“Spreading Telecommunications to Developing Areas in China: Telephones, the Internet, and the Digital Divide”

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In the framework of overcoming a global “digital divide,” China’s development seems to be a success story and perhaps a model for other developing nations. Over the past two decades, communication facilities have grown at a tremendous pace. As of the end of 2003, the nation had more than 260 million mobile phone users, 250 million fixed line connections, and 70 million Internet users. National teledensity stood at some 39 phones per 100 population, up from 0.2 phones per 100 in 1980. Multiple means of access to data networks, including high-speed broadband data transmission, is forming a key part of China’s economic and social fabric.

Within China itself, however, the recent growth has left the nation’s vast population with an internal digital divide among “haves” and “have nots.” For example, the ratio of Internet access of the most connected parts of China, in the large cities such as Beijing and Shanghai, runs up to 20 times that of the poorest regions of the country, such as Guizhou and Yunnan provinces. Teledensity rates range from more than 70 phones per 100 citizens in cosmopolitan cities like Shenzhen, to tens of thousands of rural villages without a single telephone.

The Chinese government is beginning to realize only slowly the potential problems associated with this internal urban/rural digital divide, as the disparity contributes to maintaining economic division among wealthy coastal residents and the hundreds of millions of inland countryside citizens. Those “have nots” among China’s inland unconnected residents face many challenges, including the inability to grow businesses using telephones and the Internet, the lack of access to the burgeoning use of distance education, and isolation from remote electronic medical and health services that could be life-saving for many rural poor.

The ability of officials to overcome the severe problems of unemployment, poor educational levels, and gaps in provision of health care in these regions, and the resulting discontent among those failing to gain the fruits of China's economic advance, is hampered by the lack of communications tools. In a society still dominated by one-party rule, such inequality and discontent may subsequently be channeled into accentuated waves of disruptive internal migration, or protracted demonstrations against local and national governments. The nation's internal stability and security, therefore, stands to be threatened unless vital new information and communications technologies are deployed to those seeking to improve their economic, educational, and general social well being.

In analyzing the PRC's digital divide, this article first puts the case of China in a comparative development context, and considers past studies of the importance of telecommunications spread to areas of low penetration. What are the potential benefits nations can receive by spreading communications access to a greater number of citizens? The essay also considers how other societies may construct the idea of a digital divide, and formulates a working definition specific to the level of development in China. In building this definition, we begin to see the strategies and challenges for bringing equitable access to the population of a developing nation.

The essay next turns to focus on the PRC, and traces historical government policies that enabled the country as a whole to advance so quickly up the ranks of the global communications hierarchy. In particular, it examines the ways urban and rural communications systems have expanded over the past several decades. There has been open debate about the ways government can deal with issues of access to telecommunications, and the essay considers some of the voices on each side of the policy question.

As the article will show, government leaders and institutions may have goals for developing the industry that may not necessarily take into account the broader needs of all sectors of society. Officials in charge of the telecommunications industry have, in the past two decades, generally put revenue collection ahead of equitable access. Education officials, however, have made some progress in spreading availability of data networks.

The article then considers the newer technology of data communication and transfer. It briefly traces the growth of the Internet in China, and assesses problems related to equitable access to the data network. It then examines tentative government efforts to bridge the gap. The essay concludes with an analysis of the effectiveness of these measures, and discussion of prospects of using technology to bridge the digital divide in the coming years.

The future course of the divide will likely be shaped by the interaction of these forces of technological change, institutional needs and capabilities, and equitable and fair access. The goals of government agencies may not conform with social desires and needs, nor with the ability of technology to provide services in cost-effective ways. The essay and its conclusion consider how these factors will shape the future of China's telecommunications and digital data access.

Spreading Telecommunications to Developing Areas: Prior Studies and Context for the China Case

Several scholars have explored the importance of telecommunications access for developing parts of nations, and their work has relevance for the China case. For example, a study by Heather Hudson provides important evidence for the utility of spreading telecommunications tools to rural areas of both developed and developing countries. (Hudson, 1984). Hudson's work chronicled a positive correlation between telephone spread and GDP growth, and indicated that two-way communications devices such as telephones (and, today, the Internet) were "much more important factor[s] in the development process than one-way communications systems such as radio (Hudson, 1984, pp. 43-44).[1] In the United States, spending on rural telecommunications expansion over several decades from the 1930s to the 1970s had an expanded GDP value of 6 to 7 times the program's cost (Parker, 1981, cited in Hudson, 1984, p. 52).

In developing nations, Hudson cites a study of India indicating that rural residents derived economic surplus by using a telephone rather than travelling overland on their own to personally deliver a message (Kaul, 1981, cited in Hudson, 1984, p. 63). In Sub-Saharan Africa, good telecommunications facilities contributed to greater ability to export agricultural products and raw materials (Clarke and Laufenberg, 1981, cited in Hudson, 1984, p. 70).

More recent evidence of the positive benefits of Internet connections in developing countries is less plentiful, though some studies indicate network access can be beneficial. One manager of the web café service Africa Online indicated that farmers in agricultural countries like Kenya were better able to manage their resources with access to information spread through the data network (Mundy and Sultan, 2001, p. 105). In Ghana, farmers used "tele-centers" (combinations of phone and data network access stations) to find information enabling them to decide when to travel to a specific market to buy or sell products (Falch and Anymadu, 2003, p. 31). In general, it seems reasonable to assume that the benefits Hudson's study attributed to the two-way communication tool of telephones apply in the same way when citizens are given the ability to send and receive electronic mail, and to receive other data by using web browsers.

One of Hudson's other main arguments is that the peripheral economic benefits of telecommunications are often not factored into political decisions to extend access. The ability of telecommunications to generate revenues leads to a profit-loss calculation that can leave poorer areas with little or no network connection. Hudson points out that governments often have little reservation to extend other infrastructure to developing regions – thus roads, water, and electricity are offered even when they may return little or no profit or even generate a loss, while telecommunications may lack similar subsidized support (Hudson, 1984, p. 57).

The case of China, in particular during the era of a more market-oriented economy, mirrors this trend, as this essay's evidence will indicate. However, the dilemma of Hudson's argument is that eventual economic growth in poor regions of a country may lead to positive revenue flows for telecommunications enterprises.[2] Chinese government efforts to bridge the divide could lead to profitability for such rural-based telecommunications projects.

What are the potential benefits for rural Chinese citizens that gain greater access to information and communications technologies? Chinese farmers, like their African counterparts, could benefit from using telephones to find market conditions in neighboring areas, to collect information from weather services, and, in a larger sense, in devoting more time to their work rather than travelling to physically convey a written or oral message. The Internet may not necessarily now (or in the near future) be a grand tool for a farmer in Sichuan to use e-commerce methods to sell his product in California, but it may allow him to obtain enough information about seed prices that he can more rationally plan his next-year's planting.

Other benefits arise with the potential of distance education. Rural areas and some urban districts that lack good schools and teachers may, if they have adequate telecommunications tools, tap into instruction from educators based in provincial capitals or even more distant urban areas with underutilized educational resources. In this way, high-speed data connections can help bridge an education divide. In a similar way, rural areas lacking basic health facilities may benefit from either voice or Internet connections to urban doctors. Patient diseases could be diagnosed and treated without a doctor having to travel the long distance to a remote village.

As this essay will show, the Chinese government has made significant achievements in bridging parts of the information and communications technology divide. In particular, the spread of basic fixed-line telephones to rural areas has been quick in the past few years. But on the whole it is too soon to empirically chronicle the results of Internet access in inland areas, as penetration rates remain very low. Institutional, technological, economic, and other barriers remain before some of these tools can spread beyond wealthy urban boundaries, and thereby accelerate the pace of economic and social change in the developing regions.

Defining the Divide for China

The way the "digital divide" is defined has obvious implications for narrowing the gap. How should the term be applied to a developing nation such as China?

The Organization for Economic Cooperation and Development (OECD) has defined the divide rather broadly as "the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies (ICTs) and to their use of the Internet for a wide variety of activities" (OECD, 2001, p. 4). Thus, we may consider the idea of a divide for developing countries to include basic access to telecommunications tools, as well as factors such as division along lines of regional residence, rural / urban location, and income level.

As noted above, developing countries often think of the term as an international division of network access. Thus, in the case of China, former president Jiang Zemin commented in 2000 that "the widening 'digital divide' indicates that there exists a huge gap between the developed and developing countries in terms of the level of science and technology." (Cited in Qiu, 2002, p. 158). In general, Chinese political leaders tend to think of the divide in terms of a gap between nations, though as this paper will show later, there is an open debate in China about how to bring communications tools to those domestic citizens who lack them.

The issue of an internal digital divide does have salience for many developed nations' political leaders. In the United States, for example, the idea of a digital divide and ways to bridge it has had a controversial connotation. In his 2000 State of the Union address, President Bill Clinton said "we must close the digital divide between those who've got the tools and those who don't." He called for government spending to train teachers for network instruction, and for creation of technology centers in 1000 communities (*NYT*, 1/28/2000, p. A16).

In contrast to Clinton, Michael K. Powell, the chairman of the Federal Communications Commission in the successor George Bush administration, indicated concern that the term could justify government programs to guarantee low-income people subsidies for equipment such as computers or digital televisions. At a February, 2001, news conference, Powell said "I think there is a Mercedes divide. I'd like to have one; I can't afford one. I'm not meaning to be completely flip about this. I think it's an important social issue. But it shouldn't be used to justify the notion of essentially the socialization of the deployment of the infrastructure." (*NYT*, 2/7/2001, p. C1).

The Swedish scholar Olle Findahl has implied that a digital divide in his nation could develop between those with high-speed broadband access, and those with either slower modem or no connections. (Findahl presentation, 2002). High-speed data may in fact become a measure of connection for citizens in a country where mobile telephones, computers, and Internet access are commonplace.[3]

In the case of China, I use the term in a more minimalist sense. My definition accords "communications access" to those with any sort of telephone, either fixed-line or wireless. "Digital data access" is available to those with the rudimentary tools for using data networks: a reliable supply of electricity, a wired or wireless connection, a computer or other device capable of accessing a data network, and minimal education (including basic literacy) needed for utilizing the technology. In this assessment, putting these tools in the hands of Chinese citizens is the method for bridging the divide.

In China, as this essay will indicate, we can use comprehensive national data sets to find two major divisions of telecommunications and data network access. The first comes in the form of an urban-rural access divide, and consists of a contrast between generally affluent city dwellers and poorer countryside residents. The second is seen in a regional gap, between higher income coastal Chinese, and those living in less developed central and western regions. In both cases, income and educational levels play a role in the ability of citizens to have communications and network access. Chinese government statistics support the analysis used here, as numbers breaking down access along urban-rural and provincial lines are a standard method of recording economic data.[4]

Development of Telecommunications in Rural Areas, 1950s to the 21st Century

Prior to the beginning of communist rule in China in 1949, coastal cities with a large foreign business presence had relatively advanced telephone systems. For example, Shanghai had some 85,000 lines installed for about 55,000 subscribers. Though the numbers were small, Shanghai had nearly 30 percent of all telephone lines in the country. The city boasted Asia's largest manual exchange, with a capacity of 6000 lines (Tang, 1989, pp. 43-44).

As Table 1 indicates, in the early 1950s most telephones were concentrated in the hands of urban dwellers. Some 86 percent of all phones in 1951 were in cities, yielding a 6 to 1 ratio of total urban to rural subscribers, and a penetration ratio (adjusted for population) of about 45 to 1. In the countryside, virtually all telephones were for official use; none were available to the general public.[5]

Table 1. Number of Fixed-line Urban and Rural Subscribers, Selected Years, 1951 to 2002

Year	Total Number of Urban Subscribers	Total Number of Rural Subscribers	Phones per 100 Urban Residents	Phones per 100 Rural Residents	Ratio of Urban to Rural Penetration
1951	273,600	45,500	0.41	0.0092	45
1955	375,200	103,800	0.45	0.020	23
1960	659,300	919,100	0.50	0.17	2.9
1965	771,104	492,222	0.59	0.083	7.1
1970	784,130	527,365	0.54	0.077	7.0
1975	1,032,827	659,220	0.64	0.086	7.4
1980	1,341,715	799,036	0.70	0.10	7.0
1985	2,189,554	930,744	0.87	0.12	7.3
1990	5,384,494	1,465,809	1.8	0.17	11
1995	32,635,600	8,070,000	9.3	0.94	10
2000	93,116,000	51,713,000	19.7	6.7	2.9
2002	135,950,000	78,470,000	27.1	10.0	2.7

Sources: For years to 1980: *China Statistical Yearbook*, 1981, p. 295; for 1985 and 1990, *China Statistical Yearbook*, 1995, p. 495, and *China Posts and Telecommunications Annual Report, 1996* (Beijing: "China Posts and Telecommunications" Editorial Group of MPT, 1997), p. 33; for 2000: *China Statistical Yearbook*, 2001, p. 538; for 2002: and "China Facts and Figures 2003 – china.org.cn" web site, at http://www.china.org.cn/english/eng-shuzi2003/jj/jtys1.htm. For rural and urban populations: *Statistical Yearbook of China, 1993* (Beijing: Zhongguo Tongji Chubanshe), 1993, p. 81, for population to 1990; *China Statistical Yearbook, 2002*, CD-ROM version, section 4-1, for population to 2000; and "China Facts and Figures 2003 – china.org.cn" web site, at http://www.china.org.cn/english/eng-shuzi2003/gq/mz.htm, for 2002 population.

From 1953, the government began to turn its attention to the countryside with a campaign to provide phones at the county level. A 1955 Ministry of Posts and Telecommunications (MPT) conference set the more difficult goal of having every township connected to the national network by 1960. In the mid-1950s, the slogan "xiang xiang tong dianhua" ("telephones to every township") became a rallying cry as China's "Great Leap Forward" era of often irrationally planned growth began. A mass campaign in 1960 to expand irrigation networks in the countryside alone incorporated efforts to lay 70,000 kilometers of telephone cable. The result of this particular effort was to add some 30,000 telephone subscribers.

According to government statistics noted in Table 1, by 1960 the country's rural areas had nearly 920,000 telephones, an increase of about 20 times over the 1951 number. Meanwhile, phones in urban areas grew only about 2.5 times. In fact, according to the numbers, there were now more telephones in the countryside than in the cities! However, analyses of Great Leap numbers by Western scholars assert many numbers from these years were inflated by local officials to show compliance with campaign goals, so it is not clear whether the large telephone increase of the late 1950s actually occurred.[6]

In any case, over the next five years, the actual number of phones in rural areas fell by more than 400,000, according to government numbers. During the "Great Leap," sloppy installation of phone lines had apparently failed to follow an overall plan, leaving the network with many poor connections and overall low quality (*DZYS*, 1993, p. 287). As a result, many of the lines (if they ever actually existed) were removed in the post-Leap years.

From 1962, the government turned its attention away from rural telecommunications development, and set its goal for network expansion again at the county, rather than township, level. The "Cultural Revolution" of the late 1960s and early 1970s saw a modest expansion of the network, though poor maintenance practices meant network quality lagged.

From the beginning of his leadership of China's communist party in the 1920s, revolutionary leader Mao Zedong emphasized the importance of rural citizens to the success of the China's communist system. However, the focus on providing phones and communications access to rural areas was likely more related to developing mechanisms of political control over the countryside through rapid communication means than it was an effort to broaden telephone access for farmers. For example, after 1956, the country's broadcasting and telecommunications authorities cooperated to use the phone lines for sending radio broadcasts to villages (*DZYS*, 1993, pp. 344-345). The vast number of the early telephone connections in both urban and rural settings were placed in public buildings, such as government offices or military command posts, rather than in citizens' homes.

From Table 1, we see that the number of telephone subscribers in China's countryside during Mao's reign jumped from about 45,500 in 1951 to 659,000 in 1975, a nearly 15-fold increase. Over the same period, urban phone lines, which still outnumbered rural connections, rose only about four-fold, from 274,000 to 1.03 million. Overall, as Table 1 indicates, the beginning of the Mao era saw a narrowing of the rural-urban penetration gap, from a ratio of 45 in 1951 to about 7 in the mid-1960s. However, there was little progress after the beginning of the Cultural Revolution to narrow the gap, which remained fairly constant to the mid-1980s. At that time, only about 1 in 100 urban residents had a telephone, and about 1 in 1000 in the countryside.

The rise of Deng Xiaoping and his reform policies in the 1980s signaled marked change in China's economic system. Telecommunications policy reflected the transition to a market-oriented society, and developments in the middle of the decade ignited rapid growth of telecommunications systems. The Ministry of Posts and Telecommunications (MPT) could keep nearly all of its foreign revenue to further develop the network, many government loans for growing the system were forgiven, and provincial telecommunications offices were also allowed to plow their profits into further expansion. Rates for international call completion were set high to generate further income for the system's expansion, and foreign investment to build the system (though not operate it) was encouraged.[7] High connection fees of 2000 to 3000 yuan (about $240 to $360) per line in the mid-1990s also provided an important revenue source (*SCMP*, 8/28/1997, Business Review section 2, p. 2). Government targets for numbers of new lines were rapidly met and exceeded by the late 1980s and early 1990s.

Over these years, the urban-rural telephone gap grew again rather quickly. As Table 1 indicates, in 1980 there were about 1.7 times as many telephones (7 times as many per capita) in cities as in the countryside. By 1995, attention to the city networks had led to an urban / rural ratio of 4 to 1 in total numbers of phones, and a per capita ratio of about 10 to 1.[8]

As with many other aspects of China's economic growth, the reformist government had turned its immediate attention to infrastructure growth in the cities, and a larger role for market forces in determining how investment would be made. Plans to open coastal cities as targets for foreign investment, as well as a concentration of industry in urban settings, dictated the need for rapid growth of telecommunications tools in these regions. It is therefore not surprising that the urban / rural telecommunications gap expanded during the first decade of China's new "market socialism" economic system.

The expansion of telephone access into the home in the late 1980s and 1990s also allowed the relatively wealthier urban residents to accumulate greater communications access. The number of urban residential telephone subscribers rose from only about 41,000 in 1985 to 24 million in

1995; for rural residents, the increase was from 21,000 to 5.5 million (*CSY*, 1995, p. 495, and *CPTAR*, 1997, p. 33). The majority of telephones now were for residential use, but the increase was greater for those in cities who could afford them. Until the high connection fees were phased out in the late 1990s and early 2000s, the cost of installing a phone was one key barrier to residential phone service in poorer rural areas.

By the mid-1990s, after urban phone use had spread rapidly, the government again turned its attention to rural areas. The idea of spreading telephones to villages was revived, with the slogan "cun cun tong dianhua" ("telephones to every village") used to reinforce a commitment to provide telephones to even remote parts of the nation. In 1985, about 95 percent of China's 83,000 townships but only 45 percent of 940,000 villages had access to telephones.[9] In early 1996, MPT minister Wu Jichuan announced a goal of connecting each of the country's then approximately 740,000 villages to a telephone by the year 2000 (*APTA*, 2/5/1996).[10]

The new policy had some slow though steady success. By 1998, 60 percent of villages had at least one phone (*SCMP*, 6/11/1998, Business Review section p. 1). A cut in the fixed-line connection fee from 2000 yuan ($240) to between 500 and 1500 yuan ($60 to $180) in March, 1999 facilitated the more rapid spread of residential and business connections (*CO*, 3/9/1999). In late 1999, the number of connected villages had increased to more than 75 percent. The connection fee was eliminated in July, 2001 (*XEN*, 7/6/2001), and in early 2003, 85 percent of villages had telephones (*CD*, 10/17/1999, and *FTI*, 2/13/2003).

Table 1 shows that by the year 2000, the overall penetration ratio had narrowed significantly, at least for fixed line phones, to an urban / rural ratio of about 3 to 1, and the number of rural residential phones rose to nearly 46 million (*CSY*, 2001, p. 538). The gap continued to narrow slightly in the first years of the new decade, as penetration rates in coastal and urban areas began to reach saturation levels. Still, residents of more than 100,000 villages had no access to a telephone within 5 kilometers of the village borders (*RCRC*, 2002, p. 72).

Village access also varied widely by region. As Table 2 shows, many rural parts of wealthy coastal areas enjoyed near blanket phone coverage, while rural inland areas had many villages with no access. Geography contributed to the difficulty of connecting many of these regions, with mountainous, hilly, and desert regions seeing special problems for providing connections. Of the unconnected villages, about 90 percent lie in mountainous or remote regions that are difficult to reach with fixed line systems (*RCRC* 2002, p. 72). The concluding section of the paper discusses various technologies that can overcome some of these geographical hurdles.

Table 2. Rural Telephone Access in Selected Areas of Highest and Lowest Penetration, 2001

Province / Region	Percentage of Villages with Telephone Access
Beijing	100
Shanghai	100
Tianjin	100
Zhejiang	100
Jiangsu	100
Guangdong	100
Fujian	100
Henan	100
Liaoning	94.5
Inner Mongolia	31
Gansu	30.1
Qinghai	29.1
Guizhou	16.3
Tibet	4.3

Source: Research Center for Regulation and Competition, Chinese Academy of Social Sciences, "Universal Service Obligations in China's Telecom Sector: Situations, Reforms, and Implementations", May, 2002 paper; p. 25; complete paper posted at http://wbln0018.worldbank.org/ppiaf/activity.nsf/files/A070100-S-TCI-RF-CN-FRE.pdf/$FILE/A070100-S-TCI-RF-CN-FRE.pdf. See this paper for a complete list of penetration rates by province / region.

Notes: The report categorizes "access" as having a telephone available within 5 kilometers of the village border. The above source cites "Annual Report from China Telecom in 2001" as its data reference, though does not indicate if the numbers are year-end 2000 or year-end 2001.

A rapid increase in the number of mobile phone users also has reflected a telecommunications divide. In 1993, China had only about 600,000 mobile phone subscribers (*CSY*, 1998, p. 568), but in early 2003, the number had increased to about 160 million individual mobile users (*XGN*, 6/3/2003).[11] Wealthy coastal provinces and cities take the bulk of subscribers, with Beijing, Shanghai, Guangdong, Zhejiang, and Fujian in the top five places in penetration, all at more than 13 mobile phones per 100 users in early 2001. Guizhou, Tibet, and Gansu trailed at the bottom, with only about 2 mobile phones per 100 citizens (*RCRC*, 2002, p. 18). However, from the end of 1999 to early 2001, the penetration rate of the three lowest-ranking provinces had all increased by 100 percent or more, allowing them to keep pace with the top-ranking areas.[12]

As with fixed-line phones, the Chinese government has shown some interest in providing mobile communication to the countryside. In 1994, the founding charter for China's second mobile phone carrier, China Unicom, mandated that the company was to provide telephone access to parts of the country where services were limited. Though China Unicom has avoided an actual universal service obligation, and seen most of its expansion to urban areas, new technologies such as wireless communication may play an important role in bridging the telecommunications and data divides, as the final section of this paper will discuss. Moreover, the falling cost of mobile phone connections and rising costs for fixed line construction makes it likely that, as with fixed line subscribers, many of the newest mobile users will reside in inland or rural parts of the country.

Though there has been significant progress in extending phone connections and basic communications access to rural regions, a debate continues among scholars and some government officials over the most appropriate course to follow to narrow the divide. The following section considers the issue of government financial support for bridging the gap, and focuses on recent published viewpoints arguing for and against active political moves to assist developing regions.

Issues and Debates over Addressing the Telecommunication Divide: Market Forces vs. Government Intervention

One major problem for extending phone service in the countryside since the Mao years has been revenue collection. As market mechanisms became more important for regulating China's economy in the post-Mao era, decisions on telecommunications came to conform more closely to the kind of profit-loss calculations noted in the above-cited work by Hudson.

From the 1950s, rural telecommunications losses had been common, and during the Great Leap years many party officials placed telephone calls for less than the official rate, or for free (*DZYS*, 1993, p. 291). In 1979, the MPT proclaimed new rules for regulating the rural industry, and emphasized more rigorous collection of telephone fees. As a result, in 1981 rural telecommunications revenues began to exceed outlays, rising from a deficit of 8 million yuan (about $5.3 million) in 1980 to a surplus of about 6 million yuan ($3.5 million) in 1981, and 91 million ($26 million) in 1986 (*DZYS*, 1993, p. 292-293).[13]

However, by the mid-1990s, rapid growth in urban and coastal areas had made investment in these areas more profitable. The greatest generators of profit for the MPT in 1994, for example, were Shanghai, Guangdong, and Shandong, while the inland, rural provinces of Sichuan, Shaanxi, and Gansu all were net revenue losers (Xu, 1997, pp. 44-51).

Revenue issues persisted into the following decade, as the phasing out of the connection fee made providing services to rural areas even less financially rewarding. In a poorer province such as Anhui, for example, there is no fee to the customer for the installation of a first fixed telephone line. However, the actual cost of installation is about 2000 yuan ($240), and telephone expenses income is only some 200 yuan ($24) per year (*INA*, 3/8/2002, China Business section). Nationally, revenue from rural telephone business dropped 6.4 percent in the first quarter of 2002 compared to the 2001 first quarter, and losses widened 15 percent, to 150 million yuan ($18 million), over the same period (*CO*, 4/26/2002).

By the late 1990s and early 2000s, Chinese government officials and scholars began publishing opinions on how rural and inland development should best proceed, and focused on the issue of telecommunications access. For example, Xu Li, from the Ministry of Posts and Telecommunications' policy and legal regulation department, suggested in 1997 that it was most important to maintain growth in the developed coastal areas of the nation, and in particular build networks in the urban provincial capitals. Funds and technical expertise from the coastal parts of China should be used to develop inland areas, Xu argued, but the welfare of the whole network should not be sacrificed to develop poorer parts of the country (Xu, 1997, p. 51). The economist Liu Huaide echoed this sentiment, acknowledging there was a gap between coastal and inland access to communications tools, but arguing that one should not artificially force the pace of telecommunications growth in poor areas. Liu asserted consumers in these areas may not see the need for or even understand how to use more advanced technologies such as Internet access (Liu, 2001, p. 16).

The prominent social scientist Hu Angang, long an advocate of equitable development, added his voice to the question of telecommunications access. In an article co-authored with Zhou Shaojie in 2001, he argued against relying on market forces to narrow the telecommunications and Internet gap. The government should play an active role by facilitating private and foreign investment in inland regions, and encouraging greater corporate competition for rural markets. The government should also mandate lower connection and service fees for developing regions, create a special fund to subsidize the spread of communications tools, and spur the convergence of technologies such as cable television with voice and data networks to provide greater avenues of access to less wealthy citizens (Hu and Zhou, 2001, pp. 25-29).

As we will see later in the essay, the government has taken some steps to achieve parts of the program advocated by Hu and Zhou. In particular, the introduction of new technologies, such as cable television and other broadband connection paths, can provide new tools not only for facilitating basic communications, but also for access to the data network of the Internet.

The Digital Divide of Internet Use

As in many developed nations, early use of the Internet in China came primarily from urban-based members of research and academic professions. The PRC's connection to the global Internet began in 1987, as the China Academic Network, or CANet, sent the nation's first e-mail message in September of that year.[14] China constructed several data networks over the following decade, including the China Education and Research Network (CERNET), under the auspices of the State Education Commission; the CST Net, under the Chinese Academy of Sciences (CAS); and what has come to be the largest commercial network provider, the ChinaNET, under the MPT (reorganized in 1998 as the Ministry of Information Industry, or MII).

Until the mid-1990s, much of the early Internet construction centered around major cities such as Beijing and Shanghai. In March, 1995, the CAS linked branches in Shanghai, Hefei, Wuhan, and Nanjing using the standard IP/X.25 technology, as a first step to extending the Internet to the whole country. The CAS then turned to connect a further 24 major cities to the academic network, and the ChinaNET took similar action to build a national backbone network (*CINIC*, undated, unpaginated report).

Early commercial service was found almost exclusively in the wealthiest provinces, as Beijing and Shanghai municipalities, along with Guangdong, Liaoning, and Zhejiang provinces, began offering Internet access via ChinaNET's backbone in May and June of 1995. Most of this service was offered by regional telephone companies, though some private Internet service providers did emerge in these years. However, costs for usage were high, with monthly on-line fees averaging 400 to 600 yuan (about US$50-75). These relatively high costs, at a time when average per capita monthly income even in urban Beijing stood at some 650 yuan (or $80) effectively limited use to wealthy city dwellers (Harwit and Clark, 2001, pp. 388-390). [15]

In March, 1999, at the same time it lowered telephone connection charges, the Chinese government moved to force down Internet access fees at several levels in order to make the service more affordable for private use. Hourly usage rates fell to average about 4 yuan (48 cents), or about 120-170 yuan ($15-20) per month (Harwit and Clark, 2001, p. 391). By 2001, users could access the Internet from their homes using a modem, and have fees added directly to their phone bill. Costs were as low as 0.02 yuan (about 0.25 cents) per minute, and there was no need to subscribe to a separate specialized service provider.[16]

As Table 3 indicates, by the late 1990s the lower costs meant relatively large numbers of citizens in developed cities and provinces had access to the digital data of the Internet, while poorer, mainly inland provinces, lagged. Beijing has been the leader over the past few years, with nearly 30 percent of its citizens classified as Internet users by the end of 2002. Shanghai and Tianjin have also seen large numbers of users by the early years of the new decade. Tables A and B in the Appendix give full numbers of users, as well as percentage penetration, for all provinces from 1997 to 2002.

Table 3. Percentage of Total Population Using the Internet in Areas of High and Low Use, 1998-2002, grouped according to top 5 and bottom 5 ranking areas in the 2002 count

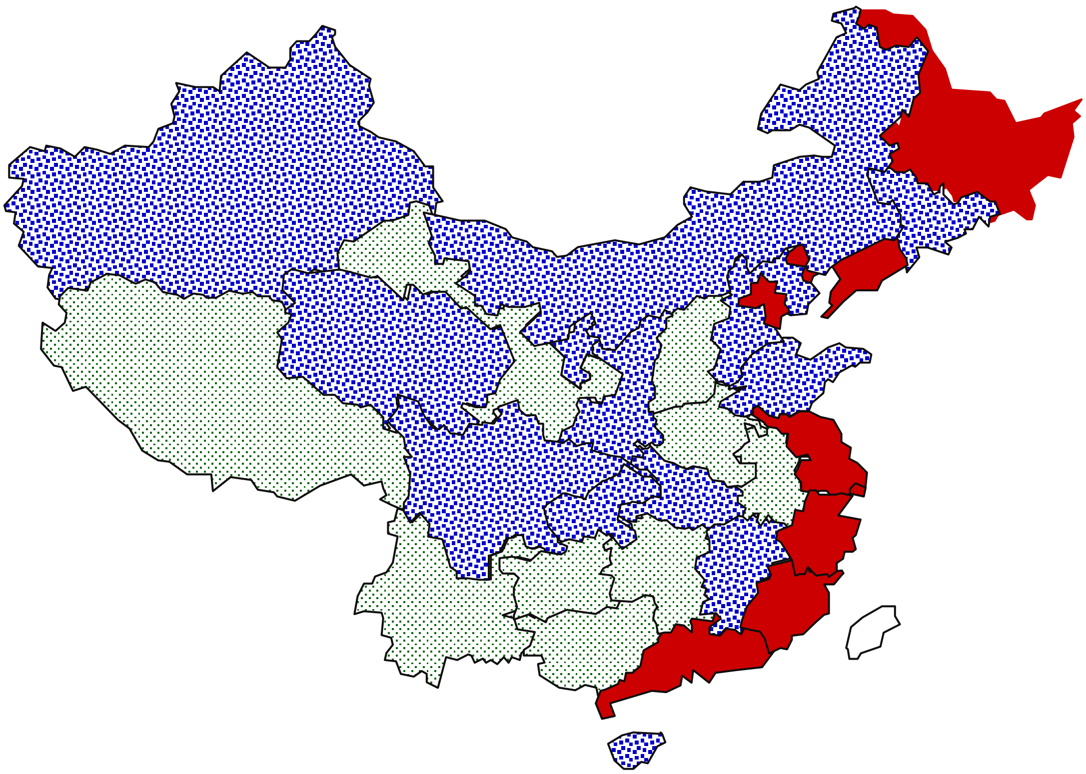
	1998	1999	2000	2001	2002
Beijing	4.0	16	21	24	29
Shanghai	0.6	6.9	12	19	26
Tianjin	0.4	2.6	5.8	9.2	14
Zhejiang	0.2	0.9	3.3	4.8	7.2
Liaoning	0.2	0.9	2.4	3.2	6.7
Yunnan	0.02	0.1	0.8	1.2	2.4
Tibet	0.02	0.1	0.3	1.2	2.3
Anhui	0.05	0.1	0.9	1.4	1.9
Henan	0.05	0.2	0.6	1.1	1.8
Guizhou	0.03	0.1	0.5	0.6	1.3
National Average	0.17	0.73	1.8	2.7	4.8
MEDIAN	0.09	0.40	1.4	1.9	3.7

Sources: Derived from China Internet Network Information Center (CNNIC) reports, various years, from CNNIC web site http://www.cnnic.net.cn; population numbers from *China Statistical Yearbook* (Beijing: China Statistical Publishing House) various years. According to the CNNIC, a user is defined as someone who has used the Internet for at least one hour per week, on average, for the past 6 months. User definition from summer, 2002, interview with a CNNIC official in Beijing.

At the low end, provinces such as Guizhou and Henan have very few users, with hardly more than one percent of each province's citizens getting access to the network. However, the annual rate of increase for Beijing users has been about 67 percent since 1998, while for Guizhou the annual increase has averaged some 162 percent and for Yunnan, about 223 percent.[17] (See Appendix A, Table A, for more complete growth numbers). The rate of increase among users in Beijing seems to be leveling off, while rapid growth continues in inland areas, indicating the gap, at least on a regional basis, has been narrowing over the past few years. Moreover, the median of Internet use has gradually been approaching the average use percentage, indicating the development of more even distribution of Internet use across various provinces.

Figure 1 indicates graphically Internet penetration across provinces. As expected, the relatively wealthier, urban coastal provinces show greater Internet user levels, while many western provinces show lesser use. However, several provinces located in inland China, such as Xinjiang, Qinghai, and Inner Mongolia, have made progress to reach at least 3 percent penetration rates, and rates of growth in these provinces have been higher than the national average over the past several years (see Appendix, Table A).

Figure 1. Internet Penetration Percentage by Region, End 2002



Above 6 % of population using the Internet

3% to 6% of population using the Internet

Below 3 % of population using the Internet

Data from CNNIC; map template courtesy of BDA (China) Ltd

The regional growth shows a rough correlation with income levels. In 2001, for example, urban residents of Beijing and Shanghai both had average monthly incomes exceeding 950 yuan

($115), and rural residents of these municipalities had monthly incomes of more than 400 yuan ($48). (See Table 4). By contrast, urban Guizhou and Anhui dwellers had monthly incomes of about 460 yuan ($56), and rural residents of these provinces 170 yuan ($21) or less. With the cost of Internet use relatively uniform across the nation, and starting at about 1 yuan ($0.12) per hour, it is not surprising the residents of poorer provinces show less ability and interest to gain Internet access.

Table 4. 2001 Average Per Capita Monthly Income for Five Areas with High and Low Internet Use

Region	Per Capita Monthly Income in Urban Areas	Per Capita Monthly Income in Rural Areas
Beijing	Yuan 963 / $116	Yuan 419 / $51
Shanghai	Yuan 1080 / $131	Yuan 489 / $59
Tianjin	Yuan 750 / $91	Yuan 329 / $40
Zhejiang	Yuan 878 / $105	Yuan 382 / $46
Liaoning*	Yuan 486 / $59	Yuan 213 / $26
Yunnan	Yuan 571 / $69	Yuan 128 / $15
Tibet	Yuan 656 / $79	Yuan 117 / $14
Anhui	Yuan 472 / $57	Yuan168 / $20
Henan	Yuan 439 / $53	Yuan 175 / $21
Guizhou	Yuan 454 / $55	Yuan 118 / $14

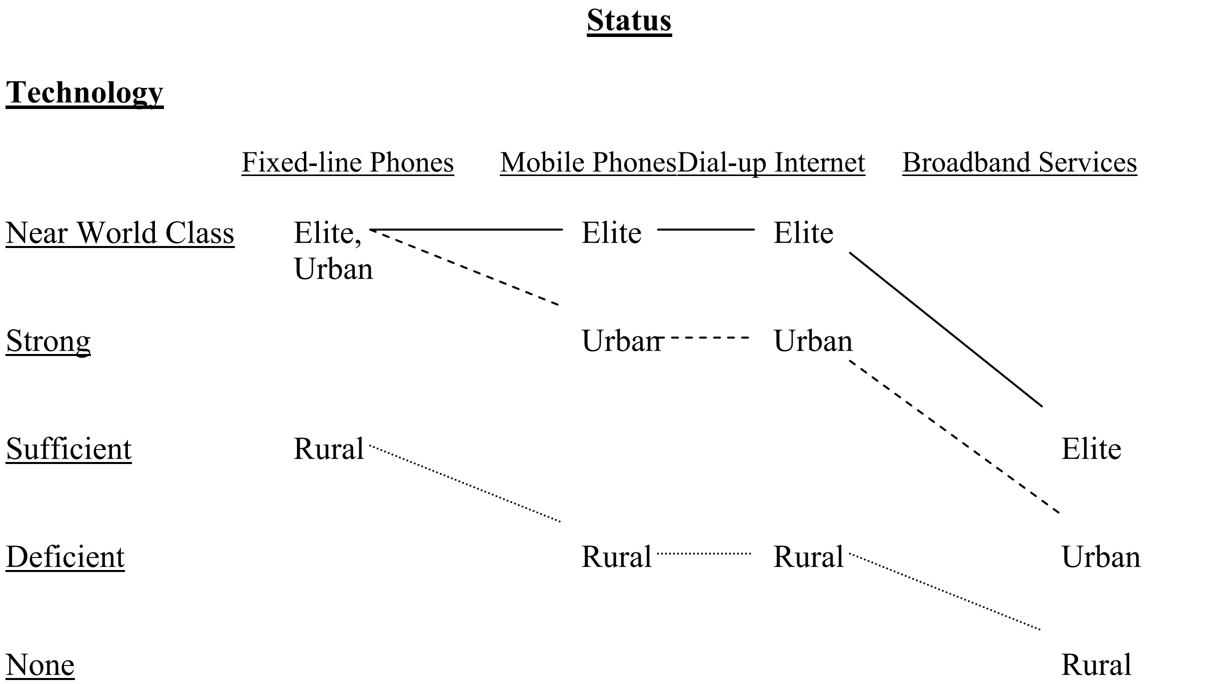
Sources: Derived from annual income statistics in *China Statistical Yearbook, 2002*, from tables 10-15 and 10-21 in CD-ROM version

*Note: Liaoning is obviously an outlying case in this chart. Its high Internet penetration rate may be explained by a greater percentage of residents (older than age 6) with a college education. At 2.3 percent with a college education or higher in 2000, it ranked fourth in the nation, and had nearly twice the national average. Derived from *China Statistical Yearbook, 2002*, CD-ROM, table 4-12. The following section of this paper also assesses the correlation of Internet use and education levels.

Though most official government statistics on Chinese Internet use evaluate numbers along provincial and regional lines, the better way to assess user disparity may be along the larger national urban / rural split. As of early 2003, China's Ministry of Science and Technology estimated that only 600,000 of the nation's nearly 60 million Internet users were living in rural areas (*CD*, 2/13/2003, unpaginated reference at website). This represented a ratio of about 100 to 1. Among rural residents, who make up about 62 percent of China's population, this would mean a miniscule 0.08 percent of rural residents are Internet users, while about 12 percent of the nation's urban residents use the network.[18]

Figure 2 gives a rough summary of the status of the information and communications technologies in the urban-rural divide. The progress to date in fixed-line phone connections to the vast majority of Chinese citizens is significant. As the chart points out, however, the rural areas significantly lag developed parts of the country for more advanced communications tools. The prospects for the spread of higher level technologies, such as dial-up Internet and broadband access, are discussed in the final section of the paper.

Figure 2. Status of the Telecommunications Revolution in Elite Urban, Urban, and Rural Areas



Note: "Status" is a subjective measure, taking into account factors such as availability, quality, and affordability of the technology. "Elite Urban" refers to citizens with a high level of disposable income in urban areas; "Urban" represents average urban residents; and "Rural" refers to any resident of countryside areas.

What are some of the main problems for bridging the rural-urban and regional Internet divide, and what steps is the Chinese government taking to bridge it? First we examine basic problems for spreading telecommunications and Internet access to rural areas, then consider ways the government may move to narrow the gap.

Current Problems of Spreading Digital Data Access to Rural Areas

There are several key problems in bridging Internet user disparity. As noted earlier in this essay, users need both a reliable way to connect to the network, as well as equipment to display and manipulate the results of a connection. Users also need the basic technological skills to utilize and interpret information from the network; basic literacy is naturally a key ingredient. On a more rudimentary level, a constant supply of electricity is also necessary to allow one to access the Internet. What are obstacles to overcoming these barriers?

The first part of this paper focused on progress of spreading basic telephone service to rural and poor areas of the country. As some 41 million (nearly 70 percent) of China's Internet users employ telephone lines to get access via a phone modem (*CINIC*, 1/2003, unpaginated report), the lack of communications connections for many citizens also hinders access to the data network.

A further problem in giving data access to rural communities is the lack of basic infrastructure. For example, as of 2002 some 30 million of China's citizens, living mainly in the northwest rural parts of the country, lacked access to electricity. A far larger number had poor or inadequate power supplies (*CD*, 2/13/2003).

Income level disparities exacerbate the problem. As of early 2003, the national income gap between urban and rural residents in terms of per capita income was about 5 or 6 to 1 (*CD*, 2/13/2003). As noted earlier, inability of rural and inland citizens to pay for Internet use fees is a major obstacle to expanded access for less wealthy Chinese. And, of course, the cost of a computer is beyond the means of many rural residents.

Low per capita income in poorer provinces can also lead to lower rates of educational attainment. Rural children often drop out of school to work in fields or local industry, and even minimal costs associated with schools can be prohibitive for the poorest farmers earning less than 1000 yuan (about $120) per year. In recent years, teachers in poor parts of the nation have abandoned their work for greater compensation in other professions.[19] Without basic educational skills, the value of Internet access is incomprehensible to many inland Chinese citizens.

Of course, basic literacy also limits citizen access to Internet information. As of 2001, some 9 percent of the country's population above 15 years of age were officially classified as illiterate or semi-literate. The rates rose to nearly 20 percent in Guizhou, 15 percent in Yunnan, and 47 percent in Tibet, where Internet penetration was among the lowest in the nation.[20]

Education disparity at higher levels may also account for some of the differences in Internet penetration, even in regions of the nation that are generally poor. For example, as Figure 1 indicates, inland provinces such as Xinjiang, Qinghai, Inner Mongolia, and Ningxia have higher Internet penetration rates than those of some of their neighbors. These provinces all have income levels that fall within 10 to 15 percent of both the urban and rural regions of the lowest-ranking areas.[21] However, among residents of Xinjiang, Qinghai, Inner Mongolia, and Ningxia, as of the year 2000, from 15 to 19 percent had senior middle school education or higher, while in Tibet, Henan, Anhui, and Guizhou, only 5 to 14 percent of residents had an equivalent level of education.[22]

Less exposure by inland provinces to high technology and foreign influences also acts as an impediment to the spread of Internet use. One recent study of poor rural areas in Sichuan province indicated many users had no notion of the Internet. For them, even the idea of owning their own telephone was a distant dream (Bu and Qiu, 2002). Few rural residents in the regions had any access to computers, or to other devices capable of making connections to data networks.

One final, though likely less vital, issue for extending services to poor, rural areas may be government hesitance to give discontented citizens access to tools that could allow organized opposition to a one-party government system.[23] In the event China's larger economy faces significant hardship, as it did in some of the years preceding the 1989 Tiananmen student demonstrations, the Internet could indeed be a useful means of coordinating opposition voices.

The political ramifications of Internet access for disadvantaged and discontented residents also are key to understanding the ways telecommunications tools may spread.[24] To date, the government has put up few ideological barriers to obtaining basic Internet access. Any citizen with money can use the data network, as long as he or she avoids posting or transmitting information that may directly threaten government interests. There is no evidence of any special rules that would deny access to rural, inland, or poor residents based solely on their social or economic standing and potential use of the Internet for anti-government purposes.

Several cases of Internet dissidence have arisen in the past few years, and have resulted in arrests of those posting information officials found critical of the government or promoting anti-government group formation. The government therefore faces some contradictory pressures, wanting to provide communications tools economic, educational, and other gains, while mindful of the utility these technologies may have for those opposed to Communist Party rule. It is likely that the publicized arrests of those posting unacceptable information, along with a still significant police presence at many levels of Chinese society, instill a feeling of self-censorship among those tempted to use the voice and data networks to challenge the one-party state.

One danger to the government, however, could arise with organized use of mobile phone messages or perhaps e-mail to coordinate an anti-government effort in an area of focused discontent. Short-message services (SMS) allow mobile phone users to send electronic notes to group members instantaneously, so that rebellious leaders could skillfully choreograph rallies or marches. These messages would be more difficult to monitor than, for example, publicly-posted web site information. However, the government's firm control over the communications backbone would likely allow it to shut down a public mobile network or e-mail service in an affected area, with the police likely retaining alternative means of communication. The government would still retain control of telecommunications tools, even in a crisis, thereby diminishing the threat that these tools could be a tool of anti-government forces in the time of crisis.

Current Programs to Bridge the Urban-Rural Digital and Communications Divide

Over the past few years, the Chinese government has formulated programs to further both communications and digital access for inland, rural citizens, and new technologies may also facilitate the bridging of the divides. This section examines current attempts to spread access more equitably to Chinese citizens; the concluding section explores new technologies that may assist in narrowing the gap.

In the case of the communications divide, the earlier part of this essay pointed out the policy priority the government has assigned to spreading basic telephone access. One specific program to address this issue, the formation of a Universal Service Fund (USF) along the lines employed in the United States and other developed nations, has only recently seen some measure of success.

The Ministry of Information Industry (MII, successor of the MPT) started research on a universal service obligation as early as 1998, after the split of the ministry's telecommunications and postal operations. In May 2000, the State Development and Planning Commission (SDPC) suggested the establishment of a Universal Service Fund in accordance with international standards. The fund would be used for both telecommunications network construction and infrastructure maintenance in rural areas, as well as for the construction of a private network for the Chinese Communist Party and the government.[25]

Steps to develop a USF were put on hold as the government moved to reorganize its basic fixed-line phone companies. After several years of debate within China's leadership ranks, in 2001 the government announced it would split the monopoly carrier China Telecom into firms serving the nation's northern and southern regions. President Jiang Zemin was reportedly a prime advocate of the split (*SCMP*, 1/15/2002). In the north, a newly reorganized corporation, China Netcom, took over from the previous monopolist China Telecom. The southern part of the nation was left under China Telecom's jurisdiction. The most needy beneficiary of a USF would be the new China Telecom, as it inherited the poorest western provinces, and lost the ability to compensate for losses there with income from many of the wealthy northern coastal provinces.

In August 2001, the MII sent a team to the United States to study how the American federal government calculated the cost and management mechanism for universal service. In June, 2002, the MII submitted a study report to the Ministry of Finance on the feasibility of setting up a USF. In the second half of 2002, the two ministries planned to discuss the details of how to raise and manage the fund. The recommended size of the proposed fund was 10 billion yuan (US$1.2 billion).[26]

Finally, in early 2003, the MII announced all of China's major fixed-line and wireless telephone companies would have to pay an annual fee of 0.24 yuan (about 3 US cents) for every phone number they owned (even ones not currently in use), in order to spread phones to rural regions. The total projected revenue would be about 400 million yuan (about $48 million) per year (*FTI*, 2/13/2003). This seemed considerably short of the necessary total fund size projected in the previous year. However, it was a meaningful beginning in the attempt to subsidize carriers who provided telephone service to regions that generated losses for the communications service providers.

China has also pursued expansion of digital data access on various fronts. For example, one of the leading forces in spreading data services to China's schools is the China Education and Research Network, or CERNET. The network was founded in 1993, and had as its goal the provision of Internet connections to universities as well as secondary and primary schools. It is administered by the Ministry of Education. CERNET did not build its own data network, but rather leases lines from the major telecommunications operating companies, such as China Telecom and China Netcom.

CERNET's first target was China's universities, and the organization had established Internet connections on about 100 campuses by 1996 (Mueller and Tan, 1997, p. 86). By mid-1998, the number had risen to 300 universities and some 200,000 users, and an average of 2000 computers per campus (Clark et. al, 1999, p. 61). The following five years saw continued growth, with nearly all of China's approximately 1000 universities connected by CERNET in early 2003. At this time, the network claimed some 10 million users, and was also the only Internet service provider in Tibet.[27]

CERNET's focus on tertiary education was primarily linked to the need for providing low-cost service. The company, subsidized by the Education Ministry, charged the institutions an annual average cost of only about Yuan 20 ($2.40) per student. This compared with a monthly charge of some Yuan 120 (about $15) for access to the commercial public ChinaNET service. In some cases, university connections did include restrictions on international network access, as this would add to the service cost. However, basic functions such as e-mail and domestic access were included in the higher education service.[28]

Despite progress at the university level, to date CERNET has connected only about 200 secondary schools and only a small number of primary schools, ones mainly in the wealthy coastal areas. This represented only a tiny fraction of the country's approximately 94,000 secondary schools and 550,000 primary schools.[29] The main limiting factor is cost, and CERNET efforts to expand connections beyond college campuses seems to have stalled for lack of funding.

Other governmental and corporate efforts have attempted to address the basic problem of computer access in schools. In early 2001, for example, China Great Wall Computer Group announced a project to invest 150 million yuan ($18 million) to supply 300 primary and high schools in inland Henan province with Internet-access instruction rooms (*CO*, 2/15/2001). However, much of the investment in computers for educational purposes still comes in coastal regions. For example, the Beijing municipal government gave some 7500 computers to the city's schools in 2001 (*INA*, 1/11/2002, China Business section), and Shandong province commissioned the Tengtu International Corporation to link 40,000 of its K to 12 schools over the years 2001 to 2014 (*BW*, 8/17/2001).

Other than these programs, interviews in China in mid-2002 indicate the government is currently taking few steps to invest in spreading communications access to Chinese "have nots." Even some of the steps noted above tend to favor educated, wealthy citizens, though some, such as provision of access to college students in poor regions, may have more direct benefit to those in greatest need.

Rural residents in particular may lose out as the data network is slow to penetrate their towns and villages. New services such as distance medicine promise to provide higher levels of medical care to those unable to find access to specialized doctors in their home region. Distance education could be another tool to bring knowledge from advanced urban instructors to rural or poor areas of the country. The lack of data and telecommunications connections will be a major impediment to the spread of such services.

New Technologies and the Future of the Digital Divide

A 2002 Chinese Academy of Social Sciences report indicates that wireless and satellite technologies are likely to be key tools available for reaching the approximately 15 percent of villages that lack phone access within five kilometers of village borders.[30] As noted above, of the unconnected villages, some 90 percent lie in mountainous or remote regions that cannot be served by fixed cable systems. For about five percent of these villages, ones with scattered populations residing more than 50 kilometers from a telephone, only satellite technology can bring a connection.

Over the past few years, rising costs of fixed-line installation and falling fees for setting up mobile systems have made mobile systems up to 80 percent cheaper to install. A wireless system may cost only 10 yuan (about $1.20) per month per line to operate, while the comparable cost for a fixed line is 30-40 yuan ($3.60-$4.80). The cost of installing a satellite line can be more than 10 times that of a mobile line, and maintenance costs are also great (*RCRC*, 2002, p. 73). Therefore, it is likely that much of the revenue from the newly-created Universal Service Fund will be channeled to creating mobile (though perhaps not satellite) networks in villages with few or no communications services.

Another method for expanding data and even phone access could come with greater convergence opportunities for transmitting voice and data. For example, as of mid-2001, China had some 90 million cable TV subscribers, and the number of subscribers was growing by about 5 million per year (*XNA*, 5/15/2001).[31] However, only about 7 million Chinese accessed the Internet through any kind of broadband connection in late 2002, and it is likely most of these subscribers were urban residents (*CINIC*, 2003).[32] And the Chinese government has prohibited use of cable TV lines for voice communication, except in some test areas including Shanghai.

Though there are apparently no plans to subsidize high-speed broadband access for poor or inland rural regions, market forces may play a role in lowering user costs and expanding the customer base for this technology. Following the government-mandated creation of rival companies China Telecom and China Netcom in 2003 (discussed above), competition between the two companies' data networks helped raise the number of those using high-speed connections to the Internet. Monthly rates for broadband access fell to as little as 130 yuan (about $16) in mid-2003, and the new low rates could propel high-speed user numbers to reach as many as 100 million subscribers by 2007.[33] However, even at this cost many of the users would likely be wealthy city dwellers.

Another new technology that in theory could greatly and quickly ease the digital divide is the transmission of Internet data information as well as voice traffic through ordinary power lines. Though still in the experimental stage, commercial use of power lines for Internet access is now available in some parts of the United States. Users paying $30 per month can get access at four times the speed of an ordinary telephone modem.[34] As China extends the very basic necessity of electricity to rural areas, the ability to use ordinary power sockets as data outlets opens a new dimension to rural communications access. Having one cable provide electricity, telephone, and Internet access would solve the key issue of providing a data pipeline, though other problems, such as access to computers, training, and basic literacy, would remain in many areas.

The tension and balance between the forces of technological change, bureaucratic interests, and equitable access has begun to shift in the past few years. Though the Mao era saw equity as a primary goal, limits on technology and political will and ability limited the ability to spread telephones in any meaningful and lasting way. The reform era of the 1980s and 1990s put a premium on economic development in coastal regions, and telecommunications officials were quick to provide new telecommunications technologies to regions that could fuel the most rapid economic growth.

By the late 1990s, new technologies, such as wireless services and data networks, made equitable access more feasible. New uses of the Internet for educational, health, and other purposes made it more socially and economically desirable as a tool for narrowing gaps in income and standards of living. The Ministry of Education's CERNET project has been an effective though limited tool to further some of these goals. However, in the larger telecommunications arena, rural and poor areas continued into the current decade to be revenue losers, inspiring Ministry of Information Industry bureaucrats to maintain their resistance to subsidized expansion of the network to less advantaged citizens.

It is unlikely the government's telecommunications officials will seek to bridge the digital divide for altruistic reasons. China's "have nots" lack the kind of political clout one might find in a democratic system. They are therefore left dependent on the will of bureaucrats who place the development of their own economic sector above that of the interests of those who may have a desire for technology, but who lack the resources to acquire them.

As this essay has indicated, though, the more basic technology of fixed-line telephone connections has started to penetrate to rural areas, and revenue losses have begun to narrow. Progress on the spread of Internet access to the countryside has been glacial though steady. It seems reasonable to assume that, as urban and developed areas become more saturated with wireless communications and data network access, the inland areas will become the new sources of profit for officials guiding the telecommunications sector. Lower cost technologies and bureaucratic interests could then shift the technology's trajectory toward more equitable provision of communications access.

It is unlikely government officials will soon relinquish control of China's telecommunications tools. But new technological and market forces acting on the sector may bring a slow but steady shift in bureaucratic emphasis toward those areas now lacking advanced communications tools. Unless these changes occur at a rapid enough pace, the economic, educational, and health divides fostered in part by the digital divide, could lead to growing resentment and perhaps even unrest in the poor, inland parts of China.

Appendix: Tables on Internet Use by Region

Table A. Internet Users by Region (Year end, except for 1997 is October 31). Ranked by 2002 Penetration (see Table 3).

Region	1997	1998	1999	2000	2001	2002	Ave. Annual % Increase 1997-2002	% Increase 2001-2002
Beijing	220,000	500,000	1,900,000	2,800,000	3,300,000	3,900,000	78%	18%
Shanghai	50,000	91,000	1,000,000	2,000,000	3,100,000	4,200,000	143	35
Tianjin	10,000	35,000	240,000	570,000	910,000	1,400,000	169	54
Zhejiang	23,000	97,000	400,000	1,500,000	2,200,000	3,300,000	170	50
Liaoning	18,000	76,000	380,000	1,000,000	1,300,000	2,800,000	174	115
Guangdong	51,000	440,000	1,200,000	2,200,000	3,500,000	5,600,000	156	60
Jiangsu	37,000	110,000	530,000	1,200,000	2,700,000	4,800,000	165	78
Fujian	17,000	64,000	240,000	810,000	1,200,000	2,200,000	164	83
Heilongjiang	9,000	44,000	150,000	550,000	940,000	2,200,000	200	134
Hubei	37,000	69,000	300,000	790,000	1,400,000	3,200,000	144	129
Jilin	6,000	22,000	130,000	540,000	610,000	1,400,000	198	130
Chongqing	4,000	31,000	170,000	460,000	540,000	1,500,000	227	178
Xinjiang	600	14,000	42,000	340,000	440,000	830,000	325	89
Shandong	25,000	77,000	460,000	1,200,000	1,400,000	3,800,000	173	171
Sichuan	15,000	74,000	270,000	1,100,000	1,800,000	3,100,000	190	72
Qinghai	600	2,100	7,100	70,000	67,000	180,000	213	169
Shaanxi	7,000	50,000	170,000	330,000	510,000	1,300,000	184	155
Hebei	16,000	35,000	230,000	560,000	940,000	2,200,000	168	134
Ningxia	< 600*	5,300	14,000	110,000	100,000	180,000	239*	80
Hainan	2,000	11,000	44,000	70,000	170,000	240,000	161	41
Inner Mongolia	2,000	8,200	45,000	270,000	400,000	710,000	224	78
Jiangxi	4,000	35,000	120,000	470,000	610,000	1,200,000	213	97
Shanxi	4,000	22,000	93,000	300,000	400,000	950,000	199	138
Gansu	3,000	12,000	51,000	250,000	440,000	710,000	198	61
Guangxi	8,000	41,000	120,000	450,000	880,000	1,200,000	172	36
Hunan	11,000	35,000	310,000	890,000	1,100,000	1,700,000	174	55
Yunnan	5,000	9,200	56,000	330,000	510,000	1,000,000	189	96
Tibet	< 600*	400	2,700	6,800	30,000	60,000	172*	100
Anhui	12,000	29,000	86,000	550,000	840,000	1,100,000	147	31
Henan	17,000	45,000	190,000	520,000	1,000,000	1,600,000	148	60
Guizhou	2,000	10,000	41,000	180,000	200,000	470,000	198	135
NATIONAL TOTAL	620,000	2,100,000	8,900,000	22,500,000	33,700,000	59,100,000	149%	75%

* Non-Significant number of users; for purposes of calculating 5-year percentage growth, 1997 number is assigned value of 400 users.

Source: Derived from CNNIC surveys, found at http://www.cnnic.net.cn, various year surveys

Table B. Percentage of population in each region using Internet, ranked by 2002 penetration.

Region	1997	1998	1999	2000	2001	2002
Beijing	1.7%	4.0%	16%	21%	24%	29%
Shanghai	0.3	0.6	6.9	12	19	26
Tianjin	0.1	0.4	2.6	5.8	9.2	14
Zhejiang	0.05	0.2	0.9	3.3	4.8	7.2
Liaoning	0.04	0.2	0.9	2.4	3.2	6.7
Guangdong	0.07	0.6	1.7	2.6	4.1	6.6
Jiangsu	0.05	0.2	0.8	1.6	3.7	6.6
Fujian	0.05	0.2	0.7	2.4	3.5	6.5
Heilongjiang	0.02	0.1	0.4	1.5	2.6	6.1
Hubei	0.06	0.1	0.5	1.3	2.4	5.4
Jilin	0.02	0.08	0.5	2.0	2.3	5.2
Chongqing	0.01	0.1	0.6	1.5	1.8	4.9
Xinjiang	0.003	0.08	0.2	1.8	2.4	4.5
Shandong	0.03	0.09	0.5	1.3	1.6	4.2
Sichuan	0.02	0.09	0.3	1.3	2.2	3.8
Qinghai	0.01	0.04	0.1	1.5	1.4	3.7
Shaanxi	0.02	0.1	0.5	0.9	1.4	3.7
Hebei	0.02	0.05	0.4	0.8	1.4	3.3
Ningxia	< 0.003*	0.09	0.3	2.0	1.8	3.3
Hainan	0.03	0.1	0.6	0.9	2.2	3.2
Inn. Mongolia	0.008	0.03	0.2	1.2	1.7	3.0
Jiangxi	0.009	0.08	0.3	1.2	1.5	3.0
Shanxi	0.01	0.07	0.3	0.9	1.2	2.9
Gansu	0.01	0.05	0.2	1.0	1.8	2.8
Guangxi	0.02	0.09	0.3	1.0	2.0	2.7
Hunan	0.02	0.05	0.5	1.4	1.7	2.7
Yunnan	0.01	0.02	0.1	0.8	1.2	2.4
Tibet	< 0.003*	0.02	0.1	0.3	1.2	2.3
Anhui	0.02	0.05	0.1	0.9	1.4	1.9
Henan	0.02	0.05	0.2	0.6	1.1	1.8
Guizhou	0.005	0.03	0.1	0.5	0.6	1.3
NATIONAL AVERAGE	0.050	0.17	0.73	1.8	2.7	4.8
MEDIAN	0.020	0.09	0.40	1.4	1.9	3.7

Note: Most recent statistics for population after 1999 are for 2000 only; percentage is calculated based on 2000 regional populations for 2001 and 2002.

Source: Derived from CNNIC surveys, found at http://www.cnnic.net.cn, various year surveys

End Notes

1. These assertions are derived from Andrew P. Hardy, "The Role of the Telephone in Economic Development," *Telecommunications Policy*, December, 1980, pp. 278-286 and Hardy, "The Role of the Telephone in Economic Development: An Empirical Analysis," Geneva: International Telecommunications Union publication, 1981. According to Hudson, Hardy's analysis found a 1 percent rise in the number of telephones per 100 population in a nine-nation study between 1950 and 1955 contributed to a rise in per capita GDP between 1955 and 1962 of about 3 percent.

2. Hudson's assertion is based on Kaul's study of India, cited above.

3. As of early 2003, however, Sweden had only about 18 percent of its households connected to the Internet via broadband access; this compared to about 23 percent in the United States, and 57 percent in South Korea (*NYT*, 5/5/03, at web site http://www.nytimes.com/2003/05/05/business/worldbusiness/05BROA.html).

4. A further way of evaluating the divide would be either intra-regional or perhaps intra-municipal evaluation; however, government statistics do not document or tabulate this diversity in any sort of comprehensive national way.

5. The following historical discussion, unless otherwise noted, is derived from *DZYS*, 1993, pp. 283-294.

6. The historian Maurice Meisner refers to the inflation of production numbers during this period as the "wind of exaggeration." (Meisner, 1999, p. 237).

7. For detail on these policies, see Wang, 1998, pp. 360-362 and Ure, 1995, p. 16.

8. In 1995, China had about 859 million rural and 352 million urban residents (*CSY*, 1998, p. 105).

9. For percentages of areas connected, *DZYS*, p. 289. For numbers of townships and villages, *2001 CSY*, 2001, section 12-3, cited at China Business Net web site, at http://211.167.234.132/engVersion/cp_tj21/l1203e.htm.

10. The number of villages is based on the number of "village committees" recorded for the years since 1996, and represents administrative reorganization that reduced the number of villages from the 1985 count. Figure is from *CSY*, 2001, section 2-1, cited at China Business Net web site, at http://211.167.234.132/engVersion/cp_tj21/l1203e.htm.

11. The total number of mobile phone subscriptions is also estimated at 212 million, though this number likely includes multiple phone numbers held by individuals. The figure of 212 million phones is found at Xinhua's *Emerging Market Datafile*, March 4, 2003.

12. For 2001 numbers, see *RCRC*, 2002, p. 18; for 1999 figures, see ZJN, 2000, p. 667.

13. Conversion to dollar numbers use exchange rates for the relevant years.

14. This history is derived from *CINIC*, and from Harwit and Clark, 2001, pp. 377-408.

15. The figure of average monthly income for Beijing urban residents is for 1997 (*CSY*, 1998, p. 332).

16. Author's observations in Beijing, May, 2001.

17. Percentages derived from base number of users in each province over the period 1998 to 2002, from CINIC web site, various year figures.

18. Figures on rural and urban population numbers from *CSY*, 2002, CD-ROM version, section 4-1.

19. For a discussion of the problems of rural education in the 1990s, see Dreyer, 2000, p. 222.

20. Figures on literacy from *CSY*, 2002, CD-ROM version, section 4-13.

21. Tibet's urban income, most likely skewed by the tourism-centered provincial capital of Lhasa, has an atypically high income level. Tibet's rural income level is a better indicator of provincial income levels.

22. The senior middle school education or higher percentages for those over 6 years of age in these provinces as of the year 2000 are: Xinjiang (19), Inner Mongolia (19), Ningxia (16), and Qinghai (15), among those with higher Internet penetration. At lower penetration levels, the percentages are: Henan (14), Anhui (11), Guizhou (9), and Tibet (5). Derived from *CSY*, 2002, CD-ROM version, Table 4-12.

23. For a comprehensive discussion of the issue of Internet dissent, see Chase and Mulvenon, 2002.

24. For an essay that argues that political considerations are relatively minimal in the expansion of user numbers, see Harwit and Clark, 2001.

25. From correspondence with Duncan Clark, managing director, BDA China (Ltd.), June, 2002.

26. From correspondence with Duncan Clark, managing director, BDA China (Ltd.), June, 2002.

27. Interview with CERNET official, January, 2003. Unless otherwise noted, the following information on CERNET is based on this interview. As of the end of 2000, China had 1040 institutions of higher education (from *CSY*, 2001, section 20-2, cited at China Business Net web site, at http://211.167.234.132/engVersion/cp_tj21/t2002e.htm).

28. Author's observation of Internet access rules at Beijing University in summer, 2002.

29. Statistics on secondary and primary schools as of 2000, from *CSY*, 2001, section 20-2, cited at China Business Net web site, at http://211.167.234.132/engVersion/cp_tj21/t2002e.htm.

30. The following paragraphs discussing wireless technology and its relative cost is derived from *RCRC*, 2002, pp. 72-73.

31. One central state planning official estimated there would be 150 million cable subscribers in 2005 (from *XNA*, 7/26/2002).

32. The 7 million figure includes cable modem as well as ADSL and other broadband data services.

33. Broadband rate and subscriber prediction from Clark, 2003 talk.

34. Details on one such program are found in CNN, 2003 report.

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Abbreviations

Asia Pacific Telecoms Analyst: *APTA*

Business Wire: *BW*

China Daily: *CD*

China Internet Network Information Center: *CINIC*

China Online: *CO*

China Posts and Telecommunications Annual Report: *CPTAR*

China Statistical Yearbook: *CSY*

Dangdai Zhongguo de Youdian Shiye: *DZYS*

Financial Times Information: *FTI*

Interfax News Agency: *INA*

New York Times: *NYT*

Research Center for Regulation and Competition: *RCRC*

South China Morning Post: *SCMP*

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