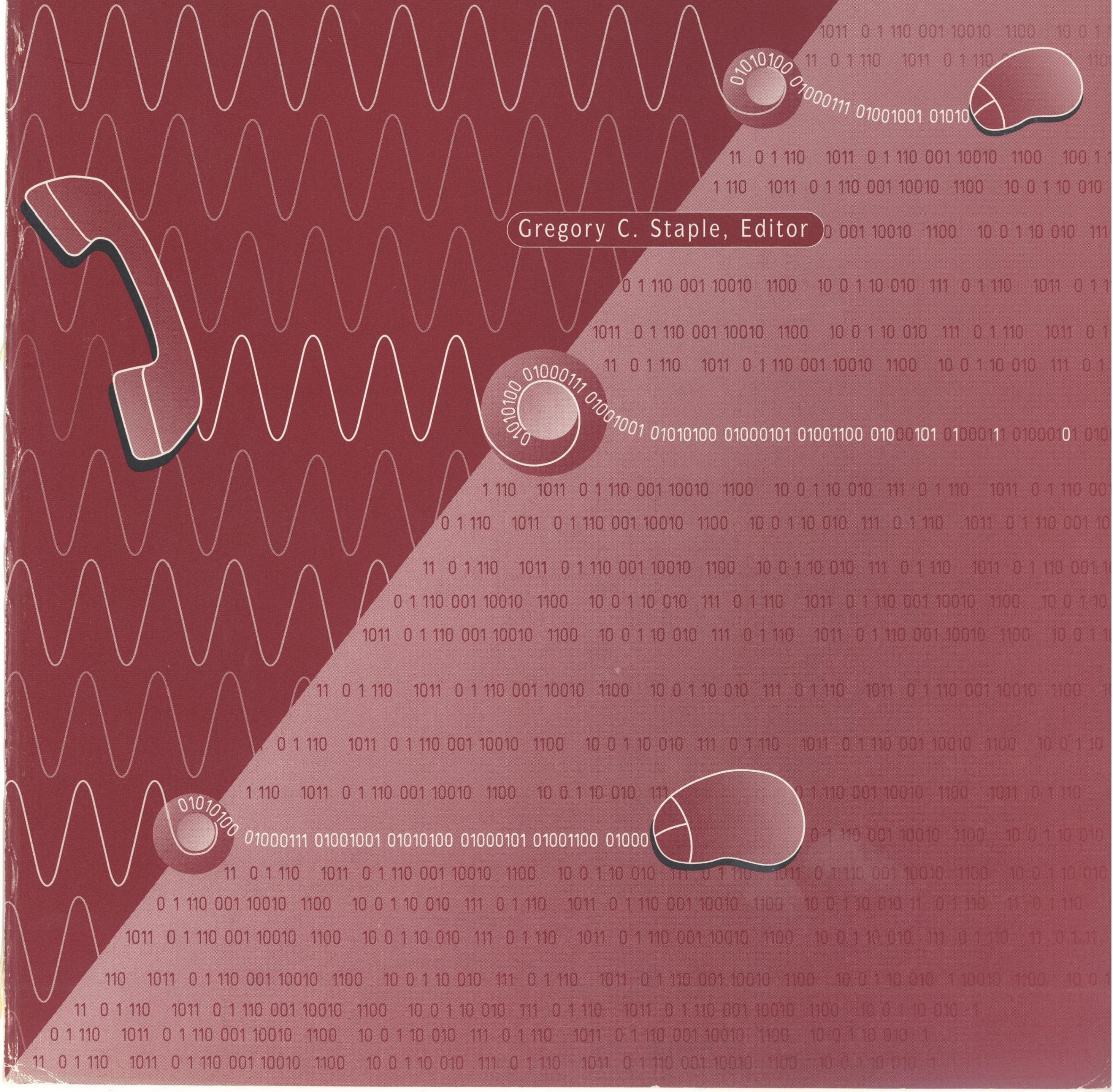
TeleGeography 97/98

Global Telecommunications Traffic Statistics & Commentary



Gregory C. Staple, Editor

TeleGeography® 1997/98

Global Telecommunications Traffic Statistics and Commentary

First Printing—October 1997

Second Printing—November 1997

Third Printing—December 1997

Fourth Printing—January 1998

ISBN 1-886142-10-6

Printed in the United States of America

TeleGeography, Inc. • 1730 Rhode Island Avenue, NW • Suite 1205 • Washington, DC 20036 USA
Tel. +1 202 467 0017 • Fax +1 202 467 0851 • E-mail: info@telegeography.com
http://www.telegeography.com

TeleGeography, Inc.

This report was prepared by TeleGeography, Inc., an independent research and publishing company based in Washington, D.C.

The *TeleGeography 1997/98* production team included:

Gregory Staple . . . . .Editor in Chief
Jason Kowal . . . . .Managing Editor
Timothy Stronge . . . . .Research Associate
Ron Kaplan . . . . .Research Associate
Zachary Schrag . . . . .Map Designer
Bárbara Medina . . . . .Research Assistant
Carmen Tatis . . . . .Research Assistant
Barbara Frank . . . . .Administrative Assistant

The following also are available from TeleGeography, Inc.:

TeleGeography 1996/97 (ISBN 886142-08-4)
Direction of Traffic 1996 (ISBN 92-61-06291-1)
New International Carriers 1997/98 (ISBN 886142-11-4)
Telecommunications Map of the World—1997 Edition (ISBN 1-86186-096-X)
The FCC Reader (ISBN 886142-09-2)
The TeleGeography 100 (ISBN 1-886142-06-8)

For all sales inquiries, please contact:

TeleGeography, Inc.
1150 Connecticut Avenue, NW
Suite 1000
Washington, DC 20036 USA
Tel. +1 202 467 0017
Fax +1 202 467 5915
E-mail: info@telegeography.com

If you have editorial questions, please contact:

Editorial Offices
TeleGeography, Inc.
1730 Rhode Island Avenue, NW
Suite 1205
Washington, DC 20036
Tel. +1 202 467 0845
Fax +1 202 467 0851
E-mail: editors@telegeography.com

And don't forget to visit our web site:

http://www.telegeography.com

Contents

List of Boxes and Figures

(continued)

List of Boxes and Figures (continued)

Preface

The essence of today's telecom evolution/revolution is summed up perfectly in the theme of *TeleGeography 1997/98*: From Club to Markets. Indeed, the old-fashioned "Gentleman's Club" of the monopoly telephone business is yielding ever-more rapidly to an era of open telecom markets. Experiments in competition have proven that telecom liberalization leads directly to infrastructure development and new-service deployment—combined with falling prices and rising quality. Now, virtually all nations are eager to embrace full or nearly-full competition in this critical sector, and thus support strong economic development.

Two of the best signs of the accelerating trend toward competition are the WTO agreement and the opening of Europe's telecom markets. Multilateral in nature, these competition-driving measures will rewrite the basic rules of paying for the vast majority of the world's voice and data calls. While bilateral correspondence will remain a pillar of global telecom, the accounting rates system it rests on faces significant revision—or at least a major rebalancing of the rates themselves. Nor are policy changes the only heralds of the new day: Internet telephony, call-back, and inexpensive wireless services are just three examples of technological imperatives bringing on full competition.

In any Brave New World, travelers need two things: courage and a reliable guide. The former, you have to supply on your own. Thankfully, TeleGeography serves as the latter, a role it has played since the beginning of the decade. BT and MCI are especially proud to continue sponsoring the TeleGeography series this year. Articles explore the developments mentioned above to a depth not readily available from other sources, and look at related issues as well. In addition, selected countries and companies are examined for their case-study value. And, as always, maps, graphs, and tables present hard-to-find data for administrators, engineers, marketers, major users, and investors—in short, anyone with a stake in the industry.

Seth D. Blumenfeld
President
MCI International

Gerry Spencer
Director, Carrier Services
BT

Acknowledgements

We wish to thank the numerous carriers, government departments, regulators and international organizations from around the world who responded to our requests for information. This report would not exist without the help of the dedicated people at these organizations who set aside the time necessary to ensure that the data reported here are as current and accurate as possible.

TeleGeography 1997/98 was supported, in part, by a publication grant from MCI Communications Corporation and British Telecommunications plc. As in the past, however, this grant was made without any precondition; TeleGeography, Inc. is solely responsible for the report's editorial contents.

The Editors

Introduction: From Club to Market

by Gregory C. Staple, TeleGeography, Inc.

"In the Network Economy, significance precedes momentum."—Kevin Kelly [1]

I. 1997: All Change

Evolution can appear to be a glacially slow process marked by countless barely perceptible changes which eons ago led to a new species or dramatically altered an old one. Look more closely though and evolution is discontinuous, first static and then punctuated by bursts of activity which are often triggered by climatic events, so that in a brief time the nature of life is forever changed. Nor has evolution stopped; it is very much in full swing should we care to look. [2]

So too with international telephone operators, long the dominant species in the global market. Over the last year, the prevailing legal and regulatory climate for these companies has utterly changed. The February 1997 World Trade Organization (WTO) Agreement on basic telecommunication services ratified the new order. Upon implementation of the Agreement, beginning in 1998, international carriers will compete directly against one another in over 50 countries accounting for over 80 percent of the $70 billion market for switched telephone traffic (see Figures 1 and 2). Competition may not take hold for a few years in many markets, but the old world has passed.

The WTO Agreement was expected, of course. It had been mooted since the 1994 General Agreement on Trade in Services (GATS) created a basic framework for liberalizing the cross-border provision of telecommunication and other services. Still, the breadth of national support for the new Agreement—a map appears on pages 22-23 below—surprised many observers, and underscores the sea-change in government thinking about the right climate for the evolution of telecommunications in the 21st century.

The new majority for competition seems to be driven more by pragmatism than ideology. As telecommunication services play an ever larger role in the economy, no country can afford to limit its citizens' access to the best or the cheapest services on offer globally. Legislating a protected market for national flag

Figure 1. International Traffic, Revenue and Subscriber Growth, 1987-2000

	Historical Trend			*Slow Growth*		*Same Growth*		*Fast Growth*	
Indicator	**1987**	**1996**	**CAGR 1987-96**	**2000**	**CAGR 1996-2000**	**2000**	**CAGR 1996-2000**	**2000**	**CAGR 1996-2000**
Calls (bn)	4.3	20.2	18.8%	35.9	15.4%	38	17.1%	40.8	19.2%
Estimated call length (mins)	4.5	3.5	-2.8%	3	-3.5%	3	-3.5%	3	-3.5%
Minutes (bn)	19.1	70.0	15.5%	107.7	11.4%	114.1	13.0%	122.4	15.0%
Per main line subscriber	42.4	94.0	9.2%	118.3	5.9%	123.4	7.0%	130.2	8.5%
Per main line plus mobile	42.2	79.3	7.3%	86.8	2.3%	88.8	2.9%	92.1	3.8%
Revenue (US$bn)	23.9	61.3	11.0%	80.1	6.9%	82.2	7.6%	85.7	8.7%
Assumptions									
Price per MiTT (US$)	1.25	0.88	-3.9%	0.74	-4.0%	0.72	-4.8%	0.70	-5.4%
Main lines (million)	451	745	5.7%	910	5.1%	925	5.6%	940	6.0%
Mobile subscribers (million)	2.5	138	56.1%	330	24.4%	360	27.1%	390	29.7%

Note. 1987-1996 based on reported data. 1996-2000 based on ITU forecasts. Scenarios are as follows.

1. Slow Growth: Traffic growth slows but network infrastructure continues on current growth trend
2. Same Growth. Continuing traffic growth rate of last five years, assuming faster network growth rate and faster rates of price-cutting.
3. Fast Growth: Faster traffic growth rate than last five years, assuming a faster network growth rate and faster rates of price-cutting, plus a significant component of new demand created by international traffic generated from mobiles.

Source: ITU *World Telecommunication Indicators Database* and ITU estimates carriers is not only costly for local users. It handicaps the supposed beneficiaries—incumbent operators—by insulating them from the innovative practices of foreign correspondents which are fast becoming their competitors.

All of this may sound like old news to some readers. Has not technology and economics already made competition the *de facto* global policy for the industry? Scores of telecom carriers market their dial tones to the world through calling cards and call-back services. Internet telephony has evolved from hobby to business in barely three years. And inexpensive satellite-telephone service soon will be available at almost any point on the planet. From this view, 1997 is an evolutionary milestone only because the world's trade and telecom ministers finally "got it."

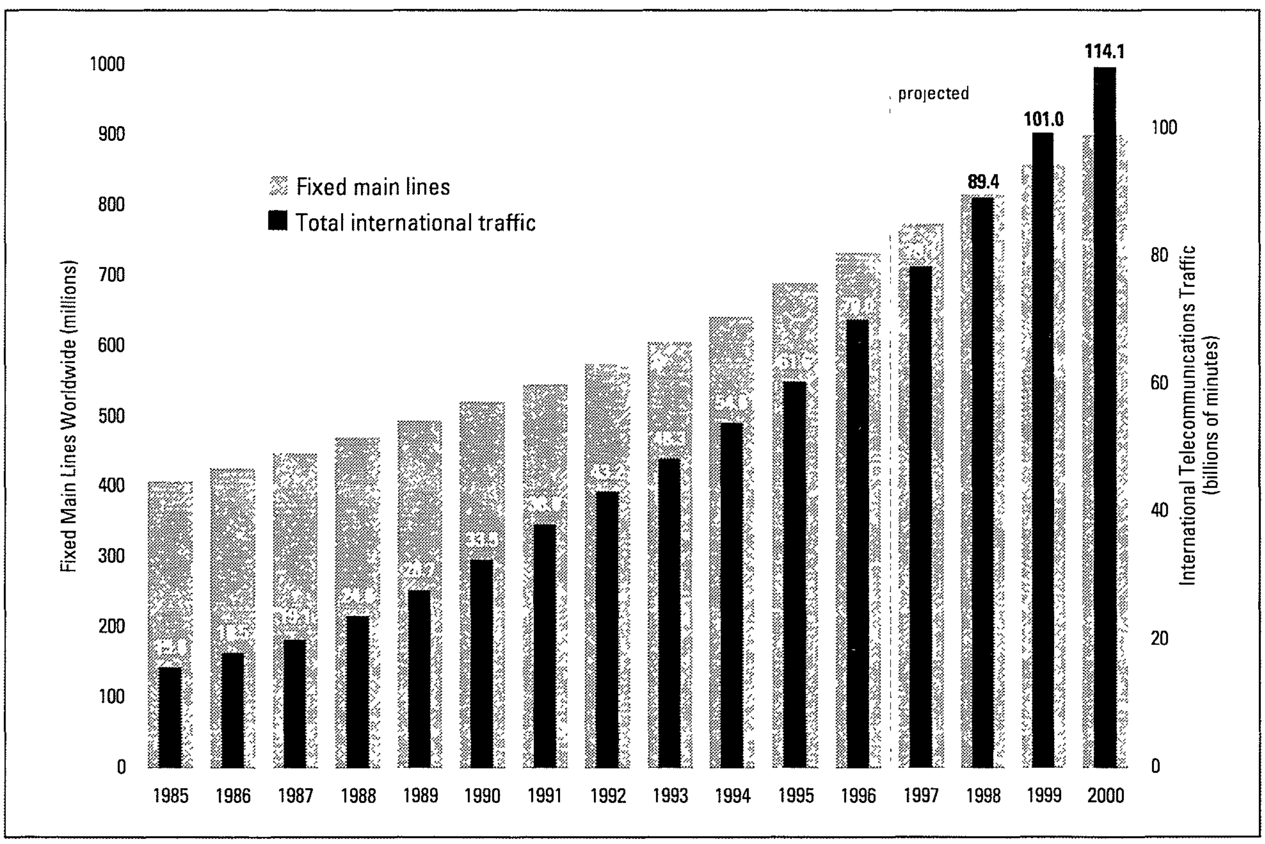
Though there is truth here, it glosses over too much of importance along the way. Law invariably lags behind technology and markets. There also is substantial anecdotal evidence that the last 12 to 18 months were marked by an unusual confluence of economic, technological and legal events, each reinforcing the next, which cumulatively pushed the business of international telephony onto a new development path.

The articles in *TeleGeography 1997/98* explore this thesis. They also describe what might lie ahead.

One commonplace view is that competition will soon make the international telecom business much like other large multinational endeavors—pharmaceuticals, oil refining, automobile manufacturing—which lately have not been so sheltered from foreign competition. These industries have seen successive mergers and acquisitions, and multinational producers in each sector now control the bulk of the market. In this view, the telecom industry's future will be similarly shaped by alliances such as Concert (BT, MCI, and Telefónica), Global One (Sprint, France Télécom and Deutsche Telekom), and the AT&T WorldPartners group.

There is another view though, to which we are more partial. It sees telecommunications as *sui generis*. The industry's core product today—a digital dial tone—is no longer service specific, and hence its market is increasingly unpredictable. Carrier services have become both a tool and a toy; they are at once the primary medium for global commerce and the world's latest playground. As well, telecom services have become part of the much bigger bit processing and distribution business. And,

Figure 2. International Traffic and Main Line Growth, 1985-2000



Note: Data include outbound international traffic on public networks only. Projections assume 13 percent traffic growth and five percent main line growth.
Source: ITU, TeleGeography, Inc.

thanks to the Internet, the bit business is largely open to all carriers. It is also furiously reinventing itself every few years.

These factors suggest that other global businesses probably do not provide a template for tomorrow's international telecom operators. Nor can the industry's path be safely forecast from yesterday's trend line. More on this later on.

We begin our review of the future by changing metaphors so as to look more closely at the industry's current economic condition.

II. From Club To Market

It has often been said that the old world of national telephony was a private Club for carriers only. If so, then the new one is a public market. The present transition from Club to market hence is likely to be dramatic, both economically and culturally.

Under Club rules—still reflected in the International Telecommunications Regulations (ITR) and related International Telecommunication Union (ITU) recommendations—the provision of international telephony is a joint venture between national carriers. Members must have licenses and, with few exceptions, only governments or their proxies get them. Service is provided by connecting domestic networks at designated border-crossing points and, on overseas routes, by joining matching "half circuits" in submarine cables and satellites.

Traffic routing is also agreed to jointly by all concerned carriers. Thus, when a call between two countries is routed through a third country, all parties must agree on the transiting arrangement.

Similarly, Club rules provide for a common accounting rate to compensate the originating and terminating carriers for handling a call. The accounting rate is typically divided 50/50, although each carrier's actual cost may vary significantly. Settlements between carriers are based on net traffic balances for a given period (see page 34 for a full explanation of how accounting rates work).

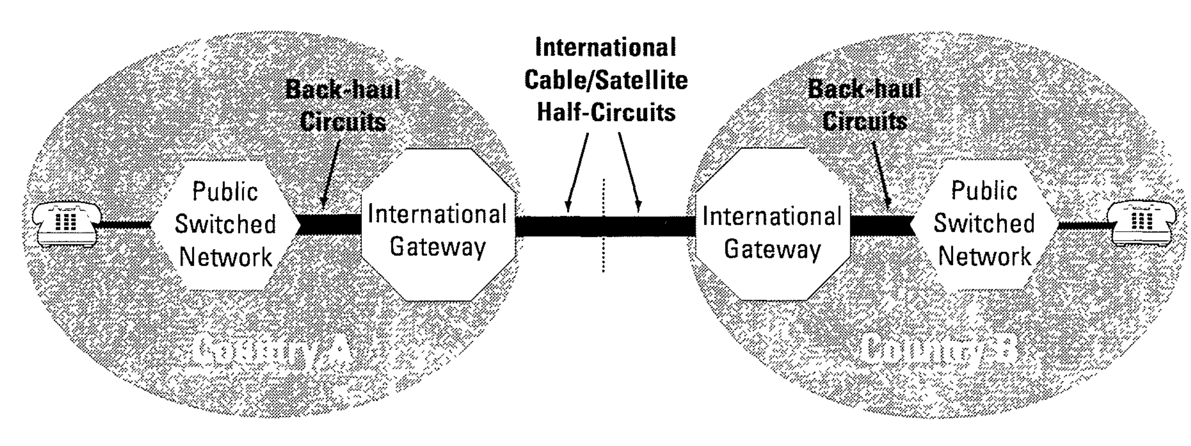
Since the early 1990s, there have been many signs that the old Club rules were breaking down. The main reason is money—the rules have tended to keep the average retail price of an international call (still more than $0.80 a minute) far above the carriers' actual service costs (estimated at below $0.20 per minute). This has provided a large incentive for non-members to enter the Club's market (e.g., by lobbying for new licenses or leasing facilities). It has also induced the Club's more efficient members to bend the rules so as to win a larger market share (by reselling their services) and to reduce their own settlement costs (by "refiling" traffic through third countries).

The Year in Review

In the last year, these market forces appear to have trumped the Club's rules, turning what was once a fairly quiet back room business into an increasingly open bazaar. Anyone who can pay their way, can play. And the rules of the game—from traffic routing to termination charges—are no longer fixed in advance. They vary from one day to the next like the prices in any street market. Consider the following:

• October 96—After a hotly contested tender, Barak, a new company owned in part by Global One, is awarded one of two new Israeli international telecom licenses; the other is won by

Figure 3. Typical Infrastructure for an International Call



Note. Figure assumes that calls are routed directly from Country A to Country B (i.e., no transit or refile arrangements are used) and that calls are routed over the public switched network

Golden Lines. What gave Barak the edge? The promise to cut the average Israeli international call charge from $1.20 to $0.25 per minute by hubbing traffic via the least expensive route.

But, then something unusual happens: days before Bezeq's monopoly was due to expire on July 1, 1997, Bezeq drops its own international call prices by as much as 80 percent. Barak and Golden Lines quickly protest, claiming, among other things, that Bezeq could only maintain its new rates by breaking Club rules.

• November 96—BT, the U.K.'s No. 1 international carrier, privatized less than a decade ago, announces it will merge with MCI, the No. 2 international carrier in the U.S. (BT already owned 20 percent of MCI's stock).

• December 96—MCI hints at the consumer benefits of end-to-end (whole circuit) service with BT by introducing a flat $0.12 per minute charge for U.S.-U.K. calls; a rate promptly matched by AT&T. Perhaps not coincidentally, the U.K. also announces that over 40 companies have been granted new international carrier licenses, including an AT&T affiliate.

• February 1997—AT&T and KDD ask America's main telecom regulator, the Federal Communications Commission (FCC), to replace the existing accounting rate on the U.S.-Japan route—approximately $0.90 per minute—with a much lower asymmetric rate. From May 1997 to April 1998, KDD would receive $0.26 per minute for landing calls, but AT&T only $0.14 per minute for originating.

KDD and AT&T also agree that, after April 1998, accounting rates should be "competitive with the cost of terminating calls in Japan and the U.S. by any facilities-based carrier which is self-provisioning calls" (i.e., domestic access charges rather than accounting rates will control the price of the call).

And, oh yes, February 1997 was the month in which Japan, the U.S. and over 50 other countries finally agreed to open their markets to foreign carriers by signing a new WTO Agreement.

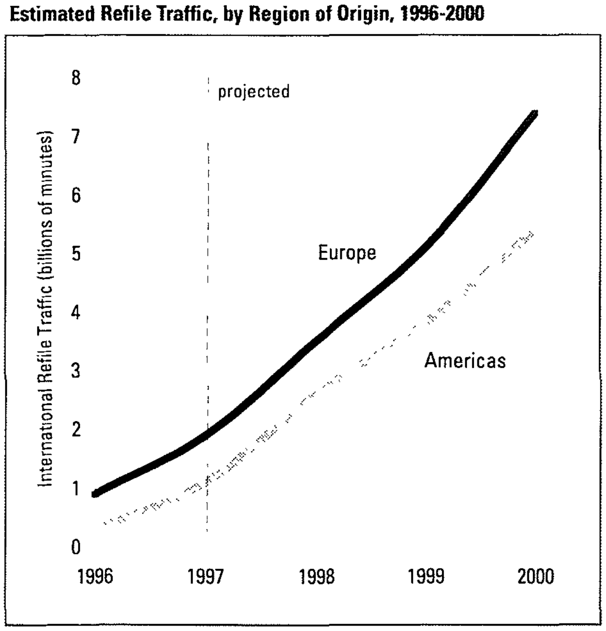
• May 97—More than 1900 delegates from 200 carriers attend the annual Intelsat Global Traffic Meeting (GTM) in Washington, D.C. The formal sessions on planning the capacity for Intelsat's next generation of communications satellites are but a sideshow to the main event: a week-long jumble of carrier stalls and meeting rooms for negotiating interconnection terms, traffic swaps, transit rates and access to submarine cable capacity. A global planning meeting—yes—but no longer for members only, and no longer for Intelsat only.

• August 97—Frustrated by the slow pace of accounting rate reform, and in the face of a $5 billion annual U.S. settlements deficit, the FCC adopts a tough new policy. After January 1, 1998, the WTO Agreement notwithstanding, no foreign-affiliated carrier will be permitted to begin U.S. service to its home country unless the foreign carrier offers all U.S. carriers serving the route settlement rates at or below a prescribed settlement benchmark. [3] The benchmark rates range between $0.15 to $0.23 per minute, depending on the economic status of the carrier's host country. All U.S. carriers are also directed to

Figure 4. Signs of the Times

Traffic Refile Is Growing...

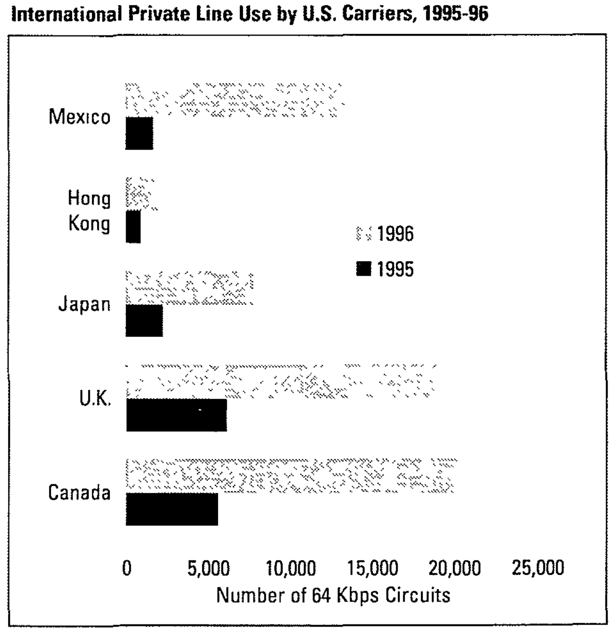
Estimated Refile Traffic, by Region of Origin, 1996-2000



Source: M J. Scheele & Associates

...So Are Private Line Bypass Options

International Private Line Use by U.S. Carriers, 1995-96

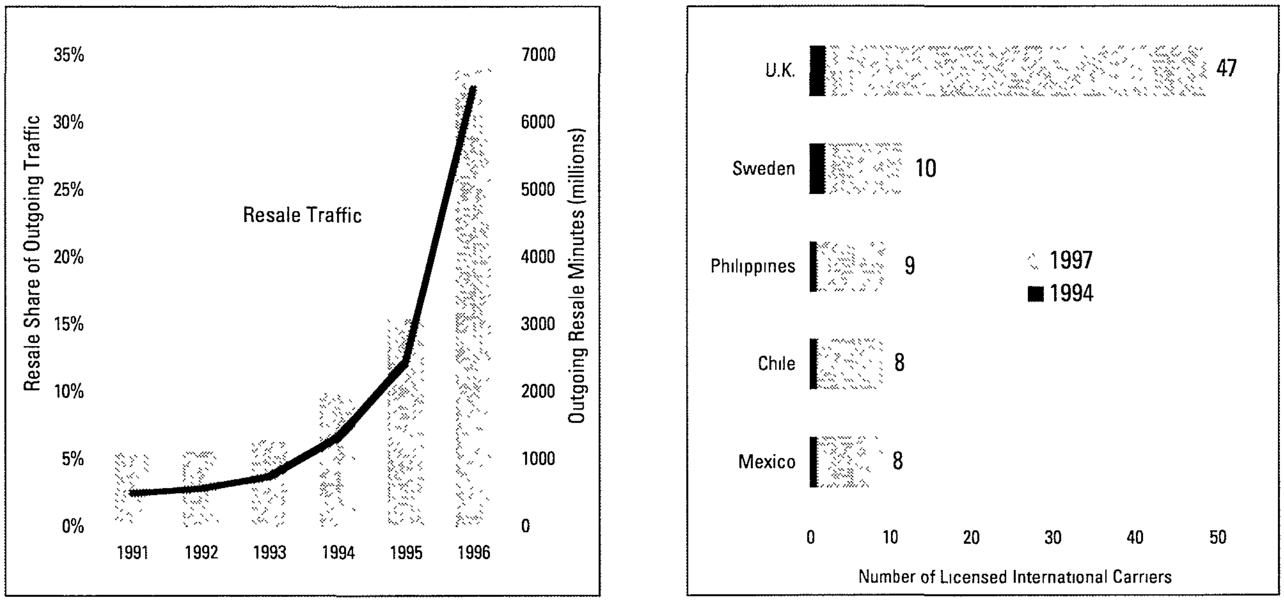


Source: FCC

Figure 5. More Signs of the Times

Call-back and Other Resellers are Hot... ***...And New Carriers Are Everywhere***

U.S. Market Share of Switched Resale Carriers, 1991-1996 **Licensed International Facilities-Based Carriers, 1994 vs. 1997**



Source: FCC

Source: *New International Carriers 1997/98*, TeleGeography, Inc.

implement settlement rates at or below the benchmark rates beginning in 1999 (see page 45 for further details).

• August 97—Deutsche Telekom, one of the Club's oldest members, announces it will acquire 21 percent of U.S.-based VocalTec Communications Ltd., the leading supplier of software for Internet telephony (see Vocaltec's profile on page 59.) Of course, telephone calls routed over the Internet entirely bypass the international accounting rate regime. Deutsche Telekom also agreed to buy more than $30 million of VocalTec products.

• September 97—After years of political infighting, the French government says that it will sell 20 percent of France Télécom to the public and another 15 percent to foreign carriers, including Deutsche Telekom. As one of the last state-owned carriers in Europe (even the Russians privatized earlier), France Télécom has long been a passionate supporter of Club rules. But in the early 1990s, the European Union timetable for liberalization started to force its hand, and France Télécom began to change. Now its accounting rates with U.S. carriers are already below the FCC's benchmark, and a domestic interconnection regime may soon make accounting rates irrelevant on many routes.

• October 97—WorldCom makes an unsolicited $30 billion all stock bid for MCI, potentially the largest corporate takeover in U.S. history. The logic: investment banking fees aside, WorldCom believes MCI's network and business customers will give it a critical size in its quest to become the leading backbone provider for the world's data networks. Hence the company's rapid buy-out of some of America's premier backbone providers, including: Wiltel (1995), MFS and UUNet (1996), Compuserve (1997), ANS Communications (1997), and now possibly, MCI, whose backbone reportedly carries 40 percent of U.S. Internet traffic (see page 76).

GTE, the third MCI suitor (it has offered $28 billion cash for MCI), has a data networking strategy too. In May 1997, GTE acquired the BBN backbone (BBN helped to develop the Internet for the U.S. Department of Defense) and has said it will spend over $2 billion to build a new "backbone 100 times bigger than today's Internet." MCI could aid the project. On the telephone side, MCI could provide GTE a vehicle for becoming the premier long distance carrier for the Americas, bringing GTE's Canadian and South American operators together with MCI and its Concert partners, especially Telefónica, which also has American interests.

Market Rules: The WTO Agreement

The *de facto* breakdown of the Club system will cause legal as well as economic uncertainty. In much of the world the WTO Agreement, and the national legislation implementing it, will set the ground rules for the new market-based regime. But, if the U.S. and U.K. experiences are any guide, liberalization is likely to be a protracted and difficult process. Indeed, as the *Financial Times* wrote in its 1997 survey of global telecom markets, "if the U.S. is finding it difficult to enforce and police open competition in its home market, what are the chances for trouble-free progress elsewhere in the world?"

There is hard work ahead. The door to many WTO markets will not simply swing open on January 1, 1998—it will need to be pushed time and again before market access (and egress) becomes routine.

The new WTO framework is discussed further in the articles section of *TeleGeography 1997/98*. It begins with a personal memoir by Alex Arena, the former Director General of OFTA (Office of Telecommunications Authority) in Hong Kong (1991-1997), and an active participant in the long-running WTO negotiations. In Arena's view, the February 1997 Agreement may be "the greatest influencing event on the industry for at least the next ten years."

Even as the WTO negotiations sought to establish a general framework for market liberalization, parallel efforts were underway at the ITU and elsewhere to adapt the accounting rate system to the market-driven economics of today's service industry. On page 33, Tim Kelly, Head of Operations Analysis at the ITU's Strategic Planning Unit, reviews the agenda. He also discusses his own "ten propositions" for reform; they have been quite influential.

Kelly argues that in a liberalized environment, where international service is no longer a joint venture, originating and terminating calls become separate businesses—a development we covered in *TeleGeography 1996/97*. Any reform of the accounting rate system thus must provide for unbundled access to the three basic network building blocks needed to send and receive calls separately: (1) the international transmission link (undersea cable and satellite circuits); (2) international gateway facilities (earth and cable stations plus linking "back-haul" circuits to local switches); and (3) access to the domestic network (see Figure 3).

Further, any reform program must recognize that market practices will develop unevenly and national conditions will lead to different prices for these three network components. The per minute cost of originating traffic may be quite different from that for terminating traffic on a given route and, such costs also may vary substantially route-by-route. (Recall the proposed AT&T/KDD accounting rate agreement above.) In addition, in competitive markets, with some carriers providing end-to-end service, others providing only one or two legs of a service, and still others choosing to connect circuits half way, several different systems for dividing costs and revenues will exist. No harm in that. Over time the market will determine which methods are preferable, so long as regulators see to it that all options are open.

Market Prices: Toward Spot Rates

When Club rules yield to market practices, and the international network is unbundled into its various parts, new price information will be needed. Today, if a carrier wants to know how much it will cost to land a minute of telephone traffic, it can look to the accounting rate which provides an all-in-one, bundled answer. Third country routing options (A to B via C) must also be considered. But the cost calculation generally means comparing one accounting rate with another, and then factoring in the forecast traffic balances and collection charges by route.

Before long though, accounting rates may be unavailable on many routes. If a carrier does not have its own foreign affiliate to "self correspond," the cost of landing a minute of telephone traffic in a given country may need to be pieced together from a survey of trans-oceanic circuit charges and domestic termination fees, each of which are likely to be volume and term sensitive, and to vary from carrier to carrier.

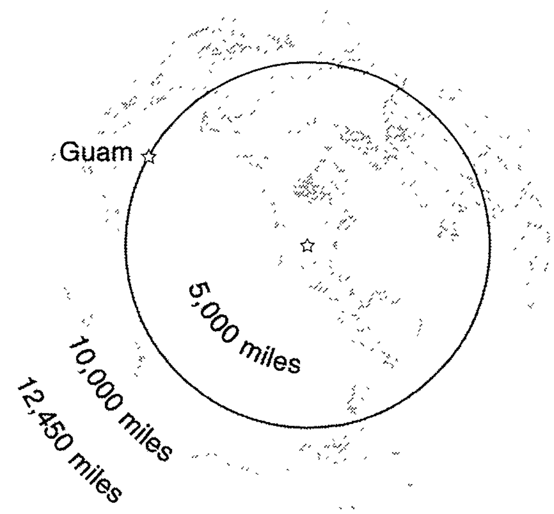
That is likely to make the correspondent relations business much more demanding. Some carriers will rise to the challenge with sophisticated routing and facilities arrangements. Others may simply prefer to auction their traffic to the carrier that can provide least-cost terminations for a given volume and term. In fact, traffic auctions by second and third tier carriers have already generated a brisk new "spot market" for transit and refile services. This has accelerated the industry's segmentation into a small group of wholesale carriers' carriers—which includes but is not limited to mega-carriers, such as Concert and Global One—and a much larger group of retail-oriented carriers. These new routing options are profiled by Michael J. Scheele and Cathleen Woodall beginning on page 39 (see also Figures 4 and 5).

The rise of traffic refile and "spot" pricing for call termination services point to a much broader set of pricing changes which are sweeping the industry. Long term operating agreements, carrier pre-subscription, and fixed tariffs are out. Short term service contracts, call-by-call carrier selection, and traffic auctions are in.

At the retail level, the price reform has been led by call-back and other resale carriers operating in the most liberal markets. In the U.S., for example, the exchange access regime mandated by the FCC permits local customers to choose their international carrier on a call-by-call basis (i.e., to "dial around" a pre-subscribed long distance carrier). For years, this has had a minimal impact on long distance competition; most users are reluctant to dial an extra access code and hence route their calls via pre-subscribed carriers (usually AT&T, MCI or Sprint). 1996 was different. By promising discounts of 40 percent or more per call, and spending heavily on TV advertising, dial-around and other resale carriers sold over six billion minutes of U.S. international traffic in 1996—over 30 percent of the total market—and a 150 percent jump in volume from 1995.

These developments are likely to be of keen interest to European carriers, who will soon be subject to equal access and presubscription rules themselves. The new rules come as a result of the Directive on number portability, proposed in

Box 1. What if Guam Were a Country?



The 1996 U.S. telecommunications reform law required U.S. long distance carriers to extend their national long distance rates to Guam, which lies 6,200 miles from the U.S. mainland. Calls from New York or Chicago or San Francisco to Guam now cost as little as $0.10 per minute. As more and more countries replace accounting rates with cost based access charges, as in Guam, international call prices may be comparable to the new rates between the U.S. mainland and Guam.

Equidistant azimuthal projection centered on Lebanon, KS.

New Rate Plan For U.S. Island May Have International Impact
The island of Guam lies in the western Pacific on roughly the same longitude as Melbourne, Australia. But this U.S. territory recently became a domestic point for U.S. telephone calls. Guam's country code (671) has been changed to a U.S. area code (671). And, under new FCC rules, effective in July 1997, U.S. long distance carriers have extended their standard, mileage-based domestic calling rates to Guam.

For example, AT&T's new domestic tariffs place Guam in the "4250 miles or more" category. Calls from the mainland cost approximately $0.29 per minute during the peak rate period, and $0.17 during off hours. (Rates for MCI and Sprint are similar.) However, the major U.S. carriers now include Guam in their flat rate calling plans which are available to subscribers for a small monthly fee. These plans permit mainlanders to call Guam for approximately $0.10 per minute and $0.05 on Sundays (with MCI).

The new tariff regime for Guam was accompanied by another important change: mainland U.S. carriers may now terminate their traffic on Guam based upon domestic access charges published by the local exchange carrier, the government-owned Guam Telephone Authority (GTA). Accounting rates have traditionally applied to U.S.-Guam traffic because Guam has been treated as a foreign point, and has an accounting rate with the U.S. (and other countries) separate from the accounting rate for the U.S. mainland.

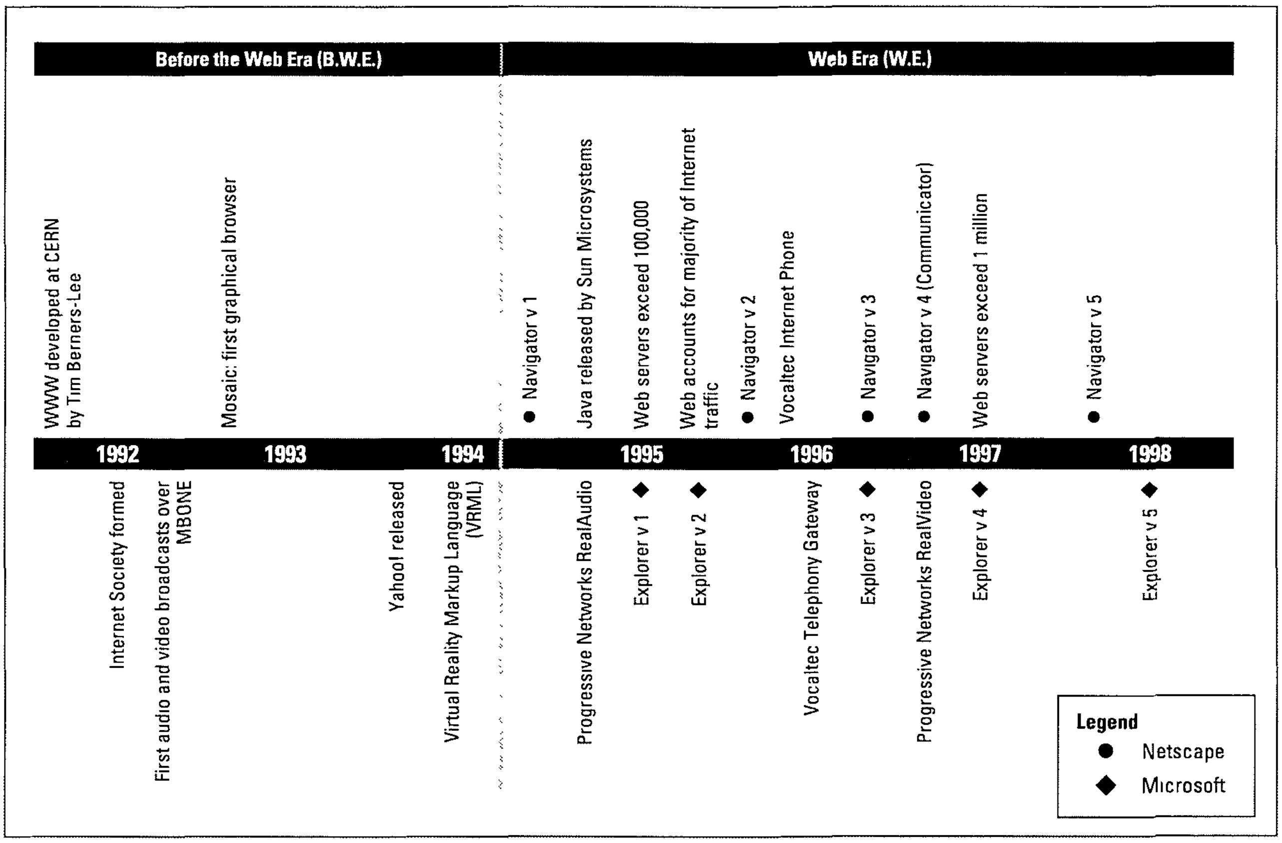
Until 1992, the U.S.-Guam accounting rate was $1.00 per minute or more, although it has since fallen to $0.25 per minute. Under the new regime, long distance carriers can acquire an end-to-end circuit from the U.S. mainland to Guam and interconnect with the GTA. The local access charge is approximately $0.06 per minute. Or a mainland carrier can provide service on a "correspondent" basis with a Guam long distance carrier, such as IT&E Overseas, Inc. (ITE), by negotiating a domestic carrier-to-carrier contract which bundles GTA's local access charge.

The FCC has taken steps to ensure that the transition to domestic interconnection charges does not lead to undue rate increases for local service. GTA can draw upon a nationwide pool of local exchange access revenues, if need be, to cover certain costs, so as to keep its access tariffs within the nationwide average. GTA's costs per access line apparently are less than many exchange carriers on the mainland, and it is thus a net contributor to the U.S. access charge pool. Soon, however, under another FCC reform program, almost all subsidies provided to U.S. local exchange carriers by the access charge pool will be supported by "universal service" fees collected from all telecom service providers and their customers.

Does the FCC's "rate-integration" plan for Guam have wider implications? It is too early to say. But the availability of "universal service" funds to smooth the transition to a domestic interconnection regime, though apparently not needed in Guam, may be instructive for other countries. As well, the new U.S. carrier tariffs for Guam plainly show that today regulation, not distance, is the major determinant of "international" call charges.

Source: TeleGeography, Inc.

Figure 6. Internet Time Scale: It's Year Three of the Web Era (3 W.E.)



Source: TeleGeography, Inc. © TeleGeography, Inc. 1997

October 1997 by the European Council. The text of the Directive can be found at www.ispo.cec.be/en/main-en.htm.

At the wholesale level, the new pressure on prices is leading carriers to update their strategies for least cost routing. Global backbones, hub and spoke networks, refile contracts and the Internet are all under review. Most carriers will probably experiment with several options. Looking ahead, it is not hard to imagine a world where every international call (and many domestic ones) is preceded by a real-time electronic auction. The originating carrier's switch will signal a pool of potential correspondents for price quotes to transmit "x" number of bits per minute to point "y." The quotes arrive in a few milliseconds; the winning bid is automatically processed; the call is initiated; and a billing record started.

Does this sound familiar? The routers that Internet Service Providers (ISPs) now use to transmit data from one part of the Internet to another operate in a similar fashion. Using complex algorithms, each switch chooses the least congested path to route the next packet of data by constantly querying a pre-programmed pool of neighboring routers, and then forwarding the packet accordingly.

The telephone network may soon follow a similar model, once switching and billing software become available to a few leading-edge carriers. Several enterprising ventures are working on this, including upstarts from the computer-telephony industry. They include Arbinet in New York (www.arbinet.com) and Israel's NetXchange (www.ntxc.com). Other entrepreneurs, notably Band-X (www.band-x.co.uk), have moved quickly to create a marketplace where buyers and sellers of wholesale telephone transmission services can meet.

The Death of Tariffs

The consequence of round-the-clock auctions for network access and call delivery are still unclear. The practice is embryonic. But, before long, the type of market-driven call routing practices which the Arbinets and Band-Xs of the world are encouraging could well spell the death of tariffs, at least in their current form.

Long distance tariffs have been in trouble for some time. Very high capacity transmission and switching equipment have made tariffs largely distance-insensitive in liberalized markets (in fact, a 20 km call may cost more than a 2000 km one). The "death of distance," to quote Frances Cairncross [4], has led many North American carriers to move toward flat per minute rates (typically $0.10 for the U.S. and $0.30 plus for the world). The "Green Pages," a pricing appendix to this book, provide a comparison of U.S. call prices with other countries.

Flat rate calling plans may remain popular for residential customers. However, business customers and resellers will probably soon demand market-based plans (i.e., off-tariff rates) which will vary by call, possibly with a per-minute cap tied to the carrier's lowest flat rate calling plan. For these large customers, paying for phone calls soon may become much like buying a few hundred (or thousand) pounds of coffee beans—what you pay depends on how much you buy, the quality of the beans and when you buy them.

III. The Internet Effect

While economics has driven regulatory reform, the industry's new economics is driven, in turn, by technology. Every day the Internet grows bigger and faster, and it poses a greater threat to the traditional carrier's Club. But the Internet is having a radical impact on other aspects of the industry too:

- As the major source of demand for new capacity. In 1998, the bandwidth allocated to Internet traffic on several trans-Pacific routes is likely to exceed that for switched telephony (see Figure 7); the pattern will be repeated on trans-Atlantic routes with a lag of a few years. One result: a ten-fold planned increase in trans-oceanic cable capacity by the year 2000 (see "The Next Generation of Mega-Cables" on page 86). Another: three different companies—Motorola, Alcatel and Teledesic—have proposed to launch separate fleets of satellites to provide broadband Internet connections around the world, at a total cost of $20 billion (see John Montgomery's November 1997 cover story in *BYTE*, "The Orbiting Internet: Fiber in the Sky," at www.byte.com). The demand for bandwidth has also spurred a rash of network acquisitions by WorldCom and others (see page 76).

- As a new time clock for product development (and much else). We are only three years into the Web Era (WE) (see Figure 6), though it may seem like 20. On planet Internet, the days and nights are very short (unless, of course, you write Internet software). Before the Web Era (BWE), major software products had a life cycle of several years. The WE has cut that to months, thus changing the pace of business for telecommunications too.

Over 40 million copies of Netscape Navigator and Microsoft Explorer, the leading Web browsers, are now in use. And each new generation of browsers places ever larger demands for bandwidth on the Internet. For instance, Netscape Communicator (i.e., Navigator 4.0), released in June 1997, is designed for work group collaboration (telephony, conference calls, scheduling, notes etc.).

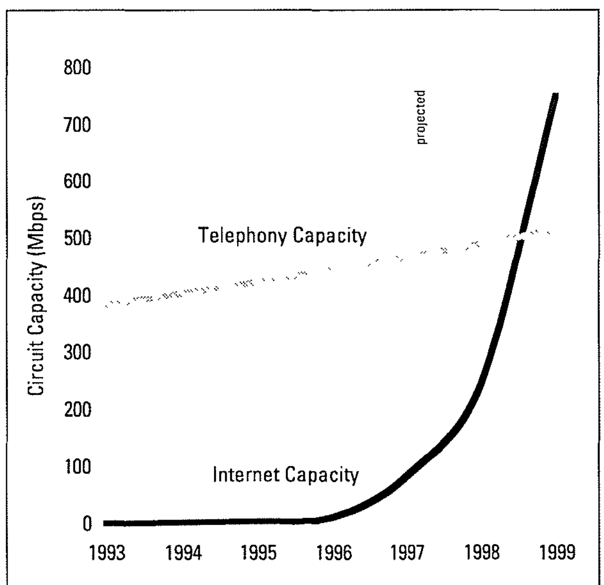
- As the biggest and richest R&D group. Research and Development (R&D) is a big budget item for telecom carriers, especially in a competitive market where the pressure for commercial pay-offs has never been greater. Now the Internet has become every telco's R&D partner, like it or not. Not only does the Net provide the essential link between hundreds of widely dispersed scientists and engineers, but it attracts venture capital like nothing else. The Internet industry is a "magnet for money and minds," in the words of the FCC's Kevin Werbach [5]. And as money flows into the sector, so does new talent, which in turn attracts further capital and more bright minds. In a few years, this virtuous circle has created a semi-public R&D consortium for the communications industry (though not for it alone) that dwarfs the R&D budget of even AT&T and Deutsche Telekom.

- As a network model. We have already suggested that the Internet's "least delay" routing methods may be used to develop "least cost" routing tables for telephone carriers in which price rather than congestion is the key variable. In fact, if the Internet is to maintain its past growth record, many observers believe that it must begin to use price as well as traffic to manage routing decisions. Confounding the skeptics, the Internet did not suffer a catastrophic crash in 1997, despite handling perhaps twice the number of users and several times the volume of traffic as the year before (see "Measuring the Internet" on page 73). The global economics of the Internet remain unsettled, however.

Until recently, most ISPs handed off traffic to one another at network exchanges without payment. Each ISP essentially treated the other as a peer on the assumption that traffic flows

Figure 7. The Net Effect

Telstra Circuit Usage on the Australia-U.S. Route, 1993-99



Source: Telstra Corp. © TeleGeography, Inc 1997 and costs were proportionate (see pages 73-74). These peering arrangements, however, are beginning to yield to network access contracts based on a backbone's size and capacity. WorldCom's ISP subsidiary, UUNet, has taken the unpopular first steps in the direction of fee-based network interconnection agreements.

Also, many foreign ISPs face the choice of provisioning their own international circuits to the U.S. or paying to access a U.S. backbone at an off-shore node (see page 75). Once installed, these "whole circuit" links benefit Internet users in the U.S. as well because traffic is two-way. Thus, as the long-haul capacity of non-U.S. ISPs continues to rise sharply (see Figure 7), the current system for funding access to the Internet's U.S. backbones will come under the same pressure for economic reform as the accounting rate regime. Demands for cost-based (i.e., traffic sensitive) access and other alternatives (e.g., peering and regional nets) are likely to win growing support [6].

Internet Telephony: *Cui Bono*?

Which brings us back to the issue of the day: Internet telephony. Will the average telephone caller see the Internet as a real substitute for the public switched network? Within a few years, the answer is almost certainly "yes" (see Figure 8). But, by then the question may be of far less concern to many carriers. Few callers know (or care) about the path or protocols their voice traverses en route. Nor will they know tomorrow when both the public telephone network and the Internet will consist of a mix of dedicated and leased facilities for IP and other protocols. Make the network smart enough and users can remain clueless.

How will we get there and how long will it take? That is the focus of a second set of articles.

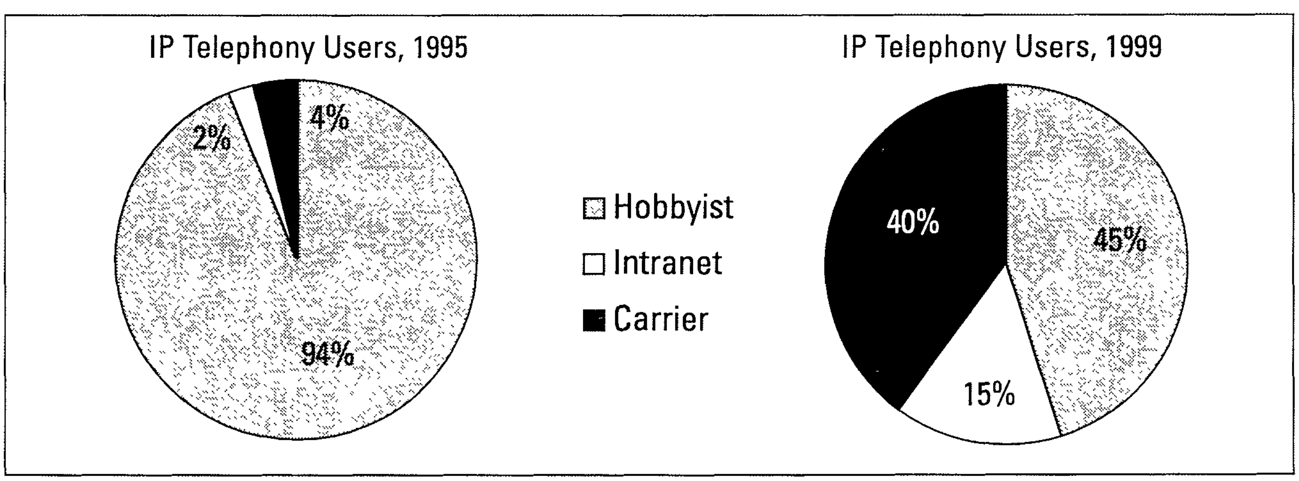
They are introduced by Vint Cerf, one of the Internet's founding fathers (he helped write the basic transmission protocols), and now Senior Vice President, Internet Architecture and Engineering at MCI. In Cerf's view, "It is clear that both packet switching and circuit switching will be used [to transport voice signals]. There is no reason why a PC can't coordinate a PSTN call with a shared application over the Internet." Other contributors to this section include: David Rosenthal of VocalTec, the leading Internet Telephony software company; Elie Wurtman of Delta Three, the first company to offer phone-to-phone Internet telephony service on a commercial basis; and Esa Hirviniemi, who manages Internet access services for Helsinki Telephony Company, which serves perhaps the most wired city in the world.

IV. What Happens Next?

It is time to return to the issue we raised at the beginning of this essay. What does the future hold for international telecom carriers? Will new technologies and trade rules "normalize" the industry, leaving the business of carrying traffic from one country to another largely intact, though ever more competitive, or are other changes on the horizon? And if so, what are they?

One reason for thinking that tomorrow will not be just a more competitive version of today is that long distance transmission capacity will increase by an unprecedented amount in the next decade. Despite the rising demand for Internet bandwidth, there seems little doubt that the optical fiber industry will keep supply two steps ahead thanks to brash start-up ventures, such

Figure 8. The Changing Face of IP Telephony



The vast majority of Internet phone calls are currently between home users, the "hobbyists," who make calls by running proprietary Internet telephony software on their personal computers. Increasingly, however, calls will be made between regular handsets and travel over the Internet Protocol (IP) telephony services of telephone carriers or over corporate intranets.

Source: Pulver.com, Inc./VON Coalition

as Ciena (www.ciena.com), and old hands, like Alcatel and AT&T's former cable unit, now Tyco Submarine Systems. Prices for long-haul capacity and services will fall accordingly, leaving most long distance carriers with a growing dilemma.

Two responses are emerging. The first is to make a virtue out of necessity and to specialize in providing capacity as a carrier's carrier, leaving the retail business largely to others. WorldCom appears to be following this course, in part. The separate backbone and distribution companies used by global alliances, such as Concert, also serve as evidence for this new two-tier industry structure. The carrier's carrier business may well be profitable in the near term as retail operators and corporate telecom managers scramble for capacity on key routes. As more bandwidth comes to market, however, it may look less attractive unless it is linked to new services (e.g., a quality of service guarantee for intranets which only the very largest end-to-end networks can match).

The explosion of bandwidth is also triggering an alternative market-oriented response. If over-supply threatens to make international telephony into a commodity business, then the answer is radically to boost demand. But how? One approach seeks to go "back to the future" by marrying the network more closely with potential applications (i.e., by vertical integration). Thus, much as the old AT&T could count on a captive manufacturer (Western Electric) for new products and a nationwide chain of local carriers (the Bell Operating Companies) to deliver long distance traffic, today's global carrier seeks to buy up the most promising new sources of traffic (e.g., Internet service providers) and products (software houses, tele-TV ventures). As GTE's Chairman, Charles Lee said in announcing his company's bid for MCI, "The key product strategy going forward for us, is a bundled service..."

But the search for new applications has led other carriers down a different path—one more in sync with the decentralized, market-oriented spirit of the day. These carriers not only view the new wave of mergers as a competitive threat but as counterproductive. The applications business is quixotic and few big companies have been successful in birthing new "killer apps" themselves. Such innovations typically come from outsiders. The best approach, therefore, is to develop a network of cooperating companies—a "business ecosystem" to use Jim Moore's phrase—so that a carrier helps to co-evolve the next generation of network services, realizing that it will not be the only one to benefit. [7]

The Network Has a Message

Yet, whether one takes an industrial-age or an information-age approach to stimulating demand, the telecom industry is likely to be changed for another fundamental reason: Today's digital telecom networks are not just a pipe or a socket for new products but, like electricity, have an implicit message of their own. And this message constantly changes the applications which people want to use.

Marshall McLuhan, the Canadian media critic (1914-1980), put it this way in *Understanding Media*: "[T]he message of electric[ity] is... totally radical, pervasive, and decentralized. For electric power and light... eliminate time and space factors, and human association exactly as do radio, telegraph, telephone and TV..." Electric light abolishes the traditions of night and day, of indoors and outdoors. "Cars can travel all night, ball players can play all night and windows can be left out of buildings." [8]

Within a decade or so, the transformational impact of the global telecom network may be similar. As hundreds of millions of people begin to recognize that the cost of talking across an ocean is little more than that of turning on an air conditioner, the existing patterns of social and business organization will shift. And that, in turn, will change the demand for international communications. We don't know yet how that demand will be impacted, anymore than people of the 19th century foresaw how air conditioning could turn places like Malaysia into the 21st century's economic powers. But it will happen.

Consciousness Raising

The fact that telecom networks, like electric power grids, are both a medium and a message also suggests another lesson that has to do with evolution itself. Since the first days of the telegraph, electric power and communication networks frequently have been seen as a surrogate nervous system. In *The House of The Seven Gables* (1851), the American novelist Nathaniel Hawthorne wrote, "...by means of electricity, the world of matter has become a great nerve, vibrating thousands of miles in a breathless point of time... the round globe is a vast head, a brain, instinct with intelligence."

This theme was later echoed by McLuhan ("our new electricity technology is not an extension of our bodies but of our central nervous system"), although McLuhan was mainly influenced by Pierre Teilhard de Chardin's book *The Phenomenon of Man*. Ordained as a Jesuit, and later trained as a paleontologist, Teilhard de Chardin believed that Homo Sapiens, the thinker, had begun a new era in evolution. "A glow ripples outward from the first spark of conscious reflection," wrote Teilhard de Chardin in 1938. "The point of ignition grows larger. The fire spreads in ever widening circles until finally the whole planet is covered with incandescence. Only one interpretation, only one name can be found worthy of this grand phenomenon... It is really a new [earthly] layer, the 'thinking layer' which since its germination at the end of the Tertiary period [two million years ago] has spread over and above the world of plants and animals." [9]

What Teilhard de Chardin meant "can be summed up in a few words," says John Perry Barlow, one of the Internet's gadflies:

"The point of all evolution up to this stage is the collective organism of mind." McLuhan said it explicitly: with electric communications "man now wear[s] .... his brain outside his skull and his nerves outside his skin; new technology breeds new man." [10]

It is a radical hypothesis and has long had its skeptics. [11] Yet it has been taken up by some natural scientists too. One of the best known is Richard Dawkins, a British zoologist. In his recent book, *River Out of Eden*, Dawkins contends that both social ideas and radio communications may indeed be evolutionary thresholds. Our global communications nets thus have a biological significance quite apart from their role as a transmission medium. [12]

The archaeological record suggests that something like this occurred 35,000 to 40,000 years ago. That was the time when Cro-Magnons, the early Homo Sapiens, reached Ice Age Europe, having migrated from the Middle East and before that from Africa. The European predecessors to the Cro-Magnons were the physically robust Neanderthals who successfully occupied western Eurasia from about 200,000 years ago until Cro-Magnons supplanted them.

The debate on why Neanderthals became an evolutionary "has-been" continues, but many experts believe the key weapon was the Cro-Magnons' brain, equipped with a large frontal lobe "wired" for associative thinking—for language and art. This is the time, says Richard Leakey (*The Origin of Humankind*) when the astonishing cave paintings, engravings and carvings of Ice Age Europe and of Africa begin to appear—artifacts "which evoke the mental worlds of people like us." "Go back beyond this, however—beyond about 35,000 years ago," says Leakey, "and these beacons of the modern human mind gutter out. No longer can we see in the archaeological record cogent evidence of the work of people with mental capacities like our own." [13]

Could the Net's collective mind lead to a similar mental leap for humankind? [14] Could the billions and billions of new circuits lead us to inventions which are as hard to imagine today as language or electricity or gene splicing may have been to Neanderthals? And if so, what business will global telcos be in then? The answer may be: the same business they have been in all along—consciousness raising. The successful telecom companies have long known that is their real evolutionary advantage.

Which brings us full circle, though we have strayed rather far from accounting rates and trade schedules. We are nearing the third millennium, however, and there is something about the span of 1000 years that leads one to ponder the larger questions of the age, even if it only makes our answers to the smaller ones more uncertain.

Notes

[1] "New Rules For the New Economy," *Wired*, September 1997, p. 186.

[2] An extensive list of biological examples can be found in Jonathan Wiener's book, *The Beak of the Finch* (Vintage Books, New York, 1995).

[3] The full text of this FCC policy and other Commission decisions affecting U.S international carriers are compiled in *The FCC Reader*, a new TeleGeography annual subscription service. For details, visit http.//www.telegeography.com

[4] See Frances A. Cairncross, *The Death of Distance* (Harvard University Press, Cambridge, MA, 1997), excerpted at http://www.deathofdistance.com This was also the title of Cairncross's 1995 survey of global telecommunications for *The Economist*; a sequel appears in the September 13, 1997 issue.

[5] "Digital Tornado· the Internet and Telecommunication Policy," FCC Office of Plans and Policy Working Paper Series No. 29, March 1997. This White Paper explains why the Internet works so well and describes its likely challenges to the public switched network It's available on the FCC's web site at http·//www.fcc.gov/Bureaus/OPP/working_papers/oppwp29.pdf.

[6] For an insightful review of the Internet's U.S -centric backbones and the consequence for foreign ISPs, see "The World Wide Weight" by Andreas Evagora in *tele.com* (September 1997), also available at http://www.teledotcom.com.

[7] See James F. Moore, *The Death of Competition* (Harper Collins, New York, 1996) excerpted at http·//www.geopartners.com/geocompetition.htm

[8] Marshall McLuhan, *Understanding Media* (New American Library, New York, 1964) pp 25 and 60

[9] Pierre Teilhard de Chardin, *The Phenomenon of Man* (Harper & Row, New York, 1959), p. 182.

[10] "Playboy Interview· Marshall McLuhan—A Candid Conversation" in *Essential McLuhan,* edited by Eric McLuhan and Frank Zingrove (Basic Books, New York, 1995) pp 264-265

[11] See, for example, the cutting review of *The Phenomenon of Man* by Sir Peter Medawar at http://physserv1.physics.wisc.edu/~shalizi/Medawar/. For a favorable view, see Kevin Kelly, *Out of Control* (Addison-Wesley, N.Y 1994) on p 202: "As very large webs penetrate the [manufactured] world, we see the first glimpses of what emerges from that net—machines that become alive, smart, and evolve... There is a sense in which a global mind also emerges in a network culture.... We humans will be unconscious of what the global mind ponders ... not because we are not smart enough, but because the design of the global mind does not allow the parts to understand the whole "

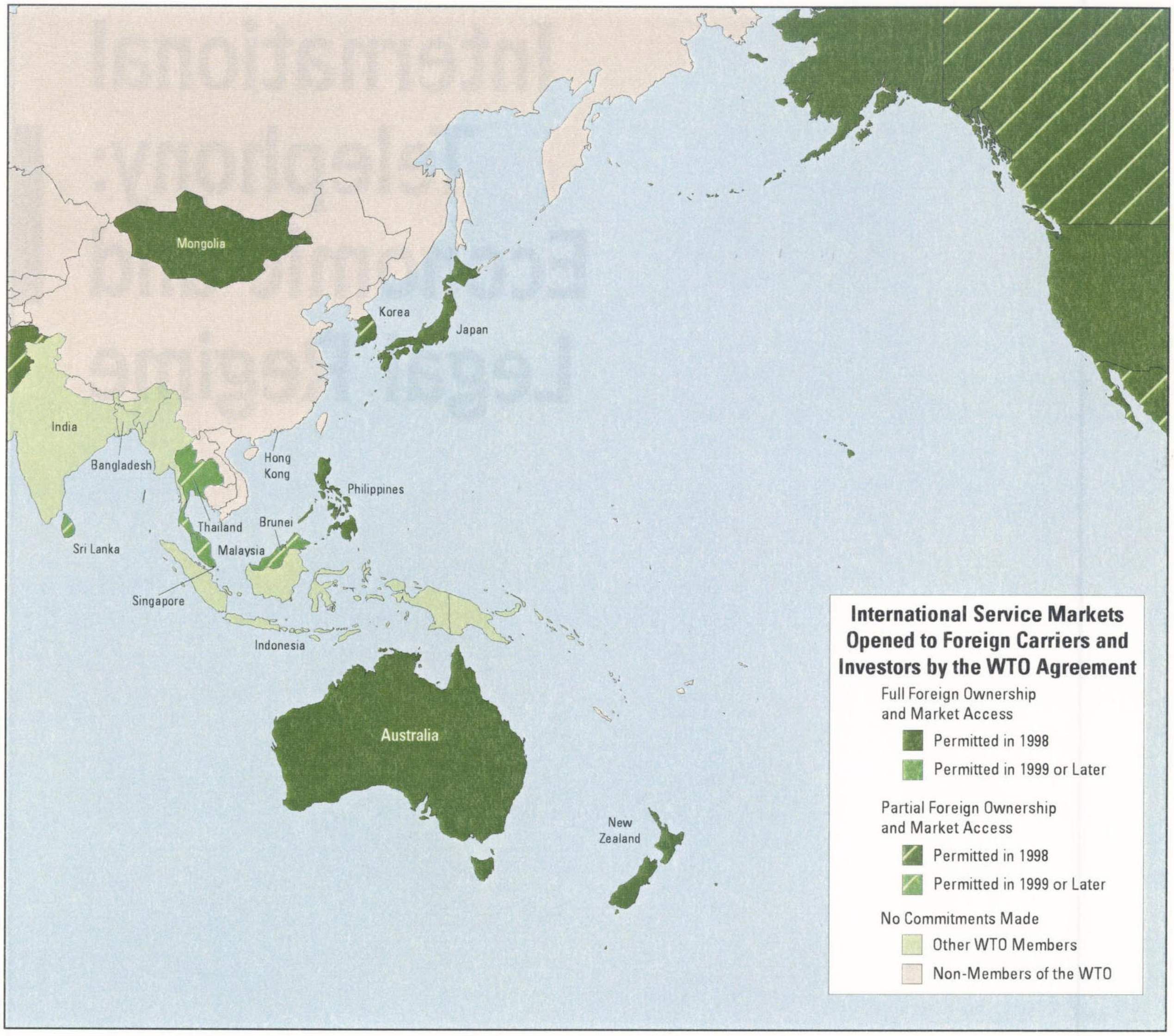
[12] Richard Dawkins, *River Out of Eden* (Orion Books, London, 1995) pp. 182-188.

[13] Richard Leakey, *The Origin of Humankind* (Basic Books, New York, 1994) p. 80

[14] This question is also explored by Peter Russel's *The Global Brain Awakens—Our Next Evolutionary Leap* (Global Brain, Inc., Palo Alto, CA 1997), first published in 1982, and excerpted at http://artfolio.com/pete/GBA.html In the 1930s, H.G. Wells, the U.K science fiction writer, similarly saw the world's communication networks as an emergent "Super Brain." See www.trendmon.demon.co.uk/wb0.htm. A review of recent literature on the Internet's evolutionary potential can be found at pespmc1.uubac.be/papers/superBRAIN.html.

International Telephony: Economic and Legal Regime

The New TeleGeography: A WTO Map of the World

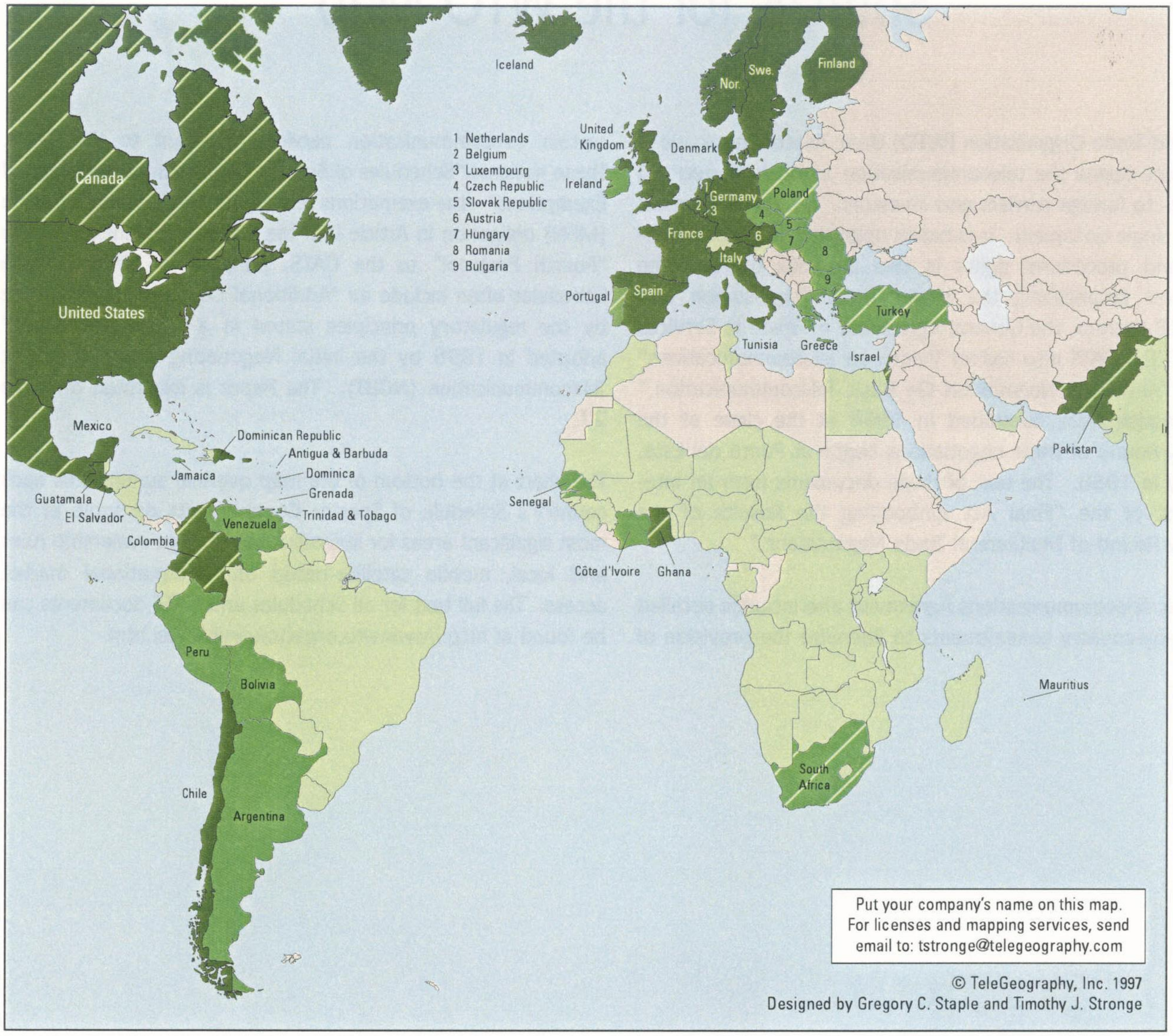


Key to Country Commitments under the WTO Agreement

- ● Full Market Access in 1998
- ○ Partial Market Access in 1998
- ● Full Market Access in 1999 or After
- ○ Partial Market Access in 1999 or After
- ○ No Commitments Offered

Note: Country commitments under the 1997 WTO Agreement on Basic Telecommunication Services include the right to offer **Local** (local telephone exchange), **International** (international telephone service), and **Satellite** (mobile satellite-based telephone service; commitments on fixed satellite services not shown). **Foreign ownership** refers to the right of a WTO member to invest in a foreign telecom carrier; some countries have exempted specific carriers.

	Local	International	Satellite	Foreign Ownership
Antigua & Barbuda	No Commitments Offered	Full Market Access in 1999 or After	Full Market Access in 1999 or After	Full Market Access in 1999 or After
Argentina	Full Market Access in 1999 or After	Full Market Access in 1999 or After	Full Market Access in 1999 or After	Full Market Access in 1998
Australia	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998
Austria	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998
Bangladesh	Partial Market Access in 1998	No Commitments Offered	No Commitments Offered	Partial Market Access in 1998
Belgium	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998
Bolivia	Full Market Access in 1999 or After	Full Market Access in 1999 or After	Full Market Access in 1999 or After	Full Market Access in 1999 or After
Brunei	Full Market Access in 1999 or After	Full Market Access in 1999 or After	Full Market Access in 1999 or After	Full Market Access in 1999 or After
Bulgaria	Full Market Access in 1999 or After	Full Market Access in 1999 or After	Full Market Access in 1999 or After	Full Market Access in 1999 or After
Canada	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998	Partial Market Access in 1998
Chile	No Commitments Offered	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998
Colombia	Partial Market Access in 1998	Partial Market Access in 1998	Partial Market Access in 1998	Partial Market Access in 1998
Côte D'Ivoire	Full Market Access in 1999 or After	Full Market Access in 1999 or After	Full Market Access in 1998	Full Market Access in 1999 or After
Czech Republic	Full Market Access in 1999 or After	Full Market Access in 1999 or After	Full Market Access in 1999 or After	Full Market Access in 1999 or After
Denmark	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998
Dominica	No Commitments Offered	No Commitments Offered	Partial Market Access in 1998	No Commitments Offered
Dominican Republic	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998
El Salvador	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998
Finland	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998
France	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998
Germany	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998
Ghana	Partial Market Access in 1998	Partial Market Access in 1998	Partial Market Access in 1998	Partial Market Access in 1998
Greece	Full Market Access in 1999 or After	Full Market Access in 1999 or After	Full Market Access in 1999 or After	Full Market Access in 1999 or After
Grenada	Full Market Access in 1999 or After	Full Market Access in 1999 or After	Partial Market Access in 1998	Full Market Access in 1999 or After
Guatemala	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998	Full Market Access in 1998
Hong Kong	No Commitments Offered	Partial Market Access in 1998	Partial Market Access in 1998	Full Market Access in 1998

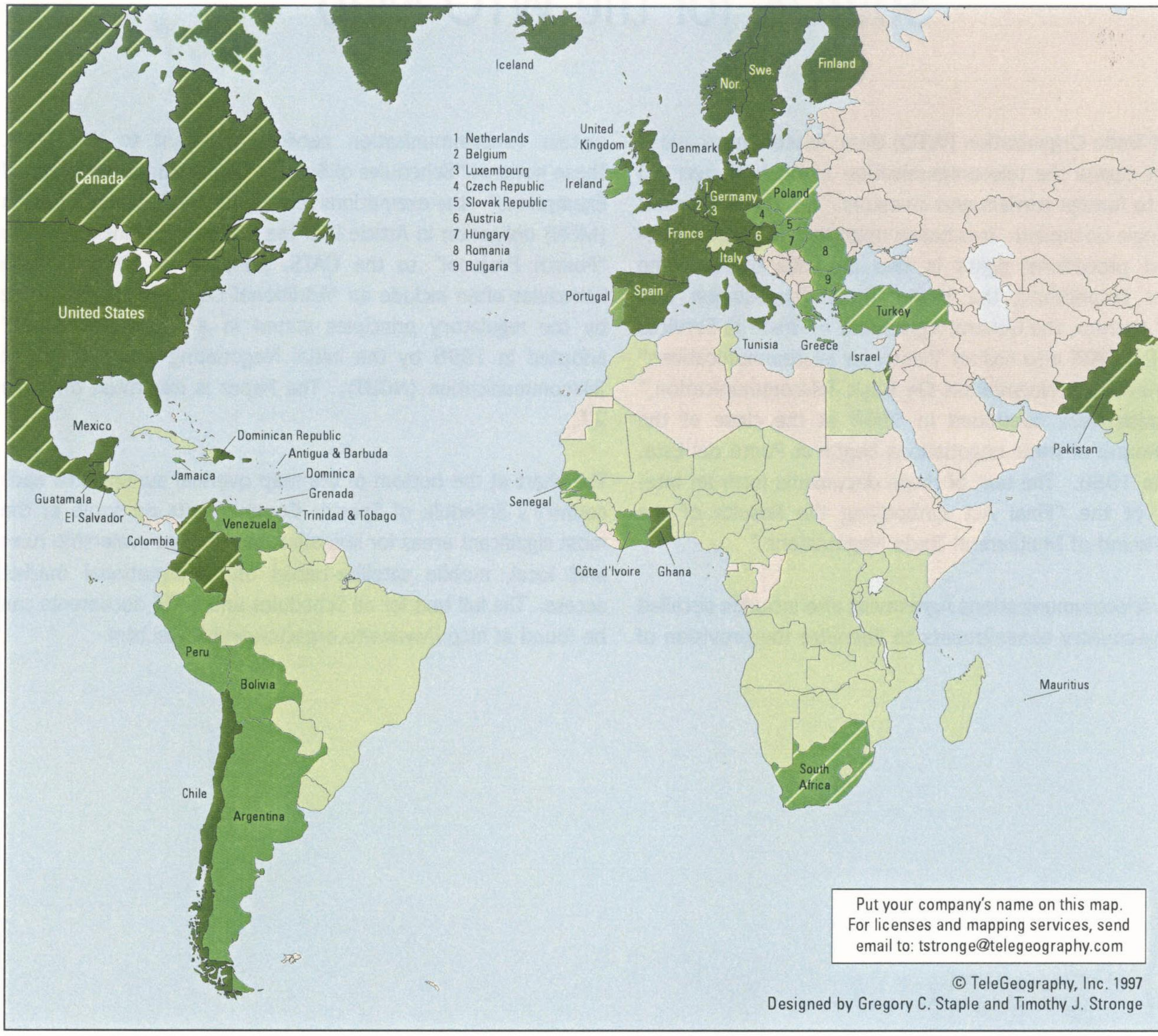


	Local	International	Satellite	Foreign Ownership
Hungary	◍	◍	◍	◍
Iceland	●	●	●	●
India	◯	○	○	◯
Indonesia	◯	○	○	◯
Ireland	◍	◍	◍	◍
Israel	◯	◯	●	◯
Italy	●	●	●	●
Jamaica	◍	◍	◯	●
Japan	●	●	●	●
Republic of Korea	●	●	●	◯
Luxembourg	●	●	●	●
Malaysia	○	○	○	◯
Mauritius	◍	◍	◍	◍

	Local	International	Satellite	Foreign Ownership
Mexico	●	●	●	◯
Mongolia	●	●	●	●
Netherlands	●	●	●	●
New Zealand	●	●	●	●
Norway	●	●	●	●
Pakistan	○	◯	◍	◯
Peru	◍	◍	◍	◍
Philippines	●	●	○	◯
Poland	●	◍	◍	◯
Portugal	◍	◍	◍	◯
Romania	◍	◍	◍	◍
Senegal	◯	◯	○	◯
Singapore	◯	◍	◍	◯

	Local	International	Satellite	Foreign Ownership
Slovak Republic	◍	◍	◍	◍
South Africa	◯	◯	○	◯
Spain	●	●	●	●
Sri Lanka	○	◯	○	◯
Sweden	●	●	●	●
Thailand	◍	◍	◍	◯
Trinidad & Tobago	◍	◍	●	◍
Tunisia	◍	○	○	◯
Turkey	◯	◯	◯	◯
United Kingdom	●	●	●	●
United States	●	●	●	●
Venezuela	◍	◍	◍	◍

Note: Belize, Brazil, Ecuador, Morocco, Papua New Guinea and Switzerland have made separate commitments.



	Local	International	Satellite	Foreign Ownership
Hungary	◍	◍	◍	◍
Iceland	●	●	●	●
India	◯	○	○	◯
Indonesia	◯	○	○	◯
Ireland	◍	◍	◍	◍
Israel	◯	◯	●	◯
Italy	●	●	●	●
Jamaica	◍	◍	◯	●
Japan	●	●	●	●
Republic of Korea	●	●	●	◯
Luxembourg	●	●	●	●
Malaysia	○	○	○	◯
Mauritius	◍	◍	◍	◍
Mexico	●	●	●	◯
Mongolia	●	●	●	●
Netherlands	●	●	●	●
New Zealand	●	●	●	●
Norway	●	●	●	●
Pakistan	○	◯	◍	◯
Peru	◍	◍	◍	◍
Philippines	●	●	○	◯
Poland	●	◍	◍	◯
Portugal	◍	◍	◍	◯
Romania	◍	◍	◍	◍
Senegal	◯	◯	○	◯
Singapore	◯	◍	◍	◯
Slovak Republic	◍	◍	◍	◍
South Africa	◯	◯	○	◯
Spain	●	●	●	●
Sri Lanka	○	◯	○	◯
Sweden	●	●	●	●
Thailand	◍	◍	◍	◯
Trinidad & Tobago	◍	◍	●	◍
Tunisia	◍	○	○	◯
Turkey	◯	◯	◯	◯
United Kingdom	●	●	●	●
United States	●	●	●	●
Venezuela	◍	◍	◍	◍

Note: Belize, Brazil, Ecuador, Morocco, Papua New Guinea and Switzerland have made separate commitments.

Sources for the WTO Map

The World Trade Organization (WTO) Basic Telecommunications Agreement opens the telecommunication markets of over 60 countries to foreign carriers and investors. But the Agreement is not a single document. It is based upon certain general principles and procedural rights in two umbrella treaties—the Agreement Establishing the World Trade Organization and Annex 1B thereto, the General Agreement on Trade in Services (GATS). The GATS also has an "Annex on Telecommunications" and an "Annex on Negotiation On Basic Telecommunication." Both treaties were concluded in 1994 at the close of the Uruguay Round of trade negotiations begun at Punta del Este, Uruguay in 1986. The text of these documents form an integral part of the "Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations."

The Basic Telecommunications Agreement also includes detailed country-by-country commitments to liberalize the provision of certain telecommunication services pursuant to the GATS. These national "Schedules of Specific Commitments and Lists of Exemptions"—the exemptions refer to the Most Favored Nation (MFN) obligation in Article II of the GATS—are annexed to the "Fourth Protocol" to the GATS, adopted in 1996. These Schedules often include an "Additional Commitment" to abide by the regulatory principles stated in a "Reference Paper" adopted in 1996 by the initial Negotiating Group on Basic Telecommunication (NGBT). The Paper is excerpted on page 27.

The chart at the bottom of the map overleaf summarizes each country's Schedule of Specific Commitments on some of the most significant areas for liberalization: foreign ownership rules and local, mobile satellite-based and international market access. The full text for all Schedules and GATS documents can be found at http://www.wto.org/wto/services/tel.htm.

The WTO Telecommunications Agreement: Some Personal Reflections

by Alex Arena

Change and telecommunications are an indisputable match. Technological change is well understood, both as a phenomenon and a driver of the telecommunications sector's growth. Less understood, however, are the changes soon to be wrought from liberalization by members of the World Trade Organization (WTO).

In this article, I shall provide some personal insights to the negotiations which led to the historic WTO Basic Telecommunications Agreement (BTA) on 15 February 1997, and what this agreement may mean to the sector's future development. The scope of the BTA is mapped by TeleGeography on page 22.

The GATS

Historically, initiatives to liberalize global trade have focused on the traded goods sectors (textiles, manufactured articles), and these were regulated under the General Agreement on Trade and Tariffs (GATT). During the Uruguay Round of trade negotiations, which began in 1984, specific attention was given to bringing services under a global trading agreement. This effort led to the General Agreement on Trade in Services (the GATS), completed in late 1993. An agreement was not easy to achieve as concepts developed over many years for trade in goods did not necessarily transfer well to trade in services. While considerable progress was made in achieving the GATS itself, the commitments from many WTO members, in terms of liberalization of their service sectors, were far from satisfactory.

At the end of the Uruguay Round, negotiators were left with little option but to harvest the offers which had been made under the GATS thus far, and to commit to further specific negotiations on key services sectors. With respect to telecommunications, agreement was reached on certain principles which were embodied in the Telecommunications Annex to the GATS, and the limited offers for liberalization which had been made by WTO members (largely relating to value added services) were incorporated into the Agreement. Other key service sectors (notably financial services and maritime services) met similar fates. For each of these sectors, new negotiating groups were established with the aim of continuing and concluding the negotiations.

This switch to a sector-specific set of negotiations was itself controversial among trade negotiators as many would have preferred a more traditional multi-sector round of negotiations, offering the potential for cross-sector trade-offs. But, as the multi-sector approach had been disappointing, a sector-specific approach came to look more attractive.

In any event, a Negotiating Group on Basic Telecommunications (NGBT) was convened, and was opened to all WTO members. [1] A deadline was set for an agreement by 30 April 1996. Early activities were slow to develop: a questionnaire was developed and circulated so that information could be obtained on the diverse range of national policies and regulatory arrangements across WTO members' jurisdictions. As more information was gathered, the more apparent it became that the differences in the degrees of liberalization and the state of national regulation would make a good basic telecommunications agreement a challenging achievement indeed.

Regulatory Issues

Early in the negotiations, it was recognized that regulation played a more important role in liberalization of this sector than in many others previously considered in the WTO or the GATT before it. In fact, it came to be understood that a member's offer, in terms of market access commitments and national treatment (two essentials in any trade liberalization), could be rendered inconsequential without an acceptable standard of national regulation to enforce fair competition.

A small group, comprising the leading negotiators and those experienced in the liberalization of the telecommunications sector, was formed with the objective of drawing up a suitable set of regulatory principles. This group met many times, and held lengthy discussions and debates that extended into late night sessions (sustained by the hospitality offered at the Japanese mission in Geneva, these meetings came to be known as the "sushi meetings").

The specific complexities of telecom regulation demanded the participation of technical experts. In mid-1995, as the trade and telecom experts came to understand how to work together, real progress was made by drawing up what is now known as the regulatory principles Reference Paper (see Box 1).

The Reference Paper was a landmark in the negotiations. Eventually 60 of the 69 governments participating in the BTA entered into additional commitments concerning the comprehensive set of pro-competitive regulatory principles in the Paper. While the Paper attempts to set out the regulatory preconditions for a fair and liberalized telecommunications market, the principles are not prescriptive—there are many ways in which it would be possible to achieve an adequate regulatory structure consistent with these principles. The success of the Paper lies in its ability to accommodate vast differences in national legislative and administrative systems.

Towards the First Deadline

During the first quarter of 1996, the mood in the negotiations turned more optimistic. Buoyed by the increasing acceptance of the Reference Paper, and substantial offers from the leading delegations (particularly the QUAD—Canada, the E.U., Japan and the U.S.), there emerged a sense that an agreement could be reached by the deadline of 30 April 1996. This mood persisted despite the failure of the financial services negotiations; lack of progress in the remaining extended track of negotiations on maritime services; and also despite significant unresolved issues dealing with international telecommunications services.

With the Reference Paper settled, increased attention was turned to the issues involved with the liberalization of international services. These services constitute about ten percent of global telecommunications revenues but they are vital to the liberalization of global trade in general.

International services, however, had long been a bilateral regime—operating with agreements between "correspondents" who were often national monopolies. Few WTO members had licensed competitive international operators, and the real prospect emerged that under a multilateral trade agreement many of these national monopolies could establish subsidiaries or affiliates in the territories of liberalized members and self-correspond. Particular concerns included the possibility that foreign carriers might engage in one-way accounting rate bypass (by routing inbound telephone traffic over international private lines) or squeeze the retail price for outbound traffic (by selling service below cost in the liberalized market chiefly to generate above cost settlements for a monopoly foreign affiliate).

Attention also was devoted to identifying the possible market dynamics in an environment where there existed substantial asymmetry in the degree of international services liberalization. It was well understood that the issue was one of preserving fair competition and that, eventually, when all WTO members liberalized, markets could be self-regulating. But because many WTO members were not proposing to liberalize, or could not liberalize international services for many years, the negotiators tried to grapple with how to safeguard the market in this interregnum (i.e., while the asymmetry in liberalization continued).

Most negotiators preferred a solution based on WTO members retaining powers to correct market abuses should they arise, for example, by imposing remedies such as proportional return of traffic and parallel accounting rates, if necessary, and applying monetary penalties or withdrawing licenses from offenders. This came to be known as the *ex-post* approach. The U.S., however, had a pre-existing practice of applying a reciprocity test, known as the Effective Competitive Opportunities (ECO) test.

Needless to say, U.S. carriers were lobbying hard to retain the degree of protection offered by the ECO test. Consequently, U.S. negotiators argued for some sort of *ex-ante* test whereby applications for licenses to operate in the U.S. could be denied based on an assessment of competitive risk. The carriers from many WTO members' territories had bad experiences with the ECO test, and its continued existence in a multilateral era was, consequently, not acceptable for most members.

As the 30 April 1996 deadline approached, renewed attempts to resolve the international competition impasse failed. To compound matters, the U.S. satellite industry became concerned (late in April 1996) with what it saw as a lack of substantial market liberalization for satellite services in the offers on the table. In the last few days of April, the U.S. made it known that it could not proceed with its offer to liberalize its telecommunications market in view of the unresolved international issues, the satellite services concerns and, in particular, its belief that not enough good quality offers had emerged (i.e., a critical mass of open markets did not exist). The negotiations were on the point of collapse; expectations of success were dashed.

Extending the Negotiations

At the same time, much goodwill had been harnessed throughout the negotiations and much progress had been made—negotiators did not want to see this effort wasted. Nor was there any support for a partial agreement, for example, based on domestic services only. Attention turned to how the negotiations could be salvaged. Thus, in the last few days of April, when maximum effort should have been spent on improving offers and obtaining new offers, earnest meetings were convened to mount a salvage package. When this package emerged it was accepted easily. It required the 34 offers (covering 48 governments) on the table to remain frozen, a new deadline of 15 February 1997 was set, and the opportunity was given for members to revise (and presumably improve) their offers after 15 January 1997. The NGBT was disbanded and a new Group on Basic Telecommunications (GBT) was established (although this was essentially the same group as the NGBT but without a distinction between participating WTO members and observing WTO members). [2]

The fact that success was finally achieved on 15 February 1997 is an indicator that the extension period was well spent. Opportunities were created for the various industry lobbies to acquaint negotiators with their concerns. (A workshop in Hong Kong in July 1996 and an open session with the satellite industry in Geneva in October 1996 are but two examples.) The successful discussions at the Policy Forum on Global Mobile Personal Communications by Satellite (GMPCS) hosted by the International Telecommunication Union (ITU) in October 1996 also assisted greatly in liberalizing this sector.

Within the GBT, it was agreed to improve the readability of member's offers in two respects—the first was to ensure that members' schedules were taken to be technology neutral unless explicitly stated otherwise. The second was that the availability of radio spectrum and the spectrum management processes generally should not be used as a disguised limitation on licensing new entrants and opening markets. Two Chairman's notes

Box 1. WTO Reference Paper on Regulation

The following are definitions and principles on the regulatory framework for the basic telecommunications services.

1. Competitive safeguards

1.1 Appropriate measures shall be maintained for the purpose of preventing suppliers who, alone or together, are a major supplier [1] from engaging in or continuing anti-competitive practices.

1.2 The anti-competitive practices referred to above shall include in particular: (a) engaging in anti-competitive cross-subsidization; (b) using information obtained from competitors with anti-competitive results; and (c) not making available to other services suppliers on a timely basis technical information about essential facilities [2] and commercially relevant information which are necessary for them to provide services.

2. Interconnection

...2.2 Interconnection with a major supplier will be ensured at any technically feasible point in the network. Such interconnection is provided: (a) under non-discriminatory terms, conditions (including technical standards and specifications) and rates and of a quality no less favorable than that provided for its own like services or for like services or non-affiliated suppliers or for its subsidiaries or other affiliates; (b) in a timely fashion, on terms, conditions (including technical standards and specifications) and cost-oriented rates that are transparent, reasonable, having regard to economic feasibility, and sufficiently unbundled so that the supplier need not pay for network components or facilities that it does not require for the service to be provided; and (c) upon request, at points in addition to the network termination points offered to the majority of users, [3] subject to charges that reflect the cost of construction of necessary additional facilities.

2.3 The procedures applicable for interconnection to a major supplier will be made publicly available.

2.4 It is ensured that a major supplier will make publicly available either its interconnection agreements or a reference interconnection offer.

2.5 A service supplier requesting interconnection with a major supplier will have recourse, either: (a) at any time; or (b) after a reasonable period of time which has been made publicly known to an independent domestic body, which may be a regulatory body as referred to in paragraph 5 below, to resolve disputes regarding appropriate terms, conditions and rates for interconnection within a reasonable period of time, to the extent that these have not been established previously.

3. Universal service

Any Member has the right to define the kind of universal service obligation it wishes to maintain. Such obligations will not be regarded as anti-competitive per se, provided they are administered in a transparent, non-discriminatory and competitively neutral manner and are not more burdensome than necessary for the kind of universal service defined by the Member.

4. Public availability of licensing criteria

Where a license is required, the following will be made publicly available: (a) all the licensing criteria and the period of time normally required to reach a decision concerning an application for a license; and (b) the terms and conditions of individual licenses. The reasons for the denial of a license will be made known to the applicant upon request.

5. Independent regulators

The regulatory body is separate from, and not accountable to, any supplier of basic telecommunications services. The decisions of and the procedures used by regulators shall be impartial with respect to all market participants.

6. Allocation and use of scarce resources

Any procedures for the allocation and use of scarce resources, including frequencies, numbers and rights of way, will be carried out in an objective, timely, transparent and non-discriminatory manner. The current state of allocated frequency bands will be made publicly available, but detailed identification of frequencies allocated for specific government uses is not required.

Notes

[1] A "major supplier" is a supplier which has the ability to materially affect the terms of participation (having regard to price and supply) in the relevant market for basic telecommunications services as a result of: (a) control over essential facilities; or (b) use of its position in the market.

[2] "Essential facilities" mean facilities of a public telecommunications transport network or services that: (a) are exclusively or predominantly provided by a single or limited number of suppliers; and (b) cannot feasibly be economically or technically substituted in order to provide a service.

[3] "Users" mean service consumers and service suppliers.

were produced on these matters respectively and, while not legally binding, members did revise their offers to comply. [3]

In parallel with the resolution of outstanding technical issues, progress was made on improving offers and the submission of new offers. By the deadline, the number of offers had swollen to 55 (covering 69 governments) and the new offers included significant markets in Indonesia, Malaysia, South Africa and Israel. The U.S. advised that it believed it had sufficient reserve powers, consistent with the GATS, to take care of its remaining technical issues; that its initiatives on benchmark accounting rates would alleviate its concerns on international issues (see page 45 below); and that a critical mass of offers had been achieved—save for direct to home (DTH) and direct broadcast satellites (DBS). (Here the U.S. stunned negotiators by taking an exemption for DTH and DBS services at the last minute.)

Still, at the final GBT meeting on the evening of 15 February 1997, the relief at actually having achieved an agreement was palpable. Against the odds, and despite its technical complexities and nascent state of liberalization worldwide, a very substantial agreement had emerged. This had happened even when other sectoral negotiations failed and despite the fact that the negotiators pushed the limits on matters like competition policy (the WTO itself had no mandate in this area until the December 1996 Singapore Ministerial meeting. [4]) The successful conclusion of this first services sector specific agreement breathed life back into the GATS, and offered new hope for future service sector negotiations.

How Good is the Agreement?

The Agreement reached in Geneva in February 1997 will, in my opinion, come to be seen as a significant achievement and a seminal one in the context of the telecommunications industry's future development. I happen to believe it will prove to be the greatest influencing event on the industry for at least the next ten years, notwithstanding the other great influences in this industry due to factors such as technological change. While the Agreement did not invent telecom liberalization, it promises to bring forward by many years, and indeed by a decade in some cases, liberalizations which may have eventually occurred but in a less coherent manner. With the Agreement, liberalization has the advantages bestowed by a multilateral WTO framework founded on the principle of Most Favored Nation (MFN) and administered under a rules-based international treaty.

In a nutshell, the BTA has some fairly obvious benefits:

- considerably enhanced and accelerated liberalization in a great number of domestic and international telecom markets covering all technologies, all sectors and allowing greater foreign investment;
- a multilateral agreement (MFN-based) in lieu of the existing world of bilateralism replete with complex rules of reciprocity;
- regulatory codification and improvement across the members participating;
- the fair market rules of the GATS;
- the sanctions of the GATS, including the dispute settlement mechanism of the WTO;
- a chance for the developing world to participate in shaping the global trade system under fair and more open rules.

The statistics on the BTA are also impressive. The global market for basic telecommunications revenues was US$600 billion in 1995, and is expected to exceed US$1 trillion before the end of the decade. Sixty-nine governments representing more than 90 percent of global revenues have participated in the Agreement and more governments will join before it takes effect on 1 January 1998.

Furthermore, one should not lose sight of the Information Technology Agreement (ITA) which was concluded in parallel, and forms a companion to the BTA (see Box 2). The ITA is con-

Box 2. The WTO Information Technology Agreement

In March 1997, negotiators in Geneva finalized the landmark Information Technology Agreement (ITA). It was endorsed by 39 countries accounting for over 90 percent of world trade in information technology (IT) products, and eliminates custom duties and other import charges on IT products by the year 2000 through annual reductions beginning on 1 July 1997. Major signatories to the ITA include Hong Kong, Malaysia, Japan, the E.U. and the U.S. Exports covered by the ITA amount to more than $500 billion annually.

The ITA covers the following products:

- Computers (including printers, scanner, monitors, hard-disk drives, power supplies, etc.);
- Telecom products (including telephone sets, fax machines, modems, pagers, etc.);
- Semiconductors (including chips and wafers);
- Semiconductor manufacturing equipment;
- Software;
- Scientific instruments.

In addition, the Agreement covers other products such as cash registers, computer network equipment, and certain photocopiers, but not electronic consumer goods.

cerned with information processing whereas the BTA is concerned with information transport and distribution. Together the ITA and BTA will underpin the phenomenon we have come to know as the information-based society. It was extremely important to have developing economies, particularly the fast growing economies in the Asia-Pacific Region, participate in these agreements lest they be left out in the cold during one of the most significant structural changes taking place in human society.

Is it possible to be too optimistic about the BTA? I think not. It seems to me remarkable that so much progress has been made in quickly liberalizing an industry which has been dominated by monopoly for so long. But it would be wrong to see the BTA as the final word on telecom liberalization. It is merely the first multilateral agreement, and while many of the commitments made by various WTO members are aggressive, there is scope for these commitments to be improved when the agreement is reviewed in the year 2000. In fact, market forces many well cause many members to implement additional liberalization measures in advance of their WTO commitments.

Implementation

Delivering an adequate level of regulatory practice will not be easy. Even governments with long established regulatory apparatus will find these insufficient to meet the regulatory principles committed in the BTA. Speaking from personal experience, having established regulatory processes for two different governments, I think it will prove very difficult for many nations to deliver on their promises. They will need considerable assistance from bodies such as the ITU, the Asia-Pacific Telecommunity (APT) and the World Bank, as well as all the support that the more developed telecom administrations may be able to give them. Practical issues such as how to organize the logistics of a new regulatory body; finding and training suitable staff; changing legislation and associated regulations are all time consuming and energy sapping.

Box 3. Hong Kong and the BTA

In all material respects Hong Kong's telecommunications arrangements have remained unchanged since sovereignty passed from the U.K. to China on 1 July 1997. This should come as no surprise as the Basic Law, adopted by China in 1990 as a framework for the territory's post-U.K. governance, grants the Hong Kong Special Administrative Region (SAR) autonomy over all matters other than foreign affairs and defense. The Hong Kong SAR, therefore, continues to have its own laws (based on common law) and maintains its own regulatory structures.

Without a doubt, Hong Kong has one of the more liberalized regimes within Asia. Other than certain external circuits and services, which are covered by the Hong Kong Telecommunications International (HKTI) exclusive license, Hong Kong has real competition in every sector. The word "external" is important as it is used in the HKTI license to cover services to and from Hong Kong. Therefore Hong Kong-China cross border traffic still remains subject to the HKTI license; however, the SAR Government is continuing negotiations with Hong Kong Telecom, HKTI's parent,* aimed at mutual resolution of the HKTI license before its scheduled expiry in 2006.

Other telecom licensing matters were also subject to consultation in the years before the handover to ensure that the Chinese side was acquainted with all major decisions. Investors entering into Hong Kong's competitive market have sought assurances that their licenses would be valid post-1997. China endorsed all licenses referred to them, and over recent years investors have proceeded with confidence. The Hong Kong market can now boast some very impressive statistics to indicate its robust condition. For example, in cellular mobile services, penetration rates have will likely exceed 30 percent of the population by the end of 1997.

Another area of the SAR's autonomy relates to trade matters. Long a member of the GATT, Hong Kong is now a WTO member, and will remain so whether or not China itself eventually accedes to the WTO. Thus, the Hong Kong SAR will continue to be an active participant in the work of the WTO and it will be responsible for honoring its commitments to the WTO. But Hong Kong's tradition is always to move early on its commitments; on 2 June 1997 Hong Kong signed the Fourth Protocol to the GATS (i.e., the BTA) well before the November 1997 deadline. Furthermore, Hong Kong has not waited to see others implementing their commitments before implementing its own.

*Editor's Note: In June 1997, Hong Kong Telecom, now majority owned by the U.K.'s Cable & Wireless (C&W), sold a 5.5 percent equity stake to China Telecom, the principal Chinese international carrier, owned by the Ministry of Posts & Telecommunications (MPT). At the time, C&W stated that it was also "prepared to transfer to China Telecom, in a subsequent phase, further shares in HKT in expectation of C&W and China Telecom becoming equal shareholders in HKT." The Chinese Government already owns at least 15 percent of HKT's equity through shares held by China Everbright Holdings Co., which is controlled by the State Council. As part of its new agreement with the MPT, it also was announced that C&W will have the opportunity to become the major telecom investor in China Telecom (Hong Kong), a new publicly listed Hong Kong company which will become a primary vehicle for injecting foreign capital into the Chinese telecom market. There are, however, doubts in the market about this ever happening.

I am pleased to say, however, that Hong Kong's current regulatory regime substantially meets the principles stated in the regulatory Reference Paper. Moreover, in several respects the regime in Hong Kong exceeds them with its development of number portability and local loop interconnection (see Box 3).

Yet, if regulatory commitments are not met by some WTO members, I suspect it will not be through a lack of will but rather a circumstance brought about by difficulties at the practical level. As there are severe sanctions in the WTO concerning dispute resolution, I expect that no WTO member will carelessly risk not meeting its obligations, but there will need to be a sensitivity to genuine calls for practical assistance.

Another issue requiring substantial attention is implementation of the fundamental Most Favored Nation (MFN) principle. There is little established history of MFN in service sectors. How it is applied in a complex sector like telecommunications—where end-to-end supply of an international service may require the joint provision of service—raises new dimensions. Clearly those WTO members that currently apply reciprocity-based entry rules will have to dispose of them by 1 January 1998, but this would not seem to be the only MFN issue likely to arise.

During the negotiations leading up to the Agreement, some thought was given to whether the accounting rate system itself was MFN-consistent because it encourages bilateral agreements and differential rates. Time did not allow a resolution of this question with the result that a handful of WTO members sought refuge by taking out MFN-exemptions on accounting rates. To stem a rush of such exemptions, all participants in the Agreement decided very late in the negotiations to enter into a "gentleman's stand-still agreement" not to subject accounting

Box 4. Accounting Rates and the MFN Rule: A Gentleman's Agreement

The legal status of many services sector commercial practices are proving problematic as the GATS is implemented. One example in Basic Telecommunications is the accounting rate system. Historically, this system involves bilaterally negotiated arrangements, and thus rates for landing a minute of telephone traffic between one WTO member and another are often vastly different. Different WTO countries pay different settlement rates to land traffic in any given WTO nation despite the fact that it costs much the same to terminate calls, irrespective of the origination point.

Under the GATS, a fundamental plank is the principle of Most Favored Nation (MFN). Article II of the GATS is quite specific: "With respect to any measure covered by this Agreement, each Member shall accord immediately and unconditionally to services and service suppliers of any other Member treatment no less favorable than it accords to like services and service suppliers of any other country." The words "immediately and unconditionally" stress the primacy of this obligation, and members are not allowed to maintain measures inconsistent with this obligation.

Several delegations in the course of the negotiations became concerned that the accounting rate system fell foul of Article II. India was the first to signal its desire to take out an MFN exemption to protect its position on accounting rates. Despite much discussion and debate among experts, it could not be satisfactorily resolved whether the accounting rate system breached the GATS. Ultimately this sort of issue can only be resolved if a WTO member lodges a dispute for resolution by a WTO Panel - an action not immediately attractive to the negotiators.

As the 15 February 1997 negotiating deadline approached, more members became nervous of their exposure on accounting rates and four more sought refuge in MFN exemptions. An avalanche of like exemptions threatened.

However, Article II was not the only consideration. For those members maintaining monopolies, Article VIII appeared relevant. It imposes obligations on monopolies and exclusive service providers not to act in a manner inconsistent with a member's MFN obligations. Hence, a member's recourse to an MFN exemption may not prevail against a challenge under Article VIII.

To prevent this issue puncturing the success of a BTA, it was decided in the last 24 hours of the negotiations to invoke a "gentleman's stand-still agreement." In essence, this informal device was intended to make the possibility of a challenge to the accounting rate system a remote prospect for at least three years. In the Chairman's final report of the Group on Basic Telecommunications, paragraph 7 was added by common agreement. It reads:

> *The Group noted that five countries had taken Article II exemptions in respect of the application of differential accounting rates to services and service suppliers to other Members. In the light of the fact that the accounting rate system established under the International Telecommunications Regulations is the usual method of terminating international traffic and by its nature involves differential rates, and in order to avoid the submission of further such exemptions, it is the understanding of the Group that:*
>
> *- the application of such accounting rates would not give rise to action by Members under dispute settlement under the WTO; and*
>
> *- that this understanding will be reviewed not later than the commencement of the further Round of negotiations on Services Commitments due to begin not later than 1 January 2000.*

This leaves unanswered the question whether the accounting rate system is GATS-consistent. The stand-still agreement has brought breathing space, however, so that the issue can be dealt with initially by the ITU (see page 37 below).

rate issues to the WTO's dispute settlement processes for three years.[5] Effectively this matter was parked in the hope that work done in appropriate fora (for example, the ITU) would assist greatly in resolving the dilemma (see Box 4).

Increasingly it appears that the accounting rate system will be an early casualty of the new regime, and it might well be replaced with a set of MFN-consistent termination charges. Once truly cost-based termination charges are in place, the economics of international telephony are also likely to become more rational, and many of the current pricing distortions in international charges should be worked away by the forces of competition (see Box 5).

A Final Comment

The WTO BTA is a sure sign that the telecom sector has entered into the mainstream of trade and commerce. Telecommunications can, and should, function like all the other industry sectors that have operated competitively for decades. The new regime for telecommunications is thus little different from the old regime for most other industry sectors. All that means is that the telecom industry must continue to evolve towards freedom of entry (and exit); market-dictated terms; the application of general competition law; and the eventual dismantling of industry-specific regulation as freely competitive markets become established. The BTA will hasten the onset of this new regime and, thankfully, will allow the global industry to side-step the emerging ills of enhanced bilateralism which were spreading under the old regime.

In the end, it was the recognition that the status quo was neither preferable to a multilateral agreement, nor helpful to their longer-term interests, that convinced many developing nations to support the BTA. The time had come for a quantum shift. The WTO negotiations provided the opportunity, and good sense prevailed to ensure that the opportunity was not squandered.

Alex Arena was an inaugural member of AUSTEL (the first Australian telecommunications regulatory authority) from 1989 to 1992, and the Director General of Hong Kong's Office of Telecommunications Authority (OFTA) from 1993 to 1997. He also led Hong Kong's delegation to the WTO negotiations on basic telecommunications services and currently is Telecommunications Special Advisor to the Government of Hong Kong Special Administrative Region.

Box 5. Predictions of the GBT's Chairman

In May, 1997, Neil McMillan, the former Chairman of the WTO Group on Basic Telecommunications (GBT), made the following remarks about the Basic Telecommunications Agreement and accounting rates. Mr. McMillan is Director of International Communications Policy at the U.K. Department of Trade and Industry (DTI).

> What does [the WTO Agreement] mean for the world market? I think it is going to, first of all, increase the trend which we're already seeing—[the] globalization of certain services. I think we will see the international alliances which had been forming over the last three to four years increasing their scope both in terms of services and in the number of members that they have....
>
> The other thing that will happen, I think, is that via people opening their markets, you'll see, for instance in Europe and in the United States, some quite fundamental changes to those markets. The accounting rate system, the traditional way that you transfer traffic from one international operator to another, will collapse very rapidly. We'll see in Europe, for instance that the accounting rate will disappear on January 1, 1998, which I'll come back to.... I think on all those developed routes, [we'll see] the ability of people to set up their own facilities and bypass the accounting rate, or for that matter [not to] bypass the accounting rate but at least negotiate a much lower level of commercial agreement for interconnection of traffic between one country and another based on the opportunity costs of building their own facilities. [This] will mean that the accounting rates will not be able to be maintained. I think they'll also put immense pressure on those countries that are not interested in competition and who have traditionally had high accounting rates because the other effect of this will be a reduction in what people charge the consumer for international telephony....
>
> And I will briefly [say] what I think is going to happen in the E.U. We have a legal obligation in all member states, with three exceptions—which are Ireland, Greece and Portugal where you have until the year 2000—all the other member states have got until January 1, 1998, to remove any limitation on the provision of basic telecommunication services and on the provision of networks. That means that, as I was saying, the accounting rate can in principle disappear within the European Community. On top of that, [the EU has] harmonizing Directives which require people to provide local access interconnection charges for any service to their network. So that means that you can't say this is a call from Germany to France that's going to have to be charged differently from a France-to-France call. It's going to be charged the same....
>
> The next stage, of course, is that one member state can also offer the rest of the European market to countries outside of Europe so the accounting rates between the rest of the world and Europe will fall very quickly as well....

Excerpted from "Global Telecom Regulatory Reforms-Accelerating the Pace of Competition," Salomon Brothers Global Equity Research, May 20, 1997.

Notes

[1] The Negotiating Group on Basic Telecommunications (NGBT) was established pursuant to a Ministerial Decision adopted by the WTO Trade Negotiations Committee on 15 December 1994, "Decision on Negotiations on Basic Telecommunications."

[2] The GBT was established pursuant to the "Decision on Commitments in Basic Telecommunications" Council for Trade in Services on 30 April 1996," WTO Document S/L/19.

[3] See "Notes for Scheduling Basic Telecommunications Services Commitments"—WTO Document S/GBT/W/2/Rev1, 16 January 1997; and "Market Access Limitations on Spectrum Availability"—WTO Document S/GBT/W/3, 3 February 1997; both notes also are appended to the GBT's Final Report, WTO Document S/GBT/4, 15 February 1997.

[4] Article IV of the Agreement Establishing the World Trade Organization establishes regular biennial meetings of the WTO at the Ministerial level. The first such meeting was held in Singapore, 9-13 December 1996. The resulting Singapore Ministerial Declaration (WTO Document WT/MIN(96)/DEC, 13 December 1996) contained, among other things new commitments on investment and competition: Ministers agreed to "establish a working group to study issues raised by Members relating to the interaction between trade and competition policy, including anti-competitive practices, in order to identify any areas that may merit further consideration in the WTO framework." Ministerial Declaration, ¶ 20.

[5] The Final Report of the GBT is officially known as the "Report of the Group on Basic Telecommunications" - WTO Document S/GBT/4, 15 February 1997. Paragraph 7 contains the "gentleman's stand-still agreement."

Is There Life for the Accounting Rate System?

by Tim Kelly, International Telecommunication Union

Ever since the first international telegram was sent in the 19th century, countries have been looking for ways to share the costs and revenue from international telecommunication. The system they hit upon—international accounting rates—is a dual price system: for each call, one price is charged to users and another to operators.

The price for users is the collection charge, or retail price. A second price is agreed by the terminating and originating Public Telecommunication Operators (PTOs); this is the accounting rate, or wholesale price. Payments between PTOs are based on net traffic balances. The PTO originating more traffic pays the terminating PTO a sum equal to the number of surplus minutes multiplied by the settlement rate. Typically this rate is one-half the accounting rate, reflecting the fact that each carrier provides half of the end-to-end transmission facilities (see Box 1).

The Beginning of the End

This payment system worked well for about 100 years, but the gap between collection charges and settlement rates progressively narrowed. In 1992, the members of the International Telecommunication Union (ITU) agreed upon ITU-T Recommendation D.140. It commits countries to negotiate accounting rates based on principles of cost-orientation, non-discrimination and transparency, and to do so within five years. That period ended in 1997. While it was clear that some progress has been made—after 1992 accounting rates fell twice as fast as they had in the previous five years—the adjustment process failed on all three counts:

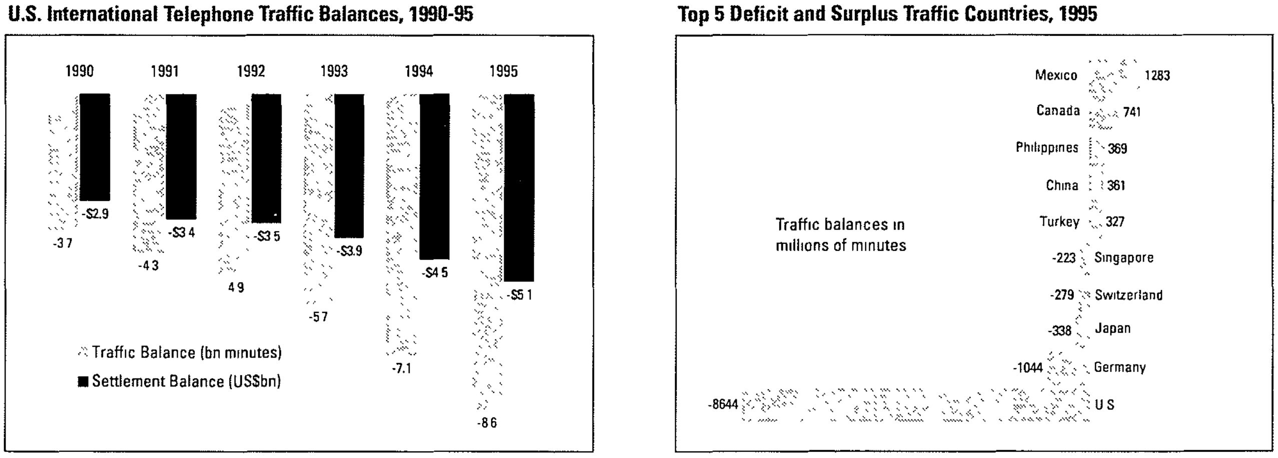
- Accounting rates are still far from being cost-oriented and international telephone services are often used to cross-subsidize other domestic services. One way of estimating the degree to which settlement rates are inflated is to compare the cost of terminating a call originated by a local mobile phone with a call originated internationally. For instance, the price charged by the U.K. operator, BT, for terminating a domestic mobile call is below $0.02 per minute whereas the costs of terminating an international call ranges from $0.08 per minute to more than $1.00 per minute. While BT would no doubt wish to reduce some of these rates, particularly with countries to which it sends more traffic than it receives, it is unable to do so without the consent of the PTO in the foreign country.

- Accounting rates are rarely non-discriminatory because they are negotiated on a bilateral basis. Thus a price charged for terminating traffic from one country might be as much as ten times higher than the price charged to another country, even though the costs of terminating the call might be similar.

- Despite the pressure for transparency, only three countries—the U.S., the U.K., and New Zealand have obliged their carriers to disclose their rates.

Figure 1. Uneven Settlements

U.S. International Telephone Traffic Balances, 1990-95 **Top 5 Deficit and Surplus Traffic Countries, 1995**



Source: *World Telecommunication Development Report 1996/97*, ITU

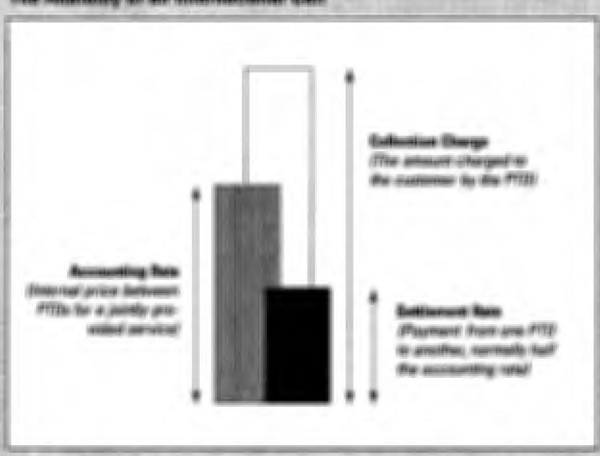
Deficits and Bypass

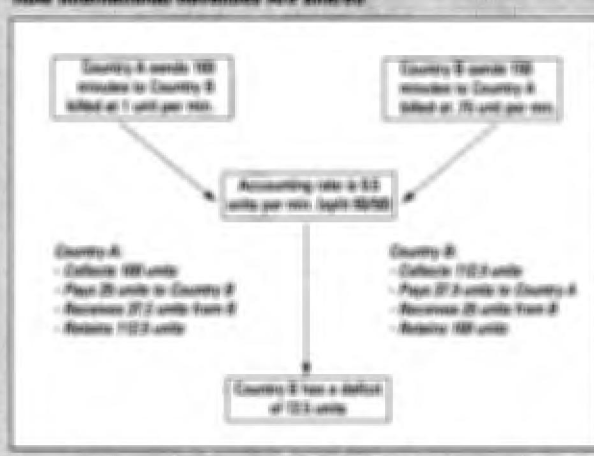
Between 1992 and 1997, many different national and international bodies tackled the accounting rate reform issue, including the U.S. Federal Communications Commission (FCC), the Paris-based Organization for Economic Cooperation and Development (OECD), the World Trade Organization (WTO), the European Union (EU) and the ITU. They had little success. Traffic and settlement imbalances had become worse. In 1995, the estimated value of gross settlement payments worldwide was $28.4 billion, or 54 percent of the total international telephone revenue of $52.8 billion; in 1990 settlements were but $15.9 billion as compared to total revenues of $32.9 billion.

The increase in settlement payments has been caused, at least in part, by differences in the rate of market liberalization. In particular, many countries have liberalized their markets for call origination (allowing, for instance, the use of call-back, calling cards and country-direct services) but have not yet liberalized the market for call termination services (disallowing new facilities-based international networks). Even where call termination services have been liberalized, incumbent ex-monopolies

Box 1. How Accounting Rates Work

[illegible]





[illegible]

remain in a strong position. Consequently, imbalances continue to grow.

The U.S., which is the home of most call-back operators, had an estimated settlement deficit of US$5.4 billion in 1996. But other countries, notably Germany, Japan, Switzerland and Singapore, also send out much more traffic than they receive (see Figure 1). Understandably, it is these countries which have the most urgent interest in reforming the system.

In the last years, several factors have added to this urgency:

- At the end of 1996, the FCC announced its intention to oblige U.S. telephone carriers to limit their per minute settlement rates to a prescribed rate or "benchmark." The benchmark rate reflects the estimated call termination costs in each country, adjusting for its economic status. In August 1997, after a period of consultation during which more than 90 foreign governments and carriers expressed their concerns, the FCC confirmed that the benchmarks would be implemented at rates ranging from $0.15 per minute for high income countries to $0.23 for low income countries (see page 45). The FCC's action is significant in representing a move away from bilaterally negotiated rates towards threatened unilateral action.

- Pursuant to the February 1997 WTO Basic Telecommunications Agreement, at least 20 countries (including most countries of Western Europe) plan to license competing international carriers as early as January 1, 1998. With liberalized market entry, international operators can establish a switch on a foreign territory, either directly or indirectly via a consortium, and then provide end-to-end service to that switch. The advantage is that they will then be able to self-correspond and will either pay a settlement charge to themselves or a local interconnection charge to a domestic carrier.

- More options have become available to operators for routing traffic. For instance, many companies are now actively publicizing their refile services, permitting operators

Box 2. Ten Propositions for Accounting Rate Reform

What direction should accounting rate reform take? The following propositions offer a personal view of one direction that could be taken:

1. The accounting rate system is in need of reform. In particular, it needs to be adapted to a competitive market environment.

2. In competitive markets, it is likely that several different systems for cost- and revenue-division may co-exist. Carriers should be able to choose which one suits them best.

3. The settlement rate comprises three separate cost components: the international transmission link, the international gateway, and call termination (national extension). Reform of the settlement rate system will involve unbundling those three elements and allowing carriers to make economically rational build or buy decisions for each separate component.

4. In a liberalized environment, the business for originating calls and the business for terminating calls are quite separate. Both should be viewed as tradable services. A country which is opening its market should provide market access for both call origination and call termination services.

5. In the majority of countries, call-termination will probably be handled mainly by an incumbent (ex-)monopoly. The regulator should thus ensure that call termination is handled in a transparent, non-discriminatory and cost-oriented manner. These principles are outlined in ITU-T Recommendation D.140.

6. Cost structures are asymmetric. Therefore there is no reason to expect or to insist that the costs for major network components will be the same in all countries. In particular, developing countries will need time and assistance to make the transition from the current accounting rate regime to a new cost-oriented system.

7. The cost of call termination should be distance insensitive within a country. While there may be minor differences related to the distance from the international gateway, these can and should be averaged out.

8. The main aim of the regulator should be to protect the customer, not to protect the industry. To this end, regulators should ensure that the gap between the collection charge and the call termination charge is minimized. The best way to achieve this is through competition. In a competitive marketplace, there should be no need for principles such as uniform termination charges or proportional return.

9. Settlement payment deficits are primarily the result of unbalanced traffic flows which are, in turn, partly the result of the adoption of alternative call origination procedures. As such, settlement payment deficits are an inevitable outcome of the battle among carriers for market share. In the transition to a competitive environment, settlement deficits can be expected to increase, rather than to decrease.

10. Incumbent operators with market power should offer the same price structure for call termination to all market players on a non-discriminatory basis, irrespective of the origin or routing of a call. Discounts may be available for volume of traffic. However, a dominant operator offering call termination should offer the same price schedule to all comers, including companies with which it has a financial relationship.

Source: Tim Kelly

to offer least cost routing, whereas previously such deals had been negotiated behind closed doors (see page 39). Equally, many companies are now offering Internet telephony and fax services, either from a computer to a telephone or, in some cases, between two telephones routed via the Internet. PTOs testing this service, or offering it commercially, include Telecom Finland, Deutsche Telekom, AT&T Japan and USA Global Link.

Box 3. Like Traffic, Like Water

International telephone traffic is a bit like water; it always tends to follow the path of least resistance. Other things being equal, the direction of traffic will follow price differentials in the same way that flows of water reflect underlying gradients.

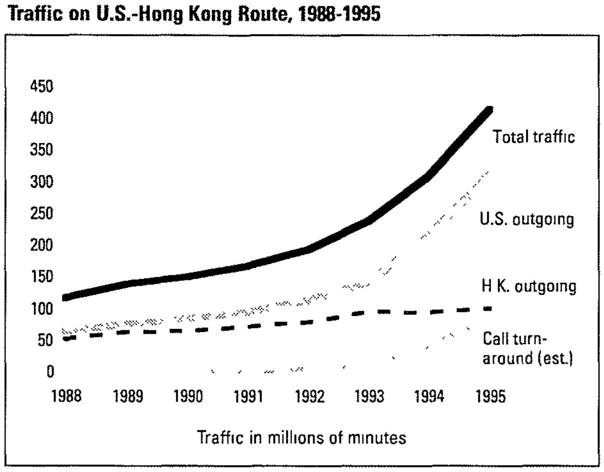
As explained above, for international telephone calls, there are really two prices: a retail price paid by consumers and a wholesale price agreed by the PTOs providing the service. Historically, thanks to the accounting rate system, there was effectively no gradient in the wholesale price because the same rate (the accounting rate) was applied in both directions. Thus, insofar as there was a price differential, it was in the prices charged to end-users (the collection charge) and the mark-up that this represented over the accounting rate. In competitive markets with significant economies of scale, such as the U.S., the margin between the retail price and the wholesale price tended to be lower than in other countries, so that marginally more traffic originated from the U.S. than from other countries.

In the early 1990s, two things happened to change that picture. First, computer technology became available which made it easier to reverse the direction of a call, through call-back, calling cards or country-direct services. Second, wholesale carriers in the U.S. began selling outbound capacity at rates either at, or just below, the settlement rate. They were able to do this because a bizarre U.S. regulation—proportionate return of traffic—meant that they could afford to lose money on outbound traffic in order to gain proportionately more return traffic and the associated per minute settlement payments. Thus proportionate return created an artificial gradient in the settlement rate on the U.S. route which made it relatively more profitable to terminate traffic in foreign countries. As a result of these developments, call-turnaround is now a multi-billion dollar industry (see charts below).

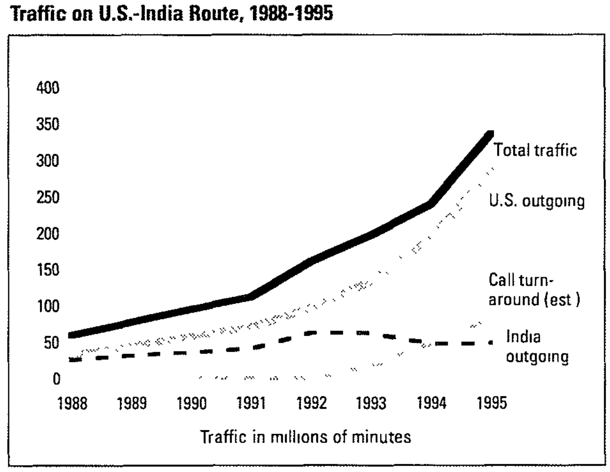
Developing countries have made angry-sounding noises about call-back and many of them have tried to ban it. But the reality is that by reversing the direction of traffic from poor countries, call-back sends developing countries more settlement payments. For a country such as India, call-turnaround probably generated around 82 million minutes of traffic in 1995 and contributed to India's net settlement in-payment of US$210 million from the U.S.

But what would happen if a real gradient were created in the settlement rate? What would happen if India charged $0.23 per minute to land traffic while U.S. carriers charged only $0.07 to terminate traffic? This proposition is not as far fetched as it may seem, because even though India is a member of the WTO, and therefore eligible to enter the U.S. market, it has not agreed to open its market to foreign carriers. Hence, because it may soon become more profitable to terminate traffic in the U.S. than in India, the direction of call-turnaround may be reversed. Even if one ignores proportionate return for the moment, which the FCC may waive, a switch located on Indian territory would be able to offer U.S. residents a rate only slightly above $0.05 per minute to call India whereas U.S. based carriers could only compete at rates above $0.25 per minute. Of course, the Indian operator offering the call-back service would have to make a net settlement payment towards the U.S., but this should be easily covered by U.S. collection charges. Perhaps those developing countries which are currently eager to ban call-back ought to think a little more seriously about this market opportunity before foreclosing their options.

Traffic on U.S.-Hong Kong Route, 1988-1995



Traffic on U.S.-India Route, 1988-1995



Source: Adapted from *Direction of Traffic Database*, ITU/TeleGeography, Inc.

All of these developments threaten to undermine the accounting rate system. But in other respects, the traditional system continues to hold sway: some 66 countries have "banned" call-back and other alternative routing systems, and only a handful of countries have so far liberalized resale or refile. This has led to increasing disparities in the pace of liberalization which will inevitably have an impact on the future of the accounting rate system.

Disappearing Trick

Still many commentators suppose that accounting rates will disappear, almost overnight, on January 1, 1998. How likely is that scenario?

- The U.S. carriers would appear to have the strongest vested interests in changing the system. But ironically, from the FCC at least, there is little talk of changing the system, just reducing the levels of settlement payments. Yet, any rational reform of the system would begin by "unbundling" accounting rates into their component parts so that carriers, in a competitive market, can make rational build or buy decisions (see Box 2). But if the accounting rate system is abandoned, the principle of 50:50 revenue division would need to go too. The FCC estimates that the cost of terminating calls in the United States to be approximately $0.04 to $0.07 per minute, whereas the FCC's lowest average benchmark rate proposed for other countries is $0.15 per minute. Thus, if accounting rates were abandoned, U.S. carriers might pay more than twice as much to terminate calls in foreign countries.

- In principle, some of the main beneficiaries of alternatives to accounting rates should be the developing countries. If they can show higher costs, they would presumably charge higher interconnection payments than they would expect to pay in developed countries. But developing countries are reluctant to change the accounting rate system because, for the moment, it works in their favor, and they are afraid to tamper. Moving away from a 50:50 cost split also might mean that the direction of call-back, and therefore the direction of settlement payments, would be reversed (see Box 3).

- With a system of interconnection charges, every single minute of traffic would need to be accounted for. Traditionally, most international telephone traffic was "traded" in that outgoing traffic more or less balanced out incoming traffic. Accounting rates only gained significance once traffic was out of balance. International operators may still find it convenient to trade traffic, particularly between alliance partners, rather than paying interconnection charges.

Box 4. Next Steps for the ITU

Even before the FCC announced its Benchmarks Order, 1997 was due to be a significant year for the future of the accounting rate system. The multilateral agreement (ITU-T Recommendation D.140) reached in 1992 set out a five-year timetable for achieving cost-oriented accounting rates.

Thus, early in 1997, with accounting rates still at variance with cost on most routes, the Secretary-General of the ITU, Dr. Pekka Tarjanne, targeted accounting rate reform as a key issue of his second term, which ends after 1998. In a series of speeches and position papers Tarjanne has outlined a set of principles that could provide the basis for reform:

- Continuity and viability of international telecommunications service;
- Transparency;
- Non-discrimination;
- Cost-oriented tariffing;
- Competition;
- The benefits of accounting rate reductions should be passed on to end-users;
- Ease of transition for developing countries.

At the start of 1997, Tarjanne also established an Informal Expert Group to advise him on accounting rate reform headed by Mr. Robert Bruce, an international lawyer. The Expert Group has moved in the same direction as the FCC Benchmarking Order—towards lower rates—but by a quite different route. The report of the group* recommended a multilateral move towards reducing accounting rates by five to ten percent per year, and argued that few settlement rates should be greater than $0.25 per minute. Furthermore, the report foresees a much more rapid move away from bilaterally negotiated accounting rates than does the FCC. ITU-T Study Group 3, which is also reviewing these issues, has established a working group to report on accounting rate reform, focusing on call termination charges which are favored by many countries.

The next major ITU event is the World Telecommunication Policy Forum in Geneva, 16-18 March 1998. It will focus on trade in telecommunications, notably the accounting and settlement system. As part of the preparations for the meeting, the ITU is commissioning a series of case studies looking at the impact of the changing telecommunications environment on specific developing countries. If a multilateral alternative to the FCC's action is to emerge, that meeting holds the best chance of success.

* The report of the Informal Expert Group, together with other ITU Recommendations, speeches, position papers and analyzes, can be found on the ITU web site at http://www.itu.int/intset.

Source: Tim Kelly

Undoubtedly, accounting rates will be replaced progressively by other systems. But the accounting rate system, which is already more than 100 years old, may surprise some with its continuing longevity. Accounting rates will most likely co-exist as one of a menu of options. Increasingly, we will see four types of relationship between countries:

- Monopoly to monopoly relations, where accounting rates or sender-keeps-all (SKA) will continue to be prevalent.

- Competitive to competitive relations, where a variety of different revenue-division mechanisms will come into play including interconnection charges, accounting rates and SKA. In the absence of an agreed framework for negotiation, commercial pressure will take over and PTOs will negotiate the highest rates they can for access to their home network and the lowest rates possible for access to foreign networks.

- Competitive to monopoly relations, where the competitive operator will be obliged to pay a half-circuit based termination charge and will no doubt try to apply a similar charge to incoming calls. Where monopoly countries continue to maintain highly differentiated rates between countries, they will be vulnerable to traffic refile. Thus, the commercial logic will dictate that they move towards uniform termination charges. Several Asia-Pacific PTOs have publicly proposed a move in this direction.

- Monopoly to competitive relations, where the temptation for the monopoly would be to establish a switch on the foreign territory while still requiring half-circuit based termination charges in reverse. This is unlikely to be permitted. For instance, the FCC has recently proposed that open market access be granted only to WTO Members, and not to others.

The post-1998 world will certainly be different, but it will take a while for the new environment to take shape. The ITU's own accounting rate reform agenda may still play an important role (see Box 4). Even taking that into account though, the most likely scenario is that the international telephony market will fragment into three distinct operations:

- Between countries, international alliances such as Concert, Global One and AT&T-Unisource will offer an end-to-end connectivity where access is permitted, or traditional half-circuit access where it is not. These alliances will face growing competition from Internet telephony, from international facilities owners (e.g., satellite operators, private cable operators) selling direct to consumers, and from a burgeoning spot-market in resale rates.

- For call-origination, competition will continue to be intense as new market entrants in areas such as call-back, Internet telephony and resale compete with more conventional carriers who will promote their brand name advantage through calling card services and loyalty schemes.

- For call termination, competition will be slow to arrive as former and actual monopolies continue to hold sway and to dictate rates for interconnection. Their dominant position will decline slowly, but it takes a long time, and considerable investment, for new networks to be deployed. Thus, PTOs will seek to charge the highest rates they are able for call termination while they still retain a dominant position.

What about users?

What impact will users notice after the changes of 1998? The FCC predicts that the average price of a call originating from the United States will fall from a current average of $0.88 per minute to approximately $0.20 within five years. That may be too optimistic. National operators in Europe and elsewhere have been using the last few months of their monopoly to complete the tariff rebalancing process by raising fixed charges and local call charges while reducing long distance and international call charges. But the actual evidence for price cutting is more limited. International call prices have actually been falling by only three to five percent per year. Indeed, in the U.S., where competition is arguably the most intense, tariffed call prices for major carriers actually rose from 1995 to 1997. Certainly, bargain prices will be available to those willing to "chop and change" between carriers. They will not be universally available, however. Telephone carriers are not yet ready to give up the golden goose of international telephony.

Dr. Tim Kelly (Tim.Kelly@itu.int) is Head of Operations Analysis at the Geneva-based ITU. He is co-author of the ITU/TeleGeography publication Direction of Traffic 1996: Trends in International Telephone Tariffs. *The views expressed here are his own and do not necessarily reflect the opinions of the ITU or its membership.*

The Market for Refile and Transit Services

by Michael J. Scheele and Cathleen Woodall,
M.J. Scheele & Associates

Settlement payments to foreign carriers are typically one of the largest costs for an international telephone company. Some companies have, however, taken advantage of new switching technologies to reduce these costs. One new option for routing traffic indirectly—traffic refile—has become increasingly popular, especially for new carriers.

The indirect routing of traffic is not new. Third country routing arrangements are as old as the industry. Many countries are landlocked, and prior to the advent of satellite communications, had to transit their traffic through neighboring countries to reach the rest of the world. In addition, for economic reasons, it is generally only rational for carriers to establish their own direct transmission facilities for routes on which they have a substantial traffic base. For smaller companies this might mean they have direct routes to only ten or 15 countries; the remainder of the countries are served on a transit basis. But transit and refile arrangements differ in important ways.

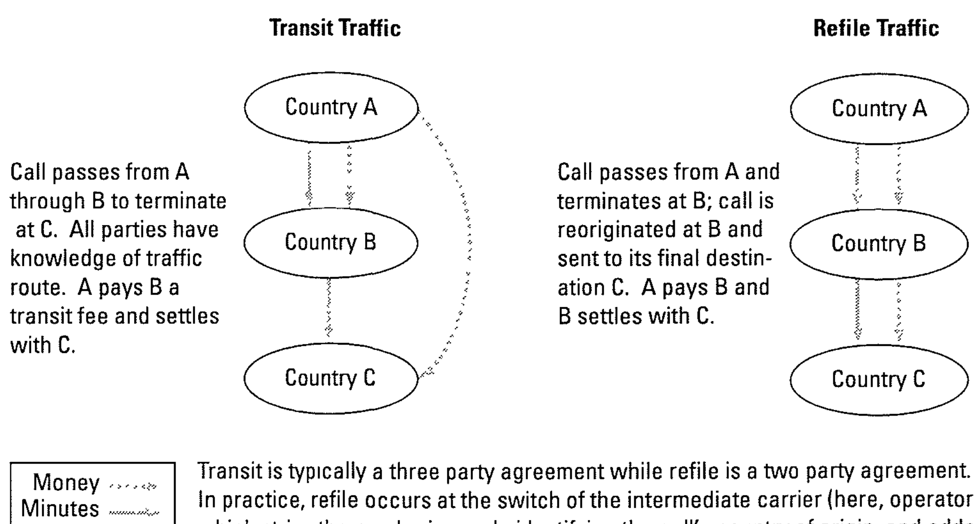
A transit arrangement, as used here, refers to an indirect routing arrangement, which has the prior approval of all parties concerned and is subject to a traditional settlement fee. In contrast, if traffic is refiled, at least one of the parties, typically the destination country, is unaware of the origin of the traffic and has not given its consent (see Figure 1).

Economics of "Smuggling"

It has been said that refile is the closest thing the telecom industry has to smuggling. For example, if a Chilean telephone carrier wished to reduce the settlement cost of sending traffic to a European country (e.g., Belgium) it might route its calls via a U.S. carrier, which will "smuggle" them into Belgium as part of its U.S. outbound traffic stream. The Chilean carrier saves money simply because the per minute payment to the U.S. carrier is less than the cost of settling with Belgium.

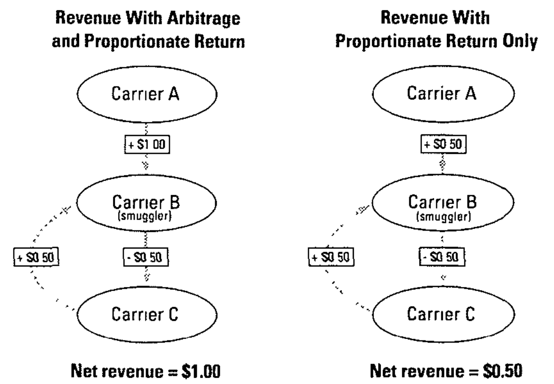
So what's in it for the U.S. refile carrier? First, the U.S. carrier could profit because the per minute fee paid *in* by the Chilean carrier (e.g., $1.00) is greater than its costs plus the per minute settlement paid *out* to the Belgian carrier (e.g., $0.50). Second, the U.S. carrier can profit by increasing its market share on the Belgium route, thus increasing the propor-

Figure 1. Transit vs. Refile



Transit is typically a three party agreement while refile is a two party agreement. In practice, refile occurs at the switch of the intermediate carrier (here, operator B) which strips the numbering code identifying the call's country of origin, and adds its own origination code. The traffic is then sent on to its final destination (C) and appears to have originated from B, not A.

Figure 2. Smuggler's Incentives



A smuggler's incentive to offer refile services is complex. Even when A's fee paid to B is less than B's settlement to C, B can still profit through a greater flow of return traffic and settlements. However, if traffic on the B to C route is imbalanced (as it usually is), the payback from proportionate return will vary. Diagrams above assume that A's settlement payment to terminate traffic with C is greater than A's payment to B.

© TeleGeography, Inc. 1997

Refile Rates on Selected Routes (US$)

Smuggled Route	Refile Rate	Settlement Rate
Belgium via the U.S.	0.14	0.21
Brazil via the U.S.	0.54	0.45
China via the U.S.	0.55	0.86
Hong Kong via the U.S.	0.20	0.40
India via the U.S.	0.71	0.79
Japan via the U.S.	0.32	0.43
Pakistan via Western Europe	0.90	1.16
Russia via Western Europe	0.41	0.37

Note: Refile rates are average for 1997. U.S. settlement rates are current to July 1997. "Western Europe" settlement rates reflect BT's U.K.-originated rate as reported by OFTEL in October 1996. Many of the refile rates above undercut the settlement rate and therefore, the carriers in these cases rely upon return traffic settlements for profit.

Source: M.J. Scheele Associates and TeleGeography, Inc.

tion of future incoming traffic (and settlements) due back from Belgium (see Figure 2). In fact, even if the settlement rates for originating and terminating points are the same, the refiler can make a profit by guaranteeing future incoming traffic. (For a full explanation of how accounting rates work see page 34.)

The Refile Decision

The decision to use refile, however, is not an easy one—there can be negative side effects. First and foremost, a carrier must consider the relative value of its correspondent relationships. When established carriers bypass traditional correspondents, they run the risk of damaging the relationship with that carrier and their future contract negotiations. Use of alternative routing may also violate existing operating agreements, which may contain specific provisions for traffic routing (see Box 1).

Thus, large carriers must consider the following before using refile services:

Figure 3. The Geography of Traffic Refile (1997)

Country/Region of Origin	Refile Hubs	Major Refile Carriers: 25-100 million minutes	Major Refile Carriers: >100 million minutes	Destination Countries
Australia	Australia	Austrian PTT	AT&T	Brazil
South America	U.K.	Belgacom	BT	China
Sweden	U.S.	Deutsche Telekom	Cherry Communications	Hong Kong
U.K.		Facilicom	Global One	India
U.S.		Mercury	MCI	Indonesia
West Africa		Swisscom	Pacific Gateway Exchange	Japan
		Telecom Italia	Primus	Korea
		Telstra	Singapore Telecom	Malaysia
		Trescom	Sprint	Pakistan
		Viatel	Téléglobe	Philippines
		WorldCom	WorldXchange	Singapore
				Russia

Note: Only major originating and terminating countries regions are listed. Not all refile carriers are listed. Some refile volumes are estimated

Source: M.J. Scheele & Associates

Figure 4. New Carriers Boost Refile Market

Selected Facilities-based International Carriers and Revenues, 1996

	US$million
ACC Corp	322
Cherry Communications	315
Facilicom	100
fONOROLA	276
PGE	162
Primus/Axicorp	210
Star	208
Total Tel	50
Trescom	139
Viatel	120
WorldXchange	212
Total	**2,114**

Source: M.J. Scheele Associates

- Will the decrease in outgoing traffic to a particular country affect their overall market share, thereby negatively affecting the overall proportionate return of minutes?
- Does refiling traffic to certain emerging, closed markets jeopardize their opportunity to be included in negotiations as these markets liberalize?
- Does the quality of the connection suffer when using an alternative carrier to refile traffic?

The Spot Market

The market for refile services is being driven in significant part by a fast-growing group of new international carriers (see Figure 4). The insurgence of these new carriers, and their quest for low or least cost routing has given rise to what has been termed the spot market. By spot market we mean a market for short term (one month or less) international transmission contracts which reflect current supply (capacity) and demand (business) conditions in the market. The spot market thus contrasts with the long term (one to five year) bilateral operating agreements which underpin the pricing arrangements of most incumbent carriers.

The international spot market began in approximately 1993 when international call-back services became a significant business in the U.S. At that time smaller U.S. international carriers and, more importantly, switchless resellers began to be offered competitive international prices from AT&T, MCI and Sprint. Without long-term commitments, new carriers can quickly reroute traffic according to the latest prevailing rates. Additional information on the spot market, as well as current rates, can be found at www.spotrates.com.

How Much Traffic Is Being Refiled?

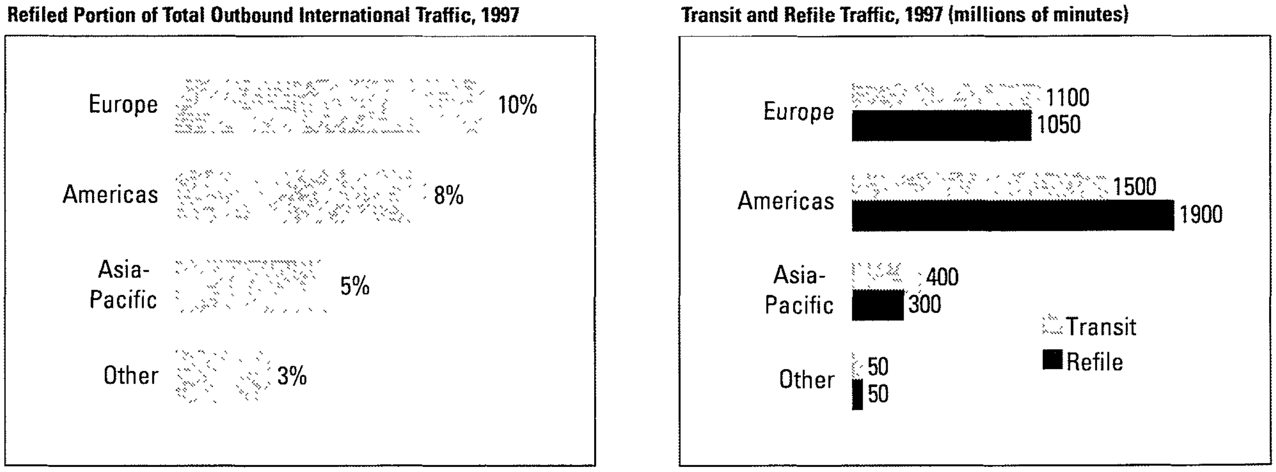
Europe and the Americas are by far the most aggressive refile and transit regions, accounting for approximately 80 percent of the world's total refile traffic (see Figure 5). In contrast, the Asia-Pacific region accounts for about 10 percent of global refile traffic. (Part of the reason for the disparity stems from Asian carriers' unwillingness to jeopardize their correspondent relationships by routing traffic outside the bilateral stream.)

The volume of transit traffic generally declines as refile traffic increases (see Figure 6). Market liberalization will enhance this trend as new routes open and new entrants to the market provide multiple choices for carrier traffic. Why pay a transit fee when your competition is refiling traffic at a lower rate?

By the year 2000, we estimate that the world's largest carriers will be refiling about 20-25 percent of their international traffic. And most of this refile traffic will still originate in the Americas and Western Europe.

Figure 5. Refile and Transit Traffic by Region of Origin

Refiled Portion of Total Outbound International Traffic, 1997 / **Transit and Refile Traffic, 1997 (millions of minutes)**



Source: M.J. Scheele & Associates

Box 1. Is Refile Legal?

No certain answer can be given—much depends on *how* and *where.*

Under the International Telecommunication Regulations (ITR, Melbourne 1988) provision of public telephone service between countries shall be provided by "mutual agreement" and carriers are to agree upon the facilities for routing traffic. The ITR arguably provide an exception for certain "special arrangements ... which do not concern [ITU] Members in general," although this provision of the ITR was adopted largely to protect the freedom of private networks. But what if carriers in Country A have no agreement with carriers in Country B? Are the mutuality terms of the ITR violated if the carriers in A route traffic via a third country to B? Many lawyers think not. But so long as all the countries involved are ITU members, some believe the ITR are controlling, and all party consent is required.

National regulations complicate the situation further. In the U.S. and some other countries, where a substantial volume of traffic is refiled, international carriers are subject to proportional return rules. For example, the U.S. Federal Communications Commission (FCC) requires U.S. carriers to accept return traffic only in proportion to the traffic they originate on a given route. But do the rules allow a U.S. carrier to count refiled traffic from a third country as U.S. originated, and thus boost its return traffic on a given route? Or is that cheating?

This is the subject of an unresolved FCC proceeding begun by a 1995 MCI petition challenging the Sprint FonAccess service—the first publicly acknowledged refile scheme by a major carrier. MCI (joined by AT&T) also argued that Sprint's service violates the ITR. To date, however, the FCC has chosen not to decide the case—thus giving tacit approval to Sprint and other U.S. carriers to expand their refile services.

In its August 1997 order adopting benchmark settlement rates for U.S. international carriers, the FCC had this to say about refile:

> *The traditional bilateral correspondent relationships between national monopoly carriers are breaking down as countries open their markets to competition. As a result ... an increasing amount of international traffic will migrate from the traditional accounting rate system to least cost routes through the use of practices such as hubbing, refile and reorigination... Least-cost traffic routing is an economically rational response to inflated settlement rates, and will continue as long as carriers maintain excessive settlement rates.*

Source: TeleGeography, Inc.

Conclusion

New international wholesale carriers and alternative call termination companies are placing as much pressure on the global accounting rate system as the large carriers. They have fewer barriers to refiling traffic and now refile 30 percent to 50 percent of their total international traffic. Incumbent carriers that use the threat of traffic refile during accounting rate negotiations also play a significant role in this new market segment.

Michael J. Scheele is President, and Cathleen Woodall is Director of Marketing, at M.J. Scheele & Associates (www.callbackinfo.com and www.spotrates.com) a telecommunications consultancy based in San Francisco. Michael Scheele and Cathleen Woodall can be reached via e-mail at: scheele@callbackinfo.com and woodall@callbackinfo.com, respectively.

Figure 6. Carrier Estimates of Transit and Refile Traffic, 1996-2000

	Aggressive PTO		Non-Aggressive PTO		Wholesale Carrier	
	Transit	Refile	Transit	Refile	Transit	Refile
1996	5%	2%	1%	0.5%	9%	17%
1997	6%	4.5%	2%	1.5%	11%	18%
1998	5%	9.5%	2%	2.75%	10%	27%
1999	4%	13.5%	1%	5.5%	6%	32%
2000	3%	20%	1%	8%	4%	43%

Note: Figures are estimated shares of carrier's total outgoing traffic.

Source: M.J. Scheele & Associates

Box 2. Refile and Global Alliances

Market liberalization has dramatically increased third country routing options for international carriers. For instance, in 1998 carriers will be able to establish their own end-to-end facilities on several routes, thus gaining the option of refiling inbound and outbound traffic via two or more markets. A carrier can then "balance off" or "net" its traffic flows and settlements on various routes. By combining its traffic flows from several countries and engaging in refiling, a pan-national carrier may be able to transform a deficit route into one with a surplus.

The proposed merger of two of the world's larger international carriers—BT and MCI—has thus raised new questions on the public interest in such refile activities. The following statements are excerpted from public comments filed with the FCC regarding the BT/MCI merger.

AT&T:

Since [1984] U.S. "reorigination" of foreign-foreign calls has become an emerging and growing market segment. Unanticipated at the time was how re-originated traffic would skew U.S. proportionate return (and thus the unit costs of settlements for U.S. carriers) and bilateral routes. Now, minutes reoriginated through the U.S. are included as part of a U.S. carrier's market share for determining the return traffic it receives from a terminating carrier. Thus, the terminating carrier allocates a greater share of return minutes to the reoriginating U.S. carrier (shifting minutes away from other U.S. competitors on the route) than the re-originating carrier would have received based on actual U.S. customer traffic ...

[If a foreign carrier has] an ownership interest in the hubbing U.S. carrier ... reorigination is a powerful tool for [that] foreign carrier to benefit its U.S. affiliate [and] to raise rivals' costs on U.S.-third country routes. Simply put BT has an opportunity to "balance off" its U.K. stream using MCI's network.

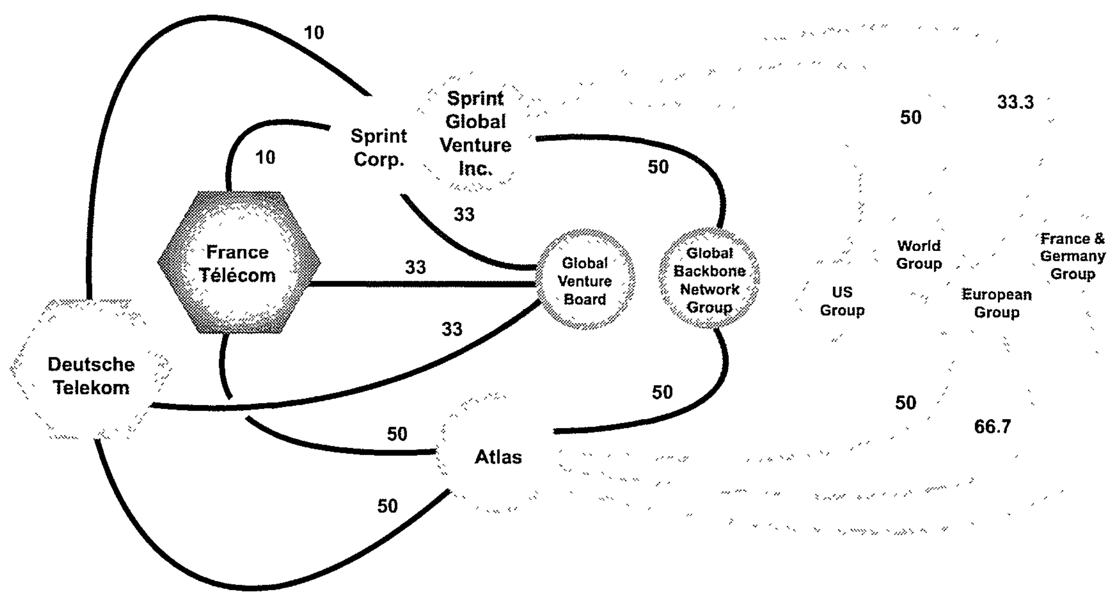
Specifically, BT could send a third country only that volume of minutes that matches the volume each third country sends to it—leaving BT with no settlements outpayment. The additional minutes generated by BT's customers above the balance could then be delivered through MCI's network in the U.S.—earning MCI a greater share of return minutes at the expense of its competitors on third country routes ... To protect against this potential injury to competition, BT should be prohibited from routing foreign-originated minutes through MCI in the U.S. to third countries.

MCI and BT:

AT&T's concern about what might happen if the U.S.-U.K. proportionate return rules and International Settlement Policy (ISP) were to be relaxed in the future ... [is] misplaced in the short term and, in the longer term are antithetical to the pro-competitive thrust of the [FCC's settlement policies]. As AT&T is well aware, services offered by MCI and BT—as well as other carriers—will continue to be governed by the ISP [FCC International Settlement Policy] and propor-

(continued on next page)

Global One



Note: Ownership interests in the diagram begin with the parents on the left and move across to the right. The four "Groups" at the far right (U.S., World, European, and France & Germany) are responsible for distributing Global One services on the local level.

Source: TeleGeography, Inc.

Box 2. Refile and Global Alliances (continued)

tionate return rules unless and until the Commission approves an alternative arrangement .... No special license conditions are necessary to enable the Commission to enforce these obligations. [MCI and BT] are not proposing to implement any alternative settlement arrangements or to diverge from the ISP ... if and when they do so, there will be time enough for the Commission to consider all issues relating to such a proposal. As competition grows on the U.S.-U.K. route, the need for strict adherence to the ISP will dissipate, and the FCC will presumably relax the ISP rules under appropriate circumstances ...

U.K. Department of Trade and Industry (DTI) and OFTEL:

[AT&T et al.] pointed to the potential for BT to "balance off" its U.K. traffic stream with third countries by sending surplus minutes to MCI for re-origination in the U.S.... Whether there is an incentive on BT to act in this manner depends on traffic flows and accounting rates on a particular route. It is an empirical question and would require detailed worked examples on specific routes to be analyzed before this question could be answered. The success of this strategy is predicated on a zero response from other operators. This might not be realistic as this strategy is likely to have an adverse effect on the third country. If it caused significant distortions, it is likely that there would be retaliation from the third country, most obviously by abandoning proportionate return and directing traffic away from BT/MCI. Adversely affected U.S. carriers are in a position to do something similar. U.S. carriers can link up with subsidiaries or global partners within other jurisdictions and can rebalance and re-originate in a similar manner (e.g., a U.S. operator can send traffic to the U.K. for reorigination, reducing BT's proportionate return). On the basis that other U.S. carriers can carry out similar activities, the efficient use of transmission capacity would appear to be in the interest of both U.K. and U.S. customers and lead to a potential lowering of collection tariffs in the event that the cost saving achieved by such use are passed on to customers.

The FCC ultimately approved the BT/MCI merger in August 1997 without imposing the routing conditions sought by AT&T. The FCC reasoned as follows:

The Commission has not found that reorigination should be prohibited or limited generally and we perceive no need to impose such a restriction uniquely on BT/MCI. We may revisit this issue in the future if it appears that distortions in settlement payments or proportionate return traffic are so great as to justify restricting this practice. For now, however, AT&T (and other U.S. carriers) will have an equal incentive and ability as BT/MCI to reoriginate traffic through the United States. Consequently, we find no reason to impose any restrictions regarding reorigination on BT/MCI.

We agree with BT/MCI that the services offered by BT and MCI will be governed by our ISP until such time as MCI proposes—and we approve—an alternative arrangement... Until then, there is no record evidence to support the need for special safeguards to enforce this requirement on BT and MCI.

Source: TeleGeography, Inc.

The FCC's Settlement Benchmarks

by Gregory Staple, Koteen & Naftalin, LLP

Because approximately forty percent of international traffic involves a U.S. party, the market rules of the U.S. telecoms regulator, the Federal Communications Commission (FCC), have long had an indirect impact on the business practices of non-U.S. telephone carriers. In August 1997, however, the FCC issued a detailed 150 page order which many U.S. carriers hope, and most foreign operators fear, will give the Commission a more direct (and, say foreigners, illegal) role in regulating the terms on which U.S. carriers send telephone calls to their foreign correspondents.

At the center of the dispute is a new set of "benchmark" or model settlement rates which the FCC's order requires all U.S. international carriers to respect. The benchmark rates range from $0.15 to $0.23 per minute—often 50 percent or more below the current rate—and will be phased in (see Figures 1 and 2). U.S. carriers must negotiate benchmark rates with carriers from richer countries by January 1999; benchmark rates must be implemented with carriers from middle income and poorer countries between 2000 and 2003.

Calculating The Benchmarks

The FCC calculated its new benchmarks using a controversial model for estimating foreign carriers' actual costs in terminating U.S. calls. The estimates are based on the per minute tariff or tariff proxy for three foreign network components: the international transmission facility (cable/satellite half-circuit); the international gateway facility; and the national extension (domestic transport and termination). Tariff component prices (TCPs) were calculated for 65 countries and these countries were then divided into four economic groups based on their 1995 Gross Domestic Product (GDP) per capita. The average TCP for each economic group was then adopted by the FCC as the benchmark for all countries within a given income category (again, see Figure 1).

Figure 1. FCC Settlement Benchmarks (US$)

Income Group	GDP per capita	Benchmark	Effective Date
Low	0-$726	$0.23	1 Jan. 2002
Lower Middle	$726-$2,985	$0.19	1 Jan. 2001
Upper Middle	$2,896-$8,955	$0.19	1 Jan. 2000
Upper	$8,956+	$0.15	1 Jan. 1999

For countries with less than 1 telephone line per 100 people, the effective date is 1 Jan. 2003. Waivers of the effective date may also be requested in certain cases.
Source: FCC

The FCC's new benchmarks are not self-executing; they rely upon U.S. carrier negotiations. And, before the first major deadline for negotiations—January 1999—the FCC's order must also survive judicial review. Several foreign carriers, including Japan's KDD and the U.K.'s Cable & Wireless, have already asked the U.S. courts to overturn the FCC's decision.

The Impact On Foreign Affiliated U.S. Carriers

Two groups of foreign carriers will be most directly affected by the Benchmarks Order: (1) foreign carriers with a U.S. presence (i.e., with an affiliated U.S. carrier); and (2) foreign carriers which have no U.S. presence, but have a significant traffic surplus with their U.S. correspondents.

Beginning in January 1998, the FCC will not grant a foreign affiliated U.S. carrier authority to serve its home market(s) unless the company's foreign affiliate(s) offer all U.S. carriers settlement rates at or below the benchmarks on affiliated routes. (A U.S. carrier with 25 percent or more of its shares owned by a foreign carrier is considered to be foreign-affiliated.) This obligation will apply immediately—even though U.S. carriers generally might not be required to settle at the benchmark rate on that route until 1999 or later.

As importantly, the FCC's order requires foreign affiliated carriers now authorized to serve their home market to implement a settlement rate at or below the benchmark on affiliated routes by April 1, 1998. Absent a rule waiver, this could lead to a "flash cut" in U.S. accounting rates on several routes, given that affiliated carriers from these markets now operate in the U.S. Failure to comply with the FCC's new rules could lead to a revocation of the U.S. affiliate's FCC authorization, or the affiliate could be ordered to settle traffic at $0.08 per minute—the so called "best practice" rate.

But what if a foreign carrier has no U.S. presence? The Benchmarks Order keeps the FCC's options open. After the deadline for a benchmark has passed, a U.S. carrier may file an enforcement petition but the FCC will only act upon it after receiving public comment. Carriers receiving a net inflow of settlements and which do not reduce their rates to the benchmark level are likely to be the first target for action. In such cases, the FCC could order all U.S. carriers to withhold any further payments in excess of the benchmark rate. A bar on third-country routing of traffic on that route could also be imposed on U.S. carriers to ensure the order is effective.

International Simple Resale

The Benchmarks Order contains one ironic twist: starting in 1998, there will be more restrictive rules for U.S.-based International Simple Resale (ISR) carriers. To reduce the incentive for major carriers to use ISR facilities (interconnected private lines) to bypass high settlement rates rather than to negotiate rate reductions, no additional U.S. routes will be opened to ISR unless the FCC rules that 50 percent of the traffic on the route is settled at or below the benchmark rate. ISR routes authorized earlier (to Canada, the U.K., Sweden and New Zealand) will not be affected.

Further, the FCC plans to monitor the impact of ISR on routing and settlement rates much more carefully. From 1998 forward, any U.S. carrier handling more than 2.5 percent of the traffic (in or out) on any given U.S. route or one percent of total U.S. traffic (in or out) will be required to file new quarterly traffic and revenue reports.

Impact of WTO Agreement

Whether or not the FCC's benchmark rates are consistent with the new obligations of the U.S. under the WTO Agreement on basic telecommunications service is a matter of continuing debate. Many foreign carriers believe that the new benchmark conditions placed on their U.S. affiliates violate America's WTO market entry commitments, and also run afoul of the Most Favored Nation (MFN) and National Treatment provisions in the General Agreement on Trade in Services (GATS). The FCC—backed by an opinion from the U.S. Trade Representative (USTR)—strongly disagrees. But the issue was unresolved as of September 1997; a separate FCC rulemaking docket implementing the WTO agreement is still pending.

In that docket, the agency also is considering a radical proposal to permit any U.S. carrier to have a non-standard settlement agreement (e.g., one with lower rates or exclusive routing terms) with carriers from WTO countries. Hence, the final impact of the FCC's Benchmarks Order on any given route will not be clear until the Commission adopts its new rules to implement the WTO Agreement. Court review of the Benchmarks Order and, most likely the decision in the WTO docket, must also be taken into account.

Figure 2. Selected Benchmarks for U.S. Carriers (US$)

Country	Current (8/97) Settlement	New Benchmark	Effective Date	Country	Current (8/97) Settlement	New Benchmark	Effective Date
Argentina	$0.46	$0.19	1/1/00	Malaysia	$0.45(b)	$0.19	1/1/00
Australia	$0.21	$0.15	1/1/99	Mexico	$0.35(c)	$0.19	1/1/00
Belgium	$0.21	$0.15	1/1/99	Pakistan	$1.00/.60(a)	$0.23	1/1/02
Bermuda	$0.51/0.45(a)	$0.15	1/1/99	Panama	$0.60	$0.19	1/1/01
Brazil	$0.45	$0.19	1/1/00	Philippines	$0.50(b)	$0.19	1/1/01
Chile	$0.55(b)	$0.19	1/1/00	Poland	$0.35	$0.19	1/1/01
China	$0.84	$0.23	1/1/02	Russia	$1.06(b)	$0.19	1/1/01
Colombia	$0.58	$0.19	1/1/01	S. Africa	$0.50	$0.19	1/1/00
Dom. Republic	$0.40(b)	$0.19	1/1/01	S. Korea	$0.49	$0.19	1/1/00
Egypt	$0.70	$0.23	1/1/02	Singapore	$0.42	$0.15	1/1/99
El Salvador	$0.50	$0.19	1/1/01	Spain	$0.31	$0.15	1/1/99
France	$0.13	$0.15	1/1/99	Switzerland	$0.17	$0.15	1/1/99
Germany	$0.10	$0.15	1/1/99	Thailand	$0.75	$0.19	1/1/01
Greece	$0.48	$0.19	1/1/00	Turkey	$0.41	$0.19	1/1/01
Guatemala	$0.48	$0.19	1/1/01	Vietnam	$1.15/1.00/.93/.85(d)	$0.23	1/1/02
Guyana	$0.85	$0.23	1/1/02				
Honduras	$0.58	$0.23	1/1/02				
Hong Kong	$0.40	$0.15	1/1/99				
India	$0.79	$0.23	1/1/02				
Indonesia	$0.60	$0.19	1/1/01				
Israel	$0.48	$0.15	1/1/99				
Italy	$0.17	$0.15	1/1/99				
Japan	$0.43	$0.15	1/1/99				
Jordan	$0.75	$0.19	1/1/01				
Kenya	$0.65	$0.23	1/1/02				

Notes:

(a) Peak/off-peak rates

(b) Rate offered by largest carrier, e.g., ENTEL in Chile

(c) Average rate; actual rates vary by service classification, call location, call destination, and time of day

(d) Growth-based rate structure is in effect

See the Green Pages at the back of this book for a listing of all FCC benchmarks and tariffed component prices.

Internet Telephony

A Vision of Convergence

by Vint Cerf, MCI Communications Corp.

One of the most exciting aspects of tracking the development of the Internet, especially for someone like myself who has been involved with its development for the better part of three decades, is seeing new technologies and applications developed for it that many of us did not foresee.

Chief among these exciting emerging new services is Internet Protocol telephony (IP telephony). Among its increasing and dedicated cadre of enthusiastic boosters, IP telephony is most often hailed as a way to force long distance carriers to lower international and domestic toll rates. Otherwise, it is believed, these carriers run the risk of seeing the millions of minutes they carry each year flee the Switchnet for the relatively inexpensive Internet. Not surprisingly, many industry analysts have openly speculated on just how damaging the widespread use of IP telephony might be for many carriers.

Unfortunately, like most promises of a free lunch, this vision of the free, or even a significantly cheaper Internet phone call is deceptive, if not completely illusory. In fact, most of the cost advantages associated with IP telephony arise from the continued existence of the obsolete model of international settlement rates—a system that despite the continued resistance to reform exhibited by some members of the World Trade Organization, is simply living on borrowed time.

So, it should be said that those who couch the collision of IP telephony with the Switchnet as an all or nothing issue, are really proffering a false choice. In fact, the future of communications belongs to those who both embrace IP telephony, and are committed to integrating it with the existing communications infrastructure.

Before I go into greater detail concerning IP telephony, I think it is important to take a closer look at the current state of the Internet, its incredible growth, and just exactly what that growth means to the global telecommunications infrastructure.

The Internet at a Crossroads

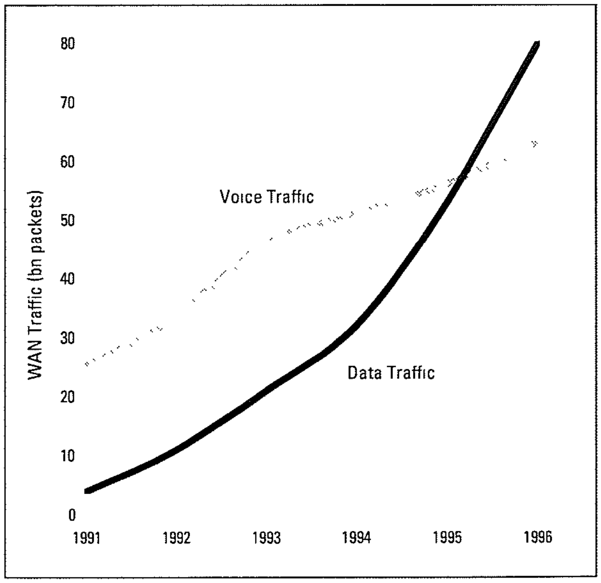
Now is an important time in the evolution of networking and the Internet in particular. The technology is clearly evolving rapidly, adding new functionality and size almost daily. Yet, in any one instance, it seems to take a long time for new features to appear and to populate the network widely. Moreover, much of the new networking technology is subject to available underlying infrastructure including high capacity fiber and high speed routers as well as hardware switches of various kinds.

It seems an impossible task to attempt to make any solid projections of what is to come over the next decade, let alone next year, but there seems to be a consensus that the Internet will continue to grow, although possibly at a lower rate than has been common in the preceding few years. Moreover, the apparent growth rates are not uniform, with some regions showing more rapid growth than others.

Data from MCI suggest a 100 percent annual increase in traffic requirements for the foreseeable future (that is a doubling of traffic annually). Data from Network Wizards (Mark Lottor) appear to show linear growth in the number of Internet hosts since January 1996 and do not seem to account on their own for the continued growth in traffic in the MCI backbone. Bellcore, using the same data, continues to project 80-90 percent growth rates for the next few years. If, indeed, there is any rate reduction, we suspect that one reason may be that the statistical methods used cannot penetrate the firewalls of many companies that are adding to their intranets at a heavy pace. Thus, much of the growth of the Internet is taking place where

Figure 1. Nortel's Network Crossover

Voice and Data Traffic on Nortel's Corporate Network, 1991-96



Note: Nortel's voice traffic is transported separately from its data. However, on average, Nortel estimates that one minute of voice traffic equals approximately 240,000 bytes or 240 packets. Also, the figure does not include voice or data traffic on Nortel's local networks.
Source: Nortel

it cannot be directly observed, except in the form of traffic emitted onto the public Internet. Moreover, we had seen higher Internet traffic growth in the past, but much of it may be migrating to corporate intranets.

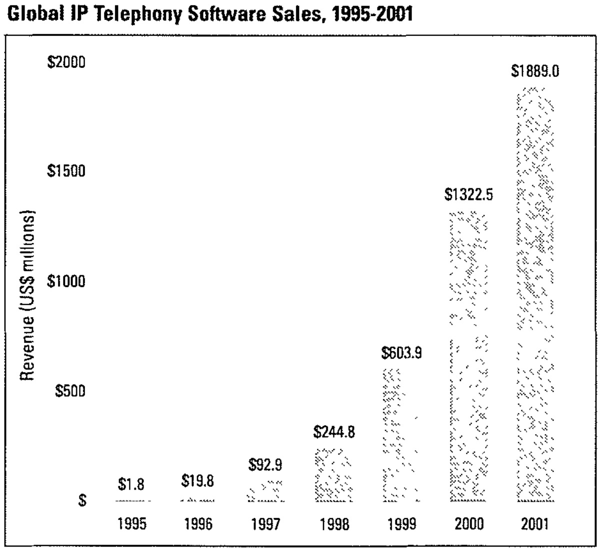
Another indicator that this may be an accurate reading of the data is that sales of equipment (routers, servers and the like) for intranet use now equal or far exceed sales for public Internet use. Zona Research estimates that by the end of 1999, intranet sales will reach $28 billion while internet sales will be only $14 billion (for a total market for internet and intranet equipment and service of $42 billion).

Perhaps more important than the statistics, however, are the discussions and debates going on around the globe about policy and the Internet. Governments look at its border-crossing character with interest and with concerns. Some governments want to find ways to control content on the Net or at least to control what content their citizens can reach. Some want to tax the fledgling electronic commerce as a new source of revenue. Some worry about the use and export/import of cryptography and the impact it has on law enforcement or intelligence gathering. Others worry about the potential for use of the Internet for fraud, copyright violations and so on.

The concerns also extend to social impacts on young people and on gullible elderly, all of whom are becoming a part of the Internet community. Although some of the concerns may be borne out of ignorance of how the Internet works, many of them are understandable. Those of us who have labored in the vineyards of the Net for many years have a duty to help these newcomers understand better what it can and cannot do and what can or cannot be controlled about it.

Figure 2. IP Telephony Growth

Global IP Telephony Software Sales, 1995-2001



Source: Frost & Sullivan (Mountain View, California), adapted from "IP Telephony's Velvet Curtain," *tele.com*, October 1997.

© TeleGeography, Inc. 1997

The increasing river of anecdotes that pour into my email about the positive effects of the Internet are a source of considerable satisfaction. Lives are being saved through access to medical information and expertise that might have gone unnoticed, but for discussion groups, web indexing services, and chat rooms devoted to special medical topics. New businesses and thus economic value are being formed by start-up companies finding niches in the business of the Internet. Electronic commerce is picking up speed and is estimated by Forrester to reach $320 billion per year by the end of the year 2000. Children are discovering the world and each other through the Internet. There is an endless line of stories about kids in school reaching specialists and scholars through the Net in ways no encyclopedia could ever hope to emulate.

I often wonder what the Net will be like, as it becomes fashioned by young people who have grown up in a world in which personal computers are the norm and the Net is taken for granted as another medium of communication.

Where are the Statistics Taking Us?

Previous estimates seemed to show a public Internet exceeding 200 million hosts by the end of the year 2000. The recent apparent linearization of growth would yield only about 80 million hosts in the public Internet by that time.

Some estimates place the number of users at 150 million by the end of 1997 and one billion by the end of the year 2000. My own guess is that these numbers are more likely to be 70 million users worldwide by the end of 1997 and 300 million by the end of the year 2000. In either case, the Internet will have reached telephone system-sized proportions by the end of the decade. These statistics also suggest that by the year 2010, at least half of all telephone calls will be carried on the Internet and that well before that time, half of all fiber capacity will be given over to the Internet. Indeed, it is estimated now that by November 1996, more than half of the trans-Pacific capacity was given over to the Internet, and that by November in 1999, the trans-Atlantic situation will be similar. The domestic situation in North America and Europe will probably not reach this kind of parity until somewhat later, perhaps around the years 2001-2005.

Other Observations

Clearly, the Internet is becoming a telecommunications force with which to be reckoned. Telecommunication carriers ignore it at their peril. Much of the dynamic growth seems to be taking place where competitive regulatory environments allow multiple service providers to offer service without restrictions. Recognizing the changing landscape, a number of major telecommunication carriers are making significant investments in Internet telephony. Examples include the 1997 acquisition of 21 percent of Vocaltec by Deutsche Telekom for $48 million, formation of an Internet telephony spin-off by AT&T in conjunction with Vocaltec, announcements by KDD that they plan to

Box 1. MCI's Vault Architecture

In the past, customers needed separate lines to communicate over a telephone network and a packet-switched network, such as the Internet. MCI's Vault system architecture eliminates that need by converting communications traffic into IP packets and then sending the packets over MCI's Internet backbone, utilizing a single line. The new V-Class of services derived from this technology will provide customers with fully integrated and seamless communications that optimize the power of our combined networks.

Possible business applications from Vault Technology include:

- Prospective home buyers might research mortgage rates using a lender's web site. Clicking a voice button on the site, they could be directly linked to a mortgage counselor who could assist with filling out a loan application. With another click, a real estate agent could take those same home buyers on a tour of available properties on the Internet.
- An editor could splice tape for the evening news in full view of a producer located in a newsroom thousands of miles away, sharing voice and data from computer to computer during collaborative work sessions.
- A traveling executive could check email while returning phone calls, and access all messages (voice, fax, pager and email) from a single web site.

Source: MCI Communications Corp.

divert some trans-Pacific voice traffic over Internet, and the rise of Internet telephony refiling by other service providers, some of which have offered call-back services in the past and are extending their service lines.

What Will This Mean To the Future of the Switchnet?

What is beginning to take shape today is this: the Internet and the Switchnet will intertwine and begin to work together—merging, melding and blurring the distinctions between the two. What will emerge will be a new communications medium, armed with a powerful new level of functionality.

For customers, the development of IP telephony should be about enabling new services. It is carriers like MCI that should worry about the specifics of the network. As a leading provider of both long distance and Internet backbone service, MCI is uniquely positioned to devise a solution.

With this in mind, earlier this year, MCI introduced Vault: a class of products that allow for the interworking of packet and circuit-switched networks. While some persist to believe in the fiction that IP telephony will sound the immediate death knell of the Switchnet, Vault technology recognizes the reality of incremental change.

Imagine that the Internet and the "Plain Old Telephone System" are two tapestries hanging side by side. On the one hand you have the Internet, a network that is dynamic and flourishing; on the other we have the venerable telephone system, as ubiquitous as it is reliable.

Now imagine if we take apart these tapestries and reweave them together one strand at a time, so the two are indistinguishable from one another. That's what Vault is all about, making the telephone system and the Internet work together invisibly and in concert. That may mean data, voice, video and audio all on the same line, or multiple lines—with the customer unconcerned about just how that is achieved.

Think of Vault as a down payment on the communications revolution. That's because Vault will enable a variety of new and powerful communications services like: find-me, follow-me, never-busy fax, and the multimedia mailbox. In practical terms this means that someday soon, one will be able to specify in simple terms how email, fax messages, pages, telephone calls and voice mail messages are to be captured and brought to one's attention.

It is easy to see what sort of applications will arise with this new capability. Consider a traveling executive who today is forced to choose between using the single phone jack in a hotel room for access either to email or for a voice call. Soon, this is a compromise one won't be forced to make anymore.

We can also expect new applications to develop for web pages. Already, some carriers have introduced a feature where clicking on a web button will alert an operator to place a call to a customer over the Switchnet. With Vault, an operator in a call center will actually initiate a voice link with a customer over the same line that carries the IP connection. In addition, the operator will also be able to determine what web page the customer initiated the call from, and be able to "push" both web pages and files directly to the customer's desktop.

This is not to say that pure voice applications will not develop. On the contrary, IP telephony presents some distinct advantages in an intracorporate setting. PCs on a LAN are always online. In addition, routing voice over a LAN can be done at a very low incremental cost. A single call adds only about 10 Kbps half duplex, or only about 0.3 percent of a T1 line. In addition, calls to and from the Switchnet can be routed on an existing Private Branch Exchange (PBX).

With the incredible growth of corporate intranets, it seems that this market presents a tremendous target of opportunity for the proponents of IP telephony.

The New Landscape
In the future, just how will we transport voice? At least for the near-term, it is clear that both packet switching and circuit switching will be used. There is no reason why a PC can't coordinate a PSTN call with a shared application over the Internet. In addition, nowhere is it written that voice must travel over the Internet. A PBX can decode how phone calls will be routed—and a PC can do the same.

As new applications are developed that better integrate the two networks, we can expect absolute usage of both the Internet and the Switchnet to continue to increase. One example of a service that recognizes this need is BT's "Passepartout"—named for the character from Jules Verne's *Around the World in Eighty Days*. Compatible with the popular Internet conferencing tool, Net Meeting, Passepartout seamlessly integrates the functions of both networks by utilizing the Switchnet for the audio portion of a conference, while routing the graphics and data over the Internet.

As for the future of IP telephony, it is critical to remember that this is fundamentally not an economic issue. The use of IP telephony will be spurred not by simple cost savings, but by the implementation of innovative new services. This in turn will encourage new, not replacement communications, and create incredible business opportunities for the carriers, both international and domestic, who embrace these changes. It is only the service providers who see IP telephony as a threat and not an opportunity, who have anything to fear from its development.

Vint Cerf is the Senior Vice President for Internet Architecture and Engineering at MCI Communications Corporation. Cerf is the co-inventor of the computer networking protocol, TCP/IP. He also served from 1992-95 as a founding member of the Internet Society.

Internet Protocol Gateways: Beyond the Cheap Call

by Esa Hirviniemi, Helsinki Telephone Company

"Internet protocol gateway" (IP-GW) is the generic name for a piece of equipment that connects calls between Internet protocol networks and telephone networks. This article explores how Internet Service Providers (ISPs), such as Helsinki Telephone Company's Kolumbus-services, can harness IP-GW technology for business purposes. The experiences and viewpoints presented here are particular to the Finnish environment, characterized by very high Internet usage and low telephony tariffs (see Figure 1).

Business Potential for IP Gateways

The major business potential for the IP-GW application is commonly thought to be the long distance and international telephony market, because IP-GW call charges are expected to be dramatically lower than the PSTN of today. In Europe, however, and especially in Finland, this scenario is likely to be less attractive. Due to competition in the Finnish market, call prices are already quite low, and the benefits gained by placing a call through an IP-GW might not be sufficient to compensate for the reduced quality of service.

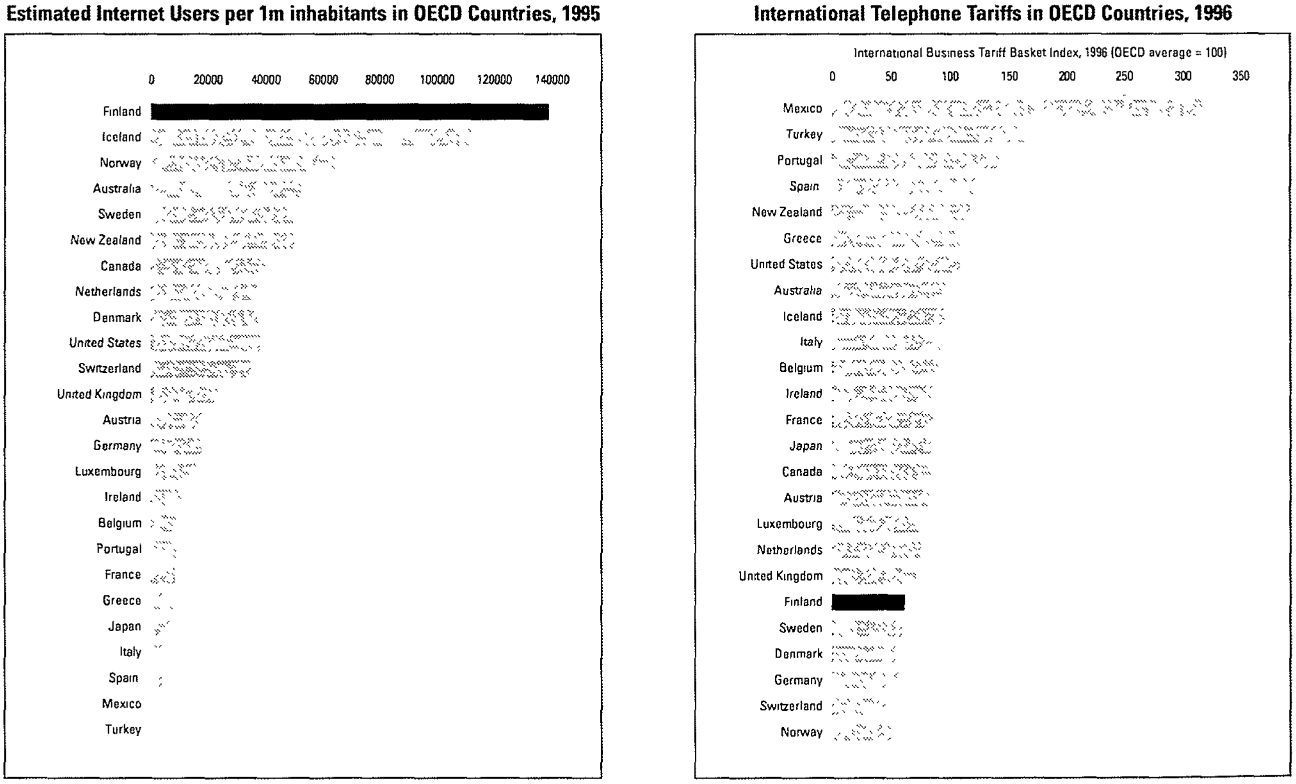
In certain niche customer segments, however, such as companies with very high overseas calling volumes, it could be economically viable to utilize IP-GW-based telephony solutions. Within an intranet environment, the customer could configure its operations in such a way as to avoid common problems of IP telephony (e.g., a worker's personal computer would always be open to receive calls).

Who Uses IP-GW?

The usage of IP-GW solutions discussed above is determined primarily by Internet access penetration, and secondly by the amount of multimedia-capable user equipment. Even though Finland has the highest Internet access penetration in the

Figure 1. Finland: Wired Nation

Estimated Internet Users per 1m inhabitants in OECD Countries, 1995 — **International Telephone Tariffs in OECD Countries, 1996**



Source: OECD/ITU

world, the user equipment, in most cases, must be upgraded to fully utilize Internet telephony solutions. These two considerations together suggest that the implementation rate of Internet telephony will be less dramatic than in other Internet business areas, such as the Internet access business itself.

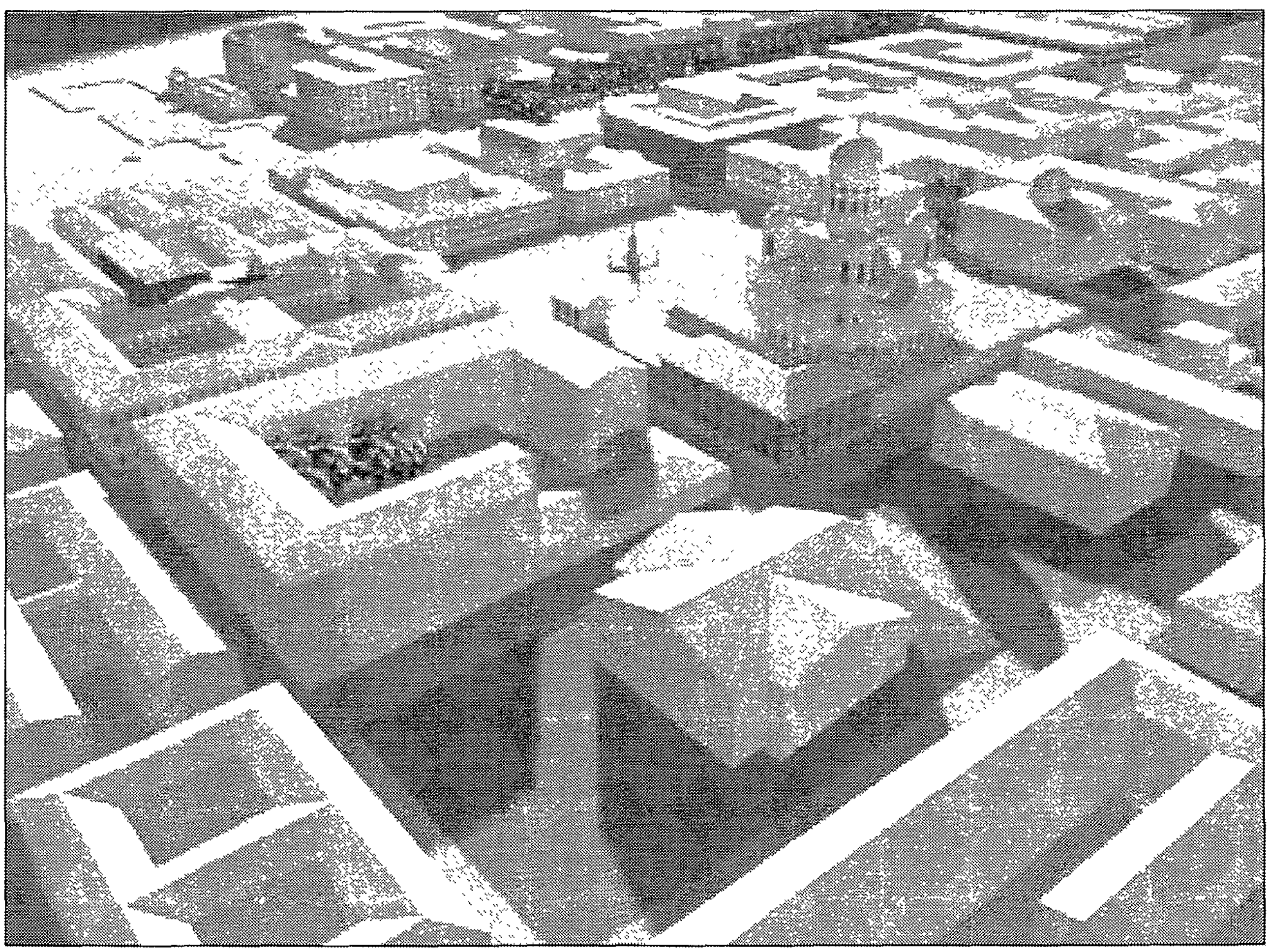
Because of the complexities involved in installing fully functional Internet telephony software on a personal computer, the pioneers will be technically-oriented users. This profile is likely to remain so for some time to come. We expect that around the year 2000—with upgraded equipment platforms and even higher Internet access penetration—the use of the IP-GW telephony solutions will begin to generate noticeable usage volumes. Our estimate for the year 2000 is that less than one percent of the international traffic out of Finland will be IP-based.

Application: Augmenting Call Center Services

IP-GW technology will allow companies to augment their already established call center services. The use of web pages as a company introduction and product overview tool could be enhanced by offering increased interactivity of the basic web service, providing a real-time dialogue between the customer and the company representative via IP-GW telephony. This way, the company could provide web-based services, parallel to those available through freephone telephony: product information, complaints, reservations, etc. From the point of view of a telecom operator, the implementation of this application would be easy, as the impact on the customer billing systems would be minimal.

In the future, it is likely that web-based applications would migrate towards fully IP based telephony solutions (i.e., IP-to-IP calls). For this to happen, the call center equipment would need to be able to process pure IP telephony in the same manner as traditional calls for functions like queues, call diversions, and announcements. Customer interaction would be enhanced to include not only speech, but also video, shared whiteboard, and community surfing. Such an industry shift would be gradual, and smaller companies probably would continue to use telephony-based equipment for a long while.

Figure 2. Virtual Helsinki



Source: Helsinki Telephone Company, http://www.helsinkiarena2000.fi

The Road from Here

Most probably, IP-GW applications will vary from country to country, and from operator to operator. In countries where call charges are relatively high, immediate benefits could be gained by bypassing the traditional public switched network with IP-based telephony solutions. In countries where the call charges are low, the focus of IP-GW implementation is likely to be value-added services, such as the augmentation of existing call center activities discussed above. In sophisticated markets such as Finland, they could be marketed as new tools for PC-minded persons to place calls, combined with additional applications such as video and shared whiteboards.

Telecommunication liberalization is increasing competition and forcing a reduction in the prices of all telecommunication services. For Internet telephony, this means applications in the long distance and international call market could be less attractive than is generally thought and, more importantly, of diminishing competitive advantage.

The Technology's Future

Several technical platforms for IP-GW functions have been under trial in Finland. The results so far indicate that the technological level of the products today provide sufficient capabilities for basic operations (i.e., converting speech samples from one format to another, switching the call), but are lacking the operational support a serious business enterprise would require. In most cases, the speech coding methods are proprietary, which considerably reduces the user-friendliness of the service and makes it difficult to plan for a wider business-oriented exploitation of the products. We expect that equipment supporting standardized speech coding (under ITU H.323) and more robust operational capabilities will become commercially available in late 1997 or early 1998. In the long run, our belief is that the IP-GW functionality will be integrated into the public telephone switch itself, as part of the IP-traffic handling functions.

Helsinki Telephone Company: Our Experience

In the spring of 1997, Helsinki Telephone Company implemented public trials of IP-GW telephony in various forms. The basic application was to use a personal computer to access a web page, from where a call could be initiated, and routed through the IP-GW to the public network, and finally to the normal freephone number of a call center. The IP-GW is also used as a part of the multi-million dollar Helsinki "Arena 2000" project, where a three-dimension model of the city of Helsinki was created on the world wide web (www.helsinkiarena2000.fi/summary). In the Arena 2000 web site, the buildings of several companies are equipped with a "telephone" icon, and clicking on the icon generates an IP-GW call to that company's call center (see Figure 2). Use of the current IP-GW equipment will be expanded in the autumn of 1997 to provide more permanent freephone access to call centers.

Esa Hirviniemi is a department head at Kolumbus-services, the Internet access service of Helsinki Telephone Company (www.hpy.fi). Helsinki Telephone Company is the largest private local telephone company in Finland and the largest member of the Finnet Group consortium. Mr. Hirviniemi can be reached by email at esa.hirviniemi@hpy.fi.

Internet Telephony for Established Telcos

by Elie Wurtman, Delta Three, Inc.

Delta Three is the first company to offer phone-to-phone Internet telephony services on a commercial basis. With Delta Three's phone-to-phone system, there is no need for a consumer to have a computer or an Internet connection. In its simplest implementation, phone-to-phone technology requires a user to call into a Delta Three Server and enter an authorization number; the transaction is similar to a calling card or prepaid card transaction. The Delta Three Server converts the analog voice into data packets and routes the data over the Internet to another Delta Three Server in the destination city. The data is converted back to analog format and switched to the local phone network as a local call.

Delta Three's Global Network

The company has created a global network over which it routes voice traffic, fax traffic and offers value-added services. Since the voice quality is dependent on the level of traffic being sent over the network, Delta Three's backbone network is a managed intranet with many gateways to the Internet.

The company has grown quickly by working with telcos. Cooperation with telcos takes two forms: selling Delta Three Carrier Services for voice calls on a bulk per-minute basis and entering into partnerships which add new points of presence (POPs) on the Delta Three network.

Delta Three's approach has been significantly enhanced by its recent strategic alliance with RSL Communications, a fast-growing international telco with operations in the U.S., Europe, Asia, and South America. RSL Communications is also a major Delta Three shareholder.

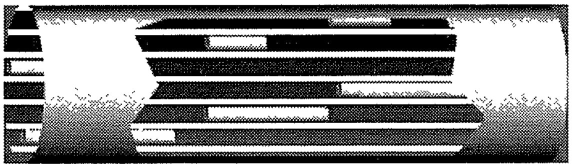
As of September 1997, Delta Three POPs were located in the U.S., Israel, U.K., Russia, Singapore, Paraguay, Colombia, Australia, Japan, Philippines, Hong Kong, and France. POPs were under construction in Mexico, Argentina, Brazil, Ecuador, El Salvador, Nicaragua, Malaysia, Korea, and China.

Delta Three is the first commercial voice and fax network to utilize packet switching technology. Traditional telephone carriers

Figure 1. Efficiency of Internet Protocol Packets

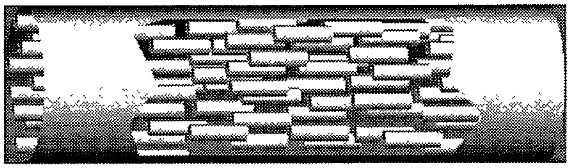
Switching

- Dedicates capacity of channels for duration of connection
- Uses available capacity inefficiently



Routing

- Available transmission capacity shared by all information
- More efficient utilization of capacity (no individual channels)



Source: Delta Three, Inc.

employ circuit-switching technology, whereby a point-to-point channel must be reserved for a conversation. The reservation must be for the maximum bandwidth of the conversation, causing the channel to be under-utilized for most of the time.

Additionally, circuit-switched networks employ large switches that require an intensive amount of coordination between switches, requiring telcos to set up a separate data network between the switches in addition to the primary voice network.

The Delta Three system, employing packet technology, utilizes infrastructure with much more efficiency than traditional circuit-switched telephony. There are no reserved channels. All data is routed over one large channel that can therefore be densely packed. Since each data packet is encoded with its destination address, the system required for routing data is greatly simplified. Low-cost routers replace expensive switches, and no separate signaling network is required (see Figure 1).

Utilization by PTTs and Telcos

Delta Three provides carrier services to telephone operators by interfacing its servers to standard telco switches. The switch treats the Delta Three Carrier Service as another routing option on the least cost routing table. By utilizing Delta Three Carrier Services, telcos typically save over 50 percent on standard carrier rates on expensive international routes.

Telephone companies are faced with unprecedented competitive challenges in today's markets. Callback is currently taking as much as 30 percent of the international phone traffic in certain countries and most carriers will soon face deregulation of their markets.

Box 1. It's for You, Mr. Commissioner

Delta Three demonstrated the use of Internet telephony for international calling when Federal Communications Commission Chairman Reed Hundt used only a standard (government issue) telephone to make an international call from his office on March 14, 1997. The call was routed over the Delta Three Global Network to its final destination at the Delta Three offices in Israel. He had this to say:

> *Today I made a phone-to-phone call using a new service called Delta Three . . . Internet Telephony is nothing new. However, [Internet] phone-to-phone is new . . . It is significant in that it allows the poorest customers—those who are the least likely to have computers and Internet access—to use the Internet ... and make affordable international calls.*

Source: Delta Three, Inc.

Figure 2. Internet Telephony Branding

	Established Telco	Call Back/ Alternative	Internet Telephony
Voice Quality	Premium	Premium to standard, depending on compression	Standard
Service Levels	Premium	Average	Average to high, depending on bandwidth available
Price	Premium	Discounted	Heavily discounted

Source: Delta Three, Inc.

Delta Three is working with a number of telcos in creating new service brands based on Delta Three Carrier Services. This brand is positioned as a low-cost, standard quality service that does not compete with the operators' premium brand. Rather, it competes with alternative services such as call-back and new market entrants. It effectively squeezes out these competing services by trapping them in a middle-of-the-road segment that offers neither great price nor premium quality.

Elie Wurtman is President of Delta Three, Inc. He can be reached by e-mail at: elie@deltathree.com.

Internet Telephony in the Mainstream Market

by David Rosenthal, VocalTec Communications Ltd.

In 1995, VocalTec introduced Internet Phone, the first commercially available Internet telephony product. Originally, Internet Phone enabled real-time audio communication between individual computers running VocalTec's software on Internet Protocol (IP) networks. Now, IP telephony has a host of different devices, services and networks enabling anyone, regardless of technical proficiency, to take advantage of IP telephony.

VocalTec launched its Telephone Gateway product in 1996. Targeting corporations, value-added resellers, and Internet Service Providers (ISPs), Telephony Gateway is a server which bridges the Public Switched Telephone Network (PSTN) and IP networks, enabling calls to be made phone-to-phone, fax-to-fax, and PC-to-phone, over the Internet or private intranets.

In 1995, VocalTec's half million users represented 94 percent of the Internet telephony software market, then valued at $3.5 million (International Data Corporation). A July 1997 Frost & Sullivan study entitled "World Internet Telephony Product" reported that VocalTec had captured almost 79 percent, by revenue, of the carrier segment of the Internet telephony gateway market and 79 percent of the consumer segment of the Internet telephony client market in 1996.

Applications

IP technology delivers three main benefits for end users: price, flexibility, and adaptability. These benefits are utilized by both business and residential customers. For example, a corporation's data networks are priced by capacity, instead of the cost per-minute basis of circuit-switched networks. By compressing analog signals into digital packets, Internet telephony products can significantly reduce the expense of standard voice calls. Because the same network can carry voice and data simultaneously, companies can consolidate their communications facilities, while still retaining their flexibility to process ever-changing proportions of voice and data traffic. Furthermore, because IP is a "smart" network, it easily adapts to video, voice mail, conferencing, messaging, data-sharing, and directory services, which can all be integrated into a company's phone services.

Services for residential customers are funneled through Internet Telephony Service Providers (ITSPs). The goal of ITSPs is to offer Internet telephony service (via PC or standard telephone) at a lower price than standard circuit switched telephony service. For example, Internet Phone 5 contains PC-to-phone features that enables calling to standard telephones using the Telephony Gateway. Users of Internet Phone sign up with ITSPs using Internet Phone's browser-based directory. Once the sign-up procedure is authenticated, Internet Phone is modified to include routing information that will enable a connection to the location of the closest terminating gateway to the target telephone number. Phone-to-phone calling resembles the process of credit card calling; the user dials an access number and reaches the Telephony Gateway's Interactive Voice Response System (IVR). The user is prompted to enter the target telephone number, and the call is routed through an IP network to the gateway closest to the terminating telephone number.

Enhanced Profitability

VocalTec anticipates that major telephone companies will add Internet telephony options to their existing calling plans. Consumers will be able to choose Internet telephony service for a lower price than regular PSTN service, and the telephone companies will benefit from lower overhead and maintenance costs associated with Internet telephony. VocalTec has already met with success in this area; several carriers are marketing the products, among them, DACOM International, Telecom New Zealand, and Telecom Finland.

In Spring 1997, VocalTec announced that Motorola would license and market Telephony Gateway and Internet Phone to

Box 1. Standards Development

VocalTec is a founding member of the Voice over IP Forum (VoIP) of the International Multimedia Teleconferencing Consortium. The company's principal technologist, Dr. Scott Petrack, is co-chair of the organization, which was founded in May 1996 to ensure and promote industry-wide interoperability of Internet voice communications products. Within the VoIP forum, VocalTec has been developing its Call Management Agent (CMA) technology, a technology expected to be extremely important to the development of truly rich and useful IP-based telephone products.

VocalTec has also been very active in the development of the emerging International Telecommunication Union (ITU) H.323 system, which began as a standard for audio/video telephone service over a local area network, and in the past year, has expanded to wide area networks as well. VocalTec has contributed its expertise in Internet communication and parts of its CMA technology to this international standards body.

Source: VocalTec

corporate clients. AT&T joined up with VocalTec in July 1997, announcing that VocalTec would supply technology and software to ITXC, a jointly funded AT&T start-up which plans to provide interexchange services to ITSPs.

VocalTec has also launched a PC-to-phone calling network provided by their ITSP customers, with support from Motorola, Dialogic, ITXC, Compaq, and DEC. Initially, the network links nine ITSPs, with connections from the Internet to the PSTN in 18 countries. VocalTec's innovations in Internet telephony were rewarded in August 1997, when Deutsche Telekom announced that it would purchase more than $30 million worth of VocalTec products and services over the next 30 months, and would acquire a 21.1 per cent stake in the company.

Enhanced Productivity

As telephone companies lower their rates, profitability motives for using IP telephony will lessen. However, people will continue to turn to IP telephony because its native intelligence aids productivity by enhancing communication. Video, file transfer, and interactive conferencing whiteboards are possible with Internet Phone 5. Atrium is a fully integrated client-server conferencing suite featuring data, application and audio conferencing for up to 150 users at a single time, enabling them to discuss, edit, annotate, and then download conference documents. Atrium conferences support multiple clients such as telephones, web browsers, Internet Phone users and Internet Conference Professional users.

Interoperability Standards

In the next year, we expect new international standards to drive a huge growth in the Internet Telephone market. Standards-based technologies make wide deployment possible, giving customers the freedom to choose the best solution from a field of competitors. Adherence to an international standard means that any Internet Phone user can talk to the user of any other Internet telephony product.

VocalTec recognizes that the real promise of IP-based telephony lies in the added functionality of new extra features—features including integration with Web-based voice mail, multi-party collaboration, and multimedia supplementary services (call waiting, call transfer, etc.). The company places a high level of importance on enabling all of these new features in a standard way so that the customer can be certain that his or her system works as a whole (see Box 1). Internet Phone 5's open architecture supports the TrueSpeech, GSM and VocalTec's own VCS data compression algorithms and selects the optimal method depending on the call. Internet Phone can support multiple standards simultaneously, giving it the potential of being the universal Internet telephony client.

Network Convergence and the Future

The future of telecommunications will be a convergence between traditional telephony and packet switched telephony. IP telephony has the advantage of efficiency, productivity and advanced multimedia. Standard telephony has the advantage of 125 years of entrenchment and the fact that telephone lines reach everywhere in the world. In the future, IP telephony will be transparent to the user; voice may be traveling over IP networks without the user's knowledge. Today you can never be sure whose phone lines your voice is carried over; tomorrow, you won't know what kind of network it is being carried over.

Box 2. Bandwidth Consumption

Bandwidth and voice quality are usually inversely proportionate, and several issues affect the quality of voice signals and the amount of bandwidth they take up on an IP network. The first is the sampling rate; this rate is found in all analog to digital conversations and is the measure of how many samples are taken in a single second. Conventional wisdom holds that a sound should be sampled two times its frequency range per second in order to receive perfect quality. The human voice has a frequency range of approximately 300 to 4300hz. Therefore, in order to sample "true voice," a digital sample has to take place 8000 times a second, or at an 8khz sampling rate. Generally speaking, voice sampling above this rate is overkill and a waste of bandwidth, and sampling below this rate will negatively affect voice quality over any digital network.

Once the analog to digital conversion has taken place, the voice is encapsulated in IP, a process that occurs roughly once every 25 milliseconds. IP encapsulation is the process whereby the data is converted into a format that can be transmitted over an IP network. Encapsulation wraps the data for transmission, including in each packet the initiating and terminating IP address, transmission time, and packet size. Every IP telephony device handles the issue of sampling and transmission differently. VocalTec's products utilize special algorithms to reduce the amount of bandwidth that the application consumes. A silence suppression algorithm limits the amount of dead air samples that are transmitted over the IP network. A compression algorithm is used to allow more information to flow over networks taking up less space. Utilizing these technical refinements, VocalTec has been able to reduce bandwidth to below 8kbps per second for an average conversation.

Source: VocalTec

David Rosenthal is an online marketing communications specialist for VocalTec Communications, Inc. He has a background in sound processing, IP networks and Internet related applications. He can be reached by email at David_Rosenthal@vocaltec.com.

Internet Traffic and Maps

A Cybermap Atlas: Envisioning the Internet

by Martin Dodge, University College London

William Gibson's evocative and oft-quoted description of cyberspace is:

> *A consensual hallucination experienced daily by billions... A graphical representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the non-space of the mind, clusters and constellations of data.*
> —Neuromancer (1984)

Cybermaps are essentially the graphical representation of data that have some form of spatial structure or arrangement. This article reviews some of the most interesting and informative cybermaps currently available and, in a sense, is a cybermap atlas. It builds on previous efforts by TeleGeography to survey the work of cyber-cartographers, particularly John December's "Cybermap Gazetteer" (*TeleGeography 1995*).

A diverse range of cybermaps are being created today, most by people working outside the traditional mapping sciences. Some cybermaps use the conventions and appearance of real world maps but many others are more abstract in form because they dispense with notions of formal geographic location and distance. It is questionable whether some of the most abstract cybermaps would be recognized by real-space cartographers as

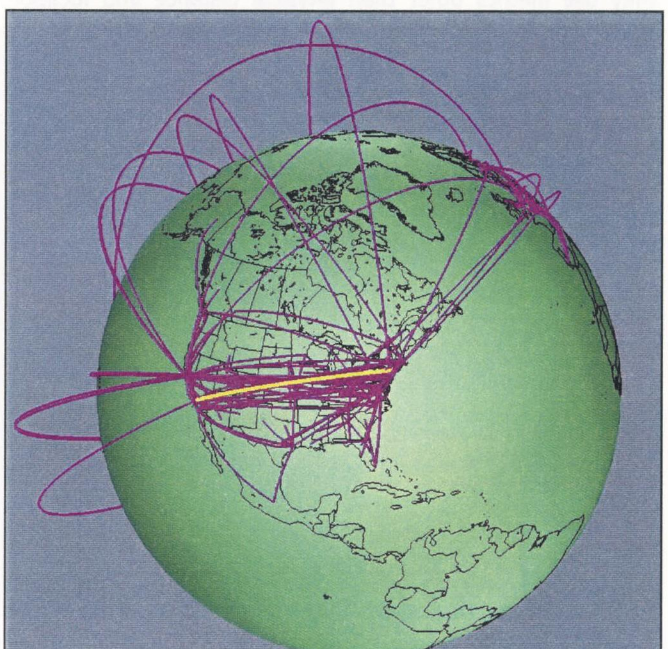


Figure 1. Global MBone Map

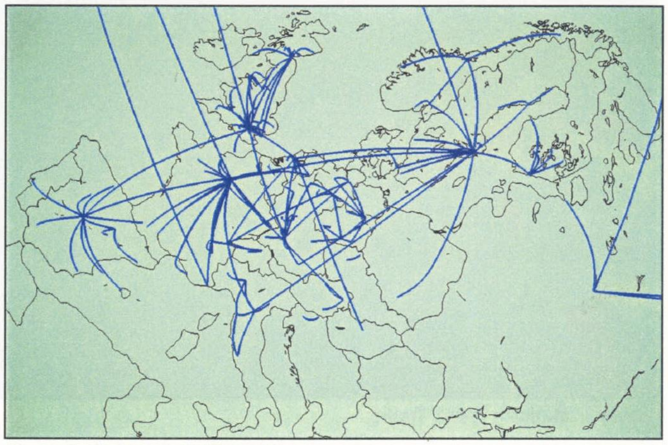


Figure 2. Continental MBone Map

maps at all. Yet, all the cybermaps examined here are intended to function as maps. That is, they are designed to aid our comprehension of the electronic land of cyberspace, its shape, patterns, landmarks and extent, and of course to help us navigate this realm more easily.

I will begin by considering some graphics that map elements of cyberspace using conventional geographic metaphors such as country boundaries, geographic coordinates (latitude and longitude) and physical distance. Geographic metaphors are useful for mapping cyberspace for two reasons. Firstly, they are a form of map representation that we are most familiar with and can, therefore, easily interpret and use. Secondly, by mapping the intersection and relations between cyberspace and real space we may reveal useful characteristics of the emerging information society. As more activities and transactions occur in cyberspace, the physical world may be impacted: for example, the impact on real-world retailing with the predicted rise of cyber-shopping.

Infrastructure Maps

The location of the Internet's infrastructure, such as computer terminals, servers, wires and switches are a common subject for cybermaps. Network infrastructure maps are available elsewhere in this edition of *TeleGeography* (see page 77) so we will not review this class of cybermap here. In addition, two good sources of Internet Service Provider (ISP) backbone maps are Russ Haynal's Web page collection (navigators.com/isp.html) and *Boardwatch Magazine's* series of maps (www.boardwatch.com/isp/backbone.htm).

Figure 3. Mapping WWW Traffic

Mapping Internet Routes

I will turn now to cybermaps which seek to plot Internet routes on a 3-dimensional globe. A group of computer scientists led by Tamara Munzner (Stanford University) and Kimberley Claffy (National Laboratory for Applied Network Research) are mapping the global topology of the Internet's Multicast Backbone (MBone) Network (see Figures 1 and 2). The MBone is really a network in a network; it uses special routing computers and software to create high capacity links on the Internet for video conferencing and other high bandwidth point to multipoint (broadcast) transmissions.

The MBone routers are geographically located and mapped onto the globe. The network linkages between them are represented by arcs traversing the world. These maps seek to provide a new means of visualizing the complex network topology of the MBone so as to identify potential problems, such as route redundancy, which are not obviously apparent from text lists of routers and their interconnections. Their MBone cybermaps are also available as three-dimensional models which can be downloaded and interactively viewed. The models are created in VRML (Virtual Reality Modeling Language), a powerful Web-based language for presenting three-dimensional objects. More details on this research and the 3D MBone cybermaps can be found at www.nlanr.net/Viz/Mbone.

Mapping WWW Traffic

Another fascinating series of global cybermaps were constructed to visualize the geographic sources of World-Wide Web traffic (see Figure 3). These cybermaps were produced by Stephen Lamm, Daniel Reid and Will Scullin (University of Illinois). They use stacked bar charts rising from the Earth's surface to show the approximate origin of the traffic. They then mapped hits (data requests) made on the National Center for Supercomputing Applications (NCSA) Web servers. The height of the bar represents the volume of traffic and the color bands represent different types of data requested.

The mapping effort is part of a larger project to monitor and analyze, in real-time, the patterns of traffic on Web servers so as to improve Internet performance. However, the cybermaps are also potent visualizations of the real world locations of the major traffic sources. Large cities such as New York, with extensive information industries and a "wired" populace, stand out. Web traffic "skyscrapers" rising above the Earth powerfully demonstrate the concentration of cyberspace as a geographic phenomenon. To learn more, visit their Web site at: www-pablo.cs.uiuc.edu/Projects/Mosaic/WWW3.

John Quarterman and his company, Matrix Information Directory Services (MIDS), are leaders in mapping the Internet and other computer networks (see www.mids.org). One of Quarterman's most interesting cybermaps is called the Internet Weather Report (IWR). Quarterman describes the IWR as "a sort of radar scan of the Internet during its daily work." It provides dynamic maps of the condition of the Internet measured by timing network latencies (round trip message times) six times a day from MIDS to over four thousand domains worldwide. For samples and a full description of the IWR, see "The Internet Weather Report" on page 69.

Information Landscape Maps

The next set of cybermaps addresses the content of the Internet such as the World Wide Web (WWW). These cybermaps use a variety of map metaphors and graphical styles. They tend to be more abstract than the examples we have seen so far because they use metrics other than physical distance and location.

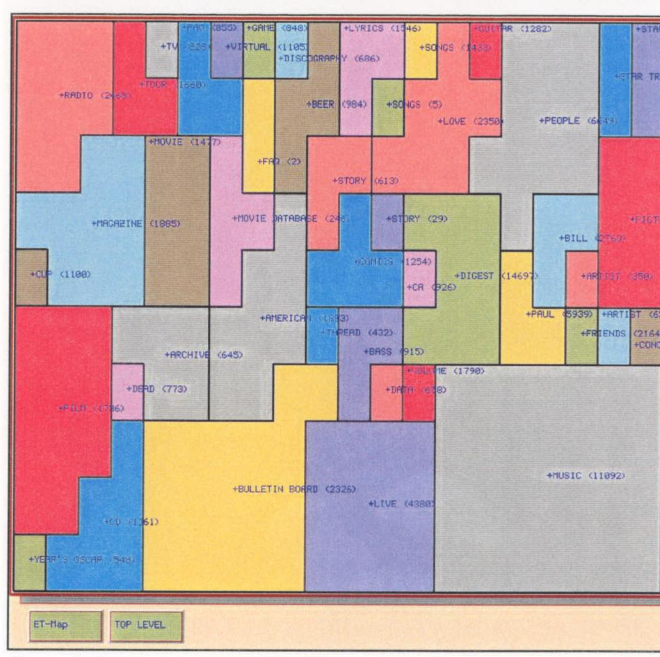


Figure 4. Entertainment Land Use Map

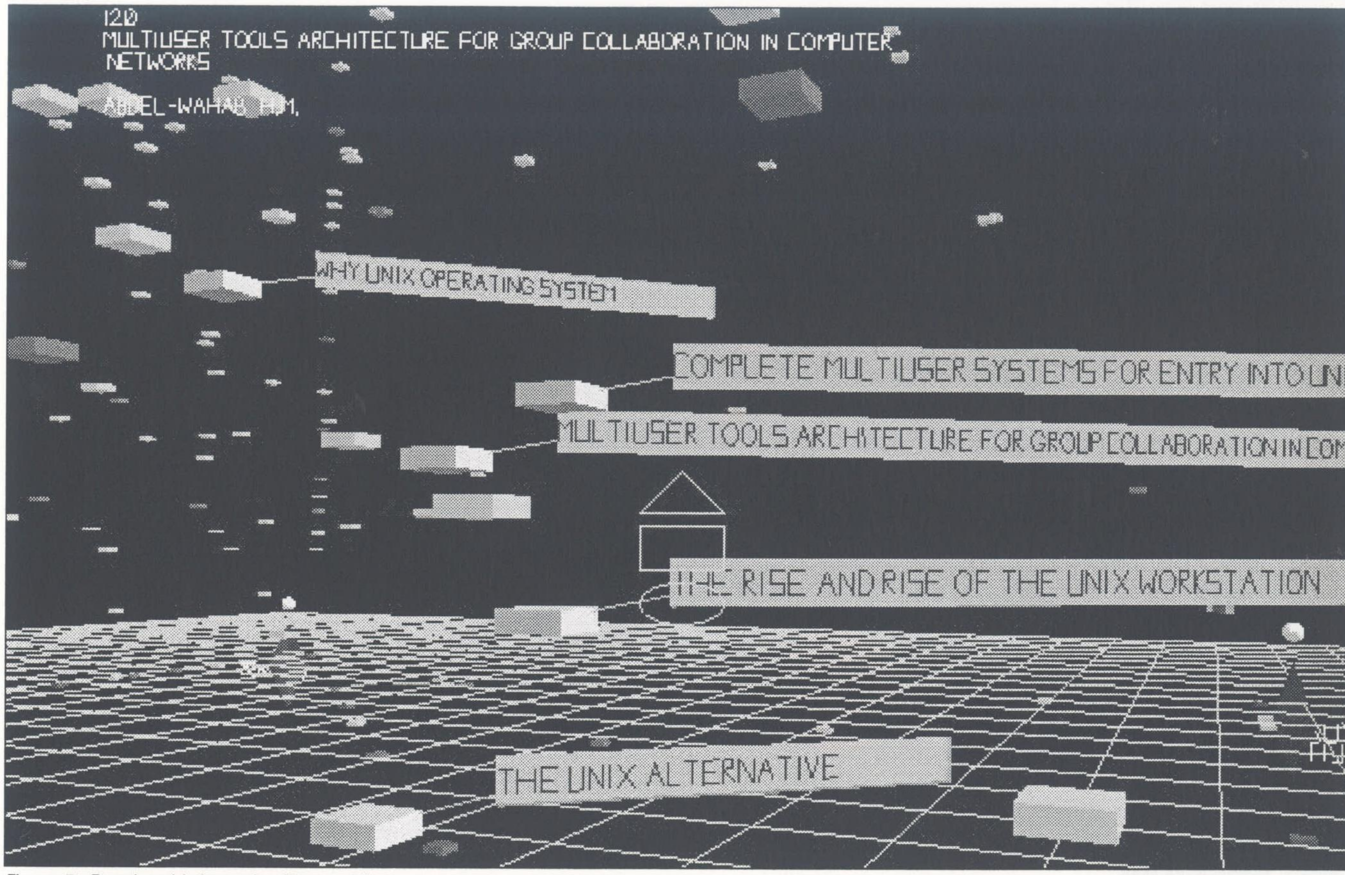


Figure 5. Populated Information Terrain Map

Much of the work in mapping information space is being undertaken by computer scientists working in scientific visualization, data-mining and virtual reality. Their aims are often to provide navigational aids in form of cybermaps to help people exploring and searching large, complex information spaces.

One promising approach toward mapping information space is the creation of land-use maps of information on the Web. These are similar in appearance to conventional land-use maps created by urban planners to zone cities. In these maps plots of "land" represent different information domains, with the size, color and position of the plots used to represent key characteristics of that domain. "ET-Map," shown in Figure 4, maps the information space occupied by the Uniform Resource Locators (URLs) of over one hundred thousand entertainment-related Web pages. It is one of a number of information land use cybermaps produced by Hsinchun Chen (University of Arizona). For more information and a chance to try out "ET-Map" go to ai.bpa.arizona.edu/som/et-map. A similar approach has been developed by Xia Lin (University of Kentucky) and can be seen at lislin.gws.uky.edu/Sitemap. Lin's "Sitemap" maps part of the Web space relating to astronomy and space science in Yahoo's hierarchical catalog.

Many cybermaps use three-dimensional landscape metaphors to map elements of cyberspace. These examples are quite unusual in nature, but they suggest the interesting possibilities of 3D cybermaps in representing information. To use these cybermaps properly, you need to interact with them in three dimensions—walking or flying through the landscapes—to gain an understanding of the information they present. They are drawn using virtual reality technologies. Consequently, the flat, static pictures presented here do not fully convey the visualization power of these cybermaps on a computer screen.

The first example is an information visualization technique called "Populated Information Terrains" (PITS) being developed by Dave Snowdon and colleagues (University of Nottingham). A screen-shot of their 3D information cybermaps is shown in Figure 5. Different elements of information are represented as

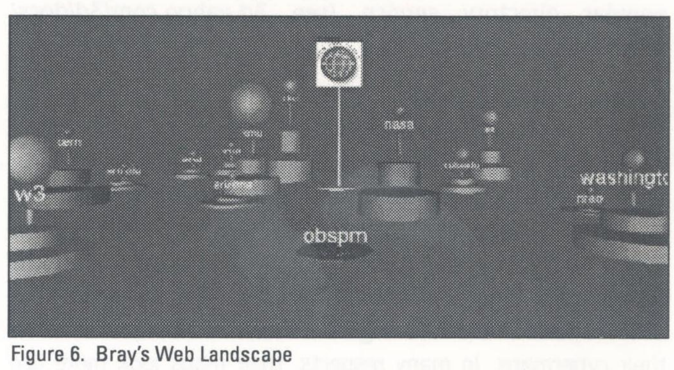


Figure 6. Bray's Web Landscape

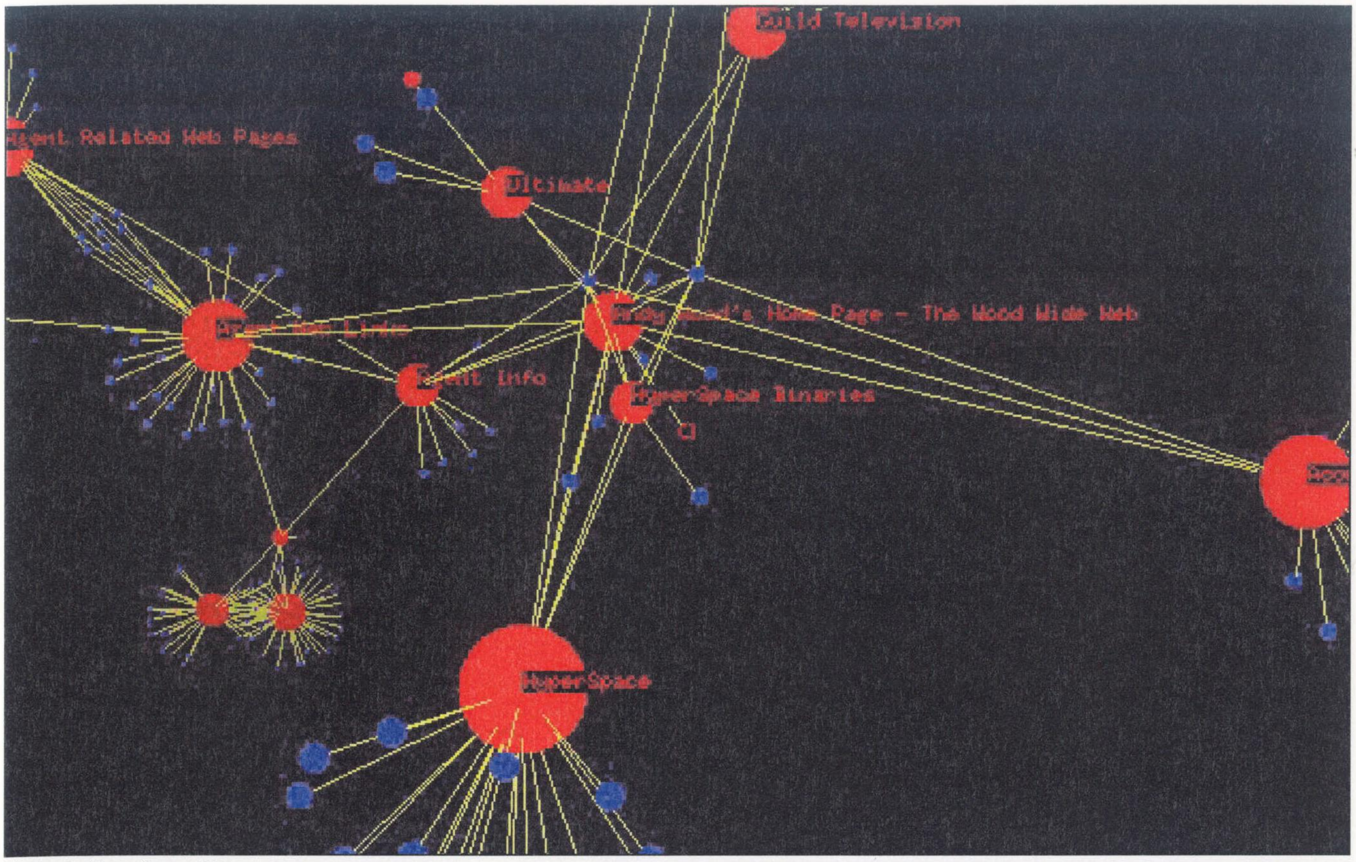


Figure 7. HyperSpace Map

bricks floating in a virtual landscape. Multiple people can use and explore the PITS landscapes at the same time (see www.crg.cs.nott.ac.uk/crg/Research/pits/pits.html).

Tim Bray (Open Text Corporation) mapped Web space as an artificial three-dimensional landscape with landmarks representing individual Web sites (see Figure 6). The shape, size and color of the landmarks represent characteristics of the Web sites such as their size in terms of the number of pages and hyperlinks to them. These characteristics were calculated from metrics derived from the OpenText search engine. For more information, see, "Measuring the Web," presented at the Fifth World Wide Web Conference (www5conf.inria.fr/fich_html/papers/P9/Overview.html). A final example of this genre is Yahoo! 3D—a three dimensional rendering of portions of the popular directory service (see 3d.yahoo.com/3d/docs/bridge.html).

Mapping Web Topology

The connections between the tens of millions of pages in the WWW give it a complex network structure. Cybermaps have been created to reveal the Web's topology. For example, the HyperSpace World-Wide Web Visualizer developed by Andrew Wood and colleagues (University of Birmingham) produces sophisticated three-dimensional topology maps of the structure of small parts of the Web. Figure 7 shows an example of one of their cybermaps. In many respects, their maps look more like molecular models used by chemists rather than conventional maps. Spheres represent Web pages and connecting lines show the hyperlinks between them. Self-organizing processes, using the notions of attraction and repulsion, are used to evolve the often complex and chaotic structures of the Web into more intelligible forms, so that similar information is clustered togeth-

Figure 8. Apple Web Site Map

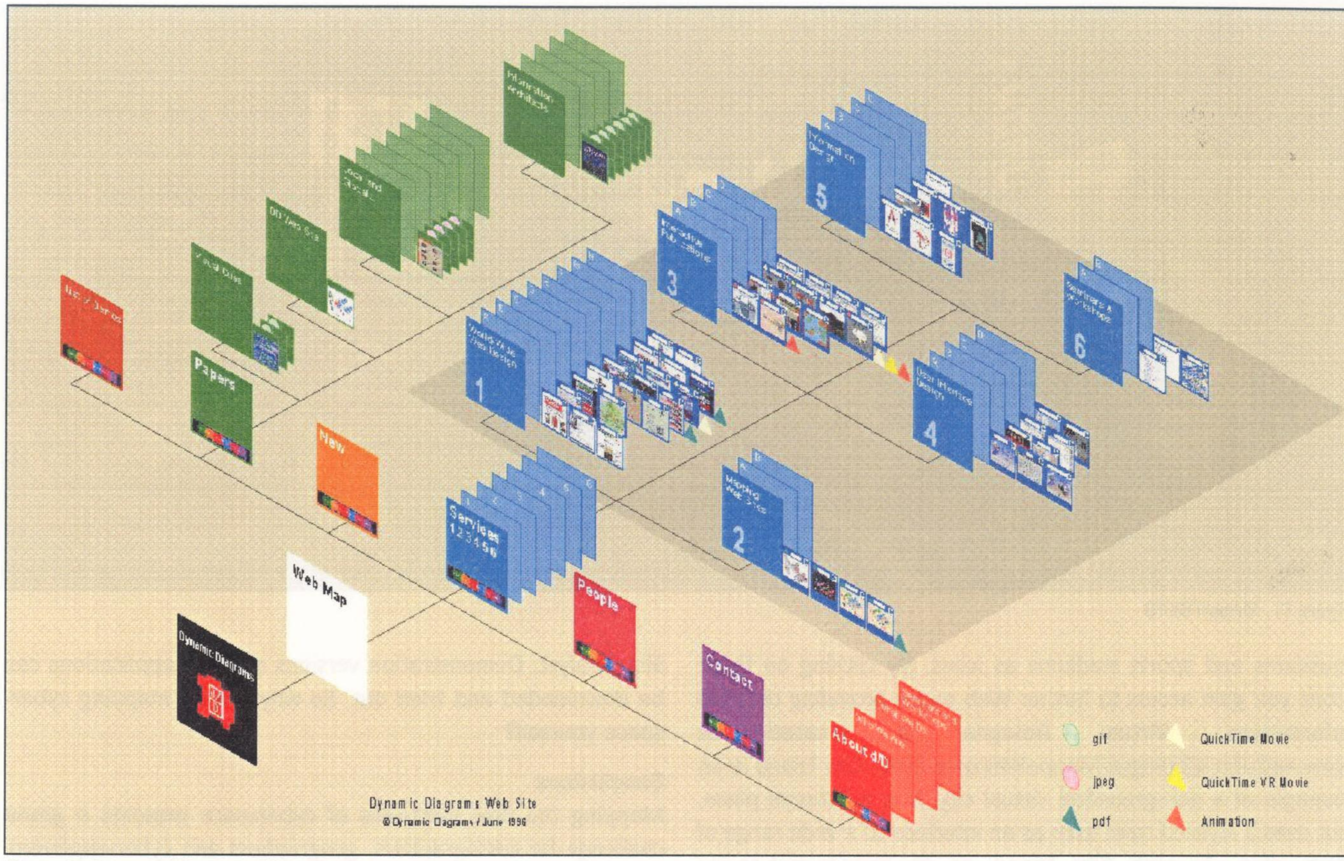


Figure 9. Dynamic Diagrams Map

er into regions. Details on the HyperSpace system can be found at www.cs.bham.ac.uk/~amw/hyperspace.

Mapping Web Sites

Another broad category of cybermaps comprise Web site maps. They can be particularly useful in assisting visitors browsing large, complex Web sites, providing an instant visual picture of what information is available and where to find it. Many site maps on the Web are arguably just organization charts, but they do serve as useful cybermaps. A good example of an organization chart-type site map is Apple's Web site map (see Figure 8) at www.apple.com/main/find.html.

A variety of innovative commercial products are becoming available for Web site developers to generate their own site maps and distribute them to the browsing public. For example, Dynamic Diagrams, Inc. has a product called MAPA, which was used to create the example shown in Figure 9. Sites are mapped in a view similar to a library card index, with individual Web pages sticking up like cards. Visit www.dynamicdiagrams.com for more details.

The Virtual City Cybermap

The city is being used as a metaphor to map information and services on the WWW in what are termed "virtual cities." The "city" interface provides a coherent framework for organizing collections of services, activities and community resources at a single point in cyberspace, just as real cities are a focal point in physical space. As well, the city is a spatial structure familiar to most people and therefore can be used as an effective metaphor for structuring and organizing information resources in a way which places people at ease.

Virtual cities can be categorized in two types —grounded and non-grounded. Grounded virtual cities are digital counterparts of real cities or towns; non-grounded cities exist only in cyberspace.

The city of Bologna has an excellent virtual equivalent on the Web. Figure 10 shows the interface to virtual Bologna, a nicely designed city map, using familiar urban features, like shops,

Figure 10. Virtual Bologna

Figure 11. VirtualTOKYO

museums and sports stadiums as icons. By clicking on these icons you gain access to further Web pages providing detailed information. Virtual Bologna is located at www.nettuno.it/bologna/MappaWelcome.html. City Island is an example of a non-grounded virtual city. It is a fictional place, but uses a stylized town map as an interface to a wide range of Web sites. To visit City Island go to www.taynet.co.uk/~gdx/mellanta/fd/cityisle/index.htm.

Although virtual Bologna is a grounded virtual city, the map interface does not attempt to model the real layout of Bologna. However, virtual cities are being constructed which are trying to model the urban form as well as providing an information interface. VRML provides the tools to construct the buildings of virtual cities. One example is VirtualTOKYO, a screen-shot of which is shown in Figure 11, created by Planet 9 Studios (www.planet9.com/earth/tokyo/index.htm). Another under development is Virtual Helsinki (www.helsinkiarena2000.fi), which is profiled on page 54.

Try Mapping Cyberspace Yourself

Commercial applications are becoming available to draw topological maps of Web structures. These are marketed primarily for the management of large Web sites, but they can also be used by cyberspace explorers to map Web spaces. Examples of the applications include CLEARweb, Visual Web and Microsoft's Site Analyst. Demonstration versions of these applications can be downloaded and tried out. So why not try mapping cyberspace yourself?

Conclusions

Mapping the new territories of cyberspace presents a grand challenge for cartographers, geographers and cyber-explorers. Hopefully this review will have acquainted you with the current state of the art in cybermaps. To keep up to date on the work of cyber-cartographers in mapping cyberspace we recommend you consult "An Atlas of Cyberspaces" at www.geog.ucl.ac.uk/casa/martin/atlas/atlas.html. A great deal of effort is being expended in mapping cyberspace, particularly in the field of information visualization. New forms of measurement and mapping are being developed to make cyberspace comprehensible for its citizens. It is likely that the resulting cybermaps will not look too much like the maps we are familiar with, but they will serve the same purpose of helping people understand the world they inhabit, be it real or digital.

Martin Dodge (m.dodge@ucl.ac.uk) is a researcher in the Centre for Advanced Spatial Analysis (CASA), University College London, and the curator of "An Atlas of Cyberspaces," at www.geog.ucl.ac.uk/casa/martin/atlas/atlas.html.

The Internet Weather Report

by John Quarterman, MIDS

The MIDS Internet Weather Report (IWR) presents daily animated geographical maps of delays in the Internet. The IWR is like daily newspaper or television weather radar reports, except instead of being about real world meteorology, it is about conditions inside the Internet. The IWR is presented in geographical maps that show round trip times (latencies) of data packets sent from our offices in Austin, Texas to thousands of Internet domains worldwide, currently every four hours, six times a day, seven days a week.

Latency

Latency is round trip time there and back again. We send a signal, or ping, to an Internet node and measure the time it takes for a response to return. We repeat this five times for each node and take the average as the latency for that node. Then we collect all the average latencies for all the nodes for each scan, and make a geographic map for that scan. Finally, we use the Java programming language to animate the six maps for each day.

The latency scale is indicated in the legend in the upper left of each map. The unit is the millisecond, so 1000 indicates one second. The smallest circles represent a latency of 100 milliseconds (fast enough to be in the same room); the largest stand for 5000 milliseconds (slow enough to be unusable). In other words, small circles indicate good Internet performance, and big circles indicate problems in the Internet.

Figure 1. Internet Weather Report for Continental United States, 8 Sept. 1997

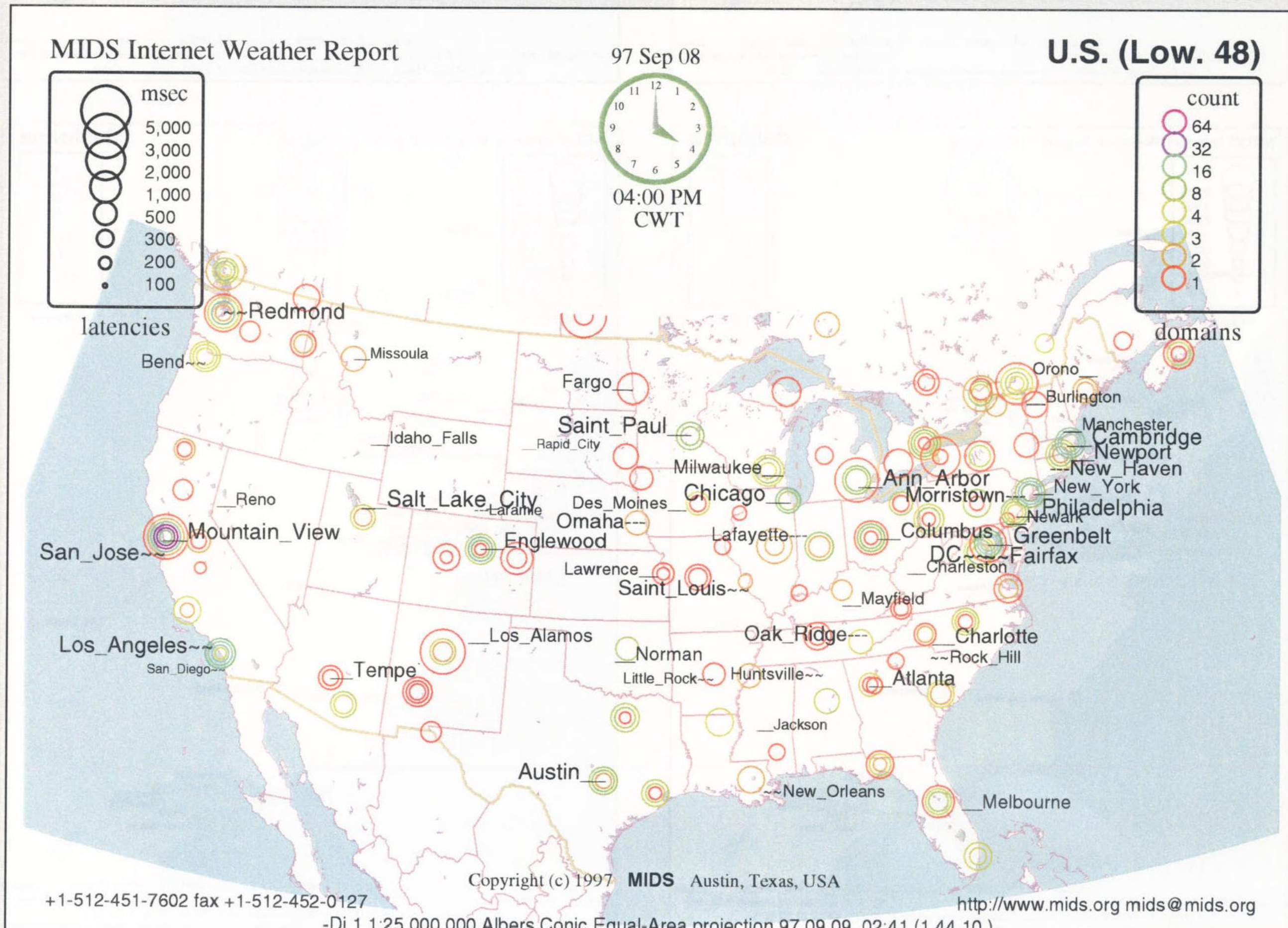
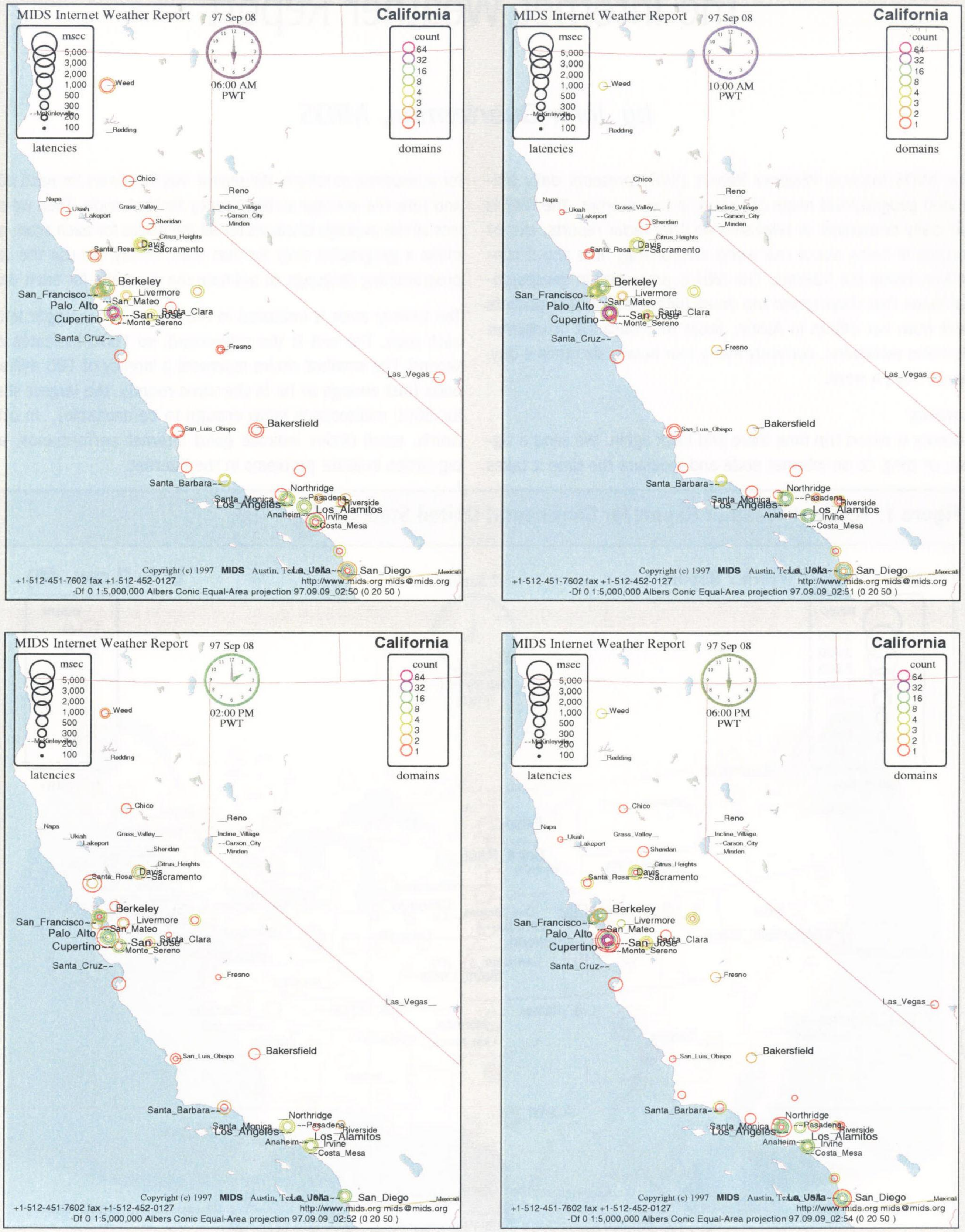


Figure 2. California's Internet Weather on September 8, 1997



Count
The size of each circle indicates the latency; bigger is slower; smaller is faster. The color of each circle may also indicate the number of hosts at a given location and latency. Red means only one host, orange is for two, yellow for three, green for nine, then cyan, blue, and so forth, in logarithmic spectrum order. Violet means 64 hosts, and usually only occurs in densely packed areas like Silicon Valley. The count color scale is indicated in the legend in the upper right of each map.

In some very densely networked areas, you can actually see a bell curve of red (few) hosts with big (slow) latency circles, blue (many) hosts with medium-sized circles, and again red (few) small (fast) circles.

Time
The use of colors gives four dimensions of data on each two dimensional map: latitude and longitude (icon placement), latency (icon size), and number of hosts at each latency and location (icon color). To these four dimensions we've added another—time. So the IWR Java movies actually show the Internet in five dimensions.

The clock and text in the center top of each map indicate the date, the local time of day, and the time-zone. Maps that cover geographical regions with multiple time-zones include the name of a city for which the indicated time-zone applies near the center of the map.

Many cities show different latency circles depending on the time of day. To see this, pick a specific city, such as Palo Alto on the California map (see Figure 2) and compare the circles around that city through an entire day. You can see a few small circles early in the morning which turn into several big circles in the middle of the afternoon. Often there are two or three distinct circles under heavy load; these are caused by several different Internet routes arriving at different speeds into that city. Load causes latencies to increase in relation to the capacity available on a given route.

Sometimes a whole map or an area will explode with big circles. That's an Internet storm, indicating that some wide area provider between our pinging node and the destinations displayed is experiencing problems (see Box 1).

Why the IWR?
People often ask why we are producing the IWR. We have several reasons: 1.) We wanted a conference paper to go to the INET '94 conference in Prague. 2.) We were told it couldn't be done. 3.) We are collecting data on the Internet and we want to give something back to the Internet. 4.) It is good marketing for MIDS. 5.) It is a good debugging tool for the various

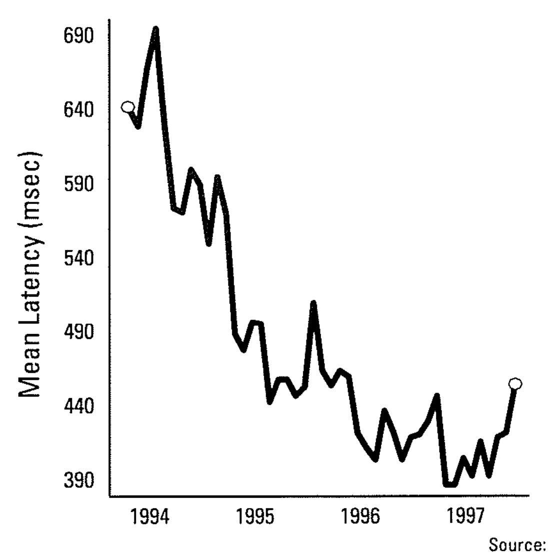
Box 1. Internet Traffic Patterns and the IWR

The Internet Weather Report shows plenty of storms. But Mr. Quarterman suggests that longer average response times for any particular site are often due to local causes, such as an overloaded computer, a slow drive or a congested Internet Service Provider which do not really affect overall Internet performance. Still, IWRs do show an interesting cyclical feature: Congestion increases during the work week with five days of relatively high latencies followed by two days of shorter latencies. Holiday seasons usually produce better performance but during the 1995 Christmas-New Year season, latencies went up, says Quarterman, perhaps because many people "got Internet connections for Christmas."

The IWRs also show that from January 1994 to January 1996 there was a 30 percent improvement in mean latencies. That is, during this period, the average round trip time decreased, which means that the quality of the Internet actually got better—not worse. Quarterman thinks that some of the Internet improvement could be due to better performance by MIDS' local ISP as well as increased port connection speeds by a number of distant sites. Nevertheless, Quarterman thinks that the 30 percent improvement is hard to explain solely by these factors.

But, does the data mean "all is cool with the Internet?" "No," says Quarterman. The "long latencies shown in the reports are real: servers that can't keep up with traffic are a problem in themselves.

Mean Latencies of MIDS Ping Tests, 1994-1997



Source: MIDS

And there are frequent outages and breaks in wide area Internet Protocol carriers and in their interconnecting points. But overall these do not appear to be any worse than they used to be and the general trend is clearly towards improvement."

Source: TeleGeography, Inc.

underlying databases that we use to produce it. 6.) Nothing else provides an ongoing visualization of the entire Internet in near real time.

In the past couple of years, Internet quality of service measurements have become a hot topic, and now we have more reasons to make the IWR. People now ask us what specifically they can get out of these Internet weather maps. To provide specific answers to this question we are adding features to the IWR.

For example, we are adding a world map and more regional maps, so you can see the Internet as a whole and more detail on specific regions. We are adding thematic maps for web servers, routers, and hosts, so you can see differences in response from different kinds of Internet nodes. We are adding maps of specific ISP networks, so you can see different responses of different ISPs. And we are adding tables and graphs so you can see the data behind the maps.

Naturally, new features require new resources. Although some fraction of the IWR will always be publicly visible for free, most of the new features will be visible to paying customers only. To sign up to use them, please see our order form at www.mids.org/order or send email to support@mids.org.

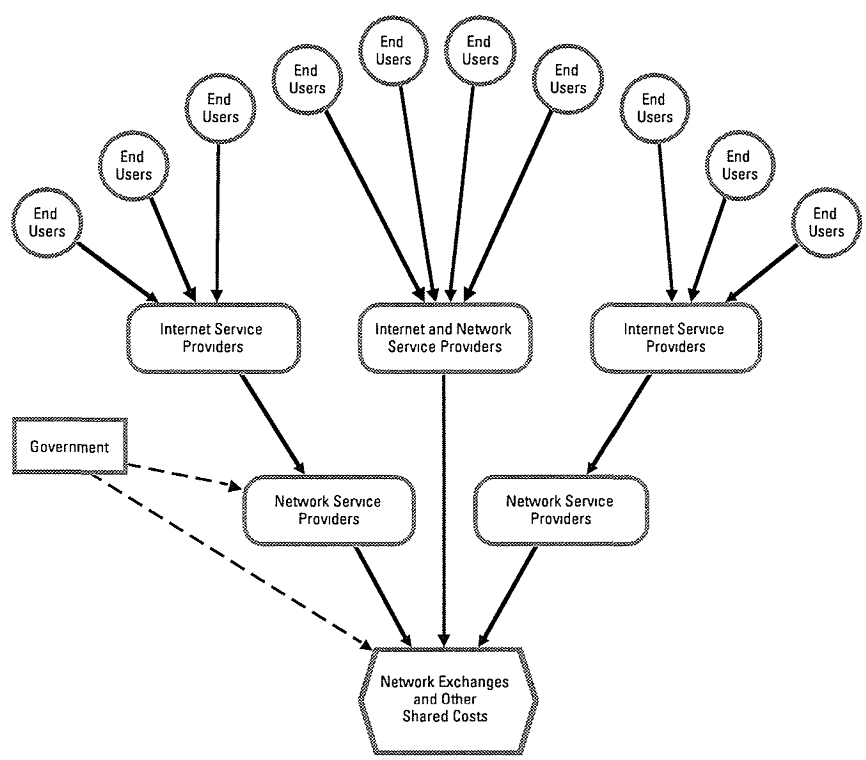
John S. Quarterman is president of Matrix Information and Directory Services (MIDS, www.mids.org), which examines the construction and demographics of the Internet and other networks in the global Matrix of computers. To contact Quarterman, send email to jsq@mids.org.

Measuring the Internet

by The Editors, TeleGeography, Inc.

How does the Internet work? How big is it? How many bits move across it? A map of the infrastructure—the main backbone networks and network exchanges—does not tell you very much about how packets of data actually get from one computer to another. Likewise, if you simply map the flow of packets from one site to another you can easily miss how the money flows. Hence, the following pages try to provide an overview of how the Internet works by presenting three different views: commercial, operational and geographical. Each provides part of the answer.

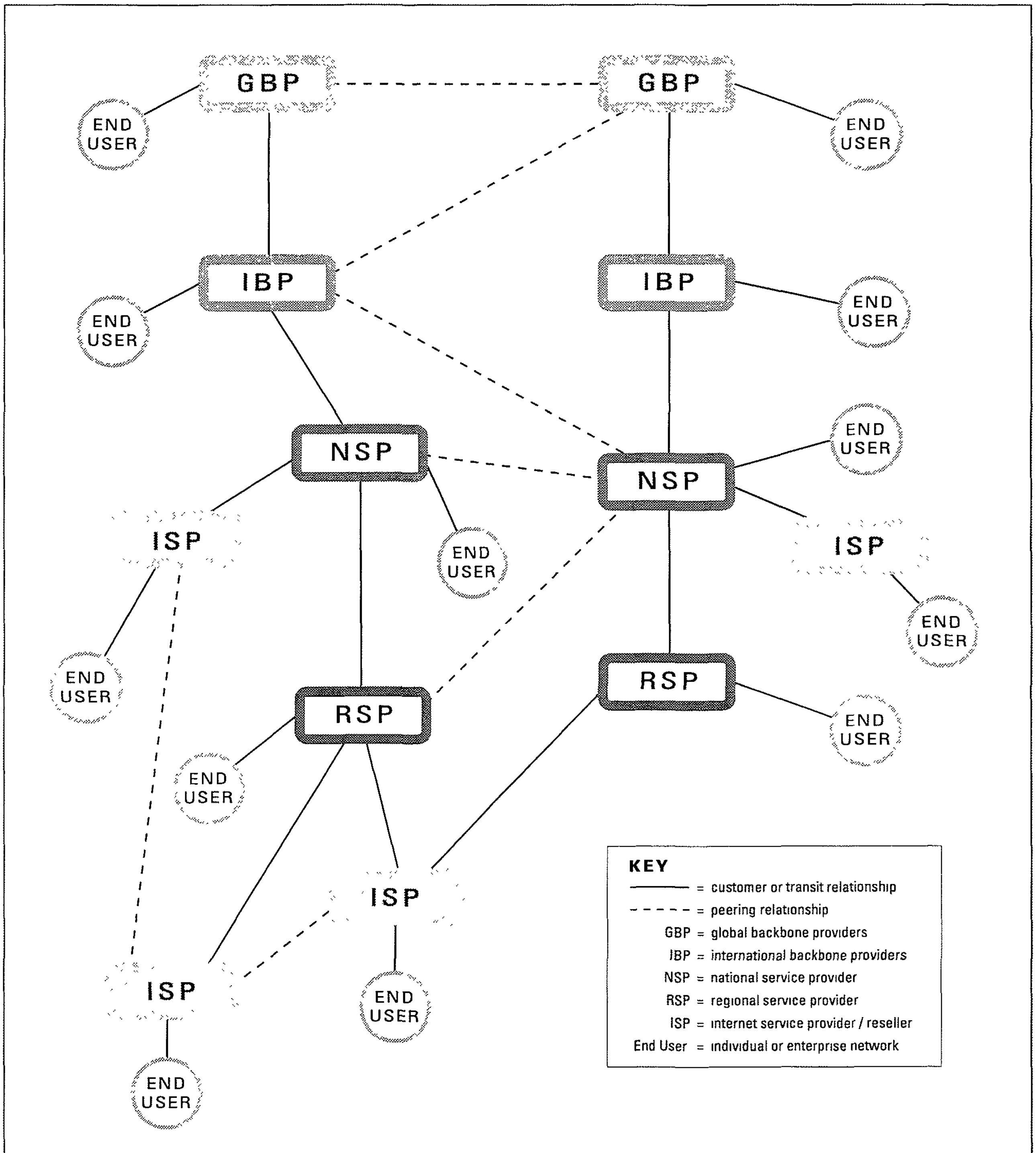
Figure 1. Internet Cash Flows



Cash flows on the Internet begin with the end user (e.g., an individual, company, or university) who pays an Internet service provider (ISP) for access. Many small ISPs, in turn, pay larger ISPs for access to their networks. Each ISP must directly or indirectly connect with, and pay for access to, a Network Service Provider (NSP). The NSPs consist of regional, national and international backbone providers that connect to each other at Internet Exchange points (IXs). In North America these Exchanges are commonly known as Network Access Points (NAPs) or Metropolitan Area Exchanges (MAEs). In some cases the functions of ISPs and NSPs are consolidated into a single entity (e.g., Internet MCI). The chart is intended to be illustrative of economic relationships in the U.S. only. The U.S. Government, which originally subsidized the network for scientific and defense purposes, has withdrawn most funding but continues to contribute towards research and essential services. The chart does not show the flow of money to infrastructure providers, which provide the access lines for end users as well as the leased circuits for ISPs.

Source: TeleGeography, Inc.

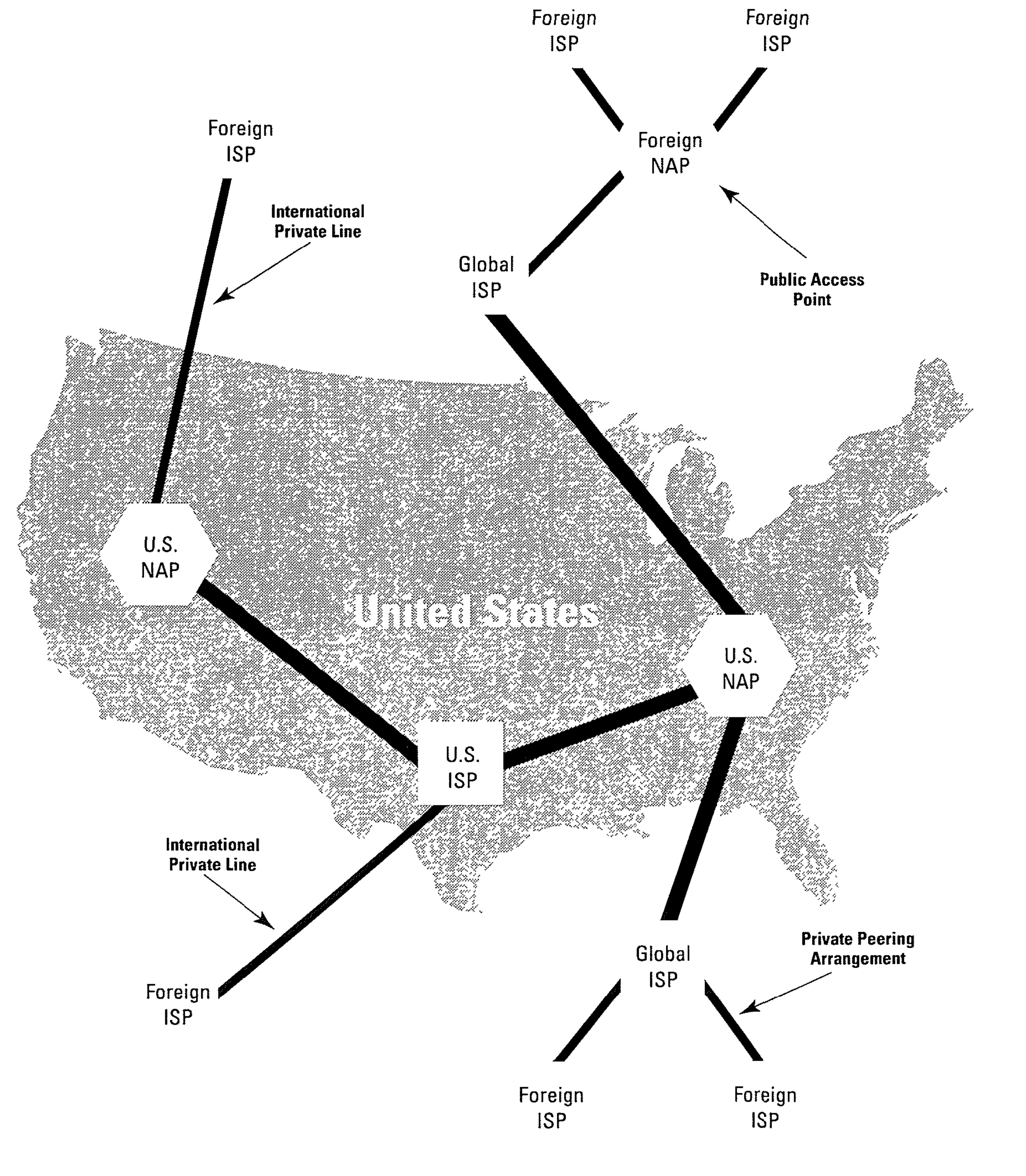
Figure 2. Internet Packet Flows



Source: adapted from Dimension Enterprises, Inc.

Competition and rapid growth are bringing both diversification and stratification in Internet infrastructure. Global connectivity can be assured only through a complex set of peering and transit relationships between providers. Peer networks exchange traffic with each other; *a network providing transit to another allows its backbone to* be used to reach a destination not on its own network. Individuals or enterprise networks choose providers based on service offerings, cost, support, and quality of service.

Figure 3. How an ISP Connects to the Internet



Note. Diagram illustrates typical alternatives for connecting to the U.S.-centric Internet. Lines between ISPs and NAPs represent Internet Protocol network links using either cable or satellite facilities at various capacities. Source: TeleGeography, Inc.

In many countries, the only way for an ISP to connect to the Internet is to pay international carriers for a private line all the way to a Network Access Point (NAP) in the U.S. Other non-U.S. ISPs may have the ability to plug into a NAP in their country (see "Foreign NAP") which is connected to the Internet by way of the other ISPs which interconnect at that point. Also, a foreign ISP could establish a private peering arrangement with a global backbone provider (see "Global ISP") that connects to NAPs in various countries.

Figure 4. Major North American Internet Backbone Providers

	Backbone Speed	NAP Connections	Began Service	Owner
ACSI	T3	3	1996	American Comm. Services, Inc.
AGIS	T3/OC3	6	1994	Apex Global Internet Services
ANS	T3	4	1990	America Online, Inc.*
AT&T	T3	4	1997	AT&T Corp.
BAC	OC3	1	1995	Bell Canada Enterprises, Inc.
BBN	T3/OC3	6	1978	GTE Corp.
Cable & Wireless	T3	4	1996	Cable & Wireless plc
Compuserve	T3	4	1993	H&R Block Corp.*
CRL	T3	6	1983	CRL Network Services, Inc.
Dataxchange	T3/OC3	3	1993	DataXchange Network, Inc.
Digex	T3	6	1993	Intermedia Communications, Inc.
DRA Net	T3	5	1992	Data Research Associates, Inc.
Epoch	T3	9	1994	Epoch Internet, Inc.
Fibernet	T3	3	1995	Fiber Network Solutions, Inc.
Genuity	T3/OC3	9	1994	Bechtel Corp.
Geonet	T3	5	1990	GeoNet Communications, Inc.
Global Center	T3/OC3	10	1994	Global Center, Inc.
Goodnet	T3/OC3	5	1995	Telesoft, Inc.
Gridnet	T3	3	1996	WorldCom, Inc.
IBM	T3	5	1994	IBM Corp.
Icon	T3/OC3	8	1996	Icon CMT Corp.
MCI	OC3/OC12	7	1995	MCI Communications Corp.**
Nap.Net	OC3	3	1995	Bechtel Corp.
Net Access	T3	3	1992	Net Access USA, Inc.
Netcom	T3	6	1992	ICG Communications, Inc.
Netrail	T3/OC3	8	1994	NetRail, Inc.
PSInet	T3	4	1988	PSINet, Inc.
Savvis	T3	0	1995	Savvis Communications Corp.
Sprint	OC3	6	1992	Sprint Corp.
TCG Cerfnet	T3/OC3	6	1989	Teleport Communications Group, Inc.
UUNet	OC3/OC12	5	1987	WorldCom, Inc.
Visinet	T3	2	1995	VisiNet, Inc.

NAP = Network Access Point
OC3 = 155 Mbit/s
OC12 = 622 Mbit/s
T3 = 45 Mbit/s
* = Planned merger of backbone with WorldCom, Inc.
** = At this printing, bids for control of MCI have been made by BT, WorldCom, and GTE.

Note: Data current to mid-1997. Presence of multiple backbone speeds (e.g., "T3/OC3") indicates different speeds for different parts of the ISP's network. Each NAP connection indicates a separate location where the ISP's backbone is connected. Private peering arrangements are non-NAP points of interconnection with other ISPs. "Owner" column reflects majority control by ultimate parent company.

Source: Adapted from "Is the Internet in Trouble?" by Robin Gareiss, *Data Communications*, September 21, 1997, see also Boardwatch Magazine.

Figure 5. U.S. Internet Backbone Connectivity, July 1997

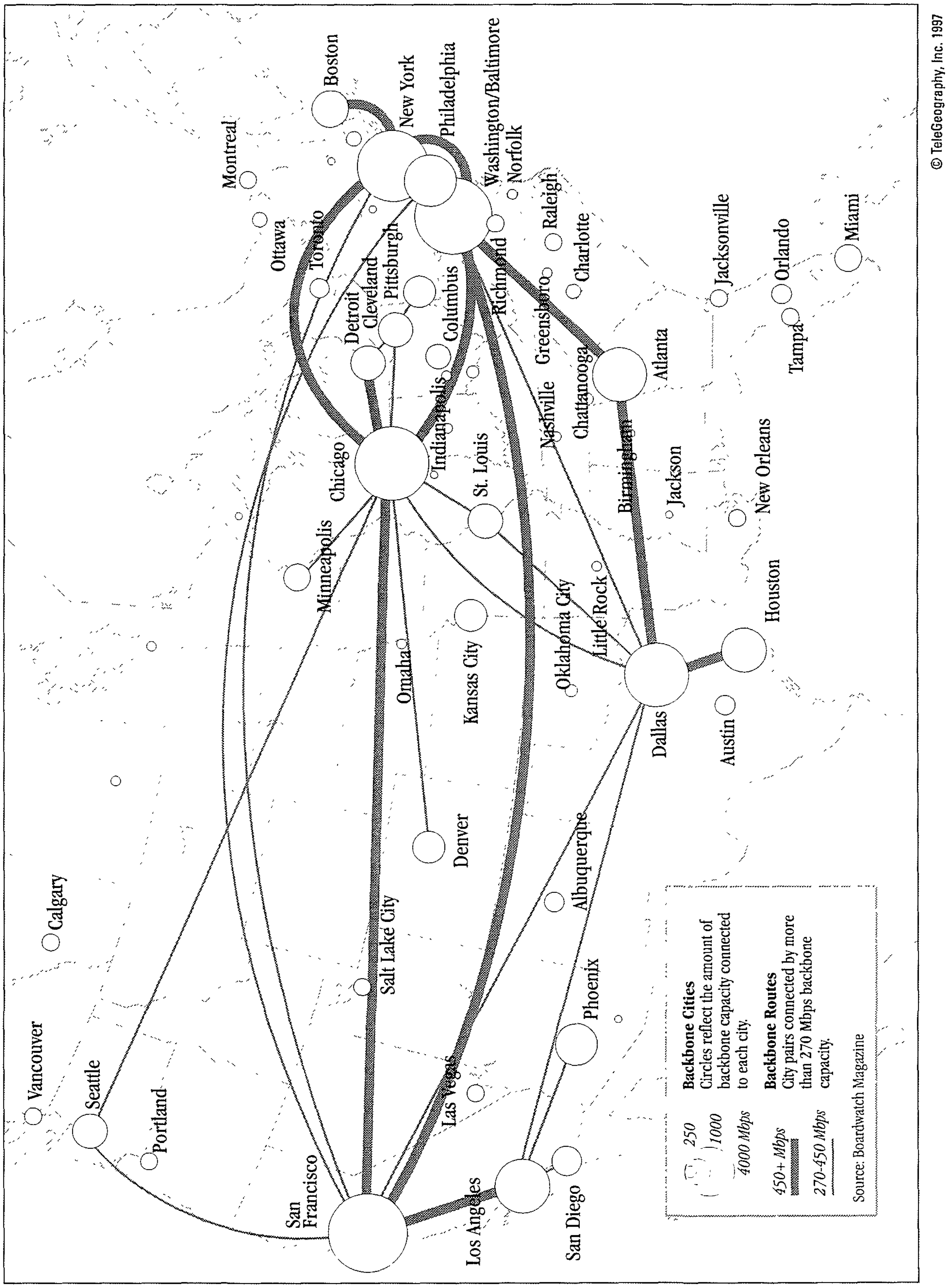
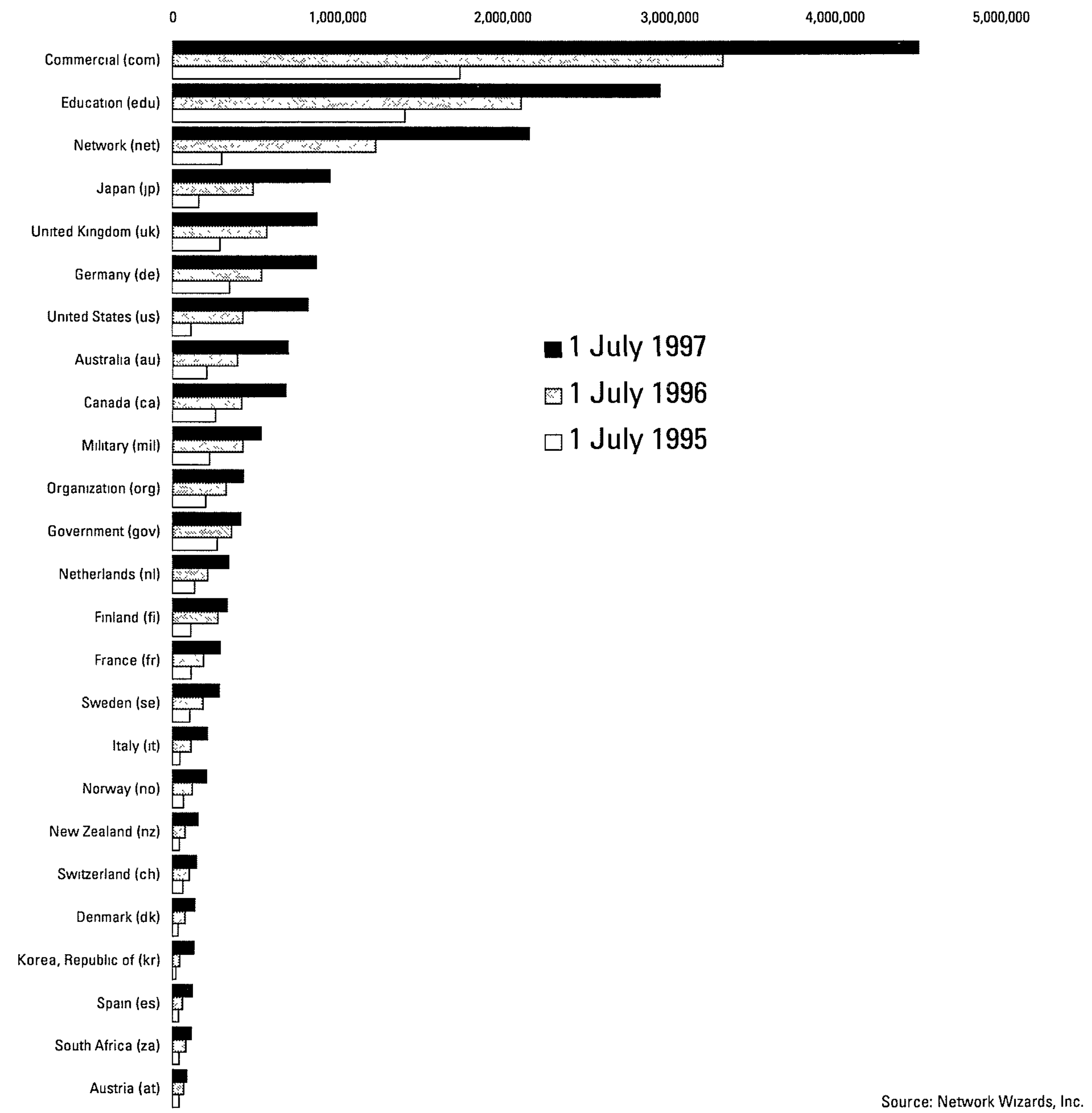


Figure 6. Top 25 Internet Hosts by Domain, 1995-1997



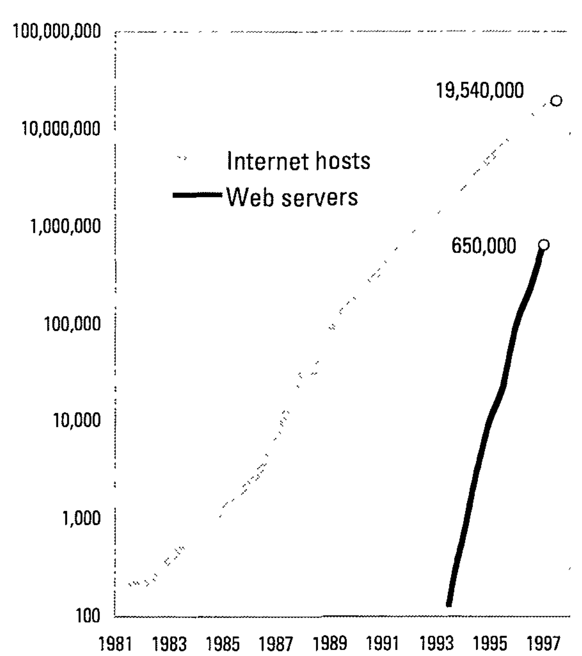
Source: Network Wizards, Inc.

Network Wizards, a California-based company owned by Internet engineer Mark Lottor, performs a biannual Internet domain name survey that "attempts to discover every host on the Internet by doing a complete search of the Domain Name System" (see www.nw.com). The chart above displays the growth of host computers tied to particular domains. Of the 224 domain names included in Network Wizard's July 1997 survey of Internet domains, over 50 have less than ten hosts active under them. Interesting host-less domains include: Antarctica (aq), Ethiopia (et), Iraq (iq), Oman (om) and Syria (sy).

Where are Internet computers located? There is no precise answer. The problem is that a host's domain name (e.g., "www.telegeography.com") is not necessarily linked to its national origin. For example, a host computer with the domain ".jp" could actually be located in New York city. Or, a host could use the domain for the defunct Soviet Union (e.g., www.chem.msu.su) although you might be hard pressed to find it on a map less than four years old. To learn about a campaign to put latitude and longitude data into the domain name system, see page 80.

Source: TeleGeography, Inc.

Figure 7. Internet Hosts and Web Servers, 1981-1997



Source Network Wizards, Inc and M. Gray

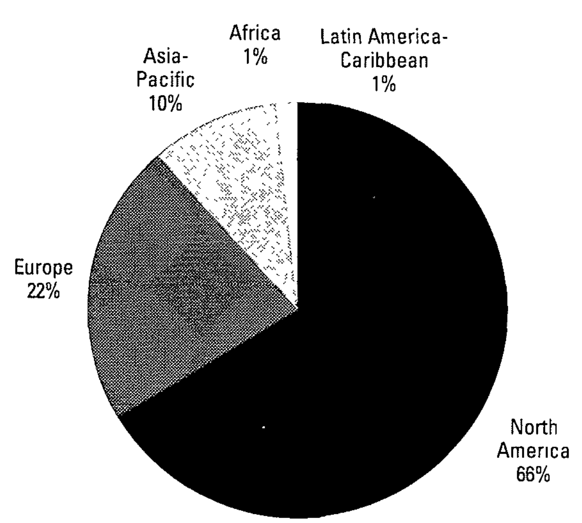
In years past, each host on the Internet represented one computer. But the definition of hosts has changed such that a single computer can act like many hosts with many names and many addresses all at once. Network Wizards, a company trying to keep track of Internet host growth, admits that "it is not possible to determine the exact size of the Internet." For more details on what is not available, visit www.nw.com/zone/host-count-history.

Mathew Gray, a graduate student and researcher at MIT's Media Lab, has been counting Web servers since 1993. His most recent estimate puts Web growth on a pace that doubles the number of servers every six months. The Internet as a whole (measured by hosts), however, appears to double only every 12 months. For the latest numbers, go to www.mit.edu/people/mkgray.

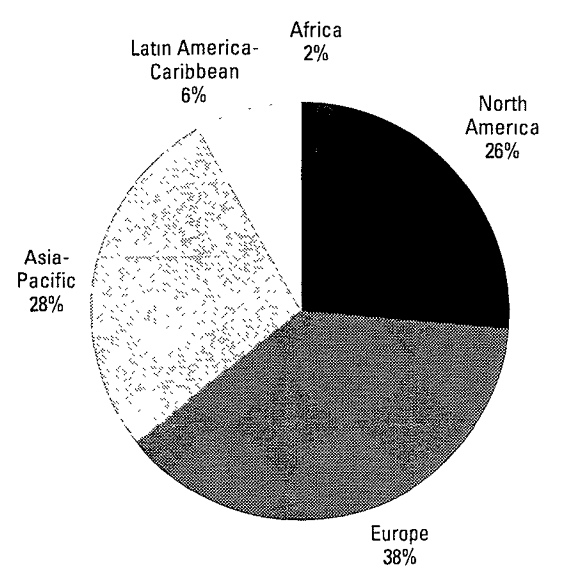
What about the number of Internet users? Unfortunately, there is no single best estimate. Varying estimates for total 1996 Internet users include: the International Telecommunication Union (60 million), Matrix Information & Directory Services (57 million), International Data Corporation (31.4 million—web only), or Nielsen Media Research (50.4 million—U.S. only). A compilation of Internet market estimates can be found on I/Pro's Cyberatlas web page at: www.cyberatlas.com.

Figure 8. Distribution of Phone Lines vs. Internet Hosts

Internet Host Distribution, Jan. 1997



Telephone Main Line Distribution, Jan. 1996



Note: In the host distribution chart, three letter domains (.com, .edu, .org, .net, .gov and .mil) have been incorporated into the total for North America although some hosts within these domains are located outside North America.

Source: Both charts are adapted from the ITU's *Challenges to the Network*, August 1997 (for details, visit www.itu.int/ti). Host data from Network Wizards (www.nw.com) and RIPE (www.ripe.net).

Box 1. The DNS Location Campaign

Where in the world is www.kei.com? Brussels? Bangkok? Boston? If RFC 1876 were adopted, a click of the mouse would bring the answer.

Internet addresses have no necessary correlation to the geophysical location of the host computers to which they are assigned. And even if the address contains a country domain—there is no telling whether the computer is in Geneva or Tokyo. The absence of geographic labels helps to give the Net its own sense of place, and to protect the privacy of its visitors.

But it is maddening for cyber cartographers as well as for many network engineers who would like to have a better fix on traffic patterns and routing arrangements. RFC 1876 just might provide a partial solution. (A Request For Comments (RFC) is a semi-formal document proposing an Internet standard, although many are never endorsed by the Internet's ad hoc governing bodies. Any RFC can be retrieved with the address ds.internic.net/rfc/rfcxxxx.txt where "xxxx" is the RFC number.)

First proposed in January 1996 by Christopher Davis, a network administrator for Kapor Enterprises, Inc., RFC 1876 describes a way to include location information about computer hosts, networks and sub-nets in the Internet's domain name system (DNS). More technically, RFC 1876 defines the format for a resource record (RR) in the DNS, and reserves a corresponding mnemonic (LOC) and numerical code so as to insert the latitude, longitude and altitude of host computers within a given domain name. The RFC would be implemented on a decentralized basis by domain name administrators and Internet service providers. Interim instructions are available at www.kei.com/homepages/ckd/dns-loc. For background on the Domain Name System, see RFCs 799 and 1480.

In *TeleGeography 1996/97* we wrote "In a perfect world...the Internet would map itself and the billions of bits flowing from one computer to another would be counted too." Implementing RFC 1876 could bring this vision one step closer.

Source: Gregory Staple

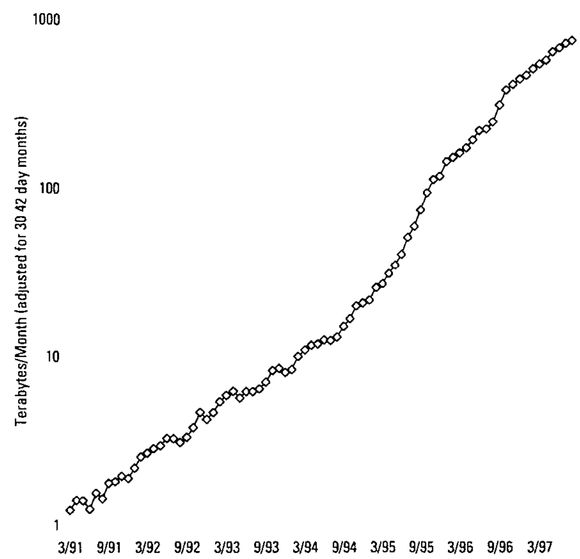
Figure 9. Plot of U.S. Domain Name Locations

Note: Locations are plotted by postal code of domain name registrants and may not correspond to physical locations of host computers.
Source: Imperative, Inc. (www.imperative.com)

Figure 10. Internet Traffic Flows, 1991-1997

George Gilder's monthly newsletter for high tech investors, the *Gilder Technology Report* (GTR), publishes one of the few publicly available estimates on the growth of Internet traffic. Each month Gilder's team collects statistics on the packets that move through selected major U.S. Network Access Points (NAPs) and Metropolitan Area Exchanges (MAEs). Based on these data sets, GTR claims that its estimates account for only 20 percent of the Internet's total traffic. As of July 1997, GTR believed that, "...total Internet traffic probably exceeds 3 petabytes (10^{15}) a month, or a some 200 fold rise since the privatization of the U.S.'s NSFNet in April 1995."

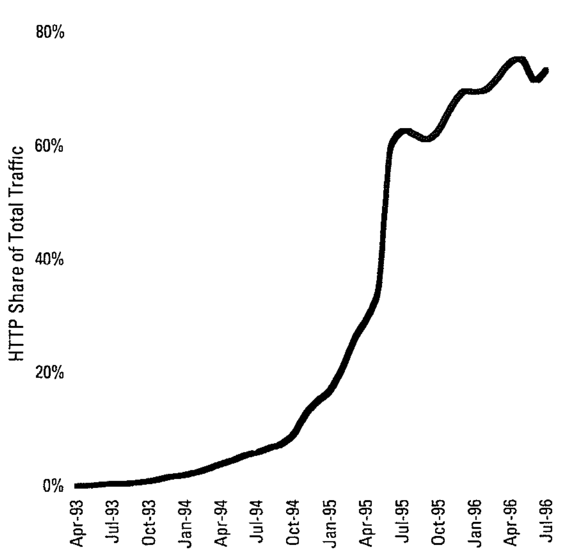
GTR's traffic estimates build on the model once used to measure traffic on the NSFnet backbone. Like the NSFnet data, it combines the traffic totals for each exchange point. Thus, bits transiting through two or more NAPs/MAEs on a single trip may be duplicated. On the other hand, this data underrepresents total traffic because it does not include traffic within an individual network, nor between networks with private exchange points, nor at other exchanges which are outside the U.S. With these qualifications the data presented here does represent a consistent subset of total Internet traffic and can be taken as a measure of the relative growth of the Internet. For information on how to subscribe to the GTR, visit www.gildertech.com or call them at +1 413 274 0211.



Source: Gilder Technology Report (www.gildertech.com)

Figure 11. Internet Traffic by Application Source

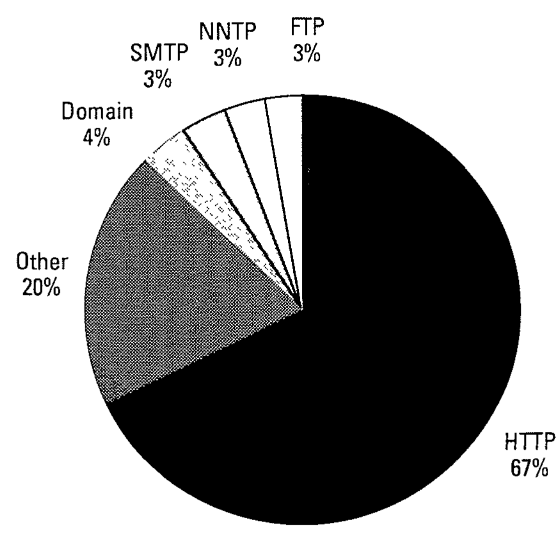
World Wide Web Share of Total Internet Traffic, 1993-1996



Note: The traffic shares above reflect HTTP packet travel on the U.S. ANS Communications backbone only (the ANS network was purchased by WorldCom in 1997).

Source: Daniel McRobb, ANS Communications (www.ans.net)

Internet Traffic by Application Packet Share, April 1997



Note: HTTP = Hypertext Transfer Protocol; Domain = Domain Name Look-up; SMTP = Send Mail Transfer Protocol; NNTP = Net News Transfer Protocol; FTP = File Transfer Protocol.

Source. Adapted from the ITU's *Challenges to the Network*, August 1997 (for details, visit www.itu.int/ti)

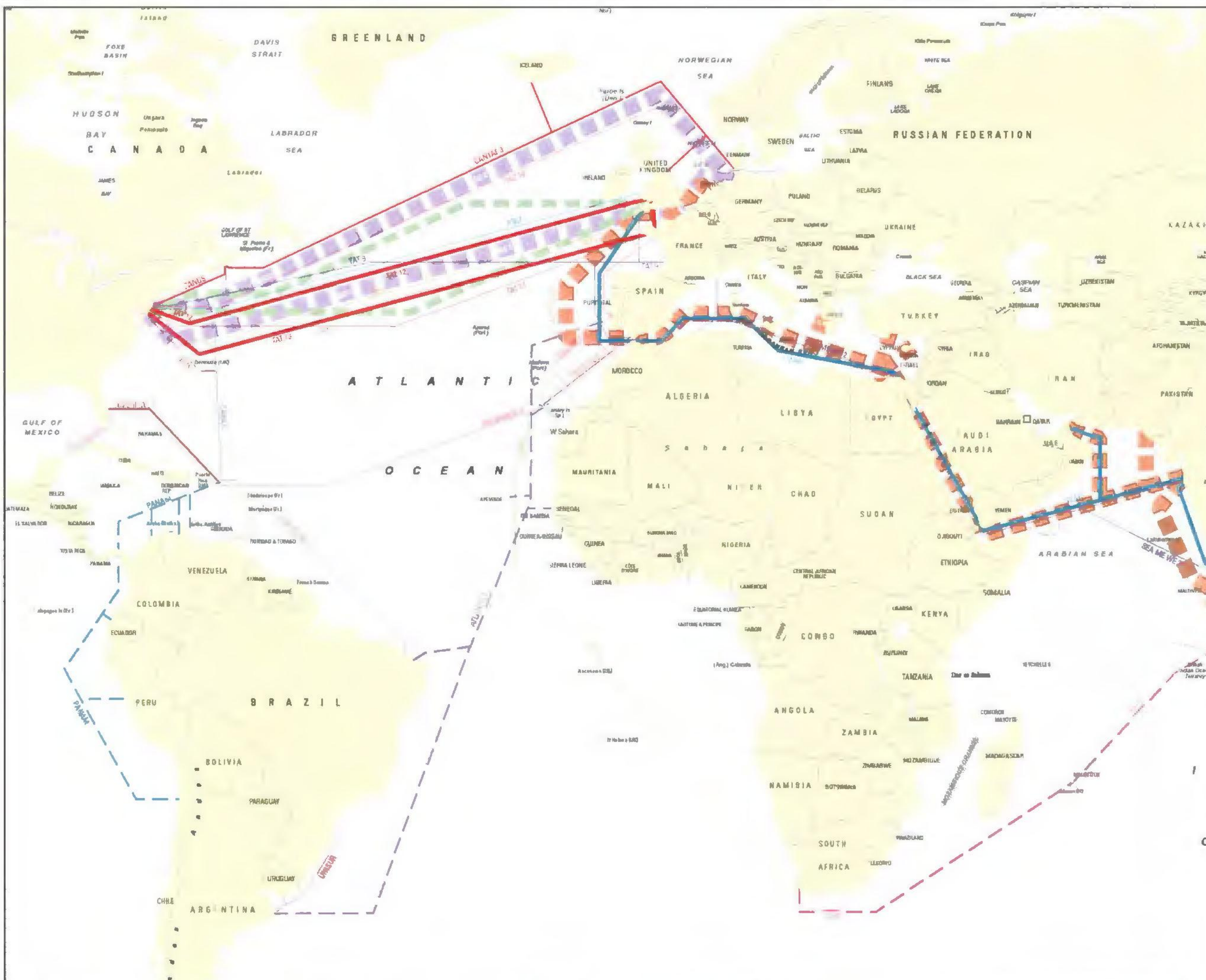
International Facilities and Carriers

Major Submarine Cables

History of Trans-Atlantic Cable Systems

Year in Service	Cable System	Cost (US$) per voice path	Capacity (voice paths)
1956	TAT-1*	557,000	89
1965	TAT-4*	365,000	138
1970	TAT-5*	49,000	1,440
1983	TAT-7*	23,000	8,400
1988	TAT-8	9,000	37,800
1993	TAT-10	2,700	113,400
1996	TAT-12/13	1,000	604,000
1998	AC-1	<125	2,457,600

* No longer in service.

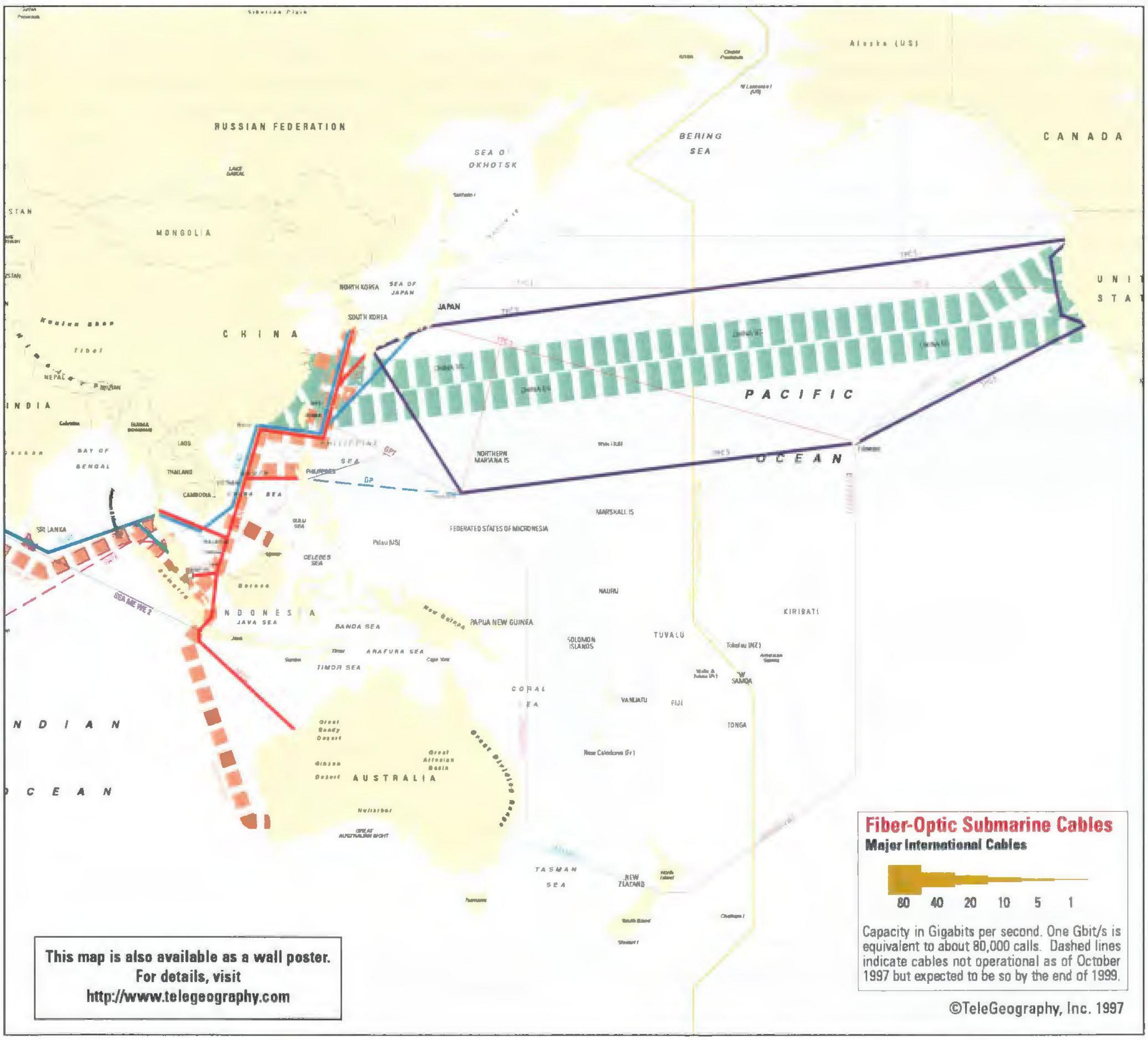


Note: Costs are capital and construction costs only, unadjusted for inflation. Table assumes that 5 virtual voice paths to be derived from a digital channel operating at 64,000 bits per second (64 Kbps). Table reports average cost per voice path for cables with multiple landing points. Reserve capacity of cables is generally excluded. Some cables (e.g., TAT 12/13) may be upgraded to increase initial capacity. Source: FCC and carriers.

History of Trans-Pacific Cable Systems

Year in Service	Cable System	Cost (US$) per voice path	Capacity (voice paths)
1957	Hawaii 1*	378,000	91
1964	TPC-1*	406,000	167
1974	Hawaii 2*	41,000	1,690
1975	TPC-2*	73,000	1,690
1988	TPC-3	16,000	37,800
1992	TPC-4	5,500	75,600
1996	TPC-5	2,000	604,000
1999	China-US	<200	4,915,200

* No longer in service.



This map is also available as a wall poster. For details, visit http://www.telegeography.com

The Next Generation of Undersea Mega-Cables

by Gregory Staple, Koteen & Naftalin, LLP

The third generation of undersea fiber optic cables which has just begun service (TAT 12/13; TPC 5) can carry approximately 5 Gigabits per second (Gbps) per fiber pair or approximately 320,000 virtual voice channels. This represents an order of magnitude increase from the second generation of fiber-optic cables (operating at 560 Megabits per second) which, in turn, provided a tenfold increase in capacity over the first fiber-optic cables such as TAT-8.

Recent trials and experiments by AT&T, Alcatel and KDD suggest that the next generation of cables, to be deployed in the 2000-2005 timeframe, will increase capacity by at least another order of magnitude to 50 Gbps and probably to 100 Gbps or more. That will be enough to transmit three million or more simultaneous telephone calls or several hundred thousand channels of compressed video services. In the meantime, several companies have already proposed an intermediate generation of trans-oceanic cables with capacities from 20 to 40 Gbps to meet the booming demands for Internet services (see Figures 1 and 2).

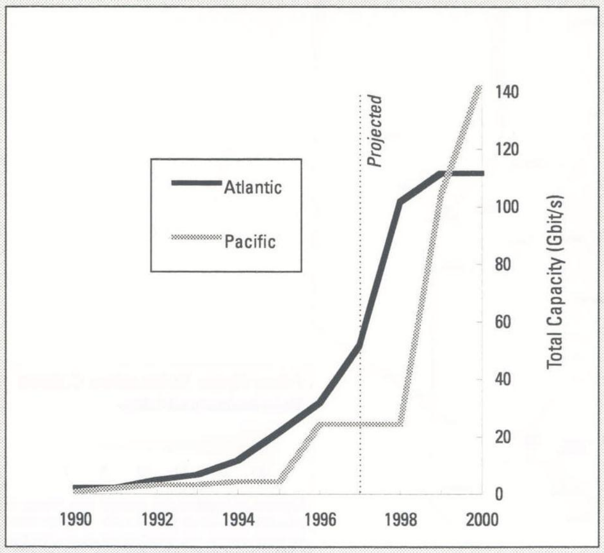
Tomorrow's fiber optic mega-cables will rely upon two technologies—optical soliton transmission and wave division multiplexing (WDM)—which leverage the benefits of earlier breakthroughs, such as optical amplifiers.

Digital communications generally are sent over a fiber optic cable by very rapidly transforming the original electrical signal into tiny pulses of laser light; the presence or absence of a pulse in a given period is used to code a binary 1 or 0. However, optical fibers can only carry a signal for a few hundred kilometers before it becomes too blurred or weak to be useable. Thus, long distance fiber optic cables contain repeaters, spaced at regular intervals, to amplify the signal.

For many years the only way to regenerate a signal in a long haul cable was to use an opto-electronic amplifier which converted the weak light pulses into an electronic signal, boosted the signal through an amplifier, and then transformed the boosted signal back into light pulses. In the late 1980s, however, amplifiers were developed to regenerate the optical signal without any electronic intermediary. These optical amplifiers typically consist of a few meters of erbium-doped fiber (EDF) inserted into the transmission path and hence are known as EDF Amplifiers or EDFAs. An EDFA permits a signal to be

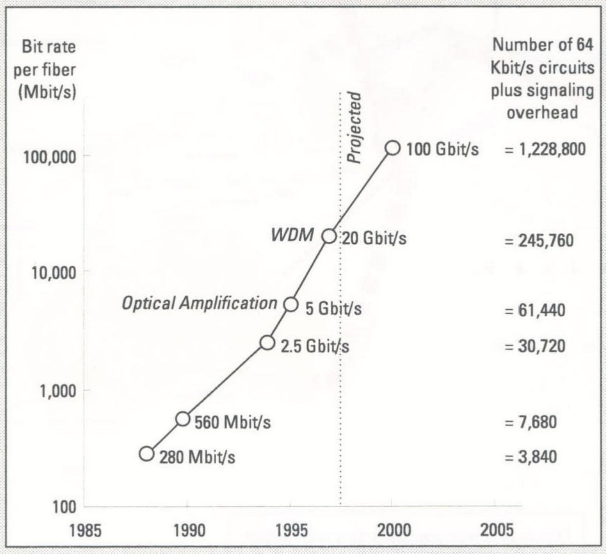
Figure 1. Submarine Cable Capacity

Trans-Oceanic Capacity, 1990-2000



Source: TeleGeography

Capacity per Fiber, 1985-2005



Source: Alcatel

Figure 2. Proposed Submarine Cable Systems

Route	System	Lead Investors/Owners	Capacity	Service Date
Trans-Atlantic	Atlantic Crossing-1	Global Telesystems Ltd. (Funded by Pacific Capital Group)	40 Gpbs	1998
	Gemini	MFS Communications, Cable & Wireless	20 Gbps	1997-1998
	Atlantis-2	Telefonica, Embratel and others	5 Gbps (upgradeable)	1999
Trans-Pacific	China-US	China Telecom, KDD, AT&T	80 Gbps	1999
	Southern Cross	WorldCom, Telecom New Zealand, Optus	40 Gbps	2000
Europe-Middle East-Asia	SEA-ME-WE3	France Telecom, Singapore Telecom, KDD and 75 others	40 Gbps	1998-1999
Africa-Middle East-Asia	South Africa-Far East (SAFE)	Telkom South Africa and Telekom Malaysia	10 Gbps	1999

"pumped up" using a laser light source thousands of kilometers away at one of the cable headends.

Notwithstanding optical amplifiers, the bit rate of long haul cable systems has generally been limited to 5 Gbps due to the way in which the light pulses propagate. But scientists have now developed a way to create unique pulses of light, known as solitons, which maintain their shape and intensity at very high bit rates over great distances. For example, in 1995 KDD demonstrated the feasibility of transmitting a 20 Gbps optical soliton data stream by time division multiplexing 10 Gbps pulses on an 8100 kilometer fiber optic cable test bed.

By coupling soliton technology with wave division multiplexing the aggregate transmission capacity of any given fiber optic cable may be increased severalfold. In one experiment by Alcatel, sixteen 2.5 Gbps channels, each with a different wavelength, were multiplexed together to create a 40 Gbps data stream over a distance of over 1400 kilometers. And in February 1996, KDD and AT&T reported they had transmitted over 110 Gbps on a 730 km test bed cable. Later the companies announced that this WDM technology would be used in the new 80 Gbps China-U.S. cable to be completed by 1999. KDD also will use WDM for a 100 Gbps cable around the islands of Japan.

Field trials of WDM technologies elsewhere are also promising. Alcatel has reported WDM transmission of four 2.5 Gbps data streams over 3500 kilometers on the RIOJA cable system between the U.K. and Spain. AT&T has conducted a similar trial transmitting 10 Gbps over a segment of the Columbus-2 cable between Florida and St. Thomas in the Caribbean; and tests on the TAT 12/13 system have led to a 10 Gbps proposed upgrade by 1999.

The commercial impact of these developments will be felt well before the next generation of cables. As with TAT 12/13, WDM technologies will permit some cable owners to upgrade capacity merely by changing the equipment at the cable head ends. Four or even eightfold capacity increases ultimately may be possible. Second, development of WDM techniques is likely to make fiber optic systems increasingly flexible and hence attractive to new investors. Because WDM can be used to create different virtual (frequency specific) channels, a cable can be partitioned to satisfy the routing requirements (landing points) of particular carriers or countries without reducing the cable's overall capacity. The global net of 300 Gbps cables planned for 2000-2003 by Project Oxygen (www.oxygen.org) is likely to take advantage of these features.

Finally, as soliton WDM technology moves into commercial production, the historical relationship between intercontinental and local prices is likely to flip flop. By 2000, for example, a call from Los Angeles to Tokyo may cost less than a call from one of Los Angeles' many area codes to another. This is the new economics which light wave technology will soon usher in.

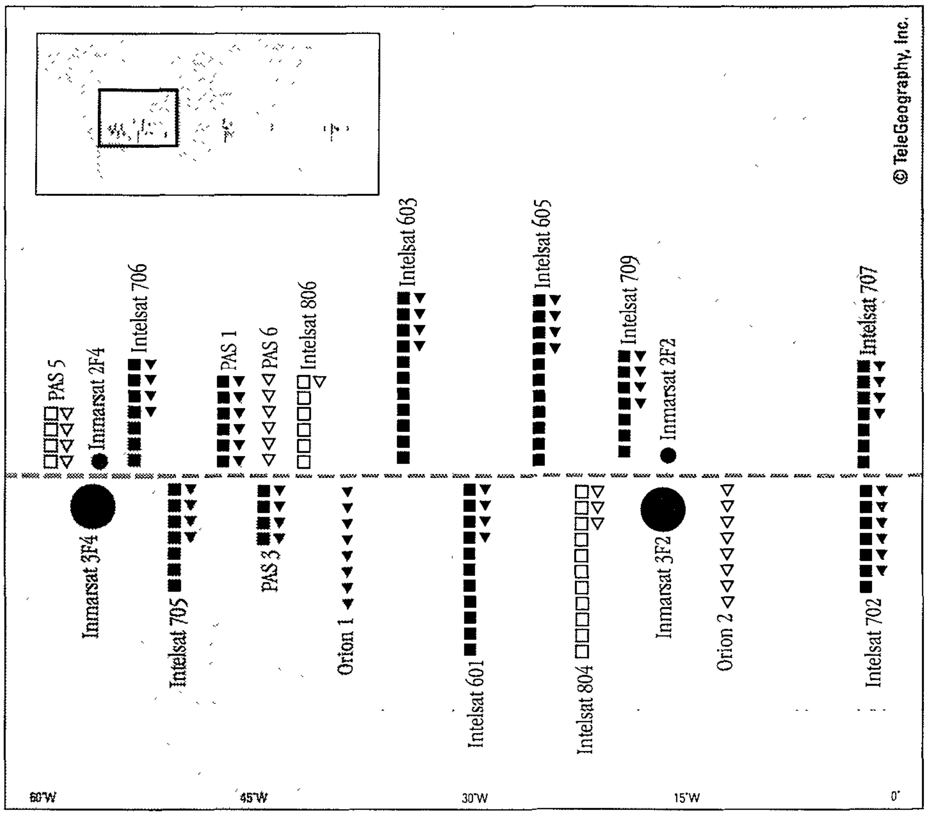
For Further Reading:

José Chesney and Jean-Francois Marcerou, "Challenges and Perspectives For the Next Generation of Transoceanic Networks"; and Shigeyuki Akiba and Shu Yamamoto, "WDM Undersea Cable Network Technology For 100 Gbps and Beyond," *Suboptic '97 Conference Proceedings*, (San Francisco, CA, 11-16 May, 1997), pp. 232-237, pp. 448-456.

Franklin W. Kerfoot and Peter K Rungs, "Future Directions For Undersea Communications," *AT&T Technical Journal* (January/February 1995) Vol. 74 #1, pp. 93-100

S.S. Sian, S.M. Webb, K.M. Gill, "Sixteen x 2 5 Gbps WDM Unrepeater Transmission Over 427 km," *Alcatel Submarine Networks*, London (June 1995).

International Communications Satellites



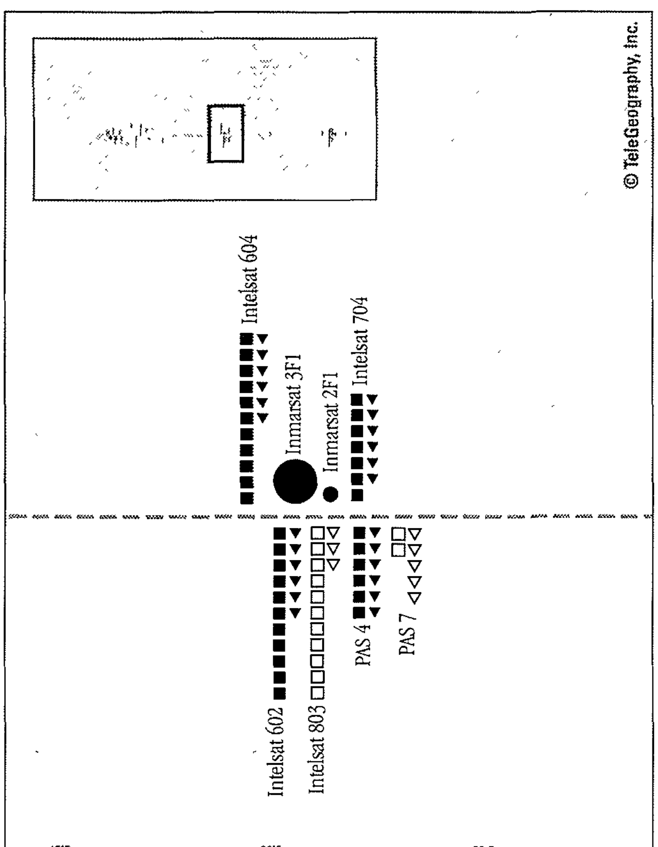
Key

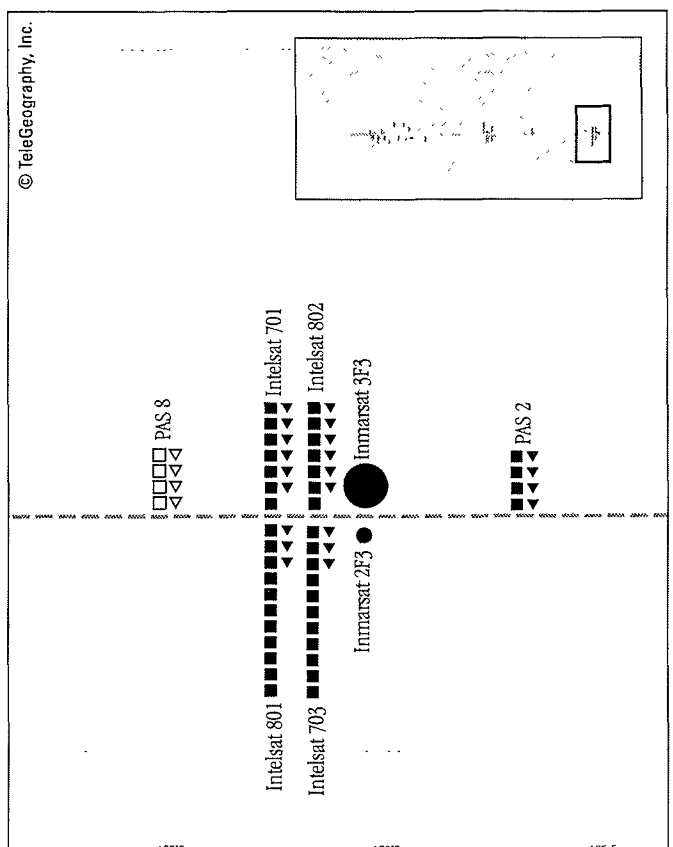
The maps on this page show international geostationary satellites only. Each square represents six 36-MHz transponder equivalents for the C-band (assigned frequencies at 4/6 GHz), while each triangle represents six 36-MHz transponder equivalents for the Ku-band (11-12/14 GHz). A 36 MHz C-band transponder can generally carry about 2,000 calls. Some capacity on satellites shown here may be used for video broadcast services.

Inmarsat satellites provide telecom services to mobile terminals (airplanes, ships, and handheld units) and are not directly comparable to satellites communicating with fixed terminals. The Inmarsat 3 series (shown as larger circles) have about eight times the power of Inmarsat 2 spacecraft and can transmit approximately 2000 calls simultaneously.

Hollow shapes indicate satellites under construction as of August 1997. All geostationary satellites orbit directly above the equator. Regional communication satellites are not shown.

Data: Euroconsult
Tel. +33 1 43 38 06 00; Fax +33 1 43 38 12 40





International Satellite Capacity and Cost, 1970-2000

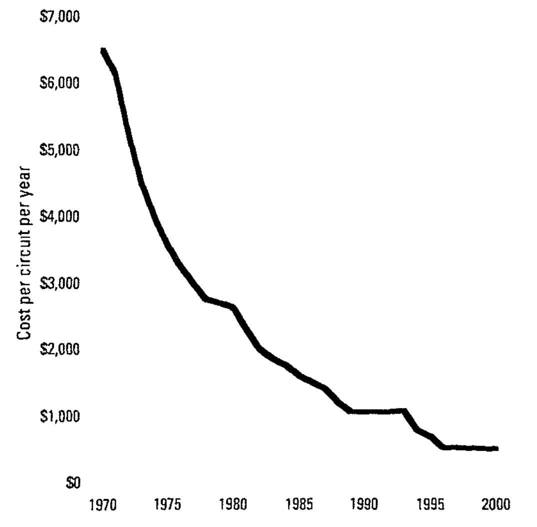
Trans-Oceanic Satellite Voice Paths, 1988-1997

	Trans-Atlantic	Trans-Pacific
1988	78,000	39,000
1989	93,000	39,000
1990	283,000	39,000
1991	283,000	27,000
1992	496,000	27,000
1993	620,800	83,300
1994	620,800	234,000
1995	710,800	234,000
1996	710,800	234,000
1997	737,500	424,500

Note: Data prior to 1993 include Intelsat satellites only After 1989, deployment of Digital Code Multiplication Equipment (DCME) made 5:1 compression possible where only 2:1 had been used previously. Capacity estimates exclude one Intelsat satellite in each region held in reserve

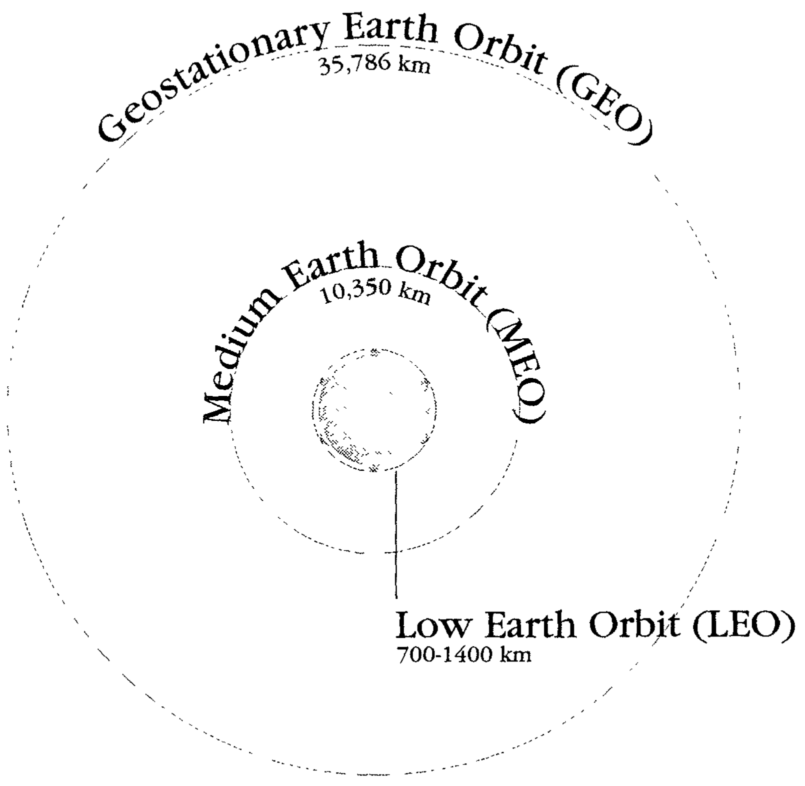
Source: TeleGeography, Inc.

Intelsat Cost per Circuit per Year, 1970-2000



Source: Euroconsult, Tel. +33 1 43 38 06 00; Fax +33 1 43 38 12 40

Communications Satellite Orbits and Beams

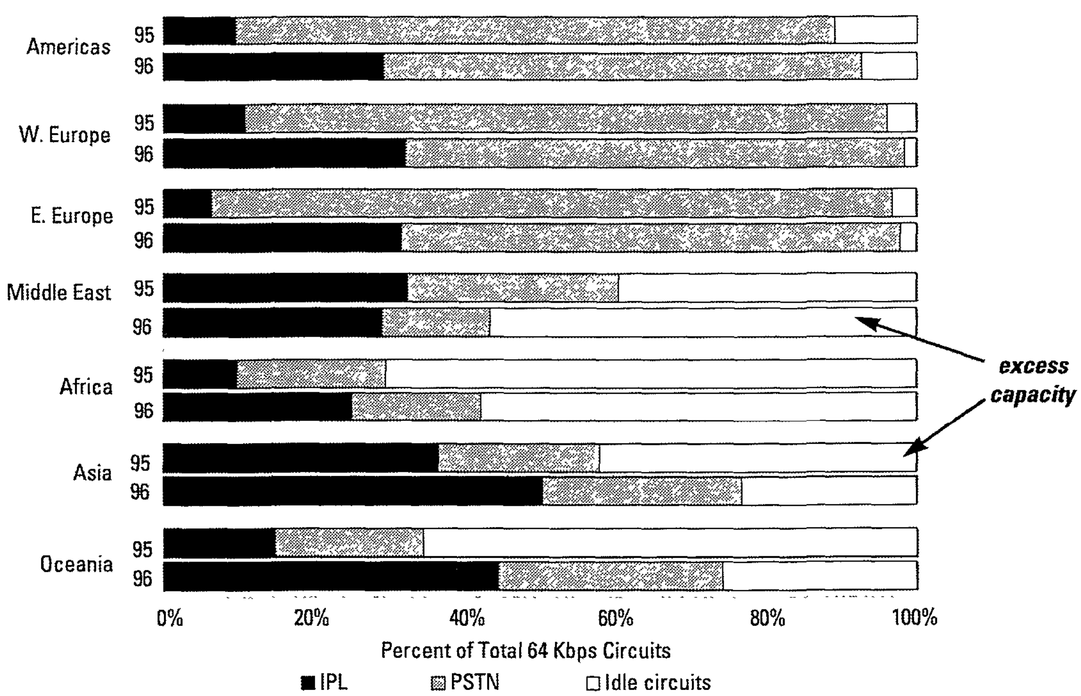


This diagram shows typical communications satellite orbits and beams. Geostationary satellites always orbit around the equator, while satellites in medium and low earth orbit move relative to the earth and cover a range of latitudes.

International Circuit Usage by U.S. Carriers

Figure 1. International Circuit Usage by Region, 1995-96

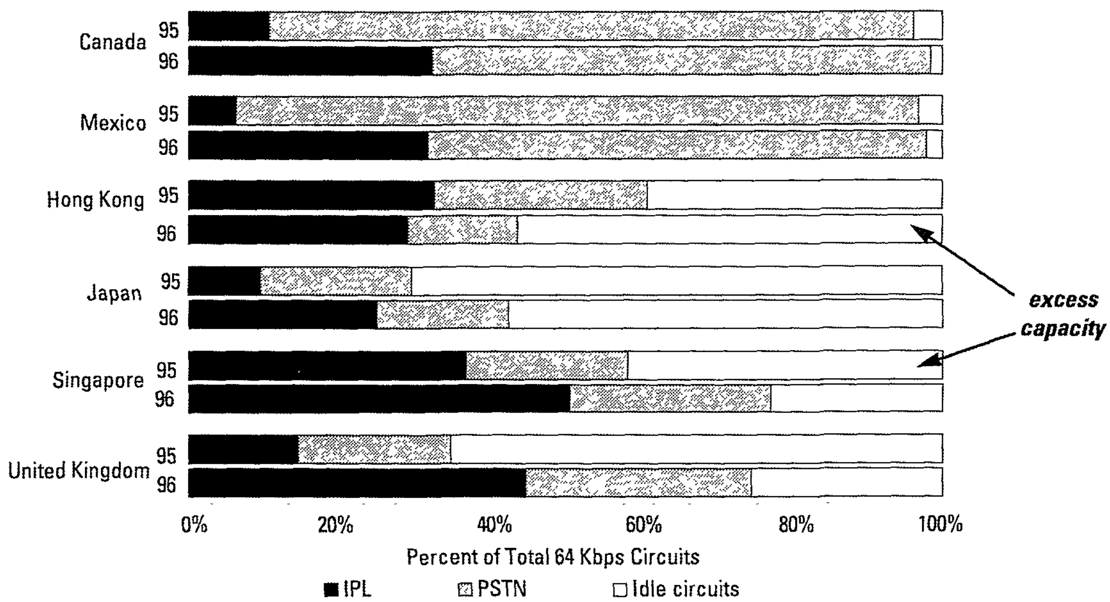
	For Private Lines	For Public Switched Network	Total Circuits In Use	Idle Circuits	Total Available
Americas 1995	9,489	79,892	89,381	10,789	100,170
1996	38,170	82,801	120,971	9,432	130,403
W. Europe 1995	9,997	22,389	32,386	54,593	86,979
1996	33,083	29,536	62,619	33,053	95,672
E. Europe 1995	241	2,886	3,127	1,470	4,597
1996	478	3,344	3,822	1,704	5,526
Middle East 1995	506	2,560	3,066	266	3,332
1996	908	2,836	3,744	560	4,304
Africa 1995	199	2,051	2,250	181	2,431
1996	406	2,416	2,822	327	3,149
Asia 1995	5,067	13,185	18,252	26,605	44,857
1996	15,015	16,475	31,490	27,163	58,653
Oceania 1995	998	3,125	4,123	1,628	5,751
1996	3,302	3,110	6,412	2,523	8,935
Total 1995	**26,497**	**126,150**	**152,647**	**n.a.**	**n.a.**
1996	**91,362**	**140,518**	**231,880**	**74,762**	**306,642**



Note: Data based on FCC circuit status reports filed by U.S. carriers and are for AT&T, MCI, Sprint and WorldCom only. Data are for circuits originating in continental U.S. "Idle" circuits are circuits owned by a carrier at year end but not in use. Totals are for all circuits to all countries within a region. Satellite capacity utilization is generally not reflected by this data because U.S. carriers do not acquire international satellite capacity in advance.

Figure 2. International Circuit Usage for Selected Routes, 1995-96

	For Private Lines	For Public Switched Network	Total Circuits In Use	Idle Circuits	Total Available
Canada 1995	5,543	44,172	49,715	1,936	51,651
1996	20,410	41,793	62,203	917	63,120
Mexico 1995	1,653	23,416	25,069	800	25,869
1996	13,312	27,784	41,096	840	41,936
Hong Kong 1995	860	742	1,602	1,036	2,638
1996	1,921	961	2,882	3,722	6,604
Japan 1995	2,241	4,619	6,860	16,259	23,119
1996	7,682	5,354	13,036	17,696	30,732
Singapore 1995	521	306	827	593	1,420
1996	1,114	582	1,696	508	2,204
U.K. 1995	6,048	8,317	14,365	27,001	41,366
1996	18,959	12,648	31,607	10,844	42,451



Note: Data based on FCC circuit status reports filed by U.S. carriers and are for AT&T, MCI, Sprint and WorldCom only. Data are for circuits originating in continental U.S. "Idle" circuits are circuits owned by a carrier at year end but not in use. Totals are for all circuits to all countries within a region. Satellite capacity utilization is generally not reflected by this data because U.S. carriers do not acquire international satellite capacity in advance.

Market Shares of Competing International Carriers

Percentage of Outgoing MiTT

Country/Carrier	1988	1989	1990	1991	1992	1993	1994	1995	1996
United States									
AT&T	89.1	83.3	78.4	74.8	70 3	62 2	60.1	54 3	50 2
MCI	7 0	10 2	14 6	17 8	21 2	24.8	26.5	28.5	28.4
Sprint	3 5	5.8	6 4	6 3	7.3	10.3	11 1	11.3	13.2
Worldcom					n.a	0.6	2.1	3 5	4 5
Others							0.2	2 4	3 7
United Kingdom									
BT	95.5	91.0	86 0	81.0	76.8	74.2	68.6	67.7	60.0
Mercury	4.5	9.0	14.0	19.0	23.2	24 0	28.1	25 8	26.8
WorldCom									6.6
GlobalOne									3.1
ACC									3 0
Others									<1
Japan									
KDD		93.3	88 0	73.3	69.7	66.9	66.3	66.2	64.9
IDC		3 7	6 5	13.3	15 3	16.9	17.3	17.3	18.1
Japan Telecom		3.0	5.5	13.4	15.0	16 2	16.4	16 5	17 0
New Zealand									
TNZ			92 0	82.0	80.0	78.4	74.8	78.0	78.2
ClearCom			8.0	18 0	20 0	21.6	25.2	22.0	19.8
Others									2.0
Republic of Korea									
Korea Telecom					79.9	74.5	68 7	72.6	73.5
Dacom					20.1	25 5	31.3	27 4	26.5
Chile									
Entel Chile					80 0	55.0	36.3	36 5	37.3
Chilesat					20 0	20.0	24.8	23 1	15 2
VTR Telecom					<1 0	<5.0	24.2	7.4	9.3
CTC-Mundo							12.8	20.2	22.2
BellSouth Chile							1.5	9 9	10 0
Iusatel							0.1	1.7	2.8
CNT							0 3	0.5	0.6
Transam									2.8
Philippines									
PLDT					91.6	84.2	69	68	78
Philippine Global Com					8 4	15.8	23	23	6
Eastern Telecom					n.a.	n.a.	7	6	5
Capitol Wireless					n.a	n a.	<1	<1	1
ICC								<1	4
Smart								<1	1
Digital									2
Philcom									2
Islacom									<1
Australia									
Telstra					98.0	87 0	76.3	73.4	62.0
Optus					2.0	13.0	21 9	23.4	27.0
IPL Resellers							1.8	3.2	11.0

Country/Carrier	1988	1989	1990	1991	1992	1993	1994	1995	1996
					Percentage of Outgoing MiTT				
Canada (Canada-U.S. route only)									
Stentor						93	80	63	57
AT&T Canada Long Distance						2	8	8	8
Sprint Canada								13	15
Fonorola								9	12
ACC								3	4
Others								4	4
Dominican Republic									
Codetel						>90	85.8	83 0	77 0
Tricom						n.a	6.7	7.5	12.8
All America Cables and Radio, Inc. (AACR)						n a	7.5	9 5	10.2
Sweden									
Telia AB						92	87	76	69
Tele-2						8	13	21	22
Others								3	9
Finland									
Telecom Finland							90	72 8	66.0
Finnet International							5	19.1	24.2
Telivo							3	7.7	8 8
Others							2	0.4	0.9
Indonesia									
PT Indosat							99 5	95.4	89.5
PT Satelindo							0.5	4 6	11 5
Denmark									
Tele Danmark									92.5
Netcom Systems									4.0
Telia A/S									3.5
Malaysia									
Telecom Malaysia									90
TRI									8
Others									2

Notes:

MiTT is Minutes of Telecommunications Traffic. Data based on outgoing international traffic for the public switched network only. Unless stated, data exclude traffic and market share of carriers reselling international private line services (IPL resellers). Market shares are for the full year, beginning in the first year of competition. In 1997, competition was introduced in Israel, Mexico and the Netherlands Market shares for new carriers in these countries will be reported in *TeleGeography 1998/99*

United States Market shares for U.S. carriers prior to 1994 exclude resellers and, prior to 1993, traffic to Canada and Mexico; for the traffic base of second tier U S. carriers, see page 179 The 1996 figures for WorldCom reflect its acquisition of MFS

United Kingdom: Carriers' traffic to Ireland is excluded prior to 1994 Market shares based on fiscal year reporting.

Japan· The figures for Japan Telecom reflect data for ITJ prior to its October 1997 merger with domestic long distance carrier Japan Telecom Co. Market shares based on fiscal year reporting.

New Zealand· Market shares for New Zealand carriers prior to 1996 exclude resellers and are based on fiscal year reporting.

Chile: In 1993, Chilean shares do not total 100% because Chilesat reportedly acted as an international gateway in 1993 The 1994 and 1995 market shares for Chile are based on traffic for the month of December only

Australia: Market shares for 1994 and 1995 are based on traffic for October to December quarters only and reflect wholesale minutes for facilities-based carriers only. Market shares in 1996 are from fiscal year ended June 1997

Canada Some data supplied by NBI/Michael Sone Associates, Toronto (Fax: +1 416 360 7546).

Indonesia· PT Satelindo began international service in September 1994.

The Top 40 International Carriers

			Outgoing Traffic (millions of MiTTs)			1996 Revenue (US$ billions)	
Rank	**Company**	**Country**	**1996**	**1995**	**Change 95-96**	**Total Rev.**	**Int'l Service Rev.**
1	AT&T (a)	United States	9452	8482	11.4%	52.5	6.3
2	MCI (a)	United States	5356	4458	20.1%	18.5	2.6
3	Deutsche Telekom	Germany	5100	5238	-2.6%	38.4	5.0
4	BT (b)	United Kingdom	3158	2909	8.6%	24.5	3.0
5	France Télécom	France	3116	2805	11.1%	25.2	3.5
6	Sprint (a)	United States	2480	1765	40.5%	14.1	0.8
7	Telecom Italia	Italy	2124	1908	11.3%	21.8	1.6
8	Swisscom	Switzerland	1936	1778	8.9%	8.6	2.1
9	Hongkong Telecom (a,b)	Hong Kong	1739	1692	2.8%	4.2	2.6
10	Stentor (c)	Canada	1650	1467	12.5%	n.a.	n.a.
11	KPN (a)	Netherlands	1534	1459	5.1%	10.3	2.0
12	China MPT (d)	China	1433	1339	7.0%	10.3	2.3
13	Mercury (b)	United Kingdom	1411	1107	27.4%	2.8	1.0
14	Belgacom (a)	Belgium	1228	1106	11.1%	3.9	0.7
15	Telefónica	Spain	1189	1025	16.0%	14.1	1.4
16	KDD (b)	Japan	1103	1086	9.3%	2.7	2.2
17	Telmex (a)	Mexico	1071	950	12.7%	6.8	1.8
18	Austrian PTT (d)	Austria	960	901	1.6%	4.2	0.9
19	Singapore Telecom (b)	Singapore	942	773	19.4%	3.0	1.3
20	Téléglobe (a)	Canada	915	898	1.8%	0.6	0.6
21	Rostelecom (e)	Russia	851	287	n.a.	n.a.	n.a.
22	WorldCom (a,f)	United States	846	544	55.6%	4.5	n.a.
23	Telstra (b)	Australia	829	806	2.9%	11.7	1.0
24	Telia AB (a)	Sweden	706	702	0.6%	5.5	0.7
25	Chunghwa Telecom	Taiwan	674	593	13.7%	n.a.	n.a.
26	Etisalat	U.A.E.	589	504	16.9%	n.a.	n.a.
27	Saudi Com. Ministry	Saudi Arabia	584	537	17.1%	n.a.	n.a.
28	Telecom Eireann (b,g)	Ireland	580	407	42.5%	2.0	0.6
29	Tele Danmark	Denmark	573	533	7.5%	3.7	0.4
30	Telekom Malaysia (a,h)	Malaysia	571	408	n.a.	2.4	n.a.
31	Korea Telecom	Rep. of Korea	520	404	28.7%	n.a.	n.a.
32	OTE	Greece	516	468	10.2%	2.5	0.5
33	Turkish PTT	Turkey	473	374	26.6%	n.a.	n.a.
34	Norwegian Telecom	Norway	444	432	2.7%	2.1	0.4
35	Telekomunikacja Polska (a)	Poland	437	381	14.8%	n.a.	n.a.
36	Videsh Sanchar (b,i)	India	384	341	12.6%	1.5	1.4
37	Telebras	Brazil	367	319	15.0%	11.5	0.8
38	Optus	Australia	355	240	48.1%	1.5	n.a.
39	Portugal Telecom (a,j)	Portugal	340	284	19.8%	3.1	n.a.
40	Bezeq (a)	Israel	320	252	26.7%	2.4	0.6

MiTT is Minutes of Telecommunications Traffic. Data are for public voice circuits only rounded to the nearest million MiTT.

a. Data based on billing point of call, not originating point.
b. Data are for the fiscal year ending 31 March Telstra FY ends 30 June.
c Stentor was formerly Telecom Canada; Stentor traffic is for U.S. only, of which approximately 70 percent is originated by Bell Canada.
d. Revenue data are for 1995.
e. Rostelecom data prior to 1996 excluded traffic to C.I.S.
f. 1996 WorldCom data reflect data from MFS acquisition. 1995 data include full year data from IDB, LDDS and WilTel acquisitions.
g. Telecom Eireann data exclude traffic to Northern Ireland.
h. Malaysia data prior to 1996 excluded cross-border traffic to Singapore.
i. Videsh Sanchar data prior to 1996 excluded traffic to Bangladesh, Nepal, Pakistan and Sri Lanka.
j. Combined totals for Portugal Telecom and Radio Marconi. Prior to 1996 merger, Portugal Telecom handled intra-continental traffic only, and Marconi carried overseas traffic.

Source TeleGeography, Inc (Traffic); ING Barings and TeleGeography/ITU (Revenue)

International Services of U.S. RBOCs

When will the RBOCs compete for international services? The short answer is "they already are," but primarily as resale carriers (see Figure 1). And even though some of the Regional Bell Operating Companies (RBOCs) may acquire their own international facilities, they won't become major competitors until they can sell international services to their own local customers. In most states that will not occur until 1998 or 1999, at the earliest. To understand why, it is helpful briefly to review America's historic communications reform law, the Telecommunications Act of 1996 (1996 Act).

The 1996 Act was motivated largely by two interrelated objectives. First, the U.S. Congress sought to foster greater competition for local telephone services by, among other things, allowing the country's major long-distance carriers—AT&T, MCI and Sprint—to compete directly for local services with incumbent carriers, such as the RBOCs.

The second goal—and the political *quid pro quo* for the first—was to free the RBOCs from the antitrust constraints imposed in 1984 when they were divested from AT&T. Once freed, the RBOCs would be able to provide interexchange, including international, service in direct competition with their former parent.

The RBOCs are by far the largest local exchange carriers (LECs) in the United States. Each RBOC serves between 15 and 22 million access lines, and collectively the RBOCs account for approximately 85 percent of all U.S. access lines. The 1996 Act permits RBOCs wishing to provide international service for calls originating outside of their local service regions to do so by simply filing a standard application under Section 214 of the Communications Act.

In contrast, for in-region international service, an RBOC must obtain Section 214 authority and apply under the new Section 271 of the Communications Act on a state-by-state basis. The FCC may not grant an RBOC Section 271 authority until, after consultation with the U.S. Department of Justice, the agency is satisfied that three competitive safeguards have been met.

First, for each state in which the RBOC seeks to provide service, the RBOC must have entered into a connection agreement with at least one unaffiliated, facilities-based (or predominantly facilities-based) competitor. Alternatively, an RBOC may publish its general terms for access and interconnection, which must have been approved by the relevant state utilities commission.

Second, the RBOC's interconnection agreement or its published terms must satisfy a competitive checklist. Specifically, interconnection must: (1) be unbundled and cost-based; (2) include access to poles and rights of way; (3) include access to emergency and directory services; (4) provide universal directory listings; (5) provide access to telephone numbers; (6) provide for local dialing parity; (7) offer number portability; (8) offer reciprocal compensation arrangements; and (9) permit resale.

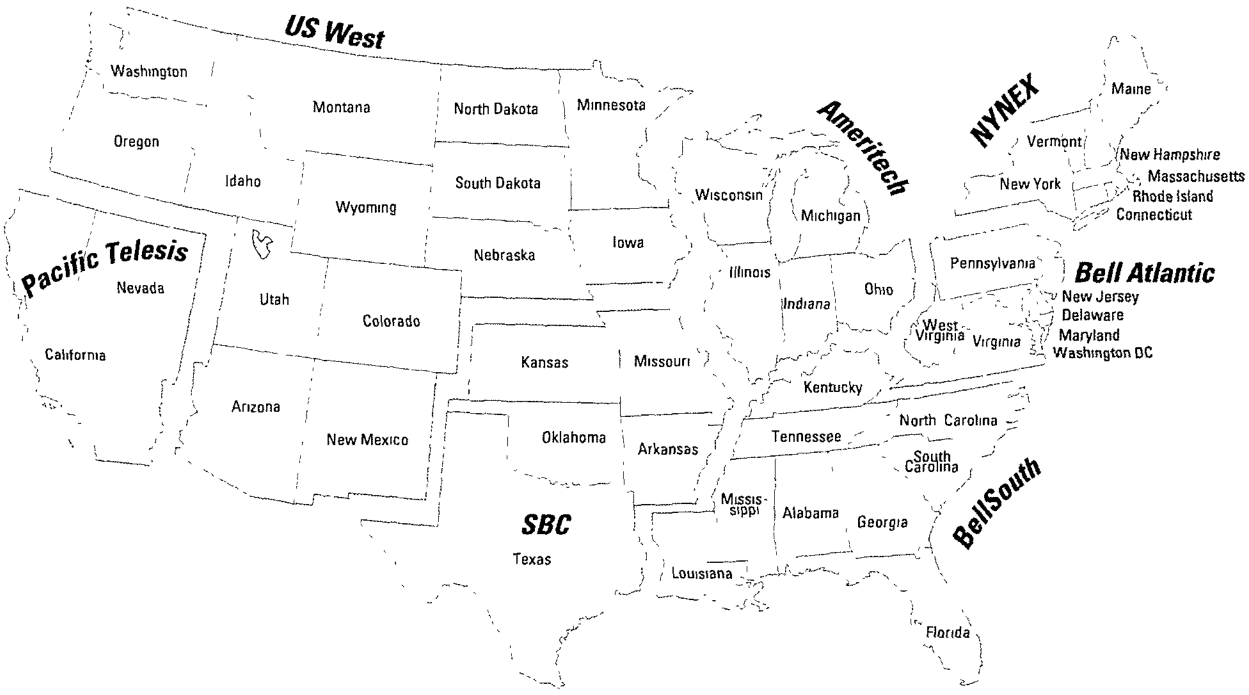
Third, once this checklist is satisfied, the FCC may only authorize an RBOC to offer in-region long-distance service if it is provided through an independent affiliate with separate officers,

Figure 1. RBOC International Services Authorized by the FCC

	Out of Region IMTS		In Region IMTS	
	Switched Resale	Facilities-Based	Switched Resale	Facilities-Based
Ameritech	July 19, 1996*	July 9, 1997*	—	—
Bell Atlantic	July 19, 1996	Feb. 7, 1997*	—	—
(NYNEX)	July 19, 1996*	Feb. 6, 1997*	pending	—
BellSouth	June 3, 1996	—	—	—
SBC	Oct. 25, 1996	—	—	—
(Pacific Telesis)	Feb. 13, 1997	Sept. 5, 1997*	pending	pending
U S West	Dec. 27, 1996	—	—	—

Note: IMTS is International Message Telephone Service. Each application for international service was filed by an RBOC subsidiary separate from the local service provider. All dates are for the earliest application granted. Data current to Sept. 1997.
*Indicates route restrictions apply where the RBOC has a foreign carrier affiliate.

Figure 2. Regions of U.S. RBOCs



Note: SBC and Pacific Telesis completed a merger in April 1997. The proposed Bell Atlantic-NYNEX merger is expected to close by December 1997.

©TeleGeography, Inc. 1997

directors, employees and accounts. This separate affiliate requirement "sunsets" after three years.

Ameritech was the first RBOC to file a Section 271 application for in-region long-distance authority with a January 1997 application to serve Michigan. However, Ameritech's application was later dismissed because its interconnection agreement had not been given final state approval. Ameritech later refiled its application, but the FCC rejected it again in August 1997, this time because the company's interconnection agreement did not satisfy three items in the competitive checklist.

In April 1997, SBC filed a Section 271 application to serve Oklahoma. But its application was opposed by the Justice Department and subsequently denied by the FCC because SBC had failed to demonstrate that it had an interconnection agreement with at least one unaffiliated, facilities-based competitor.

BellSouth became the third RBOC to file a Section 271 application. In September 1997, it asked the FCC for authority to provide long distance service in South Carolina.

Further Section 271 applications by these carriers and by other RBOCs are expected soon. Under the 1996 Act, the FCC must grant or deny a Section 271 application within 90 days.

Until the RBOCs have authority to provide long distance services in key states, they will not be able to market international service to their core customers—business and high volume residential customers within their local service regions. The FCC's Section 271 proceedings (and related local interconnection proceedings) thus will require continuing review by anyone interested in the RBOCs' future as international carriers.

This overview is adapted from a paper prepared by Koteen & Naftalin, LLP, entitled "The RBOCs Enter the Market for Domestic and International Long-Distance Services." Koteen & Naftalin, LLP, is one of Washington DC's leading communications law firms. Founded in 1953, its clients now include U.S. and foreign companies in the telecommunications, data networking, electronic equipment, broadcasting and entertainment industries. For further information, contact Greg Staple at +1 202 467 5700 (voice), +1 202 567 5915 (fax); greg.staple@koteen.com.

International Traffic Statistics

Andorra

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Spain	27.0	71.3%
2. France	7.0	18.4%
3. Portugal	1.5	3.9%
4. United Kingdom	0.6	1.7%
5. Germany	0.2	0.6%
6. Belgium	0.2	0.5%
7. Switzerland	0.2	0.5%
8. Italy	0.2	0.5%
9. Netherlands	0.1	0.4%
10. United States	0.1	0.3%
Other	0.7	1.9%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	n.a.	27.3
Outgoing	32.3	36.0	37.8
Surplus (Deficit)	n.a.	n.a.	(10.5)
Total Volume	n.a.	n.a.	65.1

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic. Data based on billing point of traffic

Argentina

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	35.0	19.3%
2. Uruguay	31.8	17.5%
3. Brazil	21.9	12.1%
4. Chile	14.1	7.8%
5. Spain	12.0	6.6%
6. Italy	9.7	5.4%
7. Paraguay	8.0	4.4%
8. Peru	7.1	3.9%
9. Bolivia	5.2	2.9%
10. France	3.9	2.1%
11. United Kingdom	3.4	1.9%
12. Mexico	3.3	1.8%
13. Germany	3.3	1.8%
14. Colombia	2.1	1.2%
15. Venezuela	2.0	1.1%
16. Canada	2.0	1.1%
17. Israel	1.5	0.8%
18. Ecuador	0.9	0.5%
19. Netherlands	0.8	0.5%
20. Japan	0.7	0.4%
Other	12.8	7.0%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	252.6	299.4	390.7
Outgoing	175.0	179.4	181.3
Surplus (Deficit)	77.7	119.9	209.4
Total Volume	427.6	478.8	572.0

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data based on billing point of traffic.

Australia

Largest Telecommunications Routes, FY 1996/97

Destination	MiTT	Percentage of Outgoing Traffic
1. United Kingdom	185	15.9%
2. New Zealand	155	13.3%
3. United States	145	12.4%
4. Hong Kong	55	4.7%
5. Singapore	45	3.9%
6. Malaysia	45	3.9%
7. Indonesia	40	3.4%
8. China	40	3.4%
9. Philippines	35	3.0%
10. Japan	35	3.0%
Other	385	33.0%

National Traffic Balance

MiTT	1994	1995	FY 1996/97
Incoming	n.a.	n.a.	n.a.
Outgoing	852	1024	1305
Surplus (Deficit)	n.a.	n.a.	n.a.
Total Volume	n.a.	n.a.	n.a.

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic. Route data are for Telstra and Optus only, and are rounded to the nearest 5 million minutes Because fiscal year reporting replaced calendar year reporting in 1996, totals for 1995 and FY 1996/97 are not directly comparable. Fiscal year ends 30 June.

Austria

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	344.5	42.0%
2. Switzerland	49.3	6.0%
3. Italy	42.5	5.2%
4. Yugoslavia	31.0	3.8%
5. Hungary	28.6	3.5%
6. United States	24.9	3.0%
7. Turkey	24.5	3.0%
8. Croatia	23.1	2.8%
9. France	21.0	2.6%
10. Poland	20.3	2.5%
11. Netherlands	19.4	2.4%
12. Czech Republic	18.3	2.2%
13. United Kingdom	16.6	2.0%
14. Slovenia	14.4	1.8%
15. Slovak Republic	11.0	1.3%
16. Romania	9.1	1.1%
17. Russia	9.1	1.1%
18. Belgium	8.7	1.1%
19. Sweden	7.4	0.9%
Other	95.5	11.7%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	774.5	n.a.	n.a.
Outgoing	819.2	901	960
Surplus (Deficit)	(44.7)	n.a.	n.a.
Total Volume	1,593.7	n.a.	n.a.

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic.

Bahamas

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	45.7	80.5%
2. Canada	3.0	5.3%
3. United Kingdom	1.7	3.0%
4. Jamaica	1.2	2.1%
5. Switzerland	0.4	0.6%
6. France	0.3	0.5%
7. Germany	0.3	0.5%
8. Turks & Caicos Islands	0.3	0.5%
9. Italy	0.2	0.4%
10. Cayman Islands	0.2	0.4%
11. Brazil	0.2	0.4%
12. Trinidad & Tobago	0.2	0.3%
13. Barbados	0.2	0.3%
14. Mexico	0.2	0.3%
15. Haiti	0.2	0.3%
16. Bermuda	0.2	0.3%
17. Austria	0.1	0.2%
18. Dominican Republic	0.1	0.2%
19. Cuba	0.1	0.2%
Other	2.1	3.6%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	n.a.	n.a.
Outgoing	n.a.	n.a.	56.7
Surplus (Deficit)	n.a.	n.a.	n.a.
Total Volume	n.a.	n.a.	n.a.

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic

Bahrain

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. India	17.7	19.2%
2. Saudi Arabia	13.5	14.6%
3. United Arab Emirates	11.2	12.1%
4. United Kingdom	8.3	9.0%
5. Kuwait	4.8	5.2%
6. Pakistan	4.3	4.7%
7. Egypt	4.3	4.7%
8. United States	4.2	4.6%
9. Qatar	3.7	4.0%
10. Oman	1.9	1.9%
11. Philippines	1.7	1.9%
12. Jordan	1.4	1.5%
13. Sri Lanka	1.1	1.2%
14. Bangladesh	1.0	1.1%
15. Morocco	1.0	1.1%
16. France	0.8	0.8%
17. Syria	0.7	0.7%
18. Germany	0.6	0.7%
19. Switzerland	0.6	0.7%
20. Yemen	0.6	0.7%
Other	8.7	9.4%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	59.1	62.6	69.4
Outgoing	86.8	88.7	92.2
Surplus (Deficit)	n.a.	(26.1)	(22.8)
Total Volume	n.a.	151.3	161.5

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic Data based on billing point of traffic

Bangladesh

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United Kingdom	5.4	16.5%
2. Japan	3.2	9.7%
3. India	2.9	8.8%
4. Hong Kong	2.9	8.7%
5. Singapore	1.9	5.7%
6. United States	1.4	4.4%
7. Pakistan	1.3	3.9%
8. Rep. of Korea	1.2	3.7%
9. Malaysia	1.2	3.7%
10. Italy	1.1	3.2%
11. Saudi Arabia	0.8	2.4%
12. United Arab Emirates	0.7	2.1%
13. China	0.6	1.9%
14. Germany	0.6	1.9%
15. France	0.6	1.8%
16. Canada	0.2	0.5%
17. Sri Lanka	0.1	0.4%
Other	12.2	36.8%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	122.1	129.2
Outgoing	22.1	33.0	38.3
Surplus (Deficit)	n.a.	89.1	90.9
Total Volume	n.a.	155.1	167.5

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic

Belarus

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Russia	74.1	70.6%
2. Ukraine	22.5	21.5%
3. Moldova	2.3	2.2%
4. Kazakhstan	2.0	1.9%
5. Armenia	1.2	1.1%
6. Uzbekistan	0.9	0.9%
7. Azerbaijan	0.7	0.7%
8. Georgia	0.5	0.5%
9. Kyrgyzstan	0.2	0.2%
10. Turkmenistan	0.2	0.2%
11. Tajikistan	0.1	0.1%

National Traffic Balance

MiTT	**1994**	**1995**	**1996**
Incoming	n.a.	n.a.	n.a.
Outgoing	n.a.	106.6	104.9
Surplus (Deficit)	n.a.	n.a.	n.a.
Total Volume	n.a.	n.a.	n.a.

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic. Data include traffic to other member states of the Commonwealth of Independent States only See page 114 for a matrix of traffic from other CIS member states

Belgium

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. France	285.0	23.2%
2. Netherlands	253.4	20.6%
3. Germany	148.9	12.1%
4. United Kingdom	108.3	8.8%
5. Italy	65.1	5.3%
6. United States	45.1	3.7%
7. Luxembourg	43.8	3.6%
8. Spain	40.9	3.3%
9. Switzerland	26.2	2.1%
10. Sweden	14.4	1.2%
11. Portugal	13.2	1.1%
12. Greece	12.3	1.0%
13. Denmark	11.9	1.0%
14. Turkey	11.4	0.9%
15. Austria	10.8	0.9%
16. Morocco	9.9	0.8%
17. Poland	9.9	0.8%
18. Ireland	7.4	0.6%
19. Canada	6.2	0.5%
20. Russia	5.9	0.5%
Other	92.3	7.5%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	1,093.9	1,172.0	1,289.1
Outgoing	1,049.0	1,105.7	1,228.4
Surplus (Deficit)	44.9	66.3	60.6
Total Volume	2,142.9	2,277.7	2,517.5

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data based on billing point of traffic.

Bolivia

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	4.8	22.4%
2. Brazil	3.4	15.9%
3. Argentina	3.2	15.0%
4. Chile	2.3	10.7%
5. Peru	1.7	7.9%
6. Germany	0.5	2.4%
7. Spain	0.5	2.1%
8. Mexico	0.5	2.1%
9. Colombia	0.4	1.9%
10. Paraguay	0.3	1.5%
11. Italy	0.3	1.4%
12. Canada	0.3	1.4%
13. Ecuador	0.2	1.1%
14. Venezuela	0.2	1.1%
15. Japan	0.2	1.1%
16. United Kingdom	0.2	1.0%
17. France	0.2	1.0%
18. Switzerland	0.2	0.9%
19. Uruguay	0.2	0.7%
20. Panama	0.2	0.7%
Other	1.6	7.3%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	49.2	53.9
Outgoing	18.0	20.8	21.4
Surplus (Deficit)	n.a.	28.4	32.5
Total Volume	n.a.	70.0	75.3

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic.

Brazil

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	120.3	32.8%
2. Argentina	28.6	7.8%
3. Italy	16.9	4.6%
4. Germany	15.9	4.3%
5. Portugal	15.3	4.2%
6. United Kingdom	14.0	3.8%
7. France	11.8	3.2%
8. Japan	9.8	2.7%
9. Spain	9.2	2.5%
10. Uruguay	8.4	2.3%
11. São Tomé and Principe	8.1	2.2%
12. Paraguay	7.2	2.0%
13. Chile	6.8	1.9%
14. Moldova	6.5	1.8%
15. Guyana	6.1	1.7%
16. Canada	6.0	1.6%
17. Bolivia	5.9	1.6%
18. Switzerland	5.4	1.5%
19. Mexico	4.7	1.3%
20. Israel	4.1	1.1%
Other	55.9	15.2%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	408.0	495.5	624.4
Outgoing	199.0	319.4	366.9
Surplus (Deficit)	209.0	176.1	257.5
Total Volume	607.0	814.8	991.3

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic. Data based on billing point of traffic

Canada

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	2850	75.7%
2. United Kingdom	155	4.1%
3. Hong Kong	60	1.6%
4. France	50	1.3%
5. Germany	45	1.2%
6. India	40	1.1%
7. Italy	35	0.9%
8. Philippines	17	0.5%
9. Netherlands	17	0.5%
10. Mexico	16	0.4%
11. Jamaica	15	0.4%
Other	465	12.4%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	3859.2	3895.8	4313.3
Outgoing	2231.9	2667.1	3519.8
Surplus (Deficit)	1627.3	1228.7	793.5
Total Volume	6091.1	6562.9	7833.1

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic and are based on billing point of traffic. Route data for the top seven routes rounded to the nearest five million minutes. U.S. route traffic is for Stentor, AT&T Canada Long Distance and IPL resellers combined, but IPL resellers' traffic is not included on other routes (e g , to the U.K.).

Chile

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	52	29.9%
2. Argentina	29	16.7%
3. Brazil	11	6.3%
4. Spain	10	5.8%
5. Peru	8	4.6%
6. Canada	6	3.5%
7. Mexico	5	2.9%
8. Germany	4	2.3%
9. France	4	2.3%
10. United Kingdom	4	2.3%
11. Ecuador	4	2.3%
12. Italy	4	2.3%
13. Bolivia	3	1.7%
14. Colombia	3	1.7%
15. Venezuela	2	1.2%
Other	25	14.4%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	n.a.	n.a.
Outgoing	73.5	136.9	173.8
Surplus (Deficit)	n.a.	n.a.	n.a.
Total Volume	n.a.	n.a.	n.a.

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic

China

Largest Telecommunications Routes, 1995

Destination	MiTT	Percentage of Outgoing Traffic
1. Hong Kong	750.0	56.0%
3. Taiwan	115.0	8.6%
2. Japan	86.8	6.5%
4. United States	75.0	5.6%
5. Rep. of Korea	45.7	3.4%
6. Macau	41.4	3.1%
7. Singapore	24.6	1.8%
8. Australia	13.5	1.0%
9. Germany	12.0	0.9%
10. Canada	10.7	0.8%
11. United Kingdom	7.2	0.5%
12. France	6.8	0.5%
13. Thailand	6.5	0.5%
14. Russia	6.2	0.5%
15. Malaysia	6.0	0.4%
16. Italy	5.3	0.4%
17. Indonesia	3.5	0.3%
18. Philippines	3.0	0.2%
19. Netherlands	2.5	0.2%
20. New Zealand	2.0	0.1%
Other	115.5	8.6%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	n.a.	n.a.
Outgoing	1,170	1,339.1	1,433.2
Surplus (Deficit)	n.a.	n.a.	n.a.
Total Volume	n.a.	n.a.	n.a.

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic.

Colombia

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	60.2	44.4%
2. Venezuela	14.1	10.4%
3. Ecuador	6.3	4.6%
4. Spain	5.7	4.2%
5. Mexico	4.8	3.6%
6. Panama	4.8	3.5%
7. Brazil	2.9	2.1%
8. Italy	2.8	2.0%
9. Peru	2.8	2.0%
10. United Kingdom	2.5	1.8%
11. Germany	2.5	1.8%
12. Argentina	2.3	1.7%
13. France	2.3	1.7%
14. Canada	2.3	1.7%
15. Chile	1.7	1.3%
16. Costa Rica	1.6	1.2%
17. Dominican Republic	1.1	0.8%
18. Switzerland	0.9	0.7%
19. Puerto Rico	0.9	0.7%
20. Japan	0.5	0.4%
Other	12.5	9.8%

National Traffic Balance

MiTT	**1994**	**1995**	**1996**
Incoming	302.8	351.5	384.2
Outgoing	120.3	127.3	135.5
Surplus (Deficit)	182.5	224.2	248.7
Total Volume	423.1	478.8	519.7

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic. Data based on billing point of traffic.

Commonwealth of Independent States

1996 Outgoing International Traffic to C.I.S. Member States (Millions of Minutes)

Origin \ Destination	Azerbaijan	Armenia	Belarus	Georgia	Kazakhstan	Kyrgyzstan	Moldova	Russia	Tajikistan	Turkmenistan	Uzbekistan	Ukraine
Azerbaijan	—	—	0.4	0.6	0.6	0.1	—	9.3	—	0.3	0.3	1.9
Armenia	—	—	0.8	1.6	0.5	—	0.2	39.7	—	0.3	0.4	4.5
Belarus	0.7	1.2	—	0.5	2.0	0.2	2.3	74.1	0.1	0.2	0.9	22.5
Kazakhstan	1.4	1.1	2.4	0.5	—	5.9	0.5	73.5	0.9	1.1	8.2	7.1
Kyrgyzstan	0.1	—	0.3	—	8.1	—	—	11.7	0.4	0.2	3.1	0.6
Moldova	0.2	0.2	2.5	—	0.4	—	—	27.3	—	—	0.2	19.3
Russia	15.1	41.9	85.8	27.3	63.8	10.4	26.2	—	6.1	5.1	32.3	257.0
Tajikistan	—	—	0.2	—	0.8	0.4	—	8.7	—	0.2	1.8	0.5
Turkmenistan	0.7	0.5	0.2	0.1	0.7	0.2	0.1	6.4	0.2	—	1.0	0.9
Uzbekistan	0.4	0.4	0.9	0.2	17.4	2.9	0.2	26.5	1.6	1.1	—	2.6
Ukraine	3.0	7.0	24.2	3.4	5.1	0.6	18.4	273.2	0.4	1.1	4.3	—

Source: Regional Commonwealth in the Field of Communications (RCC)

Costa Rica

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	23.8	43.2%
2. Nicaragua	7.7	13.9%
3. Panama	4.1	7.4%
4. Mexico	3.4	6.1%
5. Guatemala	3.2	5.8%
6. El Salvador	2.7	4.8%
7. Honduras	2.1	3.8%
8. Colombia	1.6	3.0%
9. Canada	1.0	1.8%
10. Italy	0.8	1.5%
11. Spain	0.8	1.4%
12. Germany	0.8	1.4%
13. Venezuela	0.6	1.0%
14. Peru	0.5	0.9%
15. Argentina	0.5	0.9%
16. Brazil	0.5	0.8%
17. Chile	0.4	0.8%
18. Ecuador	0.4	0.8%
19. France	0.4	0.7%
Other	4.3	7.8%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	n.a.	87.8
Outgoing	51.0	52.8	55.0
Surplus (Deficit)	n.a.	n.a.	32.8
Total Volume	n.a.	n.a.	142.8

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data based on billing point of traffic

Croatia

Largest Telecommunications Routes, 1995

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	47.6	22.6%
2. Bosnia	46.7	22.2%
3. Slovenia	27.0	12.8%
4. Italy	17.2	8.2%
5. Austria	14.4	6.8%
6. Switzerland	6.3	3.0%
7. United Kingdom	5.7	2.7%
8. United States	5.2	2.5%
9. France	4.3	2.0%
10. Netherlands	3.3	1.6%
11. Canada	2.6	1.2%
12. Sweden	2.4	1.1%
13. Macedonia	2.3	1.1%
14. Hungary	2.2	1.0%
15. Belgium	2.1	1.0%
16. Spain	2.1	1.0%
17. Australia	1.8	0.9%
18. Russia	1.6	0.8%
19. Czech Republic	1.6	0.8%
20. Denmark	1.1	0.5%
Other	13.1	6.2%

National Traffic Balance

MiTT	**1994**	**1995**	**1996**
Incoming	240.2	309.0	n.a.
Outgoing	185.5	210.7	242.4
Surplus (Deficit)	54.8	98.3	n.a.
Total Volume	425.7	519.7	n.a.

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data based on billing point of traffic

Cyprus

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United Kingdom	32.5	25.3%
2. Greece	30.8	23.9%
3. Russia	6.4	5.0%
4. Germany	5.4	4.2%
5. United States	5.3	4.1%
6. Romania	3.1	2.4%
7. Lebanon	3.0	2.4%
8. Italy	2.7	2.1%
9. Bulgaria	2.4	1.9%
10. Syria	2.4	1.8%
11. France	2.3	1.8%
12. Yugoslavia	2.3	1.8%
13. Egypt	1.9	1.4%
14. Ukraine	1.9	1.4%
15. Switzerland	1.7	1.3%
16. Sweden	1.7	1.3%
17. Netherlands	1.5	1.2%
18. Israel	1.5	1.1%
19. Canada	1.3	1.0%
20. Australia	1.1	0.9%
Other	17.6	13.7%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	79.0	87.3	92.0
Outgoing	106.6	117.4	128.6
Surplus (Deficit)	(27.5)	(30.2)	(36.6)
Total Volume	185.6	204.7	220.5

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic.

Czech Republic

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Slovak Republic	70.8	25.2%
2. Germany	65.4	23.3%
3. Austria	18.2	6.5%
4. United Kingdom	13.1	4.7%
5. Italy	10.5	3.7%
6. Poland	9.1	3.2%
7. France	8.4	3.0%
8. United States	8.0	2.8%
9. Netherlands	6.8	2.4%
10. Ukraine	6.7	2.4%
11. Russia	6.7	2.4%
12. Switzerland	6.1	2.2%
13. Belgium	3.9	1.4%
14. Hungary	3.1	1.1%
15. Canada	3.0	1.1%
16. Spain	2.9	1.0%
17. Sweden	2.6	0.9%
18. Yugoslavia	2.3	0.8%
19. Croatia	2.2	0.8%
20. Bulgaria	1.9	0.7%
Other	29.5	10.5%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	210.0	223.7	324.4
Outgoing	157.6	186.8	281.2
Surplus (Deficit)	52.4	36.9	43.2
Total Volume	367.6	410.5	605.6

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data based on billing point of traffic. Totals in years 1994 and 1995 excluded traffic to and from the Slovak Republic.

Denmark

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	105.8	18.5%
2. Sweden	95.1	16.6%
3. United Kingdom	61.5	10.7%
4. Norway	55.8	9.7%
5. United States	27.6	4.8%
6. France	23.3	4.1%
7. Netherlands	22.9	4.0%
8. Italy	13.6	2.4%
9. Switzerland	10.8	2.2%
10. Finland	12.4	2.0%
11. Belgium	11.3	1.9%
12. Spain	11.2	1.9%
13. Poland	11.0	1.9%
14. Faroe Islands	9.7	1.7%
15. Turkey	6.9	1.2%
16. Greenland	5.3	0.9%
17. Austria	5.3	0.9%
18. Greece	3.6	0.6%
19. Canada	4.1	0.7%
20. Iceland	4.8	0.8%
Other	71.1	12.4%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	500.9	551.0	600.0
Outgoing	488.4	532.6	573.2
Surplus (Deficit)	12.4	18.4	26.8
Total Volume	989.3	1,083.6	1,173.2

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic Data are for Tele Danmark only. Other carriers originated an estimated 40 million minutes of traffic from Denmark

Dominican Republic

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	89.6	81.2%
2. Spain	2.7	2.4%
3. Germany	2.1	1.9%
4. Italy	2.0	1.8%
5. Canada	1.7	1.5%
6. Cuba	1.0	0.9%
7. Venezuela	0.9	0.8%
8. Mexico	0.9	0.8%
9. Switzerland	0.8	0.8%
10. Colombia	0.7	0.6%
11. Haiti	0.7	0.6%
12. Argentina	0.6	0.6%
13. France	0.6	0.5%
14. Panama	0.4	0.4%
15. Netherlands Antilles	0.4	0.4%
16. United Kingdom	0.4	0.4%
17. Costa Rica	0.3	0.3%
18. Austria	0.3	0.3%
19. Netherlands	0.3	0.3%
20. Brazil	0.3	0.2%
Other	3.7	3.4%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	404.0	424.1	450.9
Outgoing	63.5	85.4	126.6
Surplus (Deficit)	340.5	338.7	324.3
Total Volume	467.5	509.4	577.5

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Outgoing totals for years 1994 and 1995 are for Codetel only. Route data for 1996 include Codetel and AACR only; totals include traffic from Codetel, AACR and Tricom.

El Salvador

Largest Telecommunications Routes, 1996

	Destination	MiTT	Percentage of Outgoing Traffic
1.	United States	10.0	34.8%
2.	Guatemala	6.7	23.5%
3.	Costa Rica	2.5	8.9%
4.	Honduras	2.4	8.3%
5.	Mexico	1.9	6.5%
6.	Nicaragua	1.4	4.9%
7.	Panama	0.8	2.6%
8.	Canada	0.4	1.4%
9.	Germany	0.3	0.9%
10.	Italy	0.2	0.8%
11.	Colombia	0.2	0.8%
12.	Spain	0.2	0.8%
13.	Chile	0.1	0.5%
14.	Venezuela	0.1	0.4%
15.	United Kingdom	0.1	0.4%
16.	Japan	0.1	0.4%
17.	Brazil	0.1	0.4%
18.	Ecuador	0.1	0.3%
19.	Argentina	0.1	0.3%
20.	Rep. of Korea	0.1	0.3%
	Other	0.8	2.7%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	n.a.	160.5
Outgoing	62.6	64.1	28.6
Surplus (Deficit)	n.a.	n.a.	131.9
Total Volume	n.a.	n.a.	189.1

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic Traffic reporting in 1994 and 1995 based on originating point of traffic, 1996 totals based on billing point.

Finland

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Sweden	108.9	32.8%
2. Germany	29.9	9.0%
3. United Kingdom	23.2	7.0%
4. Russia	22.2	6.7%
5. Estonia	19.9	6.0%
6. United States	15.9	4.8%
7. Norway	12.3	3.7%
8. Denmark	10.3	3.1%
9. France	9.6	2.9%
10. Netherlands	7.6	2.3%
Other	71.7	21.6%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	285	345.0	n.a.
Outgoing	259	315.4	332.0
Surplus (Deficit)	26	29.6	n.a.
Total Volume	544	660.4	n.a.

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic.

France

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	344.0	11.0%
2. United Kingdom	340.0	10.9%
3. Italy	267.0	8.6%
4. Belgium	246.0	7.9%
5. Spain	199.0	6.4%
6. United States	179.0	5.7%
7. Switzerland	163.0	5.2%
8. Portugal	140.0	4.5%
9. Netherlands	107.0	3.4%
10. Morocco	101.0	3.2%
11. Algeria	76.0	2.4%
12. Tunisia	53.0	1.7%
13. Canada	43.0	1.4%
14. Turkey	38.0	1.2%
15. Sweden	29.0	0.9%
16. Poland	28.0	0.9%
17. Denmark	23.0	0.7%
18. Israel	23.0	0.7%
19. Austria	23.0	0.7%
20. Luxembourg	22.0	0.7%
Other	671.0	21.5%

National Traffic Balance

MiTT	**1994**	**1995**	**1996**
Incoming	2,739.5	2,958.9	3,283.0
Outgoing	2,602.5	2,804.6	3,116.0
Surplus (Deficit)	137.0	154.3	167.0
Total Volume	5,342.0	5,763.5	6,399.0

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic.

French Polynesia

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. France	4.9	62.4%
2. United States	0.8	10.4%
3. New Caledonia	0.7	8.3%
4. New Zealand	0.3	3.4%
5. Australia	0.2	3.1%
6. Japan	0.1	1.1%
7. Italy	0.1	0.8%
8. Germany	0.1	0.7%
9. United Kingdom	0.1	0.6%
10. Switzerland	0.1	0.6%
Other	0.7	8.9%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	n.a.	n.a.
Outgoing	7.6	7.6	7.9
Surplus (Deficit)	n.a.	n.a.	n.a.
Total Volume	n.a.	n.a.	n.a.

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic.

Germany

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Austria	426.0	8.4%
2. Italy	393.0	7.7%
3. France	378.9	7.4%
4. Switzerland	372.0	7.3%
5. Turkey	370.1	7.3%
6. United Kingdom	362.6	7.1%
7. Netherlands	338.1	6.6%
8. Poland	315.5	6.2%
9. United States	303.9	6.0%
10. Spain	184.8	3.6%
11. Belgium	146.0	2.9%
12. Greece	124.8	2.4%
13. Croatia	102.4	2.0%
14. Denmark	101.2	2.0%
15. Czech Republic	88.9	1.7%
16. Yugoslavia	86.7	1.7%
17. Sweden	78.4	1.5%
18. Russia	77.3	1.5%
19. Hungary	70.1	1.4%
20. Portugal	69.4	1.4%
Other	710.0	13.9%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	3,384	4,215	n.a.
Outgoing	4,942	5,238	5100
Surplus (Deficit)	(958)	(1,023)	n.a.
Total Volume	8,926	9,453	n.a.

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic Data are for Deutsche Telekom only. Figures for the United States exclude traffic to Alaska and Hawaii, and are based on billing point of traffic Data for all other routes based on originating point of traffic

Ghana

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United Kingdom	5.5	33.1%
2. United States	3.9	24.0%
3. Germany	1.2	7.3%
4. Netherlands	0.6	3.5%
5. Italy	0.5	3.3%
6. Lebanon	0.5	2.8%
7. South Africa	0.4	2.7%
8. Canada	0.4	2.6%
9. France	0.4	2.5%
10. India	0.3	1.7%
11. Australia	0.3	1.6%
12. Switzerland	0.2	1.5%
13. Japan	0.2	1.4%
14. Nigeria	0.1	0.8%
15. Israel	0.1	0.8%
16. Belgium	0.1	0.8%
17. China	0.1	0.7%
18. Rep. of Korea	0.1	0.6%
19. Zimbabwe	0.1	0.5%
20. Hong Kong	0.1	0.5%
Other	1.2	7.5%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	n.a.	59.6
Outgoing	11.6	16.8	16.5
Surplus (Deficit)	n.a.	n.a.	43.1
Total Volume	n.a.	n.a.	76.0

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic.

Greece

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	90.0	17.4%
2. United Kingdom	70.9	13.8%
3. Italy	46.1	8.9%
4. United States	31.8	6.2%
5. France	24.0	4.7%
6. Cyprus	20.7	4.0%
7. Bulgaria	16.0	3.1%
8. Canada	15.3	3.0%
9. Romania	13.4	2.6%
10. Albania	12.9	2.5%
11. Belgium	12.0	2.3%
12. Netherlands	11.4	2.2%
13. Switzerland	10.4	2.0%
14. Yugoslavia	8.9	1.7%
15. Sweden	8.6	1.7%
16. Russia	7.8	1.5%
17. Turkey	7.7	1.5%
18. Australia	7.2	1.4%
19. Austria	7.2	1.4%
20. Poland	6.4	1.2%
Other	86.9	16.9%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	441.2	505.4	557.3
Outgoing	422.7	467.9	515.6
Surplus (Deficit)	18.6	37.5	41.7
Total Volume	863.9	973.3	1,072.8

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic.

Guyana

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	15.7	52.6%
2. Canada	4.4	14.8%
3. Trinidad	1.8	6.0%
4. United Kingdom	1.4	4.8%
5. Barbados	1.4	4.7%
6. Jamaica	0.5	1.7%
7. Suriname	0.4	1.5%
8. China	0.2	0.8%
9. Venezuela	0.2	0.7%
10. Netherlands Antilles	0.2	0.6%
Other	3.5	11.9%

National Traffic Balance

MiTT	**1994**	**1995**	**1996**
Incoming	75.1	139.7	162.8
Outgoing	18.4	20.6	29.8
Surplus (Deficit)	56.7	119.1	133.1
Total Volume	93.4	160.2	192.6

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic.

Hong Kong

Largest Telecommunications Routes, FY 1996/97

Destination	MiTT	Percentage of Outgoing Traffic
1. China	965.0	55.5%
2. United States	86.9	5.0%
3. Taiwan	69.5	4.0%
4. Japan	69.5	4.0%
5. Philippines	69.5	4.0%
6. United Kingdom	52.2	3.0%
7. Canada	52.2	3.0%
8. Singapore	52.2	3.0%
9. Macau	52.2	3.0%
10. Australia	34.8	2.0%
Other	234.6	13.5%

National Traffic Balance

MiTT	FY 1994/95	FY 1995/96	FY 1996/97
Incoming	1,446.4	1,598.3	1,940.8
Outgoing	1,578.4	1,691.8	1,738.6
Surplus (Deficit)	(132.1)	(93.5)	202.2
Total Volume	3,024.8	3,290.2	3,679.4

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data based on billing point of traffic. Route-by-route traffic volumes reflect reported data of Hong Kong Telecom which has been rounded to the nearest percent. Fiscal year ends 31 March.

Hungary

Largest Telecommunications Routes, 1995

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	59.4	24.0%
2. Austria	30.4	12.3%
3. Romania	14.4	5.8%
4. Italy	13.5	5.5%
5. United Kingdom	13.3	5.4%
6. United States	11.2	4.5%
7. Yugoslavia	8.4	3.4%
8. France	8.4	3.4%
9. Russia	7.5	3.0%
10. Switzerland	7.1	2.9%
11. Netherlands	6.6	2.7%
12. Slovak Republic	6.3	2.5%
13. Ukraine	5.5	2.2%
14. Belgium	3.8	1.5%
15. Sweden	3.5	1.4%
16. Israel	3.4	1.4%
17. Poland	3.3	1.3%
18. Croatia	3.2	1.3%
19. Czech Republic	2.9	1.2%
20. Greece	2.7	1.1%
Other	32.5	13.1%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	211.9	243.7	n.a.
Outgoing	236.6	247.5	265
Surplus (Deficit)	(24.7)	(24.7)	n.a.
Total Volume	448.5	448.5	n.a.

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic. Data *based on billing point of traffic.*

Iceland

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	7.2	22.1%
2. Denmark	5.5	17.1%
3. United Kingdom	3.5	10.8%
4. Sweden	3.1	9.6%
5. Norway	3.0	9.1%
6. Germany	2.5	7.6%
7. France	0.8	2.6%
8. Netherlands	0.8	2.5%
9. Spain	0.6	1.8%
10. Faroe Islands	0.6	1.8%
11. Canada	0.5	1.5%
12. Italy	0.5	1.4%
13. Belgium	0.4	1.4%
14. Finland	0.4	1.1%
15. Switzerland	0.3	0.9%
16. Luxembourg	0.2	0.7%
17. Austria	0.2	0.6%
18. Russia	0.2	0.5%
19. Portugal	0.2	0.5%
20. Poland	0.2	0.5%
Other	1.9	5.8%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	25.5	28.4	32.0
Outgoing	26.0	28.9	32.5
Surplus (Deficit)	(0.4)	(0.6)	(0.5)
Total Volume	51.5	57.3	64.5

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic Data based on billing point of traffic.

India

Largest Telecommunications Routes, FY 1996/97

Destination	MiTT	Percentage of Outgoing Traffic
1. Saudi Arabia	77.1	20.1%
2. United States	50.0	13.0%
3. United Kingdom	35.8	9.3%
4. United Arab Emirates	33.1	8.6%
5. Singapore	17.3	4.5%
6. Germany	13.9	3.6%
7. Canada	11.4	3.0%
8. Kuwait	9.8	2.6%
9. Hong Kong	9.2	2.4%
10. Oman	9.1	2.4%
11. Japan	7.74	2.0%
12. Australia	6.7	1.7%
13. France	6.4	1.7%
14. Italy	5.7	1.5%
15. Sri Lanka	5.4	1.4%
16. Malaysia	5.0	1.3%
17. Qatar	3.9	1.0%
18. Switzerland	3.8	1.0%
19. Russia	3.6	0.9%
20. Netherlands	3.5	0.9%
Other	65.8	17.1%

National Traffic Balance

MiTT	FY 1994/95	FY 1995/96	FY 1996/97
Incoming	615.0	805.4	1000.0
Outgoing	314.0	341.4	384.2
Surplus (Deficit)	300.9	464.0	615.8
Total Volume	929.0	1,146.8	1384.2

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Route traffic and totals exclude cross-border traffic to Bangladesh, Nepal and Pakistan.

Indonesia

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Singapore	61.7	24.9%
2. United States	23.3	9.4%
3. Japan	23.2	9.3%
4. Australia	22.3	9.0%
5. Malaysia	18.2	7.3%
6. Hong Kong	13.4	5.4%
7. Rep. of Korea	9.9	4.0%
8. Taiwan	9.8	3.9%
9. United Kingdom	7.7	3.1%
10. Germany	5.9	2.4%
11. China	5.3	2.1%
12. Philippines	4.6	1.9%
13. Netherlands	4.6	1.8%
14. Saudi Arabia	4.4	1.8%
15. Thailand	3.6	1.3%
16. France	3.3	1.3%
17. India	3.2	1.1%
18. Canada	2.6	0.9%
19. Italy	2.2	0.5%
20. Switzerland	1.3	0.5%
Other	17.7	7.1%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	244.7	294.0	356.4
Outgoing	182.5	216.6	280.2
Surplus (Deficit)	62.2	77.4	76.2
Total Volume	427.2	510.6	636.6

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data based on billing point of traffic. Totals for 1996 include traffic from Indosat and Satelindo; route data are for Indosat only

Iran

Largest Telecommunications Routes, 1995

Destination	MiTT	Percentage of Outgoing Traffic
1. United Arab Emirates	22.3	10.6%
2. Kuwait	22.3	10.6%
3. Germany	21.2	10.1%
4. United States	17.8	8.5%
5. United Kingdom	10.1	4.8%
6. Pakistan	8.8	4.2%
7. Turkey	7.6	3.6%
8. Sweden	6.8	3.2%
9. Canada	6.3	3.0%
10. Japan	6.1	2.9%
11. France	5.1	2.4%
12. Saudi Arabia	3.8	1.8%
13. Italy	3.6	1.7%
14. Netherlands	3.3	1.6%
15. Qatar	2.7	1.3%
16. Austria	2.1	1.0%
17. Switzerland	2.1	1.0%
18. India	1.8	0.9%
19. Denmark	1.4	0.7%
20. Spain	0.9	0.4%
Other	54.5	25.9%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	199	n.a.
Outgoing	208.4	210.4	183.2
Surplus (Deficit)	n.a.	(11)	n.a.
Total Volume	n.a.	409	n.a.

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic. Data based on billing point of traffic

Ireland

Largest Telecommunications Routes, FY 1996/97

Destination	MiTT	Percentage of Outgoing Traffic
1. United Kingdom	420	72.4%
2. United States	55	9.5%
3. Germany	20	3.4%
4. France	15	2.6%
5. Netherlands	10	1.7%
6. Italy	8	1.4%
7. Spain	7	1.2%
8. Belgium	5	0.9%
9. Canada	6	1.0%
10. Australia	5	0.9%
Other	29	5.0%

National Traffic Balance

MiTT	FY 1994/95	FY 1995/96	FY 1996/97
Incoming	442.9	n.a.	n.a.
Outgoing	323.7	407	580
Surplus (Deficit)	119.2	n.a.	n.a.
Total Volume	766.5	n.a.	n.a.

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic Data for the top five routes are rounded to the nearest five million minutes. Traffic to Northern Ireland is excluded in both totals and route data. Data are for Telecom Eireann only Fiscal year ends 31 March.

Israel

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	103.5	32.4%
2. United Kingdom	29.0	9.1%
3. Canada	23.7	7.4%
4. France	18.4	5.8%
5. Jordan	17.6	5.5%
6. Germany	16.5	5.2%
7. Italy	12.0	3.7%
8. Russia	11.1	3.5%
9. Ukraine	7.1	2.2%
10. Netherlands	6.5	2.0%
11. Turkey	6.2	1.9%
12. Australia	5.9	1.9%
13. Switzerland	5.8	1.8%
14. Belgium	3.8	1.2%
15. Spain	3.7	1.2%
16. Romania	3.6	1.1%
17. South Africa	3.4	1.1%
18. Egypt	2.8	0.9%
19. Sweden	2.4	0.8%
20. Austria	2.3	0.7%
Other	34.4	10.8%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	345.6	468.1
Outgoing	213.0	252.3	319.7
Surplus (Deficit)	n.a.	93.3	148.4
Total Volume	n.a.	597.9	787.9

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data based on billing point of traffic.

Italy

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	357.8	16.8%
2. France	250.6	11.8%
3. United States	193.2	9.1%
4. Switzerland	191.0	9.0%
5. United Kingdom	171.7	8.1%
6. Spain	77.1	3.6%
7. Belgium	61.3	2.9%
8. Austria	53.9	2.5%
9. Netherlands	47.0	2.2%
10. Greece	39.0	1.8%
11. Poland	38.8	1.8%
12. Romania	38.1	1.8%
13. Morocco	33.4	1.6%
14. Chile	29.2	1.4%
15. Croatia	27.2	1.3%
16. Canada	24.7	1.2%
17. Tunisia	24.5	1.2%
18. Albania	21.3	1.0%
19. Russia	20.4	1.0%
20. Sweden	19.7	0.9%
Other	404.2	19.0%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	1,864.0	1,999.8	2,253.5
Outgoing	1,708.0	1,908.2	2,124.0
Surplus (Deficit)	156.0	91.6	129.5
Total Volume	3,572.0	3,908.1	4,377.4

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic. Data exclude some cross-border traffic to France, Slovenia and Switzerland.

Japan

Largest Telecommunications Routes, FY 1996/97

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	367.7	22.2%
2. China	217.1	13.1%
3. Korea, Rep. of	157.0	9.5%
4. Philippines	138.0	8.3%
5. Taiwan	86.7	5.2%
6. Thailand	70.0	4.2%
7. Brazil	60.7	3.7%
8. Hong Kong	59.7	3.6%
9. United Kingdom	50.4	3.0%
10. Singapore	41.3	2.5%
11. Australia	36.6	2.2%
12. Malaysia	31.2	1.9%
13. Indonesia	30.8	1.9%
14. Canada	27.3	1.6%
15. Germany	26.4	1.6%
16. France	21.6	1.3%
17. Russia	21.2	1.3%
18. Peru	17.9	1.1%
19. Italy	12.4	0.7%
20. India	10.7	0.6%
Other	174.8	10.5%

National Traffic Balance

MiTT	FY 1994/95	FY 1995/96	FY 1996/97
Incoming	1,140.6	1,320.8	1,519.1
Outgoing	1,524.8	1,631.3	1,710.6
Surplus (Deficit)	384.2	(310.5)	(191.5)
Total Volume	2,665.4	2,952.1	3,229.7

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic Route data include only IDD calls, while totals include operator assisted calls as well Data are for KDD, Japan Telecom (formerly ITJ) and IDC Fiscal year ends 31 March.

Jordan

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Israel	11.4	15.2%
2. Saudi Arabia	9.2	12.4%
3. Egypt	7.5	10.0%
4. Syria	7.0	9.4%
5. United Arab Emirates	4.9	6.5%
6. United States	4.6	6.2%
7. Iraq	4.6	6.1%
8. United Kingdom	2.7	3.6%
9. Lebanon	2.7	3.6%
10. Kuwait	2.6	3.5%
11. Germany	1.4	1.9%
12. Qatar	1.2	1.6%
13. Italy	1.1	1.5%
14. France	0.9	1.2%
15. Oman	0.9	1.2%
16. Yemen	0.8	1.1%
17. Bahrain	0.8	1.1%
18. Turkey	0.8	1.0%
19. Canada	0.7	0.9%
20. Switzerland	0.5	0.6%
Other	8.5	11.4%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	114	118.0	133.1
Outgoing	57	71.7	74.6
Surplus (Deficit)	57	46.3	58.5
Total Volume	171	189.7	207.7

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Jordan-Israel route data include traffic to the Occupied Territories (West Bank).

Kazakhstan

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Russia	73.5	71.7%
2. Uzbekistan	8.2	8.0%
3. Ukraine	7.1	6.9%
4. Kyrgyzstan	5.9	5.8%
5. Belarus	2.4	2.3%
6. Azerbaijan	1.4	1.3%
7. Turkmenistan	1.1	1.0%
8. Armenia	1.1	1.0%
9. Tajikistan	0.9	0.9%
10. Georgia	0.5	0.5%
11. Moldova	0.5	0.5%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	n.a.	n.a.
Outgoing	n.a.	111.1	102.5
Surplus (Deficit)	n.a.	n.a.	n.a.
Total Volume	n.a.	n.a.	n.a.

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data include traffic to other member states of the Commonwealth of Independent States only See page 114 for a matrix of traffic from other CIS member states.

Republic of Korea

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	170	24.3%
2. Japan	125	17.9%
3. China	120	17.2%
4. Hong Kong	25	3.6%
5. Australia	15	2.1%
6. Germany	14	2.0%
7. Canada	14	2.0%
8. United Kingdom	13	1.9%
9. Philippines	12	1.7%
10. Indonesia	12	1.7%
11. Taiwan	9	1.3%
12. Singapore	9	1.3%
13. Thailand	9	1.3%
14. France	8	1.1%
15. Vietnam	8	1.1%
Other	136	19.4%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	555.2	672	740.6
Outgoing	440.47	557	699.3
Surplus (Deficit)	114.8	115	41.3
Total Volume	995.6	1,229	1,439.9

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic Route data for top five routes are rounded to the nearest five million minutes

Kuwait

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Egypt	23.1	16.4%
2. Saudi Arabia	15.7	11.1%
3. India	15.3	10.9%
4. Syria	9.7	6.9%
5. United Arab Emirates	8.8	6.2%
6. United States	8.4	5.9%
7. Pakistan	8.1	5.8%
8. United Kingdom	7.8	5.6%
9. Iran	6.3	4.4%
10. Jordan	5.4	3.9%
11. Lebanon	3.8	2.7%
12. Bahrain	3.8	2.7%
13. Bangladesh	2.1	1.5%
14. Philippines	1.4	1.0%
15. Qatar	1.4	1.0%
16. France	1.3	0.9%
17. Germany	1.3	0.9%
18. Canada	1.2	0.9%
19. Oman	1.2	0.8%
20. Italy	1.0	0.7%
Other	13.7	9.7%

National Traffic Balance

MiTT	**1994**	**1995**	**1996**
Incoming	127.0	130.2	131.2
Outgoing	120.6	125.9	140.7
Surplus (Deficit)	6.4	4.3	(9.4)
Total Volume	247.6	256.1	271.9

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic.

Luxembourg

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Belgium	56.2	22.6%
2. Germany	50.9	20.5%
3. France	50.3	20.2%
4. Portugal	15.7	6.3%
5. United Kingdom	14.0	5.6%
6. Italy	11.4	4.6%
7. Netherlands	8.7	3.5%
8. Switzerland	6.6	2.6%
9. United States	5.7	2.3%
10. Spain	3.9	1.6%
11. Denmark	3.2	1.3%
12. Austria	2.3	0.9%
13. Sweden	2.3	0.9%
14. Greece	1.7	0.7%
15. Ireland	1.1	0.4%
16. Finland	1.0	0.4%
17. Poland	0.9	0.4%
18. Russia	0.8	0.3%
19. Japan	0.7	0.3%
20. Canada	0.7	0.3%
Other	10.7	4.3%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	145.2	174.5	189.8
Outgoing	213.5	232.2	248.5
Surplus (Deficit)	(68.3)	(57.7)	(58.8)
Total Volume	358.7	406.7	438.3

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic.

Macau

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. China	48.6	43.2%
2. Hong Kong	47.3	42.1%
3. Portugal	3.5	3.2%
4. Taiwan	3.1	2.7%
5. United States	1.6	1.4%
6. Philippines	1.2	1.1%
7. Canada	1.1	1.0%
8. Thailand	1.1	1.0%
9. Australia	0.7	0.7%
10. United Kingdom	0.5	0.5%
11. Singapore	0.5	0.4%
12. Japan	0.4	0.4%
13. Malaysia	0.3	0.3%
14. Rep. of Korea	0.3	0.2%
15. France	0.3	0.2%
16. Indonesia	0.2	0.2%
17. Vietnam	0.1	0.1%
18. Germany	0.1	0.1%
19. New Zealand	0.1	0.1%
Other	1.3	1.1%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	84.3	90.4	92.1
Outgoing	100.3	108.1	112.5
Surplus (Deficit)	(15.7)	(17.7)	(20.4)
Total Volume	184.3	198.5	204.6

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic Data based on billing point of traffic.

Malaysia

Largest Telecommunications Routes, FY 1996/97

Destination	MiTT	Percentage of Outgoing Traffic
1. Singapore	317.3	55.6%
2. Indonesia	30.1	5.3%
3. Japan	26.2	4.6%
4. Australia	21.8	3.8%
5. United Kingdom	20.5	3.6%
6. United States	17.1	3.0%
7. Hong Kong	16.0	2.8%
8. Thailand	14.1	2.5%
9. Taiwan	12.2	2.1%
10. India	11.8	2.1%
11. Philippines	10.7	1.9%
12. Bangladesh	7.9	1.4%
13. China	6.5	1.1%
14. Germany	5.1	0.9%
15. Pakistan	4.9	0.9%
16. Saudi Arabia	4.9	0.9%
17. Rep. of Korea	4.6	0.8%
18. Myanmar	3.6	0.6%
19. New Zealand	3.3	0.6%
20. Brunei	3.0	0.5%
Other	28.9	5.1%

National Traffic Balance

MiTT	FY 1994/95	FY 1995/96	FY 1996/97
Incoming	399.7	442.0	581.9
Outgoing	342.3	408.3	570.5
Surplus (Deficit)	57.4	33.7	11.4
Total Volume	742.0	850.3	1,152.4

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data based on billing point of traffic Traffic figures for years 94/95 and 95/96 excluded some cross-border traffic to Singapore Traffic is for Telekom Malaysia only Other carriers originated an estimated 50 million minutes of additional traffic in FY 1996/97. Fiscal year ends 31 March.

Mexico

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	927.0	86.6%
2. Canada	17.7	1.7%
3. Spain	11.6	1.1%
4. Cuba	6.9	0.6%
5. Germany	6.6	0.6%
6. Colombia	6.2	0.6%
7. France	5.9	0.6%
8. Italy	5.8	0.5%
9. Argentina	5.8	0.5%
10. Guatemala	5.1	0.5%
11. United Kingdom	5.0	0.5%
12. Brazil	4.4	0.4%
13. Chile	4.0	0.4%
14. Costa Rica	3.8	0.4%
15. Venezuela	3.5	0.3%
16. Peru	3.4	0.3%
17. Israel	3.4	0.3%
18. Japan	2.9	0.3%
19. El Salvador	2.4	0 2%
20. Switzerland	2.0	0.2%
Other	37.3	3.5%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	1,829.4	2,114.0	2,489.7
Outgoing	844.1	950.0	1,070.7
Surplus (Deficit)	985.4	1,164.0	1,419.0
Total Volume	2,673.5	3,064.0	3,560.4

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data based on billing point of traffic

Moldova

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Russia	27.3	54.3%
2. Ukraine	19.3	38.5%
3. Belarus	2.5	5.0%
4. Kazakhstan	0.4	0.7%
5. Armenia	0.2	0.5%
6. Azerbaijan	0.2	0.3%
7. Uzbekistan	0.2	0.3%
8. Georgia	0.1	0.1%
9. Kyrgyzstan	0.1	0.1%
10. Turkmenistan	0.1	0.1%
11. Tajikistan	0.1	0.1%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	n.a.	n.a.
Outgoing	n.a.	50.8	50.2
Surplus (Deficit)	n.a.	n.a.	n.a.
Total Volume	n.a.	n.a.	n.a.

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic Data include traffic to other member states of the Commonwealth of Independent States only See page 114 for a matrix of traffic from other CIS member states

Netherlands

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	355.2	23.2%
2. Belgium	254.3	16.6%
3. United Kingdom	192.5	12.6%
4. France	117.8	7.7%
5. United States	95.5	6.2%
6. Italy	50.5	3.3%
7. Spain	46.5	3.0%
8. Switzerland	41.3	2.7%
9. Turkey	30.1	2.0%
10. Sweden	27.4	1.8%
11. Denmark	23.1	1.5%
12. Austria	20.7	1.3%
13. Canada	17.4	1.1%
14. Poland	14.9	1.0%
15. Norway	13.8	0.9%
16. Ireland	12.7	0.8%
17. Portugal	12.0	0.8%
18. Greece	11.7	0.8%
19. Morocco	10.6	0.7%
20. Russia	9.5	0.6%
Other	177.7	11.6%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	1,290.9	1,453.0	1,584.6
Outgoing	1,345.8	1,458.7	1,534.1
Surplus (Deficit)	(54.9)	(5.7)	50.5
Total Volume	2,636.7	2,911.7	3,118.7

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data based on billing point of traffic.

New Zealand

Largest Telecommunications Routes, FY 1996/97

Destination	MiTT	Percentage of Outgoing Traffic
1. Australia	166	47.0%
2. United Kingdom	39	11.0%
3. United States	28	7.9%
4. Hong Kong	9	2.5%
5. Japan	9	2.5%
6. Fiji	6	1.7%
7. Canada	7	2.0%
8. Singapore	6	1.7%
9. Malaysia	5	1.4%
10. Taiwan	4	1.1%
11. Western Samoa	4	1.1%
12. Germany	4	1.1%
Other	66	18.7%

National Traffic Balance

MiTT	FY 1994/95	FY 1995/96	FY 1996/97
Incoming	263	327	380
Outgoing	261	312	353
Surplus (Deficit)	2	15	27
Total Volume	524	639	733

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data are for Telecom New Zealand and Clear Communications Ltd. only. Other carriers originated approximately 7 million minutes in FY 1996/97. Fiscal year ends 31 March.

Norway

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Sweden	115	25.9%
2. Denmark	65	14.7%
3. United Kingdom	50	11.3%
4. United States	35	7.9%
5. Germany	25	5.6%
6. France	14	3.2%
7. Netherlands	14	3.2%
8. Finland	10	2.3%
9. Spain	9	2.0%
10. Italy	8	1.8%
11. Switzerland	6	1.4%
12. Belgium	5	1.1%
13. Russia	6	1.4%
14. Poland	6	1.4%
15. Canada	4	0.9%
16. Turkey	3	0.7%
17. Iceland	3	0.7%
Other	65	14.7%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	352.0	373.2	422.3
Outgoing	395.5	431.5	443.5
Surplus (Deficit)	(43.5)	(58.3)	(21.2)
Total Volume	747.5	804.7	865.8

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic. Data for the top five routes are rounded to the nearest five million minutes Data for years 1994 and 1995 based on billing point of traffic.

Oman

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. India	16.9	26.9%
2. United Arab Emirates	15.4	24.6%
3. Pakistan	4.2	6.7%
4. United Kingdom	4.2	6.7%
5. Egypt	2.5	4.0%
6. Saudi Arabia	2.1	3.4%
7. Bahrain	2.0	3.1%
8. United States	1.8	2.9%
9. Bangladesh	1.2	1.9%
10. Kuwait	1.1	1.7%
11. Jordan	1.0	1.7%
12. Qatar	0.9	1.5%
13. Philippines	0.8	1.2%
14. Sri Lanka	0.7	1.2%
15. Tanzania	0.6	1.0%
16. Germany	0.5	0.8%
17. Netherlands	0.4	0.7%
18. Sudan	0.4	0.6%
19. France	0.4	0.6%
20. Lebanon	0.4	0.6%
Other	4.9	7.9%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	49.6	53.3	58.0
Outgoing	49.5	54.4	62.6
Surplus (Deficit)	0.1	(1.1)	(4.6)
Total Volume	99.1	107.6	120.6

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic.

Pakistan

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United Kingdom	13.9	18.1%
2. United States	12.4	16.2%
3. United Arab Emirates	8.3	10.8%
4. Saudi Arabia	6.6	8.5%
5. Canada	5.6	7.2%
6. Italy	3.4	4.4%
7. France	2.4	3.1%
8. Germany	2.3	2.9%
9. Japan	1.9	2.5%
10. India	1.8	2.4%
11. Singapore	1.5	2.0%
12. Iran	1.4	1.8%
13. Kuwait	1.2	1.5%
14. Hong Kong	1.1	1.4%
15. Bangladesh	1.0	1.3%
16. Netherlands	0.8	1.0%
17. China	0.8	1.0%
18. Turkey	0.6	0.8%
19. Oman	0.6	0.7%
20. Switzerland	0.5	0.7%
Other	9.0	11.7%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	362.1	488.4
Outgoing	61.4	65.9	77.0
Surplus (Deficit)	n.a.	296.1	411.5
Total Volume	n.a.	428.0	565.4

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic Data for years 1994 and 1995 excluded traffic to India and Bangladesh Traffic data for 1996 exclude some cross-border traffic to India.

Panama

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	18.4	44.8%
2. Colombia	4.4	10.6%
3. Costa Rica	3.3	7.9%
4. Mexico	1.7	4.2%
5. Guatamala	0.9	2.3%
6. Venezuela	0.9	2.2%
7. El Salvador	0.8	1.9%
8. Dominican Republic	0.8	1.9%
9. Ecuador	0.8	1.8%
10. Brazil	0.7	1.8%
11. Peru	0.6	1.5%
12. Spain	0.6	1.5%
13. Nicaragua	0.6	1.5%
14. Honduras	0.6	1.4%
15. Argentina	0.5	1.3%
16. Canada	0.5	1.2%
17. Chile	0.5	1.1%
18. Cuba	0.5	1.1%
19. United Kingdom	0.3	0 7%
20. Japan	0.3	0.7%
Other	3.8	9.3%

National Traffic Balance

MiTT	**1994**	**1995**	**1996**
Incoming	87.3	94.2	97.7
Outgoing	35.9	39.5	41.2
Surplus (Deficit)	51.3	54.7	56.5
Total Volume	123.2	133.7	138.9

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic Data based on billing point of traffic.

Paraguay

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Argentina	8.2	32.8%
2. Brazil	6.3	25.1%
3. United States	3.0	12.0%
4. Chile	1.2	4.8%
5. Uruguay	1.2	4.8%
6. Germany	0.5	2.0%
7. Taiwan	0.4	1.6%
8. Spain	0.4	1.5%
9. Rep. of Korea	0.4	1.4%
10. Bolivia	0.3	1.4%
11. Peru	0.3	1.4%
12. Italy	0.2	0.9%
13. Japan	0.2	0.8%
14. France	0.2	0.8%
15. Mexico	0.2	0.7%
16. Colombia	0.2	0.6%
17. United Kingdom	0.1	0.6%
18. Panama	0.1	0.6%
19. Switzerland	0.1	0.6%
20. Hong Kong	0.1	0.4%
Other	1.3	5.2%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	30.6	n.a.	49.4
Outgoing	18.1	20.9	24.9
Surplus (Deficit)	12.5	n.a.	24.5
Total Volume	48.7	n.a.	74.3

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic

Peru

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	25.7	38.5%
2. Chile	6.4	9.7%
3. Spain	4.4	6.6%
4. Argentina	4.3	6.4%
5. Colombia	2.5	3.8%
6. Italy	2.4	3.7%
7. Brazil	2.2	3.3%
8. Venezuela	2.2	3.3%
9. Bolivia	1.9	2.8%
10. Japan	1.8	2.7%
11. Mexico	1.7	2.5%
12. Canada	1.6	2.5%
13. Ecuador	1.5	2.2%
14. Germany	1.3	2.0%
15. United Kingdom	1.1	1.6%
16. France	0.9	1.3%
Other	4.7	7.0%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	178.6	195.4	226.5
Outgoing	51.0	62.6	66.7
Surplus (Deficit)	127.6	132.8	159.7
Total Volume	229.6	258.0	293.2

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data based on billing point of traffic.

Philippines

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	75	31.3%
2. Japan	35	14.6%
3. Hong Kong	25	10.4%
4. Canada	13	5.4%
5. Singapore	12	5.0%
6. Taiwan	10	4.2%
7. Rep. of Korea	9	3.8%
8. Australia	8	3.3%
9. Saudi Arabia	6	2.5%
10. Malaysia	5	2.1%
11. United Kingdom	4	1.7%
12. Italy	4	1.7%
Other	34	14.2%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	617	691	767
Outgoing	160	174	240
Surplus (Deficit)	457	517	527
Total Volume	777	865	1007

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic. Data for the top three routes are rounded to the nearest five million minutes.

Poland

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	172.4	39.4%
2. United Kingdom	25.0	5.7%
3. United States	24.2	5.5%
4. France	23.2	5.3%
5. Italy	22.3	5.1%
6. Austria	15.0	3.4%
7. Netherlands	13.9	3.2%
8. Russia	13.1	3.0%
9. Ukraine	12.5	2.9%
10. Sweden	12.0	2.7%
11. Belgium	9.0	2.1%
12. Czech Republic	8.7	2.0%
13. Canada	8.1	1.9%
14. Denmark	7.4	1.7%
15. Switzerland	6.2	1.4%
16. Belarus	6.0	1.4%
17. Vietnam	5.2	1.2%
18. Spain	4.4	1.0%
19. Hungary	3.4	0.8%
20. Norway	3.2	0.7%
Other	42.0	9.6%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	643.8	649.3	725.5
Outgoing	356.6	381.4	437.2
Surplus (Deficit)	287.2	267.9	288.3
Total Volume	1,000.4	1,030.7	1,162.7

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic Data based on billing point of traffic.

Portugal

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. France	67.8	20.0%
2. Spain	53.8	15.8%
3. Germany	37.6	11.1%
4. United Kingdom	35.7	10.5%
5. Switzerland	16.9	5.0%
6. Brazil	14.4	4.2%
7. United States	14.1	4.2%
8. Italy	13.0	3.8%
9. Netherlands	11.0	3.2%
10. Belgium	10.2	3.0%
11. Angola	7.9	2.3%
12. Canada	4.8	1.4%
13. Luxembourg	3.7	1.1%
14. Cape Verde	3.4	1.0%
15. Guinea	3.3	1.0%
16. Mozambique	3.3	1.0%
17. Sweden	3.2	0.9%
18. Denmark	2.6	0.8%
19. South Africa	2.3	0.7%
20. Ireland	2.1	0.6%
Other	28.8	8.5%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	467.8	525.0	571.4
Outgoing	262.4	283.9	340.0
Surplus (Deficit)	205.4	241.1	231.4
Total Volume	730.2	808.9	911.4

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic. Data based on billing point of traffic

Russia

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Ukraine	257.0	30.2%
2. Belarus	85.8	10.1%
3. Kazakhstan	63.8	7.5%
4. Armenia	41.9	4.9%
5. Germany	38.2	4.5%
6. Uzbekistan	32.3	3.8%
7. Georgia	27.3	3.2%
8. Moldova	26.2	3.1%
9. United States	21.3	2.5%
10. Latvia	19.8	2.3%
11. Azerbaijan	15.1	1.8%
12. Lithuania	15.0	1.8%
13. United Kingdom	14.1	1.7%
14. Italy	11.5	1.4%
15. Estonia	11.3	1.3%
16. Finland	11.1	1.3%
17. Kyrgyzstan	10.4	1.2%
18. France	9.7	1.1%
19. Turkey	9.2	1.1%
20. Israel	8.7	1.0%
Other	121.5	14.3%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	365.0	448.1	1,037.6
Outgoing	229.2	287.4	851.3
Surplus (Deficit)	135.8	160.7	186.3
Total Volume	594.2	735.5	1,888.9

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data prior to 1996 did not include traffic to members of the Commonwealth of Independent States. Data are for Rostelecom only

Saudi Arabia

Largest Telecommunications Routes, 1995

Destination	MiTT	Percentage of Outgoing Traffic
1. Egypt	137.3	27.5%
2. Pakistan	56.3	11.3%
3. India	52.2	10.5%
4. Syria	21.3	4.3%
5. Yemen	17.1	3.4%
6. Jordan	16.2	3.2%
7. United Kingdom	15.9	3.2%
8. United States	14.3	2.9%
9. Bahrain	14.1	2.8%
10. United Arab Emirates	13.2	2.6%
11. Philippines	13.0	2.6%
12. Kuwait	11.1	2.2%
13. Sudan	10.9	2.2%
14. Lebanon	10.8	2.2%
15. Morocco	9.4	1.9%
16. Bangladesh	9.1	1.8%
17. Turkey	8.9	1.8%
18. France	7.9	1.6%
19. Germany	5.4	1.1%
20. Qatar	3.1	0.6%
Other	51.6	10.3%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	n.a.	n.a.
Outgoing	477	537.3	584.4
Surplus (Deficit)	n.a.	n.a.	n.a.
Total Volume	n.a.	n.a.	n.a.

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic

Singapore

Largest Telecommunications Routes, FY 1996/97

Destination	MiTT	Percentage of Outgoing Traffic
1. Malaysia	325	34.5%
3. Indonesia	80	8.5%
2. Hong Kong	70	7.4%
4. United States	45	4.8%
5. Japan	45	4.8%
6. Australia	45	4.8%
7. China	45	4.8%
8. Thailand	35	3.7%
9. United Kingdom	30	3.2%
10. India	30	3.2%
11. Philippines	30	3.2%
Other	162	17.2%

National Traffic Balance

MiTT	FY 1994/95	FY 1995/96	FY 1996/97
Incoming	n.a.	n.a.	n.a.
Outgoing	643	773	942
Surplus (Deficit)	n.a.	n.a.	n.a.
Total Volume	n.a.	n.a.	n.a.

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data are based on billing point of traffic and are rounded to the nearest five million minutes. Data for years 1994 and 1995 excluded some cross-border traffic to Malaysia. Fiscal year ends 31 March.

Slovak Republic

Largest Telecommunications Routes, 1996

	Destination	MiTT	Percentage of Outgoing Traffic
1.	Czech Republic	66.2	49.4%
2.	Germany	14.2	10.6%
3.	Austria	10.4	7.7%
4.	Hungary	5.3	3.9%
5.	United Kingdom	4.1	3.0%
6.	Italy	4.0	3.0%
7.	United States	3.5	2.6%
8.	Poland	2.7	2.0%
9.	Ukraine	2.6	1.9%
10.	Russia	2.4	1.8%
11.	Switzerland	2.2	1.7%
12.	France	2.1	1.6%
13.	Netherlands	1.6	1.2%
14.	Belgium	1.3	0.9%
15.	Croatia	1.0	0.8%
16.	Canada	1.0	0.7%
17.	Yugoslavia	0.9	0.7%
18.	Israel	0.6	0.5%
19.	Sweden	0.5	0.4%
20.	Spain	0.4	0.3%
	Other	7.1	5.3%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	68.5	81.6	159.0
Outgoing	52.5	58.8	134.1
Surplus (Deficit)	16.0	22.8	24.9
Total Volume	121.0	140.4	293.1

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic Totals in years 1994 and 1995 excluded traffic to and from the Czech Republic Data based on billing point of traffic.

Slovenia

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Croatia	26.2	49.4%
2. Germany	15.8	10.6%
3. Austria	12.1	7.7%
4. Yugoslavia	10.9	3.9%
5. Italy	9.9	3.0%
6. Bosnia	4.9	3.0%
7. Switzerland	2.5	2.6%
8. Macedonia	2.4	2.0%
9. United Kingdom	2.4	1.9%
10. France	2.0	1.8%
11. United States	1.9	1.7%
12. Russia	1.6	1.6%
13. Hungary	1.4	1.2%
14. Czech Republic	1.1	0.9%
15. Netherlands	0.9	0.8%
16. Sweden	0.8	0.7%
17. Belgium	0.8	0.7%
18. Netherlands Antilles	0.7	0.5%
19. Canada	0.5	0.4%
20. Poland	0.5	0.3%
Other	5.9	5.3%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	83.2	121.2	113.9
Outgoing	90.6	100.6	105.3
Surplus (Deficit)	(7.4)	20.6	8.6
Total Volume	173.8	221.8	219.2

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic Data exclude some cross-border traffic to Italy

South Africa

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. United Kingdom	40.9	15.6%
2. Namibia	29.9	11.4%
3. Zimbabwe	21.6	8.2%
4. United States	20.2	7.7%
5. Botswana	14.0	5.3%
6. Mozambique	11.7	4.5%
7. Germany	11.7	4.5%
8. Swaziland	11.0	4.2%
9. Lesotho	7.9	3.0%
10. Australia	6.6	2.5%
11. Portugal	4.4	1.7%
12. France	4.4	1.7%
13. Canada	3.9	1.5%
14. Netherlands	3.8	1.4%
15. Italy	3.7	1.4%
16. Israel	3.6	1.4%
17. Switzerland	3.6	1.4%
18. Zambia	3.5	1.3%
19. Malawi	2.5	1.0%
20. Taiwan	2.4	0.9%
Other	51.4	19.6%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	n.a.	n.a.
Outgoing	262.6	305.0	353.0
Surplus (Deficit)	n.a.	n.a.	n.a.
Total Volume	n.a.	n.a.	n.a.

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic.

Spain

Largest Telecommunications Routes, 1995

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	160.7	15.7%
2. France	158.2	15.4%
3. United Kingdom	147.0	14.3%
4. Italy	68.2	6.7%
5. United States	48.3	4.7%
6. Portugal	40.6	4.0%
7. Switzerland	36.1	3.5%
8. Belgium	35.4	3.5%
9. Netherlands	35.3	3.4%
10. Morocco	22.8	2.2%
11. Andorra	17.2	1.7%
12. Argentina	17.1	1.7%
13. Sweden	14.5	1.4%
14. Chile	12.9	1.3%
15. Colombia	10.5	1.0%
16. Denmark	9.5	0.9%
17. Mexico	8.9	0.9%
18. Brazil	8.8	0.9%
19. Cuba	8.7	0.8%
20. Austria	8.4	0.8%
Other	155.8	15.2%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	969.9	1,076.4	n.a.
Outgoing	948.3	1,024.6	1,189.0
Surplus (Deficit)	21.6	51.8	n.a.
Total Volume	1,918.2	2,101.0	n.a.

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic.

Sri Lanka

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. India	4.2	14.2%
2. United States	2.7	9.2%
3. United Kingdom	2.6	9.0%
4. Singapore	2.1	7.2%
5. Japan	1.8	6.2%
6. Hong Kong	1.4	4.7%
7. Australia	1.3	4.5%
8. Germany	1.2	4.1%
9. Rep. of Korea	1.0	3.4%
10. United Arab Emirates	1.0	3.2%
11. South Africa	0.9	2.9%
12. Italy	0.7	2.5%
13. France	0.6	2.2%
14. Canada	0.5	1.8%
15. Kuwait	0.5	1.8%
16. Maldives	0.5	1.8%
17. Thailand	0.5	1.7%
18. Malaysia	0.5	1.7%
19. Switzerland	0.4	1.4%
20. Netherlands	0.4	1.4%
Other	4.4	15.0%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	78.7	92.0	96.0
Outgoing	23.7	27.5	29.3
Surplus (Deficit)	55.0	64.5	66.7
Total Volume	102.4	119.5	125.3

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data based on billing point of traffic.

Sweden

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Finland	145	14.1%
2. Norway	130	12.7%
3. Denmark	105	10.2%
4. Germany	95	9.3%
5. United Kingdom	95	9.3%
6. United States	70	6.8%
7. Netherlands	45	4.4%
8. France	40	3.9%
9. Poland	30	2.9%
10. Switzerland	25	2.4%
11. Italy	20	1.9%
12. Belgium	17	1.7%
13. Spain	15	1.5%
14. Austria	10	1.0%
15. Yugoslavia	10	1.0%
Other	174	17.0%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	n.a.	n.a.
Outgoing	802	900	1026
Surplus (Deficit)	n.a.	n.a.	n.a.
Total Volume	n.a.	n.a.	n.a.

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic Data based on billing point of traffic Traffic figures are for Telia and Tele2 only Data for the top ten routes are rounded to the nearest five million minutes.

Switzerland

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	435.5	22.5%
2. France	300.5	15.5%
3. Italy	268.6	13.9%
4. United States	108.1	5.6%
5. United Kingdom	107.8	5.6%
6. Austria	79.1	4.1%
7. Portugal	70.2	3.6%
8. Spain	64.3	3.3%
9. Netherlands	47.1	2.4%
10. Yugoslavia	42.7	2.2%
11. Belgium	31.6	1.6%
12. Turkey	29.6	1.5%
13. Canada	19.8	1.0%
14. Sweden	19.5	1.0%
15. Croatia	16.7	0.9%
16. Denmark	12.5	0.6%
17. Macedonia	12.2	0.6%
18. Greece	11.5	0.6%
19. Russia	11.4	0.6%
20. Hungary	10.7	0.6%
Other	233.9	12.1%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	1,353.0	1,439.3	1,562.8
Outgoing	1,649.3	1,778.4	1,935.5
Surplus (Deficit)	(296.3)	(339.1)	(372.7)
Total Volume	3,002.3	3,217.7	3,498.4

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic Data for years 1994 and 1995 based on billing point of traffic Data for 1996 based on originating point of traffic

Taiwan

Largest Telecommunications Routes, FY 1996/97

Destination	MiTT	Percentage of Outgoing Traffic
1. China	164.5	24.4%
2. United States	130.6	19.4%
3. Hong Kong	69.7	10.3%
4. Japan	68.6	10.2%
5. Philippines	32.9	4.9%
6. Thailand	28.4	4.2%
7. Canada	22.6	3.4%
8. Singapore	20.1	3.0%
9. Indonesia	14.1	2.1%
10. Australia	13.4	2.0%
11. Malaysia	12.8	1.9%
12. Vietnam	12.5	1.9%
13. United Kingdom	9.1	1.4%
14. Germany	8.7	1.3%
15. Rep. of Korea	8.6	1.3%
16. New Zealand	5.6	0.8%
17. France	4.8	0.7%
18. Macao	3.7	0.5%
19. Netherlands	2.9	0.4%
20. Russia	2.7	0.4%
Other	38.0	5.6%

National Traffic Balance

MiTT	FY 1994/95	FY 1995/96	FY 1996/97
Incoming	613.5	545.3	736.8
Outgoing	468.5	592.8	674.0
Surplus (Deficit)	115.0	(47.5)	62.8
Total Volume	1,112.0	1,138.1	1,410.8

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data based on billing point of traffic Fiscal year ends 31 March

Thailand

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Japan	42.7	17.3%
2. United States	28.6	11.5%
3. Singapore	27.7	11.2%
4. Hong Kong	17.6	7.1%
5. Taiwan	14.9	6.0%
6. United Kingdom	12.9	5.2%
7. China	10.4	4.2%
8. Australia	10.0	4.0%
9. Germany	9.3	3.7%
10. Rep. of Korea	7.3	3.0%
11. India	5.9	2.4%
12. France	5.2	2.1%
13. Myanmar	4.7	1.9%
14. Philippines	4.2	1.7%
15. Indonesia	4.1	1.6%
16. Italy	3.5	1.4%
17. Switzerland	3.2	1.3%
18. Vietnam	2.9	1.2%
19. Netherlands	2.2	0.9%
20. Cambodia	2.0	0.8%
Other	28.1	11.4%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	313.3	277.7	376.2
Outgoing	173.2	218.8	247.4
Surplus (Deficit)	140.1	58.9	128.7
Total Volume	486.5	496.5	623.6

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic.

Turkey

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	158.7	33.5%
2. United Kingdom	40.4	8.5%
3. United States	27.7	5.9%
4. France	25.0	5.3%
5. Russia	22.0	4.7%
6. Netherlands	19.7	4.2%
7. Italy	14.6	3.1%
8. Switzerland	13.2	2.8%
9. Austria	12.3	2.6%
10. Romania	10.3	2.2%
11. Belgium	9.3	2.0%
12. Bulgaria	7.8	1.6%
13. Ukraine	7.3	1.5%
14. Greece	7.2	1.5%
15. Saudi Arabia	6.6	1.4%
16. Azerbaijan	6.0	1.3%
17. Iran	5.4	1.1%
18. Sweden	5.2	1.1%
19. Israel	4.9	1.0%
20. Denmark	4.1	0.9%
Other	66.1	14.0%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	601.4	705.0	755.0
Outgoing	284.3	373.6	473.4
Surplus (Deficit)	317.1	331.5	281.6
Total Volume	885.8	1,078.6	1,228.4

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic

Ukraine

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Russia	273.2	80.2%
2. Belarus	24.2	7.1%
3. Moldova	18.4	5.4%
4. Armenia	7.0	2.0%
5. Kazakhstan	5.1	1.5%
6. Uzbekistan	4.3	1.3%
7. Georgia	3.4	1.0%
8. Azerbaijan	3.0	0.9%
9. Turkmenistan	1.1	0.3%
10. Kyrgyzstan	0.6	0.2%
11. Tajikistan	0.4	0.1%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	n.a.	n.a.
Outgoing	n.a.	301.8	340.8
Surplus (Deficit)	n.a.	n.a.	n.a.
Total Volume	n.a.	n.a.	n.a.

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data include traffic to other member states of the Commonwealth of Independent States only See page 114 for a matrix of traffic from other CIS member states.

United Arab Emirates

Largest Telecommunications Routes, 1995

Destination	MiTT	Percentage of Outgoing Traffic
1. India	108.4	21.5%
2. Pakistan	49.0	9.7%
3. United Kingdom	33.5	6.7%
4. Egypt	33.2	6.6%
5. Saudi Arabia	30.9	6.1%
6. United States	23.4	4.6%
7. Oman	21.0	4.2%
8. Syria	18.7	3.7%
9. Iran	16.7	3.3%
10. Qatar	13.1	2.6%
11. Jordan	12.7	2.5%
12. Bahrain	12.1	2.4%
13. Kuwait	11.3	2.2%
14. Philippines	9.4	1.9%
15. Lebanon	9.0	1.8%
16. Bangladesh	7.8	1.5%
17. Sudan	6.3	1.3%
18. France	6.1	1.2%
19. Germany	5.9	1.2%
20. Yemen	4.9	1.0%
Other	70.2	13.9%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	n.a.	n.a.
Outgoing	428.2	503.6	589.3
Surplus (Deficit)	n.a.	n.a.	n.a.
Total Volume	n.a.	n.a.	n.a.

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic

United Kingdom—Outgoing

Largest Telecommunications Routes, FY 1995/96-FY 1996/97

Destination	MiTT 95/96	MiTT 96/97	Percentage of Outgoing Traffic FY 1996/97
1. United States	617.6	660.1	14.4%
2. Ireland	371.4	549.1	12.0%
3. France	360.8	405.8	8.9%
4. Germany	364.4	405.4	8.9%
5. Italy	188.0	223.9	4.9%
6. Spain	171.1	207.7	4.5%
7. Netherlands	173.5	192.7	4.2%
8. Australia	127.3	144.1	3.2%
9. Canada	120.5	132.5	2.9%
10. Belgium	105.4	124.2	2.7%
11. Switzerland	102.9	121.7	2.7%
12. Greece	62.9	79.1	1.7%
13. Sweden	66.8	72.1	1.6%
14. India	55.5	68.1	1.5%
15. South Africa	57.5	64.2	1.4%
16. Denmark	57.6	63.9	1.4%
17. Portugal	49.2	60.3	1.3%
18. Turkey	37.3	59.4	1.3%
19. Hong Kong	51.0	56.0	1.2%
20. Pakistan	51.0	44.4	1.0%
Other	824.3	834.5	18.3%

National Traffic Balance

MiTT	FY 1994/95	FY 1995/96	FY 1996/97
Incoming	3,577	4,021	4,360.0
Outgoing	3,507	4,016	4,569.2
Surplus (Deficit)	70	5	(209.2)
Total Volume	7,084	8,037	8,929.2

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic. Data are for BT and Mercury only. IPL resellers originated an estimated 700 million additional minutes in FY 1996/97. Traffic data may differ from data published by the U.K. Office of Telecommunications (OFTEL) because OFTEL reports "retail" minutes only, which exclude (a) "wholesale" minutes sold to switched resellers and (b) operator assisted calls and collect calls. Fiscal year ends 31 March.

United Kingdom—Incoming

Largest Telecommunications Routes, FY 1995/96-FY 1996/97

Destination	MiTT 95/96	MiTT 96/97	Percentage of Incoming Traffic FY 1996/97
1. United States	891.4	718.4	16.5%
2. Ireland	369.7	420.9	9.7%
3. Germany	356.2	366.5	8.4%
4. France	324.7	355.0	8.1%
5. Netherlands	170.1	170.7	3.9%
6. Australia	159.2	168.6	3.9%
7. Italy	150.7	164.8	3.8%
8. Spain	149.5	164.7	3.8%
9. Canada	132.9	132.4	3.0%
10. Switzerland	98.2	107.3	2.5%
11. Belgium	98.4	106.3	2.4%
12. Sweden	69.8	87.4	2.0%
13. Greece	63.2	72.8	1.7%
14. South Africa	56.6	64.0	1.5%
15. Denmark	58.2	61.0	1.4%
16. Hong Kong	57.0	55.0	1.3%
17. Norway	51.4	49.7	1.1%
18. Japan	46.6	48.6	1.1%
19. Turkey	32.6	40.5	0.9%
20. New Zealand	34.7	37.2	0.9%
Other	649.9	968.2	22.2%

United States—Outgoing

Largest Telecommunications Routes, 1995-1996

Destination	MiTT 1995	MiTT 1996	Percentage of Outgoing Traffic 1996
1. Canada	2,997.9	3,398.7	17.9%
2. Mexico	2,012.2	2,378.4	12.5%
3. United Kingdom	1,017.4	1,214.1	6.4%
4. Germany	657.7	778.9	4.1%
5. Japan	574.3	698.3	3.7%
6. Hong Kong	314.1	538.7	2.8%
7. France	355.4	437.3	2.3%
8. India	284.1	414.1	2.2%
9. Rep. of Korea	312.3	379.9	2.0%
10. Brazil	277.6	370.9	1.9%
11. Dominican Republic	342.9	367.5	1.9%
12. Philippines	294.8	345.0	1.8%
13. Italy	273.4	332.4	1.7%
14. Taiwan	273.2	320.6	1.7%
15. China	230.2	297.6	1.6%
16. Australia	200.1	282.0	1.5%
17. Colombia	253.2	281.7	1.5%
18. Israel	213.4	238.1	1.3%
19. Argentina	157.8	219.4	1.2%
20. Jamaica	186.3	218.9	1.1%
Other	4,491.4	5,527.5	29.0%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	6,133.1	7,010.6	8,217.6
Outgoing	13,200.3	15,637.5	18,830.0
Surplus (Deficit)	(7,067.2)	(8,776.9)	(10,612.4)
Total Volume	19,333.4	22,798.1	27,047.6

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data based on billing point of traffic. The sum of top 20 routes plus other routes does not equal outgoing total, which has been adjusted downward to reflect refiled (i.e., foreign billed and originated) traffic handled by some U.S carriers. All U.S. data exclude traffic from off-shore U.S. territories (i.e., Puerto Rico, Virgin Islands, Guam)

United States—Incoming

Largest Telecommunications Routes, 1995-1996

Destination	MiTT 1995	MiTT 1996	Percentage of Incoming Traffic 1996
1. Canada	2,063.7	2,848.5	34.7%
2. Mexico	833.9	946.3	11.5%
3. United Kingdom	678.1	748.4	9.1%
4. Japan	319.1	342.1	4.2%
5. Germany	290.3	312.4	3.8%
6. France	180.9	203.8	2.5%
7. Rep. of Korea	140.7	156.7	1.9%
8. Australia	144.0	155.4	1.9%
9. Brazil	101.3	123.3	1.5%
10. Italy	103.6	114.0	1.4%
11. Taiwan	108.4	111.7	1.4%
12. Dominican Republic	86.3	99.3	1.2%
13. Hong Kong	102.7	96.0	1.2%
14. Switzerland	77.0	91.8	1.1%
15. Netherlands	89.7	85.8	1.0%
16. Israel	70.3	78.8	1.0%
17. Sweden	62.0	70.3	0.9%
18. Colombia	58.8	61.4	0.7%
19. Spain	52.1	60.3	0.7%
20. China	52.3	58.1	0.7%
Other	1,395.5	1,453.1	17.7%

U.S.—Other Correspondents

Country	Outgoing MiTT 1995	Outgoing MiTT 1996	Incoming MiTT 1995	Incoming MiTT 1996	Country	Outgoing MiTT 1995	Outgoing MiTT 1996	Incoming MiTT 1995	Incoming MiTT 1996
Argentina	157.8	219.4	28.9	22.1	Netherlands	161.1	204.6	89.7	85.8
Austria	46.4	53.7	23.7	24.5	NL Antilles	22.7	26.4	19.2	9.1
Bahrain	9.4	12.3	4.2	4.3	New Zealand	38.5	58.7	25.7	29.2
Bangladesh	29.1	46.2	2.9	3.6	Norway	41.5	50.7	32.4	34.1
Belgium	91.5	110.7	44.4	43.3	Pakistan	101.6	133.1	9.2	10.0
Bolivia	26.6	29.3	4.9	4.7	Paraguay	12.1	14.4	2.5	2.6
Chile	64.4	78.1	44.9	51.7	Peru	118.9	143.5	23.9	25.3
Croatia	15.1	126.2	4.5	5.0	Philippines	294.8	345.0	41.7	49.0
Cyprus	8.7	8.7	4.4	4.7	Poland	125.3	159.6	31.5	27.1
Czech Republic	21.4	25.1	7.3	8.0	Portugal	41.2	43.8	12.6	14.1
Denmark	46.4	61.1	28.2	28.1	Qatar	4.6	5.9	2.2	2.5
Ecuador	131.3	155.8	12.8	32.5	Russia	73.3	94.7	25.0	30.6
El Salvador	135.3	141.0	8.9	9.8	Saudi Arabia	87.4	101.1	24.1	27.1
Finland	23.5	29.4	16.7	17.0	Singapore	100.0	148.5	51.0	52.3
Greece	85.2	87.2	30.7	32.5	Slovak Republic	10.2	12.4	2.9	3.5
Guatemala	113.8	127.2	14.1	11.6	Slovenia	3.0	3.8	1.9	1.9
Guyana	74.1	84.5	10.2	15.7	South Africa	73.3	97.3	26.7	29.3
Hungary	27.0	35.8	11.1	14.5	Spain	124.6	139.5	52.1	60.3
Iceland	8.0	8.8	6.9	7.4	Sri Lanka	8.9	14.2	2.1	1.9
India	284.1	414.1	51.8	49.1	Sweden	81.7	103.0	62.0	70.3
Indonesia	68.4	91.9	23.6	24.7	Switzerland	132.7	180.6	77.0	91.8
Iran	48.6	55.5	17.8	15.2	Syria	13.1	18.1	3.1	3.1
Ireland	104.0	119.4	46.9	53.3	Thailand	92.1	114.1	26.2	29.6
Jamaica	186.3	218.9	44.0	49.7	Trinidad	74.7	85.4	26.1	25.9
Jordan	35.8	42.9	4.2	4.7	Turkey	51.0	57.4	21.0	25.9
Kuwait	36.5	40.7	7.8	8.5	UAE	45.4	53.7	24.2	26.2
Luxembourg	8.4	9.0	5.5	5.7	Uruguay	18.9	24.5	5.4	5.6
Macau	2.8	3.2	1.2	1.5	Venezuela	116.5	151.6	56.0	57.6
Malaysia	52.5	67.7	17.7	19.4	Vietnam	31.5	113.7	1.1	5.2
Morocco	13.1	12.4	4.8	4.8	Yugoslavia	17.1	19.8	7.0	7.3

Note: All data are millions of minutes of public switched traffic only and are based on the billing point of the traffic

U.S.—Traffic by Carrier

Market Share of International Traffic by Route, 1996

	U.S. Billed Traffic				*Foreign Billed Traffic*			
	AT&T	**MCI**	**Sprint**	**WorldCom**	**AT&T**	**MCI**	**Sprint**	**WorldCom**
Argentina	42.16	35.43	12.87	9.46	15.13	49.42	19.16	15.75
Australia	37.87	19.75	17.82	6.83	42.37	20.10	21.10	5.78
Brazil	46.73	20.83	20.53	11.77	57.24	22.02	10.94	9.70
Canada	52.37	25.10	16.00	2.10	42.89	20.36	22.20	2.12
China	54.63	27.00	12.14	6.14	47.78	33.48	9.58	5.07
Colombia	48.71	26.80	8.46	16.00	42.82	37.85	6.73	12.50
Dominican Republic	26.47	34.26	5.30	16.85	51.52	37.47	5.27	4.91
Ecuador	43.21	46.36	8.83	1.56	78.20	18.67	1.85	1.29
France	42.15	28.27	16.18	12.19	44.99	33.65	14.48	6.53
Germany	50.69	31.15	11.47	5.25	48.75	32.76	11.65	5.67
Hong Kong	20.19	39.91	35.71	4.04	21.00	33.49	40.16	3.06
India	43.87	43.82	12.21	0.08	43.65	46.37	9.83	0.00
Israel	54.88	25.44	12.62	6.31	53.59	27.68	13.74	4.99
Italy	54.08	21.99	18.17	5.44	52.00	23.29	18.88	5.59
Jamaica	47.57	42.02	10.40	0.00	64.31	30.59	5.10	0.00
Japan	40.54	39.07	14.48	4.79	43.14	34.58	13.26	4.62
Rep. of Korea	48.29	29.33	16.43	5.37	48.17	32.13	14.14	4.05
Mexico	62.60	22.96	10.43	3.99	62.32	23.13	11.04	3.50
Netherlands	40.89	19.22	19.07	9.02	54.00	23.55	15.75	6.43
Philippines	60.57	27.11	9.92	0.91	55.57	26.90	6.72	0.73
Poland	70.90	17.72	8.47	0.21	69.51	21.08	9.42	0.00
Switzerland	40.38	17.86	20.55	11.98	38.54	26.81	15.27	6.90
Taiwan	38.75	38.18	17.78	5.20	40.62	37.42	13.70	5.65
United Kingdom	53.92	23.89	15.14	5.02	53.64	26.74	14.19	5.32
Venezuela	48.45	19.36	20.21	5.79	49.83	28.12	12.79	7.44

Note: Because route data for Sprint include transit and refiled traffic, Sprint market share is slightly overstated.

Traffic Carried by Second Tier U.S. Facilities-Based International Carriers, 1996

Carrier	**Outbound Minutes (m)**	**Inbound Minutes (m)**	**Top Outbound Routes (Minutes)**
fONOROLA	209.8	345.7	Canada (148.5)
Pacific Gateway Exchange (PGE)	166.3	59.0	Australia (48.0)
Cable & Wireless, Inc.	68.9	22.6	UK (32.7)
WorldxChange	63.1	28.8	UK (22.9)
RSL Com USA	58.3	—	Dominican Rep. (58.3)
Esprit	37.3	1.1	UK (22.7)
GTE Hawaiian Telephone Co.	18.6	34.8	Philippines (4.7)
Facilicom International	17.2	1.4	Sweden (6.4)
ACC Global	16.3	—	UK (16.3)
Viatel	15.6	1.4	UK (0.7)
Total	**671.3**	**494.8**	

Note: All data in millions of minutes based on billing point of call. Carriers and traffic from off-shore U.S. territories (i.e., Puerto Rico, Virgin Islands, Guam) are excluded. Data includes traffic carried on International Simple Resale (ISR) facilities.

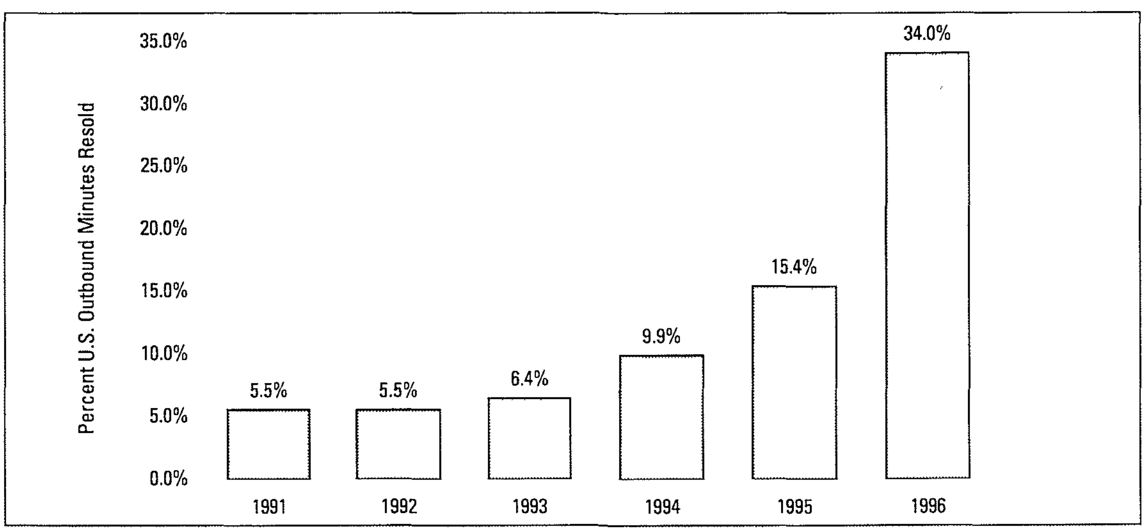
U.S.—Resale Traffic

Top 15 U.S. Switched Resale Carriers, 1996

Rank	Resale Carrier	Outbound Minutes (m)	Share of Outbound Resale Minutes
1.	WorldCom	822.4	12.7%
2.	Cable & Wireless	690.3	10.6%
3.	Cherry Communications	673.4	10.4%
4.	Telegroup	490.1	7.5%
5.	WorldxChange	423.7	6.5%
6.	Pacific Gateway Exchange	397.2	6.1%
7.	USA Global Link	361.0	5.6%
8.	LCI International	308.7	4.7%
9.	Trescom	227.1	3.5%
10.	Frontier	202.5	3.1%
11.	ACC Long Distance	119.6	1.8%
12.	Excel Telecommunications	100.6	1.5%
13.	Sprint	96.0	1.5%
14.	USFI	73.7	1.1%
15.	RSL Communications	58.7	0.9%
	Top 15 Total	**5,045.0**	**77.6%**

Note: All data in millions of minutes based on billing point of call. Carriers and traffic from off-shore U.S. territories (i.e., Puerto Rico, Virgin Islands, Guam) are excluded. Switched resale carriers are resellers of the international switched voice services that are actually provided by other, facilities-based carriers. The 6.5 billion minutes of U.S. switched resale traffic are thus included in the U.S. outgoing traffic totals on page 176.

Share of U.S. International Switched Traffic Resold, 1991-1996



Uruguay

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Argentina	29.5	54.1%
2. Brazil	7.1	13.1%
3. United States	5.7	10.5%
4. Spain	2.1	3.8%
5. Chile	1.5	2.7%
6. Italy	1.0	1.8%
7. Paraguay	0.9	1.6%
8. France	0.6	1.1%
9. Germany	0.5	1.0%
10. Canada	0.4	0.8%
11. Mexico	0.4	0.8%
12. United Kingdom	0.4	0.8%
13. Switzerland	0.4	0.6%
14. Venezuela	0.3	0.6%
15. Israel	0.3	0.6%
16. Australia	0.3	0.5%
17. Peru	0.3	0.5%
18. Colombia	0.2	0.4%
19. Bolivia	0.2	0.3%
20. Sweden	0.2	0.3%
Other	2.2	4.1%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	67.7	73.9	80.1
Outgoing	46.3	49.9	54.5
Surplus (Deficit)	21.4	24.0	25.6
Total Volume	114.0	123.8	134.5

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data based on billing point of traffic

Uzbekistan

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Russia	26.5	48.9'
2. Kazakhstan	17.4	32.0%
3. Kyrgyzstan	2.9	5.3%
4. Ukraine	2.6	4.8%
5. Tajikistan	1.6	3.0%
6. Turkmenistan	1.1	2.0%
7. Belarus	0.9	1.7%
8. Armenia	0.4	0.7%
9. Azerbaijan	0.4	0.7%
10. Georgia	0.2	0.4%
11. Moldova	0.2	0.3%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	n.a.	n.a.
Outgoing	22.7	n.a.	54.2
Surplus (Deficit)	n.a.	n.a.	n.a.
Total Volume	n.a.	n.a.	n.a.

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic. Data include traffic to other member states of the Commonwealth of Independent States only. See page 114 for a matrix of traffic from other CIS member states.

Venezuela

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	63.1	45.4%
2. Colombia	18.5	13.3%
3. Spain	8.2	5.9%
4. Italy	6.5	4.7%
5. Canada	5.2	3.7%
6. Peru	3.4	2.5%
7. Brazil	2.7	2.0%
8. Mexico	2.6	1.8%
9. Portugal	2.4	1.7%
10. Argentina	2.4	1.7%
11. France	2.1	1.5%
12. Ecuador	2.1	1.5%
13. United Kingdom	2.1	1.5%
14. Chile	1.8	1.3%
15. Dominican Republic	1.8	1.3%
16. Germany	1.7	1.2%
17. Cuba	1.2	0.9%
18. Netherlands Antilles	1.2	0.8%
19. Panama	1.0	0.7%
20. Trinidad	0.9	0.6%
Other	8.2	5.9%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	164.3	186.6	228.8
Outgoing	141.3	129.1	139.0
Surplus (Deficit)	23.0	57.4	89.8
Total Volume	305.6	315.7	367.8

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic. Data based on billing point of traffic

Vietnam

Largest Telecommunications Routes, 1995

Destination	MiTT	Percentage of Outgoing Traffic
1. China	6.0	17.1%
2. Taiwan	3.0	8.5%
3. United States	3.0	8.5%
4. Philippines	2.0	5.7%
5. Hong Kong	2.0	5.7%
6. France	2.0	5.7%
7. Rep. of Korea	1.5	4.3%
8. Singapore	1.5	4.3%
9. Thailand	1.5	4.3%
10. Germany	1.0	2.8%
Other	11.5	32.8%

National Traffic Balance

MiTT	1994	1995	1996
Incoming	n.a.	n.a.	n.a.
Outgoing	24	35.1	52.4
Surplus (Deficit)	n.a.	n.a.	n.a.
Total Volume	n.a.	n.a.	n.a.

Note: MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes of public switched traffic.

Yugoslavia

Largest Telecommunications Routes, 1996

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	54.4	22.9%
2. Austria	23.8	10.0%
3. Switzerland	21.4	9.0%
4. Croatia	19.0	8.0%
5. Italy	11.7	4.9%
6. Macedonia	10.1	4.3%
7. France	8.7	3.7%
8. Slovenia	8.6	3.6%
9. Hungary	7.4	3.1%
10. United States	7.1	3.0%
11. Greece	6.9	2.9%
12. Russia	6.5	2.7%
13. Canada	6.4	2.7%
14. Sweden	5.4	2.3%
15. United Kingdom	5.0	2.1%
16. Netherlands	3.1	1.3%
17. Bulgaria	2.8	1.2%
18. Israel	2.7	1.1%
19. Romania	2.5	1.1%
20. Australia	2.2	0.9%
Other	21.5	9.1%

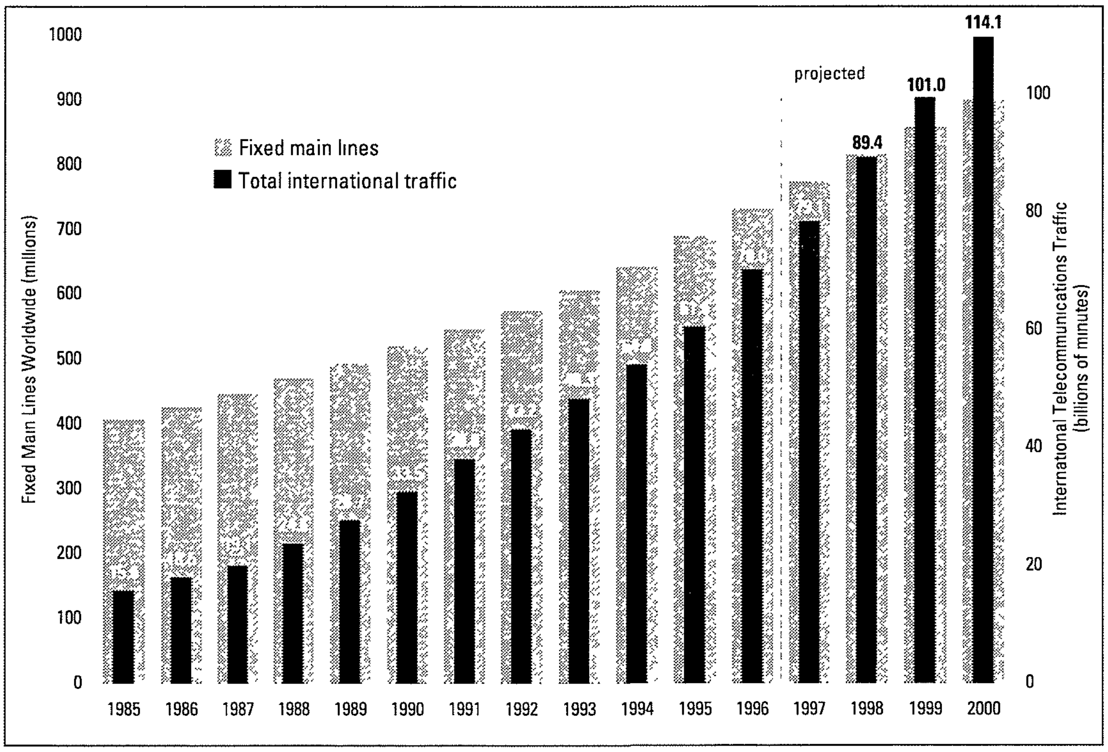
National Traffic Balance

MiTT	1994	1995	1996
Incoming	229.0	296.0	325.7
Outgoing	181.9	212.8	237.2
Surplus (Deficit)	47.1	83.2	88.5
Total Volume	410.9	508.8	562.9

Note: MiTT is Minutes of Telecommunications Traffic Data are in millions of minutes of public switched traffic. Data do not include traffic to Bosnia

Global Traffic Review

Figure 1. International Traffic and Main Line Growth



Note: Data include outbound international traffic on public networks only. Projections assume 13 percent traffic growth and five percent main line growth. Source: ITU, TeleGeography, Inc.

Figure 2. International Traffic, Revenue and Subscriber Growth

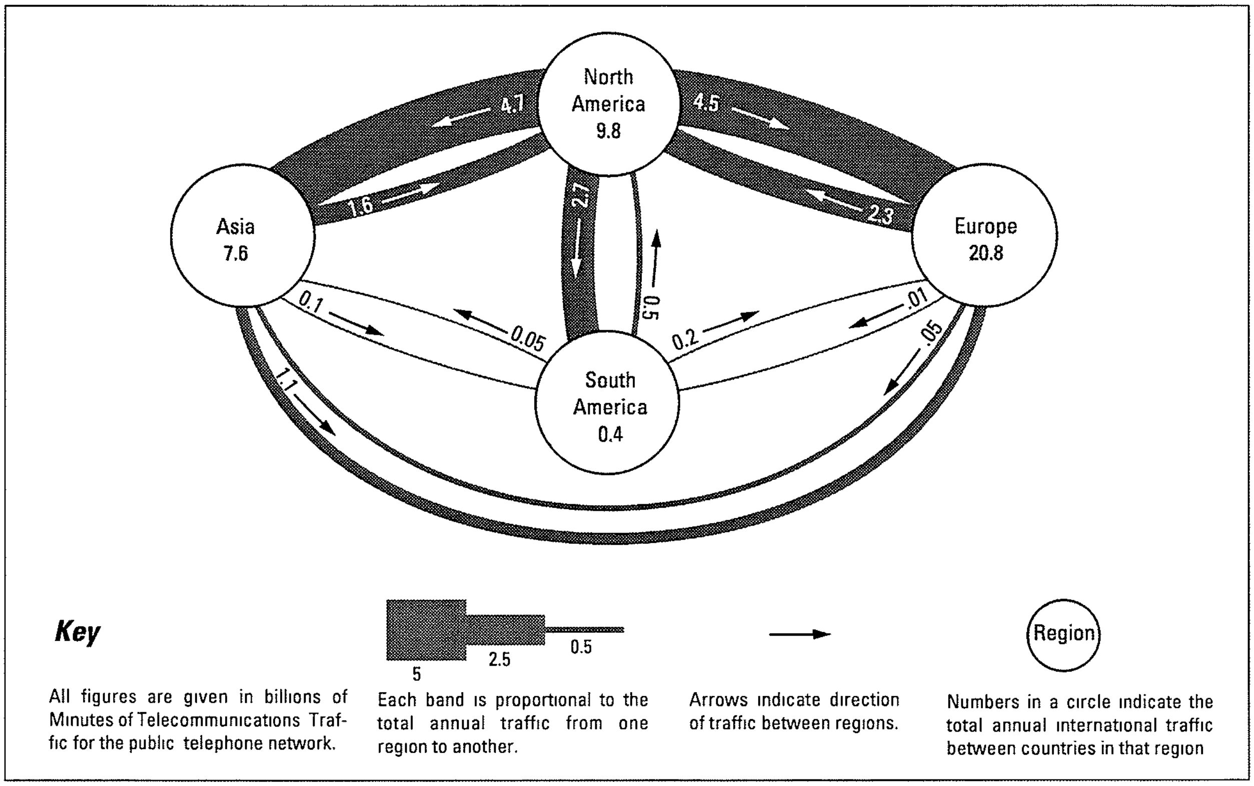
	Historical Trend			*Slow Growth*		*Same Growth*		*Fast Growth*	
Indicator	**1987**	**1996**	**CAGR 1987-96**	**2000**	**CAGR 1996-2000**	**2000**	**CAGR 1996-2000**	**2000**	**CAGR 1996-2000**
Calls (Bn)	4.3	20.2	18.8%	35.9	15.4%	38	17.1%	40.8	19.2%
Estimated call length (mins)	4.5	3.5	-2.8%	3	-3.5%	3	-3.5%	3	-3.5%
Minutes (Bn)	19.1	70.0	15.5%	107.7	11.4%	114.1	13.0%	122.4	15.0%
Per main line subscriber	42.4	94.0	9.2%	118.3	5.9%	123.4	7.0%	130.2	8.5%
Per main line plus mobile	42.2	79.3	7.3%	86.8	2.3%	88.8	2.9%	92.1	3.8%
Revenue (US$bn)	23.9	61.3	11.0%	80.1	6.9%	82.2	7.6%	85.7	8.7%
Assumptions									
Price per MiTT (US$)	1.25	0.88	-3.9%	0.74	-4.0%	0.72	-4.8%	0.70	-5.4%
Main lines (M)	451	745	5.7%	910	5.1%	925	5.6%	940	6.0%
Mobile subscribers (M)	2.5	138	56.1%	330	24.4%	360	27.1%	390	29.7%

Note: 1987-1996 based on reported data. 1996-2000 based on ITU forecasts. Scenarios are as follows:
1. Slow Growth: Traffic growth slows but network infrastructure continues on current growth trend.
2. Same Growth: Continuing traffic growth rate of last five years, assuming faster network growth rate and faster rates of price-cutting.
3. Fast Growth: Faster traffic growth rate than last five years, assuming a faster network growth rate and faster rates of price-cutting, plus a significant component of new demand created by international traffic generated from mobiles.

Source: ITU *World Telecommunication Indicators Database* and ITU estimates.

International Traffic by Region

Figure 3. Interregional Traffic Flows



Note: Data set based on top 20 international routes for 90 countries, accounting for approximately 80% of global international traffic.

Figure 4. International Traffic by Origin, 1996

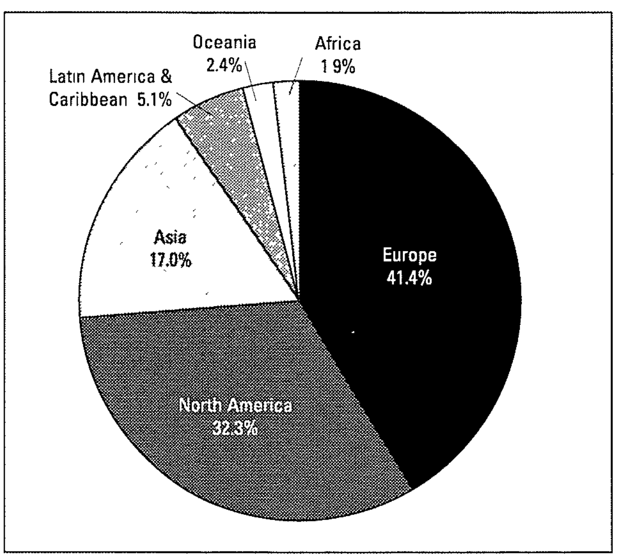


Figure 5. Traffic Growth by Region, 1995-1996

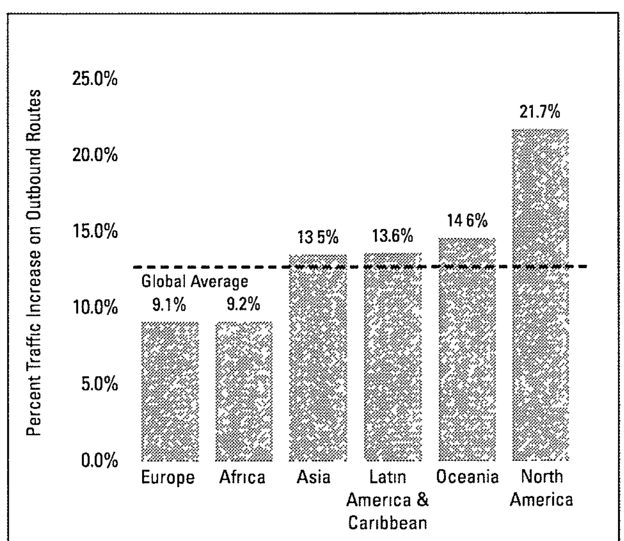
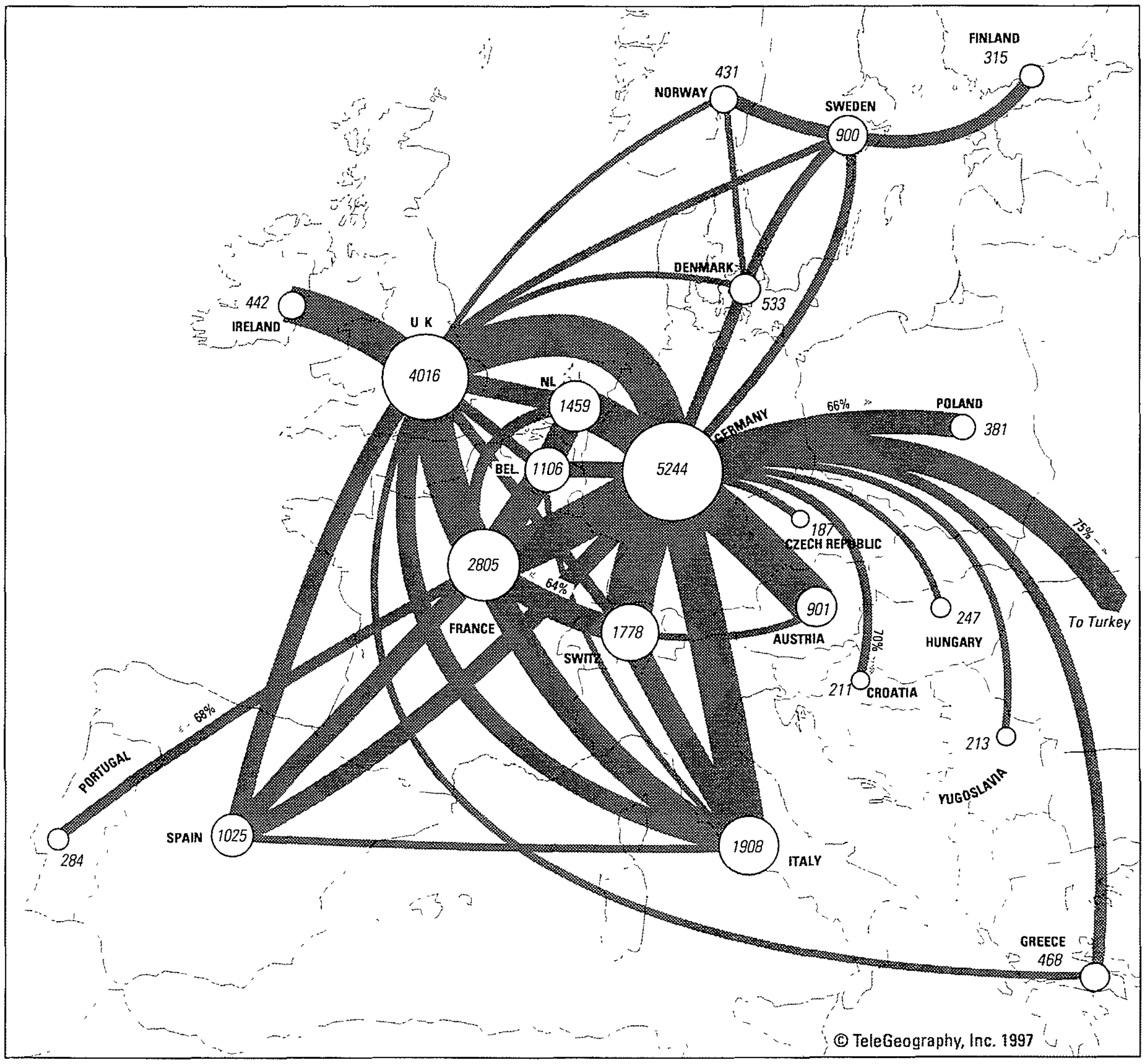


Figure 6. European Telecommunications Traffic Flows, 1995



Key

All figures are given in millions of Minutes of Telecommunications Traffic (mMiTTs), for the public telephone network.

The map shows all intra-European routes with a 1995 volume of more than 110 mMiTTs.

Traffic Flows

600 400 200

Each band is proportional to the total annual traffic on the public telephone network in both directions between each pair of countries.

Total Outgoing Traffic

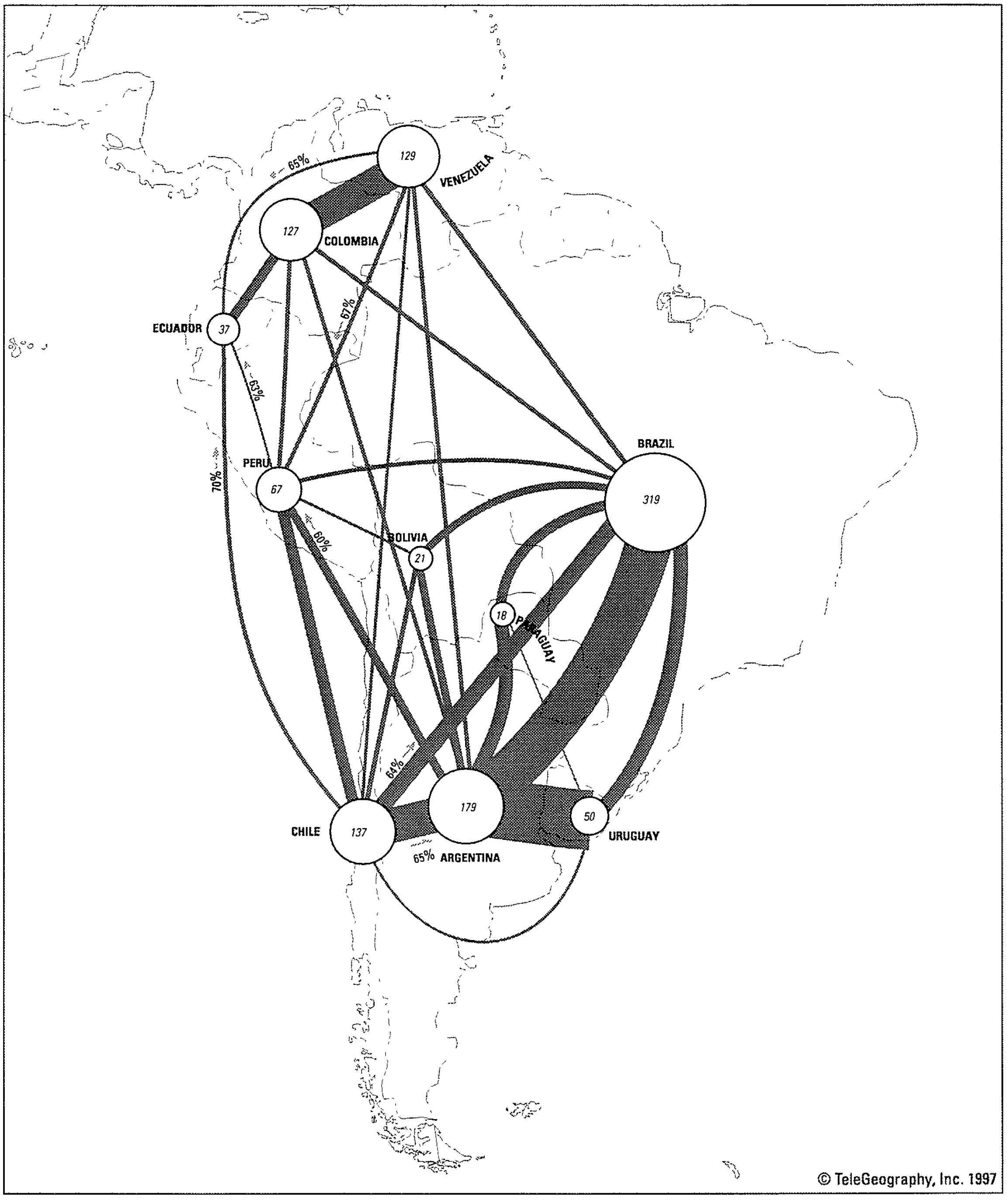
250 1,000 4,000

The area of each circle is proportional to the volume of the total annual outgoing traffic from each country, shown as a number.

Balance of Traffic

On routes where traffic in one direction accounts for more than 60% of the total, an arrow shows the direction most of the traffic flows.

Figure 7. South American Telecommunications Traffic Flows, 1995



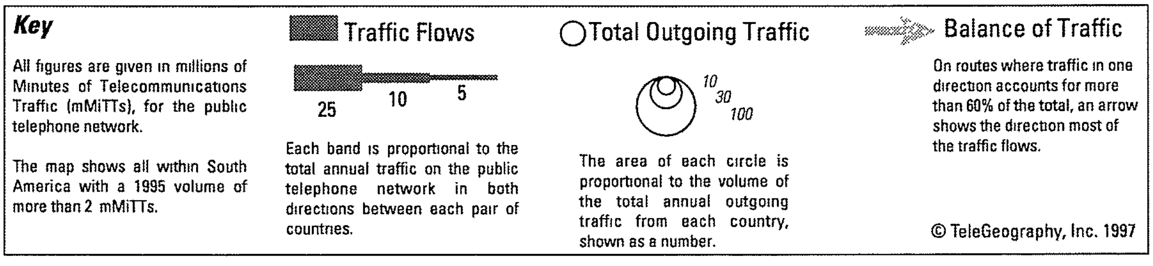


Figure 8. Southwest Asian Telecommunications Traffic Flows, 1995

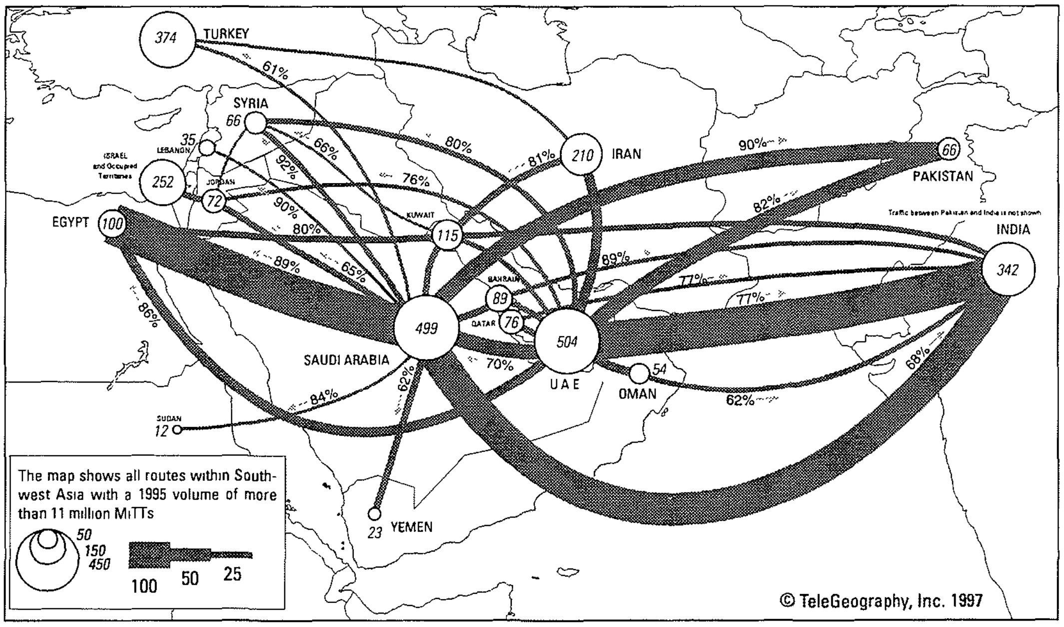
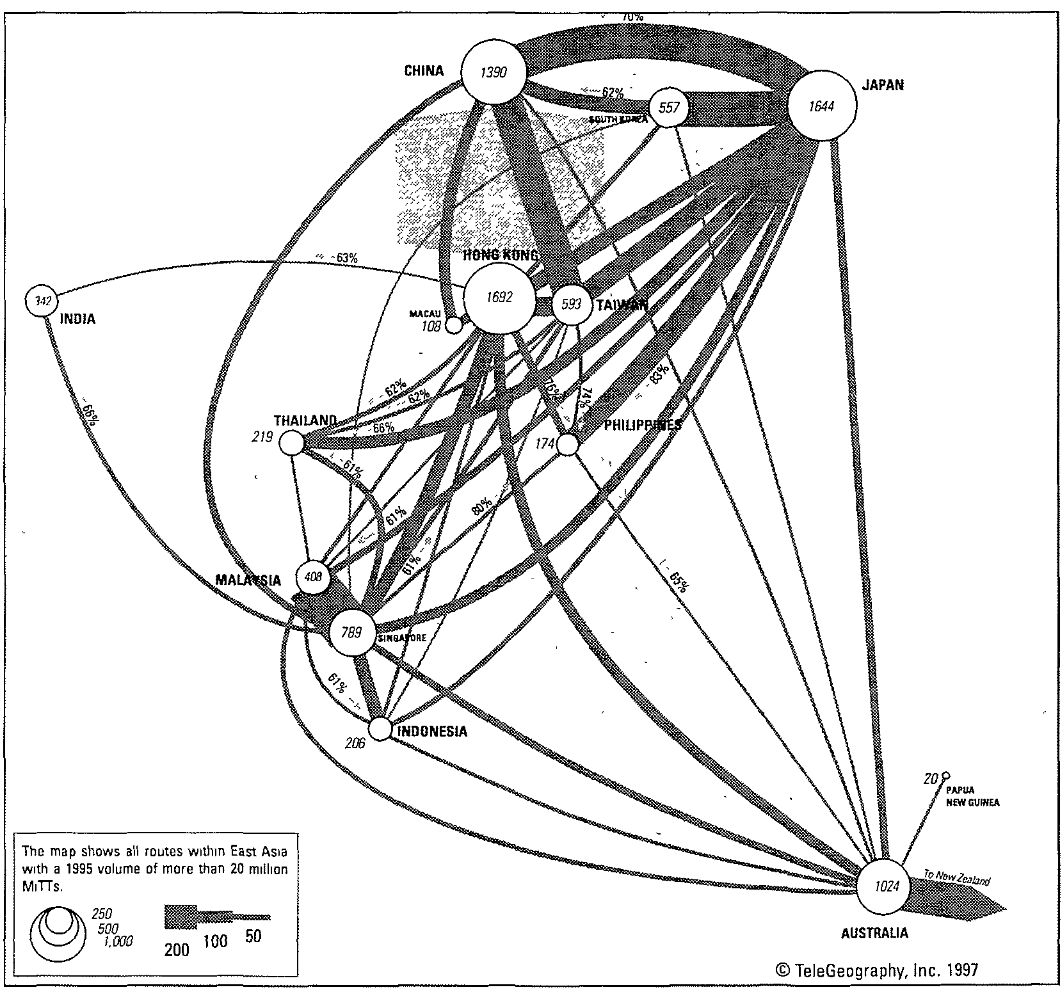


Figure 9. East Asian Telecommunications Traffic Flows, 1995



International Traffic by Country

Figure 10. International Traffic Growth for Selected Countries, 1995-1996

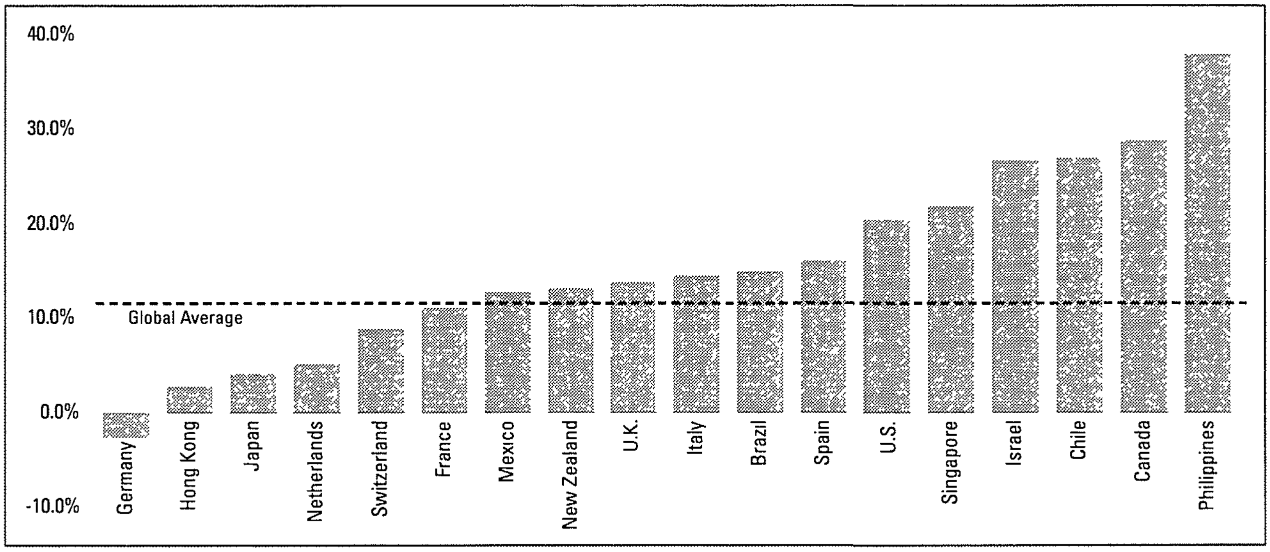


Figure 11. Traffic Balances for Selected Countries, 1996

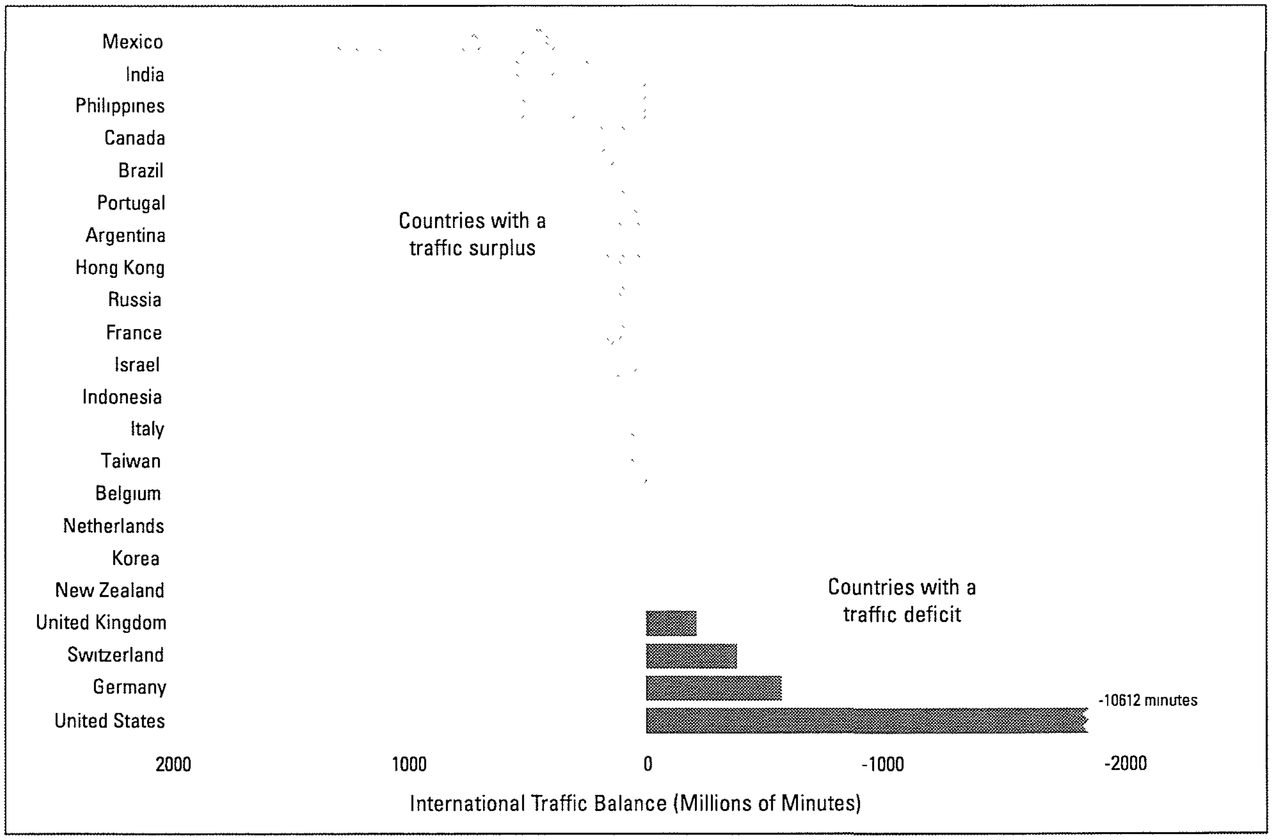


Figure 12. International Traffic Indicators, 1996 (A-J)

	International Traffic						
	Outgoing (mMiTT)	Incoming (mMiTT)	Surplus (Deficit) (mMiTT)	Population (m)	MiTT per Capita	Main Lines (thous.)	MiTT per Main Line
Andorra (a)	37.8	27.3	(10.5)	0.1	519.5	30	1,260.0
Argentina (a)	181.3	390.7	209.4	35.3	5.1	6,227	29.1
Australia (b)	1,305.0	n.a.	n.a.	18.3	71.5	9,500	137.4
Austria	960.0	n.a.	n.a.	8.0	119.7	3,779	254.0
Bahamas	56.7	n.a.	n.a.	0.3	218.6	79	717.7
Bahrain (a)	92.2	69.4	(22.8)	0.6	156.3	144	638.5
Bangladesh	38.3	129.2	90.9	123.1	0.3	297	129.1
Belarus (c)	104.9	n.a.	n.a.	10.4	10.1	2,234	47.0
Belgium (a)	1,228.4	1,289.1	60.6	10.2	120.8	4,725	260.0
Bolivia	21.4	53.9	32.5	7.5	2.8	395	54.2
Brazil	366.9	624.4	257.5	162.7	2.3	15,106	24.3
Canada (a)	3,519.8	4,313.3	793.5	28.8	122.2	18,057	194.9
Chile	173.8	n.a.	n.a.	14.3	12.1	2,248	77.3
China	1,433.2	n.a.	n.a.	1,210.0	1.2	54,940	26.1
Colombia (a)	135.5	384.2	248.7	36.8	3.7	4,256	31.8
Costa Rica (a)	55.0	87.8	32.8	3.5	15.9	639	86.1
Croatia (a)	242.4	n.a.	n.a.	5.0	48.4	1,389	174.5
Cyprus	128.6	92.0	(36.6)	0.7	172.7	266	482.8
Czech Republic (a)	210.4	324.4	43.2	10.3	20.4	2,817	74.7
Denmark (c)	573.2	600.0	26.8	5.2	109.2	3,251	176.3
Dominican Rep.	126.6	450.9	324.3	8.1	15.7	665	190.4
El Salvador	28.6	160.5	131.9	5.6	5.1	314	91.0
Finland	332.0	n.a,	n.a.	5.1	65.0	2,813	118.0
France	3,116.0	3,283.0	167.0	58.3	53.4	32,900	94.7
French Polynesia	7.9	n.a.	n.a.	0.2	34.5	54	145.5
Germany	5,100.0	n.a.	n.a.	83.5	61.1	44,100	115.6
Ghana	16.5	59.6	43.1	17.7	0.9	113	146.1
Greece	515.6	557.3	41.7	10.5	48.9	5,329	96.8
Guyana	29.8	162.8	133.1	0.7	41.8	50	593.7
Hong Kong (a,b)	1,738.6	1,940.8	202.2	6.3	275.7	3,451	503.8
Hungary (a)	265.0	n.a.	n.a.	10.0	26.5	2,662	99.6
Iceland (a)	32.5	32.0	(0.5)	0.3	120.2	155	209.1
India	384.2	1,000.0	616.0	952.1	0.4	14,450	26.6
Indonesia (a,c)	280.2	356.4	76.2	206.6	1.4	4,186	66.9
Iran (a)	183.2	n.a.	n.a.	66.1	2.8	5,825	31.5
Ireland (b,c)	580.0	n.a.	n.a.	3.6	162.6	1,390	417.3
Israel (a)	319.7	468.1	148.4	5.4	59.0	2,539	125.9
Italy (c)	2,184.0	2,253.5	69.5	57.5	38.0	25,259	86.5
Japan (b)	1,710.6	1,519.1	(191.5)	125.4	13.6	62,511	27.4
Jordan	74.6	133.1	58.5	4.2	17.7	334	223.2

Notes: MiTT is Minutes of Telecomunications Traffic. Data are in millions of minutes of public switched traffic.

a. International MiTT based on billing point of traffic.
b. International traffic for year ending 31 March.
c. Traffic data exclude some carriers or routes. (See country table for details.)

Figure 12. International Traffic Indicators, 1996 (K-Z)

	International Traffic Outgoing (mMiTT)	Incoming (mMiTT)	Surplus (Deficit) (mMiTT)	Population (m)	MiTT per Capita	Main Lines (thous.)	MiTT per Main Line
Kazakhstan (c)	102.5	n.a.	n.a.	16.9	6.1	2,120	48.3
Rep. of Korea	699.3	740.6	41.3	45.5	15.4	19,601	35.7
Kuwait	140.7	131.2	(9.4)	2.0	72.2	392	359.1
Luxembourg	248.5	189.8	(58.8)	0.4	597.5	244	1,017.6
Macau (a)	112.5	92.1	(20.4)	0.5	226.4	161	696.7
Malaysia (a, b)	570.5	581.9	11.4	20.0	28.6	3,771	151.3
Mexico (a)	1,070.7	2,489.7	1,419.0	95.8	11.2	8,826	121.3
Moldova (c)	50.2	n.a.	n.a.	4.5	11.2	593	84.6
Netherlands (a)	1,534.1	1,584.6	50.5	15.6	98.5	8,431	182.0
New Zealand (b,c)	353.0	380.0	27.0	3.5	99.5	1,782	198.1
Norway	443.5	422.3	(21.2)	4.4	101.2	2,497	177.6
Oman	62.6	58.0	(4.6)	2.2	28.6	198	316.7
Pakistan (c)	77.0	488.4	411.5	129.3	0.6	2,377	32.4
Panama (a)	41.2	97.7	56.5	2.7	15.5	320	128.8
Paraguay	24.9	49.4	24.5	5.5	4.5	181	137.9
Peru (a)	66.7	226.5	159.7	24.5	2.7	1,435	46.5
Philippines	240.0	767.0	527.0	74.5	3.2	1,787	134.3
Poland (a)	437.2	725.5	288.3	38.6	11.3	6,532	66.9
Portugal (a)	340.0	571.4	231.4	9.9	34.5	3,724	91.3
Russia (c)	851.3	1,037.6	(186.3)	148.2	5.7	25,995	32.7
Saudi Arabia	584.4	n.a.	n.a.	19.4	30.1	2,004	291.7
Singapore (a,b)	941.7	n.a.	n.a.	3.4	277.2	1,563	602.5
Slovak Republic (a)	134.1	159.0	24.9	5.4	25.0	1,246	107.6
Slovenia (c)	105.3	113.9	8.6	2.0	54.0	664	158.7
South Africa	353.0	n.a.	n.a.	41.7	8.5	4,259	82.9
Spain	1,189.0	n.a.	n.a.	39.2	30.3	15,413	77.1
Sri Lanka (a)	29.3	96.0	66.7	18.6	1.6	255	115.1
Sweden (a,c)	1,026.0	n.a.	n.a.	8.9	115.3	6,032	170.1
Switzerland	1,935.5	1,562.8	(372.7)	7.2	268.6	4,547	425.7
Taiwan (a,b)	674.0	736.8	62.8	21.5	31.4	10,011	67.3
Thailand	247.4	376.2	128.7	58.9	4.2	4,200	58.9
Turkey	473.4	755.0	281.6	62.5	7.6	14,286	33.1
Ukraine (c)	340.8	n.a.	n.a.	50.9	6.7	9,241	36.9
UAE	589.3	n.a.	n.a.	2.2	265.2	738	798.4
United Kingdom (b,c)	4,569.2	4,360.0	(209.2)	58.5	78.1	30,292	150.8
United States (a)	18,830.0	8,217.6	(10,612.4)	265.6	70.9	170,568	110.4
Uruguay (a)	54.5	80.1	25.6	3.2	16.8	669	81.5
Uzbekistan (c)	54.2	n.a.	n.a.	23.4	2.3	1,814	29.9
Venezuela (a)	139.0	228.8	89.8	22.0	6.3	2,667	52.1
Vietnam	52.4	n.a.	n.a.	74.0	0.7	1,186	44.2
Yugoslavia	237.2	325.7	88.5	10.0	23.8	2,082	114.0

Notes: MiTT is Minutes of Telecomunications Traffic. Data are in millions of minutes of public switched traffic.

a. International MiTT based on billing point of traffic.

b. International traffic for year ending 31 March.

c. Traffic data exclude some carriers or routes. (See country table for details.)

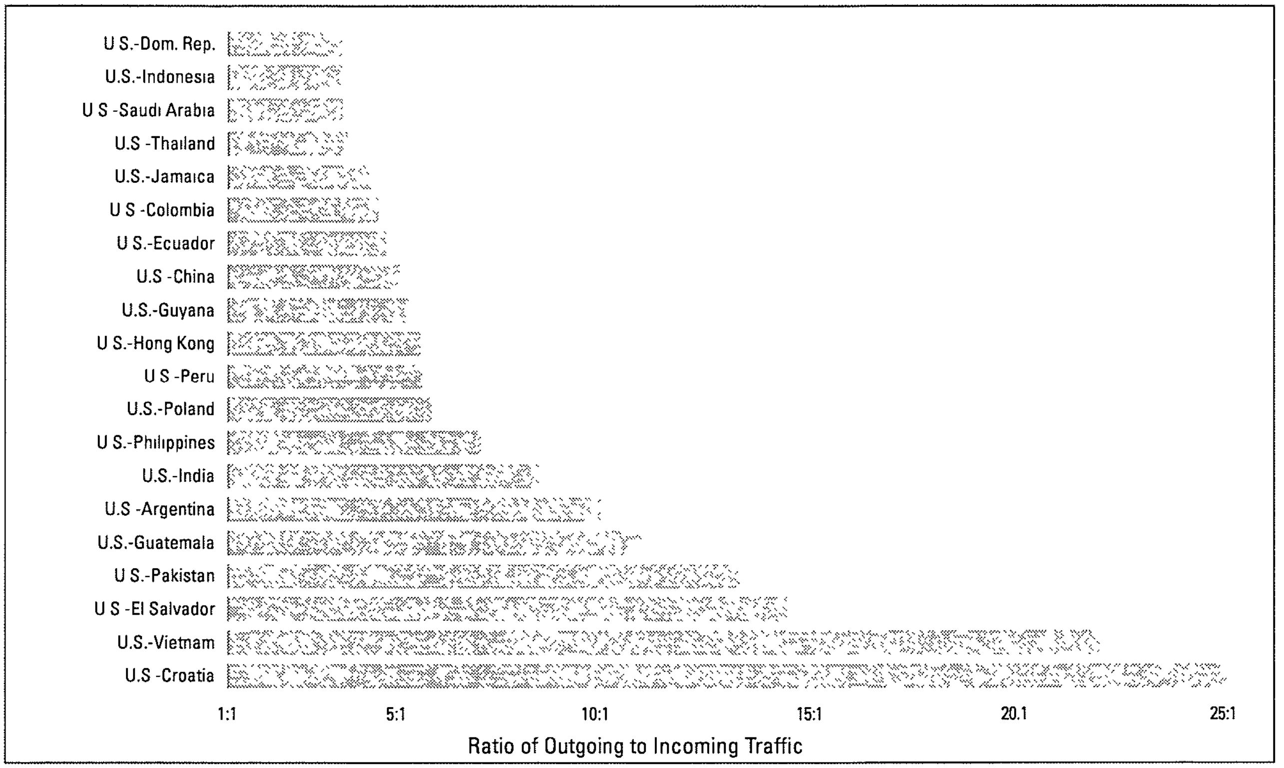
International Traffic by Route

Figure 13. The Top 50 International Routes, 1996

	Countries	MiTT each way	Total MiTT
1.	United States/Canada	3385.2/2848.5	6233.7
2.	United States/Mexico	2377.6/946.3	3323.9
3.	United States/United Kingdom	1121.7/711.9	1833.6
4.	Hong Kong/China	965.0/674.0	1639.0
5.	United States/Germany	778.2/312.4	1090.6
6.	United States/Japan	698.3/342.1	1040.4
7.	United Kingdom/Ireland	429.7/420.9	850.6
8.	Switzerland/Germany	435.5/372.0	807.5
9.	Germany/Austria	426.0/360.0	786.0
10.	Germany/United Kingdom	362.6/405.4	768.0
11.	Germany/Italy	393.0/357.8	750.8
12.	United Kingdom/France	405.8/340.0	745.8
13.	Germany/France	378.9/344.0	722.9
14.	Netherlands/Germany	355.2/338.1	693.3
15.	Singapore/Malaysia	322.7/317.3	640.0
16.	United States/Hong Kong	538.7/96.0	634.7
17.	United States/France	435.1/195.1	630.2
18.	United States/Korea	379.8/156.7	536.5
19.	Belgium/France	285.0/246.0	531.0
20.	Germany/Turkey	370.1/158.7	528.8
21.	France/Italy	267.0/250.6	517.6
22.	Netherlands/Belgium	254.3/253.4	507.7
23.	United States/Brazil	370.9/123.3	494.2
24.	Germany/Poland	315.5/172.4	487.9
25.	United States/Dominican Republic	367.3/99.3	466.6
26.	Switzerland/France	300.5/163.0	463.5
27.	United States/India	413.3/49.1	462.4
28.	Switzerland/Italy	268.6/191.0	459.6
29.	United States/Italy	328.0/114.0	442.0
30.	United States/Taiwan	320.6/111.7	432.3
31.	United States/Australia	275.7/155.4	431.1
32.	United Kingdom/Italy	223.9/171.7	395.6
33.	United States/Philippines	344.4/49.0	393.4
34.	Netherlands/United Kingdom	192.5/192.7	385.2
35.	France/Spain	199.0/175.0	374.0
36.	United Kingdom/Spain	207.7/164.7	372.4
37.	Germany/Spain	184.8/180.0	364.8
38.	United States/China	297.6/58.1	355.7
39.	United States/Colombia	281.7/61.4	343.1
40.	Australia/New Zealand	165.0/166.0	331.0
41.	Japan/China	217.1/104.2	321.3
42.	United States/Israel	238.1/78.8	316.9
43.	Australia/United Kingdom	168.6/144.1	312.7
44.	Germany/Belgium	146.0/148.9	294.9
45.	Taiwan/China	164.5/130.0	294.5
46.	United States/Netherlands	203.6/85.5	289.1
47.	Japan/Korea	157.0/114.7	271.7
48.	Canada/United Kingdom	132.4/132.5	264.9
49.	Sweden/Finland	145.0/108.9	253.9
50.	Norway/Sweden	115.0/130.0	245.0

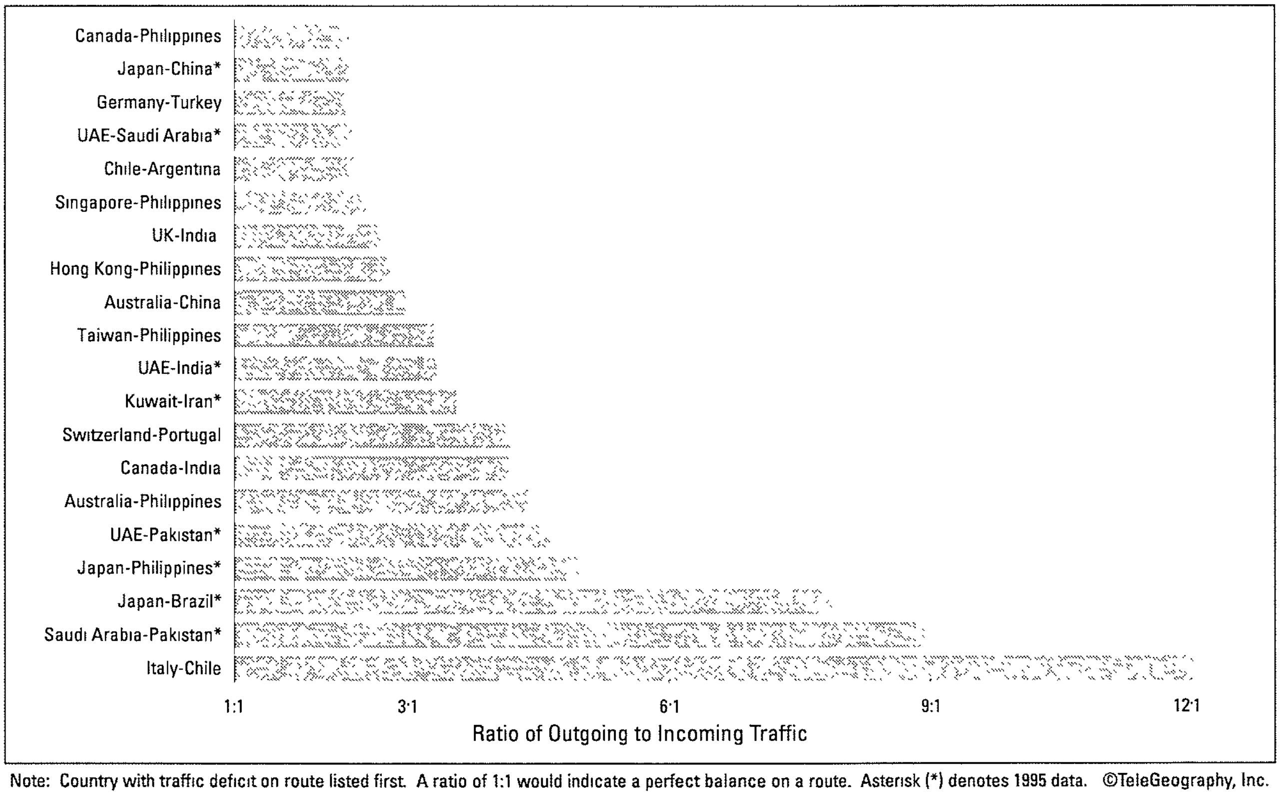
Note: All data in millions of minutes of telecommunications traffic (MiTT). The country which generates more traffic on each route is listed first. The routes listed above total 36.2 billion minutes, 53 percent of all international traffic For routes to and from the United States, calls are measured by point of billing in both directions. ISR traffic by non-US carriers is excluded.

Figure 14. Traffic Imbalances on U.S. Routes



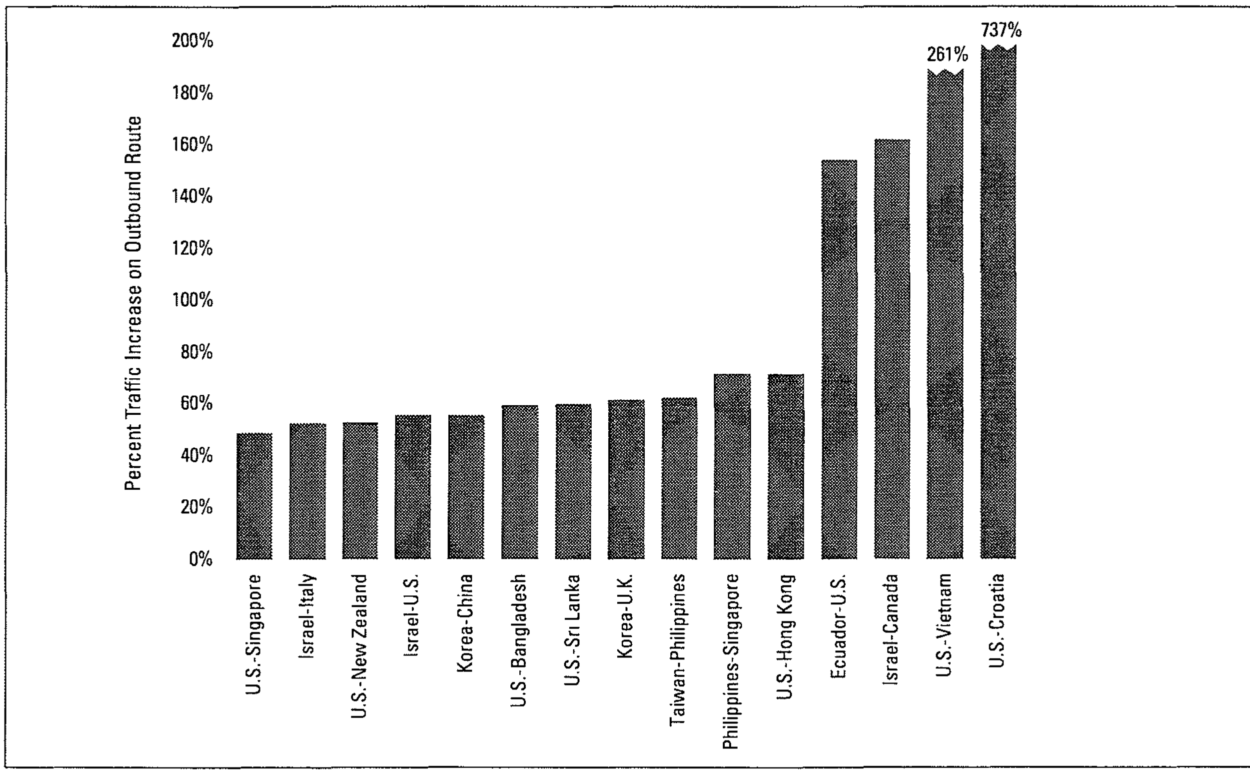
Note: Country with traffic deficit on route listed first. A ratio of 1:1 would indicate a perfect balance on a route. ©TeleGeography, Inc.

Figure 15. Traffic Imbalances on Non-U.S. Routes



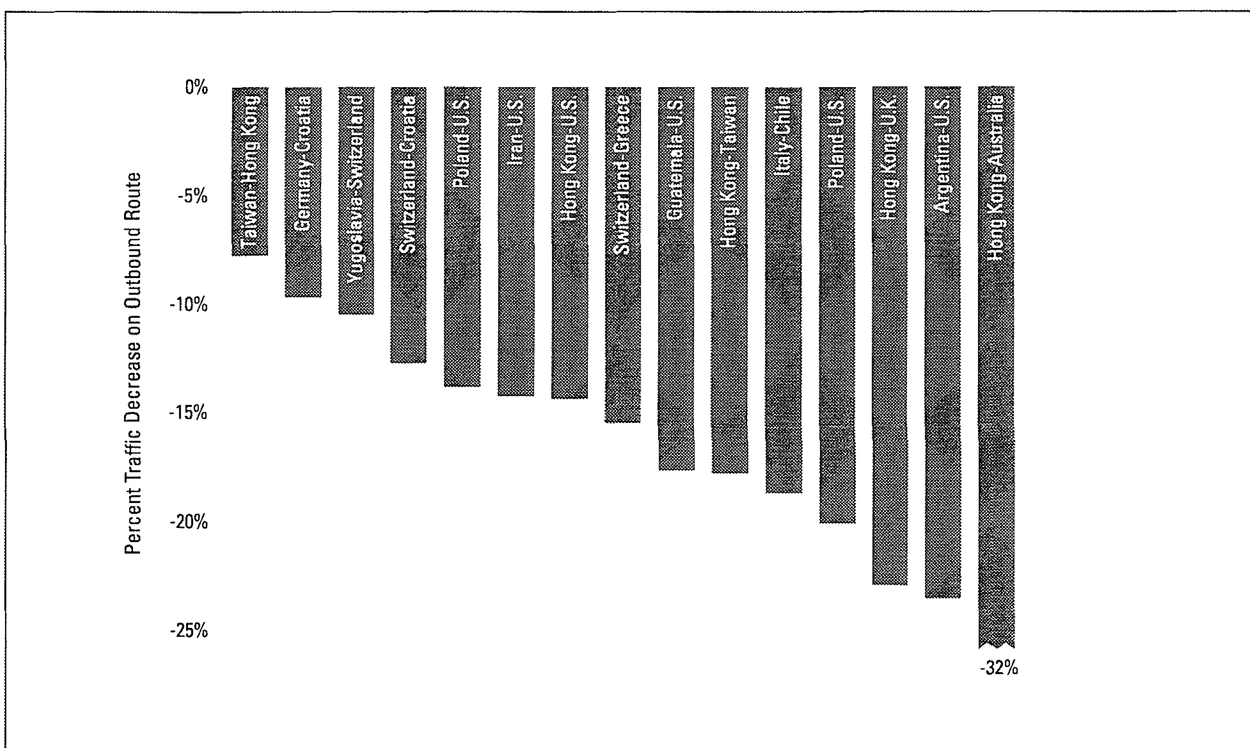
Note: Country with traffic deficit on route listed first. A ratio of 1:1 would indicate a perfect balance on a route. Asterisk (*) denotes 1995 data. ©TeleGeography, Inc.

Figure 16. International Outbound Routes with Rapidly Growing Traffic, 1995-96



Note: Country originating traffic listed first; country terminating traffic listed second. ©TeleGeography, Inc.

Figure 17. International Outbound Routes with Declining Traffic, 1995-96



Note: Country originating traffic listed first; country terminating traffic listed second. ©TeleGeography, Inc.

Methodology

The traffic statistics in *TeleGeography 1997/98* were compiled primarily from an independent survey of telecommunications service providers by TeleGeography, Inc. (TGI). For some countries and carriers, traffic data have been estimated based upon annual reports, government publications and industry interviews. See the footnotes to each table for further information. *Direction of Traffic 1996*, jointly compiled by TGI and the International Telecommunication Union (ITU), was also consulted.

To enable comparisons of countries' international traffic statistics, TGI has endeavored to apply a consistent methodology. When reviewing the traffic statistics in *TeleGeography 1997/98*, however, readers should keep in mind the following issues which may cause traffic data to appear inconsistent:

Public Switched Network vs. Private Line Traffic

Traffic volumes in *TeleGeography 1997/98* are generally reported in minutes or MiTT (Minutes of Telecommunications Traffic). In most cases MiTT refer to paid minutes of traffic on public switched voice circuits and thus include voice as well as non-voice (facsimile or data) traffic.

Unless otherwise stated, traffic carried by International Simple Resale (ISR) carriers is excluded. ISR carriers resell the capacity of international private lines (IPLs) for switched services by interconnecting their IPLs to the public switched network at one or both ends.

Traffic carried by "pure" resellers of international switched voice services is included in this report. These resellers do not own or lease their own international transmission facilities. Instead, they resell the traffic of other carriers; thus, pure resale traffic is counted as part of the MiTT for the facilities-based carrier whose services are resold.

Cross-Border Traffic

Neighboring countries may not classify local cross border traffic in the same way. That is, one country may treat some cross-border traffic as local, while its neighbor counts all such traffic as international.

Billing Point vs. Originating Point of Traffic

Unless otherwise stated in the notes to a table, the outbound MiTT reported for countries in *TeleGeography 1997/98* refers to outbound traffic originated in the reporting country even if it is billed in another country.

In the past, most international calls were billed at the point of origination. The number of billed minutes thus coincided with the volume of outgoing traffic. Billed minutes also included collect or reverse charge calls because the calls were set up by an operator in the originating country. However, the recent use of calling card and call-back services has shifted the billing point for many international calls. For example, calls from Italy to the United States (or a third country, such as Argentina) may now be set up and billed in the U.S.

Some countries, including the U.S., report international traffic data based solely on the location where the traffic is billed. Consequently, "outbound" traffic data for these countries include traffic actually originating in another. Thus, incoming MiTT reported for one country may not match the outgoing MiTT on the same route by the correspondent country. Some double counting may also occur. For example, a call from Thailand to the U.S. which is billed to a U.S. calling card is reported by the U.S. carrier as outbound U.S. MiTT; the same call also is reported as outbound MiTT by Thailand.

Accordingly, in countries where calling card and call-back services are widely used, a year-to-year comparison of national MiTT also requires examining the statistics of countries, such as the U.S. and the U.K., where the calls are hubbed.

Transit Traffic

Unlike calling card and call-back traffic, *TeleGeography 1997/98* excludes transit traffic—that is, traffic which merely passes through a given country, but is not refiled via the switched network in the reporting country.

Rounding

Rounding may cause the figures on total national incoming and outgoing traffic to appear inconsistent with other national data.

Revised Data

Some differences exist between the historical statistics (1995 or earlier) reported in *TeleGeography 1997/98* and data stated in prior TGI reports or *Direction of Traffic*. The variations reflect corrections and/or revised data subsequently provided to TGI.

International Pricing: Green Pages

Retail Prices for Three Minute Call

From/To	Australia	Belgium	Canada	Denmark	Finland	France	Germany	Greece	Ireland	Italy
Australia (Telstra) peak	n.a.	3.93	3.05	3.49	3.49	3.49	3.51	4.37	2.96	3.18
Telstra off peak	n.a.	2.83	2.17	2.61	2.61	2.61	2.54	4.15	2.17	2.17
Belgium peak	3.92	n.a.	1.96	1.18	1.70	1.18	1.18	1.70	1.57	1.57
Belgium off peak	3.92	n.a.	1.96	1.18	1.57	1.18	1.18	1.57	1.44	1.44
Czech Republic peak	5.27	2.13	3.51	2.13	2.63	2.13	1.44	2.63	3.51	2.13
Czech Republic off peak	5.27	2.13	3.51	2.13	2.63	2.13	1.44	2.63	3.51	2.13
France peak	2.66	0.98	1.18	1.18	1.18	n.a.	0.98	1.18	1.18	0.98
France off peak	2.07	0.79	0.98	0.98	0.98	n.a.	0.79	0.98	0.98	0.79
Germany (DT) peak	3.43	1.35	2.03	1.35	1.35	1.35	n.a.	1.35	1.35	1.35
DT off peak	3.43	1.18	1.91	1.18	1.18	1.18	n.a.	1.18	1.18	1.18
Greece peak	2.07	1.60	2.07	1.60	1.60	1.60	1.60	n.a.	1.60	1.60
Greece off peak	1.55	1.20	1.55	1.20	1.20	1.20	1.20	n.a.	1.20	1.20
Italy peak	3.58	1.55	1.55	1.55	1.55	1.55	1.55	1.55	1.55	n.a.
Italy off peak	3.23	1.26	1.41	1.26	1.26	1.26	1.26	1.26	1.26	n.a.
Japan (KDD) peak	5.95	6.73	3.88	6.73	6.73	6.64	6.64	6.73	6.73	6.73
KDD off peak	4.66	5.44	3.19	5.44	5.44	5.35	5.35	5.44	5.44	5.44
Switzerland peak	2.98	1.74	1.93	1.74	1.74	1.43	1.43	1.99	1.99	1.43
Switzerland off peak	2.30	1.37	1.43	1.37	1.37	1.12	1.12	1.49	1.49	1.12
Brazil peak	5.83	4.69	4.46	4.69	4.69	4.69	4.69	5.42	4.69	4.69
Brazil off peak	4.66	3.74	3.56	3.74	3.74	3.74	3.74	4.34	3.74	3.74
India peak	5.25	5.25	6.30	5.25	5.25	5.25	5.25	5.25	5.25	5.25
India off peak	3.94	3.94	5.25	3.94	3.94	3.94	3.94	3.94	3.94	3.94
Malaysia peak	2.56	5.90	3.34	5.01	6.01	5.01	6.68	8.35	6.01	5.90
Malaysia off peak	2.45	4.67	2.67	4.01	4.01	4.01	4.45	5.56	4.67	4.01
South Africa peak	2.67	6.10	2.67	6.10	6.10	4.30	4.59	6.15	4.41	6.15
South Africa off peak	2.26	5.40	2.26	5.40	5.40	3.66	3.66	5.75	3.77	5.75
U.A.E. peak	3.77	5.88	3.77	5.07	4.08	3.77	4.45	4.45	3.77	3.77
U.A.E. off peak	2.08	4.60	2.08	4.20	3.68	2.62	3.68	3.68	2.62	2.62
U.K. (BT) peak	2.20	1.15	1.19	1.15	1.55	1.15	1.15	1.43	0.93	1.43
BT off peak	1.88	1.07	1.14	1.07	1.40	1.07	1.07	1.19	0.80	1.19
U.K. (ACC) peak	1.34	0.80	0.65	0.80	1.05	0.80	0.80	1.00	0.66	1.00
ACC off peak	1.16	0.75	0.61	0.75	0.95	0.75	0.75	0.84	0.57	0.84
U.S. (MCI One)	1.35	1.05	0.32	1.05	1.05	1.05	1.05	1.05	1.05	1.05
MCI basic peak	4.52	4.64	1.46	4.37	4.43	3.98	3.74	5.84	4.04	4.49
MCI basic off peak	3.11	2.96	0.98	2.87	2.66	2.57	2.45	3.89	2.66	3.20
U.S. (AT&T One Rate)	1.35	1.05	0.36	1.05	1.05	1.05	1.05	1.05	1.05	1.05
AT&T basic peak	4.53	4.65	1.47	4.38	4.44	3.99	3.75	5.85	4.05	4.50
AT&T basic off peak	3.12	2.97	0.99	2.88	2.67	2.58	2.46	3.90	2.67	3.21
U.S. (Global Link)	0.96	1.05	0.63	1.05	0.87	1.02	0.99	1.41	1.05	1.47
U.S. (Excel WorldRate One)	1.32	1.02	0.36	2.13	1.44	1.02	1.02	2.67	1.02	1.02
Excel peak	4.50	4.62	1.68	4.35	4.41	3.96	3.72	5.82	4.02	4.47
Excel off-peak	3.06	2.94	0.42	2.85	2.64	2.55	2.43	3.87	2.64	2.19

Notes:

1. All rates are in US $ and exclusive of taxes.
2. Rates were current on July 1, 1997.
3. Rates have been calculated in real time using meter step (rounded up to next meter step for a 3 minute call).
4. Fees are $3 per month for AT&T One Rate, MCI One, and Excel WorldRate One plans.
5. Rates for calls from the U.S. to Canada and Mexico are from Washington, D.C. to Toronto and Mexico City.

Japan	Korea	Mexico	Neth'lands	Portugal	Spain	Sweden	Turkey	U.K.	U.S.	To/From
3.75	4.37	4.37	3.49	4.37	4.59	3.49	4.37	2.81	2.81	Australia (Telstra) peak
3.05	4.04	4.15	2.61	4.15	4.04	2.61	4.15	2.17	2.17	Telstra off peak
3.92	4.31	6.40	1.18	1.70	1.70	1.70	2.35	1.18	1.96	Belgium peak
3.92	4.31	6.40	1.18	1.57	1.57	1.57	1.96	1.18	1.96	Belgium off peak
5.27	5.27	7.84	2.13	3.51	2.63	2.63	2.63	2.13	3.51	Czech Republic peak
5.27	5.27	7.84	2.13	3.51	2.63	2.63	2.63	2.13	3.51	Czech Republic off peak
2.66	2.66	3.45	0.98	1.18	0.98	1.18	1.58	0.98	1.18	France peak
2.07	2.07	2.76	0.79	0.98	0.79	0.98	1.18	0.79	0.98	France off peak
3.43	3.43	3.94	1.35	1.35	1.35	1.35	1.80	1.35	2.03	Germany (DT) peak
3.43	3.43	3.94	1.18	1.18	1.18	1.18	1.80	1.18	1.91	DT off peak
2.79	2.79	2.79	1.60	1.60	1.60	1.60	1.34	1.60	2.07	Greece peak
2.38	2.38	2.38	1.20	1.20	1.20	1.20	1.01	1.20	1.55	Greece off peak
3.58	4.71	4.71	1.55	1.55	1.55	1.55	2.32	1.26	1.55	Italy peak
3.23	3.94	3.94	1.26	1.26	1.26	1.26	1.83	1.19	1.41	Italy off peak
n.a.	4.83	6.39	6.73	6.73	6.73	6.73	7.77	6.64	3.88	Japan (KDD) peak
n.a.	3.80	5.18	5.44	5.44	5.44	5.44	6.30	5.35	3.19	KDD off peak
3.98	3.98	3.98	1.43	1.99	1.99	1.62	2.42	1.43	1.93	Switzerland peak
2.98	2.98	2.98	1.12	1.49	1.49	1.37	1.93	1.12	1.43	Switzerland off peak
5.83	8.69	4.46	4.69	4.64	4.69	4.69	5.42	4.69	2.95	Brazil peak
4.66	6.96	3.56	3.74	3.70	3.74	3.74	4.34	3.74	2.36	Brazil off peak
5.25	5.25	6.30	5.25	5.25	5.25	5.25	5.25	5.25	6.30	India peak
3.94	3.94	5.25	3.94	3.94	3.94	3.94	3.94	3.94	5.25	India off peak
3.67	4.34	8.35	5.01	8.35	5.90	5.01	6.01	3.56	3.34	Malaysia peak
3.23	3.45	5.56	4.01	5.56	4.01	4.01	4.45	2.78	2.56	Malaysia off peak
5.69	5.17	6.10	4.59	5.17	5.69	5.69	5.17	3.60	3.08	South Africa peak
5.05	4.30	5.40	3.66	4.30	5.05	5.05	4.30	2.79	2.55	South Africa off peak
5.07	4.45	9.19	4.45	5.88	4.45	5.07	5.88	3.77	3.77	U.A.E. peak
4.45	3.68	5.88	3.68	4.60	3.68	4.20	4.60	2.62	2.45	U.A.E. off peak
3.11	4.36	4.36	1.15	1.43	1.43	1.15	2.72	n.a.	1.19	U.K. (BT) peak
2.95	4.14	4.14	1.07	1.19	1.19	1.07	2.31	n.a.	1.14	BT off peak
2.07	2.81	2.81	0.80	1.00	1.00	0.80	2.06	n.a.	0.65	U.K. (ACC) peak
2.03	2.69	2.69	0.75	0.84	0.84	0.75	1.75	n.a.	0.61	ACC off peak
1.44	1.77	0.75	1.05	1.05	1.05	1.05	1.80	0.36	n.a.	U.S. (MCI One)
4.34	5.45	4.52	3.92	4.94	4.85	3.92	5.51	3.26	n.a.	MCI basic peak
3.14	3.83	3.53	2.57	3.20	3.29	2.57	3.92	2.36	n.a.	MCI basic off peak
1.44	1.77	1.77	1.05	1.05	1.05	1.05	1.80	0.36	n.a.	U.S. (AT&T One Rate)
4.35	5.46	4.53	3.93	4.95	4.86	3.93	5.52	3.27	n.a.	AT&T peak
3.15	3.84	3.54	2.58	3.21	3.30	2.58	3.93	2.37	n.a.	AT&T off peak
1.23	2.40	2.79	1.20	2.07	1.23	0.72	2.04	0.60	n.a.	U.S. (Global Link)
1.41	1.32	0.75	1.59	1.47	1.02	1.02	1.89	1.02	n.a.	U.S. (Excel WorldRate One)
4.32	5.43	4.47	3.90	4.92	4.83	3.90	5.49	3.24	n.a.	Excel peak
2.76	2.43	1.56	1.83	2.67	2.40	1.83	3.00	1.68	n.a.	Excel off peak

Source: Phillips Tarifica Ltd., 40 Furnival St, London EC4A 1JQ, U.K.

Tel +44 171 4406500 • Fax +44 171 8318552 • Email: consult@tarifica.com • http://www.tarifica.com

Source for U.S. rates: TeleGeography, Inc.

International Accounting Rates

Destination	United States 1995	United States 1996	United States 1997	Chile 1995	New Zealand 1997	United Kingdom 1996
Andorra	0.62	0.61	0.57	n.a.	1.04	0.53
Argentina	1.43	1.43	1.25	2.65	1.81	1.70
Australia (Telstra)	0.59	0.45	0.42	n.a.	0.42	0.54
Austria	0.67	0.43	0.41	n.a.	0.97	0.47
Bahamas	0.60/0.30	0.60/0.30	0.60/0.30	n.a.	2.51	0.65
Bahrain	1.60	1.60	1.60	n.a.	1.39	2.09
Bangladesh	2.00	2.00	2.00	n.a.	1.42	2.09
Belarus	1.50	1.20	1.00	n.a.	1.11	0.67
Belgium	0.71	0.56	0.40	n.a.	0.84	0.31
Bolivia	1.50	1.25	1.20	2.70	2.73	1.82
Brazil	1.14	1.03	1.03	2.45	1.95	1.39
Canada	0.24/0.20	0.22/0.14	0.22/0.14	1.10	0.35	0.28
Chile (Entel)	1.10	1.00	1.00	n.a.	1.39	1.88
China	2.67	2.13	1.77	n.a.	2.27	2.27
Colombia	1.30	1.25	1.18	2.55	2.30	1.77
Costa Rica	1.35/1.00	1.15	1.15	n.a.	1.53	2.05
Croatia	1.04	1.01	0.68	n.a.	2.05	0.55
Cyprus	1.41	1.30	1.09	n.a.	1.39	0.61
Czech Republic	1.19	0.72	0.68	n.a.	0.97	0.42
Denmark	0.74	0.29	0.27	n.a.	0.84	0.21
Dominican Republic (Codetel)	1.10/0.60	0.90	0.80	n.a.	1.34	1.17
El Salvador	1.20	1.10	1.10	n.a.	0.84	2.60
Finland (Telecom Finland)	0.59	0.51	0.49	n.a.	0.84	0.36
France	0.54	0.35	0.26	2.40	0.90	0.24
French Polynesia	2.50	2.50	2.50	n.a.	0.97	2.78
Germany	0.39	0.23	0.22	1.50	0.84	0.21
Ghana	1.10	1.00	1.00	n.a.	1.25	1.11
Greece	1.26	1.01	0.95	n.a.	0.97	0.59
Guyana	1.70	1.70	1.70	n.a.	2.23	1.67
Hong Kong	1.00	0.94	0.79	n.a.	0.84	0.84
Hungary	1.34	1.01	0.84	n.a.	0.97	0.33
Iceland	1.04	0.94	0.88	n.a.	1.67	0.52
India	1.80	1.60	1.58	n.a.	1.81	1.92
Indonesia (Satelindo)	1.58	1.40	1.30	n.a.	1.48	2.14
Iran	3.00/2.50	3.00/2.50	3.00/2.50	n.a.	2.09	2.05
Ireland	0.67	0.35	0.33	n.a.	0.42	0.27
Israel	1.90/1.63/1.23	1.18	1.18	n.a.	1.88	0.70
Italy	0.71	0.52	0.38	n.a.	0.70	0.54
Japan (KDD)	0.94	0.91	0.85	n.a.	0.97	1.25
Jordan	1.50	1.50	1.50	n.a.	2.05	2.05

Notes:

1. All rates expressed in US$. Equivalent dollar values are presented for accounting rates that are established in SDRs or gold francs.
2. The average U.S. accounting rate for 1995 and 1996 is weighted by the total minutes between the U.S. and each location in that year. U.S. 1997 rates current to June 1997. Chilean accounting rates are for October 1995, New Zealand rates are for March 1997, and U.K. rates are for October 1996.
3. Where two rates are shown, there are peak/off-peak rates or growth-based rates (traffic above a benchmark level eligible for a lower rate.)
4. Rates are for largest carrier serving the route. Different accounting rates may apply to competing carriers.

Destination	United States 1995	United States 1996	United States 1997	Chile 1995	New Zealand 1997	United Kingdom 1996
Kazakhstan	2.20	2.10	2.10	n.a.	2.73	2.20
Korea (Korea Telecom)	1.26	1.23	0.98	n.a.	1.25	1.39
Kuwait	1.71	1.67	1.56	n.a.	2.27	1.39
Luxembourg	0.74	0.58	0.41	n.a.	0.97	0.40
Macau	1.50	1.35	1.35	n.a.	1.11	1.11
Malaysia (STM)	1.00	0.89	0.89	n.a.	0.97	1.00
Mexico (Telmex)	0.67	0.68	0.70	1.20	0.84	1.11
Moldova	2.08	2.08	2.08	n.a.	2.07	0.99
Netherlands	0.37	0.36	0.34	n.a.	0.70	0.41
New Zealand (TNZI)	0.59	0.43	0.27	n.a.	0.00	0.70
Norway	0.45	0.29	0.27	n.a.	0.84	0.33
Oman	2.46	2.40	2.25	n.a.	1.82	1.55
Pakistan	2.30	2.20/1.40	2.00/1.20	n.a.	1.42	2.23
Panama	1.30	1.25	1.20	n.a.	3.41	2.05
Paraguay	1.70	1.45	1.45	n.a.	1.11	1.81
Peru	1.30	1.23	1.13	1.96	1.39	1.81
Philippines (PLDT)	1.23	1.00	1.00	n.a.	1.04	1.53
Poland	1.15	0.95	0.70	n.a.	2.51	0.51
Portugal	1.20/0.74	0.83	0.68	n.a.	1.11	0.58
Russia (Rostelcom)	2.60	2.12	2.12	n.a.	2.09	0.72
Saudi Arabia	2.20	2.20	2.02/1.62	n.a.	1.82	1.82
Singapore	0.92	0.90	0.84	n.a.	0.84	1.00
Slovak Republic	1.34	1.30	0.84	n.a.	1.88	0.40
Slovenia	1.11	0.72	0.68	n.a.	1.67	0.49
South Africa	1.20	1.00	1.00	n.a.	0.84	1.81
Spain	1.44/0.95	0.64	0.60	1.34	1.11	0.59
Sri Lanka	2.00	2.00	2.00	n.a.	1.81	1.53
Sweden (Telia AB)	0.37	0.18	0.16	1.50	0.56	0.21
Switzerland	0.52	0.51	0.38	n.a.	0.70	0.29
Taiwan	1.20	1.20	1.20	n.a.	1.18	1.53
Thailand	1.55	1.50	1.50	n.a.	1.67	1.67
Turkey	1.63	1.16	1.09	n.a.	2.50	0.55
Ukraine	1.50	1.40	1.30	n.a.	0.00	1.89
United Arab Emirates	2.00/1.30	2.00/1.30	2.00/1.30	n.a.	1.11	2.05
United Kingdom (BT)	0.37	0.36/0.22	0.20/0.13	1.85	0.42	n.a.
United States	n.a.	n.a.	n.a.	1.00	0.34	0.34
Uruguay	1.80/1.10	1.27	1.10	n.a.	2.23	1.64
Uzbekistan	1.80	1.70	1.70	n.a.	1.53	1.95
Venezuela	1.30/1.00	1.15/1.00	1.00	1.96	1.82	1.64
Vietnam	2.30/2.00/1.85/1.70	2.30/2.00/1.85/1.70	2.00/1.85/1.70	n.a.	2.23	2.92
Yugoslavia	1.19	1.16	1.11	n.a.	n.a.	0.67

Source: FCC; Entel Chile SA; Telecom Corporation of New Zealand, Ltd; Office of Telecommunications (OFTEL—UK)

FCC Settlement Benchmarks

Benchmarks Methodology

These Tariffed Component Prices (TCPs) were calculated by the staff of the Federal Communications Commission (FCC) and were used to derive average benchmark settlement rates for U.S. international telephone carriers in the FCC's Report and Order IB Docket No. 96-261, FCC 97-280, released August 18, 1997 (Benchmarks Order). Implementation of the Order is staggered over several years, according to national incomes, from January 1, 1999 for high income countries to January 1, 2003, for low income countries. See "The FCC's Settlement Benchmarks" on page 45.

The TCP for each country is derived from the prices for the three network elements used to provide international phone service as identified by Recommendation D.140 of the International Telecommunication Union Telecommunication Standardization Sector (ITU-T). These elements are: (1) International transmission facilities; (2) International switching facilities; (3) National extension (domestic transport and termination).

The FCC used 1996 tariff rates for the largest carrier in each country to calculate the price for the international transmission and national extension elements. For the international transmission portion, the FCC used the rate for a high capacity (1.5 Mbps or more) international private line, assuming 4/1 compression on each 64 kbps circuit, and a usage level of 8000 minutes per 64 kbps circuit per month. For the national extension, the FCC relied upon national long distance tariffs, making some adjustments for the expected distribution of inbound traffic by time of day and distance. The per minute cost of the international switching element was derived from the accounting rate share figures stated in the ITU-T Recommendation D.300R for the international exchange component.

Details on the FCC's methodology and underlying data can be found in Appendix E to the Benchmarks Order. See also the December 1996 "Foreign Tariffed Components Prices" report prepared by the FCC's International Bureau, at Appendices C and D, which contains the relevant international private line and domestic long distance tariffs.

Copies of these documents also can be found in *The FCC Reader*, the TeleGeography, Inc. regulatory review. For details visit: www.telegeography.com/Publications/fcc.html.

Tariffed Component Prices for FCC Benchmarks

Country	International Transmission (US$)	International Switching (US$)	National Extension (US$)	Tariffed Component Price (US$ Total)
Argentina	0.067	0.034	0.220	0.321
Australia	0.048	0.019	0.120	0.187
Austria	0.081	0.019	0.214	0.314
Bahamas	0.052	0.019	0.128	0.199
Belgium	0.030	0.019	0.092	0.141
Brazil	0.066	0.034	0.178	0.278
Chile	0.029	0.034	0.123	0.186
China	0.087	0.048	0.042	0.177
Colombia	0.051	0.048	0.086	0.185
Costa Rica	0.033	0.048	0.022	0.103
Czech Republic	0.081	0.034	0.075	0.190
Denmark	0.059	0.019	0.066	0.144
Dominican Republic	0.036	0.048	0.061	0.145
El Salvador	0.059	0.048	0.011	0.118
France	0.029	0.019	0.127	0.175
Germany	0.043	0.019	0.136	0.198
Greece	0.052	0.034	0.144	0.230
Guyana	0.066	0.048	0.006	0.12
Hong Kong	0.051	0.019	0.000	0.070

Tariffed Component Prices for FCC Benchmarks (continued)

Country	International Transmission (US$)	International Switching (US$)	National Extension (US$)	Tariffed Component Price (US$ Total)
Hungary	0.061	0.034	0.049	0.144
India	0.081	0.048	0.183	0.312
Indonesia	0.068	0.048	0.239	0.355
Ireland	0.027	0.019	0.134	0.180
Israel	0.042	0.019	0.024	0.085
Italy	0.048	0.019	0.115	0.182
Japan	0.065	0.019	0.113	0.197
Jordan	0.159	0.048	0.023	0.23
Korea	0.051	0.034	0.043	0.128
Kuwait	0.071	0.019	0.000	0.090
Malaysia	0.066	0.034	0.124	0.224
Mexico	0.009	0.034	0.125	0.168
Netherlands	0.026	0.019	0.053	0.098
New Zealand	0.057	0.019	0.162	0.238
Norway	0.032	0.019	0.065	0.116
Pakistan	0.147	0.048	0.072	0.267
Panama	0.047	0.048	0.099	0.194
Peru	0.058	0.048	0.055	0.161
Philippines	0.065	0.048	0.126	0.239
Poland	0.047	0.048	0.151	0.246
Portugal	0.046	0.019	0.174	0.239
Russia	0.054	0.048	0.252	0.354
Singapore	0.050	0.019	0.007	0.076
South Africa	0.052	0.034	0.083	0.169
Spain	0.048	0.019	0.114	0.181
Sweden	0.036	0.019	0.045	0.100
Switzerland	0.044	0.019	0.143	0.206
Taiwan	0.057	0.019	0.063	0.139
Thailand	0.040	0.048	0.083	0.171
Turkey	0.054	0.048	0.077	0.179
United Arab Emirates	0.033	0.019	0.025	0.077
United Kingdom	0.024	0.019	0.087	0.130
Uruguay	0.127	0.034	0.062	0.223
Venezuela	0.037	0.048	0.153	0.238
Vietnam	0.093	0.048	0.106	0.247

Source: FCC

Internet Telephony Pricing

Internet Telephony Call Rates from the U.S., September 1997

Global Exchange Carrier

Destination	Price/min. (US$)
Australia	0.28
France	0.28
Germany	0.28
Indonesia	0.92
Israel	0.89
Japan	0.34
Korea	0.70
Netherlands	0.34
New Zealand	0.33
Switzerland	0.47
U.K.	0.27

Source: http://www.gxc.com/callrate.htm

GTX International

Destination	Price/min. (US$)
Canada	0.33
Greece	0.69
Hong Kong	0.62
Israel	0.29
Italy	0.61
Japan	0.53
Korea	0.88
Malaysia	0.82
New Zealand	0.52
Philippines	0.99
U.K.	0.42

Source: http://www.GTXintl.com/rates.htm

Global Reference: Blue Pages

National Telecommunications Indicators (A-J)

	GDP, 1996 (billions)	Population, 1996 (millions)	Main Lines, 1996 (thous.)	Lines per 100 (1996)	Cellular Users, 1996 (thous.)	PCs, 1996 (thous.)	Internet Users, 1995 (thous.)
Andorra (a)	n.a.	0.1	30.0	41.2	4.9	n.a.	n.a.
Argentina (a)	281.1	35.3	6,226.6	17.6	340.7*	850.0*	51.1
Australia (b)	348.8	18.3	9,500.0	52.0	3,815.0	5,700.0	1,011.5
Austria	233.4	8.0	3,779.0	47.1	383.5*	1,200.0	149.4
Bahamas	3.1*	0.3	79.0	30.5	n.a.	n.a.	2.5
Bahrain (a)	4.9*	0.6	144.4	24.5	40.1	29.3*	1.0
Bangladesh	29.1	123.1	296.6	0.2	2.5*	n.a.	n.a.
Belarus (c)	20.6	10.4	2,234.1	21.4	6.5	n.a.	0.2
Belgium (a)	269.1	10.2	4,725.5	46.5	410.2	1,700.0	100.4
Bolivia	6.1	7.5	395.0	5.3	7.2*	n.a.	0.7
Brazil	688.1	162.7	15,105.9	9.3	2,498.2	2,900.0	201.3
Canada (a)	568.9	28.8	18,057.1	62.7	2,589.8*	5,700.0*	1,187.6
Chile	67.3	14.3	2,248.0	15.7	335.4	540.0	100.4
China	697.6	1,210.0	54,940.0	4.5	6,850.0	3,700.0	3,146.0
Colombia (a)	76.1	36.8	4,256.3	11.6	274.6	630.0*	26.6
Costa Rica (a)	9.2	3.5	638.6	18.4	18.7*	n.a.	14.7
Croatia (a)	18.1	5.0	1,389.0	27.8	64.9	100.0*	25.1
Cyprus	7.2*	0.7	266.4	35.8	70.8	30.0*	3.0
Czech Republic (a,d)	44.8*	10.3	2,817.3	27.3	200.3	550.0*	219.7
Denmark (c)	172.2	5.2	3,251.1	61.9	1,316.6	1,600.0	200.8
Dominican Republic (d)	11.3	8.1	665.0	8.2	64.2	n.a.	1.4
El Salvador	9.5	5.6	314.2	5.6	13.5*	n.a.	n.a.
Finland	125.4	5.1	2,813.0	55.1	1,501.5	930.0*	709.6
France	1,536.1	58.3	32,900.0	56.4	2,462.7	8,800.0	502.0
French Polynesia	3.1*	0.2	54.3	23.7	n.a.	n.a.	n.a.
Germany	2,415.8	83.5	44,100.0	52.8	5,790.0	15,000.0	1,530.5
Ghana	6.3	17.7	112.9	0.6	6.2*	20.0*	0.1
Greece	90.6	10.5	5,328.7	50.6	550.0	350.0*	80.5
Guyana	0.5*	0.7	50.2	7.0	1.2	n.a.	n.a.
Hong Kong (a,b)	143.7	6.3	3,451.2	54.7	798.4*	950.0	305.6
Hungary (a)	43.7	10.0	2,661.6	26.6	265.0*	450.0	107.7
Iceland (a)	6.0*	0.3	155.4	57.5	49.0	55.0*	3.2
India	324.1	952.1	14,450.0	1.5	76.7*	1,400.0	10.2
Indonesia (a,c)	198.1	206.6	4,186.0	2.0	562.5	940.0	21.2
Iran (a)	57.6*	66.1	5,825.0	8.8	33.6	n.a.	2.6
Ireland (b,c)	60.8	3.6	1,390.0	39.0	158.0*	520.0	399.3
Israel (a)	92.0	5.4	2,539.1	46.8	1,050.0	670.0	290.0
Italy (c)	1,086.9	57.5	25,259.0	44.0	5,700.0	5,300.0	300.7
Japan (b)	5,108.5	125.4	62,511.3	49.8	10,204.0*	16,100.0	901.7
Jordan	6.1*	4.2	334.2	7.9	11.5*	35.0*	1.0

Source: International Telecommunication Union, U.S. Census Bureau and TeleGeography, Inc.

International Telephone Traffic (A-J)

Outgoing MiTT (millions) 1995	1996	Change	Incoming MiTT (millions) 1995	1996	Change	Traffic Balance (millions) 1995	1996	
36.0	37.8	5.0%	n.a.	27.3	n.a.	n.a.	-10.5	Andorra (a)
179.4	181.3	1.1%	299.4	390.7	30.5%	120.0	209.4	Argentina (a)
1,024.0	1,305.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	Australia (b)
901.0	960	6.5%	n.a.	n.a.	n.a.	n.a.	n.a.	Austria
n.a.	56.7	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	Bahamas
88.7	92.2	3.9%	62.6	69.4	10.8%	-26.1	-22.8	Bahrain (a)
33.0	38.3	16.1%	122.1	129.2	5.8%	89.1	90.9	Bangladesh
106.6	104.9	-1.6%	n.a.	n.a.	n.a.	n.a.	n.a.	Belarus (c)
1,105.7	1,228.4	11.1%	1,172.0	1,289.1	10.0%	66.3	60.6	Belgium (a)
20.8	21.4	2.9%	49.2	53.9	9.6%	28.4	32.5	Bolivia
319.4	366.9	14.9%	495.5	624.4	26.0%	176.1	257.5	Brazil
2,667.1	3,519.8	32.0%	3,895.8	4,313.3	10.7%	1,228.7	793.5	Canada (a)
136.9	173.8	27.0%	n.a.	n.a.	n.a.	n.a.	n.a.	Chile
1,339.1	1,433.2	7.0%	n.a.	n.a.	n.a.	n.a.	n.a.	China
127.3	135.5	6.4%	351.5	384.2	9.3%	224.2	248.7	Colombia (a)
52.8	55.0	4.2%	n.a.	87.8	n.a.	n.a.	32.8	Costa Rica (a)
210.7	242.4	15.1%	309.0	n.a.	n.a.	98.3	n.a.	Croatia (a)
117.5	128.6	9.4%	87.3	92.0	5.4%	-30.2	-36.6	Cyprus
186.8	210.4	n.a.	223.7	324.4	n.a.	36.9	43.2	Czech Rep. (a,d)
532.6	573.2	7.6%	551.0	600.0	8.9%	18.4	26.8	Denmark (c)
85.4	126.6	n.a.	424.1	450.9	6.3%	338.7	324.3	Dominican Rep. (d)
64.1	28.6	n.a.	n.a.	160.5	n.a.	n.a.	131.9	El Salvador (d)
315.4	332.0	5.3%	345.0	n.a,	n.a.	29.6	n.a.	Finland
2,804.6	3,116.0	11.1%	2,958.9	3,283.0	11.0%	154.3	167.0	France
7.6	7.9	3.9%	n.a.	n.a.	n.a.	n.a.	n.a.	French Polynesia
5,238.0	5,100.0	-2.6%	4,215.0	n.a.	n.a.	-1,023.0	n.a.	Germany
16.8	16.5	-1.7%	n.a.	59.6	n.a.	n.a.	43.1	Ghana
467.9	515.6	10.2%	505.4	557.3	10.3%	37.5	41.7	Greece
20.6	29.8	44.7%	139.7	162.8	16.5%	119.1	133.1	Guyana
1,691.8	1,738.6	2.8%	1,598.3	1,940.8	21.4%	-93.5	202.2	Hong Kong (a,b)
247.5	265.0	7.1%	243.7	n.a.	n.a.	-3.8	n.a.	Hungary (a)
28.9	32.5	12.3%	28.4	32.0	12.7%	-0.5	-0.5	Iceland (a)
341.4	384.2	12.5%	805.4	1,000.0	24.2%	461.2	616.0	India
216.6	280.2	29.4%	294.0	356.4	21.2%	77.4	76.2	Indonesia (a,c)
210.4	183.2	-12.9%	199.0	n.a.	n.a.	-11.4	n.a.	Iran (a)
407.0	580.0	42.5%	n.a.	n.a.	n.a.	n.a.	n.a.	Ireland (b,c)
252.3	319.7	26.7%	345.6	468.1	35.5%	93.3	148.4	Israel (a)
1,908.2	2,184.0	14.5%	1,999.8	2,253.5	12.7%	91.6	69.5	Italy (c)
1,631.3	1,710.6	4.9%	1,320.8	1,519.1	15.0%	-310.5	-191.5	Japan (b)
71.7	74.6	4.1%	118.0	133.1	12.8%	46.3	58.5	Jordan

Notes:

a. International MiTT based on billing point of traffic.
b. International traffic for year ending 31 March. Australia fiscal year ends 30 June.
c. Traffic data exclude some carriers or routes.
d. 1995 and 1996 traffic data not directly comparable. See country table for details.
* Data for previous year.

National Telecommunications Indicators (K-Z)

	GDP, 1996 (billions)	Population, 1996 (millions)	Main Lines, 1996 (thous.)	Lines per 100 (1996)	Cellular Users, 1996 (thous.)	PCs, 1996 (thous.)	Internet Users, 1995 (thous.)
Kazakhstan (c)	2.1	16.9	2,120.0	12.5	4.6*	n.a.	1.8
Korea, Rep. of	455.5	45.5	19,601.0	43.1	3,181.0	5,997.0	294.1
Kuwait	26.7	2.0	391.8	20.1	117.6*	95.0*	4.0
Luxembourg	12.9	0.4	244.2	58.7	45.0	n.a.	6.6
Macau (a)	6.4*	0.5	161.5	32.5	44.8	40.0*	1.3
Malaysia (a,b,c,d)	85.3	20.0	3,771.3	18.9	1,520.3	880.0	39.7
Mexico (a)	250.0	95.8	8,826.1	9.2	642.0*	2,700.0	146.0
Moldova (c)	3.5	4.5	593.3	13.3	0.0	9.3*	0.2
Netherlands (a)	395.9	15.6	8,431.0	54.2	804.0	3,600.0	604.2
New Zealand (b)	57.1	3.5	1,782.0	50.2	388.0*	950.0	177.8
Norway	146.0	4.4	2,496.9	56.7	1,262.4	1,193.0*	280.9
Oman	12.1	2.2	197.7	9.0	12.9	27.5*	n.a.
Pakistan (c)	60.6	129.3	2,376.8	1.8	65.0	155.0*	0.2
Panama (a)	7.4	2.7	320.0	12.1	0.0	n.a.	1.5
Paraguay	7.7	5.5	180.6	3.3	15.8*	n.a.	n.a.
Peru (a)	57.4	24.5	1,435.1	5.9	201.0	140.0*	8.3
Philippines	74.2	74.5	1,787.0	2.4	959.0	670.0	22.1
Poland (a)	117.7	38.6	6,532.4	16.9	75.0*	1,400.0	250.2
Portugal (a)	102.3	9.9	3,724.3	37.8	663.7	600.0*	89.5
Russia (c)	344.7	148.2	25,994.6	17.5	88.5*	3,500.0	221.4
Saudi Arabia	125.5	19.4	2,003.6	10.3	16.0*	n.a.	2.2
Singapore (a,b,d)	83.7	3.4	1,563.0	46.0	306.0*	660.0	102.4
Slovak Republic (a,d)	17.4	5.4	1,246.5	23.2	28.7	220.0*	28.0
Slovenia (c)	18.6	2.0	663.6	34.0	40.0	95.0*	55.9
South Africa	136.0	41.7	4,258.6	10.2	535.0*	1,600.0	462.3
Spain	558.6	39.2	15,412.8	39.3	2,997.6	3,700.0	149.9
Sri Lanka (a)	12.9	18.6	254.5	1.4	71.2	20.0*	0.1
Sweden (a,c)	228.7	8.9	6,032.0	67.8	2,025.0*	1,900.0	453.7
Switzerland	300.5	7.2	4,547.0	63.1	662.7	2,900.0	255.9
Taiwan (a,b)	243.0*	21.5	10,010.6	46.6	970.5	1,900.0	251.9
Thailand	167.1	58.9	4,200.2	7.1	1,500.0	1,000.0	39.6
Turkey	164.8	62.5	14,286.5	22.9	437.1*	880.0	50.0
Ukraine (c)	80.1	50.9	9,241.0	18.2	14.0*	290.0*	21.7
United Arab Emirates	39.1	2.2	738.1	33.2	193.8	10.5	2.3
United Kingdom (b,c)	1,105.8	58.5	30,292.3	51.8	5,735.8*	11,200.0	1,498.9
United States (a)	6,952.0	265.6	170,568.2	64.2	33,785.7*	96,600.0	10,092.7
Uruguay (a)	17.8	3.2	669.0	20.7	78.0	70.0*	8.1
Uzbekistan (c)	21.6	23.4	1,814.3	7.8	3.7	n.a.	0.4
Venezuela (a)	75.0	22.0	2,666.8	12.1	800.0	480.0	9.9
Vietnam	20.4	74.0	1,186.4	1.6	68.9	30.0*	n.a.
Yugoslavia	3.8*	10.0	2,081.6	20.9	0.0	n.a.	n.a.

Source: International Telecommunication Union, U.S. Census Bureau and TeleGeography, Inc.

International Telephone Traffic (K-Z)

Outgoing MiTT (millions)			Incoming MiTT (millions)			Traffic Balance (millions)		
1995	1996	Change	1995	1996	Change	1995	1996	
111.1	102.5	-7.8%	n.a.	n.a.	n.a.	n.a.	n.a.	Kazakhstan (c)
557.3	699.3	25.5%	672.0	740.6	10.2%	114.7	41.3	Korea, Rep. of
125.9	140.7	11.7%	130.2	131.2	0.8%	4.3	-9.4	Kuwait
232.2	248.5	7.0%	174.5	189.8	8.7%	-57.7	-58.8	Luxembourg
108.1	112.5	4.1%	90.4	92.1	1.9%	-17.7	-20.4	Macau (a)
408.3	570.5	n.a.	442.0	581.9	n.a.	33.7	11.4	Malaysia (a,b,c,d)
950.0	1,070.7	12.7%	2,114.0	2,489.7	17.8%	1,164.0	1,419.0	Mexico (a)
50.8	50.2	-1.2%	n.a.	n.a.	n.a.	n.a.	n.a.	Moldova (c)
1,458.7	1,534.1	5.2%	1,453.0	1,584.6	9.1%	-5.7	50.5	Netherlands (a)
312.0	353.0	13.1%	327.0	380.0	16.2%	15.0	27.0	New Zealand (b)
431.5	443.5	2.8%	373.2	422.3	13.2%	-58.3	-21.2	Norway
54.4	62.6	15.1%	53.3	58.0	8.8%	-1.1	-4.6	Oman
65.9	77.0	16.9%	362.1	488.4	34.9%	296.1	411.5	Pakistan (c)
39.5	41.2	4.2%	94.2	97.7	3.6%	54.7	56.5	Panama (a)
20.9	24.9	19.1%	n.a.	49.4	n.a.	n.a.	24.5	Paraguay
62.6	66.7	6.6%	195.4	226.5	15.9%	128.7	159.7	Peru (a)
174.0	240.0	37.9%	691.0	767.0	11.0%	517.0	527.0	Philippines
381.4	437.2	14.6%	649.3	725.5	11.7%	267.9	288.3	Poland (a)
283.9	340.0	19.8%	525.0	571.4	8.8%	241.1	231.4	Portugal (a)
287.4	851.3	n.a.	448.1	1,037.6	n.a.	160.7	-186.3	Russia (c)
499.1	584.4	17.1%	n.a.	n.a.	n.a.	n.a.	n.a.	Saudi Arabia
773.0	941.7	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	Singapore (a,b,d)
58.8	134.1	n.a.	81.6	159.0	n.a.	22.8	24.9	Slovak Republic (a,d)
100.6	105.3	4.7%	121.2	113.9	-6.0%	20.6	8.6	Slovenia (c)
305.0	353.0	15.7%	n.a.	n.a.	n.a.	n.a.	n.a.	South Africa
1,024.6	1,189.0	16.0%	1,076.4	n.a.	n.a.	51.8	n.a.	Spain
27.5	29.3	6.5%	92.0	96.0	4.3%	64.5	66.7	Sri Lanka (a)
900.0	1,026.0	14.0%	n.a.	n.a.	n.a.	n.a.	n.a.	Sweden (a,c)
1,778.4	1,935.5	8.8%	1,439.3	1,562.8	8.6%	-339.1	-372.7	Switzerland
592.8	674.0	13.7%	545.3	736.8	35.1%	-47.5	62.8	Taiwan (a,b)
218.8	247.4	13.1%	277.7	376.2	35.5%	58.9	128.7	Thailand
373.6	473.4	26.7%	705.0	755.0	7.1%	331.4	281.6	Turkey
301.8	340.8	12.9%	n.a.	n.a.	n.a.	n.a.	n.a.	Ukraine (c)
503.6	589.3	17.0%	n.a.	n.a.	n.a.	n.a.	n.a.	United Arab Emirates
4,016.0	4,569.2	13.8%	4,021.0	4,360.0	8.4%	5.0	-209.2	United Kingdom (b,c)
15,637.5	18,830.0	20.4%	7,010.6	8,217.6	17.2%	-8,626.9	-10,612.4	United States (a)
49.9	54.5	9.2%	73.9	80.1	8.3%	24.0	25.6	Uruguay (a)
n.a.	54.2	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	Uzbekistan (c)
129.1	139.0	7.6%	186.6	228.8	22.6%	57.4	89.8	Venezuela (a)
35.1	52.4	49.2%	n.a.	n.a.	n.a.	n.a.	n.a.	Vietnam
212.8	237.2	11.5%	296.0	325.7	10.0%	83.2	88.5	Yugoslavia

Notes:

a. International MiTT based on billing point of traffic.
b. International traffic for year ending 31 March. Australia fiscal year ends 30 June.
c. Traffic data exclude some carriers or routes.
d. 1995 and 1996 traffic data not directly comparable. See country table for details.
* Data for previous year.

International Dialing Codes, by Number

1	Canada
	Guam
	Northern Marianas
	United States
	Caribbean
20	Egypt
212	Morocco
213	Algeria
216	Tunisia
218	Libya
220	Gambia
221	Senegal
222	Mauritania
223	Mali
224	Guinea
225	Ivory Coast
226	Burkina Faso
227	Niger
228	Togo
229	Benin
230	Mauritius
231	Liberia
232	Sierra Leone
233	Ghana
234	Nigeria
235	Chad
236	Central African Republic
237	Cameroon
238	Cape Verde Islands
239	Sao Tome and Principe
240	Equatorial Guinea
241	Gabon
242	Congo (Brazzaville)
243	Congo (Kinshasa)
244	Angola
245	Guinea-Bissau
246	Diego Garcia
247	Ascension Island
248	Seychelles
249	Sudan
250	Rwanda
251	Ethiopia
252	Somalia
253	Djibouti
254	Kenya
255	Tanzania
256	Uganda
257	Burundi
258	Mozambique
259	Zanzibar
260	Zambia
261	Madagascar
262	Reunion Island
263	Zimbabwe
264	Namibia
265	Malawi
266	Lesotho
267	Botswana
268	Swaziland
269	Comoros & Mayotte
27	South Africa
290	St. Helena
291	Eritrea
297	Aruba
298	Faroe Islands
299	Greenland
30	Greece
31	Netherlands
32	Belgium
33	France
33-93	Monaco
34	Spain
350	Gibraltar
351	Portugal; Azores
352	Luxembourg
353	Ireland
354	Iceland
355	Albania
356	Malta
357	Cyprus
358	Finland
359	Bulgaria
36	Hungary
370	Lithuania
371	Latvia
372	Estonia
373	Moldova
374	Armenia
375	Belarus
376	Andorra
377	Monaco (reserved)
378	San Marino
379	Vatican City
380	Ukraine
381	Yugoslavia
385	Croatia
386	Slovenia
387	Bosnia-Hercegovina
389	Macedonia
39	Italy
40	Romania
41	Switzerland
41-75	Liechtenstein
420	Czech Republic
421	Slovak Republic
43	Austria
44	United Kingdom
45	Denmark
46	Sweden
47	Norway
48	Poland
49	Germany
500	Falkland Islands
501	Belize
502	Guatemala
503	El Salvador
504	Honduras
505	Nicaragua
506	Costa Rica
507	Panama
508	St. Pierre & Miquelon
509	Haiti
51	Peru
52	Mexico
53	Cuba
54	Argentina
55	Brazil
56	Chile
57	Colombia
58	Venezuela
590	Guadeloupe
591	Bolivia
592	Guyana
593	Ecuador
594	French Guiana
595	Paraguay
596	Martinique
597	Suriname
598	Uruguay
599	Netherlands Antilles
60	Malaysia
61	Australia
62	Indonesia
63	Philippines
64	New Zealand
65	Singapore
66	Thailand
672	Australian Territories
673	Brunei
674	Nauru
675	Papua New Guinea
676	Tonga Islands
677	Solomon Islands
678	Vanuatu
679	Fiji
680	Palau
681	Wallis & Futuna
682	Cook Islands
683	Niue
684	American Samoa
685	Western Samoa
686	Kiribati
687	New Caledonia
688	Tuvalu
689	French Polynesia
690	Tokelau
691	Micronesia
692	Marshall Islands
7	Kazakhstan
	Russia
	Tajikistan
	Uzbekistan
800	International Freephone
81	Japan
82	South Korea
84	Vietnam
850	North Korea
852	Hong Kong
853	Macau
855	Cambodia
856	Laos
86	China
870	Inmarsat Special
871	Inmarsat East Atlantic
872	Inmarsat Pacific
873	Inmarsat Indian
874	Inmarsat West Atlantic
880	Bangladesh
8816	Iridium
8817	Iridium
886	Taiwan
90	Turkey
91	India
92	Pakistan
93	Afghanistan
94	Sri Lanka
95	Burma
960	Maldives
961	Lebanon
962	Jordan
963	Syria
964	Iraq
965	Kuwait
966	Saudi Arabia
967	Yemen
968	Oman
971	United Arab Emirates
972	Israel
973	Bahrain
974	Qatar
975	Bhutan
976	Mongolia
977	Nepal
98	Iran
993	Turkmenistan
994	Azerbaijan
995	Georgia
996	Kyrgyzstan

International Dialing Codes, by Country

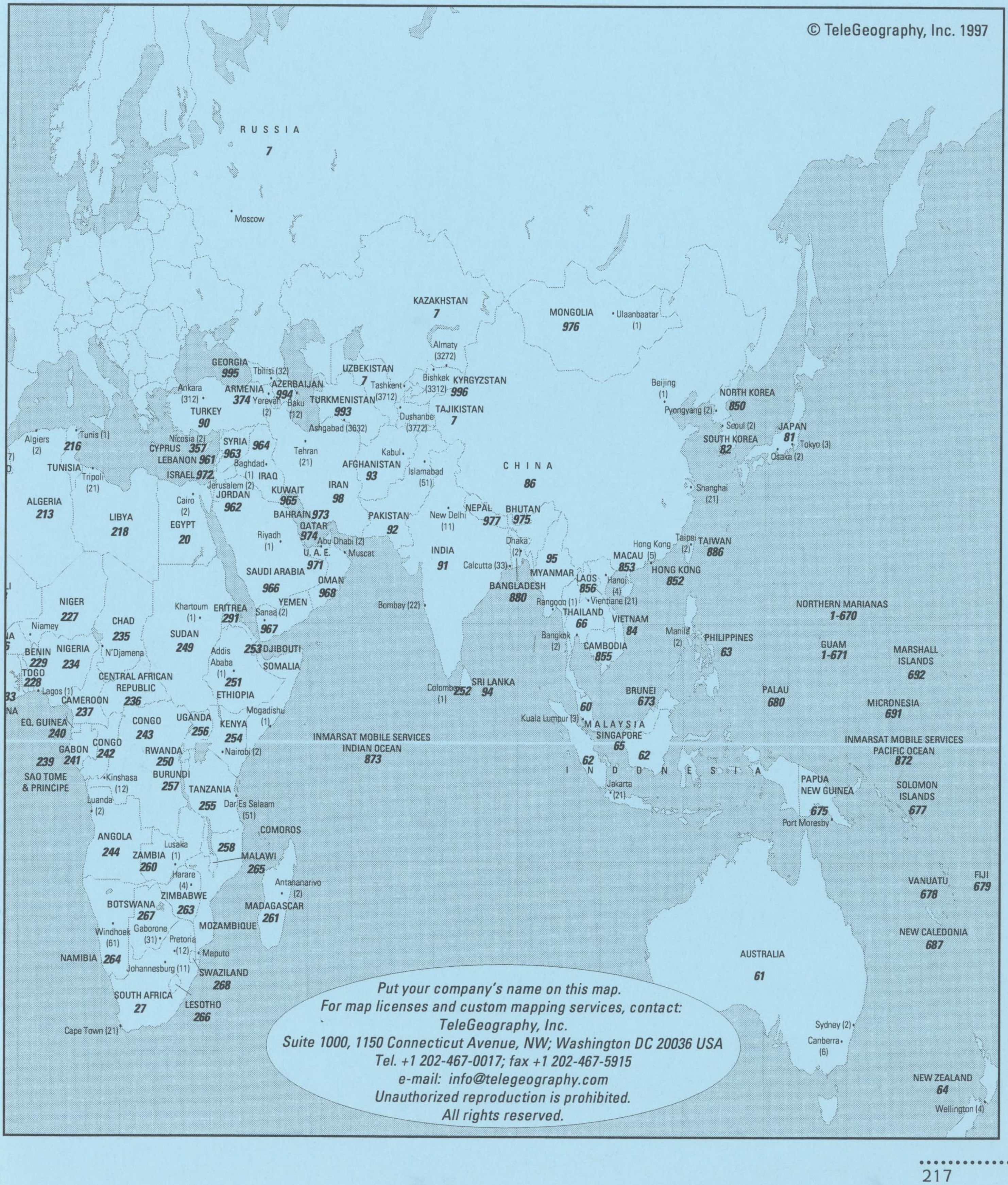
Afghanistan 93
Albania 355
Tirana 42
Algeria 213
Algiers 2
American Samoa 684
Andorra 376
Angola 244
Luanda 2
Anguilla 1-264
Antigua & Barbuda 1-268
Argentina 54
Buenos Aires 1
Armenia 374
Yerevan 8852
Aruba 297
Ascension Island 247
Australia 61
Canberra 62
Melbourne 3
Sydney 2
Australian Territories 672
Austria 43
Vienna 1
Azerbaijan 994
Baku 8922
Bahamas 1-242
Bahrain 973
Bangladesh 880
Dhaka 2
Barbados 1-246
Belarus 375
Minsk 172
Belgium 32
Brussels 2
Belize 501
Belmopan 8
Benin 229
Bermuda 1-441
Bhutan 975
Bolivia 591
La Paz 2
Bosnia 387
Sarajevo 71
Botswana 267
Brazil 55
Brasilia 61
Rio de Janeiro 21
São Paulo 11
British Virgin Islands 1-284
Brunei 673
Bandar Seri Begawan 2
Bulgaria 359
Sofia 2
Burkina Faso 226
Burma 95
Burundi 257
Cambodia 855
Cameroon 237
Canada 1
Montreal 514
Ottawa 613
Toronto 416
Cape Verde 238
Cayman Islands 1-345
Central African Republic 236
Bangui 61
Chad 235
Chile 56
Santiago 2
China, People's Republic of 86
Beijing 1
Guangzhou 20
Shanghai 21
Colombia 57
Bogota 1
Cocos Islands; Norfolk & Christmas Islands 672
Comoros 269
Congo 242
Brazzaville 81/82/83
Congo 243
Kinshasa 12
Costa Rica 506
Croatia 385
Zagreb 1
Cuba 53
Havana 7
Cyprus 357
Nicosia 2
Czech Republic 420
Prague 2
Denmark 45
Diego Garcia 246
Djibouti 253
Dominica .... 1-767[1]
Dominican Republic 1-809
Ecuador 593
Quito 2
Egypt 20
Cairo 2
El Salvador 503
Equatorial Guinea 240
Eritrea 291
Estonia 372
Tallinn 2
Ethiopia 251
Addis Ababa 1
Falkland Islands 500
Faroe Islands 298
Fiji 679
Finland 358
Helsinki 9
France 33
Paris 1
French Antilles 596
French Guiana 594
French Polynesia 689
Gabon 241
Gambia 220
Georgia 995
Tbilisi 8832
Germany 49
Berlin 30
Bonn 228
Frankfurt 69
Munich 89
Ghana 233
Accra 21
Gibraltar 350
Greece 30
Athens 1
Greenland 299
Grenada 1-473
Guadeloupe 590
Guam 1-671
Guatemala 502
Guatemala City 2
Guinea 224
Guinea-Bissau 245
Guyana 592
Georgetown 2
Haiti 509
Honduras 504
Hong Kong 852
Hungary 36
Budapest 1
Iceland 354
India 91
Bombay 22
Calcutta 33
New Delhi 11
Indonesia 62
Jakarta 21
Inmarsat
Special 870
East Atlantic 871
Pacific 872
Indian 873
West Atlantic 874
International Freephone 800
Iran 98
Tehran 21
Iraq 964
Baghdad 1
Ireland 353
Dublin 1
Iridium 8816/8817
Israel 972
Jerusalem 2
Tel Aviv 3
Italy 39
Rome 6
Milan 2
Ivory Coast 225
Jamaica 1-876
Japan 81
Osaka 6
Tokyo 3
Jordan 962
Amman 6
Kazakhstan 7
Almaty 3272
Kenya 254
Nairobi 2
Kiribati 686
Kuwait 965
Kyrgyzstan 996
Bishkek 3312
Laos 856
Latvia 371
Riga 2
Lebanon 961
Beirut 1
Lesotho 266
Liberia 231
Libya 218
Tripoli 21
Liechtenstein 41-75
Lithuania 370
Vilnius 2
Luxembourg 352
Macau 853

Macedonia .389
Skopje .91
Madagascar .261
Antananarivo .2
Malawi .265
Malaysia .60
Kuala Lumpur .3
Maldives .960
Mali .223
Malta .356
Marshall Islands .692
Martinique .596
Mauritania .222
Mauritius .230
Mayotte .269
Mexico .52
Guadalajara .36
Mexico City .5
Monterrey .83
Micronesia .691
Moldova .373
Chisinau .422
Monaco .33-93
Mongolia .976
Montserrat .1-664
Morocco .212
Casablanca .2
Rabat .7
Mozambique .258
Maputo .1
Namibia .264
Windhoek .61
Nauru .674
Nepal .977
Kathmandu .1
Netherlands .31
Amsterdam .20
Netherlands Antilles .599
New Caledonia .687
New Zealand .64
Auckland .9
Wellington .4
Nicaragua .505
Managua .2
Niger .227
Nigeria .234
Lagos .1
Niue .683
North Korea .850
Pyongyang .2

Northern Marianas .1-670
Saipan .322
Norway .47
Oslo .2
Oman .968
Pakistan .92
Islamabad .51
Palau .680
Panama .507
Papua New Guinea .675
Paraguay .595
Asuncion .21
Peru .51
Lima .14
Philippines .63
Manila .2
Poland .48
Warsaw .22
Portugal .351
Lisbon .1
Puerto Rico .1-787
Qatar .974
Reunion Island .262
Romania .40
Bucharest .1
Russia .7
Moscow .095
St. Petersburg .812
Rwanda .250
St. Kitts & Nevis .1-869
St. Lucia .1-758
St. Pierre & Miquelon .508
St. Vincent & the Grenadines .1-809
San Marino .378
São Tome and Principe .239
Saudi Arabia .966
Riyadh .1
Senegal .221
Seychelles .248
Sierra Leone .232
Freetown .22
Singapore .65
Slovak Republic .421
Bratislava .7
Slovenia .386
Ljubljana .61
Solomon Islands .677
Somalia .252
Mogadishu .1
South Africa .27
Johannesburg .11
Pretoria .12
South Korea .82
Seoul .2
Spain .34
Madrid .1
Barcelona .3
Sri Lanka .94
Colombo .1
Sudan .249
Khartoum .11
Suriname .597
Swaziland .268
Sweden .46
Stockholm .8
Switzerland .41
Berne .31
Zurich .1
Syria .963
Damascus .11
Tahiti .689
Taiwan .886
Taipei .2
Tajikistan .7
Dushanbe .3772
Tanzania .255
Dar Es Salaam .51
Thailand .66
Bangkok .2
Togo .228
Tokelau .690
Tonga .676
Trinidad & Tobago .1-868
Tunisia .216
Tunis .1
Turkey .90
Ankara .4
Istanbul .1
Turkmenistan .993
Ashkhabad .3632
Turks & Caicos .1-649
Tuvalu .688
Uganda .256
Kampala .41
Ukraine .380
Kiev .44
United Arab Emirates .971
Abu Dhabi .2
Dubai .4
United Kingdom .44
London .171/181
Manchester .161

United States .1
Chicago .312/630
Houston .713
Los Angeles .213
Miami .305
New York .212/718
Washington .202
U.S. Virgin Islands .1-340
Uruguay .598
Montevideo .2
Uzbekistan .7
Tashkent .3712
Vanuatu .678
Vatican City .379
Venezuela .58
Caracas .2
Vietnam .84
Wallis & Futuna .681
Western Samoa .685
Yemen .967
Sanaa .51
Yugoslavia .381
Belgrade .11
Zambia .260
Lusaka .1
Zanzibar (Tanzania) .259
Zimbabwe .263
Harare .4

World Dialing Codes


© TeleGeography, Inc. 1997
RUSSIA
7
Moscow
KAZAKHSTAN
7
Almaty
(3272)
MONGOLIA
976
Ulaanbaatar
(1)
GEORGIA
995
Tbilisi (32)
UZBEKISTAN
7
Tashkent
(3712)
Bishkek
(3312)
KYRGYZSTAN
996
Ankara
(312)
ARMENIA
374
Yerevan
(2)
AZERBAIJAN
994
Baku
(12)
TURKMENISTAN
993
Ashgabad (3632)
TURKEY
90
TAJIKISTAN
7
Dushanbe
(3772)
Beijing
(1)
NORTH KOREA
850
Pyongyang (2)
Seoul (2)
SOUTH KOREA
82
JAPAN
81
Tokyo (3)
Osaka (2)
Algiers
(2)
Tunis (1)
216
TUNISIA
Tripoli
(21)
Nicosia (2)
CYPRUS 357
LEBANON 961
ISRAEL 972
SYRIA
963
964
Baghdad
(1) IRAQ
Jerusalem (2)
JORDAN
962
Tehran
(21)
IRAN
98
KUWAIT
965
Kabul
AFGHANISTAN
93
Islamabad
(51)
CHINA
86
Shanghai
(21)
ALGERIA
213
LIBYA
218
Cairo
(2)
EGYPT
20
BAHRAIN 973
QATAR
974
Abu Dhabi (2)
U.A.E.
971
Muscat
Riyadh
(1)
PAKISTAN
92
New Delhi
(11)
NEPAL
977
BHUTAN
975
Dhaka
(2)
INDIA
91
Calcutta (33)
95
MYANMAR
BANGLADESH
880
Hong Kong
MACAU (5)
853
Taipei
(2)
TAIWAN
886
HONG KONG
852
LAOS
856
Hanoi
(4)
Vientiane (21)
SAUDI ARABIA
966
OMAN
968
YEMEN
Sanaa (2)
967
Bombay (22)
Rangoon (1)
THAILAND
66
Bangkok
(2)
VIETNAM
84
CAMBODIA
855
Manila
(2)
PHILIPPINES
63
NORTHERN MARIANAS
1-670
GUAM
1-671
MARSHALL
ISLANDS
692
NIGER
227
Niamey
CHAD
235
N'Djamena
Khartoum
(1)
ERITREA
291
SUDAN
249
Addis
Ababa
(1)
251
ETHIOPIA
253 DJIBOUTI
SOMALIA
BENIN
229
NIGERIA
234
TOGO
228
Lagos (1)
CENTRAL AFRICAN
REPUBLIC
236
CAMEROON
237
EQ. GUINEA
240
GABON
239 241
CONGO
242
CONGO
243
UGANDA
256
KENYA
254
Mogadishu
(1)
Nairobi (2)
RWANDA
250
BURUNDI
257
TANZANIA
255
Dar Es Salaam
(51)
SAO TOME
& PRINCIPE
Kinshasa
(12)
Luanda
(2)
COLOMBO
Colombo
(1)
252
SRI LANKA
94
BRUNEI
673
PALAU
680
MICRONESIA
691
60
Kuala Lumpur (3)
MALAYSIA
SINGAPORE
65
62
INDONESIA
62
Jakarta
(21)
INMARSAT MOBILE SERVICES
INDIAN OCEAN
873
INMARSAT MOBILE SERVICES
PACIFIC OCEAN
872
PAPUA
NEW GUINEA
675
Port Moresby
SOLOMON
ISLANDS
677
COMOROS
ANGOLA
244
ZAMBIA
260
Lusaka
(1)
258
MALAWI
265
Harare
(4)
ZIMBABWE
263
Antananarivo
(2)
MADAGASCAR
261
BOTSWANA
267
Gaborone
(31)
Pretoria
(12)
Windhoek
(61)
NAMIBIA 264
MOZAMBIQUE
Maputo
Johannesburg (11)
SWAZILAND
268
SOUTH AFRICA
27
LESOTHO
266
Cape Town (21)
VANUATU
678
FIJI
679
NEW CALEDONIA
687
AUSTRALIA
61
Sydney (2)
Canberra
(6)
NEW ZEALAND
64
Wellington (4)
Put your company's name on this map.
For map licenses and custom mapping services, contact:
TeleGeography, Inc.
Suite 1000, 1150 Connecticut Avenue, NW; Washington DC 20036 USA
Tel. +1 202-467-0017; fax +1 202-467-5915
e-mail: info@telegeography.com
Unauthorized reproduction is prohibited.
All rights reserved.

North American Area Codes, by Jurisdiction

Alabama
- Birmingham .205
- Montgomery .334

Alaska .907

Alberta
- Calgary .403
- Edmonton .780

Anguilla .264

Antigua & Barbuda .268

Arizona
- Phoenix .602
- Tucson .520

Arkansas
- Jonesboro .870
- Little Rock .501

Bahamas .242

Barbados .246

Bermuda .441

British Columbia
- Victoria .250
- Vancouver .604

British Virgin Islands .284

California
- Anaheim .714
- Bakersfield .805
- Burbank .626
- Concord .925
- Fresno .209
- Irvine .949
- Long Beach .562
- Los Angeles .213/323
- Oakland .510
- Palm Springs .760
- Redding .530
- Riverside .909
- Sacramento .916
- Palo Alto .650
- San Diego .619
- San Fernando .818
- San Francisco .415
- San Jose .408
- Santa Ana .714
- Santa Monica .310
- Santa Rosa .707

Cayman Islands .345

Colorado
- Colorado Springs .719
- Denver .303
- Ft. Collins .970

Connecticut
- Bridgeport .203
- Hartford .860

Delaware .302

District of Columbia
- Washington .202

Dominica .767

Dominican Republic .809

Florida
- Ft. Lauderdale .954
- Ft. Myers .941
- Gainesville .352
- Jacksonville .904
- Miami .305
- Orlando .407
- Tallahassee .850
- Tampa .813
- W. Palm Beach .561

Georgia
- Athens .706
- Atlanta .404
- Marietta .770
- Savannah .912

Grenada .473

Guam .671

Hawaii .808

Idaho .208

Illinois
- Aurora .630
- Cairo .618
- Chicago .312/773
- Evanston .847
- Oak Brook .708
- Peoria .309
- Rockford .815
- Springfield .217

Indiana
- Evansville .812
- Gary .219
- Indianapolis .317
- Lafayette .765

Iowa
- Council Bluffs .712
- Des Moines .515
- Dubuque .319

Jamaica .876

Kansas
- Kansas City .913
- Topeka .785
- Wichita .316

Kentucky
- Dade Park .812
- Lexington .606
- Louisville .502

Louisiana
- New Orleans .504
- Shreveport .318

Maine .207

Manitoba .204

Maryland
- Baltimore .410/443
- Rockville .301/240

Massachusetts
- Boston .617
- Cambridge .781
- Lowell .978
- New Bedford .508
- Springfield .413

Michigan
- Ann Arbor .734
- Detroit .313
- Flint .810
- Grand Rapids .616
- Lansing .517
- Pontiac .248
- Sault Ste. Marie .906

Minnesota
- Duluth .218
- Minneapolis .612
- Rochester .507
- St. Cloud .320

Mississippi
- Biloxi .228
- Jackson .601

Missouri
- Jefferson City .573
- Kansas City .816
- St. Joseph .660
- St. Louis .314
- Springfield .417

Monserrat .664

Montana .406

Nebraska
- North Platte .308
- Omaha .402

Nevada .702

Nevis .869

New Brunswick .506

New Hampshire .603

New Jersey
- Elizabeth .908
- Jersey City .201
- Newark .973
- New Brunswick .732
- Trenton .609

New Mexico .505

New York
- Albany .518
- Bronx, Queens .718/917
- Buffalo .716
- Long Island .516
- Ithaca .607
- Manhattan .212/917
- Syracuse .315
- White Plains .914

Newfoundland .709

North Carolina
- Charlotte .704
- Fayetteville .910
- Greensboro .336
- Raleigh .919

North Dakota .701

Northern Marianas .670

NW Territories/Yukon .867

Nova Scotia & Prince Edward Island .902

Ohio
- Canton .330
- Cincinnati .513
- Cleveland .216
- Columbus .614
- Dayton .937
- Marietta .740
- Oberlin .440
- Toledo .419

Oklahoma
- Enid .580
- Oklahoma City .405
- Tulsa .918

Ontario
- Hamilton .905
- London .519
- North Bay .705
- Ottawa .613
- Thunder Bay .807
- Toronto .416

Oregon
- Eugene .541
- Portland .503

Pennsylvania
- Allentown .610
- Altoona .814
- Harrisburg .717
- New Castle .724
- Philadelphia .215
- Pittsburgh .412

Puerto Rico .787

Quebec
- Montreal .514
- Quebec .418
- Sherbrooke .819
- Trois Rivières .450

Rhode Island .401

St. Kitts .869

St. Lucia .758

St. Vincent .809

Saskatchewan .306

South Carolina
- Charleston .843
- Columbia .803
- Greenville .864

South Dakota .605

Tennessee
- Chattanooga .423
- Columbia .931
- Memphis .901
- Nashville .615
- Knoxville .423

Texas
- Amarillo .806
- Austin .512
- Brownsville .956
- Dallas .214
- Deer Park .281
- Del Rio .830
- El Paso .915
- Fort Worth .817
- Galveston .409
- Houston .713/281
- Irving .972
- San Antonio .210
- Tyler .903
- Waco .254
- Wichita Falls .940

Trinidad & Tobago .868

Turks & Caicos .649

U.S. Virgin Islands .340

Utah
- Salt Lake City .801
- Provo .435

Vermont .802

Virginia
- Alexandria .703
- Richmond .804
- Roanoke .540
- Norfolk .757

Washington
- Bellevue .425
- Olympia .360
- Seattle .206
- Spokane .509
- Tacoma .253

West Virginia .304

Wisconsin
- Green Bay .920
- Madison .608
- Milwaukee .414
- Eau Claire .715
- Oshkosh .920

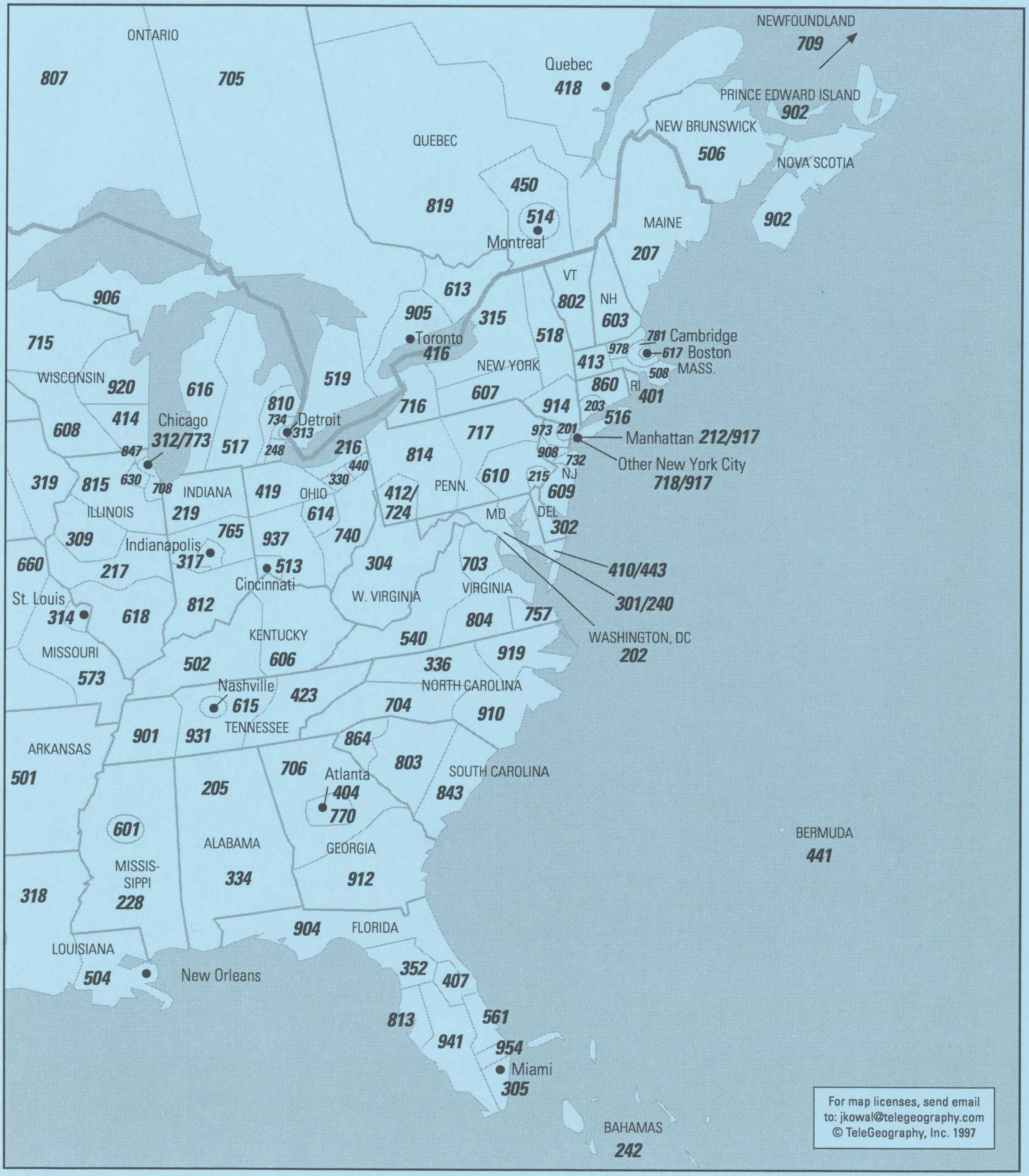
Wyoming .307

Note: Two codes separated by a slash (e.g., in Houston, Texas) indicate an overlay; multiple codes are used for the same geographic area.

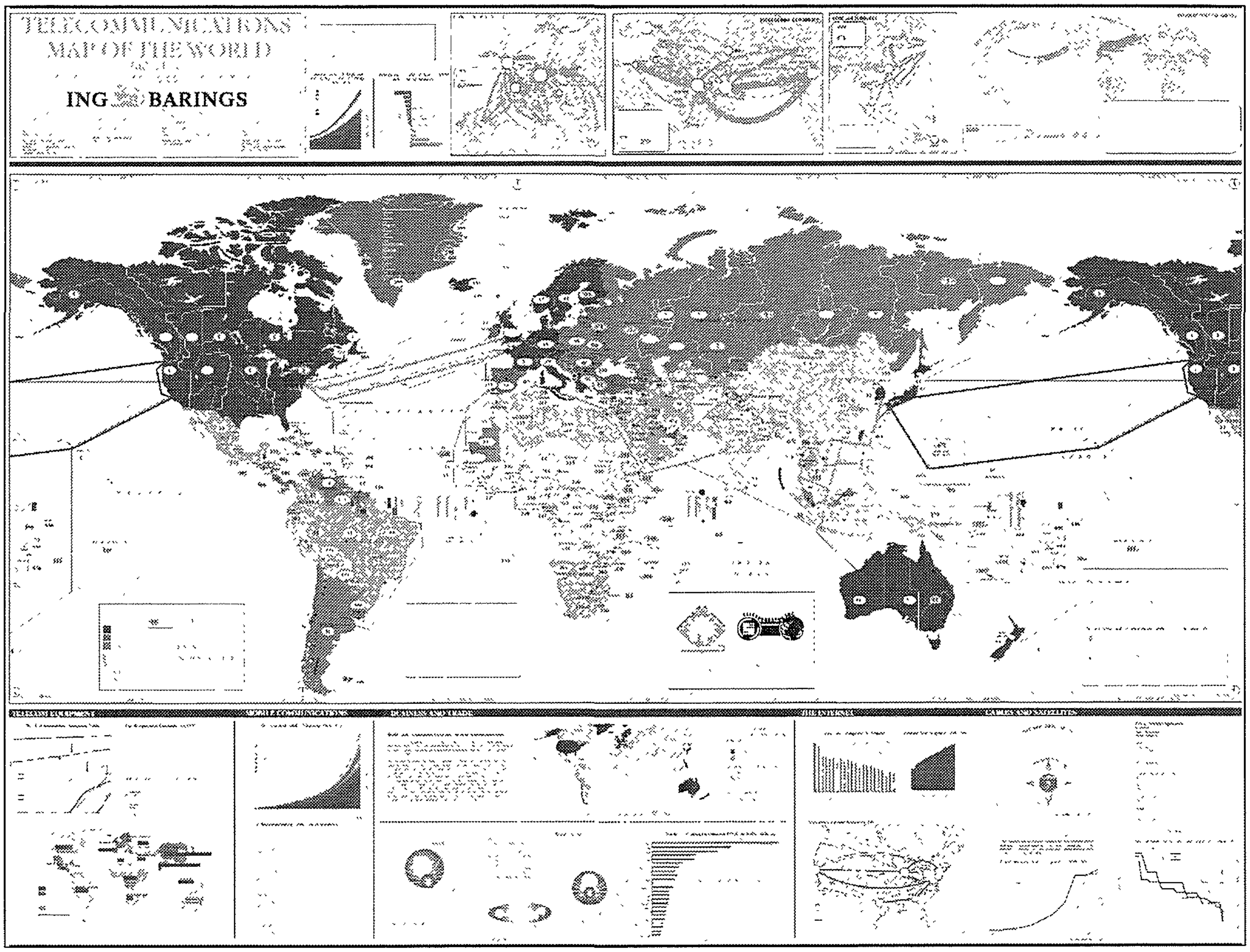
North American Area Codes, by Number

201 New Jersey
202 District of Columbia
203 Connecticut
204 Manitoba
205 Alabama
206 Washington
207 Maine
208 Idaho
209 California
210 Texas
212 New York
213 California
214 Texas
215 Pennsylvania
216 Ohio
217 Illinois
218 Minnesota
219 Indiana
228 Mississippi
240 Maryland
242 Bahamas
246 Barbados
248 Michigan
250 British Columbia
252 North Carolina
253 Washington
254 Texas
264 Anguilla
268 Antigua & Barbuda
281 Texas
281 Texas
284 British Virgin Islands
302 Delaware
303 Colorado
304 West Virginia
305 Florida
306 Saskatchewan
307 Wyoming
308 Nebraska
309 Illinois
310 California
312 Illinois
313 Michigan
314 Missouri
315 New York
316 Kansas
317 Indiana
318 Louisiana
319 Iowa
320 Minnesota
323 California
330 Ohio
334 Alabama
336 North Carolina
340 U.S. Virgin Islands
345 Cayman Islands
352 Florida
360 Washington
401 Rhode Island
402 Nebraska
403 Alberta
404 Georgia
405 Oklahoma
406 Montana
407 Florida
408 California
409 Texas
410 Maryland
412 Pennsylvania
413 Massachusetts
414 Wisconsin
415 California
416 Ontario
417 Missouri
418 Quebec
419 Ohio
423 Tennessee
425 Washington
435 Utah
440 Ohio
441 Bermuda
443 Maryland
450 Quebec
473 Grenada
500 Personal Communication Services (PCS)
501 Arkansas
502 Kentucky
503 Oregon
504 Louisiana
505 New Mexico
506 New Brunswick
507 Minnesota
508 Massachusetts
509 Washington
510 California
512 Texas
513 Ohio
513 Maryland
514 Quebec
515 Iowa
516 New York
517 Michigan
518 New York
519 Ontario
520 Arizona
530 California
540 Virginia
541 Oregon
555 Public Information Services
559 California
561 Florida
562 California
573 Missouri
580 Oklahoma
601 Mississippi
602 Arizona
603 New Hampshire
604 British Columbia
605 South Dakota
606 Kentucky
607 New York
608 Wisconsin
609 New Jersey
612 Minnesota
613 Ontario
614 Ohio
615 Tennessee
616 Michigan
617 Massachusetts
618 Illinois
619 California
626 California
630 Illinois
649 Turks & Caicos
650 California
660 Missouri
670 Northern Marianas
671 Guam
678 Georgia
664 Monserrat
701 North Dakota
702 Nevada
703 Virginia
704 North Carolina
705 Ontario
706 Georgia
707 California
708 Illinois
709 Newfoundland
710 U.S. Government Emergency
712 Iowa
713 Texas
714 California
715 Wisconsin
716 New York
717 Pennsylvania
718 New York
719 Colorado
720 Colorado
724 Pennsylvania
732 New Jersey
734 Michigan
737 Maryland
740 Ohio
757 Virginia
758 St. Lucia
760 California
765 Indiana
767 Dominica
770 Georgia
773 Illinois
780 Alberta
781 Massachusetts
784 St. Vincent/Grenadines
785 Kansas
787 Puerto Rico
801 Utah
802 Vermont
803 South Carolina
804 Virginia
805 California
806 Texas
807 Ontario
808 Hawaii
809 Dominican Republic
809 St. Vincent
810 Michigan
812 Indiana
812 Kentucky
813 Florida
814 Pennsylvania
815 Illinois
816 Missouri
817 Texas
818 California
819 Quebec
828 North Carolina
830 Texas
843 South Carolina
847 Illinois
850 Florida
860 Connecticut
864 South Carolina
867 Northern Territories
868 Trinidad & Tobago
869 St. Kitts/Nevis
870 Arkansas
876 Jamaica
877 Toll-free services
880 Toll-free services
881 Toll-free services
888 Toll-free services
900 Information Services
901 Tennessee
902 Nova Scotia & Prince
903 Texas
904 Florida
906 Michigan
907 Alaska
908 New Jersey
909 California
910 North Carolina
912 Georgia
913 Kansas
914 New York
915 Texas
916 California
917 New York
918 Oklahoma
919 North Carolina
920 Wisconsin
925 California
931 Tennessee
937 Ohio
937 Maryland
940 Texas
941 Florida
949 California
954 Florida
956 Texas
970 Colorado
972 Texas
973 New Jersey
978 Massachusetts

North American Area Codes


ONTARIO
807
705
Quebec
418
NEWFOUNDLAND
709
PRINCE EDWARD ISLAND
902
QUEBEC
NEW BRUNSWICK
506
NOVA SCOTIA
450
819
514
Montreal
MAINE
902
207
VT
613
802
NH
906
905
315
603
Toronto
416
518
781 Cambridge
715
978
617 Boston
NEW YORK
413
508
MASS.
WISCONSIN
920
616
519
860
RI
401
810
607
914
203
516
414
Chicago
734
Detroit
716
608
312/773
313
973
201
Manhattan 212/917
847
517
248
216
717
908
732
Other New York City
814
319
815
630
708
440
330
610
215
NJ
718/917
INDIANA
419
OHIO
412/
PENN.
609
724
ILLINOIS
219
614
MD
DEL
302
765
309
937
740
Indianapolis
410/443
317
513
304
703
660
217
Cincinnati
VIRGINIA
301/240
St. Louis
W. VIRGINIA
314
618
812
804
757
WASHINGTON, DC
KENTUCKY
540
202
MISSOURI
919
606
336
502
573
NORTH CAROLINA
Nashville
423
704
615
910
TENNESSEE
901
931
864
ARKANSAS
803
SOUTH CAROLINA
706
501
Atlanta
205
404
843
770
601
BERMUDA
ALABAMA
GEORGIA
441
MISSIS-
SIPPI
318
334
912
228
904
FLORIDA
LOUISIANA
504
New Orleans
352
407
813
561
941
954
Miami
305
For map licenses, send email
to: jkowal@telegeography.com
© TeleGeography, Inc. 1997
BAHAMAS
242

Notes



Telecommunications Map of the World—1997 Edition

TeleGeography, Inc./Petroleum Economist, September 1997

Map details include: submarine cables scaled by capacity; satellite locations and capacities; national teledensities; and dialing codes colored by time zone. Border illustrations display: country-by-country international traffic flows; profiles of top international carriers and alliances; cellular and Internet indicators; and a guide to market opening commitments under the WTO agreement on telecommunications services. Size is approx. 40" × 50" (1.0 m × 1.3 m). Map is shipped folded. ISBN 1-86186-096-X

All orders must be prepaid; orders will be shipped to customers by air mail within seven days.

Please send me ___ copies of the *Telecommunications Map of the World—1997 Edition* at the price of **$85**. For academic orders and orders of more than five copies, contact us for special prices. For express shipping by air courier (add $20 per copy in North America; $35 elsewhere) check here: ❑ Total enclosed:________

Name (please print)________________________Title________________________

Company________________________Signature________________________

Street________________________Floor________________________

City________________________Postal Code____________Country____________

Telephone______________Fax______________Email______________

I am paying by:

❑ **bank wire transfer**

Name of sending bank ________________________

(Please wire funds to Citibank, ABA routing code 254070116, for credit to TeleGeography, Inc. Acct No. 66555787; Citibank's address is P.O. Box 19748; Washington, DC 20036-9748 USA.)

❑ **check** (U.S. bank only. Please enclose check payable to "TeleGeography, Inc.")

❑ **credit card** (Visa, Mastercard, or American Express)

Acct no. ________________________Exp. date ________

Send your orders to:

TeleGeography, Inc.
Attn: Sales
1150 Connecticut Avenue, NW
Suite 1000
Washington, DC 20036 USA
Tel.: +1 (202) 467-0017
Fax: +1 (202) 467-0851
sales@telegeography.com

About TeleGeography, Inc.

telegeography \tĕl´ə-jē-ŏg´rə-fē\ *n* (1990) abbrv. of telecommunications geography [fr. Gk *tele,* far off, at a distance and L. *communicatus,* pp. of communicare to impart + fr. Gk *geo* (earth) + *graphein,* (to write)] 1. a new branch of geography that maps the pattern of telephone traffic and other electronic communication flows; 2. places created by or perceived solely via telecommunications (e.g., a computer network address); 3. the telecommunications artifacts (radio antennae, terminals, signs) on a site; 4. the balance of telecommunications power in one country or region vis-à-vis another (cf. geopolitics, *archaic*).

The old geography of countries and coast lines is giving way to a new geography marked by telephone codes, satellite "foot prints" and Internet addresses. Electronic networks have made the world smaller. But they also have created countless new places where people work and play. This expanding electronic terrain—call it telegeography—demands a new cartography.

That is the *raison d'etre* of TeleGeography, Inc. (TGI). Founded by Washington, D.C. lawyer, Gregory C. Staple, TGI is the world's leading publisher of reports on international telecommunications flows. It also is an authoritative source of data on the ownership of information-communication companies worldwide. In addition, the company provides customized mapping and consulting services. TGI's flagship report—TeleGeography—has been published annually since 1989 in cooperation with the London-based International Institute of Communications (IIC).

Other TGI publications include: *New International Carriers*, a three volume directory of competing international telephone companies; *The FCC Reader*, an annual subscription service providing FCC documents concerned with international telecommunications; *Telecommunications Map of the World*, a poster-sized map of world telecommunications; and *The TeleGeography 100*, a graphical guide to major information-technology businesses. TGI's directories are used by leading communication companies, consultancies, governments and financial institutions in over 60 countries.

To learn more, please visit us at http://www.telegeography.com.

TeleGeography, Inc.

1730 Rhode Island Avenue, NW • Suite 1205 • Washington, DC 20036 USA

Tel. + 1 (202) 467-0017 • Fax +1 (202) 467-0851 • E-mail: info@telegeography.com

http://www.telegeography.com

Preparation of this report was supported, in part, by grants from MCI Communications Corporation MCI and BT British Telecommunications plc

This Report is Published Annually by TeleGeography, Inc.
Suite 1205 • 1730 Rhode Island Avenue, NW
Washington, DC 20036 • USA
Tel.+1 (202) 467-0017 • Fax +1 (202) 467-0851
E-mail: info@telegeography.com • http://www.telegeography.com

ISBN 1-886142-10-6