TELEGEOGRAPHY 1993

In Cooperation with the International Institute of Communications (IIC)

GREGORY C. STAPLE - EDITOR

GLOBAL TELECOMMUNICATIONS TRAFFIC
STATISTICS & COMMENTARY

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Printed in the United States of America

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telegeography \ 'tel-ē-jē-äg-refē \ *n* (1990) abbrv. of telecommunications geography [fr. Gk *tēle*, far off, at a distance and L. *communicatus*, pp. of *communicare* to impart + fr. Gk *geō* (earth) + *graphein*, (to write)] 1. a new branch of geography that maps the global pattern of telephone traffic and other electronic communication flows; 2. the telecommunication artefacts (radio antennas, terminals, signs) on a site; 3. the balance of telecommunications power in one country or region vis-a-vis another (cf. geopolitics, *archaic*).

The Front Cover -

The age of the compass has passed. The mariner's sextant and rhumb line have given way to a network of global positioning satellites, allowing anyone with a transceiver to instantly learn their latitude and longitude.

Today we navigate in new electronic worlds generated by telephones and computers. We orient ourselves with a cybercompass: a computer "mouse" or telephone keypad. We dial directions and embark with the push of a button. We "click" on places, real and imaginary. And we measure the distance by how much it costs or by how long it takes for someone to answer our E-mail.

Illustration: Alexandra M. Rehak, Gregory C. Staple and Marian Kester Coombs

TeleGeography 1993 is published in cooperation with the IIC, an independent educational and policy research organization with members in more than 70 countries. The IIC focuses on telecommunications and broadcasting issues on a world-wide basis. Institute publications include a bimonthly magazine, Intermedia, and a range of topical briefing papers.

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The Global Telecommunications Traffic Boom (1990)
Global Telecommunications Traffic Flows and Market Structures (1989)

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We also wish to thank the Commission of the European Communities (CEC), Directorate General XIII, for underwriting our research on European telecommunications and for permitting us to publish certain Commission data on traffic to and from member states. The CEC's independent effort to improve the scope of statistics on international telecommunications flows is ever welcome.

The new maps in this year's report and the broader national coverage were also supported, in part, by special publication grants from MCI Communications Corporation and Stentor Resource Centre Inc.

TeleGeography - 1993 reflects a team effort. Alexandra M. Rehak served as the assistant editor. Word processing and desk-top publishing help were provided by Barbara Frank. Bennett Moe at Maryland CartoGraphics (Columbia, Maryland) contributed his computer graphic skills to the map pages.

We have tried to ensure the accuracy of the statistics presented here by relying upon primary sources whenever possible. But, in a project of this magnitude, some errors are bound to occur. We invite readers to bring any mistakes or inaccuracies to our attention so that they are not carried forward to future editions.

Gregory C. Staple
Editor

PREFACE

For four consecutive years, this almanac of global telecommunications statistics has highlighted new areas of the industry and uncovered emerging trends. This year, ***TeleGeography 1993*** enters the world of computer networking with the first publication of route-by-route international traffic for the Internet -- a network of computer networks.

Electronic communications -- in all its forms -- has blurred the borders of countries and continents. Nowhere is this more obvious than in the gathering and disseminating of information via computer. As we move deeper into the decade, computers and connect time become less expensive. More and more, communication across time zones is facilitated through E-mail messaging and on-line conferences or bulletin boards. And, with the interconnection of computers on a global scale, has come an explosion of new users who have entered the world of "mind and modem."

Users and suppliers of telecommunications services are all looking for better ways to provide broader access to more data in more places than what is currently available. The maps, charts and tables provided on the following pages are both interesting and beneficial tools for analyzing the dynamic growth in telecommunications worldwide, and for understanding why the convergence of computer and telecommunications technology is accelerating. They also point clearly to the growing need for seamless communications that make geographical borders transparent.

The information contained in ***TeleGeography 1993*** is invaluable to researchers, government agencies and regulators, industry watchers, as well as service providers. We are both pleased to have underwritten this, the fifth edition of ***TeleGeography***, and to recommend the power of its information to you.

Eugene Eidenberg
Executive Vice President, MCI

C.W. Scott
President and CEO
Stentor Resource Center, Inc.

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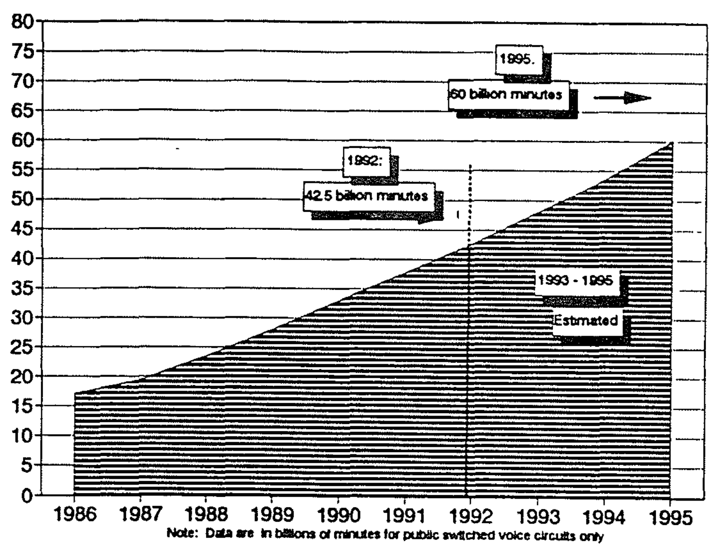
Introduction

TeleGeography 1993 marks the fifth anniversary of this report. Details on earlier editions appear at p. ii before the acknowledgements.

The inaugural edition concentrated on foreign telephone traffic from a handful of industrialized nations. This year's report provides route-by-route data on international telephone circuit traffic for over 50 countries and offers comparative statistics on as many carriers. TeleGeography now charts approximately 95% of the international calls traversing the world's public telephone networks. For 1993, we estimate that the world-wide market for international calls will total 47.5 to 48.5 billion minutes (see Figure 1) with each minute generating approximately $1 in carrier revenues, on average.

Figure 1

THE MARKET FOR INTERNATIONAL CALLS
Traffic Volume (1986-1995)



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TeleGeography 1993 also presents comprehensive statistics on the volume of trans-national data traffic (file transfers, electronic mail, database queries) handled by the world's largest public computer network -- the Internet. Outbound and inbound Internet traffic statistics and growth rates are provided for the top 25 U.S. routes; similar data are stated for Europe. With this new database, TeleGeography provides a tool for mapping the basic contours of computer-to-computer as well as phone-to-phone communications throughout the world.

The report contains a wealth of other information:

→ A quick reference section -- the TeleGeography *Blue Pages* -- lists basic communications indicators for more than 50 countries (e.g., telephone lines, fax machines, cellular phones, international traffic balances). In addition, the *Blue Pages,* at the back of the report, include reference maps showing national telephone dialing codes, time zones and political boundaries.

→ Updated tables have been compiled on the transmission capacity and cost of the principal trans-oceanic cable and satellite systems to the year 2000.

→ Current market share data are provided for carriers in countries with competitive markets.

→ New telemaps have been prepared to highlight country-by-country differences in international traffic growth and national traffic balances. The map section also includes cartograms on the world's major telecontinents.

The country-by-country statistics in this report show that the telegeography of the early 1990s is still largely a reflection of the traffic among industrialized countries. See Figure 2. But, the number of telephones in developing countries is rising. (From 1995 to 2000 China is expected to add more telephones each year than the U.S. or any Western European nation.) Likewise, the old rules regarding market entry, traffic routing and pricing in the industrialized world are beginning to bend as a new generation of competitive carriers comes of age.

These changes are already shifting the world's major telecontinents closer to Asia and the newly industrialized countries astride the Equator (Malaysia, Indonesia, Taiwan). And, within a decade, the resulting traffic patterns are likely to birth a new telegeography with its own distinctive topography.

As with past issues, several essays offer readers a perspective on the TeleGeography database. This year's articles address global computer networks; telephone numbering plans; and international mobile telephony (satellite phones and cellular roaming). However, before turning to these subjects, some general points bear mentioning.

A. Interpreting The Numbers

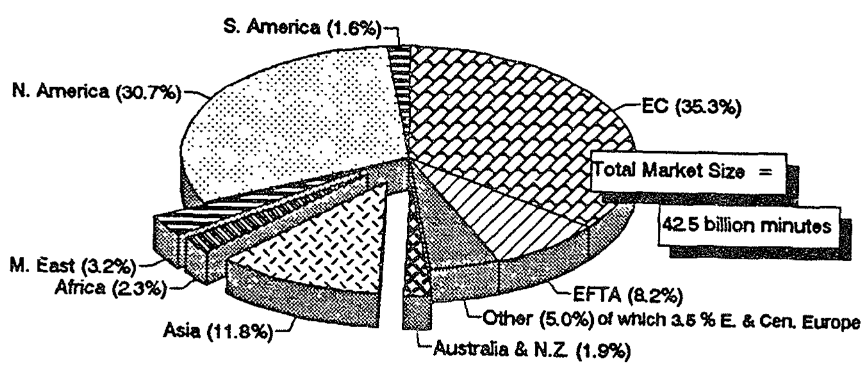
First, the international traffic statistics for 1992 confirm that economic growth continued to slow last year, not only in the English speaking countries, but worldwide. Global traffic growth in 1992 was approximately 12-13%; down from 13-14% in 1991 and 15-20% in the late 1980s. Further, the data in TeleGeography show that, in rich and poor countries alike, cross-border Minutes of Telecommunication Traffic (MiTT) are a fairly reliable indicator of basic economic trends and the differences in regional growth rates. For example, from 1990 to 1992, international MiTT grew approximately 11% in Western Europe as compared to 14% in the Americas and 25% in Asia.

Second, in the late 1980s, a buoyant world economy allowed the major carriers to "grow down" as competition was introduced because the size of their markets was expanding more rapidly than new carriers could win market share. The 1992 statistics show that this situation has changed. In the U.S., the U.K. and Japan, the volume of international traffic added by new carriers was, for the first time, greater than the volume of traffic added by the incumbent carrier (i.e., MCI added more traffic than AT&T; Mercury added more traffic than BT; IDC and ITJ together added more traffic than KDD). This suggests that head-to-head competition for international market share will be the reality for most carriers in the years ahead as markets grow more slowly. It also implies that the half dozen new international carriers which will cut their teeth in the early 1990's -- in Sweden, Australia, Malaysia, Indonesia, Israel and Chile -- may have a harder time than first generation.

Third, although the macro picture painted by global MiTT is reasonably clear, some caution must be taken in interpreting year-on-year changes in MiTT on particular routes. One reason is that TeleGeography only measures MiTT on the Public Switched Telephone Network (PSTN); the traffic data exclude international private (leased) lines which are not metered by carriers. The share of international traffic carried on leased lines probably accounts for 10-20% of total traffic on routes with substantial business traffic (e.g., the U.K.-Japan; Germany-Netherlands). No more precise figures are

Figure 2

ORIGIN OF INTERNATIONAL TELECOM TRAFFIC (1992)



1992 DATA FOR PUBLIC SWITCHED VOICE CIRCUITS generally available. However, as countries begin to relax the limitations on reselling leased line capacity to the general public for providing switched services, the share of total telephone traffic carried by private lines is likely to increase and, along with it, the need for more accurate measurements.

The rapid growth of Country Direct services since 1990 also is affecting the route-by-route statistics reported in TeleGeography. The main reason is that, since 1991, the only traffic statistics available to TeleGeography for the U.S. count Country Direct traffic as originating where it is billed (that is, in the U.S.) rather than where the call is placed (outside the U.S.). Country Direct traffic billed by U.S. carriers is thus considered as outbound not inbound U.S. traffic.

In contrast, carriers in the rest of the world have generally reported traffic data to TeleGeography based upon the "flow of traffic" (where the traffic originates) not on the "flow of funds" (where or how the carrier is compensated). The introduction of Country Direct calling plans thus has: tended to (a) inflate the volume of outbound MiTT reported from the U.S. on some routes; and (b) led to some double-counting of outbound calls because a Country Direct call to the U.S. may be reported as "outbound" traffic where it originates and terminates. The net effect of Country Direct traffic in country statistics can not be fully determined, however, without taking into account the Country Direct calling plans of non-U.S. carriers as well.

We estimate that the proportion of Country Direct calls is now at least 15-20% on major U.S. routes and 5% to 10% on routes served by European and Japanese carriers offering similar programs. Regulators in the U.S. have been asked (but have not yet agreed) to compile traffic data from carriers based on the direction of the call as well as the billing point. Similar demands are likely to be made elsewhere as trade negotiators and industry groups seek a more accurate picture of the innovative payment mechanisms which are driving the over $50 billion market for international telephone services.

B. Global Computer Networks: Mapping The Matrix

Today's telegeography is being shaped by computer networks as much as by telephony. The installed base of computers -- approximately 140 million worldwide and rising -- is rapidly being linked. Moreover, telephones and computers are becoming more alike as computers take on fax boards and modems, and telephones gain display screens and enhanced keypads. Mapping who is "on line" with whom around the world thus becomes a more and more important part of any telegeographic enterprise.

The statistics necessary to begin this survey are slowly becoming available. Although substantial transborder data traffic is routed via private networks run by airline, banking and other industries, basic metrics do exist for the traffic on the largest public networks.

Anthony M. Rutkowski, Vice President of the Internet Society, begins our survey of global data highways. The survey is supplemented by John Quarterman, the founding Editor of Matrix News in Austin, Texas.

Much of what we know about who is "on line" to whom in the world is based upon traffic flows over the Internet -- a loose affiliation of computer networks with common access protocols -- which now connects over 11 million terminals in over 60 countries. It is the world's largest and most rapidly growing data network.

The Internet traditionally has served the educational and scientific communities. Today it is fast becoming a common network for commercial and household users as well. Indeed, much of the Internet's recent growth can be attributed to the rising number of commercial gateways. These gateways make it increasingly possible for E-mail users anywhere in the world to correspond even though they subscribe to different computer networks. See p. 18.

A number of the Internet's more creative users have begun to distribute faxes and video clips; a weekly radio talk show is also available via the Internet. In a very few years, these trends may transform the Internet from a meeting place for global bitheads and other assorted *digiterati* to a popular medium which competes with the public telephone network.

Rutkowski's article is followed by a special contribution from John Quarterman. For those readers who find it helpful to keep one eye on their old wall maps while exploring cyberspace, Quarterman's personal travel log, "The Ends Of The Matrix", is the place to begin.

The electronic frontier has proven to be a fertile terrain for fiction as well. William Gibson's trilogy (Neuromancer, Count Zero, Mona Lisa Overdrive) and Marge Piercy's He, She and It are perhaps the best known. One allure of this new world is obvious. Literature traditionally has taken the landscape as a given, even if the action takes place on another planet or galaxy. But in cyberspace, geography is simply a computer artefact (software) and thus malleable. In this Alice in Wonderland world, the imaginary is the real; the real can be imagined; and the imagined can be coded. That is why some of the leading cartographers of this new space are as likely to be novelists and computer programmers as social scientists and statisticians.

C. Telephone Numbering Plans

Telephone dialing codes are the border guards of the information age. They determine what can get in and out of any locale. They mark a nation's sovereignty as much as its flag or its currency and are often better known. Without a code of one's own, as the would be telestates of Central and Eastern Europe quickly discovered, one's telephone traffic must be routed via another country's network. At best, this is inconvenient; at worst, it can lead to a national security nightmare.

The International Telecommunications Union (ITU), the Geneva-based U.N. standards body, has now assigned telephone country codes to the Baltic States; Azerbaijan and Moldova are also slated to receive individual country codes which will separate them from the rest of the former U.S.S.R. But, just as we are learning these new codes, it seems that the traditional, locale based numbering scheme is about to slip its geographical moorings. In the second major article, Stewart Fist, an Australian journalist, explains why.

For much of the last century, telephone numbers have offered a coded map of the world with a fairly transparent public key. Any (listed) telephone number begins with the country code; it is followed by the code for the regional or city exchange and then the code for the local exchange and subscriber line.

But, as Fist advises, "smart" switches, competing carriers, freephone ("800") services and the next generation of personal (wireless) communicators are forcing governments to revise the current numbering scheme.

The debate is particularly intense where competing carriers have emerged because control of a nation's numbering plan can convey a significant market advantage. This has led to growing political pressure from new carriers to ensure that national numbering organizations -- the Information Age equivalent of boundary line commissions -- operate at arms-length from the dominant carrier.

As yet, the numbering debate has focused largely on traditional concerns. However, computer technology not only allows a departure from the existing zone-based numbering system; it might also allow telephone numbers to provide much greater choice to users. For example, a dialing suffix might be used to direct a call to a fax or data terminal on the same line or to select a lower grade of service (bandwidth) with a commensurate reduction in price.

Paradoxically, although telephone numbers allow us to work as nomads, they also root us. We say "my" telephone number because, though we do not own it, the number is tied to our phone, which we (often) do own. More importantly, we associate our telephone number with the private space which we create when we use the phone.

Telegeography suggests that the rapid expansion of international communications has made our sense of place and of community whether it is generated electronically or anchored in concrete ever more important. (See p. 49.) Future telephone numbering systems that do not take account of this may not be long lived.

D. Industry Structure

The telegeography of any age is a function of regulation as much as technology. Telecommunication cables and satellites need know no boundaries; governments are defined by the boundaries they keep. The tension between telecommunications technology and national sovereignty has sharpened since the mid 1980s as the pressure for market liberalization -- licensing competing carriers -- has spread. In the 1990s, the vast pools of national telecommunications traffic, once a country's patrimony as much as its forests or its mines, have become the subject of fierce multinational bidding.

The articles section in TeleGeography 1992 discussed how the growth of Light Carriers -- carriers which resell, repackage or reprogram the services of facilities-based or Heavy Carriers -- has begun to change the paradigm for international service. The Heavy Carrier, which typically has a monopoly or oligopoly franchise, provides service by connecting its half-circuits with the matching cable or satellite facilities of another monopolist. With no protected home market and few facilities of its own, the Light Carrier seeks to provide end-to-end service on a global basis.

Because Light Carriers are driven by software rather than hardware, they have come into their own as the basic building blocks for international service -- electronic switches and long distance transmission capacity -- become more and more abundant. In the U.S., for example, there are now 19 facilities-based international carriers and over 150 resellers, including several automated call back companies.

Yet, as AT&T recently advised the U.S. Government, there is still substantial excess international transmission capacity. "In fact," said AT&T, "currently installed or planned ... submarine cable facilities ... could accommodate a tenfold increase in traffic demand."

And that situation is likely to continue. The undersea cables which will come into service in the 1995-2000 period will have a capacity of 5 Gigabits per second (Gbps) or more (i.e., enough to handle at least 300,000 simultaneous phone calls). Yet, according to AT&T, wavelength division multiplexing (WDM) can potentially put "up to 1000 channels of 1-10 Gbps each on a single fiber"!

The transition from a supply constrained to a demand driven world populated by a mix of Heavy and Light carriers is prompting a number of regulatory conflicts. One of the most bitter involves automated call-back or "boomerang box" companies, which offer reverse billing of international calls from high tariff countries. Most of these companies are based in the U.S. and the Federal Communications Commission (FCC) in Washington, D.C. has been asked to declare the call set-up practices of these companies illegal. Several South American countries have already done so, although at this writing the FCC has yet to act. Despite this legal cloud, a new report on the call back business by the TeleChoice consultancy, (see p. 38) suggests that these novel service providers will be hard to dislodge.

Our third major article explores another area of controversy between established carriers and new entrants: cross-border wireless telephony. Rob Frieden, a Professor at Penn State University and a former counsel to several entrepreneurial carriers, focuses on two businesses: satellite phones and trans-national cellular roaming. Frieden notes that while mobile-to-mobile calls now account for a very small percentage of long distance traffic and international mobile calls are a rarity, change is on the horizon.

Several major cellular radio companies (e.g., McCaw) are now allied with or owned by leading international telephone companies (e.g., AT&T) and at least two global satellite phone ventures (Iridium and Inmarsat's Project 21) seem likely to be launched. These developments, argue Frieden, are putting new pressure on the regime which wireline carriers now use to settle international accounts.

The current accounting rate regime for international telephony has been widely criticized for sustaining excessive toll charges. This regime also is at odds with the mechanisms being developed to compensate carriers for providing cross border "roaming" service to cellular subscribers. In these circumstances, Frieden suggests that the debate over trans-national mobile services may well point the way toward alternative settlement and access charge regimes for the international telephone industry as a whole.

E. TeleGeography 1994

Our plans for TeleGeography 1994 are already on the drawing board. We began by mapping the world's telephone and data flows -- two projects which we will continue to refine. Next year, we plan to turn our attention to the developing market for global V-mail (video mail) and teleconferencing. We also want to get back to the basics by taking a closer look at the major demand drivers for international communications -- economic, social and cultural -- and how the most successful carriers have tailored their services in response. As always though, we welcome the assistance of our readers and invite your comments and suggestions.

Gregory C. Staple
September 1993
Washington, D.C.

ARTICLES AND COMMENTARY

WHO'S "ON LINE" WITH WHOM: THE NEW GLOBAL INTERNETWORKING BUSINESS FROM COMPUTER BULLETIN BOARDS TO NATIONAL INFOSTRUCTURE

By Anthony M. Rutkowski and others

Computers have been talking to other computers for more than a generation. For much of this time, however, there were three separate networking worlds. One world was mainly occupied by corporate users who needed high capacity, dedicated networks to handle the day-to-day demands of processing very large volumes of financial transactions, customer orders, inventory records and the like at geographically dispersed sites.

A second networking world was created by the non-profit sector -- government, universities and research institutes. In contrast to the corporate world, these networks prided themselves on being fairly open and non-structured, allowing people and computers to build a practical set of internetworking tools to accommodate their varied interests.

The personal computer boom in the 1980s led to yet a third networking world as millions of new users came "on line." Although the Personal Computer (PC) based networks overlapped in large part with the non-profit nets already in place, they were also serviced by a new breed of commercial vendors, including Compuserve, Delphi and thousands of smaller computer Bulletin Boards Services (BBSs).

Anthony M. Rutkowski, Vice President of the Internet Society and Director of Technology for Sprint, was the principal author. Daniel P. Dern (ddern@world.std.com), author of The Internet Guide For New Users (McGraw-Hill, 1993) and Gregory C. Staple (gstaple@mcimail.com), a communications lawyer at Koteen & Naftalin, Washington, D.C. also contributed.

By the early 1990s, these three networking worlds had begun to converge, making the world of computer networking at once more plural and more alike. At the center of this convergence is a new global internetworking business. One computer world is being linked with another and new electronic gateways and services are being opened to a wider and wider public. In the process, the specialized research and PC driven networks of yesterday are all becoming a vital part of tomorrow's national infostructure.

The Past As Prologue

Not very long ago, computer networks were based on large central mainframes, with remote "dumb" terminals connected by basic public data networks. This universe became a little more varied when minicomputers and supercomputers arrived. But the same basic networking model was retained; a central machine was surrounded by a cluster of computer terminals. And on the telecommunications side, most carriers designed their products to support this simple world of monopoly providers and remote computer processing.

However, the computer world did not stand still. PCs and work stations began to very quickly shrink mainframes down to desktop size. Local Area Networks (LANs) and a vast array of computer operating systems and applications also entered the market. Some of these small but powerful computers were designed to communicate and share resources simultaneously with large numbers of other computers using "client-server" models. The slogan, "The Computer is the Network," was born and along with it the business of internetworking.

The basic internetworking technology was largely devised in the early 1970s by researchers working for the U.S. Department of Defense Advanced Projects Research Agency (DARPA). The networking "glue" to accomplish this integration was a set of computer protocols known as TCP/IP (Transmission Control Protocol/Internet Protocol). These protocols provided standards for diverse computers to talk to one another in a fast and efficient manner. It didn't take long before companies trying to integrate their own computer networks began using the TCP/IP technology and it diffused quickly into the private sector.

In a matter of years, the collection of DARPA based networks called the "Internet" grew from a handful of computers to several thousand computers in hundreds of locations. Then, in 1985, in what is sometimes referred to as the Second Great U.S. Communications Divestiture (the first being AT&T's separation from its local operating companies), DARPA kicked its child out of the house to find civilian and commercial step parents. Many stepped forward. Soon government, scientific and academic organizations throughout the U.S. and Europe all began to help grow the Internet. At about the same time, various large companies also began using the ICP/IP technology in their dedicated enterprise networks. A few thousand interconnected computers became a few hundred thousand by the end of the 1980's.

Defining Internets and "The Internet"

The distinction between internets and the network of internets called the Internet is a source of endless confusion. The term "internet" (lower case "i") refers to any network using "open" computer protocols that allow dissimilar kinds of computer systems to communicate with each other. For all practical purposes, the Internet Protocol (IP) is the predominant way of accomplishing this, although there are many smaller scale implementations using proprietary and public domain protocols, including some proposed under the name Open Systems Interconnection (OSI).

The Internet Protocol is best envisioned as a kind of universal overlay network that rides on top of the basic telecommunication network. It makes little difference if the underlying network is telephone wires, radio or fibre optics cable. So long as the transmission medium moves electrical signals from one point to another, it can carry the IP protocol. Similarly, for IP communications, it makes little difference whether the computers are mainframes, supercomputers, minis, Apple MacIntoshes or IBM compatible PCs.

This incredible ability to link together directly any kind of computer or process running on a computer with that of any other computer or process anywhere represents the enormous value of the Internet Protocol and accounts for its wide implementation. Most of the newer enterprise networks being constructed by corporations today are IP internets. IP networking has long been provided as part of every AT&T UNIX computer operating system and has recently become a standard feature of most other computer operating system now made, including the popular Windows for PCs.

At September 1993, there were more than 50,000 internets registered for unique network addresses. This base was growing by more than 500 new internets per week. The Internet consists of about one-third of these internets.

This IP network of networks is also richly endowed with gateways to countless other specialized networks, especially those for electronic mail. This larger agglomeration, which includes Bitnets, Fidonets, UUCP Nets, MiniTel based nets, and virtually every public messaging system in the world, has been annointed "The Matrix" by John Quarterman, a popular analyst in the field. The Matrix encompasses an estimated 20 million users. (See p. 20 below.)

The very notion of such a massive unbounded communications medium may be difficult to comprehend. Most networks -- for buses, airlines, even telephony -- are reasonably discrete. But, in some ways, the Internet is similar to the more familiar radio spectrum which is also an unbounded and loose collection of millions of users all sharing a common medium.

The Internet Is Not Just For Electronic Mail

One of the most common myths about the Internet is that it merely provides an inexpensive way for academics to exchange e-mail. In fact, rather a small fraction of the traffic -- less than 20 percent -- is e-mail. The Internet currently supports more than 1000 different kinds of computer services, although only about 400 are defined, registered services, and only a few dozen are in widespread use. The rest are largely experimental or provide specialized gateways between different kinds of computer networks.

Approximately 50 percent of the Internet traffic is file transfers. The Internet allows extremely fast and easy movement of files, including the "binary" files that constitute the software code used by computer programs. Not surprisingly, some of the Internet sites with the heaviest global traffic are those used for distributing new versions of UNIX software.

A partial listing of the accessible information on the Internet includes:

- Real-time access to databases, indexes and interactive programs. These include over two million public-domain and shareware programs (which can be down-loaded to the user's own computer), plus documents, images and other files at over 2,000 archive sites;
- Over 2,000 "Gopher" servers, providing access to over 1 million files, services and resources, structured by topic, organization or location. (Gopher is a customized search and data retrieval program.);
- Several hundred full-text-searchable databases accessed through WAIS (Wide-Area Information System), a search engine developed originally by researchers at the Boston based Thinking Machines Corp.;
- Over 700 on-line library catalogs with a mix of record entry, abstract and full-text items;
- Government archives, thousand of special-interest BBSs, document repositories and information services;
- Remote-log on access to supercomputer centers and to leading on-line information services such as Dialog, Dow Jones, and MEAD Data; and
- Usenet News newsgroups (from 3,000 to 5,000 topical discussions open to anyone, and an unknowable number of private, by-invitation-only, discussions).

Other heavily used capabilities include directory services, remote log-on, remote mounting of computer drives, network management and dozens of new browsing and knowledge tools. One of the best known examples of the latter are "Knowbots®" (for knowledge robots) that search the information resources of the Internet at the behest of their human masters. (The concept is the brainchild of the "father" of the Internet and Internet Society President, Vinton G. Cerf.)

Finding Your Way In The Internet

The most rapidly growing new knowledge service on the Internet, Gopher, is named for the mascot of the University of Minnesota. This research tool, although only two years old, has spread to thousands of sites worldwide and its traffic is growing at an annual rate exceeding 1000 percent. Gopher is best envisioned as an information kiosk where one can use a joystick or "mouse" to browse by selecting geographic-markers or information key words. Its interface is so basic that even young children can use it.

Numerous private companies, libraries, museums and government agencies have created Gopher kiosks to provide public information, white page directories, product information and sales brochures. Some entrepreneurial publishers even provide abstracts of their books and the ability to instantly place an order via these kiosks.

New multimedia services which permit audio and video multicasting also are beginning to appear. The Internet Society, among others, has used these services for the global conferences needed to establish Internet standards. Currently more than 500 sites in 20 countries participate interactively in Internet standards-making conferences via two "tv channels" which are multicast worldwide. As new multimedia standards for Internet mail come into widespread use, the distribution of images, sounds, complex graphics and texts with non-Roman character sets is expected to grow rapidly.

Some popular uses of the Internet entwine several capabilities under such headings as "networked collaboration" or "collaboratories." These services enable researchers or specialists in a given field to form virtual committees to pursue common interests.

Another Internet capability is a network management service for highly distributed networks with many different kinds of computers and devices. Actually a collection of tools, the Internet Simple Network Management Protocol (SNMP) has been adopted by both the computer networking and telecommunications worlds. Some of SNMP's more unusual implementations include the control of remote stereo systems, toasters and soft drink vending machines.

Economics of the Internet

A second important but frequently misunderstood facet of the Internet is the network's economics. It is not uncommon to hear remarks about the Internet being "free." The Internet is NOT free. However, because of its architecture, technology and accounting practices, the costs are low and often shielded from some end users. The Internet consists of 17,000 networks (at August 1993) and the costs for connectivity and operation are collectively borne by all those networks. A great many of these networks are institutional enterprise networks, operated as part of the normal business of companies, academic institutions and government agencies. There is also a "no settlements" policy; networks nearer to the end user purchase capacity from a higher level backbone network on a flat rate, not a volume sensitive basis. Lastly, the connectionless technology employed by the Internet allows extremely efficient sharing of transport and switching facilities.

Fee structures typically range from a low of $20 per month for basic service by dial-up modem to $2000 per month for service via a 1.5 Megabit leased line connection. Global carriers such as Sprint allow resellers to market the services and offer a multitude of different access options including free phone ("800") numbers and X.25 data services. Prices usually tend to be higher outside the U.S. due to the lack of competition in providing circuit capacity.

Commercialization of the Internet

Most of the registered internets today already are commercial entities. And most of the growth today of internets and the Internet is dramatically commercial. The recent announcements by all of the major telephone carriers in the U.S. to provide Internet services underscores this trend. The rapidly rising demand for services by major business customers is another sign of the Internet's changing character. In 1994, the trend will doubtless accelerate as the U.S. government withdraws subsidies from its core backbone network, the National Science Foundation (NSF) Net. Some lament the transition to a more public global and commercial environment. Yet, because the Internet now encompasses so many diverse uses, users, and technologies world wide -- mirroring society -- it is likely that a rich mixture of networking cultures will continue to coexist.

Analyzing the Tables and Charts

The tables in this article and the charts which follow display some of the major relationships and trends for internetworking. The Internet community frequently refers to this information as metrics.

The Internet world of metrics has both positive and negative features. One constant problem with Internet metrics is completeness. The Internet's architecture, involving 17,000 or more networks, is ever growing. The good news is that much of the traffic proceeds through a relatively few network backbone computers which keep very detailed and comprehensive data on traffic flows and use. The Internet Society, in Reston, Virginia, consistently publishes different renditions of the data as it becomes available. Figures 1 to 5 in this article reflect the metrics that are seen at the U.S. NSF Net backbone and the largest European backbone at CERN (European Center For Nuclear Research) near Geneva, Switzerland.

The Internet is a highly disaggregated world of distributed networks whose backbones route traffic for all the networks which are made known to them. For example, many commercial internets which use only commercial Internet back bones (e.g., PSI, ANS

(Cont. on p. 16)

Figure 1

Who's "On-Line" With The U.S.?

Monthly Internet Traffic To and From the Largest U.S. Correspondent Network in Megabytes (June 1993)

	Country	Networks	Inbound Megabytes	Outbound Megabytes	Inbound % of Total	Outbound % of Total
N.America	United States	5,576	6,057,255	5,445,963	53%	47%
	Canada	429	116,703	277,418	30%	70%
	Mexico	34	5,892	52,274	10%	90%
	TOTAL	6,039	6,179,850	5,775,656	52%	48%
L. America	Brazil	52	1,873	9,592	16%	84%
	Chile	14	3,351	7,484	31%	69%
	Argentina	1	62	3,065	2%	98%
	Venezuela	5	510	1,890	21%	79%
	Costa Rica	2	33	1,098	3%	97%
	Ecuador	28	126	599	17%	83%
	TOTAL	102	5,954	23,728	20%	80%
Europe	United Kingdom	420	69,838	169,383	29%	71%
	Germany	443	47,511	112,331	30%	70%
	France	453	89,776	80,677	53%	47%
	Netherlands	131	52,166	48,870	52%	48%
	Italy	169	13,475	47,699	22%	78%
	Switzerland	87	40,880	45,218	47%	53%
	Sweden	87	32,202	39,341	45%	55%
	Finland	102	50,763	27,171	65%	35%
	Norway	52	15,926	23,745	40%	60%
	Austria	84	9,052	23,120	28%	72%
	Spain	39	2,433	23,058	10%	90%
	Denmark	8	7,232	13,613	35%	65%
	Belgium	14	1,225	7,196	15%	85%
	Ireland	24	802	4,445	15%	85%
	Czech Republic	51	1,076	4,243	20%	80%
	Greece	11	640	3,706	15%	85%
	Portugal	35	999	3,586	22%	78%
	Turkey	9	489	3,226	13%	87%
	Hungary	20	479	3,177	13%	67%
	Poland	45	844	3,061	22%	78%
	Slovakia	13	489	1,453	25%	75%
	Iceland	13	377	1,413	21%	79%
	Luxembourg	4	40	278	13%	87%
	TOTAL	2,353	439,335	693,284	39%	61%
Mid. East	Israel	48	6,737	17,454	28%	72%
	Kuwait	1	12	330	4%	96%
	TOTAL	49	6,750	17,784	28%	72%
Africa	South Africa	42	1,656	9,723	15%	85%
	Tunisia	1	2	5	30%	70%
	TOTAL	43	1,658	9,728	15%	85%
Asia	Australia	189	59,348	93,818	39%	61%
	Japan	257	19,475	41,825	32%	68%
	Taiwan	78	33,222	40,593	45%	55%
	Singapore	16	3,417	19,019	15%	85%
	South Korea	35	4,322	17,737	20%	80%
	Hong Kong	8	1,682	13,988	11%	89%
	New Zealand	50	2,031	7,526	21%	79%
	India	3	1,375	1,499	48%	52%
	Thailand	13	258	883	23%	77%
	Malaysia	3	87	423	17%	83%
	TOTAL	653	125,216	237,311	35%	65%

NOTES: The table is based on traffic to and from the U.S. National Science Foundation (NSF) Network, presently the largest Internet backbone. It serves as a global traffic exchange mechanism among the 9,239 networks indicated. The basic data is available on the network server: nis.nsf.net. Some smaller country traffic is not shown, but the networks and traffic are counted in the regional totals.

Figure 2

Who's "On-Line" With The U.S.?
Internet Traffic to and From The Largest U.S. Correspondent in Megabytes (June 1993)

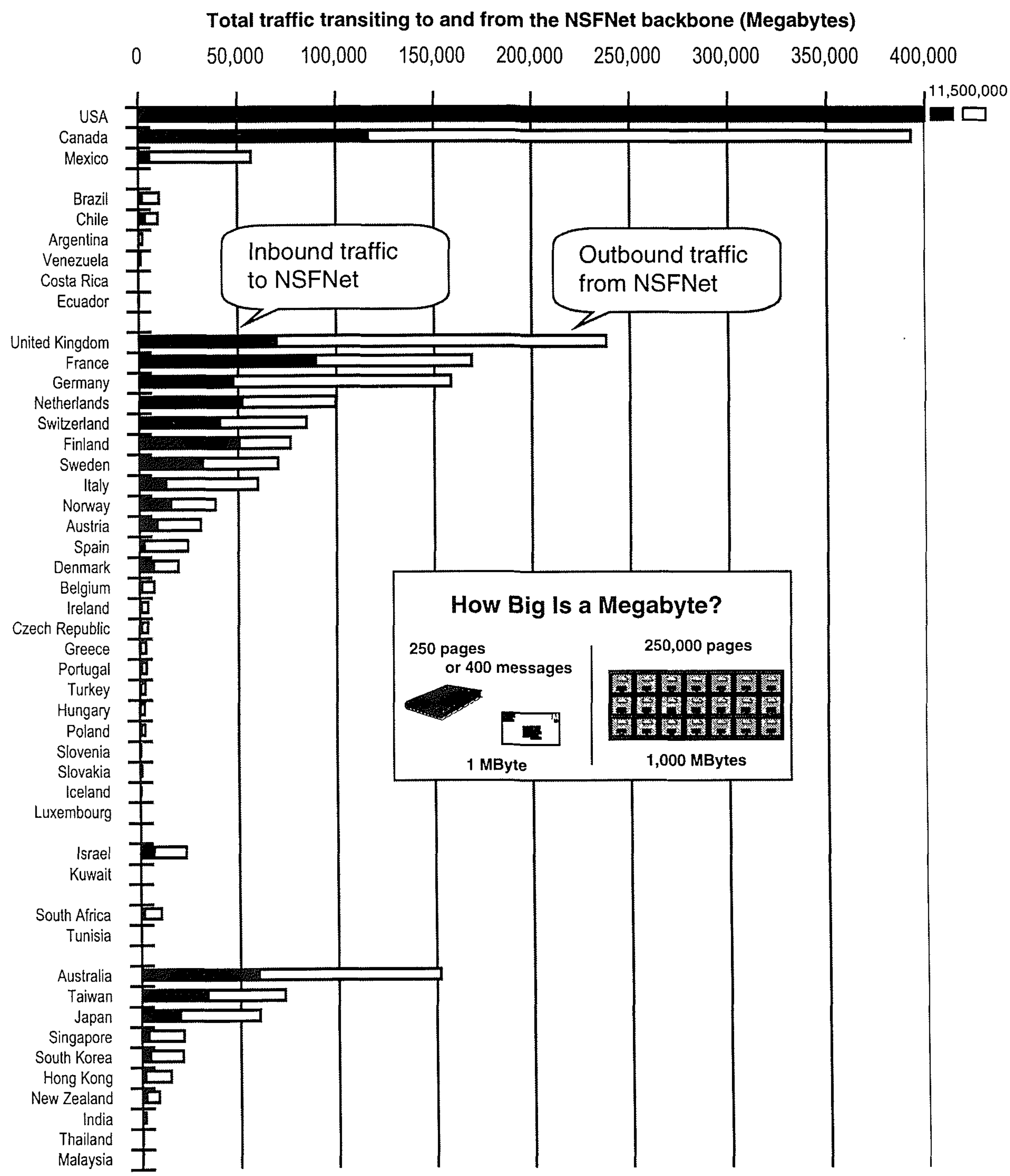


Figure 3

Who's "On-Line" With Europe?

Monthly Traffic To and From The Largest European Correspondent (CERN) in Megabytes
(March 1993)

	Country	Inbound Megabytes	Outbound Megabytes	Inbound % of Total	Outbound % of Total
N.America	United States	195,000	104,000	65%	35%
	Canada	4,200	6,700	39%	61%
	Mexico	500	300	63%	38%
	TOTAL	199,700	111,000	64%	36%
Europe	Switzerland	77,400	63,200	55%	45%
	Germany	41,400	59,300	41%	59%
	Italy	20,400	79,800	20%	80%
	Netherlands	38,300	44,800	46%	54%
	France	27,500	30,300	48%	52%
	Austria	17,200	35,400	33%	67%
	United Kingdom	13,600	14,600	48%	52%
	Sweden	5,400	7,300	43%	57%
	Spain	1,800	10,100	15%	85%
	Finland	7,600	3,400	69%	31%
	Hungary	1,400	4,600	23%	77%
	Czech Republic	1,100	5,100	18%	82%
	Norway	1,900	3,900	33%	67%
	Poland	2,100	3,100	40%	60%
	Denmark	700	1,800	28%	72%
	TOTAL	257,800	366,700	41%	59%
M.East	Israel	0	9,800	0%	100%
Asia	Australia	4,300	3,000	59%	41%
	Taiwan	1,200	1,300	48%	52%
	Japan	1,000	1,500	40%	60%
	TOTAL	6,500	5,800	53%	47%

NOTES: The CERN (the European Center for Nuclear Research) is presently the largest European traffic exchange point for the Internet. It serves as a global traffic exchange mechanism for even more networks than the U.S. NSFNet. This data was collected on a one-time basis and is derived from J.M. Jouanigot O. Martin, and J. Yu, "IP Traffic Measurements and Analysis at CERN," Proceedings of the International Networking Conference (INET '93) San Francisco, CA 17-20 August 1993. The data is also available on the network server: mordor.standford.edu. Traffic from smaller countries is not shown.

Figure 4

Who's "On-Line" With Europe?
Internet Traffic to and From The Largest European Correspondent (CERN) in Megabytes (March 1993)

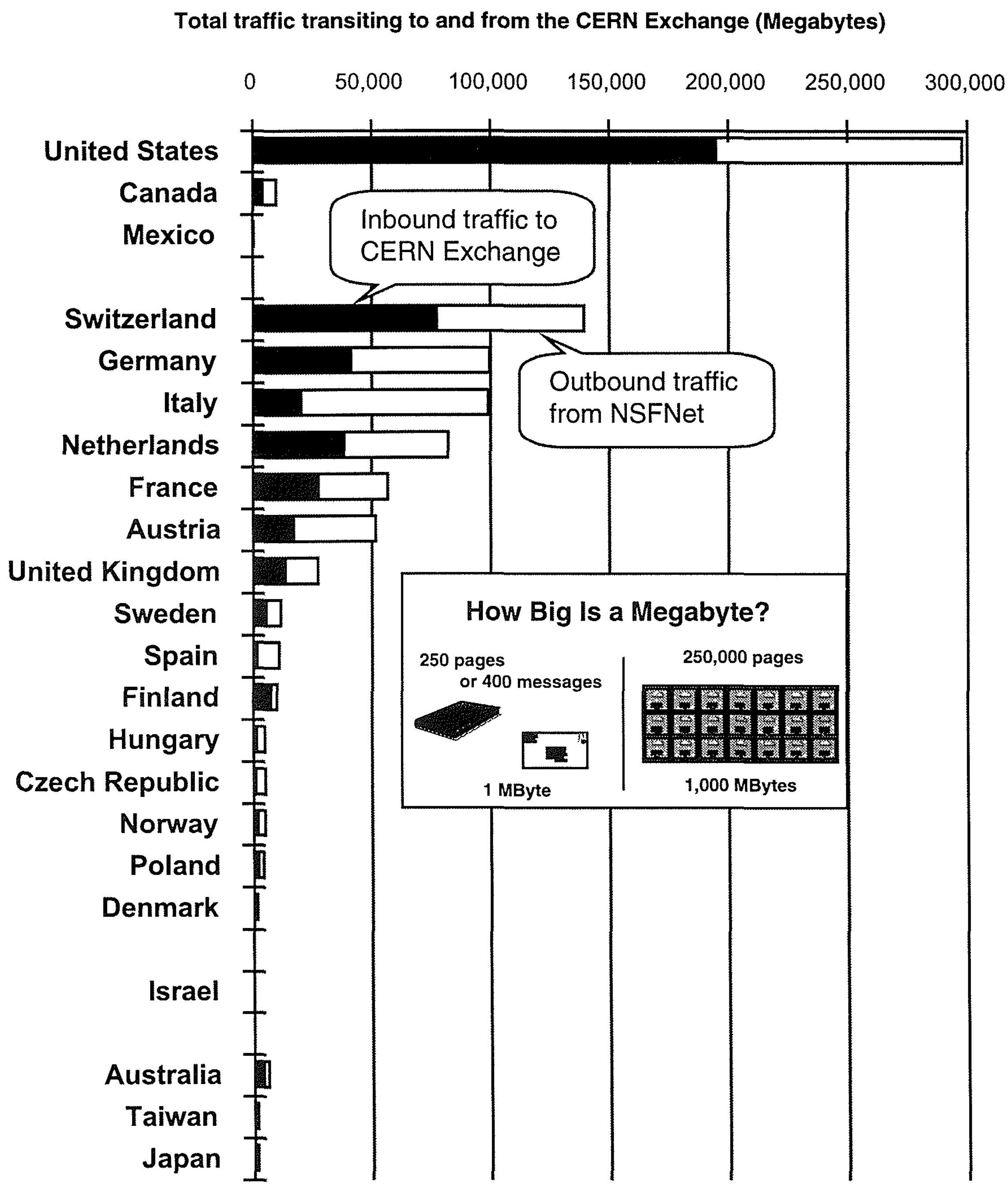


Figure 5

Internet Global Traffic Growth

Increase In Internet Networks and Traffic Volumes
From and To the NSF Net Backbone in Megabytes
(Sept 1991 to June 1993)

	Networks			Inbound Traffic			Outbound Traffic		
Country	Sep/1991	Jun/1993	Ave. Annual Growth	Sep/1991	Jun/1993	Ave. Annual Growth	Sep/1991	Jun/1993	Ave. Annual Growth
United States	1,758	5,571	124%	1,034,428	6,057,250	277%	1,108,022	5,445,958	224%
Canada	144	429	113%	47,953	116,703	82%	34,103	277,418	408%
United Kingdom	44	420	488%	12,602	69,838	260%	4,177	169,383	2,260%
Germany	144	443	119%	19,256	47,511	84%	8,131	112,331	732%
Australia	96	189	55%	22,601	59,348	93%	11,000	93,818	430%
France	95	453	215%	8,757	89,776	529%	5,495	80,677	782%
Mexico	5	34	331%	2,366	5,892	85%	1,521	52,274	1,907%
Netherlands	52	131	87%	10,716	52,166	221%	5,397	48,870	460%
Italy	30	169	265%	5,549	13,475	82%	4,772	47,699	514%
Switzerland	35	87	85%	9,427	40,880	191%	7,715	45,218	278%
Japan	73	257	144%	4,616	19,475	184%	2,239	41,825	1,011%
Taiwan	0	78		0	33,222		0	40,593	
Sweden	25	87	142%	8,926	32,202	149%	7,386	39,341	247%
Finland	12	102	429%	4,217	50,763	631%	9,880	27,171	100%
Norway	8	52	314%	4,571	15,926	142%	2,510	23,745	484%
Austria	14	84	286%	3,904	9,052	75%	1,030	23,120	1,225%
Spain	7	39	261%	932	2,433	92%	419	23,058	3,088%
Singapore	2	16	400%	2,420	3,417	24%	325	19,019	3,284%
South Korea	9	35	165%	3,942	4,322	6%	613	17,737	1,597%
Israel	16	48	114%	5,569	6,737	12%	1,859	17,454	479%
Hong Kong	1	8	400%	256	1,682	319%	28	13,988	28,279%
Denmark	3	8	95%	2,821	7,232	89%	1,074	13,613	667%
South Africa	0	42		0	1,656		0	9,723	
Brazil	8	52	314%	232	1,873	405%	43	9,592	12,578%
New Zealand	15	50	133%	1,536	2,031	18%	539	7,526	741%
Chile	1	14	743%	67	3,351	2,805%	52	7,484	8,100%

CO+RE, Sprint Link, InfoNet, PipEx, SwipNet, TIPNet) may route little or none of their traffic over the government supported NSF Net and CERN backbones. However, based on the metrics informally reported by other networks, these statistics are known to represent the major portion of global internetworking traffic.

Several other observations can be made about the metrics charted here. Although the number of networks and the traffic for the U.S. greatly exceeds that for any other country, connectivity outside North America is growing. Like other telecommunications streams, there is a simple but strong correlation to GNP, with some exceptions. The Nordic nations, for example, proportionately have far more Internet connectivity than either their size or GNP would indicate. Similarly, many developing countries have significant and rapidly growing connectivity. This speaks to the ability of internetworking to permit such countries to compensate for an otherwise underdeveloped infrastructure.

The traffic balance metrics (in/out statistics) in the tables also bear examination. They suggest that Internet traffic has a significant correlation with the availability of accessible and valuable information products. Because so much more information is openly accessible in the U.S., it's Internet hosts seem to be more heavily queried. More traffic thus typically flows out of the U.S. than into it, but not because more people in the U.S. are calling out, as in the telephone world.

In contrast to Figures 1 - 5, the charts following this article focus on the global distribution of hardware or computer hosts serving the Internet and other networks. Taken together this information on facilities and flows provides a reasonably good overview of the global Matrix.

Internetworking In The 1990s

The Internet traffic charted in TeleGeography offers one doorway into the internetworking business of the 1990s. As the number of internets and users continues to double each year, the Internet and internetworking will very quickly become a central part of every nation's infostructure.

Anyone who has worked "on line" or dialed into a computer BBS for a social chat, or to receive assistance with a technical problem, knows that connectivity is often it's own reward. The more people and resources that are reachable through a medium, the more valuable it becomes, attracting still more people and resources.

The internetworking businesses of the 1990s are already taking advantage of this phenomenon to make the net a vital tool for virtually every kind of institutional, governmental, professional, social, or personal activity -- domestically and internationally. These twin dimensions -- the business and the social ones -- will continue to shape the evolution of the world's internets as they evolve into the next public telephone network.

- END -

Where In The World Is *carmensandiego @ mci.com?*

"email/*eemayl*/1. n. Electronic mail automatically passed through computer networks and/or via modems over common-carrier lines. Contrast **snail-mail, paper-net, voice-net**. 2. vt. To send electronic mail."

Eric Raymond, Editor, The New Hacker's Dictionary (MIT Press, Cambridge, MA, 1991).

Messages sent over computer networks, such as the Internet, are known as electronic mail, or *e-mail*. This method of communication has become so popular that the word *e-mail* is now also used as a verb (cf. definition above), making the same grammatical crossover that the noun "telephone" made at the end of the 19th century. As with telephoning, to e-mail someone you need an address which directs your message through the network to the appropriate destination.

Computer addresses, such as *carmensandiego@mcicom*, have long baffled the uninitiated. The addresses seem to belong to a world of their own -- a virtual space without geographical landmarks or obvious directions about how to get there. By comparison, the country and city codes in most telephone numbers give callers a sense of place, although these physical handholds may soon become a relic of computer technology too. (See "Numbering the World's Phones" below.)

What do computer network addresses actually mean and how do you find them?

INTERNET E-MAIL

Internet e-mail addresses are fairly straightforward. If both the sender and the recipient are connected to the Internet (a likely scenario for over half of the 20-million plus e-mailers in the world), is the standard address format which is used. Internet addresses consist of two parts: a *username* and a *hostname*.

Suppose, for example, we want to send e-mail to the following address (which is fictitious):

carmensandiego@telegeography.com

carmensandiego is the *username* or local part, and refers to the mailbox, user i.d., or login name of the recipient. These names may be personal, corporate, or even based on a random assignment by a network manager. Once the e-mail message reaches the host computer, the computer uses the *username* to figure out where to "deliver" it.

telegeography.com is the host part of the address. It identifies the host computer where the account is located using a standard Internet format.

Each host computer on the Internet is assigned a unique 32-bit numerical address. To make life easier for human users, this numerical address is converted to an assigned domain name through the Domain Name System (DNS). The DNS refers both to the method of name-assignment and to the worldwide database of Internet names and addresses.

DNS names are organized in a hierarchical fashion, moving from more specific to more general domains as one reads from left to right. The lowest level of the *hostname* ('telegeography' in our example) comes first: it refers to a specific host computer. Next, separated by a period, there may be the name of a higher network or of the organization the computer belongs to. For example, if our *hostname* were *telegeography.iic.com*, *iic* would refer to the sub-network which *telegeography* belonged to.

The rightmost part of the name (*.com* in our example) refers to the high-level domain under which our organization is categorized within the DNS. These high-level organizational domains were created along with the DNS; they include COM (commercial organizations), EDU (educational), GOV (governmental), MIL (military) and ORG(miscellaneous organizations). For Internet host computers outside of the U.S., two-letter country codes are commonly used for the highest-level domains (e.g., 'uk' for the United Kingdom, or 'ch' for Switzerland).

cont'd.

Where In The World Cont'd.

The confusing aspect of computer network addresses is that, unlike telephone numbers, they do not necessarily indicate geographical location. A name points to a numerical address associated with a specific computer; the computer itself may be anywhere in the world. Just because a name is part of the domain 'uk' doesn't mean that the computer is located in the U.K.; it may only be registered there, and like an oil tanker registered in Liberia, could be berthed halfway around the Internet world.

E-MAIL OUTSIDE THE INTERNET

There are a number of computer networks which are not part of the Internet but which can still exchange e-mail with Internet networks. This is done through 'email gateway' computers, which translate the different e-mail protocols when mail is sent from one network to another (for a discussion of this international system of networks connected through gateways, see "How Big Is The Matrix" below.)

E-mail addresses for users of these other networks (known as outernets) may need to provide more information than the standard Internet addresses. Some outernet computers have DNS names; in this case, the DNS database will automatically find the right gateway for the e-mail to go through. MCIMail (userid@mcimail.com), America Online (user@aol.com), and Compuserve (userid@compuserve.com) are examples.

For other outernet networks, the e-mail sender may need to specify the gateway computer. For example, to send e-mail to someone on the UUCP or BITNET networks, you may need an address in the following format:

username%hostname@gateway-hostname

The e-mail is sent to gateway-hostname, which then delivers it to the specified user on the hostname computer.

INTERNET ADDRESS "BOOKS"

What if you don't know the name of the account or computer you want to reach? Unfortunately, no general Internet directory exists, yet. However, a number of Internet functions and 'white pages' type directories are helpful. Some of them are:

Finger: This command, for computers with a UNIX operating system, allows you to find a user if you know the host computer.

Whois: This is both the name of a white pages directory and the command you need to access it. It contains over 70,000 entries and can look up people by last name or by a piece of the last name.

X.500 Directory Services: This service is a collection of directories, having an agreed X.500 protocol, with each member group being responsible for keeping the directory of its lower organization up-to-date. It is most easily accessed by logging on to an e-mail computer which runs the **fred** query application. X.500 may be the wave of the future for Internet directory searches, but currently many users are still not listed.

For more information, see Tracy Laquey and Jeanne C. Ryer, The Internet Companion: A Beginner's Guide to Global Networking (Addison-Wesley, Reading, MA., 1993) and Ed Krol, The Whole Internet User's Guide & Catalog (O'Reilly & Associates, Inc. Sebastopol, CA, 1992)

A.R.

How Big Is The Matrix?

Network	Host Computers	Users	Avg. Users Per Host	Countries	Data Source
The Internet	1,486,000	11,145,000	7.5	54	Mark Lottor
Enterprise "IP" Nets	1,000,000	7,500,000	7.5	?	MIDS (estimate)
BITNET	3,284	243,016	74	55	BITEARN node list
FidoNet	21,400	1,712,000	80	77	FidoNet node list
UUCP	16,400	492,000	30	120	UUCP map
Total	2,527,084	21,092,016	8.4	138	

The Matrix may be defined as all computer networks worldwide that exchange electronic mail. The four global networks that carry most of the public traffic through the Matrix are Internet, BITNET, FidoNet and UUCP. There are also many large enterprise networks -- private networks dedicated to a particular company (Exxon, Mitsubishi, Citicorp) or industry (e.g., SWIFT, which serves the banking industry; SITA which serves the airline industry). The table above shows the current size (mid-1993) of these networks. The data were compiled by Matrix Information and Directory Services, Inc. (MIDS); a/k/a mids@tic.com. A graphic portrayal of the interrelationship between these networks appears on the opposite page.

Glossary:

The Internet is a network of networks, mostly leased line but also dialup, operating from 2400-bits per second (bps) to 100 Megabits per second, which utilizes the *TCP/IP* (Transmission Control Protocol/Internet Protocol) protocols. The key TCP/IP protocol is the Internet Protocol which provides a uniform address space and permits routing across diverse networks from one computer to another. The Transmission Control Protocol uses IP to provide reliable delivery of bitstreams in order and without loss or duplication from a process on one machine to a process on another machine.

BITNET (Because Its Time Network) is the mostly IBM mainframe and Digital VMS, mostly 9600 bps leased line, mostly academic and research network that uses the NJE (Network Job Entry) protocols. The size of BITNET is defined by the BITEARN node list, which gazettes hosts for EARN (European Academic and Research Network), GULFNET (Arabian Gulf countries), NetNorth (Canada), BITNET (United States), and other NJE networks.

FidoNet is the mostly DOS, mostly dialup, network of PCs used mainly by hobbyists. It uses FidoNet protocols and its size is defined by the FidoNet node list. *cont'd*

Travelers' Tales . . . . *The Net*

"Nili spoke up. 'I don't understand what you're planning to do. How will you get past their guards? Which complex will you try to enter? ...'

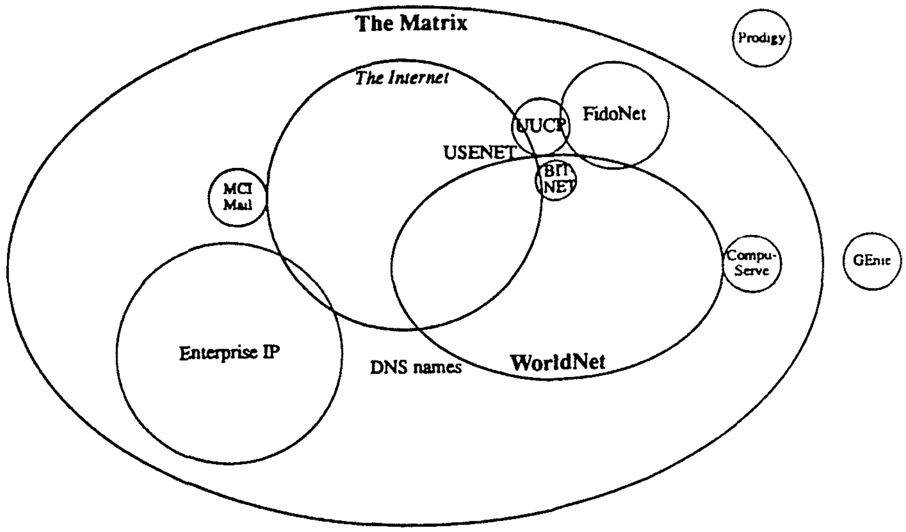
Yod turned to her 'We won't be physically present.... Our attack is purely mental. We use the worldwide Net to travel. All Bases need to communicate with the Net, but all of them -- like our own -- are defended against intruders.'

'Who does the Net belong to?'

cont'd.

cont'd ...

How Big Is The Matrix?



Glossary Cont'd

UUCP (Unix-to-Unix Copy Protocol) is the store-and-forward network of mostly UNIX, mostly dialup machines. The users are a diverse group and the size is partly defined by the UUCP node list.

Each of the four networks described above supports other applications in addition to mail. One application carried across all four of them in USENET (Users Network) news, which provides conferencing services allowing people to post and read messages on numerous machines worldwide. USENET is often referred to as a network, but it isn't really, since there is no USENET transport protocol. USENET news is carried over whatever underlying mechanisms are available on a carrier network.

The Internet has numerous applications that are not provided by these other three networks, including remote login (TELNET), interactive file transfer (FTP), distributed file indexing (archie), remote document indexing (WAIS), remote menu lookup (Gopher), and remote text searching (World Wide Web-WWW).

If you can FTP to is.internic.net, you are on the Internet; if you can't, you're not. If you can send mail to is.internic.net, you are in the Matrix; if you can't you're not. If you are on the Internet, you are in the Matrix. But, remember if you are in the Matrix, you may not be in the Internet.

Adapted, with permission, from "Network Sizes" Matrix News, Vol. 3, No. 8, August 1993

'The Net's a public utility,' Malkah said 'Communities, multis, towns, even individuals subscribe.'

'Your town doesn't subscribe?' Avram asked Nili incredulously.

Nili shrugged. 'We know a lot about some things, less about others. It doesn't seem as if your Net has made you universally wise.'

They were all a little shocked. It was a truism that everyone was on the Net, although a poor child might grow up in the Glop, work for a gang or sell labor to a multi, die of one of the viral plagues that swept the Glop every year, and never once plug in to access the Net. Nili did not partake in what was universally considered the central artifact of contemporary cultures."

From He, She and It by Marge Piercy (Ballantine Books, N.Y., 1991)

THE ENDS OF THE MATRIX

By John S. Quarterman

Where are the geographical ends of the networked world? The question is interesting, partly because the answer keeps changing. Here's a mid-1993 report. If you know more, please let me know.

SOUTH

In 1990 the U.S. Palmer, Siple, and South Pole stations were all connected to the Matrix -- the worldwide web of computer network which exchange electronic mail (E-mail). The stations used a satellite link to a NASA machine in Florida. But the Siple station is usually closed now, making the South Pole station the most southerly networked place in the world, at 90 degrees south. Amundsen-Scott South Pole Station does not have a permanent link and does not use the usual protocols of the four main networks: the Internet, UUCP, FidoNet and BITNET. But E-mail still goes to and from the Matrix.

The "AQ" designation for Antarctica was registered as an Internet address under the Domain Name System (DNS) in March 1992 by the New Zealand Department of Scientific and Industrial Research (DSIR). DSIR has a permanent satellite link to Scott Base on Ross Island. They run IP (Internet Protocol) over that link, and it is routed with the Internet. But apparently it isn't configured for international access; I can't reach it from here. This is apparently because they reserve their bandwidth for scientific voice and data traffic.

However, two kilometers away is the U.S. McMurdo base. McMurdo was first connected to the Internet in about February 1992. Apparently there was some problem with 200 mph winds during the Antarctic winter, but McMurdo has been up solidly since at least December 1992 (Antarctic summer). That's about 78S 166E.

It is rumored that Australia has a link to their Antarctic base (Casey station?) to Hobart, Tasmania, but it is apparently not routed with the rest of the Internet. Other countries are also considering Internet connections from Antarctica, and some may be up already. There are no FidoNet, UUCP, or BITNET sites in Antarctica that I know.

The southernmost networked place *not* in Antarctica appears to be Hobart, Tasmania, which has UUCP, FidoNet, and Internet connections. There is no BITNET in Australia or New Zealand.

NORTH

The northernmost networked place in the world is harder to discover because there are so many contenders.

Most northerly appears to be a node on the NASA Science Network (part of the Internet) in Thule (Qaanaaq), Greenland, at 77 40N 69 0W. There are a few towns farther north than that, in Greenland, on Ellesmere Island, in Svalbard, and in Franz Josef's Land, but they don't seem to be networked.

The second most northerly place on the matrix appears to be a PC clone running the Waffle Protocol on the North Slope of Alaska in Atqasuk: 70 28 10N 157 23 45W. This node is not north of the North Pole, but it is north of North Pole, a town in Alaska. This host is really with the UUCP net, and has the associated Internet domain name, coldbox.cojones.com. It also uses the WWIVnet protocols. According to the owner of coldbox, Atqasuk has 220 Eskimos, 15 Caucasians, and no roads. Other than Atqasuk, the northernmost

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networked place in the United States is apparently Fairbanks, Alaska.

The most northerly Canadian hosts appear to be in the Northwest Territories. The most northerly one is a UUCP node in Rankin Inlet, 62 48 41N 92 6 57W. Next most northerly networked in the Northwest Territories is Yellowknife, with both FidoNet and UUCP, at 62 27 43N 114 26 04W. The most northerly networked Yukon town appears to be Whitehorse, at 60 43N 135 03W, with a FidoNet node and a UUCP node.

Egedsminde, Greenland is a small island south of the larger island of Disko, off the west coast of Greenland at about 68 50N 52 45W: there is a FidoNet node there. The Danes named the town after Hans Egede, a missionary, but the Inuit call it Ausiait. Nuuk is also on FidoNet, at 64 10N 51 35W.

Iceland is farther north, and Kopasker appears to be the most northerly site in Iceland, with both Internet and UUCP connections, at 66 20 30N 16 29 30W. Reykjavik is only a few degrees farther south, and has UUCP, FidoNet, BITNET, and Internet connections, at 64 08 35N 21 57 35W. Other northerly nodes on the matrix include:

Norway -- Tromsoe, with Internet and FidoNet connections, at 69 40N 18 50E. This is also the site of the most northerly networked university in the world.

Sweden -- Malmberget, on FidoNet, at 67 10N 20 40E, followed by Lulea, with FidoNet, UUCP, and Internet connections at 65 35 22N 22 10 00E.

Finland -- Tornio, on FidoNet, at 65 50N 24 12E, followed by Oulu, with Internet, BITNET, and FidoNet connections, at 65 13 00N 25 19 00E.

In Russia, Murmansk doesn't seem to be networked, but Sverodvinsk and Archangelsk are, around 64 34N 39 50E, on FidoNet. Then there is Komi, on UUCP, at 63 33 00N 53 38 00E; Petrozavodsk, Karelia, also on UUCP, at 61 47N 34 20E; Ivanovo, on FidoNet, at 60 32N 36 22E; and eventually St. Petersburg, on most networks, at 59 55N 30 15E.

WEST

Westernmost doesn't mean much on a round planet, but the networked place farthest west in longitude from Greenwich is Hawaii, with Honolulu at more than 157 degrees west. Exactly which town on which island is the westernmost networked is unclear

EAST

Easternmost from Greenwich is Fiji, where the Department of Mathematics of the University of the South Pacific in Suva, at 18 6S 178 30E, has a UUCP link to New Zealand, such as Wellington, which is connected to most networks except BITNET, at 41 17 25S 174 46 07E. Christchurch is also far east, followed by Port-Villa, Vanuatu, on the RIO UUCP network, at 17 44S 168 19E. Then there is Scott Station (NZ), Antarctica, on the Internet; Noumea, New Caledonia, on RIO; and McMurdo Station (US), Antarctica, on the Internet, all between 166 and 167 degrees east.

ENDS

Gold Coast, Queensland, is probably the easternmost networked place in Australia, on FidoNet, at 28 04S 153 25E.

Russia's easternmost networked outpost appears to be Magadan, north of the Sea of Okhotsk, and at the end of the road from the west, with both FidoNet, and UUCP, at 59 34N 150 48E. There appears to be nothing on the Kamchatka Peninsula, or farther east. Sakhalin Island is on the map, with UUCP.

Guam's easternmost networked point is on FidoNet, at 13 29 02N 144 48 23E.

The easternmost networked place in Japan is Kushiro, Hokaido on the Internet, at 42 58N 144 23E. Sapporo follows soon after, with Internet and UUCP connections.

Acknowledgements - Particular thanks to Rick Broadband (north), Bob Faulhaber (south), Eartmut Haberland (north), Bryan Lockwood north), Marty Lyons (south), and Peter Salus (north).

Travelers' Tales . . . . *Cyberspace*

"Case was twenty-four. At twenty-two, he'd been a cowboy, a rustler, one of the best... [H]e'd operated on an almost permanent adrenaline high, a byproduct of youth and proficiency, jacked into a custom cyberspace deck that projected [him] into the matrix... The matrix had its roots in primitive arcade games and military experimentation with cranial jacks... in early graphics programs... Cyberspace. 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 nonspace of the mind, clusters and constellations of data, like city lights receding..."

From Neuromancer by William Gibson (Berkley Publishing, N.Y. 1985)

Travelers' Tales . . . . *The Metaverse*

"Hiro's not actually here at all. He's in a computer generated universe that his computer is drawing onto his goggles and pumping into his earphones. In the lingo, this imaginary place is known as the Metaverse. Hiro spends a lot of time in the Metaverse....

[T]he Street ... is the Broadway, the Champs Elysées of the Metaverse.... It does not really exist. But right now, millions of people are walking up and down it.

The dimensions of the Street are fixed by a protocol, hammered out by the computer-graphics ninja overlords of the Association for Computing Machinery's Global Multimedia Protocol Group.... [But] [d]evelopers can build their own streets feeding off of the main one. They can build buildings, parks, signs, as well as things that do not exist in Reality... vast hovering overhead light shows, special neighborhoods where the rules of three-dimensional spacetime are ignored, and free-combat zones where people can go to hunt and kill each other....

In the real world--planet Earth, Reality--there are somewhere between six and ten billion people.... Perhaps a billion of them have enough money to own a computer [and] maybe a quarter of them actually bother to own computers, and a quarter of these have machines that are powerful enough to handle the Street protocol. That makes for about sixty million people.... Add in another sixty million or so who can't really afford it but go there anyway, by using public machines, or machines owned by their school or their employer... That's why the damn place is so overdeveloped...

[There is] a narrow monorail track running down the middle. The monorail is a free piece of public utility software that enables users to change their location on the Street rapidly and smoothly. A lot of people just ride back and forth on it, looking at the sights.... When Hiro first saw this place, ten years ago, the monorail hadn't been written yet; he and his buddies had to write car and motorcycle software in order to get around. They would take their software out and race it in the black desert of the electronic night."

From Snow Crash by Neal Stephenson (Bantam Books, N.Y., 1992)

LIFE IS BETTER ON THE NET ... OH REALLY? By John Perry Barlow

Net.Plus	Net.Minus
1. It allows you to meet interesting people from all over the world.	
Did you ever have a pen pal when you were a kid? Now you can have thousands of them.	Imagine the hit your productivity will take as you try to maintain an active correspondence with all of these disembodied souls.
2. No matter where your body may be, your mind can always be found online.	
Your physical self is a frenetically moving target. No one can get you on the phone anymore. But they can always send you e-mail.	Maybe you'd like to disappear for a little bit. Maybe you don't want the world tugging at your sleeve.
3. You can commute to work at the speed of light, earning big dollars at home.	
Why spend a couple of hours every day driving to and from your terminal. Put a terminal in the rumpus room and stay home.	Imagine how it feels to get through an entire day at work without ever getting dressed. Isn't the life of a Knowledge Worker bleak enough already?
4. It provides access to all the world's written knowledge with a few keystrokes.	
Thanks to Net-roaming "agents," burgeoning ftp archives, and vast commercial databases, it is now possible to retrieve any material that can be stored electronically.	It might take quite a few keystrokes. The interfaces are savage. Keyword searches give you too little or way too much. Cyberspace is an infinite bramble of white noise.
5. You can conduct passionate long-distance love affairs in e-mail.	
The art of the *billet doux* has been in steep decline since the invention of the telephone. Bodice-bursting correspondence is making a major come-back. Talk about safe sex.	Love is about bodies. In their absence, imagination fills in the blanks, usually incorrectly. Without emotional inertia, obsessive relationships are inevitable.
6. The Net eliminates such barriers as race, gender, attractiveness, or social grace.	
Many social ills arise from perceptions of difference based on physical characteristics. In cyberspace, everyone's body is the same - nobody has one.	Difference is not the only thing we communicate with our bodies. Words alone, without body language or physically conveyed cultural information, are often wildly misleading.
7. It helps keep you and your teen-age kids off the streets.	
While you might otherwise be wasting your time out looking for trouble, online interaction can satisfy many of these impulses at home.	Here, at worst, you're likely to have some well-understood interaction with Officer O'Reilly. Online you can find yourself in trouble with the Secret Service, NSA, and FBI.
8. It's interactive and therefore less addictive than television.	
Television happens to you. In the online environment, you are happening too. You can do a lot more exploring with a keyboard than a TV clicker.	What - sunrise already? "Connection addiction" is common, if poorly understood. Some of the afflicted log is as many as 70 hours a week.
9. You'll rediscover the community lacking in your physical world.	
Virtual communities are springing up all over cyberspace. They provide their "residents" a sense of belonging and human connection.	As Bruce Sterling says, "It ain't no Amish barn raising in there...." A virtual community is like highly processed food. Critical nutrients are missing.
10. No matter how obscure your interests, you can always find someone who wants to talk.	
There's an online conference for everyone, ranging from, say, the global participants in alt.sex.bondage to Latter Day Saints comparing notes on genealogy.	And talk. And talk. And talk. Many conferences generate a megabyte of new commentary each week. The only way to separate signal from noise is to read it all.
11. Terabytes of software are available online, either free or dirt cheap.	
Bulletin boards, commercial online services, and Internet ftp archives bulge with freeware and shareware programs, some of which are as good as the commercial equivalent.	You get what you pay for. And the connect times fees for downloading "free" software can be steep. And much of it, written by beginners, is toxic with weird code. Or viruses.

John Perry Barlow is the co-founder of the Electronic Frontier Foundation (EFF). His article is reprinted, with permission, from the May/June 1993 issue of Wired magazine, 544 Second St., San Francisco, CA 94107; Fax: 415-904-0669; Voice: 415-904-0660. E-mail: subscriptions @ wired.com

GLOBAL TELEPHONE NUMBERING PLANS - FROM GEOGRAPHY TO SERVICES

By Stewart Fist

With the possible exception of minting a new currency, few changes are likely to disrupt a nation's social and economic fabric so much as launching a different telephone numbering plan. Each particular number change may be only a moth-hole sized annoyance but they come in plague proportions.

Many countries nevertheless are facing the prospect of new national numbering plans. And changes are also on the horizon internationally. By the decade's end, the current system of International Direct Dialing (IDD) for country codes -- "44" for the U.K., "61" for Australia and so on -- may not connect callers to many of the world's telephones.

There are various reasons:

- **Non-geographical Services.** New radio based services are making some forms of numbering identification quite independent from geographically-based wireline services. Digital phones based on the GSM (Global System for Mobile communications) have already been designed to 'roam' across national borders in Europe. LEO (Low Earth Orbiting) satellite phone systems will extend their reach globally.

- **Trans-national Services.** New telephone services are being designed for organizations and corporations which operate on a regional basis. These services need to be recognized at the global or regional level in a numbering plan rather than solely at the national level.

- **Intelligent Network Services.** Call-diversion and 'follow-me' services have begun to migrate from the company switchboard to national networks. Soon they may be available on a global level via the proposed Universal Personal Telecommunications (UPT) service -- a one number one person scheme. A user's UPT number is completely divorced from the geographically based number of his or her local residence.

- **Political Changes.** Finally, the break-up of the Soviet Republic and the disintegration of many of the states in Eastern Europe has put pressure on the global numbering plan for the release of new country codes.

Background

To understand the stresses on the current global numbering plan and the options for tomorrow, some background is helpful. The current regional or zone system for telephone country codes dates from 1964. The codes adopted then were based on early 1960's projections of telephone population densities and population growth. The numbering plan also assumed a reasonably stable political and technological world.

But "these assumptions are no longer valid," notes Dr. Theodore Irmer, the Director of the U.N. telephone standards body which overseas global numbering plans. "We face increasing problems in allocating international country codes. [And] we

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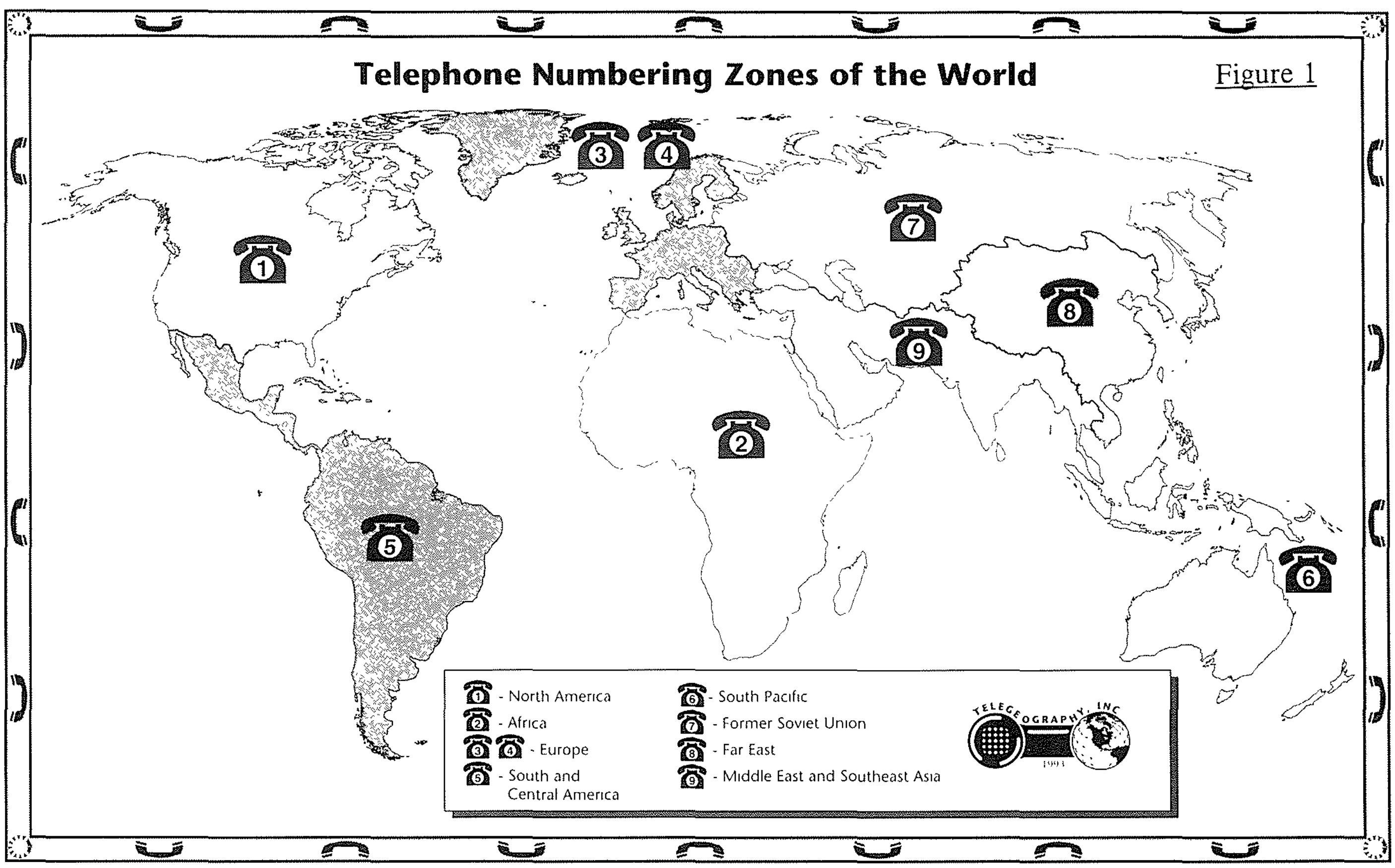
shouldn't underestimate the high political importance that countries attribute to their international code. For them, it's a symbol of their independence and self-confidence."

These changes to the old world order are revitalizing activity in the Telecommunications Standards Section (TSS) of the International Telecommunication Union (ITU) which Dr. Irmer heads. Formerly known as the CCITT (International Telegraph and Telephone Consultative Committee), the Geneva based TSS has allocated telephone numbering issues for the next generation of phones and services to Study Group 2 (SG-2). It is this obscure technical committee which will be the battleground during the 1990s for the world's future telephone codes.

CCITT Recommendations

The current 1964 international numbering plan for the world reflects a CCITT Recommendation known as E.164, itself an update of an older scheme, known as E.163. The foundation of these schemes is a 'country code' (one to three digits long) followed by a national number which is set by the country's telephone authorities.

The style of the country code varies from continent to continent. But essentially it consists of a single-digit World-Zone code followed by a one or two digit national identifier. In North America, however, the Zone Code is followed directly by regional area codes which have no national significance. See Figure 1. (A global map of



dialing codes for countries and capital cities appears in the *TeleGeography Blue Pages* at the back of this report.)

There are also quite separate numbering plans currently in use for non-voice services. For example, CCITT Recommendation F.69 is the calling code standard for telex. Recommendation X.121 is used for international data (mainly X.25 packet-switching); it consists of a four digit Data Network Identification Code (DNIC) followed by a Network Terminal Number (NTN) which doesn't have any geographical significance.

SG-2 is attempting to prepare a general set of numbering principles so that data networks could use either X.121 or E.164. As yet, however, there is no consensus on how best to do this.

Network Intelligence

One thing on which Study Group 2's members do agree is that E.164 must lose some of its geographical rigidity. The technical ground work for change has been laid over the last two decades by the progressive introduction of network intelligence. In 1964, the world's telephone system, especially at the international level, was largely bound by hard-wired mechanical switching. A strict numbering hierarchy thus was generally required to pass a call from geographic zones to countries, regions and local exchanges.

Today, however, international exchanges can call upon all the flexibility and customization possibilities provided by computerization and software control. With common channel signaling systems, such as SS7, a switch can search an internal 'look-up' table to determine the routing for a particular numbering scheme. Thus, each country (or carrier) can be identified as a single entity, not subject to hierarchical (regional or zone) switching. These technological changes have made possible the first major departure from the current global numbering plan.

Until now, as noted above, country codes have been strictly allocated to World Zones with the same numerical prefix. For example, any country code beginning with a "3" or "4" is in Europe. See Figure 1. Those headed by a "5" are in Central and South America; a "6" indicates the Oceanic and Australian region.

"Most people aren't even aware that this zone differentiation exists," says Paul Reptis, an engineer with Telstra, Australia's international carrier. "They will know the country code. But they won't appreciate the regional significance of this code." A future recommendation from SG-2 will be to abandon this unnecessary zonal rigidity and, in the process, a large number of new 'country codes' will be made available for future use.

Problems arise, of course, in attempting to 'retro-fit' the world's telephone networks with new numbering plans. Unless the nations concerned all benefit, some countries will be loath to make a change. Moreover, changing international country codes is a costly and complex business.

Historically, this antipathy to change has been most troublesome for the technology leaders. In North America, for instance, Zone 1 telephone codes are limited to the U.S., Canada and miscellaneous Caribbean nations. Further, the zone has been divided up with little geographic or national significance and the zone code "1" is not incorporated in the three digit sub-regional code, thus increasing the length of the international dialing codes for callers from other zones.

For example, the Zone+Area Code for Minneapolis, Minnesota, is "1-612" while to reach Ottawa, Canada it is "1-613". There is no country-code separation here at all -- just a zone + area code. The Caribbean is even more confusing; the "1-809" sequence is shared by both Jamaica and Puerto Rico, while "1-808" will get you Hawaii. As a consequence, the caller often has no indication of distance or geographical proximity from the North American Numbering Plan (NANP).

Ex U.S.S.R. Telephone Codes Figure 2

Except for the remnants of the ex-Soviet Union, where numbering chaos still reigns (See Figure 2), the rest of the world has followed a pattern of using either two- or three-digits to identify the country (which includes a single zone-identification digit at the head). Europe is subdivided into two zones. But, again, this was done in an *ad hoc* fashion over time, with no geographical significance.

Who Controls National Numbering Plans?

Under the existing CCITT Recommendations, each country is responsible for the allocation of national codes within its own borders and some zones have their own numbering groups. Generally, these groups are dominated by the old monopoly telephone companies which has made numbering a key issue in the battle between old and new telephone carriers. Especially when the older carrier owns and produces local telephone directories, control over national telephone numbering plans can be a useful weapon indeed.

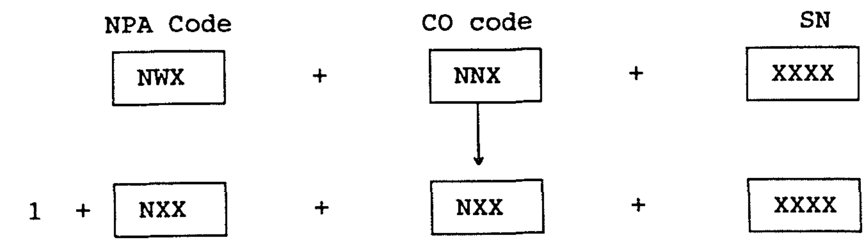
In Australia, for instance, Australian Telecom has allocated to itself large blocks of easy-to-remember numbers. The 018 service prefix, which identifies all analogue cellular phone services, now has an inquiry number of 018 018 018 for Telecom's own MobileNet service, which their competitors claim provides MobileNet with considerable advantage.

In the U.S., Bellcore, once part of AT&T and now owned by the seven Regional Bell Operating Companies (RBOCs), has long had responsibility for administering the North American Numbering Plan (NANP) for Zone 1. See Figure 3. In recent years this has led to a vigorous fight between MCI, Sprint and the RBOCs over Bellcore's alleged favoritism. "It's a question of ... control", says Peter Guggina,

Figure 3

The Future of The North American Numbering Plan (NANP)

Telephone numbers in the North American Numbering Plan (NANP) generally consist of 10 digits in the format NWX-NXX-XXXX, where X is any digit 0-9; N is any digit 2-9; and W is 0 or 1. The first three digits are referred to as the Numbering Plan Area (NPA) or area code. The next three digits are the central office code (COC). And the last four digits are the station number.



Key: N = 2 to 9 NPA = Numbering plan area
W = 0 or 1 SN = Station or Subscriber number
X = 0 to 9 CO = Central Office

The NANP is running out of numbers. Hence, in 1995, interchangeable NPAs will be introduced using the NXX format. This will increase the number of available NPAs by 640, representing a fivefold increase in numbering resources. (There are 160 numbers (8x2x10) in the format NWX. By going from NWX to NXX, the number of potential NPAs is increased from 160 to 800 (8x10x10). After subtracting the eight N11 abbreviated dialing codes -- see below -- the number of available NPAs is increased from 152 to 792.)

The post-1995 numbering plan in North America will thus be organized as follows:

N00 Codes		N11 Codes (short codes)		Other NPA Codes	
200	Unallocated	211	Unallocated	N0X N1X N2X N3X	For geographical based services; mainly public telephony but also paging, cellular mobile, premium rate.
300	Unallocated	311	Unallocated	N4X N5X N6X N7X	Reserved for both geographic and non-geographic services. Also one set of 80 NPA codes reserved for expansion of NANP to 11 digits.
400	Unallocated	411	Directory Information	N8X N9X	For non-geographic services; e.g. mobile, satellite, Universal Personal Telecommunications (UPT).
500	Personal Communications Services	511	Unallocated		
600	Non geographical services in Canada	611	Repair service		
700	Carrier specific services	711	Unallocated		
800	Freephone	811	Local business office		
900	Information services	911	Emergency services		

Key: NANP = North American Numbering Plan NPA = Numbering Plan Area
N = 2 to 9 X = 0 to 9

Source: FCC and BellCore

the Director of Technical Standards Management for MCI. "We believe the numbering administrator should maintain a neutral posture; Bellcore shouldn't be free to apply their own judgement, or control issues, when there is a lack of consensus. Simply put - an administrator cannot be owned by any entity that has a vested interest in the administration of numbering resources."

The conflicts between the RBOCs and other U.S. carriers are likely to sharpen in the months ahead as competition for mobile services intensifies. (AT&T's $12.6 billion acquisition of McCaw Communications is a case in point.) Significantly, in August 1993, the U.S. Federal Communications Commission (FCC) asked Bellcore to halt the assignment of "500" number area codes for Personal Communication Services (PCS) pending further public comments. Shortly thereafter, Bellcore's CEO, George H. Heilmeier, surprised many observers by advising the FCC that Bellcore would relinquish its historic role as the NANP Administrator. Heilmeier urged the FCC to find a successor quickly. Alternatives suggested include the National Telecommunications Information Administration (NTIA) in the U.S. Department of Commerce as well as various government-industry councils.

The European Commission (EC) is also attempting to play a role in regional numbering issues. It has already taken steps to harmonize access and emergency codes across Europe. Further, the EC has tentatively decided to set up a European Numbering Office (ENO) to supervise the region. An EC draft Directive on Open Network Provision (ONP) says that, as a first step, control of national numbering plans should pass from the monopoly Post Telegraph and Telephone (PTT) administrations to national regulatory authorities.

First Come, First Served

The general pattern of number allocation based on World Zones may appear to be logical. Yet, it hasn't always worked well in the past. In general, the countries that developed international telecommunications facilities early and had the greater populations quickly took the two-digit country codes within their zone. Later, as it became obvious that more than ten country-codes would be needed in each zone, the few remaining unallocated proposed two-digit codes were reserved for three-digit use. This was very much a stop-gap measure.

Thus, France and Spain ("33" and "34") were early IDD users in Europe's Zone 3, while "35" was eventually reserved and subdivided into Portugal ("351"), Ireland ("353"), Malta ("356") and Finland ("358"). This practice has been widely followed in most world zones (except, of course Zone 1). However, with the break-up of Eastern Europe, the few remaining two-digit codes weren't enough for all the new countries that have emerged.

Fortunately, the unification of Germany released the old East German ("37") country code for subdivision and reallocation. A similar process will also be followed with the fragmentation of the old Yugoslavian "38" codes, into "38x" for Croatia, "38y" for Serbia, and, possibly "38z" for Bosnia Hertzegovnia, if it still exists.

The Far East developed international telephone connections at a stage when it was already apparent that three digit codes were essential and so these were allocated in Zone 8 from an early stage. As a consequence, there are still forty 'country-codes' available in this region. This has permitted the existing plan to be extended beyond its original strictly geographical use, as discussed below.

From Country Codes to Service Codes

Because the old telephone zone system currently has little value for major carriers, and because it has little practical significance for telephone users, why not abandon it altogether? After all, the system was always inefficient; some zones obviously had too few numbers to allocate (without forcing major revisions to the existing codes), while others had more than they could use.

"The pressure on country codes is not coming from countries, although it may appear to be that, with the break up of Yugoslavia and other Eastern European countries," says AT&T's Robert Madden. "This is just an aberration which is noticeable at this time. The real demand being placed on country codes is for service-identification rather than country-identification."

"The only 'service' to which country-codes are now allocated is the Inmarsat ship-to-shore satellite telephony services," explains Paul Reptis. "But it is a sort-of geographic code; you've got to find out where the ship is -- which ocean it is in."

Inmarsat was given four Far Eastern (Zone 8) codes. The "871" number addresses the East Atlantic; "874" is for Atlantic West; and "872" and "873" are for the Pacific and Indian Oceans respectively. Further allocations will later be used to split both the Pacific and the Indian oceans into twin zones as well.

Inmarsat's minor divergence from the old zone system is now being extended further by a current proposal for regional and global freephone numbering. The idea is to use the Far East series from "800" to "809" for an International Numbering Scheme (INS). (Don't confuse your INS's! The same acronym is used for both the International Numbering Scheme and Intelligent Network Services; one depends on the other.)

David Lewin of London consultancy, Ovum, points out that phone number sequences serve purposes other than just dialling. They are also important to give the customer an indication of distance, time-differences, costs, and the type of service they are accessing. These functions need to be considered when designing number systems. The widespread use of the code "800" (or something similar) for freephones is a case in point; geography isn't the only factor to be taken into account. See Figure 4.

The International Numbering Scheme proposal backed by Lewin and a group of European numbering experts would make "800" into a global freephone service prefix, with free connection for the customer from any part of the world. This would be important to those who "leave home without their American Express" card or have it stolen. Not coincidentally, it would also foster global access to the "Country Direct" and "Country Beyond" calling plans of major carriers.

It may be fortuitous, therefore, that this "80x" number series has remained vacant in the Far East allocation plan. To provide for a slightly more geographically-restricted range -- ideal, say for Car Rental firms, and the like -- the INS proposal suggests that the codes "801" to "809" would be available for freephones within existing World Zones, using the standard zone code as the third digit. These prefixes would be used for premium rate services and directory inquiries also.

Under the foregoing plan, "803" and "804" would thus be available for pan-European use. This would enable EC wide businesses to advertise a singe "803 xxx xxxx" number in all these countries. These pan-'zone' numbers would exist in parallel to existing national numbers for the same services. The "801" series would become a pan-North American sequence, and the "809" freephone or directory numbers wold be used by pan-Middle East services or corporations.

Not everyone is convinced Lewin's approach is a good idea, however. "[It] is the thin edge of the wedge. If the Study Group agrees to this proposal, where do we stop?" asks one member of SG-2. "The answer is that you can't. Which suggest that there will always be a shortage of country codes in the foreseeable future."

Personal Phone Numbers

A further demand for more international codes will come from personal communications, often loosely described as Universal Personal Telecommunications (UPT). The term UPT seems to cover every concept from being branded-at-birth with a telephone number to plans for globally-extended hardware-based cellular networks using pocket communicators. CCITT Recommendation E.168, a recent update to E.164, calls for the reservation of one 'country-code' as a global service identifier for UPT. And this is the most likely course to be followed. When calls are placed to a personal number, the network will route them to wherever that person happens to be by using an internal network database. This database must be checked whenever a caller dials a

Figure 4

The Information In A Telephone Number

- Distance: Through the use of readily identifiable zone, country and area-codes the calling party has some appreciation of the distance and likely cost associated with any given call.

- Choice of Service: Number prefixes at a national level, such as "800" in the U.S., tell the caller that this is a "free" (receiver paid) service. However there is no universal standard for these access identifiers; other prefixes are used in other countries. User groups have therefore called for harmonization of the various prefixes needed for access codes to premium services ("900" in the U.S.), international directory services assistance, and for emergency services. Access codes are also used to carry other embedded information. For instance, recorded information services may be split between those suitable for general-family ("0891" in the U.K.) and adult-only ("0898" in the U.K.; "976" in the U.S.).

- Choice of Carrier: Sometimes numbers do identify a carrier network. In the U.K., the "0500" prefix is used to select a destination on the Mercury network.

- Choice of Terminal: Numbers can be used to identify mobile and satellite phones, telex machines, etc. In the case of mobile terminals, these numbers also often carry the implication that any unanticipated costs (due to distance) will be absorbed by the receiver, rather than the originator of the call.

- Service Quality: Some carriers use a special access code for higher quality lines, such as those used for international facsimile transmission. However, in the future, users may be able to select from a range of different service qualities for voice as well as data services. For instance, an access code could enable users to chose a 4 or 8 kbit/s international voice circuit at a cut-rate, and suffer the slight loss of quality over the standard 64 kbit/s circuit.

- Called Party Identification: The Universal Personal Telecommunication (UPT) number scheme is aimed at assigning one number per person, irrespective of location or the subscriber's business or private life. Directory listings for wire-line numbers, however, generally let the caller know whether she is ringing a residence or a business and hence the social role of the person being called. UPT may change all that.

S.F.

UPT number because the network needs to translate the dialed number into a real number.

Because UPT will be starting from ground zero with no pre-existing applications, the idea of having a single universal prefix throughout the world carries obvious advantages -- especially since the UPT number will have no geographical significance.

According to AT&T's Madden, the UPT recommendations "are now coming into the final stages of development, and there are early trial applications -- precursors of UPT. But ... the viability of the idea depends on the customers. Will there be a strong market for these kinds of services? Early indications say, 'Yes' there is a market for it, and the optimists say that ultimately all numbers will be personal numbers." But, says Madden, "it won't happen in my lifetime!"

UPT and Number Portability

The UPT concept concentrates on mobility -- the ability to have people call you anywhere at any time, plus the ability to call out from anywhere and have the cost of the call billed to a standard account.

One example of this service is AT&T's $7 a month EasyReach "700" number. It is advertised as a 'lifetime telephone number'. No matter where you are in the U.S., your long-distance calls, through AT&T, will follow you. (The AT&T access code must be dialed before the "700" number.)

EasyReach gives its subscribers the ability to re-program their particular directory-reference through a Touch-tone phone using a PIN (Personal Identification Number) security code to divert calls. Users can also filter calls by giving callers a special PIN-number.

Number portability is a quite different concept. 'Portability' here means something less transient than mobility; it is the ability to maintain the same number if you change carriers, or shift to a new home, or even change countries. As discussed above, in most networks, numbers are still largely geographical and they contain carrier-required information which determines whether the charging is to be local, long-distance or international. Intelligent Networks can overcome this problem but only at the cost of complexity. Hence, because number portability implies a loss of carrier and geographical identification, many technical hurdles must be overcome before portability can be implemented.

Likewise, because UPT services personalize fixed networks (they rent people a number rather than a phone line) they also raise large technical hurdles. The network must be able to immediately recognize that a UPT call requires intelligent processing and route the signal to the appropriate database which holds the user-profile data. (Ideally, this database will need to be a shared national facility, independent of any of the national carriers.) The signal is then returned to the exchange from which it originated so that the call can be set up.

Number portability, UPT and other new services (e.g., virtual private network offerings) thus are all heavily dependent on the database and processing power of intelligent networks. This has created a paradox; network intelligence provides many of the answers but at the same time it also creates new and more complex demands. For as switching becomes wholly computerized, it creates an open invitation for network developers to 'push the envelop' of numbering possibilities beyond geography.

Conclusion

The international telephone network has been described as the world's largest machine. This metaphor underscores the interworking of the network's many parts and it is what makes telecommunications so standards-driven. As voice, text and video services are integrated in the 1990s, the size of this machine will double and then possibly quadruple over the rest of the decade. A further doubling of network terminals may occur as we progressively break away from wireline delivery, allowing mobile radio and satellite connections across borders and continents.

Figure 5

Dialing Past The Receptionist

What's been left out of the numbering debate?

The debate over new telephone numbering plans seems to have overlooked the possibility for using standard codes to reach an extension line within an office or a designated terminal (e.g., fax rather than phone). Yet, agreed international standards for extension service dialing could be a boon to users; it might also make more efficient use of existing access lines.

With many large companies, users can already direct-dial the main switchboard and be connected to an extension or direct-dial the extension itself. This is possible because the carrier treats the company switch as if it were a sub-exchange and allocates to it a range of numbers (usually the last two or three digits of the main number) for extensions. Some call-diversion facilities and voice-mail systems will then allow one to dial an extra digit to divert a call to a mail-box, a secretary or back to the switchboard.

ISDN (Integrated Services Digital Network) offerings in some countries have a similar extension dialing capability. With a basic-rate ISDN plan for homes or small businesses, eight numbers can be allocated to each service. The last digit in the series is then used by a network termination box (at the customer's premises) to divert an incoming call to one of eight extensions.

But what is needed for normal telephone services is a standardized set of post-dial suffixes which any caller knows. The caller shouldn't need to consult a special directory or know the extension digits from past calls.

A telephone call could then be picked-up instantly by a small intelligent switch (before the bell is rung) at the customer's premises. The switch would interpret any further dial tones as commands to connect a designated extension. If no further dial tones are received in, say, two seconds, the switch would ring the bell and revert to normal phone operations.

It has been suggested that the standardized set of suffixes should be:

-- Nos. 1 to 4 for extension phones, in a hierarchical order of importance. (In a small business, Ext. 1 would be the manager; at home it might be the family-room phone). As an alternative, these numbers could be used to generate distinct ringing tones which identify which person is being called.

-- No. 5 - reserved for user-nominated devices and two-digit suffixes.

-- No. 6 - reserved for home/security control systems (with two-digit suffixes).

-- No. 7 - for direct connection to a computer or local area network.

-- No. 8 - for direct connection to an audio/data recording device.

-- No. 9 - for direct connection to a facsimile machine.

-- No. 0 - used to recall the switch board in larger businesses and to cancel previous suffix dialing in small businesses.

The foregoing numbering proposals are not considered by the main telephone standards body to be part of network dialing. This leaves them in limbo. An international forum with a greater emphasis on customer requirements might see things differently.

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All of this makes having a fool-proof, international way of addressing the myriad communications terminals in the world -- from smart card operated mobile terminals to company laser printers to the home phone -- many times more complex. The proliferation of communications terminals also makes solving the numbering problem ever more urgent.

The current global numbering standards (E.163, E.164 and E.168) were devised by monopoly national carriers and implemented through simple bilateral connection agreements. Fortunately, most national-boundary changes have been accommodated by this early numbering structure. But service competition is now putting more pressure on numbering authorities. So too is the recent expansion of regional carriers into trans-national telecommunications corporations, with a mix of international virtual network services.

To date, solutions to these numbering problems have largely been seen from the technical and/or marketing perspectives of carriers. Customers interests have primarily been considered only when new or more profitable services can be provided (e.g., pay-per-call offerings). As the impact of the number debates rises, however, perhaps, it is time for a change.

What appears to be needed in the numbering field, as with many other standards matters, is a consumer body capable of grappling with these deeply technical issues and able to state the consumer interests with conviction.

One place to start might be electronic directory services. They are an integral part of numbering. They provide alternatives to numbering portability problems and can be the source of messaging and call-forwarding information. Yet, major carriers have been reluctant to provide cheap, accurate electronic directory services because paper directories are such a highly profitable "milch-cow".

Consumer input is also needed regarding plans for UPT. The one person-one number UPT approach depends on intelligent network databases as well. And it raises the problem of whether to assign numbers to people in their personal or business/employment capacity. This decision has important social as well as economic consequences. If separate numbers are used to identify people in their separate roles (as parent or manager or girlfriend), then we will need many more numbers than are now available. And better directory services to sort through them.

At root, however, the major problem with new numbering plans is not technological but social. Technologies may change overnight and can be introduced to a network in months or years. But it takes decades to implement number changes at the pace that the society can absorb.

The cost of even incremental changes (a new city or regional code) can be enormous, as London and Tokyo have recently learned. Hence, it is probably safe to say that the steady shift away from geographically-based numbering plans is likely to be a painful and contentious process for years to come. It is essential that users be involved.

- END -

For Further Reading:

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Automated Call-Back Services: An Update

by Daniel Briere and Mark Lagner

Since the U.S. long distance telecommunications market was opened to competition in the 1970s, resale of telecom services has been a fact of life. Various types of resale offerings have flourished -- facilities-based private line resale, switchless resale, international private line resale, and now, "call back services." All of these resale services try to take advantage of differences in the way carriers price their services for various market segments.

Call back services, for example, generate profit from the disparity in international call prices around the world. The Call back provider offers customers in high-priced countries access to switches in low-cost countries. These switches take a caller's request for an outbound international call originating in a high priced country and provide the caller with a dial tone in the low-cost country.

Who are the main players?

The call back market is becoming crowded. Most call back providers operate out of the U.S. Market leaders include companies such as Viatel and IDT of New York, TeleNational of Omaha, NE, and Telegroup of Fairfield, IA. Each of these companies has their own approach to the market; all except IDT provide some form of value added service capabilities in conjunction with the inexpensive call back arrangement. The number of players in the market will continue to grow rapidly as new providers discover the call back market and established players recruit alternative marketing channels.

What is the technology?

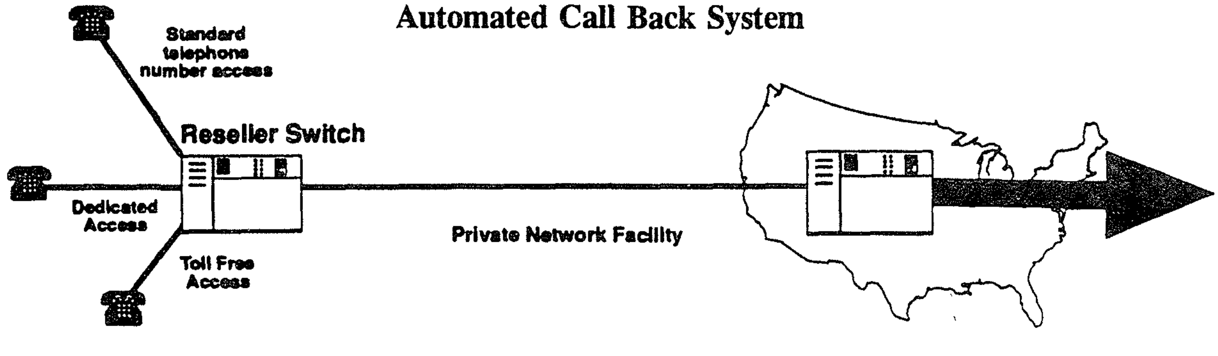
Call back can be provided through any type of switching equipment, including PBXs and central office switches. However, most call back providers use "programmable" switches manufactured by companies such as Summa, Harris or NACT. Such switches have a flexible architecture allowing for the integration of billing and value-added services, e.g., voice mail platforms, which call back providers offer as part of their services. A basic programmable switch costs approximately $45,000; a fully outfitted one may cost $200,000 or more. For individual companies which would like to set up their own call back arrangement, small "black box" systems, provided by companies such as Logotronix, provide the call back capabilities for one or two lines for approximately $1,000.

What will happen in the future?

Resale almost never occurs as planned by carriers or regulators, thanks to the entrepreneurial spirit and staying power of resellers. These companies are adept at looking for the easiest way around obstacles and the next available opportunity in the market. The history of the U.S. market suggests that resellers do not easily go away.

Some governments and carriers have tried to stop call back resale by making it illegal. Call back providers have not responded by going out of business; they have concentrated their energies on working around the language of the law and new service platforms. Some hide behind "value added" services; others alter the product slightly so the definition used in the laws no longer specifically applies. The bottom line is that call back will not go away because a particular carrier or government wishes it so; the business will only wind down when the conditions which created the profitable call arbitrage -- high international accounting and

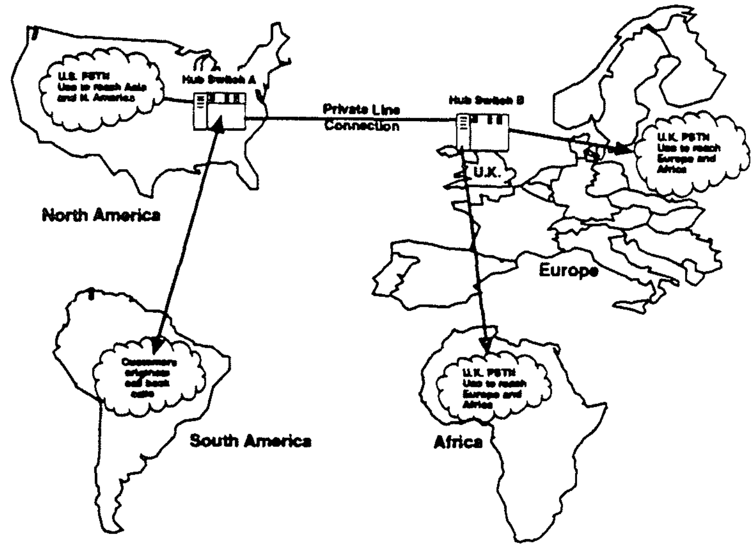
Automated Call Back System



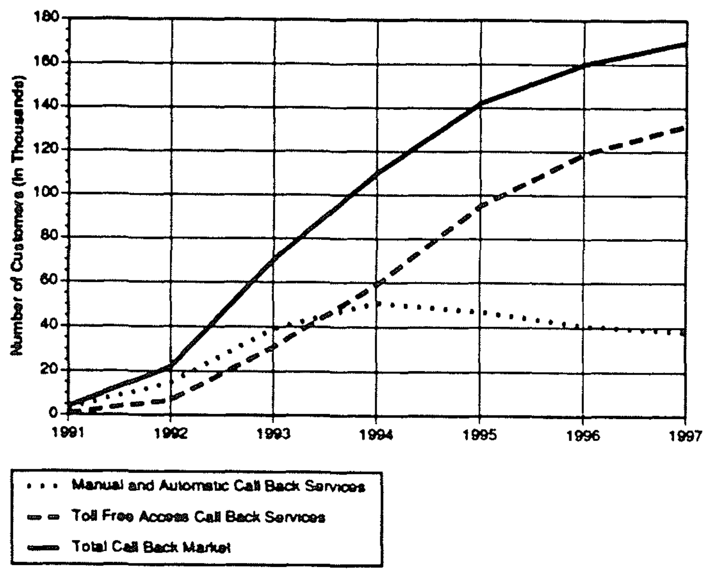
Customer accesses private line network. Customer is provided with U.S. dial tone and places calls as if in the U.S.

collection rates and dissatisfied local customers -- begin to disappear.

The fact that so many customers are willing to move so quickly to totally unknown providers should be a shock to carriers. Based on an internal study, one South American carrier has made estimates that more than 5% of its international voice traffic will be carried by resellers by the end of 1993. The primary reason: The huge discounts offered by the competing services.



Using hubbing in a call back arrangement.



Estimated average account size: 1992: $2,000; 1993: $3,700; 1994: $5,000

Even at low rates, the profit margins can be substantial. The next big profit booster for the call back providers will be when international toll-free ("1-800") rates drop to the same range for outbound IDD rates. As this occurs in the U.S., there will be even more room for resellers to lower rates in response to competitive challenges by foreign carriers.

Is there no end to the price competition? Yes, but only when prices approach costs. The problem for most countries where call back is common is that they do not want to lower their rates. The result will be that calling streams will be diverted to resale, and if not call back, then something else. Resellers in the U.S. have proven that "where there is a will, there is a way" -- a phrase which nicely captures the attitude of most call back entrepreneurs.

Adapted from the TeleChoice Report on International Call Back Services by Daniel Briere and Mark Langner. For additional information contact: TeleChoice, Inc., 15 Bloomfield Ave., Suite 3, Verona, NJ 07044, Voice: (201) 239-0700; Fax: (201) 239-4443.

Satellite Phones and Cross-Border Cellular Service: New Challenges For Incumbent Carriers

by Rob Frieden

Mobile communications is one of the largest new markets for incumbent telecommunication carriers as well as their competitors. The global base of cellular radio subscribers is fast approaching 30 million; it was already 23 million in January 1993, up 43% from January 1992. Moreover, cellular telephony is becoming as important in developing countries as in industrialized ones, with nations such as Thailand and the Philippines having higher ratios of wireless to wireline phones than many OECD countries.

As the base of wireless subscribers mounts, some industry observers have begun to predict that the distinction between fixed and mobile communications will begin to disappear in the mid-1990s. Well over 90% of cellular radio calls today originate or terminate on the wireline network. End-to-end wireless calls -- cellular handset to cellular handset -- are still the exception. International cellular service (cross-border roaming aside) is even rarer, with the only large scale service now available through Inmarsat's global satellite system. See Figure 1.

Over the next decade, however, this situation could change significantly. A range of new trans-national mobile services will come on line and a growing volume of traffic will be routed outside the wireline Public Switched Telephone Network ("PSTN").

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These new wireless services will "by-pass" traditional facilities and toll revenue division arrangements by using terrestrial and satellite systems as well as new interconnection arrangements between and among wireline and wireless systems. AT&T's recent $12.6 billion offer to acquire McCaw Communications, Inc., the largest U.S. cellular telephone carrier, evidences the stakes involved and the desire of wireline carriers to vie for the wireless market.

Incumbent carriers are reacting with a mix of fear and skepticism. There is fear that insurgent mobile telecommunication carriers will be able to migrate traffic and revenue to their own networks. Yet, there is skepticism that these "by-passers" will be able to carry large enough volumes of predominately wireless traffic at a cost which is significantly below that of the terrestrial network.

The remainder of this article looks briefly at: (a) current proposals for end-to-end international mobile services; and (b) the ways in which mobile carriers will likely settle accounts between themselves and with terrestrial carriers. A concluding section comments on the impact that cross-border mobile service arrangements may have on the traditional interconnection and settlement practices of terrestrial carriers.

A New Service Paradigm For Mobile Communications

Since its inception in the early 1980s, most wireline carriers have provided cellular radio service as an adjunct to their existing services. Although cellular radio required a network of new base station facilities, the core infrastructure was already in place, because the vast majority of traffic either originated or terminated on wireline facilities.

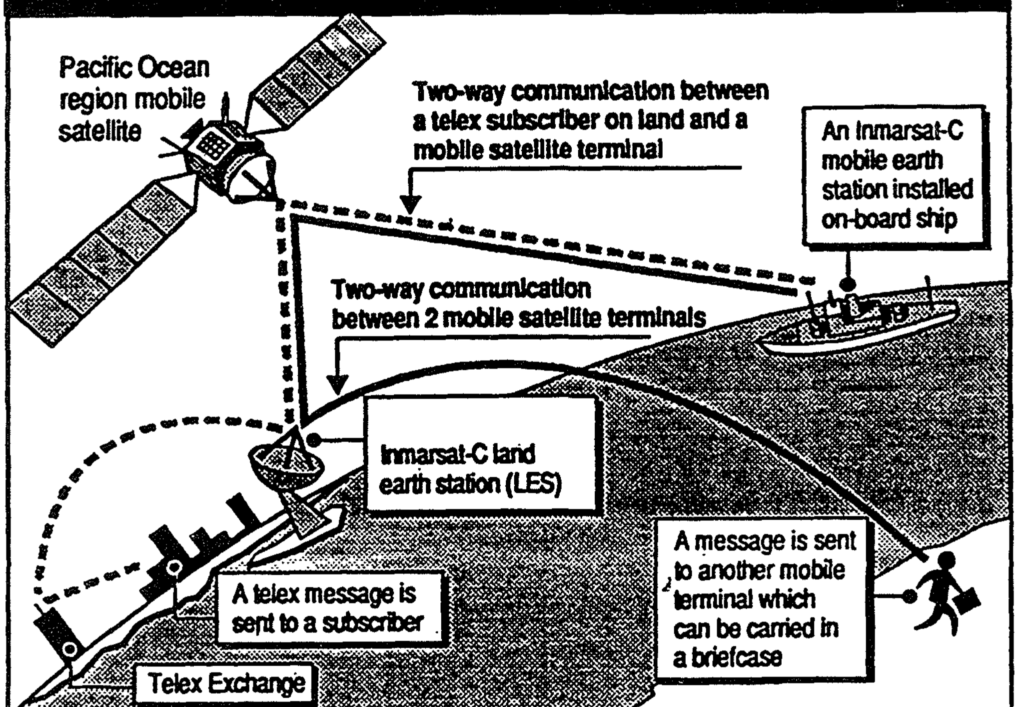
Until recently, therefore, most wireline carriers saw mobile radio primarily as a secondary transmission vehicle. It would add, not subtract, traffic from the wireline PSTN, which was the core facility. This meant that because terrestrial carriers continued to own "bottleneck" wireline distribution facilities, they could negotiate access terms with the mobile services industry from a position of strength.

Consumers had a similarly limited view of cellular telephony. For most, the service was simply a convenience -- a way to avoid pay phones and to avoid "dead time" when driving to and from work or making service calls. The average subscriber did not think in terms of bypassing the conventional telephone network or using mobile facilities to avoid long distance toll charges. (Indeed, there is substantial evidence that, even in competitive markets such as the U.S., most cellular subscribers don't even know the identity of their long distance carrier). Mobile radio fundamentally was a local service, limited by the range of transmitters, operating on a few channels and without broad geographical coverage.

This comfortable world is now changing nationally and internationally. In Europe and North America, continent-wide cellular radio systems will soon

Figure 1

Inmarsat's Current Mobile Satellite Service



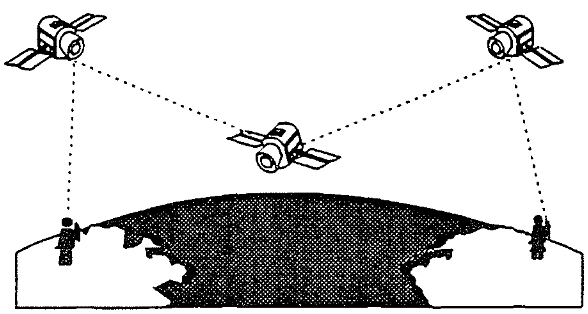
Source: Adapted From Singapore Telecom

Figure 2

How Satellite Phone Calls May Be Routed

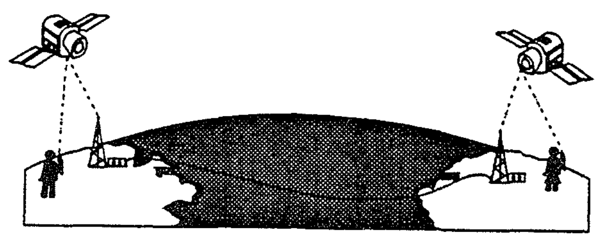
Motorola's Original Iridium Plan

A fleet of sophisticated satellites in low-Earth orbit pick up mobile phone calls from anywhere on Earth and could relay them from satellite to satellite, bypassing long-distance companies.



Competing Satellite Plans

The satellites' only role is to link mobile phones to regional ground stations. Calls are switched and routed between ground stations over long distance phone lines. Far fewer satellites are needed, especially if unpopulated areas and oceans are not covered, and the satellites can be much simpler in design.



SOURCE: *Office of Technology Assessment, 1993, based on Motorola, Loral, from The New York Times, August 26, 1992, p. D5.*

become a reality. It appears that the level of demand and entrepreneurial interest will support multiple operators: there will be a mix of conventional mobile radio and regional geostationary satellite systems. Later these systems will be joined by micro- and pico-cell Personal Communication Networks ("PCN") plus a new series of low earth orbiting, satellite delivered global phone services. Taken together these systems may give mobile telecommunications the potential to compete head-to-head with terrestrial networks in terms of coverage, price and versatility.

Satellite-Delivered Mobile Telecommunications

At least a dozen Low Earth Orbiting (LEO) and Middle Earth Orbiting (MEO) satellite systems for mobile telephony have been announced. The best known include Iridium, a consortium led by Motorola; TRW's Odyssey; the Loral/Qualcomm Globalstar; and Inmarsat's Project 21. With some variation, each of these ventures aims to provide ubiquitous, wireless, digital coverage to pocket-sized telephones via a fleet of satellites. See Figures 2 and 3.

For example, Iridium plans to build a new mobile service from scratch by investing $3.4 billion in a constellation of 66 new LEOs. These satellites will operate in circular, polar orbits at an altitude of 42.5 nautical miles. In August 1993, Iridium announced that it had obtained binding investor commitments for an initial equity offering of $800 million.

Investors in Iridium include: BCE Mobile of Canada; Muidiri Investments BVI, Ltd., a Venezuelan consortium; Raytheon; Sprint, the third largest U.S. long distance carrier; Mawarid Group, a diversified Saudi Arabian industrial group; Khrunichev Enterprise, a Russian aerospace engineering organization and manufacturer of the Proton rocket; China's Great Wall Industry Corp.; United Communication Industry Co., Ltd., a major cellular and paging operator in Thailand; and a consortium of 18 Japanese companies led by Kyocera and Daini Denden (DDI), Japan's second largest domestic long distance carrier.

In contrast, Inmarsat's Project 21 vision anticipates incremental service evolution; service would start with a fourth generation of high-powered GSO (Geostationary Orbiting) satellites in the late 1990s, possibly augmented by MEO satellites and terrestrial cellular systems. Inmarsat recently introduced a suitcase size portable (Standard M) terminal designed to provide mobile phone and data services via the cooperative's existing GSO satellites. Inmarsat plans to introduce a hand held Standard-P terminal to provide global satellite phone service in conjunction with future generations of satellites.

Proponents of Mobile Satellite Systems (MSS) recognize the need to integrate their services with available terrestrial options. MSS users are likely to pay $3.00 or more per minute. Thus, users will want to have a transceiver that can access lower priced cellular radio or Personal Communication Service (PCS) where available. Additionally, the deployment of dual-mode (terrestrial and satellite) terminals means that existing terrestrial operators might consider MSS a new profit center, rather than yet another competitor and potential bypasser.

Revenue Settlements and Facilities Access

As mobile telecommunication carriers generate larger long distance and international traffic volumes, they will more aggressively seek alternatives to conventional traffic routing and toll revenue division arrangements. AT&T's proposal to acquire McCaw Communications has focused the industry's attention on this issue in the U.S. Although the traffic routing and settlements impact of the AT&T-McCaw deal probably will not become clear for sometime (even assuming approval by the FCC and antitrust authorities, the deal will not close until 1994), it has highlighted the need for established carriers to rethink their role in linking mobile systems together and the charges connected therewith. Otherwise they may be by-passed by a mix of mobile carriers and their wireline allies. If that happens, a new settlements process for long-haul mobile traffic may arise which involves the daisy chain interconnection of local facilities or a new type of settlements arrangement between mobile carriers and resellers.

Today wireline carriers do not compensate wireless carriers when they terminate calls originating on wireline networks; the charge is passed through to the mobile service subscriber. This is also true for international calls; the wireline carrier, not the cellular radio carrier, receives the lucrative settlement payment from the foreign carrier which originates a call. As the subscriber base of cellular companies rises, however, the ability of wireline carriers to "fence out" their cellular correspondents from this international revenue stream is likely to be less and less defensible.

Further, mobile telecommunication operators and their subscribers now pay a separate and arguably over-priced access fee for originating and terminating local calls on the PSTN. Long distance charges (domestic and international) are simply added to that. Thus, as long distance call volumes rise, mobile operators have an incentive to bypass these access charges via leased lines that have lower access charges and are exempt from the application

Figure 3

Major Satellite Phone Ventures

Name of System	Description of Venture	Owners
Project 21	A developing concept for Inmarsat's 4th satellite generation to serve handheld land mobile terminals without burden to the cooperative's maritime service mission. Cost: $1 billion or more.	Inmarsat, a cooperative of over 70 primarily government owned carriers based in London, U.K.
IRIDIUM	A constellation of 66 low earth orbiting ("LEO") satellites providing ubiquitous service; design includes inter-satellite links to reduce ground segment complexity. Cost: $3.4 billion.	Motorola, Inc., Shaumburg, IL and a consortium of investors including BCE Mobil; Sprint; Khrunichev Enterprises (Russia); DDI (Japan); Great Wall Industry Corp. (China) and United Communication Industry Co. (Thailand).
Globalstar	24-28 LEO satellites for U.S. or global coverage; technical design includes code division multiple access. Cost: $748-829 million.	Loral Aerospace, Inc., New York, NY; Qualcomm, Inc., San Diego, CA.
Odyssey	A constellation of 12 middle earth orbiting (MEO) satellites in 3 planes. Cost: $1.3 billion.	TRW, Inc. Redondo Beach, CA.
Aries	48 polar orbiting LEO satellites in 4 planes. Cost: $292 million.	Constellation Communications, Inc. (Microsat Launch Systems, Inc., Herndon, VA); Defense Systems, Inc., McLean, VA and private investors.
American Mobile Satellite Corporation (AMSC)	The company plans to provide mobile telephone, paging, data communication and geo-locational services via two dedicated GSO satellites. Prior to the launch of its first satellite, scheduled for late 1994, AMSC will provide service using capacity leased from Inmarsat. AMSC has a U.S. domestic monopoly and will serve the North American market.	Major shareholders in AMSC are: Hughes Communications, Inc. (Los Angeles, CA); McCaw Cellular Communications (Kirkland, WA); and Mobile Telecommunications Technologies Corp. (Jackson, MS).

Figure 4

International Cellular Roaming: Settling Accounts

Today international cellular roaming (e.g., using a Venezuelan cellular phone in the U.S.) follows two primary settlement models: one for frequent settlements (typically in adjacent countries); and the other to handle infrequent roaming, where operators are likely to negotiate on an ad hoc basis.

Frequent roaming typically requires standard billing and record keeping protocols; clearing houses to collect, process and format billing records; and a central bank to receive and disburse funds. All of these measures have been put in place to settle revenue for cellular roaming traffic between the United States, Canada and Mexico. These systems piggy-back on the systems for settling U.S. domestic roaming traffic.

In the U.S., Cybernet Corporation, a wholly owned subsidiary of the Cellular Telecommunications Industry Association (CTIA), provides member carriers with standard protocols and billing formats for the exchange of roamer billing data. Two major clearing houses collect billing data and submit the financial position of member carriers to a designated bank for receipt or payment of funds.

To support these arrangements, U.S., Canadian and Mexican carriers have executed agreements and implemented the necessary software programming for real-time "backhauling" of cross-border roamer traffic to the cellular user's home carrier. Each operator has the capacity to meter roamer traffic and apply the agreed upon toll rate.

Roaming of U.S. cellular units in other countries has not yet generated significant traffic streams, primarily because a number of different technical standards and rampant toll fraud. As yet, therefore, U.S. operators have not agreed to extend the geographical scope of the North America clearing houses arrangements beyond Mexico and Canada. Similarly, the promise of pan-European roaming has yet to reach fruition, although users can roam across the Scandinavian nations and implementation of North American style clearing house procedures is contemplated soon.

Limited one-way international roaming opportunities do exist in South America. For example, BellSouth International provides subscribers in its five Latin American franchises (Guadalajara, Mexico; Caracas, Venezuela; Santiago, Chile; Buenos Aires, Argentina; Montevideo, Uruguay) the opportunity to roam in North America. While the Latin American systems operate on the same frequencies and use the same analog technology as most United States systems, the roaming subscriber must physically bring in the radio for activation of a secondary telephone number.

The Latin American cellular operator (the "home carrier") must notify BellSouth (the "serving carrier") of the number provided from a dedicated pool of BellSouth Mobility numbers. In effect, the foreign roamer is treated by the U.S. network as a domestic roamer, able to use the widespread service opportunities available to BellSouth subscribers. The roamer incurs regular domestic roaming charges that are first posted with BellSouth Mobility and subsequently forwarded to the foreign cellular operator for customer billing and collection.

United States cellular customers do not have reciprocal roaming opportunities in South American, because of the absence of a clearing house that can validate calls and prevent toll fraud. Absent a roaming agreement, customers can make international calls using a credit card but at a rate well above typical roaming charges.

R.F.

Figure 5

Mobile Satellite Services: Settling Accounts

Future access options for global satellite phone services are likely to include one or more of the following:

1) Facilities-Based Access Changes -- Cost-based interconnection to the Public Switched Telephone Network (PSTN) at an agreed international gateway on terms and conditions similar to those paid by other inter-exchange carriers;

2) Accounting Rate Based Changes -- Access to the domestic network at agreed international gateways based on the accounting rates negotiated between wireline carriers.

3) End-to-End Billing -- A sum of the tariffs method under which each carrier responsible for a portion of the routing is paid its tariff rate, which is passed through to the subscriber by the originating carrier.

4) Sender Keep All -- An agreement among carriers who hand-off and receive roughly the same traffic volumes to dispense with any revenue division or billing arrangement, opting instead to collect and keep all charges received from the originating caller, with a share paid to the satellite carrier.

5) Flat Rate or "Commission" Billing -- The satellite carrier compensates the terminating or originating terrestrial carrier based on a fixed charge per minute regardless of where the call is picked up or delivered.

of accounting rate settlements. Ad hoc arrangements between adjacent or regional mobile carriers are also likely to emerge.

Significantly, in the U.S., the international settlements policy governing terrestrial carriers has not been applied to cross-border cellular radio traffic thus far. See Figure 4. For example, United States subscribers using a Mexican carrier to route a call back to the United States pay a "roaming fee" which is not necessarily commensurate with the wireline accounting rate between AT&T and Tel Mex; nor is the cellular roaming necessarily divided equally between the Mexican and U.S. cellular operators as in the case for terrestrial accounting rates. Ad hoc arrangements outside the existing accounting rate region apparently also exist for cellular roaming in Europe.

The prospect for wider utilization of mobile telecommunications facilities for routing international traffic thus is beginning to generate real concern among some carriers. The revenue impact of these arrangements is one issue. Another is the legality of ad hoc cross-border mobile settlements in lieu of the conventional accounting rate regime. This is also why regulatory hurdles (e.g., interconnection terms) rather than technology may be the most troublesome barriers faced by new satellite phone providers. See Figure 5.

Beyond that, with "smart switches" and flexible routing arrangements, much of the international mobile traffic requiring interconnection can be aggregated in such a way as to make it difficult for the wireline carrier to identify the origin of the call or to require an accounting rate settlement. In most cases, the wireline carriers tasked with terminating traffic into the PSTN typically have no knowledge of where a call originates. Billing is done by the sending carrier. And, while automatic number identification (ANI) and out-of-band signaling technology (such as SS7) may be in place in the future, it remains uncertain whether foreign wireline carriers will be able to demand the availability of such information as a precondition to the carriage of mobile (or other) inbound foreign traffic.

Without such information, incumbent carriers may receive foreign-originated traffic, but treat it as local. When this occurs, the terminating carrier misses an accounting rate settlement or at least some degree of financial compensation beyond what it would charge for conventional, often non-metered, local exchange service. Worst of all perhaps, the terminating carrier has no reliable means of calculating the volume of the traffic which should have generated inbound settlements.

In sum, over time, cross-border mobile radio services, the permeability of regional private line networks, transborder satellite footprints, resale of leased lines and a host of other factors seems likely to tip future settlements policies in favor of the mobile carriers and their customers.

Conclusion

Mobile telecommunications has evolved to a point where it can no longer be considered a minor aspect of the telephone world dominated by wireline carriers. Consumer demand for wireless services, and increasing use of mobile technologies for cross-border calls, will strengthen the importance of new wireless carriers and force incumbent carriers to rethink the terms and conditions for access to the wireline network.

Further, at some point, incumbent carriers and regulators will have to confront the consequences of two increasingly independent systems for traffic routing and toll settlements. Mobile systems present financial challenges to the status quo both when they route traffic into the PSTN at rates lower than wireline settlements and when a growing percentage of traffic never accesses the wireline PSTN.

A "hands off" regulatory policy might well accelerate the demise of the existing accounting rate regime -- a regime which has been notably slow to flow through technology-based cost reductions to users. Yet, if change happens piecemeal, some mobile traffic will incur excessive charges to access the PSTN while other, probably larger, traffic flows are likely to avoid access payments altogether. In these circumstances, regulatory intervention may be inevitable.

- END -

For Further Reading

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TELEGEOGRAPHY AND THE EXPLOSION OF PLACE

Why The Network That Is Bringing The World Together Is Pulling It Apart

By Gregory C. Staple

If you often feel that the world simultaneously is getting bigger and smaller, coming together and falling apart, you are in good company. In the last year this theme has become common in novels and news magazines alike.

"All the countries were big, single blobs of color, from one side to the other", muses the young heroine in William Gibson's latest 21st century tale, Virtual Light, as she looks at a set of vintage maps. "There'd been countries big as anything: Canada, USSR, Brazil. Now there were lots of little ones where those had been.... Even California had all been one big state, once."

Henry Louis Gates, the chair of Harvard's Afro-American Studies Department, wrote in a similar vein in The Economist's 150th anniversary issue (11 September 1993): "We live in confusing times.... [W]hat communism joined, nationalism has been all too eager to pull asunder. In the industrialized West, though ... never in this century has ... supranational unification seemed closer to realization."

"Today, both the forces of fragmentation and the forces of consolidation are abundantly on display," continued Gates. "Just which side is history on, anyway?"

Patrick Glynn, another American scholar, recently framed the issue this way in Commentary magazine (July 1993): "On every continent, in almost every major nation and in almost every walk of life, the overriding political reality today is that of increasing social separatism and fragmentation...by ethnic group, race, religion and even (to a less dramatic extent ...gender or sexual orientation)." This clash, observed Glynn, "between ethnic and other types of particularism on the one hand, and, what might be called democratic universalism," on the other hand, seems to be replacing the Left-Right and class divisions of the past century; it is becoming "the new dialectic of a new age."

But, why is this the "new dialectic" of our time? What is driving the process? Why is the world being divided even as it is being unified? How is it that an increasingly cosmopolitan economic order seems to progress in step with an ever greater insistence upon local identity?

Is this phenomenon a passing one, limited to the end of the Cold War? Or are there underlying factors, operating on a wider scale, which will make the tension between localism and globalism, between self-determination and economic integration, between nationalism and trans-national (human) rights, a much more permanent fixture on the world stage.

Any answer to these questions will inevitably be a partial one. But surely the novel role played by information technology and, more specifically, the global telecommunications network -- the largest and most complex machine the world has ever known -- helps to solve this intellectual puzzle. There are two main reasons.

First, the network, as we now know it, did not exist a generation ago. What was once, circa 1960, a disparate group of poorly connected national *telephone* systems has become an integrated web of telecommunications and computer terminals implicating half of humanity.

Thirty years ago, North America and Europe accounted for over 85% of the world's 150 million telephone lines. Fax was virtually unheard of and computer networking was an oxymoron. The sole trans-Atlantic telephone cable could handle but 89 calls and a handful of tropospheric radio links were the only way for the human voice to cross the Pacific.

By contrast, the global network now comprises over 600 million telephone lines and more than 1.2 billion terminals in approximately 190 countries. Today's telephone subscriber can expect to spend a year of their life on the phone (two years, if they live in North America). The cable and satellite network across the Atlantic can now handle almost a million simultaneous calls. And, in 1993, almost every aspect of people's work and play touches the network at least once.

Second, the global telecommunications network has a uniquely contradictory dynamic. Though the network actually has fewer and fewer moving parts (silicon chips are the order of the day), in the social and economic sphere it works as if powered by a giant array of mechanical pistons. The downstroke of the piston creates a geographical implosion, compressing space and time, and bringing economies together. But with the piston's upstroke comes a geographical explosion, fragmenting shared experiences and values, and creating a multiplicity of new places to be cultivated by partisans of one vision or another.

Up and down the pistons go, in country after country, day in and day out, three hundred and sixty five days a year. And with each cycle, as each new telephone and computer and facsimile connection is made, the piston simultaneously compresses and explodes the everyday geography of its users.

"The network works as if powered by a giant array of mechanical pistons. The downstroke of the piston creates a geographical implosion, compressing space and time, and bringing economies together. But with the piston's upstroke comes a geographical explosion, fragmenting shared experiences and values, and creating a multiplicity of new places to be cultivated by partisans of one vision or another.... Global telecommunications has not led to the end of geography so much as to the rebirth of place."

Most chronicles of the communications revolution have focused on the first half of the piston's cycle -- on the downstroke, the geographical implosion. But in many ways, it is the upstroke -- the powerstroke -- and the geographical explosion of place accompanying it, which is more telling and to which this essay draws attention.

Whose side is the network on? Both sides. Everyone's side and no one's.

The network is at once universal and parochial. It affords people great intimacy and yet can make a virtue out of their separateness. It is able to unify and to divide; to open new markets even as it razes old ones; to knit together a diaspora across the world while factionalizing a tightly knit community elsewhere. It is at once specialized and non-discriminatory; public and private; empowering politicians and pornographers, international conservation groups and local mining companies. It respects neither geography nor sovereignty and thus provides a common vehicle for both the centripetal (economic) and centrifugal (social and political) impulses of the day.

The network's routine contraction and expansion of place, and the hopes and fears engendered by these changes, have important implications for the telecommunications industry as well as for public policy. The network is creating a vast new electronic landscape, even as it devalues the physical locations many people have known for generations. Not surprisingly, this process has triggered contrary responses.

As George Gilder has said, "In an age when men can inscribe new words on grains of sand [silicon chips], particular territories are fast losing significance." It is people and ideas that matter, not places and things. Yet, "blood and soil" are still paramount in many parts of the world. And there is a strong, often desperate impulse to defend the land of one's birthright (by force of arms, if necessary) lest this sacred space be polluted by the outside world or washed into an electronic no-man's-land.

Religious fundamentalists are often at the forefront of this reaction. For example, Iranian customs officials recently seized scores of satellite TV dishes smuggled across the border from Turkey. Private possession of satellite antennas, which can receive various foreign TV programs, is forbidden in Iran.

At the same time, however, there are growing popular demands to expand and secure the myriad new electronic spaces the network has opened. The network brings new worlds into people's homes. And here, the operative words in many countries are "privacy" and "property rights," community values be damned.

In sum, the global telecommunications network has not led to the end of geography so much as to the rebirth of place.

To better understand how we have reached this geographical juncture, a brief historical aside is useful.

The Rural Bias

Telecommunications was born into an overwhelmingly rural society. At the time of the telegraph's invention in the 1840's at least two-thirds of Europe's people lived in the countryside. Similarly, of America's 20 million inhabitants, only 1 in 7 lived in cities; rural populations predominated in much of Asia and Africa as well. The frontier, be it West of the Mississippi or East of Aden, was remote. On land, news traveled at horse speed and intercontinental connections depended on the vagaries of wind and sail.

In this environment it is little wonder that the telegraph and later the telephone (1876) were hailed as tools of unification. The telegraph would end the tyranny of space. And with trans-oceanic cables, America would no longer be isolated from Europe, nor Europe from her colonies. There would be instantaneous communications from Vancouver to Bombay. Trade and commerce would flourish and military surprises would become a relic of the past.

Of course, in the ensuing century, economic and political integration proceeded fitfully, at best. Much of the Western world lived through wars and depressions on a scale which led to an isolationist sentiment among many. But, in the 1960s, following the launch of the Russian satellite, Sputnik, the popular vision of telecommunications as the great integrator was given new life. Marshall McLuhan, the Canadian communications theorist, was its best known spokesman. In his book, The Gutenberg Galaxy (1962), and elsewhere, McLuhan suggested that the widespread availability of satellite communications would create a "global village". We would all be neighbors on the same "electronic common."

It may also be worth recalling the words of Arthur C. Clarke, the intellectual father of the communication satellite, at the 1971 signing ceremony establishing Intelsat, the multinational co-op which owns the world's principal telecommunication satellites. "What the railroads and telegraph did [in the U.S.] a century ago," said Clarke, "jets and communications satellites are doing now to all the world.... For today, gentlemen, [there were apparently no women signators] whether you intend it or not -- whether you wish it or not -- [y]ou have just signed the first draft of the Articles of Federation of the United States of Earth."

Twenty years later, however, Clarke's United States of Earth remain elusive. And the global electronic common is still embryonic. The closest proxies, CNN, the satellite distributed news network, and the Internet, the trans-national matrix of computer networks, together reach less than 1 or 2% of the world's population.

Nor do we live in one electronic village. The telecommunities which are constantly forming and reforming on the network are as likely to share a common set of goals or values as those of any two households chosen randomly from the world's telephone directories.

To be fair, McLuhan's legacy is easily misread. While McLuhan did indeed state that electronic media had contracted the world into "a single large village" he also argued that the "electric age, by involving all men deeply in one another" would lead to a new "tribalism" -- a tribalism which would make impossible Western "literate man's dream of [a] solution to the problem of human differences." In 1990s terms, cyberspace is tribal space, universalist pleas notwithstanding.

With the benefit of hindsight, we also know now that the promise of a global village has proven false for another reason both McLuhan and Clarke discussed -- ever cheaper international communications. The proliferation of electronic places in the world hence is largely a matter of economics. As the price of getting on the telecoms map has fallen, the demand for places has mushroomed. The luxury overseas call of the 1960s has become the routine global chat of the 1990s.

A Generational Leap

In January 1961, when President John F. Kennedy took office, a three minute phone call from the U.S. to Europe or Asia (assuming a connection could be made) typically cost $18 -- the equivalent of $90 today. The cost of calling in the other direction usually was much greater.

Prices were high, in part, because the supply of international circuits was limited. High capacity communications satellites were a decade away and, as noted, the only trans-Atlantic telephone cable, completed but four years earlier, had less than 100 voice paths. (Radio telephone service began across the Atlantic in 1927 and until 1956 this very limited service was the only means by which Europe could talk to America.) The first trans-Pacific telephone cable did not begin service until 1964 and could handle just over 150 calls.

However, when President Bill Clinton took office in January 1993, there was sufficient satellite and cable capacity to accommodate at least 800,000 simultaneous telephone calls across the Atlantic. Carrier tariffs for trans-Atlantic calls had fallen to $1.00-$1.50 a minute in many European states and half that in the U.S.

Not surprisingly, these price changes and the expanding base of telephones across the world dramatically changed the electronic landscape. Again, the U.S. provides an example. In 1960, Americans made just 1.3 million overseas telephone calls, of which almost 80% were to Western Europe and the Caribbean. Only five countries -- the U.K., Germany, the Bahamas, Cuba and Japan -- accounted for 50,000 or more calls annually. By 1990, the U.S. made approximately 50,000 calls daily to a score of countries, including Korea, Brazil, Taiwan, Colombia, Australia, Italy and the Dominican Republic; the U.K. received over 250,000 calls each day.

These statistics point to another fundamental change in our electronic terrain. Thirty years ago a few industrialized countries owned the vast majority of the world's telephones; computer modems were the preserve of Big Science and Big Business and the fax machine was a poor substitute for telex. Yet, by the early 1990s, electronic mail and fax machines were consumer staples in many countries and the number of telephone lines had quadrupled to approximately 600 million. Further, in less than a generation, developing countries from Indonesia to Iran, and from Brazil to China, had added more telephones than the world's industrialized countries (excluding the U.S.) had installed during the telephone's first 100 years!

By comparison, the number of international airline routes, bounded as they are by the need for airports, connecting roads and the like, has yet to exceed a few thousand. And even that quintessential 20th century travel machine, the automobile, found itself hard put to compete with this explosion of new spaces on the network until, of course, it gained a phone of its own.

Yet, this explosion of places on the global network tells only part of the story. Many of the same advances in micro-electronics and information processing which made international telephony affordable for millions also dramatically expanded peoples' personal communications space through other media. The Sony Walkman and the Video Cassette Recorder (VCR), almost unknown in 1970, now offer a novel electronic environment for tens of millions of people. So too, of course, do cable and satellite TV.

"Our new electronic communications devices and the cybercompasses which direct them -- the telephone key pad, computer "mouse" and TV remote -- have created a vast new geographic overlay.... This virtual geography has a hold on our lives every bit as powerful as that of the places where we live or work or go to school. Indeed, in many cases, these places have become folded into this new electronic terrain."

Taken together, the worldwide take up of these new electronic communications devices and the cybercompasses which direct them -- the telephone key pad, computer "mouse" and TV remote -- have created a vast new geographic overlay. We call it by various names, depending on how we enter and exit or what we do when we are there. The network. Cyberspace. Television.

But whatever the name, there is little doubt that this virtual geography has a hold on our lives every bit as powerful as that of the places where we live or work or go to school. Indeed, in many cases, these places have become folded into this new electronic terrain.

With this background in mind, the next section of this essay looks at how the network's simultaneous explosion (the piston's upstroke) and compression of place (the downstroke) is affecting our views on three subjects: immigration, trade and community values.

Immigration

Immigration is as old as the nation state. But never before has it been possible for so many immigrants from so many different countries to call home. The upsurge of immigration in the 1980s has thus made the network's contradictory dialectic an everyday fact of life for more and more nations.

For example, a June 1993 U.N. population study reports that over 100 million people (2% of the world's population) left their home country since 1980 in search of a better life. There are now more than 20 million legal immigrants in Western Europe and since 1990 the number has been growing by almost 2.5 million annually. Countries such as Italy, Spain and Greece, which historically had a net outflow of immigrants, now have a net influx. In the 1980's, the U.S. gained approximately 9 million new immigrants. One third came from Asia, a quarter from Mexico and another quarter from Latin America and the Caribbean.

While the new immigrants have had a hostile reception in some countries, they have been a boon to telephone carriers. Over the last few years, in both the U.S. and Europe, most of the fastest growing telephone routes have been to countries which have seen large scale emigration. This new market for social calling -- to Guatemala and the Philippines, to Turkey and Tunisia, to South Africa and India -- has boosted demand during a comparatively weak business market. With each call home, immigration has helped the world's major carriers to build out their networks, to amortize the next generation of undersea cables and to recognize ever greater economies of scale. Thus, while calling home may be a very personal experience for the participants, from the standpoint of network economics, each immigrant's call brings the world closer for everyone.

The global reach of the network has also allowed immigrant communities to turn their very separateness into an asset by leveraging their multi-national contacts. Indeed, Joel Kotkin's insightful new book, Tribes, argues that the most successful ethnic disaporas today provide a model for advancement in the 1990s. "As the conventional barriers of nation states and regions become less meaningful," writes Kotkin, "it is likely [that] dispersed peoples -- and their worldwide business and cultural networks -- will increasingly shape the economic destiny of mankind."

Tribes focuses on the Japanese, the Chinese, the Indians and the Jews. But Kotkin sees other ethnic communities gaining ground as well, including Armenians, Koreans and Palestinians, to name but a few. Kotkin also contends that "[t]he power of global tribes derives from their successful coalescing of two principles that many people believe are contradictory: an "intrinsic tribal" sense of ethnic identity which is historically unique and, secondly, "the ability to adapt to a cosmopolitan global economy." To bridge these two worlds, Kotkin states, the most successful "global tribes" have placed a premium on education as well as religious or ethical training.

"In our networked world, 'tribal' and 'cosmopolitan' values are no longer antagonistic. They are complementary. In fact, it is the network's very ability to sustain people's sense of separateness, to create a special place for their own way of life, while connecting them to the larger world that is its leitmotif."

Kotkin is only partially right. Education and religion often do help people feel at home abroad. But in our networked world, "tribal" and "cosmopolitan" values are no longer antagonistic. They are complementary. It is the network's very ability to sustain people's sense of separateness, to create a special place for their own way of life, while connecting them to the larger world that is its *leitmotif.*

The network's capacity to transform a community's separateness into a global asset can also create problems. As the telephone makes next door around the world, immigrant families may be less likely to look across the street for social and economic support. Similarly, while telephone service may be invaluable in helping immigrants reach out to other local communities for jobs, social assistance, schooling and child care, it may also unite them with their own nearby electronic neighbors for shopping, entertainment and charity.

One final point about calling home which has much wider implications: No passport is needed to traverse the global network. Its electronic highways and byways may be messaged by citizen and alien alike. The network thus unites families and factions; it attracts brides and bombers; and it allows doctors to follow their patients abroad as much as it does drug dealers their cargoes. It is this public openness, affording a kind of universal private asylum, in a world still ruled by border guards and immigration quotas, which exemplifies the contradictions at the network's very core.

Trade and the Economy

The network's ability to compress the world's geography (the piston's downstroke) is perhaps most evident in the economic sphere. Here too, however, the contrary is true as well.

Coca Cola, BMW, General Mills, Levi Strauss, Visa, Intel, Citicorp, Sony. The brand names which we see around the world testify to the critical role which international telecommunications has played in unifying distant markets and in the rise of global corporations. The consumer benefits have been enjoyed by millions. There are also economic costs. Some companies and communities are able to leverage the network to open up new horizons and others find their vistas have been foreshortened by the new electronic space they share with people and factories an ocean away.

On the one hand, instant global communications allows companies to sever their ties to nearby markets and to operate on a trans-national scale -- matching buyers and sellers, marshalling inventories, coordinating production runs and filling orders (just in time). These economies of scale and lower transaction costs have led to large economic savings.

Yet, on the other hand, the network is a grim reaper. By enabling companies to exploit the differential resources and productivity of one locale vis-a-vis another, the network can impoverish whole communities even as it enriches others.

"Reach out and touch someone," AT&T advertised in the 1980's. But what happens when whole countries reach out and touch one another via faxes and bank wires? Just ask people in the American Midwest or any European manufacturing center. When Osaka (home of Nissan) or Ulasan (the Korea home of Hyundai Motors) uses these new information pipelines to reach out and touch Detroit or Lyon, the politics of nations are thrown into the balance. Japanese and Korean cars may be or may not be superior. But without the means which modern telecommunication and broadcast facilities offer to finance and market these products quickly, their acceptance in foreign markets would probably take decades not years. And what is true of cars, is also true of a host of other products, from textiles to machine tools and foodstuffs to finance.

John Naisbitt first pointed to the role of telecommunications in this restructuring of community and (work) place in his popular 1982 book, Megatrends. Cheap global communications, wrote Naisbitt, "collapses the information float--the time it takes information to travel from sender to receiver." The result? Take away the float and many domestic enterprises are left trying desperately to tread water. For absent a life raft of trade barriers, the tempo and cost of production in Indian or Korean workshops and factories immediately becomes the regulator of commerce a continent away.

Lee Kuan Yew, architect of Singapore's economic miracle, bluntly summed up this process as follows: "Globalization ... widen[s] income difference in each society. America's top 10% will still enjoy the highest incomes in the world. But the wages of its less educated citizen will drop to those of workers in the developing countries with equal or higher educational standards. Telecommuting transfers jobs worldwide."

Community Values

The network's piston-like power to compress peoples horizons even as it creates new spaces for others is not limited to the economic sphere. This dynamic is equally evident in the social arena as well. And it has brought conflict with it too.

"We may all live in electronic neighborhoods, but the residents of one digital street often know nothing of what the "Boyz in the Hood" are doing on the next one... When a newspaper in Texas drew attention to the fact that a local computer BBS had an archive of pornographic photos, ... the Usenet newsgroup 'alt.sex pictures' instantly moved to Finland.... Of course, ten years from now, when many computers have wireless modems, and satellite telephones are a commonplace, the BBS computer itself could be moved around the world at will. Thus, for the guardians of community values, the world has suddenly gotten impossibly large."

For much of the world's history, geography has provided something of a buffer, a "greenbelt," between the values of city and countryside and between one religious community and the next. Yet in much of the world the electronic network now threatens to plow under what remains of this greenbelt. Telegeography transports every villager's home into the metropolis and settles the atheist next door to the true believer.

To date, television, has suffered the brunt of the moral backlash loosed by this new electronic geography. Video cassettes are confiscated by border police; satellite channels are denied "landing rights;" TV shows with "too much" violence or sex are threatened with advertising boycotts; and broadcast tribunals are created to protect the national culture.

The telecoms network, however, is fast becoming the next battleground. In its infancy, the telephone only brought foreign voices into our homes, and then but fleetingly. The marketplace for clothes, entertainment, banking etc. remained in the community. So too did the library and the newsstand. But as the network has begun to change from a purveyor of POTS (plain old telephone service) to PANS (pictures and new services), the clash between local and metropolitan values has heightened.

By 1993, the network had made the life of the city, its markets and its fashions, its vices and its knowledge, a part of the common electronic landscape. This expansion of social space predictably has made many people very uneasy. But others have welcomed the opportunities which new network services are making available and are keen to test the limits of these electronic frontiers.

The values of virtual communities are being pitted against the ethics of actual communities. People "on the line" are ranged against those "on the land." And, as often as not, there are also strong differences among the myriad communities which now call the net their home, just as there are among neighborhoods in the "real" world.

A good overview of the these different communities is provided by the tens of thousands of free phone or "800" number services now available in North America and Europe. The directory for France's teletex service, Minitel, also is instructive. There are electronic neighborhoods for everyone; for psychotherapists, food fanciers, pet owners, language students, financiers and genealogists.

The same is true of the computer world. According to Howard Rheingold's new book, Virtual Community, in the U.S. alone there are now 60,000 electronic bulletin board services (BBSs) which allow people to chat with each other using electronic mail (E-mail). Each BBS supports a dozen to several hundred or even thousands of participants, notes Rheingold. "There are religious BBSs of every denomination, sex BBSs of every proclivity, political BBSs, from all parts of the spectrum, outlaw BBSs, law enforcement BBSs, BBSs for the disabled, for educators, for kids, for cults ... [the] list ... is dozens of pages long. [And] [t]he BBS culture has spread from the United States to Japan, Europe, Central and South America."

Most people are unaware of this wildly-varied assortment of new cultures emerging on the network. We may all live in electronic neighborhoods, but the residents of one digital street often know nothing of what the "Boyz in the Hood" are doing on the next one.

When they do find out, the result can be outrage. One man's computer game is another's obscenity. One woman's public data base is another's national security threat. One community's weekly electronic meeting is another's blasphemy.

Most of the activities on the network are private. Almost all countries have rules against wiretapping or eavesdropping on telephone or computer traffic. And that is one of the network's great attractions; you can travel anonymously -- and leave your passport at home.

For instance, many people who would not wish to be seen in an "adult" bookstore or a bordello will happily spend a few minutes or a few hours entertaining themselves with pay-per-call sex services. Some nations have tried to control such network based "dial-a-porn" services by requiring the telephone companies to block pay-per-call numbers unless the subscriber requests otherwise. But the network is global. And dial-a-porn services, which are now a multi-billion dollar business, can easily migrate off-shore. Blocking foreign dial-a-porn services is very difficult; it may mean blocking all telephone calls with the country housing the offending audio service.

The Network's Digital Dialectic Makes The World More....

compact	*dispersed*
integrated	*balkanized*
centralized	*decentralized*
manageable	*chaotic*
prosperous	*divided*

And Makes One Feel More....

worldly	*unique*
intimate	*distant*
secure	*exposed*
accessible	*alone*
informed	*confused*
connected	*displaced*

The technical difficulty of enforcing local values in a virtual world is even greater for computer-based services (i.e., the telephone network of tomorrow). For example, Howard Rheingold reports that when a newspaper in Texas drew attention to the fact that a local computer BBS had an archive of pornographic photos, as well, incidentally, as numerous mundane government documents, the "Usenet newsgroup 'alt.sex pictures' instantly moved to Finland." Network traffic to Finland jumped significantly overnight, writes Rheingold, but there was little local authorities could do.

Of course, ten years from now, when many computers have wireless modems, and satellite telephones are a commonplace, the BBS computer itself could be moved around the world at will. Thus, for the guardians of community values, the world has suddenly gotten impossibly large. The network has exploded the number of places which must be walled off. And. at the same time, it has collapsed the borders which formerly existed between one community and the next.

Closing Thoughts

How might the tele-communications industry and government respond to the new geographic era we have entered? I have two suggestions.

First, the current debate in most countries regarding the future information infrastructure or "infostructure" deserves more candor. As one of America's most beloved practical philosophers, Yogi Berra, said: "If you don't know where your going, you might end up somewhere else."

Too often, the job creating, new business, economic integration arguments advanced for extending and widening a nation's electronic highways have been accepted at face value. The unwritten premise is that the nation which is able to transmit the most bits per square meter from one locale to another will be the economic victor in the 21st century. Perhaps. But so long as telecommunications networks remain open to all -- citizens and aliens, buyers and sellers -- any local expenditure will also yield substantial benefits to the global community. Or as economists put it, infostructure expenditures have large externalities.

Beyond that, the network dialectic described above strongly suggests that the infostructure of the 1990s will lead us in quite different directions, and simultaneously so. This may be unavoidable. But we need to probe more deeply any claim that tomorrow's electronic highways are a one way ticket to prosperity and the global common.

My second suggestion is to make sure that public policy and technical decisions about the network, from standards to telephone numbering plans to electronic mail gateways to new service offerings, enhance peoples own sense of place. In a networked world, it is all too easy to feel displaced -- literally and figuratively -- if one is not connected. That is why access to the network and the terms on which access will be available to future network services (i.e., interactive data and video offerings) are not just telecommunications policy issues but critical social and economic policy matters for society as a whole.

Similarly, the more time people spend in one electronic realm or another, the more they wish to make it their own. It may be virtual property, but it gives people as much joy and pain as real property and thus many people expect to have the same ability to personalize and protect the virtual places they now occupy.

Telephone calling cards are one example. For years, except for the color, calling cards (like credit cards) were anonymous, almost identical plastic rectangles. Lots of people, however, wanted these network tokens to be particular and personal, marked with their own countries and signs. The Japanese responded first and other countries quickly followed. Tens of thousands of customized calling cards now circulate in the world and many more are on the way.

Another example is automatic number identification (ANI), sometimes known as "caller ID." Although the telephone is a very intimate medium it can be rung randomly by friend and foe alike. Many people resent this invasion of privacy, but lack a secretary or voice mail system to protect them, especially at home. AIN and caller ID provides the "electronic doorman" they seek by disclosing the number of the calling party at the same time the telephone rings. Of course, caller ID also compromises the anonmity of the caller; but so too does the "peep hole" on people's doors or the return address on an envelope. Conflicts like these between the privacy of the network traveler and the privacy of the host are likely to be increasingly common as people seek to make cyberspace a better place to live. In a world where communication is possible "any place, any time" the response of many people is, please, "not here, not now."

Consumer interest in caller ID services also points to another category of network filters. With tens of thousands of databases and millions of terminals on line, information overload is a common complaint. Hence the demand for increasingly sophisticated audio and data screening services. The great popularity of Internet search and retrieval services, such as "gopher", and the personalized electronic newspaper services now coming to market, also respond to these needs.

Consumer support for the deregulation of telephone equipment provides a final example. Most people want to own their own phones. And they also want to own their own telephone numbers as they change houses and jobs. In Beijing, for example, when local authorities auctioned off telephone numbers, many thousands of dollars were paid for the rights to use the most auspicious numbers.

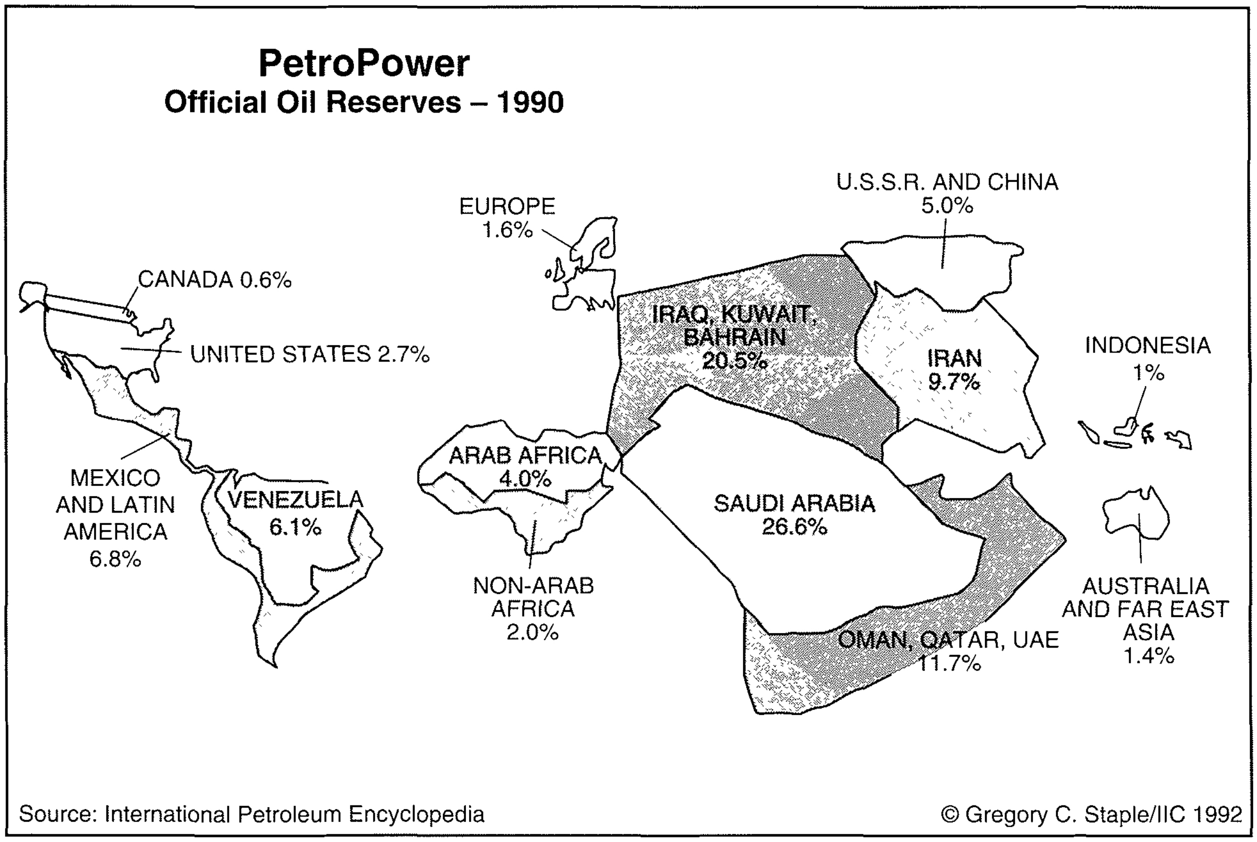
I am also reminded of a poem by the Ghanian writer, Atukwei Okai, which harks back to a much earlier-age:

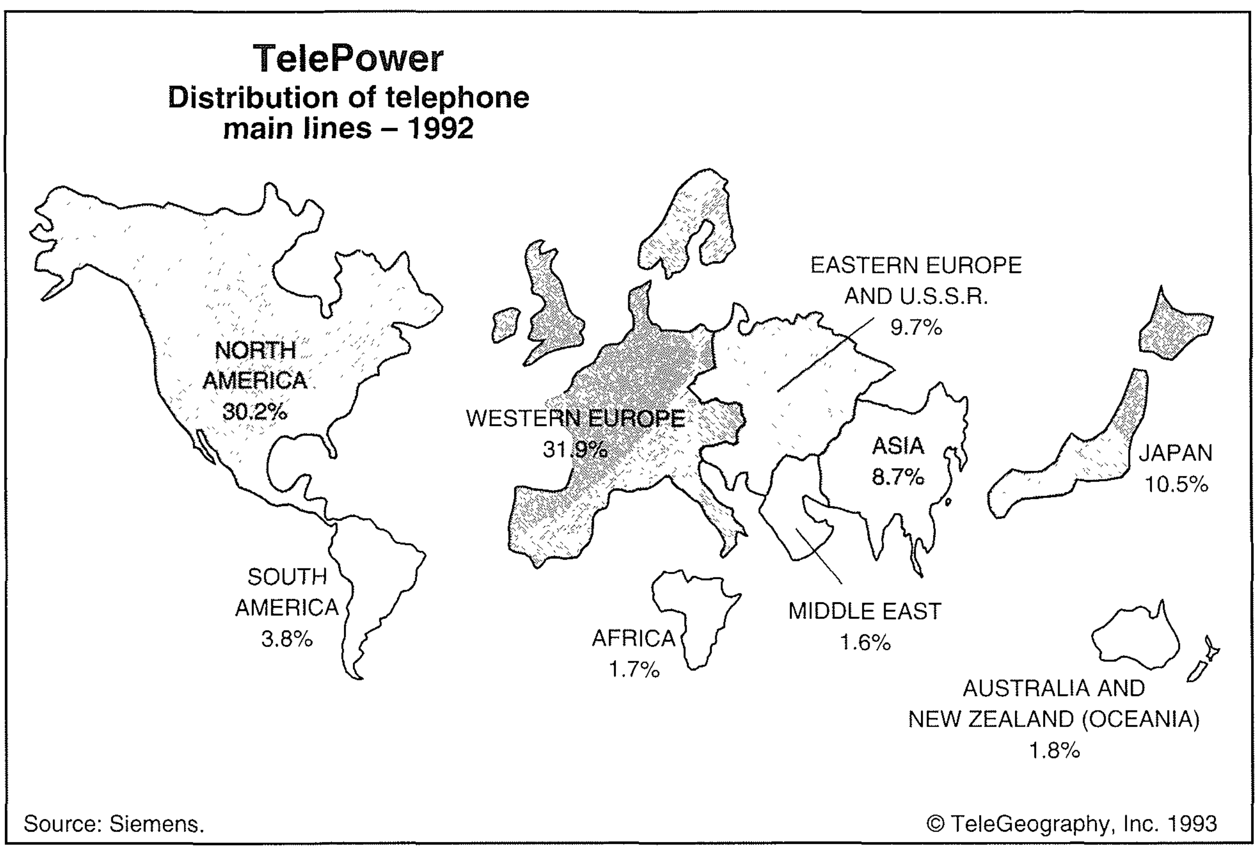
"Of course we are glad to be born to Universe.
But we'd love to have our home address somewhere
Specific directions about our house our home,
Our little place in a monstrous world.
Yes we'd like to hand our own address
Up at the crossroads of this earth
Lest the gods should one day come looking
For us in the wrong place."

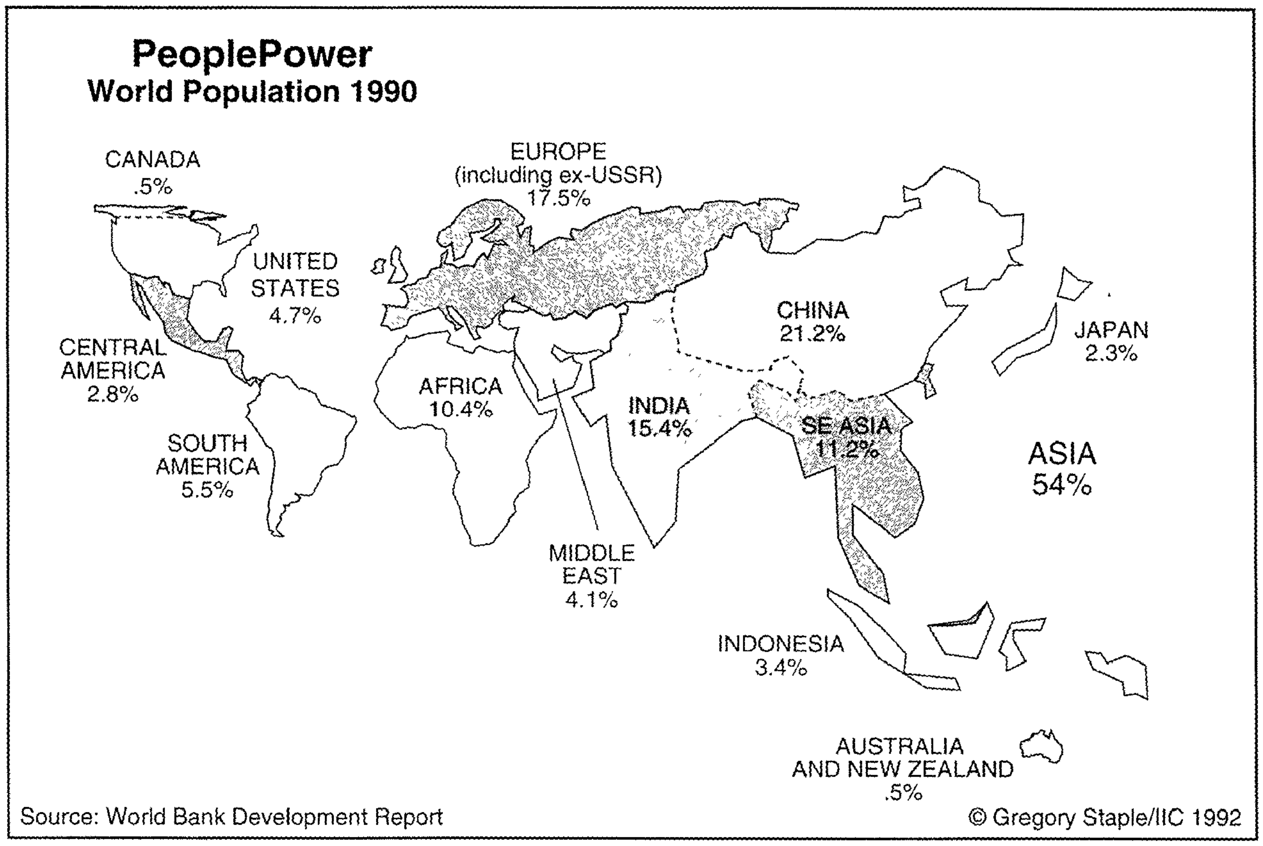
Tribal space or cyberspace, the human desire for a sense of place runs deep. The more places there are in the world, the stronger this desire seems to be. Those governments and carriers which respond accordingly are unlikely to go far astray.

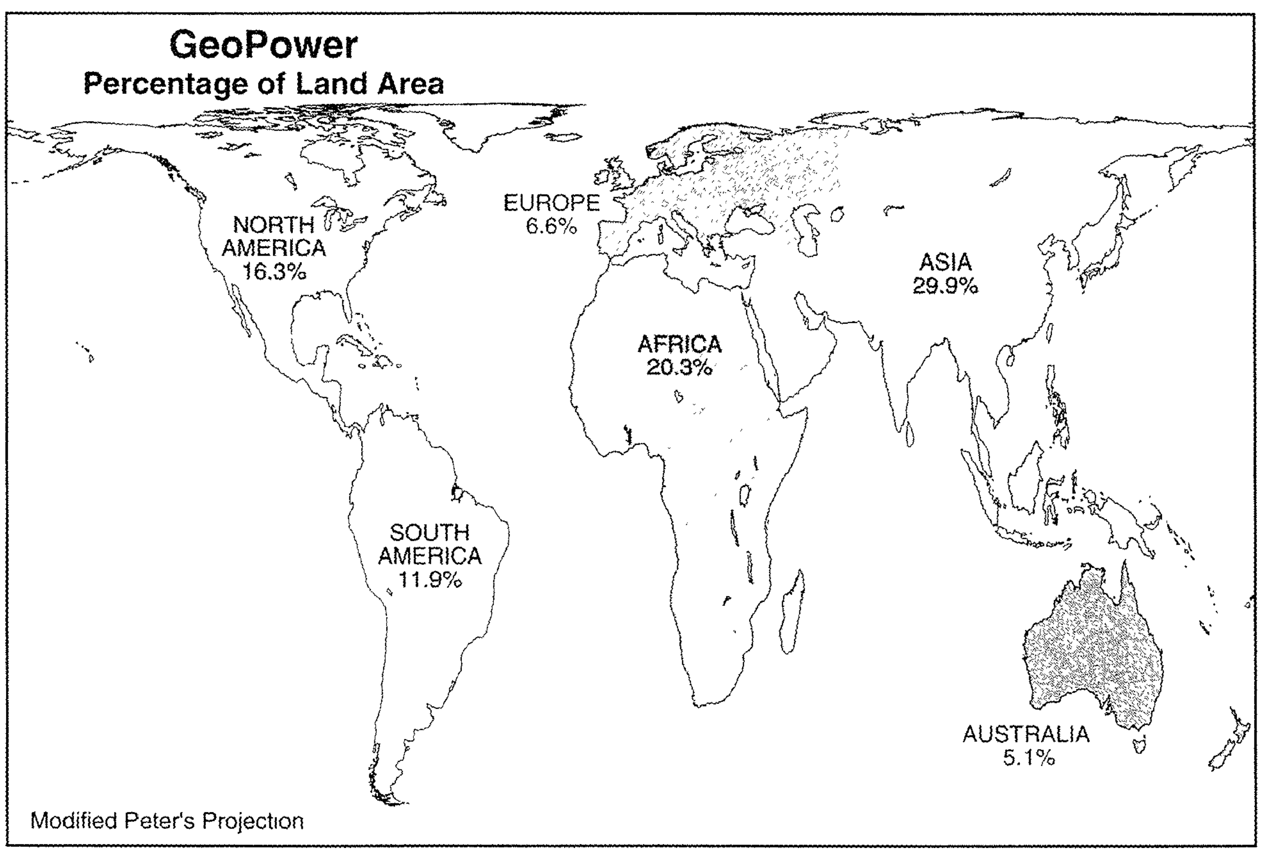
- END -

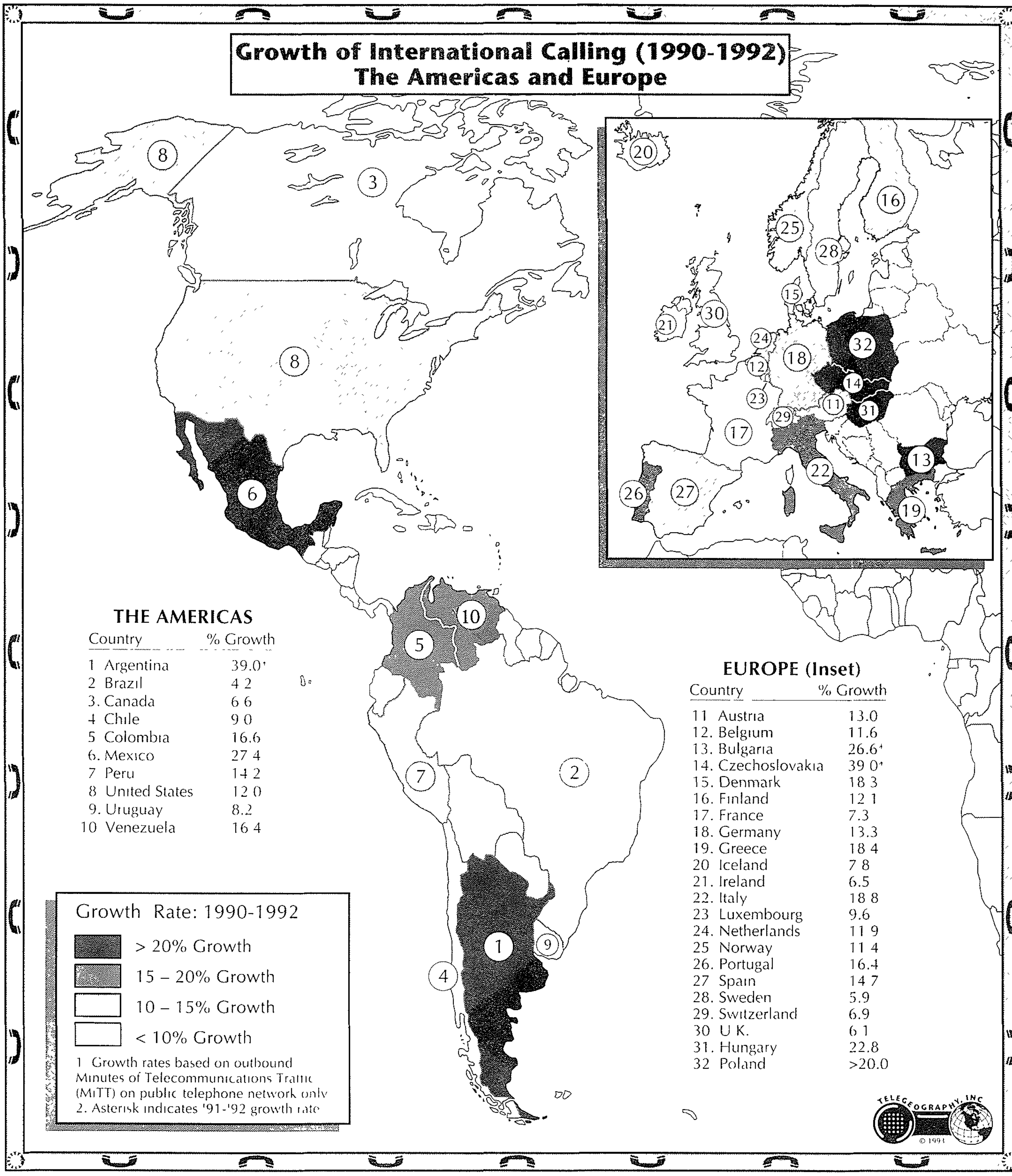
TELEMAPS


PetroPower
Official Oil Reserves – 1990
EUROPE
1.6%
U.S.S.R. AND CHINA
5.0%
CANADA 0.6%
UNITED STATES 2.7%
IRAQ, KUWAIT, BAHRAIN
20.5%
IRAN
9.7%
INDONESIA
1%
MEXICO AND LATIN AMERICA
6.8%
VENEZUELA
6.1%
ARAB AFRICA
4.0%
SAUDI ARABIA
26.6%
NON-ARAB AFRICA
2.0%
AUSTRALIA AND FAR EAST ASIA
1.4%
OMAN, QATAR, UAE
11.7%
Source: International Petroleum Encyclopedia
© Gregory C. Staple/IIC 1992

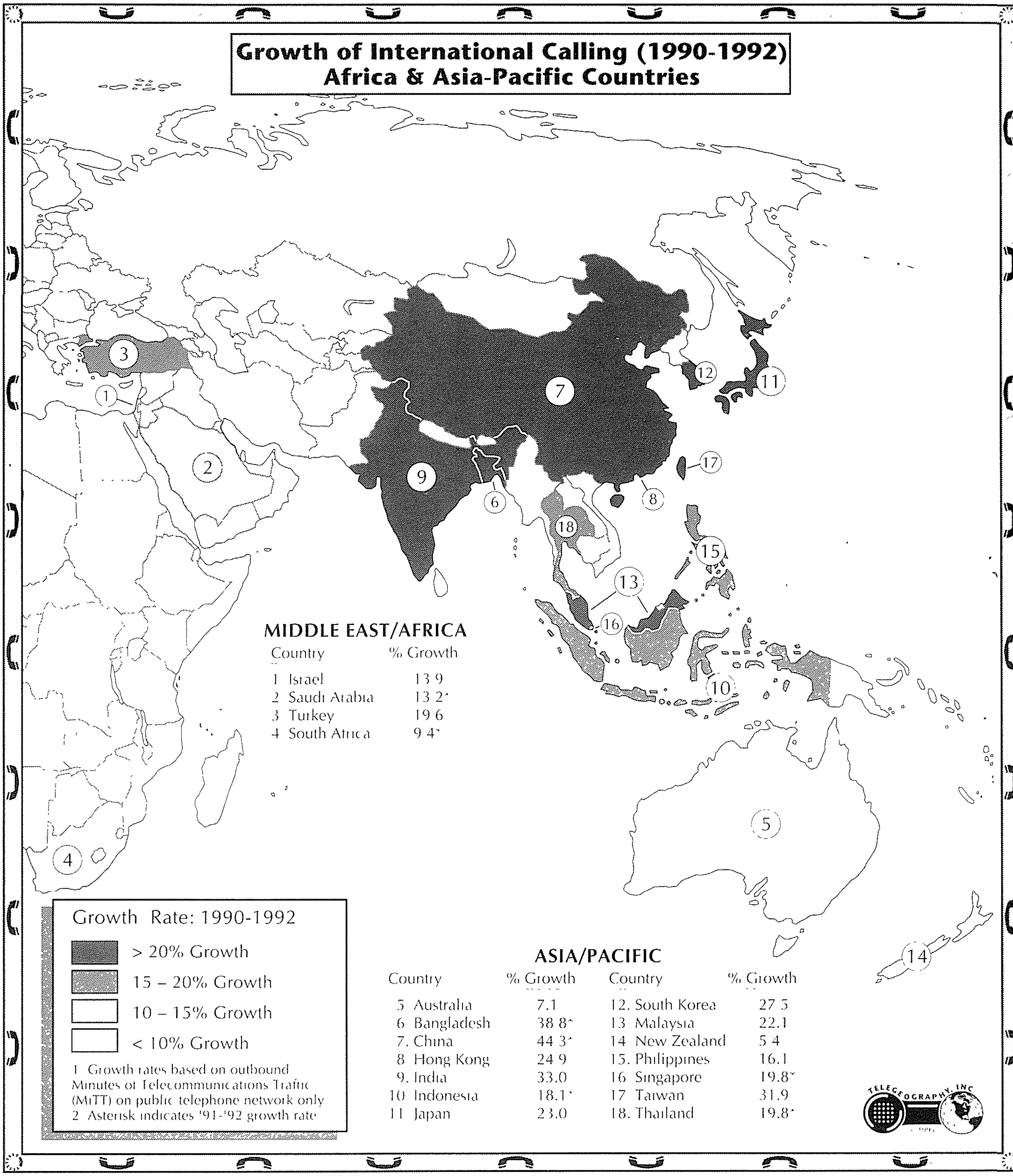

TelePower
Distribution of telephone main lines – 1992
EASTERN EUROPE AND U.S.S.R.
9.7%
NORTH AMERICA
30.2%
WESTERN EUROPE
31.9%
ASIA
8.7%
JAPAN
10.5%
SOUTH AMERICA
3.8%
AFRICA
1.7%
MIDDLE EAST
1.6%
AUSTRALIA AND NEW ZEALAND (OCEANIA)
1.8%
Source: Siemens.
© TeleGeography, Inc. 1993


PeoplePower
World Population 1990
CANADA
.5%
EUROPE
(including ex-USSR)
17.5%
UNITED
STATES
4.7%
CENTRAL
AMERICA
2.8%
CHINA
21.2%
JAPAN
2.3%
AFRICA
10.4%
INDIA
15.4%
SE ASIA
11.2%
SOUTH
AMERICA
5.5%
ASIA
54%
MIDDLE
EAST
4.1%
INDONESIA
3.4%
AUSTRALIA
AND NEW ZEALAND
.5%
Source: World Bank Development Report
© Gregory Staple/IIC 1992


GeoPower
Percentage of Land Area
NORTH
AMERICA
16.3%
EUROPE
6.6%
ASIA
29.9%
AFRICA
20.3%
SOUTH
AMERICA
11.9%
AUSTRALIA
5.1%
Modified Peter's Projection


Growth of International Calling (1990-1992)
The Americas and Europe
THE AMERICAS
Country % Growth
1 Argentina 39.0*
2 Brazil 4 2
3. Canada 6 6
4 Chile 9 0
5 Colombia 16.6
6. Mexico 27 4
7 Peru 14 2
8 United States 12 0
9. Uruguay 8.2
10 Venezuela 16 4
EUROPE (Inset)
Country % Growth
11 Austria 13.0
12. Belgium 11.6
13. Bulgaria 26.6*
14. Czechoslovakia 39 0*
15. Denmark 18 3
16. Finland 12 1
17. France 7.3
18. Germany 13.3
19. Greece 18 4
20 Iceland 7 8
21. Ireland 6.5
22. Italy 18 8
23 Luxembourg 9.6
24. Netherlands 11 9
25 Norway 11 4
26. Portugal 16.4
27 Spain 14 7
28. Sweden 5.9
29. Switzerland 6.9
30 U K. 6 1
31. Hungary 22.8
32 Poland >20.0
Growth Rate: 1990-1992
> 20% Growth
15 – 20% Growth
10 – 15% Growth
< 10% Growth
1 Growth rates based on outbound Minutes of Telecommunications Traffic (MiTT) on public telephone network only
2. Asterisk indicates '91-'92 growth rate
TELEGEOGRAPHY, INC

Growth of International Calling (1990-1992)
Africa & Asia-Pacific Countries



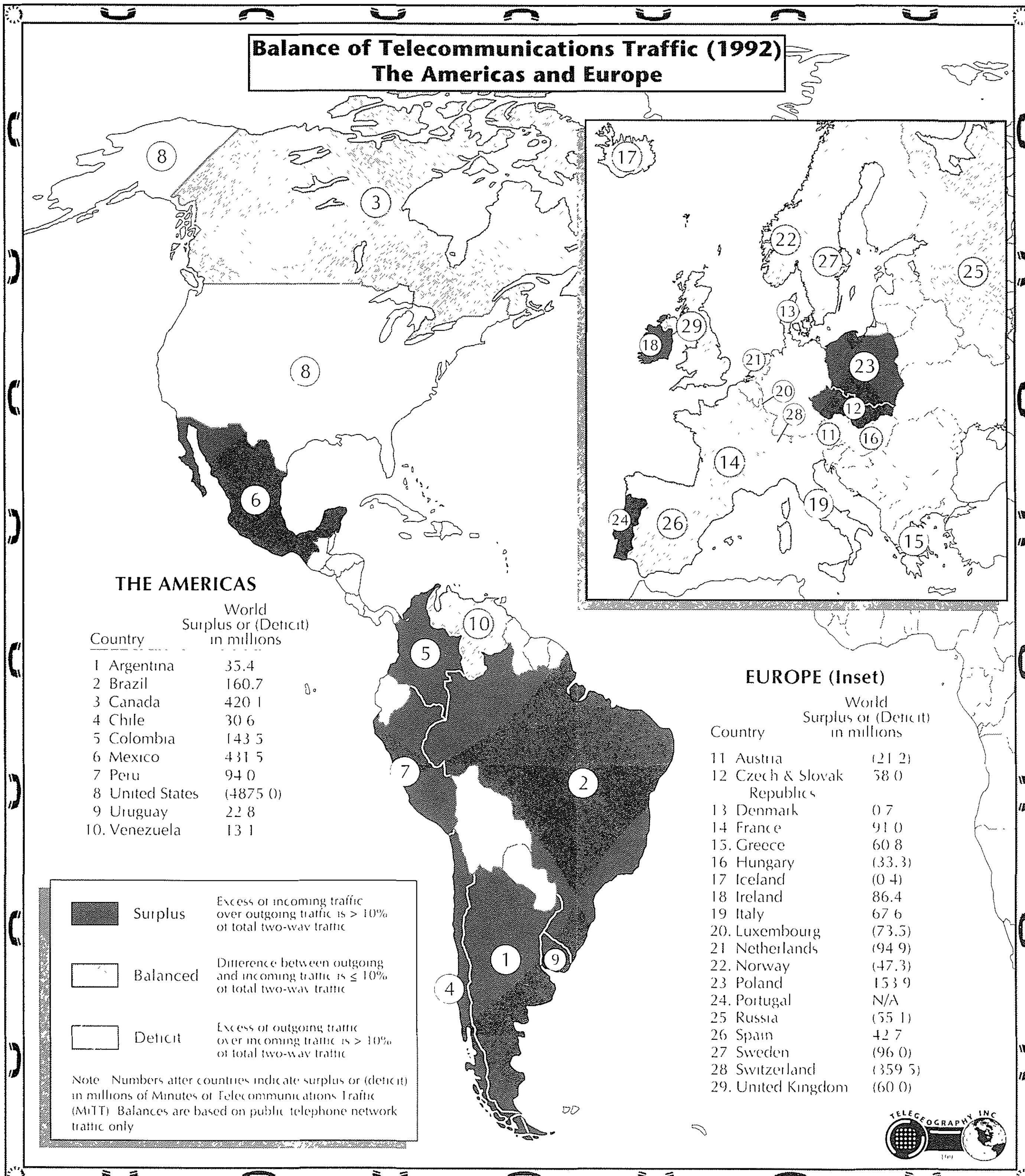
MIDDLE EAST/AFRICA

Country	% Growth
1 Israel	13.9
2 Saudi Arabia	13.2*
3 Turkey	19.6
4 South Africa	9.4*

ASIA/PACIFIC

Country	% Growth	Country	% Growth
5 Australia	7.1	12. South Korea	27.5
6 Bangladesh	38.8*	13 Malaysia	22.1
7. China	44.3*	14 New Zealand	5.4
8 Hong Kong	24.9	15. Philippines	16.1
9. India	33.0	16 Singapore	19.8*
10 Indonesia	18.1*	17 Taiwan	31.9
11 Japan	23.0	18. Thailand	19.8*

Balance of Telecommunications Traffic (1992)
The Americas and Europe



THE AMERICAS

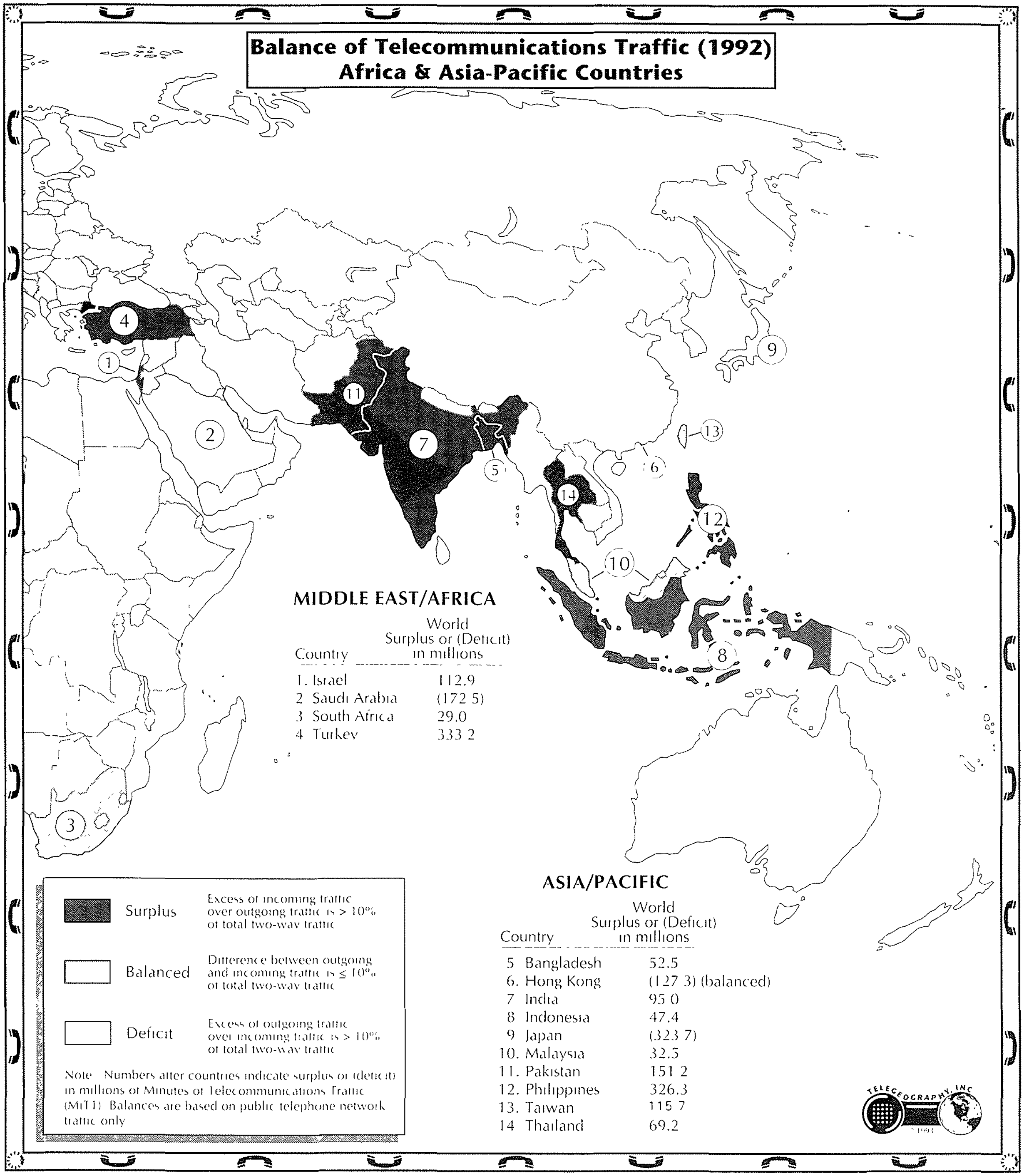
Country	World Surplus or (Deficit) in millions
1 Argentina	35.4
2 Brazil	160.7
3 Canada	420.1
4 Chile	30.6
5 Colombia	143.5
6 Mexico	431.5
7 Peru	94.0
8 United States	(4875.0)
9 Uruguay	22.8
10. Venezuela	13.1

▆	Surplus	Excess of incoming traffic over outgoing traffic is > 10% of total two-way traffic
▭	Balanced	Difference between outgoing and incoming traffic is ≤ 10% of total two-way traffic
▭	Deficit	Excess of outgoing traffic over incoming traffic is > 10% of total two-way traffic

Note Numbers after countries indicate surplus or (deficit) in millions of Minutes of Telecommunications Traffic (MiTT) Balances are based on public telephone network traffic only

EUROPE (Inset)

Country	World Surplus or (Deficit) in millions
11 Austria	(21.2)
12 Czech & Slovak Republics	58.0
13 Denmark	0.7
14 France	91.0
15. Greece	60.8
16 Hungary	(33.3)
17 Iceland	(0.4)
18 Ireland	86.4
19 Italy	67.6
20. Luxembourg	(73.5)
21 Netherlands	(94.9)
22. Norway	(47.3)
23 Poland	153.9
24. Portugal	N/A
25 Russia	(55.1)
26 Spain	42.7
27 Sweden	(96.0)
28 Switzerland	(359.5)
29. United Kingdom	(60.0)



Balance of Telecommunications Traffic (1992)
Africa & Asia-Pacific Countries
MIDDLE EAST/AFRICA
Country
World Surplus or (Deficit) in millions
1. Israel 112.9
2 Saudi Arabia (172 5)
3 South Africa 29.0
4 Turkey 333 2
ASIA/PACIFIC
Country
World Surplus or (Deficit) in millions
5 Bangladesh 52.5
6. Hong Kong (127 3) (balanced)
7 India 95 0
8 Indonesia 47.4
9 Japan (323 7)
10. Malaysia 32.5
11. Pakistan 151 2
12. Philippines 326.3
13. Taiwan 115 7
14 Thailand 69.2
Surplus
Excess of incoming traffic over outgoing traffic is > 10% of total two-way traffic
Balanced
Difference between outgoing and incoming traffic is ≤ 10% of total two-way traffic
Deficit
Excess of outgoing traffic over incoming traffic is > 10% of total two-way traffic
Note Numbers after countries indicate surplus or (deficit) in millions of Minutes of Telecommunications Traffic (MiTT) Balances are based on public telephone network traffic only
TELEGEOGRAPHY, INC

The United States Telecontinent

This map reflects the volume of switched telecommunications traffic to and from the United States in 1990. The area of the United States overlapped by another country (eg. the U.K.) is roughly proportional to the percentage of United States traffic to that country (for the U.K., 8%). The area of the correspondent country overlapping the United States reflects the percentage of that country's international traffic sent to the United States (for the U.K., 21%, because 21% of U.K. traffic was sent to the United States). Note: Country maps are not to scale and overlapping is only approximate.

The German Telecontinent

This map reflects the volume of switched telecommunications traffic to and from Germany in 1991. The area of Germany overlapped by another country (eg, Austria) is roughly proportional to the percentage of German traffic to that country (for Austria, 9%). The area of the correspondent country overlapping Germany reflects the percentage of that country's international traffic sent to Germany (for Austria, 43%, because 43% of Austrian traffic was sent to Germany). Note: Country maps are not to scale and overlapping is only approximate.

The Japanese Telecontinent

This map reflects the volume of switched telecommunications traffic to and from Japan in 1990. The area of Japan overlapped by another country (eg, the U.S.) is roughly proportional to the percentage of Japanese traffic to that country (for the U.S., 23%). The area of the correspondent country overlapping Japan reflects the percentage of that country's international traffic sent to Japan (for the U.S., 4%, because 4% of U.S. traffic was sent to Japan). Note: Country maps are not to scale and overlapping is only approximate.

Traffic Database For TeleContinent Maps

United States TeleContinent

Calling Country	% Outgoing MiTT To U.S. From Calling Country	% Outgoing MiTT From U.S. To Calling Country
Canada	71.2	22.8
Mexico	88.8	10.0
United Kingdom	20.9	8.0
Germany	6.4	6.3
Japan	22.5	4.1
France	6.3	2.6
Italy	9.4	2.2
Dom. Republic	70.0	2.1
South Korea	27.6	2.1
Philippines	51.0	2.1
Colombia	59.0	1.7
Taiwan	26.5	1.5
Brazil	34.1	1.4
Israel	34.1	1.4
Jamaica	55.0	1.2
Australia	15.5	1.2
Hong Kong	9.6	1.1
El Salvador	60.0	1.1
Switzerland	4.3	1.0
Netherlands	5.9	0.9

German TeleContinent

Calling Country	% Outgoing MiTT to Germany From Calling Country	% Outgoing MiTT From Germany To Calling Country
Austria	43	9
Switzerland	23	8
France	11	8
United Kingdom	11	8
Turkey	40	8
Italy	16	7
United States	6	7
Netherlands	23	7
Yugoslavia	26	4
Spain	14	3
Belgium	13	3
Greece	22	2
Denmark	18	2
Sweden	10	2
Luxembourg	20	1
Portugal	16	1
Canada	2	1

Japanese TeleContinent

Calling Country	% Outgoing MiTT to Japan From Calling Country	% Outgoing MiTT From Japan To Calling Country
United States	4.1	22.5
South Korea	33.6	12.1
Taiwan	20.4	7.2
Philippines	12.4	6.7
China	3.0	4.2
United Kingdom	1.6	4.2
Hong Kong	5.5	3.7
Thailand	20.2	3.1
Singapore	12.0	2.6
Germany	1.0	2.3
Australia	4.8	2.2
Brazil	3.0	2.2
France	0.5	1.8
Malaysia	16.3	1.7
Canada	0.4	1.3
Indonesia	11.5	1.1

* *MiTT is Minutes of Telecommunications Traffic. Data are for public voice circuits only in 1990.*

STATISTICAL TABLES

Table 1

CAPACITY AND COST, PER VOICE PATH, OF SELECTED TRANS-OCEANIC CABLES (1956-2000)

Year In-Service	Cable System	Cost ($ US) per voice path	Capacity in voice paths
Trans-Atlantic Systems			
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
1989	PTAT	6,000	85,000
1993	TAT-10	4,000	75,600
1994	CANTAT-3	1,000	302,000
1996-97	TAT 12/13	1,000	600,000
Trans-Pacific Systems			
1957	Hawaii 1	378,000	91
1964	TPC-1	406,000	167
1974	Hawaii 3	41,000	1690
1975	TPC-2	73,000	1690
1988	TPC-3	16,000	37,800
1991	North Pacific Cable	5,000	85,000
1992	TPC-4	5,500	75,600
1996	TPC-5	2,000	600,000
Asia-Middle East-Europe Systems			
1997	FLAG (Japan-Saudi Arabia-U.K)	1,500	600,000

Notes: Costs are capital and construction costs only stated in $US to the nearest $500 unadjusted for inflation. Current technology permits approximately 5 virtual voice paths to be derived from a digital channel operating at 64,000 bits per second (64 Kbit/s). Fiberoptic submarine cables are expected to have a useful life of at least 25 years. Table reports average cost per voice path for cables with multiple landing points. For example, the TAT-9 system interconnects the U.S. and Canada with the U.K., France and Spain. The average U.S.-U.K. cost per voice path is approximately $4000. Reserve capacity of cables generally is excluded.

Source: FCC and Carriers

Table 2

CAPACITY, IN VOICE PATHS, OF TRANS-OCEANIC CABLE SYSTEMS (1986-2000)

Trans-Atlantic (North America to Europe)

Year	Cable Voice Paths
1986	22,000
1987	22,000
1988	60,000
1989	145,000
1990	145,000
1991	221,000
1992	296,600
1993	372,200
1994	674,000
1995	1,274,000
1996	1,274,000
1997-2000	1,274,000 (minimum available)

Trans-Pacific (North America to Japan via Hawaii or Guam)

Year	Cable Voice Paths
1986	2,000
1987	37,800
1988	37,800
1989	37,800
1990	37,800
1991	114,200
1992	190,520
1993	266,120
1994	266,120
1995	266,120
1996	866,120
1997-2000	1,466,120 (minimum available)

Notes: Estimate of cable voice paths assume that 5 virtual voice paths can be derived from one 64kbit digital circuit; cable estimates do not include circuits held in reserve for cable/satellite restoration services. Estimates of trans-Atlantic capacity exclude proposed PTAT-2 cable in 1997-2000 timeframe. Estimates of trans-Pacific cable circuits exclude proposed, SE-ME-WE-3, CANPAC-1, and Trans-Siberian Link (TSL) cables, all scheduled for 1996-1997 timeframe.

Regional capacity estimates do not necessarily imply that full capacity is available to satisfy demand on any given bilateral route.

Source: FCC and Carriers

Table 3

CAPACITY, IN VOICE PATHS, OF TRANS-OCEANIC SATELLITE SYSTEMS (1986-2000)

Trans-Atlantic (North America to Europe)

Year	Satellite Voice Paths
1986	78,000
1987	78,000
1988	78,000
1989	93,000
1990	283,000
1991	283,000
1992	496,600
1993	620,800
1994	620,800
1995	710,800
1996	710,800
1997-2000	737,500 (minimum available)

Trans-Pacific (North America to East Asia)

Year	Satellite Voice Paths
1986	39,000
1987	39,000
1988	39,000
1989	39,000
1990	39,000
1991	27,000
1992	27,000
1993	83,300
1994	234,000
1995	234,000
1996	234,000
1997-2000	424,500 (minimum available)

Notes: Estimates of satellite voice paths are based on Intelsat satellites only prior to 1993; satellite estimates exclude one Intelsat satellite in each region held in reserve. Estimates also assume one voice path per channel until 1989 deployment of Intelsat VI series with 24,000 channels or 120,000 voice paths using Digital Code Multiplication Equipment (DCME). The Intelsat VII series, deployed in 1992, have a nominal capacity of 18,000 channels or 90,000 voice paths using DCME. For 1993-2000 time period, estimates assume full capacity of the following non-Intelsat systems is available: ***Trans-Atlantic*** *PAS-1; PAS-2, Orion-1 and TDRS-41;* ***Trans-Pacific*** *PAS-4; Rimsat/Express (2 satellites) and TDRS-174. In the near term, some additional satellite capacity also is likely to be available from Intersputnik, Hispasat and, after 1997, from the Iridium and Inmarsat proposed mobile telephone satellite systems. Currently, non-Intelsat satellites are limited to 1250 64kbps circuits per satellite for public switched telephony. These limits are expected to be lifted or phased-out in 1997.*

Regional capacity estimates do not necessarily imply that full capacity is available to satisfy demand on any given bilateral route.

Source: FCC and Carriers

Table 4a

THE TRAFFIC BASE OF THE TOP 20 INTERNATIONAL CARRIERS (1991-1992)

Rank	Carrier	1992 Outgoing MiTT in Millions*	1991 Outgoing MiTT in Millions*	Percent Growth in MiTT 1991-92	Country
1	AT&T*	6984	6557	6.5	United States
2	DBP Telekom*	4087	3605	13.4	Germany
3	France Telecom	2449	2295	6.7	France
4	BT	2188	2105	3.9	United Kingdom
5	MCI*	2083	1600	30.2	United States
6	Swiss PTT	1551	1429	8.5	Switzerland
7	Stentor*	1520	1425	6.7	Canada
8	Hong Kong Telecom	1137	913	24.5	Hong Kong
9	Netherlands PTT*	1134	1018	11.4	Netherlands
10	Iritel*	1116	980	13.9	Italy
11	Sprint*	940	723	30.0	United States
12	Belgacom	911	823	10.7	Belgium
13	KDD	893	850	5.6	Japan
14	Telefonica	804	719	11.8	Spain
15	Teleglobe*	722	647	11.6	Canada
16	Austrian PTT	713	642	11.1	Austria
17	Telia AB*	691	672	3.5	Sweden
18	Telmex	684	500	36.8	Mexico
19	Mercury	661	493	34.1	United Kingdom
20	Telstra	659	610	8.0	Australia

MiTT is Minutes of Telecommunications Traffic. Data are for public voice circuits only rounded to the nearest million MiTT. For U.S. carriers (1991 and 1992) and the Netherlands PTT (1992 only) MiTT are based on billing point of call not originating point.

* Data for North American carriers include continental traffic. Stentor was formerly Telecom Canada; Stentor traffic is for U.S. and Mexico only of which approximately 70% was originated by Bell Canada. For Italy, Iritel (formerly ASST) handles intra-continental traffic only; Italcable carries overseas traffic (See Table 4b). For DBP Telekom, all data includes outgoing traffic from the former East Germany. Telia AB was formerly Televerket.

Note: BT, KDD, Hong Kong Telecom and Mercury data are for the Fiscal Year (April 1992 to March 1993).

Table 4b

THE TRAFFIC BASE OF THE SECOND 20 INTERNATIONAL CARRIERS (1991-1992)

Rank	Carrier	1992 Outgoing MiTT in Millions*	1991 Outgoing MiTT in Millions*	Percent Growth in MiTT 1991-92	Country
1	China PTT	635	440	44.3	China
2	Saudi Com. Ministry	465	411	13.1	Saudi Arabia
3	Danish PTT	425	395	7.6	Denmark
4	Singapore Telecom*	412	344	19.8	Singapore
5	DGT Taiwan	369	255	44.7	Taiwan
6	Italcable	358	239	49.8	Italy
7	Norwegian Telecom	349	309	12.9	Norway
8	Hellenic Telecom. Org	299	245	22.0	Greece
9	U.A.E. Comm. Ministry	299	262	14.1	U.A.E.
10	Telecom Eireann*	297	273	8.8	Ireland
11	Videsh Sanchar*	260	186	39.8	India
12	Korea Telecom	245	229	7.0	Rep. of Korea
13	Finnish PTT	235	215	9.3	Finland
14	Turkish PTT	227	198	14.6	Turkey
15	Telkom South Africa	222	203	9.4	South Africa
16	Telekom Malaysia	217	176	23.3	Malaysia
17	Telekom Poland	213	N/A	N/A	Poland
18	IDC Japan	197	154	27.9	Japan
19	ITJ Japan	193	156	23.7	Japan
20	Hungarian PTT	184	165	11.5	Hungary

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

* Telecom Eireann data includes traffic to the U.K.; Videsh Sanchar data excludes traffic to Pakistan; Singapore Telecom data includes traffic to Malaysia (except local border traffic). Telecom Portugal only handles intra-continental traffic; overseas traffic is carried by CPRM which had 41 million MiTT outbound in 1992.

Additional Notes:

1. The next largest carriers ranked by 1992 outgoing MiTT in millions ( ) include: the Luxembourg PTT (181); Czech Telecom International (178); Intertelecom Russia (176), Telecom Portugal (171); Embratel Brazil (170); Bezek Israel (153); New Zealand Telecom (149), Communication Authority of Thailand (132), PLDT Philippines (124); and Telintar Argentina (124).

2. Data for Singapore Telecom, Telecom New Zealand, Videsh Sanchar, ITJ and IDC are for Fiscal Year (April 1992 - March 1993).

Table 4c

THE TRAFFIC BASE OF THE TOP 20 INTERNATIONAL CARRIERS (1988-1992)

Rank	Carrier	1992 Outgoing MiTT in Millions*	1988 Outgoing MiTT in Millions*	Cumulative Annual Growth in Outgoing Traffic 1988-92	Country
1	AT&T*	6984	4778	7.9	United States
2	DBP Telekom	4087	2479	10.6	Germany
3	France Telecom	2449	1570	9.3	France
4	BT	2188	1654	5.8	United Kingdom
5	MCI*	2083	262	51.4	United States
6	Swiss PTT	1551	1014	8.9	Switzerland
7	Stentor*	1520	1054	7.6	Canada
8	Hong Kong Telecom	1137	441	20.9	Hong Kong
9	Netherlands PTT*	1134	706	9.9	Netherlands
10	Iritel♦*	1116	734	11.0	Italy
11	Sprint*	940	131	48.3	United States
12	Belgacom	911	561	10.2	Belgium
13	KDD	900	529	11.2	Japan
14	Telefonica	804	330	19.5	Spain
15	Teleglobe*	722	358	15.1	Canada
16	Austrian PTT	713	401	12.2	Austria
17	Telia AB*	691	485	7.1	Sweden
18	Telmex*	684	211	26.5	Mexico
19	Mercury	661	75	54.5	United Kingdom
20	Telstra	659	415	9.7	Australia

MiTT is Minutes of Telecommunications Traffic. Data are for public voice circuits only rounded to the nearest million MiTT. For U.S. carriers and Netherlands PTT, 1992 data is based on billing point of call not point of origin.

♦ 1989 data/CAGR 1989-92.

* Data for North American carriers include continental traffic. Stentor was formerly Telecom Canada; Stentor traffic is for U.S. and Mexico only of which approximately 70% was originated by Bell Canada. For Italy, Iritel (formerly ASST) handles intra-continental traffic only; Italcable carries overseas traffic (See Table 4b). For DBP Telekom, 1992 data includes outgoing traffic from the former East Germany. Telia AB was formerly Televerket.

Note: BT, KDD, Hong Kong Telecom and Mercury data are for the Fiscal Year (April 1992 to March 1993).

Table 5

Market Share of Competing International Carriers
Percent Outgoing MiTT (1986-1993)

Country/Carrier	1986	1987	1988	1989	1990	1991	1992
U.S.							
AT&T	94.3	93.0	89.1	83.3	78.4	74.8	70.3
MCI	4.0	4.7	7.0	10.2	14.6	17.8	21.2
Sprint	1.6	2.3	3.5	5.8	6.4	6.3	7.3
U.K. (F.Y.)							
BT	99.8	98.5	95.5	91.0	86.0	80.7	76.0
Mercury	0.2	1.5	4.5	9.0	14.0	19.5	24.0
Japan (F.Y.)							
KDD				93.3	88.0	73.7	69.7
IDC				3.7	6.5	13.5	15.3
ITJ				3.0	5.5	12.8	15.0
New Zealand (F.Y.)							
TNZ					92.0	82.0	80.0
ClearCom					8.0	18.0	20.0
Korea							
Korea Telecom							79.9
Dacom							20.1
Chile *(Est. for 1993 to 30 June)*							
Entel							73.0
Chilesat							25.0
VTR Telecom							2.0
Philippines							
PLDT							91.6
Eastern Telecom							8.4
Sweden *(Est. for 1993 to 30 June)*							
Televerket							95.0
Tele-2							5.0

Notes: 1. MiTT is Minutes of Telecommunications Traffic. Data based on international outgoing traffic for the public switched network only. Market shares are for the full year, beginning in the first year of competition. Market shares for U.S. carriers exclude traffic to Canada and Mexico; for U.K. carriers traffic to Ireland is excluded.

2. Competing international telephone carriers (**bold type**) have also been authorized in the following markets, but were not operational or had very limited international traffic at 1 July 1993: Australia (Telstra; **Optus, AAP Telecommunications**); Malaysia (Telekom Malaysia; **Technology Resource Industries (TRI)**; Indonesia (PT Indosat; **PT Satelindo**); Israel (Bezeq; **DARCOM Communications Ltd.**); Finland (Telecom Finland, **Helsinki Telephone and others**). In addition, since September 1992, TeleGlobe, Canada's overseas carrier, has competed with Stentor, the Canadian consortium of provincial telephone companies, for service between Canada and Mexico.

Table 6

INTERNATIONAL ROUTES WITH THE LARGEST VOLUME OF TELECOMS TRAFFIC (1992)

Continental	(out/in)	Intercontinental	(out/in)
More than 1 Billion MiTT*			
U.S - Canada	(2226/1511)	U.S. - U.K.✣	(734/502)
U.S.- Mexico	(1277/609)		
More than 500 Million MiTT			
Austria - Germany	(303/329)	U.S. - Germany✣	(563/236)
Switzerland - Germany	(358/315)	U.S.- Japan✣	(367/282)
France - Germany	(303/818)		
France - U.K.✦	(275/269)		
Germany - U.K.✦	(287/325)		
Germany-Italy	(288/227)		
Netherlands - Germany	(264/250)		
Hong Kong✦ - China (PRC)	(535/412)		
More than 250 Million MiTT			
France - Italy	(217/209)	U.S. - France✣	(240/157)
France - Belgium	(216/221)	U.S. - S. Korea✣	(208/96)
France - Spain	(157/139)	U.S. - Italy✣	(207/118)
France - Switzerland	(196/264)	Germany - Turkey✣	(295/83)
Netherlands - U.K.✦	(147/134)		
Netherlands - Belgium	(189/185)		
Switzerland - Italy	(224/149)		
U.K.✦ - Ireland✦	(218/206)		
U.K.✦ - Italy	(135/118)		

* *MiTT is Minutes of Telecommunications Traffic. Data are for two-way traffic for switched voice circuits only.*

✣ *On U.S. routes, to reduce double counting, data from U.S. carriers has been used for outbound and inbound traffic. See Methodology pages.*

✦ *Data for outgoing routes from these countries are for F.Y. 1992/93*

AMERICAS TRAFFIC TABLES

Table 7

Argentina

Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. U.S.A.	27.6	22.2%
2. Uruguay	21.1	17.0%
3. Brazil	12.5	10.0%
4. Chile	10.2	8.2%
5. Spain	8.9	7.1%
6. Italy	8.1	6.5%
7. Paraguay	5.8	4.7%
8. France	2.9	2.4%
9. Germany	2.7	2.2%
10. Canada	2.3	1.9%
11. U. K	2.2	1.8%
12. Peru	2.1	1.7%
13. Bolivia	2.1	1.7%
14. Mexico	1.9	1.5%
15. Switzerland	1.5	1.2%
Other	7.2	5.8%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	132.5	159.7
Outgoing	N.A.	89.4	124.3
Surplus(Deficit)	N.A.	43.1	35.4
Total Volume	N.A.	221.9	284.1

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 8

Brazil
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. U.S.A.	61.3	36.1%
2. Argentina	17.7	10.4%
3. Germany	9.1	5.4%
4. Italy	8.6	5.1%
5. Portugal	7.5	4.4%
6. U.K.	6.4	3.8%
7. France	6.2	3.6%
8. Uruguay	4.7	2.7%
9. Japan	4.4	2.6%
10. Paraguay	4.0	2.4%
11. Switzerland	3.7	2.2%
12. Chile	3.6	2.1%
13. Spain	3.6	2.1%
14. Canada	2.7	1.6%
15. Mexico	2.3	1.4%
Other	24.2	14.2%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	261.6	330.6
Outgoing	156.5	171.2	169.9
Surplus(Deficit)	N.A.	90.4	160.7
Total Volume	N.A.	432.8	500.5

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 9

Canada

Largest Telecommunication Routes (1992)

Destination	MITT	Percent of Outgoing Traffic
1. U.S.A	1511.4	67.3%
2. U.K	117.2	5.2%
3. Hong Kong	43.0	1.9%
4. France	41.3	1.8%
5. Germany	38.9	1.7%
6. Italy	30.1	1.3%
7. Australia	19.8	0.9%
8. Jamaica	18.7	0.8%
9. Japan	17.9	0.8%
10. India	17.5	0.8%
11. Philippines	16.6	0.7%
12. Netherlands	14.3	0.6%
13. Mexico	13.0	0.6%
14. Portugal	12.9	0.6%
15. Switzerland	11.9	0.5%
Other	322.2	14.3%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	358.5	398.2	441.2
Outgoing	565.2	647.3	722.3
Surplus(Deficit)	(206.7)	(249.1)	(281.1)
Total Volume	923.7	1045.5	1163.5

Note: Incoming and outgoing totals exclude all Canada-U.S. and Canada-Mexico traffic.

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 10

Chile
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. U.S.A.	15.3	27.8%
2. Argentina	8.9	16.2%
3. Brazil	3.1	5.6%
4. Spain	2.6	4.7%
5. Peru	2.2	4.0%
6. Germany	1.9	3.5%
7. Canada	1.4	2.5%
8. U.K.	1.3	2.4%
9. France	1.3	2.4%
10. Bolivia	1.2	2.2%
11. Italy	1.2	2.2%
12. Mexico	1.0	1.8%
13. Venezuela	0.9	1.6%
14. Colombia	0.8	1.5%
15. Uruguay	0.7	1.3%
Other	11.2	20.4%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	61.8	85.6
Outgoing	N.A.	49.0	55.0
Surplus(Deficit)	N.A.	12.8	30.6
Total Volume	N.A.	110.8	140.6

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 11

Colombia
Largest Telecommunication Routes (1992)

Destination	MITT	Percent of Outgoing Traffic
1. U.S.A.	50.0	52.9%
2. Venezuela	9.2	9.7%
3. Spain	3.4	3.6%
4. Panama	3.3	3.5%
5. Ecuador	3.0	3.2%
6. Mexico	2.6	2.8%
7. Italy	2.3	2.4%
8. U.K.	2.0	2.1%
9. Brazil	2.0	2.1%
10. France	1.7	1.8%
11. Germany	1.7	1.8%
12. Argentina	1.2	1.3%
13. Canada	1.0	1.1%
14. Chile	0.9	1.0%
15. Bolivia	0.2	0.2%
Other	10.0	10.6%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	N.A.	238.0
Outgoing	69.5	N.A.	94.5
Surplus(Deficit)	N.A.	N.A.	143.5
Total Volume	N.A.	N.A.	332.5

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 12

Mexico

Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. U.S.A.	610.0	89.2%
2. Canada	8.9	1.3%
3. Spain	7.6	1.1%
4. Germany	4.7	0.7%
5. Colombia	4.4	0.6%
6. France	4.2	0.6%
7. U.K.	3.6	0.5%
8. Italy	3.5	0.5%
9. Guatemala	2.9	0.4%
10. Argentina	2.6	0.4%
11. Brazil	2.5	0.4%
12. Venezuela	2.1	0.3%
13. Japan	2.1	0.3%
14. Costa Rica	1.9	0.3%
15. Peru	1.8	0.3%
Other	20.7	3.0%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	N.A.	1115.0
Outgoing	421.1	500.2	683.5
Surplus(Deficit)	N.A.	N.A.	431.5
Total Volume	N.A.	N.A.	1798.5

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 13

Peru
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. U.S.A.	15.3	47.5%
2. Chile	2.1	6.7%
3. Spain	2.0	6.3%
4. Argentina	1.3	3.9%
5. Venezuela	1.2	3.9%
6. Brazil	1.2	3.7%
7. Italy	1.1	3.3%
8. Colombia	0.9	2.8%
9. Canada	0.8	2.5%
10. Ecuador	0.7	2.3%
11. Mexico	0.7	2.2%
12. Germany	0.7	2.2%
13. France	0.6	1.9%
14. Bolivia	0.6	1.8%
15. U.K	0.6	1.8%
Other	2.3	7.2%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	N.A.	126.1
Outgoing	24.6	N.A.	32.1
Surplus(Deficit)	N.A.	N.A.	94.0
Total Volume	N.A.	N.A.	158.2

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 14a

United States--Outgoing Traffic

Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. Canada	2226.4	21.9
2. Mexico	1276.8	12.6%
3. U.K.	733.7	7.2%
4. Germany	563.0	5.5%
5. Japan	366.8	3.6%
6. France	239.8	2.4%
7. Dominican Republic	231.3	2.0%
8. South Korea	207.8	2.0%
9. Italy	207.3	2.0%
10. Philippines	200.3	2.0%
11. Colombia	172.0	1.7%
12. Taiwan	162.9	1.6%
13. Brazil	144.7	1.4%
14. Israel	137.7	1.4%
15. Jamaica	124.4	1.2%
16. Hong Kong	114.3	1.1%
17. Australia	113.6	1.1%
18. Spain	104.9	1.0%
19. El Salvador	99.9	1.0%
20. India	97.9	1.0%
21. Switzerland	93.5	0.9%
22. Netherlands	92.7	0.9%
23. Guatemala	88.0	0.9%
24. Peru	80.1	0.8%
25. Venezuela	75.9	0.7%
Other	2217.9	21.8%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	2542.8	2829.8	3149.4
Outgoing	5275.9	5984.5	6670.4
Surplus(Deficit)	(2733.1)	(3154.7)	(3521.0)
Total Volume	7818.7	8814.3	9819.8

Note: Incoming and outgoing traffic totals exclude Canada and Mexico traffic. 1991 and 1992 data are based upon the billing point of the traffic. See Methodology pages.

*MiTT is Minutes of Telecommunications Traffic. Data are in millions of minutes for public voice circuits

Table 14b

United States--Incoming Traffic

Largest Telecommunication Routes (1992)

Country of Origin	MITT	Percent of Incoming Traffic
1. Canada	1511.4	28.7%
2. Mexico	608.5	11.5%
3. U.K.	501.5	9.5%
4. Japan	282.1	5.4%
5. Germany	235.7	4.5%
6. France	156.6	3.0%
7. Italy	118.0	2.2%
8. Australia	104.3	2.0%
9. South Korea	96.1	1.8%
10. Hong Kong	82.6	1.6%
11. Taiwan	82.4	1.6%
12. Netherlands	66.7	1.3%
13. Switzerland	66.1	1.3%
14. India	60.1	1.1%
15. Sweden	53.4	1.0%
16. Venezuela	53.0	1.0%
17. Spain	52.7	1.0%
18. Colombia	50.4	1.0%
19. Brazil	49.3	0.9%
20. Dominican Republic	48.4	0.9%
21. Israel	48.1	0.9%
22. Jamaica	42.4	0.8%
23. Singapore	34.2	0.6%
24. Bahamas	33.7	0.6%
25. Belgium	32.9	0.6%
Other	798.7	15.2%

Note: Data are based on billing country rather than physical point of origin.

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 14c

United States--Growth in Traffic for Top 25 Routes ('90-'92)

COUNTRY	Outgoing CAGR '90-'92	Incoming CAGR '90-'92	Total Volume CAGR '90-'92 ('92 Volume x 10^6)
1. Canada	23.5%	3.2%	**13.9%** (3738)
2. Mexico	27.9%	27.6%	**27.8%** (1885)
3. U.K.	8.1%	3.4%	**6.1%** (1235)
4. Germany	6.7%	9.2%	**7.4%** (799)
5. Japan	7.1%	11.6%	**9.0%** (649)
6. France	9.1%	7.5%	**8.4%** (396)
7. Dominican Republic	18.4%	11.4%	**17.1%** (280)
8. Italy	10.7%	23.9%	**15.0%** (325)
9. South Korea	12.3%	34.3%	**18.0%** (304)
10. Philippines	10.2%	14.4%	**10.6%** (224)
11. Colombia	13.9%	10.5%	**13.1%** (222)
12. Taiwan	16.4%	16.2%	**16.4%** (245)
13. Brazil	15.3%	-6.3%	**8.5%** (194)
14. Israel	13.4%	8.8%	**12.2%** (186)
15. Jamaica	13.4%	18.7%	**14.6%** (167)
16. Hong Kong	15.7%	13.4%	**14.7%** (197)
17. Australia	10.2%	9.3%	**9.8%** (218)
18. Spain	23.3%	22.5%	**23.0%** (158)
19. El Salvador	9.0%	2.4%	**8.4%** (108)
20. India	29.0%	26.6%	**28.1%** (158)
21. Switzerland	9.8%	5.8%	**8.1%** (160)
22. Netherlands	14.3%	11.1%	**12.9%** (159)
23. Guatemala	11.7%	24.2%	**13.6%** (107)
24. Peru	11.5%	6.1%	**10.7%** (93)
25. Venezuela	24.0%	18.3%	**21.5%** (129)

Note: Routes are ranked by 1992 outgoing traffic volume. CAGR is Cumulative Annual Growth Rate.
1992 data are based on billing country rather than physical point of origin.

'MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 15

Uruguay
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. Argentina	17.8	59.1%
2. Brazil	3.4	11.4%
3. U.S.A	2.1	7.1%
4. Spain	1.0	3.5%
5. Chile	0.7	2.3%
6. Paraguay	0.5	1.6%
7. Italy	0.4	1.5%
8. Germany	0.3	1.1%
9. France	0.3	1.0%
10. U.K	0.2	0.8%
11. Canada	0.2	0.7%
12. Israel	0.2	0.7%
13. Switzerland	0.2	0.7%
14. Venezuela	0.2	0.7%
15. Mexico	0.2	0.6%
Other	2.2	7.3%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	48.0	53.0
Outgoing	25.8	29.3	30.2
Surplus(Deficit)	N.A.	18.7	22.8
Total Volume	N.A.	77.3	83.2

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 16

Venezuela
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. U.S.A.	53.7	46.5%
2. Colombia	12.7	11.0%
3. Spain	7.3	6.3%
4. Italy	5.4	4.6%
5. Peru	2.8	2.4%
6. Portugal	2.3	2.0%
7. Canada	2.3	2.0%
8. Germany	2.0	1.7%
9. France	2.0	1.7%
10. Mexico	1.9	1.6%
11. Argentina	1.8	1.6%
12. Brazil	1.8	1.5%
13. Dominican Rep.	1.7	1.5%
14. U.K.	1.7	1.4%
15. Chile	1.4	1.2%
Other	14.8	12.8%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	103.9	128.6
Outgoing	85.3	91.7	115.5
Surplus(Deficit)	N.A.	12.2	13.1
Total Volume	N.A.	195.6	244.1

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

EUROPEAN COMMUNITY

TRAFFIC TABLES

Table 17

Belgium
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. France	220.5	24.2%
2. Netherlands	184.9	20.3%
3. Germany	119.3	13.1%
4. U.K	82.5	9.1%
5. Italy	47.0	5.2%
6. U.S.A	31.1	3.4%
7. Luxembourg	28.1	3.1%
8. Spain	26.6	2.9%
9. Switzerland	23.5	2.6%
10. Sweden	11.5	1.3%
11. Portugal	9.5	1.0%
12. Greece	9.0	1.0%
13. Denmark	8.1	0.9%
14. Austria	6.9	0.8%
15. Ireland	5.1	0.6%
Other	97.4	10.7%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	754.1	748.5	N.A.
Outgoing	731.3	822.7	911.0
Surplus(Deficit)	22.8	(74.2)	N.A.
Total Volume	1485.4	1571.2	N.A.

Note: 1992 route data are based on Belgacom provisional data.

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 18

Denmark
Largest Telecommunication Routes (1992)

	Destination	MiTT	Percent of Outgoing Traffic
1.	Germany	77.7	18.3%
2.	Sweden	76.1	17.9%
3.	U.K.	46.6	11.0%
4.	Norway	44.0	10.3%
5.	U.S.A.	21.0	4.9%
6.	France	19.3	4.5%
7.	Netherlands	16.3	3.8%
8.	Italy	10.7	2.5%
9.	Switzerland	9.7	2.3%
10.	Spain	8.9	2.1%
11.	Finland	8.8	2.1%
12.	Belgium	8.5	2.0%
13.	Poland	6.8	1.6%
14.	Turkey	4.6	1.1%
15.	Austria	3.9	0.9%
	Other	61.5	14.5%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	343.2	397.2	425.2
Outgoing	362.3	394.5	424.5
Surplus(Deficit)	(19.1)	2.7	0.7
Total Volume	705.5	791.7	849.7

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 19

France
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. Germany	303.0	12.4%
2. U.K	275.3	11.2%
3. Italy	217.1	8.9%
4. Belgium	215.6	8.8%
5. Switzerland	195.5	8.0%
6. Spain	156.9	6.4%
7. U.S.A	153.1	6.3%
8. Portugal	114.1	4.7%
9. Netherlands	80.4	3.3%
10. Morocco	61.6	2.5%
11. Algeria	54.6	2.2%
12. Tunisia	32.5	1.3%
13. Canada	31.7	1.3%
14. Turkey	29.3	1.2%
15. Sweden	22.0	0.9%
Other	506.3	20.7%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	2183.0	2355.0	2540.0
Outgoing	2126.0	2295.0	2449.0
Surplus(Deficit)	57.0	60.0	91.0
Total Volume	4309.0	4650.0	4989.0

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 20

Germany
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. Austria	329.0	8.0%
2. France	318.0	7.8%
3. Switzerland	315.0	7.7%
4. Turkey	295.0	7.2%
5. Italy	288.0	7.0%
6. U.K	287.0	7.0%
7. Netherlands	250.0	6.1%
8. U.S.A	235.0	5.7%
9. Yugoslavia (former)	150.0	3.7%
10. Spain	118.0	2.9%
11. Belgium	115.0	2.8%
12. Poland	104.0	2.5%
13. Czechoslovakia	96.0	2.3%
14. Greece	77.0	1.9%
Other	1110.0	27.2%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	2600.0	2900.0	3100.0
Outgoing	3185.0	3605.0	4087.0
Surplus(Deficit)	(585.0)	(705.0)	(987.0)
Total Volume	5785.0	6505.0	7187.0

Note: Annual incoming MiTT are rounded to the nearest 100 million; all other data are rounded to nearest million MiTT. Data include traffic from the former East Germany (i.e. all data are reported for the unified Germany). In 1990, prior to unification (September 1990), East Germany originated about 40 million MiTT to foreign countries (excluding West Germany); in 1991 Eastern Länder accounted for approximately 48 million MiTT; and in 1992 approximately 60 million MiTT.

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 21

Greece

Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. Germany	61.5	20.6%
2. U.K.	39.9	13.4%
3. Italy	26.4	8.8%
4. U.S.A.	25.3	8.5%
5. France	17.4	5.8%
6. Cyprus	12.5	4.2%
7. Canada	8.8	2.9%
8. Switzerland	8.5	2.8%
9. Belgium	8.5	2.8%
10. Australia	8.1	2.7%
11. Netherlands	8.0	2.7%
12. Austria	4.9	1.7%
13. Sweden	4.8	1.6%
14. Turkey	4.5	1.5%
15. Egypt	3.3	1.1%
Other	56.4	18.9%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	320.1	359.7
Outgoing	213.3	245.0	298.9
Surplus(Deficit)	N.A.	75.1	60.8
Total Volume	N.A.	565.1	658.5

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 22

Ireland
Largest Telecommunication Routes (FY 1992/93)

Destination	MiTT	Percent of Outgoing Traffic
1. U.K.	206.0	69.5%
2. U.S.A	27.7	9.3%
3. Germany	12.3	4.1%
4. France	10.0	3.4%
5. Netherlands	5.7	1.9%
6. Italy	4.1	1.4%
7. Spain	3.8	1.3%
8. Belgium	3.7	1.2%
9. Canada	3.0	1.0%
10. Australia	2.6	0.8%
11. Switzerland	2.2	0.8%
12. Denmark	1.7	0.6%
13. Sweden	1.7	0.6%
14. Japan	0.8	0.3%
15. Austria	0.7	0.2%
Other	10.5	3.5%

National Traffic Balance

*MiTT	FY 1990/91	FY 1991/92	FY 1992/93
Incoming	122.2	140.4	383.0
Outgoing	75.1	83.4	296.6
Surplus(Deficit)	47.1	57.0	86.4
Total Volume N.A.	197.3	223.8	679.6

Note: FY ends on 31/3. Traffic balances for 1990 and 1991 exclude the U.K.

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

<u>Table 23</u>

Italy

Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. Germany	226.5	15.4%
2. France	209.1	14.2%
3. U.S.A	155.0	10.5%
4. Switzerland	148.7	10.1%
5. U.K	117.9	8.0%
6. Spain	56.0	3.8%
7. Belgium	44.4	3.0%
8. Austria	39.1	2.7%
9. Yugoslavia (former)	39.0	2.6%
10. Netherlands	31.5	2.1%
11. Greece	22.9	1.6%
12. Morocco	20.1	1.4%
13. Canada	17.3	1.2%
14. Hong Kong	16.6	1.1%
15. Tunisia	16.0	1.1%
Other	313.3	21.3%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	N.A.	1541.0
Outgoing	1043.1	1219.5	1473.4
Surplus(Deficit)	N.A.	N.A.	67.6
Total Volume	N.A.	N.A.	3014.4

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 24

Luxembourg
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. Belgium	41.6	23.0%
2. Germany	36.0	19.9%
3. France	35.2	19.5%
4. Portugal	11.8	6.5%
5. U.K.	10.9	6.0%
6. Italy	9.1	5.0%
7. Netherlands	6.7	3.7%
8. Switzerland	5.7	3.2%
9. U.S.A.	4.1	2.3%
10. Denmark	3.1	1.7%
11. Spain	2.9	1.6%
12. Sweden	1.9	1.0%
13. Austria	1.8	1.0%
14. Greece	1.2	0.7%
15. Japan	0.7	0.4%
Other	8.2	4.5%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	N.A.	107.5
Outgoing	150.6	165.3	181.0
Surplus(Deficit)	N.A.	N.A.	(73.5)
Total Volume	N.A.	N.A.	288.5

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 25

Netherlands

Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. Germany	263.7	23.3%
2. Belgium	189.3	16.7%
3. U.K	146.8	12.9%
4. France	86.6	7.6%
5. U.S.A	66.1	5.8%
6. Italy	36.5	3.2%
7. Switzerland	32.0	2.8%
8. Spain	30.8	2.7%
9. Turkey	27.7	2.4%
10. Sweden	18.1	1.6%
11. Denmark	16.8	1.5%
12. Austria	16.7	1.5%
13. Canada	11.9	1.0%
14. Norway	10.0	0.9%
15. Poland	9.7	0.9%
Other	181.1	16.0%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	851.8	N.A.	1039.0
Outgoing	905.2	1017.7	1133.9
Surplus(Deficit)	(53.4)	N.A.	(94.9)
Total Volume	1757.0	N.A.	2172.9

Note: 1992 data are based upon the billing point of the traffic. See Methodology pages.

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 26

Portugal
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. France	44.5	21.0%
2. Spain	32.5	15.3%
3. U.K	23.4	11.0%
4. Germany	20.9	9.9%
5. Switzerland	12.0	5.7%
6. U.S.A	9.2	4.3%
7. Italy	8.3	3.9%
8. Brazil	7.7	3.6%
9. Belgium	7.5	3.5%
10. Netherlands	7.0	3.3%
11. Angola	4.5	2.1%
12. Canada	4.2	2.0%
13. Sweden	3.0	1.4%
14. Denmark	2.0	0.9%
15. Greece	1.8	0.8%
Other	23.5	11.1%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	325.9	384.0	N.A.
Outgoing	156.5	186.1	212.0
Surplus(Deficit)	169.4	197.9	N.A.
Total Volume	482.4	570.1	N.A.

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 27

Spain
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. France	139.4	17.3%
2. U.K	115.0	14.3%
3. Germany	112.4	14.0%
4. U.S.A	75.1	9.3%
5. Italy	57.7	7.2%
6. Netherlands	31.6	3.9%
7. Portugal	30.6	3.8%
8. Switzerland	29.7	3.7%
9. Belgium	27.2	3.4%
10. Morocco	16.6	2.1%
11. Argentina	14.1	1.8%
12. Sweden	13.1	1.6%
13. Denmark	8.2	1.0%
14. Venezuela	7.7	1.0%
15. Colombia	7.5	0.9%
Other	118.7	14.8%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	653.0	736.9	847.2
Outgoing	611.0	718.7	804.5
Surplus(Deficit)	42.0	18.2	42.7
Total Volume	1264.0	1455.6	1651.7

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 28

United Kingdom
Largest Telecommunication Routes (FY 1992/93)

Destination	MiTT	Percent of Outgoing Traffic
1. U.S.A.	575.0	20.2%
2. Germany	325.0	11.2%
3. France	269.0	9.3%
4. Ireland	218.0	7.5%
5. Italy	135.0	4.7%
6. Netherlands	134.0	4.6%
7. Spain	115.0	4.0%
8. Canada	95.0	3.3%
9. Australia	90.0	3.1%
10. Switzerland	86.0	3.0%
11. Belgium	79.0	2.7%
12. Sweden	54.0	1.9%
13. India	53.0	1.8%
14. Denmark	47.0	1.6%
15. Japan	43.0	1.5%
16. Greece	43.0	1.5%
17. Norway	42.0	1.5%
18. South Africa	39.0	1.3%
19. Portugal	36.0	1.2%
20. Hong Kong	35.0	1.2%
Other	336.0	11.8%

National Traffic Balance

*MiTT	FY 1989/90	FY 1991/92	FY 1992/93
Incoming	2330.0	2692.0	2789.0
Outgoing	2253.0	2598.0	2849.0
Surplus(Deficit)	(77.0)	94.0	(60.0)
Total Volume	4583.0	5286.0	5638.0

Note: FY ends on 31/3.

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits and have been rounded to the nearest million.

Table 29a

Cross-Border Traffic Between the Nations Of The European Communities: A Statistical Matrix (1992)

O U T G O I N G M i T T $(X10^6)$*

INCOMING MITT		B	D	FRG	S	F	G	IR	IT	L	N	P	U.K.		Total		Surplus (Deficit)
N	BELGIUM	--	9	115	27	216	8	4	44	42	189	8	79		741		(1)
C	DENMARK	8	--	73	8	18	2	2	9	3	17	2	47		189		(8)
O	GERMANY	119	78	--	112	303	61	12	227	36	264	21	325		1558		(46)
M	SPAIN	27	9	118	--	157	3	4	56	3	31	33	115		556		17
I	FRANCE	221	19	318	139	--	17	10	209	35	87	45	269		1369		23
N	GREECE	9	2	77	3	17	--	0	23	1	9	1	43		185		(58)
G	IRELAND	5	2	13	6	13	1	--	5	1	8	1	218		273		17
	ITALY	47	11	288	58	217	26	4	--	9	36	8	135		839		101
M	LUXEMBOURG	28	2	31	2	17	1	0	6	--	7	2	12		108		(52)
I	NETHERLANDS	185	16	250	32	80	8	6	32	7	--	7	134		757		(46)
T	PORTUGAL	10	2	34	31	114	1	1	9	12	8	--	36		258		107
T	UNITED KINGDOM	83	47	287	115	275	40	206	118	11	147	23	--		1352		(61)
	TOTAL EC	742	197	1604	533	1427	168	249	738	160	803	151	1413		8185		

* MiTT is Minutes of Telecommunication Traffic. Matrix shows millions of MiTT. Data based on survey of operators and are for public voice circuits only. U.K. and Ireland outgoing traffic are for 1992/93 FY ending 31 March 1993.

Table 29b

Cross-Border Traffic Between the Nations Of The European Communities: A Statistical Matrix (1991)

OUTGOING MiTT $(X10^6)$*

INCOMING MiTT		B	D	FRG	S	F	G	IR	IT	L	N	P	U.K.	Total	Surplus (Deficit)
	BELGIUM	--	8	108	25	179	7	3	40	38	172	7	76	663	(18)
	DENMARK	7	--	69	8	19	2	2	8	3	15	2	40	175	(4)
	GERMANY	110	69	--	103	265	55	11	200	33	238	19	306	1409	(97)
	SPAIN	23	8	108	--	142	2	4	48	3	26	26	114	504	18
	FRANCE	203	18	295	130	--	15	9	189	32	77	39	250	1257	(31)
	GREECE	8	2	78	3	15	--	0	19	1	7	1	46	180	34
	IRELAND	4	2	12	7	11	1	--	4	1	7	1	187	237	10
	ITALY	43	10	266	47	203	22	3	--	8	33	7	129	771	116
	LUXEMBOURG	31	2	29	1	16	1	0	5	--	6	2	10	103	(54)
	NETHERLANDS	169	15	234	29	75	7	5	29	6	--	6	115	690	(34)
	PORTUGAL	8	2	31	27	105	0	0	7	10	7	--	33	230	98
	UNITED KINGDOM	75	43	276	106	258	34	190	106	10	136	22	--	1256	(50)
	TOTAL EC	681	179	1506	486	1288	146	227	655	145	724	132	1306	7475	

* MiTT is Minutes of Telecommunication Traffic. Matrix shows millions of MiTT. Data based on survey of operators and are for public voice circuits only. U.K. and Ireland outgoing traffic are for 1991/92 FY ending 31 March 1992.

EUROPEAN FREE TRADE ASSOCIATION

TRAFFIC TABLES

Table 30

Austria
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. Germany	303.0	42.5%
2. Switzerland	53.3	7.5%
3. Italy	35.4	5.0%
4. Serbia/Montenegro	28.7	4.0%
5. Hungary	24.5	3.4%
6. Czechoslovakia	23.4	3.3%
7. U.S.A.	23.4	3.3%
8. U.K.	22.9	3.2%
9. Turkey	22.3	3.1%
10. France	19.2	2.7%
11. Netherlands	17.2	2.4%
12. Croatia	17.0	2.4%
13. Poland	16.6	2.3%
14. Slovenia	11.8	1.6%
15. Belgium	7.5	1.0%
Other	87.4	12.2%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	513.3	574.0	692.3
Outgoing	558.6	641.9	713.4
Surplus(Deficit)	(45.3)	(67.9)	(21.1)
Total Volume	1071.9	1215.9	1405.7

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 31

Finland

Largest Telecommunication Routes (1991)

Destination	MiTT	Percent of Outgoing Traffic
1. Sweden	89.0	41.4%
2. Germany	19.0	8.8%
3. U.S.A	14.0	6.5%
4. U.K	13.0	6.0%
5. U.S.S.R.(former)	12.0	5.6%
6. Denmark	7.0	3.3%
7. Norway	7.0	3.3%
8. France	6.0	2.8%
9. Switzerland	4.0	1.9%
10. Netherlands	4.0	1.9%
11. Italy	4.0	1.9%
12. Spain	4.0	1.9%
Other	32.0	14.9%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	213.0	N.A.	N.A.
Outgoing	187.0	215.0	235.0
Surplus(Deficit)	26.0	N.A.	N.A.
Total Volume	400.0	N.A.	N.A.

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits rounded to the nearest million

Table 32

Iceland
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. U.S.A.	6.1	27.7%
2. Denmark	3.0	13.8%
3. U.K.	2.5	11.5%
4. Sweden	2.5	11.4%
5. Norway	1.9	8.5%
6. Germany	1.7	7.7%
7. France	0.7	3.1%
8. Netherlands	0.6	2.8%
9. Faroe Islands	0.5	2.3%
10. Canada	0.3	1.4%
11. Spain	0.3	1.3%
12. Italy	0.3	1.3%
13. Belgium	0.2	1.1%
14. Finland	0.2	1.1%
15. Switzerland	0.2	1.0%
Other	1.1	5.0%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	N.A.	21.7
Outgoing	N.A.	N.A.	22.1
Surplus(Deficit)	N.A.	N.A.	(0.4)
Total Volume	N.A.	N.A.	43.8

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 33

Norway
Largest Telecommunication Routes (1991)

Destination	MiTT	Percent of Outgoing Traffic
1. Sweden	90.0	29.2%
2. Denmark	45.0	14.6%
3. U.K	40.0	13%
4. U.S.A	24.0	7.8%
5. Germany	23.0	7.5%
6. France	10.0	3.7%
7. Finland	8.0	2.6%
8. Spain	6.0	1.9%
9. Switzerland	5.0	1.6%
10. Italy	5.0	1.6%
11. Belgium	4.0	1.3%
12. Poland	3.0	1.0%
13. Canada	3.0	1.0%
14. Yugoslavia (former)	2.0	0.6%
15. Austria	2.0	0.6%
16. Iceland	2.0	0.6%
17. Turkey	2.0	0.6%
Other	34.5	11.2%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	N.A.	301.0
Outgoing	281.2	308.5	349.0
Surplus(Deficit)	N.A.	N.A.	(48.0)
Total Volume	N.A.	N.A.	650.0

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits rounded to the nearest million

Table 34

Sweden
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. Finland	98.0	14.4%
2. Norway	95.0	13.9%
3. Denmark	84.0	12.3%
4. Germany	70.0	10.3%
5. U.K.	60.0	8.8%
6. U.S.A.	53.0	7.8%
7. France	26.0	3.8%
8. Spain	17.0	2.5%
9. Italy	16.0	2.3%
10. Netherlands	15.0	2.2%
11. Switzerland	14.0	2.1%
12. Belgium	12.0	1.8%
13. Austria	9.0	1.3%
14. Turkey	6.0	0.9%
15. Canada	6.0	0.9%
16. Portugal	4.0	0.6%
17. Czechoslovakia	4.0	0.6%
Other	93.0	13.6%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	571.0	595.0
Outgoing	616.0	672.0	691.0
Surplus(Deficit)	N.A.	(101.0)	(96.0)
Total Volume	N.A.	1243	1286.0

Note: Data are estimated to nearest million MiTT.

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 35

Switzerland
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. Germany	357.7	23.1%
2. France	264.3	17.0%
3. Italy	224.4	14.5%
4. U.K	82.4	5.3%
5. Austria	69.1	4.5%
6. U.S.A	65.3	4.2%
7. Portugal	58.8	3.8%
8. Spain	52.8	3.4%
9. Yugoslavia	45.5	2.9%
10. Netherlands	36.5	2.4%
11. Turkey	29.4	1.9%
12. Belgium	27.4	1.8%
13. Sweden	16.1	1.0%
14. Canada	11.7	0.8%
15. Czechoslovakia	11.0	0.7%
Other	198.5	12.8%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	1015.7	1124.0	1191.5
Outgoing	1356.3	1429.4	1551.0
Surplus(Deficit)	(340.6)	(305.4)	(359.5)
Total Volume	2372.0	2553.4	2742.5

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

EASTERN EUROPE
TRAFFIC TABLES

Table 36

Czechoslovakia
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. Germany	43.8	24.6%
2. Austria	19.6	11.0%
3. U.S.A	10.6	5.9%
4. Italy	8.7	4.9%
5. Hungary	8.2	4.6%
6. U. K.	7.3	4.1%
7. U.S.S.R. (former)	7.1	4.0%
8. Poland	6.7	3.8%
9. Switzerland	6.1	3.4%
10. France	5.9	3.3%
11. Yugoslavia (former)	5.2	2.9%
12. Netherlands	4.2	2.3%
13. Belgium	2.5	1.4%
14. Canada	2.4	1.3%
15. Sweden	2.0	1.1%
Other	37.6	21.1%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	179.5	236.0
Outgoing	N.A.	128.1	178.0
Surplus(Deficit)	N.A.	51.4	58.0
Total Volume	N.A.	307.6	414.0

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 37

Hungary
Largest Telecommunication Routes (1992)

Destination	MITT	Percent of Outgoing Traffic
1. Germany	45.9	25.0%
2. Austria	24.9	13.6%
3. U.S.A	12.9	7.0%
4. Italy	10.3	5.6%
5. Romania	8.9	4.8%
6. U.K	8.8	4.8%
7. Czechoslovakia	7.2	3.9%
8. Switzerland	6.5	3.5%
9. France	6.3	3.4%
10. Russia	5.8	3.1%
11. Netherlands	4.2	2.3%
12. Sweden	4.2	2.3%
13. Canada	3.4	1.9%
14. Belgium	3.0	1.6%
15. Australia	2.4	1.3%
Other	30.0	16.3

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	109.4	N.A.	150.5
Outgoing	121.9	N.A.	183.8
Surplus(Deficit)	(12.5)	N.A.	(33.3)
Total Volume	231.3	N.A.	334.3

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 38

Poland
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. Germany	63.0	29.6%
2. U.S.A	25.3	11.9%
3. France	12.6	5.9%
4. U.K	12.1	5.7%
5. Russia	11.5	5.4%
6. Italy	9.4	4.4%
7. Sweden	8.6	4.1%
8. Austria	8.6	4.0%
9. Netherlands	6.4	3.0%
10. Canada	5.9	2.8%
11. Czechoslovakia	5.4	2.5%
12. Belgium	4.8	2.3%
13. Denmark	4.2	2.0%
14. Switzerland	3.4	1.6%
15. Ukraine	3.0	1.4%
Other	28.5	13.4%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	N.A.	366.6
Outgoing	N.A.	N.A.	212.7
Surplus(Deficit)	N.A.	N.A.	153.9
Total Volume	N.A.	N.A.	579.3

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 39

Russia

Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. Germany	24.5	14.0%
2. U.S.A.	20.6	11.7%
3. Poland	11.4	6.5%
4. Yugoslavia (former)	8.4	4.8%
5. Bulgaria	6.9	3.9%
6. Finland	6.8	3.9%
7. U.K.	6.2	3.5%
8. Czechoslovakia	6.0	3.4%
9. Hungary	5.9	3.4%
10. France	5.9	3.4%
11. Belgium	3.5	2.0%
12. Sweden	2.9	1.7%
13. Spain	2.4	1.4%
14. Canada	2.3	1.3%
15. Switzerland	2.3	1.3%
Other	59.6	33.9%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	N.A.	230.7
Outgoing	N.A.	N.A.	175.6
Surplus(Deficit)	N.A.	N.A.	55.1
Total Volume	N.A.	N.A.	406.3

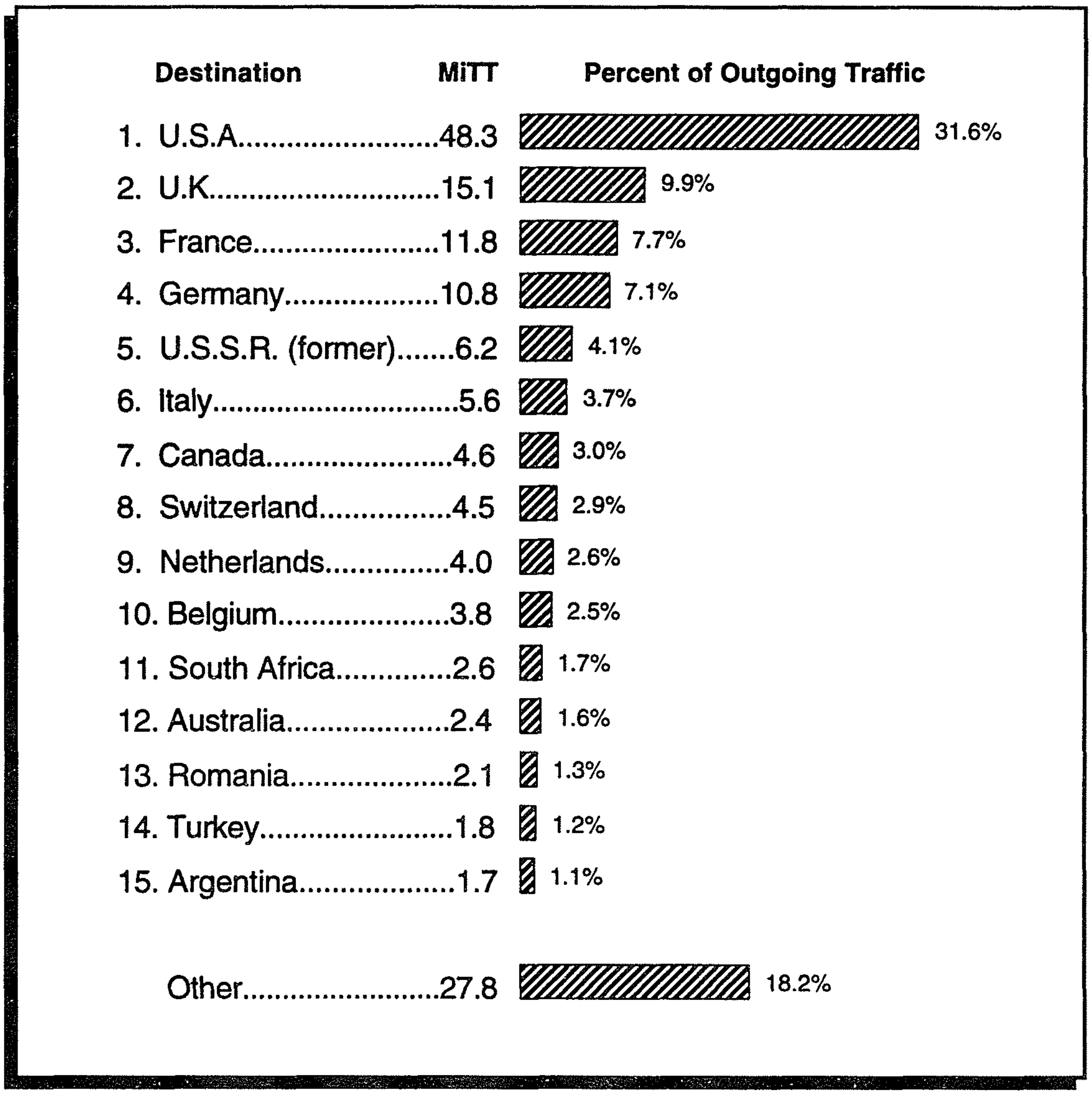
Note: Outgoing total and 'other' include traffic between Russia and the other states of the former U.S.S.R.

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

MIDDLE EAST
& AFRICA
TRAFFIC TABLES

Table 40

Israel
Largest Telecommunication Routes (1992)



National Traffic Balance

*MiTT	1990	1991	1992
Incoming	202.0	247.0	266.0
Outgoing	118.0.	139.4	153.1
Surplus(Deficit)	84.0	107.6	112.9
Total Volume	320.0	386.4	419.1

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 41

Saudi Arabia
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. Egypt	123.8	26.6%
2. Pakistan	49.0	10.5%
3. U.S.A	30.3	6.5%
4. India	23.8	5.1%
5. U.K	21.4	4.6%
6. U.A.E	20.7	4.4%
7. Yemen	17.4	3.8%
8. Jordan	16.5	3.5%
9. Kuwait	15.3	3.3%
10. Philippines	13.1	2.8%
11. Bahrain	12.4	2.7%
12. Turkey	11.7	2.5%
13. Syria	9.7	2.1%
14. Bangladesh	9.3	2.0%
15. France	9.2	2.0%
Other	81.2	17.5%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	266.7	292.1
Outgoing	N.A.	410.6	464.6
Surplus(Deficit)	N.A.	(143.9)	(172.5)
Total Volume	N.A.	677.3	756.7

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 42

South Africa
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. U.K.	37.1	16.7
2. Namibia	27.5	12.4
3. Zimbabwe	18.8	8.5
4. U.S.A	17.6	7.9
5. Botswana	12.8	5.8
6. Germany	10.8	4.9
7. Swaziland	9.9	4.5
8. Mozambique	9.4	4.2
9. Lesotho	7.1	3.2
10. Australia	5.4	2.4
11. Portugal	4.1	1.8
12. France	3.9	1.8
13. Israel	3.7	1.7
14. Italy	3.6	1.6
15. Canada	3.6	1.6
Other	46.4	20.9

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	N.A.	250.7
Outgoing	N.A.	202.6	221.7
Surplus(Deficit)	N.A.	N.A.	29.0
Total Volume	N.A.	N.A.	472.4

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 43

Turkey
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. Germany	82.8	36.5%
2. U.K	18.0	8.0%
3. U.S.A	15.9	7.0%
4. France	14.9	6.6%
5. Netherlands	10.8	4.8%
6. Switzerland	8.8	3.9%
7. Italy	7.9	3.5%
8. Austria	7.0	3.1%
9. Bulgaria	5.0	2.2%
10. Belgium	4.7	2.1%
11. U.S.S.R (former)	4.6	2.0%
12. Romania	4.3	1.9%
13. Greece	3.9	1.7%
14. Saudi Arabia	3.6	1.6%
15. Iran	3.2	1.4%
Other	31.4	13.8%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	441.2	470.0	560.0
Outgoing	158.5	198.1	226.8
Surplus(Deficit)	282.7	271.9	333.2
Total Volume	559.7	668.1	786.8

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

ASIA
TRAFFIC TABLES

Table 44

Australia
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. U.K.	112.0	17.0%
2. U.S.A	104.0	15.8%
3. New Zealand	90.0	13.7%
4. Japan	32.0	4.9%
5. Hong Kong	28.0	4.2%
6. Singapore	20.0	3.0%
7. Italy	19.0	2.9%
8. Germany	17.0	2.6%
9. Canada	16.0	2.4%
10. Philippines	14.0	2.1%
11. Greece	12.0	1.8%
12. Indonesia	11.0	1.7%
13. Papua New Guinea	11.0	1.7%
Other	210.0	31.9%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	439.0	N.A.	N.A.
Outgoing	574.7	610.0	659.0
Surplus(Deficit)	(135.7)	N.A.	N.A.
Total Volume	1013.7	N.A.	N.A.

Note: Data are estimated to the nearest million MiTT. The next largest outgoing traffic streams are to Malaysia; China; Yugoslavia; Taiwan; Fiji; France; Thailand; Netherlands; South Africa; South Korea; Ireland; Switzerland; India; Sweden; Turkey; Sri Lanka; and Israel.

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 45

Bangladesh
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. U.K.	2.8	19.5%
2. U.S.A	1.7	11.8
3. Hong Kong	1.7	11.5
4. India	1.4	9.6
5. Japan	1.3	9.2
6. Singapore	1.2	8.6
7. Saudi Arabia	0.7	4.8%
8. Pakistan	0.6	4.5%
9. Australia	0.4	2.9%
10. Germany	0.4	2.9%
11. Thailand	0.4	2.7%
12. U.A.E.	0.4	2.5%
13. Italy	0.3	2.4%
14. South Korea	0.2	1.5%
15. Canada	0.1	0.8%
Other	7.0	4.9%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	N.A.	66.8
Outgoing	N.A.	10.3	14.3
Surplus(Deficit)	N.A.	N.A.	52.5
Total Volume	N.A.	N.A.	81.1

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 46

China
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. Hong Kong	412.0	64.9%
2. Japan	56.9	9.0%
3. Taiwan	47.1	7.4%
4. U.S.A	30.3	4.8%
5. Macao	24.8	3.9%
6. South Korea	9.3	1.5%
7. Singapore	7.3	1.2%
8. Australia	6.2	1.0%
9. Germany	5.2	0.8%
10. Canada	4.9	0.8%
11. Thailand	3.5	0.6%
12. France	3.5	0.5%
13. U.K	3.2	0.5%
14. Italy	2.6	0.4%
15. Malaysia	2.1	0.3%
Other	16.2	2.5%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	N.A.	N.A.
Outgoing	N.A.	440.0	635.1
Surplus(Deficit)	N.A.	N.A.	N.A.
Total Volume	N.A.	N.A.	N.A.

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 47

Hong Kong

Largest Telecommunication Routes (FY 1992/93)

Destination	MITT	Percent of Outgoing Traffic
1. China	535.0	47.0%
2. U.S.A	80.0	7.0%
3. Taiwan	68.0	6.0%
4. Canada	57.0	5.0%
5. Japan	45.0	4.0%
6. U.K	45.0	4.0%
7. Macao	34.0	3.0%
8. Singapore	34.0	3.0%
9. Australia	34.0	3.0%
10. Philippines	34.0	3.0%
Other	171.0	15.0%

National Traffic Balance

*MiTT	FY 1990/91	FY 1991/92	FY 1992/93
Incoming	645.5	783.0	1009.4
Outgoing	729.4	913.2	1136.6
Surplus(Deficit)	(83.9)	(130.2)	(127.2)
Total Volume	1374.9	1696.2	2146.0

Note: Data are estimated to nearest million MiTT, based on market share data rounded to nearest percent. Fiscal year ends on 31/3.

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 48

India

Largest Telecommunication Routes (FY 1992/93)

Destination	MiTT	Percent of Outgoing Traffic
1. U.S.A.	62.1	24.0%
2. Saudi Arabia	28.4	10.9%
3. U.A.E.	28.2	10.9%
4. U.K.	24.8	9.6%
5. Singapore	8.9	3.4%
6. Canada	6.4	2.5%
7. Germany	5.5	2.1%
8. Hong Kong	5.2	2.0%
9. Japan	4.4	1.7%
10. Australia	4.2	1.6%
11. Oman	3.2	1.2%
12. France	2.9	1.1%
13. Qatar	2.8	1.1%
14. Malaysia	2.4	0.9%
15. Italy	2.2	0.9%
Other	68.2	26.3%

National Traffic Balance

*MiTT	FY 1990/91	FY 1991/92	FY 1992/93
Incoming	N.A.	N.A.	354.6
Outgoing	N.A.	185.8	259.6
Surplus(Deficit)	N.A.	N.A.	95.0
Total Volume	N.A.	N.A.	614.2

Note: Outgoing totals and route data do not include India-Pakistan traffic. Fiscal year ends on 31/3.

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 49

Indonesia
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. Singapore	28.8	24.4%
2. U.S.A	12.5	10.6%
3. Japan	12.3	10.4%
4. Australia	8.5	7.2%
5. Hong Kong	8.3	7.0%
6. South Korea	6.0	5.1%
7. Taiwan	5.9	5.0%
8. Malaysia	5.2	4.4%
9. U.K	4.1	3.4%
10. Germany	3.4	2.9%
11. Netherlands	3.2	2.7%
12. France	2.5	2.1%
13. Philippines	1.9	1.6%
14. Canada	1.6	1.3%
15. Thailand	1.5	1.2%
Other	12.5	10.6%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	135.7	165.5
Outgoing	N.A.	100.0	118.1
Surplus(Deficit)	N.A.	35.7	47.4
Total Volume	N.A.	235.7	283.6

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 50

Japan
Largest Telecommunication Routes (FY 1992/93)

Destination	MiTT	Percent of Outgoing Traffic
1. U.S.A	258.8	20.2%
2. South Korea	133.1	10.4%
3. China	93.8	7.3%
4. Philippines	89.3	7.0%
5. Taiwan	79.0	6.2%
6. Thailand	55.5	4.3%
7. Brazil	49.3	3.8%
8. Hong Kong	43.8	3.4%
9. U.K	42.7	3.3%
10. Iran	37.2	2.9%
11. Malaysia	31.0	2.4%
12. Sigapore	30.5	2.4%
13. Australia	25.8	2.0%
14. Germany	25.7	2.0%
15. France	18.7	1.5%
16. Canada	16.6	1.3%
17. Indonesia	16.3	1.3%
18. Peru	16.1	1.3%
19. Pakistan	15.0	1.2%
20. Italy	8.9	0.7%
Other	196.4	15.3%

*MiTT	FY 1990/91	FY 1991/92	FY 1992/93
Incoming	747.0	836.8	891.5
Outgoing	937.0	1160.5	1283.3
Surplus(Deficit)	(190.0)	(323.7)	(391.8)
Total Volume	1684.0	1997.3	2174.8

Note: FY ends on 31/3.

*MiTT is Minutes of Telecommunications Traffic

Data are in millions of minutes for public voice circuits and have been rounded to the nearest million.

Table 51

South Korea

Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. U.S.A.	93.5	30.6%
2. Japan	80.1	26.2%
3. Hong Kong	14.6	4.8%
4. Philippines	12.6	4.1%
5. China	10.8	3.5%
6. Germany	7.5	2.5%
7. Taiwan	7.3	2.4%
8. U.K.	6.6	2.2%
9. Australia	5.7	1.9%
10. Singapore	5.7	1.9%
11. Indonesia	5.5	1.8%
12. Canada	5.1	1.7%
13. France	4.3	1.4%
Other	46.6	15.2%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	350.2	425.1	N.A.
Outgoing	188.1	229.2	305.9
Surplus(Deficit)	162.1	195.9	N.A.
Total Volume	538.3	654.3	N.A.

Note: 1990 and 1991 figures are for Korea Telecom only.

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 52

Malaysia
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. Singapore	97.3	44.9%
2. Japan	16.3	7.5%
3. U.S.A	12.7	5.9%
4. Australia	12.0	5.5%
5. U.K	11.2	5.2%
6. Hong Kong	10.4	4.8%
7. Taiwan	9.2	4.2%
8. Thailand	7.4	3.4%
9. Indonesia	6.0	2.8%
10. India	4.5	2.1%
11. Canada	2.2	1.0%
Other	9.8	4.5%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	163.4	N.A.	249.0
Outgoing	140.9	176.2	216.5
Surplus(Deficit)	22.5	N.A.	32.5
Total Volume	304.3	N.A.	465.5

Note: Above totals do not include local Malaysia-Singapore border traffic. Incoming totals for 1990 and 1992 are estimated to the nearest million MiTT.

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 53

New Zealand
Largest Telecommunication Routes (FY 1992/93)

Destination	MiTT	Percent of Outgoing Traffic
1. Australia	72.0	48.3%
2. U.S.A	16.0	10.7%
3. U.K	16.0	10.7%
4. Fiji	4.0	2.7%
5. Hong Kong	4.0	2.7%
6. Japan	4.0	2.7%
7. Canada	3.0	2.0%
8. Singapore	3.0	2.0%
9. Taiwan	2.0	1.3%
10. Germany	2.0	1.3%
11. West Samoa	1.0	0.7%
12. Malaysia	1.0	0.7%
13. Netherlands	1.0	0.7%
14. France	1.0	0.7%
15. Switzerland	1.0	0.7%
Other	18.0	12.1%

National Traffic Balance

*MiTT	FY 1990/91	FY 1991/92	FY 1992/93
Incoming	N.A.	N.A.	N.A.
Outgoing	N.A.	N.A.	149.0
Surplus(Deficit)	N.A.	N.A.	N.A.
Total Volume	N.A.	N.A.	N.A.

Note: Total outgoing traffic has been estimated to the nearest million MiTT. Fiscal year ends on 31/3.

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 54

Philippines
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. U.S.A.	53.5	39.4%
2. Japan	21.1	15.5%
3. Hong Kong	11.8	8.7%
4. Canada	7.3	5.4%
5. Australia	6.0	4.4%
6. Singapore	4.4	3.2%
7. Taiwan	3.9	2.9%
8. South Korea	3.3	2.4%
9. Saudi Arabia	3.0	2.2%
10. U.K	2.5	1.8%
11. Italy	2.3	1.7%
12. Guam	2.1	1.5%
13. Malaysia	1.8	1.3%
14. Germany	1.3	1.0%
Other	11.6	8.5%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	255.4	385.4	462.1
Outgoing	100.7	128.5	135.8
Surplus(Deficit)	154.7	256.9	326.3
Total Volume	356.1	513.9	597.9

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 55

Singapore

Largest Telecommunication Routes (FY 1992/93)

Destination	MiTT	Percent of Outgoing Traffic
1. Malaysia	110.0	26.7%
2. Indonesia	40.0	9.7%
3. U.S.A	35.0	8.5%
4. Hong Kong	34.0	8.3%
5. Japan	34.0	8.3%
6. U.K	22.0	5.3%
7. Thailand	19.0	4.6%
8. Australia	17.0	4.1%
9. India	14.0	3.4%
10. Philippines	12.0	2.9%
11. China	10.0	2.4%
12. Germany	9.0	2.2%
13. France	8.0	1.9%
Other	48.0	11.7%

National Traffic Balance

*MiTT	FY 1990/91	FY 1991/92	FY 1992/93
Incoming	N.A.	N.A.	N.A.
Outgoing	N.A.	344.0	412.0
Surplus(Deficit)	N.A.	N.A.	N.A.
Total Volume	N.A.	N.A.	N.A.

Note: Data are estimated to the nearest million MiTT. Fiscal year ends on 31/3. Above totals do not include local Malaysia-Singapore border traffic.

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 56

Sri Lanka

Largest Telecommunication Routes (1991)

Destination	MiTT	Percent of Outgoing Traffic
1. India	1.6	10.3%
2. U.K.	1.6	10.3%
3. Singapore	1.5	9.6%
4. Japan	1.0	6.4%
5. U.S.A.	1.0	6.4%
6. Hong Kong	0.9	5.8%
7. Germany	0.8	5.1%
8. U.A.E.	0.6	3.8%
9. Australia	0.5	3.2%
10. Canada	0.4	2.6%
Other	5.7	36.5%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	N.A.	N.A.
Outgoing	9.0	15.0	N.A.
Surplus(Deficit)	N.A.	N.A.	N.A.
Total Volume	N.A.	N.A.	N.A.

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 57

Taiwan (Republic of China)

Largest Telecommunication Routes (FY 1992/92)

Destination	MiTT	Percent of Outgoing Traffic
1. U.S.A.	82.2	22.3%
2. Hong Kong	64.3	17.5%
3. Japan	55.1	14.9%
4. China (P.R.C.)	52.9	14.3%
5. Singapore	13.4	3.6%
6. Thailand	9.0	2.4%
7. Canada	8.8	2.4%
8. Philippines	8.5	2.3%
9. Malaysia	8.3	2.2%
10. Australia	6.8	1.9%
11. Germany	6.5	1.8%
12. Indonesia	6.0	1.6%
13. South Korea	6.0	1.6%
14. U.K.	5.5	1.5%
15. France	3.9	1.0%
Other	31.4	8.5%

National Traffic Balance

*MiTT	FY 1989/90	FY 1990/91	FY 1992/93
Incoming	301.0	415	484.4
Outgoing	212.0	254.7	368.7
Surplus(Deficit)	89.0	160.3	115.7
Total Volume	513.0	669.7	853.1

Note: Fiscal year 1989/90 ends on 30/6/1990. Later fiscal years end on 31/3.

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

Table 58

Thailand
Largest Telecommunication Routes (1992)

Destination	MiTT	Percent of Outgoing Traffic
1. Japan	23.1	17.4%
2. U.S.A	20.5	15.5%
3. Singapore	13.4	10.1%
4. Hong Kong	11.7	8.8%
5. Taiwan	9.2	6.9%
6. U.K	6.6	5.0%
7. Australia	5.2	3.9%
8. Germany	4.6	3.5%
9. China	3.9	2.9%
10. France	3.5	2.6%
11. Korea	3.0	2.3%
12. Italy	2.4	1.8%
13. India	2.3	1.7%
14. Canada	1.8	1.4%
15. Switzerland	1.7	1.3%
Other	19.7	14.9%

National Traffic Balance

*MiTT	1990	1991	1992
Incoming	N.A.	N.A.	201.6
Outgoing	N.A.	110.5	132.4
Surplus(Deficit)	N.A.	N.A.	69.2
Total Volume	N.A.	N.A.	334.0

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits

METHODOLOGY AND SOURCES

The traffic statistics in TeleGeography 1993 were compiled primarily from an independent survey of telecommunications service providers. In a few cases (Australia, Singapore, Sri Lanka, Sweden), traffic data have been estimated based upon annual reports, government publications and industry interviews.

The following publications were also consulted in preparing this report:

Asia-Pacific Telecommunication Indicators (ITU, Geneva, 1993); European Telecommunication Indicators (ITU, Geneva, 1992); Arab States Telecommunication Indicators (ITU, Geneva 1992), Internationale Fernmeldestatistik (Siemens, Munich, 1993); The World's Telephones A Statistical Compilation as of January 1991-1992, (AT&T, Indianapolis, IN, 1993); and The World's Telephones A Statistical Completion as of January 1990 (AT&T, Indianapolis, IN, 1992).

A common accounting unit known as MiTT -- Minutes of Telecommunications Traffic -- is used throughout the report for traffic on public switched voice circuits. MiTT includes operator assisted and credit card calls; it may also include voice as well as non-voice (facsimile, data) traffic. For a discussion of the origins of MiTT and its various applications (eg., economic forecasting, competition policy, geography), see G. Staple and M. Mullins "Telecom Traffic Statistics - MiTT Matter", Telecommunications Policy, Vol. 14, No. 2, June 1989, pp. 105-128. See also Communications Outlook 1993 (OECD, Paris, 1993) for a comparison of MiTT with other telecommunication indicators.

The outbound MiTT volumes reported for countries in TeleGeography 1993 generally reflect outbound traffic metered by national carriers regardless of whether the traffic was billed domestically or to a foreign location (e.g., to a foreign calling card or credit card.) However, the outbound MiTT data for the U.S. (in 1991 and 1992) and the Netherlands (in 1992) are based on the billing point of the call. Thus, for example, a "Country Direct" call from Thailand to the U.S., billed to a U.S. calling card or credit card, would be counted as outbound (not inbound) U.S. MiTT; the same call also would be included as outbound MiTT by Thailand. Consequently, in some cases, the incoming traffic data reported in the U.S. MiTT table is not directly comparable with the outgoing MiTT to the U.S. reported in the tables for other countries.

There may also be other reasons why the inbound traffic on a given route differs from the outbound traffic stated for the originating country (e.g., calendar vs. fiscal year data). In any event, the route-by-route traffic data reported in TeleGeography for each country generally is based upon the survey data supplied to TeleGeography by the originating country not the terminating country. Calendar year data have been used wherever possible; fiscal year data are used elsewhere (e.g., the U.K., Ireland, Japan, Taiwan).

Carrier traffic statistics do not include traffic from foreign subsidiaries or investment interests, unless stated.

Some differences exist between the historical statistics (i.e., 1988 to 1991) reported in TeleGeography - 1993 and data stated in prior reports. The variations reflect corrections and/or revised data subsequently provided to TeleGeography.

NOTES

TELEGEOGRAPHY 1993

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Table 1(b)

NATIONAL TELECOMMUNICATION INDICATORS (1992)

(Data at 1/1/93 except as indicated)

Country	Telephone Lines (Millions)	Mobile Telephone Subscribers (Thousands)	Fax Machines (Thousands)	Internet Host Computers
Argentina	3.7	45.0	60.0	1
Australia	8.3	440.0	450.0 (1991)	346
Austria	3.5	172.5	130.0	1
Bangladesh	0.3 (1991)	0 (1991)	1.4 (1991)	0
Belgium	4.3	61.5	150.0	26
Brazil	10.7	30.7	150.0	68
Bulgaria	2.3	0 (1991)	N/A	0
Canada	16.2	786.0 (1991)	500.0	406
Chile	1.2	64.4	20.0	9
China (PRC)	11.5	177.0	89.3	0
Colombia	2.8	3.4	50.0	0
Czech and Slovak Republics	2.6	5.0	29.4	106
Denmark	3.0	206.5	100.0 (1991)	10
Finland	2.7	354.0	105.0	98
France	30.1	325.7	630.0	457
Germany	35.4	771.9	1172.0	516
Greece	4.5	14.3	13.3	11
Hong Kong	2.8	202.0 (1991)	172.2	9
Hungary	1.3	23.3	24.72	14
Iceland	0.1	15.3	4.0	7
India	6.8	0 (1991)	20.0 (1990)	2
Indonesia	1.3 (1991)	24.6 (1991)	25.0	0
Ireland	1.1	32.0 (1991)	75.0	32
Israel	1.7	15.2 (1990)	35.0	48
Italy	23.7	783.0	191.0 (1991)	233
Japan	57.3	1378.1 (1991)	482.0 (1991)	216
Korea, Repub. of	15.9	271.9	250.0	38
Luxembourg	0.2	1.1	5.0	4
Malaysia	2.1	83.1	46.0	3
Mexico	6.8	267.2	150.0	23
Netherlands	7.4	166.0	372.8	127
New Zealand	1.5	100.2	50.0 (1991)	60
Norway	2.3	280.0	107.0	48
Pakistan	1.1 (1991)	8.5 (1991)	4.1 (1991)	0
Peru	0.6	27.1	5.0	0
Philippines	0.7	10.9	0.5	0
Poland	3.9	2.8	25.1	38
Portugal	3.2	37.3	27.8	35
Russia	22.9	6.0	N/A	0
Saudi Arabia	1.6	15.8	N/A	0
Singapore	1.1 (1991)	81.9	39.4 (1991)	28
South Africa	3.5	12.5	N/A	46
Spain	13.8	180.3	195.0	68
Sri Lanka	.1 (1991)	2.0 (1991)	5.9 (1991)	0
Sweden	5.9	656.0	300.0	111
Switzerland	4.2	220.7	135.0	81
Taiwan (ROC)	7.4	384.8	200.0 (1991)	165
Thailand	1.8	248.7	7.5 (1991)	12
Turkey	9.5	61.4	62.9	6
United Arab Emirates	0.5	48.9	23.9	0
United Kingdom	26.1	1230.0	915.0 (1991)	368
United States	144.1	11033.0	6000.0	5904
Uruguay	0.5 (1991)	0 (1991)	10.0	0
Venezuela	1.8	7.4	30.0 (1990)	6

Sources: Columns 2, 3 and 4, ITU; Column 5, Internet Society
Figures in Columns 3 and 4 are approximate only.

Table 1(a)

NATIONAL TELECOMMUNICATION INDICATORS (1992)

(Data at 1/1/93 except as indicated)

Country	Population (millions)	Per Capita GNP ($ US)	Area (000 sq. km)	Telephone Lines per 100 people
Argentina	33.1	2,790	2,767	11.18
Australia	17.5	17,050	7,687	47.43
Austria	7.9	20,140	84	44.3
Bangladesh	119.3	220	144	0.25
Belgium	10.0	18,950	31	43
Brazil	156.3	2,940	8,512	6.85
Bulgaria	9.0	1,840	111	25.56
Canada	27.4	20,440	9,976	59.12
Chile	13.6	2,160	757	8.82
China (PRC)	1155.8 (1991)	370	9,561	.99
Colombia	33.4	1,260	1,139	8.38
Czech and Slovak Republics	15.7	2,470	128	16.56
Denmark	5.2	23,700	43	57.69
Finland	5.0	23,980	338	54
France	57.4	20,380	552	52.44
Germany	80.6	23,650	357	43.92
Greece	10.3	6,340	132	43.69
Hong Kong	5.8	13,430	1	48.28
Hungary	10.3	2,720	93	12.62
Iceland	0.3	24,960	103	33.33
India	880.0	330	3,288	0.77
Indonesia	191.2	610	1,905	0.68
Ireland	3.6	11,120	70	30.56
Israel	5.2	11,950	21	32.69
Italy	57.8	18,520	301	41
Japan	123.8	26,930	378	46.43
Korea, Repub. of	43.7	6,330	99	36.38
Luxembourg	0.4	25,963	<1	50
Malaysia	18.8	2,520	330	11.17
Mexico	89.5	3,030	1,958	7.60
Netherlands	15.1	18,780	37	49.01
New Zealand	3.4	12,350	269	44.12
Norway	4.3	24,220	324	53.49
Pakistan	115.5	400	796	0.95
Peru	22.5	1,070	1,285	2.67
Philippines	64.3	730	300	1.09
Poland	38.4	1,790	38.2	10.16
Portugal	9.9	5,930	92	32.32
Russia	148.9 (1991)	3,220	17,075	15.38
Saudi Arabia	15.9	7,820	2,150	10.06
Singapore	2.8	14,210	1	39.29
South Africa	39.8	2,560	1,221	8.79
Spain	39.1	12,450	505	35.29
Sri Lanka	17.4	500	66	.57
Sweden	8.7	25,110	450	67.82
Switzerland	6.8	33,610	41	61.76
Taiwan (ROC)	20.6 (1991)	9,448	36	35.92
Thailand	57.8	1,570	513	3.11
Turkey	58.8	1,780	779	16.16
United Arab Emirates	1.7	19,870 (1990)	84	29.41
United Kingdom	57.7	16,550	245	45.23
United States	255.0	22,240	9,373	56.51
Uruguay	3.1	2,840	177	16.13
Venezuela	20.7	2,730	912	8.70

Sources: Columns 2 and 5, ITU; Columns 3 and 4, World Bank Development Report

Table 1(c)

NATIONAL TELECOMMUNICATION INDICATORS (1992)

Country	Outgoing MiTT (Millions)	Outgoing MiTT Per Capita	Outgoing MiTT Per Access Line	Balance of MiTT (deficit)/surplus (millions)
Argentina	124.3	3.8	33.6	35.4
Australia	659.0	37.7	79.4	N/A
Austria	713.4	90.3	203.8	(21.1)
Bangladesh	14.3	0.1	47.7	52.5
Belgium	911.0	93.7	217.9	N/A
Brazil	169.9	1.1	15.9	160.7
Bulgaria	88.6	9.8	38.5	N/A
Canada	2246.5	82.0	138.7	429.8
Chile	55.0	4.0	45.8	30.6
China (PRC)	635.1	0.5	55.2	N/A
Colombia	94.5	2.8	33.8	143.5
Czech and Slovak Republics	178.0	11.3	68.5	58.0
Denmark	424.5	81.8	141.8	0.7
Finland	235.0	47.0	87.0	N/A
France	2449.0	42.7	81.4	91.0
Germany	4087.0	50.7	115.5	(987.0)
Greece	298.9	29.0	66.4	60.8
Hong Kong	1136.6	196.0	405.9	(127.2)
Hungary	183.8	17.8	141.4	(33.3)
Iceland	22.1	73.7	221.0	(0.4)
India	259.6	0.3	38.2	95.0
Indonesia	118.1	0.6	90.8	47.4
Ireland	296.6	82.4	269.6	86.4
Israel	153.1	29.4	90.1	112.9
Italy	1473.4	25.5	63.2	67.6
Japan	1283.0	10.5	22.5	(391.8)
Korea, Repub. of	305.9	7.0	19.2	N/A
Luxembourg	181.0	452.5	905.0	(73.5)
Malaysia	216.5	11.5	103.1	32.5
Mexico	683.5	7.6	100.5	431.5
Netherlands	1133.9	75.1	153.2	(94.9)
New Zealand	149.0	43.8	99.3	N/A
Norway	349.0	81.0	151.5	(48.0)
Pakistan	39.7	0.3	36.1	151.2
Peru	32.1	1.4	53.5	94.0
Philippines	135.8	2.1	194.0	326.3
Poland	212.7	5.5	54.5	153.9
Portugal	212.0	21.4	66.3	N/A
Russia	175.6	1.2	7.7	55.1
Saudi Arabia	464.6	29.2	290.4	(172.5)
Singapore	412.0	147.1	374.5	N/A
South Africa	221.7	5.6	63.3	29.0
Spain	804.5	20.6	58.3	42.7
Sri Lanka	15.5	0.9	155.0	N/A
Sweden	691.0	78.4	115.6	(96.0)
Switzerland	1551.0	228.1	369.3	(359.5)
Taiwan (ROC)	368.7	17.9	49.8	115.7
Thailand	132.4	2.3	73.6	69.2
Turkey	226.8	3.9	23.9	333.2
United Arab Emirates	299.0	175.9	598.0	N/A
United Kingdom	2849.0	49.4	109.2	(60.0)
United States	10173.6	39.9	70.6	(4904.3)
Uruguay	30.2	9.7	60.4	22.8
Venezuela	115.5	5.6	64.2	13.1

Source: TeleGeography 1993

INTERNATIONAL TELEPHONE DIALING CODES

Code	Country	Capital (city code)
1	Canada	Ottawa (613)
1	United States	Washington, D.C. (202)
1-809	Anguilla	
1-809	Antigua & Barbuda	
1-809	Bahamas	Nassau
1-809	Barbados	Bridgetown
1-809	Bermuda	
1-809	British Virgin Islands	
1-809	Carriacou	
1-809	Cayman Islands	
1-809	Dominca	
1-809	Dominican Republic	Santo Domingo
1-809	Grenada	
1-809	Jamaica	Kingston
1-809	Montserrat	
1-809	Nevis Islands	
1-809	Puerto Rico	San Juan
1-809	St. Kitts	
1-809	St. Lucia	
1-809	St. Vincent & the Grenadines	
1-809	Trinidad & Tobago	Port of Spain
1-809	Turks & Caicos Islands	
20	Egypt	Cairo (2)
212	Morocco	Rabat (7)
213	Algeria	Algiers (2)
216	Tunisia	Tunis (1)
218	Libya	Tripoli (21)
220	Gambia	Banjul
221	Senegal	Dakar
222	Mauritania	Nouakchott
223	Mali	Bamako
224	Guinea	Conakry (4)
225	Ivory Coast	Yamoussoukro
226	Burkina Faso	Ouagadougou
227	Niger	Niamey
228	Togo	Lome
229	Benin	Porto Novo
230	Mauritius	Port Louis
231	Liberia	Monrovia
232	Sierra Leone	Freetown (22)
233	Ghana	Accra (21)
234	Nigeria	Abuja
235	Chad	N'Djamena
236	Central African Republic	Bangui (61)
237	Cameroon	Yaounde
238	Cape Verde Islands	Praia
240	Equatorial Guinea	Bata
241	Gabon	Libreville
242	Congo	Brazzaville (81, 82, 83)
243	Zaire	Kinshasa (12)
244	Angola	Luanda (2)
245	Guinea-Bissau	Bissau
247	Ascension Island	
248	Seychelles	
249	Sudan	Khartoum (11)
250	Rwanda	Kigali
251	Ethiopia	Addis Ababa (1)
252	Somalia	Mogadishu (1)

Code	Country	Capital (city code)
253	Djibouti	Djibouti
254	Kenya	Nairobi (2)
255	Tanzania	Dar Es Salaam (51)
256	Uganda	Kampala (41)
257	Burundi	Bujumbura
258	Mozambique	Maputo
260	Zambia	Lusaka (1)
261	Madagascar	Antananarivo (2)
262	Reunion Island	
263	Zimbabwe	Harare (4)
264	Namibia	Windhoek (61)
265	Malawi	Lilongwe
266	Lesotho	Maseru
267	Botswana	Gaborone (31)
268	Swaziland	Mbabane
27	South Africa	Pretoria (12)
297	Aruba	all locations (8)
298	Faeroe Islands	
299	Greenland	
30	Greece	Athens (1)
31	Netherlands	Amsterdam (20)
32	Belgium	Brussels (2)
33	Andorra	all locations (628)
33	France	Paris (1)
33	Monaco	all locations (93)
34	Spain	Madrid (1)
350	Gibraltar	
351	Portugal, Azores & Madeira Isla	Lisbon (1)
352	Luxembourg	
353	Ireland	Dublin (1)
354	Iceland	Reykjavik (1)
355	Albania	Tirana (42)
356	Malta	Valletta
357	Cyprus	Nicosia (2)
358	Finland	Helsinki (0)
359	Bulgaria	Sofia (2)
36	Hungary	Budapest (1)
370	Lithuania	Vilinius (2)
371	Latvia	Riga (2)
372	Estonia	Tallinn (2)
373	Moldova	Chisinau
385	Croatia	Zagreb (41)
386	Slovenia	Ljubljana (61)
39	Italy	Rome (6)
40	Romania	Bucharest (0)
41	Liechtenstein	all locations (75)
41	Switzerland	Bern (31)
42	Czech Republic	Prague (2)
42	Slovakia	Bratislava (7)
43	Austria	Vienna (1)
44	Great Britain	London (71, 81)
45	Denmark	Copenhagen
46	Sweden	Stockholm (8)
47	Norway	Oslo (2)
48	Poland	Warsaw (22)
49	Germany	Bonn (228)
501	Belize	Punta Gorda (7)
502	Guatemala	Guatemala City (2)

INTERNATIONAL TELEPHONE DIALING CODES

Code	Country	Capital (city code)
503	El Salvador	San Salvador
504	Honduras	Tegucigalpa
505	Nicaragua	Managua (2)
506	Costa Rica	San Jose
507	Panama	Panama
508	St. Pierre & Miquelon	
509	Haiti	Port au Prince (1)
51	Peru	Lima (14)
52	Mexico	Mexico City (5)
53	Cuba	Havana (7)
54	Argentina	Buenos Aires (1)
55	Brazil	Brazilia (61)
56	Chile	Santiago (2)
57	Colombia	Bogota (1)
58	Venezuela	Caracas (2)
590	Guadeloupe	
591	Bolivia	La Paz (2)
592	Guyana	Georgetown (2)
593	Ecuador	Quito (2)
594	French Guiana	Cayenne
595	Paraguay	Asuncion (21)
596	French Antilles	
597	Surinam	Paramibo
598	Uruguay	Montevideo (2)
599	Netherlands Antilles	
60	Malaysia	Kuala Lumpur (3)
61	Australia	Canberra (62)
62	Indonesia	Jakarta (21)
63	Philippines	Manila (2)
64	New Zealand & Chatham Islands	Wellington (4)
65	Singapore	
66	Thailand	Bangkok (2)
670	Saipan, Rota & Tinian	
671	Guam	
673	Brunei	Bandar Seri Begawan
674	Nauru	
675	Papua New Guinea	Port Moresby
676	Tonga Islands	
679	Fiji	
684	American Samoa	
685	Western Samoa	
686	Kiribati	
687	New Caledonia	
689	French Polynesia	
689	Moorea	
689	Tahiti	

Code	Country	Capital (city code)
691	Micronesia	
692	Marshall Island	
7	Belarus	Minsk (0172)
7	Ukraine	Kiev (044)
7	Kazakhstan	Alma Ata (3272)
7	Kyrgyzstan	Bishkek (3312)
7	Russia	Moscow (095)
7	Turkmenistan	Ashkhabad (363)
7	Uzbekistan	Tashkent (3712)
7	Tajikistan	Dushanbe (3772)
7	Georgia	Tbilisi (8832)
7	Armenia	Yerevan (8852)
7	Azerbaijan (future code: 994)	Baku (8922)
81	Japan & Okinawa	Tokyo (3)
82	Republic of Korea	Seoul (2)
84	Vietnam	Hanoi (4)
850	North Korea	Pyongyang
852	Hong Kong	(5)
853	Macao	
855	Cambodia	Phnom-Penh
856	Laos	Vientiane
86	China, People's Republic of	Beijing (1)
880	Bangladesh	Dhaka (2)
886	Taiwan	Taipei (2)
90	Turkey	Ankara (4)
91	India	New Delhi (11)
92	Pakistan	Islamabad (51)
93	Afghanistan	Kabul
94	Sri Lanka	Colombo (1)
95	Myanmar (Burma)	Rangoon
960	Maldives	
961	Lebanon	Beirut (1)
962	Jordan	Amman (6)
963	Syria	Damascus (11)
964	Iraq	Baghdad (1)
965	Kuwait	
966	Saudi Arabia	Riyadh (1)
967	Yemen	Sanaa (2)
968	Oman	Muscat
971	United Arab Emirates	Dubai (4)
972	Israel	Jerusalem (2)
973	Bahrain	Al Manama
974	Qatar	Doha
975	Bhutan	Thimphu
976	Mongolia	Ulan Bator
977	Nepal	Kathmandu
98	Iran	Tehran (21)

Note: No city code is required for capital cities unless indicated.

NORTH AMERICAN AREA CODES

Code	State	City
201	New Jersey, Northern	Newark
202	District of Columbia	Washington
203	Connecticut	all
204	Manitoba (Canada)	all
205	Alabama	all
206	Washington, West (Seattle)	Seattle
207	Maine	all
208	Idaho	all
209	California, Central	Fresno
210	Texas, South Central	San Antonio
212	New York City	Manhattan
213	California, Southern	Los Angeles
214	Texas, Central	Dallas
215	Pennsylvania, Eastern	Philadelphia
216	Ohio, Northeastern	Cleveland
217	Illinois, Central	Springfield
218	Minnesota, Northern	Duluth
219	Indiana, Northern	Gary
301	Maryland, Northern	Rockville
302	Delaware	all
303	Colorado, Northern	Denver
304	West Virginia	all
305	Florida, Southern	Miami
306	Saskatchewan (Canada)	all
307	Wyoming	all
308	Nebraska, Western	North Platte
309	Illinois, Central	Peoria
310	California, Southern	Long Beach
312	Illinois, Northeast	Chicago
313	Michigan, Eastern	Detroit
314	Missouri, Eastern	St. Louis
315	New York, Northern	Syracuse
316	Kansas, Southern	Wichita
317	Indiana, Central	Indianapolis
318	Louisiana, Western	Shreveport
319	Iowa, Eastern	Dubuque
401	Rhode Island	all
402	Nebraska, Eastern	Omaha
403	Alberta (Canada)	all
404	Georgia, Central	Atlanta
405	Oklahoma, Southwestern	Oklahoma City
406	Montana	all
407	Florida, Eastern	West Palm Beach
408	California, Central	San Jose
409	Texas, Southeastern	Galveston
410	Maryland, Southern	Baltimore
412	Pennsylvania, Southwestern	Pittsburgh
413	Massachusetts, Western	Springfield
414	Wisconsin, Eastern	Milwaukee
415	California, Northern	San Francisco
416	Ontario, Southeastern (Canada)	all
417	Missouri, Southern	Springfield
418	Quebec, Northern (Canada)	all
419	Ohio, Northwestern	Toledo
501	Arkansas	all
502	Kentucky, Western	Louisville
503	Oregon	all
504	Louisiana, Southeastern	New Orleans
505	New Mexico	all
506	New Brunswick (Canada)	all
507	Minnesota, Southern	Rochester
508	Massachusetts, Central	Worcester
509	Washington, East (Spokane)	Spokane
510	California, Northern	Oakland
512	Texas, South Central	Austin
513	Ohio, Southwestern	Cincinnati
514	Quebec, Southern (Canada)	Montreal
515	Iowa, Central	Des Moines
516	New York, Northeastern	Hempstead
517	Michigan, Central	Lansing
518	New York, Northeastern	Albany

Code	State	City
519	Ontario, Southern (Canada)	London
601	Mississippi	all
602	Arizona	all
603	New Hampshire	all
604	British Columbia (Canada)	all
604	Northwest Territory (Canada)	all
605	South Dakota	all
606	Kentucky, Eastern	Covington
607	New York, Southern	Binghamton
608	Wisconsin, Southern	Madison
609	New Jersey, Southern	Atlantic city
612	Minnesota, Central	Minneapolis
613	Ontario, Southeastern (Canada)	Ottawa
614	Ohio, Southeastern	Columbus
615	Tennessee, Eastern	Nashville
616	Michigan, Western	Grand Rapids
617	Massachusetts, Eastern	Boston
618	Illinois, Southern	Centralia
619	California, Southern & Central	San Diego
701	North Dakota	all
702	Nevada	all
703	Virginia, Northern	Alexandria
704	North Carolina, Western	Charlotte
705	Ontario, Northeastern (Canada)	North Bay
706	Georgia, Northern	Athens
707	California, Northern	Santa Rosa
708	Illinois, Northeast	Oak Brook
709	Newfoundland (Canada)	all
712	Iowa, Western	Council Bluffs
713	Texas, Southeastern	Houston
714	California, Southern	Anaheim
715	Wisconsin, Northern	Eau Claire
716	New York, Western	Buffalo
717	Pennsylvania, Central	Harrisburg
718	New York City	Bronx, Queens
719	Colorado, Southern	Colorado Springs
801	Utah	all
802	Vermont	all
803	South Carolina	all
804	Virginia, Southern	Richmond
805	California, Central	Bakersfield
806	Texas, Northern	Amarillo
807	Ontario, Northwestern (Canada)	Fort William
808	Hawaii	all
809	Puerto Rico	all
812	Indiana, Southern	Evansville
813	Florida, Southwestern	Tampa
814	Pennsylvania, Central	Altoona
815	Illinois, Northern	Rockford
816	Missouri, Northern	Kansas City
817	Texas, Central	Fort Worth
818	California, Southern	Burbank
819	Quebec, Southern (Canada)	Sherbrooke
901	Tennessee, Western	Memphis
902	Nova Scotia (Canada)	all
902	Prince Edward Island (Canada)	all
903	Texas, Eastern	Tyler
904	Florida, Northern	Jacksonville
906	Michigan, Northern	Escanaba
907	Alaska	all
908	New Jersey, Central	New Brunswick
909	California, Central	Riverside
910	North Carolina, Central	Greensboro
912	Georgia, Southern	Savannah
913	Kansas, Northern	Topeka
914	New York, Southeastern	White Plains
915	Texas, Western	El Paso
916	California, Northern	Sacramento
917	New York City	auxiliary code
918	Oklahoma, Northeast	Tulsa
919	North Carolina, Eastern	Raleigh

NOTES

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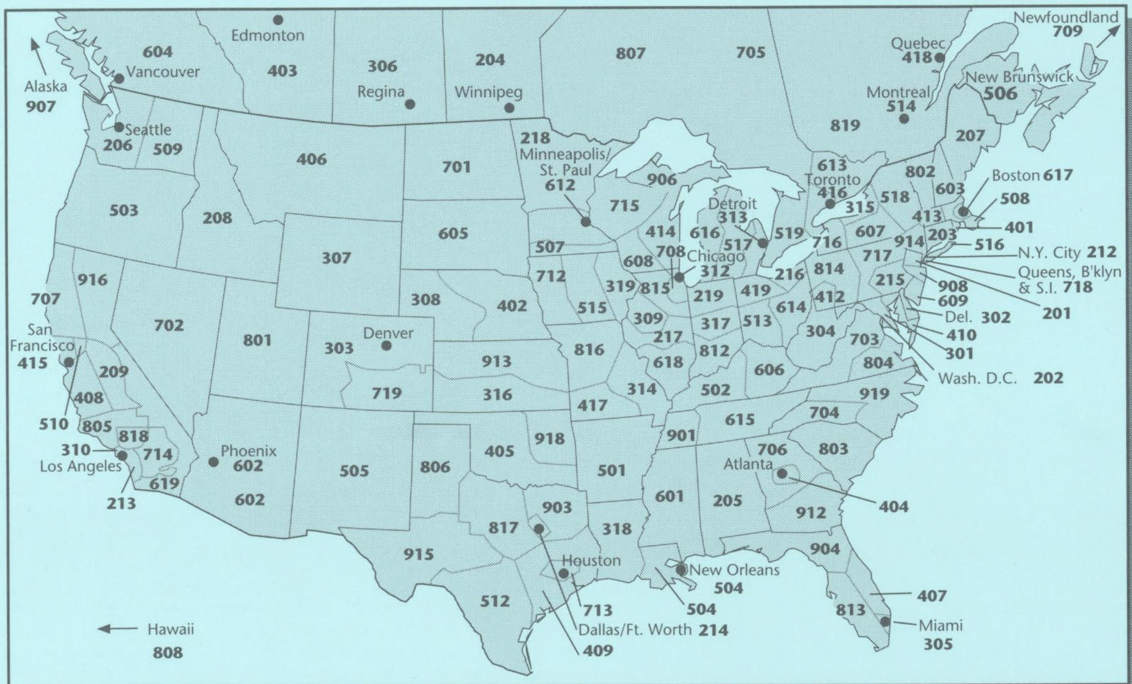
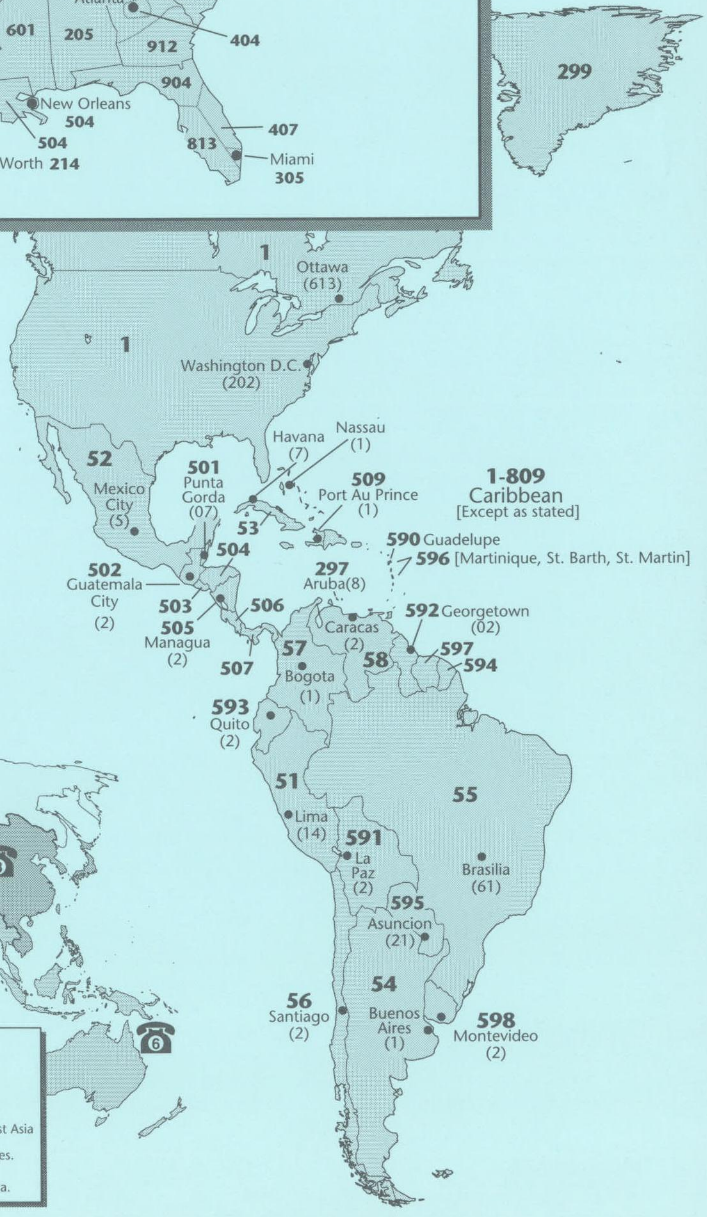
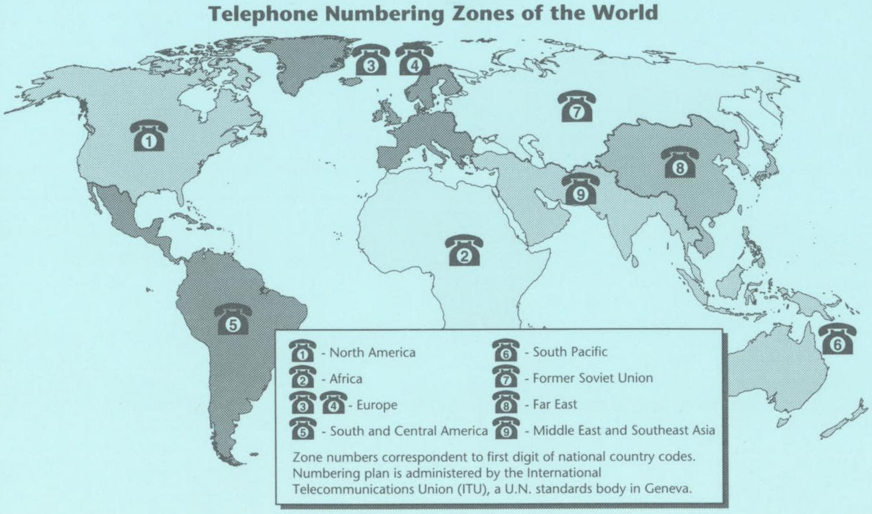
World Telephone Codes:

TeleGeography, Inc., Suite 1000, 1150 Connecticut Avenue, N.W., Washington D.C. 20036 / Tel. 202-467-0017; fax 202-467-5915

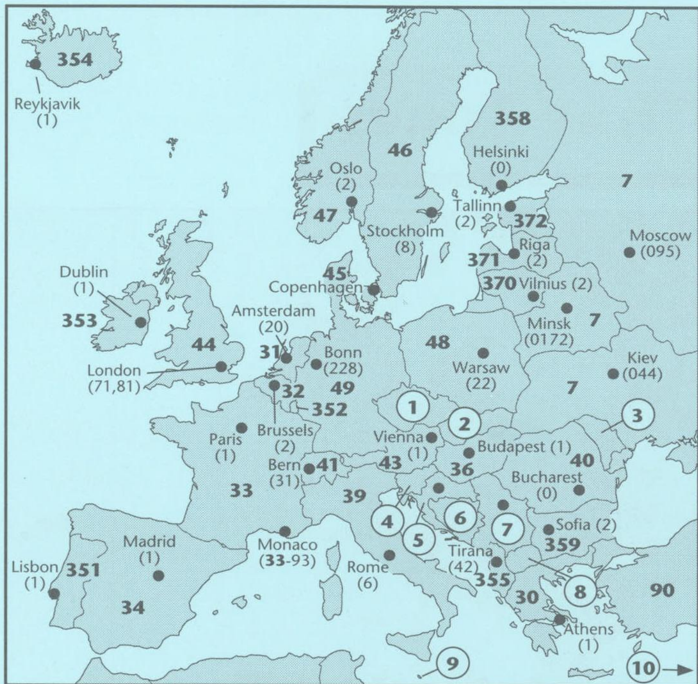




Telephone Numbering Zones of the World



Countries and Capitals

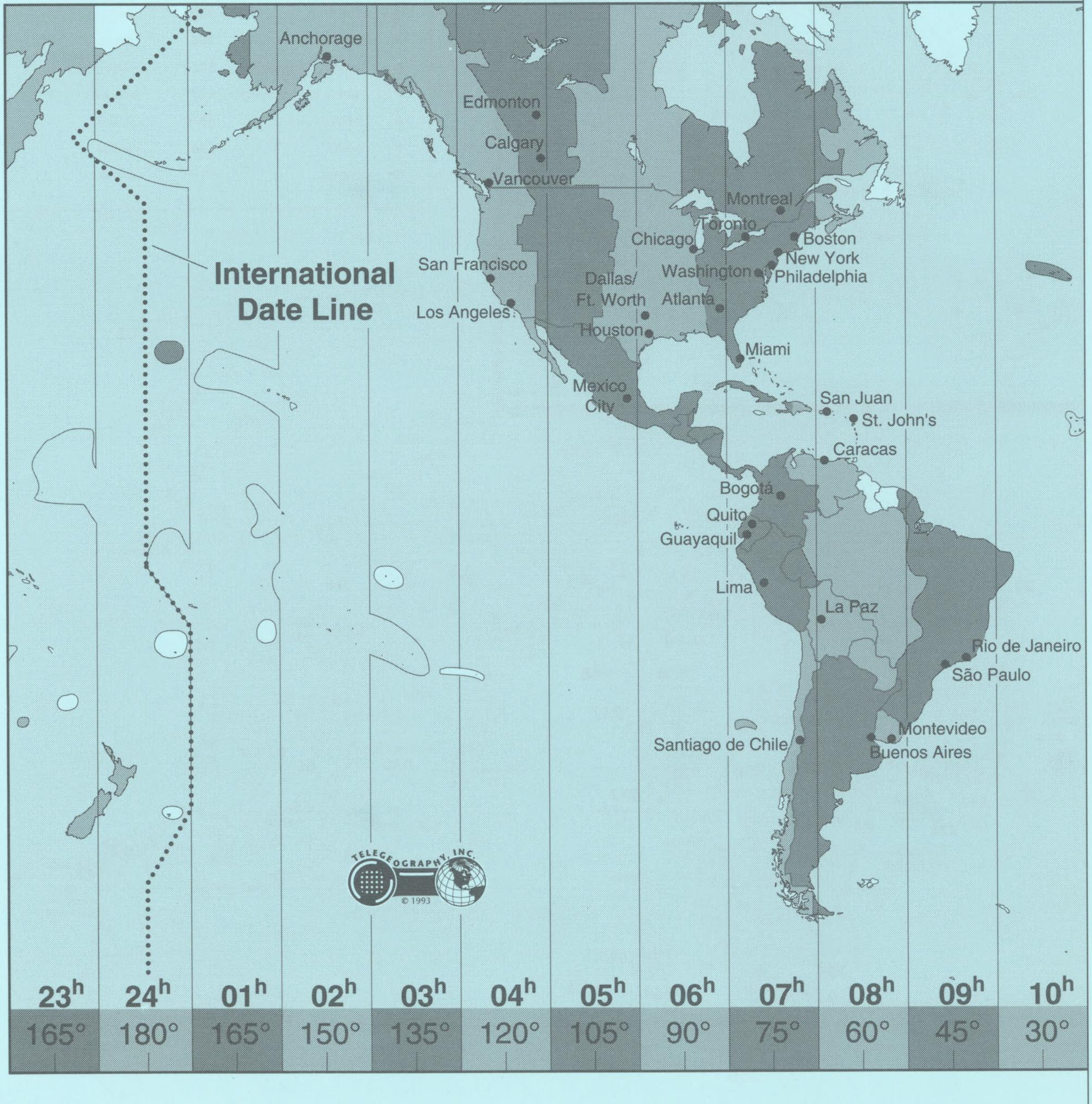


KEY FOR EUROPE INSET

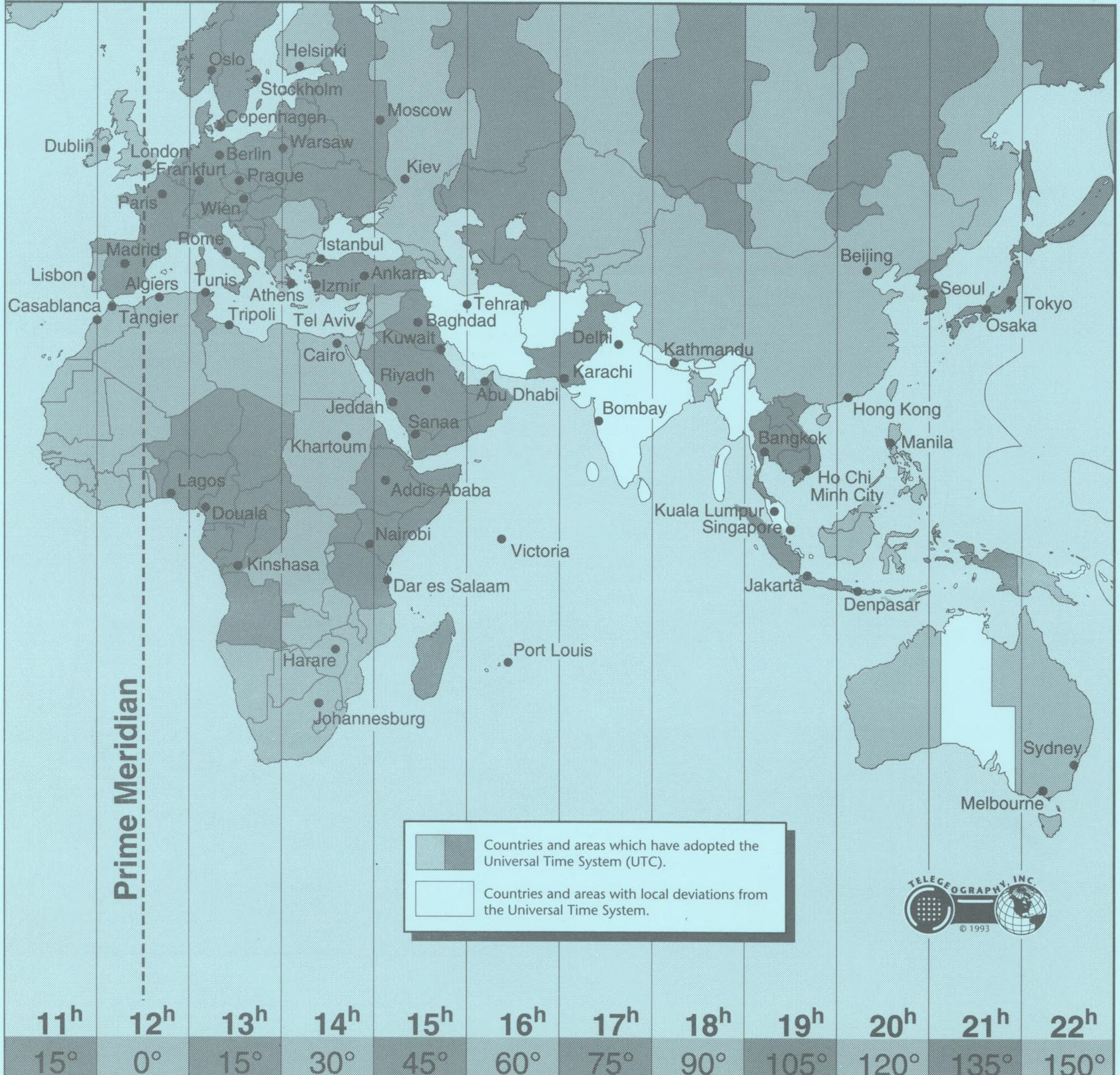
Key Number	Country	Telephone Code	Capital City	City Code
1	Czech Republic	42	Prague	2
2	Slovakia	42	Bratislava	7
3	Moldova	373	Kishinëv	2
4	Slovenia	386	Ljubljana	61
5	Croatia	385	Zagreb	41
6	Bosnia/Herzegovina	387	Sarajevo	71
7	Serbia & Montenegro	381	Belgrade	11
8	Macedonia	389	Chisinau	-
9	Malta	356	Valletta	-
10	Cyprus	357	Nicosia	2

Note: No city code is required for listed cities unless stated.

World Time Zones



World Time Zones



A POLITICAL


ARCTIC OCEAN
GREENLAND (DEN.)
ALASKA (U.S.)
CANADA
PACIFIC OCEAN
UNITED STATES
ATLANTIC OCEAN
Tropic of Cancer
MEXICO
BAHAMAS
CUBA
DOMINICAN REP.
PUERTO RICO (U.S.)
ANTIGUA AND BARBUDA
GUADELOUPE (FR.)
DOMINICA
MARTINIQUE (FR.)
ST. LUCIA
BARBADOS
TRINIDAD AND TOBAGO
BELIZE
HONDURAS
JAMAICA
HAITI
GRENADA
GUATEMALA
EL SALVADOR
NICARAGUA
COSTA RICA
PANAMA
VENEZUELA
GUYANA
FR. GUIANA
SURINAME
COLOMBIA
ECUADOR
Equator
KIRIBATI
TOKELAU
W. SAMOA
AM. SAMOA
COOK IS. (N.Z.)
TONGA
NIUE (N.Z.)
FRENCH POLYNESIA
PITCAIRN (U.K.)
Tropic of Capricorn
PERU
BRAZIL
BOLIVIA
PARAGUAY
CHILE
ARGENTINA
URUGUAY
FALKLAND IS. (U.K.)
PACIFIC OCEAN
Antarctic Circle
80°
60°
40°
20°
0°
160°
140°
120°
100°

GEOGRAPHY 1993

EUROPE
1. NETHERLANDS
2. BELGIUM
3. LUXEMBOURG
4. CZECH REPUBLIC
5. SLOVAKIA
6. SWITZERLAND
7. LIECHTENSTEIN
8. AUSTRIA
9. HUNGARY
10. SLOVENIA
11. CROATIA
12. BOSNIA
13. YUGOSLAVIA
14. ALBANIA
15. MACEDONIA
16. MOLDOVA

ASIA

17. GEORGIA
18. ARMENIA
19. AZERBAIJAN
20. TURKMENISTAN
21. UZBEKISTAN
22. TAJIKISTAN
23. KYRGYZSTAN

AFRICA

24. BURKINA FASO
25. TOGO
26. EQUATORIAL GUINEA

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