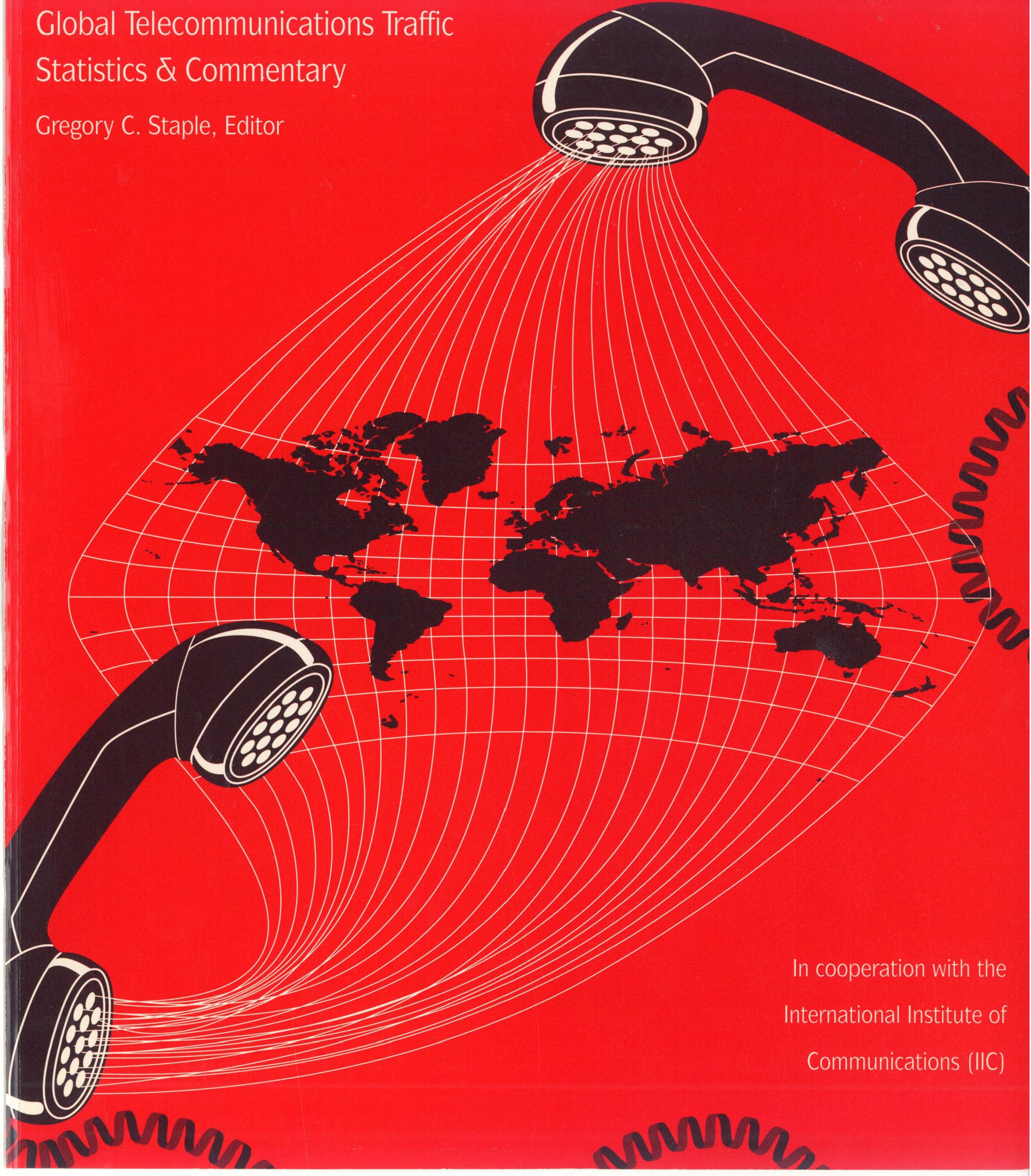
TeleGeography 1995

Global Telecommunications Traffic Statistics & Commentary

Gregory C. Staple, Editor



In cooperation with the International Institute of Communications (IIC)

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telegeography \tĕl´ə-jē-ŏg´rə-fē \ *n* (1990) abbrv. of telecommunications geography [fr. Gk *tele,* far off, at a distance and L. *communicatus,* pp. of communicare to impart + fr. Gk *geo* (earth) + *graphein,* (to write)] 1. a new branch of geography that maps the pattern of telephone traffic and other electronic communication flows; 2. places created by or perceived solely via telecommunications (e.g., a computer network address); 3. the telecommunications artifacts (radio antennae, terminals, signs) on a site; 4. the balance of telecommunications power in one country or region vis-à-vis another (cf. geopolitics, *archaic*).

TeleGeography, Inc./IIC

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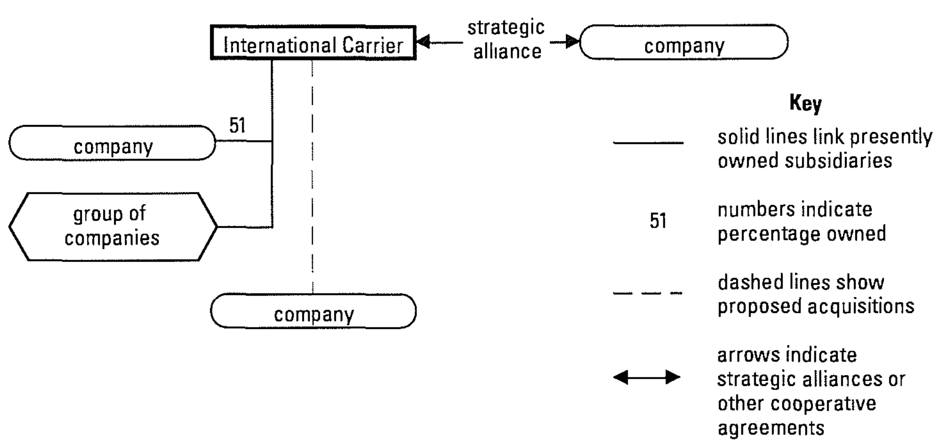

The charts represent the main business of each company. Minor corporate subsidiaries have been excluded in some cases. Except where noted, subsidiaries are wholly owned.

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Preface

Few industries are re-shaping society as dramatically as telecommunications. An equally fascinating and important story is the transformation of the industry itself. The powerful fusion of telecommunications with computing, information services and entertainment has created a new frontier of networks that opens new worlds and offers unprecedented business opportunities. *TeleGeography 1995* is a precise chronicle of this fast-paced telecommunications world, and also an indispensable guide to the future terrain.

In many ways, this book is like the industry itself: continually growing in new directions to meet the changing needs of the market. In addition to the usual analysis of international traffic flow, this year's edition offers an invaluable overview of the players who are constructing and reconfiguring the information superhighway. In an era of megamergers and cross-industry alliances, you have to know the players to understand how they are shaping the marketplace. To fathom current trends requires awareness of the interrelation of technological advances, governmental oversight, cultural standards and industry responsibility. *TeleGeography* provides insightful perspectives on these and other vital topics.

As it has been since its first edition in 1989, *TeleGeography* remains an invaluable resource for everyone interested in global telecommunications as it is today ... and as it will be tomorrow. MCI and BT are *proud to co-sponsor this valuable book.*

Timothy F. Price
President and Chief Operating Officer
MCI Telecommunications Corporation

Alfred Mockett
Managing Director
BT Global Communications

Acknowledgments

We are indebted to the numerous carriers, government departments, regulators and international organizations from around the world who responded to our requests for information. Special thanks are due particularly to the dedicated people at these organizations and at the International Telecommunication Union (ITU) in Geneva who set aside the time necessary to ensure that the data reported here are as current and accurate as possible.

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.

This year's edition of *TeleGeography* was also supported, in part, by publication grants from MCI Communications Corporation and British Telecommunications plc. As in the past, however, these grants were made without any precondition; TeleGeography, Inc. is solely responsible for the report's editorial contents.

Gregory C. Staple
Editor

Introduction

It is common to hear that geography is of less and less importance in a world where anyone can instantly communicate almost anything, anywhere and anytime. Though this may be true, it only tells part of the story about the impact of modern telecommunications networks. For many people, the rise of global communications has not led to the end of geography so much as the explosion of place. The less the old geography of passports, oceans and time zones seems to matter, the more a new geography of dialing codes, channel guides and Net sites has come to the fore.

In 1995 over 75 million new telephone numbers will be added globally; Internet addresses are doubling every year; and the next generation of digital satellite-to-home TV services is changing electronic vistas from Malaysia to Mexico. As the distributor of *Baywatch,* the world's most widely viewed TV program, has said: "Once a show is on satellite, it's like the rain. It falls on the rich and poor alike—and both watch. . . ."

TeleGeography provides a unique guide to much of this electronic landscape. It maps the world's international telecommunications traffic, route-by-route and minute-by-minute, covering over 65 countries and almost 100 carriers. Readers who are not familiar with the varied contours of this terrain may first wish to look at the maps beginning at page 92 or to browse the national statistical tables at the back of this report.

The data compiled here primarily reflect international traffic on public telephone networks. But some data is provided for international private (leased) line networks such as the Internet, the world's largest computer network (see pages 64-65).

One highlight of this year's edition is an original portfolio of cyberspace maps or cybermaps by John December, author of *The World Wide Web Unleashed.* Their territory is the Internet and its various channels, including the World Wide Web, the multimedia space on the Net. A review of this novel cartographic genre begins on page 66.

New International Carriers

Since its first edition in 1989, *TeleGeography* has charted both the pattern of global telecommunications and the carriers providing the connections. Traffic patterns invariably reflect the characteristics of the underlying carriers—their facilities, their service offerings, their charges and connection arrangements. During the last few years, however, monitoring the traffic base of the world's carriers has become more difficult.

The number of international carriers has grown dramatically as market liberalization and technology have brought tens of new companies into the market. More than 15 countries now permit facilities-based competition for international telephone service and resale carriers are active in many other nations via call back services and calling cards.

> *ALL INTERNATIONAL CARRIERS NOW RELAY BILLIONS OF BITS FROM ONE COUNTRY TO ANOTHER. IT IS LAW AND REGULATION (NOT TECHNOLOGY) WHICH DICTATE WHO CAN CARRY THE TELEPHONE BITS, AND ON WHAT BASIS.*

Who owns these carriers? How large is their business? How do you contact them? To answer these and other questions we have launched a companion directory called *New International Carriers.* The first edition contains details on over 350 carriers and their managing directors, owners and affiliates.

Tracking international telephone flows also has become more challenging because digital encoding and transmission technologies are blurring the boundaries between various kinds of international service providers. Today the technology used to pick up and deliver telephone calls from one country to another may be virtually indistinguishable from that used to pick up and deliver e-mail or video clips. Digitization has created a common metric; almost all international carriers now relay billions of bits from one country to another. It is law and regulation (not technology) which dictate who can carry the telephone bits, who can carry the data and video bits, and on what basis.

The terms "information superhighway" and "infobahn" have been coined to describe the multi-purpose communications networks which can transmit these streams of voice, data and video information at the same time. Governments prefer another term: the global information infrastructure (GII). But however named, the business of international communication is being radically transformed.

Mapping the Information Superhighway

To help readers better understand the dimensions of these changes, a special section has been added to *TeleGeography 1995.* At its core are a series of charts showing the myriad investment links and alliances which now exist between the world's major telecoms carriers and other large information companies—cable TV networks, publishers, film studios, broadcasters and computer software providers.

To use the information highway metaphor, these charts map the global telecoms lane side-by-side with the cable TV, broadcasting and publishing lanes. And they follow these lanes around the world—from North America to Europe to Asia. Detailed corporate ownership charts are also provided for the world's largest information companies, including AT&T, Time Warner, Microsoft, TCI, Bertelsmann, News Corporation, Deutsche Telekom, IBM and NTT.

The charts show that media convergence is no longer a prediction but a reality as major multinational corporations establish their presence in every technology and in every region of the world.

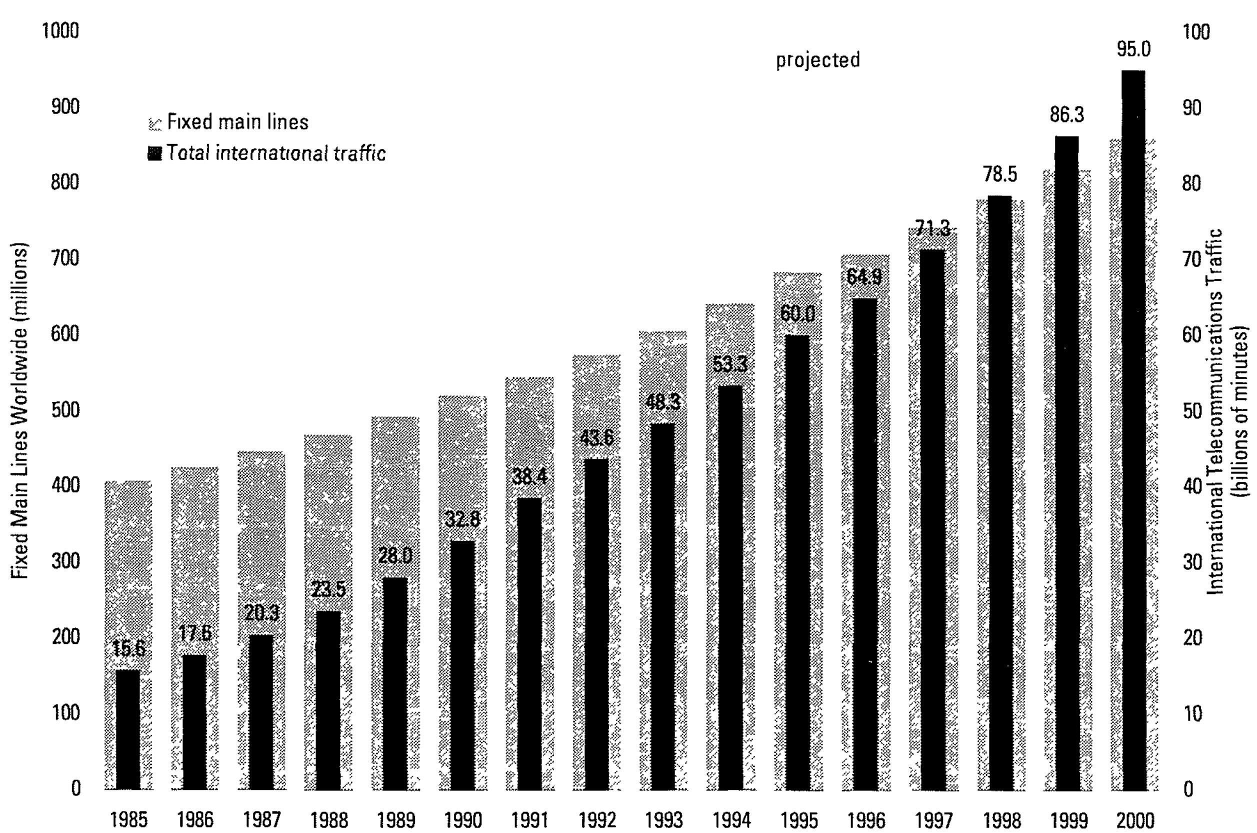
For example, an international telephone call may now begin at a point and click menu on a computer screen; be uplinked by a private satellite carrier; downlinked an ocean away by a competing operator; and end on a cellular telephone provided by yet another company. Similarly, a telephone operator's new partner is now as likely to come from the cable TV, mobile satellite or computer software business as the telephone industry. See, for example the charts on pages 8 to 26. International carriers must learn to navigate this wider communication space if they are to survive.

The Need for New Policy

Public policy makers also need a broader perspective in a world where the boundaries between electronic information services are fast eroding. As telephone and other communications networks become multi-purpose information highways, they become desirable routes to market for numerous businesses, from film production to catalog merchandising, and from banking to publishing. But will network access be open to all?

Telephone common carriers typically must connect their facilities, pass off transit traffic and provide user access on reasonable terms; private computer networks need not. What rules should apply when both networks carry large numbers of conversations? What if the customer interface to the network is a proprietary one such as IBM's Lotus Notes or Microsoft's Windows 95?

Figure 1. International traffic continues to grow faster than the number of lines



Note: Data include outbound Minutes of Telecommunication Traffic (MiTT) on public telephone networks only.
Source: ITU, TeleGeography, Inc.

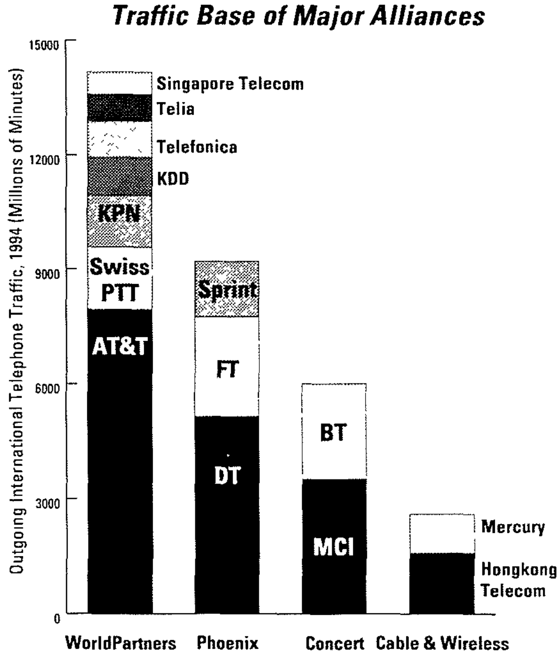
Figure 2. The Top 20 Carriers: Traffic Base and Revenues

Company	Country	Traffic 1994 (mMiTTs)	Revenues 1994 ($USm) Inat'l Telecom	Total	Inat'l as % of Total
1. AT&T	United States	7,947	5,752	75,094	7.7%
2. Deutsche Telekom	Germany	5,147	4,949	37,778	13.1%
3. MCI	United States	3,517	2,793	13,338	20.1%
4. France Télécom	France	2,603	3,494	22,426	15.6%
5. BT	United Kingdom	2,489	3,135	22,507	13.9%
6. Telecom Italia	Italy	1,708	1,480	18,658	7.9%
7. Swiss PTT	Switzerland	1,649	1,713	6,814	25.1%
8. Hongkong Telecom	Hong Kong	1,578	2,111	3,483	60.6%
9. Stentor	Canada	1,525	n.a.	n.a.	n.a.
10. Sprint	United States	1,471	854	12,662	6.7%
11. KPN	Netherlands	1,346	1,351	6,857	19.7%
12. China MPT	China	1,090	1,392	7,214	19.3%
13. Belgacom	Belgium	1,049	602	3,568	16.9%
14. Mercury	United Kingdom	1,018	856	2,549	33.6%
15. KDD	Japan	1,011	1,923	2,415	79.6%
16. Telefónica	Spain	948	1,046	11,871	8.8%
17. Téléglobe	Canada	861	313	956	32.7%
18. Telmex	Mexico	844	1,758	8,592	20.5%
19. Austrian PTT	Austria	819	797	3,656	21.8%
20. Telstra	Australia	690	1,023	9,755	10.5%

International revenues are net of settlements for North American carriers.
See page 88 for additional carriers and information.

Figure 3. Traffic Origin: North America and Europe account for 75%

Traffic Base of Major Alliances



These groups of international carriers generated 32 billion minutes of outgoing international telecommunications traffic in 1994, 60% of the world total of 53 billion minutes

Global MiTT by origin, 1994

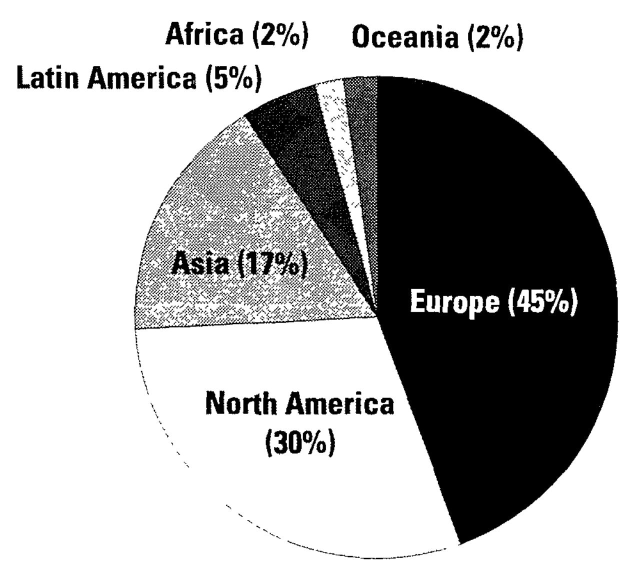
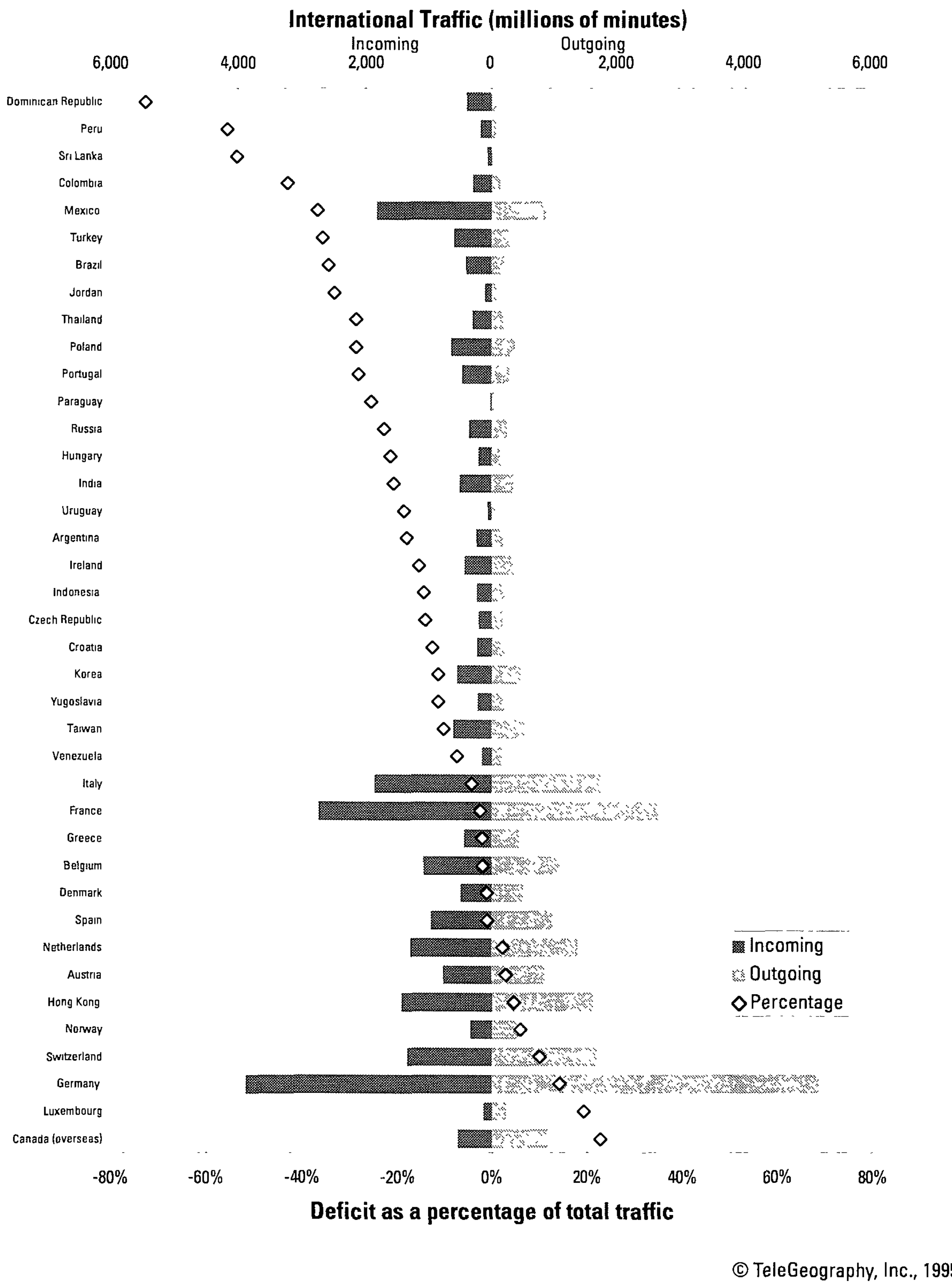


Figure 4. Richer Countries Call Out, Poorer Countries Have a Traffic Surplus



And what about cross-ownership? Should a company be permitted to own more than one lane of the information highway (TV station, on-line network, telephone company) in the same area? Should foreign ownership of these highways be restricted?

The information superhighway also raises critical social and cultural issues. Telephone carriers are not responsible for the content of the messages they distribute. Publishers and broadcasters are. What obligations should multimedia networks have? What standards of libel or public decency or fair use of copyrighted materials should apply? And who should decide—information owners? Customers? Local communities where the information is received? National regulators?

These questions are but a few of those now being posed about the global infobahn and the services it may carry. They are explored further for *TeleGeography 1995* by three commentators.

The first article, "Managing the Information Superhighway," is by Rex Winsbury, the London-based Editor of *InterMedia*, the bi-monthly journal of the International Institute of Communications (IIC). It is followed by an antitrust perspective on public access to the information superhighway by Marc Schildkraut, a Washington DC lawyer, formerly responsible for the U.S. Federal Trade Commission's investigation of Microsoft. Finally a Brussels lawyer, Bernard Amory, previously at the European Commission, outlines the impact of European competition rules on the information superhighway.

The Internet: Model or Menace?

Our survey of the information superhighway closes by surveying the corporate economy of the Internet. For millions of people, the Internet has already become the information superhighway.

As Christopher Anderson put it in the *Economist* earlier this year: "With great fanfare telephone and cable companies have launched dozens of trials to demonstrate their vision of speedy electronic networks, connecting homes to a boundless trove of information, communication, education and fun." Yet, "while the giants have been talking about an information superhighway, the ants have actually been building one: the Internet." Thanks to new software for linking and displaying computer-based information, since 1993 the Internet has become not just a way to send e-mail or download the occasional file but a place to visit, with pictures, sound and movies which can be toured simply by pointing and clicking a mouse.

The Internet's extraordinary new popularity presents international telephone carriers with a dilemma. On one level it is a great success story. After all, the Internet is the world's largest international private line network and the reliable high-speed circuits which knit it together are all leased from telephone carriers. And profitably so.

But, Anderson continues, "A simple question: if the Internet runs over telephone lines, why does it cost the same to send an e-mail message around the world as it does to send it next door?" "Talk to a friend abroad for an hour" advises Anderson, "and you may be charged $50. Make the same call on the Internet, using software for companies such as VocalTec, and you pay ... nothing more than the cost of the local phone call. Even allowing for your monthly [Internet] access fee, the call costs just a few cents." Why?

> *FOR MILLIONS OF PEOPLE, THE INTERNET HAS ALREADY BECOME THE INFORMATION SUPERHIGHWAY.*

There are no simple answers. But as millions of new users start logging onto the Net, this question is sure to be asked with growing urgency. The answer turns, in part, on differences between the architecture of the Internet and of the telephone system. The latter primarily uses circuit switching which means that a dedicated circuit must be created to complete a call between any two international points. That can be relatively costly, though not so much as some carriers would have their customers believe.

In contrast, on the Internet, a transmission does not require a dedicated line; the information is digitally encoded, split up into packets, and sent down a line along with hundreds of other packets. Along the way, private computer switches, known as routers, inspect each packet, read the address, chose the most efficient route, and send them on their way. The packets that make up a single message may be sent via different routes. At their destination, another computer reassembles the information so that it can be understood.

The Internet's architecture thus allows transmission pipes to be used very efficiently. Likewise, switching costs are decentralized and shared. But some of the Internet's economic savings are deceptive. Much of the Internet is still run on university and government hardware, so the full costs are not passed on to new users. And, to date, the Internet has not had to cope with millions of voice calls or movie clips. Even allowing for digital compression, this type of "multimedia" traffic may require thousands of times more circuit capacity.

Major international telephone companies have that capacity, of course, and they are also trying to use it efficiently. Very fast new digital switching techniques, such as ATM (Asynchronous Transmission Mode), have broad support in the industry. In principle, such techniques, which are analogous to the Internet packet switching protocols, along with greater use of fiber optic cables, should keep the telephone companies competitive.

The challenge for the Internet will be to scale up. Current efforts are focused on the Multimedia Backbone (Mbone), a high speed overlay net for handling video conferencing and radio programs. But Mbone access is geographically limited and the image quality is still poor. Telephone companies also need to rethink their service architectures. As the demand for networked data and video services grows, companies may need to give a greater priority to more decentralized switching facilities that are competitive with the computer (client-server) model adopted by the Internet.

Once it is more widely recognized that telephone companies and the Internet both share the same digital pipes (and some switches), and that both carry similar information—conversations, data files, pictures—it is logical to ask why the network should be partitioned in such an *ad hoc* fashion. That is, why should the terms and conditions of access to one part be heavily regulated and the other not? Would not users be better off if more of the network were treated like the Internet?

Large carriers are likely to hedge their bets on this issue by providing telephone services via the Internet and via their public networks, letting the user choose which to use and how to route the traffic. By keeping one foot in both worlds, network resources can then be allocated depending upon which products seem most popular in the market place and how regulators ultimately react.

Next Year

We will continue to track the co-evolution of the Internet and the international telephone network in *TeleGeography 1996*. Plans are also being made to publish more data on the international private line networks operated by major corporations. As always, we invite your comments and suggestions.

Gregory Staple
Zachary Schrag
September 1995
Washington, D.C.

Figure 5: Trends in the global information economy

Traffic growth trends, 1985-1994 and projections, 1995-2000

	Historical trend			*Base case*		*11% growth*		*13% growth*	
Indicator	**1985**	**1994**	**CAGR 1985-94**	**2000**	**CAGR 1995-2000**	**2000**	**CAGR 1995-2000**	**2000**	**CAGR 1995-2000**
Calls (Bn)	3.2	14.3	18.3%	29.6	12.8%	33.2	15.1%	37.0	17.1%
Estimated call length (mins)	4.7	3.7	-2.5%	3.0	-3.5%	3.0	-3.5%	3.0	-3.5%
Minutes (Bn)	14.8	53.3	15.3%	88.7	8.9%	99.7	11.0%	110.9	13.0%
Per subscriber	36.2	82.3	9.6%	99.4	3.2%	111.8	5.2%	124.4	7.1%
Revenue (US$bn)	20.0	50.6	10.8%	65.9	4.5%	83.1	8.6%	92.5	10.6%
Price per MiTT ($)	1.35	0.95	-3.8%	0.74	-4.0%	0.74	-4.0%	0.74	-4.0%
Main lines (M)	410	647	5.2%	892	5.5%	892	5.5%	892	5.5%
Mobile subscribers (M)	0.7	53.0	61.8%	261	30.4%	261	30.4%	261	30.4%
Expansion (MiTT) due to:	**1985**	**1994**	**1985-94**	**2000**	**1995-2000**	**2000**	**1995-2000**	**2000**	**1995-2000**
Network expansion	657	3,152	36.4%	4,481	63.1%	4,736	49.3%	5,010	40.3%
Organic growth	867	2,456	63.6%	1,494	36.9%	7,546	50.7%	13,483[a]	59.7%
Total	*1,523*	*5,608*	*100.0%*	*5,975*	*100.0%*	*12,282*	*100.0%*	*18,493*	*100.0%*

Note: 1985-1993 based on reported data. 1995-2000 based on ITU forecasts. Traffic growth due to network expansion implies extra traffic generated by new subscribers. Organic growth implies extra traffic generated by existing subscribers.

[a]Includes estimate for traffic generated by new mobile subscribers.

Source: *Direction of Traffic* (ITU/TeleGeography, Inc., forthcoming 1996) © ITU/TGI 1995

Articles

MAPPING THE GLOBAL INFORMATION INFRASTRUCTURE

The information superhighway, whether defined as a computer network, multimedia conduit or interactive TV, has created a new corporate geography.

In the past, the horizontal scope of most communications businesses—telephony, broadcasting, cable TV, publishing—stopped at the national border. Vertical ties between these industries also were relatively limited. Most companies were specialists: telephone companies were not involved in broadcasting; print publishers had no interest in telephony or cable TV systems. The reason was as much economics as regulation. For the most part, cross-border and cross-industry combinations did not make business sense.

That may no longer be true. Customer demand and technological innovation now make trans-national and trans-industry investments, mergers and alliances attractive for more and more companies. And the pace of such activity is quickening. For example, since 1994 two of America's long-distance carriers (MCI and Sprint) have sold stakes to foreign telephone carriers and established joint global service platforms. In 1995, IBM acquired a major software group (Lotus) and formed an alliance with STET, the parent of Italtel. The Walt Disney Company, a major film producer, has launched a joint venture with several American telephone companies and also has agreed to buy the ABC television network.

This new corporate geography is of growing public interest because there is now a wide consensus that the private sector should build the world's information superhighways. Reliance on private sector investment and competition (not public monopolies) has been a keystone of U.S. information policy since 1993. Similar principles were endorsed this year by the G-7 Information Society Conference in Brussels and by the ministerial meeting of the Asia Pacific Economic Community (APEC) in Seoul.

In the section which follows, *TeleGeography* provides an introductory guide to these private-sector architects of the Global Information Infrastructure (GII). It profiles the main players and charts the horizontal (cross-national) and vertical (cross-industry) dimensions of these companies' activities in the US, Canada, the UK, France, Germany, Italy and Japan. These country-by-country industry convergence charts are supplemented by detailed corporate ownership charts for the largest media businesses in each nation.

Although we have tried to make these charts as up-to-date as possible, some caveats are necessary. First, the corporate geography of the GII is ever changing. Moreover, not all subscribe to the logic of convergence. AT&T's plan to unbundle its computer, equipment and communication services business is a case in point. The failed merger of Bell Atlantic and TCI is another. Thus, in practice, any broad generalization about the merits of integration versus specialization is tempered by unique political, social and personal considerations. The corporate geography mapped here is also a very human geography. The pace and the pattern of media convergence in any given country depends as much upon history, local regulatory disputes, boardroom personalities and chance as on economics or technology.

Second, although the vertical and horizontal expansion of large media conglomerates may be the most visible sign of the GII's evolution, it would be a mistake to suggest that this new landscape has only two dimensions. While some companies have expanded across borders, others are deepening their relationships at home; intra-industry ties have grown even as cross-industry links have expanded. Companies which compete fiercely in one market may cooperate in others. Like the communications networks on which it depends, the information economy's corporate superstructure is more and more web-like and the charts which appear below only provide one view of this new world.

A Quick Guide to the Charts

See also page vii for an alphabetical index of corporate ownership charts.

The Top 50 Info-Communication Companies

	Information communication sales 1994 US$ m	as % of total sales	Change in Total Profit (1993-94)	Type of Business
1 NTT (JPN)	79,070	100%	52.9%	S
2 AT&T (USA)	71,977	96%	--	C, M, S
3 IBM (USA)	64,052	100%	--	C
4 Sony (JPN)	44,758	100%	--	C, M, E
5 NEC (JPN)	43,326	100%	434.6%	C, M
6 Deutsche Telekom (DEU)	37,713	100%	--	S
7 Matsushita (JPN)	37,321	48%	269.5%	C, M, E
8 Fujitsu (JPN)	36,603	100%	--	C, M
9 Hitachi (JPN)	30,213	35%	74.5%	C, M
10 Toshiba (JPN)	29,939	56%	268.1%	C, M
11 HP (USA)	24,991	100%	35.9%	C
12 Siemens (DEU)	23,540	45%	0.6%	C, M
13 France Telecom (FRA)	23,288	100%	91.5%	S
14 BT (GBR)	22,645	100%	-3.8%	S
15 Motorola (USA)	22,245	100%	52.6%	C, M
16 Philips (NLD)	21,112	63%	8.1%	C, M, E
17 STET (ITA)	20,932	100%	23.5%	C, M, S
18 Alcatel Alsthom (FRA)	20,407	68%	-48.7%	M
19 GTE (USA)	19,944	100%	172.3%	M, S
20 Canon (JPN)	19,333	100%	47.0%	C
21 BellSouth (USA)	16,845	100%	145.4%	S
22 BCE (CAN)	15,868	100%	--	M, S
23 Xerox (USA)	15,088	85%	--	C
24 Samsung (KOR)	14,617	100%	511.3%	C, M
25 Bell Atlantic (USA)	13,791	100%	--	S
26 DEC (USA)	13,451	100%	--	C
27 MCI (USA)	13,338	100%	36.6%	S
28 Nynex (USA)	13,307	100%	--	S
29 Sprint (USA)	12,662	100%	1522.4%	S
30 Ameritech (USA)	12,569	100%	--	S
31 Mitsubishi (JPN)	12,191	33%	103.4%	C, M
32 Telefónica (ESP)	11,985	100%	16.9%	S
33 Sanyo (JPN)	11,974	52%	--	C, M
34 SBC (USA)	11,619	100%	--	S
35 Intel (USA)	11,521	100%	-0.3%	C
36 Ricoh (JPN)	11,464	100%	95.3%	C
37 Sharp (JPN)	11,034	60%	10.0%	M
38 U S West (USA)	10,953	100%	--	S
39 Compaq (USA)	10,866	100%	87.7%	C
40 Ericsson (SWE)	10,699	100%	39.3%	M
41 Texas Instruments (USA)	10,315	100%	46.4%	C
42 Telbras (BRA)	10,038	100%	-59.0%	S
43 Telstra (AUS)	9,769	100%	87.8%	S
44 PacTel (USA)	9,235	100%	--	S
45 Apple (USA)	9,189	100%	258.2%	C
46 Telmex (MEX)	8,655	100%	-12.7%	S
47 TWE (USA)	8,460	100%	-34.3%	E
48 Cable & Wireless (GBR)	8,366	100%	-51.0%	S
49 Unisys (USA)	7,400	100%	-82.2%	C
50 Oki (JPN)	7,300	100%	--	C, M

Key: C=computers, M=other manufacturing, S=communications services (carriers), E=entertainment and news. Companies are ranked by information-communication sales revenues from the provision of equipment or services for processing and disseminating electronic information as well as the creation of electronic information content. It does not include revenues from non-electronic information activities such as publishing and postal services. Source: ITU

Who is Multimedia Ready?

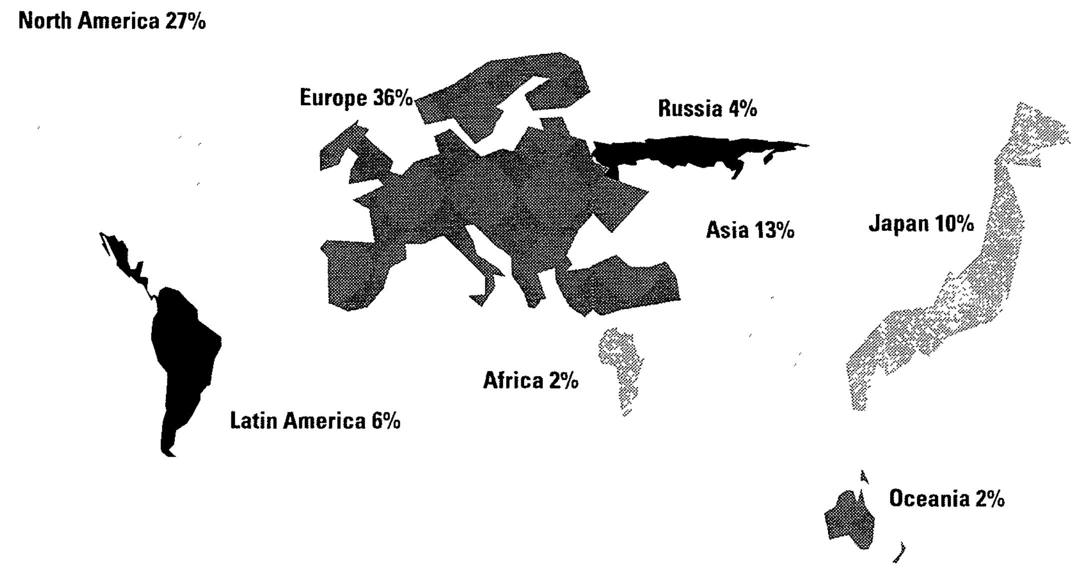
The multimedia revolution will march down several highways, and the penetration rates of telephones, televisions, personal computers, and cable television subscriptions show the degree to which the world's major economies have embraced communications technologies. Since countries with more television sets are better candidates for video-on-demand, and countries with a large installed base of personal computers are more likely to adopt new Internet applications, the chart below suggests where convergence may have the most impact.

Units per 100 people, 1994

Country	Telephone lines	Televisions	Personal computers	Cable TV subs.
Argentina	14.1	38.0	1.7	13.2
Australia	49.6	48.2	21.7	n.a.
Austria	46.5	48.0	10.7	13.0
Belgium	44.9	46.6	12.9	35.7
Brazil	7.4	29.0	0.9	0.3
Canada	57.5	65.0	17.5	26.9
Chile	11.0	23.0	3.1	2.3
China	2.3	23.1	0.2	2.5
Czech Republic	20.9	39.0	3.6	5.7
Denmark	60.4	55.0	19.3	12.8
France	54.7	58.0	14.0	2.8
Germany	48.3	55.1	14.4	18.0
Greece	47.8	22.0	2.9	n.a.
Hong Kong	54.0	35.9	11.3	0.6
Hungary	17.0	42.0	3.4	8.1
India	1.1	5.5	0.1	1.1
Indonesia	1.3	8.7	0.3	n.a.
Israel	39.4	29.5	9.4	13.3
Italy	42.9	45.0	7.2	n.a.
Japan	48.0	64.1	12.0	8.3
Korea (Rep. of)	39.7	32.4	11.2	5.8
Malaysia	14.7	23.1	3.3	n.a.
Mexico	9.2	20.0	2.3	2.2
Netherlands	50.9	48.0	15.6	37.5
Philippines	1.7	12.1	0.6	0.5
Poland	13.1	30.0	2.2	3.6
Portugal	35.0	25.0	5.0	n.a.
Russia	16.2	37.9	1.0	n.a.
Singapore	47.3	38.0	15.3	n.a.
South Africa	9.5	10.1	2.2	n.a.
Spain	37.1	49.6	7.0	0.8
Sweden	68.3	48.0	17.2	21.9
Switzerland	59.7	41.0	28.8	32.3
Taiwan	40.0	31.5	8.1	14.1
Thailand	4.7	18.7	1.2	n.a.
Turkey	20.1	27.0	1.1	0.4
United Kingdom	48.9	45.0	15.1	1.6
United States	60.2	79.0	29.7	23.2
Venezuela	10.9	18.0	1.3	1.0

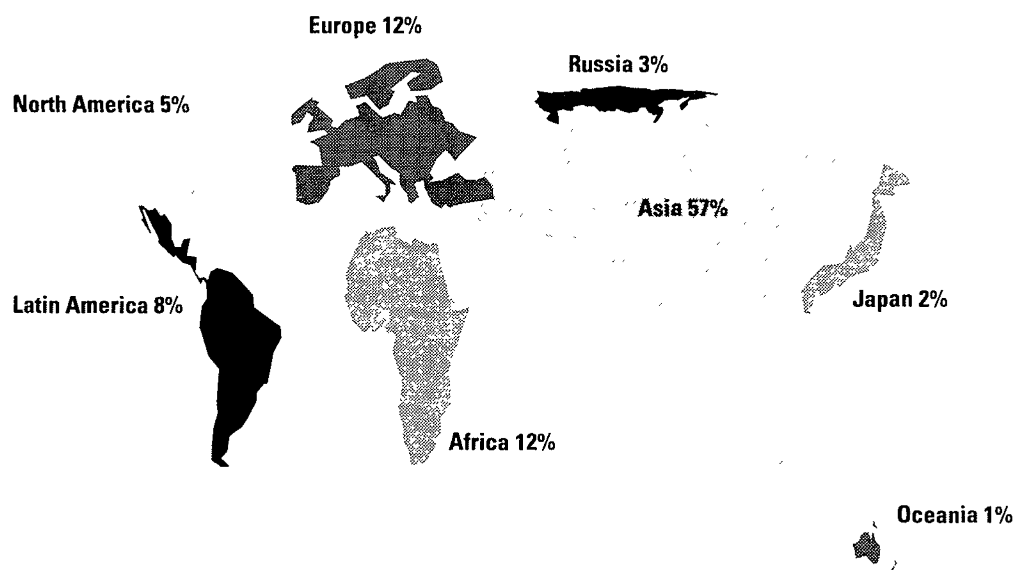
Source: ITU

Phone Power: Distribution of Main Telephone Lines, 1993



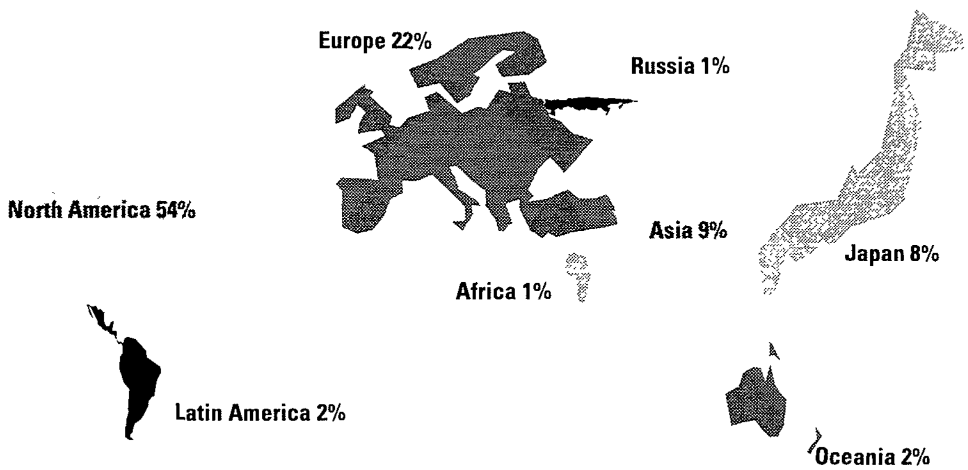
Source: ITU

People Power: Distribution of Population, 1994



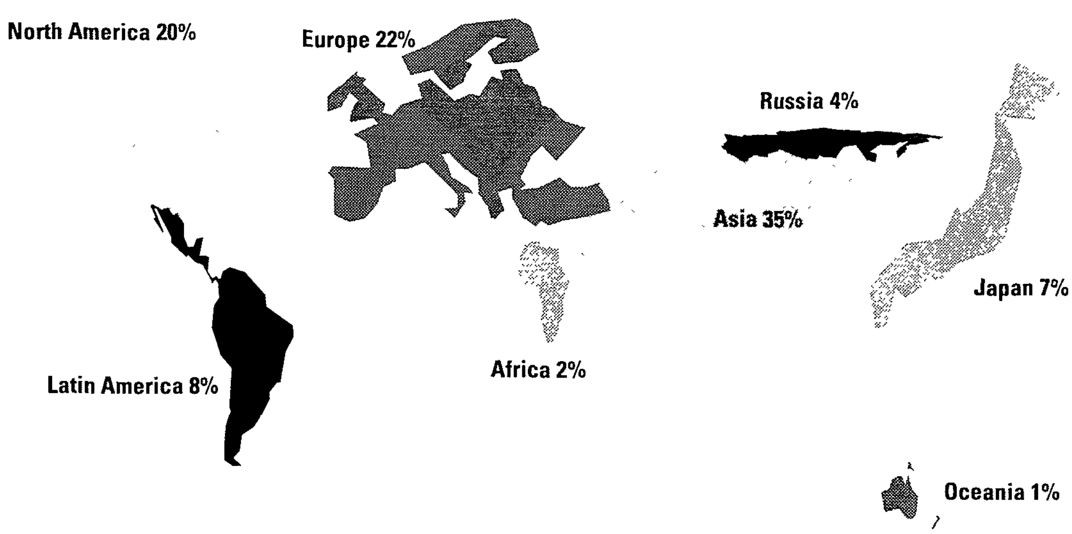
Source: United Nations Population Division

PC Power: Distribution of Personal Computers, 1993



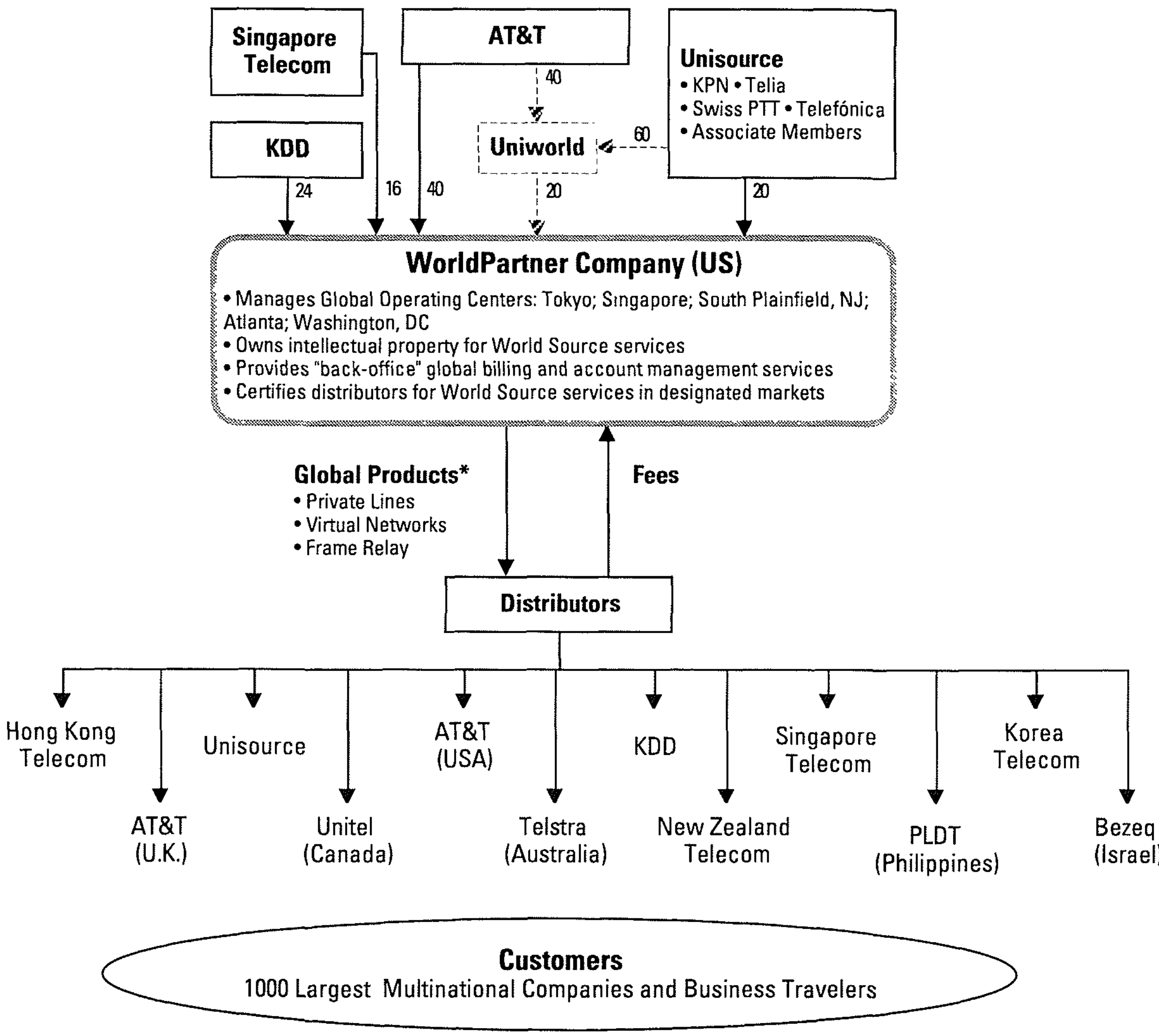
Source: ITU

TV Power: Distribution of Television Sets, 1993



Source: ITU

WorldPartners



* A WorldPartner may join another global alliance. But WorldPartner Co. will not authorize competing distribution of WorldSource services in territory where Partner has been certified.

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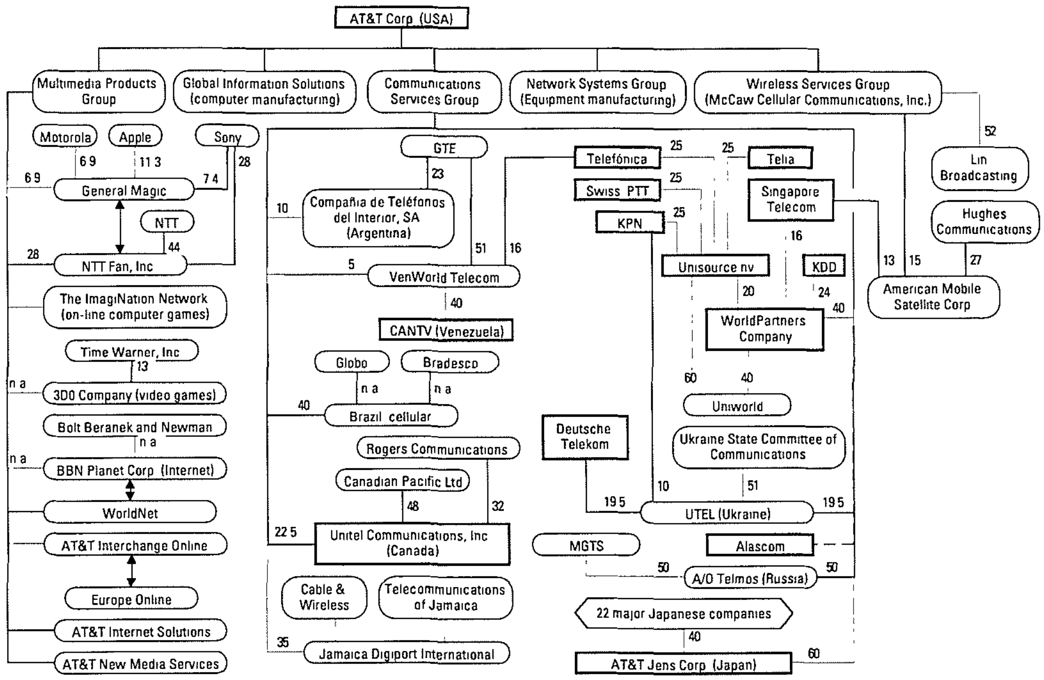
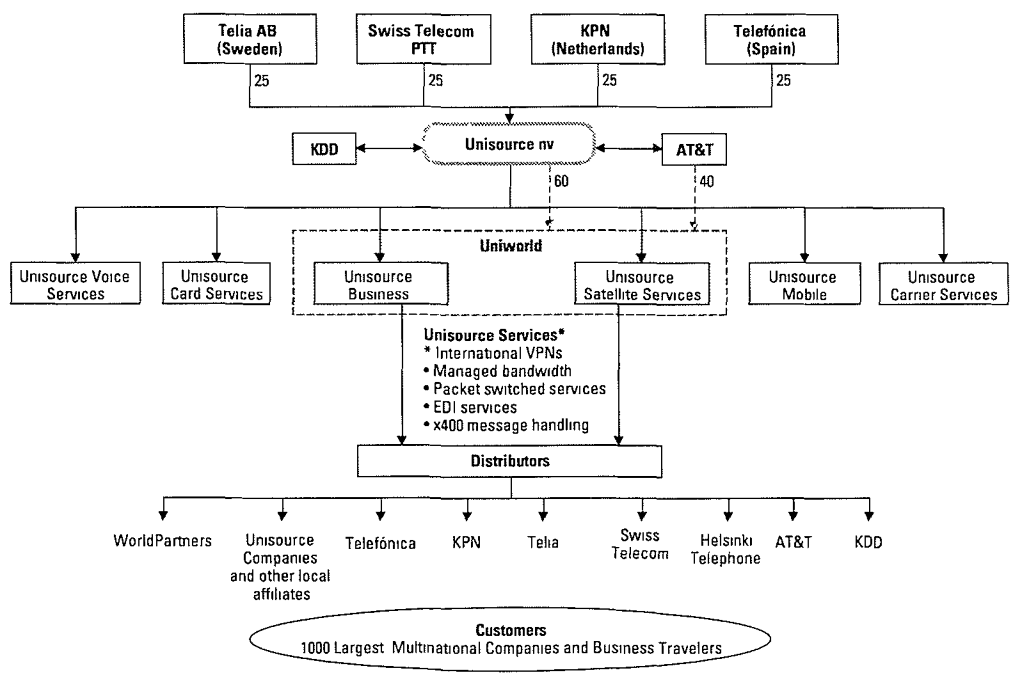
AT&T



Notes In September 1995, AT&T announced its plans to spin off its Global Information Solutions (formerly NCR) and telecommunications equipment manufacturing divisions into separate companies AT&T is expected to increase its share in Unitel to 33%

Prepared September 1995

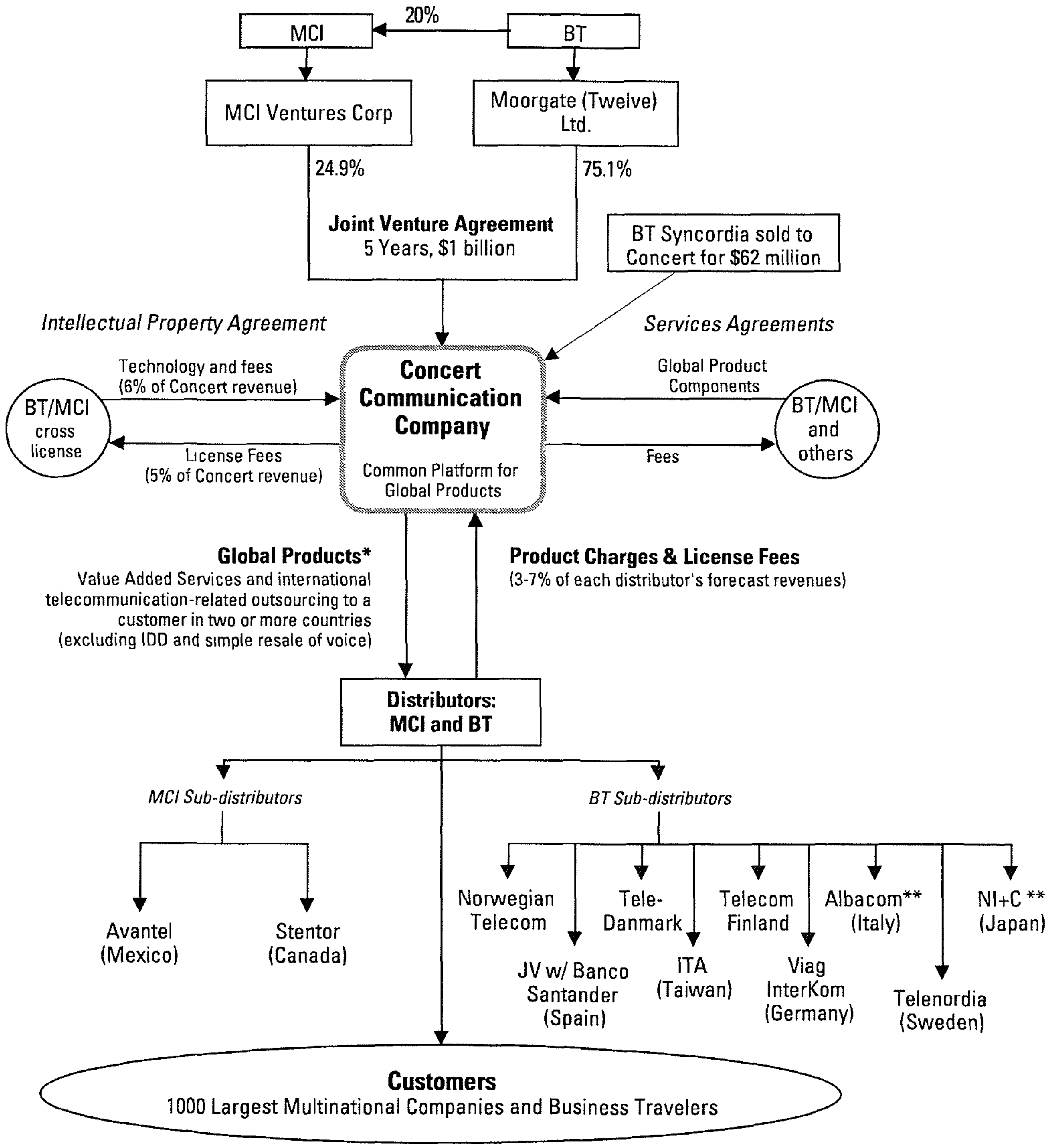
Unisource



* Distributors of Unisource Services are not precluded from handling other global services, and Unisource members will also distribute AT&T WorldSource services in Europe

Prepared August 1995

Concert



* Agreements between the parties restrict BT's provision of Concert's Global Products or similar services in MCI's territory (the Americas); *MCI's provision of such products and services is restricted in BT's territory (the rest of the world).*

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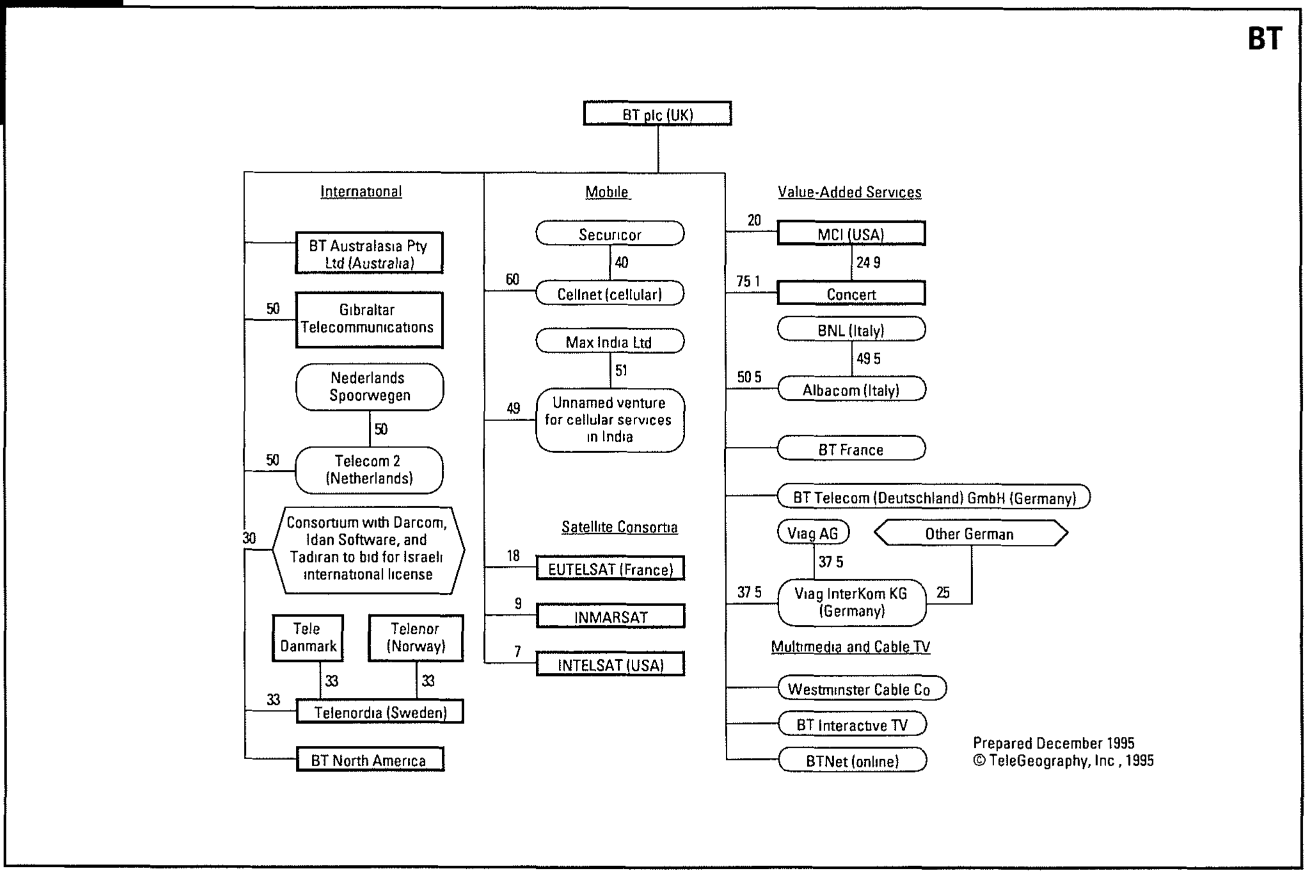
** NI+C is a value added carrier owned by NTT and IBM. Albacom is a joint venture between BT and Banca Nazionale del Lavaro (BNL).


BT
BT plc (UK)
International
BT Australasia Pty Ltd (Australia)
50
Gibraltar Telecommunications
Nederlands Spoorwegen
50
50
Telecom 2 (Netherlands)
30
Consortium with Darcom, Idan Software, and Tadiran to bid for Israeli international license
Tele Danmark
Telenor (Norway)
33
33
33
Telenordia (Sweden)
BT North America
Mobile
Securicor
40
60
Cellnet (cellular)
Max India Ltd
51
49
Unnamed venture for cellular services in India
Satellite Consortia
18
EUTELSAT (France)
9
INMARSAT
7
INTELSAT (USA)
Value-Added Services
20
MCI (USA)
24 9
75 1
Concert
BNL (Italy)
49 5
50 5
Albacom (Italy)
BT France
BT Telecom (Deutschland) GmbH (Germany)
Viag AG
Other German
37 5
37 5
Viag InterKom KG (Germany)
25
Multimedia and Cable TV
Westminster Cable Co
BT Interactive TV
BTNet (online)
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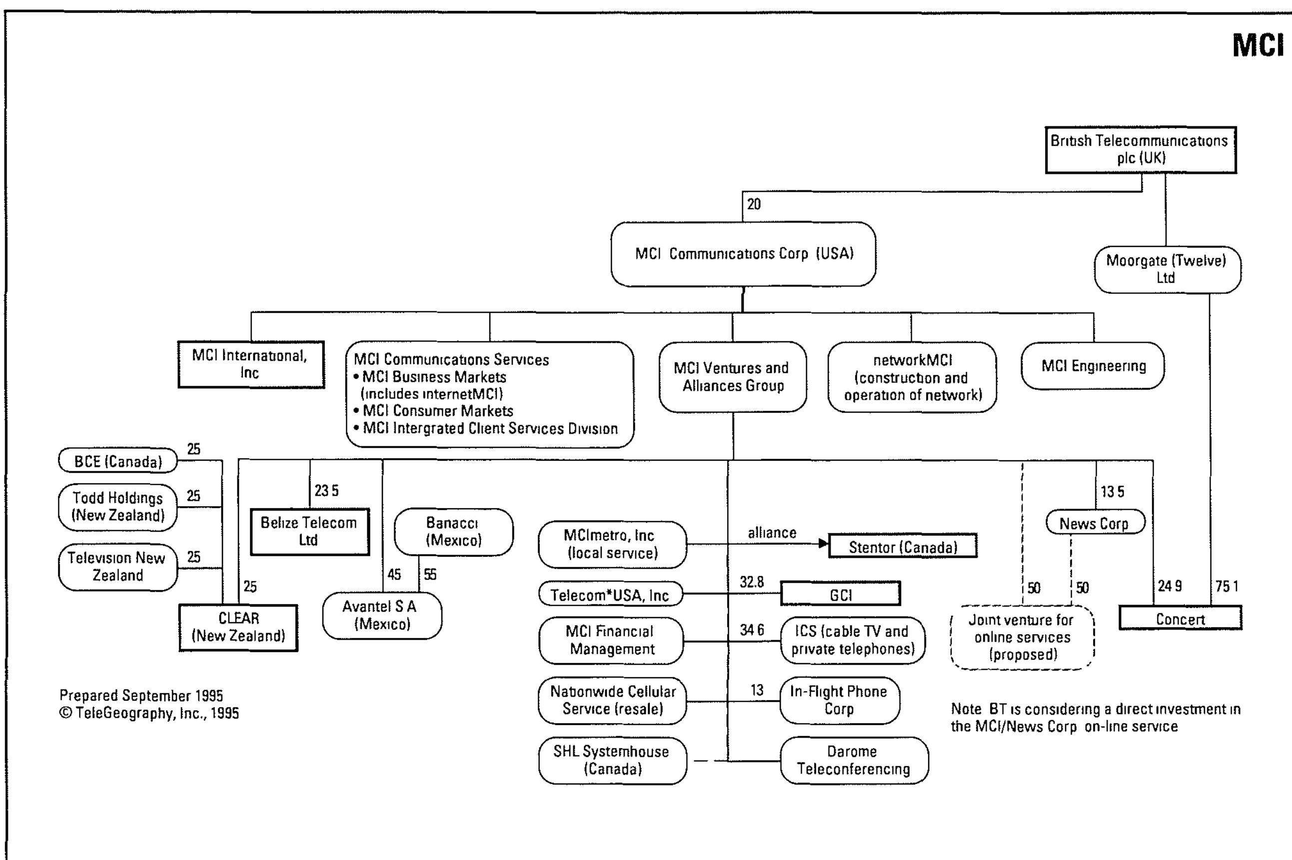
MCI
British Telecommunications plc (UK)
20
MCI Communications Corp (USA)
Moorgate (Twelve) Ltd
MCI International, Inc
MCI Communications Services
• MCI Business Markets (includes internetMCI)
• MCI Consumer Markets
• MCI Intergrated Client Services Division
MCI Ventures and Alliances Group
networkMCI (construction and operation of network)
MCI Engineering
BCE (Canada)
25
Todd Holdings (New Zealand)
25
Television New Zealand
25
25
CLEAR (New Zealand)
23 5
Belize Telecom Ltd
Banacci (Mexico)
45
55
Avantel S A (Mexico)
MCImetro, Inc (local service)
alliance
Stentor (Canada)
Telecom*USA, Inc
32.8
GCI
MCI Financial Management
34 6
ICS (cable TV and private telephones)
Nationwide Cellular Service (resale)
13
In-Flight Phone Corp
SHL Systemhouse (Canada)
Darome Teleconferencing
13 5
News Corp
50
50
Joint venture for online services (proposed)
24 9
75 1
Concert
Note BT is considering a direct investment in the MCI/News Corp on-line service
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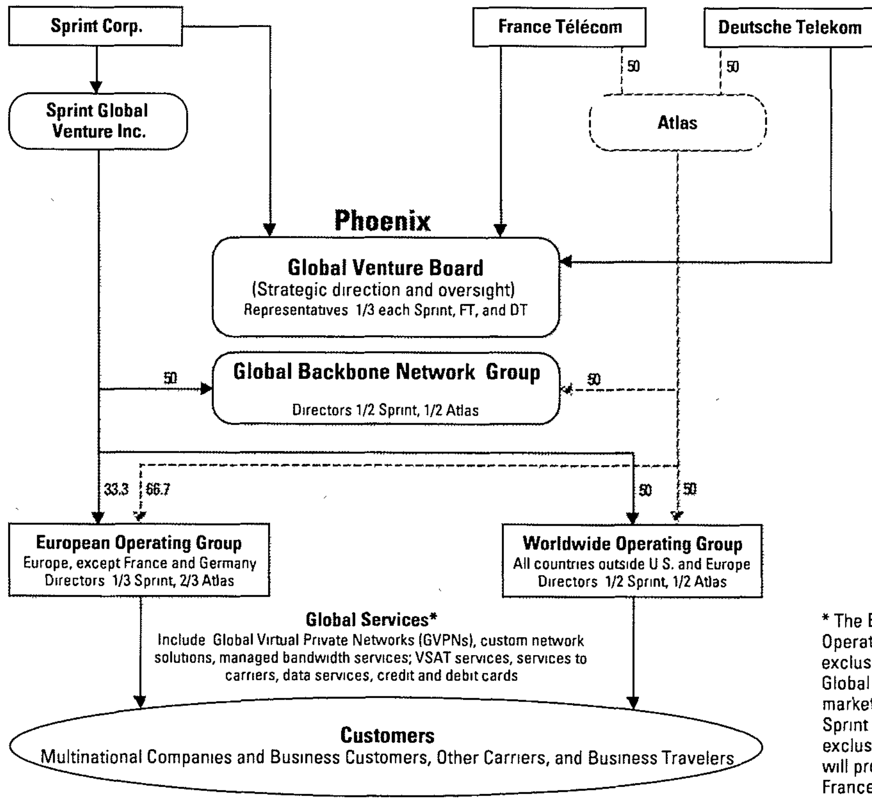
Phoenix



* The European and Worldwide Operating Groups will be the exclusive vehicle for providing Global Services in designated markets.
Sprint will provide Global Services exclusively in the U.S.; FT and DT will provide Global Services in France and Germany

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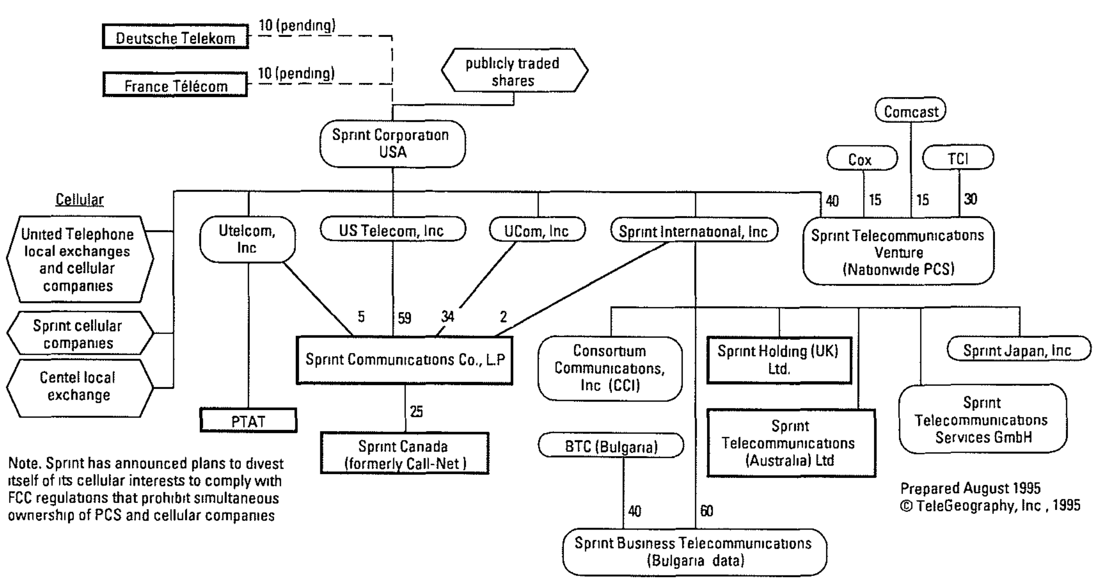
Sprint



Note. Sprint has announced plans to divest itself of its cellular interests to comply with FCC regulations that prohibit simultaneous ownership of PCS and cellular companies

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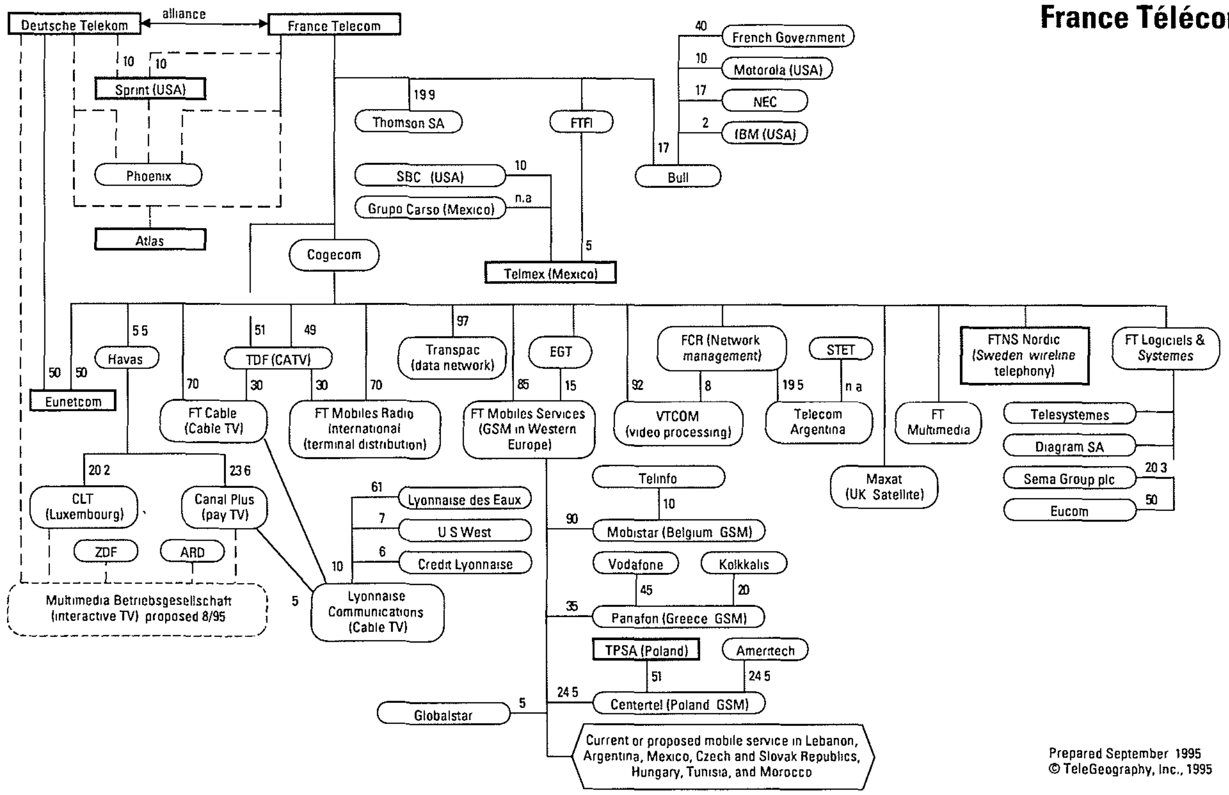
France Télécom



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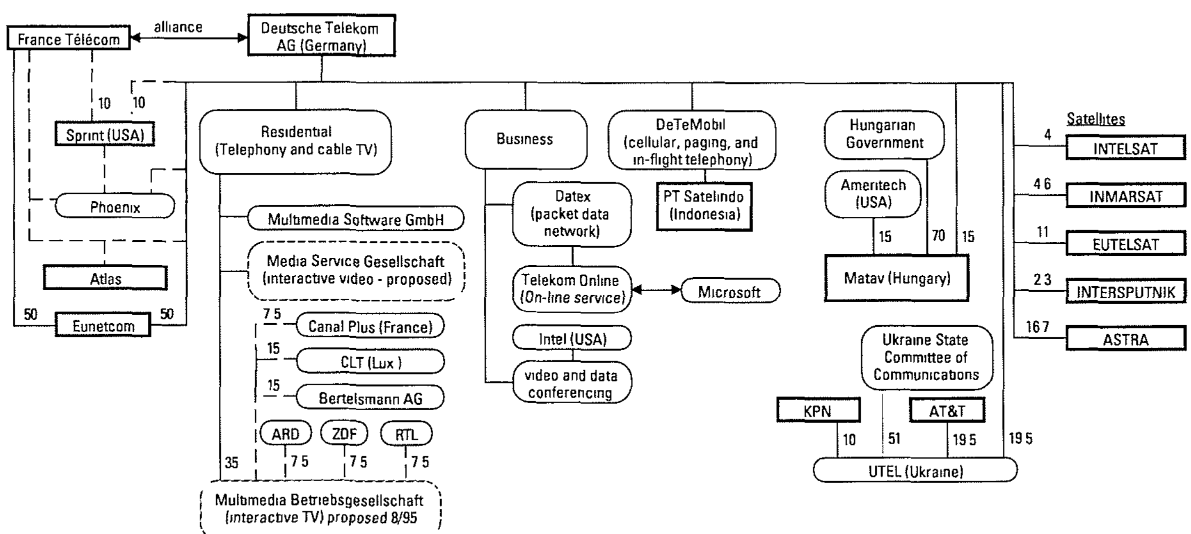
Note Motorola has announced its plans to increase its share in Bull to 17% The French Government intends to reduce its share to 36 4%

Deutsche Telekom



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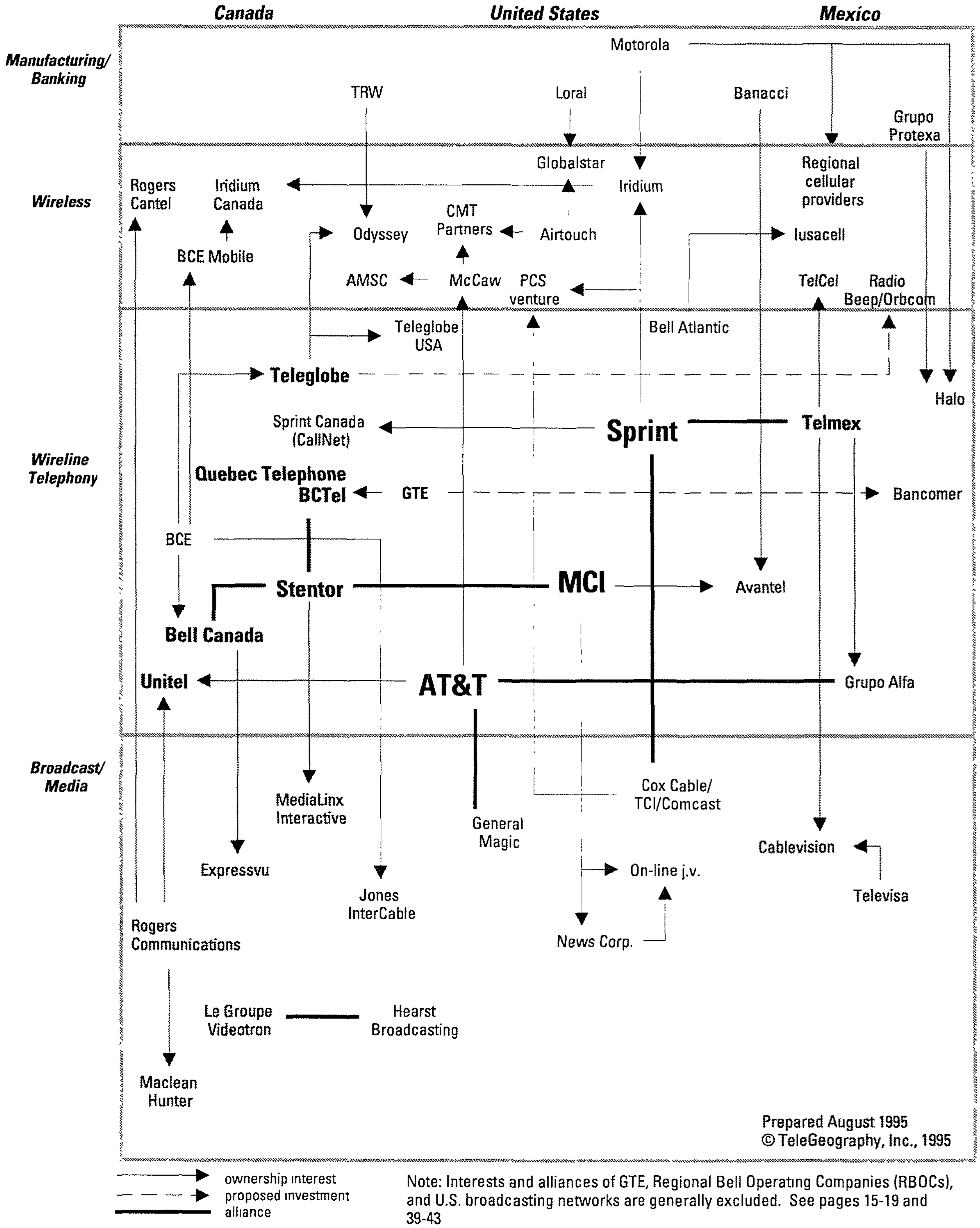
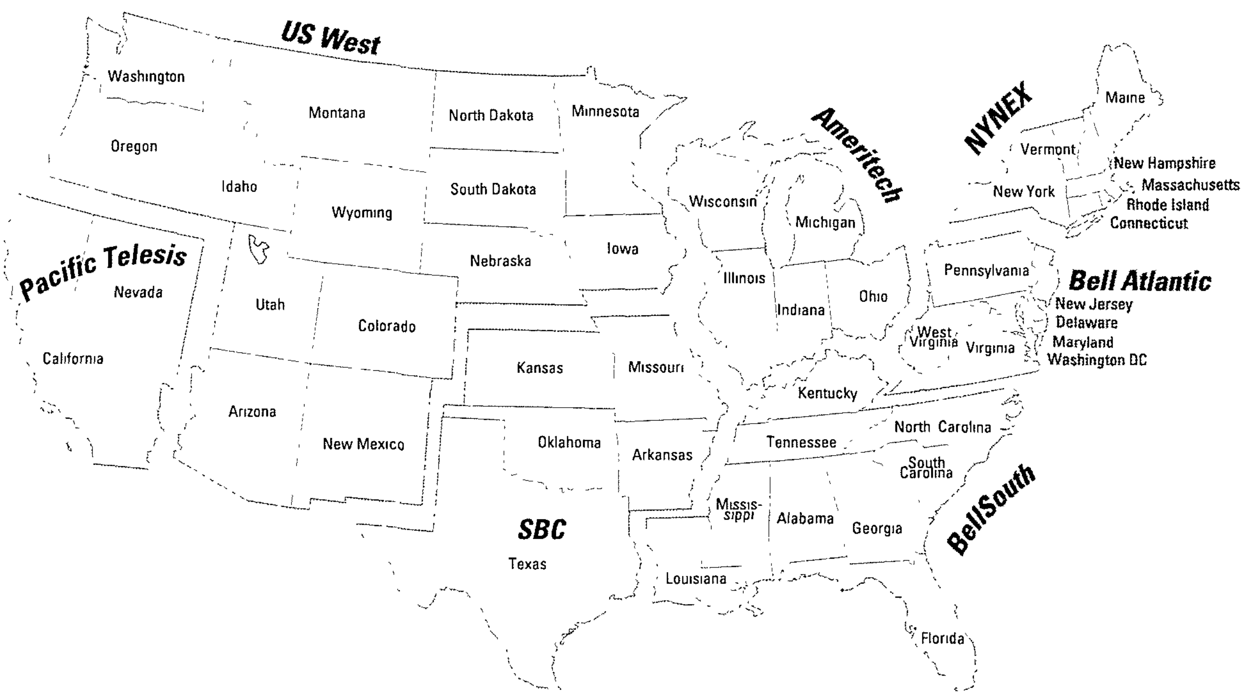
North America—Industry Convergence

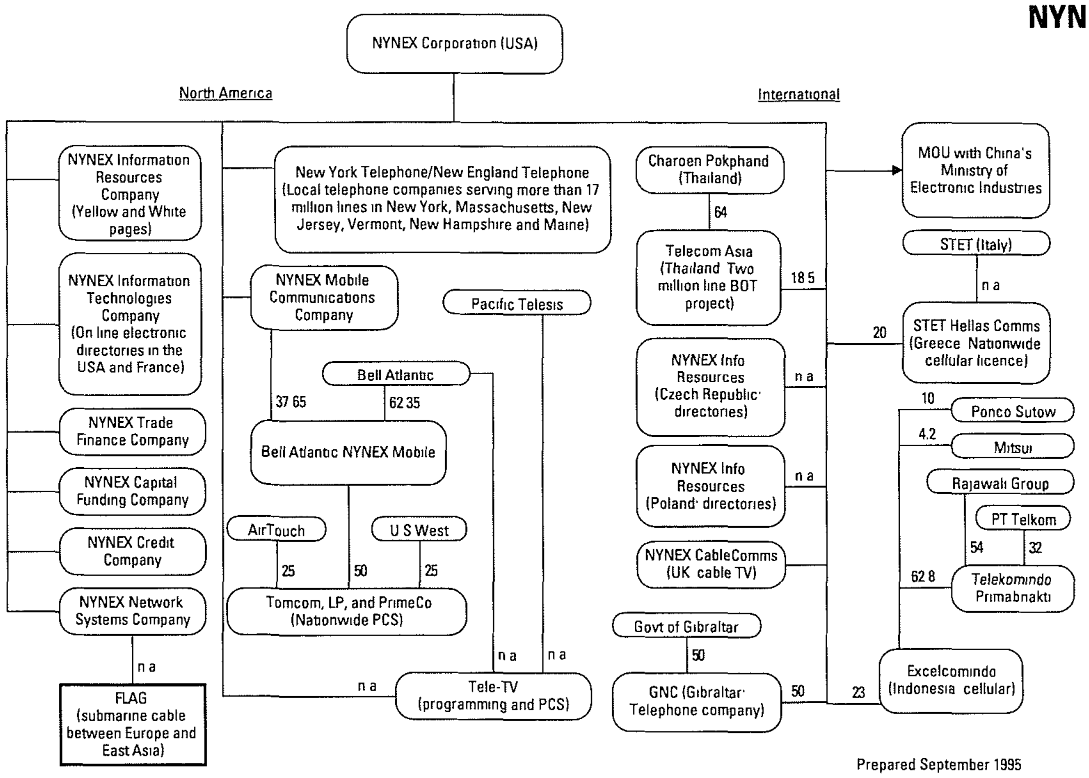


Note: Interests and alliances of GTE, Regional Bell Operating Companies (RBOCs), and U.S. broadcasting networks are generally excluded. See pages 15-19 and 39-43

The Regional Bell Operating Companies



NYNEX



Note In November 1993, NYNEX Corporation purchased 24 million shares of cumulative convertible preferred Viacom stock for $1 2 billion, but does not have voting privileges The two companies are expected to announce joint ventures by the end of 1995

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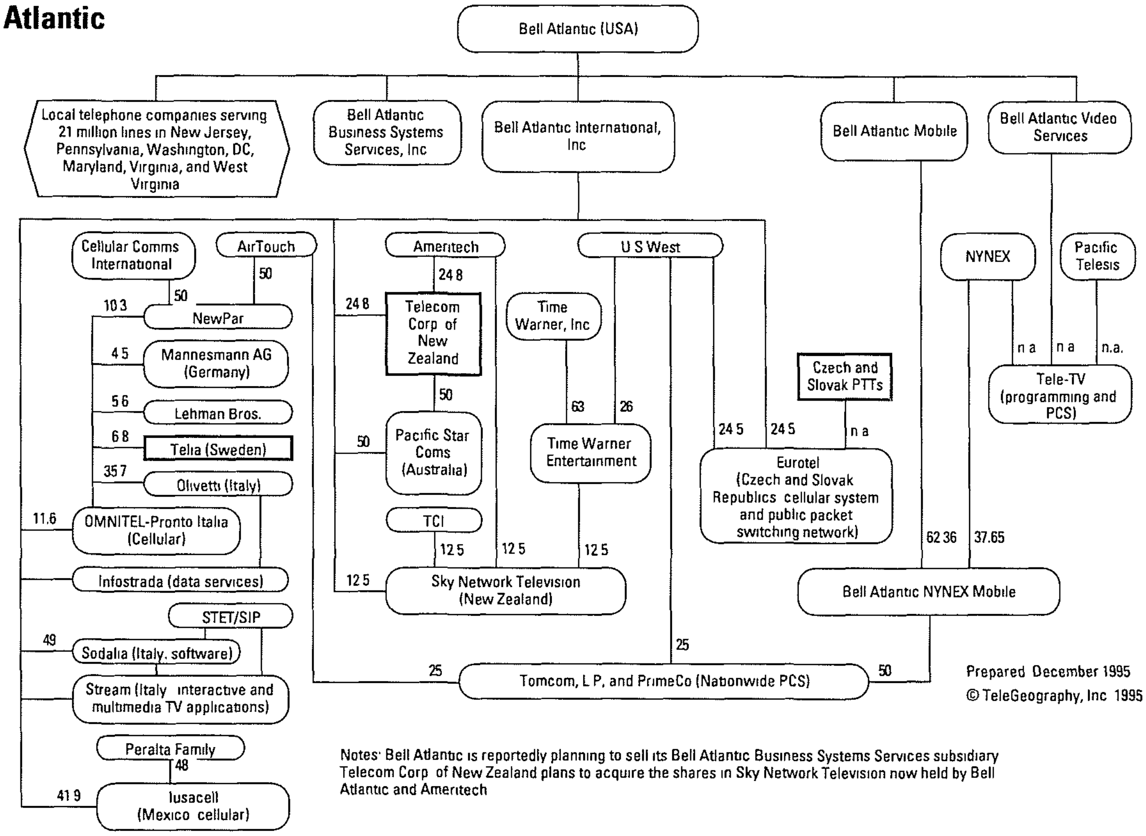
Bell Atlantic



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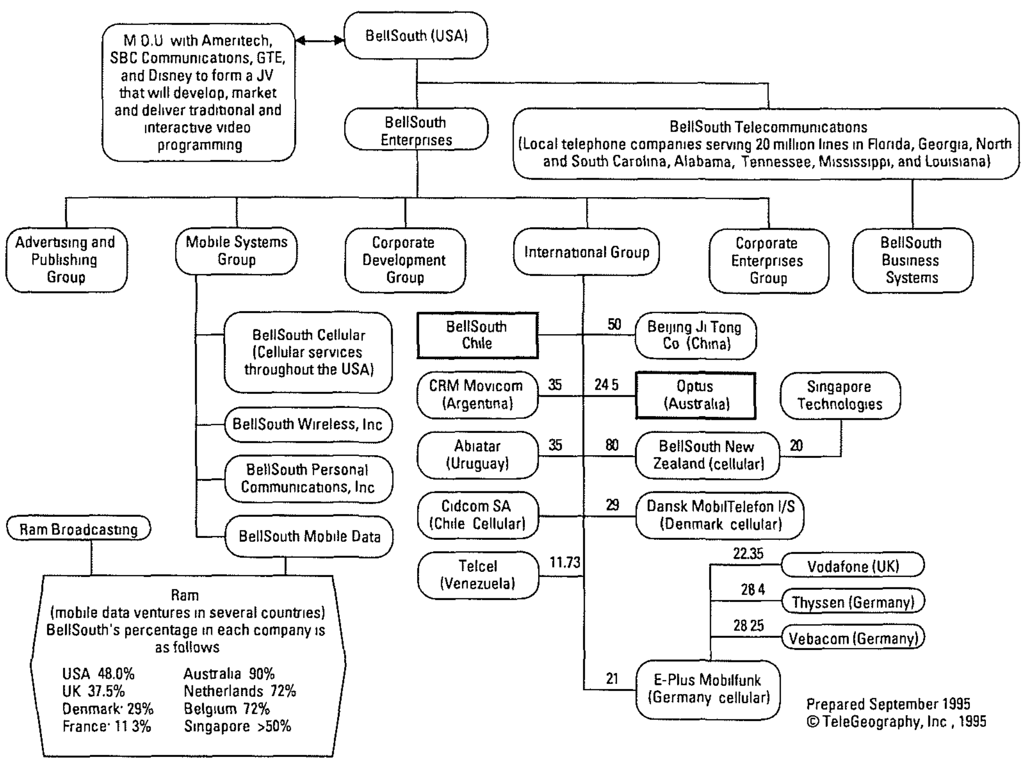
Notes: Bell Atlantic is reportedly planning to sell its Bell Atlantic Business Systems Services subsidiary. Telecom Corp of New Zealand plans to acquire the shares in Sky Network Television now held by Bell Atlantic and Ameritech

BellSouth



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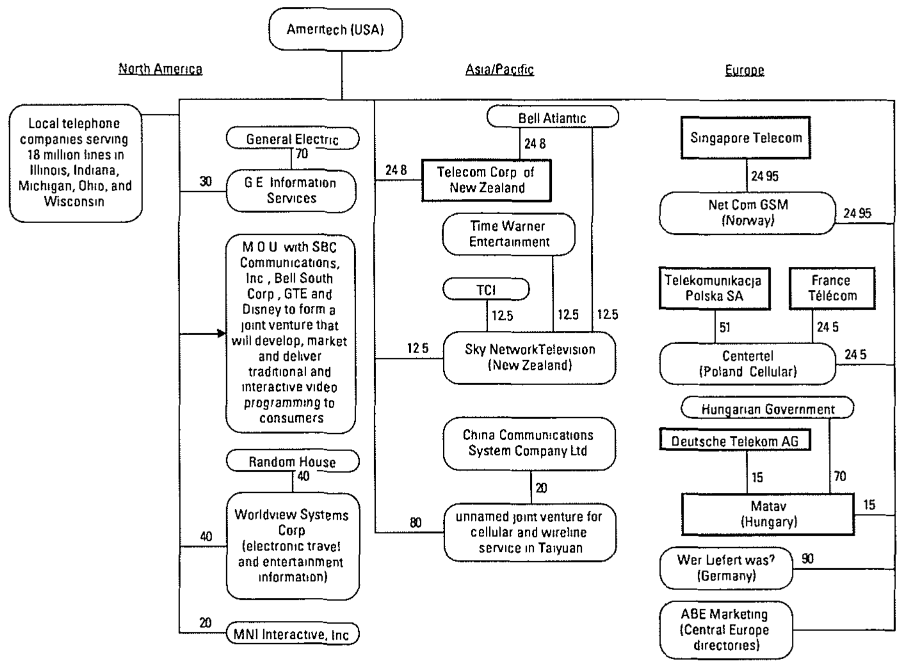
Ameritech



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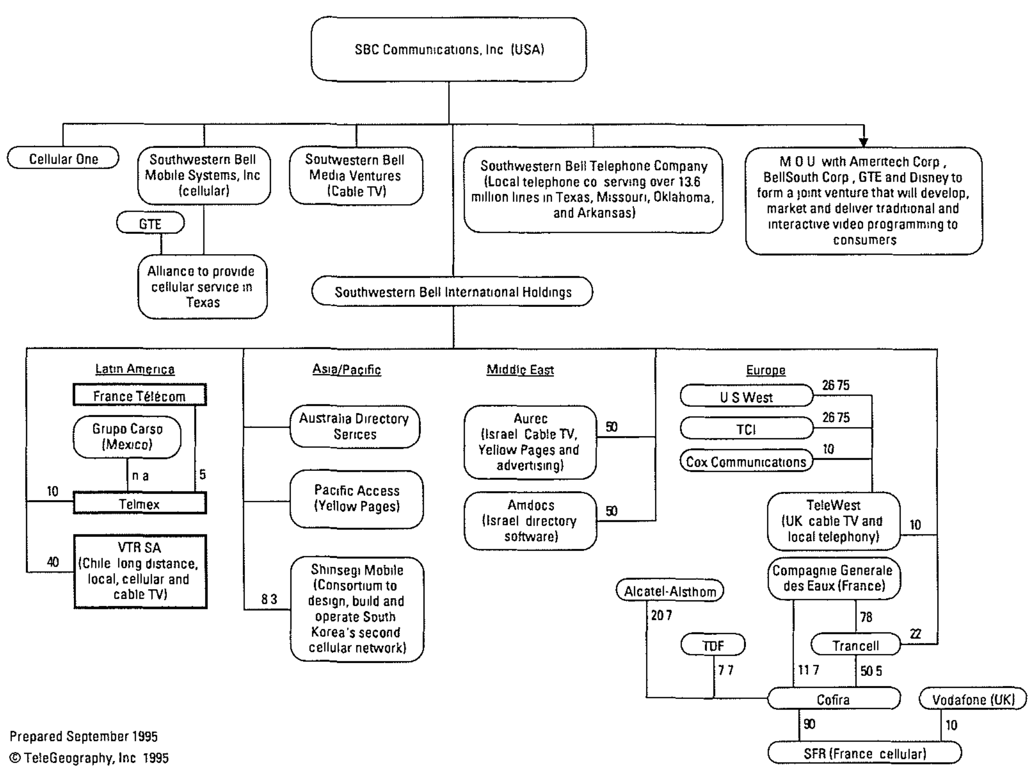
Note Telecom Corp of New Zealand plans to acquire the shares in Sky Network Television now held by Bell Atlantic and Ameritech In December 1995, an Ameritech-led consortium was awarded a 49 9% share of Belgacom, the Belgian telephone company, for $2 49 billion. The consortium is composed of Ameritech (37%), Tele Danmark (35%), and Singapore Telecom (28%)

SBC



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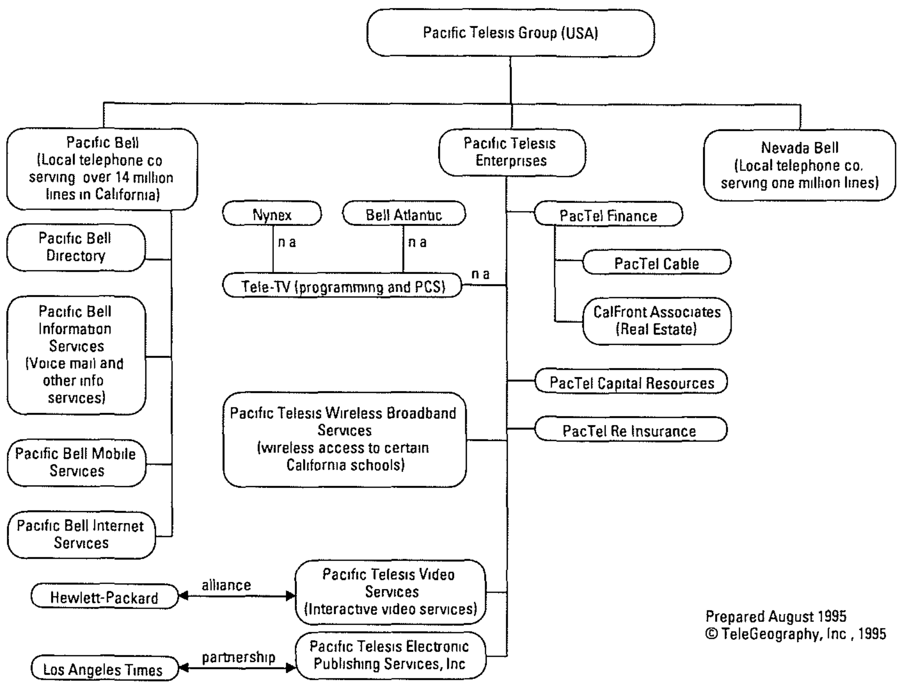
Pacific Telesis



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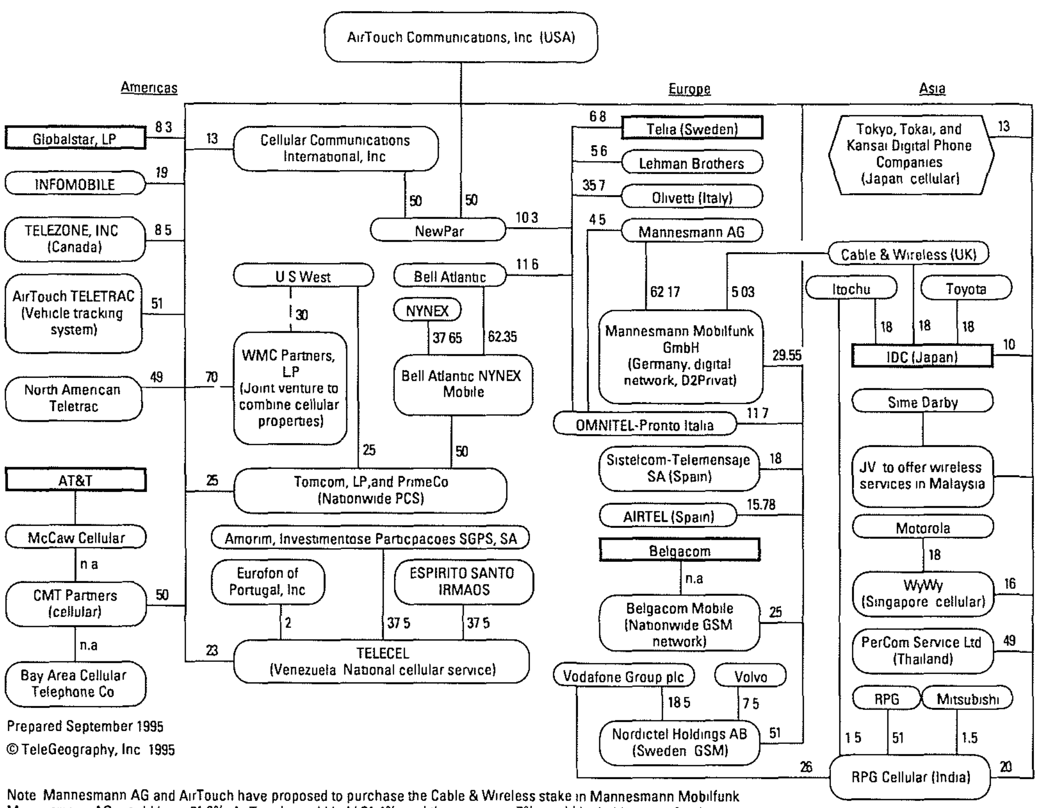
AirTouch



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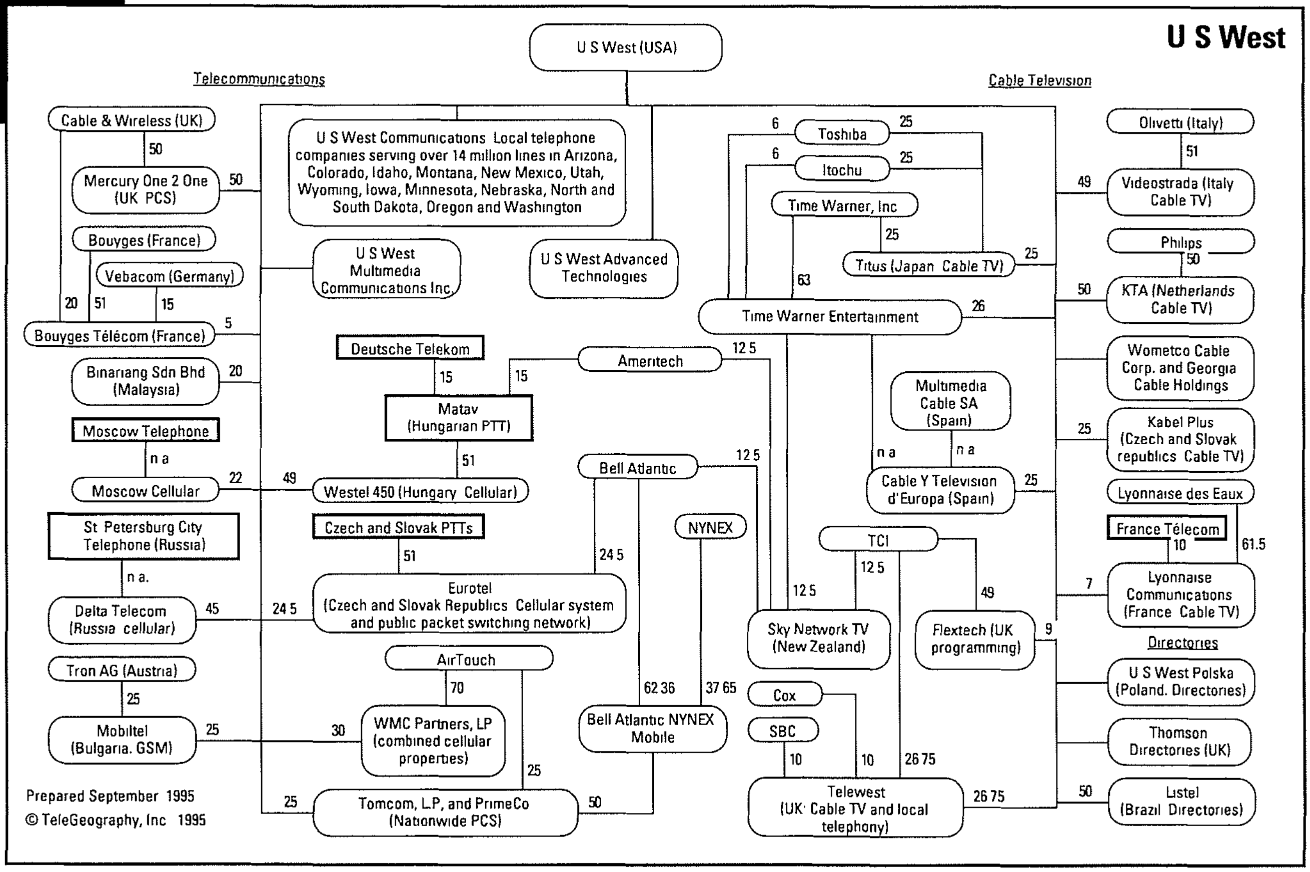
Note Mannesmann AG and AirTouch have proposed to purchase the Cable & Wireless stake in Mannesmann Mobilfunk Mannesmann AG would have 61 6%, AirTouch would hold 31 4%, and the remaining 7% would be held in trust for the two companies

U S West



U S West (USA)
Telecommunications
Cable Television
Cable & Wireless (UK)
Mercury One 2 One (UK PCS)
Bouyges (France)
Vebacom (Germany)
Bouyges Télécom (France)
Binariang Sdn Bhd (Malaysia)
Moscow Telephone
Moscow Cellular
St Petersburg City Telephone (Russia)
Delta Telecom (Russia cellular)
Tron AG (Austria)
Mobiltel (Bulgaria. GSM)
U S West Communications Local telephone companies serving over 14 million lines in Arizona, Colorado, Idaho, Montana, New Mexico, Utah, Wyoming, Iowa, Minnesota, Nebraska, North and South Dakota, Oregon and Washington
U S West Multimedia Communications Inc
U S West Advanced Technologies
Deutsche Telekom
Matav (Hungarian PTT)
Ameritech
Westel 450 (Hungary Cellular)
Bell Atlantic
Czech and Slovak PTTs
Eurotel (Czech and Slovak Republics Cellular system and public packet switching network)
NYNEX
AirTouch
WMC Partners, LP (combined cellular properties)
Bell Atlantic NYNEX Mobile
Tomcom, L.P, and PrimeCo (Nationwide PCS)
Toshiba
Itochu
Time Warner, Inc
Titus (Japan Cable TV)
Time Warner Entertainment
Multimedia Cable SA (Spain)
Cable Y Television d'Europa (Spain)
TCI
Sky Network TV (New Zealand)
Flextech (UK programming)
Cox
SBC
Telewest (UK Cable TV and local telephony)
Olivetti (Italy)
Videostrada (Italy Cable TV)
Philips
KTA (Netherlands Cable TV)
Wometco Cable Corp. and Georgia Cable Holdings
Kabel Plus (Czech and Slovak republics Cable TV)
Lyonnaise des Eaux
France Télecom
Lyonnaise Communications (France Cable TV)
Directories
U S West Polska (Poland. Directories)
Thomson Directories (UK)
Listel (Brazil Directories)
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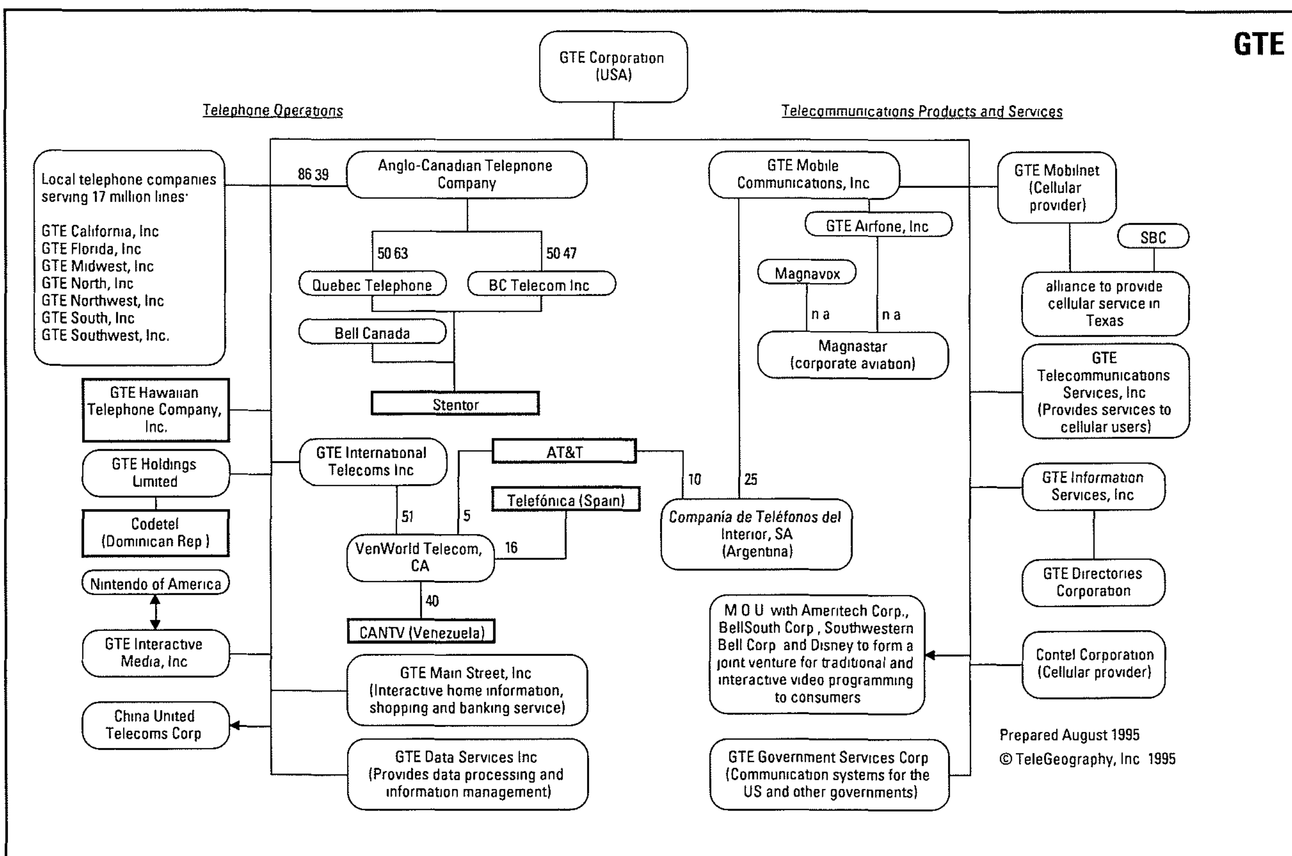
GTE



GTE Corporation (USA)
Telephone Operations
Telecommunications Products and Services
Local telephone companies serving 17 million lines:
GTE California, Inc
GTE Florida, Inc
GTE Midwest, Inc
GTE North, Inc
GTE Northwest, Inc
GTE South, Inc
GTE Southwest, Inc.
GTE Hawaiian Telephone Company, Inc.
GTE Holdings Limited
Codetel (Dominican Rep)
Nintendo of America
GTE Interactive Media, Inc
China United Telecoms Corp
Anglo-Canadian Telepnone Company
Quebec Telephone
BC Telecom Inc
Bell Canada
Stentor
GTE International Telecoms Inc
AT&T
Telefónica (Spain)
VenWorld Telecom, CA
CANTV (Venezuela)
GTE Main Street, Inc (Interactive home information, shopping and banking service)
GTE Data Services Inc (Provides data processing and information management)
GTE Mobile Communications, Inc
GTE Airfone, Inc
Magnavox
Magnastar (corporate aviation)
Compania de Teléfonos del Interior, SA (Argentina)
M O U with Ameritech Corp., BellSouth Corp , Southwestern Bell Corp and Disney to form a joint venture for traditional and interactive video programming to consumers
GTE Government Services Corp (Communication systems for the US and other governments)
GTE Mobilnet (Cellular provider)
SBC
alliance to provide cellular service in Texas
GTE Telecommunications Services, Inc (Provides services to cellular users)
GTE Information Services, Inc
GTE Directories Corporation
Contel Corporation (Cellular provider)
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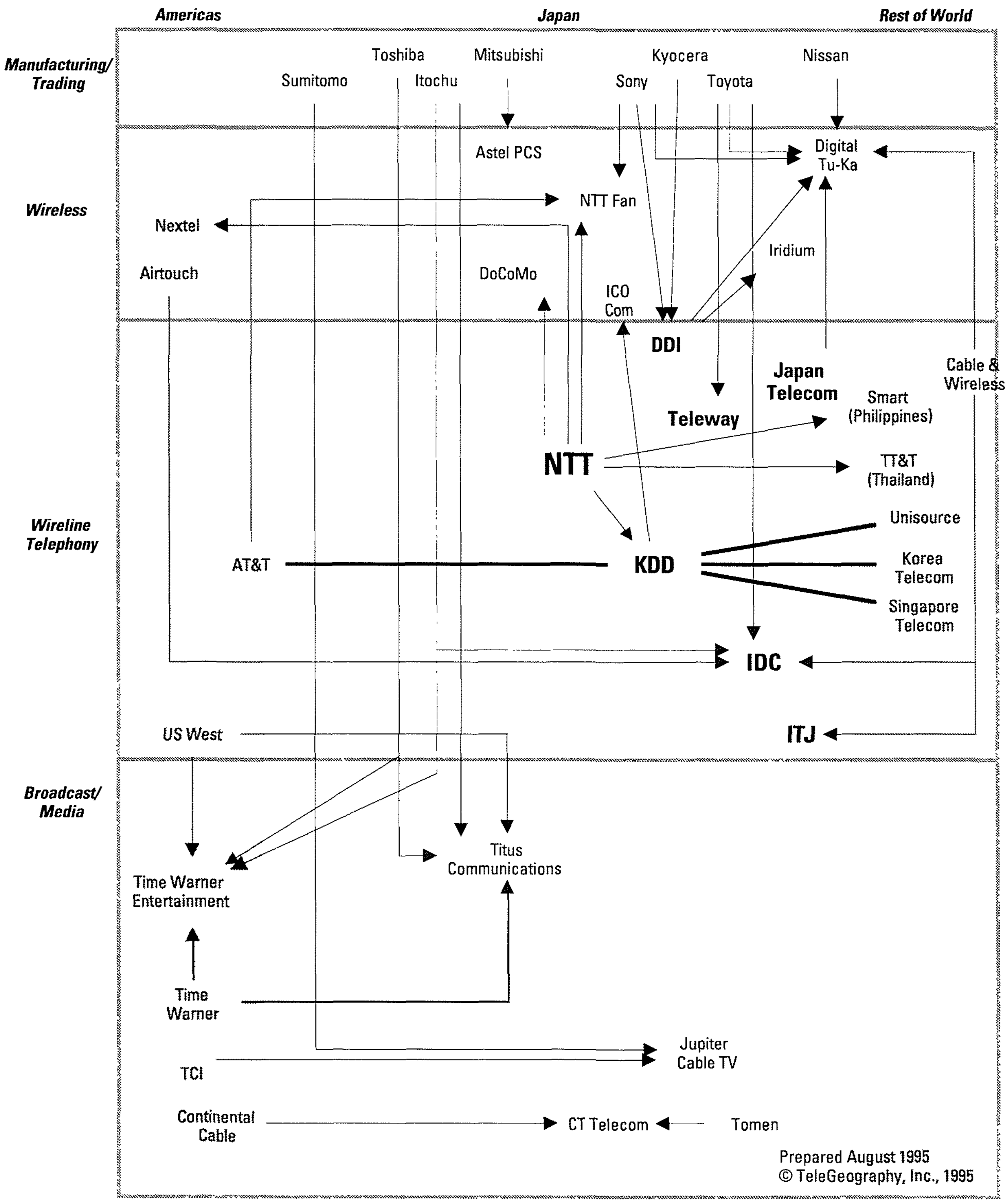
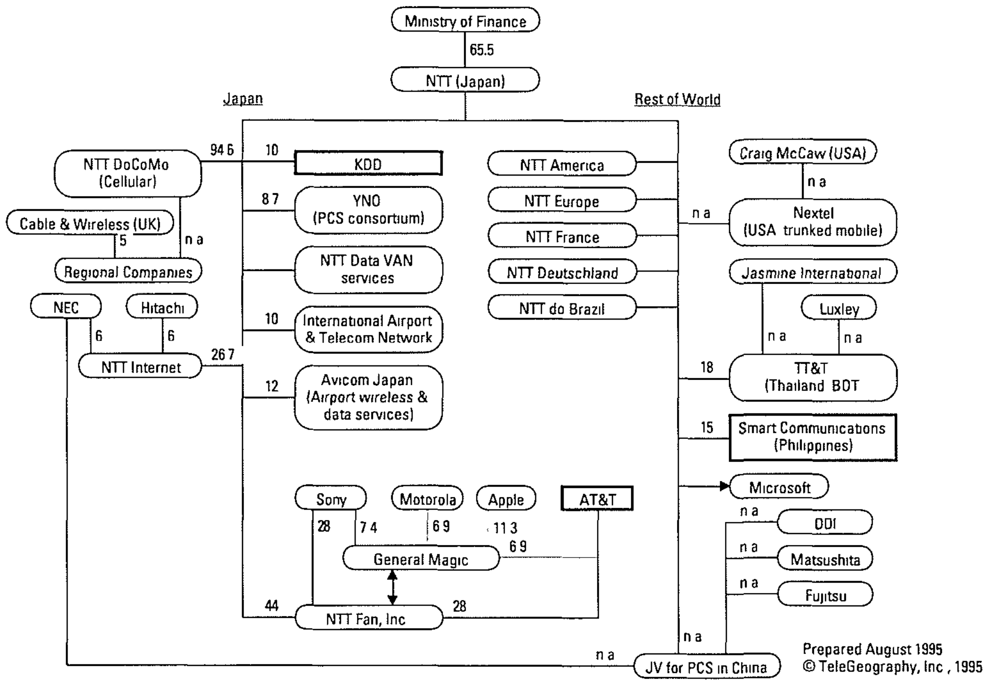
Japan—Industry Convergence



Note: NTT, DDI, Japan Telecom and Teleway Japan are authorized to provide domestic telephone service; KDD, ITJ and IDC are authorized to provide international service. Competing local exchange carriers, such as TTNet (Tokyo), are not included.

NTT


Ministry of Finance
65.5
NTT (Japan)
Japan
Rest of World
NTT DoCoMo (Cellular)
94 6
10
KDD
8 7
YNO (PCS consortium)
Cable & Wireless (UK)
5
n a
Regional Companies
NTT Data VAN services
NEC
Hitachi
6
6
10
International Airport & Telecom Network
NTT Internet
26 7
12
Avicom Japan (Airport wireless & data services)
NTT America
NTT Europe
NTT France
NTT Deutschland
NTT do Brazil
Craig McCaw (USA)
n a
n a
Nextel (USA trunked mobile)
Jasmine International
Luxley
n a
n a
18
TT&T (Thailand BOT)
15
Smart Communications (Philippines)
Microsoft
n a
DDI
n a
Matsushita
n a
Fujitsu
Sony
Motorola
Apple
AT&T
28
7 4
6 9
11 3
6 9
General Magic
44
NTT Fan, Inc
28
n a
n a
JV for PCS in China
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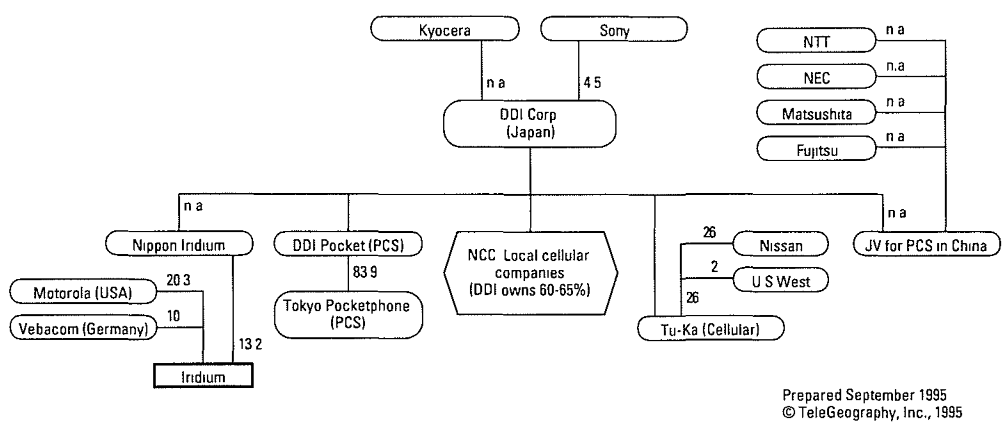
DDI


Kyocera
Sony
n a
4 5
DDI Corp (Japan)
NTT
n a
NEC
n.a
Matsushita
n a
Fujitsu
n a
n a
Nippon Iridium
DDI Pocket (PCS)
NCC Local cellular companies (DDI owns 60-65%)
26
Nissan
2
U S West
26
n a
JV for PCS in China
Motorola (USA)
20 3
Vebacom (Germany)
10
13 2
Iridium
83 9
Tokyo Pocketphone (PCS)
Tu-Ka (Cellular)
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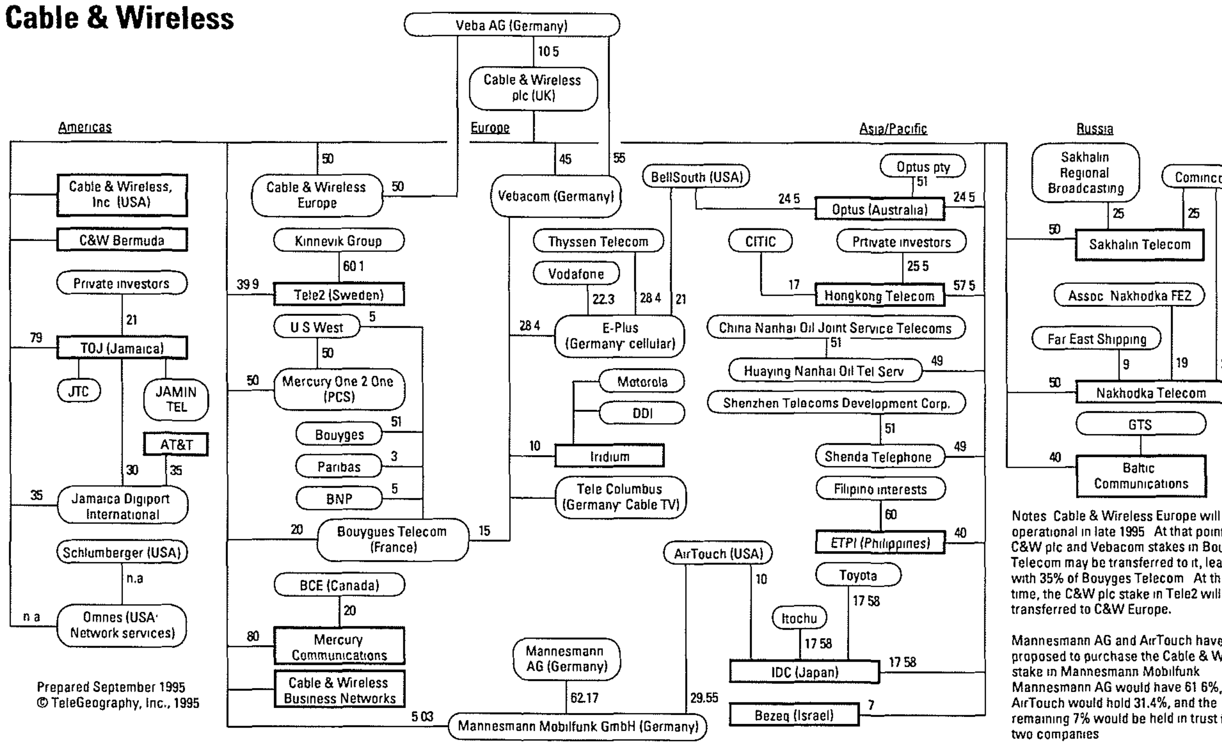
Cable & Wireless

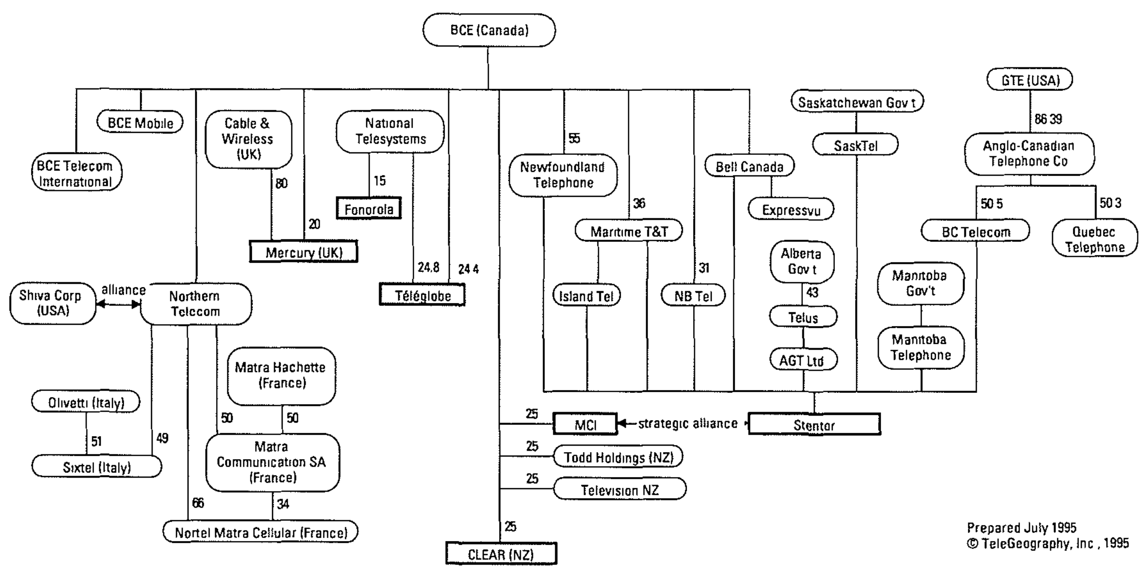


Notes Cable & Wireless Europe will become operational in late 1995 At that point, the C&W plc and Vebacom stakes in Bouyges Telecom may be transferred to it, leaving it with 35% of Bouyges Telecom At the same time, the C&W plc stake in Tele2 will be transferred to C&W Europe.

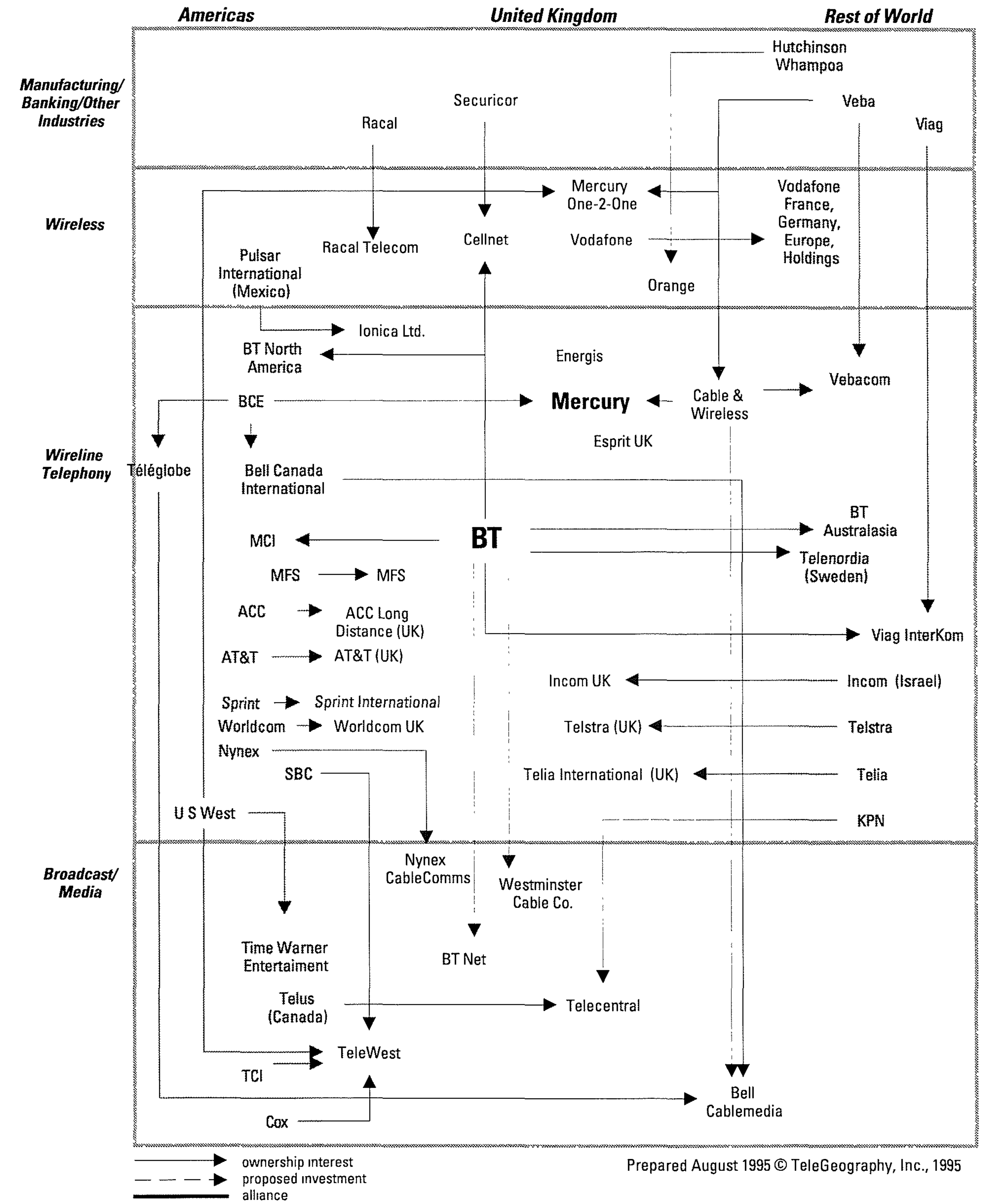
Mannesmann AG and AirTouch have proposed to purchase the Cable & Wireless stake in Mannesmann Mobilfunk Mannesmann AG would have 61 6%, AirTouch would hold 31.4%, and the remaining 7% would be held in trust for the two companies

C&W interests in Africa, the Indian Ocean, and many Caribbean islands are excluded

BCE



United Kingdom—Industry Convergence



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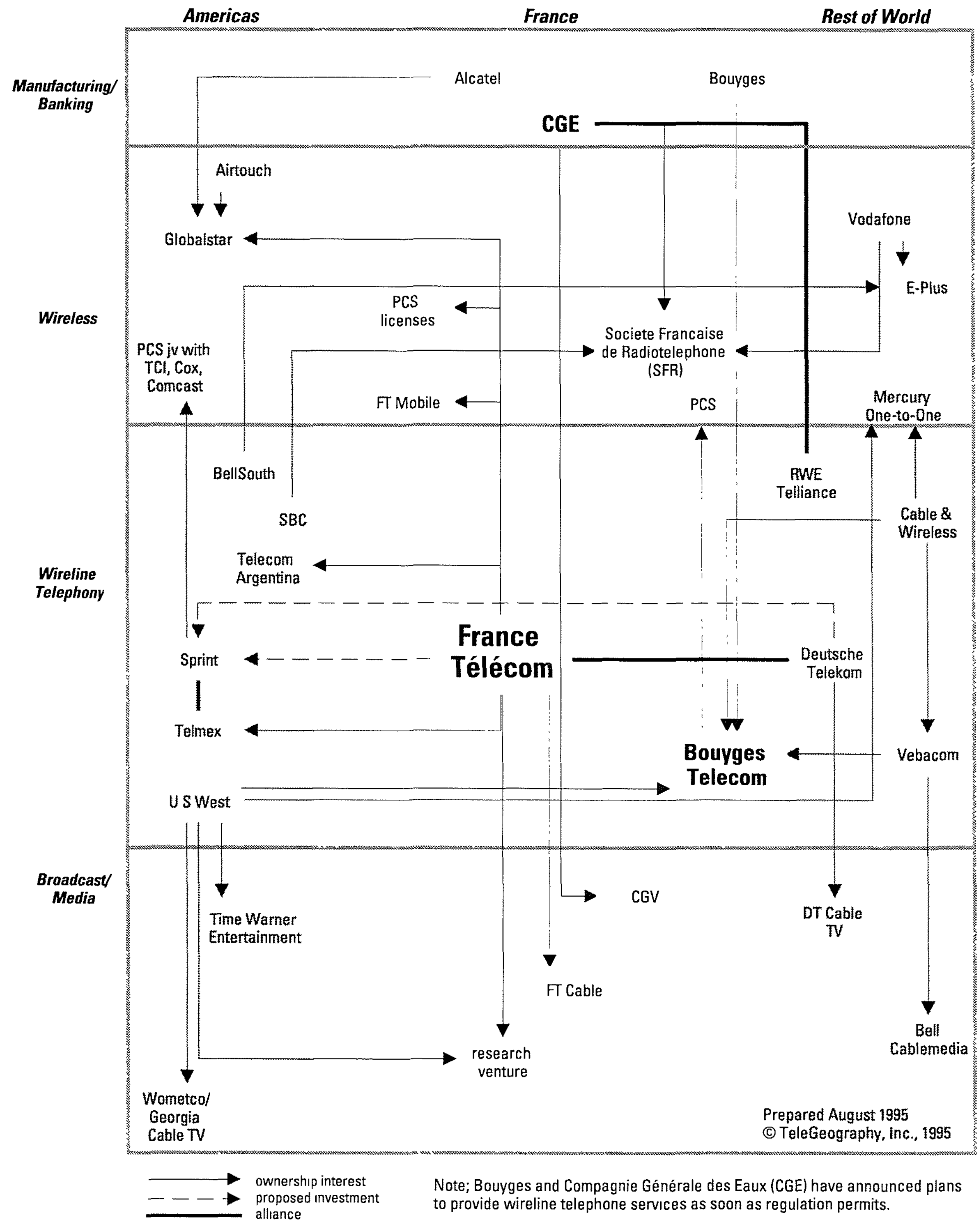
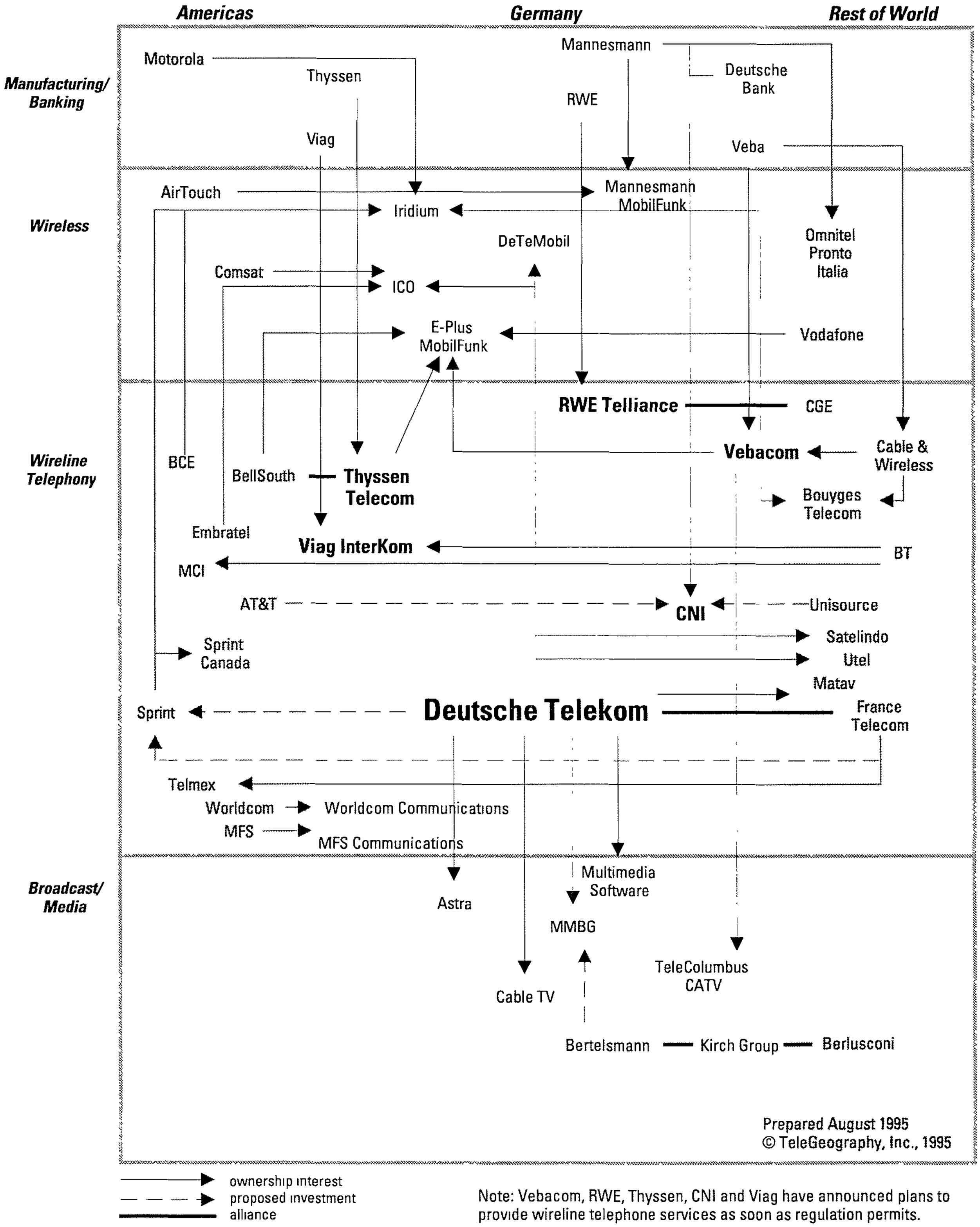
France—Industry Convergence



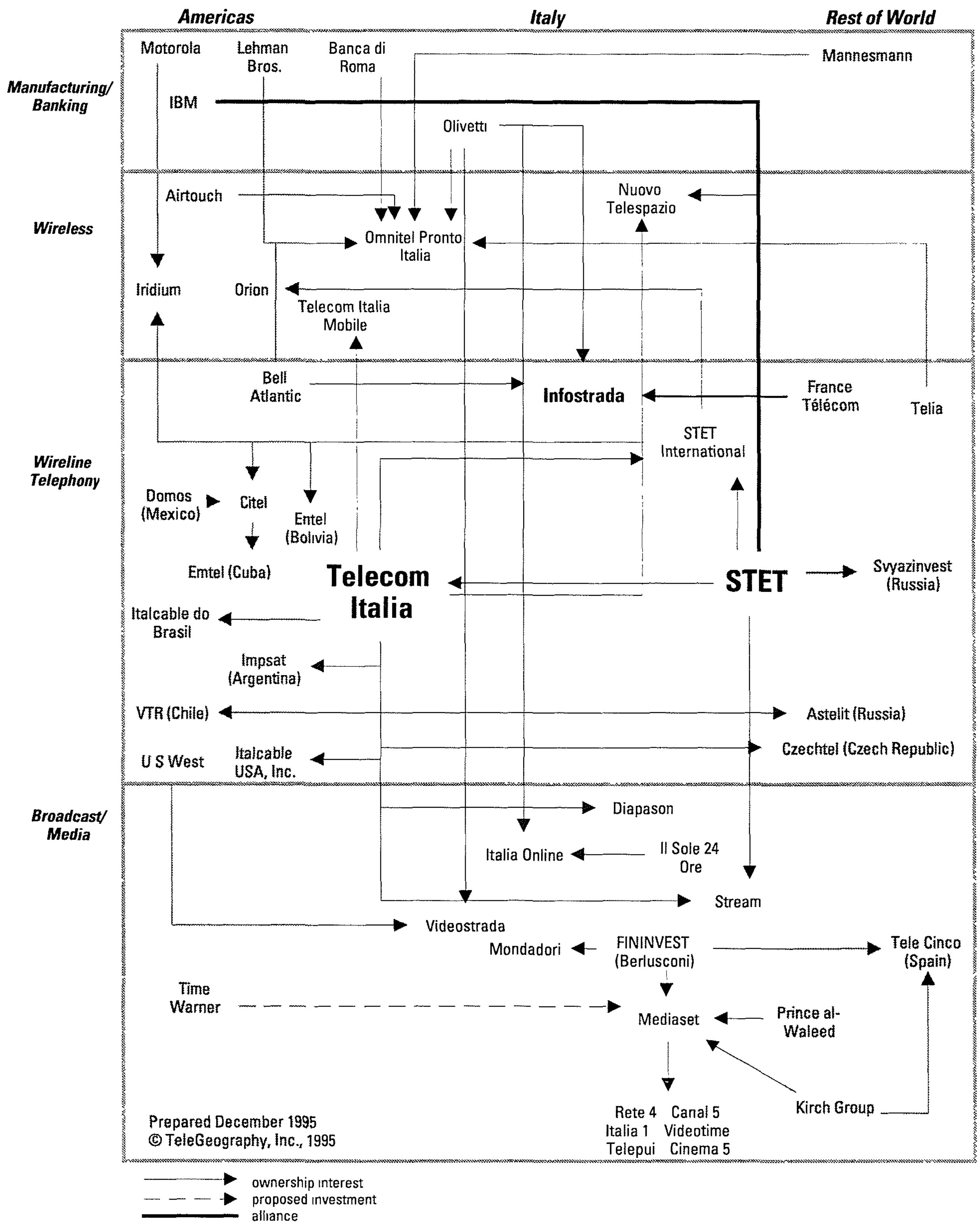
Note; Bouyges and Compagnie Générale des Eaux (CGE) have announced plans to provide wireline telephone services as soon as regulation permits.

Germany—Industry Convergence



Note: Vebacom, RWE, Thyssen, CNI and Viag have announced plans to provide wireline telephone services as soon as regulation permits.

Italy—Industry Convergence



MANAGING THE INFORMATION SUPERHIGHWAY

Wanted: Rules for "Good Gatekeepers"

by Rex Winsbury

The Trojan Wars, say some scholars, were really about the powerful position that the ancient city of Troy had established as the gatekeeper of the Dardanelles: the narrow neck of water through which trading ships passed enroute from the cities of ancient Greece to the grain-rich shores of the Black Sea. Troy was able to extract tribute from the vessels that passed, and even to block access to markets and consumers, until the Greek army decided to do away with this self-appointed and greedy tax collector using the latest technology—the Trojan Horse.

The image recurs in various forms in today's information economy—as tollbooth, as bottleneck, as digital porter (the intelligent device of the future which will hold your personal profile, search the information highway for you, and screen phone calls), and as the equivalent of seaports and airports, where tomorrow's immigration authorities and customs officers will monitor the traffic and charge entrance and departure taxes. But the fear remains the same—that somewhere in the value chain between producer and consumer, someone will establish control of a key command post in the distribution chain and therefore a position of commercial power. That "gatekeeper" will be able to grant or deny access to markets and demand dues and tolls from competitors wishing to use that gateway to reach the consumer.

The gatekeeper metaphor fits easily into that even more powerful metaphor which has shaped the communications debate over the past two years—the metaphor of "the information highway," itself derived from the open road networks that were the nerve systems both of ancient empires and modern states. Just as "the information highway" has become an evocative and positive description of where we think we are going in communications (just because it can mean many things to many people, yet unifies these separate meanings), so too "the gatekeeper" who controls access to the "information highway" has become an evocative and negative description of what we fear (just because it can mean many things to many people, yet unifies their separate concerns).

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Promises and Threats

The fact that these two terms are fashionable rhetoric drawing upon ancient images, and so may give way soon to an even newer fashion, should not disguise their fundamental force and importance. On the one hand, the image of the "information highway" expresses a basic political and cultural idea—what the U.S. Vice President, Al Gore, has called "a metaphor for democracy"—of information flowing freely and without hindrance among citizens of one country and between citizens of many countries. Here, very early on, we see the tight interconnection—one might call it the mutually enabling function—between the commercial ambitions of expanding and diversifying information enterprises, and the pursuit of socio-political ideals.

Thus the image of "the gatekeeper" conjures up a basic political and social threat, one which will gather force as national governments and supra-national institutions (such as the European Union or the World Trade Organization) get to grips with a fundamental question that will outlive changes of fashion in terminology.

The Key Question

That question is this: as digitization drives previously separate industries into convergence, and so makes obsolete the quite different sets of public regulation that have for generations governed these separate industries, where will the public interest lie, and what will be the role and justification of regulation in the name of the public interest? Put another way, should the current rule-books that reflect past technologies and principles simply be discarded as companies in the previously distinct industries of telecommunications, computing, broadcasting and publishing cross both industrial and geographical boundaries to form international multimedia mega-corporations?

Clearly these old rule-books are increasingly unworkable and obsolete. Some say they should just be scrapped, and "the market" should be left to go its own way, driven by technology but guided by that "invisible hand of the market" that somehow equates with the public good. Others say that the role of regulation, in this era of transition towards a global open market, is to simulate or mimic true competition in areas where true competition does not yet exist (say, in some European national telecommunications markets or in the U.S. regional telecommunications markets). Come competition, it is said, industry-specific

Box 1. Media Reregulation in the UK

The U K government, while insisting that "there is a continuing case for specific regulations governing media ownership, beyond those [in] the general competition law, . to maintain diversity and plurality," has put forward radical proposals for the reregulation and liberalization of media ownership The proposals, Media Ownership, the Government's Proposals, *(May 1995), may set the trend at least within the member states of the European Union. Initially, these proposals cover only the press, television and radio, on the grounds that other markets are too new to be included—yet.*

To allow multimedia companies to emerge that are strong in many aspects of mass communications while retaining its right to regulate what the document calls "the concentration of market power," the U.K. government expects to:

- *abandon the present concept of separation of ownership between the sectors, with separate rules for each sector;*
- *define a total media market,*
- *define individual media markets and market shares by audience or revenue share rather than equity holdings;*
- *establish the relationship between a market share in one market (the press) and in another (TV) by means of a "media exchange rate" that expresses the relative weight of each sector (i.e., not all sectors are deemed to be equally important),*
- *using this "exchange rate," define a level of market share of the total media market that would trigger regulatory review; and*
- *make the regulator the normal antitrust authority; in the case of the UK, that would be the Office of Fair Trading (i.e., special media regulations, yes, but special regulator, no).*

This approach has problems, e.g., how to fix the "exchange rate" between sectors and where to fix the level of total media market share that would trigger the regulator's attention. The suggestion is 10 percent of the U.K. total media market.

But significantly, this idea of special asymmetrical regulation for dominant players recurs in a consultative document issued in August 1995 by Oftel, the U.K. telecoms regulator. Titled, Beyond the telephone, the television and the PC, *it suggests that in the future the market for broadband switched mass-market services (which could of course include what is now termed television as well as telecommunications, in the common bit-stream of the future) regulation should differ according to degree of market dominance.*

Out of the four sectors Oftel foresees in this new market—content creation, service provision, distribution networks, and consumer equipment—regulation should concentrate on network operators. Oftel also suggests that a rule requiring "any-to-any connectivity" should only apply to dominant network operators, who would be required to grant open access to all service providers. Structural separation between content providers and network operators, even dominant ones, is unnecessary, provided there is accounting separation.

The two U.K government documents converge on two ideas, reflecting media convergence One is support for a new freedom to develop cross-media ownership and services, whether between press and TV or between telcos and content providers. The other is a sense that, in the future, public policy for the communications sector will focus, not on detailed rules of structural separation, but on the behavior of companies with market dominance.

The European Union regulatory landscape: National rules on pluralism and cross-media ownership

	B	DK	D	G	E	F	IRL	I	L	NL	P	UK
Monomedia press						✔		✔				
Monomedia TV or radio	✔		✔	✔	✔	✔	✔	✔	✔		✔	✔
Multimedia	✔		✔		✔	✔		✔		✔	✔	✔
Max. TV shareholding			✔	✔	✔	✔			✔		✔	
Disqualified persons	✔	✔	✔				✔			✔	✔	✔

Monomedia press: Limit on mergers between press companies; Monomedia TV or Radio: Limit on mergers between TV or Radio companies; Multimedia: Limit on cross-media holdings; Max. TV shareholding: Limit on TV holdings; Disqualified persons: Those barred from media ownership. Chart courtesy of Denton Hall, U.K.

regulation and regulators should wither away and the policing of communications should be left to the cybercops of the competition authorities, the anti-trust laws and the copyright conventions.

Abuse of Power

Yet the image of the gateway is still important, even in that scenario of minimalist public intervention. There is a need to define the public interest to provide some clear idea around which action can, where necessary, be taken against practices that are deemed to be undesirable in the new, seamless world of communications. The idea of "the gateway" is in this sense a metaphor for "the abuse of a dominant position," and abuse of power—in this case, abuse of commercial power—is as undesirable from the point of view of commerce itself as it is from the point of view of government and society.

Older ideas of the public interest were expressed in regulations that (for example) prevented newspaper companies from owning TV stations, or vice versa; prevented telecom companies from owning cable TV companies; prevented cable TV companies from carrying voice telephony; or prevented foreign companies from buying up "our" companies. All of these are recognized as imminently unworkable. When everything is digital, and may be carried or presented in almost any media, sorting out the bits for regulatory purposes will become futile. Bits will be bits and we will all be part of the same global bitstream.

The bitstream also signals the final demise of one of the classic arguments in favor of state regulation: the argument based on the scarcity of a public resource. As long as the electromagnetic spectrum was a finite resource subject to many demands (not least from the spectrum-hungry military) there was a need for an independent arbiter to ration it and decide priorities of use. Much the same argument applied to limited-capacity copper cabling.

But now digital technology, which is much more spectrum-efficient than analog systems, and the development of high-capacity fiber-optic cables, compression techniques, and a new generation of digital satellites, are about to turn scarcity into plenty. The exact scale of this switch to abundance will vary from place to place. But take the U.K. as an example. According to a recent government analysis *(Digital Terrestrial Broadcasting: the Government's Proposals,* August 1995), the switch to digital will add 18 new terrestrial TV channels to the existing five and will increase to over 200 the number of cable and satellite TV channels available to viewers. If BT or the cable companies ever decide to run fiber-optic cable all the way into every home, these figures will take another dramatic leap upwards toward infinity.

But what (if anything) should take the place of these older regulations based on a structural division of power between the different communications industries? If they are not replaced, they become—are—barriers to trade and economic development. Equally, it is inconceivable that governments will surrender all interest in what goes on. Information and the media are central to both political and cultural life. There also is the recurrent political accusation that the media corrupts morals. President Bill Clinton has endorsed proposals to install a V-chip in U.S. television sets to screen out unwanted violent programming. And his Republican challenger, Senator Robert Dole of Kansas, has confronted Hollywood and Time Warner with the charge that "you have sold your souls, but must you debase our nation?" These types of concerns will not go away, no matter who (Sony, U S West) is the significant investor.

In addition, it is a central justification of government in a democratic society that it exists to combat abuses of power that harm the rights and lives of individual citizens. That abuse of power may be by any organized group in society, whether it be the military, the trade unions, a church—or by industrial groups fixing markets and monopolizing trade.

So even under the minimalist view of regulation in the unified communications industry of the near future, it is still of vital importance to reach some consensus about what constitutes, or will constitute, an abuse of power. And, it is important that both industry and politicians agree, roughly, what that idea means. There is nothing worse, for industry as much as for anyone else, than an ambiguous or even capricious rule-book.

Rewriting the Rulebooks

That is where the idea of "the gatekeeper" comes in useful. It still begs the question of what, exactly, constitutes abuse of power. But at least it represents an idea around which rule-books might be rewritten, and there is a general agreement that the rule-books not only have to be rewritten, but also that they should be rewritten in parallel with market and technological developments, rather than after them, if emerging markets are not to be distorted or delayed. That is why the search for a "new dynamic" for a new form of regulation that is not bound by the past, could usefully start with this notion of the gatekeeper/bottleneck.

Today's multimedia has been described by the 1995 ITU *World Telecommunication Development Report* as "a cabbage patch in which many wired, weird and wonderful species are blooming between the experimental plots and the field trials." Still, it is not too early to think hard about what, if anything, to put in the place of the existing legal frameworks. This is evidenced by, for example, the new telecommunications and broadcasting laws being debated in the USA, the proposed changes in media cross-ownership rules in the U.K. (see Box 1), the constant stream of new or revised TV and telecommunications directives emanating from the European Commission in Brussels, and the struggles by key emerging nations like South Africa to reconcile the new internationalism with their equally imperative need to nurture long-neglected indigenous cultures. (See Box 2.)

In short, the image of "the gatekeeper" as a metaphor for abuse of power goes to the very heart of the emerging definition of the public interest in the new era of convergence based on a mix of political, social, economic and cultural concerns. It will replace, indeed is replacing, older notions and regulations based on limits on ownership, separation of industries, separation of geographical areas, circulation ceilings and the rest of the apparatus aimed at the supply side. We no longer live in an age of spectrum or channel scarcity. Instead, future regulation will be based on the demand side, on markets, access to markets, and control of markets.

Some Actual Cases

The evidence for this is already all around us. It stretches (looking at only the past year or so) from the prevention of the Microsoft take-over of Intuit in the U.S. (see page 48); to the banning on anti-competition grounds by the European competition authority of the proposed Media Services pay-TV alliance in Germany between Deutsche Telekom, the Kirch Group and Bertelsmann; to the similar stopper put on Nordic Satellite Distribution, the proposed satellite TV alliance between Kinnevik and two telcos in Scandinavia (see page 52); to the rows over BSkyB's program supply deals to cable systems and its grip on encryption technology in the U.K. (see Box 3); and to the objections raised against the Atlas and Phoenix joint ventures between Deutsche Telekom, France Télécom and Sprint on both sides of the Atlantic. (See page 47.)

All these are cases where new alliances or mergers were barred or (in the BSkyB case) at least modified as a result of the intervention, not of traditional regulators, but of antitrust and competition authorities. The proposal by the U.K. government to abandon historical controls which limit cross-media ownership, based on share ownership, and to base future policy on a (controversial) system of measuring power in the media marketplace, is another indicator and a possibly ground-breaking example that other governments may follow, at least within the European Union (see Box 1).

Getting to Specifics

The whole point of a concept like "abuse of power" is that, like libel or privacy, there can never be an exhaustive defin-

Box 2. South Africa: Balancing Culture and Markets

A clear example of the clash between technological and political-cultural imperatives is seen in South Africa After years of ostracism from the world community due to the apartheid regime, it is desperate to rejoin the world, in communications as in other aspects of economic life. Like the rest of Africa, it risks even greater marginalization if it cannot offer sophisticated telecommunications for business, and its newly enfranchised citizens will no longer tolerate second rate information and entertainment media.

Yet after years of neglect or repression under the apartheid regime, South Africa's indigenous black cultures need not just protection, but positive nurturing, if South Africa is to achieve its ambition of becoming the so-called "rainbow nation." Local production of films and TV programs is an acknowledged issue in the task of building one nation out of South Africa's complex web of cultural and religious communities

Dr. Ivy Matsepe-Casaburri, the educator who now chairs the board of the South African Broadcasting Corporation (SABC), wrote recently in Inter Media (June/July 1995):

"This still dichotomised society has not only had a history of racial and gender oppression but also geographic and cultural fragmentation and subordination from which it needs to be freed or to escape ... If we spurn becoming part of the family of nations, we sound a deathknell to advancement and progress . However, protecting national and cultural interests is vital, especially among developing countries who feel disempowered to make a global impact because of lack of resources and know-how; especially when there is doubt whether sufficient acknowledgment of different cultures will exist, and when suspicions abound about whose agendas will actually be served."

Hence, media policy in South Africa provides a mixed message. On the one hand, the privatization of South Africa's state-owned telecommunications monopoly, Telkom, has been postponed, and international competition in the SA telecom market has been ruled out for the foreseeable future—plainly a protectionist move. On the other hand, SA has seen innovative uses of cellular communications technology serving fixed-site payphones to bring telephone access to a much wider share of the black population. At the same time, BOP TV has been satelliting Western-style TV programming into SA from neighboring Botswana and South Africa's own M-Net company has been spearheading the spread of satellite pay-TV to the whole of southern and central Africa.

Box 3. BSkyB: The First Mover as Gatekeeper

BSkyB, the largest U.K. based satellite TV company which is effectively controlled by Rupert Murdoch, has inevitably been the center of controversy, in particular on two counts. One is the terms upon which BSkyB supplies programming to U.K. cable operators. The other is the de facto control held by BSkyB over the encryption subscriber access system prevailing in the U.K. and in other markets. At issue is the tension between aggressive creation and exploitation of new markets, and the dominance and gateway control that early market leadership can confer—the so-called first-mover advantage.

In the first case, BSkyB initially agreed on preferential terms for program supply with the UK's two biggest cable TV operators, TeleWest and Nynex, who between them control about one-third of the market. In return, the two operators gave a pledge not to invest in cable-only channels competitive with BSkyB channels, notably for sports and for pay-per-view.

Since there had previously been a strong effort among cable operators to establish rival cable-only programming to reduce BSkyB's grip on the cable programming market, this deal was seen by other cable operators as a body blow to the independence of cable, as well as consolidating BSkyB's dominant position as a program supplier. The cable operators filed a formal complaint, saying the deal was anti-competitive. Following intervention by (significantly) the U.K. Office of Fair Trading, rather than the media regulators, the BSkyB agreement was modified. BSkyB issued a revised rate card under which other cable operators could buy programming on the same terms as TeleWest and Nynex. But the restriction on TeleWest and Nynex investing in rival cable channels remains so far unresolved.

In the second case—more protracted and confused—other actual or potential satellite TV program suppliers, such as the BBC, the U.K. terrestrial commercial TV companies (ITV) and some US-based satellite channels expressed fears that BSkyB's grip on the only widespread pay-per-view system used in analogue pay-TV (Videocrypt) might be translated into a similar grip on the only similar widespread system for digital TV, both satellite and terrestrial.

There was an expectation that BSkyB, which is also a candidate for some of the new digital terrestrial channels in the UK, might promote a dual-purpose digital satellite and terrestrial set-top box, with a built-in VideoGuard decoder, thus becoming the effective gatekeeper to the new world of digital TV. Similar fears were echoed in other European markets where there is a dominant pay-TV supplier. The U.K. government has been reluctant to intervene, since it wants to see new markets develop unhindered. So the argument has centered around the wording of a new European Commission Directive which seeks to define the technical characteristics of a future set-top box which interfaces between the consumer and the TV channel provider.

No one wants the consumer to have to buy a plethora of set-top boxes. But can the supplier of a leading conditional access system realistically be expected to make room on it for all those rivals who want to use it to reach the consumer, even if the system has the capacity to do so? Or, in the era of unified digital media and unified media regulation, is the doctrine of open access and "any-to-any connectivity" to apply equally to a dominant wireline telecommunications operator and to a dominant wireless pay-TV operator?

ition of what it means in practice. As circumstances change, so too will perceptions of what is abuse. But already some more specific questions have emerged. For example:

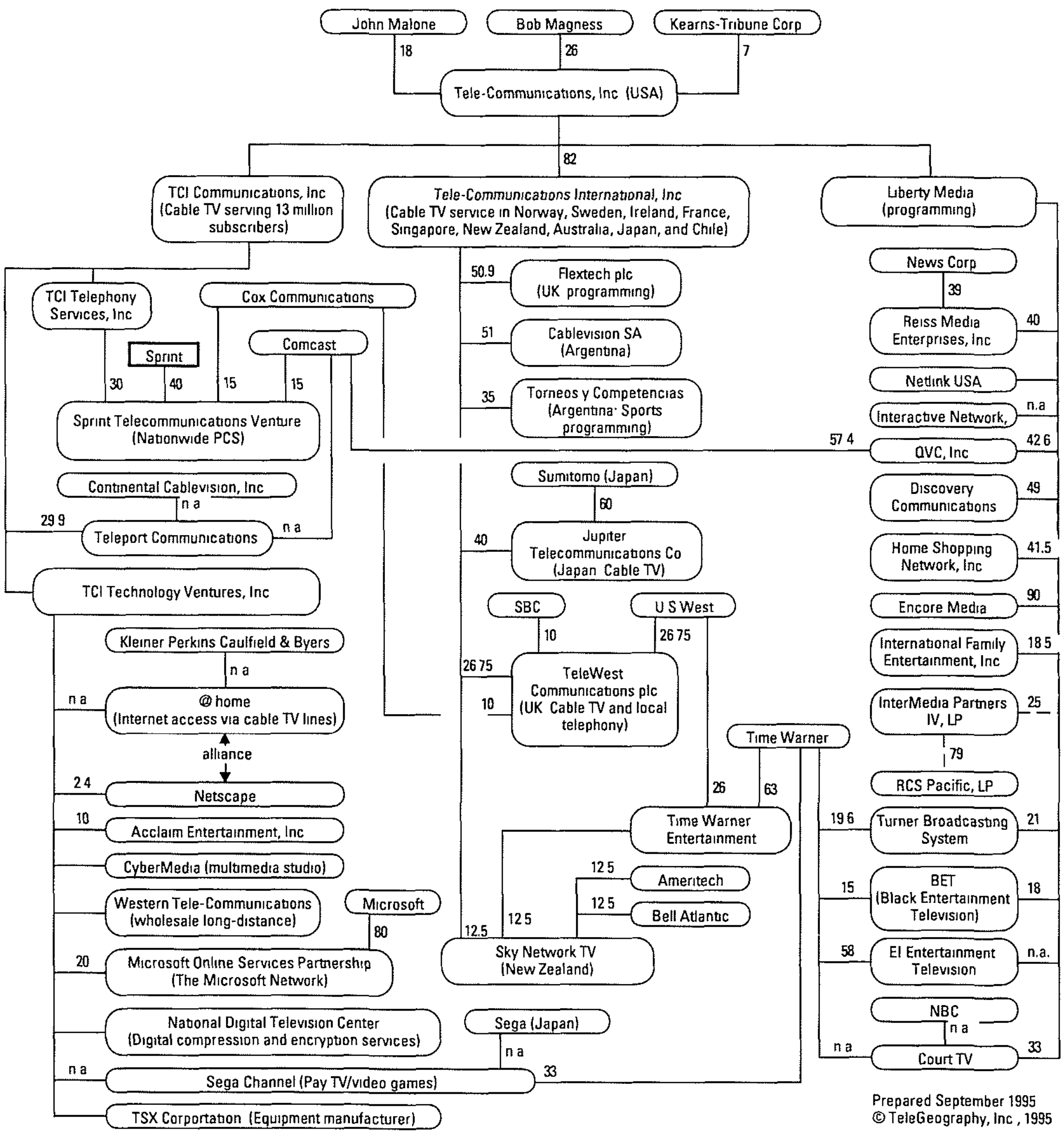
1. Does size in itself constitute an abuse of power? This is a particularly relevant question in European telecom markets yet to be deregulated, such as Germany and France, where the state telecom monopolies are kicking hard at the trend in upcoming European directives to define "the presumption of significant market power" as beginning at 25 percent of the market, a level at which special "asymmetrical" regulations may be justified. (Asymmetrical regulation usually refers to a dual regime with one set of rules for the incumbent or former monopolist and another set of rules for new entrants.)

2. Does vertical integration itself constitute an abuse of power? This is a relevant question when telcos, content providers and makers of consumer reception devices (PCs, set-top boxes and their software, otherwise known as Customer Premises Equipment, or CPEs) join together. But it is a particularly relevant question for such a market as U.S. cable TV, where, according to a 1994 FCC survey, 56 of the 106 nationally distributed program services had vertical ties with MSOs (multiple systems operators), such as TCI, and this connection was even stronger among the most popular and widely reviewed program services. Such links were a prime reason why the U.S. antitrust authorities conditioned TCI's 1994 acquisition of Liberty Media, another MSO, to ensure that Liberty would afford non-TCI linked program suppliers "equal access" (See, e.g., Figure 1).

The potential for vertically integrated companies to reduce competition also arises in the international telecommunications market. For example, both the new BT-MCI joint venture, Concert, and the Sprint-Deutsche Telekom-France Télécom alliance, known as Phoenix, were scrutinized by competition authorities in the U.S. and Europe primarily because the new ventures would combine (vertically integrate) a dominant local and long distance provider in one market with a major long distance provider elsewhere. The vertically integrated venture might have an incentive to discriminate against unallied long-distance providers. As a condition to their proceeding with these ventures, the U.S. antitrust authorities required the companies to abide by certain non-discrimination and disclosure requirements. (See page 47 for further details).

3. What is the definition of a market within which power may be abused when delivery technologies, such as satellites and the Internet, transcend national boundaries? This is also a particular question for the new global alliances such as Concert and Phoenix. Are these new ventures simply adding a marginally different set of international services to those now offered on a traditional correspondent basis—that is, the services now provided by connecting a telco in one country with a correspondent in another? Or, as some competition authorities have argued, should the market power of these new ventures be judged in relation to a new market for seamless (end-to-end) global telecommunica-

Fig. 1. Tele-Communications, Inc.



Note The shares in Tele-Communications International not held by Tele-Communications, Inc , are publicly traded Certain classes of Liberty Media stock are also publicly traded, but Tele-Communications, Inc., retains 100% control tions services? If so, then what matters most is the combination of national partners *vis-à-vis* other potential national combinations (seamless global platforms). Accordingly, where one venture is allied with a monopoly service provider (as is the case for Phoenix) then the venture should be disallowed unless satisfactory terms for local interconnection of other potential global service providers are established.

4. Is it possible to define a gateway in technological terms (e.g., control of a proprietary set-top box technology or an entrenched encryption and subscriber management system, or of a network navigator or channel menu) when technology is moving so fast that today's gateway may be tomorrow's bypass? This has been much discussed in the U.S. and has been the subject of a furious row in Europe between the new privately owned pay-TV operators (BSkyB, Canal Plus, Nethold, Kirch) and the older public and commercial broadcasters, such as the BBC and U.K. independent television companies.

5. Will general competition rules, not specific to the communications industries but applicable to all industries, be sufficient to regulate convergent communications, rather than industry-specific regulators like the U.S.'s FCC, the UK's Oftel and ITC, and so on? (OK, we all hate regulators, but when the other guy's being unfair, we shout for the referee.) Given that the key equation in the future may be that price regulation will be justified where, but only where, a bottleneck/gateway is shown to exist, it suggests that some degree of specialist supervision may be needed (and desired by most parties) for some time to come.

6. Is the idea of a global regulator (or, in the case of the European Union, its equivalent, a Europe-wide regulator) a noble dream that answers to today's realities of an international marketplace, or a bureaucratic nightmare? Sir Leon Brittan, vice-president of the European Commission and a noted champion of free competition, has repeatedly called for global rules to facilitate global ventures. Interestingly,

Box 4. Top 20 Cable Television Operators Worldwide

Ranked by number of subscribers 1994

		Cable TV revenue		Subscribers	
Rank	Company	1994 (US$ m)	Change 1993-94	1994 (000s)	Change 1993-94
1	Deutsche Telekom (Germany) a	2,280.0	32.1%	14,600	8.1%
2	TCI (USA)	4,247.0	2.3%	11,695	9.3%
3	Time Warner Cable (USA)	2,220.0	0.5%	7,500	4.7%
4	Comcast Corporation (USA)	1,065.3	-2.7%	3,329	24.0%
5	Continental Cablevision Inc. (USA)	1,177.2	--	3,081	6.4%
6	Rogers Cablesystems Ltd. (Canada) a	449.0	12.4%	2,553	34.6%
7	Cox Cable Communications (USA)	--	--	1,852	3.8%
8	Cablevision Systems Corp. (USA)	837.2	25.6%	1,768	28.2%
9	Newhouse Broadcasting (USA)	--	--	1,425	3.9%
10	Adelphia Communications (USA)	319.0	4.5%	1,322	6.5%
11	Times Mirror (USA)	498.1	5.9%	1,314	8.8%
12	Cablevision Industries Corp. (USA)	408.3	2.8%	1,311	4.6%
13	Svenska Kabel-TV (Sweden) a	75.8	-0.2%	1,259	0.7%
14	Viacom Cable (USA)	406.2	-2.4%	1,139	4.0%
15	Jones Intercable, Inc. (USA)	132.4	8.0%	1,134	7.0%
16	Sammons Communications Inc. (USA)	--	--	1,101	2.9%
17	Casema (Netherlands) a	105.2	35.6%	1,100	34.4%
18	Falcon Cable TV (USA)	--	--	1,054	-9.5%
19	Century Communications Corp. (USA)	318.2	5.4%	941	2.4%
20	Crown Media (USA)	--	--	906	6.3%
	Total above	**14,538.9**	**7.6%**	**60,384**	**9.2%**

a. Wholly- or majority-owned by telecommunication operators or holding companies with strong interest in telecommunications.
Source: ITU adapted from company reports.

these are most likely to develop under the aegis of the World Trade Organization (WTO) rather than through traditional regulatory mechanisms; and the WTO is all about markets, competition—and abuse of markets.

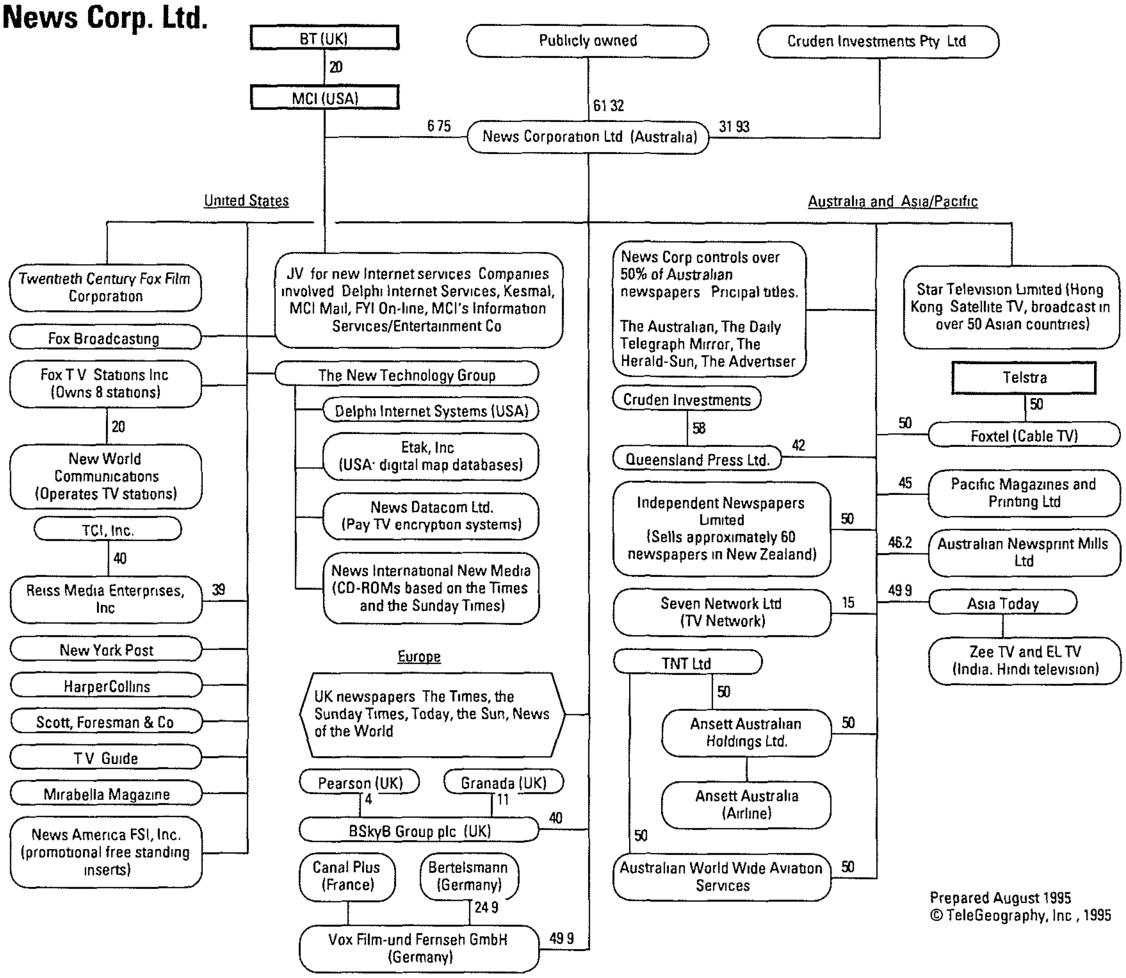
For a century or more, the global telecoms rule maker has been the ITU, the International Telecommunication Union. But its rules have been technical, concerning standards and allocation of the radio spectrum. Recently, it has begun moving to fill the vacuum in other forms of global regulation.

At its 1994 plenipotentiary meeting held in Kyoto, Japan, the ITU set up a new World Telecommunications Policy Forum where ITU members can exchange experience and information about the transition to privatized and liberalized markets. The Forum is focusing first on global mobile satellite systems. Even if the Forum remains a talking shop, the ITU has at last moved toward the adoption of a global free-phone numbering scheme, which may herald a global role for the ITU in regulating that new scarce resource: numbers.

In parallel, the European Union is moving toward a common, unified numbering scheme (e.g., 00 for an international line), just as it is moving toward reciprocal recognition of national licenses, to create a more unified pan-European equipment market. Thus there is a general move toward regulation on a supra-national scale in the name of assisting rather than restricting new markets.

7. Does the fierce debate between advocates of symmetrical versus advocates of asymmetrical regulation (i.e., one set of rules for monopolists or ex-monopolists, and another for new entrants) disguise the real battle for power over who controls that crucial bottleneck, the limited-capacity "last mile" of copper into the consumer's home? That last link will be one of the pragmatic gateways, as the capacity of the main broadband and fiber trunklines increases dramatically faster and further than the capacity of the "last drop" in the home. Is it realistic to expect real competition at this level of the "last drop"? Is it practical, as in the U.K. and Finland (and doubtless elsewhere) to define real competition and free access as a choice for the consumer

Fig. 2. News Corp. Ltd.

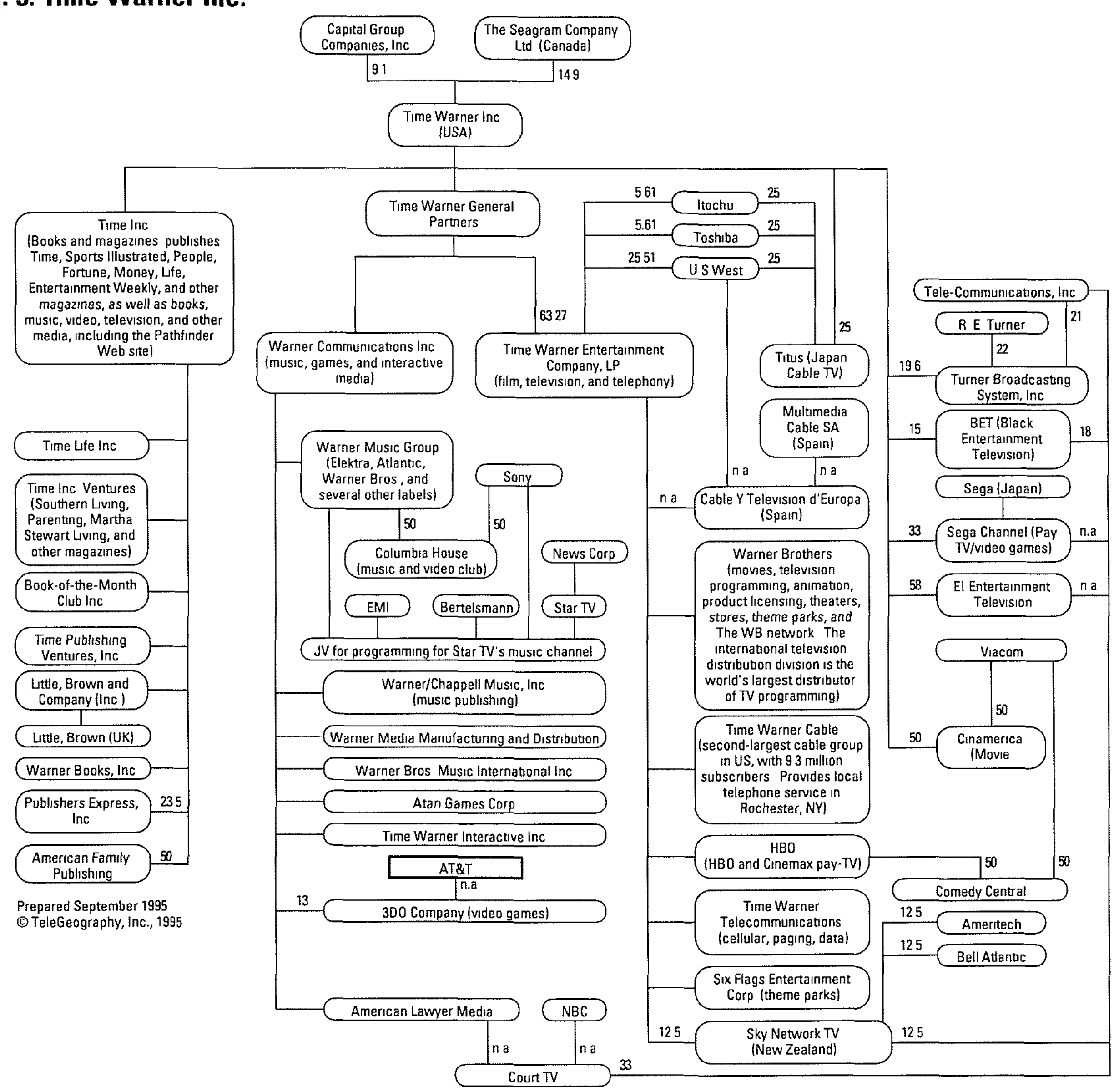


between at least three suppliers, per service or indeed per call?

8. Is it desirable or practical, or too late and too uncommercial, to separate conduit from content, as is often suggested in some fora? It is notable that all the recent cases mentioned above of intervention by the European Union competition authority (Directorate General IV) have involved alliances involving both conduit and content (business data in one case, and pay TV in the others). Recall also the antitrust conditions imposed on TCI's acquisition of Liberty Media.

It is said that there is natural tension between conduit and content in terms of anticipated investment pay-back periods. Typically, investment in conduit (e.g., cable in the ground) may be evaluated against a 20 year timescale, whereas investment in content (say, a Tinseltown movie) typically has a payback horizon of a year or two. Also, huge investments in infrastructure may demand a period of certainty to ensure a payback, which may equate with a period of limitation on competition, enforced by regulation. On the other hand, the provision of services requires open access by any means to as many customers as possible. Also, telcos are used to charging by the minute, second or

Fig. 3. Time Warner Inc.



Notes Itochu and Toshiba have proposed trading their stakes in Time Warner Entertainment for 2% shares in Time Warner, Inc This would leave Time Warner General Partners with 74 49% of Time Warner Entertainment. In September Time Warner, Inc., announced its intention to acquire all of Turner Broadcasting U S West filed suit to block the merger bit—a deterrent to usage. But service providers are used to charging by the event or by subscription, in ways that encourage usage. How can the same organization manage both investment timeframes and both markets and both types of revenue at the same time?

Yet for all that, there have been mega-investments by some telcos in content providers. There is MCI's investment of up to $2 billion for 13.5 percent of News International (see Figure 2) and U S West's 25 percent of Time Warner (Figure 3). Then there is the multimedia joint venture between BellSouth, SBC Communications, Ameritech and Walt Disney (Figure 4) and the uncertain link established between Tele-TV (a programming consortium owned by Bell Atlantic, Nynex and Pacific Telesis) and the Creative Artist Agency, a big power in Hollywood.

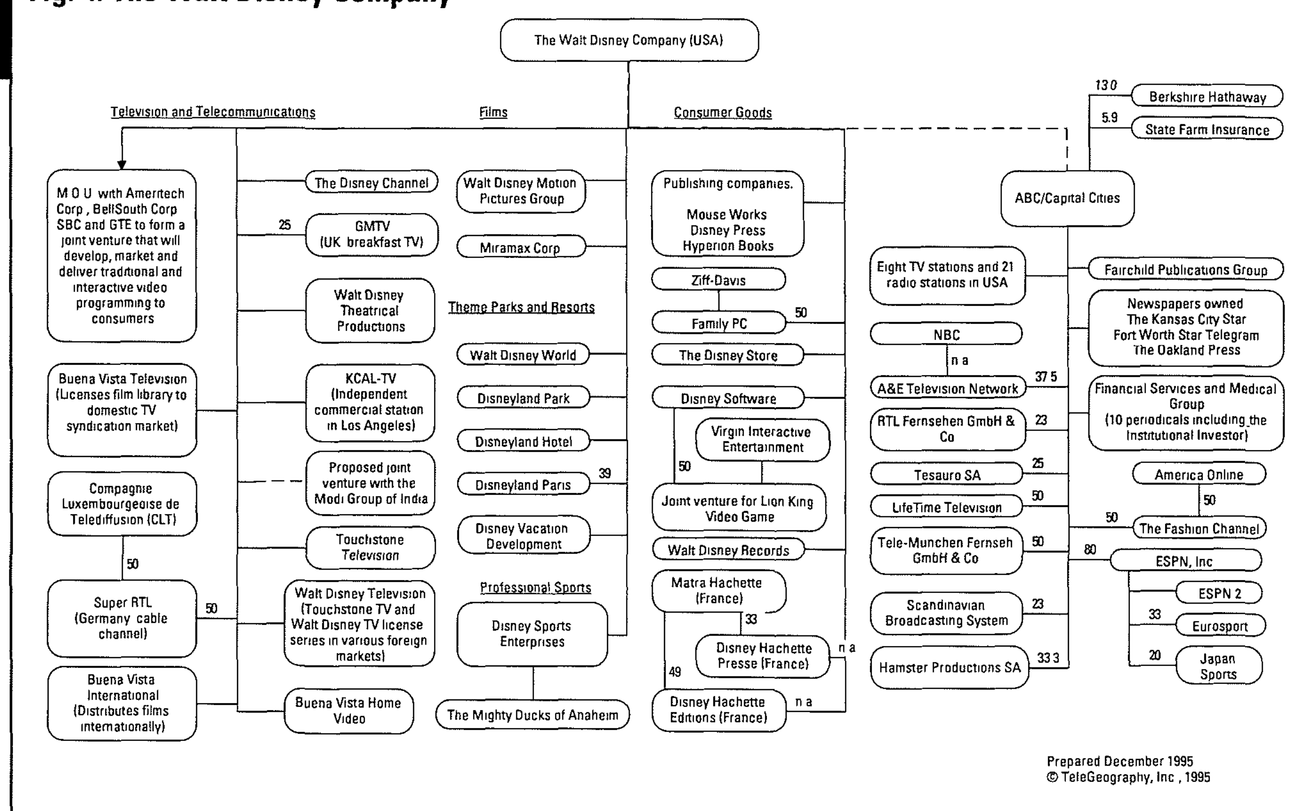
As mentioned, in the U.S. cable industry, a nexus between conduit and content is the norm. Again, see Figure 1 for a list of TCI's "friendly" producers. (See also Box 5 on page 38.) However, there are competing examples: Viacom, for example, has restructured itself as a content company, whereas Time Warner straddles conduit and content. And many telcos, with BT as a notable example, maintain that they need the freedom to carry and deliver all kinds of video services, as well as voice, to the consumer if they are to justify the huge expenditures involved in building comprehensive national broadband networks. A more complete profile of other large content producers, including Viacom, Bertelsmann, MCA, and Pearson is provided in Appendix 1.

It is probably too early to judge, but perhaps this idea of segregating conduit from content is an interesting albeit impractical attempt to recreate the old idea of separation of industrial powers, when the only workable answer lies in the particulars of future events—in watching the marketplace and market behavior, and in empowering the consumer.

9. Is what the Europeans call ONP (Open Network Provision) the model for all communications industries everywhere? ONP is about the legal right and technical ability to interconnect any network with any network. Interconnection is the key issue for a competitive market, since otherwise, groups of customers are shut off from potential services. The refusal to interconnect could become a classic case of abuse of market power, since it is about control of access to users by refusing to open a gateway (control of numbers could be another classic gateway).

It is hardly surprising, therefore, that interconnection issues have been at the heart of the *quid pro quo* long debated by the U.S. Congress regarding the terms on which local telephone companies may enter the long-distance business. America's existing long-distance carriers (AT&T, MCI, Sprint)

Fig. 4. The Walt Disney Company



have argued strongly that the Regional Bell Operating Companies (RBOCs), which now provide local service to over 85% of the U.S. market, must satisfy certain minimum access conditions (e.g., non-discriminatory tariffs, unbundling of separate service elements, number portability) before the terms of the 1984 antitrust decree (the AT&T Modified Final Judgment) are relaxed and they are permitted to offer long-distance service. The RBOCs do not disagree in principle; the dispute is over what competitive access means in practice and how long the conditions should be in place before the local market is declared "open."

There is much at stake here. Full and seamless interconnect appears to be the only true route to full freedom for consumer, business or residential customers—the freedom to roam the information highways and construct "The Daily Me" popularized by Nicholas Negroponte and his guru-team at the MIT Media Lab (sometimes known to Europe as "Channel Moi"). But how do you get it? Through EU Directive, U.S. legislation, or market forces?

CONSUMERS—TRAINED BY YEARS OF CHANNEL SWITCHING AND NET SURFING—HAVE BECOME THEIR OWN GATEKEEPERS; SOON THEY MAY ACCEPT NO OTHER.

10. In the argument over who will be king in the multimedia marketplace—content, technology, or telecommunications—there is, after all, a fourth contender, the user—and more particularly the software-empowered user of the future who can configure his or her own multimedia presentation. There are those who predict that such users will make nonsense of today's mega-alliances because consumers—trained by years of channel switching and net surfing—will cut their corporate media and daily content into billions of extremely thin, infinitely diverse, individual slices. (One need only look at the best selling computer games to see what might happen. Sega and Nintendo control over 90% of the hardware but tens of small software shops successfully challenge the majors for game revenues.) In this scenario, citizens become their own gatekeeper; soon they may accept no other.

Concluding thoughts

Tomorrow's competitors to today's telecommunications and cable TV companies may not be invaders of the same type from a different region or country, or even today's fashionable cross-media and cross-frontier alliances and mergers. Instead, tomorrow's competitor may be the Internet, or something very like it, whose business model and power structure is vastly different to that of the traditional telco or cable TV MSO.

The business model of today's companies is like that of the old IBM mainframe computer, and may be almost as obsolete. The IBM mainframe—a large machine with functions and control centralized in one processor—made IBM's fortune but then nearly ruined the company when the market shifted toward distributed intelligence in individual PCs. Likewise, today's apparently solid communications companies whose technical and business structure is hierarchical, centralized, tightly organized and producer-driven, may find that the market suddenly shifts with seismic effects toward a model which is flatter, fragmented, and consumer-driven: the Internet model.

Who owns U S West or Deutsche Telekom? You can look up the list of stockholders. Who owns the Internet? There are dozens of access providers, software companies, and content providers who can claim a share (see article beginning on page 53). The headquarters of Nynex, TCI and NTT appear on maps. But the Internet has no single headquarters.

Other new technologies—such as pay-per-view, video-on-demand, personal phone numbers and global mobile roaming—may be pointing in this same direction, toward decentralization, more power for the consumer, and new and more flexible business models. There will be huge business opportunities there, but the players may be (or become) both more numerous and different in type, size, function, and revenues. Look at the PC market today, or indeed the direction that mobile telephony is taking toward multiple suppliers, tariffs, technologies, routes, and functions.

To be only slightly fanciful, what happens when I can dial up Paramount-Orion-Warner Studios direct on my Nokia-Samsung personal handyphone and ask to see *Son of Batman III* at 8pm on my multimedia Sony-Macintosh?

If the Internet is the prototype supermarket of the information society, then it is quite thinkable that some of today's communications companies may adapt and flourish, while others may one day be consigned to the rubbish bin of history, like railroad, textile, steel, coal, and many other corporate giants before them. Meanwhile, in the Internet supermarket, public policy should concentrate on who is manning the checkouts. ◆

Box 5. Who Owns the Content?

Film

Parent	Studio	1994 # of Films	1994 Gross ($m)	1994 Share	1993 # of Films	1993 Gross ($m)	1993 Share
Disney	Buena Vista	36	$1,015.7	19.3%	36	$821.2	16.3%
Time Warner	Warner Bros.	42	$846.5	16.1%	37	$928.5	18.5%
Viacom	Paramount	19	$732.1	13.9%	N/A	$459.8	9.3%
MCA	Universal	22	$657.3	12.5%	22	$690.5	13.9%
News Corp.	Fox	18	$495.8	9.4%	21	$538.6	10.7%
Sony	Sony	35	$485.8	9.2%	26	$561.2	11.2%
Turner	New Line	14	$324.1	6.2%	N/A	N/A	N/A
Disney	Miramax	28	$199.2	3.8%	24	$148.4	2.9%
Independent	MGM/UA	12	$144.4	2.8%	12	$91.3	1.8%
Independent	Gramercy	13	$96.3	1.8%	N/A	N/A	N/A
Independent	Savoy	5	$72.6	1.4%	N/A	N/A	N/A
	Other	138	$189.2	3.6%	107	$221.4	N/A
	Total	382	$5,259.0			$4,460.9	

Source. Variety

Television Programming

Company	Country	1994 Rev ($m)	
Fuji TV Network	Japan	$8,210	
Fininvest	Italy	$7,432	
Viacom	USA	$7,363	
Capital Cities/ABC	USA	$6,379	
MCA	USA	$4,800	e
Kirch Group	Germany	$4,286	e
CBS	USA	$3,712	
NBC	USA	$3,361	
TBS (Turner)	USA	$2,809	
Tokyo Broadcasting	Japan	$2,121	
Paramount	USA	$1,407	e
QVC Networks	USA	$1,222	e
Liberty Media (TCI)	USA	$1,153	e
Groupo Televisa	Mexico	$1,044	

e -estimate

Source. Broadcast and Cable Yearbook 1995, Industry Publications; Variety

Music

Parent	Company	1994 Revs. ($m)	Share
Time Warner	Warner	$4,620	14%
Philips	Polygram	$3,630	11%
Sony	Sony Music	$3,630	11%
Bertelsmann	BMG/RCA	$3,300	10%
Thorn-EMI	EMI	$3,300	10%
Seagram	MCA	$1,980	6%
Others		$12,540	38%
Total		$33,000	

Source· Financial Times

Books

Company	Country	1992 Book Rev ($m)
Bertelsmann	Germany	$3,680
Readers Digest	USA	$1,720
Reed-Elsevier	UK/Netherlands	$1,680
Paramount	USA	$1,600
Time Warner	USA	$1,300
Havas	France	$1,280
Pearson	UK	$1,260
Matra Hachette	France	$1,170
Harcourt	US	$1,000
News Corporation	Australia	$1,000

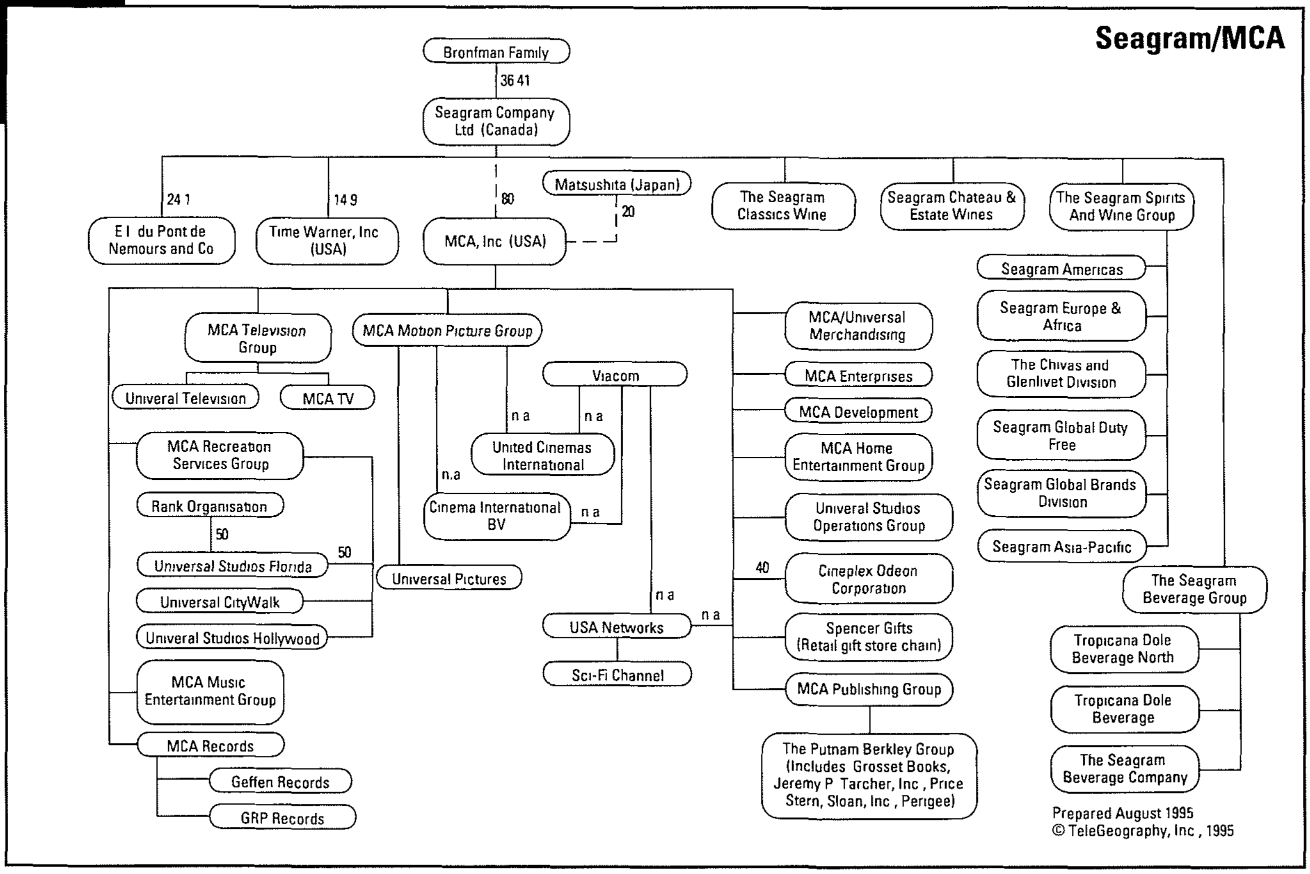
Source. Market Research International

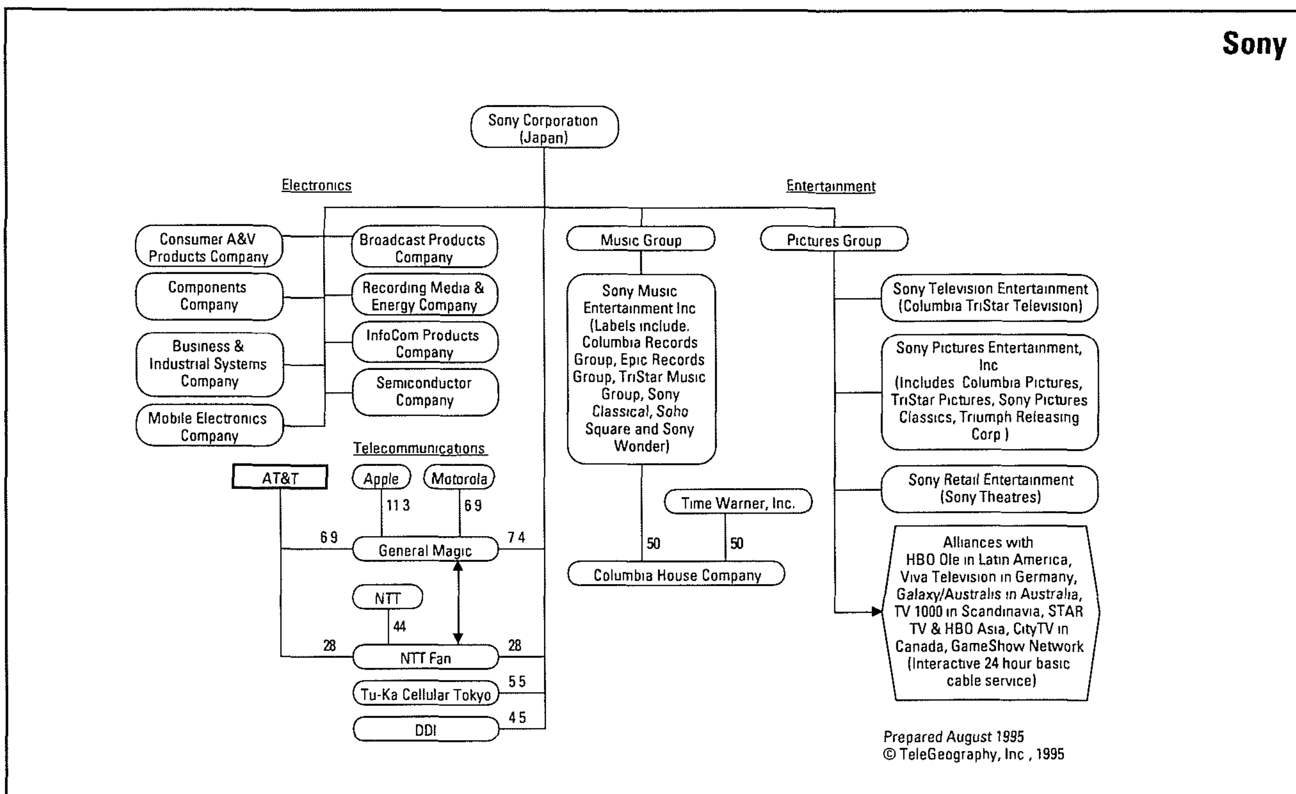
Computer Games (Cartridges)

Company	Platform	1994 Sales ($m)
Sega	Saturn	$130.0
Nintendo	Ultra 64	$126.0
3DO	3DO	$30.0
Atari	Jaguar	$16.9
Sony	Playstation	N/A

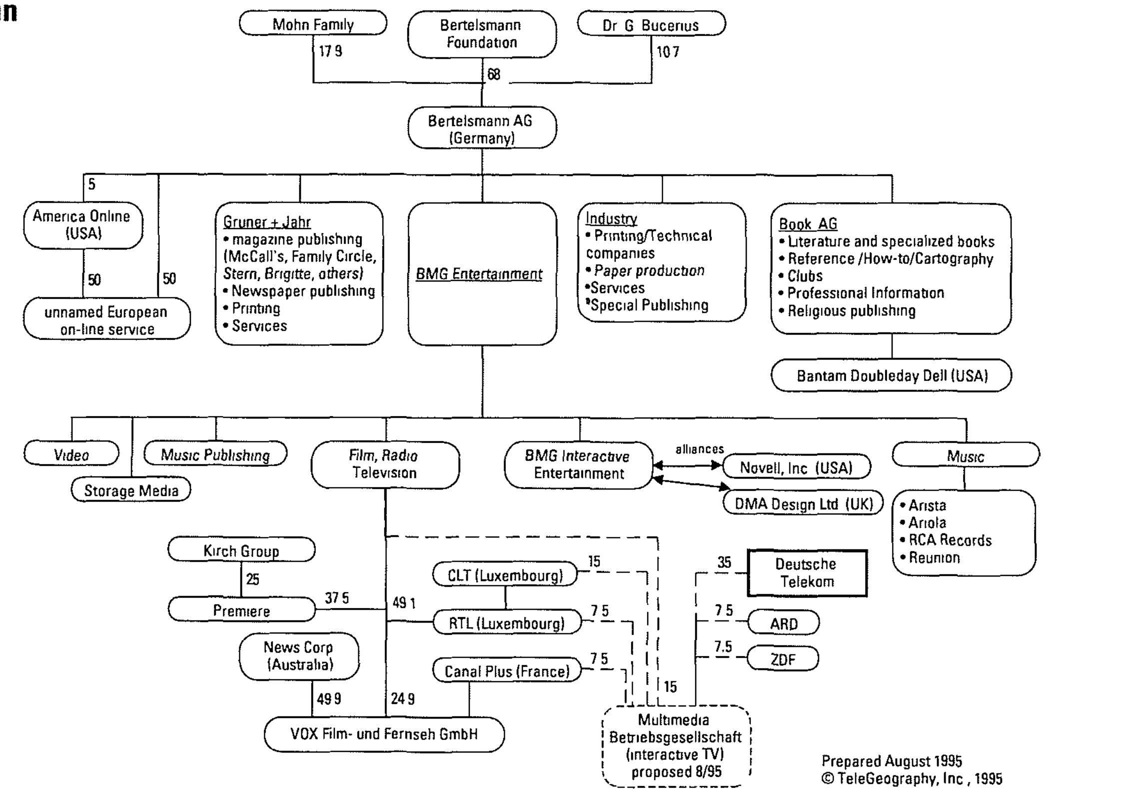
Source: Variety

Appendix 1: Major Entertainment and Publishing Companies

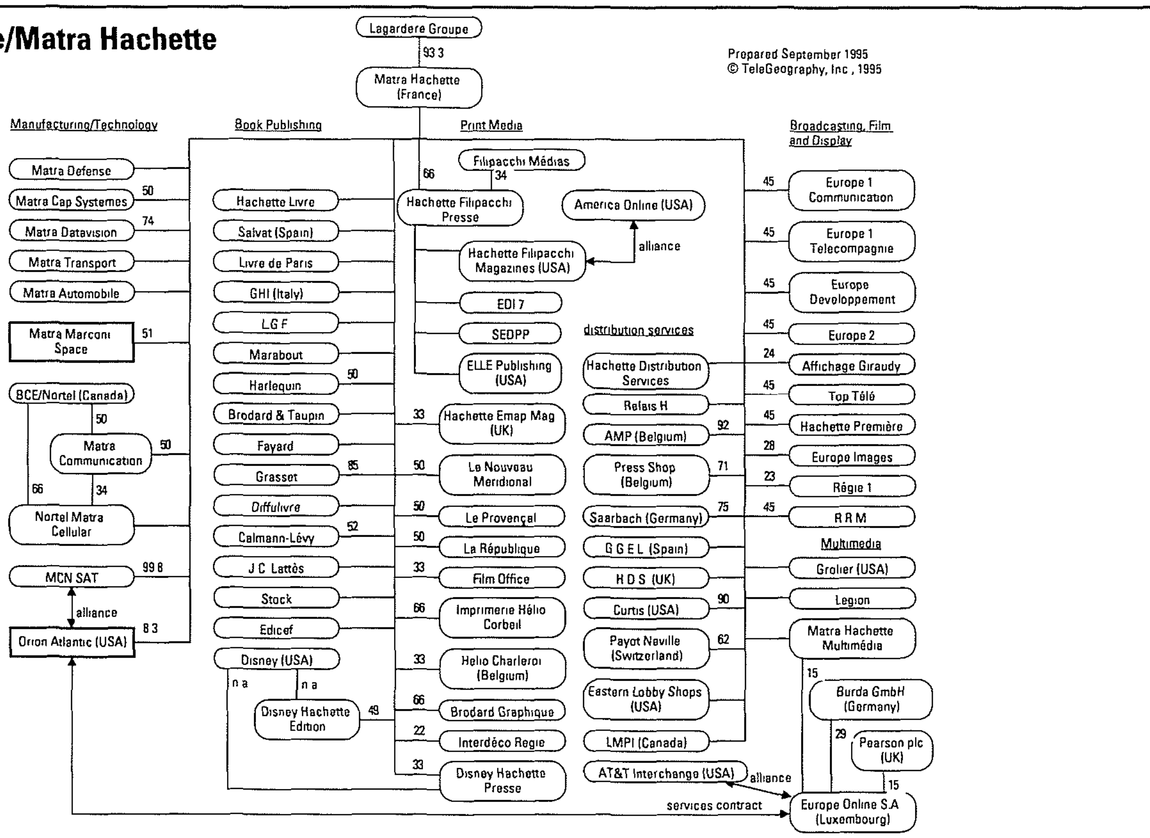




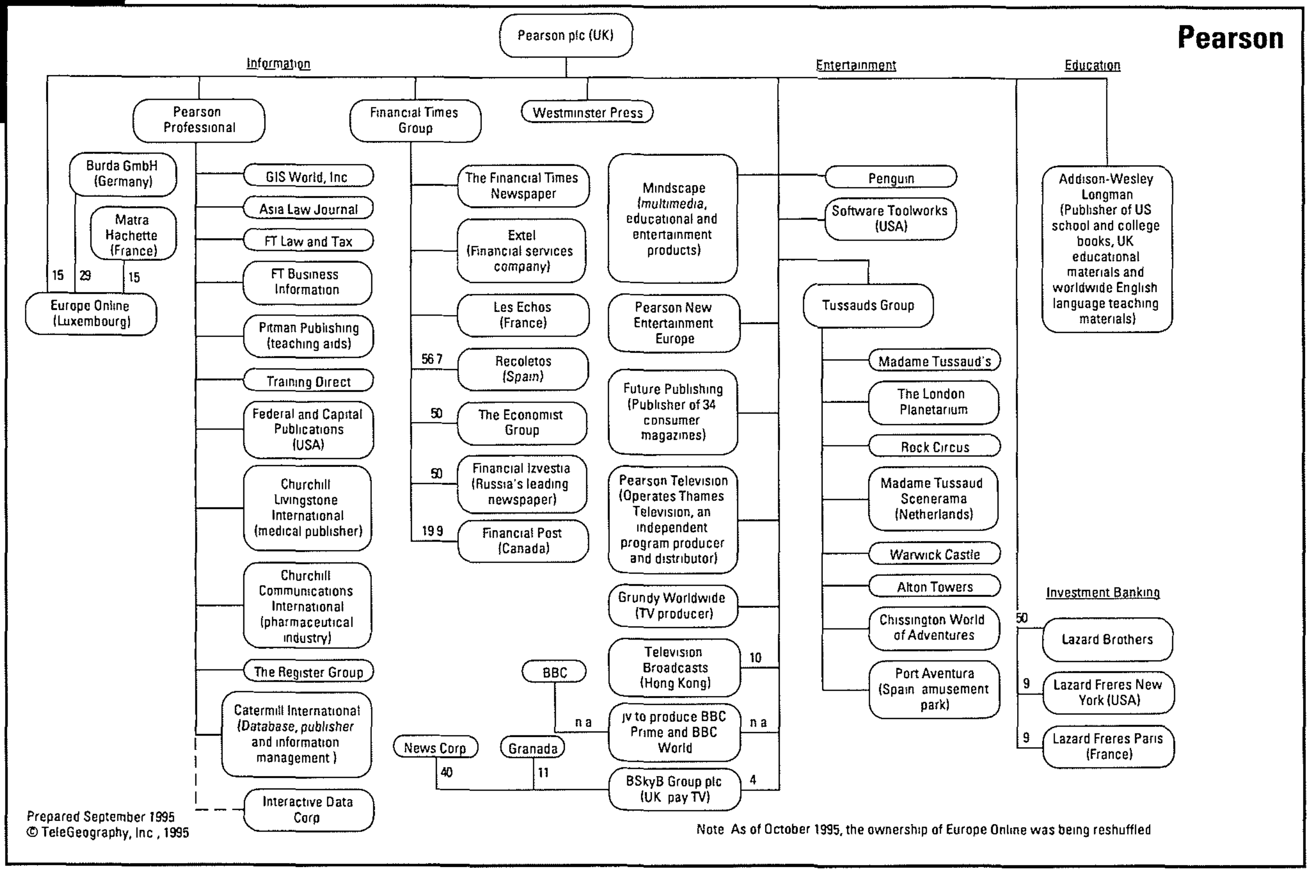
Bertelsmann



Lagardère/Matra Hachette



Note As of October 1995, the ownership of Europe Online was being reshuffled



Pearson
Pearson plc (UK)
Information
Entertainment
Education
Pearson Professional
Financial Times Group
Westminster Press
Burda GmbH (Germany)
Matra Hachette (France)
15
29
15
Europe Online (Luxembourg)
GIS World, Inc
Asia Law Journal
FT Law and Tax
FT Business Information
Pitman Publishing (teaching aids)
Training Direct
Federal and Capital Publications (USA)
Churchill Livingstone International (medical publisher)
Churchill Communications International (pharmaceutical industry)
The Register Group
Catermill International (Database, publisher and information management)
Interactive Data Corp
The Financial Times Newspaper
Extel (Financial services company)
Les Echos (France)
56 7
Recoletos (Spain)
50
The Economist Group
50
Financial Izvestia (Russia's leading newspaper)
19 9
Financial Post (Canada)
Mindscape (multimedia, educational and entertainment products)
Pearson New Entertainment Europe
Future Publishing (Publisher of 34 consumer magazines)
Pearson Television (Operates Thames Television, an independent program producer and distributor)
Grundy Worldwide (TV producer)
Television Broadcasts (Hong Kong)
10
BBC
n a
JV to produce BBC Prime and BBC World
n a
News Corp
Granada
40
11
BSkyB Group plc (UK pay TV)
4
Penguin
Software Toolworks (USA)
Tussauds Group
Madame Tussaud's
The London Planetarium
Rock Circus
Madame Tussaud Scenerama (Netherlands)
Warwick Castle
Alton Towers
Chissington World of Adventures
Port Aventura (Spain amusement park)
Addison-Wesley Longman (Publisher of US school and college books, UK educational materials and worldwide English language teaching materials)
Investment Banking
50
Lazard Brothers
9
Lazard Freres New York (USA)
9
Lazard Freres Paris (France)
Prepared September 1995
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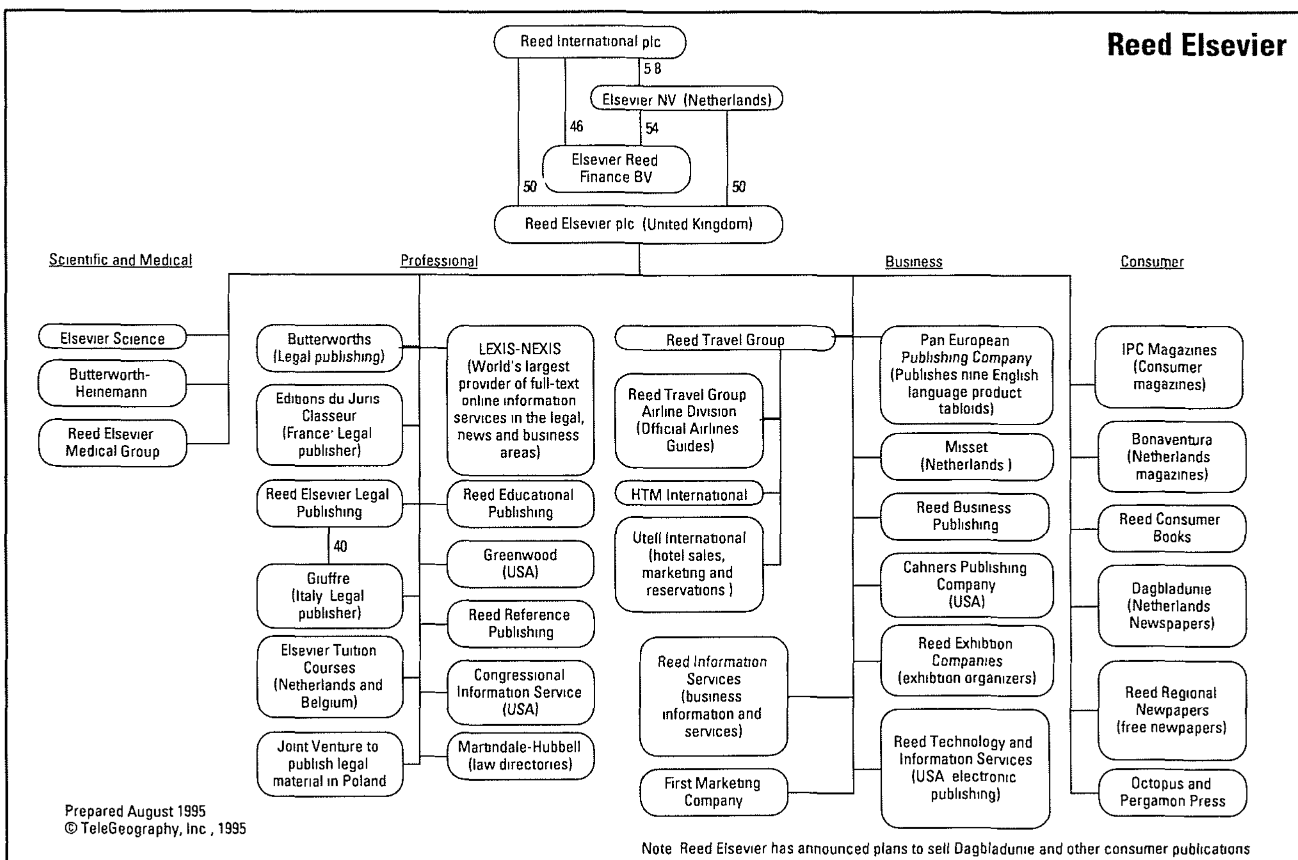
Note As of October 1995, the ownership of Europe Online was being reshuffled



Reed Elsevier
Reed International plc
58
Elsevier NV (Netherlands)
46
54
Elsevier Reed Finance BV
50
50
Reed Elsevier plc (United Kingdom)
Scientific and Medical
Professional
Business
Consumer
Elsevier Science
Butterworth-Heinemann
Reed Elsevier Medical Group
Butterworths (Legal publishing)
Editions du Juris Classeur (France Legal publisher)
Reed Elsevier Legal Publishing
40
Giuffre (Italy Legal publisher)
Elsevier Tuition Courses (Netherlands and Belgium)
Joint Venture to publish legal material in Poland
LEXIS-NEXIS (World's largest provider of full-text online information services in the legal, news and business areas)
Reed Educational Publishing
Greenwood (USA)
Reed Reference Publishing
Congressional Information Service (USA)
Martindale-Hubbell (law directories)
Reed Travel Group
Reed Travel Group Airline Division (Official Airlines Guides)
HTM International
Utell International (hotel sales, marketing and reservations)
Reed Information Services (business information and services)
First Marketing Company
Pan European Publishing Company (Publishes nine English language product tabloids)
Misset (Netherlands)
Reed Business Publishing
Cahners Publishing Company (USA)
Reed Exhibition Companies (exhibition organizers)
Reed Technology and Information Services (USA electronic publishing)
IPC Magazines (Consumer magazines)
Bonaventura (Netherlands magazines)
Reed Consumer Books
Dagbladunie (Netherlands Newspapers)
Reed Regional Newpapers (free newpapers)
Octopus and Pergamon Press
Prepared August 1995
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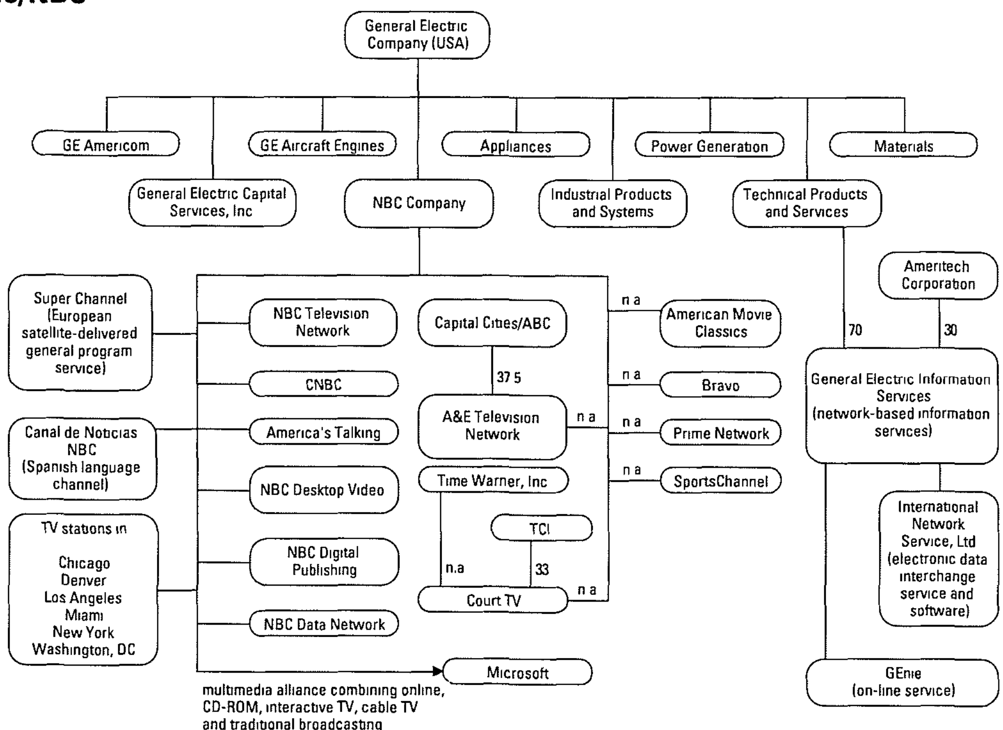
Note Reed Elsevier has announced plans to sell Dagbladunie and other consumer publications

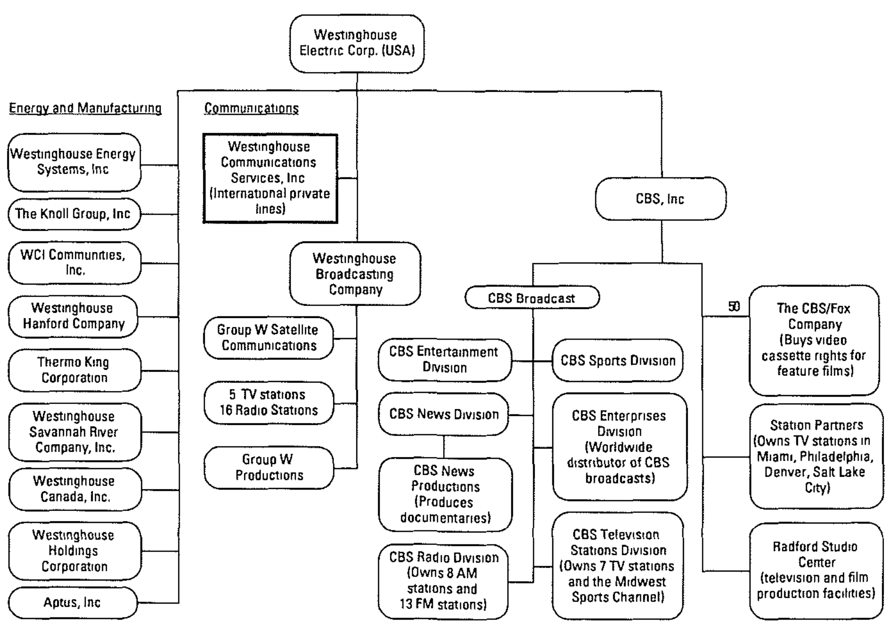
General Electric/NBC



Prepared December 1995 © TeleGeography, Inc , 1995

Note In December 1995, Microsoft announced that it would invest $220 million over 5 years to help NBC launch a new 24 hour cable news channel (MSNBC) and related on-line service

Westinghouse/CBS



Prepared August 1995
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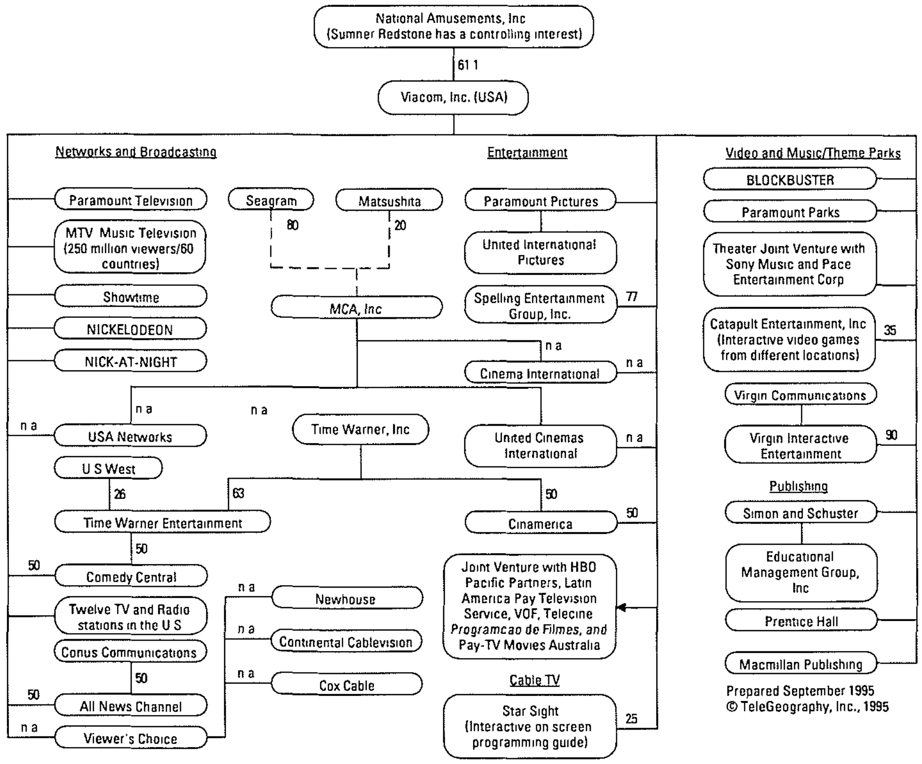
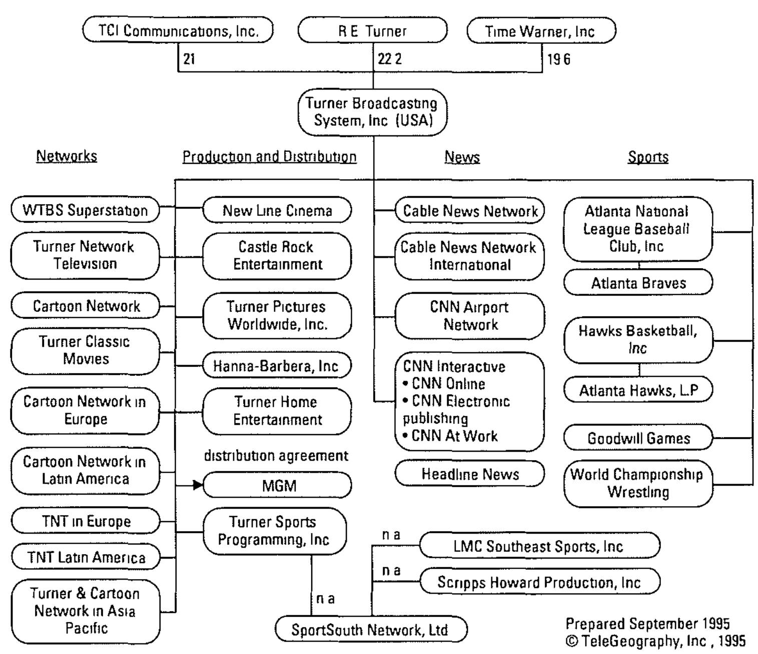
Viacom



Note In November 1993, NYNEX Corporation purchased 24 million shares of cumulative convertible preferred Viacom stock for $1 2 billion, but does not have voting privileges The two companies are expected to announce joint ventures by the end of 1995

TBS



Note. In September 1995, Time Warner proposed to buy all of TBS Mr. Turner would then become vice chairman of Time Warner

UNITED STATES ANTITRUST AND ACCESS TO THE INFORMATION HIGHWAY

by Marc G. Schildkraut

The United States antitrust laws guard against restraints on the competitive process in the hopes of delivering to the American consumer the highest quality products at the lowest prices. Under Federal legislation, dating from the 19th century, the U.S. courts have identified a host of such restraints that may undermine competition. Some of these restraints can limit access to the information superhighway, and ultimately affect the price and quality of technology.

This tour of antitrust and the information superhighway begins with a review of the basic antitrust laws. As we shall see, the courts have developed several methods of safeguarding the price and quality of products and services. Under the right circumstances, these safeguards can be applied to ensure equal access to the information highway. We will then visit one of the key thoroughfares on the information superhighway, a computer's operating system. Denial of appropriate access to operating systems may severely handicap certain competitors. Antitrust laws also might be used to provide such competitors with the access they need to compete.

I. Restraints of Trade

A. Contracts, Combinations and Conspiracies

To guard against anticompetitive restraints, the courts and antitrust enforcement agencies must first identify which restraints are anticompetitive. The courts first grappled with this identification process in turn-of-the-century Sherman Act cases. (This act, adopted in 1890, was America's first major antitrust law.) Section 1 of the Act rejects all contracts, combinations and conspiracies that restrain trade.

Because many arrangements between companies restrain trade to some extent, the courts have interpreted the statute as only prohibiting those arrangements that "unreasonably" restrain trade. But what is an "unreasonable" restraint? The courts have answered the question by developing what is now known as the "rule of reason." One of the first and best formulations of the rule of reason was offered by Judge (later Supreme Court Justice) Taft in 1898. According to Taft, a restraint was lawful if it was merely ancillary to the main purpose of a legitimate contract.[1] A restraint was unlawful, however, if it was broader than necessary to serve the main purpose of that contract. Moreover, if the contract's only purpose was to restrain competition, there would be nothing to justify it and the courts could condemn it without any in-depth analysis. In more modern terminology, the courts would bar an arrangement if its anticompetitive effects outweighed its procompetitive effects.

Forcing the courts into evaluating this balance for every restraint of trade would consume a great deal of court resources. So the courts developed two kinds of screens. First, for some sorts of restraints, the courts have developed threshold criteria below which no anticompetitive restraint is plausible. The courts will permit such restraints without in-depth analysis. Exclusive dealing arrangements offer a good example. An exclusive dealing arrangement is an agreement under which a buyer agrees to purchase products or services from only one supplier. Such arrangements can have both procompetitive and anticompetitive effects. The arrangement can be anticompetitive because it prevents suppliers from competing for buyers. The arrangement can be procompetitive because it helps the supplier and buyer coordinate their promotions of a particular product.

Courts will weigh these procompetitive and anticompetitive effects if necessary, but it is not always necessary. The courts have found they can avoid balancing if the seller accused of exclusive dealing has a small market share or if the arrangement itself covers only a small part of the market. The courts reason that under the circumstances, the parties could not have entered into the exclusive deal for anticompetitive reasons. And even if they did, the arrangement could not have an anticompetitive effect.

Second, based on experience, the courts have found some restraints (called *per se* restraints) to be so pernicious that they may be condemned without analysis. Horizontal *per se* restraints—involving agreements among competitors—include price fixing, market division agreements, and group boycotts. A vertical *per se* restraint involving agreements between a supplier and buyer would, for example, prevent a seller from dictating the buyer's resale price (i.e., "resale price maintenance").

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B. Monopolization

While most antitrust cases involve coordinated action by several firms, single-firm monopolizing conduct can also violate the antitrust laws. Section 2 of the Sherman Act governs such conduct. As interpreted by the courts, not all monopolies or acts in furtherance of a monopoly are illegal. Just as in the case of joint conduct, the courts do not want to discourage efficiency-enhancing behavior. Thus, for instance, it is perfectly legal for a firm to achieve a monopoly by offering better products or lower prices. If, however, a dominant firm's conduct is "predatory" or "exclusionary," the conduct may be illegal. To determine whether the conduct is exclusionary and hence anticompetitive, the courts have developed variants of the rule-of-reason test. Under one formulation, it is unlawful for a dominant firm to act in a way that tends to impair the opportunities of rivals and either does not further competition on the merits or does so in an unnecessarily restrictive way.[2]

C. Acquisitions

Another key U.S. competition law is the Clayton Act. It governs the antitrust analysis of acquisitions. In the case of acquisitions, the courts have a very low threshold of tolerance. This stems from the words of Section 7 of the Clayton Act, which condemns acquisitions that may substantially lessen competition, rather than acquisitions that actually restrain trade. According to Clayton Act jurisprudence, an acquisition is unlawful if it would result in a dominant firm that might unilaterally raise prices or in an unduly concentrated market where several firms might raise prices jointly.

Courts do not just look at market shares in assessing an acquisition. They look at a host of other factors. One of the most important is ease of entry. If entry is easy, market concentration is irrelevant. If firms in such a market tried to raise price above competitive levels, other firms would enter the market, forcing prices back down.

Interestingly, even though courts weigh procompetitive and anticompetitive effects of restraints of trade and monopolizing conduct, they will not typically attempt to strike a similar balance in the case of an acquisition. Although this may be changing, courts have typically not recognized increases in efficiencies arising from an acquisition as a factor in assessing the competitive effects of acquisitions.

II. The Antitrust Laws and the Information Superhighway

A. Forerunners of the Information Superhighway

To understand the issues which information networks raise for antitrust enforcers, it is good idea to step back and think about earlier precedents. These forerunners offer some opportunities to reason by analogy to the present.

Consider first the English language. English-speaking people use this language to communicate. We thus could view the English language as a network and English speakers and writers as participants in that network, using the network to convey ideas. There is, however, an important by-product of this English communication: improvements in the network. Speakers and writers invent new words and phrases that more efficiently convey ideas; people reading and hearing the words retain more of these words, which they in turn can use to convey their ideas more efficiently; they develop new media to transmit the ideas, including writing and electronic media, which again reinforces the importance of the English language as a communication network. These improvements, some an unintended result of the simple act of communicating, are known as "network externalities."

A hypothetical hints at the importance of antitrust in regulating networks.[3] Suppose a single firm had a copyright to the modern English language. The firm decides to expand into the book publishing business. To give itself an advantage, it denies the use of modern English to other publishers. Will these publishers switch to Middle English? Will they switch to Esperanto? Or will they just go out of business? The English network is so vast that it would be extremely difficult for publishers to use anything but English to address an English-speaking audience. Thus, our English-language monopolist could take advantage of the externali-

Box 1 Enforcement of the U.S. Antitrust Laws

In many countries, a single antitrust agency enforces the antitrust laws, not so in the United States, where there are two federal agencies, multiple state agencies, and private plaintiffs, as well The two federal agencies are the Antitrust Division of the Department of Justice and the Federal Trade Commission. The Antitrust Division enforces antitrust laws by bringing suit in federal court The Division can bring both civil and criminal actions. The FTC, on the other hand, has only civil authority It also has its own administrative court to enforce the antitrust laws. In addition to these federal agencies, state attorneys general can enforce the federal antitrust laws by suing in federal court Most states also have their own antitrust laws, which attorney generals can attempt to enforce in state courts. In addition, private parties injured by a restraint can file a court action in federal and many state courts If the plaintiff prevails, in many instances, they may obtain awards that are three times the actual damages suffered.

ties that have built up in the English-language network to dominate another field, book publishing.

Not all networks are as efficient as the English language. Sometimes networks survive despite seemingly superior options. For example, the keyboard on which I am typing this article has a row of keys on the left side below the number keys that spell out "QWERTY." The story, perhaps apocryphal, is that early typewriter manufacturers arranged the keys as inefficiently as possible to slow down typists who were typing too fast and jamming prototype typewriters. Today, many typists could type twice as fast if the keys were more efficiently arranged, and modern keyboards do not jam. Yet typists continue to use the QWERTY arrangement.

The main reason is that there are now tens of millions of QWERTY keyboards and the vast majority of typists are trained to use them. Because most typists do not bring their own keyboards to work, the benefit of retraining typists for more efficient arrangements is simply not worth the cost. In other words, more efficient keyboards cannot overcome the barrier to entry created by the network externalities of the installed base.[4]

IS THERE A DIFFERENCE BETWEEN THE ONLY BRIDGE IN TOWN AND THE ONLY INFORMATION SUPERHIGHWAY ACROSS AMERICA?

B. Antitrust Meets the Superhighway

One of the earliest highways across America was the railroad system. In some places, including St. Louis, Missouri, access to the railroad system required using bridges to cross rivers. In the early part of this century, an association of railroads controlled the only railroad terminal in St. Louis and the only nearby bridges across the Mississippi river. The association denied competing railroads access to its terminal and bridges. Under that arrangement, non-association railroads could not compete unless they built their own bridges and terminals. If it was difficult to build such facilities—that is, if it was difficult to enter—the association might be able to insulate itself from competition for an extended period.

In 1912, the case of the unfriendly railroad association reached the Supreme Court in *United States v. Terminal Railroad Ass'n.*[5] After examining the likely effects of the denial of access to the bridges and terminals, the Court held there were circumstances under which a firm or firms could not deny access to facilities. According to the court, such denial would violate the antitrust laws if access was essential to competition. Because the non-association railroads could not compete without access, the Court ordered the Association to grant access to competing railroads. Thus, the "essential facility doctrine" was born.

The telephone system is a more modern analogy to an information superhighway. And, as one might expect, denial of access to parts of the telephone system offered a substantial competitive advantage to those that have such access. This issue arose in the 1980s case of *MCI Communications v. AT&T.*[6] MCI was then a small long-distance carrier that needed access to the local telephone networks to complete its customers' long-distance calls. AT&T was the dominant long-distance carrier and was the sole local carrier in much of the country.

After determining that AT&T had monopoly power over local telephone service in many areas, the court concluded that AT&T could not refuse to connect MCI to its local network. Such a refusal was unlawful, according to the court, "because a monopolist's control over an essential facility can extend monopoly power . . . from one market [local service] to another [long distance service]." The court set out four elements that established liability under the "essential facility" doctrine: 1) a competitor's inability to duplicate the facility; 2) a monopolist's control over an essential facility; 3) the denial of the use of the facility; 4) the feasibility of providing access to the facility. The facts before the Court met this standard because MCI could not duplicate AT&T's local telephone network; AT&T had a monopoly share of the local telephone market; AT&T was denying MCI access to the local telephone exchanges; and AT&T could easily provide access to the exchanges.

Notice how this four-part test is consistent with the general monopolization standard: AT&T's conduct impaired the opportunities of rivals that could only compete if they had access to AT&T's essential facility. Such denial of access was unnecessarily restrictive because providing access was feasible. As the recent merger enforcement actions discussed in Box 2 demonstrate, the antitrust authorities remain concerned about unequal access to local telephone lines.

C. Access to Computer Operating Systems

Is there a difference between the only bridge in town and the only information superhighway across America? What if a single firm controlled all the toll booths onto the superhighway? Let's consider a computer operating system (OS) as an example. An OS offers a practical way for applications and peripheral equipment to communicate with the central microprocessor of the computer. Without the ability to communicate with the OS, an application cannot run.

Suppose that an OS monopolist also produced applications and suppose the monopolist could find a way to deny access to the OS to its application competitors. Under such cir-

Box 2. Applying Antitrust to International Telecom Deals

While antitrust authorities have paid a good deal of attention to access to the information superhighway, they have not forgotten that telephone lines are the primary means of accessing the highway In two recent matters, the Antitrust Division has acted to safeguard access to the telephone lines of foreign countries.

In one case, British Telecom proposed to purchase a significant share of MCI and to form a joint venture, known as Concert, to provide telecommunications services world wide. In another case, Sprint, France Télécom and Deutsche Telekom proposed a joint venture (Phoenix) to provide global telecommunications services In both cases, the Division worried that the joint ventures would obtain unfair access to the local networks of the foreign partners. To proceed with the venture, the parties agreed to terms that would prevent the ventures from discriminating against other international carriers For example, under the orders agreed to by the parties, the joint ventures cannot provide certain services until competitors have the opportunity to provide similar services in the home market of the foreign partners The parties also must publish the rates and conditions under which they gain access to the networks of the foreign partners. The ventures are also prohibited from gaining access to networks of the foreign partners that is superior to the access of other international carriers.

Approval of the agreements by the U.S. District Court in Washington, DC, will mean that, as with the 1984 AT&T Consent Decree, the courts, rather than the FCC, may take the lead in setting the terms under which several major international carriers may serve the US-Europe market until at least 2001. Each decree gives the U.S District Court continuing oversight jurisdiction for at least five years

Details of the BT/MCI agreement can be found in Vol. 59, Federal Register, *June 27, 1994, pp. 33009-33024. The Sprint/FT/DT agreement is still being reviewed by the courts. For details of the agreement, see Vol. 60,* Federal Register, *August 24, 1995, pp. 44049-44078*

cumstances, the OS monopolist has much in common with our English-language monopolist. By denying publishers access to modern English, the monopolist could extend its English monopoly to book publishing. Similarly, by denying application developers access to the lingua franca of computers, the OS monopolist might be able to extend its monopoly to the application market.

Now consider the QWERTY keyboard analogy. The OS monopolist need not have even produced the best OS. Over time, the OS's dominance increases because of network externalities. Application developers produce software that works on the OS. Users buy those applications and computers that run those applications. A different OS would require different applications and perhaps even different hardware. Users are not likely to dump their software and hardware investment over the side just because another OS offers marginal advantages.

There are several ways that an OS monopolist could deny application developers access. First, software developers communicate with the OS through the Application Programmer Interface (API)—a set of proprietary coding rules—published by the OS developer. The OS developer could delay publishing new API specifications to give itself a head start. It might even exclude some of the APIs from the published version to give itself a perpetual advantage. These non-published APIs are known as "secret calls."

An important part of the process of developing a new version of an OS is the beta (pre-release) testing process. Application developers are eager to be part of the process so that they can get a head start developing new versions of their applications that work with the new version of the OS. An OS developer could give its applications an advantage by barring certain application competitors from the beta testing process.

Finally, a truly hell-bent OS developer could deliberately create incompatibilities between the new version of the OS and the applications of its competitors. It could add code to the OS, for instance, that identified competitors' applications and then refused to run them.

As described in Box 3, competitors have accused Microsoft of using some of these tactics to deny them equal access to Microsoft's operating systems.

Thus, we can see how a court might apply the essential facility doctrine to an OS. First, application developers could not duplicate a competitively viable OS because users are tightly tied to the existing standard by their investment in software, hardware, and training (even if like the QWERTY keyboard, the OS is not the most efficient system available). Second, our hypothetical assumes that a monopolist controls the essential facility, the OS. Third, the monopolist has denied the "use" of the facility by prohibiting access to the beta program or by failing to publish or delaying publication of new APIs. The monopolist also may have denied access

Box 3. Microsoft's Antitrust Battles

Round 1. *In early 1990, the Federal Trade Commission (FTC) began investigating the competitive practices of Microsoft Corporation. Once the investigation became public, many of Microsoft's competitors began complaining about a variety of Microsoft's practices.*

Microsoft developed the operating system, Microsoft Disk Operating System or MS-DOS, now used on over 70% of the world's 180 million personal computers. In the late 1980s, another developer, Digital Research, developed a competing operating system, DR-DOS, that was compatible with applications written for MS-DOS. DR-DOS also contained many features not found in the version of MS-DOS then available Nevertheless, DR-DOS had considerable trouble selling its OS. Most operating systems came bundled with new personal computers. Thus, the main direct purchaser of the OS were the computer manufacturers, also known as original equipment manufacturers (OEMs), which licensed the operating system from the OS developer. Under a typical license, an OEM would pay the OS developer each time the OEM installed the OS on a PC

DR-DOS had difficulty licensing its OS to many OEMs because of Microsoft's licensing program. One of Microsoft's OEM licensing programs was known as the "per processor" license Microsoft required "per processor" licensees to pay a royalty each time the OEM sold a PC, even if the PC had a different operating system installed. Thus, if a per processor licensee wanted to install DR-DOS on a PC, it would still have to pay Microsoft for its OS. This was a substantial disincentive for the OEM to install DR-DOS

The per processor license had an impact similar to an exclusive dealing arrangement. As a result of either the exclusive dealing or per processor arrangement, OS competitors of Microsoft could not compete for OEM accounts. In an exclusive dealing arrangement, the contract directly foreclosed such competition. In the case of the per processor arrangement, the OEM had to pay twice to install a Microsoft competitor's OS, creating the same foreclosing effect as an exclusive dealing contract.

Application developers that competed with Microsoft had a different complaint. They said that Microsoft provided information about the development of the OS to Microsoft's own application division before they would provide the same information to competing application developers. They argued that to compete on a level playing field, they needed equal access to the development of the operating system. This became more important after the introduction of Microsoft's graphical interface for applications programs, known as Windows. To be competitive, application developers had to get new Windows applications to market as quickly as Microsoft got its applications to the market. In essence, the competing developers were arguing that Microsoft's OS was an essential facility and they were entitled to equal access to important OS information.

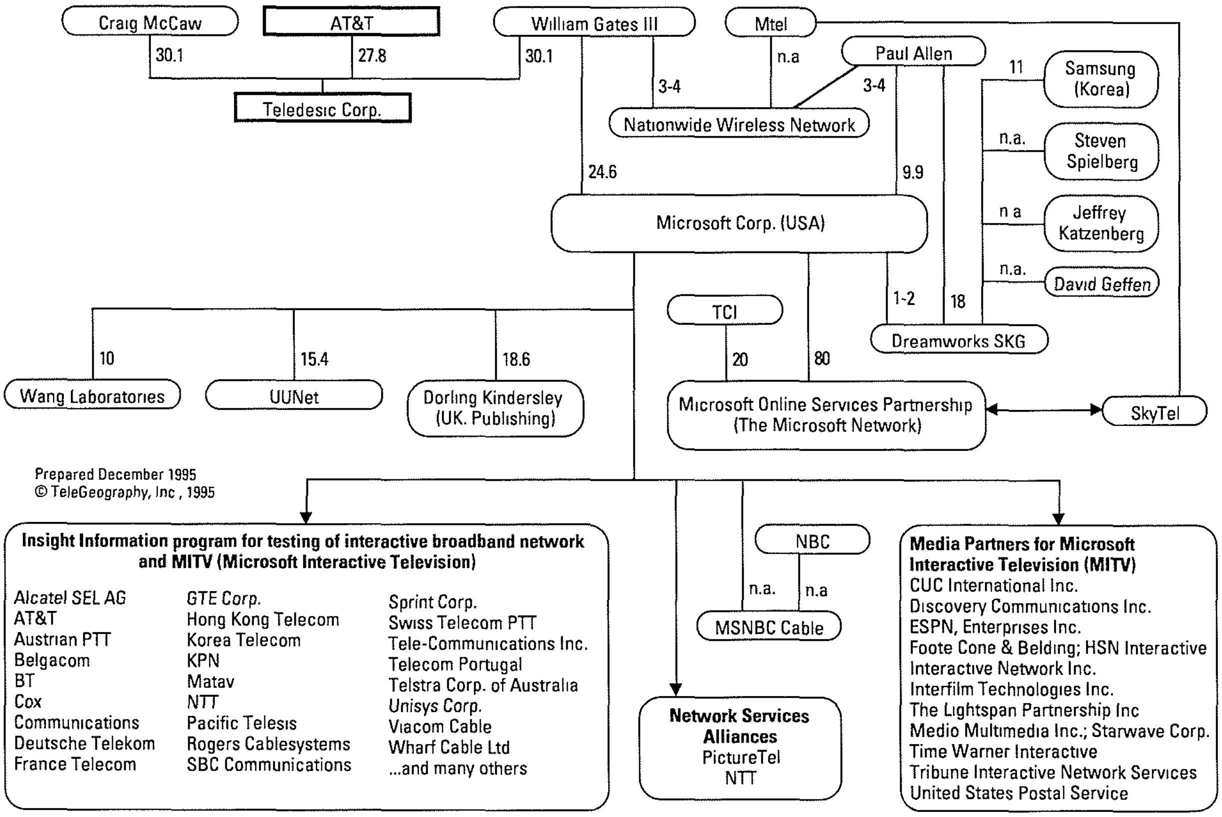
The FTC was never able to resolve the per processor claim and never reached the essential facility claim The FTC is composed of five commissioners that vote on enforcement actions. One of the five commissioners was unable to vote because of a financial conflict. The other four commissioners continually split 2-2 on the per processor claim.

Round 2. *Unable to resolve the matter in any way, the FTC transferred the matter to the Antitrust Division of the Department of Justice (DOJ). After additional investigation, the DOJ and Microsoft entered into a legal settlement, known as a consent decree, under which Microsoft agreed to abandon the per processor arrangement However, the matter was not settled without some fireworks. Several anonymous competitors attempted to derail the settlement, which required review by U.S. District Court, because it did not address their competitive concerns. They complained again that Microsoft's OS division was giving unfair access to Microsoft's application developers. They also complained that Microsoft was unfairly pre-announcing its own products ("vaporware") to stifle the sale of competing products.*

The District Court judge agreed with the complainers and refused to accept the settlement between the DOJ and Microsoft. However, an appellate court concluded that the District Court had overstepped its authority and accepted the order that banned the per processor arrangement.

Round 3. *In 1995, Microsoft proposed to buy Intuit. Intuit produced Quicken, the leading checkbook-management program. Microsoft produced Microsoft Money, the number two checkbook-management program. The two firms together controlled the vast majority of the checkbook-management software market.*

Microsoft recognized that the DOJ was very likely to challenge the acquisition as a violation of Section 7 of the Clayton Act. To avoid this challenge, Microsoft agreed to sell Microsoft Money to Novell, Inc., another major software company (it owns WordPerfect) if it were able to buy Intuit Microsoft reckoned that with the sale of Money, there would be no increase in con-



centration in the checkbook-management software market. Microsoft did not reckon with the reaction of the DOJ. In a virtually unprecedented move, the Department challenged the acquisition in court despite Microsoft's promise to divest itself of the overlap that caused the Clayton Act problem The Department argued that the proposed divestiture was not adequate because Microsoft continued to have a royalty interest in the sale of Money and that Microsoft was not making a complete divestiture of everything that it ought to divest to make Money a success in someone else's hands. Underlying the Department's challenge, however, was probably a feeling that no one other than Microsoft could compete successfully with Quicken. Rather than fight a court battle with the Department, Microsoft abandoned the acquisition.

Round 4. *Microsoft introduced Windows 95, its new graphical OS for the PC, in August 1995. Microsoft included in Windows 95, a quick and easy way for users to sign up with Microsoft's new on-line service, the Microsoft Network (MSN). Prior to the introduction, America Online, Prodigy, CompuServe and other on-line competitors complained that this would give Microsoft an unfair advantage with the tens of millions of users that will buy Windows 95. The competitors' argument seemed to be based on the concept that Windows 95 is an essential facility and they are entitled to equal access to that facility (e.g., each on-line competitor is entitled to equal point-and-click access with their own icon in Windows 95)*

Of course, they would have to convince the Department that a sign-up procedure in Windows 95 really is essential to such competition. Microsoft would argue that there are many other ways to attract on-line users, including magazine advertising, direct mail and bundling agreements with particular OEMs (which are not precluded by Windows 95).

To collect more information about these issues, the DOJ issued a subpoena for documents to Microsoft. It later withdrew its subpoena and stated that it had no immediate plans to stop Microsoft from introducing Windows 95 but was continuing to investigate

Round 5. *Concurrent with its investigation of Microsoft's MSN sign-up procedure within Windows 95, the Department is also reviewing complaints from OEMs that a Windows 95 license requires the OEMs to waive their right to enforce certain of their copyrights and patents. This investigation appears to be proceeding at a slower pace than the MSN investigation.*

—M.G.S.

by creating deliberate incompatibilities. Fourth, the OS monopolist is clearly capable of offering the access it has denied.

Most essential facilities have been more tangible than operating systems. They are bridges, telephone lines, electric lines, etc. An OS, by comparison, is a piece of intellectual property (like the English language). This is, nevertheless, probably not a bar to the use of the essential facility standard. For instance, in a 1945 case involving the Associated Press, the Supreme Court held that the AP could not exclude competitors of members from access to the copyrighted stories transmitted on the association's newswire service.[7] More recently in 1991, a lower court held that Bellsouth had transgressed the essential facility doctrine by refusing to supply Donnelley with proprietary listings it needed to compete in the directory business.[8] According to the court, there was no reason that the essential facility doctrine could not apply "to information wrongfully withheld."

Courts have also found that the deliberate creation of a technological incompatibility can satisfy the exclusionary element of a monopolization claim. According to one lower court, it would be illegal for a dominant firm to "design for an illegal purpose (such as effectuating a tie)... [with an] intent [that] was solely an illegal one."[9] However, because the courts are wary about deterring important technological innovations, they will not condemn a technological incompatibility unless it is clear that the incompatibility was not a by-product of some "technologically beneficial results."[10]

Several cases have held that unless the monopolist intentionally creates an incompatibility between its new product and the products of competitors, it is under no duty to predisclose technical information about its product. The courts worry that undue scrutiny of a monopolist's new product introductions would stifle innovation. Thus, for example, when Kodak introduced a new camera, a lower court held that Kodak was under no obligation to predisclose the specifications to that camera so that competing camera producers could develop cameras that worked with the film designed for the new Kodak camera.[11] Because the Supreme Court has never ruled on this predisclosure issue, it is not clear whether an OS developer has the obligation to provide new APIs or access to beta tests to application developers.

D. Other Legal Avenues to Access

An antitrust suit is not the only means to ensure access to the information highway. Court rulings limiting patents, copyrights and trade secrets also can have a profound effect on competition. A leading case in this area is *Sega Enterprises Ltd. v. Accolade Inc.12* Sega produced a video game console, but did not publish the API that game developers needed to produce games for the console. To produce such games, Accolade "reverse assembled" the Sega console OS. Sega sued, arguing that reverse assembly required the copying of Sega's OS code. The court concluded, however, that such copying was "fair use" under the copyright act.

IV. The Future

In the future, the courts are likely to face many questions on the antitrust rules of the road. Most will not involve simple access to the information superhighway, but the speed limits that new competitors face. If incumbent firms controlling key technology can can drive as fast as they wish while setting low speed limits for the competition, we may see the antitrust equivalent of a multi-car pile up. One can only hope that the courts react accordingly, fostering access for everyone without unduly reducing the speed limits for those with the most revved-up technology engines. ◆

Notes

1. *United States v. Addyston Pipe & Steel Co.,* 85 F 271, *affirmed,* 175 U.S. 211 (1899).
2. *Aspen Skiing Co. v. Aspen Highlands Skiing Corp.,* 472 U.S. 585, 605 n.68 (1985).
3. This is an adaptation of a hypothetical offered by Scott McNealy, the Chief Executive Officer of Sun Microsystems, Inc In Mr. McNealy's hypothetical, Bill Gates, the CEO of Microsoft, was the owner of the English language.
4. This example was presented by the law firm of Wilson, Sonsini, Goodrich & Rosati in its Amici Curie memorandum in opposition to the proposed final judgment in *United States v. Microsoft Corporation,* Civ. Action No. 94-1564 (D.C., D.C. 1994). That proposed judgment can be found at vol. 59, *Federal Register,* p.42, 845 (1994). The judgment was rejected by the District Court (see *U.S v. Microsoft Corp.,* 159 F.R.D. 318 D.D.C. 1995). But on appeal the District Court was reversed and the case was reassigned to a new judge. See *U.S v Microsoft Corp.,* 56 F. 3rd 1448. (D.C. Cir. 1995).
5 224 U S. 383 (1912).
6. See 708 F.2d 1081 (1983).
7. 326 U.S. 1 (1945).
8. *Bellsouth Advertising & Publishing Corp v Donnelley Information Publishing,* 719 F. Supp. 1551 (S.D Fla 1988), aff'd, 933 F.2d 952 (11th Cir 1991).
9 *Transamerica Computer Products v. IBM,* 481 F. Supp 965, 1003 (N.D. Cal.), *aff'd,* 698 F.2d 1377 (9th Cir. 1979)
10. *Response of Carolina, Inc. v. Leasco Response, Inc.,* 537 F.2d 1307, 1330 (5th Cir. 1976).
11. *Berkey Photo, Inc. v Eastman Kodak Co*, 603 F2d 263 (2d Cir. 1979), *cert. denied,* 444 U.S 1093 (1980)
12. 977 F.2d 1510 (9th Cir 1992).

APPLYING EU COMPETITION RULES TO TELECOMS AND MULTIMEDIA ALLIANCES

by Bernard E. Amory and Katrina C. Cochran

The now famous 1987 Green Paper outlined the basic policy of the European Union (EU)—then the European Communities—on telecommunications.[1] Though the popularity of the word "multimedia" was still far in the future, the telecommunications industry (highly regulated and characterized by state-ownership) was already converging with the computer industry (typified by private ownership and fierce competition). Such convergence raised the issue of applying EU competition rules, beginning with the Green Paper, to both sectors.

The Green Paper aimed to liberalize and harmonize the telecommunications sector across the member states. Most of its proposals have now been implemented: the market for terminal equipment was liberalized in 1988;[2] all telecommunications services except public voice telephony were liberalized by a 1990 Directive;[3] and, also in 1990, measures were adopted to foster open and non-discriminatory access to the network infrastructures, which could have otherwise remained under monopoly control.[4]

But regulatory reform seems to be a never-ending process. The Commission has now adopted the 1991 action plan on Europe's path to the Global Information Society.[5] This plan addresses the new opportunities offered by multimedia and attempts to solve some of the regulatory problems resulting from the expected convergence of telecommunications, information technologies, and publishing and broadcasting sectors. Further, the EU has also decided that the telecommunications market will be fully liberalized in 1998,[6] with the elimination of the remaining monopolies on infrastructures and public voice telephony. Also by 1998, legislation on audio-visual services will be adopted to promote the creation of pan-European multimedia services.

Competition Rules and Telecommunications

The Green Paper proposed continued and strict application of EC competition rules to telecommunications. In reality, prior to 1987, there had been very few cases applying Articles 85 and 86 of the EC Treaty to telecommunications. (Article 85 prohibits agreements restrictive of competition, and Article 86 prohibits abuses of dominant position.) The landmark decision of the European Court of Justice in *Italian Republic v. Commission*,[7] confirming that state-owned telecommunications operators were subject to the application of the competition rules, was a notable exception. Subsequently, the Commission issued Guidelines[8] explaining how the competition rules would be applied to this sector.

Following the adoption of the Green Paper, the Commission's interventions mostly concerned loose cooperation agreements between telecoms operators. These were generally cleared subject to conditions intended to ensure that operators with monopolies on network infrastructures did not discriminate in favor of their joint venture against third party service suppliers that were dependent on them for access to the networks. Infonet provides a good example of such a clearance.[9] The Commission also used its powers to put an end to old anti-competitive practices, such as price fixing in relation to leased circuits and refusals to provide access to infrastructure.[10]

Strategic Alliances

It was only in 1993, when the EC's regulatory framework and its future development became clearer, that operators began forming major structural alliances. The first alliance to come before the Commission involved BT and MCI;[11] BT purchased 20% of MCI, and BT and MCI formed Concert, a joint venture owned 75.1% by BT and 24.9% by MCI, to provide international value-added services. In its decision, the Commission indicated that the formation of Concert would improve the provision of services in the EU by combining BT and MCI technologies and through the construction of a genuinely seamless international network with its own switching, call processing, signalling, databases and software.

Another important factor in the Commission's decision to clear the BT/MCI alliance was that the U.K. and U.S. telecommunications markets are both highly competitive, and BT and MCI are subject to regulations in their home markets to prevent cross-subsidization or discrimination.

The Commission could not take a similar position when it was asked to review Atlas, a later joint venture between France Télécom (FT) and Deutsche Telekom (DT), as the French and German markets are still characterized by monopolies on network infrastructure and the provision of voice tele-

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phony. Although the matter is still being investigated, as is the cooperation between Sprint, FT and DT, the Commission stated, on a preliminary basis, that Atlas raised problems of compatibility with the competition rules.[12] In October 1995, however, after FT and DT agreed to exclude their data transmission subsidiaries from Atlas until 1998 and to make certain other concessions to foster competition, the Commission indicated that it would approve the Atlas venture.[13]

The third major strategic alliance involving European operators is Unisource, owned by Dutch, Swiss, Spanish and Swedish national carriers. Commission competition authorities have not yet been formally notified of the Unisource alliance, but they have nevertheless started an investigation.

Multimedia Alliances

European telecom operators and media companies are also forming strategic alliances. Because of the nature of the proposed arrangements, such ventures have, so far, fallen under the Merger Control Regulation.[14] The Commission is concerned about possible market dominance.

In November 1994, the Commission refused to clear a pay television joint venture (called MSG) between Deutsche Telekom and two media companies, Bertelsmann and Kirch.[15] Deutsche Telekom is the leading cable TV operator in Germany, and Bertelsmann and Kirch have widespread music and video activities and operate the only pay-TV channel in Germany. The Commission was, therefore, concerned that the joint venture would create or aggravate a dominant position in three markets. MSG would obtain a dominant position on the market for administrative and technical services for pay-TV; Bertelsmann and Kirch would obtain a dominant position on the German-speaking pay-TV market and the existing dominant position of Deutsche Telekom on the cable infrastructure market would be protected, and thus strengthened. The EU Competition Commissioner declared that "the Commission (was) committed to leave future markets in the multi-media sector open to competition ... television without frontiers can only be accomplished if program suppliers from other Member States are not faced with prohibitive entry barriers in national markets."

In 1995, the Commission rejected another proposed multimedia joint venture involving telecommunications operators and media companies, this one involving the Danish and Norwegian national telecommunications operators and Kinnevik, a Swedish media group.[16] The proposed Nordic Satellite Distribution would have distributed satellite television programs in the Nordic region. The Commission decided to block the transaction because it would seriously harm competition in satellite, cable and pay-TV services. Indeed, the joint venture would have had the ability to control most of the satellite transponder capacity in the region, and two of the partners, the Danish and Norwegian national telecommunications operators, were already the largest cable-TV operators in their respective countries.

For the time being, the Commission is striving to balance various interests, recognizing that multimedia developments may require new forms of cooperation while seeking to prevent market dominance and barriers to entry. ◆

Notes

1. Communication of the Commission, Towards a dynamic European economy, Green Paper on the development of the Common Market for telecommunications services and equipment, COM(87) 290 of 30/06/1987 (hereafter the "Green Paper")

2 Commission Directive of 16/05/1988 on competition in the markets for telecommunications terminal equipment, O.J. No. L 131 of 27/5/1988, as amended.

3. Commission Directive of 28/06/1990 on competition in the markets for telecommunications services, O.J. No. L. 192 of 24/07/1990, as amended.

4. This is known as open network provision ("ONP"). See notably the ONP Framework Directive, Council Directive of 20/06/1990 on the establishment of the internal market for telecommunications services through the implementation of open network provision, O.J. No L. 192 of 24/07/1990

5. Communication of the Commission COM (94) 347 final of 19/07/1994

6 See Draft commission Directive amending Commission Directive 90/388/EEC, regarding the implementation of full competition in telecommunication markets (not yet published in O.J.).

7. ECR 1985, 873, known as the British Telecommunications case.

8. Guidelines on the application of EEC Competition rules in the telecommunications sector, O.J. No. C233 of 6/9/1991.

9. O.J No. C7 of 11/01/1992.

10. See for example CEPT Leased Lines, Bull. EC 1/2 - 1990 p. 19 and Belgian Leased Lines, Bull. EC 1/2 - 1990 p. 19.

11. BT-MCI, Commission Decision of 27/07/1994, O.J. No L233 of 27/08/1994

12. Press Release IP/95/524 of 24/05/1995

13 See *Financial Times,* October 17, 1995, p 3.

14. Council Regulation (EEC) No. 4064/89 on the control of concentrations between undertakings, O.J. No. L. 395 of 30/12/1989.

15. MSG Media Service, Commission Decision of 9/11/1994, O J No. L 364 of 31/12/1994.

16 Nordic Satellite Distribution. See notice in O.J. of No C53 of 4/03/1995 Decision not yet published

The Internet Becomes an Industry

by Zachary M. Schrag

The Internet joined the economic mainstream on Wednesday, August 9, 1995, when Netscape Communications Corp.'s newly issued shares became one of the hottest stocks on Wall Street. The company's underwriters originally planned to offer 3.5 million shares at $14 but were so hounded by interested investors they increased the offering size to 5 million shares and doubled the price. Even so the market quickly bid up the stock to over $70 a share, valuing the company at over $2 billion, though the price has since fallen back somewhat.

While Netscape's initial public offering made Wall Street history, it was but one of several Internet-related offerings in 1995 with large price gains. Fortunes are being made overnight as investors try to buy (and sell) slices of the Internet. But to join in this activity, one must have a working outline of who owns the Internet today.

The Internet is most often defined as hardware, as "a network of networks," i.e., millions of computers linked together by telephone lines. It can also be seen as software: a basic means of allowing computers to talk with one another (the TCP/IP protocol) plus various proprietary and non-proprietary tools that allow users to find information and connect with each other. Other definitions portray the Internet as a resource, a community, or a social phenomenon.

But as the Internet matures and becomes less of a novelty and more of a reality, it is useful to see it in yet another light: the Internet is an industry.

The dictionary defines an industry as "a distinct group of productive or profit-making enterprises," and the Internet is indeed quickly being passed from its governmental and academic parents to a brood of companies that at least hope to make a profit. Like the older information industries—such as publishing, telecommunications, and broadcasting—the Internet is composed of many enterprises, each of which sells its products and services either to consumers or to other companies in the industry, or both (see Box 3).

One distinguishing (and confusing) aspect of the Internet industry is its varying degrees of vertical integration. Some companies aim to fill a single service niche, while others hope to attract customers by providing everything in a single package. And in this new and turbid industry, companies are constantly seeking new niches and offering new services.

Varying degrees of integration may prove crucial in determining the winners and losers of the intensifying competition. Small companies that specialize only in one field may prove leaner and more flexible than larger companies trying to do everything and therefore doing nothing well. But larger companies can use one activity to promote others. Most companies involved in the Internet wear two or more hats, so the categories below characterize not so much types of companies as types of functions. For example, most on-line services have their own networks, but some do not. Remember, then, that a single company may belong in several of the following categories.

This list mainly describes the situation in the United States, where the Internet is best established, and where the Internet has evolved from a system run by the government and univiersities to a mostly commercial network. More than half of the networks connected to the Internet are in the U.S., and American backbones are so much faster than those elsewhere that many countries route their traffic through the United States to reach a neighboring country. Other countries are now catching up with the U.S. in infrastructure and in the transition to for-profit administration, so the current situation in the U.S. could well be the model of the global Internet of tomorrow.

Internet Service Providers

Internet traffic consists of packets of data transmitted along leased telephone lines and directed by powerful computers known as routers. The first entity to handle Internet traffic—to lease the lines and run the routers—was the United States government. But in May 1995, the government turned over this role to a club of private companies known as Internet service providers (ISPs) (see Box 1). These providers own backbone networks—routers in dispersed cities linked by high bandwidth (up to 45 Mbps) lines leased from long-distance telephone carriers. The largest backbone belongs to MCI which, along with Sprint and ANS (owned by America Online), handles approximately 80% of all Internet traffic. Other major access providers are PSI, UUNet, BBN Planet, NETCOM, IBM, and EUNet. While most of these companies are based in the United States, most of them have links to other countries in the form of alliances and subsidiaries.

Most large network service providers belong to the Commercial Internet eXchange Association (CIX, see http://www.cix.org), a non-profit organization based in Sterling, Virginia. Like telephone carriers, CIX members pass off traffic from one to another, but they do not charge each other for this, so there is no need for a settlement

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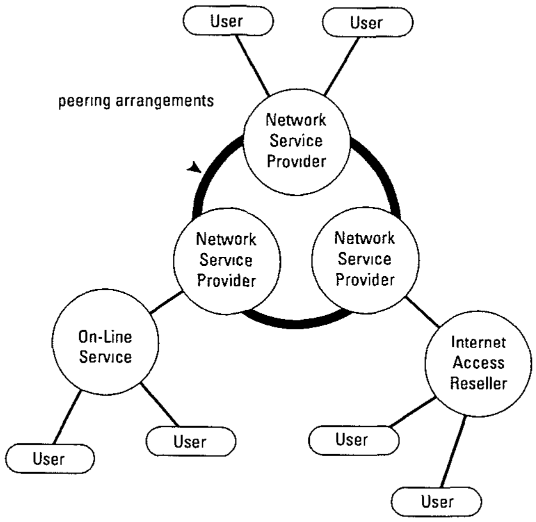
Box 1. Follow the Packets



Most traffic on the Internet flows across backbone networks owned by a few Network Service Providers who have agreements (peering arrangements) to pass off packets to one another without charge. Some users (whether individuals, corporations, or other organizations) have accounts with these providers; others access the Internet through an on-line service or a reseller. See also the map on page 80.

system. (In the telephone world, this is known as a "sender keep all" system.) They make money by selling capacity—connections to their networks, and thus to the entire Internet.

Capacity is a commodity, like electric power. It is generally sold by the month, whether as a 1.544 Mbps dedicated line for a large organization or a 28,800 bps dial-up connection for a hobbyist. Major providers sell both wholesale and retail. The wholesale purchasers are on-line services (see page 58) and smaller, local providers that operate in a single city, selling capacity to individuals and firms. Retail purchasers include businesses, universities (which may have hundreds of individual users connected to their internal networks) and individuals.

A typical ISP is UUNet Technologies, based in Fairfax, Virginia. UUNet's backbone is a network of lines (primarily 45Mbps and DS-3s) leased from WilTel and MFS, which UUNet uses to transmit Internet traffic across the United States. It also has a link to EUNet in Europe. Until August 1995, UUNet primarily sold Internet capacity to large businesses and to access resellers. But an alliance with EarthLink, a California company, will allow individuals around the United States to purchase dial-up accounts to UUNet's backbone. The company's biggest customer (and the owner of a 15% stake in the company) is Microsoft, and UUNet plans to build a new backbone network to serve the Microsoft Network, Microsoft's on-line service. UUNet became a publicly traded company in June 1995. As if to illustrate just how fuzzy are the divisions between market sectors, the company advised new investors that its potential competitors included its major suppliers, several of its major customers, and even its parent company, Microsoft (see also Box 2 on Netscape).

Beyond the confines of the CIX are hundreds, perhaps thousands, of access resellers. Many of these resellers are quite small, with only a single computer, a handful of modems, a few skilled technicians, and a dedicated line to a backbone belonging to one of the major providers.

Recently, major telecommunications companies have announced plans to offer Internet access to their customers. Pacific Bell, the regional Bell operating company in California, has planned service for early 1996. And Tele-Communications, Inc. (TCI), the cable TV provider, has plans (through its @Home subsidiary) to provide access via its CATV network at vastly higher speeds than can be achieved over telephone lines. The entry of these companies, with their capital and technological and marketing muscle, could erode the profits of the more traditional providers.

Because Internet capacity is a commodity, providers must work to differentiate themselves with features like 24-hour technical support, proprietary software, nationwide access, and special pricing plans. Some providers primarily serve large corporations who wish to connect their internal computer networks to the Internet, while others target the consumer market, drawing in customers with easy-to-use software packages, acting as software companies themselves.

Software Companies

In one sense, the Internet is nothing but software, specifically a standard connection protocol (called TCP/IP) allowing computers and computer networks to communicate with one another. Starting with this standard, software companies have brought to market a wide variety of tools for networking computers. Server programs—the software analogs of radio transmitters—allow companies and organizations to make data available on the network, while client programs—acting as receivers—allow individuals to find and use that data.

Since 1993, much of the exponential growth of the Internet has been credited to the World Wide Web, a particular application of the TCP/IP protocol. Whereas earlier client programs could be difficult to use, many Web clients (known as browsers) can be controlled solely with mouse-clicks and require scarcely more computer skill than does withdrawing cash from an automated teller machine. And Web servers can be made quite flashy, allowing companies to deploy all of their advertising and marketing savvy to the new medium. Users can create on-screen "pages," composed of text, graphics, sound, and even video.

As with television and radio, the transmitters (servers) are vastly more expensive than the receivers (clients). Software companies writing Internet software make most of their money by selling the server programs to content providers and other companies wishing to establish an Internet presence, and by licensing their software to on-line services. Browsers can also be profitable. Individual users can often get their browsers for little or no money, but the companies giving away the browsers—advertisers, on-line services, or access providers—must pay for the license to do so.

Netscape Communications, of Wall Street fame, is a software company (see Box 2). By distributing its Navigator browser software, generally considered the best browser available, free to individuals and non-profit users, it has created an enormous base of users. (Netscape also sells the software to businesses for less than US $50.) Because corporations want to buy server software that will work well with their customers' browser software, this vast body of Netscape users has boosted sales of Netscape server software. And unless a Netscape user actively decides otherwise, each time she enters the World Wide Web she will begin at the Netscape home page. The result is that millions of people visit Netscape's home page daily, increasing Netscape's stature as a content provider. Finally, Netscape has licensed both the client and server software for incorporation into various on-line services, providing yet another revenue stream.

Internet software is not limited to basic client and server applications. More specialized programs aim to add functions to the Internet. For example, Progressive Networks (http://www.realaudio.com/), a privately held company in

Box 2. Commercializing the Internet: Netscape and the Competition

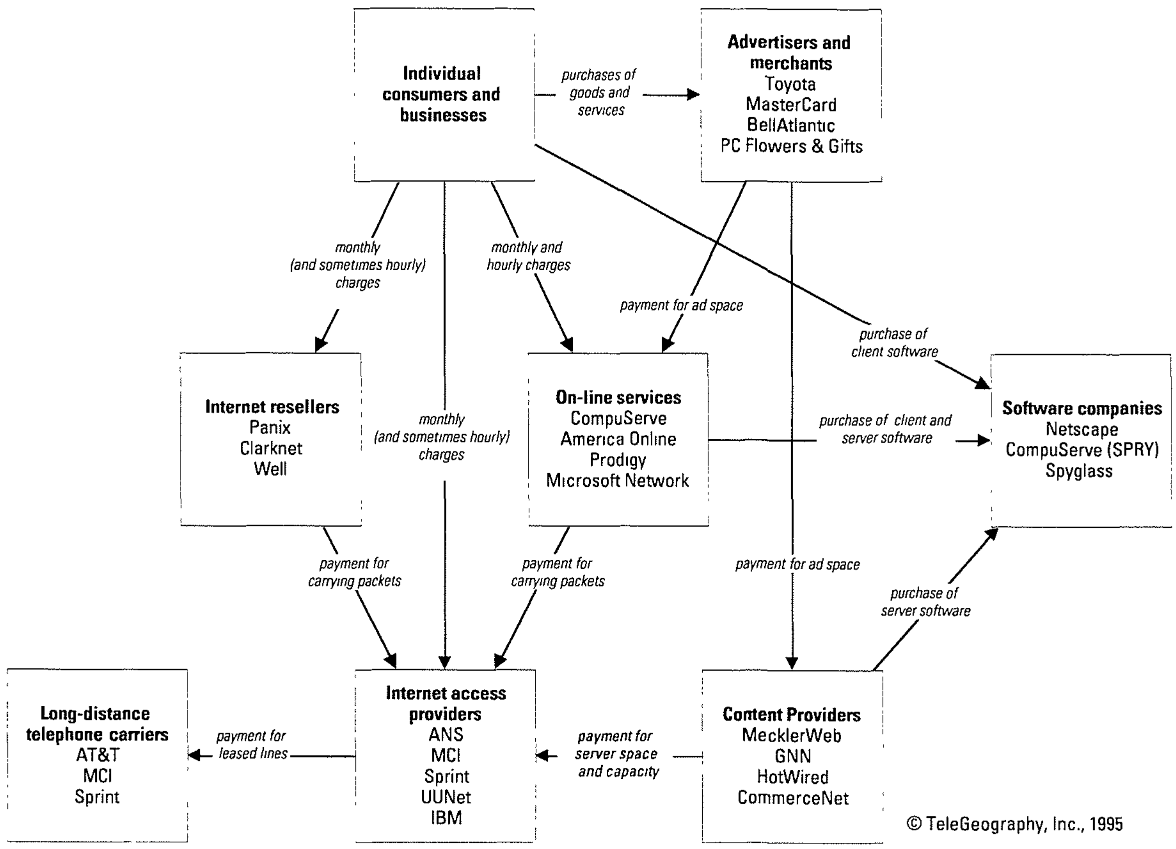
The following is excerpted from the Prospectus released by Netscape Communications Corporation dated July 17, 1995, and filed with the U.S. Securities and Exchange Commission (SEC) in connection with the company's initial public offering of common stock.

"The Company Netscape Communications Corporation ("Netscape" or the "Company") is a leading provider of open client, server and integrated applications software that enables information exchange and commerce over the Internet and private Internet Protocol ("IP") networks . . These products allow individuals and organizations to execute secure financial transactions across the Internet, such as the buying and selling of merchandise, publications, software and information. In addition, through the use of the Company's software, organizations can extend their internal information systems and enterprise applications to geographically dispersed facilities, remote offices and mobile employees.... The Company's goal is to make its software the de facto standard for navigating, publishing information and executing transactions on the Internet and private IP networks. The Netscape Navigator, introduced in December 1994, was the first commercially available client for the World Wide Web (the "Web") to include built-in security capabilities, which facilitate commercial transactions over the Internet The Company's products enable the creation, manipulation, organization and retrieval of documents that contain audio and video clips, graphical images and formatted text .... The Company was incorporated in Delaware in April 1994. Netscape's home page can be located on the Web at http·//home.netscape com.

"Developing Market; Unproven Acceptance of the Company's Products. The market for the Company's software and services has only recently begun to develop, is rapidly evolving and is characterized by an increasing number of market entrants who have introduced or developed products and services for communication and commerce over the Internet and private IP networks. . Moreover, critical issues concerning the commercial use of the Internet (including security, reliability, cost, ease of use and access, and quality of service) remain unresolved and may impact the growth of Internet use. While the Company believes that its software products offer significant advantages for commerce and communication over the Internet and private IP networks, there can be no assurance that commerce and communication over the Internet or private IP networks will become widespread, or that the Company's products for commerce and communication over the Internet or private IP networks will become widely adopted for these purposes.

"Further, market acceptance of the Company's server and integrated applications software products is substantially dependent upon the adoption of the Internet and private IP networks for commerce and communications. The adoption of the Internet for commerce and communications, particularly by those individuals and enterprises which have historically relied upon alternative means of commerce and communication, generally requires the acceptance of a new way of conducting business and exchanging information "

Box 3. Follow the Money



This chart shows only some of the transactions among players in the Internet industry (arrows indicate payments). Company names listed in each box are but examples; each category includes dozens or hundreds of companies. Not all Internet companies cater to the consumer, but ultimately they all depend on the consumer for their revenues.

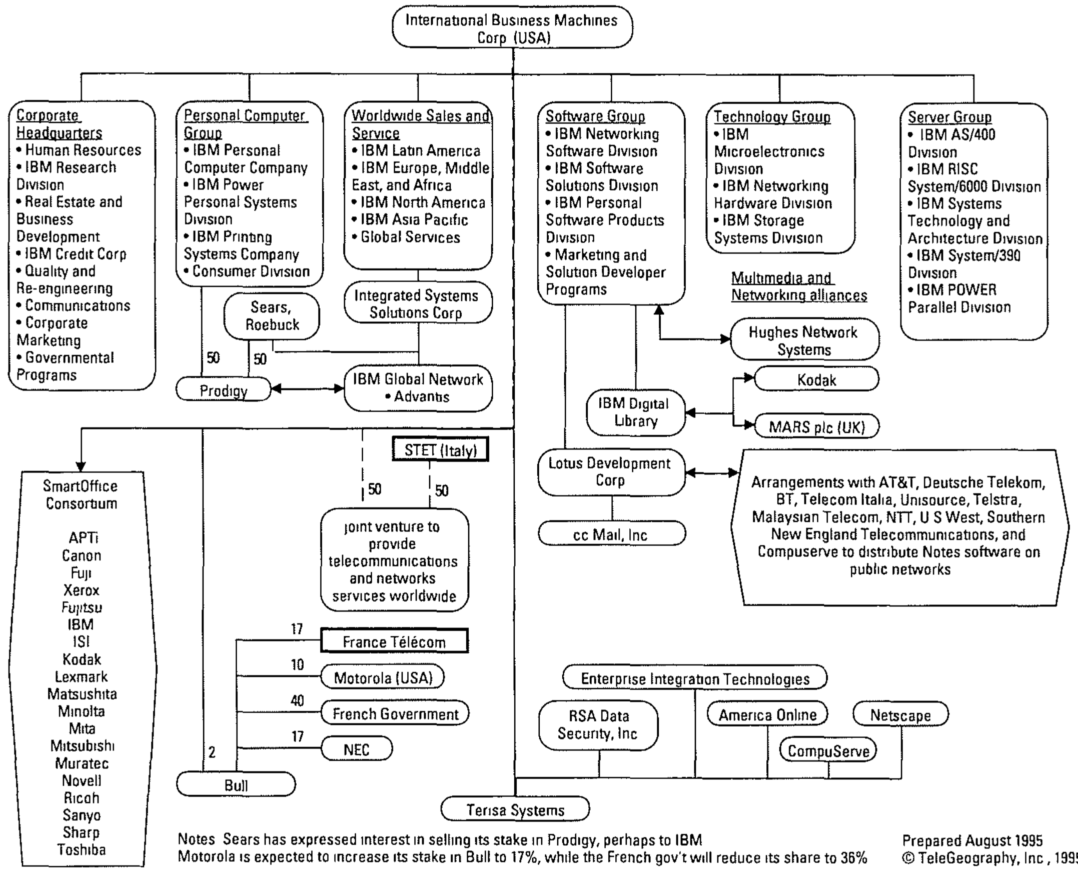
Seattle, Washington, has written software called RealAudio that allows users to listen to sound files as they download them, potentially making sound a much more common medium on the Net. Several companies—such as Caddis International and Digital Planet—aspire to monitor traffic on the Internet the way Arbitron and Nielsen monitor TV viewing habits, so that advertisers could know how best to reach their target markets.

The Holy Grail of software companies is to create a proprietary software standard that all other companies must license. In particular, several companies are trying to write software that would allow secure financial transactions over the Internet. Such a program could bring the creator royalties for each transaction: a potentially enormous revenue stream once the Internet becomes a common means of buying and selling goods and services.

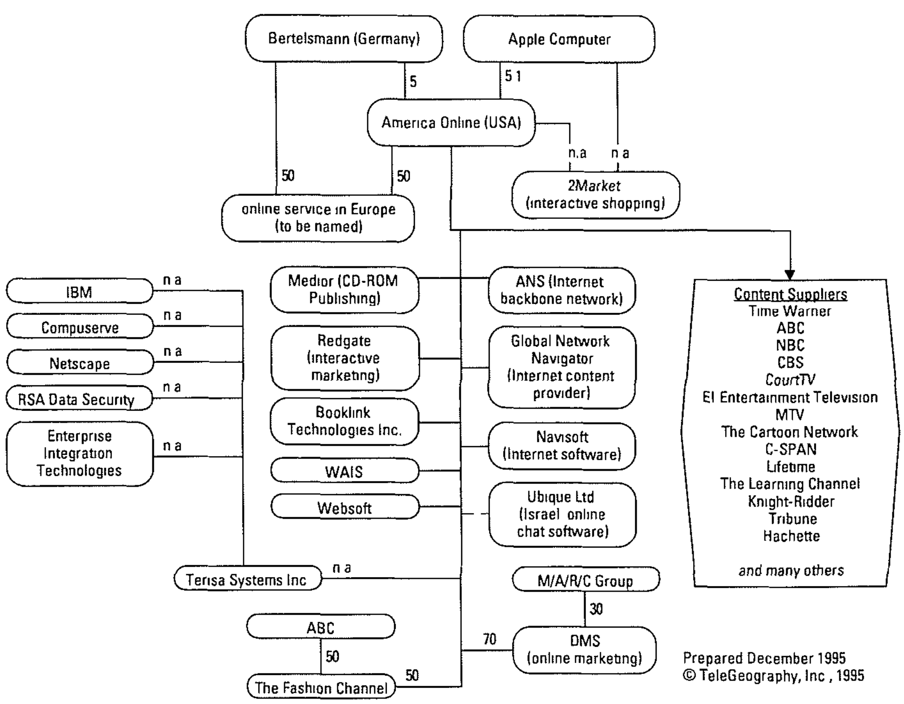
Content Providers

One could say that anyone posting a message or running a server on the Internet is a "content provider." But a small subset of providers do something special—they make money by charging other companies to be mentioned. Many of these content providers can be thought of as electronic magazines. In fact, some of the most popular sites on the World Wide Web, such as HotWired and Playboy, have print counterparts. These sites attract users by offering them information and entertainment in the form of articles, graphics, software, sound, video, and tools for navigating the Internet, such as search programs and indices to other sites. The content providers then take advantage of the stream of users visiting their sites by renting out space on their home pages to advertisers and merchants. Like all other sites, these providers depend on Internet access providers for connection to the Internet and on software companies for the server software.

IBM



America Online



Note The Bertelsmann-AOL venture is allied with Deutsche Telekom, and Deutsche Telekom has an option to purchase 5% of America Online

Like print magazines, content providers make most of their money selling advertising space, usually in the form of graphics that are linked to the advertiser's own page elsewhere. To buy a link on the Playboy Web page (http://www.playboy.com/), allowing Playboy readers (and viewers) to connect to one's own Web page with a single click, costs $30,000 for three months. In contrast, the Electronic Newsstand (http://www.enews.com/), another very popular site, sells links for as little as $1000 a month. Content providers also collect the names and e-mail or postal addresses of their users, allowing them to generate valuable mailing lists. And some, especially news organizations like the *San Jose Mercury News*, charge users directly for access to their Web pages.

Another form of content provider is the on-line shopping mall. Visitors to these sites can not only get information about the site, but can also purchase products and services. Like tenants in a real shopping mall, the merchants involved pay monthly rent to the mall owner. They may also turn over a percentage of each sale made on-line. While there are various software methods that allow users to make on-line purchases without worrying about credit card numbers and other valuable data being intercepted by unauthorized hackers, no single means has emerged as the standard. The software company whose product becomes standard will potentially become extremely profitable.

Content providers may have the brightest future in the long term. The inexorable advance of computer technology may sap the profits from the access and software businesses, but there is no substitute for the human creativity needed to write news articles, make photographs, compose music, and devise games. As long as theft of intellectual property can be kept to manageable proportions, copyrights will have value. And as the Internet continues to grow, guides to the Net and shopping malls that organize vendors will become all the more needed.

Box 4. The Internet as a Telephone Service: There is No Free Lunch

In 1995 several companies released software that allows people to use the Internet for two-way, real-time voice conversations, just as they would telephones. (Among the most prominent are VocalTec's Internet Phone, [http://www vocaltec.com/], Electric Magic's NetPhone [http://www.emagic.com/] and Camelot's Digiphone [http.//www.planeteers com/].) Users of these packages can talk to each other from across the street or across the ocean while paying only their regular Internet fees of $25 or so per month. Does the introduction of this technology herald a new age of nearly-free telephony and the death of the major telcos?

No The long-term future of anything concerning the Internet is impossible to predict, but for the next few years several factors will likely keep the technology from becoming a serious threat to traditional carriers.

■ ***Quality.*** *Internet voice programs use compression algorithms to squeeze conversation through the limits of a 14.4 kbps modem. At best, the result sounds like a speaker phone, with background hiss and hiccups. At worst, one hears only garbled static. And because each word must be broken down into packets, transmitted across the Net, and reassembled, there can be delays or gaps at the other end Compression can strip emotion from the voice, making the technology only a marginal improvement over e-mail and text-based chat systems. Ethernet connections, eliminating the modem, improve the quality, but such connections are comparatively rare. Foreign accents, common in international telephony, only aggravate problems in comprehension*

Developers of Internet voice software do not foresee great improvements soon. Instead, they expect their programs to be used in situations that already depend on speaker phones (such as international conference calls) and in cases where few would pay the standard voice tariff (such as travelers calling their families and chatting for an hour).

■ ***Regulation.*** *Almost every country in the world requires licenses for the provision of realtime voice transmission, many have guaranteed monopolies, and several European countries have explicitly banned Internet telephony. It is unlikely that an individual user would face prosecution, but caution could lead highly visible corporations to steer clear of the new technology. Why would a company offer technical support via Internet telephony if it might break the law by doing so?*

■ ***Compatibility.*** *The Internet voice programs demand that each user have a fairly fast computer with a fast modem, a microphone and speakers or headphones. Despite the exponential spread of PCs, it will be a long time before such equipment approaches the ubiquity of the telephone. Moreover, the various software packages now available cannot yet talk to each other, vastly limiting the number of potential conversations.*

■ ***Capacity.*** *Using the Internet to make long-distance and international calls is like pulling off the expressway to take a shortcut through a residential neighborhood. It may benefit you, but if everyone does it the shortcut becomes even more congested than the highway.*

On-line Services

On-line services bundle three functions; they provide their customers—generally individuals, including many who subscribe for home use—with software, connectivity, and content. (CompuServe, Inc., an on-line service and access provider owned by H&R Block, calls itself a "one-stop shop.") Typically the software for accessing the service is free, and on-line services try to attract new customers by sending their front-end software by direct mail or including it with new computers and modems. Purchasers of new Macintosh computers find the software for Apple's eWorld service already installed on their hard drives, and purchasers of Microsoft Windows 95 have instant access to the Microsoft Network.

Rather than offering direct access to the Internet, the way local access providers do, on-line services connect users to smaller but better-organized networks. These networks include content not found on the larger Internet: electronic versions of magazines, software libraries, newsgroups, and access to advertisers and merchants. In addition, on-line services may offer their customers gateways to the Internet, though usually at a higher per-minute price than that paid by customers of Internet service providers.

Because software, connectivity, and content are provided by a single company, computer users going on-line for the first time often find it easier to deal with an on-line service than with the more nebulous Internet. Moreover, on-line services often have a much cheaper base monthly rate (around US$10 per month) than do Internet access providers, though hourly charges and payment for premium services can make the total bill more expensive. As these services offer greater access to the full Internet and the Internet becomes more user-friendly, the distinction between people

The Internet's packet-switching protocols are more efficient than traditional circuit-switching, but any given amount of circuitry and switches can still only transmit so much. Like other multimedia uses of the Internet, such as the transmission of video or large graphics files, voice traffic could easily swamp networks designed primarily for text communications, especially in developing countries whose cities are linked by single 28 8 kbps lines. Richard Muirden of the Royal Melbourne Institute of Technology estimates that 200 simultaneous voice conversations could fill Australia's entire Internet connection to the outside world, and it would not take that many to noticeably slow performance for any Australian Internaut trying to connect to a server elsewhere. The enormous American backbones would be difficult to clog, but calling within the United States is already so cheap that one would have to spend dozens of hours putting up with the poor quality of Internet telephony to recoup the cost of the necessary software and hardware. And even in the US, Internet voice calls could congest the connections between local access providers and the backbones.

If Internet telephone software does become very popular, service providers will have to create more capacity by leasing more lines and purchasing more routers, and they will almost certainly find a way to pass the costs of additional capacity onto those people causing the congestion. Currently the Internet generally runs on flat-rate billing (customers only pay a monthly fee, regardless of the amount of traffic they generate) and equal-priority transmission (every packet of data must wait its turn). But the transition to Internet Protocol version 6—a new version of the basic Internet protocol, expected within the next few years—may change that. The new protocol will likely give top priority to realtime applications like two-way conversations, but it may also allow providers to bill users of these applications for the traffic they generate. The Audio/Video Transport Working Group of the Internet Engineering Task Force (IETF) has promised to develop mechanisms to "provide low-delay service and guard against unfair consumption of bandwidth by audio/video traffic."

■ ***Competition.*** *The attraction of Internet telephony is that at $25 a month it is a pittance for global telephone service. But by the time the Internet can handle the additional load of many voice conversations, users may find themselves either paying by the minute to transmit voice, or paying more per month for the high-priority access that will make voice conversations possible. Meanwhile, international telephone tariffs will continue to drop, reducing the price advantage of Internet telephony even more. It is possible that greater competition, renegotiation of accounting rates, and improved technology (such as new cables and ATM switching) could bring users top-quality, traditional telephony for little more than they would pay for balky conversation by computer.*

Today's Internet telephone software has exploited a loophole, but that loophole is not infinitely expandable. There is still no free lunch.

—Z.M S.

using an on-line service and those connecting through an access provider is becoming less significant.

On-line services require software to distribute to their customers and network capacity to transmit their customer's packets. In some cases the software companies and Internet access providers are divisions of the same company running the service. For example, CompuServe Information Service uses the CompuServe Network to transmit its data, and its Internet software is supplied by CompuServe Internet (formerly SPRY, Inc.). Other on-line services purchase software and capacity from other companies, as does the Microsoft Network which licenses software from Spyglass and contracts with the access provider UUNet for capacity.

Some analysts have argued that as the Internet becomes more user-friendly, the on-line services will lose their *raison d'etre* and will fade away. But users will always need software, connectivity, and content to go on-line, and the existing on-line services have demonstrated their skills in meeting these needs and attracting new customers. While the packaging may change, there is no inherent reason why these companies should disappear.

Advertisers and Merchants

As the Internet evolves into a popular communications medium, companies outside the computer business are looking for ways to take advantage of this new technology to sell more products.

One way is by advertising goods and services. Seasoned Internet users frown on "spamming": sending unsolicited e-mail promotions. But the electronic analogs of other traditional forms of advertising—such as luring potential customers with information and entertainment while exposing them to ads (as is done in print and on television), or offering free samples, or sponsoring contests—have become accepted and even commonplace, especially on the World Wide Web. Some companies, such as Time Warner, run their own elaborate Web pages to draw interest. Others may simply advertise on the page of a content provider. And many do both, paying content providers to link their Web pages and thus maximize coverage.

Unlike print ads, a company's on-line presence need not be one-way, and companies can cheaply offer 24-hour information of the sort that previously required toll-free numbers and trained operators. Manufacturers can post specifications of their newest products. Investment firms can report quarterly results of their mutual funds. Shipping companies can allow customers to track their packages. Airlines and hotels can accept reservations. In none of these interactions does any cash change hands, yet each lends a competitive advantage to the company involved.

Finally, some merchants actually make retail sales over the Internet. Amorous Internauts can navigate to the PC Flowers & Gifts home page, fill out a form with their credit card numbers and the address of their beloved, and have flowers, chocolates, or teddy bears shipped. In such a transaction, consumers and merchants depend on secure links devised by software companies to protect their credit accounts. Although the volume of such sales remains small, most observers predict enormous growth in such sales within the next decade.

While any Web page can be accessed directly, many advertisers and merchants also make arrangements with various "on-line malls," run by on-line services and content providers. The on-line service will provide "space" to the merchant, in the form of actual computer memory and listings in the mall directory. In return, the merchant pays the on-line service a fixed amount per month, plus a commission for each sale made on-line.

One prominent cyberspace advertiser is Fidelity Investments (http://www.fid-inv.com/), one of the largest stock brokers and mutual fund (unit trust) managers in the United States. Fidelity pays several content providers, including Time Warner's Pathfinder site (http://www.pathfinder.com/) and the Electronic Newsstand, to provide links to its Web page. It also publishes its Web address in its print ads and in brochures sent to customers—for now, more people find the site through print than on the Internet itself. And it has areas similar to its Web page on two on-line services.

Having found the site, an investor can read mutual fund prospectuses or take advantage of more interactive features, such as a program that, given a child's age and educational plans, can tell a parent how much to invest for college. All of this is done at relatively little cost to either the customer or Fidelity, and it can be done at any hour of the day without the user leaving his home or office.

Fidelity still requires the customer to send a check through the mail, but other brokerage houses in the U.S. and U.K. plan to set up accounts and trade stocks over the Internet.

The Internet Matures

The several sectors of the Internet industry are all still fairly competitive and unstable, with low barriers to entry and vast opportunities for entrepreneurs with technical skills. Perhaps some anarchism inherent in the centrifugal TCP/IP technology will preserve this instability. Or perhaps the Internet will follow previous industries and become a tight oligopoly of vertically integrated companies.

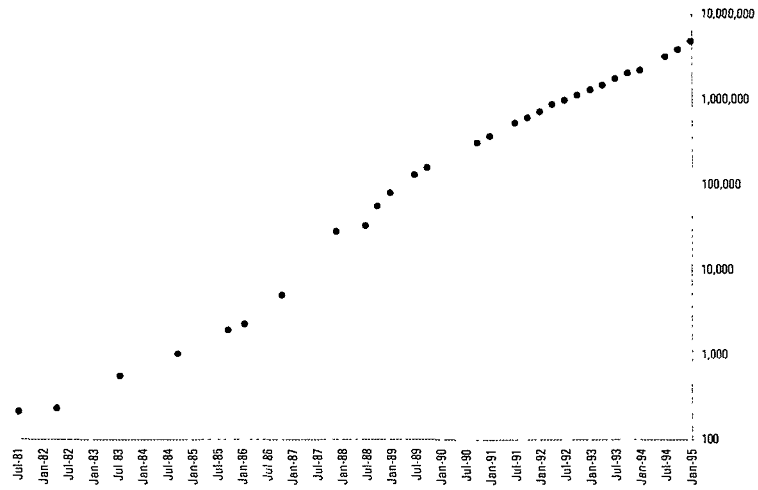
What is most certain is that the Internet will continue to grow (see Box 5) and become more reliable, and that all types of businesses—from airlines to supermarkets to steel mills—will depend on it for some part of their business-to-

Box 5. How Long Can it Grow?

Anything that doubles in size every year is worthy of attention And whether measured in hardware connected or traffic flows, the Internet just keeps doubling. The number of Internet hosts (computers of any kind attached to the Internet capable of supporting the TCP/IP protocol and possessing a unique global address) has been growing at 90% or more every year since 1983, and some experts expect this trend to continue through the end of the century. This would mean that by January 2000 there would be 125 million hosts worldwide, and perhaps ten times that number of Internet users.

Can today's growth rates last that long? When new technologies are adopted, they tend to exhibit sigmoid (s-shaped) growth curves: a long period of slow growth, then a short period (five to twelve years) of explosive growth, then another slow, steady growth period until an asymtotic limit (e.g., saturation of a market) is approached.

Internet Host Growth, 1981-95

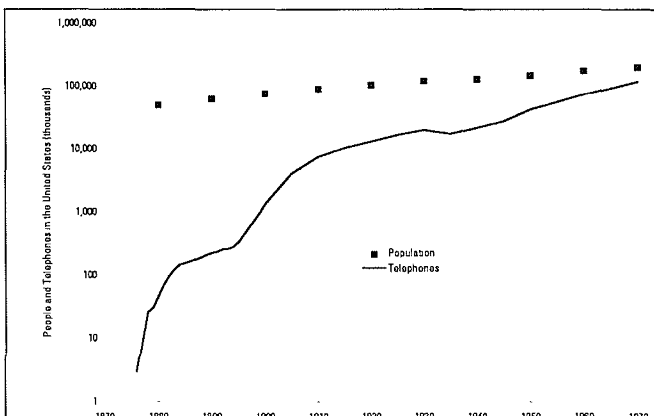


Source: Network Wizards, http://www.nw.com/zone/host-count-history

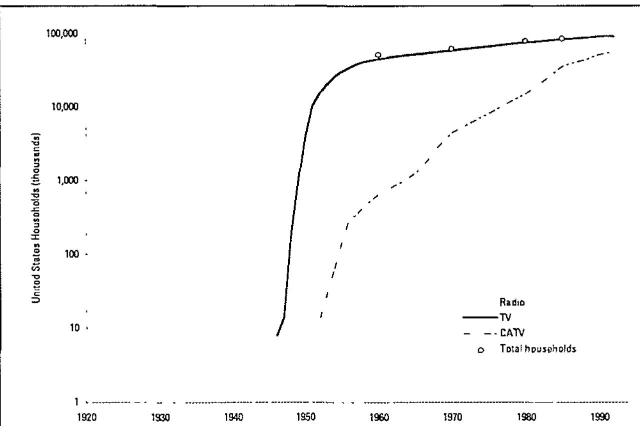
The sigmoid growth of the telephone in the United States shows that enormous growth of a new technology may not continue very long after its introduction. Had the 63% annual growth from 1876 to 1884 been maintained, by 1900 there would have been more telephones than people in the country Instead, growth flattened out after 1884 when the first wave of doctors, businessmen, and other early-adopters all had their phones. It took two more periods of explosive growth, from 1895-1905 and 1945-50 before the number of telephones approached the number of people.

But some technologies need only a single, steep sigmoid growth spurt. In 1948, 127,000 U.S. households had television sets. By 1958, 41,924,000, 80% of all American households, did. That's 73% compound annual growth over 10 years, though because the growth was sigmoid, growth slowed after 1951 and by 1958 was only 8% annually.

It is possible that the Internet, like the telephone, will need several spurts to dominate the world, and that the growth we see now is but the middle (or even the end) of an early spurt. Perhaps once all the world's most dedicated computer nerds and technophiles (say, 100 million people) are hooked up, Internet growth will flatten until new applications are developed and another burst begins. But with computers and telephone lines getting cheaper and faster every year, there is no reason why Internet growth will necessarily flatten soon. As hand-held computers and even video games get their own addresses, internetworked computers could spread like televisions, going from exotic novelty to everyday appliance in industrialized countries in the space of a decade, and conquering the developing world in scarcely more time.



Staggered sigmoid growth: telephones (total) in United States.
Source: U.S. Bureau of Census. *Historical Statistics of the United States, Colonial Times to1970, Statistical Abstract of the United States 1995*



Fast sigmoid growth: household radio sets, television sets, and cable TV subscriptions. Cable shows staggered growth, radio some hesitation, but TV took the country in a single spurt.

Box 6. Selected Internet Companies.

This chart provides some examples of companies now making money—or at least trying to—on the Internet. It is by no means an exhaustive list, nor does it necessarily list the top companies in the business. It merely tries to show the diversity in size, function, and longevity of companies in the Internet industry.

	ACCESS	SOFTWARE	CONTENT	ON-LINE	INTERNET ACTIVITIES
America Online, Inc. (NASDAQ:AMER)	•	•	•	•	America Online (AOL), the fastest-growing on-line service, also owns ANS + CORE, one of the largest backbones. AOL also offers an Internet-only service for consumers who want Internet access but who do not want AOL's basic service. AOL has become a content provider by purchasing the Global Network Navigator, a popular Web site with indices, search tools, and links to thousands of other sites. 1994 revenues: $104.4 million.
Apple Computer, Inc. (NASDAQ:AAPL)		•		•	A computer manufacturer and operating-system software producer, Apple launched eWorld, its on-line service, in 1994. It recently released its own Web browser. 1994 revenues: $9,188.7 million.
Bolt Beranek and Newman Inc. (NYSE:BBN)	•				BBN Planet is a BBN subsidiary and a national Internet access provider. Its customers are organizations, rather than individuals. In July 1995 AT&T purchased an $8 million share in BBN Planet, and the two companies will cooperate in marketing Internet services to businesses. FY 1994 revenues: $165.8 million.
British Telecommunications plc (LSE.BT.L)	•				BT is both an access provider, through its subsidiary BT Net, and a supplier of leased lines to EuropaNET, which is managed by DANTE. It is also considering a direct investment in the on-line joint venture being formed by MCI and News Corp. FY 1994 revenues: $7,322.0 million.
CompuServe, Inc. (NYSE·HRB)	•	•		•	Best known as an on-line service, CompuServe (owned by H&R Block) has its own backbone network as well, and may offer an Internet-only service. In March 1995 it acquired SPRY Inc., an Internet software company, for $100 million. FY 1995 revenues: $582.8 million.
DANTE	•				DANTE is a non-profit company that manages EuropaNET, the largest European backbone.
International Business Machines Corp. (NYSE:IBM)	•	•	•	•	A leading provider of Internet access outside the United States, IBM also has an extensive Web site that includes the Software Mall, where software companies can hawk their products. It also sells server software for its computers. IBM is co-owner of Prodigy, an on-line service. 1994 revenues: $64,052.0 million.
MCI Communications Corp. (NASDAQ:MCIC)	•			•	MCI leases both phone lines and Internet capacity, and in 1995 launched its own on-line service, InternetMCI, using software licensed from Netscape. It also has a popular Web site and an interest in News Corp., which owns the Delphi on-line service. 1994 revenues: $13,338.0 million.
Mecklermedia			•		Its Internet World magazine is sold at newsstands, but excerpts are available on-line at the MecklerWeb site. UUNet provides capacity for MecklerWeb.

	ACCESS	SOFTWARE	CONTENT	ON-LINE	INTERNET ACTIVITIES
Microsoft (NASDAQ:MSFT)				•	Microsoft has long maintained an ftp server for customer support, and launched the Microsoft Network (MSN), an on-line service, along with its Windows 95 operating system. MSN uses software licensed from Spyglass. 1994 revenues: $4,649.0 million.
Netcom On-Line Communications Services, Inc. (NASDAQ NETC)	•				Netcom is one of the largest providers of Internet access to individuals, with 150,000 subscribers as of June 1995. It offers subscribers its proprietary NetCruiser browser software which will include Internet Phone software that allows two-way voice conversations over the Internet. 1994 revenues: $12.4 million.
Netscape Communications Corp. (NASDAQ NSCP)		•	•		Netscape's Web browser, which is given away free to non-commercial users, has become the most popular tool for surfing the Net. Netscape has sold its server software to many major companies and has licensed it to MCI for use in its on-line service. Netscape's home page is among the most frequently visited on the Internet. 1994 revenues: $0.7 million.
PSI (Performance Systems International, Inc.) (NASDAQ:PSIX)	•				An Internet access provider with access points throughout the United States, PSI also serves cities in Japan and the United Kingdom and has plans to expand to Korea. It serves both organizations and individuals, wooing the latter with its InterRamp client software. 1994 revenues: $15.2 million.
Sprint Corp. (NYSE:FON)	•				Sprint is both a major long-distance telecommunications carrier and one of the largest Internet access providers. It offers service in the United States and several other countries worldwide. 1994 revenues: $6,805.1 million.
Spyglass (NASDAQ:SPYG)		•			Spyglass has licensed its software for use by the Microsoft Network. It became a publicly traded company in 1995. 1994 revenues: $3.6 million.
Sun Microsystems (NASDAQ:SUNW)		•			Sun is primarily a hardware company, with 55% of the market for Unix computers. But its Java programming language has made it a serious player in the Internet software market (see page 77). FY 1995 revenues: $5,901.0 million.
UUNet Technologies, Inc. (NASDAQ:UUNT)	•				A major access provider, UUNet supplies Internet access to the Microsoft Network. The company went public in May 1995. Microsoft owns 15%. 1994 revenues: $12.4 million.
VocalTec, Inc.		•			VocalTec writes software that allows users to have ordinary telephone conversations over the Internet without paying long-distance telephone fees. It has licensed its technology to Lotus, Motorola, and Netcom.
Yahoo! Corp.			•		Yahoo's convenient guide to the Web has made it a very popular site, and it recently added a newsfeed from Reuters to make the site more attractive and lure more advertisers. The company was founded by two students at Stanford University.

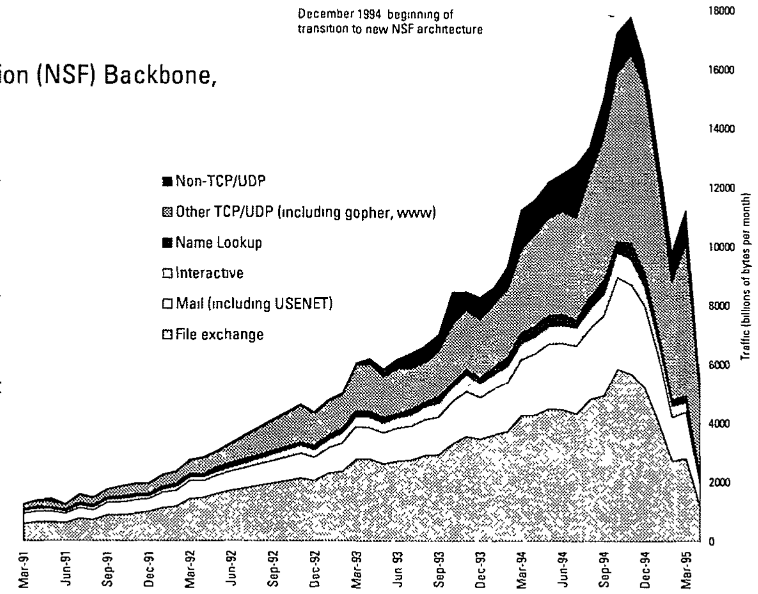
NSF Traffic Growth, 1991-95

Traffic on the U.S. National Science Foundation (NSF) Backbone, by category of service

Until its decommissioning on April 30, 1995, the NSF Backbone Network was the most heavily used, large-scale Internet interconnection facility in the world. Under the new architecture, traffic flows on commercial networks, such as ANS, MCInet, and Sprintlink, and it is no longer possible to measure Internet use by protocol as before.

TCP/UDP are basic Internet standards that allow up to 128,000 different network applications and services to be provided over the Internet. Non-TCP/UDP standards include Open Systems Interconnection (OSI) and various special network services.

Source: Merit, ftp://nic.merit.edu/nsfnet/statistics/history.ports



Host Computers and Web Servers by Internet Domain, 1995

Domain	Hosts (July)	Web Servers (June)	Web servers per 1000 hosts
Commercial (com)	1,743,390	4,782	2.7
Education (edu)	1,411,013	6,443	4.6
Germany (de)	350,707	1,061	3.0
Network (net)	300,481	943	3.1
United Kingdom (uk)	291,258	972	3.3
Government (gov)	273,855	984	3.6
Canada (ca)	262,644	786	3.0
Military (mil)	224,778	219	1.0
Australia (au)	207,426	548	2.6
Organization (org)	201,905	677	3.4
Japan (jp)	159,776	370	2.3
Netherlands (nl)	135,462	289	2.1
France (fr)	113,974	436	3.8
United States (us)	113,226	309	2.7
Finland (fi)	111,861	325	2.9
Sweden (se)	106,725	268	2.5
Norway (no)	66,608	181	2.7
Switzerland (ch)	63,795	252	4.0
Italy (it)	46,143	216	4.7
New Zealand (nz)	43,863	69	1.6
South Africa (za)	41,329	86	2.1
Austria (at)	40,696	135	3.3
Spain (es)	39,919	74	1.9
Denmark (dk)	36,964	107	2.9
Korea, Republic of (kr)	23,791	145	6.1

The vast majority of computers using three-letter domains (com, edu, org, gov, mil, and net) are located in the United States. Note the low number of web servers per host in New Zealand, where organizations with web pages are charged every time someone downloads a file from their page.

Sources: Network Wizards, Internet Domain Survey (http://www nw.com/zone/WWW/top.html); net.Genesis (http://www.netgen.com/cgi/comprehensive)

Traffic to and from the NSFNet Backbone, November 1994

This graph shows inbound and outbound traffic from the top 47 countries to the NSFNet backbone for November 1994, the last month before the beginning of the transfer of traffic away from the backbone, which was decomissioned at the end of April 1995. The figures give a rough idea of Internet traffic flows between the United States and the rest of the world. Countries with less developed networks tend to have more unidirectional flows; they receive much more data than they send. So too with telephone traffic. See p. xiv.

Source: Merit, ftp://nic.merit.edu/nsfnet/statistics/1994/nsf-9411.country

Notes on Mapping the Net

From Tribal Space to Corporate Space

by Gregory C. Staple

"Even good map[s]... are but approximations of what is out there." *Barry Lopez*

What are maps? How do maps differ from pictures? Whose interests do maps serve? These questions have been argued at least since Claudius Ptolemy drew the first comprehensive geophysical map of the Earth from a Western viewpoint in the 2nd Century. There is still no agreement on the answers. But the birth of the electronic frontier—cyberspace—has given the debate rich new material.

As yet though, maps of cyberspace are almost as rare as 16th century portalans. Explorers practice their trade without maps. Finding an uncharted passage, rounding a mysterious cape, is what the job is all about. The late 20th century pioneers of cyberspace, hackers and webmasters, are no exception. Their exploits have become front page news but we are still waiting for the maps. Few among this frontier fraternity have both the navigational and drafting skills of a Ferdinand Magellan or a James Cook. Even for those that do, the challenge of mapping cyberspace is in some ways more formidable than that faced by the sea captains of the past.

Cyberspace is an imaginary world—a virtual reality—an artifact of computer software whose form may be as varied as the human imagination. Moreover, whereas computer networks were once a more or less local affair, comprising a few thousand sites in the U.S. and its major allies, the network is now global, linking millions of sites via an ever expanding web of connections. The streams of traffic which once coursed back and forth over this network have grown to Amazonian proportions.

The challenge which cyberspace presents for the mapmaker, however, is only partly a matter of size and form. We've become accustomed to mapping places that can't be seen without computers—distant galaxies, a few angstroms of DNA, synapses in the brain. Indeed, as recounted in Stephen Hall's extraordinary 1992 book, *Mapping The Next Millennium,* computer-based imaging systems and instrumentation have spurred a cartographic renaissance of the very big and the very small. And cyberspace is both very big and at the same time very small.

In addition, cyberspace seems to be infinitely mutable. All maps begin to lose their accuracy as soon as they are printed. A greenbelt becomes a new subdivision; a country splits in two; with a new bridge an island becomes a peninsula. But cyberspace changes daily, even hourly, as new computer links are added and others decay.

So how do you map cyberspace? On what scale? With what images?

Visualizing Cyberspace

"Ultimately maps ... gain their power and usefulness from making connections and enabling unanticipated connections." *David Turnbull*

One of my favorite starting points is the pen of Saul Steinberg. Since the 1950s, Steinberg's cover illustrations for the *New Yorker* magazine have provided a running guide to America's changing perspective on the world. Of course, Steinberg is not known as a mapmaker. Most *bona fide* cartographers would dismiss his street scenes of New York as "pictures" (about as harsh a professional rebuke as you can make). But his most famous cover illustration, the New Yorker's view of New York, and a recent successor showing New York's Lexington Ave. crossing Wilshire Boulevard in Los Angeles, are nonetheless powerful mental maps.

Drawn almost 20 years apart, the illustrations show two very different worlds. The first, published on March 29, 1976, is parochial and, from a geographical standpoint, neatly ordered from East to West. In the foreground is lower Manhattan, but it could be any local neighborhood. (This largely accounts for the innumerable knockoffs of Steinberg's graphic.) Beyond its borders, only a few landmarks are known and foreign nations, even the most populous on Earth, are no more than small clouds on the horizon.

The perspective in the second illustration (published February 13, 1995) is strikingly different. Here geography has somehow come unstuck; around the corner is across the continent. East and West have become one and the same. Everything is on top of everything else; it is all local and nothing really exists. Sound familiar? Welcome to cyberspace.

Gregory C. Staple is a partner in the Washington, D.C. communications law firm of Koteen & Naftalin and the Editor of TeleGeography.

Although Steinberg's depiction of our post-modern world may seem cartoonish, it is not so far removed from that of most scientists. Ask a communications engineer to draw a picture of cyberspace and you are likely to get a sea of clouds (Steinbergian?) each representing a different network, with various lines (transmission facilities) linking them together (Figure 1). So what does cyberspace look like? A cloud? A sprawl? Or something else again?

Defining Cyberspace

A principal reason why many contemporary representations of cyberspace are confusing, whether drawn by artists or engineers, is that they try to combine the hardware and software side of the on-line world. Though intertwined, these two aspects of the Net are best mapped separately. So let us start with a definition: Cyberspace is information space.

The hardware side of cyberspace, the physical architecture of computers, switches (routers), transmission facilities and embedded software, is largely invisible to most people. The industry describes this as being "transparent to the user," meaning "opaque" in common speech. You can't see the wires. That's part of the Net's beauty. What most people want to see (and do) is the Net's other side—the information architecture. That is really what cyberspace is all about and, as such, is the logical point of departure for cybermaps.

It is hard to overemphasize this basic definitional point. Until quite recently, most computer networks, including the Internet, were primarily viewed as a shared (distributed) computational resource and only secondarily as a communications medium. This has now changed. The Internet and its various components (the World Wide Web, gopherspace, etc) are now more accurately viewed as a distributed information space—a seamless interactive database or mailroom or picture library—depending upon your point of view. What the user wants to know is how one piece of information (message, image, sound) is connected to another, not the underlying physical structure of the computer and communication systems.

Defining cyberspace as information space also helps to resolve the perennial cartographic dilemma of how to transcribe multidimensional objects onto two-dimensional paper. On the Net, space frequently seems to run away in every which direction. A loose translation of one Chinese expression for the Internet is "ten thousand dimensional web in heaven and net on earth." Mapping "ten thousand dimensions" on paper is a non-starter, of course. But if these dimensions might be considered to be a part of a greater whole—information space—then paper may still be of some utility.

As used here, therefore, the term cybermap refers to a map of the Internet's informational space. The cybermap gazetteer by John December which follows this article generally adopts a similar convention.

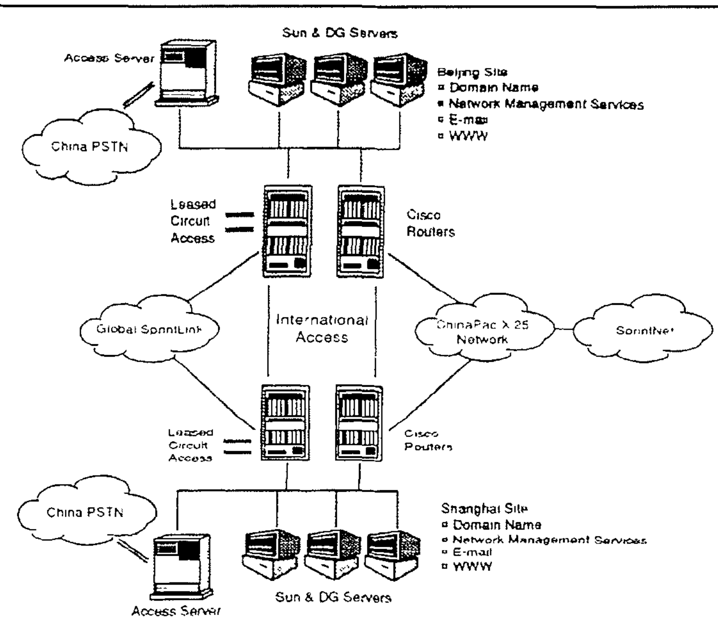


Figure 1. The cyberspace of engineers is based on hardware; the maps show network clouds linked by telephone lines.

Source: Sprint/Pyramid Research Inc.

Cartographic Conventions

While a workable definition of cyberspace is probably one prerequisite for mapping, it is not the only one. Because cyberspace is an a-geographical world, mapping this new world tests the conventions of mapmaking in other ways.

Western cartography has long been based upon two fundamental conventions: a) space is continuous and ordered, in the sense that one part is always followed by another part (there are no gaps); and b) the map is not the territory; that is, the territory exists wholly apart from the map of it. Cyberspace and many cybermaps appear to violate both of these conventions as, for example, does Steinberg's drawing of Lexington and Wilshire.

That is one reason why Steinberg's drawings are often considered to be pictures or, at best, "primitive" maps—i.e., they are cartographically unconventional. But so too is cyberspace and, as I shall suggest below, in this primitive world tribal maps may provide one of the most valuable guides for getting around, at least until the "powers that be" step in. To see why, let's take a closer look at the conventions involved.

The Continuity of Space

Spatiality is at the core of human consciousness and our attempts to make sense of the world. It is reinforced as soon as we learn how to touch and crawl, and then soon taken for granted as we put one foot in front of the other and take in a room or a garden at a single glance. It is perhaps not surprising therefore that spatiality is a central element in almost all our representations of the world, including what we call maps.

The geographers Arthur H. Robinson and Barbara Bartz Petcenik offer the following comment on the primacy of our sense of space in ordering our knowledge of the world: "As we experience space, and construct representations of it, we know that it will be continuous. Everything is somewhere and no matter what other characteristics objects do not share, they always share relative location, that is spatiality; hence the desirability of equating knowledge with space. This assures an organization and a basis for predictability, which is shared."

But even fairly primitive transportation and communications technologies can make connectivity, not spatiality, the most important factor in navigation. For the first several thousand years of civilization—until the coming of the railroad—water transport was often easier than overland transport, making one port effectively "closer" to another port—hundreds of miles away—than to mountain towns at a fraction of the geographical distance. Various non-European cultures understood the importance of such connections and drew maps accordingly.

The historian, Malcolm Lewis, who has written extensively about American Indian maps, points out that they "differed from post-Renaissance European maps in two fundamental respects; geometrical structure and the selections and ordering of information content." European maps have a projective geometry based on a co-ordinate system (latitude and longitude). Indian maps are topologically structured, observes Lewis, "conserving connectivity between the parts, but distorting distance, angles and, hence, shape." See, for example, Figure 2.

In *The Songlines,* Bruce Chatwin suggests that this outlook was also common to Australia's indigenous peoples: "Aboriginals were wanderers..[they did] not imagine territory as a block of land hemmed in by frontiers but rather as an interlocking network of 'lines' or 'ways through.'" It was a matter or survival. Australia's arid interior is vast and irregular rains mean that places with water and vegetation may change dramatically from year to year. The route is everything. Thus as one Aboriginal explained: "All our words for 'country'...are the same as the words for 'line.'"

In short, most tribal cultures never viewed the land they knew through the spectacles of Euclidean geometry. Cybermaps like tribal maps accordingly may dispense with conventional perspective to conserve connectivity. They are true to the land, not to the theodolite. See Figure 3.

Maps and Territories

Another basic precept of Western cartography is that the map is not the territory. After all, if the map were identical with the territory it would literally be the territory. It would have a scale of an inch to an inch, and apart from anything else, it would be unworkable.

Cyberspace also challenges this convention. The map and the territory often appear to be one and the same. This is especially so in that part of the Internet known as the World Wide Web and may in fact help to explain the Web's great popularity. The Web is its own map. See Figure 4. On the Web, space appears on the computer screen as a continuous series of texts (or sounds or images) with one screen document connected to the next *via* imbedded hypertext links.

The hypertext links are typically displayed in bold or by an icon (e.g., for links to graphic or audio materials) so that the text on each screen also displays a map of the connections to other portions of the Web's information space. A mouse click on the highlighted Web text or "hotlink" will take you there—i.e., display the document by making a network connection to the computer housing the linked Web document you have selected. The document may be on a computer an ocean away or merely on another portion of the computer hard drive used by the first document. No matter; the hypertext map will provide the directions. No knowledge is

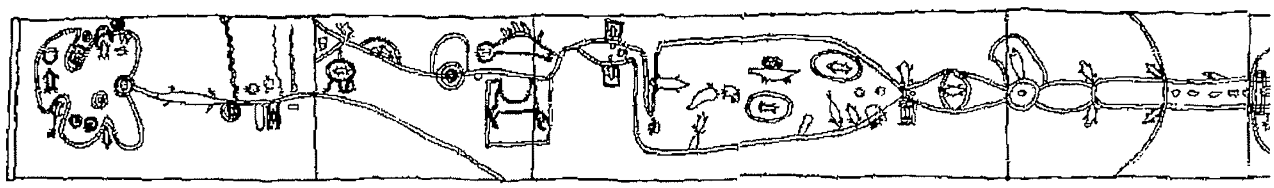


Figure 2. The migration map of Ojibway Chief Red Sky, an American Indian, shows the linkages between geographical features—lakes, rivers, sandbars, and islands—of the Great Lakes region. The map does not follow the Western conventions of scale, but neither does cyberspace. Source: S. Dewdney, *The Sacred Scrolls of the Southern Ojibway* (University of Toronto Press, 1975)

needed about the computer's location or about the tens of intervening communications links which may be involved in the process.

Hence, one approach to mapping the Web is compiling a set of the hypertext screens for different Web sites (typically known as "Home Pages"). In fact, many new Web guidebooks consist of little else.

But the on-line world breaks down the distinction between maps and territories in a deeper sense as well. Navigating the Net largely requires the mastery of a set of "hands-on" skills. Many of these skills are intuitive and very hard to articulate (like learning to surf or ride a bike). Ask computer hackers to tell you how they got some information off the Net and their replies are likely to be incoherent; ask them to draw you a map and you are likely to get annoyed scowls. Join them at the keyboard and their web mastery is immediately apparent.

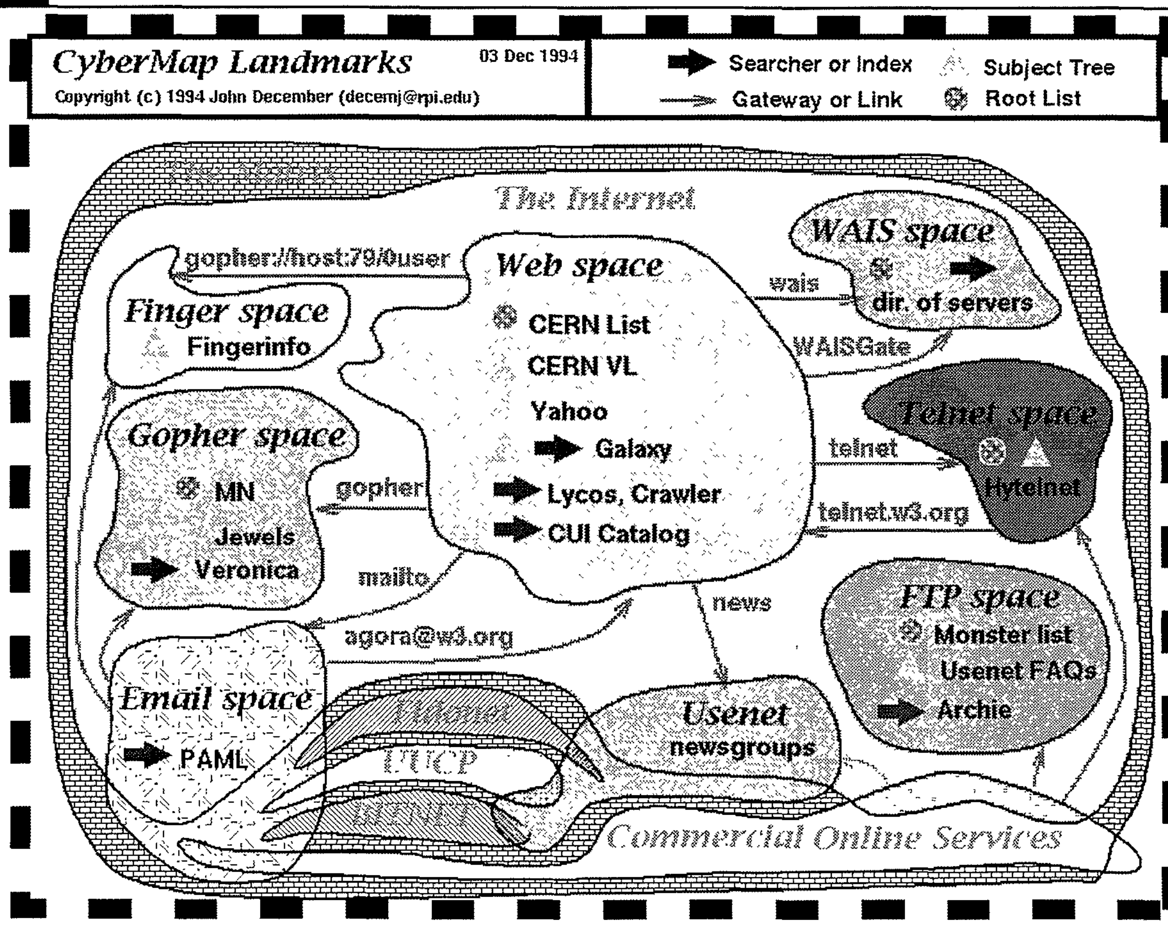
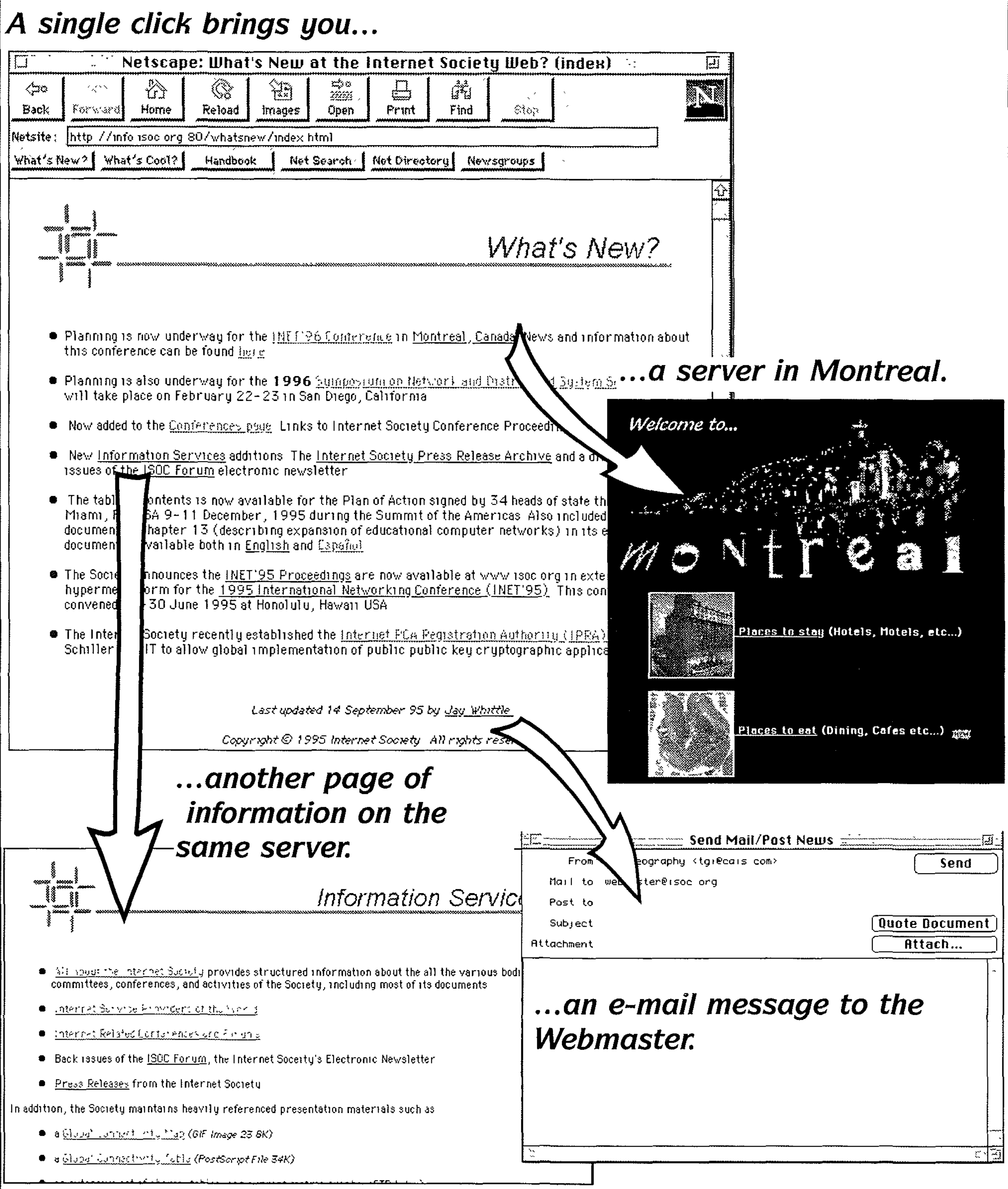


Figure 3. Like Red Sky's chart, John December's map of Cyberland shows the linkages between essential features of the territory.

Figure 4. The Web is its own map. The page below, from the Internet Society's home page, is an exemplary use of hypertext. The What's New page functions as both a bulletin of important information, such as announcements of upcoming events, and as a tool for finding additional information. The Society's server is in Northern Virginia. But In the new geography of cyberspace, another file on the same computer and a file in Montreal, Canada, are exactly the same distance away: one click. Web maps may also be annotated by e-mailing the author.



This may help us understand why there are now millions of people in cyberspace but few maps showing how to get there. In a very real sense the session is the map. Or to paraphrase Marshall McLuhan, the medium is the map.

The Future of Cybermaps

"Once [a] map [is] completed, cartographers ancient or modern never retain control over the territory....The territory, literally and figuratively, is ceded to the powers that be."

Stephen S. Hall

Whether one accepts today's tribal charts of cyberspace as "real" maps or not, the history of cartography suggests that it will not be long before they are superseded by a more mercantile genre. As Hall, and other historians of mapmaking have observed, " the domains that explorers chart, and the maps they produce, open up territories to interests that view them differently.... [B]e they goldfields, stands of timber or... human cultures... maps serve as the groundplan, the blueprint, the graphic agenda for subsequent exploitation."

While still in their infancy, cybermaps are fast falling into this older pattern. Since approximately 1993, when the World Wide Web began to showcase the Internet's market potential and the voluntary ban on commercial traffic began to erode in the U.S. (triggered, in part, by the end of government funding) most of the world's major information companies have begun to stake out their territory in cyberspace.

IT IS OFTEN SAID THAT "NO ONE OWNS THE INTERNET." BUT EACH OF THE INDIVIDUAL PARTS—THE TRANSMISSION FACILITIES, FILE SERVERS, SOFTWARE AND ON-LINE INFORMATION—GENERALLY DOES HAVE A LEGAL OWNER.

It is often said that "No one owns the Internet." This may have some philosophical truth insofar as the Internet is more than the sum of its parts. But each of the individual parts—the transmission facilities, file servers, software and on-line information—generally does have a legal owner. The software part of cyberspace is particularly important, of course. It at once provides the illusion of space as well as the tools for navigation. Tools, such as application programs (for e-mail or information retrieval) and net interfaces or browsers (Mosaic, Netscape) comprise some of the most valuable intellectual property in this new world.

Not surprisingly, therefore, the Net's most advanced navigational tools and the cyberscouts who created them have drawn the attention of a new breed of corporate land barons. Where possible, these new world property companies have not only bought the software they need to exploit this new terrain, but the cyberscouts (a/k/a software development teams) which created them. (Today's small development teams for Internet software are the 20th century equivalent of sea captain, pilot, crew, draftsman, printer, typographer and bookbinder all rolled into one.)

One of the shrewdest of these new property companies is Netscape Communications, which was created by Jim Clark, an entrepreneurial engineering professor and the founder and former Chairman of Silicon Graphics, now a multibillion-dollar computer software company. In 1994 Clark persuaded Marc Andreessen and colleagues, who had developed Mosaic, the first popular Web browser, to join his new company. Netscape's own Web browser, Netscape Navigator, reportedly recoded from scratch, has since become the market leader, making both Clark and Andreessen extremely wealthy.

Many early corporate settlers of cyberspace, however, are finding that despite a variety of new navigational tools and telephone help lines the geography is still chaotic. Everyone is next door to everyone else. Or as James Joyce put it in *Finnegan's Wake*, "Here comes everybody."

The information you need is always one more mouse click away. There is no central directory information. And just when you've learned how to find a site, the address changes. Again, however, if history is any guide, as the corporate frontier expands across cyberspace, the seemingly disconnected local geographies of the Net may well be encompassed by a standard global grid. Such grids have also been a mainstay of Western cartography (they were also used in China) since Ptolemy's time.

From Chaos to Grids

Ptolemy's *Geographica* (circa 150 CE) was the first Western map of the entire world. But Ptolemy's genius lay not in his encyclopedic knowledge but in his methodology: his new map presented all the known information in a standardized and consistent way with grid lines of latitude and longitude. David Turnbull, the Australian scholar, writes, "This metrication meant that all points were commensurable: that is, distances and directions could be established between one place and any other. Further, unknown places could be given coordinates." Thus, continues Turnbull: "The significance of Ptolemy's *Geographica* was not just in its use of a grid: it was also an atlas which enabled the co-ordination of maps of individual lands into one map of the world."

Ptolemy's grid based maps, capable of incorporating the known and the unknown, came to be a distinguishing feature of Western maps as compared to tribal or aboriginal maps. Unlike tribal maps, which were typically local in scale and had no common metric, Ptolemy's map and its successors which refined the application of latitude and longitude, were generalizable and quantifiable. They afforded an exact description of territory and of property rights. Such grid based maps will have an inevitable appeal to cyberspace's new land companies as well.

How will the grid come to cyberspace? We can't be sure yet—indeed, it is possible that cyberspace will never be so quartered—but software innovations and industry agreements are both likely to play a role. Two areas, in particular, bear watching: Internet directory services and universal browsing tools.

These areas are of special interest because, although it is invisible to most users, the Internet already has a type of grid known as the Domain Name System (DNS). The DNS is a distributed database which contains a discrete 32 bit numeric address (typically a network, subnet and system number) for every registered computer in the world and a translation program so that these addresses can be converted into the alphabetical name each host computer is commonly assigned (e.g., 204.157.31.32 = tgi.cais.com). When an Internet user types in the name of a host to be contacted, the user's computer first asks a DNS computer for the address and then routes the user's communication accordingly. The DNS is administered by the InterNIC, a non-profit organization near Washington, D.C.

IF HISTORY IS ANY GUIDE, AS THE CORPORATE FRONTIER EXPANDS ACROSS CYBERSPACE, THE SEEMINGLY DISCONNECTED LOCAL GEOGRAPHIES OF THE NET MAY WELL BE ENCOMPASSED BY A STANDARD GLOBAL GRID.

In theory, the DNS provides a metric for mapping the Internet quadrant by quadrant or numbering block by numbering block. In practice, however, such a map would likely be quite confusing and of limited economic value. The DNS currently is both arbitrary and incomplete. Hosts may be assigned numbers according to their line-of business (education, military, commercial) or on a geographical basis. The DNS is also decentralized; sub-administrators (e.g., for computers assigned numbers in the educational block) may assign (or even take back) new sub-network or system addresses according to their own rules so that sub-addresses may not be numerically consistent.

Beyond that, the DNS covers only host computers; individual users are commonly linked to the Net through thousands of local e-mail systems which have their own internal numbering rules. The quickest way to find someone's E-mail address is often to telephone them and ask. There is no comprehensive national or international directory of e-mail addresses.

But the shortcomings of the Internet's current grid are likely to be a passing phase. Most of the problems which now make it so hard to pinpoint any given site in cyberspace with any consistent metric are likely to be fixed within the next decade. AT&T and other organizations are working on global e-mail directories. And an updated Domain Name System is being considered by the InterNIC and the Internet Society's Engineering Task Force. As importantly, the courts have begun to address the legal status of the InterNIC and affiliates to resolve numbering disputes and parcel out unique names in cyberspace. In fact, for most companies the right to use their own name in cyberspace and to move it from one numeric address to another (portability) may be more important than gaining the rights to any particular address.

The typical Internet user probably will never know whether the Net's numbering system has changed. Internet browsers, such as Netscape, already provide a largely seamless connection to the Net's disparate information spaces and sites. And even more user-friendly software applications are on the way. They will offer point-and-click links to global directories which will soon be taken for granted much as they are for the world's telephone networks.

Yet once network addresses are rationalized and the procedures for changing them become legally defined, new kinds of property-based maps of cyberspace are likely to arise tied to the locational metric (grid) used to define these rights. Such maps may be of limited navigational use. But like the real estate plats on file at local town halls, they may be of decisive legal and economic value. (For example, a grid register may protect a site from being "moved" without due process or taken by the government without just compensation.) Tomorrow's cybermaps then will record the boundaries of corporate space on the Net even as earlier ones illustrated its tribal origins.

• • •

What will become of today's cybermaps? Some will continue to circulate. The Net's frontiers are still expanding rapidly. But because these early maps are largely tied to our current software and naming conventions, most will become obsolete. Within a decade, in fact, *TeleGeography's* first cybermaps may be viewed as no more than a set of historical pictures, a guide to a world and a set of skills which no longer exist. Intriguing? Yes. But of limited use, more art than map. Cybermaps: Collect them while you can. ◆

For further reading:

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Barry Lopez. *Arctic Dreams.* New York: Charles Scribner's Sons, 1986.

Ed Kroll. *The Whole Internet Users' Guide and Catalog.* Sebastopol: O'Reilly & Associates, Inc., 1992.

David Turnbull. *Maps are Territories, Science is an Atlas.* Chicago: University of Chicago Press, 1993.

A CYBERMAP GAZETTEER

Maps of the On-Line World for Browsing and Business

by John December

Perhaps you've heard of a place that exists inside computers. You may have seen it in the movies--characters in two new films *VIRTUOSITY* and *The Net* struggle with the mystery and intricacy of global computer networks. Maybe you've read William Gibson's 1984 novel *Neuromancer* in which the main character navigates a sensory maelstrom called The Matrix that connects the world's computers. Or perhaps you've observed the growing coverage of the on-line world in the press and the new interest the business community has for anything on-line.

But is the world of on-line communication really like that shown in the movies or described in science fiction? Global communication networks are not science fiction, of course. Since the 1960s the world's cooperatively-run patchwork of computer networks, known as the Internet, has grown rapidly. It now encompasses over 6.5 million hosts (networked computers) and at least 25 million users.[1]

Yet the world of on-line communication remains largely unmapped, leaving many people to visualize it only through depictions in movies and novels.

While technical diagrams can show the schematic topology of computer networks, the abstract world of on-line communication, cyberspace, eludes a simple graphical representation. The activity in cyberspace is surprising diverse: people use the Internet and on-line services for information retrieval, communication and interaction. How can maps capture the scale and scope of these activities? What shapes and symbols should be used? What markers and signposts do cyberspace navigators need? And, if cyberspace can be mapped, will these new charts help us identify its owners, if owners there are?

Definitions

Cyberspace: *an abstract place in which people communicate information or otherwise interact using electronic terminals.*

This is a broad definition. Does it include the phone call to your Aunt Martha to get her potato salad recipe? Yes, but this gazetteer will focus on communications in cyberspace where the participants use computers as the end-point device for sending or receiving messages. Cyberspace certainly does include phone lines—they are often the basis for data transfer. But I won't be mapping calls to Aunt Martha here.

Cybermap: *a graphical representation of cyberspace, typically showing information sources (sites) and relationships (links) between different sites and networks of sites.*

A cybermap is similar to a physical map: they each attempt to evoke what is out there as well as show relationships. And, like physical maps that try to show the human activity associated with a particular place--trade and manufacturing for example--these cybermaps attempt to show the human geography of cyberspace and not merely the "lay of the land."

A comprehensive glossary of the technical terms in this article is provided on page 82.

Mapping Networks

Engineers begin with blueprints, and early maps of cyberspace were often schematic diagrams of the physical computer networks. Network information centers such as SuraNet, UUnet, and the Digital Equipment Corporation (DEC) carry a wide range of these maps.[2] These schematics or network topologies typically portray the routers and telephone lines that comprise a network, as well as points where several networks exchange traffic (see Figure 1).

While of crucial importance to the administrators of the Internet, these maps are of little interest to typical end-users. Internet navigators do not need to know what switches and wires a message uses in order to make a connection. Instead, the navigator needs to know if it is possible to reach a user or information resource on another computer network using a particular information protocol. Hence, while network topological maps can help answer the question "can you get there from here," the level of detail is usually too fine for the end-user.

Brandon Plewe has adapted the geographical approach for the general user with his Web-based Virtual Tourist (see Figure 1). This series of maps on the country and province level plots Internet servers, leaving out the dedicated telephone lines that connect them. The maps serve both as documents, showing where servers are, and as navigational tools, for a mouse-click on a server connects the user to that computer.

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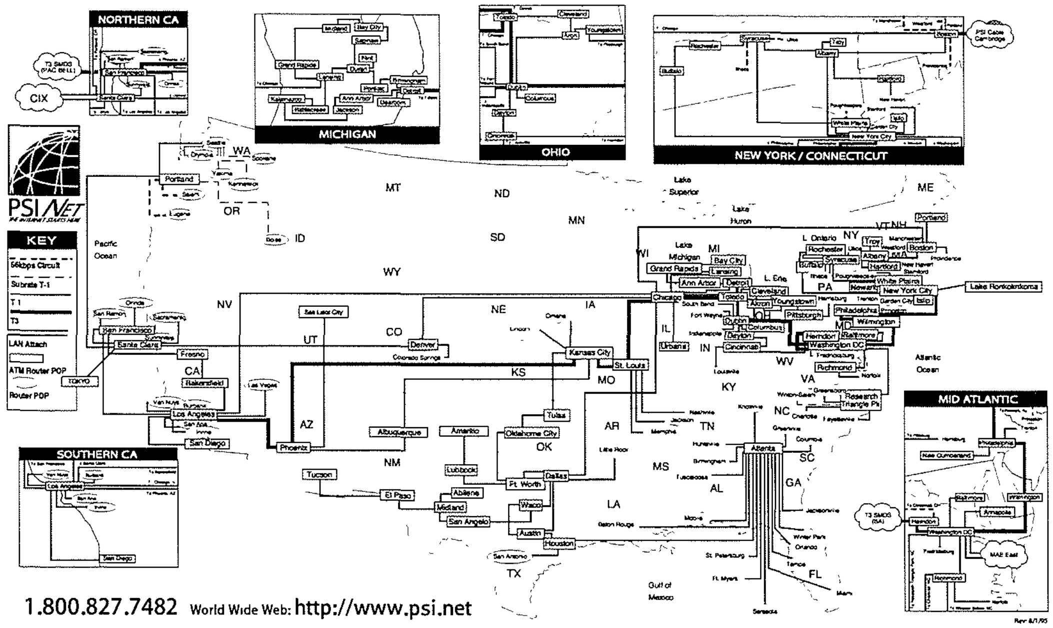
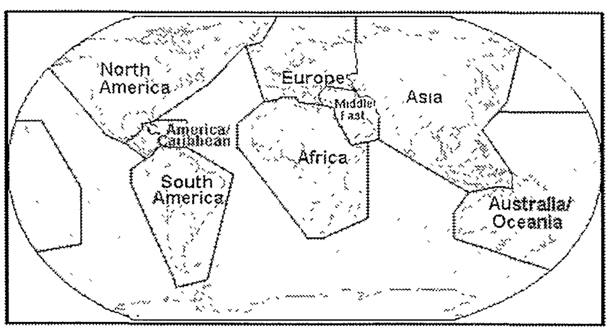
Figure 1. The Underlying Network Geography



The PSI Network

A network topology map, like the one above, is a reminder that cyberspace is not entirely an abstraction. The underlying infrastructure of routers, telephone lines, access points, and exchange points makes the virtual geography of the Internet possible.



The Virtual Tourist

The opening map (left) of the Virtual Tourist (http://wings.buffalo.edu/world/) shows the world. This map is an imagemap, meaning that each pixel on the map is potentially a link to another Web resource. By clicking on the opening world map, you can focus on successively smaller geographical regions. For example, by clicking on North America on the world map, you get an outline map of the United States. You can then click on North Carolina to get this detailed map (below) of North Carolina Internet information servers.

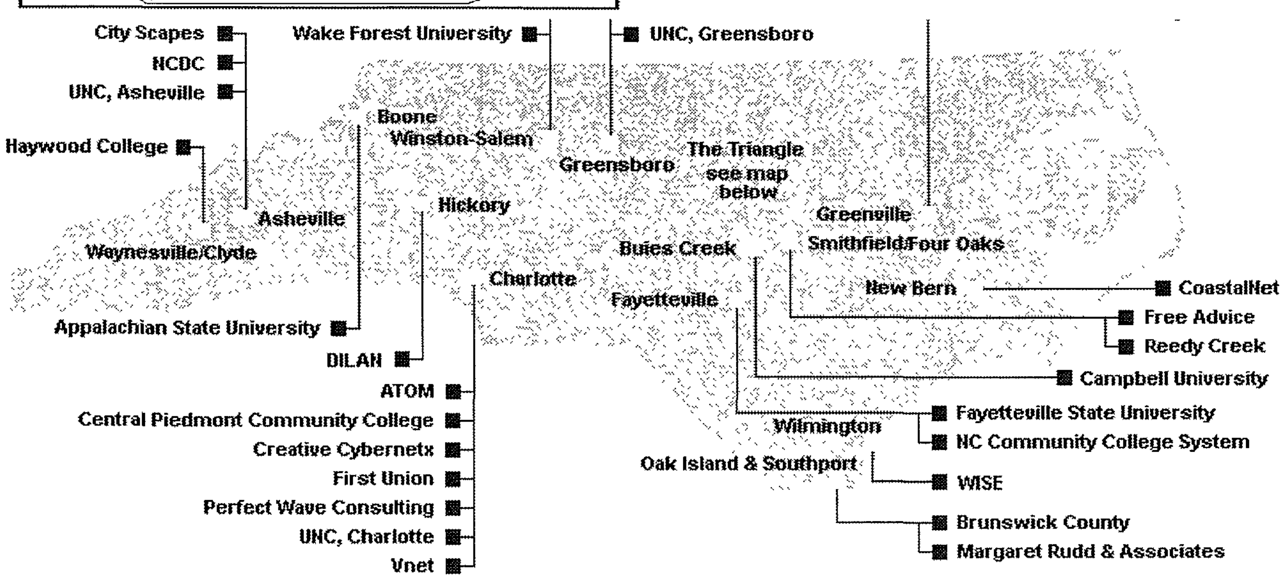
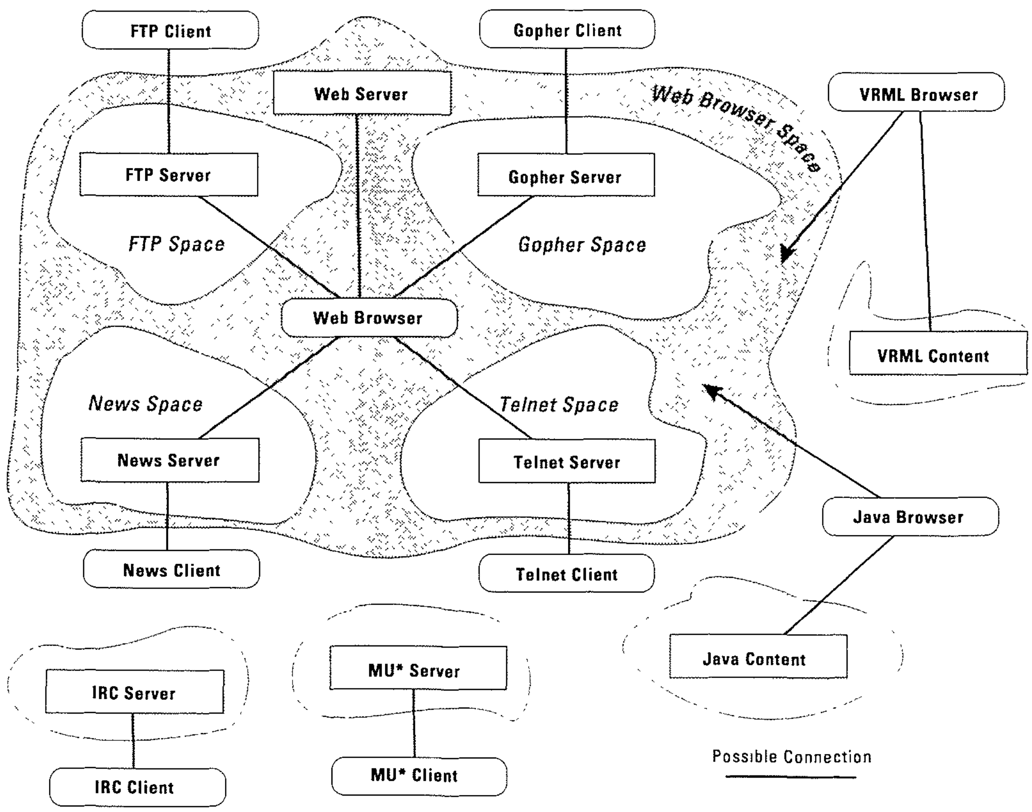


Figure 2. You Can't Get There from Here.

Some clients can access only the server type matching the protocol for which they were built (e.g., a Gopher client can access only Gopher servers). Other kinds of clients are multi-protocol. In particular, World Wide Web clients can access most of the popular information protocols on the Internet. But most browsers cannot reach MU* (multi-user) and IRC (chat) servers, leaving these protocols as islands in cyberspace.



Mapping Protocols

Since the early 1990s, John Quarterman has provided high-level maps of global networks on the Matrix, which he defines as the set of all networks that can exchange electronic mail.[3] I too differentiate regions of cyberspace based on the kind of information that can be exchanged. I broaden this distinction to include many other information protocols used in cyberspace. Each information protocol defines what I call an information space, or the set of resources that can be retrieved using a particular information protocol.

The physical world is distinguished by mountains, forests, and oceans. Data communication protocols carve the online world into *information spaces.* Only specific kinds of software recognizes each information space's data communications protocol (See Figure 2). Thus, just as a traveler in the physical world needs a boat to travel on water or up a river, a cyberspace navigator requires special equipment to navigate (or observe) certain on-line information.

The Internet is itself comprised of a variety of information spaces, each defined by a protocol. Users on other networks must use gateways to access these Internet information spaces. Many developing countries lack access to the Internet, but can reach parts of cyberspace using other networks. They can, for example, send and receive e-mail, and reach Usenet, an application for disseminating text discussion among cooperating computer hosts. But there are many sections of the Internet, e.g. gopherspace, that they cannot penetrate.

Users with full Internet access are less restricted by protocols. Just as the airplane is an all-purpose vehicle that can fly over land, water, or ice, the browsers that dominate today's Internet are equally adept at retrieving information from servers running the most popular protocols: HTTP, gopher, ftp, and news. Many browsers can even send and receive mail. But new kinds of information found on some Web pages require new, specialized clients.

For example, a new software language called Java, originated by Sun Microsystems, allows developers to create computer programs which can be transferred over the Internet and used in a Java-enabled Web browser. A Java programmer can create an interactive game, educational lesson or advertisement and link it to a Web page. When a user with a Java-enabled Web browser accesses this page, the software, known as an applet, that runs the game or other application is automatically downloaded to the user's computer for execution. Java's ability to deliver new applications will dramatically increase the level of interactivity possible on the Web.

Virtual Reality Modeling Language (VRML) will also open up the Web to three-dimensional visualization. Like Java, VRML is a language used to describe content that only special browsers can interpret. VRML allows programmers to describe three-dimensional scenes. that only users of VRML-enabled browsers can explore. Applications for VRML include architectural models, interactive art, and scientific modeling.

Other information spaces remain unintegrated into graphical or general use browsers. Notably, IRC (Internet Relay Chat) as well as MU* (Multiple User Dialogue/Dimension/Simulation/Chat), are spaces for real-time text interchange among participants. These spaces

Figure 3. Landmarks of the Internet

Web space

- Server list: Comprehensive List from net.Genesis corporation http://www.netgen.com/cgi/comprehensive
- Subject trees: Yahoo subject tree http://www.yahoo.com/ and Global Network Navigator http://gnn.com/
- Keyword searchers: Lycos spider http://www.lycos.com/ and Webcrawler http://webcrawler.com/

FTP space

- Server list: ftp://rtfm.mit.edu/pub/usenet/news.answers/ftp-list/
- Subject tree: ftp://rtfm.mit.edu/pub/usenet/
- Keyword searcher: http://pubweb.nexor.co.uk/public/archie/servers.html

Usenet

- Server list: Usenet newsgroup archives for comp.mail.maps ftp://rtfm.mit.edu/pub/usenet/comp.mail.maps/
- Subject tree: Newsgroups news:
- Keyword searcher: DejaNews http://www.dejanews.com/

Gopher space

- Server list: Minnesota Gopher gopher://gopher.micro.umn.edu:70/1
- Subject tree: Gopher Jewels http://galaxy.einet.net/GJ/
- Keyword searcher: Veronica gopher://veronica.scs.unr.edu/11/veronica

Telnet space

- Server list / Subject tree: Hytelnet http://www.usask.ca/cgi-bin/hytelnet
- Keyword searcher: http://galaxy.einet.net/hytelnet/HYTELNET.html

WAIS space

- Server list / Subject tree / Keyword searcher: WAIS, Inc. http://www.wais.com/

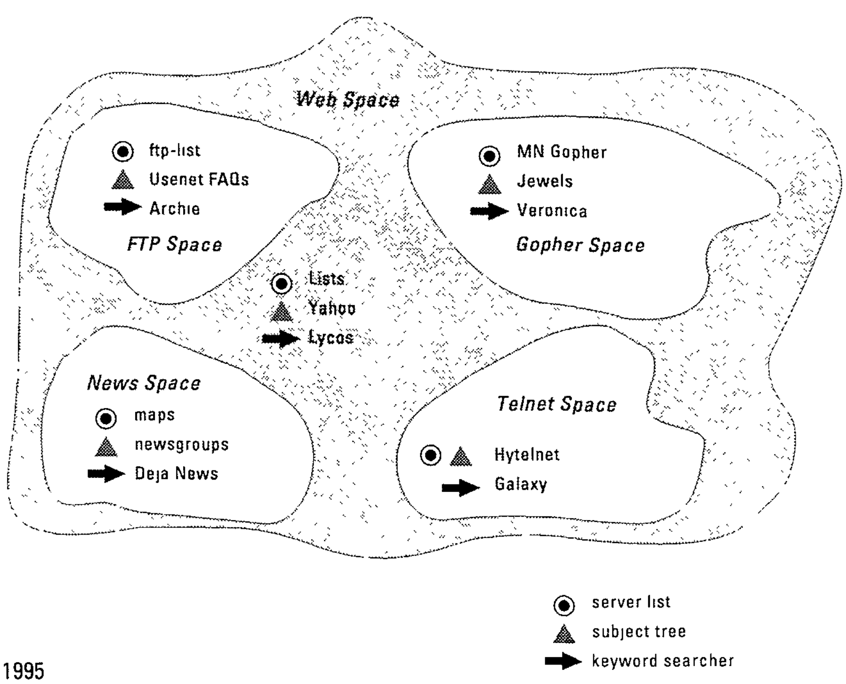
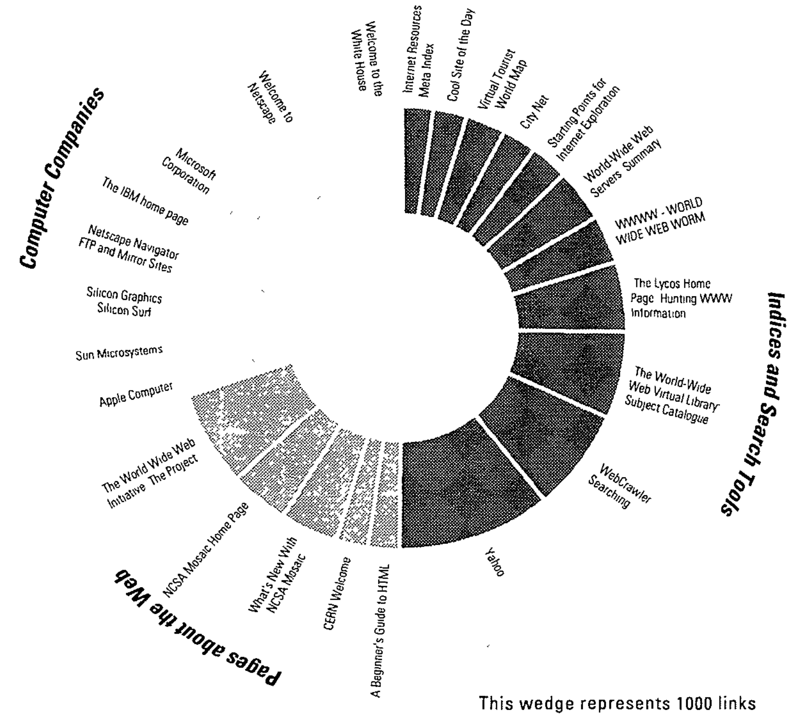


Figure 4. Frontage on Main Street

Though the Web has no central entry point, the most popular entry points serve as the jumping off points for navigation. This map shows the major Web servers based on how many Web documents reference them. It is based on the WebCrawler's (http://webcrawler.com/) database as of August 14, 1995, with data from 196,051 documents on over 46,224 different servers.

Not surprisingly, navigational tools such as those mapped in Figure 3, p. 77, are among the most frequently referenced sites. Major computer companies have also thrust themselves into center stage, and the many links to the White House symbolize American prominence on the Web.



	Web Site	Links	URL (address)
1	Yahoo	3437	http://www.yahoo.com/
2	Welcome to Netscape	2593	http://home netscape.com/
3	WebCrawler Searching	2312	http://webcrawler com/
4	The World-Wide Web Virtual Library· Subject Catalogue	1918	http://www.w3 org/hypertext/DataSources/bySubject/ Overview.html
5	The Lycos Home Page· Hunting WWW Information	1565	http //lycos.cs.cmu edu/
6	The World Wide Web Initiative: The Project	1293	http://www.w3.org/hypertext/WWW/TheProject.html
7	NCSA Mosaic Home Page	1267	http://www.ncsa uiuc.edu/SDG/Software/Mosaic/ NCSAMosaicHome.html
8	What's New With NCSA Mosaic	1264	http://www.ncsa.uiuc edu/SDG/Software/Mosaic/Docs/ whats-new.html
9	Welcome to the White House	1221	http://www.whitehouse.gov/
10	WWWW - WORLD WIDE WEB WORM	1145	http://www.cs.colorado edu/home/mcbryan/WWWW html
11	World-Wide Web Servers: Summary	1143	http://www.w3.org/hypertext/DataSources/WWW/ Servers.html
12	Microsoft Corporation	1124	http://www.microsoft.com/
13	The IBM home page	996	http://www.ibm.com/
14	Netscape Navigator FTP and Mirror Sites	945	http://home netscape.com/comprod/mirror/index html
15	The World Wide Web Initiative: The Project	883	http://www.w3.org/
16	Starting Points for Internet Exploration	883	http://www.ncsa.uiuc edu/SDG/Software/Mosaic/ StartingPoints/NetworkStartingPoints.html
17	City.Net	810	http://www.city.net/
18	Silicon Graphics' Silicon Surf	804	http://www.sgi com/
19	Virtual Tourist World Map	801	http://wings.buffalo.edu/world/
20	Sun Microsystems	794	http://www.sun com/
21	Cool Site of the Day	759	http://cool.infi.net/
22	Apple Computer	742	http://www.apple.com/
23	Internet Resources Meta-Index	719	http://www.ncsa.uiuc.edu/SDG/Software/Mosaic/ MetaIndex.html
24	CERN Welcome	712	http://www1.cern.ch/
25	A Beginner's Guide to HTML	694	http://www ncsa uiuc.edu/General/Internet/WWW/ HTMLPrimer.html

require a special client, or in some cases, are accessible through Telnet interfaces. No clients have emerged for IRC and MU* which do for these spaces what Mosaic and its successors have done for the Web: provide a user-friendly, graphical interface to content and activity. These spaces then remain very much "isolated" islands in cyberspace, unintegrated into a general-use browser (see Figure 2).

Mapping Content

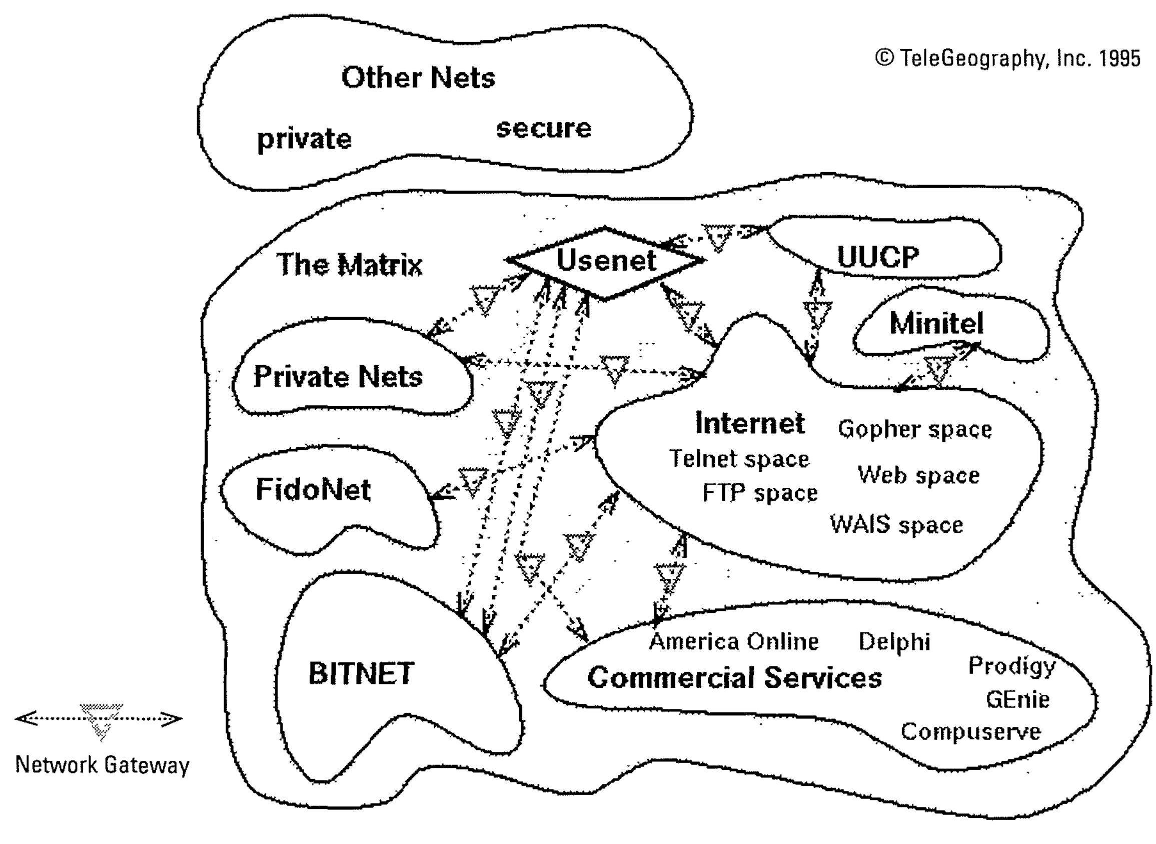
Even with a multipurpose browser and access to millions of public databases, it can be difficult to find specific information. Most users are not interested in the technical details of where an article, photograph, or sound clip is stored or how it will be compressed, broken down into packets, and transmitted with error-checking to their computer. All they want is to find it and read, view, or listen to it. They don't need cartographers; they need librarians.

The best librarians are on-line (see Figure 3). Every week thousands of sites are added to the Internet, making any paper catalog obsolete as soon as the ink is dry. But on-line catalogs are continuously updated, and users can choose among several excellent catalogs such as Yahoo and the Global Network Navigator. Like the systems libraries use to order human knowledge, these catalogs organize sites into major subject areas (e.g. business & finance, education, government, and pages about the Web itself). These categorizations can be arbitrary, and a user might have trouble guessing, for example, if information about the U.S. Small Business Administration would fall under "business" or "government."

A complete map of the Web's hypertext linking relationships would be unprintable—making such a map would be analogous to mapping every interstate, state highway, and dirt county road in the United States on a postcard. Fortunately, there are a number of powerful search tools available online as well. Searching with keywords, a user can explore the parts of cyberspace that interest her and build up her own catalog of knowledge.

Figure 5. Network Gateways: A Cyberspace Divided

In this map, the major computer networks huddle in the mass of the Matrix, the term for the global collection of computer networks that can exchange electronic mail. The Internet serves as a common ground for much communication on-line, with commercial on-line services building gateways for electronic mail as well as other communication and data protocols to the Internet. Major national services such as France's Minitel (http://www.minitel.fr/) now provide gateway communication from their services to the Internet.



PC Computing magazine has created a subject guide to the World Wide Web using a subway-map metaphor, with major subject categories represented as different subway lines connecting various Web sites.[4] Like all subject guides, this subway-map approach is subjective: links show semantic or associative connections among resources apparent in the cartographer's mind, not necessarily actual hyperlinks that exist on the Web. While this approach is very useful for giving users a subject breakdown of the Web's information space, it doesn't reveal the actual hypertext topology of the Web.

Mapping Property

Having an airplane, a map, and clear weather does not mean that you can fly anywhere you like; violate restricted airspace, and you will likely be shot down. While most of the Internet is open to all comers, a great deal of cyberspace is partitioned off, with access only for those who belong (see Figure 5).

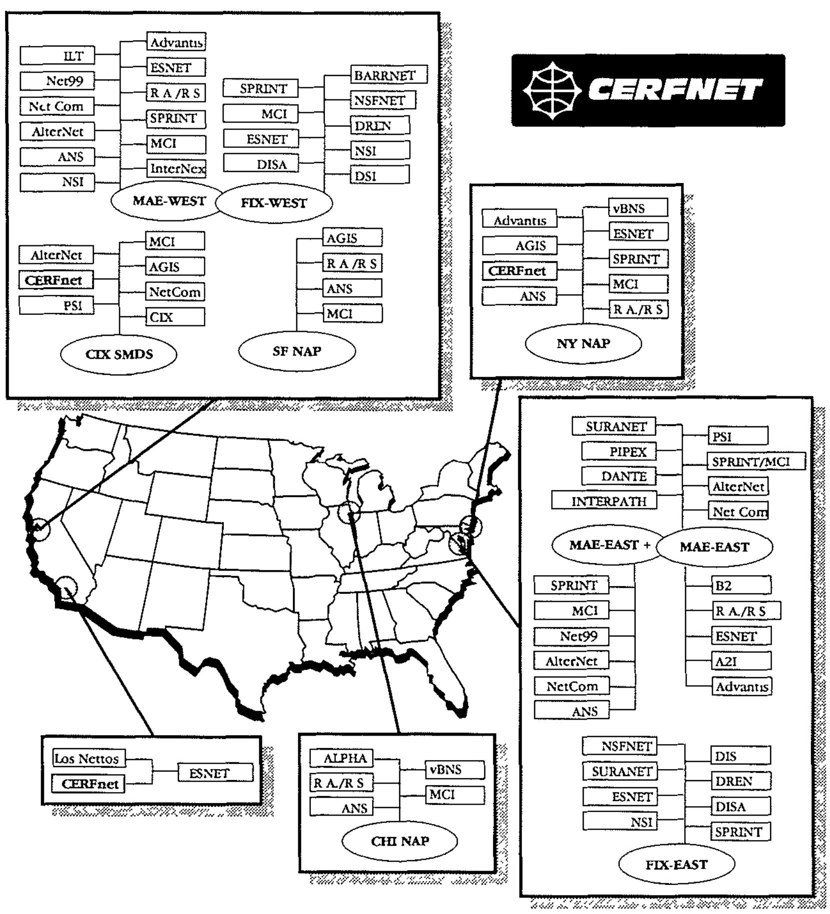
Within the Internet, there are many sites that restrict access. Some demand only the user's name, address, and other personal information, which is later used to generate mailing lists and to prove to advertisers the popularity of a given site. Other sites are proprietary databases, and a user must set up an account with a credit card and pay up to $100 per hour to use the site. Conversely, the National Science Foundation vBNS (Very High Speed Backbone) permits traffic only for research and educational uses.

On-line services—for example, Prodigy, CompuServe, America Online (AOL), the Microsoft Network, and Minitel—have created gateways to let their subscribers reach the Internet. These gateways are only one-way. An AOL subscriber may be almost unaware of having slipped out of AOL's proprietary network and into the general Internet. But the Internet user who does not subscribe has no means of accessing America Online's resources.

Finally, there are other networks that don't connect to the Internet or exchange electronic mail with the Matrix because

Figure 6. The New Internet

The old NSFnet is gone, leaving in its place not a single backbone but a group of for-profit networks that have agreed to exchange traffic at designated points. The names on the map—MCI, Sprint, ANS (owned by America Online), and others—are a reminder that maps can be used to stake claims. Source: CERFnet.



of privacy or security reasons. For example, the global banking system, proprietary local area networks (LANs), and even private global networks don't connect with or exchange data with the Matrix or the Internet.

Challenges in Mapping Cyberspace

This compendium of cybermaps doesn't capture the whole extent of cyberspace. Like the crude, hand-sketched charts of early explorers, these maps touch on what I, as a cyberspace participant, have found relevant in my own explorations. These maps necessarily present a view of cyberspace distorted by my perspective and by the need to simplify cyberspace in order to create a graphic model of it.

Creating better cybermaps requires advances in many techniques. Rendering cybermaps in the future should become more automated. For example, the approach taken by Kaleida Labs using the ScriptX language and class library produces network topological maps from a database of computer hosts.[5] Using these tools, identifying relevant data and defining methodologies which translate this data to produce a variety of maps will challenge cybercartographers for some time to come.

In particular future cybercartographers will need to work on:

- **Defining Methodologies:** Physical maps often use land area as a basis for depicting the size of territories. In cyberspace, a variety of methodologies for translating the structure of cyberspace into map renderings (either two or three-dimensional maps) need to be developed. For example, cartographers might use graphics to depict the number of files retrieved ("hits") from a Web server.[6] Others might track the volume of sales generated by a server (analogous to maps showing import/export revenues of a country).

- **Defining and Gathering Network Information:** Global cyberspace involves cooperating organizations around the world working to achieve interconnectivity among tens of thousands of networks using hundreds of communication protocols. Gathering statistics on this activity is not easy. There are no standard reporting procedures, nor any international body coordinating the collection of comprehensive statistics on activity in cyberspace. Improving the cybermaps and charts presented in this article would require much more detailed statistics from all access, service, and information providers in cyberspace.

Until the end of April 1995, the NSF Net backbone project provided an excellent repository of traffic by protocol and through major points of the backbone. However, this data was limited in that it only showed a sample of Net traffic—that which flowed over the NSFnet backbone. Global cyberspace is much more complex than this. Commercial on-line services are part of cyberspace, yet they rarely release statistics about how much traffic crossed their gateways. Other spaces, such as for MU* and IRC, are non-commercial islands of uncoordinated activity which go unnoticed, with few descriptive statistics available.

Traffic is not the only important indicator to be mapped. Other variables are service (what companies provide connectivity?), the number of users (how many users does each company serve?), usage (how long are users logged into their accounts?), and revenues (how much does each user spend?).

• • •

Cyberspace is a frontier of the human imagination and intellect. With activities ranging from text discussion in MU*s to three-dimensional rendering of spaces with VRML, on-line activity has grown increasingly popular. Mapping cyberspace presents a challenge that will remain both exciting and ever more relevant as the world of on-line communication continues to grow. ◆

Notes

1 Starting with just a few host computers in 1969, the Internet connected 300,000 hosts by 1990 See M. Lottor, "Internet Growth (1981-1990)," RFC1296, ftp://nic.merit.edu/documents/rfc/rfc1296.txt. By July 1995, Internet survey statistics showed that the number of hosts on the Internet exceeded 6.6 million, over 100% more than the year before. See Network Wizards, "Internet Domain Survey, July 1995," http://www nw.com/zone/WWW/report.html Using these host statistics, the Internet Society has estimated that there are more than 25 million users of the Internet in 125 countries. For a discussion of the problems of estimating the number of Internet users, see J. Quarterman, "New Data on the Size of the Internet and the Matrix," http://www.tic.com/mids/pressbig.html The Internet Society estimates can be found at http.//www.isoc.org/.

It is not only the number of on-line networks and users that has grown The World Wide Web has achieved wide popularity since its introduction in 1993 By July 1995, there were over 21,000 computers providing Web information to at least 4 million users Matthew Gray's Web Wanderer Program contains a large database of Web servers (http://www.netgen.com/).

2.See ftp://ftp.sura.net/pub/maps/, ftp://ftp.uu.net/inet/maps/, ftp://gatekeeper.dec.com/pub/maps/.

3. See *TeleGeography 1993*, page 21, and generally http.//www.tic.com/.

4. See http://www.pc-computing.ziff.com/~pccomp/webmap/. The map is also bundled with *Atlas to the World Wide Web* by Bob Powell and Karen Wickre (Ziff Davis Press, Emeryville, 1995). For another application of the subway map approach, see http://ucmp1.berkeley edu/subway.html The Subway Navigator (http://metro.jussieu.fr.10001/) has maps of real subway systems in cities around the world.

5. See http://web kaleida.com/u/hopkins/arpanet/arpanet.html.

6. Commercial companies tracking Web usage include Webster Network Strategies, Inc 's WebTrack (http://www.webster.com/) and Digital Planet's NetCount (http://www.digiplanet com/DP1/netcount.html).

Internet Glossary

Anchor: The area of a hypertext document which is either the source or destination of a hypertext link.

Application: A software program that performs some task; an executable file located on a computer host.

Browser: A software program for accessing the World Wide Web; synonym for a Web client.

Client: A software program which requests information or services from another software application, a server program, and displays this information in a particular form generally specified by the computer hardware.

Data communication: The exchange of digital information among hosts according to particular protocols.

Database or content: The information provided by a network server.

Domain name: The alphabetic name for a host; this name is mapped to the computer's numeric Internet Protocol (IP) address.

FTP (File Transfer Protocol): A means to exchange files across a network.

FTP space: All information that can be retrieved from servers using the FTP protocol.

Gopher: A protocol for disseminating information on the Internet using a system of subject-oriented menus; items in the menus can be links to other documents, searches, or links to other information services.

Gopherspace: All information that can be retrieved from servers using the gopher protocol.

Graphical browser: A Web client which displays on-line images and fonts and which usually offers mouse-based point-and click commands.

HTML (Hypertext Markup Language): The software code used to create Web pages; Web browsers display these pages according to a browser-defined rendering scheme.

HTTP (Hypertext Transfer Protocol): The native protocol of the Web, used to transfer hypertext documents; also, the first part of a Web URL.

Home page: An entry page or screen of information for access to a local web; a page that a person defines as his or her principal page, often containing personal or professional information.

Host: A computer that is connected to a network.

HotJava™: A Web browser developed by Sun Microsystems capable of displaying programs written in the Java™ programming language.

Hypermedia: Hypertext which includes multimedia: text, graphics, images, sound, and video.

Hypertext: Text which is linked to other texts in the same document or otherwise and thus not constrained to a single sequence; Web-based hypertext is not constrained to a single server for creating meaning (i.e., it may include text distributed on several computers).

Internet: The cooperatively run, globally distributed collection of computer networks that exchange information via the TCP/IP protocol suite.

IRC (Internet Relay Chat): IRC provides real-time, many-to-many text discussion divided into channels, like CB radio.

Java™: An object-oriented programming language developed by Sun Microsystems for creating distributed, executable applications.

Keyword searcher: An application which helps users locate resources based on matching a set of words or phrases.

LAN: Local Area Network.

Link: A connection between one hypertext document and another.

Lynx: A nongraphical Web browser, developed by the University of Kansas.

Matrix: The set of all networks that can exchange electronic mail either directly or through gateways. This includes the Internet, BITNET, FidoNet, UUCP, and commercial services such as America Online, CompuServe, Delphi, Prodigy, as well as other networks.

Mosaic: A graphical Web browser originally developed by the National Center for Supercomputing Applications (NCSA); now includes a number of commercially licensed products.

MU*: MU*s offer groups of users real-time interaction (usually using text). They are traditionally used for social role-playing games.

Navigating: The act of observing the content of the Web for some purpose.

Net, The: An informal term for the Internet or a subset or a superset of the Matrix.

Network: A set of computers or other communication devices connected by telecommunication facilities.

Network access point: A major entry point to a network.

Network gateway: A connection between two networks where information coded in different protocols can be exchanged.

Network router: A computer which directs the flow of data from computer to computer in a network.

News space: All information posted to USENET groups.

Node (Page): A single file of hypertext markup language.

Packet: A set of digital data handled as a unit in data transmission.

Protocol: A set or rules or sequence of operations that specify how computers exchange or process digital information.

Server: A software application which provides information or services based on requests from client programs.

Server list: A list of servers which provide information in a particular protocol.

Site: File section of a computer on which Web documents (or other documents served in another protocol) reside; for example, a Web site, a Gopher site, an FTP site.

Spider: A keyword searcher for the Web.

Subject Tree: A breakdown of information in a hierarchical structure by subject or topics.

Surfing: The act of navigating the Web, typically using techniques for rapidly processing information in order to find subjectively valuable resources.

Telnet: A protocol for sharing information across networks using a technique for terminal emulation; a distant telnet user can "log in" to a remote computer as if they were a local user.

URL (Uniform Resource Locator): The addressing scheme on the Web. A URL identifies a resource on the Web: it tells a browser the computer and the site where a web page is located and what type of file or application it is. The URL for my home page URL is http://www.december.com.

Usenet: An application for disseminating asynchronous text discussion among cooperating computer hosts; The Usenet discussion space is divided into newsgroups, each on a particular topic or subtopic.

VRML (Virtual Reality Modeling Language): A specification for three-dimensional rendering used in conjunction with Web browsers.

WAIS (Wide Area Information Search): An information organizing application that responds to natural language queries by searching indexes of databases and retrieving resources.

Weaving: The act of creating and linking Web pages.

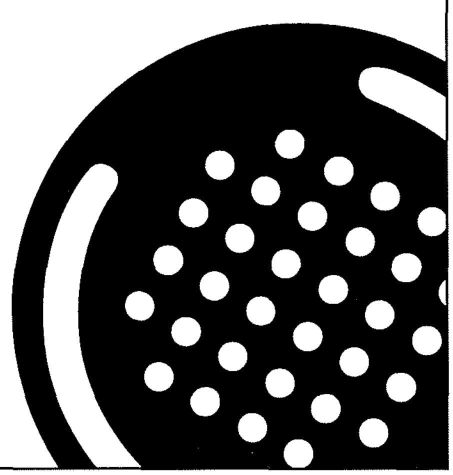
Web: A set of hypertext pages that is considered a single work; typically, a single web is created by cooperating authors or an author and deployed on a single server with links to other servers; a subset of the Web.

Web (The World Wide Web): A hypertext information and communication system popularly used on the Internet computer network with data communications operating according to a client/server model. Web clients can access multi-protocol and hypermedia information using an addressing scheme which involves URLs.

Web server: Software which provides services to Web clients.

Web space: All information that can be retrieved from servers using the hypertext transfer protocol.

Facilities and Carriers



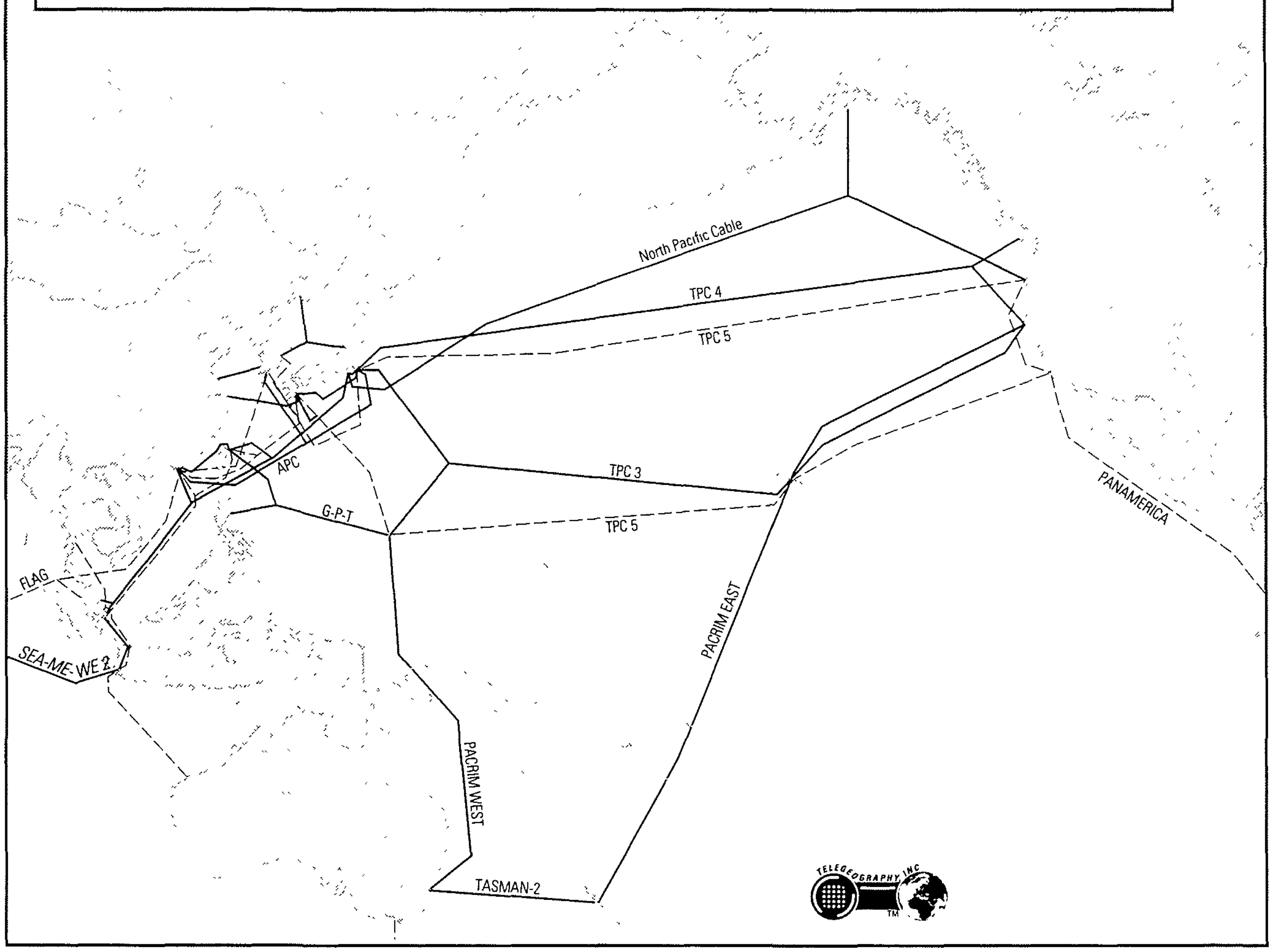
Trans-Pacific and Eurasian Cable Systems

Year in Service	Cable System	Cost (US$) per voice path	Capacity (voice paths)
1957	Hawaii 1*	378,000	91
1964	TPC-1*	406,000	167
1974	Hawaii 2*	41,000	1,690
1975	TPC-2*	73,000	1,690
1988	TPC-3	16,000	37,800
1991	North Pacific Cable	5,000	85,000
1992	TPC-4	5,500	75,600
1996	TPC-5	2,000	605,000
1997	FLAG	1,500	605,000

* No longer in service.

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). Fiber optic 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 connects 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 is generally excluded

Source: FCC and carriers.



MAJOR SUBMARINE CABLES

Trans-Atlantic Cable Systems

Year in Service	Cable System	Cost (US$) per voice path	Capacity (voice paths)
1956	TAT-1*	557,000	89
1965	TAT-4*	365,000	138
1970	TAT-5*	49,000	1,440
1983	TAT-7*	23,000	8,400
1988	TAT-8	9,000	37,800
1989	PTAT	6,000	85,000
1991	TAT-9	5,500	75,600
1993	TAT-10	4,000	75,600
1994	CANTAT-3	1,000	302,000
1996-97	TAT-12/13	1,000	600,000

* No longer in service.

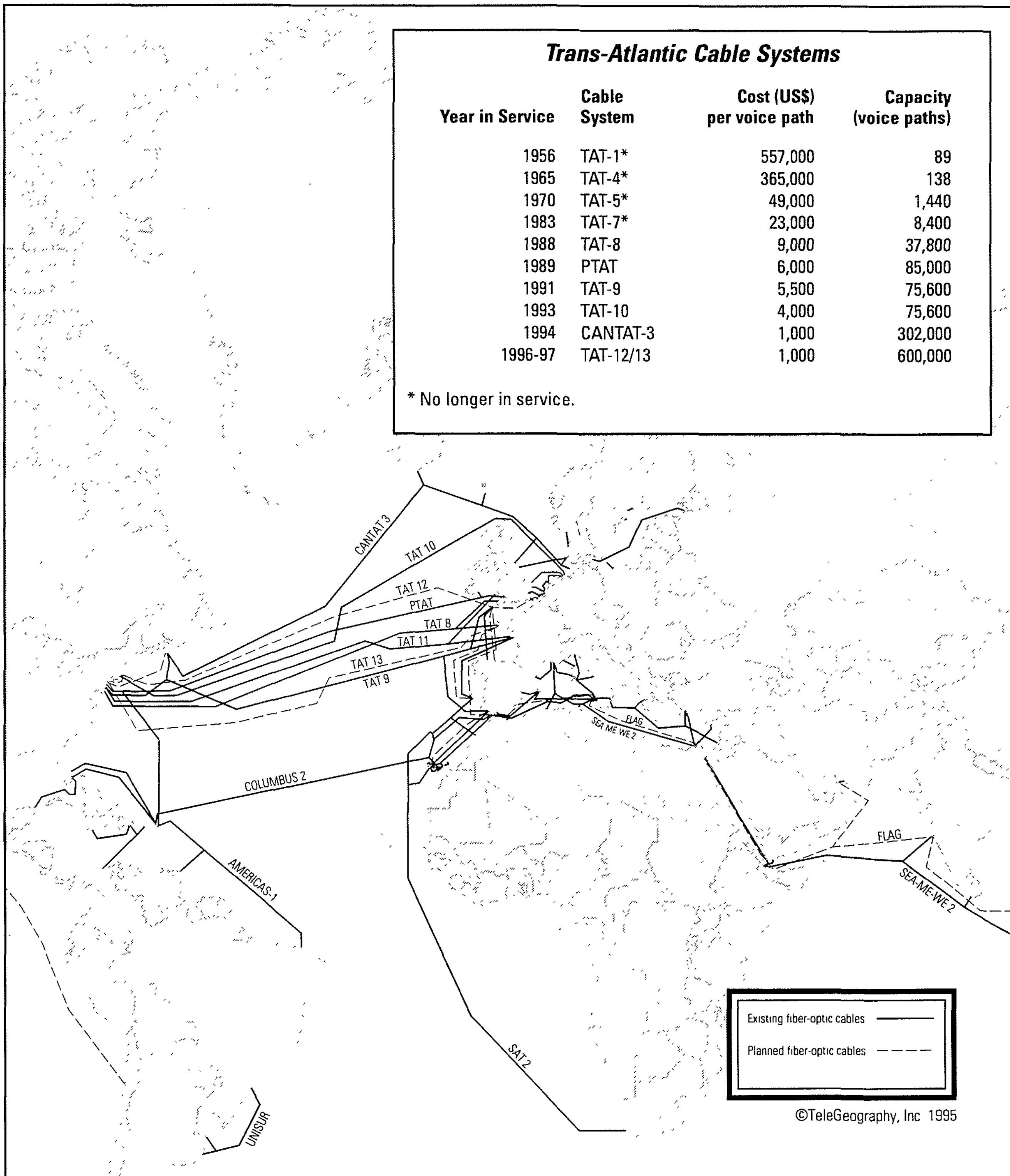


Table 1: Cable and Satellite Capacity on Trans-Atlantic and Trans-Pacific Routes, 1986-2000

	Trans-Atlantic (North America-Europe) Voice Paths		Trans-Pacific (North America-East Asia) Voice Paths	
Year	**Cable**	**Satellite**	**Cable**	**Satellite**
1986	22,000	78,000	2,000	39,000
1987	22,000	78,000	37,800	39,000
1988	60,000	78,000	37,800	39,000
1989	145,000	93,000	37,800	39,000
1990	145,000	283,000	37,800	39,000
1991	221,000	283,000	114,200	27,000
1992	296,600	496,000	190,500	27,000
1993	372,200	620,800	264,000	83,300
1994	664,000	620,800	264,000	234,000
1995	1,264,000	710,800	264,000	234,000
1996	1,264,000	710,800	864,600	234,000
1997-2000*	1,264,000	737,500	1,464,600	424,500

**minimum available*

Notes: Estimates of cable voice paths assume that 5 virtual voice paths can be derived from one 64 kbit/s 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 time-frame. Estimates of trans Pacific cable circuits are based on capacity from North America to Japan via Hawaii or Guam and exclude proposed SE-ME-WE-3, CANPAC-1, and Trans-Siberian Link (TSL) cables, all scheduled for 1996-97 timeframe.

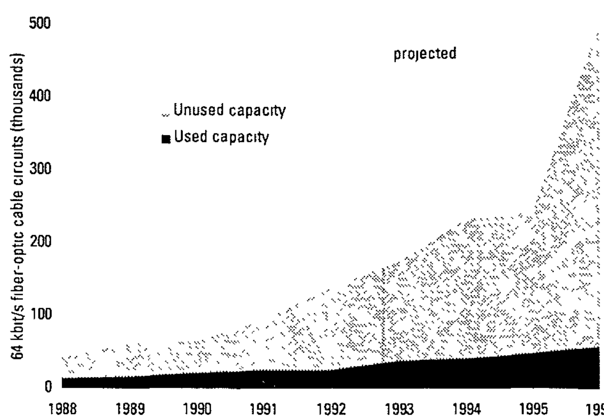
Estimates of satellite voice paths are based on Intelsat satellites only prior to 1993; satellite estimates exclude one Intelsat satellite in each region held in reserve. Estimates also assume one voice path per channel until 1989 deployment of Intelsat VI series with 24,000 channels or 120,000 voice paths using Digital Code Multiplication Equipment (DCME). The Intelsat VII series, deployed in 1992, has 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-3, Orion-1 and TDRS-4; **Trans-Pacific** PAS-2; Rimsat/Express (2 satellites) and TDRS-174.

In the near term, some additional telecommunications circuits are likely to be available from Intersputnik, Hispansat and, after 1997, from the Iridium, Globalstar, and ICO Communication proposed mobile satellite systems. Currently, non-Intelsat satellites are limited to 8000 64 kbit/s circuits per satellite for public switched telephony. This limit will be phased out by 1998. Additionally, the capacity of the following "national" satellite systems may provide some trans-Pacific telecommunications service: Optus (Australia), Palapa Pacific (Indonesia), and, in the North Pacific, Aurora (U.S.).

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

Source: FCC and carriers.
©TeleGeography, Inc. 1995

Trans-Atlantic and Trans-Pacific Cable Utilization, 1988-1996



Source: Communications Week International

The Next Generation of Cables: Beyond 50 Gbit/s

The third generation of undersea fiber optic cables now entering service (TAT 12/13; TPC 5/6—see pp. 84-85) can carry approximately 5 Gigabits per second (Gbit/s) per fiber pair or approximately 320,000 virtual voice channels. This represents an order of magnitude increase from the second generation of cables (operating at 560 Mbit/s) which, in turn, provided a tenfold increase in capacity over first generation cables such as TAT-8.

Recent trials and experiments by AT&T, Alcatel and KDD suggest that the next generation of cables, to be deployed in the 2000-2005 timeframe, will increase capacity by at least another order of magnitude to 50 Gbit/s and possibly to 80 Gbit/s or more. That will be enough to transmit at least 3.5 million simultaneous telephone calls or several hundred thousand channels of compressed video services.

The enormous capacity of the next generation of fiber optic cables will result from two new technologies—optical soliton transmission and wave division multiplexing (WDM)—which leverage the benefits of earlier breakthroughs, such as optical amplifiers.

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

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

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

By coupling soliton technology with wave division multiplexing (WDM) the aggregate transmission capacity of any given fiber optic cable may be increased several fold. In one experiment, sixteen 2.5 Gbit/s channels, each with a different wavelength, were multiplexed together to create a 40 Gbit/s data stream over a distance of over 1,400 kilometers. Field trials of WDM technologies are also promising: Alcatel has reported WDM transmission of four 2.5 Gbit/s data streams over 3,500 kilometers on the RIOJA cable system between the U.K. and Spain; AT&T has conducted a similar trial transmitting 10 Gbit/s over a segment of the Columbus-2 cable between Florida and St. Thomas in the Caribbean. AT&T labs report that capacities of 50 Gbit/s or more over distances of 10,000 kilometers should be feasible using soliton WDM.

The commercial impact of these developments will be felt well before the next generation of cables is in the water. As shown by the RIOJA and Columbus-2 trials, WDB technologies will permit some cable owners to upgrade capacity merely by changing the equipment at the cable head ends. Four or even eightfold capacity increases may be possible. Second, development of WDM techniques is likely to make fiber optic systems increasingly flexible and hence attractive to new investors. For example, because WDM can be used to create different virtual (frequency specific) channels on a cable, a cable can be partitioned to satisfy the routing requirements (landing points) of particular carriers or countries without reducing the cable's overall capacity.

Finally, as soliton WDM technology moves into commercial production, the historical relationship between inter-continental and local prices is likely to flip flop. By 2003, for example, a call from Los Angeles to Tokyo via the latest trans-Pacific cable may cost less than a call from one of Los Angeles' many area codes to another. This is the new telecom economics which light wave technology will soon usher in.

G.S.

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Table 2: The Top 40 International Carriers, 1990-94

			Outgoing Traffic (millions of MiTTs)				
Rank	**Company**	**Country**	**1994**	**1993**	**Change 93-94**	**1992**	**1990**
1	AT&T (a,b)	United States	7947	7129	11.5%	6984	6080
2	Deutsche Telekom (c)	Germany	5147	4680	10.0%	4087	3146
3	MCI (a,b)	United States	3517	2839	23.9%	2083	1184
4	France Télécom (a)	France	2603	2576	1.0%	2449	2126
5	BT (d)	United Kingdom	2489	2310	7.7%	2188	2170
6	Telecom Italia (e)	Italy	1708	1610	6.1%	1473	1045
7	Swiss PTT	Switzerland	1649	1572	4.9%	1551	1356
8	Hongkong Telecom (a,d,f)	Hong Kong	1578	1377	14.6%	1137	1120
9	Stentor (b,g)	Canada	1525	1552	-1.7%	1520	1344
10	Sprint (a,b)	United States	1471	1175	25.2%	940	577
11	KPN (a)	Netherlands	1346	1238	8.7%	1134	905
12	China MPT (f)	China	1090	870	25.3%	635	350
13	Belgacom (a)	Belgium	1049	979	7.2%	911	731
14	Mercury (d)	United Kingdom	1018	820	24.1%	661	354
15	KDD (d)	Japan	1011	952	6.2%	893	764
16	Telefónica	Spain	948	847	11.9%	804	611
17	Téléglobe (a)	Canada	861	808	6.6%	676	565
18	Telmex (a)	Mexico	844	n.a.	n.a.	684	421
19	Austrian PTT (a)	Austria	819	767	6.8%	713	559
20	Telia AB (i)	Sweden	697	683	2.0%	693	631
21	Telstra (h)	Australia	690	640	7.8%	n.a.	565
22	Singapore Telecom (d,j)	Singapore	643	480	34.0%	412	223
23	Worldcom	United States	555	n.a.	n.a.	n.a.	n.a.
24	Saudi Com. Ministry	Saudi Arabia	499	448	11.4%	465	320
25	DGT Taiwan (a)	Taiwan	498	455	9.5%	369	242
26	TeleDanmark	Denmark	488	452	8.0%	425	362
27	Etisalat	U.A.E.	428	342	25.2%	299	242
28	OTE (a)	Greece	423	336	25.8%	299	213
29	Norwegian Telecom	Norway	396	376	5.2%	349	281
30	Telekomunikacja Polska	Poland	357	273	30.6%	213	81
31	Telekom Malaysia	Malaysia	342	258	32.6%	217	140
32	Korea Telecom	Rep. of Korea	327	265	23.4%	245	188
33	Telecom Eireann (a,d,l)	Ireland	324	316	2.5%	297	262
34	Videsh Sanchar (d,k)	India	314	284	10.6%	260	147
35	Telkom South Africa	South Africa	n.a.	255	n.a.	222	156
36	Turkish PTT	Turkey	284	265	7.3%	227	159
37	IDC (d)	Japan	263	239	10.0%	197	56
38	ITJ (d)	Japan	251	228	10.1%	193	61
39	HTC	Hungary	237	213	11.3%	184	122
40	Telecom Finland	Finland	233	253	-7.9%	235	215

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

a. 1993 and 1994 traffic based on billing point of call, not originating point.
b. Data for North American carriers include cross-border traffic.
c. For Deutsche Telekom, all data include outgoing traffic from the former East Germany.
d. Data are for the Fiscal Year (April 1993 to March 1994). HKT and Mercury are majority owned by Cable & Wireless (U.K.).
e. Combined totals for Iritel and Italcable. Prior to 1994, Iritel (formerly ASST) handled intra-continental traffic only, and Italcable carried overseas traffic .
f. Includes Hong Kong-China traffic.
g. Stentor was formerly Telecom Canada; Stentor traffic is for U.S. only of which approximately 70% is originated by Bell Canada.
h. Telstra was formerly AOTC.
i. Telia AB was formerly Televerket.
j. Singapore Telecom data, except for 1990, include traffic to Malaysia (except local border traffic).
k. Videsh Sanchar data exclude traffic to Bangladesh, Nepal, Pakistan and Sri Lanka.
l. Telecom Eireann data exclude traffic to Northern Ireland.

Table 2a: Market Share of Competing International Carriers, 1988-95

Percentage of Outgoing MiTT

Country/Carrier	1988	1989	1990	1991	1992	1993	1994	1995
United States								
AT&T	89.1	83 3	78.4	74.8	70.3	62.2	60.1	
MCI	7.0	10.2	14.6	17.8	21.2	24.8	26 5	
Sprint	3.5	5.8	6.4	6.3	7.3	10.3	11.1	
Worldcom					n.a	0.6	2.1	
U.K. (F.Y.)								
BT	95.5	91.0	86.0	81.0	76.8	74.2	68 6	
Mercury	4.5	9.0	14.0	19.0	23.2	24.0	28.1	
IPL Resellers						2.2	3.3	
Japan (F.Y.)								
KDD		93.3	88.0	73.3	69 7	66.9	66.3	
IDC		3 7	6.5	13.3	15.3	16.9	17.3	
ITJ		3 0	5.5	13 4	15.0	16.2	16.4	
New Zealand (F.Y.)								
TNZ			92.0	82.0	80.0	78.4	74.8	
ClearCom			8.0	18.0	20.0	21.6	25.2	
Korea, Republic of								
Korea Telecom					79.9	74.5	68.7	
Dacom					20.1	25.5	31.3	
Chile								
Entel Chile					80 0	55.0	n.a.	42.5
Chilesat					20 0	20.0	n.a.	20.5
CTC-Mundo					-	-	n.a.	20.5
VTR Telecom					<1 0	<5.0	n.a	12.0
BellSouth Chile					-	-	n a.	4.0
Philippines								
PLDT					91.6	84.2	69	
Philippine Global Com					8.4	15.8	23	
Eastern Telecom					n.a	n a.	7	
Capitol Wireless					n.a.	n.a.	<1	
Sweden								
Telia AB						92.3	86.9	
Tele-2						7.7	13.1	

Notes: MiTT is Minutes of Telecommunications Traffic. Data based on outgoing international traffic for the public switched network only. Unless stated, data exclude traffic and market share of carriers reselling international private line services (IPL resellers). Market shares are for the full year, beginning in the first year of competition. Market shares for U.S. carriers exclude IPL resellers and prior to 1993 exclude resellers and traffic to Canada and Mexico; minor U.S. carriers are not listed. For U.K. carriers traffic to Ireland is excluded prior to 1994.
In 1993, Chilean shares to not add up to 100% because Chilesat reportedly acted as an international gateway in 1993. This gateway handled an additional 20% of outbound traffic originated by CTC, the largest local exchange company, prior to the establishment of CTC Mundo. The 1995 figures for Chile are April 1995 industry estimates.

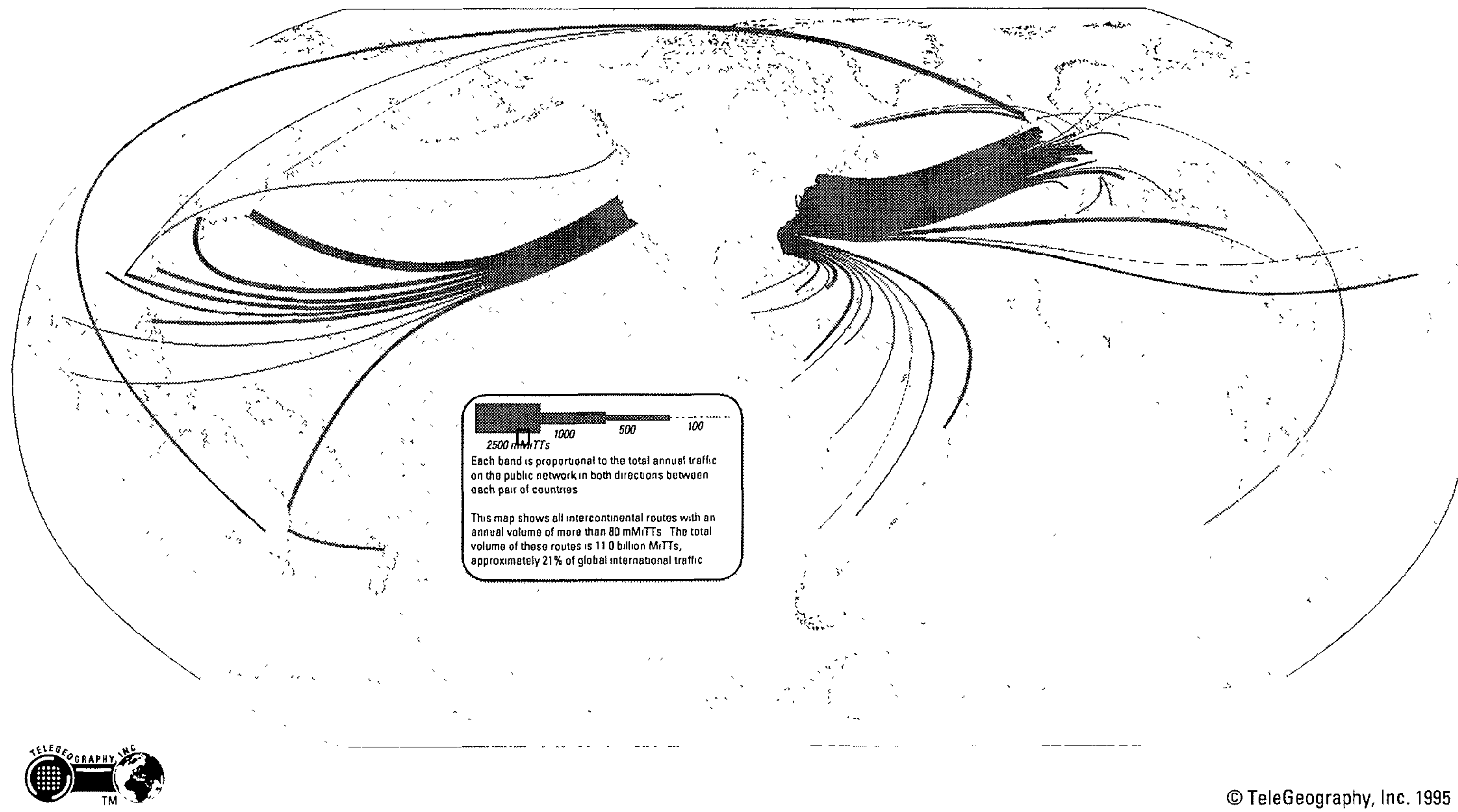
Table 2b: Market Share of Competing International Carriers, 1988-95 (cont'd)

	Percentage of Outgoing MiTT							
Country/Carrier	**1988**	**1989**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**
Australia								
Telstra					98.0	87.0	81.0	
Optus					2.0	13.0	19.0	
Canada (Canada-U.S. route only)								
Stentor						93	85	
Unitel						2	8	
Westel						<1	<1	
IPL Resellers						4	6	
Finland								
Telecom Finland							90	73
Finnet International							5	18
Telivo							3	6
Others							2	3
Dominican Republic								
Codetel						>90	85.8	
Tricom						n.a	6.7	
All America Cables and Radio, Inc. (AACR)						n.a.	7.5	
Indonesia								
PT Indosat							99	>95
PT Satelindo							<1	<5

Notes: MiTT is Minutes of Telecommunications Traffic. Data based on outgoing international traffic for the public switched network only. Unless stated, data exclude traffic and market share of carriers reselling international private line services (IPL resellers). Market shares are for the full year, beginning in the first year of competition. For Australia, market share of AAP, estimated at less than 2%, is excluded. For Finland, Finnet International and Telivo only began service in July 1994, and 1995 figures reflect June 1995 market shares. For Indonesia, PT Satelindo only began international service in September 1994; the 1995 figures reflect June 1995 market estimates.

Traffic Flows

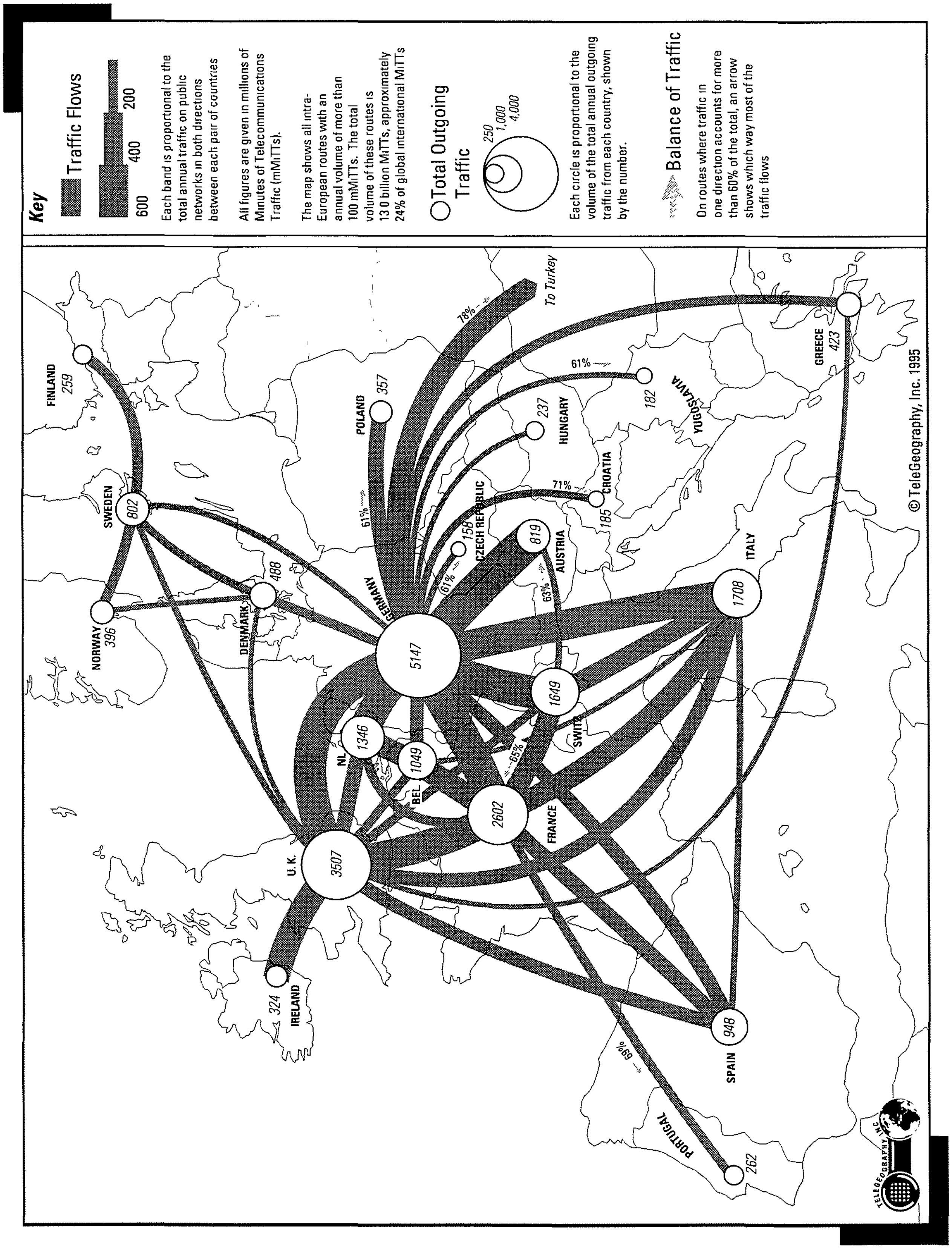
Intercontinental Telecommunications Flows, 1994



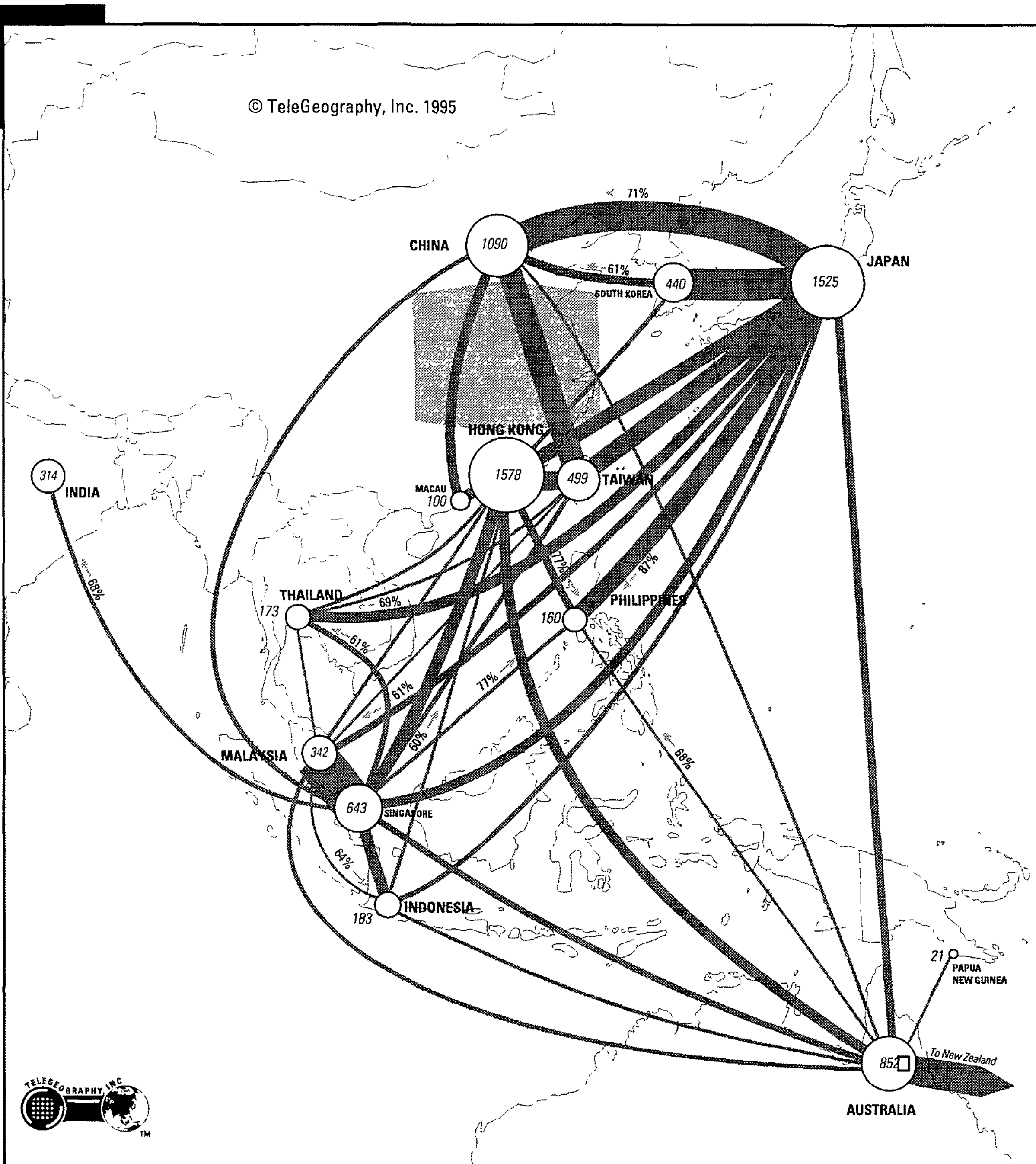
USA/UK	1494	USA/Colombia	287	USA/Spain	168	USA/Ecuador	121	Canada/Germany	87
USA/Germany	879	USA/Brazil	283	USA/Venezuela	152	USA/Belgium	120	Hong Kong/Australia	84
USA/Japan	770	Australia/UK	260	Algeria/France	147	USA/Guatemala	118	Japan/UK	84
USA/France	475	USA/Israel	255	USA/Poland	144	USA/Greece	116	Canada/France	84
USA/Korea	406	Canada/UK	254	France/Morocco	142	USA/Singapore	116	USA/Chile	82
USA/Dominican Republic	370	Australia/New Zealand	242	USA/Argentina	142	Hong Kong/UK	114		
USA/Italy	351	USA/India	240	USA/Sweden	132	USA/Saudia Arabia	106		
USA/Taiwan	319	USA/China	217	USA/Ireland	132	USA/Thailand	101		
USA/Hong Kong	314	USA/Netherlands	212	USA/El Salvador	129	UK/South Africa	94		
USA/Philippines	300	USA/Jamaica	203	USA/Peru	126	USA/Pakistan	92		
USA/Australia	293	USA/Switzerland	188	Hong Kong/Canada	122	USA/Russia	92		

Data in millions of MiTTs The country with more outgoing traffic on each route is listed first

EUROPEAN TELECOMMUNICATIONS FLOWS, 1994



East Asian Telecommunications Flows, 1994



Key

All figures are given in millions of Minutes of Telecommunications Traffic (mMiTTs), for the public telephone network
The map shows all intra-Asian routes with an annual volume of more than 20 mMiTTs The total volume of these routes is 4 9 billion MiTTs, approximately 9% of all global international traffic.

Traffic Flows

200 100 50

Each band is proportional to the total annual traffic on the public telephone network in both directions between each pair of countries.

Balance of Traffic

On routes where traffic in one direction accounts for more than 60% of the total, an arrow shows the direction most of the traffic flows.

Total Outgoing Traffic

250
500
1,000

The area of each circle is proportional to the volume of the total annual outgoing traffic from each country, shown as a number.

SOUTH AMERICAN TELECOMMUNICATIONS FLOWS, 1994

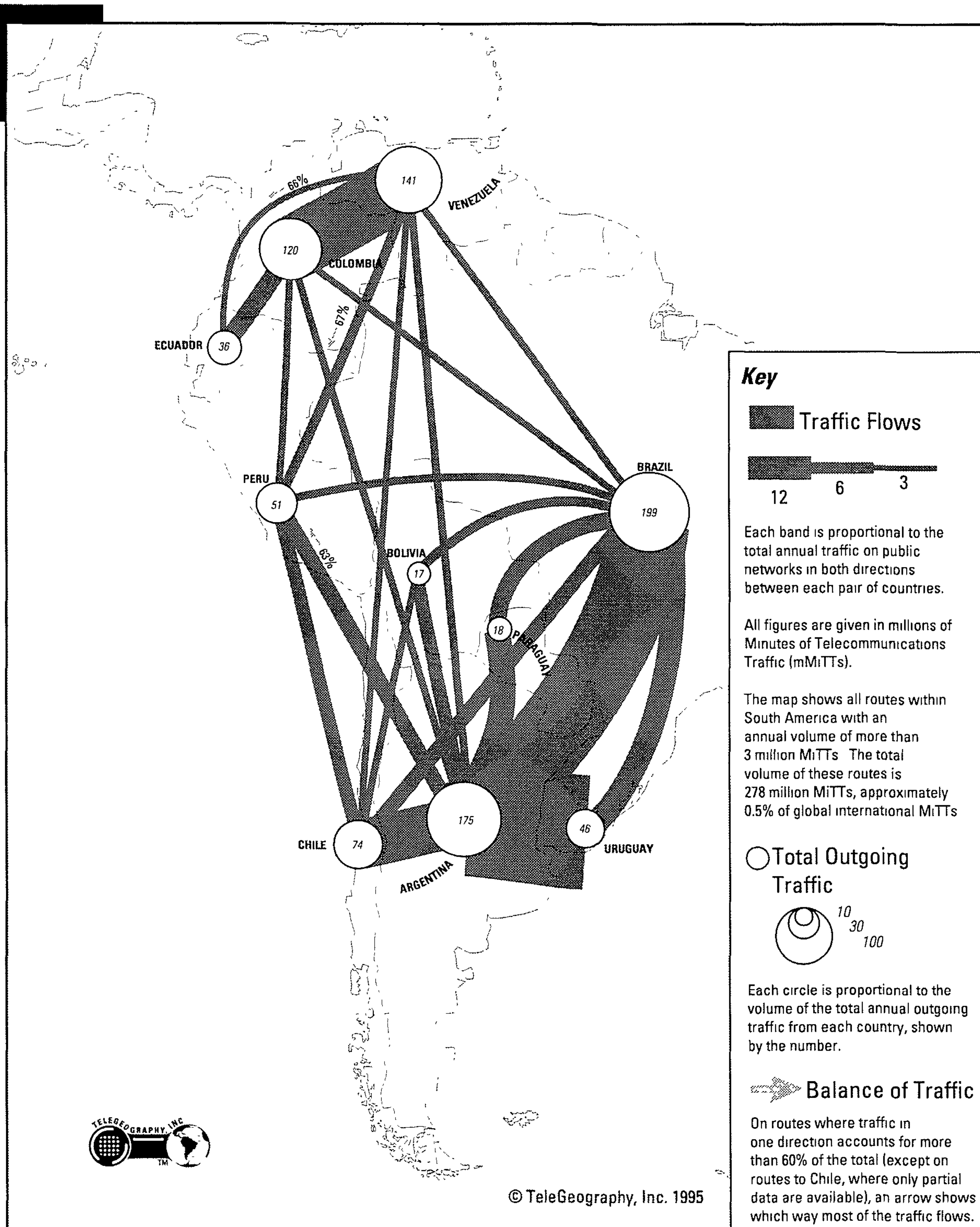


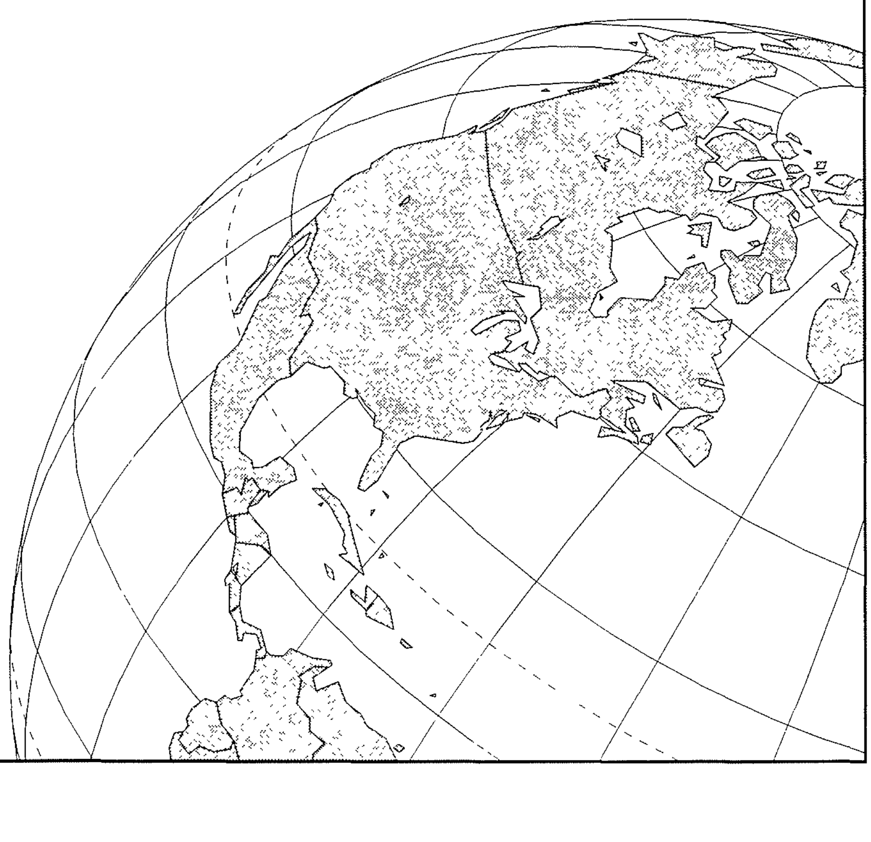
Table 3: The Top 50 International Routes, 1994

	Countries	MiTT each way	Total MiTT
1.	United States /Canada	2635.2/1688.1	4323.3
2.	United States /Mexico	1654.3/747.0	2401.3
3.	United States /United Kingdom	905.5/588.7	1494.2
4.	Hong Kong /China	820.8/650.0	1470.8
5.	United States /Germany	603.3/275.8	879.1
6.	United States /Japan	465.6/304.7	770.3
7.	Germany /Austria	389.1/344.5	733.6
8.	Germany /France	371.1/299.6	670.7
9.	Germany /Switzerland	367.1/297.5	664.6
10.	Germany /United Kingdom	353.8/309.0	662.8
11.	Netherlands /Germany	313.5/306.3	619.8
12.	Germany /Italy	342.7/267.3	610.0
13.	United Kingdom /France	307.0/300.5	607.5
14.	United Kingdom /Ireland	312.0/211.3	523.3
15.	United States /France	304.5/170.0	474.6
16.	Belgium /France	250.9/212.6	463.5
17.	Italy /France	226.4/217.6	444.0
18.	Netherlands /Belgium	221.3/217.4	438.8
19.	Germany /Turkey	340.5/98.1	438.6
20.	Switzerland /France	282.0/149.5	431.5
21.	United States /Korea	282.7/123.5	406.2
22.	Switzerland /Italy	235.5/168.9	404.4
23.	United States /Domin Rep.	309.7/60.5	370.2
24.	United States /Italy	250.4/101.0	351.4
25.	Singapore /Malaysia	190.0/159.8	349.8
26.	Germany /Poland	197.7/124.4	322.1
27.	United States /Taiwan	225.6/93.4	319.0
28.	France /Spain	163.9/152.3	316.2
29.	United States /Hong Kong	213.3/100.5	313.8
30.	Netherlands /United Kingdom	165.4/143.0	308.4
31.	United States /Philippines	258.6/41.7	300.3
32.	United States /Australia	154.4/138.4	292.8
33.	Germany /Spain	152.6/138.9	291.5
34.	United Kingdom /Italy	155.0/135.1	290.1
35.	United States /Colombia	229.2/58.1	287.3
36.	United States /Brazil	221.5/61.8	283.3
37.	Spain /United Kingdom	142.4/134.0	276.4
38.	Germany /Belgium	137.8/133.3	271.1
39.	Australia /United Kingdom	150.3/112.0	262.3
40.	Japan/Korea	150.3/106.5	256.8
41.	United States /Israel	195.4/59.8	255.2
42.	Canada /United Kingdom	150.0/104.0	254.0
43.	Japan /China	171.0/70.8	241.8
44.	Australia /New Zealand	171.0/70.7	241.7
45.	United States /India	188.6/51.7	240.4
46.	Sweden /Finland	113.0/106.0	219.0
47.	United States /China	169.2/48.3	217.5
48.	Sweden /Norway	109.0/104.0	213.0
49.	United States /Netherlands	129.9/82.3	212.2
50.	United States /Jamaica	167.3/35.8	203.1

All data in millions of minutes of telecommunications traffic (MiTT). The country which generates more traffic on each route is listed first. The routes listed above total 27.7 billion minutes, 52% of all international traffic. For routes to and from the United States, calls are measured by point of billing in both directions. See Methodology, page 169.

Americas

International Traffic



Argentina

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	35.9	20.5%
2. Uruguay	31.9	18.2%
3. Brazil	20.8	11.9%
4. Chile	12.4	7.1%
5. Spain	11.3	6.5%
6. Italy	9.4	5.4%
7. Paraguay	7.3	4.1%
8. Peru	5.3	3.0%
9. Bolivia	4.2	2.4%
10. France	3.9	2.2%
11. Germany	3.6	2.1%
12. United Kingdom	3.3	1.9%
13. Mexico	3.3	1.9%
14. Colombia	2.0	1.1%
15. Venezuela	1.8	1.1%
16. Taiwan	1.6	0.9%
17. Canada	1.6	0.9%
18. Israel	1.5	0.9%
19. Hong Kong	1.0	0.6%
20. Netherlands	0.8	0.5%
Other	11.9	6.8%

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

National Traffic Balance

MiTT	**1992**	**1993**	**1994**
Incoming	159.7	192.3	252.6
Outgoing	124.3	137.1	175.0
Surplus (Deficit)	35.4	55.4	77.7
Total Volume	284.1	239.4	427.6

Note: Data based on billing point of traffic.

Brazil

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	64.7	32.5%
2. Argentina	20.1	10.1%
3. Portugal	10.0	5.0%
4. Italy	9.9	5.0%
5. Germany	9.8	4.9%
6. United Kingdom	7.9	4.0%
7. France	7.5	3.8%
8. Uruguay	6.3	3.1%
9. Japan	4.8	2.4%
10. Paraguay	4.8	2.4%
11. Spain	4.7	2.4%
12. Chile	4.4	2.2%
13. Switzerland	3.6	1.8%
14. Mexico	3.1	1.6%
15. Canada	2.7	1.4%
16. Sao Tome and Principe	2.7	1.3%
17. Bolivia	2.4	1.2%
18. Netherlands	2.0	1.0%
19. Colombia	2.0	1.0%
20. Venezuela	2.0	1.0%
Other	23.7	11.9%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	330.6	373.8	408.0
Outgoing	169.9	182.4	199.0
Surplus (Deficit)	160.7	191.4	209.0
Total Volume	500.5	556.2	607.0

Note: Data based on billing point of traffic.

Canada

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	1795	67.6%
2. United Kingdom	130	4.9%
3. Hong Kong	59	2.2%
4. France	49	1.8%
5. Germany	46	1.7%
6. Italy	38	1.4%
7. Australia	27	1.0%
8. India	24	0.9%
9. Jamaica	23	0.9%
10. Philippines	21	0.8%
11. Japan	20	0.8%
12. Netherlands	17	0.6%
13. Mexico	16	0.6%
14. China	16	0.6%
15. Portugal	14	0.5%
Other	361	13.6%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	445.4	503.4	543.8
Outgoing	675.9	761.5	861.2
Surplus (Deficit)	(230.5)	(258.1)	(317.4)
Total Volume	1121.3	1264.9	1405.0

Notes: Incoming and outgoing totals are for Téléglobe only and exclude all Canada-U.S. traffic. Téléglobe data based on billing point of traffic. U.S. route traffic is for Stentor, Unitel, Westel and IPL resellers combined, but IPL resellers' traffic is not included on other routes (i.e., to the U.K. and Australia). For further details, see notes on page 108. Route data are rounded to the nearest million minutes.

Chile

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	28.0	38.1%
2. Argentina	13.0	17.7%
3. Spain	4.0	5.4%
4. Brazil	3.5	4.8%
5. Peru	3.0	4.1%
6. Canada	2.0	2.7%
7. United Kingdom	2.0	2.7%
8. Italy	2.0	2.7%
9. Germany	1.5	2.0%
10. France	1.5	2.0%
11. Bolivia	1.5	2.0%
12. Mexico	1.5	2.0%
13. Venezuela	1.0	1.4%
14. Colombia	1.0	1.4%
15. Uruguay	1.0	1.4%
Other	7.0	9.5%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	85.6	105.0	n.a.
Outgoing	55.0	61.7	73.5
Surplus (Deficit)	30.6	43.3	n.a.
Total Volume	140.6	166.7	n.a.

Note: Data are rounded to the nearest 500,000 minutes and are for Entel Chile, CTC-Mundo, ChileSat, and VTR only.

Colombia

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	60.3	50.1%
2. Venezuela	13.4	11.1%
3. Spain	5.1	4.2%
4. Ecuador	5.0	4.2%
5. Panama	4.4	3.7%
6. Mexico	4.0	3.3%
7. Italy	3.2	2.7%
8. United Kingdom	2.7	2.2%
9. Brazil	2.6	2.2%
10. Costa Rica	2.4	2.0%
11. France	2.2	1.8%
12. Germany	2.2	1.8%
13. Peru	2.0	1.7%
14. Argentina	1.9	1.6%
15. Canada	1.6	1.3%
16. Chile	1.3	1.1%
17. Switzerland	0.8	0.7%
18. Dominican Republic	0.7	0.6%
19. Netherlands	0.6	0.5%
20. Sweden	0.4	0.3%
Other	2.8	2.3%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	238.0	278.7	302.8
Outgoing	94.5	102.4	120.3
Surplus (Deficit)	143.5	176.3	182.5
Total Volume	332.5	381.1	423.1

Note: Totals may appear inconsistent with other figures due to rounding.

Dominican Republic

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	43.3	68.1%
2. Puerto Rico	8.3	13.0%
3. Spain	1.5	2.3%
4. Italy	1.1	1.7%
5. Canada	1.0	1.6%
6. Germany	0.9	1.4%
7. Venezuela	0.8	1.2%
8. Mexico	0.5	0.8%
9. Colombia	0.4	0.6%
10. Panama	0.4	0.6%
11. Cuba	0.4	0.6%
12. Haiti	0.3	0.5%
13. Switzerland	0.3	0.5%
14. Curacao	0.3	0.4%
15. France	0.2	0.4%
16. Korea, Rep. of	0.2	0.3%
17. Argentina	0.2	0.4%
18. Costa Rica	0.2	0.3%
19. United Kingdom	0.2	0.3%
20. Netherlands Antilles	0.2	0.3%
Other	2.9	4.6%

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National Traffic Balance

MiTT	1992	1993	1994
Incoming	n.a.	n.a.	404.0
Outgoing	53.5	58.3	63.5
Surplus (Deficit)	n.a.	n.a.	340.5
Total Volume	n.a.	n.a.	467.5

Note: Data are for Codetel only and are based on billing point of traffic. AACR had approximately 6.3 million MiTT outbound and 34.4 million MiTT inbound in 1994.

Ecuador

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	19.2	52.7%
2. Colombia	4.7	12.9%
3. Chile	1.2	3.3%
4. Peru	1.1	3.0%
5. Venezuela	1.1	3.0%
6. Brazil	0.9	2.5%
7. Spain	0.7	1.9%
8. Argentina	0.7	1.9%
9. Panama	0.7	1.9%
10. Mexico	0.6	1.6%
11. Germany	0.6	1.6%
12. Canada	0.6	1.6%
13. Italy	0.5	1.4%
14. United Kingdom	0.4	1.1%
15. France	0.4	1.1%
16. Costa Rica	0.3	0.8%
17. Switzerland	0.3	0.8%
18. Japan	0.2	0.5%
19. Bolivia	0.2	0.5%
20. Hong Kong	0.2	0.5%
Other	2.0	5.5%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	87.4	102.3	128.6
Outgoing	28.6	33.6	36.4
Surplus (Deficit)	58.9	68.7	92.2
Total Volume	116.0	136.0	165.0

Note: Data based on billing point of traffic. Totals may appear inconsistent with other figures due to rounding.

Mexico

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	745.2	88.3%
2. Canada	13.3	1.6%
3. Spain	9.1	1.1%
4. France	8.9	1.1%
5. United Kingdom	5.2	0.6%
6. Cuba	5.0	0.6%
7. Germany	4.9	0.6%
8. Colombia	4.5	0.5%
9. Italy	4.1	0.5%
10. Argentina	3.4	0.4%
11. Guatemala	3.3	0.4%
12. Brazil	3.1	0.4%
13. Chile	2.6	0.3%
14. Costa Rica	2.3	0.3%
15. Venezuela	2.0	0.2%
16. Peru	1.8	0.2%
17. Japan	1.7	0.2%
18. El Salvador	1.7	0.2%
19. Switzerland	1.7	0.2%
20. Panama	1.5	0.2%
Other	18.7	2.2%

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National Traffic Balance

MiTT	1992	1993	1994
Incoming	1,115.0	1,370.6	1,829.4
Outgoing	683.5	625.4	844.1
Surplus (Deficit)	431.5	745.2	985.4
Total Volume	1,798.5	1,996.0	2,673.5

Note: Data based on billing point of traffic. 1993 figures do not include traffic generated by Teléfonos del Noroeste (Telnor), a Telmex subsidiary. Totals may appear inconsistent with other figures due to rounding.

Paraguay

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Argentina	5.8	32.2%
2. Brazil	5.0	27.4%
3. United States	2.4	13.2%
4. Chile	0.8	4.3%
5. Uruguay	0.7	4.0%
6. Italy	0.6	3.4%
7. Germany	0.4	2.1%
8. Spain	0.3	1.8%
9. Taiwan	0.3	1.5%
10. Bolivia	0.2	1.3%
11. Korea, Rep. of	0.2	1.3%
12. Peru	0.2	1.2%
13. France	0.2	1.0%
14. Japan	0.1	0.8%
15. Hong Kong	0.1	0.8%
16. United Kingdom	0.1	0.6%
17. Switzerland	0.1	0.6%
18. Canada	0.1	0.6%
19. Mexico	0.1	0.5%
20. Panama	0.1	0.5%
Other	0.1	0.7%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	n.a.	24.5	30.6
Outgoing	13.7	15.5	18.1
Surplus (Deficit)	n.a.	9.0	12.5
Total Volume	n.a.	40.0	48.7

Note: Totals may appear inconsistent with other figures due to rounding.

Peru

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	22.5	44.1%
2. Chile	4.0	7.8%
3. Argentina	3.0	6.0%
4. Spain	3.0	5.9%
5. Italy	2.0	3.9%
6. Brazil	1.8	3.5%
7. Colombia	1.8	3.5%
8. Venezuela	1.7	3.3%
9. Bolivia	1.3	2.6%
10. Mexico	1.2	2.4%
11. Ecuador	1.2	2.4%
12. Japan	1.2	2.4%
13. Germany	1.0	1.9%
14. Canada	1.0	1.9%
15. United Kingdom	0.9	1.7%
16. France	0.8	1.6%
17. Switzerland	0.5	1.0%
18. Panama	0.5	1.0%
19. Costa Rica	0.3	0.6%
20. Uruguay	0.2	0.3%
Other	1.3	2.5%

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National Traffic Balance

MiTT	1992	1993	1994
Incoming	128.1	152.4	178.6
Outgoing	32.1	39.0	51.0
Surplus (Deficit)	96.0	113.4	127.6
Total Volume	160.2	191.4	229.6

Note: Data based on billing point of traffic. Totals may appear inconsistent with other figures due to rounding.

United States (Outgoing)

Largest Telecommunications Routes, 1994

Destination	MiTT 1993	MiTT 1994	Percentage of Outgoing Traffic 1994
1. Canada	2493.1	2635.2	20.0%
2. Mexico	1398.8	1654.3	12.5%
3. United Kingdom	799.8	905.5	6.9%
4. Germany	572.4	603.3	4.6%
5. Japan	397.2	465.6	3.5%
6. Dominican Republic	253.3	309.7	2.3%
7. France	263.6	304.5	2.3%
8. Korea	237.3	282.7	2.1%
9. Philippines	219.1	258.6	2.0%
10. Italy	229.6	250.4	1.9%
11. Colombia	200.2	229.2	1.7%
12. Taiwan	184.3	225.6	1.7%
13. Brazil	171.4	221.5	1.7%
14. Hong Kong	142.8	213.3	1.6%
15. Israel	162.6	195.4	1.5%
16. India	134.1	188.6	1.4%
17. China	110.1	169.2	1.3%
18. Jamaica	144.5	167.3	1.3%
19. Australia	126.1	154.4	1.2%
20. Netherlands	107.3	129.9	1.0%
Other		3,636.0	27.5%

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National Traffic Balance

MiTT	1992	1993	1994
Incoming	3149.4	3284.4	3698.0
Outgoing	6670.4	7500.3	8910.8
Surplus (Deficit)	(3521.0)	(4125.9)	(5212.8)
Total Volume	8814.3	9819.8	12608.8

Note: Data based on billing point of traffic. Totals may appear inconsistent with other figures due to rounding. Incoming and outgoing traffic totals exclude Canada and Mexico traffic and traffic from non-Continental U.S. territories (Puerto Rico, Virgin Islands, and Guam). Route-by-Route data also exclude these territories. Canada traffic excludes IPL resellers, which in 1994 reported 147 million minutes of U.S.-billed traffic and 107 million minutes of Canada-billed traffic. No U.S. certified IPL resellers operated in 1994 on any other U.S. route.

United States (Incoming)

Largest Telecommunications Routes, 1994

	Destination	MiTT 1993	MiTT 1994	Percentage of Incoming Traffic 1994
1.	Canada	1602.3	1688.1	27.5%
2.	Mexico	456.1	747.0	12.2%
3.	United Kingdom	499.9	588.7	9.6%
4.	Japan	287.8	304.7	5.0%
5.	Germany	263.2	275.8	4.5%
6.	France	161.7	170.0	2.8%
7.	Australia	118.2	138.4	2.3%
8.	Korea, Rep. of	101.4	123.5	2.0%
9.	Italy	98.7	101.0	1.6%
10.	Hong Kong	89.4	100.5	1.6%
11.	Taiwan	88.5	93.4	1.5%
12.	Netherlands	76.7	82.3	1.3%
13.	Switzerland	66.0	72.8	1.2%
14.	Brazil	46.9	61.8	1.0%
15.	Dominican Republic	57.6	60.5	1.0%
16.	Israel	53.2	59.8	1.0%
17.	Sweden	53.5	58.2	0.9%
18.	Colombia	51.8	58.1	0.9%
19.	Venezuela	45.6	54.9	0.9%
20.	India	55.5	51.7	0.8%
	Other		1241.7	20.2%

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Note: Data based on billing point of traffic. Incoming traffic reported by the United States may not match outgoing traffic to the United States reported by other countries due to different accounting procedures (some countries may report U.S.-billed calls to the U.S. as outgoing calls to the U.S.), different fiscal years, and inclusion or exclusion of operator-assisted calls. See Methodology (page 169) for more information.

USA: Other Correspondents

Country	Outgoing MiTT 1993	Outgoing MiTT 1994	Incoming MiTT 1993	Incoming MiTT 1994	Country	Outgoing MiTT 1993	Outgoing MiTT 1994	Incoming MiTT 1993	Incoming MiTT 1994
Argentina	84.8	110.5	26.6	31.3	Macau	1.7	2.4	1.0	1.1
Austria	37.4	41.1	21.7	21.7	Malaysia	32.7	41.1	12.7	14.6
Bangladesh	20.1	23.2	1.9	2.1	New Zealand	24.7	29.3	19.2	23.1
Belgium	75.3	81.3	35.2	38.6	Norway	34.7	38.5	28.3	28.9
Bulgaria	5.7	7.5	1.3	2.0	Pakistan	68.7	84.0	7.5	8.4
Chile	49.7	55.0	17.8	27.2	Paraguay	89.6	9.7	14.7	2.1
China	110.1	169.3	41.1	48.4	Peru	219.1	105.5	35.9	20.1
Croatia	10.5	14.1	3.4	4.4	Poland	81.6	110.3	28.7	34.0
Cuba	8.4	5.0	3.3	0.4	Portugal	47.1	41.7	10.4	11.2
Cyprus	6.3	7.5	3.8	4.1	Qatar	3.3	3.9	1.7	1.7
Czech Republic	10.5	18.2	3.4	6.5	Russia	45.6	61.9	12.8	29.8
Denmark	36.4	41.5	23.6	25.2	Saudi Arabia	67.6	77.5	29.7	28.2
Ecuador	86.4	108.4	12.1	12.8	Singapore	56.6	72.8	37.4	43.2
El Salvador	107.0	120.7	7.8	8.0	Slovak Republic	3.9	2.8	0.5	2.9
Estonia	0.8	1.4	0.4	1.7	Slovenia	2.1	2.9	0.0	1.4
Finland	19.1	22.0	15.9	16.0	South Africa	36.3	53.7	20.8	24.3
Greece	75.5	82.1	25.3	34.2	Spain	109.5	117.0	45.4	50.6
Guatemala	93.8	105.1	14.1	12.7	Sri Lanka	6.1	7.8	1.7	1.8
Hungary	20.4	24.5	14.0	9.8	Sweden	62.0	74.0	53.5	58.2
Iceland	7.3	7.9	6.4	6.6	Switzerland	104.4	115.0	66.0	72.8
Indonesia	44.8	56.4	17.5	12.8	Syria	8.2	10.2	2.3	2.7
Iran	38.7	43.7	21.3	18.3	Thailand	62.8	78.3	18.8	22.5
Ireland	75.7	91.5	31.4	40.2	Turkey	40.1	45.6	16.8	17.7
Jamaica	144.8	167.4	37.4	36.1	UAE	27.9	32.6	17.4	19.8
Jordan	26.5	31.7	3.9	4.0	Uruguay	15.1	16.6	3.1	4.5
Kuwait	21.3	27.5	7.7	7.6	Venezuela	87.9	97.3	45.6	54.9
Luxembourg	6.6	7.9	4.7	5.2	Yugoslavia	18.7	19.9	1.1	9.0

Note: All data based on the billing point of the traffic. See Methodology.

Uruguay

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Argentina	26.5	57.3%
2. Brazil	5.9	12.8%
3. United States	4.6	9.9%
4. Spain	1.6	3.5%
5. Chile	1.1	2.4%
6. Paraguay	0.8	1.7%
7. Italy	0.7	1.5%
8. France	0.5	1.0%
9. Germany	0.4	0.9%
10. United Kingdom	0.4	0.8%
11. Mexico	0.3	0.7%
12. Israel	0.3	0.6%
13. Canada	0.3	0.6%
14. Switzerland	0.3	0.6%
15. Venezuela	0.3	0.6%
16. Colombia	0.2	0.4%
17. Australia	0.2	0.4%
18. Peru	0.2	0.4%
19. Panama	0.1	0.3%
20. Sweden	0.1	0.3%
Other	1.6	3.4%

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National Traffic Balance

MiTT	1992	1993	1994
Incoming	53.0	58.0	67.7
Outgoing	30.2	37.4	46.3
Surplus (Deficit)	22.8	20.6	21.4
Total Volume	83.2	95.4	114.0

Note: Data based on billing point of traffic.

Venezuela

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	57.0	40.4%
2. Colombia	19.3	13.7%
3. Spain	8.3	5.9%
4. Italy	6.4	4.5%
5. Dominican Republic	4.0	2.8%
6. Peru	3.5	2.5%
7. Canada	2.9	2.0%
8. Mexico	2.5	1.8%
9. Portugal	2.5	1.8%
10. Brazil	2.5	1.8%
11. Chile	2.4	1.7%
12. Argentina	2.3	1.6%
13. France	2.2	1.6%
14. Ecuador	2.1	1.5%
15. Germany	2.1	1.5%
16. United Kingdom	1.8	1.3%
17. Puerto Rico	1.5	1.0%
18. Netherlands Antilles	1.5	1.0%
19. Hong Kong	1.3	0.9%
20. Lebanon	1.2	0.8%
Other	14.0	9.9%

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National Traffic Balance

MiTT	1992	1993	1994
Incoming	128.6	148.3	164.3
Outgoing	115.5	133.3	141.3
Surplus (Deficit)	13.1	15.0	23.0
Total Volume	244.1	281.6	305.6

Note: Data based on billing point of traffic.

Europe

International Traffic

Austria

Largest Telecommunications Routes, 1994

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

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National Traffic Balance

MiTT	1992	1993	1994
Incoming	692.3	751.0	774.5
Outgoing	713.4	767.4	819.2
Surplus (Deficit)	(21.1)	(16.4)	(44.7)
Total Volume	1,405.7	1,518.4	1,593.7

Belgium

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. France	250.9	23.9%
2. Netherlands	217.4	20.7%
3. Germany	133.3	12.7%
4. United Kingdom	93.0	8.9%
5. Italy	55.4	5.3%
6. United States	38.7	3.7%
7. Luxembourg	37.5	3.6%
8. Spain	31.9	3.0%
9. Switzerland	24.7	2.4%
10. Sweden	12.1	1.1%
11. Portugal	11.2	1.1%
12. Greece	11.0	1.0%
13. Denmark	9.8	0.9%
14. Turkey	9.4	0.9%
15. Austria	8.7	0.8%
16. Morocco	8.5	0.8%
17. Poland	7.7	0.7%
18. Ireland	5.9	0.6%
19. Canada	5.1	0.5%
20. Norway	4.9	0.5%
Other	72.0	6.9%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	952.7	1,025.3	1,093.9
Outgoing	911.1	979.4	1,049.0
Surplus (Deficit)	41.6	45.9	44.9
Total Volume	1,863.8	2,004.7	2,142.9

Note: Data based on billing point of traffic. Totals may appear inconsistent with other figures due to rounding.

Croatia

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	44.2	23.9%
2. Slovenia	24.0	12.9%
3. Italy	14.3	7.7%
4. Austria	13.7	7.4%
5. Switzerland	6.0	3.2%
6. United Kingdom	5.0	2.7%
7. France	4.2	2.3%
8. United States	4.0	2.2%
9. Netherlands	2.8	1.5%
10. Macedonia, TFYR	2.4	1.3%
11. Sweden	2.2	1.2%
12. Hungary	2.0	1.1%
13. Belgium	1.7	0.9%
14. Canada	1.7	0.9%
15. Czech Republic	1.6	0.9%
16. Australia	1.5	0.8%
17. Spain	1.5	0.8%
18. Russia	1.4	0.8%
19. Denmark	1.3	0.7%
20. Slovak Republic	0.8	0.4%
Other	48.9	26.4%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	189.1	170.3	240.2
Outgoing	104.7	117.2	185.5
Surplus (Deficit)	84.4	53.0	54.8
Total Volume	293.8	287.5	425.7

Notes: Data based on billing point of traffic. 1994 traffic totals include traffic to and from Bosnia, not counted in previous years. 1994 outgoing traffic to Bosnia was approximately 30 million minutes. Totals may appear inconsistent with other figures due to rounding.

Cyprus

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. United Kingdom	29.7	27.9%
2. Greece	22.2	20.8%
3. United States	4.9	4.6%
4. Germany	4.5	4.3%
5. Russia	4.0	3.8%
6. Lebanon	2.6	2.5%
7. France	2.5	2.3%
8. Romania	2.4	2.3%
9. Yugoslavia	2.3	2.2%
10. Italy	2.3	2.1%
11. Syria	1.8	1.7%
12. Bulgaria	1.7	1.6%
13. Egypt	1.5	1.4%
14. Switzerland	1.5	1.4%
15. Israel	1.5	1.4%
16. Canada	1.3	1.2%
17. Sweden	1.2	1.1%
18. Netherlands	1.2	1.1%
19. Ukraine	1.1	1.0%
20. Austria	1.1	1.0%
Other	15.3	14.4%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	73.7	72.2	79.0
Outgoing	85.3	93.8	106.6
Surplus (Deficit)	(11.6)	(21.6)	(27.5)
Total Volume	159.0	166.0	185.6

Note: Data based on billing point of traffic.

Czech Republic

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	50.1	31.8%
2. Austria	15.1	9.6%
3. United Kingdom	10.2	6.5%
4. Italy	8.1	5.1%
5. France	6.7	4.3%
6. United States	6.5	4.1%
7. Poland	5.8	3.7%
8. Switzerland	5.1	3.2%
9. Netherlands	4.9	3.1%
10. Canada	4.5	2.9%
11. Russia	4.4	2.8%
12. Belgium	3.1	2.0%
13. Ukraine	2.9	1.8%
14. Hungary	2.3	1.5%
15. Spain	2.1	1.3%
16. Vietnam	2.0	1.3%
17. Sweden	1.9	1.2%
18. Hong Kong	1.9	1.2%
19. Croatia	1.8	1.1%
20. Yugoslavia	1.7	1.1%
Other	16.5	10.5%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	n.a.	n.a.	210.0
Outgoing	n.a.	141.4	157.6
Surplus (Deficit)	n.a.	n.a.	52.4
Total Volume	n.a.	n.a.	367.6

Note: Data based on billing point of traffic and exclude traffic to and from the Slovak Republic.

Denmark

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	96.3	19.7%
2. Sweden	79.9	16.4%
3. United Kingdom	52.5	10.7%
4. Norway	49.0	10.0%
5. United States	23.5	4.8%
6. France	21.9	4.5%
7. Netherlands	19.1	3.9%
8. Italy	12.0	2.5%
9. Switzerland	10.4	2.1%
10. Finland	9.9	2.0%
11. Belgium	9.6	2.0%
12. Spain	9.2	1.9%
13. Faroe Islands	8.6	1.8%
14. Poland	8.2	1.7%
15. Turkey	5.1	1.0%
16. Greenland	4.5	0.9%
17. Austria	4.2	0.9%
18. Canada	3.2	0.7%
19. Iceland	3.2	0.7%
20. Greece	3.2	0.7%
Other	54.7	11.2%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	425.2	460.0	500.9
Outgoing	424.5	452.3	488.4
Surplus (Deficit)	0.7	7.7	12.4
Total Volume	849.7	912.3	989.3

Note: Totals may appear inconsistent with other figures due to rounding.

Estonia

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Russia	14.0	29.1%
2. Finland	13.8	28.7%
3. Sweden	3.9	8.0%
4. Ukraine	2.6	5.4%
5. Germany	2.3	4.8%
6. Latvia	2.2	4.5%
7. Lithuania	1.3	2.7%
8. United States	1.2	2.5%
9. Belarus	1.1	2.3%
10. Denmark	0.8	1.7%
11. United Kingdom	0.8	1.6%
12. Netherlands	0.5	1.0%
13. Norway	0.4	0.8%
14. France	0.3	0.6%
15. Poland	0.2	0.5%
16. Belgium	0.2	0.5%
17. Italy	0.2	0.5%
18. Switzerland	0.2	0.4%
19. Kazakhstan	0.2	0.4%
20. Canada	0.2	0.4%
Other	1.7	3.6%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	n.a.	n.a.	50.8
Outgoing	n.a.	41.2	48.1
Surplus (Deficit)	n.a.	n.a.	2.7
Total Volume	n.a.	n.a.	98.9

Note: Data based on billing point of traffic. Totals may appear inconsistent with other figures due to rounding.

Finland

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Sweden	104	40.2%
2. Germany	22	8.5%
3. Russia	21	8.1%
4. United Kingdom	17	6.6%
5. United States	16	6.2%
6. Estonia	14	5.4%
7. Norway	9	3.5%
8. Denmark	8	3.1%
9. France	7	2.7%
10. Netherlands	6	2.3%
11. Switzerland	6	2.3%
12. Italy	5	1.9%
13. Spain	4	1.5%
14. Belgium	4	1.5%
Other	16	6.2%

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National Traffic Balance

MiTT	1992	1993	1994
Incoming	n.a.	n.a.	285
Outgoing	235	n.a.	259
Surplus (Deficit)	n.a.	n.a.	26
Total Volume	n.a.	n.a.	544

Note: Data are rounded to the nearest million minutes. Data include Telecom Finland, Finnet International, Telivo, and Ålands Mobiltelefon.

France

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. United Kingdom	300.5	11.5%
2. Germany	299.6	11.5%
3. Italy	217.6	8.4%
4. Belgium	212.6	8.2%
5. Spain	163.9	6.3%
6. United States	160.9	6.2%
7. Switzerland	149.5	5.7%
8. Portugal	123.0	4.7%
9. Netherlands	88.3	3.4%
10. Morocco	78.4	3.0%
11. Algeria	61.0	2.3%
12. Tunisia	41.2	1.6%
13. Canada	34.6	1.3%
14. Turkey	29.5	1.1%
15. Sweden	23.7	0.9%
16. Poland	21.7	0.8%
17. Greece	19.1	0.7%
18. Denmark	18.9	0.7%
19. Austria	18.5	0.7%
20. Luxembourg	18.1	0.7%
Other	521.9	20.1%

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National Traffic Balance

MiTT	1992	1993	1994
Incoming	2,540.0	2,710.0	2,739.5
Outgoing	2,449.0	2,576.0	2,602.5
Surplus (Deficit)	91.0	134.0	137.0
Total Volume	4,989.0	5,286.0	5,342.0

Germany

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Austria	389.1	7.6%
2. France	371.1	7.2%
3. Switzerland	367.1	7.1%
4. United Kingdom	353.8	6.9%
5. Italy	342.7	6.7%
6. Turkey	340.5	6.6%
7. Netherlands	306.3	6.0%
8. United States	299.0	5.8%
9. Poland	197.7	3.8%
10. Spain	152.6	3.0%
11. Belgium	137.8	2.7%
12. Greece	115.5	2.2%
13. Croatia	110.1	2.1%
14. Denmark	100.5	2.0%
15. Czech Republic	79.0	1.5%
16. Sweden	64.0	1.2%
17. Netherlands Antilles	64.0	1.2%
18. Portugal	58.6	1.1%
19. Hungary	58.1	1.1%
20. Dominican Republic	57.8	1.1%
Other	1181.6	23.0%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	3,100.0	3,707.8	3,881.2
Outgoing	4,087.0	4,679.6	5,147.1
Surplus (Deficit)	(987.0)	(971.8)	(1,265.9)
Total Volume	7,187.0	8,387.4	9,028.3

Note: Data based on originating point of traffic. 1993 data based on billing point of traffic.

Greece

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	78.2	18.5%
2. United Kingdom	56.0	13.2%
3. Italy	37.4	8.8%
4. United States	29.6	7.0%
5. Canada	24.1	5.7%
6. France	21.6	5.1%
7. Cyprus	15.8	3.7%
8. Belgium	10.7	2.5%
9. Netherlands	10.4	2.5%
10. Australia	10.4	2.5%
11. Switzerland	9.7	2.3%
12. Romania	8.9	2.1%
13. Bulgaria	8.7	2.1%
14. Albania	7.4	1.7%
15. Yugoslavia	7.3	1.7%
16. Russia	6.2	1.5%
17. Austria	6.0	1.4%
18. Turkey	6.0	1.4%
19. Sweden	5.9	1.4%
20. Poland	4.9	1.2%
Other	57.6	13.6%

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National Traffic Balance

MiTT	1992	1993	1994
Incoming	359.7	406.1	441.2
Outgoing	298.9	336.2	422.7
Surplus (Deficit)	60.8	70.0	18.6
Total Volume	658.6	742.3	863.9

Note: Totals may appear inconsistent with other figures due to rounding.

Hungary

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	54.7	23.1%
2. Austria	28.5	12.1%
3. United States	15.3	6.5%
4. Italy	12.3	5.2%
5. Romania	12.3	5.2%
6. United Kingdom	12.1	5.1%
7. Yugoslavia	8.3	3.5%
8. France	7.8	3.3%
9. Russia	7.5	3.2%
10. Switzerland	6.9	2.9%
11. Slovak Republic	6.5	2.7%
12. Netherlands	6.0	2.5%
13. Ukraine	5.0	2.1%
14. Sweden	4.2	1.8%
15. Belgium	3.6	1.5%
16. Canada	3.4	1.4%
17. Poland	3.0	1.2%
18. Croatia	2.9	1.2%
19. Czech Republic	2.6	1.1%
20. Greece	2.3	1.0%
Other	31.2	13.2%

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National Traffic Balance

MiTT	**1992**	**1993**	**1994**
Incoming	150.5	192.8	211.9
Outgoing	183.8	213.2	236.6
Surplus (Deficit)	(33.3)	(20.4)	(24.7)
Total Volume	334.3	406.0	448.5

Note: Data based on billing point of traffic. Totals may appear inconsistent with other figures due to rounding.

Iceland

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	6.6	25.3%
2. Denmark	3.5	13.6%
3. United Kingdom	2.8	10.8%
4. Sweden	2.8	10.6%
5. Norway	2.3	8.7%
6. Germany	2.0	7.7%
7. France	0.7	2.8%
8. Netherlands	0.7	2.7%
9. Faroe Islands	0.5	2.1%
10. Spain	0.4	1.5%
11. Belgium	0.4	1.4%
12. Italy	0.4	1.4%
13. Canada	0.3	1.3%
14. Finland	0.3	1.2%
15. Switzerland	0.3	1.0%
16. Luxembourg	0.2	0.7%
17. Austria	0.2	0.6%
18. Russia	0.1	0.5%
19. Portugal	0.1	0.4%
20. Ireland	0.1	0.4%
Other	1.4	5.4%

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National Traffic Balance

MiTT	1992	1993	1994
Incoming	21.7	23.4	25.5
Outgoing	22.1	24.1	26.0
Surplus (Deficit)	(0.4)	(0.7)	(0.4)
Total Volume	43.8	47.5	51.5

Note: Data based on billing point of traffic.

Ireland

Largest Telecommunications Routes, FY 1994/95

Destination	MiTT	Percentage of Outgoing Traffic
1. United Kingdom	211.3	65.3%
2. United States	38.4	11.9%
3. Germany	13.7	4.2%
4. France	11.1	3.4%
5. Netherlands	6.4	2.0%
6. Italy	4.8	1.5%
7. Spain	4.8	1.5%
8. Belgium	4.1	1.3%
9. Canada	3.9	1.2%
10. Australia	3.4	1.1%
11. Switzerland	2.4	0.7%
12. Denmark	1.9	0.6%
13. Sweden	1.9	0.6%
14. Japan	1.0	0.3%
15. Austria	0.8	0.2%
16. Norway	0.7	0.2%
17. Hong Kong	0.7	0.2%
18. South Africa	0.7	0.2%
19. Portugal	0.7	0.2%
20. Saudi Arabia	0.6	0.2%
Other	10.3	3.2%

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National Traffic Balance

MiTT	FY 1992/93	1993/94	1994/95
Incoming	383.0	423.0	442.9
Outgoing	296.6	315.8	323.7
Surplus (Deficit)	86.4	107.2	119.2
Total Volume	679.6	738.8	766.5

Notes: Data based on billing point of traffic. Traffic to Northern Ireland is excluded in both totals and route data. Totals may appear inconsistent with other figures due to rounding. Fiscal year ends 31 March.

Italy

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	267.3	15.6%
2. France	226.4	13.3%
3. Switzerland	168.9	9.9%
4. United Kingdom	135.1	7.9%
5. United States	102.5	6.0%
6. Spain	62.1	3.6%
7. Belgium	49.9	2.9%
8. Austria	44.9	2.6%
9. Netherlands	36.6	2.1%
10. Canada	33.3	1.9%
11. Greece	28.5	1.7%
12. Morocco	28.1	1.6%
13. Croatia	24.6	1.4%
14. Poland	23.1	1.4%
15. Romania	22.2	1.3%
16. *Tunisia*	19.9	1.2%
17. Sweden	14.0	0.8%
18. Russia	13.6	0.8%
19. Hungary	11.6	0.7%
20. Slovenia	11.2	0.7%
Other	384.0	22.5%

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National Traffic Balance

MiTT	1992	1993	1994
Incoming	1,541.0	1,672.7	1,864.0
Outgoing	1,473.4	1,609.7	1,708.0
Surplus (Deficit)	67.6	63.0	156.0
Total Volume	3,014.4	3,282.4	3,572.0

Note: Data based on billing point of traffic. Totals may appear inconsistent with other figures due to rounding.

Luxembourg

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Belgium	48.5	22.7%
2. Germany	43.2	20.2%
3. France	41.8	19.6%
4. Portugal	13.6	6.4%
5. United Kingdom	13.1	6.1%
6. Italy	10.5	4.9%
7. Netherlands	7.7	3.6%
8. Switzerland	6.3	2.9%
9. United States	5.2	2.4%
10. Denmark	3.4	1.6%
11. Spain	3.2	1.5%
12. Austria	1.9	0.9%
13. Sweden	1.8	0.8%
14. Greece	1.4	0.6%
15. Ireland	0.9	0.4%
16. Japan	0.7	0.3%
17. Canada	0.6	0.3%
18. Hong Kong	0.6	0.3%
19. Norway	0.6	0.3%
20. Finland	0.6	0.3%
Other	8.2	3.8%

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National Traffic Balance

MiTT	1992	1993	1994
Incoming	107.5	131.7	145.2
Outgoing	181.0	199.3	213.5
Surplus (Deficit)	(73.5)	(67.6)	(68.3)
Total Volume	288.5	331.0	358.7

Note: Totals may appear inconsistent with other figures due to rounding.

Macedonia, TFYR

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	5.3	15.0%
2. Yugoslavia	4.9	13.8%
3. Bulgaria	3.3	9.3%
4. Croatia	2.5	7.1%
5. Switzerland	2.3	6.5%
6. Slovenia	2.2	6.3%
7. Turkey	1.7	4.7%
8. United States	1.7	4.7%
9. Austria	1.5	4.2%
10. Italy	1.2	3.5%
11. Greece	0.9	2.7%
12. Australia	0.8	2.2%
13. Sweden	0.6	1.8%
14. Russia	0.6	1.6%
15. Netherlands	0.6	1.6%
16. France	0.6	1.6%
17. United Kingdom	0.6	1.6%
18. Albania	0.5	1.3%
19. Canada	0.3	0.9%
20. Belgium	0.3	0.8%
Other	3.1	8.7%

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National Traffic Balance

MiTT	1992	1993	1994
Incoming	n.a.	48.0	78.3
Outgoing	n.a.	27.6	35.1
Surplus (Deficit)	n.a.	20.4	43.2
Total Volume	n.a.	75.6	113.4

Note: Totals may appear inconsistent with other figures due to rounding.

Netherlands

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	313.5	23.3%
2. Belgium	221.3	16.4%
3. United Kingdom	165.4	12.3%
4. France	102.2	7.6%
5. United States	83.4	6.2%
6. Italy	43.5	3.2%
7. Switzerland	38.8	2.9%
8. Spain	37.4	2.8%
9. Turkey	27.7	2.1%
10. Sweden	21.7	1.6%
11. Denmark	19.8	1.5%
12. Austria	18.6	1.4%
13. Canada	15.2	1.1%
14. Poland	13.3	1.0%
15. Norway	11.7	0.9%
16. Greece	11.3	0.8%
17. Morocco	10.3	0.8%
18. Portugal	10.0	0.7%
19. Ireland	9.3	0.7%
20. Netherlands Antilles	8.6	0.6%
Other	162.9	12.1%

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National Traffic Balance

MiTT	1992	1993	1994
Incoming	1,039.0	1,159.0	1,290.9
Outgoing	1,133.9	1,238.2	1,345.8
Surplus (Deficit)	(94.9)	(79.2)	(54.9)
Total Volume	2,172.9	2,397.2	2,636.7

Note: Data based on billing point of traffic. Totals may appear inconsistent with other figures due to rounding.

Norway

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Sweden	104	26.3%
2. Denmark	57	14.4%
3. United Kingdom	56	14.1%
4. United States	29	7.3%
5. Germany	22	5.6%
6. France	14	3.5%
7. Netherlands	11	2.8%
8. Finland	9	2.3%
9. Hong Kong	8	2.0%
10. Spain	7	1.8%
11. Switzerland	6	1.5%
12. Netherlands Antilles	6	1.5%
13. Italy	5	1.3%
14. Belgium	5	1.3%
15. Poland	4	1.0%
Other	53	13.4%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	314.0	322.5	352.0
Outgoing	349.0	376.2	395.5
Surplus (Deficit)	(35.0)	(53.7)	(43.5)
Total Volume	663.0	698.7	747.5

Note: Data are rounded to the nearest million minutes and are based on billing point of traffic.

Poland

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	124.4	34.9%
2. United States	34.3	9.6%
3. France	20.0	5.6%
4. United Kingdom	17.6	4.9%
5. Italy	17.1	4.8%
6. Austria	12.9	3.6%
7. Russia	11.7	3.3%
8. Australia	11.5	3.2%
9. Netherlands	11.0	3.1%
10. Sweden	10.7	3.0%
11. Netherlands Antilles	9.1	2.5%
12. Ukraine	8.9	2.5%
13. Canada	7.3	2.1%
14. Belgium	6.6	1.9%
15. Denmark	5.6	1.6%
16. Switzerland	5.5	1.5%
17. Czech Republic	5.2	1.5%
18. Belarus	4.4	1.2%
19. Spain	2.9	0.8%
20. Lithuania	2.7	0.8%
Other	27.3	7.7%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	366.6	431.5	643.8
Outgoing	212.7	272.7	356.6
Surplus (Deficit)	153.9	158.8	287.2
Total Volume	579.3	704.2	1,000.4

Portugal

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. France	54.9	20.9%
2. Spain	39.8	15.2%
3. Germany	29.4	11.2%
4. United Kingdom	28.4	10.8%
5. Switzerland	13.6	5.2%
6. United States	11.1	4.2%
7. Italy	10.4	4.0%
8. Brazil	10.1	3.9%
9. Belgium	8.4	3.2%
10. Netherlands	8.3	3.1%
11. Angola	5.6	2.1%
12. Canada	4.1	1.6%
13. Sweden	2.9	1.1%
14. Luxembourg	2.8	1.1%
15. Cape Verde	2.4	0.9%
16. Mozambique	2.3	0.9%
17. Denmark	2.2	0.8%
18. Guinea-Bissau	2.2	0.8%
19. South Africa	2.1	0.8%
20. Austria	1.5	0.6%
Other	19.9	7.6%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	n.a.	438.2	467.8
Outgoing	212.0	232.6	262.4
Surplus (Deficit)	n.a.	205.6	205.4
Total Volume	n.a.	670.8	730.2

Notes: Data based on billing point of traffic. Totals are combined for Portugal Telecom, which handles traffic to Europe, and CPRM, which handles overseas traffic. In 1994 Portugal Telecom handled 210.8 million MiTT outgoing and 375.2 million MiTT incoming.

Russia

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	35.8	15.6%
2. United States	27.1	11.8%
3. United Kingdom	12.4	5.4%
4. Finland	11.0	4.8%
5. France	9.2	4.0%
6. Yugoslavia	8.2	3.6%
7. Turkey	8.0	3.5%
8. Israel	7.6	3.3%
9. Poland	7.4	3.2%
10. China	5.2	2.3%
11. Austria	5.1	2.2%
12. Bulgaria	4.9	2.1%
13. Netherlands	4.9	2.1%
14. Switzerland	4.8	2.1%
15. India	4.7	2.1%
16. Sweden	4.4	1.9%
17. Hungary	4.1	1.8%
18. Czech Republic	4.0	1.7%
19. Spain	3.2	1.4%
20. Greece	3.2	1.4%
Other	54.0	23.6%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	230.7	268.0	365.0
Outgoing	175.6	201.0	229.2
Surplus (Deficit)	55.1	67.0	135.8
Total Volume	406.3	469.0	594.2

Note: Data are for Rostelecom only and do not include traffic to and from other former Soviet republics.

Slovak Republic

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	11.3	21.5%
2. Austria	8.7	16.6%
3. Hungary	5.0	9.5%
4. Italy	3.1	5.9%
5. United States	2.9	5.4%
6. United Kingdom	2.0	3.9%
7. Russia	2.0	3.7%
8. Switzerland	1.8	3.5%
9. Ukraine	1.7	3.2%
10. Netherlands	1.1	2.1%
11. Poland	1.1	2.1%
12. Croatia	0.9	1.7%
13. Belgium	0.8	1.5%
Other	10.2	19.4%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	22.3	33.6	68.5
Outgoing	24.5	30.5	52.5
Surplus (Deficit)	(2.1)	3.1	16.0
Total Volume	46.8	64.1	121.0

Note: Totals may appear inconsistent with other figures due to rounding. Data do not include traffic to and from the Czech Republic.

Slovenia

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Croatia	28.8	31.8%
2. Germany	12.4	13.7%
3. Austria	9.9	11.0%
4. Italy	9.1	10.1%
5. Yugoslavia	6.8	7.5%
6. Switzerland	2.5	2.8%
7. Macedonia, TFYR	2.2	2.4%
8. United States	2.1	2.3%
9. United Kingdom	1.8	2.0%
10. France	1.7	1.8%
11. Bosnia and Hercegovina	1.4	1.5%
12. Hungary	1.1	1.2%
13. Russia	1.0	1.1%
14. Czech Republic	1.0	1.1%
15. Netherlands	0.8	0.8%
16. Sweden	0.7	0.8%
17. Belgium	0.6	0.7%
18. Slovak Republic	0.4	0.5%
19. Australia	0.4	0.4%
20. Spain	0.3	0.4%
Other	5.6	6.2%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	n.a.	55.8	83.2
Outgoing	46.2	62.8	90.6
Surplus (Deficit)	n.a.	(7.0)	(7.4)
Total Volume	n.a.	118.6	173.8

Note: Data based on billing point of traffic.

Spain

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. France	152.3	16.1%
2. United Kingdom	142.4	15.0%
3. Germany	138.9	14.6%
4. United States	76.1	8.0%
5. Italy	64.3	6.8%
6. Portugal	37.7	4.0%
7. Netherlands	37.2	3.9%
8. Switzerland	32.6	3.4%
9. Belgium	31.9	3.4%
10. Morocco	20.3	2.1%
11. Argentina	16.5	1.7%
12. Sweden	13.2	1.4%
13. Hong Kong	12.7	1.3%
14. Denmark	9.6	1.0%
15. Mexico	8.8	0.9%
16. Colombia	8.8	0.9%
17. Brazil	7.9	0.8%
18. Venezuela	7.8	0.8%
19. Dominican Republic	7.6	0.8%
20. Chile	7.4	0.8%
Other	114.4	12.0%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	847.2	908.4	969.9
Outgoing	804.5	846.9	948.3
Surplus (Deficit)	42.7	61.5	21.6
Total Volume	1,651.7	1,755.3	1,918.2

Note: Data based on billing point of traffic. Totals may appear inconsistent with other figures due to rounding.

Sweden

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Finland	113	14.1%
2. Norway	109	13.6%
3. Denmark	86	10.7%
4. United Kingdom	75	9.4%
5. Germany	64	8.0%
6. United States	58	7.2%
7. France	30	3.7%
8. Netherlands	23	2.9%
9. Spain	20	2.5%
10. Italy	17	2.1%
11. Switzerland	17	2.1%
12. Belgium	15	1.9%
13. Other	175	21.8%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	595	630	n.a.
Outgoing	693	740	802
Surplus (Deficit)	(98)	(110)	n.a.
Total Volume	1288	1370	n.a.

Notes: Data include traffic of Telia and Tele-2 only and are based on billing point of call and are rounded to the nearest million minutes.

Switzerland

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	370	22%
2. France	282	17%
3. Italy	236	14%
4. United Kingdom	94	6%
5. Austria	83	5%
6. United States	73	4%
7. Portugal	58	3%
8. Spain	53	3%
9. Netherlands	41	2%
10. Turkey	35	2%
11. Belgium	29	2%
12. Yugoslavia	28	2%
13. Canada	20	1%
14. Croatia	19	1%
15. Sweden	18	1%
Other	212	13%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	1,191.5	1,258.7	1,353.0
Outgoing	1,551.0	1,572.0	1,649.3
Surplus (Deficit)	(359.5)	(313.3)	(296.3)
Total Volume	2,742.5	2,830.7	3,002.3

Note: All route data are rounded to the nearest million minutes.

Turkey

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	98.1	34.5%
2. United Kingdom	24.6	8.7%
3. United States	17.4	6.1%
4. France	16.3	5.7%
5. Netherlands	12.2	4.3%
6. Russia	10.7	3.8%
7. Switzerland	9.3	3.3%
8. Italy	8.6	3.0%
9. Austria	7.3	2.6%
10. Romania	6.3	2.2%
11. Belgium	5.6	2.0%
12. Bulgaria	5.5	1.9%
13. Israel	4.9	1.7%
14. Saudi Arabia	4.6	1.6%
15. Greece	4.5	1.6%
16. Iran	4.3	1.5%
17. Sweden	2.9	1.0%
18. Canada	2.6	0.9%
19. Ukraine	2.5	0.9%
20. Denmark	2.3	0.8%
Other	34.0	12.0%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	560.0	605.0	601.4
Outgoing	226.8	264.6	284.3
Surplus (Deficit)	333.2	340.4	317.1
Total Volume	786.8	869.6	885.8

United Kingdom

Largest Telecommunications Routes, FY 1994/95

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	582	16.6%
2. Ireland	312	8.9%
3. Germany	309	8.8%
4. France	307	8.8%
5. Italy	155	4.4%
6. Netherlands	143	4.1%
7. Spain	134	3.8%
8. Australia	112	3.2%
9. Canada	104	3.0%
10. Switzerland	88	2.5%
11. Belgium	87	2.5%
12. Sweden	57	1.6%
13. Hong Kong	51	1.5%
14. Denmark	50	1.4%
15. South Africa	49	1.4%
16. India	49	1.4%
17. Greece	48	1.4%
18. Pakistan	43	1.2%
19. Portugal	41	1.2%
20. Japan	41	1.2%
Other	745	21.2%

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

National Traffic Balance

MiTT	FY 1992/93	FY 1993/94	FY 1994/95
Incoming	2789	3086	3577
Outgoing	2849	3130	3507
Surplus (Deficit)	(60)	(44)	70
Total Volume	5638	6216	7084

Note: Data are rounded to the nearest million minutes. Data are for BT and Mercury only and exclude traffic between the Irish Republic and Northern Ireland. Traffic of IPL resellers is also excluded; these resellers had approximately 70 million outbound MiTT in FY 1993/94 and 120 million outbound MiTT in FY 1994/95. See Methodology, page 169. Fiscal year ends 31 March.

Yugoslavia

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Germany	46.1	25.3%
2. Austria	20.5	11.3%
3. Switzerland	19.6	10.8%
4. Macedonia, TFYR	9.2	5.1%
5. France	8.2	4.5%
6. Italy	8.1	4.5%
7. United States	7.0	3.8%
8. Slovenia	6.4	3.5%
9. Hungary	5.9	3.2%
10. Sweden	5.9	3.2%
11. Greece	5.6	3.1%
12. Russia	5.2	2.9%
13. United Kingdom	3.9	2.1%
14. Canada	3.2	1.8%
15. Netherlands	2.8	1.5%
16. Bulgaria	2.3	1.3%
17. Australia	1.9	1.0%
18. Turkey	1.8	1.0%
19. Cyprus	1.8	1.0%
20. Czech Republic	1.5	0.8%
Other	15.0	8.2%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	n.a.	223.5	229.0
Outgoing	142.8	181.5	181.9
Surplus (Deficit)	n.a.	42.0	47.1
Total Volume	n.a.	405.0	410.9

Former Soviet Union

International Telecommunications Routes, 1994 (thousands of minutes)

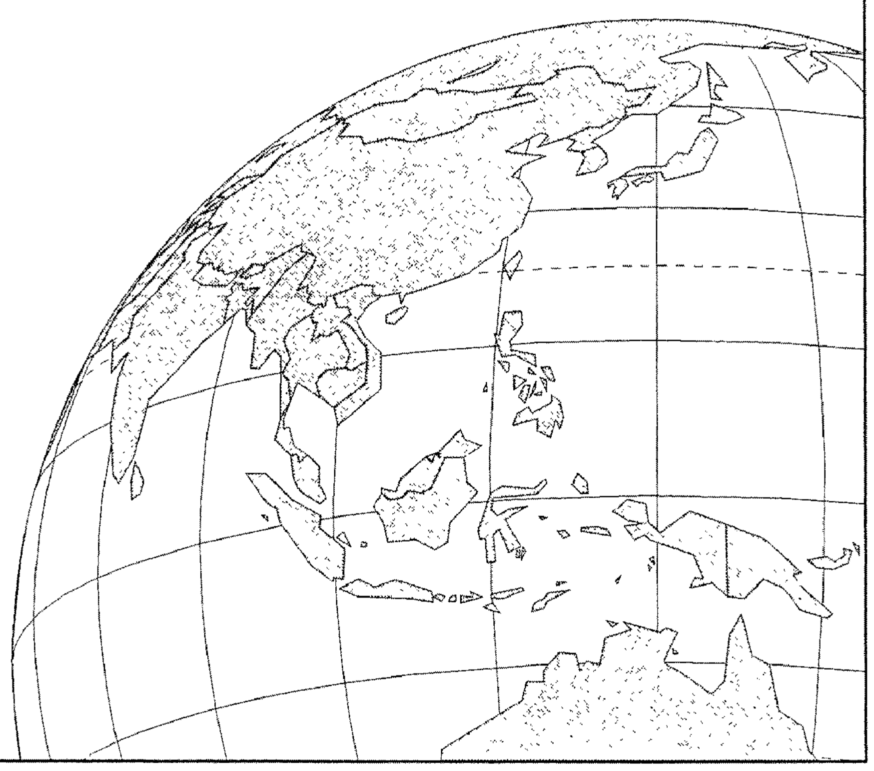
From: / To:	Azerbaijan	Armenia	Belarus	Georgia	Kazakhstan	Kyrgyzstan	Moldova	Russia	Tajikistan	Turkmenistan	Uzbekistan	Ukraine
Armenia	5.1		1283.3	1261.4	465.8		281.2	40775.8	30.4	682.7	638.7	5942.5
Azerbaijan			570.1	430.6	626.6	95.9	140.6	18852.5	39.9	323.5	390.9	2659.2
Estonia	145.7	115.5	1126.6	51.7	196.8	3.8	148.2	14426.2	13.9	27.1	83.7	2667.6
Kazakhstan*	323.8	266.0	555.9	87.3		1565.0	119.3	22007.0	286.6	177.7	2361.9	1537.6
Kyrgyzstan	74.9	18.3	337.6	11.6	1011.2		67.7	18209.3	718.4	393.2	359.5	928.6
Latvia			2339.9					16314.4			3687.5	
Lithuania	287.2	227.4	7536.5	117.3	547.6	45.0	454.1	24081.2	58.9	56.1	382.5	8428.4
Moldova	220.1	352.5	2854.8	38.3	608.2	55.4		3028.7	39.8	75.7	194.1	2251.4
Turkmenistan	367.1	493.9	279.1	45.7	487.3	162.9	50.2	6063.3	338.9		815.4	923.6
Ukraine	5445.3	9985.0	34367.3	3832.2	7444.3	1056.8	25483.5	378124.6	984.3	357.2	7834.0	
Uzbekistan	363.1	352.9	554.5	198.0	2838.8	1144.4	147.5	14663.0	1002.1			1442.3

From: / To:	USA	UK	France	Germany	Turkey
Armenia	726.9	49.7	154.3	100.0	51.5
Azerbaijan	381.2	22.9	4.0	25.5	1954.5
Estonia	1230.7	767.3	303.3	2341.2	62.7
Kazakhstan*	1216.0	550.8	336.8	3324.3	1084.0
Kyrgyzstan	155.7	40	16.6	333.3	71.9
Latvia	863.9	544.5	166.8	1781.9	443.2
Lithuania	685.6	325.6	298.5	2628.8	42.6
Moldova	571.1	103.2	98.0	84.5	191.5
Turkmenistan					
Ukraine					
Uzbekistan	24.0	33.3	4.7	95.8	39.3

* September-December 1994 only.
Source: Regional Commonwealth in the Field of Communications (RCC)

Asia, Middle East & Africa

International Traffic



Australia

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. United Kingdom	148	17%
2. United States	138	16%
3. New Zealand	132	15%
4. Hong Kong	37	4%
5. Japan	31	4%
6. Singapore	26	3%
7. Canada	22	3%
8. Germany	21	2%
9. Italy	19	2%
10. Malaysia	18	2%
11. Philippines	17	2%
12. Indonesia	14	2%
13. Greece	12	1%
14. China	12	1%
15. Papua New Guinea	11	1%
Other	194	23%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	n.a.	n.a.	n.a.
Outgoing	670	735	852
Surplus (Deficit)	n.a.	n.a.	n.a.
Total Volume	n.a.	n.a.	n.a.

Note: Data are for Telstra and Optus combined and are rounded to the nearest million minutes.

Bangladesh

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. India	2.6	11.7%
2. United States	2.6	11.6%
3. United Kingdom	2.5	11.5%
4. Hong Kong	1.4	6.5%
5. Singapore	1.4	6.4%
6. Saudi Arabia	1.2	5.4%
7. Korea, Rep. of	1.0	4.7%
8. Pakistan	0.9	4.2%
9. Japan	0.9	4.0%
10. Malaysia	0.8	3.6%
11. United Arab Emirates	0.5	2.3%
12. Germany	0.5	2.3%
13. China	0.4	1.9%
14. Thailand	0.4	1.8%
15. Italy	0.4	1.8%
16. France	0.4	1.7%
Other	4.1	18.6%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	66.8	83.9	n.a.
Outgoing	14.3	17.2	22.1
Surplus (Deficit)	52.5	66.7	n.a.
Total Volume	81.1	101.1	n.a.

China

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Hong Kong	670	61.5%
2. Taiwan	85	7.8%
3. Japan	71	6.5%
4. United States	54	5.0%
5. Macau	34	3.1%
6. Korea	27	2.5%
7. Singapore	15	1.4%
8. Australia	14	1.3%
9. Germany	7	0.6%
10. Canada	6	0.6%
11. United Kingdom	6	0.6%
12. France	6	0.6%
13. Malaysia	5	0.5%
14. Russia	4	0.4%
15. Thailand	4	0.4%
Other	82	7.5%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	n.a.	n.a.	n.a.
Outgoing	635	870	1090
Surplus (Deficit)	n.a.	n.a.	n.a.
Total Volume	n.a.	n.a.	n.a.

Note: Data are rounded to the nearest 1 million minutes, except for Hong Kong, which is rounded to the nearest 10 million minutes.

Hong Kong

Largest Telecommunications Routes, FY 1994/95

Destination	MiTT	Percentage of Outgoing Traffic
1. China	821	52%
2. United States	95	6%
3. Taiwan	79	5%
4. Canada	63.	4%
5. Japan	63	4%
6. United Kingdom	63	4%
7. Macau	47	3%
8. Singapore	47	3%
9. Australia	47	3%
10. Philippines	47	3%
Other	205	13%

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

National Traffic Balance

MiTT	FY 1992/93	1993/94	1994/95
Incoming	1,009.4	1,260.3	1,446.4
Outgoing	1,136.6	1,376.9	1,578.4
Surplus (Deficit)	(127.2)	(116.5)	(132.1)
Total Volume	2,146.0	2,637.2	3,024.8

Note: Data based on billing point of traffic. Totals may appear inconsistent with other figures due to rounding. Fiscal year ends 31 March.

India

Largest Telecommunications Routes, FY 1994/95

Destination	MiTT	Percentage of Outgoing Traffic
1. Saudi Arabia	65.0	20.7%
2. United States	48.7	15.5%
3. United Arab Emirates	32.3	10.3%
4. United Kingdom	30.1	9.6%
5. Germany	11.5	3.7%
6. Singapore	11.3	3.6%
7. Kuwait	9.6	3.1%
8. Canada	7.2	2.3%
9. Hong Kong	6.7	2.1%
10. Oman	6.3	2.0%
11. Australia	6.2	2.0%
12. Japan	5.2	1.7%
13. France	4.8	1.5%
14. Italy	4.1	1.3%
15. Sri Lanka	3.8	1.2%
16. Qatar	3.6	1.1%
17. Netherlands	3.1	1.0%
18. Switzerland	2.6	0.8%
19. Bahrain	2.5	0.8%
20. Malaysia	2.5	0.8%
Other	47.0	15.0%

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

National Traffic Balance

MiTT	FY 1992/93	FY 1993/94	FY 1994/95
Incoming	354.6	441.0	615.0
Outgoing	259.6	283.9	314.0
Surplus (Deficit)	95.0	157.1	300.9
Total Volume	614.2	724.8	929.0

Note: Data based on billing point of traffic. Outgoing totals and route data do not include calls to Bangladesh, Nepal, Pakistan and Sri Lanka. Fiscal year ends 31 March. Totals may appear inconsistent with other figures due to rounding.

Indonesia

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Singapore	42	23.0%
2. United States	20	11.0%
3. Japan	17	9.3%
4. Australia	15	8.2%
5. Hong Kong	12	6.6%
6. Taiwan	9	4.9%
7. Malaysia	8	4.4%
8. Korea, Rep. of	7	3.8%
9. United Kingdom	6	3.3%
10. Germany	5	2.7%
11. Netherlands	5	2.7%
12. France	3	1.6%
13. Philippines	3	1.6%
14. China	3	1.6%
15. Thailand	3	1.6%
16. Canada	2	1.1%
17. Italy	2	1.1%
18. Saudi Arabia	2	1.1%
19. India	2	1.1%
20. Switzerland	1	0.5%
Other	16	8.8%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	165.5	201.8	244.7
Outgoing	118.1	143.8	182.5
Surplus (Deficit)	47.4	58.0	62.2
Total Volume	283.6	345.6	427.2

Note: Data based on billing point of traffic. Data are for Indosat only, rounded to the nearest million minutes.

Iran

Largest Telecommunications Routes, 1993

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	21.2	13.6%
2. United Arab Emirates	19.9	12.7%
3. Germany	16.6	10.6%
4. Kuwait	16.0	10.2%
5. Japan	10.3	6.6%
6. United Kingdom	8.4	5.4%
7. Pakistan	6.6	4.2%
8. Sweden	6.5	4.2%
9. Canada	5.6	3.6%
10. France	4.6	2.9%
11. Turkey	4.6	2.9%
12. Italy	4.4	2.8%
13. Saudi Arabia	3.7	2.4%
14. Qatar	3.1	2.0%
15. Netherlands	2.3	1.5%
16. Austria	2.2	1.4%
17. Switzerland	2.0	1.3%
18. Denmark	1.5	0.9%
19. Bahrain	1.4	0.9%
20. Korea, Rep. of	1.3	0.8%
Other	14.2	9.0%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	n.a.	n.a.	n.a.
Outgoing	131.3	156.5	208.4
Surplus (Deficit)	n.a.	n.a.	n.a.
Total Volume	n.a.	n.a.	n.a.

Japan

Largest Telecommunications Routes, FY 1994/95

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	295.0	20.6%
2. China	171.0	11.9%
3. Korea	150.3	10.5%
4. Philippines	121.7	8.5%
5. Taiwan	83.4	5.8%
6. Thailand	64.1	4.5%
7. Hong Kong	54.6	3.8%
8. Brazil	54.0	3.8%
9. United Kingdom	45.2	3.1%
10. Singapore	36.1	2.5%
11. Malaysia	31.8	2.2%
12. Australia	31.0	2.2%
13. Germany	26.2	1.8%
14. Indonesia	23.6	1.6%
15. Peru	23.2	1.6%
16. Iran	21.7	1.5%
17. Canada	20.2	1.4%
18. France	20.1	1.4%
19. Pakistan	14.8	1.0%
20. Italy	10.5	0.7%
Other	137.2	9.6%

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

National Traffic Balance

MiTT	FY 1992/93	FY 1993/94	FY 1994/95
Incoming	891.5	981.2	1140.6
Outgoing	1283.5	1411.2	1524.8
Surplus (Deficit)	(392.0)	(429.8)	(384.2)
Total Volume	2174.8	2392.4	2665.4

Note: Route data include only IDD calls, while total data include operator assisted calls as well. Fiscal year ends 31 March. Data are for KDD, ITJ, and IDC combined.

Jordan

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Saudi Arabia	7.9	13.9%
2. Iraq	7.2	12.6%
3. Egypt	5.5	9.6%
4. Syria	5.3	9.3%
5. United States	4.0	7.0%
6. United Arab Emirates	3.3	5.9%
7. Israel	2.8	4.9%
8. United Kingdom	2.5	4.4%
9. Kuwait	2.4	4.1%
10. Lebanon	1.6	2.9%
11. Germany	1.2	2.2%
12. Italy	0.9	1.6%
13. Qatar	0.9	1.6%
14. France	0.9	1.5%
15. Oman	0.7	1.2%
16. Cyprus	0.7	1.2%
17. Yemen	0.6	1.1%
18. Turkey	0.6	1.1%
19. Bahrain	0.6	1.0%
Other	7.3	12.8%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	n.a.	100	114
Outgoing	46	50	57
Surplus (Deficit)	n.a.	50	57
Total Volume	n.a.	150	171

Notes: Data based on billing point of traffic. Traffic to Israel includes traffic to the West Bank.

Korea, Republic of

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	122.2	27.8%
2. Japan	106.5	24.2%
3. China	43.1	9.8%
4. Hong Kong	18.6	4.2%
5. Germany	11.5	2.6%
6. Australia	9.4	2.1%
7. Philippines	9.4	2.1%
8. United Kingdom	9.3	2.1%
9. Indonesia	8.9	2.0%
10. Taiwan	8.8	2.0%
11. Canada	8.6	1.9%
12. Singapore	7.9	1.8%
13. France	6.5	1.5%
14. Thailand	5.6	1.3%
15. Italy	4.4	1.0%
16. Vietnam	4.4	1.0%
17. Russia	3.9	0.9%
18. Malaysia	3.2	0.7%
Other	48.2	11.0%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	453.9	510.5	555.2
Outgoing	305.9	355.4	440.4
Surplus (Deficit)	148.0	155.1	114.8
Total Volume	759.8	865.9	995.6

Note: Data are for Korea Telecom and DACOM combined and are based on billing point of traffic.

Kuwait

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Egypt	20.0	16.6%
2. Saudi Arabia	14.0	11.6%
3. United States	11.3	9.4%
4. India	11.1	9.2%
5. United Arab Emirates	7.8	6.5%
6. United Kingdom	7.1	5.9%
7. Pakistan	7.0	5.8%
8. Syria	6.7	5.5%
9. Jordan	6.2	5.1%
10. Iran	4.9	4.1%
11. Bahrain	3.2	2.7%
12. Lebanon	2.5	2.1%
13. Bangladesh	1.6	1.3%
14. Germany	1.4	1.2%
15. France	1.3	1.1%
16. Philippines	1.1	1.0%
17. Qatar	1.1	0.9%
18. Italy	1.0	0.9%
19. Oman	1.0	0.8%
20. Canada	0.9	0.8%
Other	9.1	7.6%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	n.a.	n.a.	127.0
Outgoing	112.7	116.8	120.6
Surplus (Deficit)	n.a.	n.a.	6.4
Total Volume	n.a.	n.a.	247.6

Note: Totals may appear inconsistent with other figures due to rounding.

Macau

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. China	44.9	44.9%
2. Hong Kong	43.7	43.7%
3. Portugal	2.7	2.7%
4. Taiwan	1.7	1.7%
5. Thailand	1.1	1.1%
6. United States	1.0	1.0%
7. Canada	0.9	0.9%
8. Philippines	0.6	0.6%
9. Australia	0.5	0.5%
10. United Kingdom	0.4	0.4%
11. Singapore	0.4	0.4%
12. Japan	0.4	0.4%
13. Malaysia	0.3	0.3%
14. France	0.2	0.2%
15. Korea, Rep. of	0.2	0.2%
Other	1.3	1.3%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	68.6	78.0	84.3
Outgoing	76.9	89.9	100.0
Surplus (Deficit)	(8.3)	(11.9)	(15.7)
Total Volume	145.5	167.9	184.3

Malaysia

Largest Telecommunications Routes, FY 1994/95

Destination	MiTT	Percentage of Outgoing Traffic
1. Singapore	159.8	46.7%
2. Japan	22.9	6.7%
3. United Kingdom	18.6	5.4%
4. Australia	16.9	4.9%
5. United States	14.6	4.3%
6. Indonesia	14.1	4.1%
7. Hong Kong	13.7	4.0%
8. Taiwan	10.9	3.2%
9. Thailand	10.2	3.0%
10. India	7.9	2.3%
11. Philippines	7.0	2.0%
12. China	5.7	1.7%
13. Germany	4.0	1.2%
14. Korea, Rep. of	3.4	1.0%
15. Brunei	2.8	0.8%
16. Canada	2.7	0.8%
17. New Zealand	2.4	0.7%
18. France	2.0	0.6%
19. Italy	1.6	0.5%
20. Netherlands	1.5	0.4%
Other	19.6	5.7%

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

National Traffic Balance

MiTT	FY 1992/93	1993/94	1994/95
Incoming	249.0	304.2	399.7
Outgoing	216.5	258.1	342.3
Surplus (Deficit)	32.5	46.1	57.4
Total Volume	465.5	562.3	742.0

Notes: Traffic is for Telekom Malaysia only and does not include local Malaysia-Singapore border traffic. Data based on billing point of traffic. Totals may appear inconsistent with other figures due to rounding. Fiscal year ends 31 March.

New Zealand

Largest Telecommunications Routes, FY 1994/95

Destination	MiTT	Percentage of Outgoing Traffic
1. Australia	110	47.8%
2. United Kingdom	33	14.3%
3. United States	23	10.0%
4. Hong Kong	6	2.6%
5. Japan	5	2.2%
6. Fiji	5	2.2%
7. Canada	5	2.2%
8. Singapore	5	2.2%
9. Malaysia	4	1.7%
10. Taiwan	3	1.3%
11. Western Samoa	2	0.9%
12. Germany	2	0.9%
13. China	2	0.9%
14. South Africa	2	0.7%
15. India	2	0.7%
16. Thailand	2	0.7%
17. Korea, Rep. of	2	0.7%
18. Netherlands	1	0.4%
19. Indonesia	1	0.4%
20. Philippines	1	0.4%
Other	16	7.0%

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

National Traffic Balance

MiTT	FY 1992/93	FY 1993/94	FY 1994/95
Incoming	n.a.	n.a.	241
Outgoing	170	191	230
Surplus (Deficit)	n.a.	n.a.	11
Total Volume	n.a.	n.a.	471

Note: Data rounded to the nearest million minutes for Telecom New Zealand and Clear Communications Ltd. combined. Fiscal year ends 31 March.

Pakistan

Largest Telecommunications Routes, 1993

Destination	MiTT	Percentage of Outgoing Traffic
1. United Kingdom	8.4	14.8%
2. United States	7.7	13.5%
3. United Arab Emirates	6.1	10.7%
4. Saudi Arabia	6.0	10.6%
5. Germany	2.5	4.4%
6. India	2.0	3.5%
7. Japan	1.5	2.7%
8. Iran	1.4	2.4%
9. France	1.2	2.2%
10. Singapore	1.2	2.2%
11. Hong Kong	1.1	2.0%
12. Kuwait	1.1	2.0%
13. Canada	0.9	1.7%
14. China	0.9	1.6%
15. Netherlands	0.8	1.3%
16. Italy	0.8	1.3%
17. Switzerland	0.7	1.2%
18. Korea	0.6	1.0%
19. Qatar	0.5	1.0%
20. Turkey	0.5	0.9%
Other	10.7	18.9%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	n.a.	305.7	n.a.
Outgoing	44.2	56.5	61.4
Surplus (Deficit)	n.a.	249.2	n.a.
Total Volume	n.a.	362.2	n.a.

Note: Traffic to Bangladesh is excluded from route data.

Philippines

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. United States	55	34.4%
2. Japan	25	15.6%
3. Hong Kong	14	8.8%
4. Canada	11	6.9%
5. Australia	8	5.0%
6. Singapore	7	4.4%
7. Taiwan	6	3.8%
8. Korea, Rep. of	4	2.5%
9. Saudi Arabia	4	2.5%
10. United Kingdom	3	1.9%
11. Malaysia	3	1.9%
12. Italy	2	1.3%
Other	18	11.3%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	462.1	n.a.	617
Outgoing	135.8	164	160
Surplus (Deficit)	326.3	n.a.	457
Total Volume	597.9	n.a.	777

Note: Traffic to the United States includes traffic to Guam. Data are rounded to the nearest million minutes and include PLDT, Eastern Telecoms, CapWire, and Philippine Global Com. only.

Qatar

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. United Arab Emirates	10.2	16.3%
2. India	9.8	15.7%
3. Egypt	7.6	12.1%
4. Saudi Arabia	5.9	9.5%
5. Bahrain	3.9	6.2%
6. United Kingdom	3.7	5.8%
7. Pakistan	3.5	5.6%
8. United States	1.7	2.8%
9. Jordan	1.5	2.4%
10. Kuwait	1.5	2.4%
11. Bangladesh	1.4	2.2%
12. Oman	1.1	1.8%
13. Iran	1.1	1.8%
14. France	1.0	1.6%
15. Philippines	0.8	1.2%
Other	8.0	12.7%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	n.a.	n.a.	n.a.
Outgoing	50.7	58.3	62.7
Surplus (Deficit)	n.a.	n.a.	n.a.
Total Volume	n.a.	n.a.	n.a.

Saudi Arabia

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Egypt	129.5	26.0%
2. Pakistan	51.7	10.4%
3. India	30.4	6.1%
4. United States	27.7	5.6%
5. United Arab Emirates	26.0	5.2%
6. United Kingdom	22.5	4.5%
7. Kuwait	19.4	3.9%
8. Syria	17.3	3.5%
9. Jordan	16.1	3.2%
10. Bahrain	14.9	3.0%
11. Yemen	14.2	2.8%
12. Philippines	12.4	2.5%
13. Sudan	9.4	1.9%
14. Morocco	9.1	1.8%
15. Bangladesh	9.0	1.8%
16. Turkey	8.4	1.7%
17. Lebanon	8.2	1.6%
18. France	8.0	1.6%
19. Qatar	6.4	1.3%
20. Germany	5.6	1.1%
Other	52.6	10.5%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	292.1	n.a.	n.a.
Outgoing	464.6	454.9	498.9
Surplus (Deficit)	(172.5)	n.a.	n.a.
Total Volume	756.7	n.a.	n.a.

Singapore

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Malaysia	190	29.5%
2. Indonesia	52	8.1%
3. Hong Kong	51	7.9%
4. United States	43	6.7%
5. Japan	42	6.5%
6. Thailand	29	4.5%
7. Australia	25	3.9%
8. United Kingdom	25	3.9%
9. Taiwan	24	3.7%
10. Philippines	24	3.7%
11. India	24	3.7%
12. China	24	3.7%
13. Germany	10	1.6%
14. Korea	10	1.6%
15. France	6	0.9%
16. Brunei	6	0.9%
Other	58	9.0%

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

National Traffic Balance

MiTT	FY 1992/93	FY 1993/94	FY 1994/95
Incoming	n.a.	n.a.	n.a.
Outgoing	412	480	643
Surplus (Deficit)	n.a.	n.a.	n.a.
Total Volume	n.a.	n.a.	n.a.

Notes: Data rounded to the nearest million minutes. Fiscal year ends 31 March. Totals exclude local Malaysia-Singapore border traffic. Route data are for 1994 calendar year.

Sri Lanka

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. India	3.0	12.7%
2. United Kingdom	2.5	10.5%
3. Singapore	1.9	8.0%
4. United States	1.8	7.6%
5. Japan	1.5	6.3%
6. Hong Kong	1.4	5.9%
7. Australia	1.0	4.2%
8. Germany	1.0	4.2%
9. Korea, Rep. of	0.9	3.8%
10. United Arab Emirates	0.8	3.4%
11. Italy	0.5	2.1%
12. France	0.5	2.1%
13. Canada	0.5	2.1%
14. Saudi Arabia	0.5	2.1%
15. Malaysia	0.5	2.1%
16. Kuwait	0.5	2.1%
17. Netherlands	0.4	1.7%
18. Thailand	0.4	1.7%
19. Maldives	0.4	1.7%
20. Pakistan	0.4	1.7%
Other	3.3	13.9%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	n.a.	65.0	78.7
Outgoing	17.8	19.5	23.7
Surplus (Deficit)	n.a.	45.5	55.0
Total Volume	n.a.	84.5	102.4

Note: Data based on billing point of traffic.

Syria

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Lebanon	4.7	11.7%
2. Jordan	4.6	11.6%
3. Kuwait	4.1	10.3%
4. United States	2.5	6.3%
5. Russia	2.3	5.7%
6. France	2.3	5.7%
7. Egypt	2.3	5.6%
8. Germany	1.8	4.6%
9. Saudi Arabia	1.7	4.4%
10. United Kingdom	1.5	3.8%
Other	12.2	39.3%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	N.A.	59.3	78.0
Outgoing	22.0	36.7	40.0
Surplus (Deficit)	N.A.	22.6	38.0
Total Volume	N.A.	96.0	118.0

Taiwan

Largest Telecommunications Routes, FY 1994/95

Destination	MiTT	Percentage of Outgoing Traffic
1. China	109.1	21.9%
2. United States	94.8	19.0%
3. Hong Kong	73.6	14.8%
4. Japan	62.6	12.6%
5. Singapore	15.9	3.2%
6. Thailand	14.8	3.0%
7. Canada	14.1	2.8%
8. Philippines	13.4	2.7%
9. Malaysia	10.4	2.1%
10. Indonesia	9.7	1.9%
11. Australia	9.4	1.9%
12. Germany	7.6	1.5%
13. United Kingdom	7.3	1.5%
14. Korea, Rep. of	7.2	1.4%
15. Vietnam	5.6	1.1%
16. France	4.5	0.9%
17. New Zealand	3.0	0.6%
18. Italy	2.8	0.6%
19. South Africa	2.3	0.5%
20. Netherlands	2.0	0.4%
Other	28.4	5.7%

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

National Traffic Balance

MiTT	FY 1992/93	FY 1993/94	FY 1994/95
Incoming	484.4	490.8	613.5
Outgoing	368.7	440.7	498.5
Surplus (Deficit)	115.7	50.1	115.0
Total Volume	853.1	931.5	1,112.0

Note: Data based on billing point of traffic. Fiscal year ends March 31.

Thailand

Largest Telecommunications Routes, 1994

Destination	MiTT	Percentage of Outgoing Traffic
1. Japan	27.9	16.1%
2. United States	21.9	12.6%
3. Singapore	18.6	10.7%
4. Hong Kong	13.2	7.6%
5. Taiwan	12.2	7.0%
6. United Kingdom	8.8	5.1%
7. Australia	6.7	3.9%
8. Germany	6.7	3.9%
9. China	6.5	3.8%
10. Korea, Rep. of	5.4	3.1%
11. France	4.2	2.4%
12. India	3.8	2.2%
13. Italy	3.0	1.7%
14. Myanmar	2.7	1.6%
15. Indonesia	2.5	1.4%
16. Switzerland	2.4	1.4%
17. Philippines	2.3	1.3%
18. Vietnam	2.0	1.2%
19. Cambodia	1.6	0.9%
20. Canada	1.6	0.9%
Other	19.3	11.2%

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

National Traffic Balance

MiTT	1992	1993	1994
Incoming	212.7	218.7	313.3
Outgoing	132.4	161.8	173.2
Surplus (Deficit)	80.3	56.9	140.1
Total Volume	345.1	380.5	486.5

Methodology and Sources

The traffic statistics in *TeleGeography 1995* were compiled primarily from an independent survey of telecommunications service providers. For some countries and carriers, traffic data have been estimated based upon annual reports, government publications and industry interviews. See the footnotes to each table for further information. *Direction of Traffic: International Telephone Traffic 1983-1992* (Geneva: TeleGeography, Inc./ITU, 1994) and *Internationale Fernmeldestatistik* (Munich: Siemens, 1995) were also consulted.

A common accounting unit known as MiTT (Minutes of Telecommunications Traffic) is used throughout the report. MiTT generally refers to paid minutes of traffic on public switched voice circuits and thus includes voice as well as non-voice (facsimile, data) traffic. For the origins of MiTT and its various applications (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 the *World Telecommunication Development Report* (Geneva: ITU, 1995) and *Communications Outlook* (Paris: OECD, 1995) for a comparison of MiTT with other telecommunication indicators.

Calling card traffic

Historically, most international calls were billed at the point of origination. The number of billed minutes thus coincided with the volume of outgoing traffic. Billed minutes also included collect or reverse charge calls because the calls were set up by an operator in the originating country. However, the recent use of credit and debit cards has shifted the billing point for many international calls. For example, calls from Italy to the United States (or a third country, such as Argentina) may now be set up and billed in the U.S.

Unless otherwise stated in the notes to a table, the outbound MiTT reported for countries in *TeleGeography 1995* refers to outbound traffic originated in the reporting country even if it is billed in another country. That is, unless stated, traffic originated in another country but billed to a calling card or credit card in the reporting country is not counted as outbound traffic.

Some countries (including the U.S.) report international traffic data based solely on the location where the traffic is billed; consequently, "outbound" traffic data for these countries include Home Country direct traffic originating in third countries (e.g., a call originated in Italy to a U.S. number and billed to a U.S. calling card). For these and other reasons (such a different fiscal years), the national statistics in *TeleGeography* are not directly comparable, and incoming MiTT reported for one country may not match the outgoing MiTT on the same route by the correspondent country. Some double counting may also occur. For example, a Country Direct call from Poland to the U.S. which is billed to a U.S. calling card is reported here as outbound U.S. MiTT; the same call also is reported as outbound MiTT by Poland.

Third-country routing

The growing volume of traffic routed *via* a third country using Home Country Beyond and "call back" services is also making national traffic statistics harder to interpret. A Home Country Beyond call may originate in Country A, be billed to a calling card in Country B and terminate in Country C. Similarly, a call routed *via* a "call back" service may be placed by a subscriber in Country A, but originate in Country B and terminate in Country C. In both cases, the calls from Country A to Country C generally will not be counted in Country A's outbound MiTT but may be reflected by an increased volume of MiTT from Country B to Country C.

Accordingly, in countries where Home Country Beyond and call back services are widely used, a year-to-year comparison of national MiTT also requires examining the statistics of countries, such as the U.S., where the calls are being refiled or hubbed.

To assist readers in making such comparisons, the U.S. tables in *TeleGeography 1995* have been expanded to provide 1993 and 1994 route-by-route statistics for over sixty countries. For further discussion of the methodological issues raised by the growth of alternative call routing arrangements, see *Direction of Traffic op. cit.* Chapter 7.

Resellers

Traffic carried by resellers of international switched voice services generally is included in the MiTT for the facilities-based carrier whose facilities are resold. But unless otherwise stated, MiTT data exclude traffic carried by resellers of international private line (IPLs) connected to the public switched network at one or both ends. Transit traffic is also excluded.

Other factors

There may also be other reasons (beyond those referred to above) which cause inbound traffic data on a given route to differ from the outbound traffic data for the originating country (e.g., calendar vs. fiscal year data). Further, neighboring countries may not classify local cross-border traffic in the same way (i.e., one country may count all such traffic as international, while the other does not.) 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.

Some differences exist between the historical statistics (1993 or earlier) reported in *TeleGeography 1995* and data stated in prior reports or *Direction of Traffic*. The variations reflect corrections and/or revised data subsequently provided to *TeleGeography*. In addition, rounding may cause the figures on total national traffic and surpluses and deficits to appear inconsistent with other national data by ±0.2 million minutes.

Blue Pages

International Dialing Codes, by Number

1	Canada
	United States
1-809	Anguilla, Antigua & Barbuda, Bahamas, Barbados, British Virgin Islands, Cayman Islands, Dominica, Dominican Republic, Grenada, Jamaica, Montserrat, Puerto Rico, St. Lucia, St.. Kitts & Nevis Islands, St.. Vincent & the Grenadines, Trinidad & Tobago, Turks & Caicos , U.S. Virgin Islands
1-441	Bermuda
20	Egypt
212	Morocco
213	Algeria
216	Tunisia
218	Libya
220	Gambia
221	Senegal
222	Mauritania
223	Mali
224	Guinea
225	Ivory Coast
226	Burkina Faso
227	Niger
228	Togo
229	Benin
230	Mauritius
231	Liberia
232	Sierra Leone
233	Ghana
234	Nigeria
235	Chad
236	Central African Republic
237	Cameroon
238	Cape Verde Islands
239	Sao Tome and Principe
240	Equatorial Guinea
241	Gabon
242	Congo
243	Zaire
244	Angola
245	Guinea-Bissau
246	Diego Garcia
247	Ascension Island
248	Seychelles
249	Sudan
250	Rwanda
251	Ethiopia
252	Somalia
253	Djibouti
254	Kenya
255	Tanzania
256	Uganda
257	Burundi
258	Mozambique
259	Zanzibar
260	Zambia
261	Madagascar
262	Reunion Island
263	Zimbabwe
264	Namibia
265	Malawi
266	Lesotho
267	Botswana
268	Swaziland
269	Comoros & Mayotte
27	South Africa
290	St. Helena
291	Eritrea
297	Aruba
298	Faroe Islands
299	Greenland
30	Greece
31	Netherlands
32	Belgium
33	France
33-93	Monaco
34	Spain
350	Gibraltar
351	Portugal; Azores
352	Luxembourg
353	Ireland
354	Iceland
355	Albania
356	Malta
357	Cyprus
358	Finland
359	Bulgaria
36	Hungary
370	Lithuania
371	Latvia
372	Estonia
373	Moldova
374	Armenia
375	Belarus
376	Andorra
377	Monaco (reserved)
378	San Marino
379	Vatican City
380	Ukraine
381	Yugoslavia
385	Croatia
386	Slovenia
387	Bosnia-Hercegovina
389	Macedonia, TFYR
39	Italy
40	Romania
41	Switzerland
41-75	Liechtenstein
42	Czech Republic
42	Slovak Republic
43	Austria
44	United Kingdom
45	Denmark
46	Sweden
47	Norway
48	Poland
49	Germany
500	Falkland Islands
501	Belize
502	Guatemala
503	El Salvador
504	Honduras
505	Nicaragua
506	Costa Rica
507	Panama
508	St. Pierre & Miquelon
509	Haiti
51	Peru
52	Mexico
53	Cuba
54	Argentina
55	Brazil
56	Chile
57	Colombia
58	Venezuela
590	Guadeloupe
591	Bolivia
592	Guyana
593	Ecuador
594	French Guiana
595	Paraguay
596	Martinique
597	Suriname
598	Uruguay
599	Netherlands Antilles
60	Malaysia
61	Australia
62	Indonesia
63	Philippines
64	New Zealand
65	Singapore
66	Thailand
670	Northern Marianas
671	Guam
672	Australian Territories
673	Brunei
674	Nauru
675	Papua New Guinea
676	Tonga Islands
677	Solomon Islands
678	Vanuatu
679	Fiji
680	Palau
681	Wallis & Futuna
682	Cook Islands
683	Niue
684	American Samoa
685	Western Samoa
686	Kiribati
687	New Caledonia
688	Tuvalu
689	French Polynesia
690	Tokelau
691	Micronesia
692	Marshall Islands
7	Kazakhstan
	Kyrgyzstan
	Russia
	Tajikistan
	Turkmenistan
	Uzbekistan
81	Japan
82	South Korea
84	Vietnam
850	North Korea
852	Hong Kong
853	Macau
855	Cambodia
856	Laos
86	China (PRC)
871	Inmarsat East Atlantic
872	Inmarsat Pacific
873	Inmarsat Indian
874	Inmarsat West Atlantic
880	Bangladesh
886	Taiwan
90	Turkey
91	India
92	Pakistan
93	Afghanistan
94	Sri Lanka
95	Myanmar (Burma)
960	Maldives
961	Lebanon
962	Jordan
963	Syria
964	Iraq
965	Kuwait
966	Saudi Arabia
967	Yemen
968	Oman
971	United Arab Emirates
972	Israel
973	Bahrain
974	Qatar
975	Bhutan
976	Mongolia
977	Nepal
98	Iran
994	Azerbaijan
995	Georgia

International Dialing Codes, by Country

Afghanistan	**93**
Albania	**355**
Tirana	42
Algeria	**213**
Algiers	2
American Samoa	**684**
Andorra	**376**
Angola	**244**
Luanda	2
Anguilla	**1-809**
Antigua & Barbuda	**1-809**
Argentina	**54**
Buenos Aires	1
Armenia	**374**
Yerevan	8852
Aruba	**297**
Ascension Island	**247**
Australia	**61**
Canberra	62
Melbourne	3
Sydney	2
Australian Territories	**672**
Austria	**43**
Vienna	1
Azerbaijan	**994**
Baku	8922
Bahamas	**1-809**
Bahrain	**973**
Bangladesh	**880**
Dhaka	2
Barbados	**1-809**
Belarus	**375**
Minsk	172
Belgium	**32**
Brussels	2
Belize	**501**
Belmopan	8
Benin	**229**
Bermuda	**1-441**
Bhutan	**975**
Bolivia	**591**
La Paz	2
Bosnia	**387**
Sarajevo	71
Botswana	**267**
Brazil	**55**
Brasilia	61
Rio de Janeiro	21
São Paulo	11
British Virgin Islands	**1-809**
Brunei	**673**
Bandar Seri Begawan	2
Bulgaria	**359**
Sofia	2
Burkina Faso	**226**
Burundi	**257**
Cambodia	**855**
Cameroon	**237**
Canada	**1**
Montreal	514
Ottawa	613
Toronto	416
Cape Verde	**238**
Cayman Islands	**1-809**
Central African Republic	**236**
Bangui	61
Chad	**235**
Chile	**56**
Santiago	2
China, People's Republic of	**86**
Beijing	1
Guangzhou	20
Shanghai	21
Colombia	**57**
Bogota	1
Cocos Islands; Norfolk & Christmas Islands	**672**
Comoros	**269**
Congo	**242**
Brazzaville	81/82/83
Costa Rica	**506**
Croatia	**385**
Zagreb	1
Cuba	**53**
Havana	7
Cyprus	**357**
Nicosia	2
Czech Republic	**42**
Prague	2
Denmark	**45**
Diego Garcia	**246**
Djibouti	**253**
Dominca	**1-809**
Dominican Republic	**1-809**
Ecuador	**593**
Quito	2
Egypt	**20**
Cairo	2
El Salvador	**503**
Equitorial Guinea	**240**
Eritrea	**291**
Estonia	**372**
Tallinn	2
Ethiopia	**251**
Addis Ababa	1
Falkland Islands	**500**
Faroe Islands	**298**
Fiji	**679**
Finland	**358**
Helsinki	0
France	**33**
Paris	1
French Antilles	**596**
French Guiana	**594**
French Polynesia	**689**
Gabon	**241**
Gambia	**220**
Georgia	**995**
Tbilisi	8832
Germany	**49**
Berlin	30
Bonn	228
Frankfurt	69
Munich	89
Ghana	**233**
Accra	21
Gibraltar	**350**
Greece	**30**
Athens	1
Greenland	**299**
Grenada	**1-809**
Guadeloupe	**590**
Guam	**671**
Guatemala	**502**
Guatemala City	2
Guinea	**224**
Guinea-Bissau	**245**
Guyana	**592**
Georgetown	2
Haiti	**509**
Honduras	**504**
Hong Kong	**852**
Hungary	**36**
Budapest	1
Iceland	**354**
Reykjavik	1
India	**91**
Bombay	22
Calcutta	33
New Delhi	11
Indonesia	**62**
Jakarta	21
Inmarsat	
East Atlantic	871
West Atlantic	874
Pacific	872
Indian	873
Iran	**98**
Tehran	21
Iraq	**964**
Baghdad	1
Ireland	**353**
Dublin	1
Israel	**972**
Jerusalem	2
Tel Aviv	3
Italy	**39**
Rome	6
Milan	2
Ivory Coast	**225**
Jamaica	**1-809**
Japan	**81**
Osaka	6
Tokyo	3
Jordan	**962**
Amman	6
Kazakhstan	**7**
Alma Ata	3272
Kenya	**254**
Nairobi	2
Kiribati	**686**
Kuwait	**965**
Kyrgyzstan	**7**
Bishkek	3312
Laos	**856**
Latvia	**371**
Riga	2
Lebanon	961
Beirut	1
Lesotho	**266**
Liberia	**231**
Libya	**218**
Tripoli	21
Liechtenstein	**41-75**
Lithuania	**370**
Vilinius	2
Luxembourg	**352**
Macau	**853**
Macedonia (TFYR)	**389**
Skopje	91
Madagascar	**261**
Antananarivo	2
Malawi	**265**
Malaysia	60
Kuala Lumpur	3
Maldives	**960**
Mali	**223**
Malta	**356**
Marshall Islands	**692**
Martinique	**596**
Mauritania	**222**
Mauritius	**230**
Mayotte	**269**
Mexico	**52**
Guadalajara	36

- Mexico City ... 5
- Monterrey ... 83

Micronesia ... 691
Moldova ... 373
- Chisinau ... 422

Monaco ... 33-93
Mongolia ... 976
Montserrat ... 1-809
Morocco ... 212
- Casablanca ... 2
- Rabat ... 7

Mozambique ... 258
- Maputo ... 1

Myanmar (Burma) ... 95
Namibia ... 264
- Windhoek ... 61

Nauru ... 674
Nepal ... 977
- Kathmandu ... 1

Netherlands ... 31
- Amsterdam ... 20

Netherlands Antilles ... 599
Nevis Islands ... 1-809
New Caledonia ... 687
New Zealand ... 64
- Auckland ... 9
- Wellington ... 4

Nicaragua ... 505
- Managua ... 2

Niger ... 227
Nigeria ... 234
- Lagos ... 1

Niue ... 683
North Korea ... 850
- Pyongyang ... 2

Northern Marianas ... 670
- Saipan ... 322

Norway ... 47
- Oslo ... 2

Oman ... 968
Pakistan ... 92
- Islamabad ... 51

Palau ... 680
Panama ... 507
Papua New Guinea ... 675
Paraguay ... 595
- Asuncion ... 21

Peru ... 51
- Lima ... 14

Philippines ... 63
- Manila ... 2

Poland ... 48
- Warsaw ... 22

Portugal ... 351
- Lisbon ... 1

Puerto Rico ... 1-809
Qatar ... 974
Reunion Island ... 262
Romania ... 40
- Bucharest ... 1

Russia ... 7
- Moscow ... 095
- St. Petersburg ... 812

Rwanda ... 250
St. Kitts ... 1-809
St. Lucia ... 1-809
St. Pierre & Miquelon ... 508
St. Vincent & the Grenadines ... 1-809
San Marino ... 378
São Tome and Principe 239
Saudi Arabia ... 966
- Riyadh ... 1

Senegal ... 221
Seychelles ... 248
Sierra Leone ... 232
- Freetown ... 22

Singapore ... 65
Slovak Republic ... 42
- Bratislava ... 7

Slovenia ... 386
- Ljubljana ... 61

Solomon Islands ... 677
Somalia ... 252
- Mogadishu ... 1

South Africa ... 27
- Johannesburg ... 11
- Pretoria ... 12

South Korea ... 82
- Seoul ... 2

Spain ... 34
- Madrid ... 1
- Barcelona ... 3

Sri Lanka ... 94
- Colombo ... 1

Sudan ... 249
- Khartoum ... 11

Suriname ... 597
Swaziland ... 268
Sweden ... 46
- Stockholm ... 8

Switzerland ... 41
- Berne ... 31
- Zurich ... 1

Syria ... 963
- Damascus ... 11

Tahiti ... 689
Taiwan ... 886
- Taipei ... 2

Tajikistan ... 7
- Dushanbe ... 3772

Tanzania ... 255
- Dar Es Salaam ... 51

Thailand ... 66
- Bangkok ... 2

Togo ... 228
Tokelau ... 690
Tonga ... 676
Trinidad & Tobago ... 1-809
Tunisia ... 216
- Tunis ... 1

Turkey ... 90
- Ankara ... 4
- Istanbul ... 1

Turkmenistan ... 7
- Ashkhabad ... 3632

Turks & Caicos ... 1-809
Tuvalu ... 688
Uganda ... 256
- Kampala ... 41

Ukraine ... 380
- Kiev ... 44

United Arab Emirates ... 971
- Abu Dhabi ... 2
- Dubai ... 4

United Kingdom ... 44
- London ... 171/181
- Manchester ... 161

United States ... 1
- Chicago ... 312/630
- Houston ... 713
- Los Angeles ... 213
- Miami ... 305
- New York ... 212/718
- Washington ... 202

Uruguay ... 598
- Montevideo ... 2

Uzbekistan ... 7
- Tashkent ... 3712

Vanuatu ... 678
Vatican City ... 379
Venezuela ... 58
- Caracas ... 2

Vietnam ... 84
Wallis & Futuna ... 681
Western Samoa ... 685
Yemen ... 967
- Sanaa ... 51

Yugoslavia ... 381
- Belgrade ... 11

Zaire ... 243
- Kinshasa ... 12

Zambia ... 260
- Lusaka ... 1

Zanzibar (Tanzania) ... 259
Zimbabwe ... 263
- Harare ... 4

North American Area Codes, by State and Province

Alabama
- Birmingham ... 205
- Montgomery ... 334

Alaska ... 907

Alberta ... 403

Arizona
- Phoenix ... 602
- Tucson ... 520

Arkansas ... 501

British Columbia & NW Territories ... 604

California
- Anaheim ... 714
- Bakersfield ... 805
- Burbank ... 818/562
- Fresno ... 209
- Long Beach ... 310/562
- Los Angeles ... 213/562
- Oakland ... 510
- Riverside ... 909
- Sacramento ... 916
- San Diego ... 619
- San Francisco ... 415
- San Jose ... 408
- Santa Rosa ... 707

Colorado
- Colorado Springs ... 719
- Denver ... 303
- Ft. Collins ... 970

Connecticut
- Bridgeport ... 203
- Hartford ... 860

Delaware ... 302

District of Columbia
- Washington ... 202

Florida
- Ft. Myers ... 941
- Gainesville ... 352
- Jacksonville ... 904
- Miami ... 305/954
- Orlando ... 407
- Tampa ... 813

Georgia
- Athens ... 706
- Atlanta ... 404
- Marietta ... 770
- Savannah ... 912

Hawaii ... 808

Idaho ... 208

Illinois
- Aurora ... 630
- Cairo ... 618
- Chicago ... 312
- Evanston ... 847
- Oak Brook ... 708
- Peoria ... 309
- Rockford ... 815
- Springfield ... 217

Indiana
- Evansville ... 812
- Gary ... 219
- Indianapolis ... 317

Iowa
- Coucil Bluffs ... 712
- Des Moines ... 515
- Dubuque ... 319

Kansas
- Topeka ... 913
- Wichita ... 316

Kentucky
- Dade Park ... 812
- Lexington ... 606
- Louisville ... 502

Louisiana
- New Orleans ... 504
- Shreveport ... 318

Maine ... 207

Manitoba ... 204

Maryland
- Baltimore ... 410
- Rockville ... 301

Massachusetts
- Boston ... 617
- Springfield ... 413
- Worcester ... 508

Michgan
- Detroit ... 313
- Flint ... 810
- Grand Rapids ... 616
- Lansing ... 517
- Sault Ste. Marie ... 906

Minnesota
- Duluth ... 218
- Minneapolis ... 612
- Rochester ... 507
- St. Cloud ... 320

Mississippi ... 601

Missouri
- Kansas City ... 816
- St. Louis ... 314
- Springfield ... 417

Montana ... 406

Nebraska
- North Platte ... 308
- Omaha ... 402

Nevada ... 702

New Brunswick ... 506

New Hampshire ... 603

New Jersey
- Elizabeth ... 908
- Newark ... 201
- Trenton ... 609

New Mexico ... 505

New York
- Albany ... 518
- Bronx, Queens ... 718/917
- Buffalo ... 716
- Hempstead ... 516
- Ithaca ... 607
- Manhattan ... 212/917
- Syracuse ... 315
- White Plains ... 914

Newfoundland ... 709

North Carolina
- Charlotte ... 704
- Greensboro ... 910
- Raleigh ... 919

North Dakota ... 701

Nova Scotia & Prince Edward Island ... 902

Ohio
- Cincinnati ... 513
- Cleveland ... 216
- Columbus ... 614
- Toledo ... 419

Oklahoma
- Oklahoma City ... 405
- Tulsa ... 918

Ontario
- Ft. William ... 807
- London ... 519
- North Bay ... 705
- Ottawa ... 613
- Toronto ... 416

Oregon
- Eugene ... 541
- Portland ... 503

Pennsylvania
- Altoona ... 814
- Harrisburg ... 717
- Philadelphia ... 215
- Pittsburgh ... 412

Puerto Rico & Caribbean ... 809

Quebec
- Montreal ... 514
- Quebec ... 418
- Sherbrooke ... 819

Rhode Island ... 401

Saskatchewan ... 306

South Carolina
- Charleston ... 803
- Greenville ... 864

South Dakota ... 605

Tennessee
- Memphis ... 901
- Nashville ... 615
- Knoxville ... 423

Texas
- Amarillo ... 806
- Austin ... 512
- Dallas ... 214/972
- El Paso ... 915
- Fort Worth ... 817
- Galveston ... 409
- Houston ... 713/281
- San Antonio ... 210
- Tyler ... 903

Utah ... 801

Vermont ... 802

Virginia
- Alexandria ... 703
- Richmond ... 804
- Roanoke ... 540

Washington
- Olympia ... 360
- Seattle ... 206
- Spokane ... 509

West Virginia ... 304

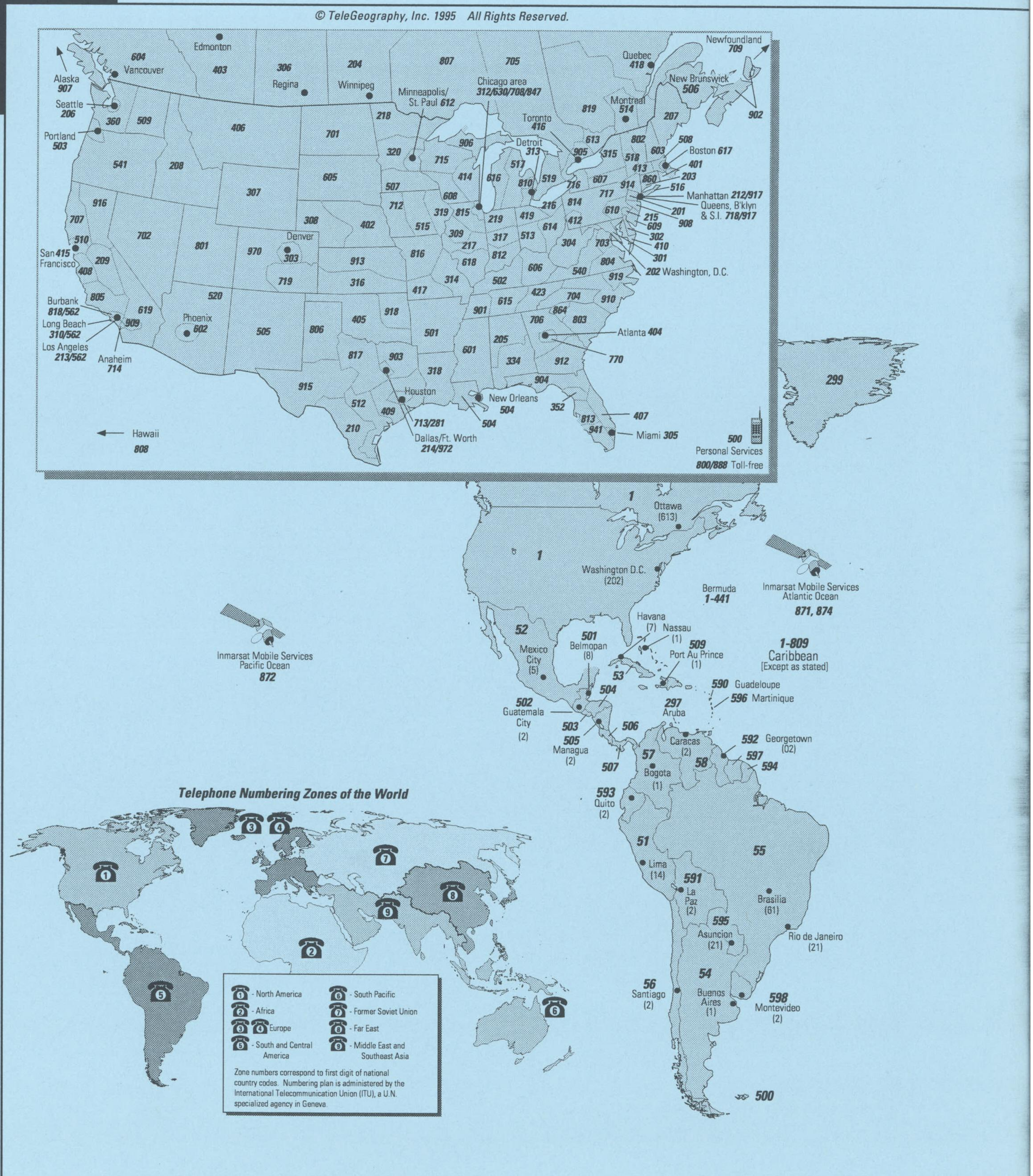
Wisconisin
- Madison ... 608
- Milwaukee ... 414
- Eau Claire ... 715

Wyoming ... 307

Two codes separated by a slash (e.g., in Dallas, Texas) indicate an overlay; multiple codes are used for the same geographic area.

North American Area Codes, by Number

201	New Jersey
202	District of Columbia
203	Connecticut
204	Manitoba
205	Alabama
206	Washington
207	Maine
208	Idaho
209	California
210	Texas
212	New York City
213	California
214	Texas
215	Pennsylvania
216	Ohio
217	Illinois
218	Minnesota
219	Indiana
281	Texas
301	Maryland
302	Delaware
303	Colorado
304	West Virginia
305	Florida
306	Saskatchewan
307	Wyoming
308	Nebraska
309	Illinois
310	California
312	Illinois
313	Michgan
314	Missouri
315	New York
316	Kansas
317	Indiana
318	Louisiana
319	Iowa
320	Minnesota
334	Alabama
352	Florida
360	Washington
401	Rhode Island
402	Nebraska
403	Alberta
404	Georgia
405	Oklahoma
406	Montana
407	Florida
408	California
409	Texas
410	Maryland
412	Pennsylvania
413	Massachussetts
414	Wisconsin
415	California
416	Ontario
417	Missouri
418	Quebec
419	Ohio
423	Tennessee
441	Bermuda
500	Personal Communication Services (PCS)
501	Arkansas
502	Kentucky
503	Oregon
504	Louisiana
505	New Mexico
506	New Brunswick
507	Minnesota
508	Massachusetts
509	Washington
510	California
512	Texas
513	Ohio
514	Quebec
515	Iowa
516	New York
517	Michigan
518	New York
519	Ontario
520	Arizona
540	Virginia
541	Oregon
555	Public Information Services
562	California
601	Mississippi
602	Arizona
603	New Hampshire
604	British Columbia & NW Territories
605	South Dakota
606	Kentucky
607	New York
608	Wisconisin
609	New Jersey
610	Pennsylvania
612	Minnesota
613	Ontario
614	Ohio
615	Tennessee
616	Michigan
617	Massachusetts
618	Illinois
619	California
630	Illinois
701	North Dakota
702	Nevada
703	Virginia
704	North Carolina
705	Ontario
706	Georgia
707	California
708	Illinois
709	Newfoundland
710	U.S. Government Emergency Telecommunications Service
712	Iowa
713	Texas
714	California
715	Wisconsin
716	New York
717	Pennsylvania
718	New York City
719	Colorado
770	Georgia
800	Toll-free services
801	Utah
802	Vermont
803	South Carolina
804	Virginia
805	California
806	Texas
807	Ontario
808	Hawaii
809	Puerto Rico and Caribbean
810	Michigan
812	Indiana/Kentucky
813	Florida
814	Pennsylvania
815	Illinois
816	Missouri
817	Texas
818	California
819	Quebec
847	Illinois
860	Connecticut
864	South Carolina
888	Toll-free services
900	Information Services
901	Tennessee
902	Nova Scotia and Prince Edward Island
903	Texas
904	Florida
905	Ontario
906	Michigan
907	Alaska
908	New Jersey
909	California
910	North Carolina
912	Georgia
913	Kansas
914	New York
915	Texas
916	California
917	New York City
918	Oklahoma
919	North Carolina
941	Florida
970	Colorado
972	Texas



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Alaska 907
604 Vancouver
Edmonton 403
306 Regina
204 Winnipeg
807
705
Chicago area 312/630/708/847
Minneapolis/ St. Paul 612
Quebec 418
Newfoundland 709
New Brunswick 506
902
Montreal 514
819
Toronto 416
Seattle 206
Portland 503
360
509
406
701
218
320
906
Detroit 313
613
802
603
508
Boston 617
401
203
516
Manhattan 212/917
Queens, B'klyn & S.I. 718/917
201
908
215
609
302
410
301
202 Washington, D.C.
207
905
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San Francisco 415
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209
702
801
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Denver 303
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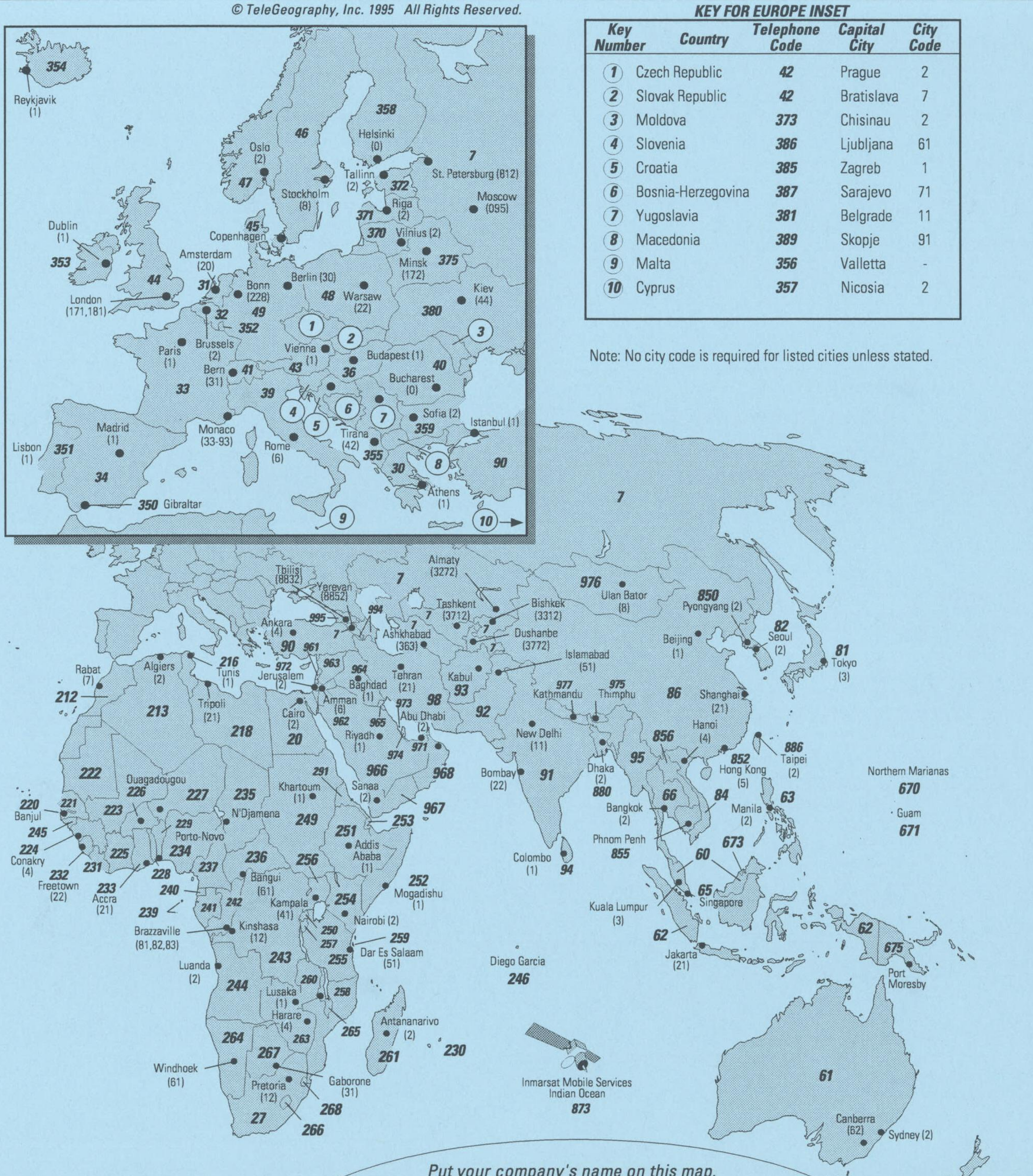
816
618
314
812
606
502
417
615
423
704
910
864
803
706
Atlanta 404
770
912
Burbank 818/562
Long Beach 310/562
Los Angeles 213/562
Anaheim 714
805
619
909
520
Phoenix 602
505
806
405
918
501
901
601
205
334
904
817
903
318
915
512
409
Houston 713/281
Dallas/Ft. Worth 214/972
210
504
New Orleans 504
352
813
941
407
Miami 305
Hawaii 808
500 Personal Services
800/888 Toll-free
299
1
Ottawa (613)
1
Washington D.C. (202)
Bermuda 1-441
Inmarsat Mobile Services Atlantic Ocean 871, 874
Inmarsat Mobile Services Pacific Ocean 872
Havana (7)
Nassau (1)
509 Port Au Prince (1)
1-809 Caribbean [Except as stated]
52 Mexico City (5)
501 Belmopan (8)
53
504
590 Guadeloupe
596 Martinique
502 Guatemala City (2)
297 Aruba
503
505 Managua (2)
506
Caracas (2)
592 Georgetown (02)
597
594
57 Bogota (1)
58
507
593 Quito (2)
51 Lima (14)
55
591 La Paz (2)
Brasilia (61)
595 Asuncion (21)
Rio de Janeiro (21)
54
56 Santiago (2)
Buenos Aires (1)
598 Montevideo (2)
500
Telephone Numbering Zones of the World
1 - North America
2 - Africa
3 4 Europe
5 - South and Central America
6 - South Pacific
7 - Former Soviet Union
0 - Far East
9 - Middle East and Southeast Asia
Zone numbers correspond to first digit of national country codes. Numbering plan is administered by the International Telecommunication Union (ITU), a U.N. specialized agency in Geneva.

World Telephone Codes



KEY FOR EUROPE INSET

Key Number	Country	Telephone Code	Capital City	City Code
1	Czech Republic	42	Prague	2
2	Slovak Republic	42	Bratislava	7
3	Moldova	373	Chisinau	2
4	Slovenia	386	Ljubljana	61
5	Croatia	385	Zagreb	1
6	Bosnia-Herzegovina	387	Sarajevo	71
7	Yugoslavia	381	Belgrade	11
8	Macedonia	389	Skopje	91
9	Malta	356	Valletta	-
10	Cyprus	357	Nicosia	2

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

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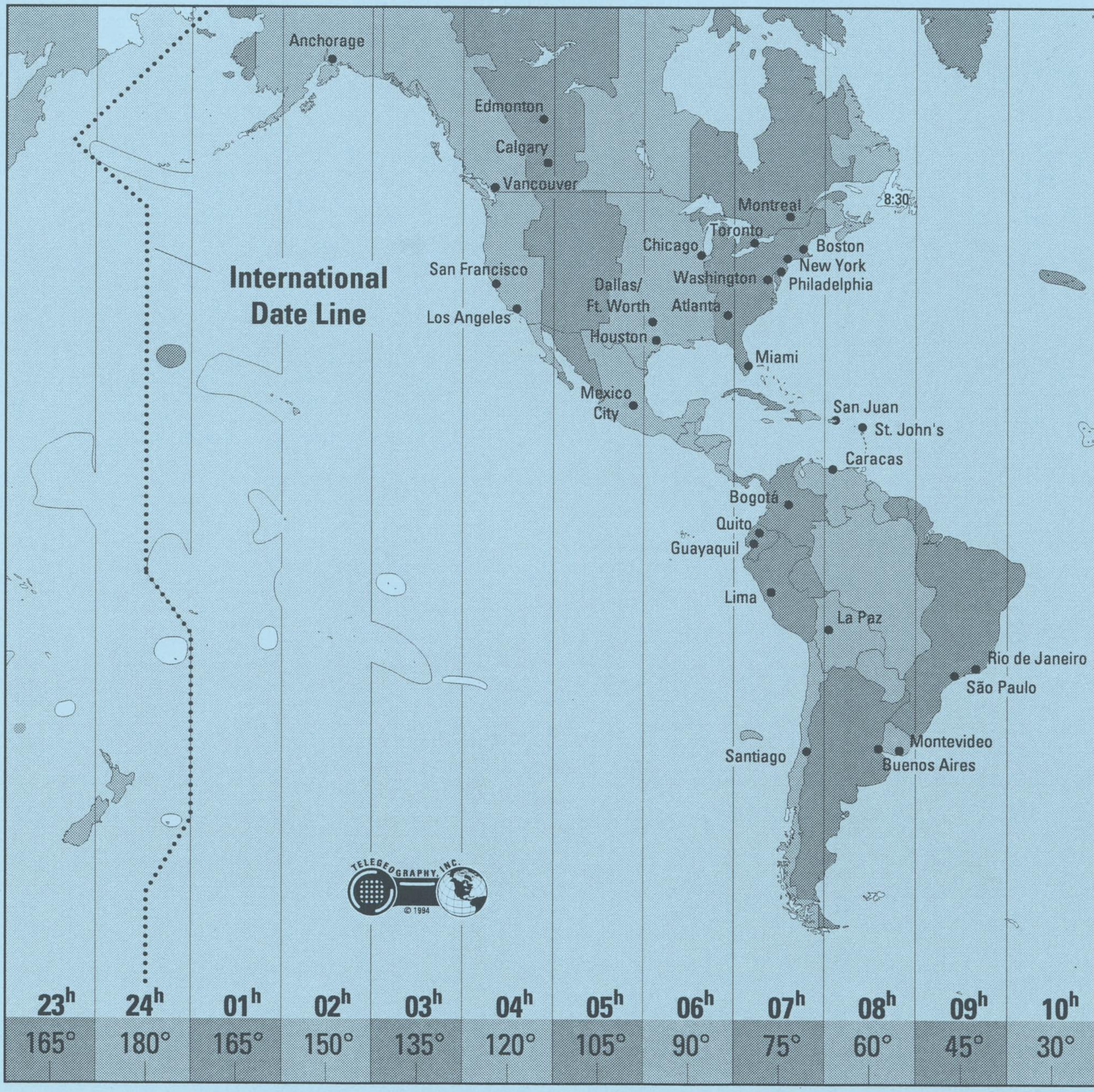

Anchorage
Edmonton
Calgary
Vancouver
Montreal
8:30
Toronto
Chicago
Boston
New York
Philadelphia
San Francisco
Washington
Dallas/
Ft. Worth
Atlanta
Los Angeles
Houston
Miami
International
Date Line
Mexico
City
San Juan
St. John's
Caracas
Bogotá
Quito
Guayaquil
Lima
La Paz
Rio de Janeiro
São Paulo
Montevideo
Buenos Aires
Santiago
TELEGEOGRAPHY, INC.
© 1994
23h 165°
24h 180°
01h 165°
02h 150°
03h 135°
04h 120°
05h 105°
06h 90°
07h 75°
08h 60°
09h 45°
10h 30°

Time Zones


Helsinki
Oslo
Stockholm
Moscow
Copenhagen
Dublin
London
Berlin
Warsaw
Frankfurt
Prague
Kiev
Paris
Vienna
Rome
Istanbul
Madrid
Beijing
Lisbon
Algiers
Tunis
Ankara
Izmir
Athens
Seoul
Tokyo
Casablanca
Tehran
Osaka
Tangier
Tripoli
Tel Aviv
Baghdad
16:30
17:45
Kuwait
15:30
Delhi
Kathmandu
Cairo
Karachi
Riyadh
Abu Dhabi
Jeddah
17:30
18:30
Hong Kong
Sanaa
Bombay
Bangkok
Manila
Khartoum
Ho Chi Minh City
Lagos
Addis Ababa
Douala
Kuala Lumpur
Singapore
Nairobi
Victoria
Kinshasa
Dar es Salaam
Jakarta
Denpasar
Port Louis
Harare
Johannesburg
21:30
Sydney
Melbourne
Prime Meridian
Countries and areas which have adopted the Universal Time System (UTC).
Countries and areas with local deviations from the Universal Time System.
TELEGEOGRAPHY, INC.
© 1994
11h 12h 13h 14h 15h 16h 17h 18h 19h 20h 21h 22h
15° 0° 15° 30° 45° 60° 75° 90° 105° 120° 135° 150°


ARCTIC OCEAN
GREENLAND (DEN.)
ALASKA (U.S.)
CANADA
UNITED STATES
PACIFIC OCEAN
ATLANTIC OCEAN
Tropic of Cancer
MEXICO
BAHAMAS
DOMINICAN REP.
PUERTO RICO (U.S.)
CUBA
BELIZE
HONDURAS
HAITI
JAMAICA
ANTIGUA AND BARBUDA
GUADELOUPE (FR.)
DOMINICA
MARTINIQUE (FR.)
ST. LUCIA
BARBADOS
TRINIDAD AND TOBAGO
GRENADA
GUATEMALA
EL SALVADOR
NICARAGUA
COSTA RICA
PANAMA
VENEZUELA
GUYANA
FR. GUIANA
SURINAME
COLOMBIA
ECUADOR
Equator
KIRIBATI
TOKELAU
W. SAMOA
AM. SAMOA
TONGA
NIUE (N.Z.)
COOK IS. (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°

Political Geography

EUROPE

1. NETHERLANDS
2. BELGIUM
3. LUXEMBOURG
4. CZECH REPUBLIC
5. SLOVAK REPUBLIC
6. SWITZERLAND
7. LIECHTENSTEIN
8. AUSTRIA
9. HUNGARY
10. SLOVENIA
11. CROATIA
12. BOSNIA
13. YUGOSLAVIA
14. ALBANIA
15. MACEDONIA (F.Y.R.)
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

National Telecommunications Indicators (A-L)

	Population 1994 (millions)	Area (Miles^2 thous.)	Main Lines 1994 (millions)	Main Lines 1990 (millions)	Lines/100 people 1994	Cellular phones 1994 (thous.)	Fax machines 1994 (thous.)	PCs 1994 (thous.)
Algeria	27.3	920	1.1	0.8	4.1	1.3	4.1	n.a.
Argentina	34.2	1,068	4.8	3.1	14.1	202.2	n.a.	n.a.
Australia	17.8	2,968	8.9	7.8	49.6	1,250.0	450.0	3,870.0
Austria	7.9	32	3.7	3.2	46.5	278.2	n.a.	850.0
Bahrain	0.5	<1	0.1	0.1	24.8	17.6	5.1	n.a.
Bangladesh	117.8	56	0.3	0.2	0.2	1.1	2.0	n.a.
Belgium	10.1	12	4.5	3.9	44.9	126.9	n.a.	1,300.0
Brazil	159.1	3,286	11.7	9.4	7.4	574.0	n.a.	1,400.0
Bulgaria	8.8	43	3.0	2.2	33.5	n.a.	n.a.	n.a.
Canada	29.1	3,852	16.8	15.3	57.5	1,890.0	n.a.	5,100.0
Chile	14.0	292	1.5	0.9	11.0	n.a.	n.a.	n.a.
China	1,190.9	3,705	27.2	6.9	2.3	1,566.0	200.0	1,800.0
Colombia	36.3	440	3.5	2.4	9.7	101.5	79.7	n.a.
Croatia	4.5	22	1.2	0.8	26.8	21.7	28.4	n.a.
Cyprus	0.7	4	0.3	0.2	45.0	22.9	n.a.	n.a.
Czech Republic	10.3	30	2.2	1.6	20.9	20.0	58.5	n.a.
Denmark	5.2	17	3.1	2.9	60.4	503.5	n.a.	1,000.0
Dominican Republic	7.7	19	0.6	0.3	7.9	20.0	n.a.	n.a.
Ecuador	11.2	109	0.7	0.5	5.9	17.9	n.a.	n.a.
Egypt	57.6	387	2.4	1.7	4.3	n.a.	n.a.	n.a.
Estonia	1.5	17	0.4	0.3	24.5	13.8	10.0	n.a.
Finland	5.1	131	2.8	2.7	55.1	649.2	124.0	810.0
France	57.7	213	31.6	28.1	54.7	803.9	n.a.	8,060.0
Germany	81.1	138	39.2	31.9	48.3	2,501.4	1,446.6	11,650.0
Greece	10.4	51	5.0	3.9	47.8	167.0	n.a.	300.0
Hong Kong	5.8	<1	3.1	2.5	54.0	431.8	257.0	660.0
Hungary	10.2	36	1.7	1.0	17.0	143.0	n.a.	350.0
Iceland	0.3	40	0.1	0.1	55.7	21.8	n.a.	n.a.
India	913.6	1,269	9.8	5.1	1.1	n.a.	50.0	880.0
Indonesia	189.9	735	2.5	1.1	1.3	78.2	55.0	530.0
Iran	65.8	636	4.3	2.2	6.6	9.2	30.0	n.a.
Ireland	3.5	27	1.2	1.0	35.0	88.0	n.a.	490.0
Israel	5.4	10	2.1	1.6	39.4	n.a.	n.a.	n.a.
Italy	57.2	116	24.5	22.4	42.9	2,239.7	n.a.	4,121.0
Japan	124.8	146	59.9	54.5	48.0	4,300.0	6,000.0	15,000.0
Jordan	4.2	34	0.3	0.2	7.2	1.4	31.0	n.a.
Korea, Republic of	44.5	38	17.6	13.3	39.7	960.3	375.0	5,000.0
Kuwait	1.7	7	0.4	0.3	22.6	85.6	n.a.	n.a.
Luxembourg	0.4	1	0.2	0.2	55.3	13.8	n.a.	n.a.

Source: International Telecommunication Union

International Telephone Traffic

Outgoing mMiTT			Incoming mMiTT			Surplus/(Deficit)	
1993	1994	Change 93-94	1993	1994	Change 93-94	1993	1994
121.0	118.0	-2.5%	n.a.	n.a.	n.a.	n.a.	n.a.
137.1	175.0	27.6% a	192.3	252.6	31.4%	55.2	77.7
735.0	852.0	15.9%	n.a.	n.a.	n.a.	n.a.	n.a.
767.4	819.2	6.7%	751.0	774.5	3.1%	(16.4)	(44.7)
77.0	86.8	12.7%	55.1	n.a.	n.a.	(21.9)	n.a.
17.2	22.1	28.6%	83.9	n.a.	n.a.	66.7	n.a.
979.4	1,049.0	7.1% a	1,025.3	1,093.9	6.7%	45.9	44.9
182.4	199.0	9.1% a	373.8	408.0	9.1%	191.4	209.0
91.0	82.7	-9.1%	76.4	n.a.	n.a.	(14.6)	n.a.
761.5	861.2	13.1%	503.4	543.8	8.0%	(258.1)	(317.4)
61.7	73.5	19.1%	105.0	n.a.	n.a.	43.3	n.a.
870.0	1,090.0	25.3%	n.a.	n.a.	n.a.	n.a.	n.a.
102.4	120.3	17.4%	278.7	302.8	8.6%	176.3	182.5
117.2	185.5	58.3%	170.3	240.2	41.1%	53.0	54.7
93.8	106.6	13.6%	72.2	79.0	9.5%	(21.6)	(27.6)
141.4	157.6	11.5% a	n.a.	210.0	n.a.	n.a.	52.4
452.3	488.4	8.0%	460.0	500.9	8.9%	7.7	12.5
58.3	63.5	8.9% a	n.a.	404.0	n.a.	n.a.	340.5
33.6	36.4	8.3% a	102.3	128.6	25.7%	68.7	92.2
80.0	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
41.2	48.1	16.7%	n.a.	50.8	n.a.	n.a.	2.7
n.a.	259.0	n.a.	n.a.	285.0	n.a.	n.a.	26.0
2,576.0	2,602.5	1.0%	2,710.0	2,739.5	1.1%	134.0	137.0
4,679.6	5,147.1	10.0%	3,707.8	3,881.2	4.7%	(971.8)	(1,265.9)
336.2	422.7	25.7%	406.1	441.2	8.6%	70.0	18.5
1,376.9	1,578.4	14.6% a,b	1,260.3	1,446.4	14.8%	(116.5)	(132.1)
213.2	236.6	11.0% a	192.8	211.9	9.9%	(20.4)	(24.7)
24.1	26.0	7.7% a	23.4	25.5	9.0%	(0.7)	(0.4)
283.9	314.0	10.6% a,b	441.0	615.0	39.5%	157.1	301.0
143.8	182.5	26.9% a	201.8	244.7	21.3%	58.0	62.2
156.5	208.4	33.2%	n.a.	n.a.	n.a.	n.a.	n.a.
315.8	323.7	2.5% a,b	423.0	442.9	4.7%	107.2	119.2
175.5	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1,609.7	1,708.0	6.1% a	1,672.7	1,864.0	11.4%	63.0	156.0
1,411.2	1,524.8	8.0% b	981.2	1,140.6	16.2%	(430.0)	(384.2)
50.0	57.0	14.0% a	100.0	114.0	14.0%	50.0	57.0
355.4	440.4	23.9% a	510.5	555.2	8.8%	155.1	114.8
116.8	120.6	3.2%	n.a.	127.0	n.a.	n.a.	6.4
199.3	213.5	7.1%	131.7	145.2	10.2%	(67.6)	(68.3)

See individual country tables for carriers and routes included in outgoing and incoming traffic totals.

a. MiTT based on billing point of traffic.
b. Year ending 31 March.

Source: TeleGeography, Inc.

National Telecommunications Indicators (M-Z)

	Population 1994 (millions)	Area (Miles^2 thous.)	Main Lines 1994 (millions)	Main Lines 1990 (millions)	Lines/100 people 1994	Cellular phones 1994 (thous.)	Fax machines 1994 (thous.)	PCs 1994 (thous.)
Macau	0.4	<1	0.1	0.1	36.7	24.7	7.2	n.a.
Macedonia	2.1	10	0.3	0.3	16.1	n.a.	1.8	n.a.
Malaysia	19.5	127	2.9	1.6	14.7	58.1	571.7	640.0
Mexico	91.9	756	8.5	5.4	9.2	n.a.	n.a.	2,100.0
Moldova	4.4	13	0.5	0.5	12.3	0.5	n.a.	n.a.
Morocco	26.5	172	1.0	0.4	3.7	n.a.	13.8	n.a.
Netherlands	15.4	16	7.8	6.9	50.9	321.0	n.a.	2,400.0
New Zealand	3.5	104	1.7	1.5	47.0	229.2	50.0	n.a.
Norway	4.3	125	2.4	2.1	55.4	588.8	n.a.	820.0
Pakistan	126.3	307	2.0	0.8	1.6	30.0	8.0	n.a.
Paraguay	4.8	157	n.a.	0.1	n.a.	7.7	n.a.	n.a.
Peru	23.3	496	0.8	0.6	3.3	n.a.	n.a.	n.a.
Philippines	66.2	116	1.1	0.6	1.7	200.4	35.0	n.a.
Poland	38.3	121	5.0	3.3	13.1	38.9	n.a.	850.0
Portugal	9.8	36	3.4	2.4	35.0	173.5	n.a.	490.0
Qatar	0.5	4	0.1	0.1	21.7	8.0	9.8	n.a.
Russia	148.4	6,592	24.1	20.7	16.2	27.7	n.a.	n.a.
Saudi Arabia	17.5	830	1.7	1.2	9.6	16.0	n.a.	n.a.
Singapore	2.8	<1	1.3	1.1	47.3	235.6	n.a.	430.0
Slovak Republic	5.3	19	1.0	0.7	18.8	5.9	37.9	n.a.
Slovenia	1.9	8	0.6	0.4	29.5	16.8	n.a.	n.a.
South Africa	40.6	471	3.8	3.3	9.5	n.a.	340.0	875.0
Spain	39.6	195	14.7	12.6	37.1	411.9	n.a.	2,750.0
Sri Lanka	18.1	25	0.2	0.1	1.0	11.0	30.0	n.a.
Sweden	8.7	174	6.0	5.8	68.3	1,380.0	n.a.	1,500.0
Switzerland	7.1	16	4.3	3.9	59.7	332.2	175.0	2,050.0
Syria	14.2	71	0.7	0.5	4.9	n.a.	4.2	n.a.
Taiwan	21.3	14	8.5	6.3	40.0	584.3	430.0	1,720.0
Thailand	58.7	198	2.8	1.3	4.7	643.0	60.0	680.0
Tunisia	8.8	63	0.5	0.3	5.4	20.0	2.7	44.0
Turkey	60.8	301	12.2	6.9	20.1	174.8	87.6	n.a.
United Arab Emirates	1.9	32	0.6	0.4	33.2	91.5	29.7	n.a.
United Kingdom	58.1	94	28.4	25.8	48.9	3,757.0	n.a.	8,800.0
United States	260.5	3,619	156.8	136.3	59.5	24,134.4	14,052.0	77,500.0
Uruguay	3.2	68	0.6	0.4	18.4	7.0	n.a.	n.a.
Venezuela	21.4	352	2.3	1.5	10.9	n.a.	n.a.	n.a.
Yugoslavia	10.7	40	2.0	1.7	18.4	n.a.	13.7	n.a.

Source: International Telecommunication Union

International Telephone Traffic

Outgoing mMiTT 1993	1994	Change 93-94		Incoming mMiTT 1993	1994	Change 93-94	Surplus/(Deficit) 1993	1994
89.9	100.0	11.2%		77.9	84.3	8.2%	(12.0)	(15.7)
27.6	35.1	27.2%		48.0	78.3	63.1%	20.4	43.2
258.1	342.3	32.6%	a,b	304.2	399.7	31.4%	46.1	57.4
n.a.	844.1	n.a.	a	n.a.	1,829.4	n.a.	n.a.	985.3
119.7	73.9	-38.3%		n.a.	n.a.	n.a.	n.a.	n.a.
125.0	129.8	3.9%		n.a.	n.a.	n.a.	n.a.	n.a.
1,238.2	1,345.8	8.7%	a	1,159.0	1,290.9	11.4%	(79.2)	(54.9)
191.0	230.0	20.4%		n.a.	241.0	n.a.	n.a.	11.0
376.2	395.5	5.1%	a	322.5	352.0	9.1%	(53.7)	(43.5)
56.5	61.4	8.7%		305.7	n.a.	n.a.	249.2	n.a.
15.5	18.1	17.0%		24.5	30.6	25.1%	9.0	12.5
39.0	51.0	30.8%	a	152.4	178.6	17.2%	113.4	127.6
164.0	160.0	-2.4%	a	n.a.	617.0	n.a.	n.a.	457.0
272.7	356.6	30.8%		431.5	643.8	49.2%	158.8	287.2
232.6	262.4	12.8%	a	438.2	467.8	6.8%	205.6	205.4
58.3	62.7	7.6%		n.a.	n.a.	n.a.	n.a.	n.a.
201.0	229.2	14.0%		268.0	365.0	36.2%	67.0	135.8
454.9	498.9	9.7%		n.a.	n.a.	n.a.	n.a.	n.a.
480.0	643.0	34.0%	b	n.a.	n.a.	n.a.	n.a.	n.a.
30.5	52.5	72.1%		33.6	68.5	104.2%	3.1	16.0
62.8	90.6	44.2%	a	55.8	83.2	49.1%	(7.0)	(7.4)
255.0	n.a.	n.a.		n.a.	n.a.	n.a.	n.a.	n.a.
846.9	948.3	12.0%	a	908.4	969.9	6.8%	61.5	21.6
19.5	23.7	21.5%	a	65.0	78.7	21.1%	45.5	55.0
740.0	802.0	8.4%		630.0	n.a.	n.a.	(110.0)	n.a.
1,572.0	1,649.3	4.9%		1,258.7	1,353.0	7.5%	(313.3)	(296.3)
36.7	40.0	9.0%		59.3	78.0	31.5%	22.6	38.0
440.7	498.5	13.1%	a,b	490.8	613.5	25.0%	50.1	115.0
161.8	173.2	7.0%		218.7	313.3	43.3%	56.9	140.1
67.0	64.0	-4.5%		n.a.	n.a.	n.a.	n.a.	n.a.
264.6	284.3	7.5%		605.0	601.4	-0.6%	340.4	317.1
341.6	428.2	25.3%		n.a.	n.a.	n.a.	n.a.	n.a.
3,130.0	3,507.0	12.0%	b	3,086.0	3,577.0	15.9%	(44.0)	70.0
7,500.3	8,910.8	18.8%	a	3,284.4	3,698.0	12.6%	(4,215.9)	(5,212.8)
37.4	46.3	23.8%	a	58.0	67.7	16.7%	20.6	21.4
133.3	141.3	6.0%	a	148.3	164.3	10.8%	15.0	23.0
181.5	181.9	0.2%		223.5	229.0	2.5%	42.0	47.1

See individual country tables for carriers and routes included in outgoing and incoming traffic totals.

a. MiTT based on billing point of traffic.
b. Year ending 31 March.

Source: TeleGeography, Inc.

Notes

Notes

Notes

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