Using VocalTec equipment (both hardware and software), China Telecom was the first of the three carriers to launch services on 28 April 1999 in an initial roll-out comprising 25 cities (Table 3). The roll-out was fairly small in financial terms, with the US$ 2 million project utilizing 100 E1 connections.[19] However, the network was rated as one of the fastest IP Telephony roll-outs to date, taking just two months. To build a circuit-switched network of comparable size and capacity would have taken 1.5 years and cost three times the amount.[20]

Yang Xianzu, China Unicom's Chairman and President (until early-1999 Yang an MII Vice Minister) stated that, in 1999, Unicom would, by contrast, invest Rmb 2 billion (US$ 241 million) to complete its IP Telephony trial in 12 test cities and build up a data and computer network covering as many as 90 additional cities. Unicom's 12-city trial network reached full capacity in only 80 days instead of the predicted six months.

During the trial, the three companies issued IP Telephony phone cards with face values of Rmb 50, Rmb 100, Rmb 200, Rmb 300 and Rmb 500. The cards contained a unique account number for use from any phone from within the service areas of the respective companies (see Table 4). (The cards were not interchangeable.) To access the service, a user entered the local access number (a POP) of the vendor, account number, area code, and phone number. The phone charges were then deducted from the account.

The MII's initial pricing structure for the trial showed the potential consumer appeal of IP Telephony (see Table 4).[21] During the initial trial stage, domestic long-distance charges were levied at Rmb 0.30 (US$ 0.04) per minute, while international long distance calls were charged at Rmb 4.8 (US$ 0.58) per minute. Long-distance calls to Hong Kong, Macau and Taiwan were charged in two ways. When calling from mainland China (except Shenzhen) to Hong Kong, from mainland China (except Zhongshan and Zhuhai) to Macau, or from mainland China to Taiwan, the charge was Rmb 2.5 (US$ 0.30) per minute. When calling from Shenzhen to Hong Kong, or from Zhongshan or Zhuhai to Macau, the

charges were Rmb 1.5 (US$ 0.18) per minute. In November 1999, China Telecom expanded the number of countries to which its IP telephone cards provide service from 16 to 50.[22]

Several technical issues appeared early in the trial, but were effectively solved. First, there was limited access capability (in cities where the service was available), so that certain customers had to dial local long distance for access, thereby incurring higher charges. This problem was dealt with by the provision of national access numbers. Second, all three networks experienced serious traffic congestion and dropped calls as they failed to cope with the levels of traffic—particularly during peak periods. As a result of the traffic load and slow response time, a high percentage of calls were not picked up on the first attempt. The gateway for Beijing Telecom, for example, had to go through a capacity upgrade only weeks after the service was introduced. Finally, voice quality was poor because of deep compression, traffic load and possibly lost packets. These problems were alleviated after network expansion and new management tools were implemented by all three service providers. Assessing trial results, the MII announced at the outset of the trial that how and who they would subsequently license to provide IP Telephony services would depend on the results of the trial. The results of the trial, however, seemed to depend on who was asked.

**Table 3: Testing IP**

*Cities selected for IP Telephony trial, primary equipment suppliers and local access number, 2000*

| Company | Primary equipment supplier[23] | Local access number | Trial cities |
|---|---|---|---|
| China Telecom | Clarent VocalTec | 17900 | All cities above town level in China and 350 foreign countries and areas.<br>*Original trial cities:* Beijing, Changchun, Changsha, Chengdu, Chongqing, Dalian, Dongguan, Fuzhou, Guangzhou, Hangzhou, Harbin, Jinan, Kunming, Nanjing, Qingdao, Shanghai, Shenyang, Shenzhen, Suzhou, Tianjin, Wuhan, Xiamen, Xian, Zhengzhou, Zhuhai |
| Unicom | Cisco | 17910 | 103 cities in China and 160 foreign countries and areas.<br>*Original trial cities:* Beijing, Chengdu, Chongqing, Dalian, Fuzhou, Guangzhou, Hangzhou, Nanjing, Shanghai, Shenzhen, Tianjin, Xiamen |
| Ji Tong | GRIC Clarent | 17920 | 45 cities in China and 190 foreign countries and areas.<br>*Original trial cities:* Beijing, Dalian, Dongguan, Guangzhou, Hangzhou, Ningbo, Qingdao, Shanghai, Shenzhen, Tianjin, Wuhan, Xiamen |
| Netcom | Cisco | 17930 | 26 cities in China and 70 foreign countries and areas.<br>*Original trial cities:* Beijing, Tianjin, Nanjing, Zhengzhou, Fuzhou, Guangzhou, Hangzhou, Shijiazhuang, Jinan, Wuhan, Changsha, Shanghai, Shenzhen, Xiamen, Chongqing, Xi'an, Chengdu, Shenyang, Dalian, Kunming, Changchun, Qingdao, Yantai, Suzhou, Wuxi, Changzhou |
| China Mobile | Clarent | 17950 | 20 cities in China and 229 foreign countries and areas.<br>*Original trial cities*: Beijing, Shanghai, Guangzhou, Nanjing, Hangzhou, Tianjin, Dongguan, Shenzhen, Zhuhai, Huizhou, Shantou, Jiangmen, Shunde, Nanhai, Wuxi, Suzhou, Ningbo, Zhenjiang, Wenzhou. |

*Source:* Ministry of Information Industry, China.

**Table 4: Falling prices**

*MII's IP Telephony prices versus non-IP prices*

| Services | Telephony (non-IP) tariffs (Rmb/min) | | IP Telephony tariffs (Rmb/min) | |
|---|---|---|---|---|
| | 1999 | 2000 | 1999 | 2000 |
| Domestic long distance | 0.9-1.1 | 0.5-1.0 | 0.3 (US$ .04) | 0.3 (US$ .04) |
| HK, Macau, Taiwan[24] | 5.0 | 1.65-5.0 | 2.55 | 2.5 |
| International | 12-15 | 12-15 | 4.8 (US$ .58) | 4.8 (US$ .58) |

*Source:* Ministry of Information Industry, China.

### 5.3 Assessing trial results

China Telecom went out of its way to play down both the impact of the trial upon the market and the demand for such services. Two months into the trial, company spokesmen announced that IP Telephony services had been a disappointment in China: "Long distance and international IP phone trials have failed to attract the anticipated response on the local market."[25] According to a report from the Beijing Telecom Administration, the total business volume of international phone services had decreased 5.67 per cent in the first half of the year, while the total business volume of domestic long-distance calls had increased "only" 25.6 per cent. The report showed that customers preferred to use IP phone cards for domestic long-distance calls, with the number of domestic long-distance calls made via the Internet 3.17 times greater than that of international calls. The "unsuccessful trial" was attributed to limited market demand for international phone calls and the relatively small area where the trial was held.

However, this data was contradicted by both the evidence and the tone from the other IP Telephony operators. While international calls accounted for less than 50 per cent of Unicom's IP business, by November 1999 the carrier—which had not previously been licensed to carry international voice traffic—was already generating "several million minutes" in monthly traffic between China and the United States. Between June and November, Unicom had acquired nearly 700'000 customers through its 12-city trial. Another important outcome of the trial is that Unicom's 12-city trial network reached full capacity in only 80 days instead of the 180 days predicted at the start of the operations. Company representatives interviewed were predicting that 10 per cent of international phone calls from China would be carried over the Internet by 2000 and 35 per cent by 2003.[26]

Indeed, using IP Telephony as a lever to liberalize the international services market in China has prompted aggressive roll-out plans. Unicom, for example, had planned to have IP Telephony gateways in 250 of China's biggest cities by the end of 2000.[27] It publicly aspired to a 50 per cent share of China's IDD traffic by 2003. In the past, Unicom had more often than not failed to achieve its own ambitious sales targets. By June 2000, Unicom had recorded 183 million minutes of VoIP use and US$ 21.6 million in sales, accounting for 27.1 per cent of all VoIP minutes (China Telecom claimed 57.3 per cent of all minutes), and 30.4 per cent of all revenue (with only China Telecom higher at 31.5 per cent). By November 2000 the company had established IP Telephony gateways in 104 cities and service to 160 international locations (Table 3). With a customer base in excess of two million cell phone subscribers, Unicom stood to benefit enormously given that it had previously collected no revenue for outgoing international calls.

Initially, Unicom was required to carry IP Telephony traffic over China Telecom's digital data network. However, with industry estimates suggesting that China's VoIP services could account for up to 20 per cent of all packet-based telephony traffic carried worldwide by 2005 (equalling some 60 billion voice minutes), the incentive was there for Unicom to concentrate on building its own network. As a result, by the end of 2000 Unicom had began work on a VoIP network spanning more than 310 cities across 30 provinces, and consisting of five hubs in Beijing, Shanghai, Chengdu, Shenzhen and Guangzhou. When completed, the network will be the world's largest national dedicated VoIP network.

Similarly, Jitong portrayed the IP Telephony trial as an unmitigated success. At Jitong's sales offices in Shanghai more than 2'000 people lined up to buy the IP Telephony cards when they went on sale on May 19—some of them having lined up at 2:00 a.m. Jitong employed a small army of people through 15 sales agencies to push their cards and in their first month of service was able to sell some 50'000 in just five cities. From June to August 1999, the total revenue from sales of IP phone cards was estimated at US$ 35 million, with an annual potential of US$ 150-200 million (assuming the service is expanded). And yet, compared with Jitong's strong IP sales force, China Telecom's IP cards sales were like "the shy blossom of roses," according to one newspaper editorial. China Telecom set up only one sales counter at the Beijing Long-Distance Telephone Exchange Bureau, and issued only a very limited number of IP cards. While the cards sold out quickly, the difference in emphasis and effect was telling.[28]

### 5.4 China Netcom

The fourth carrier to be licensed by the government to trial IP Telephony services was a new [State] company, China International Network Telecommunications Co. Ltd. (China Netcom). Netcom, in and of itself, provides an interesting study of where the IP Telephony market may be headed in China and what the government's designs may be.

In 1998, a number of Chinese economists in the State Development and Planning Commission (SDPC) began calling for the establishment of a new telecommunication firm incorporating the existing network and equipment of the railway industry. Plans for the MoR's network had been considered by both senior Chinese leaders and the leaders of the ministry for several years (see Box 4). With some 35'000 kilometres of fibre already laid, the MoR had the largest high-speed network outside of the MII.[29] (It was the MoR's spare network capacity which was the initial conceptual basis for domestic competitor Unicom back in 1993. However, the MPT managed to thwart Unicom's fixed-line ambitions and Unicom became effectively a "cellco".)

One part of the motivation for the plan for Netcom was to foster competition in the domestic telecommunication market, as earlier reforms and the existing structure had not created an "effective competition mechanism". Another part was the emergence of the Internet and the market for broadband communications.

As a result, a high-speed Internet project, known formally as the Broadband Internet Protocol Network Model Project, was ratified by the SDPC under the State Council. This was to be a broadband, high-speed network designed and built for Internet Protocol (IP) services. In the first instance, the project involved the Chinese Academy of Sciences (CAS), the Ministry of Railways (MoR), the State Administration of Radio, Film and Television (SARFT) and the Shanghai Municipal People's Government.[30] Each of the four participants had an equal stake in the company, capitalized at US$ 50 million.[31] The initial plan was to build a backbone network linking 15 major cities on the eastern seaboard of China, including Beijing, Shanghai and Guangzhou.[32] The company designated to run the project was Netcom.

Netcom's 20 Gbit/s IP/DWDM (dense wavelength division multiplexing) fibre-optic network backbone will cover 6'000 miles and 15 Chinese cities and be ready for operation by late-2000. With one of the highest-speed backbones in the world, Netcom aims to link corporate and government buildings in major cities directly to the IP backbone, providing 2-10 Mbit/s to the desktop—enough to download video in real time. In addition to focusing on the corporate market, Netcom is pursuing the opportunity to create a niche as a wholesaler of broadband network capacity. Netcom began trials of IP Telephony services across its 15 cities in October 1999.[33]

On 30 March 2000, China's Ministry of Information Industry (MII) granted licences to China Telecom, China Unicom, Jitong Communications and China Netcom to perform commercial operations of IP Telephony services. Officials from the Telecommunications Administration Bureau of MII informed that another licence is reserved for China Mobile, which will provide IP phone service by using the wireless application protocol (WAP). China Mobile will obtain its operating licence once it completes the application process, which may take another month.

### Box 4: Future Transportation with the Ministry of Railways

The Ministry of Railways' (MoR) telecommunications network, by far the largest and most advanced of the "private" telecom systems in China, is formidable. This is because the MoR has long occupied a central strategic position in the nation's infrastructure development plan. In 1985, the MOR received the first of a series of World Bank loans dedicated to building a reliable internal ('private') communications network. (This was a US$ 259 million loan for route electrification along the Chongqing-Guiyang line.) By 1986, the system accounted for 5-12 per cent of the total estimated active local circuits installed in China, with 250'000 line subscribers nationwide. By the end of 1993, the MoR was estimated to be in control of some 80'000 exchange lines and 500'000 mainlines.

By 1998, the Ministry was actively exploring the creation of multilateral Internet peering sites in China to improve network efficiency and the co-location of Web servers, and the building of an international exchange so as to enable pan-Asian traffic exchange and reduce dependence on costly international connectivity. As it did so, the MoR (in a bid to supplement its revenues by moving into the lucrative telecommunication sector) was eyeing the growing enterprise market—estimated to encompass 5-10 per cent of China's population. Highlighting the less-than-comprehensive reach of China's telecommunication administration, the MoR had also begun talking with several of the more geographically remote and economically disadvantaged PTAs to build independent IP networks and e-commerce services.

In addition then to the resources that it had provided separately to Netcom and Unicom, the MoR also commissioned Hong Kong systems integrator Computer and Technologies Holdings to build a US$ 3 million voice over IP network for the ministry itself. According to the company, the MoR plans to offer the service to 36 cities throughout China once it is licensed. The internal VoIP network will provide dial-up links between phones, faxes and PCs. The network's E1 network backbone will span 29 nodes with Cisco 7'500 routers installed at the ministry's support centre in Beijing, as well as in Shanghai, Guangzhou, Lanzhou, Chengdu, Zhengzhou and Shenyang. The network will be capable of supporting up to one million customers initially.

*Source:* Computer & Technologies Holdings.

## 6. Going forward: The growth of the China IP market

In addition to the VoIP licences being utilized by Netcom and China Mobile, the MII had also granted licences to the Ministry of Railways (Railcom) and to Shenzhen China Motion Company, and was further expected to grant licences to groups such as the State Administration of Radio Film and TV and CITIC Pacific. Government estimates already suggested that the IP Telephony market (for both equipment and services) could amount to some Rmb 100 billion (US$ 12.2 billion) by the year 2002.

With national teledensity at 13 per cent at the end of 2000, and more than 50 per cent of villages still without basic communications access, one suggestion for the government's rather dramatic push has been that IP Telephony may be the low-cost solution to vastly increasing universal access. Another suggestion is that, as part of its "buy local" push, the government believes that it cannot afford to fall behind in the adoption of new technologies.

Indeed, there is a general consensus in the Chinese telecommunication administration that IP Telephony based on packet-switching technology will eventually replace the traditional telephone technology. To this end, the government has established an IP Telephony standards group, consisting of 27 domestic telecommunications research institutes and equipment manufacturers to:

- establish a set of technology standards for IP Telephony in China;
- support and facilitate interconnection among Chinese IP gateways;
- evaluate the four existing test networks (China Telecom, China Unicom, Jitong and Netcom);
- support deployment of domestic IP products; and
- work on laws and regulations relating to IP Telephony.

Localization has already become an issue in China's IP Telephony programme, following complaints from vendors that they have been shut out from the market during the trial period. Following patterns established with a previous generation of basic telecom equipment such as switches, Chinese telecom companies have been offered discounts of up to 60 per cent by foreign vendors, keen to get in at the ground level of what is already becoming an extensive roll-out. VocalTec, for example, offered a basic platform (not including billing) covering about 20 million subscribers to China Mobile (the newly separated arm of China Telecom) for US$ 500'000 in mid-1999. CMC responded that this was "too expensive"!

By early-2000, China Telecom had begun building a network encompassing 1'000 E1 lines, estimated to be one of the largest roll-outs in the world; Unicom had begun construction on what will be—when complete—the world's largest dedicated VoIP network; Jitong was already generating more than 50 per cent of its revenues from VoIP traffic, and estimations were that Netcom could soon be generating 70 per cent of revenue the same way.

### Box 5: Equipment production and national champions

If Chinese telecommunication equipment vendors (such as Huawei and Zhongxing) were to develop the necessary production lines to become national champions, let alone world class vendors, then China Telecom could not simply shut down the market. However, nor could China's protected telecommunication services and the Internet market simply be opened to international competition—particularly if the domestic vendors were to be given the chance to catch the leading foreign equipment manufacturers in R&D. Thus, the government offered a limited number of licences to leading domestic telecoms concerns, and at the same time, encouraged China Telecom to undertake a dramatic build-out programme, so as to maintain its dominant position.

From the viewpoint of the State in China, the challenge continued to be to steer regulatory reforms in the direction of industrial and technological modernization without weakening China's bargaining position with the world's leading multinational IT companies. At root, that bargaining position is to demand a commitment to technology transfer into China. The multinationals will be hoping for a growing convergence of interests between themselves and Chinese enterprise partners, especially where research and development, intellectual property rights, licensing and franchising issues are involved. Nevertheless, IP telephony has offered a valuable window of opportunity in China's lucrative toll services market.

## 7. Conclusion

China's official licensing and commencement of IP Telephony was expected to begin sometime in 2001, as part of the full telecommunications and Internet regulations. (A comparatively comprehensive set of telecommunications regulations were issued by the MII in September 2000. However, the several areas, notably Internet services, remained unclarified, and the ministry had issued several statements that a full set of regulations would be issued prior to China's accession to the WTO.) As a result, the IP Telephony test period had been extended for a second time beginning April 2000 for nine months to January 2001.

Then again, for all intents and purposes, the IP Telephony business in China had already been launched quite successfully by the end of 1999, with the four trial licensees having committed resources, developed networks, and begun to market their services—with varying degrees of aggressiveness.

In quite a dramatic reversal of attitude, the government had gone from trying to marginalize IP services and alternative network solutions, to actively licensing and promoting such options, and then to sponsoring the incumbent telecom operator, China Telecom, and the government-anointed competitor, China Unicom, to build two of the largest such networks in the world. In the space of less than a year, IP Telephony had moved from *de facto* illegal status in China, to being at the centre of telecommunication development, and prospectively one of the world's largest markets.

The government's turnaround has not, however, simply reflected a wholehearted intent to respond to and drive nascent market demand. Rather, it can be seen, on the one hand, to reflect the MII's concern over lost revenues and China Telecom's desire to dominate all major telecommunication sectors, and on the other, to reflect the government's desire to promote sustained economic development and technological growth. Through focusing on the emergence of this new market sector, the MII has also begun to refocus the roll-out of a plethora of new networks on an advanced "next-generation" data communications platform—and this is perhaps where the importance of the IP Telephony market developments in China lies.

To comprehend the government's push for an IP Telephony network alternative the various contending forces of Internet development in China need to be put into context. By 1995, China already had an Internet "gray market". The imminent arrival of commercial Internet access, its convergence with existing data traffic, its perceived importance to sustained economic development, along with the types of content that were being transmitted, motivated the government to commercialize access to the Internet. It also motivated the Ministry of Posts and Telecommunications to refocus its attention on the Internet, having underestimated its early significance. Within two years the MPT had very successfully achieved its goal of market dominance. But its implementation of a centralized network administration meant that by 1998 there was once again a "grey market" in the provision of various Net-based services—certain networks were successfully bypassing China Telecom's ATM network—and if left unanswered, these services would eventually challenge China Telecom's dominant market position.

Perhaps not surprisingly then, the outside observer can perceive several contending objectives within the government's IP Telephony initiative. The first is the contradiction between the MII's concerns over lost revenues and China Telecom's ambition to dominate the market. To grab market share with a new service offering in a competitive field, China Telecom has had to price and market its service competitively, hence prices have been driven down—at precisely the time the government is looking for the necessary investment to roll out a new infrastructure platform. Given that telecommunications in China was, by 1999, the second largest contributor to State coffers (after the tobacco industry), many in the government were loathe to cannibalize this revenue stream, by opening the doors to such competitive offerings as IP Telephony.

The second, and related, challenge was the trade-off between control and market growth. Uptake of the new IP Telephony service required a wide roll-out and convenient access. But, following on the heels of concerns related to the Internet and to information access, there were again voices in the government arguing for a slower, more orderly development of the market, rather than a chaotic, market-driven approach. Equally, however, with a teledensity of only 13 per cent, IP Telephony was seen by certain sections within the government as a possible low-price means to rapidly increase China's universal access to basic communications.

Third, China's highly centralized ATM network infrastructure was already stressed, and it was increasingly recognized that the squeeze on cheap access and high-speed connectivity would result in China being poorly positioned to participate in international e-commerce. China's single network structure limited availability and escalated the prices for bandwidth—marketed both as leased data circuits to ISPs and as plain old telephone service to enterprises and consumers—as well as for Internet access.

Finally, there was the issue of domestic market development in the face of increased international competition. Government estimates in mid-1999 suggested that the IP Telephony market could amount to Rmb 100 billion (US$ 12.5 billion) by the year 2002—for both equipment and services. But while China was producing much of its own basic telecommunications equipment by 1999, the equipment required for broadband and IP-based infrastructure was new and comprised leading edge technology. Telecommunication officials in China were therefore quite concerned that they would once again be forced to rely on foreign vendors. Therefore, in a bid to drive down the prices charged by foreign vendors and to stimulate domestic production, the government's strategy was to initiate and centralize domestic demand. This coordinated approach suggested countering China Telecom's built-in dominance of the market by opening it to some degree of "controlled" competition. The government's solution was to mimic its earlier success in market "liberalization" by introducing a limited competitor as a pace-setting "hare" for China Telecom to chase—the aim being to promote domestic development while simultaneously maintaining overall market control.

Ironically, with the government ready to open the market to new licensees, many inside of the three existing competitors—Unicom, Jitong and Netcom—already suspected that the basic business proposition for IP Telephony was finished. China Telecom's price revisions meant that all three were looking for replacement revenue streams with long-term growth potential. Nobody doubted the importance of IP services, nor that voice traffic in China would increasingly be IP traffic. However, IP Telephony as a stand-alone business proposition had rapidly become questionable.

[1] In late-1998 the proprietors of a small computer shop in the southern Chinese province of Fujian were arrested and hustled off to jail for selling Internet Protocol (IP) telephony services to the public. The prosecution failed. For more information see Section 5.1.

[2] Tan Zixiang 1995. "China's Information Superhighway: What it is and who controls it," *Telecommunications Policy*, 19(8): 721-31.

[3] Triolo, Paul and Peter Lovelock. 1996. "Up, Up, and Away—With Strings Attached: Internet in China," *China Business Review*, 23(6): 18-29; Foster, Will. 1998. *The Global Diffusion of the Internet*. [mimeo, provided February.]

[4] PRC State Council, "Interim Regulation on International Interconnection of Computer Networks in PRC," Order No. 195 (1 February 1996), as modified by PRC State Council's Order No. 218, 1997 (20 May 1997).

[5] Under regulations promulgated on 30 December 1997, the MPS was charged with ensuring that the Internet was not used to harm the interests of the State. See "Regulations on the Security and Management of Computer Information Networks and the Internet" (US Embassy, Beijing, "New Regulations Codify PRC Internet Practice," <http://www.redfish.com/USEmbassy-China/sandt/netreg.htm>. The Chinese full text is available at <http://www.edu.cn/law/glbf.html>). The new regulations were a codification of existing practices and built on "The Regulations of Safety Protection for Computer Information Systems" and "Notice on Strengthening the Management of Computer Information Network and Internet Registration Information", both of February 1996, and the 'Temporary Regulations on Electronic Publishing' of March 1996. (Order No. 147 requires users to register with the MPS.)

[6] There were also clauses against making falsehoods or destroying the order of society as well as promoting feudal superstitions, sexually suggestive material, gambling, violence and murder.

[7] This is not to say that the issue of content control is trivial in China—it is in fact very important—but controlling it is does not have the priority among government agencies that many [outside or Western] observers stress.

[8] CNNIC Newsletter, No.1, November 1997. See <www.cnnic.net.cn>.

[9] This is because there are usually more than one individual to each official account in China, i.e., multiple users. CNNIC realizes this and assigns multipliers to different categories—1.85 users per dial-up account, 3.96 users per leased line. But the government agency goes no further than this; making no distinction between the different kinds of users—whether they are in business, government or education. Surveys of different work places, however, have consistently found more people logging on from each account, especially for dial-up and leased lines in businesses and for leased lines used in government offices.

[10] By contrast, the Persian Gulf governments only allowed the monopoly PTT to offer Internet service, in the interests of maintaining control. This kept prices high, slowed growth and put a damper on sales and innovation.

[11] See <www.cnw.com.cn/cnw/99new/9929/992915.asp>.

[12] IP telephony operators in China, and most of the equipment manufacturers selling to those operators, initially favoured the more mature technology of ATM (asynchronous transfer mode) over IP, which sacrificed some bandwidth but guaranteed quality of service. (However, almost all were in agreement that the future of IP telephony would be based on more advanced optical networking technology, most likely IP over DWDM (dense wavelength division multiplex).) This was primarily a result of the extensive deployment of ATM that had already occurred in China's rush to build out its PSTN and DDN networks. ATM technology was designed in the 1980s to optimize voice transmission in a regulated environment, and China had been a large adopter of the technology.

[13] China Internet Corporation (CIC), is a Hong Kong-based company, created in 1996—linked with Xinhua news agency—that has subsequently turned into chinadotcom. CIC first suggested it would control all international Internet gateways, and then that it would build a "China Wide Web", which would offer the Internet in China serving only palatable material, initially Chinese-language Reuters and Bloomberg wires, minus any politically sensitive stories. In July 1999, China.com raised US$ 84 million with its listing on the Nasdaq stock exchange—the first China Internet company to do so. The company then raised US$ 395.25 million in a second stock offering in January 2000. In November the company changed it's name from China.com to chinadotcom.

[14] This network, established by a Chinese businessman, was based on domestic information sources—travel, book reviews and so on—and chat groups. Modelled on CompuServe and America Online, it was made available via proprietary software. It attracted a certain amount of attention, and succeeded in selling the Ministry of Posts and Telecommunications and the Ministry of Foreign Trade and Economic Cooperation a one-third ownership stake. Users, however, never rose beyond a few thousand, and the business disappeared.

[15] Uninet is a commercial IN under the Shanghai municipal government. Information can be found at: <www.uninet.com.cn>.

[16] This method is particularly useful for users who have an Internet account elsewhere and want to access their e-mail. Because usage shows up on a phone bill, however, it may not always be appropriate or, in the case of hotels which block such lines, possible to use this means.

[17] In December 2000, there was a promotional offer for Rmb 12.5 for five hours and Rmb 2'500 for 1'000 hours.

[18] At the end of 1999, the MII announced that, with new Internet regulations in the process of being drafted and placed before the State Council, the existing IP telephony licences would be extended. Once the new Internet regulations were published, the existing licences were expected to be extended and new licences awarded.

[19] E1 refers to European (digital signal level) 1 and has a capacity of 2.048 Mbit/s; while a T1 carries 1.544 Mbit/s.

[20] See the Yankee Group report: "Internet Telephony in the Asia-Pacific Region," *Asia-Pacific Communications*, Vol. 7, No. 12, August 1999.

[21] The price pressure from IP Telephony on traditional phone services had already been made clear when, on 28 February the MII announced major price reductions in existing phone service and installation fees.

[22] See *Tongxin Chanye Bao* (Communications Weekly), November 17. The 34 added countries were: Albania, Algeria, Argentina, Australia, Austria, Belgium, Brazil, Colombia, Denmark, Egypt, Finland, Greece, Hungary, Iceland, India, Indonesia, Korea, Malaysia, Mexico, New Zealand, Norway, the Philippines, Poland, Portugal, Romania, Singapore, Slovakia, Sweden, South Africa, Spain, Thailand, Turkey, the Ukraine and the United Kingdom.

[23] In October 1999, China Telecom announced a deal with Clarent for a new dedicated IP-based "Economy International Direct Dial (IDD)" phone service. The prepaid calling card is called *YiTong* in Chinese, which means "will provide even more prosperous communication over time."In October 1999, China Telecom announced a deal with Clarent for a new dedicated IP-based "Economy International Direct Dial (IDD)" phone service. The prepaid calling card is called *YiTong* in Chinese, which means "will provide even more prosperous communication over time."

[24] Except HK-Shenzhen & Macau-Zhuhai, Macau-Zhongshan (see text).

[25] Quoted in ChinaByte (<www.chinabyte.com>), 11 August.

[26] The Yankee Group has predicted that upwards of one-third of all China's international traffic minutes could be carried over IP telephony services by 2002. See the Yankee Group report: "Internet Telephony in the Asia-Pacific Region," *Asia-Pacific Communications*, Vol. 7, No. 12, August 1999.

[27] In late-1998, China gave State-owned Unicom, its second-largest telecommunications carrier, permission to become the country's fifth Internet service provider.

[28] Even with limited attention to the market, the Beijing Telecom office had over 500 people per day sign up for telephone service during the first two days following the announcement. Previously the office had handled about 20 telephone subscriptions per day.

[29] China Telecom's fibre-optic network runs to approximately 200'000 km.

[30] As one commentator put it, "CAS provides the 'brains', MoR the trunk lines, SARFT the access lines, and the Shanghai city government its Internet gateway called Shanghai Infoport."

[31] In addition to the original investment, the Ministry of Finance issued Rmb 200 million in 10-year bonds on behalf of the company.

[32] The eldest son of Chinese President, Jiang Zemin, is linked to the project unofficially through his role as IT supervisor to the Shanghai city's government. China Netcom's CEO is Edward Tian, a 37 year old national who was educated in the United States at Texas Tech University.

[33] One of the first commercial offerings from Netcom, in late-1999, was pre-paid VoIP telephony services to the Chinese *ex-pat* community, estimated at some 50 million people, in the United States and Japan. The service is to be made available via local resellers. On-demand content services will also be offered.