

THE INTERNET IN DEVELOPING COUNTRIES

Development of the global Internet has been phenomenal. It has grown from a small, closed, text-based computer network of a few thousand scientific and government users in the early 1980s to some 43 million Internet hosts in some 58,000 separate but interconnected networks supporting an open global network of an estimated 150 million Internet users in early 1999. During 1998, the last remaining “uncon-

nected” countries established links to the Internet, turning it into a truly global network. But these figures represent just one side of a very lop-sided picture. A closer look reveals great disparities between high- and low-income regions in terms of both Internet hosts and users. More than 97% of all Internet hosts are in developed countries that are home to only 16% of the world’s population (see Figure 1).

At the individual country level, the Internet penetration gap between developed and developing

countries is just as striking, if not more so, than at the regional level. Singapore, for example, with a population of about 3.7 million, has a thousand times as many Internet hosts as the 60 poorest countries—which account for more than three billion people. Iceland, with a population of 250,000, has almost 20 times as many Internet hosts as 100 of the world’s poorest countries.

Although there are differences in the availability of Internet services among developing countries as striking as those separating

Access means much higher user fees and costs to ISPs for connecting to the global Net, and geographic dispersion limited to a few big cities.

Figure 1. Growing fast, but unevenly.

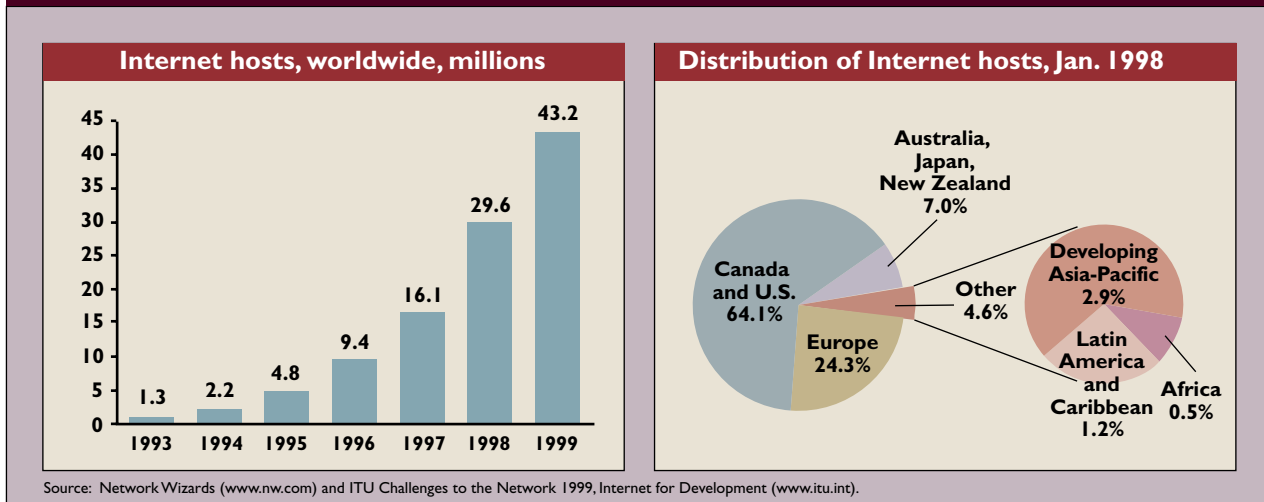
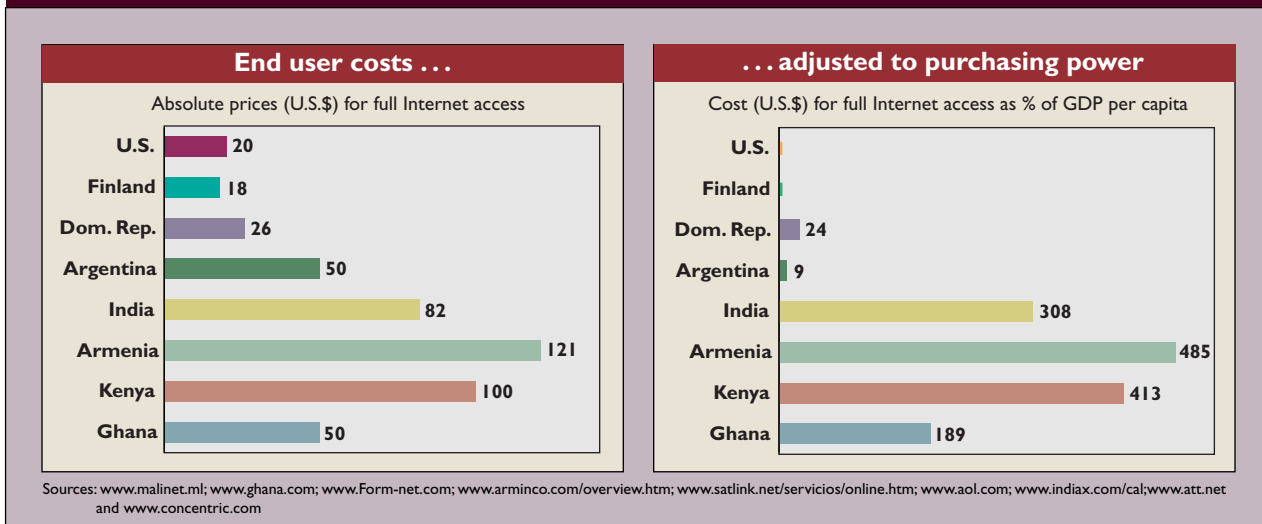


Figure 2. End-user costs in absolute and relative terms.



developed and developing countries, shared problems also unite this diverse group of countries. The high cost of Internet services is one of them.

The cost and pricing of Internet services for individual users can be broken down into two components—setup costs and operating costs. Setup costs are often significant, regardless of the part of the world in which the Internet connection is made. However, setup costs relative to per capita income are much higher in developing countries than they are in developed ones. In the U.S., the average professional could well afford three computers for the equivalent of a month's salary. In Tanzania, a computer costs three times an average professional's monthly salary. Moreover, the professional work force is much smaller and the ratio of professional workers to the total working population much lower in developing countries. The amount of market-driven Internet development in

most of these countries cannot go beyond the small group constituting the professional class.

Operating costs in developing countries are also high. Although the absolute price difference might not be significant, the purchasing power of most people in the developing world makes access to Internet services an extremely expensive proposition. In Ghana, for instance, an account with Africa Online costs \$50 a month (all monetary amounts cited in this article are in U.S.\$), nearly twice the monthly income of most Ghanaians. In Armenia, a former Soviet republic, where the absolute price for an Internet connection is \$121, after adjusting for gross domestic product per capita, Internet users there pay an astounding 485 times as much as users in Finland, for probably inferior service (see Figure 2).

The cost to ISPs for access to the international Internet backbone also varies greatly, depending on

Figure 3. Correlating ISP network access costs and end-user prices.

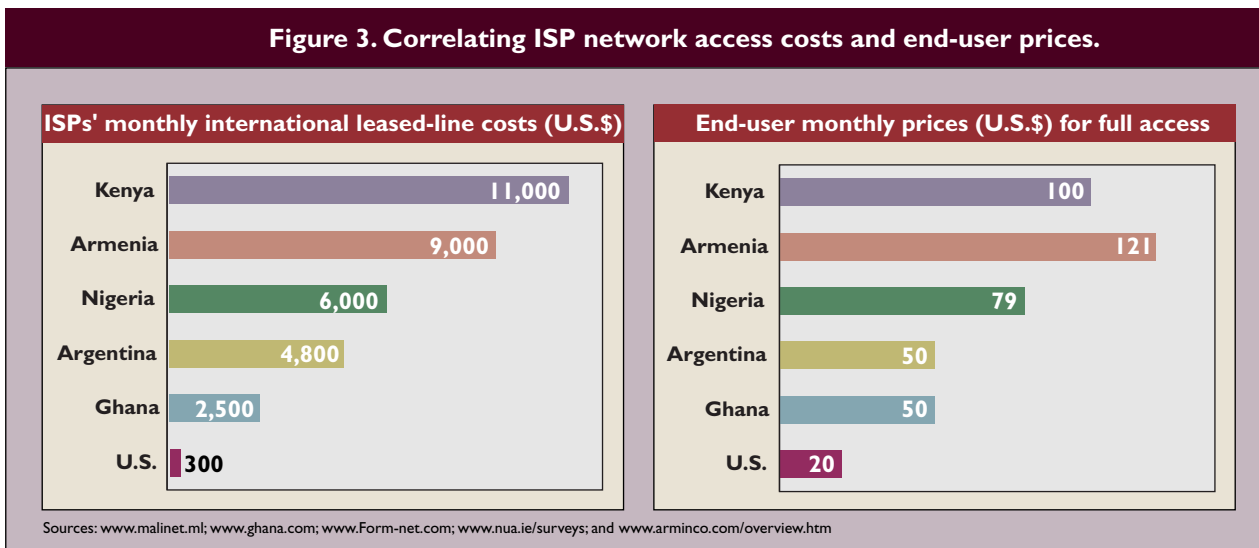
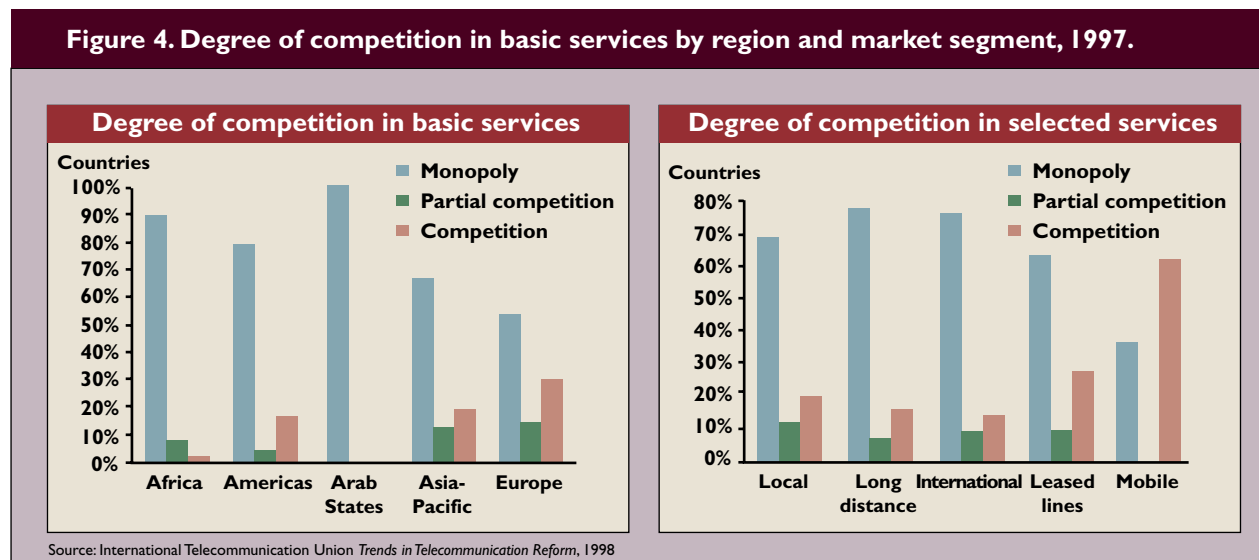


Figure 4. Degree of competition in basic services by region and market segment, 1997.



which country they're in. Indeed, as shown in Figure 3, international leased-line charges are a direct and major factor behind the high end-user prices charged in developing countries—as suggested by the strong correlation between costs incurred by ISPs to access the network and the end-user access prices in any given country.

Competitive Market for Access

A major underlying reason for the great disparity in Internet access prices—whether for end users or for ISPs accessing the international network—is the differences in market characteristics between various countries. In low-income countries, the most widely prevailing type of market structure is the one in which the ISP market is open to competition, usually to private-sector companies, while basic telephone services (local and international) are still under monopoly conditions (see Figure 4). The lack

of competitiveness in the international services market of most developing countries is perhaps the biggest single factor responsible for the high costs of international leased lines in these countries.

Ghana and Kenya could be viewed as having nearly identical competitive end-user ISP markets, the only difference being that in Ghana access to the international network is open to competition. As a result, Ghanaian ISPs pay approximately \$2,500 for a half-circuit, or the local portion of the international network infrastructure, while in Kenya ISPs pay some \$8,000 for a half circuit [1]. Thus the fact that Kenya has a vigorously competitive market of 10 ISPs and a similar number on the way does little to bring down end-user prices, which average \$100 per month for full Internet access.

Earlier this year, a number of operators in the Asia-Pacific region issued a joint statement claiming it is inappropriate for the ISPs and operators in the Asia-

Pacific region to bear the entire cost of the international Internet backbone between the Asia-Pacific region and the U.S. They requested U.S. operators and ISPs share the cost of the international Internet backbone between the U.S. and the Asia-Pacific region, according to their usage or benefits (see the sidebar “Cost Sharing Between Asia-Pacific and U.S. Telecom Carriers”). The Asia & Pacific Internet Association estimates global subsidies by non-U.S. ISPs to U.S. telecommunication operators stemming from the practice of paying for whole circuits could amount to as much as \$5 billion per year.

The lack of low-cost regional IP backbones is one of the main reasons ISPs around the world are willing to pay for the full circuit for a connection to the U.S. For example, the aggregate bandwidth between the Asia-Pacific region and the U.S. increased by 1.6Gbps from 1997 to 1998, while in the Asia-

Pacific region, only the link between Japan and Korea is greater than 45Mbps (and was unchanged between 1997 and 1998) [2]. So much U.S.-bound bandwidth is already deployed that the laying of competing infrastructure has become an expensive and daunting proposition. Furthermore, bandwidth to the U.S. is quite inexpensive relative to circuit costs to other countries, reducing further the incentive to build regional IP backbones. As a case in point, the price for a 45Mbps circuit for a connection between countries within the Asia-Pacific region ranges from \$500,000 to \$700,000 per month, according to the Asia & Pacific Internet Association, whereas U.S. carriers charge on average about \$25,000 per month for a 45Mbps circuit between the U.S. and Asia.

The fact that in most developing countries local calls for Internet services are metered as if they were a

Cost Sharing Between Asia-Pacific and U.S. Telecom Carriers

A number of major Asian telecommunications carriers issued the following statement last January on why and how they want to restructure the international circuit settlement arrangements between themselves and their U.S. counterparts. They argued it is inappropriate for ISPs and carriers in their part of the world to bear the entire cost of international Internet backbone between the Asia-Pacific region and the U.S. Their goal is for U.S. carriers and ISPs to share these costs according to the “usage and benefits” of that backbone.

Telecommunications operators, that is, providers of international infrastructure or capacity for the Internet, signed hereunder.

Bearing in mind

That the Internet Protocol is an epoch-making information technology; and

that the Internet has opened up many new possibilities, including turning information into valued products and will contribute to dramatically increase economic and industrial activities not only in developed countries but in developing countries.

Recognizing

That the Internet was devised mainly in the U.S. and has been developed at the initiative of the U.S.; and

that the majority of contents flowing on the Internet is of U.S. origin.

Recognizing further

That the international circuit capacity for the Internet connection from the Asia-Pacific region to the U.S. has been growing at a tremendous rate in the last few years; and

that, at the end of 1997, the aggregate bandwidth for this international Internet back-

bone had exceeded that for international telephone service in some countries, such as in Japan and Korea, and such difference expanded in 1998.

Conscious

That as more content is developed in the Asia-Pacific region, more and more traffic flow is from the Asia-Pacific region to the U.S.;

that the Internet infrastructure in the Asia-Pacific region is being developed so the amount of transit via the U.S. is rapidly decreasing;

that the Internet is increasingly being used as a new platform for international communications (two-way traffic), as in email, e-commerce, and Internet telephony, making the flow of Internet traffic between U.S. and non-U.S. customers increasingly bi-directional; and

that the Internet is being developed not only in the U.S. but in other countries around the world under the premise of interconnecting the respective resources of those countries, and thus the Internet is becoming the common property of the entire world population.

Concerned

That the increasing demand for information

voice connection also works against development of local Internet markets. To overcome these hurdles, some countries have implemented regulations that have brought down the prices of lines leased to ISPs and the prices charged for local calls to Internet users (see Table 1).

To make their services more affordable to users, ISPs in developing countries have also come up with a range of pricing schemes. Many have sought to follow the typical developed-country model of a fixed monthly fee for unlimited Internet access. But while in the industrialized world such service typically costs \$15–\$25, in most of the developing world fees are much higher and access time is limited. In Brazil, for example, the local IBM ISP subsidiary charges \$39.75 per month for 20 hours of dial-up service and \$2.75 for each additional hour. Other ISPs offer the incentive of time-managed pricing whereby users are

charged less for using the Internet during nonpeak times. Thus, Microcom in Nigeria offers a 40% discount if the Internet is accessed exclusively between 6 p.m. and 8 a.m. (see www.arminco.com/overview.htm and www.br.ibm.com/servicos/sernet/interintera/acdiscons/acdiscons.html).

Some have a fixed monthly fee and a per-kB download charge, like the Armenian Internet Co., which charges \$100 per month plus 42¢ per MB. Also typical of developing countries are ISPs offering email-only service, for which they charge much lower fees. For example, in Kenya, where full Internet access averages \$100 per month, email-only access is available for \$10 per month.

Despite the availability of creative pricing schemes, Internet services in most developing countries rarely spread beyond the capital and a few large urban centers. In Kenya, for instance, over 85% of the country's

from the Asia-Pacific region and the related bi-directional traffic make the U.S. ISPs in effect free-riding on the circuits and gateways and ports provided by the Asia-Pacific region ISPs; and

that given the faster growth rate of the Internet than of telephone service, the amount of global subsidy on international Internet circuits will be more than the alleged subsidy by the U.S. operators in the telephone area.

Believing

That equitable cost sharing of international circuits for the Internet will maximize the benefit of hundreds of millions of Internet users around the world.

Respecting

The study of appropriate cost sharing of international circuit for the Internet as pursued by the International Telecommunication Union.

Resolve

That it is inappropriate for the ISPs and operators in the Asia-Pacific region to bear the entire cost of international Internet backbone between the Asia-Pacific region and the U.S.—currently the case for historical and other reasons; and

that the current practice should be rectified so the ISPs in the Asia-Pacific region need not pay for the full port charge to the providers in the U.S. in exchange for the U.S. provider carrying the traffic to the U.S.

Request the U.S. operators and ISPs

Recognize the facts described; share the cost of international Internet backbone between the U.S. and the Asia-Pacific region according to their usage or benefits; and

discuss and build up with us an appropriate cost-sharing scheme of Internet interconnection links between the U.S. and the Asia-Pacific region.

Invite the Asia-Pacific and other region's operators and ISPs

To join in this resolution to urge the U.S. operators to share the cost of the international Internet backbone between the U.S. and other regions.

Urge every operator and ISP via various activities, including the International Telecommunication Union

To study appropriate mechanisms to measure the actual traffic as the basis of usage-based or cost-oriented charging and settlement arrangements.

As resolved by:

The Communications Authority of Thailand, Kingdom of Thailand; Chunghwa Telecom Co. Ltd., Taiwan; Indonesia Satellite Corp., Republic of Indonesia; KDD Corp., Japan; Korea Telecom, Republic of Korea; Philippines Long Distance Telephone Co.; Republic of the Philippines; Singapore Telecommunications Ltd., Republic of Singapore; and Telekom Malaysia,

≈ IN 1997, OVER 60% OF THE PEOPLE IN DEVELOPING COUNTRIES LIVED IN RURAL AREAS, YET OVER 80% OF THE MAIN TELEPHONE LINES WERE IN URBAN CENTERS. ≈

Internet users are in Nairobi, the capital, while Moscow accounts for 64% and Buenos Aires for 60% of all Russian and Argentine users, respectively ([1], and www.internet-magazine.co.uk/news/aug/26d.htm and www.secom.gov.ar).

One major factor leading to this skewed user profile is that ISPs are rarely present in the interior of most developing countries, and ISPs established in

cities in the country's interior. Moreover, ISPs charge for technical support depending on the remoteness of the customer. Swift Global, for example, charges 5,000–20,000 Ugandan shillings (\$3.65–\$14.60) per half hour of technical support, depending on the user's distance from Kampala.

Conclusion

Despite the significant growth of the Internet on a global scale over the past few years, the poorer regions of the world continue to face a combination of obstacles to the rapid diffusion of Internet services. Lack of competition—especially in international service—has made access to the international network expensive. And the fact that ISPs in developing countries have to pay for the full cost of leased lines to Internet backbones in the U.S. adds to the already high costs of providing Internet services in the southern hemisphere. Worse still, the dire lack of intraregional infrastructure means that even Internet communications with neighboring countries have to be routed through the U.S. Transferring these costs to end users—whose purchasing power is already limited—has rendered Internet access a very costly proposition throughout the developing world. The result, for the time being, is relatively slow growth of a skewed Internet market, with a small number of users concentrated in a few large urban centers. **C**

Table 1. Regulatory intervention in Argentina.

Influence of regulatory intervention on the prices of leased lines (top) and local rates for an Internet call (bottom) in Argentina, 1997 (in U.S.\$)

Speed	Before	After	Change
64Kbps	\$8,905/mo.	\$4,793/mo.	-46.18%
2Mbps	\$114,096/mo.	\$63,182/mo.	-44.62%

Pricing scheme	Before	After	Variation
Peak-time prices	1.35	0.64	-52.50%
Regular prices	1.01	0.64	-36.67%
Discount prices	1.01	0.42	-58.25%

Source: Secretaría de Comunicaciones de Argentina

the capitals do not provide plain old telephone service in the interior. In Cameroon, dial-up services at local call rates are available only in Yaounde and Douala, the country's two biggest cities. Elsewhere in the country, it is necessary to make costly long-distance calls to reach the ISPs. The lack of adequate infrastructure in the interior is also a major hindrance. In 1997, over 60% of the people in developing countries lived in rural areas, yet over 80% of the main telephone lines were in urban centers.

In the few instances where services have been established in the interior, local users pay higher prices for services their counterparts generally receive in the larger cities. Starcom, an ISP in Uganda, for example, charges \$30 for email-only services in the capital, Kampala, and \$50 in Jinja and Mbale, two smaller

REFERENCES

1. Arum, G. Kenya to build Internet backbone. *Telecom. Afr.* (Apr. 1998).
2. Greene-Raveendran, B. International Internet infrastructure financing. Paper presented at the 18th Meeting of the APEC Working Group on Telecommunications (Papua-New Guinea, Sept. 7-11, 1998); see www.apia.org/i3fcontents.htm.

BEN PETRAZZINI (Ben.Petrazzini@itu.int) is a telecommunication policy analyst in the Strategic Planning Unit of the International Telecommunication Union in Geneva, Switzerland.

MUGO KIBATI (mkibati@rpcp.mit.edu) is a graduate student in the Technology, Management, and Policy Program and a research assistant in the Internet Telephony Consortium, Center for Technology Policy and Industrial Development at the Massachusetts Institute of Technology in Cambridge, Mass.

© 1999 ACM 0002-0782/99/0600 \$5.00