
Infrastructure: Communications Systems

Fixed-line and wireless telecommunications form the backbone through which most Internet traffic travels. The communications infrastructure is therefore crucial to the growth of the Internet, in particular of value-added services such as media-rich content and electronic commerce. Policymakers can lay the foundation for a high-quality, fairly priced, and technologically up-to-date telecommunications infrastructure by introducing into their countries a combination of privatization, competition, and independent regulation. Where applied, such a policy framework has resulted in increased telephone ownership, lower prices for local calls, and higher network quality, thus increasing the ability of individuals and businesses to use the Internet.

Rapid change in the IT sector and the growing convergence between telephones, PCs, and TVs pose additional challenges for communications policymakers. The widespread delivery of the Internet via satellite and cable is not far away. TVs and wireless telephones are joining PCs as common tools to connect to and surf the Web. New technology can break down voice, text, and video into data packets that can be routed over the Internet, allowing individuals to talk locally or internationally via their Internet connections.

Communications policies must be flexible to adapt to this rapidly changing environment. Policymakers need to address not only the current state of competition, but also how these changes and growing convergence affect existing market participants and new entrants. Perhaps most important, policymakers should work with the private sector to ensure the interoperability of standards and protocols, so that all the sections of the Internet highway can link seamlessly.

The Current Environment

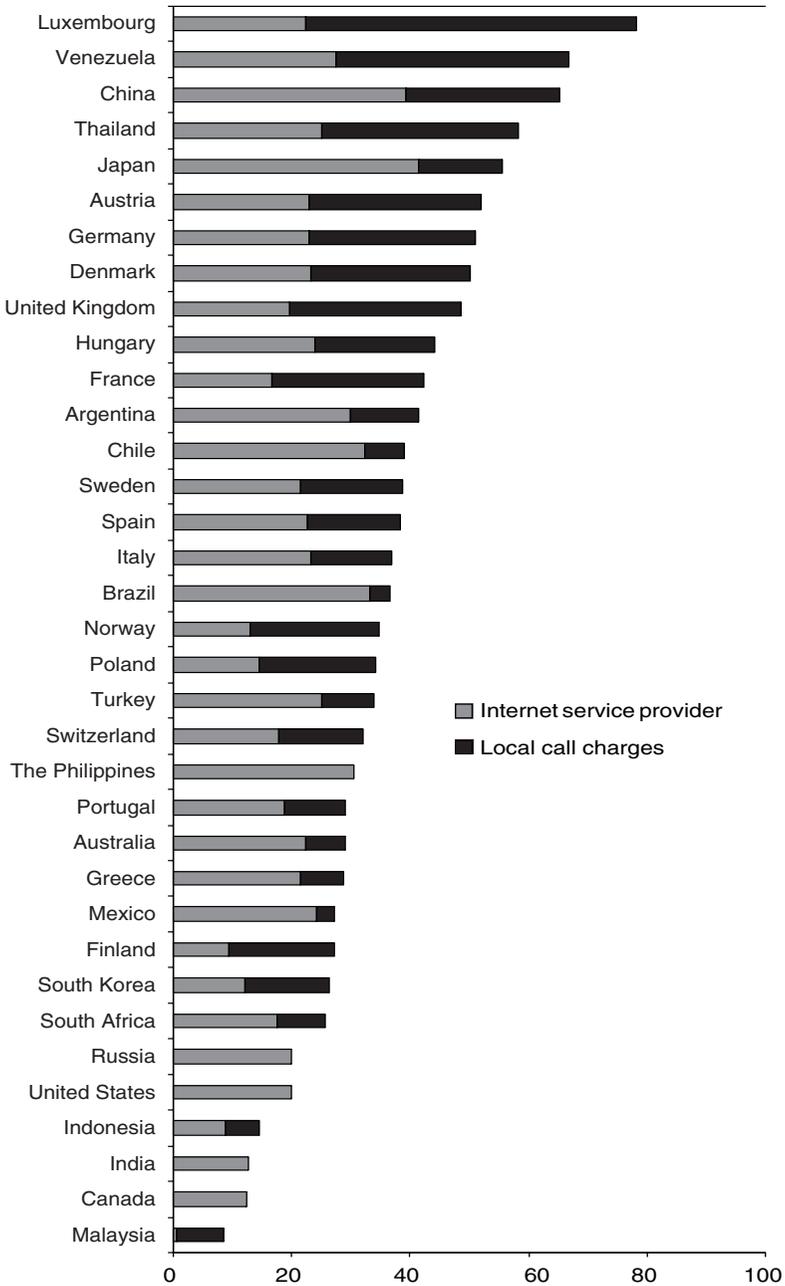
Basic telecommunications data as gathered by the ITU show that many countries still lack the state-of-the-art communications infrastructure needed to support and encourage Internet traffic (ITU 1999). A number of the world's lower-income countries, including most of sub-Saharan Africa, have less than 1 telephone line per 100 inhabitants (this measure is known as "teledensity"). Even several upper-middle-income countries, such as Malaysia and Mexico, have less than 20 lines per 100 inhabitants, compared to over 65 lines per 100 for much of Western Europe. Particularly troublesome is that many countries with low teledensity experienced only single-digit percentage growth in the number of main telephone lines between 1995 and 1998. There it can take several months or even several years for a company or an individual to get a new telephone line, a direct constraint on growth.

A second direct constraint is the price of a local telephone call. ITU data show that the cost of connecting to the Internet varies substantially by country, in large part because local telephone charges are so different (see figure 3.1). For example, in the United States, an individual pays about \$20 per month for unlimited Internet access, with minimal or no per-minute local call fees. In China, almost half of the \$65 per month in access fees is local call charges (ITU 1999, A-30, table 9). These charges can make Internet access affordable only to an elite few, especially in countries with lower per capita GDP. For example, in Uganda monthly Internet access charges are 107 percent of monthly income; in Mozambique, 29 percent of monthly income. By contrast, in the United States and Australia, Internet access fees account for less than 2 percent of monthly GDP per capita (ITU 1999, 31). Ongoing research by the OECD has confirmed that those countries with local call charges had lower Internet host penetration than countries without such charges.

In some countries, ISPs are mitigating high local call charges by offering no-subscription-fee Internet accounts. Typically, the ISPs form alliances with telecom providers to share local call charges; they also generate revenue by selling online advertising and tracking their customers' movements ("clickstream behavior") on the Web. Freeserve in the UK was one of the first ISPs to implement no-subscription-fee Internet access country-wide. Now other ISPs from around the world are following Freeserve's lead. While these ISPs offer an attractive option for many consumers, the access—in large part because of local call charges—is anything but free. Per-minute charges create a disincentive for individuals to take the time to explore ("surf") the Internet to discover what information or goods or services companies on the Web have to offer.

The impact of the time-tolled call, particularly where connections are slow, should not be underestimated. Individuals paying access fees based on their connection times often use the Internet only to read and send

Figure 3.1 Internet monthly access prices for 20 hours of off-peak use, selected economies (US dollars)



Source: ITU 1999.

electronic mail. As long as per-minute fees continue, users must pay to browse through the goods, services, and prices available online. Imagine, for instance, a library where readers had to pay by the minute, or a mall that charged window shoppers by the hour! These charges create a disincentive to using the Internet for information-gathering or electronic commerce—precisely those areas where the Internet offers the greatest efficiencies and economic benefit. Per-minute charges also limit the ability of companies to research what other businesses are doing on the Internet, and to investigate what market niches remain to be exploited.

Privatization, Competition, and Regulation

Policymakers can reduce or eliminate these local call charges, thereby encouraging Internet use, by introducing into the telecommunications sector a combination of privatization, competition, and independent regulation. Such a policy framework also promises to increase teledensity and enhance universal service, and make the sector more technologically up-to-date.

Empirical and anecdotal research by the World Bank and academic and private researchers demonstrates that privatizing public telecommunications offices (PTOs), introducing fixed-line as well as wireless competition, and creating an independent telecommunications regulatory body can significantly improve the telecommunications sector (see table 3.1). Such policies are strongly correlated with increases in per capita telephone mainlines, public payphones, and connection capacity, with decreases in the price of a local telephone call (Wallsten 1999, 1; Wellenius et al. 1992). For example, in Latin America and Asia, the teledensity in countries with privatized telecommunications grew twice as fast during the first five years after privatization as in countries that did not privatize (Petrazzini 1996, 37).

These policies also promote a telecommunications sector that is more technologically up-to-date, including greater network digitization and higher service quality. For example, countries in Latin America with privatized and/or competitive telecommunications sectors have had more digitization than those countries with monopoly, state-owned PTOs. Also, a study of the OECD countries revealed that liberalized telecommunications markets offer consumers higher service quality, as measured by the number of faults cleared by the next working day, the number of unsuccessful local calls, or the number of faults per 100 main lines. With the introduction of competition into OECD telecom markets, there has been a 97 percent reduction in waiting time to get telecom service, 15 percent lower call failure rate, 39 percent fewer faults per 100 lines, and 34 percent lead in the number of phones digitized (Petrazzini 1996, 40-1).

Table 3.1 Projected benefits to users from competitive telecom services in 2010, and cumulative gains, 1997-2010¹
(billions of dollars)

	Cost savings 2010	Quality benefits 2010	Total gains 2010	Cumulative gains 1997- 2010 ²
Income level				
Low	10	15	25	177
Middle	25	25	49	346
High	50	25	75	523
Total	85	65	149	1046
Region/country				
European Union ³	27	14	41	288
Latin America	9	9	17	120
East Asia and Pacific	12	18	30	211
Japan	19	10	29	201
South Asia	3	5	8	56
Rest of world	14	10	24	169

1. Excludes nations presumed to be competitive: the United States, Canada, UK, Denmark, Finland, New Zealand, and Sweden.
2. Calculated by straight-line cumulation of benefits over the 14 years, inclusive, starting with zero in 1997 and ending with \$149 billion in 2010.
3. Refers only to the less competitive European nations: Austria, Belgium, France, Germany, Ireland, Italy, the Netherlands, and Spain.

Source: Gary Hufbauer, based on 1995 data. First printed in Petrazzini (1996).

Privatization alone, however, will not maximize improvements in the telecommunications sector, and can sometimes have deleterious effects. Indeed, privatization without competition, which occurs when a government grants a newly-privatized PTO exclusivity, can lead to higher connection prices, especially if government subsidies for local calls are removed. In Mexico, for example, local telephone call charges rose 1,065 percent in early 1990 because of the privatization of Telmex. Similarly, in Argentina charges rose 258 percent as the state-owned PTO prepared for privatization (Petrazzini 1996).

But the introduction of competition along with privatization almost always leads to lower prices and higher service levels. Chile, for example, introduced competition into its domestic and international telephony in 1994; this brought about rapid modernization of the telecommunications network, new services, and prices that are among the world's lowest.¹ Indeed, by that year local telephone call charges had dropped by an

1. See Wellenius (ND). It is important that Chile also introduced competition in data, value-added, and cable TV services and private networks in the late 1980s.

average of 36 percent from late-1980 levels (Petrazzini 1996, 32-33). Similarly, the 1998 sale of a majority stake in El Salvador's PTO to France Telecom, as well as the auction of a second cellular license to Telefónica of Spain, has produced a flurry of activity within El Salvador's once-sleepy telecommunications sector. In fact, it now takes only a day or two to get a new phone line in El Salvador, compared with up to 6 years previously, and the entire country is covered for cellular service.²

In almost all countries seeking to privatize and introduce competition into the telecommunications sector, the benefits have been shown to be greatest when there is an independent telecommunications regulator. The World Bank has been active in working with policymakers in developing countries to establish such bodies (Wellenius et al. 1992). Independent regulation is particularly critical to guard against a monopoly telecommunications provider extending its rent-seeking behavior into the Internet. For example, in Morocco the telecommunications provider, IAM, recently started offering Internet access to subscribers at rates believed to be below cost in order to gain market share, a move that threatens to put the country's many private ISPs—which must rely on IAM's infrastructure—out of business. The telecommunications regulator, a fairly new body with limited technological expertise, will need substantial enforcement capacity to correct IAM's recent behavior so that Internet delivery will remain competitive in Morocco.³

External enforcement of competition in the telecommunications sector is now possible with the World Trade Organization's (WTO) Basic Telecommunications Agreement. The agreement binds signatories to certain regulatory principles as well as investment access commitments. It requires countries to establish an independent telecommunications regulator and provide transparent rules for the use of scarce commodities such as broadcast spectrum. Where a country's regulator is weak, for lack of funding, human capacity, or political reasons, outside countries can seek redress through WTO dispute settlement procedures.

Convergence and Interoperability

Privatization, competition, and independent regulation are necessary so that the fixed-line and wireless telecommunications infrastructure can support and encourage the growth of Internet traffic. There are additional challenges facing policymakers, given rapid technological developments and the growing convergence between telephones, PCs, and TVs. Satellites

2. Field research conducted by Sarah Cleeland Knight February 2000. It still costs roughly \$0.80 per hour to call locally in El Salvador.

3. Field research conducted by Catherine L. Mann and Sarah Cleeland Knight, September 1999.

and cable now complement fiber optics and copper lines in forming the backbone of the Internet. Wireless telephones are in some countries more popular than PCs for using the Internet. It is becoming more common for individuals to use Internet connections to talk on the telephone.

Current communications regulations, conceived for the public switched telephone network (PSTN), may not be well equipped to adapt to such technological change and convergence. Regulatory flexibility is needed to ensure that new market entrants as well as existing participants can be competitive. Policymakers also need to work with the private sector to ensure that standards and protocols link all the sections of the Internet highway.

One example of how technological developments strain existing regulations is the emergence of Internet telephony, or voice-over Internet services. Companies like Cisco Systems (CPN: the Cisco Powered Network) have made it possible to break down voice, text, and video into data packets that can be routed over the Internet. As a result, voice communication can travel through the Internet from computer to computer, computer to telephone, or even from telephone to telephone, anywhere in the world.

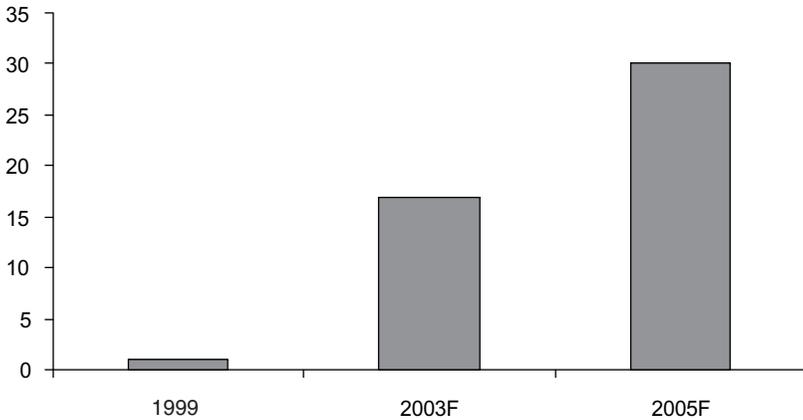
While the quality is still relatively low compared to traditional voice connections, Internet telephony is much cheaper to deliver, making it a popular alternative especially in those countries where calls are costly and service less than first-rate. As a result, a number of Internet telephony providers have sprung up, including NetVoice, IPVoice, eYak, and Net2-Phone—the last of which charges less than 10 cents per minute to ring any telephone in the United States from overseas. Traditional providers are also jumping on the Internet telephony bandwagon: AT&T and Sprint are both starting to offer such services in Asia (*Business Week*, 13 September 1999, 34). As a result, Internet telephony is expected to grow from less than 1 percent of global telecom traffic in 1999 to 17 percent by 2003 and more than 30 percent by 2005 (*Business Week Online*, 1 May 2000). (See figure 3.2.)

Some countries, however, are trying—rather unsuccessfully—to protect their PTOs by banning competitive delivery of Internet telephony services. For example, Poland's telecom ministry is trying to crack down on Internet-relayed international calls that circumvent the state-controlled PTO by threatening fines or even the withdrawal of telecommunications licenses (*FoxNews.com*, 12 January 2000). Internet telephony is also banned in India, although several companies are providing it anyway, so that individuals can call the United States for less than a tenth of the traditional service rates (*Times of India*, 27 January 2000). Similarly, Teléfonos de México has been trying to stop the Internet telephony services offered by AT&T and British Telecommunications (*Business Week Online*, 1 May 2000).

Instead of trying to block the inevitable growth of Internet telephony, governments should embrace this new, potentially more efficient commu-

Figure 3.2 The growing importance of Internet telephony

percent of total global telecom traffic



Source: *Business Week Online*, “The Talking Internet,” 1 May 2000.

nications service. Internet telephony’s prices are much lower, but so is its quality; thus, it is likely to be a net addition to rather than a substitute for traditional voice traffic, especially in developing countries. It is also difficult to enforce a ban on Internet telephony, especially once the calls have been patched on to the PSTN (ITU 1999, 112-17). Internet telephony could even be an attractive addition to a PTO’s bundle of communications services.

Internet telephony is just one of a number of technological changes spurring the convergence of telephones, PCs, and TVs. Such technological change requires policymakers to make communications regulations more flexible, to encourage new solutions, approaches, and innovations.

Today, individuals and businesses access the Internet using a variety of interfaces, from hand-held devices like Palm Pilots to mobile telephones. The build-out of these interfaces is occurring at different speeds in different countries: Relatively high mobile phone penetration in Japan and Europe is driving the private sector in those areas to reconfigure Web pages to fit the smaller screens. In China, where TV penetration is relatively high, companies like Microsoft are offering WebTV, a service that allows individuals to surf the Internet from their televisions. In contrast, in the United States the focus is on media-rich content delivered through PCs. Rather than choosing to support one technological “winner” among these different interfaces, policymakers should encourage interoperability, so that the value delivered to users is maximized. Such interoperability will increase the value of all interfaces rather than render one or more of them obsolete.

One example where policymakers should work with the private sector to increase interoperability is in bridging the different standards for wireless connections. Currently the world is divided in its use of wireless telephone standards: GSM (global system for mobile communications) is the dominant standard for much of the world except North America, with an estimated 215 million users. In the United States, CDMA (code division multiple access) and TDMA (time division multiple access) dominate. As a result, most subscribers in the United States cannot use their mobile phones in Europe or Asia, vastly limiting the benefits to users who travel abroad. The private sector is moving closer to achieving interoperability between the different standards: In early April 2000, for example, operators and providers of CDMA, TDMA, and GSM began collaborating on the GSM Global Roaming Forum, an international organization open to all industry organizations (*PR Newswire*, 7 April 2000). Governments should support such efforts in every way possible so that interoperability is not stymied by inefficient regulation or bureaucratic process.

Conclusion

With such rapid technological change and convergence, government regulation or intervention that (even by mistake) limits new entrants or system interoperability will put a country behind the technological frontier and limit the value of the network for both businesses and individuals. Private sector consortia like Symbian, a joint venture among Ericsson, Motorola, Nokia, Psion, and Matsushita working toward standard technology for wireless Internet delivery, will increase the number of users of the Internet highway, as well as the benefits they derive. Such standards can be a valuable foundation for new business development, especially where the private sector is small or nascent. As a result, companies can concentrate on creating value-added Internet services like media-rich content and electronic commerce, especially those that target niche audiences, without having to reinvent the wheel.

The interoperability of standards and protocols is an important complement to the other changes to telecommunications regulation required to encourage use of the Internet and electronic commerce. Privatization of PTOs; competition in fixed-line, wireless, and other forms of Internet delivery; and the presence of an independent regulatory body can work together to create a high-quality, fairly priced, and technologically up-to-date telecommunications infrastructure that supports the growth of Internet traffic and electronic commerce.