International Institute of Communications (IIC)

TELEGEOGRAPHY 1992

GLOBAL TELECOMMUNICATIONS TRAFFIC STATISTICS AND COMMENTARY

GREGORY C. STAPLE - EDITOR

THE GERMAN TELECONTINENT

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Cover Illustration - *The cover maps the German TeleContinent circa 1991. TeleContinents follow the boundaries of networked communities rather than physical or political ones and the dimensions change as network facilities and traffic patterns change.*

The German TeleContinent mapped here is based upon the volume of public switched telecommunication traffic to and from Germany's major correspondents in 1991. The area of Germany overlapped by another country (eg, Austria) is proportionate to the percentage of German traffic to that country (for Austria, 9%). The area of the correspondent country overlapping Germany approximates the percentage of that country's international traffic sent to Germany (for Austria, 43%, because 43% of Austria's foreign traffic was sent to Germany).

The shape of the TeleContinent may seem unfamiliar at first. But so were the physical continents drawn by 16th Century cartographers. Those early maps were based on incomplete "coastal surveys," as is the cover illustration, and improved as better information became available.

Concept: Gregory C. Staple and Evelyn M. Aswad.
Illustration: Maryland CartoGraphics.

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1990 - The Global Telecommunications Traffic Boom
1989 - Global Telecommunications Traffic Flows and Market Structures

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

The new maps in this year's report and the broader national coverage were also supported, in part, by a special publication grant from MCI Communications Corporation. The grant came without any editorial pre-conditions; the IIC remains solely responsible for the report's editorial contents.

TeleGeography - 1992 reflects a team effort. Evelyn M. Aswad was the senior research assistant. Word processing and desk-top publishing help were provided by Barbara Frank. Bennett Moe at Maryland CartoGraphics (Columbia, Maryland) contributed his computer graphic skills to the illustrations.

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

Gregory C. Staple
Editor

PREFACE

For the past three years, IIC almanacs of global telecommunications statistics have brought to light the expected and the not so expected forces and trends at work in shaping the industry's future.

TeleGeography 1992 is no exception. As expected, the international telecommunications market is booming. But what is not so expected is the customer demand driving this explosive growth. The traditional view sees this growth as the result of the movement of money and goods across borders, that is, business calling. TeleGeography 1992 suggests otherwise.

In fact, there are three social factors contributing to the increased traffic growth on international routes. First, the difference between the price of an international call and a domestic call is narrowing. Second, the world's population is increasingly mobile with new demands created by the travel industry and the travelers themselves. Third, families separated by work or emigration are making greater use of telecommunications systems.

These findings suggest a new balance between business calling and social calling in forecasting global demand for long distance services. Recognition of this trend has been evidenced over the past year in part by the introduction, mainly by U.S. carriers, of calling plans based on convenience and economy for friends and family worldwide.

An increasingly mobile population also points up a trend just starting to emerge: The basic shape of the global industry is changing more rapidly than ever before, dwarfing even what occurred in the U.S. in the 1980s. All major service providers around the world are in uncharted waters, maneuvering for position. It is a time of new entrants and new strategies.

This report brings a useful and important dialogue to the discussion. It suggests that we are moving to a new "paradigm" in the industry -- a shift away from the nationalistic, monopolistic, half-circuit era to the multinational, competitive era, offering customers, regardless of where they live, work or visit, one-stop shopping and end-to-end service.

Five to ten years from now, this new paradigm will be fully in effect. We see major players forming in groups, or alliances, to serve the needs of an increasingly global customer, whether transnational business or individual. But, in reaching this point, it is clear that of all the forces having an impact on the ultimate structure of the industry -- such as the degree of competition and technical change -- global traffic will be a determining factor.

Because this report is helpful both from a statistical point of view and in providing stimulating commentary, MCI is proud to be a part of this fourth edition. TeleGeography 1992 is a valuable resource for telecommunications users, government agencies and regulators, students of the industry, and those of us who are service providers. We recommend it wholeheartedly.

Bert C. Roberts, Jr.
Chairman and Chief Executive Officer
MCI Communications Corporation

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MISCELLANEOUS TABLES, FIGURES AND TEXT BOXES

Introduction

TeleGeography 1992 is an almanac of global telecommunications statistics -- the fourth volume in an annual series launched in 1989 by the International Institute of Communications (IIC). This year's report is also a sourcebook of ideas about the business of providing international telecoms services and how that business may change in the coming decade.

The report's statistics map the millions of minutes of telephone and facsimile traffic which flowed daily between the world's major economies in 1990 and 1991. This is a unique database covering over 40 countries and 525 bilateral routes. It tells us at the national level who is talking to whom and for how long. There are also statistics on the transmission capacity and cost of the principal trans-oceanic cable and satellite systems to 1997.

The information in TeleGeography 1992 is intended for a diverse audience including financial analysts, regulators, advertising executives, journalists, equipment manufacturers and business consultants. Professionals in these fields and many others should find the factual nuggets which they need to carry out their day-to-day work.

But the report also should be useful to a wider public, indeed, for anyone who is looking for reliable information about how much, how fast and along what axes the global telecommunications network is remapping the world. General questions such as these are at the center of the review essays in Telegeography 1992.

Beyond McLuhan

At least since Marshall McLuhan, the Canadian communications theorist (1911-1980), writers debating the impact of communications on society may be placed into two camps. In one camp are the structuralists who, like McLuhan, believe that the new behavioral patterns stimulated by a medium -- the changes in where, when and how we work and play -- are the message. The other camp believes that the content of the messages transmitted -- what is said or shown and what it means -- are of primary importance. Commentary about the visual media, television and film, has dominated this discourse. There are now schools of media (sic) study devoted to broadcasting and cinema at universities throughout the world. The telephone (circa 1876) antedates these other media by years. Still, some 580 million telephone lines later, the total literature on the social impact of the telephone today can be placed on a modest bookshelf. A desktop would be sufficient to hold the few quantitative studies.

This edition of the IIC's traffic report tries to redress this imbalance, at least in part. Since the report's inception, it has been partial to McLuhan's work, with qualification. We have argued, for example, that the major message of the global telecommunication network is TeleGeography and the new networked communities it has birthed. The pattern of cross-border traffic flows shows us the terrain; the emerging telecontinents and the teleislands, the electronic deserts and information belts.

Yet, we have also argued that one can not understand the evolution of TeleGeography without delving below the surface of traffic flow statistics into local political and social conditions. For every million minutes has a hundred thousand conversations behind it. How best to interpret this global gossip? Again, the expert opinion is divided.

Social Calling vs. Business Calling

There are the functionalists who view the telephone primarily as an instrument to get things done (make an appointment, respond to a query, close a deal, summon help, etc) and the communitarians who view the telephone's intrinsic purpose as social and cultural -- as one of providing connections, of kinkeeping, of sharing and caring, in short, of building and maintaining community.

These two views are not mutually exclusive. We all telephone for intrinsic and instrumental purposes. However, it is fair to say that the prevailing view in the telephone industry, and especially as regards international calls, is an instrumental one. The global telecom traffic boom thus is seen as a reflection of the growing cross-border flows of money, goods and, secondarily, people.

The foregoing view may have been justified in the past. But today, as the price of trans-continental telephone calls becomes closer to that for domestic calls, the view has become outdated. Moreover, there is substantial evidence that social calling, particularly among families divided by work or emigration, has provided the most explosive traffic growth on many international routes. (See Figure 1 below.)

It is incumbent upon all of us therefore to know more about the differences between instrumental and intrinsic calling patterns. And differences there are. One of the consistent findings of the few studies that have been done on national calling patterns is that intrinsic calls are far longer than instrumental calls, indeed often 20 or 30 minutes or more as compared to 2 or 3 minutes for instrumental calls. Average call lengths, which still drive most tariff schemes, even during offpeak periods, mask this.

Another important finding is that women make far more intrinsic calls than do men. In other words, telephone traffic patterns *are* gender specific. That men and women have different conversational styles and goals is now widely recognized. (See p. 7 below.) That these differences carry over to the telephone might not be surprising had it not been more or less ignored for so long by the international telecoms community.

When it comes to talking about new facilities or services, engineering and economic concepts tend to dominate. Instrumental and functional arguments prevail. Technology and trade, we are told, comes first for the telephone user; families and friends are second.

We are fortunate to have two articles which provide a more balanced view of the current demand for the international telephone network today. The first is by Ann Moyal, an Australian scholar, whose survey research has already contributed greatly to understanding the role of women's calling patterns in Australia's economic and social development. The essay here extends her insights to the demand for international telecom services. She suggests, among other things, that women's preference for voice rather than text communication (fax) is often overlooked.

Aharon Kellerman, an Israeli geography professor, contributed the second article. He has been analyzing country-by-country differences in international calling patterns since the mid 1980s, focusing on the linkages between communications and the flow of money and goods, on the one hand, and the flow of people (tourism, immigration), on the other. These studies have led Kellerman, like Moyal, to conclude that the demand for social communication has been underestimated by the international telecoms industry. He notes, for example, that social calling among many communities (eg, recent immigrants) is often quite disproportionate to income.

These two articles are complemented by an essay on the techniques which carriers use to forecast the demand for international telecoms traffic and the need for rethinking these methods in the face of more liberalized markets. The author is Paul Paterson, formerly the Chief Economist of Australia's OTC Ltd.

Paterson argues that as competition increases the uncertainty for international carriers, the tools of scenario analysis may be better able to generate a range of operationally useful traffic forecasts than the more traditional econometric approaches now in favor. In rough terms, scenario analysis involves identifying the key forces driving an outcome so as to articulate the different pathways that might be taken tomorrow and the likely outcomes. To quote Peter Schwartz, an early American student of scenario analysis, it provides "a tool for ordering one's perceptions about alternative future environments in which one's decisions might be played out." (See The Art of the Long View, (Doubleday, N.Y. 1991)).

Paradigm Shift

The growing level of economic uncertainty within the international telecommunications industry is highlighted by the final essay in this year's report. It suggests that the industry is in the midst of a paradigm shift.

The current paradigm for international telecoms services is underpinned by facilities-based or "Heavy Carriers", typically having a monopoly or oligopoly.

Figure 1

CALL LENGTH BY DESTINATION FOR OUTGOING TELEPHONE CIRCUIT TRAFFIC FROM JAPAN - 1990 FY

Country Called	Call Length In Minutes	Total Outgoing MiTT*	Growth (%) From Prior Year (1989 FY)
Brazil	7.19	20.3	232.9
Philippines	6.45	63.2	102.4
Peru	6.41	3.5	295.0
Bangladesh	6.18	3.3	196.9
Pakistan	5.39	9.7	142.4
United States	5.23	210.8	30.6
China	5.13	39.8	91.2
Canada	4.93	11.9	44.4
Thailand	4.74	29.4	65.9
Netherlands	3.23	4.9	24.9
Spain	3.22	3.5	28.6
India	3.05	3.5	26.7
Italy	3.03	7.7	26.5
Hong Kong	2.98	34.5	14.5

Source: Ministry of Posts & Telecommunications (MPT)

CALL LENGTH BY DESTINATION FOR OUTGOING TELEPHONE CIRCUIT TRAFFIC FROM U.S. - 1990

Country Called	Call Length in Minutes	Total Outgoing MiTT*	Growth (%) From Prior Year (1989)
Poland	13.98	64.2	19.7
El Savador	12.94	84.0	22.6
Guatemala	11.75	70.5	23.0
Philippines	10.93	163.3	26.6
Peru	10.73	64.4	18.6
Dominican Rep.	10.06	165.0	12.6
Colombia	9.74	132.5	9.4
Saudi Arabia	9.34	68.1	108.6
Jamaica	8.96	96.8	23.0
Ireland	8.95	54.6	11.4
Germany, FR	8.54	493.5	18.6
Israel	7.99	106.8	17.3
Greece	7.82	57.9	10.5
Rep. of Korea	7.32	163.9	16.0
Spain	7.11	68.9	20.5

Source: Federal Communications Commission (FCC)

** MiTT is Minutes of Telecommunications Traffic*

These carriers -- France Telecom, KDD, Singapore Telecom -- provide end-to-end international service by interconnecting matching "half-circuits" in international cable and satellite facilities and compensating one another through a system of bilaterally negotiated accounting rates.

Beginning in the 1980s, technology and market liberalization began to challenge this service paradigm. Very high capacity fiber optic cables and automated digital switched dramatically cut the real cost of service on many inter-continental routes. At the same time, the U.S. and several other countries (Japan, the U.K., Sweden, Australia) began to place additional pressures on the monopoly pricing and compensation arrangements within the industry by licensing new international carriers and challenging industry restrictions on the resale of cross border private lines.

As a result, by 1990 the potential for a new Light Carrier service paradigm began to emerge. The Light Carrier would resell, repackage and reprogram the offerings of Heavy Carriers. Its market would be global not national. End-to-end service would be the goal. And, wherever located, customers would be offered direct access to the world's lowest priced carriers via "800" (freephone) numbers, private lines or automated call-back devices to complete their calls.

In the U.S., this new paradigm is primarily being pioneered by new companies such as International Discount Telecommunications (IDT), Gateway USA and Viatel. However, several established carriers also have begun to expand their global reach by developing Light Carrier products (eg, virtual private networks, world-connect programs and credit card calling schemes). Other carriers have set up subsidiaries to take advantage of international resale opportunities.

However the industry's structure evolves though, the ebb and flow of global traffic will have a determining impact. The more buoyant the demand, the more scope there is likely to be for change. As the 1980s have demonstrated, competition is most likely to succeed when the established carrier(s) can "grow down".

In that regard, the message of this year's report continues to be a positive one. The worldwide volume of international telephone circuit traffic grew approximately 13% from 1990 to 1991. For 1992 the global volume of international switched traffic will be approximately 40 billion minutes; (it was 31 billion minutes in 1990).

The continuing economic recession in Europe and most of the English speaking world did trim growth as compared to the 1987-1990 period. But traffic from the largest Asian economies made up for it somewhat as growth rates continued at 20% to 30% or more. As noted earlier, more detailed route-by-route traffic statistics for over forty countries appear in the body of the report.

We are already making plans for TeleGeography 1993. One of our primary goals is to fill in the blank spaces on our communications maps, especially in Eastern Europe and the ex-Soviet Union. We welcome the assistance of those readers who are in a position to help us achieve this goal and, as always, invite comments and suggestions about the report from all quarters.

Gregory C. Staple
Washington, D.C. - August 28, 1992

Women Calling!
The Gendered Use Of The Telephone

Ann Moyal

Introduction

Telecommunication is traditionally a male - dominated arena. It is the male engineer, technician, manager, strategic planner and policy-maker who have devised and installed the telegraph, the telephone, radio and television broadcasting stations, the communications satellite, and the advanced digital and mobile communication infrastructures and networks that link and continue to upgrade our spiralling telecommunication world.

It is perhaps not surprising then that "malestream" thinking has placed a high priority on business communication as the pre-eminent information flow and tended to consign social and domestic telecommunication usage to a secondary and less significant role.

One point seems plain. Historically men have not considered women's communication to be part of an important information network, nor have they paused in the competitive pressure for faster, more integrative and technically powerful systems, to assess the distinctive telecommunication needs of 50% of our national populations -- women.

The time for reappraisal is at hand. There are several pointers to the need. The study of domestic telephone usage is emerging as a rising research field. (See the select bibliography below). The first international conference on The Sociology of the Telephone, held at Hohenheim University, Stuttgart, attracted some 200 carrier representatives and scholars in 1989[1]; further sessions were held on the topic at the International Communication Association Congress at Dublin the following year; in 1991 a Telecom Australia (now Australian and Overseas Telecommunication Corporation, AOTC) and CIRCIT Workshop on Research on Domestic Telephone Use convened in Melbourne, addressed a range of social and cross-cultural telephone use issues and their implications for national and international policies.[2]

A pioneering national study of women's telephone use has also focussed the question of gender. The author's Women and the Telephone in Australia,[3] based on a deep slice, qualitative survey of 200 women across the country, revealed a dynamic, but hitherto invisible, caring feminine culture of the telephone that has been politically and economically overlooked. Its evidence, collected by a team of researchers, comprising women of wide demographic and social backgrounds, exposed an area of kinkeeping, mutual support, volunteer work, and social caring, that contributes significantly to the stability and well-being of the community. Overall it revealed that the telephone needs of women are more complex and distinctive than the rest of society has perceived.

Genderlects

In her best selling book, You Just Don't Understand, American linguist, Deborah Tannen, has drawn attention to a fundamental difference in the communication goals of men and women and to the cross-currents and confusions such differences produce. Men, she writes, see conversation as a means of conveying information. Women, contrastingly,

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engage in a mesh of connecting communication with close friends and family, keeping each other informed on events in their lives, telling what's happened, empathizing, rejoicing, listening, and, in time of loss or tragedy, sorrowing with each other. Such patterns form early. Boys and girls, as Tannen points out, grow up in "different worlds of words". Boys' games tends to grow round the hierarchy of a leader who tells others what to do. Giving orders confers status, and there are winners and losers.

Girls' games, by contrast, are less concerned with winning personal status. Often, girls simply sit and talk. Within the group, intimacy is key. Girls are eager to be liked. Sharing secrets and personal talk to establish closeness, they are already shaping the character of friendships in their adult lives.[4]

Women's communication, then, is to create intimacy and closeness, to communicate thoughts and impressions, to support and be supported, to connect. "Small talk", Tannen concludes, "serves a big purpose". Contrarily, men's goal is independence; their world of words is frequently impersonal, factual, and talk-focussed, and while personal friendship talk between men is not unknown, the male of the species will commonly choose a woman to confide his intimate thoughts. Coining a word for these patterns, Tannen calls them "genderlects".

Women and men's differing styles of communication have been transferred to the telephone. Men, indeed, have long complained of it. Ever since Mark Twain's story "The Telephone Conversation" appeared in 1880, women have been characterized as "gossiping" or "chinwagging" on the phone, and literature and the media have perpetuated the view. Yet according to feminist sources, the original derivation of "gossip" is "relating", "a feminized affinity", "talking comfort".[5]

Women and the Telephone -- The Australian Evidence

Evidence from the national survey of Australian women's telephone use confirms the importance of the telephone in maintaining close personal links for women and in establishing intimacy at a distance. The sample encompassed women at home and in the workforce; single, married, divorced and widowed women; sole parents, women in young, middle-aged, mature and elderly subgroups, and women drawn from immigrant backgrounds. Taped interviews were used as a flexible and open-ended methodology for retrieving direct and reflective material.

Women in the survey used the domestic telephone for both "instrumental" (functional) and "intrinsic" (relational) use.[5] Their instrumental calls averaged 2-6 a week (more in cases of illness, home renovating etc.) and fall within the international carrier allocation of three minutes as the basic unit of telephone call conversation time. The number, however, of intrinsic calls made weekly rated between 14-40 (20-28 on average in metropolitan centers and 14-25 in rural regions) and occupied from five to twenty minutes, and not infrequently thirty to forty five minutes, and on some occasions, more than an hour. For local calls, some trunk, and some (though fewer) international calls, the call's duration and sense of unpressured communication was seen as an important part of the purpose and satisfaction of the call.

Excerpts from the Australian voices confirm that high sense of gratification that women's telephone networking confers.

Home-based women: "The telephone is very important to me because suburban home life is lonely and the phone is a link with people one loves. There's a need to communicate feeling and caring. What I want to know is how my friends 'feel' and I can hear this on the telephone".

Mature woman doing professional work at home: "The telephone is the 'frontline' when it comes to giving or receive news, good or bad. With friends, it's picked up instantly in all sorts of situations, to share a success, air a grievance, share news about health or holidays. It contributes to my sense of direction and participation. For my sister and a close friend overseas, it's a way of maintaining our intimacy

CONVERSATIONAL GENDERLECTS: CROSS BORDER TRAFFIC?

"Each person's life is lived as a series of conversations.

* * *

More men feel comfortable doing 'public speaking' while more women feel comfortable doing 'private speaking'. Another way of capturing these differences is by using the terms *report-talk* and *rapport-talk*.

For most women, the language of conversation is primarily a language of rapport: a way of establishing connections and negotiating relationships. Emphasis is placed on displaying similarities and matching experiences. From childhood, girls criticize peers who try to stand out or appear better than others. People feel their closest connections at home, or in settings where they *feel* at home -- with one or a few people they feel close to and comfortable with -- in other words, during private speaking. But even the most public situations can be approached like private speaking.

For most men, talk is primarily a means to preserve independence and negotiate and maintain status in a hierarchical social order. This is done by exhibiting knowledge and skill, and by holding center stage through verbal performance such as storytelling, joking, or imparting information. From childhood, men learn to use talking as a way to get and keep attention. So they are more comfortable speaking in larger groups made up of people they know less well -- in the broadest sense, 'public speaking.' But even the most private situations can be approached like public speaking, more like giving a report than establishing rapport.

* * *

If women speak and hear a language of connection and intimacy, while men speak and hear a language of status and independence, then communication between men and women can be like cross-cultural communication, prey to a clash of conversational styles. Instead of different dialects, it has been said they speak different genderlects. ...

* * *

When most men talk to their friends on the phone, they may discuss what's happening in business, the stock market, the soccer match, or politics. They do gossip (although they may not call it that) in the sense of talking about themselves and other people. But they tend to talk about political rather than personal relationships. If men do mention their wives and families, the mention is likely to be brief, not belabored and elaborated in depth or detail.

* * *

[And, as one man said to a friend], 'If I do [telephone], it's because I have something to ask, and when I get the answer, I hang up.'

* * *

[I]f men see life in terms of contest, a struggle against nature and other men, for women life is a struggle against the danger of being cut off from their community."

From ***You Just Don't Understand*** *by Deborah Tannen, Ph. D. (William Morrow & Co., N.Y. 1990)* and keeping up our exchange of life's details and ideas."

A retired country town resident: "Each night my daughter and I talk for half an hour by phone. We discuss the routine of the days, things we want to do when we meet. It helps my life entirely. It helps my daughter too."

Woman studying at home to re-enter the workforce: "The phone creates a psychological neighborhood for women which alleviates loneliness and is very important. Feminism has made us more aware of the need to be close to other women. Through phoning we encourage and support each other."

Young urban mother: "With a husband away on business overseas, the telephone is great for emotional security. When my daughter had a 'run-in' with her teacher, I didn't know what to do, I had to talk to him. I rang my husband in Vancouver and cried on the phone for an hour."

A 75 year old widow: "People have helped me in my bereavement, talking to me. It has been wonderful and made easier through the privacy of the telephone."

Across the spectrum, women's commitment to the telephone neighborhood has grown exponentially in the last two decades. For elderly and aged women, it has great importance allowing them continued autonomy and independence at home and, through their intrinsic calls, bringing a sense of involvement, well-being, and self-esteem.

In Australia, mother/daughter contact loomed large. Grandmothers kept in touch with grandchildren; the telephone bound the extended family; men delegated their family calling to wives; and it was women who kept in caring touch with widowed fathers, brothers, and sons.[6]

Migrant Telephone Use

The Australian survey also shed light on the telephone behavior of a country where one in five residents was born overseas and where the parents of some 40% of the population originated in other countries. For the migrant, once settled and with established income, the domestic telephone played a vital role. While immigrant men use the phone for business, their wives and daughters soon adopt it for extended family contact, to tap in -- in their own language -- to their ethnic communities, and to keep their contacts with former homelands firm. The more carefully timed international family calling (maintaining bonds with mothers, monitoring health, celebrating anniversaries) has also widened significantly in the last decade. Indeed, AOTC informs that their predominant overseas caller is the younger professional woman, born outside Australia, of high occupational rating, who uses the international telephone for long social calls to friends.[7]

The finding is crucial. For professional women, the international telephone call has evident priority over non-voice telecommunication forms. While the fax machine in Australia (with an installed base that placed her seventh after USA, Japan, Germany, UK, France and Canada in 1990), commands the major share of overseas business communication conducted by men, present research confirms that women choose the international voice telephone for their business transactions abroad.[8]

Moreover, as Tannen has also noted, women mix their business dealings with more personal talk. "After they have settled their business, they bring each other up to date on their personal lives".[9] In international calling, as in local telephone use, women present different styles and manifest different communication needs.

Conclusion

These insights are being extended in the USA and Europe. Current research in France and Germany informs that women use the domestic telephone twice as much as men, their habits are more relational, more conversations take place, and more news is exchanged with family and friends.[10] In the USA, communication scholar, Lana Rakow's study of forty rural women and their telephone talk in the mid-west town of Prospect, Illinois, underscores the importance of the "gendered work" of women's telephone information flow, and emphasizes the critical absence of women from the creation and decision-making about telecommunication technology and the uses for which it is devised.[11]

Clearly we need to understand more about women's behavior and attitudes to old technologies, and new. In our changing, high paced, stressful, and alienated societies, with their ageing profiles, fractured and scattered families, the rise of the sole parent, and the loneliness of suburban life, we need to take account of the significant social traffic of the national and international voice telephone.

With the telephone's inception, companies set out to promote the development of the technology for business use. It was women, however, who influenced the wide extension of national networks through the telephone's social use.[13] It is a lesson telecommunication carriers would be wise to note today. Given women's predilection for the telephone and the social importance of their information flow, more national carriers might usefully adopt practices current in some countries of offering innovative tariff schemes to residential customers for offpeak international calling, encouraging women to keep in more frequent touch with distant communities and kin.[14]

"Women's talk" and women's needs for particular connectivity and exchange should also be considered as more national and international computer services come on line. Already a substantial part of our electronic and audiovisual technologies is concentrated in private homes. Knowledge about the private domain and the specific role of women in using these technologies is hence crucial for their development.[15] As yet, however, little research has been launched.[16]

In the marketing of new technologies -- mobile and cellular telephony, are a case in point -- it is the male user who is borne in mind. Yet women in suburban and country dwellings, elderly and home bound women, are potential key consumers of these facilitating products, just as women in "homeworking" settings or in rural "telecottages" are an important, but as yet neglected, market for a whole range of telecommunication and computer services and products.

In sum, unless telecom network planners, marketeers, economists, and corporate strategies develop a more gender-balanced sense of why and how people use the telephone network in the present age, and promote research in this new field, they are not likely to be able to craft effective policies and products for the telecommunication age ahead. The same is true of policy-makers and legislators. At national and international levels, it is thus imperative, if we are to encourage telecommunication practices which relate to, and enhance, our social cohesion and harmony as well as our business lives, to draw women, their advice and viewpoints into telecommunication decision-making.

Endnotes

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The Social Demand For International Telecommunications: The Hidden Promise

Aharon Kellerman

Consider the following:

* It was estimated that in the early 1960s only 20% of U.S. international telephone calls were residential. By 1989, for AT&T, the figure was 67%. Even more of Teleglobe Canada's traffic is accounted for by residential lines. (See Figure 1.)

* Bezeq, Israel's telephone company, reported that the average length of an international call was 3.8 minutes in 1990, 50% longer than the average domestic call, and that an average residential international call was approximately 33% longer than an average business international call.

The evidence notwithstanding, the so-called "telecommunications revolution" is too often associated solely with the business sector, where data and fax transmissions have led the change. But, in the household sector, although Plain Old Telephone Service (POTS) is usually the only service, world wide direct dialing has revolutionized the daily life of millions of people. And, as the two opening points suggest, households may well offer the "hidden promise" for further growth of cross-border telecommunications in the 1990s.

Before analyzing some of the ways in which international business and social calls differ, it may be helpful to profile the main geographical patterns of international telecommunications.

Destinations

International calling patterns of countries may be divided into four categories, so far as call destinations are concerned.[1] First is the traditional or conservative-cultural pattern, in which priority is given to countries which share the same or similar languages, despite different geographical patterns of international economic activity. Striking in this group are Germany and the Scandinavian nations where households play a major role in the demand for international telecommunications.

A second pattern is the global or world economic one, evidencing close ties with or among the G7 countries, as is the case for example with the U.K. and the Netherlands. Here the business community may tip the balance, although the U.K. appears to present something of a mixed case.[2]

A third possible pattern is a modern-cultural one which assumes a wide and limitless opening of the system, so that it may seem as if everybody speaks and exchanges messages with everybody else. The trends in the U.S. resemble such a pattern. Countries from the two other global cores, namely Europe and the Pacific Rim, jointly with countries from Latin America and the Middle East, lead the list of most frequently called countries, thus reflecting extensive economic as well as social ties.

The fourth pattern, is a mixed one, so that favored calling destinations consist of older cultural and

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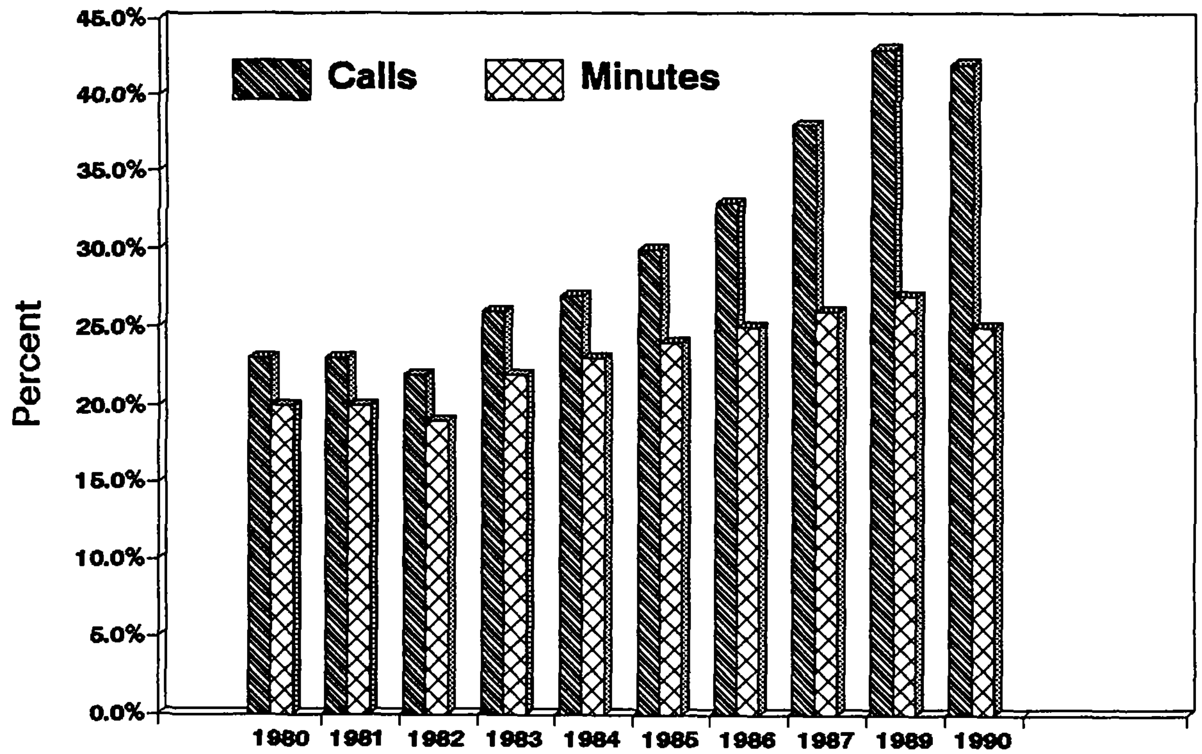
Figure 1

Business Traffic as a Percentage of Teleglobe's Total Outward Telephone Traffic



Source: Teleglobe Canada

CANADA-OVERSEAS TELECOMMUNICATIONS IN A GLOBAL ENVIRONMENT (1991) McCARTHY TETRAULT

economic connections, side by side with global economic powers and new cultural-social ties. Most countries, especially in the developed world, may be classified in this last group.

Interestingly, the three latter patterns imply a partial or full convergence between emerging destinations for economic and social-cultural connections. This may further imply that whereas the mix of international calls differs from business to households, the country destinations may be similar.

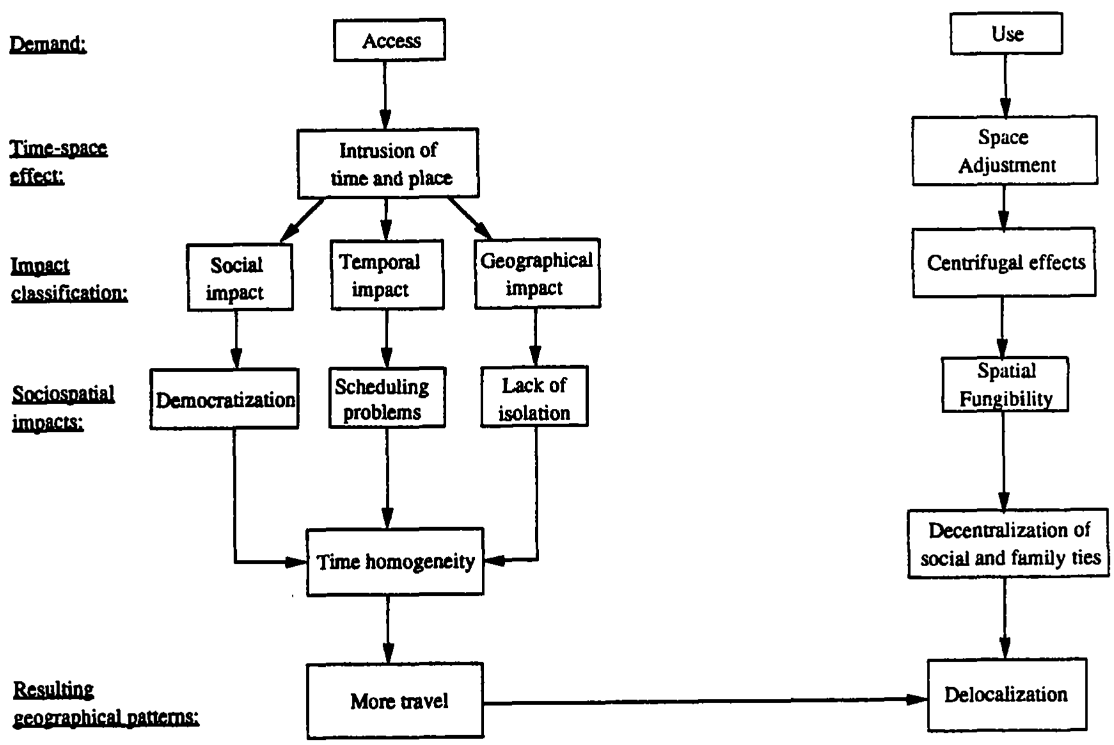
The Telecommunications Process

Now let us return to the question of social international calling. What are its distinguishing characteristics and what implications does this have for national calling patterns.

Let us start by looking at the telecommunication process. Demand for service consists of two dimensions: *the passive demand for a network access (to* receive a call) and the active demand for network usage (to make a call).

Figure 2

Socio-Spatial Diagram of the Telecommunications Process



Both dimensions of this telecommunications process have a geographical impact. See Figure 2. Moreover, the impact of social communications is different from the impact of business communications because the process -- the way in which calls are made and received -- is different.

Let us look at access first. Because of the international time differences, especially at the transoceanic level, social phone calls may reach households at unusual times of the day, and they are normally received with a high level of "temporal tolerance". Thus, Marshall McLuhan's claim that "the telephone is an *irresistible intruder* in time and place"[3] is of special significance as far as international telecommunications is concerned. It further means that people may expect social international calls not only at home but at other places as well, interfering with business or recreational schedules. And, as calling prices fall, potential customers per households may increase, as adolescents and even children enter the market.[4] These aspects of social calling -- temporal tolerance, spatial tolerance and the group nature (calls may be directed to a family rather than a person) -- tend to give social calls a different geographical dispersion. They may also spur social international travel in ways business calls do not, thus creating additional demands for international telecommunications, by the travel industry, as well as by the travellers themselves, calling home while away.

I have attempted to study the relationships between the international movement of information, on the one hand, and those of people, commodities, and capital, on the other, in various national contexts.[5] Among other things, these studies showed that U.S. international telecommunications is tied more to the international movement of people, than to the movements of capital or commodities. This applies both to the annual growth rate in international calls, as well as to the distribution of calls by countries of destination. More restricted analyses of British data revealed similar trends, while for various other nations international telecommunications at large is more related to exchange of commodities.

The relationships between travel and international calls reported above, obviously apply to outgoing calls even more than to incoming calls. The use of the telephone system thus helps to bring about a decentralization of social and family ties (see Figure 2). The "adjustment of space" or the shrinking of distances as a result of enhanced communications may also permit a dispersion of economic activity, and a further dispersion of employees, who can keep in touch with old homes through telecommunications. A "delocalization" effect may develop, which also results in more travel.[6]

Another important aspect of social international calls is that the geographical origins tend to be dispersed throughout the population, both at the inter- and intraurban levels. As striking is the absence of any clear relationship between the socioeconomic levels of calling households and demand for international telecommunications services! New immigrants, normally at the lower strata of income tend to consume more calls, since their needs to converse with friends and family members in old homes may be high. The lack of detailed published data on the geographical origins of international calls, however, has made it difficult to assess the tendency. Further research would obviously be of more than academic interest to marketing and planning groups within the telecoms industry.

In contrast to social calling, the origins of business international calls tend to be geographically concentrated, and at various scales. Cities which host concentrations of information activities and headquarters of transnational corporations typically produce more calls than other cities. At the intraurban level, downtown areas or suburban offices and high-tech industrial parks constitute major geographical origins for international phone calls.[7]

Conclusion

Our experience with international calling in the last decade suggests that an infrastructure for international telecommunications built on the assumption of high business usage may ultimately become driven by the demands for social communications. In fact, there is no denying the basic demand for social international telecommunications and the innovative means people will use -- regardless of income level -- to make a connection.

For example, international calls between Israel and Arab countries are not sanctioned by all Arab states. Yet, the computerization of the international telephone system permits direct-dialing beyond otherwise sealed borders through a computer located in a third country, or even through one-sided direct-dialing offered by a common carrier. Both options currently allow people in Israel, the West Bank and Gaza, on the one hand, to call Jordan, Syria and other Arab countries.

In the future, software defined networks will offer a further outlet for social international calling. So will other innovations (of which the picturephone is potentially the most important). Moreover, the longer term impact on emigration and travel patterns of good-quality picturephones should not be underestimated.

In sum, contrary to some thinking, social international communications appears to have sustained the last decade's international telecommunications boom and may provides the "hidden promise" for the next one. For unlike business communications, the traditional drivers of income, time and place are not necessarily determinant. There is a different process at work and a different geographical result -- distinctions which the more market oriented international carriers have begun to exploit.

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U.S. SOCIAL CALLING PLANS: THE COMPETITION HEATS UP

U.S. telephone companies have often led the way in marketing innovative pricing and service plans for residential users. The parade of new social calling programs for local and long distance services thus may soon find their way into other national markets.

At the local level, THE SOCIALIZER PACKAGE, offered by the Chesapeake and Potomac Telephone Company (C&P), a Bell Atlantic subsidiary serving the Baltimore-Washington area, is typical. Under this plan, offerings such as three-way calling, traditionally described as a business conference call, are featured as a service for "family reunions." By combining this service with "Answer Call", "Return Call", and "Call Waiting", C&P claims that customers can now "stay in contact with family and friends at home or away."

C&P's efforts to focus on close knit tele-communities is mirrored by one of the best known U.S. long distance calling programs, the MCI Friends and Family plan. Since it was launched in 1990, it has attracted over 7 million new customers. According to company officials, MCI wanted to create a product that would both reduce the number of customers switching to other carriers and increase its subscriber base. MCI customers said that they wanted across-the-board discounts that were not limited by the originating time of a call since friends and families expect to receive calls at all hours.

The MCI Friends and Family program thus allows residential customers to create their own Calling Circles of between 1 to 20 frequently called friends or family. Members of the Circle currently must be or chose to become MCI customers. Every call placed to a Calling Circle member receives a 20 percent discount. MCI later extended this service to international calls by allowing one international number into each Calling Circle.

The success of the MCI Friends and Family program has led Sprint, the third largest U.S. long distance carrier, to design its own new residential and small business calling plan. Marketed as "THE MOST", the Sprint plan provides a 20% across-the-board discount to the number each customer calls "the most" each month, regardless of the carrier to which the called party subscribes.

If "the most" called party happens to be a Sprint subscriber, an additional 20% discount is given to the caller. The total net discount amounts to 36%. Sprint also advertises that privacy is not an issue with "THE MOST." Its computers automatically recognize a fellow Sprint subscriber, so a customer need not reveal the names of friends and family for the discount to register.

New research data on these phone services tend to confirm the growing force of social calling at all levels of the network. MCI discovered that subscribers to its Friends and Family plan call their families twice as often as their friends. Sisters are the most frequently called relative.

Sprint, in turn, now runs television commercials featuring people of varied cultural backgrounds responding to the question "Who Are You Going To Call The Most This Month?" The answer: "my sister" or "my mom." Sprint then provides the postscript: "Doesn't anyone call their father any more? " Yes, but because most men don't seem to talk as long on the phone, outside of work (see p. 7), they are unlikely to be a profitable target for social calling programs.

Gregory C. Staple and Evelyn Aswad

Preparing for the Future: Forecasting Demand and Planning Capacity for International Telecommunications in a Changing Environment

Paul Paterson

Rapid, fundamental and far-reaching change is a predominant feature of our life and times as world citizens in this last decade of the 20th century. And nowhere is this more true than for international telecommunications.

Driven by technological advances, increased customer sophistication and a global movement towards market based solutions, the operating environment, and indeed the core activities of telecom service providers, are changing dramatically.

In "Winning the Global Telecommunications Market" (see the next article), Greg Staple presents a convincing view of a brave new world of international telecommunications that could be in place by the year 2000. The old regime of dominant, nationalistic, monopolistic, hardware-intensive and bilaterally interdependent carriers ("Heavy Carriers") is contrasted to a future regime of more quixotic, multinational, competitive, software driven, end-to-end carriers ("Light Carriers").

This view should be extremely useful to existing and potential carriers trying to best position themselves for future success. However, even though in many markets the international telecommunications industry has clearly moved away from the old "Heavy Carrier" world, the new "Light Carrier" world is not here yet. Carriers in a number of major (and some minor) markets -- totaling perhaps half of international telecommunications traffic, and certainly more than half of intercontinental traffic -- face an in-between or transition situation.

Legislated monopoly rights have been abolished, but only a limited number of competitors -- and usually only one -- are allowed. While off-shore customers are beginning to be pursued, this market is embryonic and a tiny part of revenue. And end-to-end provision of service is still a goal for the future.

It is this in-between, transitional world that existing carriers must not only survive, so as to participate in the 21st century, but must be able to profit from so as to be well equipped to fight tomorrow's battles. Market outcomes now will shape the future. In short, there is a real imperative for carriers to make money today in the world as it is!

It is in this context that carrier practices in forecasting and analyzing the demand for international telecommunications are considered. In both the old, more stable world and the current transitional environment, understanding the demand for international telecommunications and projecting forward traffic volumes affects carrier performance -- but for different reasons.

Under traditional arrangements, the importance of demand forecasting has been primarily in relation to *network dimensioning*. Significant rigidities and inflexibilities in network provisioning arrangements have made it important to forecast future traffic levels as accurately as possible to minimize two types of

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cost. These costs are the direct cost of holding expensive excess capacity and the "cost" of foregone revenue from inadequate capacity to meet customer demand.

In the current transitional world, the relevance of demand forecasting and demand analysis is somewhat different. Technological, institutional and market changes make network provisioning more flexible. Furthermore, with reductions in network capacity charges, the cost of holding excess capacity has declined. Hence from this angle, *accurate forecasting* has diminished in importance.

In other ways, however, the importance of understanding demand has increased. In particular, with margins reduced by competition, reasonable forecasts of business volumes are required to ensure there are no major adverse cash-flow surprises. Further, with the increased importance of overhead costs comes the need to know the revenue base that will be available to sustain these costs. Finally, but perhaps most important of all, there is a critical need to understand the *characteristics of demand* -- including own-price and cross-price elasticities of demand -- to design appropriate competitive strategies.

In Section I below the role and methodology of demand forecasting in the traditional monopoly, facilities-based, bilateral environment is described and evaluated. The verdict? Some serious shortcomings are apparent, but there has been reasonable performance in a "Heavy Carrier" context nonetheless.

Section II is devoted to considering the objectives that demand analysis and demand forecasting need to meet today. This includes a review of attempts to overcome the shortcomings of the traditional approach in a changed context, and possible further modifications. Here it is concluded that the old approach has not, and cannot, serve the carriers well in the face of new uncertainties.

In Section III a new approach to planning and preparing for the future, scenario analysis, is proposed as an important tool in the battle for survival and market strength.

I. The Provision of International Telecommunications Services -- the Traditional Setting

Since its beginning over 100 years ago international telecommunications has always held a certain air of mystique. This stems from an impression of baffling concepts and terminology, mind-boggling technology, a clique of long-established market participants, unique institutional arrangements and the allure of familiarity with far-off parts of the world.

Successive editions of the **IIC Global Traffic Report** have been a breakthrough in providing previously unavailable international telecommunications traffic statistics. As a result, the basic dimensions of many country pair (origin -- destination) markets for international telecommunications services are now known. Nonetheless, an air of mystery as to the workings of the international telecoms market still prevails. The first task then is to dispel some of this mystique.

How Services are Provided

A key characteristic of international telecommunications is that, in virtually all cases, services are provided by joint production, involving an international carrier at both the originating and terminating ends of the link.[1]

This arises from the statutory restrictions of facilities-based carriers that exist in some form in every country. There are at the most only a limited number and often only one sovereign international carrier allowed to operate in any country. This is turn means that no one carrier can on its own provide end-to-end service and needs to interwork with other carriers to provide full services to customers.

Interworking with other carriers has two dimensions: first the establishment of telecommunications capacity between country pairs; and second the provision of services over this capacity.

To establish telecommunications capacity between country pairs, the convention that is followed is for carriers to acquire bulk capacity on international telecommunications media -- either cable or satellite -- on a "half-circuit" basis. This capacity is brought to life by matching own half circuits with those of another carrier. For example, an international carrier in the US might acquire a certain amount of bulk half circuit capacity on a particular Intelsat satellite servicing the Atlantic region,[2] and establish country specific capacity to (say) UK and France by entering into half-circuit partner arrangements with BT (or Mercury) and France Telecom.[3]

Provision of service over this capacity requires a separate bilateral agreement between the carriers at each end, often referred to as **overseas correspondent relations**.[4] With over 200 international destinations, each carrier has this number of bilateral relationships. This means that over 20,000 contractual correspondent relationships exist at one time.[5] No wonder observers from outside the industry are perplexed!

Take for example the situation with an international telephone call. One international carrier picks up the call from the originating party (either directly from the caller or via a separate domestic carrier) and carries it to a notional mid-point between the two countries. It then hands the call on to an international carrier in the terminating country to run it over the border into the destination country and through to the called party.

Each correspondent relation involves striking a level of recompense provided to the terminating carrier by the originating carrier. For telephone calls, only the originating carrier bills the caller, but the terminating carrier also incurs costs in carrying the call to its destination, requiring payment from the originating carrier to the terminating carrier for providing this service. This is done on the basis of the **accounting rates** between the two carriers.[6]

Facilities Planning

An important element in providing service for "Heavy Carriers" is facilities planning and provisioning. The approach taken to this reflects in particular the practice of joint provisioning, and the engineering focus of those who are usually involved in the process. Facilities planning and network dimensioning for international telecommunications takes place at two different levels, usually characterized as long term and short term network planning.

Long term network planning relates to the acquiring of bulk half-circuit capacity on satellite and cable media. This in turn can be seen as having two dimensions: involvement in the provision of the actual transmission medium and the acquisition of the capacity of these media.

Consider first the provision of satellite capacity. Intelsat, a consortium of all major and many smaller international carriers, is the prime provider of satellite capacity. To determine the amount of capacity that needs to be provided, Intelsat's investors hold an annual **Global Traffic Meeting**. Each participant estimates future volumes of traffic in and out of its country (by origin/destination). These figures are synthesized in an interactive way by Intelsat staff to arrive, after a number of steps, at regional satellite capacity needs for the next 25 years.

There are in fact two critical steps in this process. One is formulating an assumption about *traffic compression* technology -- how much capacity is needed to carry a certain amount of traffic and when shifts in this technology will occur in the future. The other critical step is making an assumption on the cable-satellite split of traffic. The intentions of cable consortia and carrier plans on using these cables are each considered. Because the cable providers are in fact the same carriers who sit around the table at the Intelsat Global Traffic Meeting, these meetings have become surrogate forums for cable planning as well.

In contrast to Intelsat, however, consortia are formed on an as-needed basis to plan, fund and implement the laying and commissioning of international cables. Carriers have certain ownership shares in these cables. These rights can be taken up for their own immediate use or be left idle for a future time; leased out to other carriers on a fixed term basis (carrier leases); or sold off to other carriers for the life of the cable ("indefeasible rights of use" or IRUs).[7]

For planning and providing both of these transmission media -- satellite and cable -- a short term and a long-term view of future traffic volumes is required.

The short term element of facilities planning and provision involves arranging live complete circuit capacity over these facilities by matching own half-circuits with those of other carriers. This entails on-going bilateral discussions with all correspondent carriers with which direct (as opposed to transit) links are established. The short-term aspect of capacity provision is far more dynamic. It involves dimensioning to achieve a certain grade of service (typically a "1% grade of service" for advanced carriers, meaning no more than 1% of calls fail due to congestion in the international network during the busy hour), but at the same time minimizing circuit provisioning costs.

Forecasting Demand

To know how much bulk capacity to acquire on cable and satellite media, and how many "live" circuits to establish with individual carriers month-to-month and year-to-year, forecasts of future traffic volumes are required.

As anyone who has seriously tried their hand at it knows, forecasting -- or at least accurate forecasting -- is never easy. Forecasting future traffic flows for international telecommunications is no exception. However, the key characteristics of the "Heavy Carrier" international telecommunications environment -- joint provision of facilities and services, large lumpy investments and long lead times -- has made the task of charting future traffic volumes particularly important.

Up to the present, telephone service (including fax) has been the main type of international telecommunications traffic and has been responsible for almost all international carrier revenues (typically over 90%). Accordingly demand forecasting has primarily focussed on telephone traffic.

Forecasting international public switched telephone network (PSTN) volumes -- minutes of outbound and inbound traffic -- is done with varying degrees of sophistication by carriers around the world. Differences reflect not only the technical expertise within the organizations but also the nature of traffic growth and the associated specific needs for forecast information.

Growth in international PSTN traffic is typically far higher for developing than mature markets. Hence, under reasonable macroeconomic conditions, PSTN traffic across the Atlantic, the most mature intercontinental market, has grown at around 10-15% per annum in recent years. For developing countries, international traffic growth of 30-40% annually is closer to the norm. This reflects not only a growing outward focus of these economies but also increasing number of households passing discretionary income thresholds beyond which international telephone calls become a consumption option. Growth of international traffic may also be boosted by rapid expansion in access to telephones (telephone penetration) and reduction in the congestion of domestic networks, which deters and limits access to the international network.

In between these two extremes, developed countries that are not yet fully mature in their telecommunications market have shown traffic growth of 20-30% annually, under reasonable macroeconomic conditions.

Differential growth rates has meant that the international traffic forecasting needs of carriers varies. Whereas for carriers in developing countries the critical challenge has been to provide enough international capacity to meet demand, for mature markets fine-tuning capacity and picking the turning points in traffic growth has been more important.

Furthermore, because traffic growth in developing countries (and to a lesser extent developed countries whose telecommunications markets are still maturing) is often driven primarily by factors other than macroeconomic conditions, in general this growth will be less affected by cyclical shifts in economic conditions. Accordingly, whereas some carriers have believed they could adequately meet their forecasting needs by fairly simple trend analysis, for increasing numbers more sophisticated forecasting is desired.

The more sophisticated approaches have, to date, mostly involved generating point estimates, or a range around a point, from econometric equations.[8] The econometric equations are in turn derived from economic theory and general observations on the working of the market. It is this more sophisticated approach that is now considered in some detail.

Traditional Forecasting Techniques

Telephone calls are both a personal consumption item and an input service to business. Factors reflecting both these elements are usually taken into account when forecasting international telephone traffic.

Business use factors:

- the level of economic activity within countries (GDP growth in originating and terminating countries);
- volumes of international trade with terminating country;
- tourist numbers (including business visitors);
- price; and
- trend factors reflecting increased usage of telecommunications beyond that stimulated by the above factors.

Residential use factors:

- growth in disposable incomes (again GDP, or per capita GDP, growth);
- the number of foreign born residents
- the number of nationals living abroad;
- price; and
- trend factors (as above).

The statistic generally forecast is paid minutes of international traffic.[9]

Based on these models, what are the key drivers of international telephone traffic? The prime influences that come to light are price, economic activity (GDP) in both the originating and terminating country, and trade and migration/tourism flows. Of these, the more important have been GDP and price. While trade and tourism/migration often have the expected impact, the size of their impact has not in general been large.

In determining the effect of movements in these factors on international telephone traffic through the use of models of telephone demand estimated by econometric means, single equation models treating outbound and inbound traffic (paid minutes) separately have generally been used (see, for example, Bhatia 1989). Total ("whole world") inbound and outbound traffic generally is forecast. In addition to this separate forecasts of traffic are often made for the major country pairs -- individual "stream" traffic in the parlance of the industry.

In many cases, the econometric equations provide that some of the factors affecting usage (as listed above) will impact traffic volumes with a time lag. Many international traffic demand models allow for changes in price to have a cumulative impact over a number of years. The reasoning is that users need time, on the one hand, to perceive and to internalize price changes and, on the other hand, subsequently to change their usage patterns. Allowing for cumulative lagged impacts has been done both directly by including past values of these measures in the equations and indirectly by including a lagged dependent variable amongst the explanatory variables (see Bhatia 1989).

How successful have these traffic modelling exercises been in meeting their intended purpose?

Measured in terms of within-period goodness-of-fit (how much of the movement in traffic over the period used to estimate the model is captured), the models generally have done reasonably well. This probably is not surprising as it is usually not difficult to "explain" most of the within-sample variation in a dependent variable (here international traffic) in an econometric equation by experimenting with different combinations and forms of the explanatory variables used.[10] This is particularly true when there are strong trend elements in the measure being "explained" -- in this case strong growth in international traffic.

The Limitations Of Current Models

However, a number of theoretical and practical considerations suggest that this kind of demand modeling may have significant limitations.[11] One concern is the separate modelling of inbound and outbound international traffic. This would appear to fly in the face of perceived market behavior and statistical evidence that there are links between inbound and outbound traffic. These links are, in fact, both of substitution and complimentarity.

For example, a fall in the price of a call from country A to country B relative to the price of a call from B to A is likely to result in an increase in traffic from A to B, not only from an increase in the overall volume of traffic between A and B from a straight price-volume effect, but also from the substitution for calls from B to A by calls from A to B. In other words the evidence shows that there is some discretion in whether the party in A calls B or the party in B calls A, with this decision influenced in part by relative prices (and also relative incomes, time-of-day calling patterns etc).

On the other hand, there is also evidence that increases in outbound traffic stimulate additional inbound traffic -- a "call begets a call" effect. This is notably true for fax traffic, where the prevailing view in the industry is that correspondence by fax in most cases generates a fax or a telephone call in reply.

To accurately capture the dynamics of the market for international telephone traffic, this interaction, or simultaneity, between inbound and outbound traffic needs to be reflected in forecasting models. Without capturing this simultaneity, the estimated coefficients of the explanatory variables are likely to misstate the true market response. Forecasting performance will be affected accordingly.

Another major shortcoming with many current forecasting models is the lack of explicit attention to structural changes in the market. Two major structural changes that are relevant in most countries are: the traffic stimulation effects from the availability of international direct dialing (IDD) facilities to customers; and the enormous growth in the use of facsimile. Both these factors have changed structural relationships in the telecommunications market and, as such, should be explicitly reflected in the equations representing this market. What is known of forecasting models in use suggests that this is not done in most cases.

Yet another difficulty with past demand forecasting models is that they have not separated out business and residential traffic. The potential for distortion here arises from (a) the combination of likely differences in responsiveness to stimuli (eg. elasticity with respect to price change or GDP growth) of businesses and households and (b) the changing mix of business and household traffic over time. Some evidence suggests that social traffic is growing faster than business traffic and may be expected to do so in the future as both prices fall and household income rise. Hence, there have been suggestions that social traffic is now about 70% of all telephone traffic out of the U.S., and perhaps an average of around 50-60% for other OECD countries.[12]

Given these three major considerations -- a failure to reflect the interdependent nature of inbound and outbound traffic, the absence of explicit recognition of major structural changes and no separate modelling of household and business traffic -- it is not surprising that, despite good within-sample data fits, econometric equations of international traffic show marked coefficient instability. That is, the estimated coefficients in the equations tend to change significantly (although not necessarily from being elastic to inelastic or vice

Demand Forecasting And Pricing

An interesting issue in demand forecasting for international telecommunications is the role of price. There is a marked contrast here between the monopoly circumstances that were virtually universal a decade ago and the competitive conditions now applying in a number of major markets (U.S., U.K. and Japan) and some of the smaller markets (Australia, N.Z. and Korea). Economic theory suggests that, for a monopolist, profits will be maximized by setting prices that result in a level of consumption at which the marginal revenue from selling another unit is just equal to the marginal cost of provision. That is, price is used to hold consumption to the level where profits are maximized.

Under competition, the supplier does not have this luxury and prices will be driven down towards costs, but with price acting as a rationing mechanism none-the-less.

When price acts as a rationing mechanism, its inclusion in demand forecasting models and its use as a predictive measure is valid (in so far as reasonable forecasts of price movements can be made). While this would seem to be the case for developed countries and carriers, rationing by queuing has always been a feature of telecommunications in developing countries where there is in general more traffic than the network can handle at a reasonable grade of service. This means that the impact attributed to price in econometric equations is likely to be distorted, adding a further concern about the validity of forecasting models in these circumstances.

The developed country practice of using price as a regulatory lever -- e.g. prices capped to grow at less than the rate of inflation by some specified amount -- will also distort the functioning of price as a rationing mechanism. Accordingly this will again create distortions in demand models.

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versa) as the data period over which they are estimated is altered, casting doubt on the validity of any one set of estimates.

Actual forecasting performance is hard to judge, but it can be said that while in general traditional forecasting models have picked up trend movement well, like so many economic models they have not been particularly good at picking the shifts in trend or the cyclical turning points.[13]

Beyond that, there recently has been a need to forecast other services -- leased circuit capacity and more advanced products such as IVPNs (international virtual private networks) and ISDN. Although these services are still relatively small, they are the most rapidly growing part of traffic and are generally expected to be very significant future users of network capacity. Forecasting techniques for non-telephone services have, by necessity, generally not involved estimated econometric equations as there is not a history of service provision to use. Instead, market penetration models have tended to be the basis for these forecasts.

II. Demand Forecasting and Analysis in a Changing Environment

As the industry begins to move away from the "Heavy Carrier" world considered in the previous section, the role of demand forecasting and demand analysis is changing. First, a number of factors are reducing the importance of accurate demand forecasts for facilities planning purposes:

- The market for transit traffic is now very competitive and prices have been pushed down sharply, meaning carriers can overflow their traffic beyond their own established capacity at low cost, giving a buffer to forecasting accuracy;

- Network dimensioning now occurs in fairly big lumps, whereby carriers tend to add circuits in groups of thirty voice channels (2 Megabyte bearers) so there is a big jump in capacity that also acts as a buffer (30 physical circuits are equivalent to at least 120 derived voice paths with digital compression and multiplexing equipment -- DCME);

- The cost of transmission capacity is coming down, so the cost of being over-dimensioned is no longer such a big issue;

- If a carrier is wrong in its forecasts, it can compensate by bringing forward or slowing down facilities provisioning;

- For new fiber optic cables, carriers acquire capacity up-front when the cables go in the water, and then "turn on" this capacity as it is needed; and

- There is scope for carriers to hold a portfolio of short term, medium term and long term contracts with Intelsat for capacity on satellite transponders.

While these considerations reduce the relevance of demand analysis for facilities planning, they are nonetheless being replaced by other compelling reasons for a renewed attention to demand analysis with a different focus. Specifically:

- Good estimates are required of the price elasticity of demand and inter-carrier price elasticity of demand for effective participation in a competitive market; and

- Forecasts of traffic volumes are required for budgeting and for cost control (ensuring overheads per unit of output are not excessive).

Own price elasticities of demand give an indication of likely total market expansion as prices fall from competition (eg, how much the total telecom paid traffic will grow.) In addition, inter-carrier elasticities are important in deciding the appropriate pricing strategy for carriers now competing for market share. And for all carriers, product cross price elasticities are important in deciding the relative price of different product offerings.

For international telephony, demand forecasting models typically indicate an own price elasticity of demand close to or greater than one (i.e. elastic). (See Bhatia 1989; De Fontenay, Shugard and Sibley 1990). That is, there is a relatively strong volume response to changes in price. Some studies show that this response occurs over a 2 to 3 year time horizon rather than instantaneously. These results accord with the strong growth in international telephone traffic coincident with declining real prices over the past decade. They also accord with the widely held view that demand for network access and local call services is least elastic; demand for domestic long distance service somewhat more elastic; and demand for international calls is the most elastic of all.

However, demand elasticity estimates based on past relationship may not be a good guide to their future magnitudes for the following reason. The introduction of competition in international telecommunications in Australia, New Zealand, Japan, U.K. and earlier on in the US, and the relative ease of entry into these markets, has and will cause sharp falls in prices. Accordingly, even if historical relationships were accurately captured in the econometric equations, there is no guarantee they will provide a good guide to elasticities in the future.[14]

Direct estimates of inter-carrier elasticities of demand -- the change in volume of business when a carrier's price is changed *relative to its competitors* -- have not been attempted on a widescale basis. This is not surprising, as competition in international telecommunications is relatively new in most markets where it

International Price Trends

What developments in the price of international telecommunications services can we expect over the next few years?

- Large price reductions with the advent of competition and reductions in accounting rates.
- De-averaging across streams as competition squeezes niches of excessive profits.
- Reduction in distance linked prices to reflect the true economies of the industry.
- Customer calling plans to differentiate the product under competition and segment the market.

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has been introduced. Furthermore, isolating pure price effects in the market share behavior of competitive markets will always be difficult, given the importance of other factors such as the roll-out of equal access arrangements, promotional activities and active product differentiation.

In some cases, estimates of inter-carrier elasticities have been derived indirectly based on the assumed relationship to total market elasticity. While it is clear that inter-carrier elasticities will be higher than total market elasticities -- users' propensity to switch carriers as price change can be expected to be greater than their propensity to change the overall level of their use -- the extent of this difference is not at all clear. The arbitrary nature of these assumptions leads to substantial uncertainties about future traffic volumes.[15]

This heightened uncertainty about future traffic volumes for carriers in a competitive situation places the carriers in an invidious position. The reduced margins synonymous with competition mean reasonable traffic forecasts are required to avoid unanticipated adverse cash flow outcomes. Yet, at the same time, forecasting has become a more uncertain art.

In this environment and especially given the increased relevance of uncertainty and risk in the face of competition, carriers need some way of forecasting the future in a more dynamic fashion. One technique that meets this need is scenario analysis.

III. Planning In a Changing World -- The Appeal of Scenario Analysis

Scenario analysis can help carriers better to take into account the growing uncertainty which now exists about future international traffic volumes for several reasons.

First, scenario analysis is not bound by what has been measured in the past or by existing data sets. Rather it is forward looking and can consider a number of future traffic outlooks. Further, scenario analysis can factor in many of the uncertainties affecting current forecasts -- underlying macroeconomic conditions; the timing of technology shifts (eg, new advances in compression); demand for broadband capacity (eg, video-phones and video-mail); the market penetration performance of competitors and changes in the relationships between these variables and traffic volumes.

In more general terms, scenario analysis involves identifying the key driving forces of market outcomes, classifying these into "certainties" and "uncertainties", and interworking the uncertainties into logical combinations to give a strictly limited number of possible outcomes (see Wack 1985).

Consider the following example of the approach.

For international telecommunications, the key driving forces might be characterized as: the macro-economic situation; regulatory developments; technological advances; and finally the positioning of other carriers in response to these developments.

Of these, technology and regulatory developments might be considered "certainties" -- technology in the sense that the new technology and derivative products which will be in the market by the end of the decade are now at an advanced stage of R&D. These might include, for example, private communications network (PCN) products and improved optical transmission and switching technologies.

The evolution of the regulatory environment to the year 2000 could also be considered to be a "certainty", in that current trends are most unlikely to be turned around over this period. These trends are for commercialization and privatization of carriers as well as liberalization, including the widespread introduction of competition, in both national and international markets.

On the other hand, the macroeconomic outlook and the response of other carriers could be deemed to be a significant "uncertainty."

A full application of scenario analysis would involve a very careful consideration of the nature of the four driving forces, including the possible paths of the "uncertainties" -- the macroeconomic situation and the behavior of other carriers. The interactions between the four drivers would be examined in depth to identify those combinations of events that can logically occur together and to eliminate those combinations that are not consistent. In this way it is possible to limit the number of scenarios, which should be no more than three or four to be manageable.

This analysis might lead to developing four different scenarios, based on high or low macroeconomic growth over the planning horizon, and an aggressive market share strategy or a more "collusive" approach by competitors. High growth and a collusive approach by competitors would result in high traffic volumes for a particular carrier in the future; low economic growth and aggressive market share behaviors by competitors would result in low future traffic volumes; and the other combinations would lead to in-between solutions.

Different network dimensioning decisions could then be tested against these possible future traffic outcomes. This testing of dimensioning decisions against the various traffic scenarios might proceed as follows:

- What is the strategic threat to the carrier of each of the four outcomes, given a certain dimensioning plan? In particular, would the carrier's survival be threatened by a particular traffic outcome (given current overflow possibilities)? What would be the cost of dimensioning in such a way as to avoid this threat?

- What are the financial implications of various traffic outcomes under certain dimensioning plans? What is the relative trade off between the cost of dimensioning to meet higher traffic requirements and the foregone profit from being under-dimensioned?

IV. Conclusions: Are Past Views of the Future Good Enough?

Telecommunications around the world is in a state of rapid and fundamental change. The world of the "Heavy Carrier", although not yet gone completely, is clearly on the wane. As we head into a new environment, be it a world of the "Light Carrier" or some other paradigm, carriers need to make the right market decisions *now* to survive and be sufficiently robust financially to prosper in the industry shake-out.

This essay has identified a number of serious shortfalls in the demand models used to forecast international traffic. Although it might be argued that these deficits were not particularly damaging in the past, they could be fatal in today's competitive environment. Hence, the demand models used by carriers need to be improved by an additional methodology for dealing with uncertainty and risk; *scenario analysis* is recommended.

Despite its clear appeal, not only in telecommunications but in all industries facing major uncertainties, scenario analysis is an underpracticed methodology. This appears to stem in part from decision makers being more comfortable with point estimates than a diverse range of possible outcomes. Moreover, point estimates provided by another part of the organization can be used to legitimize decisions taken; if targets are not met, the forecasters can be blamed.

To overcome such barriers to a more widespread introduction of this important technique, organizational structures may need to change; network and financial planners, as well as other executives might be made be more accountable for bottom line outcomes. In other words, if forecasters have a larger stake in the outcome of their work and network and financial planners have some "ownership" of the forecasting paradigm, dynamic forecasting approaches such as scenario analysis may be more readily embraced throughout the organization.

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1. Sometimes a carrier in between is also involved, acting in a *transit carrier* role. This is explained below.

2. Intelsat is a non-profit international consortium of carriers headquartered in Washington, D.C., which owns and operates satellites covering the whole of the globe. It leases out capacity on these satellites to international carriers.

3. For countries to which a carrier does not have much traffic, direct telecommunications links may not be established, with capacity to those countries provided indirectly by using a carrier in a third country as a *transit carrier*. Under this arrangement, the originating carrier has established capacity to the transit carrier and "hands on" the traffic to the transit carrier which does have direct links to the terminating country to run it through to its final destination.

4. Where traffic between two countries is sent <u>via</u> a transit carrier, the transit carrier is also part of this agreement.

5. Calculated as (200 x 200)/2 = 20,000.

6. The virtually universal convention in international telecommunications is to set the amount paid by one carrier to another for terminating a minute of traffic, the **settlement rate**, at half a bilaterally negotiated **accounting rate**. The original logic of this arrangement was that the accounting rate would cover recompense to both carriers, with the originating carrier that bills the customer keeping half and handing the other half to the terminating carrier. The accounting rate applies to both inbound and outbound traffic. Hence, the settlement rate is almost always the same for traffic in either direction. When traffic is carried via a transit carrier, the accounting rate is split between the three parties on a negotiated basis. See Ergas and Paterson (1990) for a full description and analysis of the accounting rate system.

7. The commissioning of high capacity, low unit cost fiber optic submarine cables has created somewhat of a crises for Intelsat, with the prospect of carriers abandoning satellites for cable transmission (the latter generally felt to be the preferred medium in a technical quality sense). However, two factors have tempered this outcome. First, Intelsat has responded with new aggressive and competitive price levels and packaging. Second, carriers have realized it is not in their best interests to allow Intelsat to languish (it provides back-up capacity in the case of cable failure, and gives access to destinations not linked by cable) and for this reason in concert have moderated this shift to cable.

8. Short-term forecasting (up to 12 months) has also been performed using autoregressive time series techniques. See Nijdam (1990).

9. Paid minutes are the traffic for which carriers are actually paid by the calling party, and for which they pay (outbound) or receive (inbound) settlement payments to/from the carrier at the other end. It is in effect the volume of traffic from a user perspective. Paid minutes excludes automatic call set-up and clearing-down time, operator time, network testing etc. These excluded elements need to be factored in when using the paid minutes forecasts to dimension the network.

10. In addition, a number of *functional forms* for the econometric equations have been used, not only to reflect views on the true nature of relationships between traffic and the explanatory variables, but also to maximize the within-sample fit of the equation to the data. This has included data in original form as well as partial and full logarithm functional forms.

11. See De Fontenay, Shugard and Sibley (1990) for a detailed consideration of some recent developments in demand forecasting models.

12. Part of the difficulty in this area is the fact that social and business traffic shares cannot be measured accurately. While traffic from business and household access lines can be separately identified, in countries for which business hours are out of phase from those major correspondent countries, many business calls will be made at night from household access lines.

13. In using econometric models to forecast demand, the explanatory variables in the equations themselves need to be forecast, in itself a source of error.

14. For example, the fact that a 5% fall in price has caused a (say) 7.5% increase in international traffic in the past does not imply that in the future a 50% reduction in price will cause a 75% increase in traffic volumes.

15. Because of the difficulties in modelling market share outcomes based on various price differential scenarios, it has been natural for carriers facing competition to look at overseas market penetration experience. This is likely to be of limited relevance, however, because of the predominant importance of "equal access" arrangements. Equal access refers to the manner in which the new carrier can be selected by customers relative to the incumbent. The large differences in market penetration experience in countries introducing competition -- US, UK, Japan, New Zealand and most recently Korea -- are due in part to differences in equal access arrangements.

Winning The Global Telecoms Market:

The Old Service Paradigm And The Next One

by Gregory C. Staple

What is the best way for a telephone company to sell low priced international calls to the world? Form alliances with foreign carriers? Lower accounting rates? Resell the international services of other companies? Offer virtual private networks? Promote credit card payment plans?

Almost every major carrier is searching for the right strategy to market its network to other countries. It is good business to try to service your best customers when they travel or work abroad. But the potential market is much larger than that. At least 60% of the world's 580 million plus telephone subscribers still pay relatively high prices for making foreign calls because they happen to live in Rome rather than London, Jakarta not Osaka, Mexico City not Los Angeles. (See eg, Figure 3 below).

By 1995, these "off-shore" users will be courted by more and more trans-national "telephone companies". Some of the courtiers will ring familiar -- BT, AT&T, France Telecom, Bell South. But there will be many new players -- from banking (Visa); data networking (Electronic Data Systems (EDS)); the operator services industry (International Telecharge); the resale business (ACC Corp.). Some will be spun-off by existing carriers (a la BT's Syncordia). Others will be start-up businesses funded by venture capital (Viatel).

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All of these companies will have something in common: they will be advancing a new international service model -- a model which, by the decade's end, will profoundly reshape and expand the market for international services.

Paradigm Shift

The business of providing international telecom services is going through a paradigm shift. Service is currently provided by national carriers which interconnect their "half-circuits" to provide end-to-end channels. These facilities-based or "Heavy Carriers" jointly own the international cable and satellite systems comprising the backbone of the global network.

Each Heavy Carrier is essentially sovereign on its own territory. It sets the charges for originating foreign calls and typically also has a national monopoly (or oligopoly) on picking up and delivering international traffic.

Beginning in the 1980s, technology and competition began to challenge this service paradigm. Advances in micro-electronics, fiber optics and network software, on the one hand, and progressive market liberalization, on the other, have brought forward a new paradigm for end-to-end global service. The paradigm is being pioneered by a novel type of "Light Carrier".

The Light Carrier provides international service by reselling, rerouting, repackaging or reprogramming the offerings of Heavy Carriers. Primarily software based, the Light Carrier is a telephone company in name only. It is driven by services and applications, not facilities, and it may not own a single trans-oceanic cable or satellite circuit.

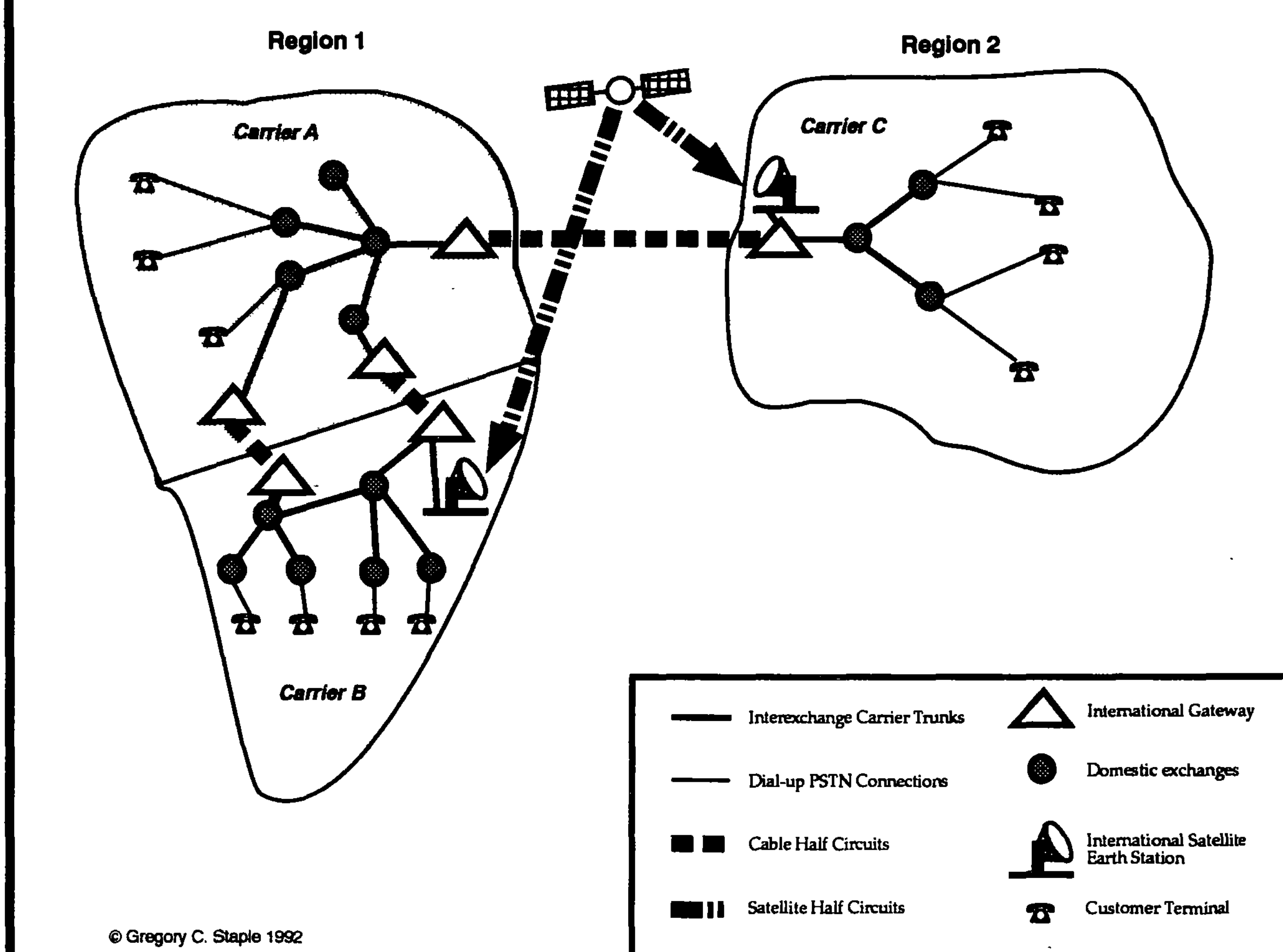
The Heavy Carrier's services are sold in one country. The Light Carrier's market is global. Wherever located, the Light Carrier offers subscribers direct access to the network dial-tones of the world's lowest priced service providers via "800" (free phone) numbers, private lines or automated call-back equipment. Least cost global routing is the goal. Thus, for the Light Carrier, there are no national monopolies and a customer's home country does not dictate call charges or the choice of carrier.

Figures 1 and 2 provide a network schematic, in abbreviated form, for the two competing paradigms described above.

Implications

There are no truly global Light Carriers today. Nor will there be for several years. Even then, their service offerings may be limited. The new service paradigm sketched above is just that -- a generic pattern or an archetype. But like other innovations driven forward by technology and market demand the Light Carrier idea is gaining momentum.

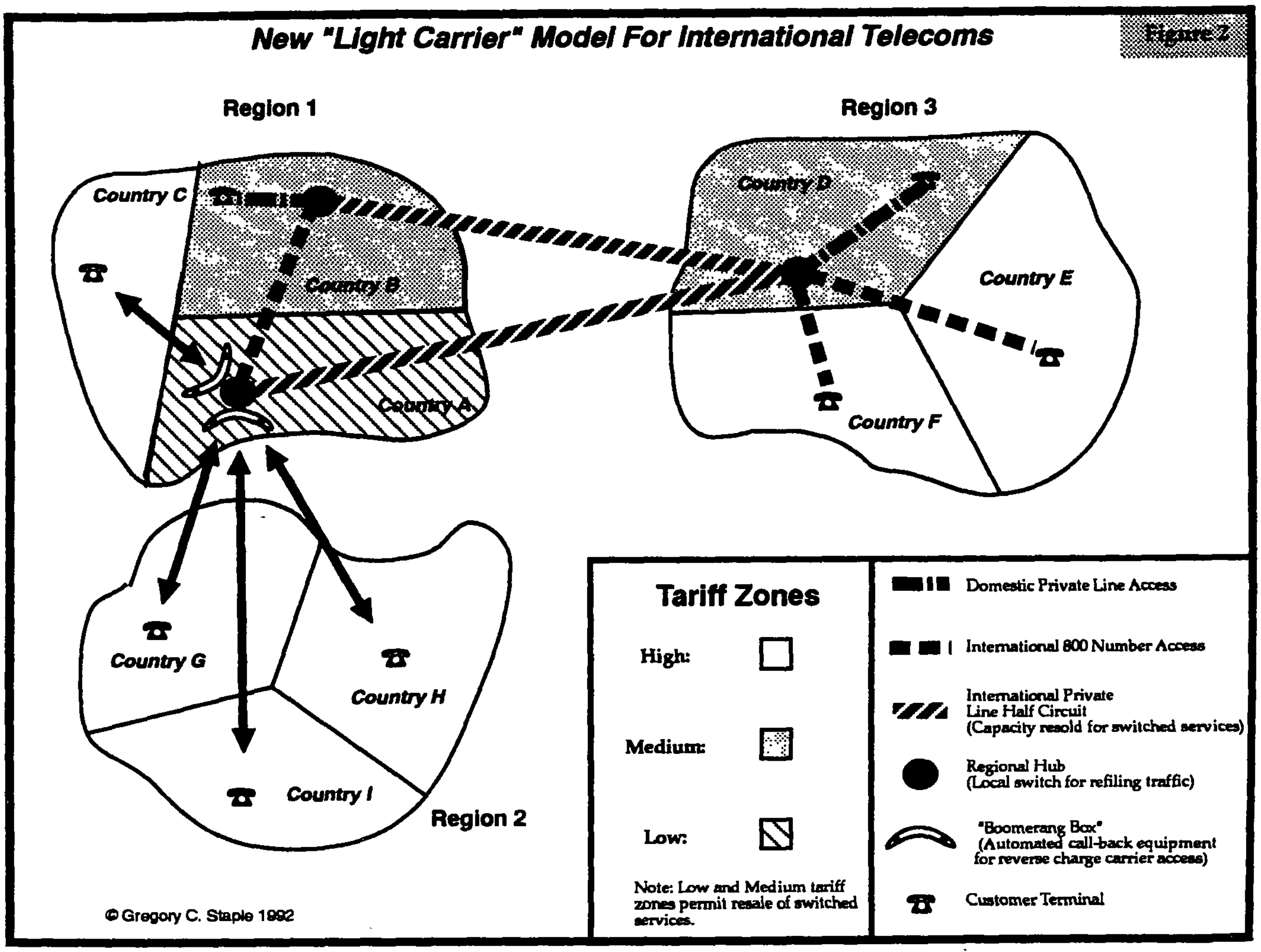
Traditional "Heavy Carrier" Model For International Telecoms Figure 1



Much of the paradigm's appeal is its "one world" vision. There already is one global network technologically. Worldwide direct international dialing to at least 200 states and territories is now commonplace. The connection is almost instantaneous and most telephone callers neither know (nor care) whether the transmission is digital or analogue, is routed by cable or satellite, is handled by one carrier or a dozen, so long as the network works. And the price is reasonable.

But therein lies the rub. For many users, the price is plainly out of line with the carriers' falling cost structures and users now know it. The gap between the promise of a universally accessible and inexpensive global telecoms platform and the current service paradigm, rooted as it is in national carriers and monopoly charging practices, has thus become a hard fact of life for the industry. Closing this gap -- whether through further price reforms or structural changes -- has and will continue to be a contentious process. The stakes are high.

If a new Light Carrier model proves to be viable, it could shift billions of dollars in annual revenues from national telephone companies to new multinational service providers. As importantly, Light Carriers might offer an alternative global entry vehicle for companies from middle and low income countries which, until now, have not been able to aspire to the



type of global presence which many European and North American carriers recently have won. The potential impact of the new service model on carrier revenues and charges thus is potentially far reaching.

The remainder of this article looks more closely at the various issues raised by this paradigm shift. The next section, Part I, provides a fuller description of the current international service model and the pricing and traffic routing rules supporting it. Part II profiles the new paradigm and some of the regulatory questions affecting its future.

Part III examines several of the Light Carriers which have begun to exploit the new service paradigm. Part IV focuses on the counter-strategies of the major Heavy Carriers to sell their dial-tones on a multinational basis. Part V offers additional thoughts on the importance of the new service paradigm for carriers and countries alike.

I. The Current Model For International Services

Foreign telecommunications today can be characterized as a joint venture among independent national monopolies (or oligopolies). The venture is supported by: (a) a facilities regime based upon carrier ownership of half-circuits in international cable and satellite facilities and (b) a financial regime which generally compensates or "settles" with carriers for interconnecting their half-circuits and corresponding domestic networks through a 50/50 division of an agreed "accounting rate."

These two regimes -- half-circuits and 50/50 settlements -- are complementary. Any proposal to depart from the current facilities regime inevitably impacts the settlements regime.

A. The Facilities Regime

The "half-circuit" regime for international facilities has its origins in the monopoly structure of the telecommunications industry. It also reflects national security concerns regarding alien ownership of the "domestic" portion of international cable and satellite facilities.

A half-circuit typically extends from an international gateway (cable head end) in one country to a notional midpoint (the halfway point in a cable or a geostationary satellite). Because two matching half-circuits must be interconnected to provide end-to-end service, a whole circuit cannot be established absent the consent of each national regulator and/or carrier. Even where competition exists, therefore, the regime makes it physically impossible for a carrier from Country A to pick up and land traffic in Country B without a carrier from that country supplying facilities (and vice versa).

The half circuit regime has considerable appeal for carriers. It encourages cost sharing and broad multilateral ownership of facilities without jeopardizing exclusive national rights. Further, intercontinental cables and satellites have significant scale economies. The bigger the facility and the more the costs are shared, the harder it is may be for an alternative facility to be competitive. Ratebase regulated carriers arguably have an additional incentive to invest in such large capital intensive facilities.

The half-circuit regime also can readily accommodate intra-modal (satellite/cable) competition. International satellite communication requires an uplink in one country and a downlink in another. Equivalent half-circuits (radio channels) consequently may be separately assigned to each country.

The general application of the half-circuit regime and its entrenched institutional status often suggests that the regime is mandated by international law. This is not the case. With certain exceptions, for satellite communications, the regime's legal force is largely a reflection of carrier contracts and national regulatory preferences, not international treaties.

Of importance in this regard are the new International Telecommunication Regulations (ITR) adopted in 1989 by the then 160 members of the International Telecommunications Union (ITU).[1] The ITR, which prefigure the current paradigm shift, reflect a compromise. They provide that countries shall cooperate in establishing international facilities; that international routes shall be determined by mutual agreement; that such routes shall not be unilaterally changed; and that carriers shall be compensated for interconnecting their services by way of accounting rates consistent with the Recommendations of the CCITT (International Telegraph and Telephone Consultative Committee), the ITU's standards body.[2]

At the same time, the ITR expressly state that countries may enter into "special arrangements" (ie, alternative agreements) on telecommunications matters which do not concern the ITU's members in general. Further, countries may allow non-carriers to enter into such arrangements.[3] Consequently, the ITR is arguably broad enough, some might say was intended, to accommodate various facilities and services models; it reaffirms the status quo without prejudging the future.

The impact of the ITR thus far has been limited. It has yet to be ratified by many countries, including the United States (at July 1, 1992), and few "special arrangements" have been negotiated. Moreover, as noted, the ITR does not require any country to depart from the status quo with respect to the ownership of international satellite or cable facilities. Any new arrangement must be made on a case-by-case basis in connection with a particular international satellite or cable facility.

U.S. support for private international satellite facilities -- Pan American Satellite (PAS), Columbia Communication, Orion -- has probably been the most contentious. Provided landing rights can be negotiated, private satellites can offer end-to-end circuits to users. The carrier owned multinational satellite organizations (Intelsat, Inmarsat, Eutelsat), which by treaty monopolize most public international telecommunications, furnish half-circuits to users. And they do so only indirectly via national carriers which may not supply competing uplinks or downlinks on each other's territory.[4]

There are no analogous treaties governing the provision of international telecom cables. This has made it somewhat easier to plan and construct "private" international cables, such as PTAT, the trans-Atlantic cable completed in 1989. But, as yet, private cables have not led to a break from the industry's half-circuit convention because the cables have been leased primarily to carriers for public service and national regulators have barred carriers from acquiring whole circuits so as to preserve the exclusive rights of local operators.

The current facilities regime thus has proven resistant to change, private facilities notwithstanding. Even so, at least a half dozen countries are beginning to rethink the benefits of the current arrangements.[5] The questions being put forward are similar: Should regulators continue to limit investment in international cable or satellite facilities to carriers and their proxies? How should shares in "bottleneck" cable and satellite facilities be allocated (or reallocated) among competing parties as market conditions change?

Should third parties (non-carriers) have direct access to circuits provided by Intelsat and its sister organizations? What about whole circuits (ie, authorizing competitive uplinks and downlinks)? Further, if third party investment in international cables and satellites is precluded, to what extent should private leases be permitted? And, on what terms may international leased lines be interconnected with the public switched telephone network (PSTN)?

The answers given to these questions in the years ahead will directly affect the future of any new service paradigm. See Part II below.

B. The Financial Regime

The network model described above -- sovereign carriers interconnecting at a midpoint -- is supported by a unique two-tier rate regime for international service. There is a wholesale rate for carriers and a retail rate for customers.

The wholesale rate is known as the accounting rate. It determines how much a carrier must pay its foreign correspondent for taking a call from the mid-point of an international circuit (or border crossing point) and terminating it. Accounting rates are negotiated bilaterally and are typically stated in $US or Special Drawing Rights (SDRs) per minute of service. (The value of the SDR reflects a "basket" of major currencies; at 1 July 1992, 1 SDR = $1.44).

Carriers divide the accounting rate by one half to determine what each is due. That amount is known as the settlement rate. Settlements between carriers are based on net traffic balances. Separate accounting rates exist for different services (eg, telephone, telex, packet switched data). Transit rates are also negotiated for indirectly routed traffic that uses the facilities of other carriers.

An example may help to clarify these rules. Consider, for instance, calls between the U.S. and the U.K. that are routed via AT&T and BT. AT&T's accounting rate with BT for peak period telephone service is currently .54 SDR ($.78) per minute. AT&T thus owes BT .27 SDR ($.39) per minute for each outbound call. During a given accounting period, if AT&T sends more minutes to BT than it receives, AT&T would owe BT .27 SDR x (the number of outbound minutes - inbound minutes).

Telephone users do not pay accounting rates for international services. They pay retail or tariff rates. These retail charges are set by each national carrier, subject to domestic regulation.

The settlement rate (the payment per minute to the foreign carrier) generally places a floor under the carrier's retail charge on a given route. However, some carriers may price their services below the settlement cost per minute because the lost revenue is more than offset by revenue from return traffic on the same route. Retail charges may also vary depending upon the time of day when the call is initiated, the aggregate level of demand and taxes.

In theory, accounting rates and public collection charges are both cost-based; CCITT Recommendations require as much. They should therefore be linked. But there is strong evidence that this cost nexus (and hence the linkage) has broken down. Costs have fallen (See eg, Tables 4 and 5 to this report). Reductions in accounting rates and collection charges have varied greatly from country-to-country. (See Figures 3, 4 and 5 below).

In addition, because each of the world's approximately 200 national telephone companies may negotiate a different settlement rate with its 199 foreign correspondents, price discrimination has arisen between routes having very similar costs. The extent of this discrimination is hard to gauge because few accounting rates have been made public. It appears, however, that many national telecom carriers have behaved like an airport authority which charges airplanes a different landing fee based primarily on their country of origin rather than the landing facilities required.[6]

Again, some examples may be instructive. So far as accounting rates are concerned, a European carrier may pay a U.S. carrier a settlement ranging from approximately $.27 to $1.00 for landing a minute of traffic from Europe which traverse essentially the same international facilities. See Figure 4. More disturbingly perhaps, the public collection charge for an international call between Europe and the U.S. may vary by 200% or more depending upon where it is originated. See Figure 3.

Similarly, within Europe, there are still large differences betwen tariffs on the same routes. A 1991 survey by the Union of European Consumers (BEUC) found that the minimum charge for a call from Bonn to Dublin cost 2.12 ECU and 3.11 ECU in the reverse direction; the minimum charge for a call from London to Madrid (using Mercury) cost 2.27 ECU as compared with 3.32 ECU from Madrid to London. (At 1 July 1992, 1 ECU = $1.35) See Figure 5.

It is this disparity between the cost of international service, on the one hand, and the level of accounting rates and collection charges, on the other hand, which has provided the immediate impetus for alternative service providers. Arbitrage can be profitable. Nevertheless, the ability of new service providers to prosper in the long term is likely to depend on more fundamental changes in network technologies and regulation. We turn to these interrelated issues next.

Peak Rate International Telephone Calls Between OECD Member Countries (December 1991)

Figure 3

From: \ To:	Australia	Austria	Belgium	Canada	Denmark	Finland	France	Germany	Greece	Iceland	Ireland	Italy	Japan	Luxembourg	Netherlands	New Zealand	Norway	Portugal	Spain	Sweden	Switzerland	Turkey	United Kingdom	United States
Australia	***	1.39	1.39	1.16	1.24	1.24	1.24	1.39	1.55	2.17	1.16	1.24	1.55	1.55	1.39	1.00	1.24	1.55	1.71	1.24	1.39	1.55	1.16	1.24
Austria	2.40	***	0.74	1.54	0.74	1.14	0.74	0.74	1.14	1.14	1.14	0.74	2.40	0.74	0.74	2.40	1.14	1.14	1.14	1.14	0.74	1.14	1.14	1.54
Belgium	3.25	0.98	***	1.17	0.88	0.98	0.63	0.63	0.88	0.98	0.63	0.88	2.20	0.44	0.52	3.25	0.98	0.88	0.88	0.98	0.63	0.98	0.63	1.17
Canada	1.20	1.53	1.53	***	1.29	1.29	1.20	1.53	1.62	1.20	1.34	1.62	1.62	1.34	1.29	1.34	1.29	1.82	1.71	1.20	1.34	1.82	1.20	0.44
Denmark	1.67	0.54	0.45	1.28	***	0.38	0.54	0.45	0.54	0.77	0.54	0.54	2.05	0.45	0.45	2.56	0.38	0.54	0.54	0.38	0.54	0.77	0.54	1.28
Finland	1.14	0.38	0.74	1.14	0.38	***	0.74	0.74	0.74	0.38	0.74	0.74	1.91	0.74	0.74	1.14	0.38	0.74	0.74	0.38	0.74	0.74	0.74	1.14
France	2.95	1.02	0.70	1.45	0.70	1.02	***	0.70	0.70	1.02	0.70	0.70	2.95	0.70	0.70	2.95	1.02	0.70	0.70	1.02	0.70	1.02	0.70	1.45
Germany	1.88	0.69	0.69	1.88	0.69	0.78	0.69	***	0.69	0.78	0.69	0.69	1.88	0.69	0.69	1.88	0.78	0.69	0.69	0.78	0.69	0.78	0.69	1.88
Greece	2.11	0.65	0.84	2.11	0.84	0.92	0.84	0.84	***	1.53	0.84	0.84	2.68	0.84	0.84	2.68	0.93	0.84	0.84	0.92	0.65	0.65	0.84	2.11
Iceland	2.38	1.39	1.39	1.55	0.98	1.02	1.39	1.14	1.55	***	1.39	1.55	3.58	1.39	1.02	3.12	0.98	1.39	1.14	0.98	1.39	1.55	1.14	1.55
Ireland	2.78	1.43	0.98	1.80	0.98	1.43	0.98	0.98	0.98	1.43	***	0.98	2.78	0.98	0.98	2.78	1.43	0.98	0.98	1.43	0.98	1.43	0.77	1.80
Italy	2.81	0.80	0.91	2.59	0.91	1.05	0.80	0.80	0.80	1.05	1.05	***	3.31	0.80	0.91	3.31	1.05	1.05	0.91	1.05	0.80	1.05	0.91	2.59
Japan	1.93	2.47	2.47	1.93	2.47	2.47	2.47	2.47	2.47	2.47	2.47	2.47	***	2.47	2.47	1.93	2.47	2.47	2.47	2.47	2.47	2.47	2.47	1.58
Luxembourg	3.66	0.61	0.43	2.20	0.61	0.98	0.61	0.61	0.61	1.46	0.61	0.61	3.66	***	0.43	3.66	0.79	0.61	0.61	0.79	0.61	1.46	0.61	2.20
Netherlands	2.25	0.78	0.59	1.39	0.59	0.96	0.59	0.59	0.78	0.96	0.78	0.78	2.25	0.59	***	2.25	0.78	0.78	0.78	0.78	0.59	0.96	0.59	1.39
New Zealand	0.91	1.73	1.73	1.65	1.73	1.73	1.73	1.73	1.91	1.91	1.73	1.73	1.73	1.91	1.73	***	1.73	1.91	1.91	1.73	1.73	1.91	1.65	1.65
Norway	2.36	0.68	0.68	1.14	0.34	0.34	0.68	0.68	0.68	0.68	0.68	0.68	2.36	0.68	0.68	2.36	***	0.68	0.68	0.34	0.68	0.68	0.68	1.14
Portugal	2.40	1.00	1.00	2.40	1.00	1.17	1.00	1.00	1.00	1.17	1.00	1.00	3.15	1.00	1.00	3.46	1.17	***	1.00	1.17	1.00	1.17	1.00	2.40
Spain	3.92	1.37	1.17	2.84	1.17	1.37	1.17	1.17	1.17	1.37	1.17	1.17	3.92	1.17	1.17	3.92	1.37	1.17	***	1.37	1.37	1.37	1.17	2.84
Sweden	2.54	0.82	0.68	1.14	0.37	0.37	0.82	0.68	1.05	1.05	0.82	0.82	2.54	0.82	0.68	2.54	0.37	1.05	1.05	***	0.82	1.05	0.82	1.14
Switzerland	2.23	0.79	0.79	1.40	0.98	0.98	0.79	0.79	0.98	1.40	0.98	0.79	2.23	0.79	0.79	2.23	0.98	0.98	0.98	0.98	***	0.98	0.98	1.40
Turkey	2.58	1.50	1.50	2.58	1.50	1.50	1.50	1.50	1.02	N.A.	1.50	1.50	2.58	1.50	1.50	N.A.	1.50	1.50	1.50	1.50	1.50	***	1.50	2.58
United Kingdom	1.21	0.76	0.58	0.94	0.58	0.76	0.58	0.58	0.58	1.01	0.56	0.58	1.93	0.58	0.58	1.21	0.76	0.58	0.58	0.76	0.58	1.01	***	0.94
United States	1.71	1.23	1.30	0.67	1.24	1.39	1.22	1.26	1.46	1.50	1.19	1.25	1.69	1.39	1.21	2.06	1.24	1.50	1.30	1.21	1.30	1.50	1.07	***

Source: OECD Tariff comparison model -- Figures record the price per minute of a four minute call (without tax) in 1991 US$.

II. The New Service Paradigm

Communications satellites and cable systems need know no boundaries. Governments are defined by the boundaries they keep. Part I of this essay showed how the current paradigm for international service seeks to accommodate this tension between technology and politics by giving governments and their surrogates (national carriers) the upper hand.

The emerging Light Carrier service paradigm argues for a new balance. It would give a greater role to markets as compared to regulators in determining entry and pricing policies for international services so that users can benefit more fully from the boundary-less global electronic network.

A. Technology: Fiber Optics and Intelligent Networks

Since the 1970s, order of magnitude improvements in telecom transmission and switching technologies have radically changed the facilities-based constraints on international telephony. As recently as 1975, the most

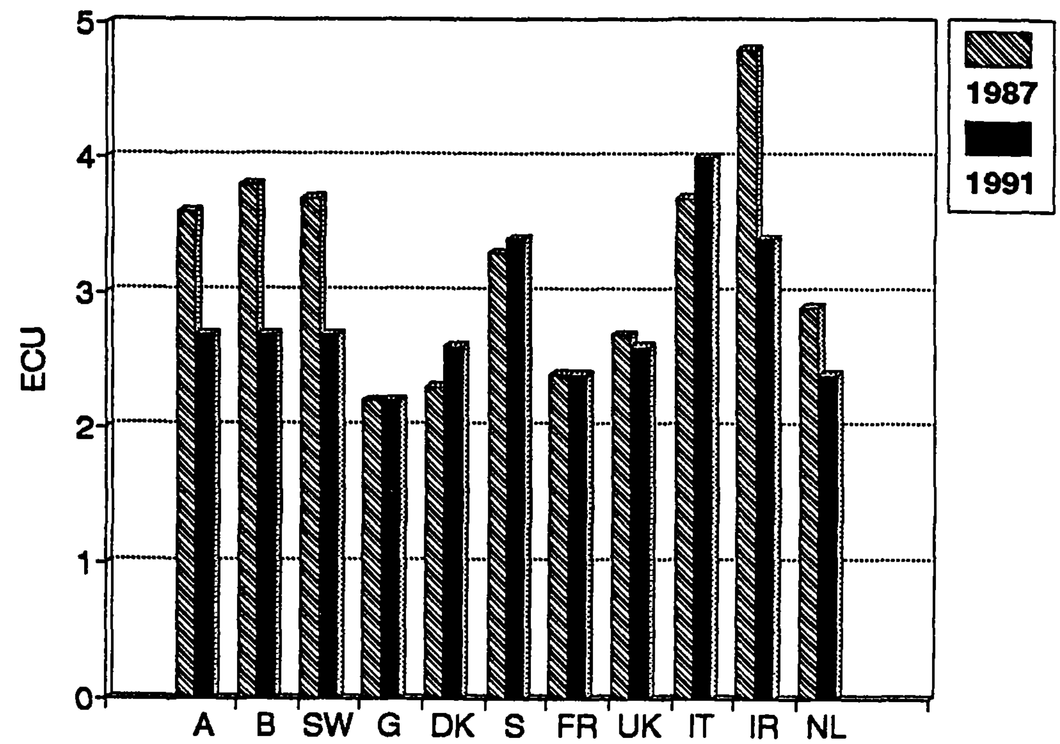
Figure 4

U.S. TELEPHONE ACCOUNTING RATES WITH OECD COUNTRIES (March 1992)

OECD COUNTRY	1992	NOTES
Australia	0.68 SDR	1. A time-of-day accounting rate applies.
Austria	0.9 SDR	
Belgium	1.0 SDR	
Canada[1]	$0.28/0.24	2. A growth-based accounting rate applies.
Denmark	1.0 SDR	
Finland	0.8 SDR	
France[1]	0.7 SDR	3. At March 31, 1992 1 Special Drawing Right (SDR) = $1.43
Germany	0.8 SDR	
Greece	1.4 SDR	
Iceland	1.0 SDR	
Ireland	$1.10/0.92	*Source: FCC*
Italy[1,2]	1.2 SDR	
Japan	0.95 SDR	
Luxembourg	1.0 SDR	
Netherlands	0.8 SDR	
New Zealand[1]	1.2 SDR	
Norway	0.8 SDR	
Portugal[1,2]	1.2/.65 SDR	
Spain[1]	1.5/1.0 SDR	
Sweden	0.5 SDR	
Switzerland	0.808 SDR	
Turkey	$2.00	
United Kingdom[1]	(BT) .54/.38 SDR (Mercury) .50 SDR	

Figure 5

Price of Average Five Minute Off-Peak Calls Between European Countries (1987 and 1991)



Key: A - Austria; B - Belgium; SW - Switzerland; G - Germany; DK - Denmark; S - Spain; FR - France; UK - U.K. (BT); IT - Italy; IR - Ireland; NL - Netherlands

Source: Telephone Services In The EEC, Bureau Européen des Unions de Consommateus (BEUC), Brussels, September 1991

modern trans-oceanic cables had a capacity of less than 10,000 voice paths at a cost of $25,000 or more per path. The generation of trans- oceanic fiber optic cables installed in the 1990s will offer 600,000 or more voice paths with each path costing $2,500 or less. (See Table 4 to the report.) The proliferation of very large capacity transmission facilities like these plainly calls into question the rationale for the pricing and access rules adopted in an environment where transmission capacity was relatively scarce.

The story is much the same when it comes to telecom switching systems. Since the 1950s, approximately every three years the cost of processing electronic bits has halved and the trend is a continuing one. Likewise, every three years the number of transistors which can be squeezed onto a single computer chip quadruples with four million set chips the current norm.[7] These developments have made it economical for both carriers and users to build a vastly greater level of intelligence into switching, network control and terminal facilities.

The rise of digital "intelligent networks" and the rapidly growing base of "smart" terminals directly affect the current service paradigm. At the center of the "intelligent network" is a new common-channel signaling system knows as Signaling System 7 (SS7). A digital network employing SS7 has one channel for transmitting routing, billing and service information and another channel for transmitting a user's message.

Where common-channel signaling is unavailable, telephone networks use in-band signaling which sends the coded instructions necessary to set up a calling path through a network of switches and transmission links over the same communications path used by the message itself. This link-by-link call setup process is slow and often needlessly consumes capacity for calls that are never completed. In-band signaling also requires that data on network numbering be stored (and continually updated) at every switching center in the network.

With common-channel signaling, call routing and billing instructions are sent over a dedicated channel to all switching points in the network simultaneously from the same Service Control Point (SCP). The SCP is in effect a large computer where all numbering, call processing and customer credit information are stored. SS7 thus allows a network to analyze and route calls selectively through networks owned by different operators while at the same time providing the information necessary for the proper billing of those calls.[8]

The billing and data base functions supported by SS7 and related products also facilitate a wide variety of value added services, third party payment plans and interconnection arrangements for independent service providers. Beyond that, the multinational deployment of SS7 and fiber optic transmission facilities can be synergistic.

Large users require a mix of transmission capacity to handle their needs for networked voice, data and video communications. The capacity and routing required for each service may be different and may also vary from day-to-day. Networks must be able to sustain communication rates that range from tens of bits to millions of bits per second; from a few keyboard character strokes to the real time exchange of large data bases and full motion computer work station models.

Traditional analog transmission and switching systems usually could not handle these changing needs. Circuit capacity was limited and was dedicated to a particular function; connections were often hard-wired; and the possible transmission paths through the switch were bounded by the physically created electro-mechanical connections which could be made.

In contrast, software controlled digital switches have almost infinite flexibility. Switching is a function of the software program. The instructions can be changed and adapted to accommodate new routes. Switches can also be used to partition the bandwidth assigned to a particular user (or carrier) thereby making more efficient use of high capacity transmission facilities.

These network signaling and switching capabilities have been complemented by a new generation of "smart" terminal equipment. This has further decentralized (and, in part, privatized) carriers' historical monopoly over switching and call routing. Private Automatic Branch Exchanges (PABXs) are programmed to select the least cost international route; facsimile machines and voice mail systems use store and forward technology to time shift transmissions and to convert basic services to enhanced ones; software entrepreneurs design automated call-back devices ("boomerang boxes") to facilitate call arbitrage.

In sum, as discussed further in Part IV, plentiful transmission capacity, "smart terminals" and "intelligent networks" make it increasingly possible to separate the ownership of transmission facilities from the ownership of the service provider, and hence to promote service competition on a whole new scale. Whether or not these possibilities are realized will depend largely on national regulatory responses.

B. Regulation: Making Technology Available To Users

The main question before regulators is much the same from country-to-country: "To what extent should the basic elements of the international network be made available to third parties?"

There is no regulatory consensus on the answer. Some regulators have required carriers to "unbundle" (ie, separately tariff) access to the main facilities used for international service (eg, gateway earth stations, satellite circuits) and to permit these components to be supplied competitively. Another option is to require carriers to resell raw transmission capacity in bulk so that third parties can utilize it for a range of value added and basic services.

But how much liberalization is in the public interest? Should service liberalization be used to repeal carriers' historical monopoly over international telecom facilities so as to promote competition on a whole-circuit (end-to-end) basis? Or should competition be introduced in a form which preserves the basic rights of existing carriers? In recent years, the answer to these questions has become increasing bound up with the extent to which the terms and conditions third parties may utilize international private lines (IPLs).

IPLs have long offered the potential for corporate users (or their network managers) to create pan-national Light Carriers. IPLs offer large volume users an end-to-end circuit at a much lower cost per call than the public network because private lines are priced at a flat monthly rate by each national carrier providing one-half of the through circuit. An IPL may be economic if it is used as little as three to four hours a day. The IPL also ensures that the user's monthly charges will be the same regardless of the country from which most of the calls originate.

In practice, at least two sets of rules have prevented customers from using IPLs to transform themselves into carriers. First, citing current CCITT Recommendations, telephone companies have barred users from interconnecting IPLs with the PSTN at both ends or from freely reselling capacity to third parties.[9] Second, national rules limited the entry of new facilities-based international carriers.

Since the 1980s, however, major users and some governments have lobbied to relax the CCITT's Recommendations on IPLs. One important result has been the establishment of a more liberal regime for international value added networks (IVAN) services, such as E-mail, data processing and on-line information services. Most OECD countries now permit VAN providers to lease IPLs so as to offer these services between two or more countries. Bilateral IVAN agreements typically spell out which services can be sold.[10]

IVAN agreements, however, are a half-way house; they offer a legal vehicle for a limited degree of service competition where one (and often both) of the countries restrict competition for basic services. Of far greater long run importance to Light Carriers is the ability to resell the capacity of IPLs on an unrestricted basis, often called international simple resale (ISR).

ISR makes IVAN agreements largely irrelevant, much as resale of switched services in domestic markets has made licensing regimes for value added carriers more or less redundant. Conversely, absent ISR, an IVAN may offer the only viable market access strategy for a Light Carrier.

The debate over ISR has now devolved from the international to the national arena. In 1991, after long deliberation, the CCITT voted to liberalize the D-1 series of Recommendations regarding IPLs. The new D-1 series basically lets each country decide for itself whether international circuits can be subleased or interconnected to the PSTN at one or both ends.[11]

Since the CCITT's action, a number of countries -- Canada, the U.S., the U.K., Australia, Sweden, New Zealand -- have taken steps to permit ISR. Competition law may lead to similar initiatives within other members of the European Economic Communities (EEC). Yet implementation of ISR is likely to proceed slowly. In each country reciprocity is the watch word.[12] Unless a reasonably equivalent freedom to resell IPLs is available at the foreign end

Figure 6

From Minute-by-Minute Settlements To National Traffic Contracts

"The advent of international resale signals the commencement of potentially significant changes to the existing structure of the traditional relationship between international telephony carriers (more commonly known as PTOs). ... Current business arrangements use accounting rates to pay for delivered traffic and endeavor to share traffic in direct proportion to traffic received. This situation may not survive. Contracts for incoming and outgoing traffic may underlie the future correspondent relationships...

If Proportionate Return breaks down carriers will need to manage their incoming streams more actively. The bilateral nature of traffic delivery using direct routes may no longer be the order of the day with carriers competing for global traffic hubs on commercial terms preferable to traditional bilateral A/R [Accounting Rate] conditions.

A wholesale market will emerge where existing PTOs become suppliers to non facilities based resellers. Existing carriers will operate at both ends of international circuits, bypassing existing cooperative business arrangements, and offering resale based products in niche markets."

Bruce Stanford, Vice President, Correspondent Relations, BT North America Inc., "International Resale Presentation", TeleStrategies Conference, East Rutherford, New Jersey, April 14, 1992.

of the circuit, a country is unlikely to approve ISR. Moreover, reciprocity may well be judged on commercial terms; formal regulatory equivalence may be insufficient.

In terms of network access, ISR is arguably a big step forward from IVAN agreements. Still ISR does not automatically mean more competition. That depends upon the rules for interconnecting international resellers with the switched network. It is a two step process. To be fully competitive, resellers need transmission capacity plus reasonable access to the dominant carriers' higher level switching and database functions -- that is, to the intelligent network. Unless a reseller's service offerings can interwork with the network database of the main carrier, its ability to offer innovative routing, billing and service features may be comparatively limited.

The need for competitive access to these network services is not unique to international resellers. The issue is already being considered by regulators in the context of domestic proceedings concerning Open Network Access (ONA) and Open Network Provision (ONP). ISR merely adds further issues to the regulatory equation.

One such issue is trade in services. It has been argued that authorizing a foreign company to resell IPLs for switched services is functionally the same as licensing an additional carrier. Yet, the terms on which foreign companies may be permitted to provide basic telecom services is at the heart of the current round of negotiations for a new General Agreements on Trade in Services (GATS). Trade negotiations, it is claimed, not telecom regulators have the necessary competence to decide the issue.

Second, ISR forces regulators to consider how a new system of domestic interconnection agreements can coexist with the current settlements regime. International carriers are now paid a negotiated "settlement" rate per minute for landing foreign traffic. If ISR is legal, a foreign carrier could opt to land its traffic on its own IPL and negotiate a separate agreement for domestic carriage with the most competitive service provider available. (See Figure 6) The impact of this type of international carrier bypass has yet to be thought through by regulators.

Finally, ISR also calls into question the public benefits of existing rules on the routing of international traffic. In principle, ISR enables a carrier to use an IPL to hub or refile outbound traffic from one country (the U.S.) via the PSTN of a second country (the U.K.) for final delivery to a third country (Germany). The economic incentive for hubbing stems from the differential accounting rates which apply to the two routes, i.e., the cost to a carrier of a U.S.-U.K. private line plus the U.K.-German settlement rate is less than the U.S.-German settlement rate for a minute of traffic.

The International Telecommunications Regulations (ITR) arguably bar a carrier from one country from unilaterally rerouting traffic to that country absent consent. The rules are designed to safeguard the financial interests of all national carriers. Yet, even if such anti-hubbing provisions are enforceable, which is doubtful, such restrictions cannot easily be squared with national competition policies. By and large competition laws disallow inter-company agreements which have the effect of raising prices or restricting new suppliers.[13] Again, regulators have only just begun to consider this issue.

The Light Carriers in business today have grown as best they can within the regulatory boundaries described above. Accordingly they are only partially formed. The next part of this essay surveys their early efforts.

III. The Emergence Of The Light Carrier

A. Managed Networks

The largest Light Carriers are currently the companies which manage the cross-border private line and data processing requirements of major multinational businesses. Leading players -- Electronic Data Systems (EDS), Computer Sciences Corporation (CSC), General Electric Service Company (GEIS) -- account for several billion dollars in annual revenues.

These outsourcing vendors (so named because their clients have contracted-out business to them) usually own limited transmission and switching facilities. The outsourcing vendor is a specialist at bundling and unbundling the tariffed offerings of other carriers; configuring networks; optimizing routing; and integrating widely dispersed intra-corporate networks having different operating standards.

The network which GEIS manages for GE alone covers 1800 locations in over 35 countries. In 1990, it accounted for over 750 million minutes of switched traffic including more than 20 million minutes of international traffic.[14] But, despite their size, most outsourcing vendors see themselves as customers rather than competitors of the international telcos. That could change.

So long as IPLs could not be resold and interconnected freely with the switched network, the line between private and public networks was fairly clear. Outsourcing companies operated on the private side; carriers operated on the public side. When these restrictions end, the clients and traffic bases of the outsourcing companies might be leveraged to launch a broader business. The technical and operational skills of some outsourcing vendors rivals that of many smaller carriers. So too does their international reach.

B. Value Added Carriers

A second group of Light Carriers may evolve from the growing range of companies now providing international value added or enhanced services. The value added carriers overlap, in part, with network management companies such as EDS and GEIS. They can be distinguished insofar as services are offered to the general public. Typical value added service offerings include E-mail, enhanced fax, voice mail and on-line computer services.

The 1991 market for international value added services, broadly construed, was approximately $2 billion. BT Tymenet and Sprint Net each had about 25% of the market; Infonet (an MCI, France Telecom, DBP Telekom led -consortium) and AT&T's Istel (U.K.) accounted for approximately 8% each; network managers (IBM, GEIS) accounting for much of the remaining market.[15]

As discussed earlier, services offered by these value added carriers are generally bounded by the degree of service competition in the least liberal market. (ie, IVAN agreements only include services which have been liberalized in both countries.) As this boundary line changes, so too will the business of these companies.

Most value added carriers will probably continue to service the niche markets they have developed. Others will use the value added business as a stepping stone to the market for basic services and, like AT&T/Istel in Europe, will construct alternative network platforms for the future. In that way, these carriers hope to straddle both worlds -- to deploy a facilities-based (Heavy) or non-facilities based (Light) strategy depending upon local market conditions.[16]

C. International Resellers

Historical price differences between the wholesale (private line) and retail (public switched) tariffs for international services have long suggested that a profitable business might be built by reselling the wholesale service to individual customers below prevailing retail rates. This potential profit has been responsible for much of the attention ISR has received.[17]

In the long run, however, tariff arbitrage, may not be so important to Light Carriers as the opportunity for network access which ISR offers. With limited exception, as described in Part II, the "bottleneck" transmission facilities of the global network -- the trans-oceanic cables and satellites -- can not be owned by non-carriers. For third parties to be able to buy an unrestricted leasehold interest in these facilities thus represents a major departure from the old order.

Simply put, ISR opens up the possibility for a new kind of hub and spoke network architecture based on international private line bridges between the lowest priced carriers in a region. For North America, the hub is likely to be the U.S. (or Canada, on certain routes); for Europe, the U.K.; for Asia, Japan or Hong Kong or possibly Australia. Each of the hubs of this triangular network would have "spokes" to other markets in the region via "800" numbers private lines or automated call back devices. See Figure 2.

ISR is also important to the evolution of the Light Carrier model because resale may provide a means for smaller carriers and carriers from developing countries to establish a global presence. A national carrier wishing to send or receive traffic from a foreign country now must buy its own cable or satellite circuits or rely upon other carriers and pay the associated transit charges. If ISR and third-country hubbing arrangements become more widely available, third country carriers may be able to increase greatly their global connectivity while reducing the transit charges they have historically paid.

There are over 200 countries and principalities which have telephone service. Full global connectivity thus requires a country to make arrangements for handling traffic on at least 199 different bilateral routes. Yet, even in a satellite age, the dictates of geography can make direct interconnection impossible (eg, because the two countries are not within the same satellite footprint). Indirect routing, via one or more third country carriers, is thus the rule.

Except in Western Europe, transit traffic was once a relative small part of the global traffic flow. But in the last two decades, trade, investment, tourism and emigration have broadened most countries' foreign traffic streams. This has created new demands for global connectivity. In this environment, the growing market for innovative third country transit services could eventually stimulate ISR as much as the retail demand for cheap global telephone calls.

D. "Boomerang Boxes": Automated Call-Back Services

The country-by-country adoption of international direct dialing (IDD) has been singularly important in boosting foreign calling. IDD largely privatizes the call set-up process by shifting control from telephone company operators to users. This shift greatly improved users' ability to schedule the timing and duration of calls. By enabling users to make "call-me-back" arrangements anonymously , IDD also gave users control over a call's origination point -- a matter of some significance when the price for a given route may vary by 100 or 200% depending on where the call begins. (See Figure 3).

Enter International Discount Telecommunications (IDT), one of the most publicized telecom "start-up" companies of the 1990s.[18] IDT is the archetypical Light Carrier; it has no transmission facilities in the U.S. or any other country and very little other hardware. IDT makes use of the fact that, on many routes, U.S. international outbound calls cost the user substantially less than calls in the other direction.

For a monthly line fee, IDT assigns foreign subscribers a U.S. telephone number associated with a dedicated port on an IDT call conferencing switch which works like a boomerang. The subscriber calls the U.S. number and hangs up after the phone begins ringing. IDT's switch is programmed to dial-back from the U.S. to the subscriber's overseas number and, when the phone is answered, conference in a separate U.S. telephone line. The foreign caller then has a U.S. dial tone and can use the line to complete a call in the U.S. or any other country at U.S. rates.

IDT's model is not unique. Several other small companies (Viatel; Credit Card Calling Systems; Gateway USA) reportedly provide similar "boomerang box" services. Moreover, in theory, the IDT model can be used to provide a public line bridge between any two markets having significant differences in their foreign call tariffs.

The public line telecom bridges between countries offered by IDT complement the private line bridges now used by other Light Carriers. In terms of the larger paradigm, these two kinds of bridges are the spokes of the Light Carrier network; they route subscriber's traffic to and from the carrier's low-cost regional hubs. The regional hubs, in turn, are linked via resold private lines. Again, see Figure 2.

IV. The Heavy Carrier Response: From Virtual Networks To Credit Cards

One should not assume that Light Carriers will win the race to exploit the new international facilities and pricing model described above. The established carriers are also trying to adapt the model to their own needs. The last part of this essay profiles some of their initiatives.

A. Virtual Private Networks

International Virtual Private Networks (VPNs) are one of the Heavy Carriers' primary responses to the new economic and technological realities of the 1990s.[19]

A VPN is a network within a network; it is "logically" separate rather than physically so. The VPN relies upon the software built into the digital switches and billing facilities of the public network to give customers the unlimited point-to-point service and calling options ordinarily associated with private links.

Users access the VPN via a domestic private line to the switch of a participating local carrier. The user can then adopt a seven digit global dialing plan to obtain two-way connections between its home office and various overseas sites, suppliers and customers. The rates for VPN are higher than private line services but are significantly less than public tariffs.

In the United States and, to a lesser extent in the U.K., VPNs have attracted a growing number of corporate users. AT&T and other major carriers have sought to build on this demand by extending their VPN offerings overseas and, in so doing, to migrate the traffic of some of their largest international private line customers back to the public switched network.

Why can global VPN carriers afford to undercut their international tariffs for such large traffic streams which although "virtually" private are also "virtually" public? The answer is that international VPNs are public services in terms of the international settlement process. AT&T and its global VPN partners have simply agreed to settle accounts for VPN designated traffic at a discounted accounting rate, allowing some of the savings to be passed on to customers.

VPNs are also a compromise in one other important respect. The service preserves the sovereignty of each carrier's network; traffic is handed over at a midpoint because each carrier merely furnishes the other a virtual private link; no physical facilities are actually leased to the foreign carrier or to the end-user.

The VPN is thus an acceptable and, in many ways, an ingenious vehicle for bridging the two service paradigms. VPNs do not require new international facilities; they make available network intelligence to the user; move carriers down the road toward global pricing; place additional downward pressure on switched accounting rates and offer a valuable service. Their attractions should not be underestimated.

B. Calling Card Programs

Alternative billing and call set-up services provide another popular way for major carriers to extend their networks to foreign countries without actually doing so.

International calls have traditionally been billed to the terminal where the call originates and, for obvious reasons, national carriers normally do not extend credit to transient foreign customers. Hence, with the first telephone call home, many foreigners learn that the "global village" is in reality a crazy-quilt of national telephone companies which operate on the pay-as-you go principle in the local currency and under local tariffs.

In 1989, the CCITT adopted a set of new Recommendations (E. 118) to widen the use of telephone credit cards which could change these quaint national practices forever.[20] Some of the options which these new Recommendations will foster include the following:

1. Reciprocal recognition of carrier calling cards.

Telephone company credit cards today are company-specific. They can be used only to charge calls over the issuing company's network or for home-country direct services. The new E. 118 Recommendations look to reciprocal recognition of national calling cards. Full implementation of this Recommendation, which requires countries to issue new cards and user identification numbers, is not expected until at least 1994. But several carriers have already started service trials so that card holders can bill both domestic and international calls in foreign countries to their local calling cards. (eg, a France Telecom calling card will be accepted by AT&T in California).

2. Credit card payment plans.

The new CCITT Recommendation also contemplate the widespread use of bank credit cards for international telephone service, subject to agreement with local carriers. In 1990, Visa and Mastercard both began to explore these options. The largest Visaphone and Masterphone programs rely upon agreements with U.S. carriers (MCI, Sprint). U.S. and foreign customers of these companies can use their Visa/Master cards to make domestic and international calls -- including home-country direct and third-country calls -- from almost any "foreign" state (eg, an MCI customer can use a Visa card to call from Greece to the U.S. or from Greece to England).

BT will launch a similar program for the four million U.K. Visacard holders in 1993.[21]

These credit card programs compete with carrier calling cards. For the consumer, however, the result is much the same -- competition. If your home country's international rates for a given route seem too high, your credit card could give you the option of "originating" a call on the network of any lower priced foreign carrier which will honor it.

3. Third country calling programs.

To complement their calling card and credit card programs, U.S. carriers also have begun to pioneer third-country calling programs. AT&T and MCI have been the most aggressive. These programs take the carriers' popular home-country direct programs one step further by enabling a customer to use her calling card in Country A to call Country B by first calling the U.S. and having the U.S. carrier complete the call to Country B. AT&T's advertisements put it this way: "Germany to Hong Kong. Bolivia to Egypt. India to Israel. These kinds of phone calls haven't always been easy to make. ... Now with an AT&T card, they can be. AT&T World Connect Service It's Got The Whole World Talking".[22]

Other carriers and regulators are talking too. One reason is that the U.S. based third-country calling programs have the potential for undermining traditional call routing and settlement patterns. As noted earlier, the 1989 International Telecommunications Regulations arguably bar carriers from unilaterally changing call routing agreements by, for example, hubbing traffic through a nearby third country to reduce the cost of outbound settlements. Some carriers take the view that third country call plans which route bilateral traffic (Italy - Argentina) via the U.S. (substituting a U.S. - Argentina settlement rate for the Italy - Argentina rate), have the same impact and hence should be barred absent the consent of all the countries involved, which U.S. carriers say they have secured.

Such complaints notwithstanding, the billing mechanisms for these and other calling card services have been carefully integrated into the established accounting rate system. Third country direct and credit card calls originated overseas are treated as outgoing calls from the card holder's home country for settlement purposes. A home-country direct call from Italy to the U.S. thus leads to settlements being paid by a U.S. carrier to Italcable for "landing" the call.

The widespread acceptance of calling cards and bank cards for international telephone service could be dramatic. As these cards proliferate, the tens of millions of telephone users who live in a "high price" foreign call zones will, via country-direct or equivalent international "800" numbers, have direct access to the dial tones of the carriers in "low priced" zones to complete their international calls.

The global base of Visa cards in 1991 exceeded 280 million, more than double the estimated base of telephone calling cards. By "monetizing" this card base for telephone service, Visa and its participating telcos arguably have the financial power to substitute their international facilities and price platforms for those of their smaller rivals. Still this strategy has its risks.

The entry barriers are modest. Competition may develop from any low cost carrier which can strike a deal with a reliable financial partner to process the bills of its foreign credit card customers. And, if a national carrier is willing to honor one company's credit cards, regulators will almost certainly require it to accept the credit cards of its competitors.

Cardphone programs also risk transforming credit card issues into potential resale competitors. Visa International has been careful to avoid doing business with resale carriers and to preserve its reputation as a global business owned by local card issuers. But as the Visaphone program grows in size, the incentives to take a more direct stake in the telecom business itself could prove irresistible for some of the company's affiliates.

C. Outsourcing Ventures

As the prospect of ISR draws closer and the network management business continues to enjoy steady growth, several major carriers have begun to look more closely at getting into these businesses too. Doing so might mean competing against customers or long-time correspondents. Yet it might forestall additional competition as well as providing a new Light Carrier option for the future.

Syncordia is perhaps the best known "Light Carrier" hedge to date. Based in Atlanta and majority owned by BT, Syncordia was founded in 1991 to provide global telecom services to major multinationals. The company has candidly described itself as a "reseller." It's goal: To provide "end-to-end virtual networks for intra-corporate communications...integrating both voice and data," between the world's major business centers.[23]

At this writing, Syncordia is still in a start-up stage. It has not been authorized to engage in ISR in any major market. Nor has it been able to bring in the French, German and Japanese partners it initially contemplated.

Less visible than Syncordia is the ad hoc effort of Cable & Wireless to tie together affiliated carriers in the U.S. (CWCI), H.K. (HK Telecom International), the U.K. (Mercury), Japan (IDC), the Philippines (Eastern Telecom) and Australia (Optus). The C&W companies already offer a Global VPN service in competition with BT, AT&T and KDD. But although the C&W group has a physical network capable of providing end-to-end service among the Far East, North America and Europe, the individual C&W companies appear to have interconnected their national networks at arms-length. That is, C&W group traffic is picked up and delivered under the same settlement terms as are offered to non-affiliated carriers. National regulators have required no less.

The big question is whether ISR will change that. If Mercury and other C&W affiliates must resell their own facilities, will C&W also develop a pan-national resale product, outside the current VPN category to compete with the likes of Syncordia?

The foregoing list of "Light" strategies for Heavy Carriers is far from exhaustive. The potential for trans-national wireless carriers also deserves separate attention. In contrast to Iridium's Heavy Carrier strategy, cross-border resellers of cellular telephone services in Western Europe and in the Americas may well show the way forward for terrestrial networks.[24] Because cellular carriers have not grown up in the accounting rate, half-circuit world of the terrestrial carriers, new arrangements for "international roaming" and end-to-end service may be easier to agree.

V. Conclusions

This essay has argued that the international telecom service business is shifting paradigms. The old paradigm -- nationalistic, monopolistic, hardware intensive, tied to half-circuits -- supported the rise of the Heavy Carrier. The new paradigm -- multi-national, competitive, software driven, offering end-to-end service -- is being pioneered by the Light Carrier.[25]

This paradigm shift has been anticipated by other observers. In 1986, for example, Peter Huber noted that as switching costs fell relative to transmission costs, competition among private and public switches would increase and the pyramid-like architecture of the telecommunication network would become more geodesic.[26] In a similar vein, Eli Noam later suggested that the evolving domestic network might be best described as a "network of networks," public and private.[27] The changing structure of the international network reflects these trends.

The thesis of this essay is not that Light Carriers will soon displace Heavy Carriers or that facilities ownership is no longer important. To the contrary. A facilities-based competitor will almost always be better positioned to mount a more lasting competitive challenge where transmission expenses constitute a significant portion of the end-to-end service cost.

By comparison, a Light Carrier's profitability, is crucially dependent upon the size of the resale margin provided for in the price of leased facilities and may be at risk whenever the underlying Heavy Carrier reduces these margins. For that reason alone, a Light Carrier strategy based solely upon arbitrage opportunities and which does not offer customers additional value, in terms of access, billing, service options or otherwise, may not be sustainable over the long run.

The evolution of the international service industry is thus likely to be marked by a combination of Light Carrier and Heavy Carrier strategies. Light Carriers will seek to gain better control over their long run costs by contracting forward for bulk transmission capacity and by entering into joint ventures with facilities-based carriers. They will also seek to pare down their use of more costly transmission facilities by using creative hubbing, routing and billing arrangements (ie, by investing in switching rather than transmission capacity at the margin).

Conversely, Heavy Carriers will attempt to meet the Light Carrier challenge in the 1990s by leasing instead of owning capacity and by offering their own brand of global service. Beyond that, a Heavy Carrier buy-out of the more successful Light Carriers can not be ruled out.

How rapidly and how far Light Carriers will be able to go in establishing themselves and in securing a sustainable operating structure for the future will depend largely upon the regulatory environment which these carriers face in the principal European, American and Asian markets. Regulation (not technology) is crucial. A progressive evolution of the market for international telecom services simply will not occur absent a further commitment to liberalization in these key regions.

The last two years has seen a number of encouraging steps both nationally (eg, regarding resale) and internationally (eg, regarding the scope for private satellite systems). But much remains to be done if the market is to have access to the best which both the Light Carrier and Heavy Carrier paradigm can provide.

The paradigm shift described in this essay also poses a fundamental question for carriers about their future strategy and organization. This is especially true for smaller carriers which are just beginning to play an international role, whether in Central Europe or South East Asia. Is a carrier's strategy for international service based on the regulatory and technological platform of the 1960s or the 1990s? Is the model AT&T or EDS? BT or Syncordia? France Telecom or Sovintel? IBM or Novell and Dell Computers?

We probably don't know yet what the most successful type of Light Carrier will be. As suggested earlier, some will be new entrepreneurial efforts, following on from network integrators. Some may come from the multi-national ventures of cellular telephone companies. And others may be software driven start-up ventures. In fact, the chances are that the "Apple Computer" company of the Light Carrier industry has not yet been incorporated. What is clear though is that the old paradigm is no longer the only model available and in twenty years time may not even be the dominant one.

1. International Telecommunication Regulations (ITU, Geneva 1989), Articles 1.1, 3.1, 3.3, 6.2 and Appendix 1, Sections 1.1 and 1.4. See also Convention Of The International Telecommunication Union (ITU, Geneva 1990), Articles 29 and 30.

2. See "General Tariff Principles Charging And Accounting in International Telecommunications Services" CCITT Blue Book, Vol. II, Fascicle II.1, Recommendation D.150 (ITU, Geneva, 1989).

3. See International Telecommunication Regulations, op cit, note 1, at Article 9.3.

4. See eg, Agreement Relating to the International Telecommunication Satellite Organization (Intelsat) 28 U.S.T. 3813, T.I.A.S. No. 7532, Article XIV, and the companion Intelsat Operating Agreement. For further discussion of these restrictions, see Green Paper on a common approach in the field of satellite communications in the European Community (COM(90)490 final, 20.11.90), pp. 31-32; 100-104.

5. For example, the European Commission (EC) satellite Green Paper, op cit, note 4, proposes to abolish the exclusive rights of carriers within the Community as regards the provision of international satellite uplinks and downlinks and to provide users unrestricted access to international space segment capacity. Interconnection with the public telephone network may be restricted by member states. However, such restrictions may be short lived if the EC moves forward with its proposed directive to permit pan-European voice telephony by a single carrier. See Communications Week International 20 April 1992, p.1. In 1984 the U.S. determined that separate (non-Intelsat) international satellite systems were in the public interest and in 1991 committed itself to the complete elimination of the restrictions on the interconnection of such systems with the public switched telephone network [PSTN] by January 1997. In June 1992 the Intelsat Board of Governors took a significant step toward implementing the U.S. agenda by agreeing routinely to approve the use of up to 1250 64 kilobit per second circuits per separate satellite system for services interconnected with the PSTN. See Telecommunications Reports, December 2, 1991, pp. 14-17 and June 22, 1992, p. 30. Australia and the United Kingdom have also liberalized the provision of international satellite earth station and space segment capacity.

6. See generally Organization For Economic Co-Operation And Development (OECD), Working Party On Telecommunication and Information Services Policies (TISP) "International Telecommunication Tariffs: Charging Practices And Procedures," DSTI/ICCP/TISP(91)2, 18 April 1991, and "Pricing Principles And International Telecommunications," DSTI/ICCP/TISP(91)3, 18 April 1991, prepared for the 13-14 May 1991 OECD Meeting of the Ad Hoc Group of Experts on International Telecommunications Charging Practices and Procedures. See also "Analysis of Telephone Accounting Rates," DSTI/ICCP/TISP(92)3, 27 April 1992.

7. See eg, L. G. Tesler, "Networked Computing in the 1990s" Scientific American, Vol. 265, No. 3, September 1991, pp.86-93. See also G. Gilder, Microcosm The Quantum Revolution In Economics And Technology, (Simon & Schuster, N.Y. 1989).

8. An overview of SS7 and "intelligent networks" is provided by the FCC's Notice of Inquiry, In the Matter of Intelligent Networks, CC Docket No. 91-346, FCC 91-383, released December 6, 1991. As discussed therein, the services offered by a network employing SS7 depend largely on the software functions embedded in network Service Control Points (SCPs). Third parties desiring to offer competitive options thus require access to these SCPs or the ability to operate independent call-control software (non-network SCPs) in conjunction with the SCPs of the main carriers. See also The NTIA Infrastructure Report Telecommunications in the Age of Information, NTIA Special Publication 91-26, (U.S. Department of Commerce, Washington D.C. 1991) pp. 109-119 and Competition and Choice: Telecommunications Policy for the 1990s A Consultative Document, (U.K. Department of Trade and Industry, London, 1990), pp. 20-23.

9. See CCITT Blue Book op cit note 2, Recommendation D.1.

10. For background on current IVAN agreements and some examples, see "International Value-Added Network Services - An Introduction," National Telecommunications and Information Administration Publication TM-90-256, (U.S. Department of Commerce, Washington D.C., 1990).

11. See Revised CCITT Recommendation D.1, "General Principles for the Lease of International (Continental and Intercontinental) Private Telecommunication Circuits and Networks, Sections 3.1.1. and 4.1. (ITU, Geneva, May 1991).

12. In the U.S., Federal Communications Commission (FCC) rules require any party seeking authority for ISR to show that "equivalent resale opportunities exist between the U.S. and [the target] country." 57 Federal Register 646, 647 (January 8, 1992). In the U.K., the Department of Trade and Industry (DTI) has stated that there must be "broad comparability... in any licensing or authorization procedures attaching to the provision of such [international resale] services in the overseas country." Competition and Choice: Telecommunications Policy for the 1990s Cm 1460 (HMSO, London, 1991), p. 15.

13. Notably, in 1985, the European Court of Justice upheld the European Commission in finding that, notwithstanding CCITT Recommendations to the contrary, British Telecom had abused its dominant position under Article 86 of the Treaty of Rome by prohibiting telex message forwarding agencies in the U.K. from using the BT network to refile messages which originated and terminated in other countries. See Case 41/83, Italian Republic v. Commission, (1985) ECR 873. See also Guidelines on the application of EEC competition rules in the telecommunications sector (91/C233/02;OJ C233/2, 06.09.91).

14. S. M. Welland, "Networks Of The Future And Their Application In The General Electric Company To Serve The Vision Of The 1990's", presentation to FCC "Networks Of The Future" meeting, Washington D.C., May 1, 1991.

15. K. Lynch, "Global Services Showdown," Communications Week International, 11 May 1992, p.22.

16. See eg, E. Messmer, "AT&T storms Europe in data net offensive," Network World, March 16, 1992, p.1. For further background on AT&T's European strategy see, P. Fuhrman "An unlikely trustbuster," Forbes, February 18, 1991, pp. 100-104.

17. See eg, B. Crockett, "The Resale Struggle Begins," Global Networks, Vol. 1 No. 2, Summer 1991, pp.17-22.

18. See eg, A. Ramirez, "Reversing Rates For Overseas Callers," The New York Times, January 9, 1992, p.D1.; "Rome to Bonn Via New Jersey," BusinessWeek, April 13, 1992, pp.84-85.

19. For a comprehensive review of global VPN offerings, see "The TeleChoice Report on International Virtual Networks," 3 vols. (TeleChoice, Montclair, New Jersey, 1991).

20. See "Telephone Network And ISDN - Operation, Numbering, Routing And Mobile Service," CCITT Blue Book Volume II, Fascicle II.2, Recommendation E.118 (ITU, Geneva, 1989).

21. "Visa plans phone service," Financial Times, May 6, 1992, p.11. Total Visaphone billings in 1991 reportedly exceeded $70 million and are projected to rise to over $300 million in 1994.

22. "Introducing AT&T World Connect Service..." The New York Times, May 1, 1992, p.D18.

23. "Comments" of Syncordia Corporation before the FCC, File No. ITC-92-066, January 27, 1992, pp.1-3. For additional background on Syncordia see "Global Services Showdown," op cit, note 15.

24. See eg, "BellSouth to begin offering Pan-American roaming in 1992," Bell South International Review, May 1992, p.1.

25. A similar competitive divide exists in the semiconductor industry between "heavy" companies, such as Intel, which own fabrication plants ("fabs") to manufacture the microprocessors which they design and "light" companies, such as Chips & Technologies and Advanced Micro Devices (AMD), which contract manufacturing to independent foundaries. "Whether it was [Jerry] Sanders [CEO of AMD] or T.J. Rodgers [the founder of Cypress computers] who said it first, the phrase 'real men have fabs' has become part of the folklore of Silicon Valley. Real chip companies make things. They don't sit around drawing clever designs and then turn them over to someone else to manufacture." But, continues one well known Silicon Valley analyst, a "persuasive counter argument has been made that real men have fabs, but rich men don't. With the cost of a fabrication facility hitting the half-billion dollar mark, start ups [are] better off concentrating on profitable chip designs ... [And] fabless companies are loved by Wall Street." K. Wieger, "The Empire Strikes Back," Upside, June 1992, Vol. 4, No. 6, p. 39.

26. The Geodesic Network 1987 Report on Competition in the Telephone Industry ["The Huber Report"] (US Government Printing Office, Washington D.C., 1987).

27. E. M. Noam, "The Public Telecommunications Network: A Concept In Transition," Journal of Communications, Winter 1987, pp. 40-58.

A PRIMER ON BITS

The bit, a contraction of binary digit, is the fundamental metric of the information age. The term was coined in 1957 by John Tukey of Bell Labs.

The binary language of bits is ones and zeroes (0, 1, 10, 11, 100, 101, 110, 111, etc.). Inexpensive electronic circuits can be designed to function with two commands -- on/off or 0/1. Information coded in bits -- on/off signals -- thus can be readily processed by computers and other electronic devices.

This is how bits are counted: 8 bits = 1 byte; 1000 bytes = 1 kilobyte (kb); 1000 kb = 1 Megabyte (Mb); 1000 Mb = 1 Gigabyte (Gb)

Both aural and visual information can be encoded digitally. In an analog telephone system, the electrical voltage generated by a receiver is proportional to the pressure of the sound waves. In a digital system, the signal is encoded by sampling the voltage 8,000 times per second and assigning the sample magnitude a binary value on a scale up to 256 (using 8 bits). The corresponding transmission rate is thus 64,000 bits per second (bits/s).

Letters and numbers are typically encoded by an 8 bit group. Graphic displays are broken into small picture elements -- pels or pixels -- and then encoded. One pel in a black and white image is usually encoded by 8 bits (allowing 256 shades of gray); a color pixel may be assigned 24 bits (allowing 256 variations of each primary color -- blue, green and red).

The number of bits required to encode some common information is stated below:

Typed page (A4, double spaced)	1.75 kilobits
A novel (250 pages)	375 kilobits
Stereo music (compact disc quality, uncompressed)	1.4 Mbit/s
Black and white TV image (freeze frame videophone)	19.2 kbits/s
Full motion color TV image (25 frames per second)	90 Mbits/s

Digital voice transmission systems are comprised of standard 64 kbit circuits. To convey large amounts of information efficiently, telephone companies multiplex (time sequence) these circuits together into standard digital frames or packages. In North America the standard multiplex levels for digital circuits are shown on the following chart:

Multiplex Level	Bit Rate (in Mbits/s)	Number of 64 kbit/s channels (including overheads)
T-1 (DS-1)	1.544	24
T-2 (DS-2)	6.312	96
T-3 (DS-3)	44.736	672

BIT PRIMER (cont.)

Europe has different multiplex standards based upon 30 voice equivalent channel groups (eg. the basic digital frame is an E-1 circuit of 2.048 Mbits/s or 32 x 64,000 bits providing one extra channel for signalling and one for frame recognition).

Major trans-oceanic cables operating in the mid-1990s will have three or more fiber optic paths operating at 560 Mbits/s on each path or 7560 standard 64 kbit channels. The Minimum Investment Unit (MIU) in a cable is commonly 30 voice equivalent channels (an E-1 circuit) plus the necessary signaling capacity, which together is knows as a MAUO (Minimum Assignable Unit of Operation). See Tables 4 and 5 to this report for the capacity and cost of selected trans-oceanic cables.

How much information can be transmitted over a telecommunications circuit? The answer depends upon the coding scheme, how much the coded bit stream can be compressed and the carrying capacity of the circuit.

In a digital system the transmission capacity is stated in bits meaning that a 64 kbit circuit can transmit 64,000 bits/s, enough for a high quality telephone call. In fact, digital compression typically enables 4 or 5 voice paths (and as many as 8) to be derived from a standard 64 kbit channel. By convention, a Grade 3 (G-3) facsimile machine transmits information at 9,600 bits/s and thus approximately 4 or 5 fax calls may use a single, 64 kbit channel. At the other end of the scale are video conferencing systems which typically require at least two 64 kbit channels, even after the signal has been compressed.

The traffic statistics compiled in this report are stated in Minutes of Telecommunications Traffic (MiTTs). How many bits in a MiTT? The answer is "it varies" because MiTTs cover analog as well as digital circuits. And, even if the MiTT statistics covered only digital circuits, it would still be necessary to take into account variations in transmission, coding and signal compression technologies. Nevertheless, assuming that all the information is transmitted over a standard 64 kbit circuit, order of magnitude calculations can be made for the capacity required to handle a given volume of digitized data, text, audio and video information.

The speed with which computers can process digital information is measured in MIPS or Millions of Instructions per Second. MIPS and MiTTs meet in the marketplace, in terminal equipment (fax machines, videophones) and central office switches. The statistical relationship between faster computers -- more MIPS -- and the demand for transmission capacity -- more MiTTs -- has yet to be fully explored. However, in the multimedia world of the late 1990s, this linkage will become more and more important as service providers and equipment manufacturers seek to ensure that transmission and switching facilities are adequate to handle the demands of the next generation of communications terminals.

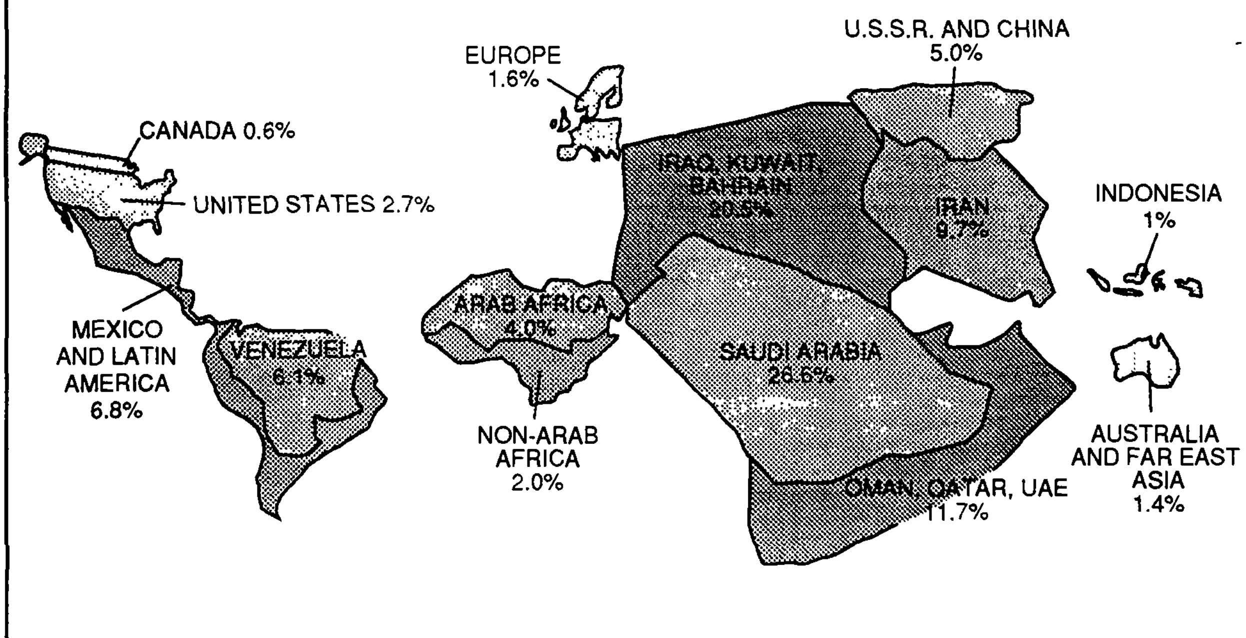
Further reading: Robert Lucky, Silicon Dreams: Information, Man and Machine (St. Martins Press, N.Y., 1989); Anton A. Huurdeman, Transmission A Choice of Options (Alcatel Trade International Paris, 1991)

STATISTICAL TABLES

AND

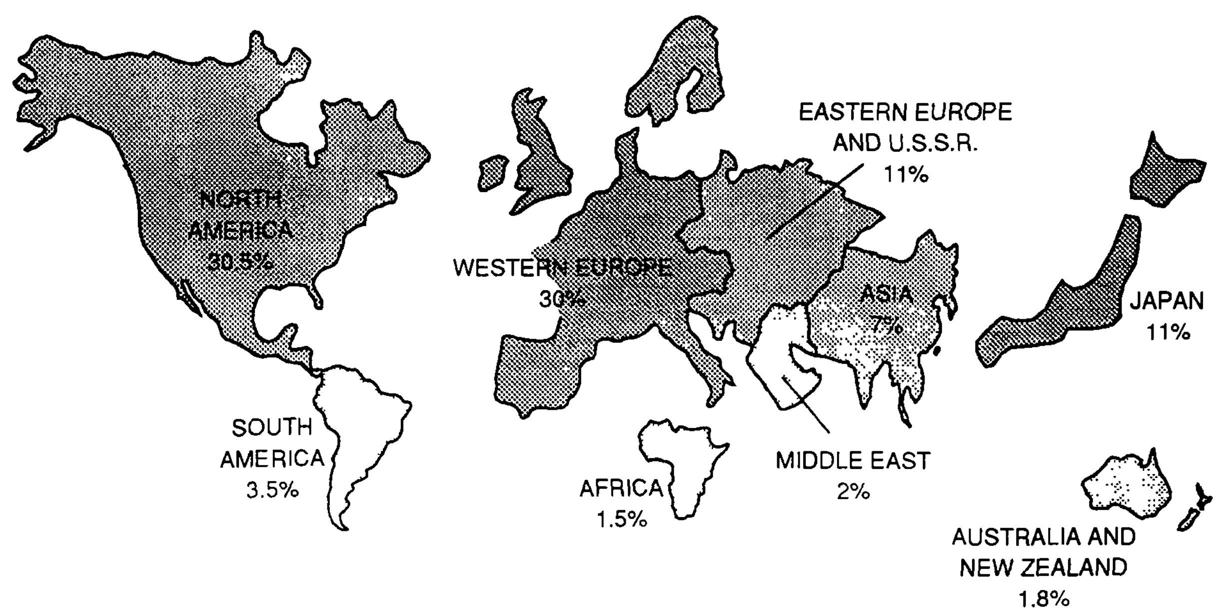
MAPS

PetroPower
Official Oil Reserves – 1990

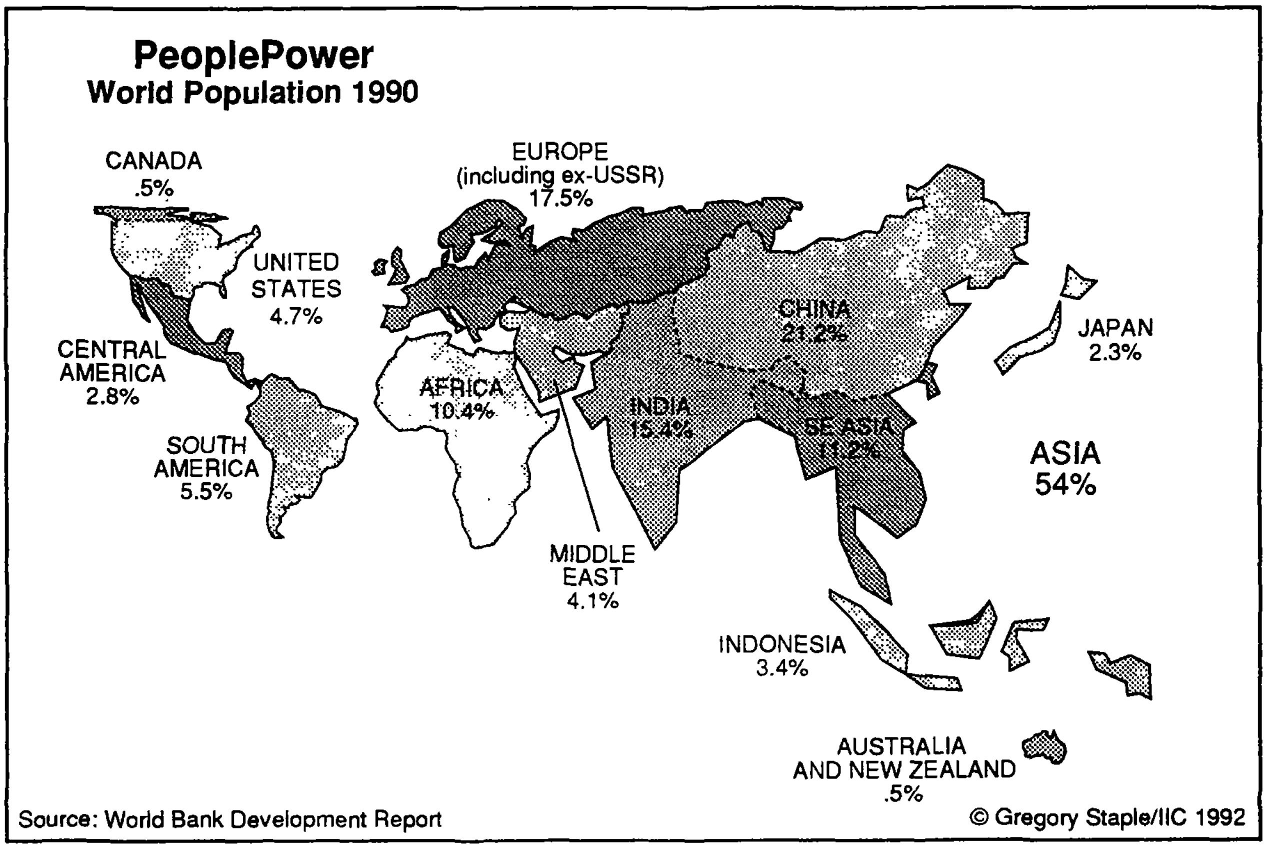


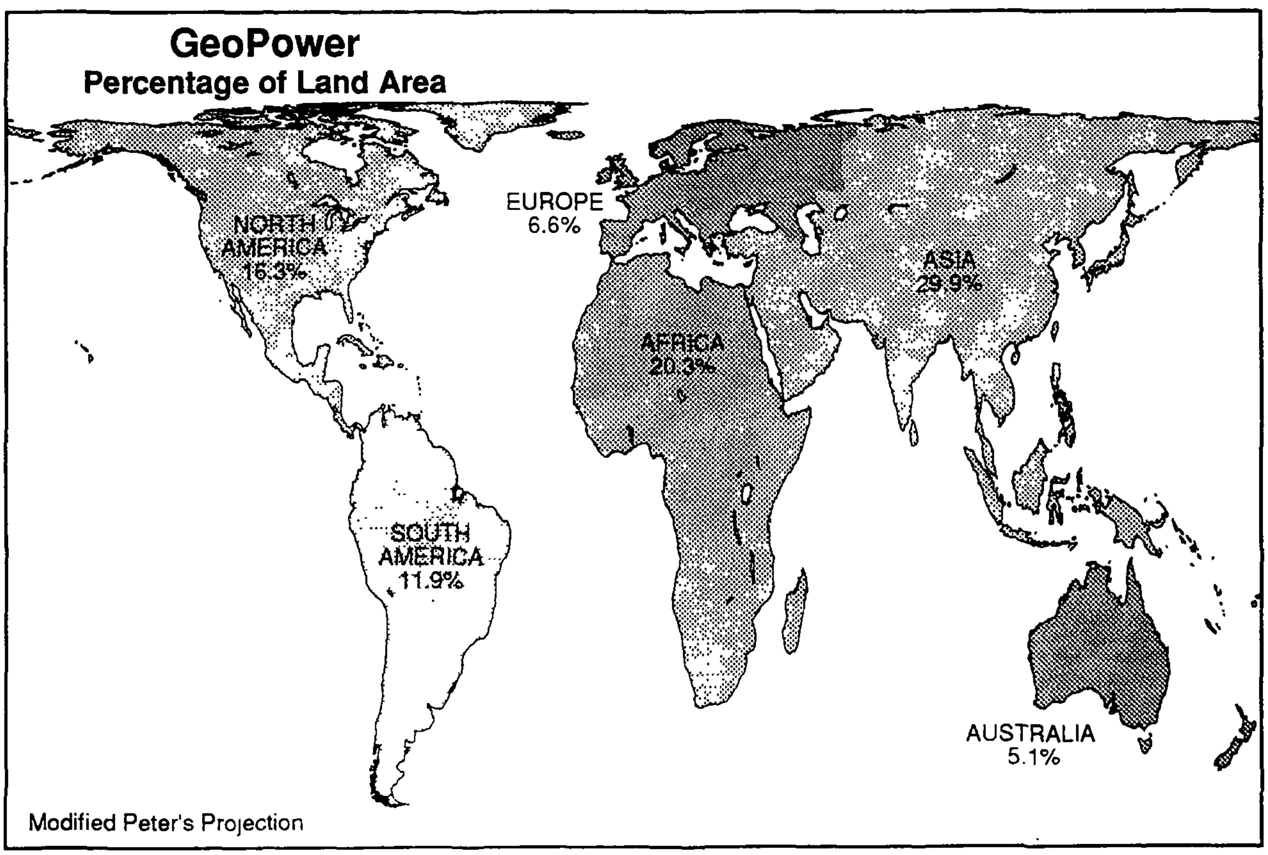
Source: International Petroleum Encyclopedia

TelePower
Distribution of telephone main lines – 1990



Source: Siemens and AT&T Yearbooks


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


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

What Is Plugged Into The Global Network?
1 Jan. 1992 and (1 Jan. 1997 estimated) in Millions of Units.

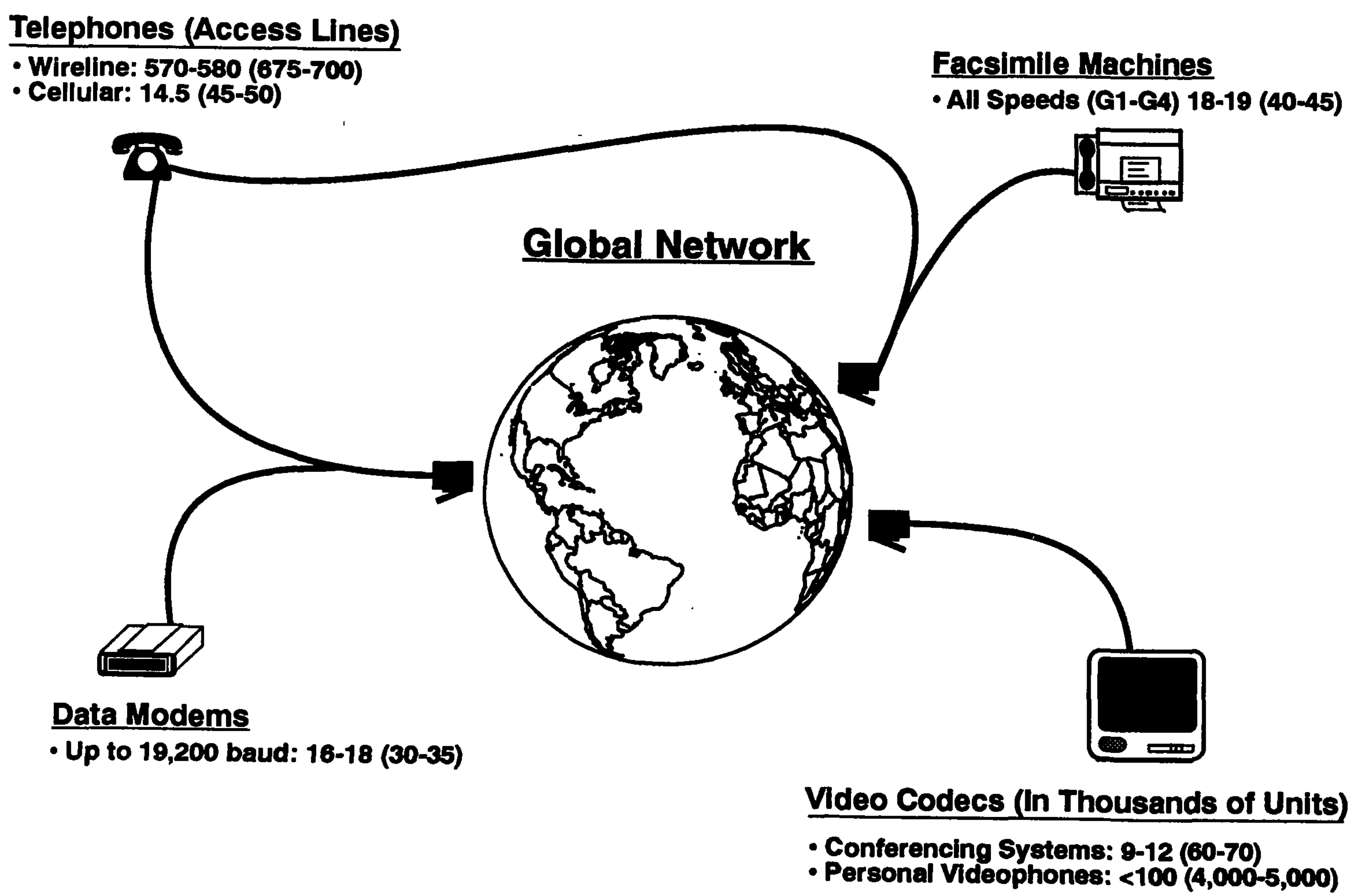


Table 1

NATIONAL STATISTICS (1990)

Country	Population (millions)	Per Capita GNP (US $)	Area (000 sq. km)	Telephone Lines per 100 people
Argentina	32.3	2,370	2,767	10.9
Australia	17.0	17,080	7,687	47.1
Austria	7.6	19,240	84	41.8
Belgium	10.0	15,440	31	39.7
Brazil	150.2	2,680	8,512	6.3
Canada	26.5	20,450	9,976	57.7
Chile	13.2	1,940	757	6.2
China (PRC)	1133.7	370	9,561	.9
Colombia	32.8	1,240	1,139	7.7
Denmark	5.1	22,090	43	56.6
Finland	5.0	26,070	338	53.5
France	56.5	19,480	552	49.0
Germany	79.5	22,730	357	40.1
Greece	10.0	6,000	132	39.3
Hong Kong	5.8	11,540	1	42.7
Hungary	10.6	2,780	93	9.4
India	849.5	350	3,288	.6
Indonesia	181.6	560	1,905	.5
Ireland	3.5	9,550	70	28.1
Israel	4.6	10,970	21	34.9
Italy	57.6	16,850	301	38.8
Japan	123.5	25,430	378	44.8
Korea, Repub. of	42.8	5,400	99	31.6
Luxembourg	.4	28,770	<1	49.7
Malaysia	17.8	2,340	330	8.9
Mexico	86.2	2,490	1,958	6.0
Netherlands	14.9	17,330	37	46.5
New Zealand	3.4	12,680	269	48.7
Norway	4.2	23,120	324	50.3
Philippines	61.4	730	300	1.1
Portugal	10.4	4,890	92	22.6
Russia	148.2	N/A	17,000	14.8
Saudi Arabia	14.9	N/A	2,150	9.3
Singapore	2.7	12,310	1	38.4
South Africa	35.9	2,520	1,221	9.4
Spain	39.3	10,920	505	32.4
Sweden	8.6	23,680	450	68.3
Switzerland	6.7	32,790	41	58.8
Taiwan (ROC)	20.6	N/A	36	30.5
Thailand	55.8	1,420	513	2.3
Turkey	56.3	1,630	779	12.2
United Arab Emirates	1.6	19,860	84	26.8
United Kingdom	57.5	16,070	245	45.5
United States	250.9	21,700	9,373	54.5
Uruguay	3.1	2,560	177	13.4
Venezuela	19.7	2,560	912	7.5

Sources: World Bank; Siemens

Table 2

NATIONAL TELECOMMUNICATION STATISTICS (1990)

Country	Telephone Lines (Millions)	Mobile Telephone Subscribers (Thousands)	Fax Machines (Thousands)
Argentina	3.5	N/A	N/A
Australia	8.0	291	400
Austria	3.2	43	110
Belgium	3.9	43	N/A
Brazil	9.4	2	90
Canada	15.3	583	430
Chile	.8	N/A	N/A
China (PRC)	6.9	38	N/A
Colombia	2.4	N/A	35
Denmark	2.9	148	N/A
Finland	2.7	226	60
France	27.6	284	580
Germany	31.9	274	920
Greece	3.9	N/A	40
Hong Kong	2.5	141	120
Hungary	1.0	N/A	N/A
India	5.1	N/A	N/A
Indonesia	.9	N/A	N/A
Ireland	1.0	N/A	40
Israel	1.6	15	N/A
Italy	22.4	266	300
Japan	55.3	867	4300
Korea, Repub. of	13.5	N/A	N/A
Luxembourg	.2	.6	N/A
Malaysia	1.6	85	27
Mexico	5.2	60	N/A
Netherlands	6.9	79	180
New Zealand	1.6	55	70
Norway	2.1	197	90
Philippines	.7	N/A	N/A
Portugal	2.4	7	30
Russia	22.0	N/A	N/A
Saudi Arabia	1.4	15	N/A
Singapore	1.0	51	50
South Africa	3.3	N/A	N/A
Spain	12.6	55	260
Sweden	5.8	478	170
Switzerland	3.9	51	N/A
Taiwan (ROC)	6.6	138	N/A
Thailand	1.3	N/A	40
Turkey	6.9	32	30
United Arab Emirates	.4	N/A	N/A
United Kingdom	26.1	1,177	670
United States	136.3	5,300	4400
Uruguay	.4	N/A	N/A
Venezuela	1.5		N/A

Sources: ITU, Siemens, Industry Interviews

Table 3a

TELECOMMUNICATION TRAFFIC BALANCE FOR SELECTED COUNTRIES (1991)

Country	Outgoing MiTT in Millions	Incoming MiTT in Millions	Balance of MiTT	(Deficit)/ Surplus as % of Total MiTT
Argentina	89.4	132.5	43.1	19.4
Austria	641.9	574.0	(67.9)	(5.6)
Belgium	822.7	748.5	(74.2)	(4.7)
Brazil	171.2	261.6	90.4	20.9
Canada	647.3	398.1	(249.1)	(23.8)
Chile	49.0	61.8	12.8	11.6
Denmark	394.5	397.2	2.7	0.3
France	2295.0	2355.0	60.0	1.3
Greece	245.0	320.1	75.1	13.3
Hong Kong	913.0	783.0	(130.0)	(7.7)
Indonesia	100.0	135.7	35.7	15.1
Ireland	83.4	140.4	57.0	25.5
Israel	139.4	247.0	107.6	27.8
Italy	239.0	281.3	42.3	8.1
Korea, Repub. of	229.2	425.1	195.9	29.9
Luxembourg	165.3	95.0	(70.3)	(27.0)
Netherlands	1017.7	966.8	(50.9)	(2.6)
Philippines	128.5	385.4	256.9	50.0
Portugal	187.0	384.0	197.0	35.0
Saudi Arabia	410.6	266.7	(143.9)	(21.2)
Spain	718.7	736.9	18.2	1.3
Switzerland	1429.4	1124.0	(305.4)	(12.0)
Taiwan	254.7	344.5	89.8	15.0
Turkey	198.1	470.0	271.9	40.7
United States	5984.5	2829.8	(3154.7)	(35.8)
Uruguay	29.3	48.0	18.7	24.2

* *MiTT for Ireland excludes traffic to and from the U.K. For Italy, MiTT are for Italcable (inter-continental) traffic only; for Portugal MiTT are for CPRM (inter-continental) traffic only; for Canada, MiTT are for TeleGlobe traffic only (excluding the U.S. and Mexico); for U.S., MiTT exclude Canada and Mexico traffic.*

Table 3b

TELECOMMUNICATION TRAFFIC BALANCE FOR SELECTED COUNTRIES (1990)

Country	Outgoing MiTT in Millions	Incoming MiTT in Millions	Balance of MiTT	(Deficit)/ Surplus as % of Total MiTT
Belgium	731	755	24	1.6
Canada	565	358	(207)	(22.4)
Denmark	362	343	(19)	(2.7)
Finland	186	213	27	6.8
France	1921	2091	170	4.2
Hungary	122	110	(12)	(5.2)
Ireland	75	122	47	23.9
Israel	118	202	84	26.3
Italy	208	257	49	10.5
Japan	937	747	(190)	(11.3)
Korea, Repub. of	188	350	162	30.1
Luxembourg	151	83	(68)	(29.1)
Malaysia	80	100	20	11.1
Netherlands	905	852	(53)	(3.0)
Norway	281	277	(4)	(0.7)
Portugal	157	326	169	35.0
Spain	611	653	42	3.3
Switzerland	1356	1016	(340)	(14.3)
Taiwan	212	302	90	17.5
Turkey	159	441	282	47.0
United States	5265	2604	(2661)	(33.8)

* *MiTT for Ireland excludes traffic to and from the U.K. For Italy, MiTT are for Italcable (inter-continental) traffic only; for Portugal MiTT are for CPRM (inter-continental) traffic only; for Canada, MiTT are for TeleGlobe traffic only (excluding the U.S. and Mexico); for U.S., MiTT exclude Canada and Mexico traffic.*

Table 4

CAPACITY AND COST, PER VOICE PATH, OF SELECTED TRANS-OCEANIC CABLES (1956-1997)

Year In-Service	Cable System	Cost ($ US) per voice path	Capacity in voice paths
Trans-Atlantic Systems			
1956	TAT-1	557,000	89
1965	TAT-4	365,000	138
1970	TAT-5	49,000	1,440
1983	TAT-7	23,000	8,400
1988	TAT-8	9,000	37,800
1989	PTAT	6,000	85,000
1992	TAT-9	5,500	75,600
1993	TAT-10	2,500	125,000
1994	CANTAT-3	1,000	338,000
1996-97	TAT 12/13	1,000	600,000
Trans-Pacific Systems			
1957	Hawaii 1	378,022	91
1964	TPC-1	405,928	167
1974	Hawaii 3	41,183	1690
1975	TPC-2	72,781	1690
1988	TPC-3	51,852	18,900
1991	North Pacific Cable	5,000	85,000
1992	TPC-4	5,500	75,600
1996	TPC-5	2,000	600,000
Asia-Middle East-Europe Systems			
1997	FLAG (Japan-Saudi Arabia-U.K)	1,500	600,000

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

Source: FCC and Carriers

Table 5

ESTIMATED CAPACITY OF TRANS-OCEANIC CABLE AND SATELLITE SYSTEMS (1986-1996)

Trans-Atlantic
(North America to Europe)

Year	Cable Voice Paths	Satellite Voice Paths
1986	22,000	78,000
1987	22,000	78,000
1988	60,000	78,000
1989	145,000	93,000
1990	145,000	283,000
1991	221,000	283,000
1992	346,000	496,000
1993	471,000	496,000
1994	851,000	540,000
1995	1,451,000	720,000
1996	1,451,000	720,000

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

Year	Cable Voice Paths	Satellite Voice Paths
1986	2,000	39,000
1987	21,000	39,000
1988	21,000	39,000
1989	21,000	39,000
1990	21,000	39,000
1991	106,000	27,000
1992	183,000	27,000
1993	183,000	117,000
1994	183,000	207,000
1995	221,000	207,000
1996	881,000	207,000

Notes: Estimates based on year cable/satellite facilities begin service. Estimate of cable voice paths assume that 5 virtual voice paths can be derived from one 64kbit digital circuit; cable estimates include circuits held in reserve for cable/satellite restoration services. Estimates of trans-Pacific cable circuits exclude proposed, SE-ME-WE-3, CANPAC-1, FLAG and Trans-Siberian Link (TSL) cables, all scheduled for 1996-1997 timeframe. Estimates of satellite voice paths based on Intelsat satellites only and Intelsat's July, 1991 deployment and launch schedule; satellite estimates exclude one satellite in each region held in reserve. Satellite estimates also assume one voice path per channel until 1989 deployment of Intelsat VI services with 24,000 channels or 120,000 voice paths using Digital Code Multiplication Equipment (DCME). The Intelsat VII series, deployed in 1992, have a nominal capacity of 18,000 channels or 90,000 voice paths using DCME. Several thousand additional satellite voice paths in the Atlantic and Pacific likely will be available to 1996 from PanAmSat (PAS-1; ORBX-2); Columbia Communications (using NASA's TDRSS system); and InterSputnik. Regional capacity estimates do not necessarily imply that full capacity is available to satisfy demand on any given bilateral route.

Source: FCC and Carriers

Table 6a

THE TRAFFIC BASE OF THE TOP 20 INTERNATIONAL CARRIERS (1990-1991)

Rank	Carrier	1991 Outgoing MiTT in Millions*	1990 Outgoing MiTT in Millions*	Percent Growth in MiTT 1990-91	Country
1	AT&T	6557	6080	7.8	United States
2	DBP Telekom	3557	3146	13.1	Germany
3	France Telecom	2295	2126	7.9	France
4	BT	2213	2170	1.9	United Kingdom
5	Cable & Wireless	1660	1291	28.6	United Kingdom
6	MCI	1600	1184	35.1	United States
7	Swiss PTT	1429	1356	5.4	Switzerland
8	Stentor	1425	1344	6.0	Canada
9	Netherlands PTT	1018	905	12.5	Netherlands
10	ASST	980	837	17.1	Italy
11	KDD	850	764	11.3	Japan
12	Belgacom	823	731	12.6	Belgium
13	Sprint	723	577	25.3	United States
14	Telefonica	719	611	17.7	Spain
15	Swedish Telecom	659	615	7.2	Sweden
16	Teleglobe	647	565	14.5	Canada
17	Austrian PTT	642	559	14.8	Austria
18	AOTC	610	565	8.0	Australia
19	China PTT	594	N/A	N/A	China (PR)
20	TelMex	500	421	18.8	Mexico

* MiTT is Minutes of Telecommunications Traffic. Data are for public voice circuits only rounded to the nearest million MiTT. Data for U.S. carriers includes traffic to Mexico and Canada. Stentor was formerly Telecom Canada; Stentor traffic is for U.S. and Mexico only of which approximately 70% was originated by Bell Canada. For 1991, Cable & Wireless total includes Hong Kong Telephone (913), Mercury (427) and other majority owned companies (320). For Italy, ASST handles intra-continental traffic only; Italcable carries overseas traffic. See Table 6b.

Note: BT, KDD, C&W data are for the 1991 FY (April 1991 to March 1992).

Table 6b

THE TRAFFIC BASE OF THE SECOND 20 INTERNATIONAL CARRIERS (1990-1991)

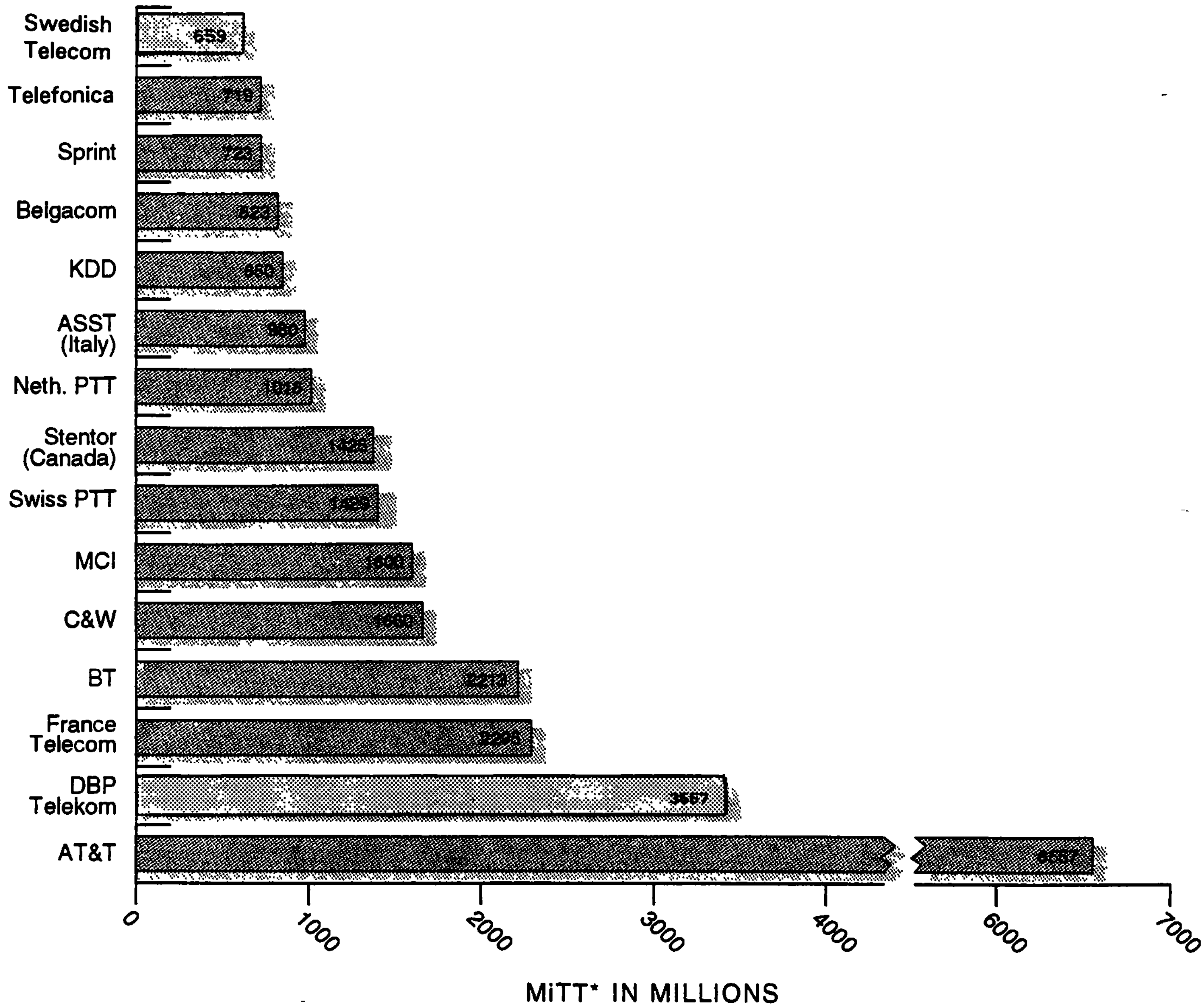
Rank	Carrier	1991 Outgoing MiTT in Millions*	1990 Outgoing MiTT in Millions*	Percent Growth in MiTT 1990-91	Country
21	Saudi Com. Ministry	411	320	28.4	Saudi Arabia
22	Danish PTT	395	362	9.1	Denmark
23	Norwegian Telecom	308	281	9.6	Norway
24	Emirates Telecom Corp.	283	242	16.9	U.A.E.
25	Telecom Eireann	273	262	4.2	Ireland
26	Singapore Telecom	265	223	19.0	Singapore
27	DGT Taiwan	255	212	20.3	Taiwan
28	Hellenic Telecom	245	213	15.0	Greece
29	Italcable	239	208	14.9	Italy
30	Korea Telecom	229	188	21.8	Rep. of Korea
31	Telecom Finland	215	186	15.6	Finland
32	Telkom SA	203	N/A	N/A	South Africa
33	Turkish PTT	198	159	24.5	Turkey
34	Videsh Sanchar	186	N/A	N/A	India
35	Embratel	171	157	8.9	Brazil
36	Luxembourg PTT	165	151	9.3	Luxembourg
37	Intertelecom	160	N/A	N/A	Russia
38	ITJ	156	61	155.7	Japan
39	Telecom Portugal	148	127	16.5	Portugal
40	IDC	147	56	162.5	Japan

* MiTT is Minutes of Telecommunications Traffic. Data are for public voice circuits only rounded to the nearest million MiTT. Telecom Eireann data includes traffic to the U.K.; Videsh Sanchar data excludes traffic to Pakistan; Singapore Telecom data excludes traffic to Malaysia. Telecom Portugal only handles intra-continental traffic; overseas traffic is carried by CPRM which had 36 million MiTT outbound in 1991. Intertelecom traffic is estimated 1991 share for Russia only.

Note: Data for Singapore Telecom, Telecom New Zealand, Videsh Sanchar, ITJ and IDC are for 1991 FY (April 1991 - March 1992).

Table 6c

THE TRAFFIC BASE OF THE TOP 15 INTERNATIONAL CARRIERS (1990-1991)



* MiTT is Minutes of Telecommunications Traffic. Data are for public voice curcuits only rounded to the nearest million MiTT. Data for U.S. carriers includes traffic to Mexico and Canada. Stentor was formerly Telecom Canada. Stentor traffic is for U.S. and Mexico only, of which approximately 70% was originated by Bell Canada. For 1991, Cable & Wireless (C&W) total includes Hong Kong Telephone (913), Mercury (427) and other majority owned companies (320). For Italy, ASST handles intra-continental traffic only; Italcable carries overseas traffic. See table 6b.

Note: BT, KDD, C&W data are for the 1991FY (April 1991 to March 1992)

Table 6d

THE TOP 15 INTERNATIONAL CARRIERS:

Growth Rates, Traffic Base and Access Lines

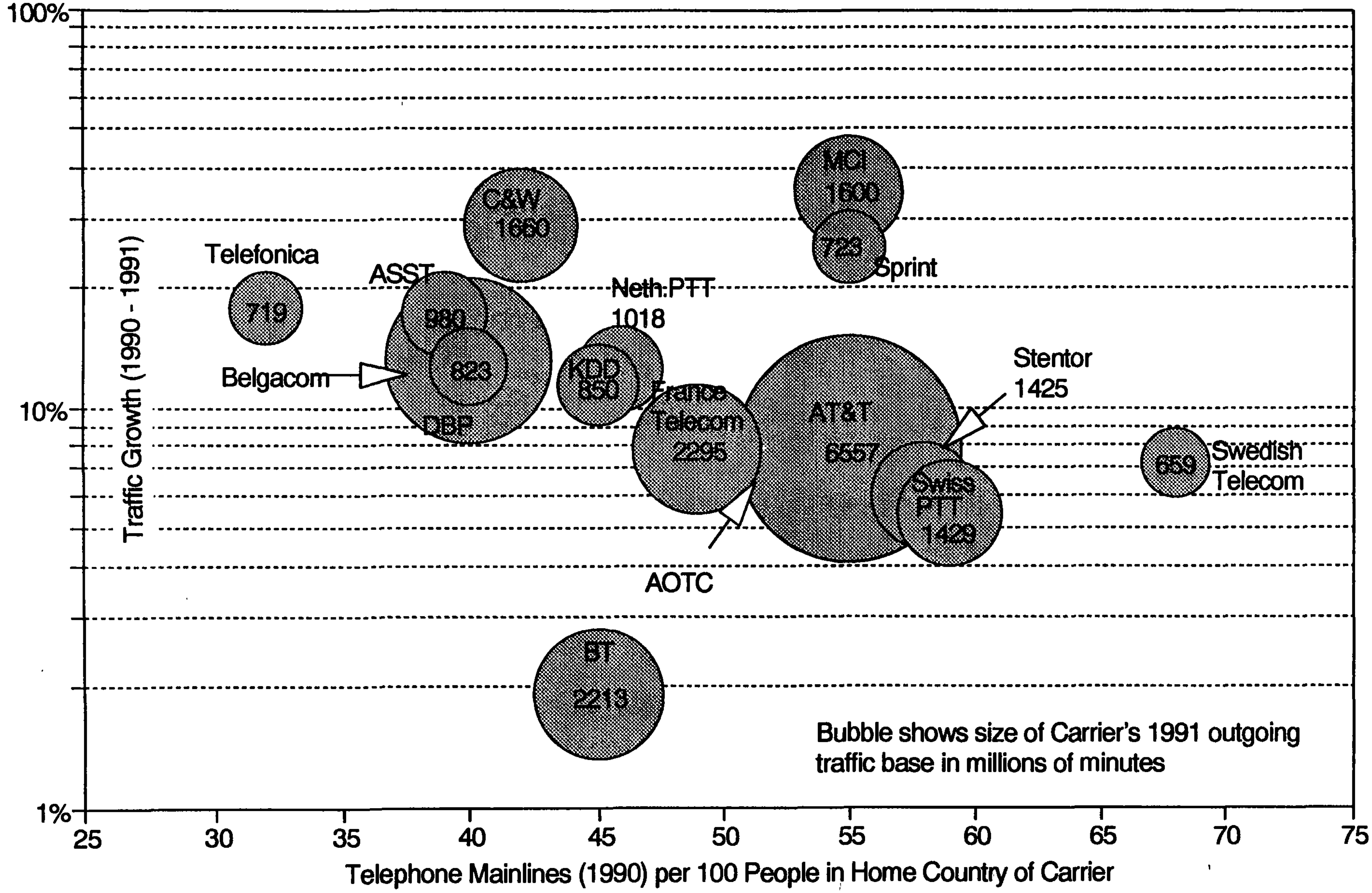


Table 7

Market Share of Competing International Carriers:
Percent of Outgoing Voice Circuit MiTT* (1986-1991)

United States			
	AT&T	MCI	US Sprint
1986	94.3	4.0	1.6
1987	93.0	4.7	2.3
1988	89.1	7.0	3.5
1989	83.3	10.2	5.8
1990	78.4	14.6	6.4
1991	74.8	17.8	6.3
United Kingdom			
	BT	Mercury	
1986/87 (FY)	99.8	0.2	
1987/88 (FY)	98.5	1.5	
1988/89 (FY)	95.5	4.5	
1989/90 (FY)	91.0	9.0	
1990/91 (FY)	86.0	14.0	
1991/92 (FY)	81.2	18.8	
Japan			
	KDD	ITJ	IDC
1989/90 (FY)	93.3	3.7	3.0
1990/91 (FY)	88.0	6.5	5.5
1991/92 (FY)	73.7	13.5	12.8
Korea			
	Korea Telecom	Dacom	
1992 (6 mo.)	81.5	19.5	
New Zealand			
	TNZ	Clearcom	
1990/91 FY	92.0	8.0	

* *MiTT is Minutes of Telecommunication Traffic. Data are for the full year except as stated.*

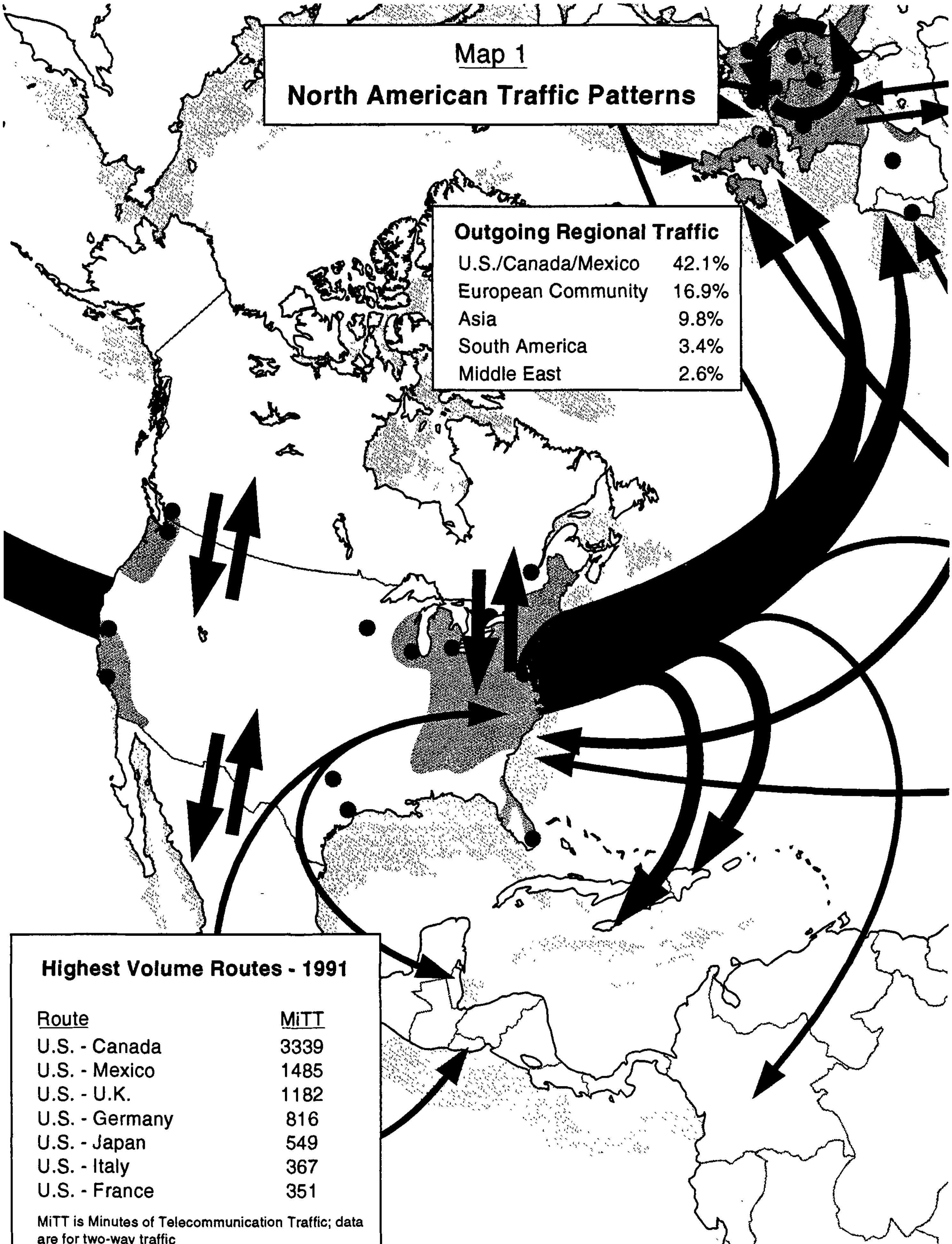
Sources: US: FCC (excludes traffic to Canada and Mexico)
UK: Oftel and Industry Interviews (excludes traffic to Ireland)
Japan: MPT and Industry Interviews
New Zealand and Korea: Industry Interviews

Table 8

INTERNATIONAL ROUTES WITH THE LARGEST VOLUME OF TELECOMS TRAFFIC (1991)

Continental	Intercontinental
More than 1 Billion MiTT*	
U.S - Canada	U.S. - U.K.
U.S.- Mexico	
More than 500 Million MiTT	
Austria - Germany	U.S. - Germany
Switzerland - Germany	U.S.- Japan
France - U.S.	
France - Germany	
Germany - U.K.	
Hong Kong - China (PRC)	
More than 250 Million MiTT	
France - Italy	France - U.S.
France - Belgium	Rep. of Korea - U.S.
France - Spain	Italy - U.S.
France - Switzerland	Turkey - Germany
Netherlands - U.K.	
Netherlands - Belgium	
Netherlands - Germany	
Switzerland - Italy	
U.K. - Germany	
U.K. - Ireland	
Germany - Italy	

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



Map 1
North American Traffic Patterns

Outgoing Regional Traffic

U.S./Canada/Mexico	42.1%
European Community	16.9%
Asia	9.8%
South America	3.4%
Middle East	2.6%

Highest Volume Routes - 1991

Route	MiTT
U.S. - Canada	3339
U.S. - Mexico	1485
U.S. - U.K.	1182
U.S. - Germany	816
U.S. - Japan	549
U.S. - Italy	367
U.S. - France	351

MiTT is Minutes of Telecommunication Traffic; data are for two-way traffic

Table 9

Argentina
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Venezuela	1.1	1.2%
Bolivia	1.2	1.3%
Mexico	1.3	1.5%
Switzerland	1.4	1.6%
Peru	1.4	1.6%
U.K.	1.6	1.8
France	2.1	2.3%
Germany	2.4	2.7%
Paraguay	2.8	3.1%
Italy	5.6	6.3%
Chile	5.7	6.4%
Spain	5.8	6.5%
Brazil	8.8	9.8%
U.S.	18.8	21.0%
Uruguay	20.0	22.4%
Other	9.6	10.7%

National Traffic Balance

*MiTT	1986	1990	1991
Total In / Out	N/A	N/A	221.9
Incoming	N/A	N/A	132.5
Outgoing	N/A	N/A	89.4
Surplus / (Deficit)	N/A	N/A	43.1

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

Table 10

Brazil
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Mexico	2.0	1.2%
Canada	2.9	1.7%
Chile	3.6	2.1%
Spain	3.7	2.2%
Switzerland	4.3	2.5%
Paraguay	4.3	2.5%
Uruguay	4.4	2.6%
Japan	5.3	3.1%
U.K.	6.8	4.0%
France	6.9	4.0%
Portugal	7.8	4.6%
Germany	9.3	5.4%
Italy	9.4	5.5%
Argentina	14.1	8.2%
U.S.	61.8	36.1%
Other	24.7	14.4%

National Traffic Balance

*MiTT	1986	1990	1991
Total In / Out	N/A	N/A	432.8
Incoming	N/A	N/A	261.6
Outgoing	N/A	156.5	171.2
Surplus / (Deficit)	N/A	N/A	90.4

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

Table 11

Canada
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Portugal	11.5	0.6%
Netherlands	13.3	0.6%
Trinidad & Tobago	13.7	0.7%
India	14.1	0.7%
Mexico	15.0	0.7%
Philippines	16.2	0.8%
Japan	16.5	0.8%
Jamaica	16.5	0.8%
Australia	18.8	0.9%
Italy	28.1	1.4%
Hong Kong	36.2	1.8%
Germany	36.3	1.8%
France	36.6	1.8%
U.K.	110.7	5.4%
U.S.	1410.0	68.8%
Other	256.8	12.5%

National Traffic Balance

*MiTT	1989	1990	1991
Total In / Out	776.2	923.7	1045.5
Incoming	308.9	358.5	398.2
Outgoing	467.3	565.2	647.3
Surplus / (Deficit)	(158.4)	(206.7)	(249.1)

Note: Balance excludes U.S. and Mexico traffic.

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

Table 12

Chile
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Venezuela	0.9	1.8%
Bolivia	1.1	2.2%
Italy	1.1	2.2%
U.K.	1.4	2.9%
France	1.4	2.9%
Canada	1.5	3.1%
Germany	2.0	4.1%
Peru	2.2	4.5%
Spain	2.5	5.1%
Brazil	3.0	6.1%
Argentina	8.5	17.3%
U.S.	14.6	29.8%
Other	8.8	18.0%

National Traffic Balance

*MiTT	1986	1990	1991
Total In / Out	N/A	N/A	110.8
Incoming	N/A	N/A	61.8
Outgoing	N/A	N/A	49.0
Surplus / (Deficit)	N/A	N/A	12.8

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

Table 13

Mexico
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Peru	1.4	0.3%
Costa Rica	1.4	0.3%
Japan	1.6	0.3%
Venezuela	1.6	0.3%
Brazil	1.7	0.3%
Argentina	1.8	0.4%
Guatemala	2.1	0.4%
Italy	2.5	0.5%
France	3.1	0.6%
U.K.	3.4	0.7%
Colombia	3.4	0.7%
Germany	3.5	0.7%
Spain	5.6	1.1%
Canada	7.6	1.5%
U.S.	447.8	89.5%
Other	11.7	2.3%

National Traffic Balance

*MiTT	1986	1990	1991
Total In / Out	N/A	N/A	N/A
Incoming	N/A	N/A	N/A
Outgoing	210.7	421.1	500.2
Surplus / (Deficit)	N/A	N/A	N/A

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

Table 14a

United States--Outgoing Traffic
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Spain	83.9	0.9%
El Salvador	89.0	1.0%
Hong Kong	95.2	1.1%
Australia	99.0	1.1%
Jamaica	103.6	1.2%
Brazil	122.3	1.4%
Taiwan	128.0	1.4%
Israel	129.6	1.4%
Colombia	149.8	1.7%
Saudi Arabia	164.4	1.8%
Italy	177.8	2.0%
Philippines	182.5	2.0%
Rep. of Korea	183.9	2.1%
Dominican Rep.	195.6	2.2%
France	210.2	2.3%
Japan	338.0	3.8%
Germany	559.9	6.3%
U.K.	659.8	7.4%
Mexico	1037.5	11.6%
Canada	1929.0	21.6%
Other	2312.5	25.8%

National Traffic Balance

*MiTT	1986	1990	1991
Total In / Out	4025.9	7818.7	8814.3
Incoming	1368.2	2542.8	2829.8
Outgoing	2657.7	5275.9	5984.5
Surplus / (Deficit)	(1289.5)	(2733.1)	(3154.7)

Note: Balance excludes Canada and Mexico traffic.

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

The United States Telecontinent

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

The United States TeleContinent: Data Base For Map

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

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

Map Concept: Gregory C. Staple and Evelyn M. Aswad.
Illustration: Maryland CartoGraphics

Table 14b

United States--Incoming Traffic
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Dominican Rep	48.4	1.0%
India	49.1	1.0%
Spain	49.4	1.0%
Colombia	51.1	1.1%
Sweden	51.9	1.1%
Israel	52.4	1.1%
Netherlands	60.0	1.3%
Switzerland	64.0	1.4%
Brazil	64.6	1.4%
Hong Kong	74.3	1.6%
Taiwan	74.8	1.6%
Rep. of Korea	81.3	1.7%
Italy	84.7	1.8%
Australia	93.5	2.0%
France	146.8	3.1%
Germany	229.6	4.9%
Japan	257.4	5.5%
Mexico	467.9	9.9%
U.K	484.9	10.3%
Canada	1410.0	30.0%
Other	811.5	17.2%

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

Table 15

Uruguay
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Venezuela	0.2	0.7%
Mexico	0.2	0.7%
Switzerland	0.2	0.7%
Israel	0.2	0.7%
U.K.	0.3	1.0%
France	0.3	1.0%
Germany	0.3	1.0%
Canada	0.4	1.4%
Paraguay	0.4	1.4%
Italy	0.5	1.7%
Chile	0.7	2.4%
Spain	1.0	3.4%
U.S.	3.3	11.3%
Brazil	4.0	13.7%
Argentina	16.3	55.6%
Other	1.0	3.4%

National Traffic Balance

*MiTT	1986	1990	1991
Total In / Out	N/A	N/A	77.3
Incoming	N/A	N/A	48.0
Outgoing	N/A	N/A	29.3
Surplus / (Deficit)	N/A	N/A	18.7

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

Table 16

Venezuela
Largest Telecommunication Routes (1990)

Destination	*MiTT	Percent of Outgoing Traffic
U.K.	1.3	1.5%
Puerto Rico	1.3	1.5%
Mexico	1.3	1.5%
Brazil	1.5	1.8%
France	1.6	1.9%
Argentina	1.7	2.0%
Canada	1.8	2.1%
Dominican Republic	1.9	2.2%
Germany, FR	1.9	2.2%
Peru	2.0	2.3%
Portugal	2.1	2.5%
Italy	5.1	6.0%
Spain	6.1	7.2%
Colombia	8.7	10.2%
United States	35.0	41.0%
Other	12.0	14.1%

National Traffic Balance

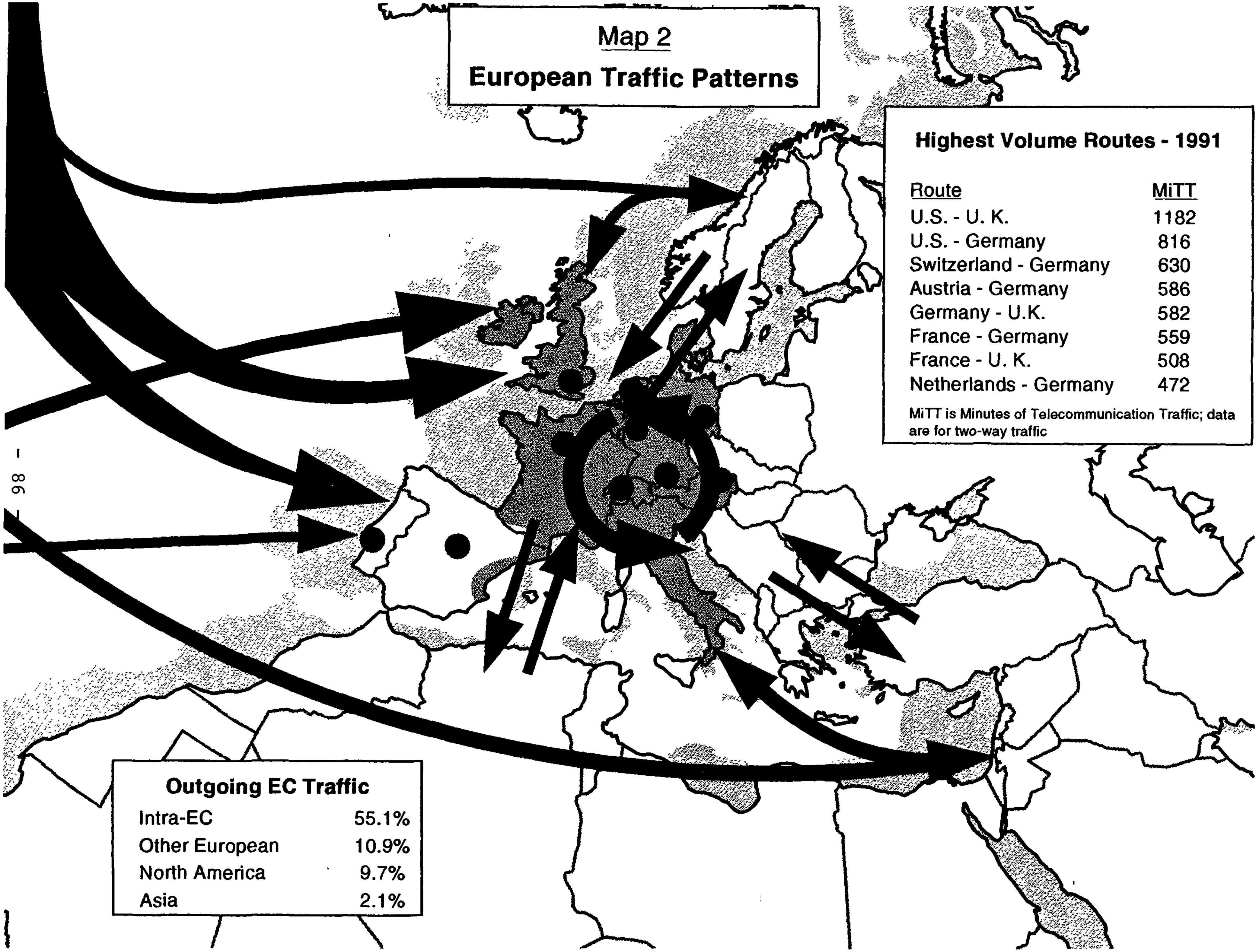
*MiTT	1989	1990	1991
Total In / Out	N/A	N/A	N/A
Incoming	N/A	N/A	N/A
Outgoing	N/A	85.3	N/A
Surplus / (Deficit)	N/A	N/A	N/A

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

EUROPEAN TRAFFIC

TABLES

Map 2
European Traffic Patterns



Highest Volume Routes - 1991

Route	MiTT
U.S. - U. K.	1182
U.S. - Germany	816
Switzerland - Germany	630
Austria - Germany	586
Germany - U.K.	582
France - Germany	559
France - U. K.	508
Netherlands - Germany	472

MiTT is Minutes of Telecommunication Traffic; data are for two-way traffic

Outgoing EC Traffic

Intra-EC	55.1%
Other European	10.9%
North America	9.7%
Asia	2.1%

Table 17

Belgium
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Morocco	5.2	0.6%
Denmark	7.1	0.9%
Greece	7.5	0.9%
Turkey	7.6	0.9%
Portugal	8.3	1.0%
Sweden	10.7	1.3%
Switzerland	22.2	2.7%
Spain	23.4	2.8%
U.S.	29.6	3.6%
Luxembourg	30.5	3.7%
Italy	43.2	5.3%
U.K.	75.3	9.2%
Germany	109.5	13.3%
Netherlands	168.7	20.5%
France	202.5	24.6%
Other	71.4	8.7%

National Traffic Balance

*MiTT	1989	1990	1991
Total In / Out	1310.0	1485.4	1571.2
Incoming	666.1	754.1	748.5
Outgoing	643.9	731.3	822.7
Surplus / (Deficit)	22.2	22.8	(74.2)

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

Table 18

Denmark
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Austria	3.7	0.9%
Turkey	4.6	1.2%
Poland	5.3	1.3%
Belgium	7.8	2.0%
Spain	8.2	2.1%
Finland	8.3	2.1%
Switzerland	9.0	2.3%
Italy	9.8	2.5%
Netherlands	15.0	3.8%
France	18.0	4.6%
U.S.	19.6	5.0%
Norway	41.8	10.6%
U.K.	43.3	11.0%
Germany	69.4	17.6%
Sweden	73.0	18.5%
Other	57.8	14.7%

National Traffic Balance

*MiTT	1989	1990	1991
Total In / Out	634.4	705.5	791.7
Incoming	311.0	343.2	397.2
Outgoing	323.4	362.3	394.5
Surplus / (Deficit)	(12.4)	(19.1)	2.7

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

Table 19

France
Largest Telecommunication Routes (1991)

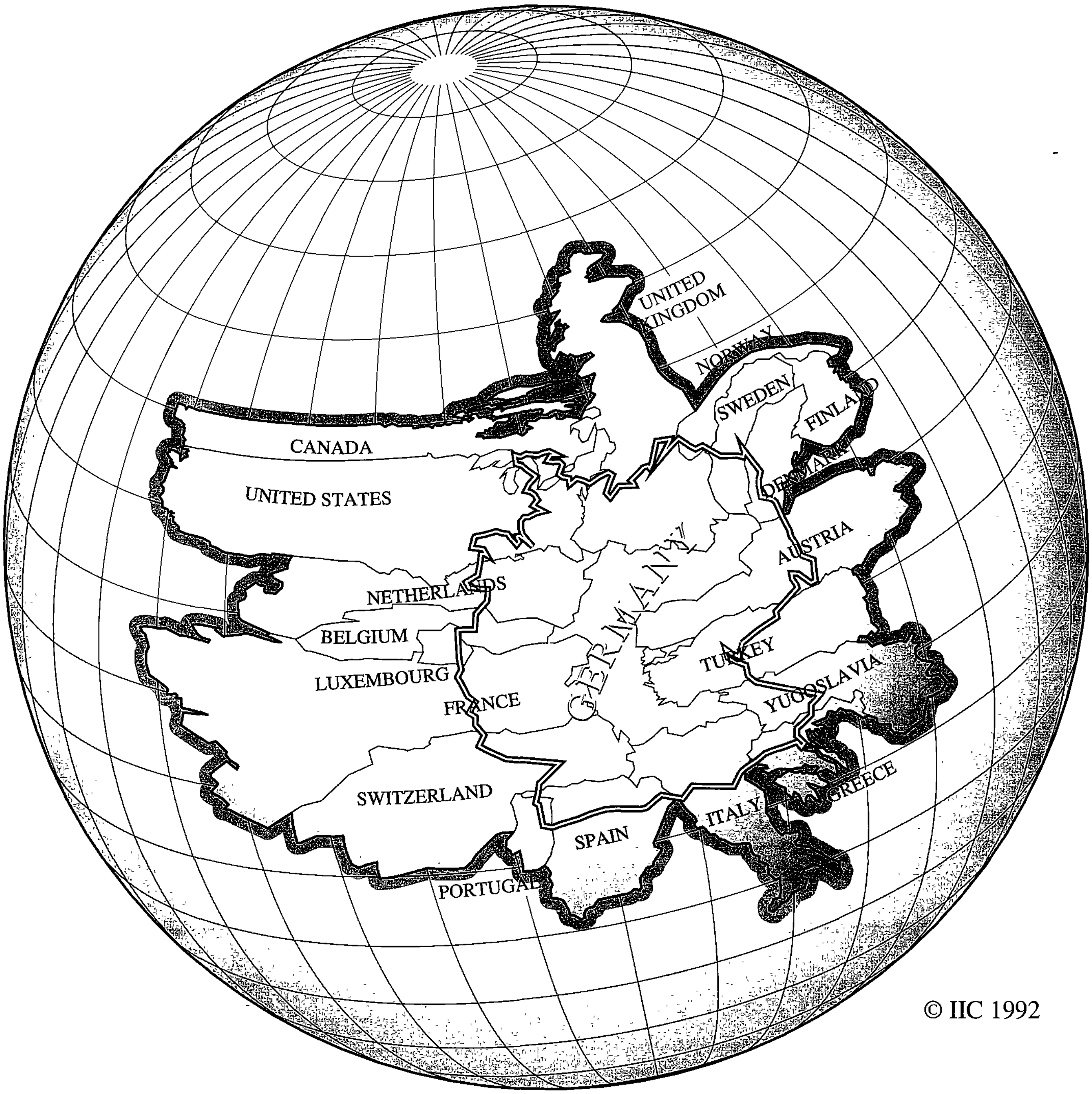
Destination	*MiTT	Percent of Outgoing Traffic
Sweden	20.7	0.9%
Canada	28.6	1.2%
Turkey	29.9	1.3%
Tunisia	35.6	1.6%
Morocco	51.1	2.2%
Algeria	51.5	2.2%
Netherlands	75.4	3.3%
Portugal	105.2	4.6%
Switzerland	135.0	5.9%
U.S.	141.0	6.1%
Spain	141.7	6.2%
Belgium	179.1	7.8%
Italy	203.0	8.8%
U.K.	257.8	11.2%
Germany	264.5	11.5%
Other	574.9	25.1%

National Traffic Balance

*MiTT	1988	1990	1991
Total In / Out	3210.0	4309.0	4650.0
Incoming	1640.0	2183.0	2355.0
Outgoing	1570.0	2126.0	2295.0
Surplus / (Deficit)	70.0	57.0	60.0

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

The German Telecontinent



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

The German TeleContinent: Data Base For Map

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

* *MiTT is Minutes of Telecommunications Traffic. Data are for public voice circuits only in 1991 rounded to the nearest percent.*

Map Concept: Gregory C. Staple and Evelyn M. Aswad.
Illustration: Maryland CartoGraphics

Table 20

Germany
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Luxembourg	29.0	.8%
Portugal	31.0	.9%
Sweden	60.0	1.7%
Denmark	69.0	1.9%
Greece	78.0	2.2%
Spain	108.0	3.0%
Belgium	108.0	3.0%
Yugoslavia	152.0	4.3%
U.S.	231.0	6.5%
Netherlands	234.0	6.6%
Italy	266.0	7.4%
Turkey	270.0	7.6%
U.K.	276.0	7.8%
France	295.0	8.3%
Switzerland	298.0	8.4%
Austria	309.0	8.7%
Other	743.0	20.9%

National Traffic Balance

*MiTT	1988	1990	1991
Total In / Out	4559.0	N/A	N/A
Incoming	2080.0	N/A	N/A
Outgoing	2479.0	3145.0	3557.4
Surplus / (Deficit)	(399.0)	N/A	N/A

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits.
Traffic orginated in the former East Germany is not included.

Table 21

Greece
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Canada	4.1	1.7%
Sweden	4.4	1.8%
Austria	4.5	1.8%
Turkey	4.5	1.8%
Yugoslavia	5.0	2.0%
Australia	5.2	2.1%
Netherlands	6.9	2.8%
Belgium	7.4	3.0%
Switzerland	7.8	3.2%
Cyprus	10.9	4.4%
France	15.2	6.2%
U.S.	21.4	8.7%
Italy	22.0	9.0%
U.K.	33.5	13.7%
Germany	54.8	22.4%
Other	37.4	15.3%

National Traffic Balance

*MiTT	1989	1990	1991
Total In / Out	N/A	N/A	565.1
Incoming	N/A	N/A	320.1
Outgoing	191.7	213.3	245.0
Surplus / (Deficit)	N/A	N/A	75.1

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

Table 22

Ireland
Largest Telecommunication Routes (1991FY)

Destination	*MiTT	Percent of Outgoing Traffic
Hong Kong	0.5	0.2%
Japan	0.8	0.3%
Sweden	1.3	0.5%
Denmark	1.6	0.6%
Switzerland	2.0	0.7%
Australia	2.6	1.0%
Canada	3.0	1.1%
Italy	3.3	1.2%
Belgium	3.3	1.2%
Spain	3.6	1.3%
Netherlands	5.1	1.9%
France	9.2	3.4%
Germany	11.0	4.0%
U.S.	26.2	9.6%
U.K.	190.0	69.5%
Other	9.9	3.6%

National Traffic Balance

*MiTT	1989FY	1990FY	1991FY
Total In / Out	174.0	197.3	223.8
Incoming	107.0	122.2	140.4
Outgoing	67.0	75.1	83.4
Surplus / (Deficit)	40.0	47.1	57.0

Note: Traffic balance data exclude the U.K.

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

Table 23

Italy
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Sweden	11.1	0.9%
Brazil	12.5	1.0
Tunisia	13.2	1.1%
Canada	15.9	1.3%
Greece	18.9	1.5%
Netherlands	28.6	2.3%
Yugoslavia	32.7	2.7%
Austria	35.2	2.9%
Belgium	40.1	3.3%
Spain	48.3	4.0%
U.K.	105.8	8.7%
U.S.	110.0	9.0%
Switzerland	135.8	11.1%
France	189.1	15.5%
Germany	200.1	16.4%
Other	222.2	18.2%

National Traffic Balance

*MiTT	1988	1990	1991
Total In / Out	1860	N/A	N/A
Incoming	1075	N/A	N/A
Outgoing	785.0	1043.1	1219.5
Surplus / (Deficit)	290	N/A	N/A

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

Table 24

Luxembourg
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Japan	0.7	0.4%
Greece	1.1	0.7%
Austria	1.5	0.9%
Sweden	1.8	1.1%
Spain	2.6	1.6%
Denmark	3.2	1.9%
U.S.	3.8	2.3%
Switzerland	5.3	3.2%
Netherlands	6.2	3.8%
Italy	8.2	5.0%
Portugal	10.1	6.1%
U.K.	10.4	6.3%
France	32.0	19.4%
Germany	32.9	19.9%
Belgium	38.0	23.0%
Other	7.3	4.4%

National Traffic Balance

*MiTT	1989	1990	1991
Total In / Out	224.5	N/A	N/A
Incoming	95.0	N/A	N/A
Outgoing	129.5	150.6	165.3
Surplus / (Deficit)	(34.5)	N/A	N/A

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

Table 25

Netherlands
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Yugoslavia	8.0	0.8%
Norway	9.8	1.0%
Canada	11.6	1.1%
Denmark	15.1	1.5%
Austria	15.2	1.5%
Sweden	16.4	1.6%
Turkey	25.5	2.5%
Spain	25.8	2.5%
Switzerland	28.6	2.8%
Italy	32.7	3.2%
U.S.	65.0	6.4%
France	76.7	7.5%
U.K.	135.7	13.3%
Belgium	171.7	16.9%
Germany	238.1	23.4%
Other	141.9	13.9%

National Traffic Balance

*MiTT	1988	1990	1991
Total In / Out	1282.6	1757.0	N/A
Incoming	576.6	851.8	N/A
Outgoing	706.0	905.2	1017.7
Surplus / (Deficit)	(129.4)	(53.4)	N/A

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

Table 26

Portugal
Largest Telecommunication routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Guinea-Bissau	1.7	0.9%
Denmark	2.5	1.3%
Canada	3.1	1.7%
Sweden	3.2	1.7%
Angola	3.4	1.8%
Netherlands	6.4	3.4%
Belgium	7.0	3.7%
Brazil	7.4	3.9%
Italy	7.8	4.2%
U.S.	8.5	4.5%
Switzerland	11.7	6.2%
Germany	19.5	10.4%
U.K.	24.6	13.1%
Spain	26.6	14.2%
France	36.6	19.5%
Other	17.0	9.1%

National Traffic Balance

*MiTT	1989	1990	1991
Total In / Out	396.0	482.4	571.0
Incoming	270.0	325.9	384.0
Outgoing	126.0	156.5	187.0
Surplus / (Deficit)	144.0	169.4	197.0

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

Table 27

Spain
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Colombia	6.1	0.8%
Mexico	6.5	0.9%
Venezuela	6.6	0.9%
Ireland	7.2	1.0%
Denmark	7.6	1.1%
Israel	9.1	1.3%
Argentina	13.6	1.9%
Belgium	25.0	3.5%
Portugal	27.4	3.8%
Netherlands	28.8	4.0%
U.S.	46.5	6.5%
Italy	47.2	6.6%
Germany	102.9	14.3%
U.K.	106.1	14.8%
France	129.8	18.1%
Other	148.3	20.6%

National Traffic Balance

*MiTT	1989	1990	1991
Total In / Out	1077.0	1264.0	1455.6
Incoming	551.1	653.0	736.9
Outgoing	525.9	611.0	718.7
Surplus / (Deficit)	25.2	42.0	18.2

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

Table 28

United Kingdom
Largest Telecommunication Routes (1991FY)

Destination	*MiTT	Percent of Outgoing Traffic
Portugal	33.0	1.2%
South Africa	37.0	1.4%
Hong Kong	37.0	1.4%
Denmark	42.0	1.6%
Japan	42.0	1.6%
India	43.0	1.6%
Greece	46.0	1.7%
Norway	48.0	1.8%
Sweden	49.0	1.8%
Belgium	76.0	2.8%
Switzerland	80.0	3.0%
Canada	81.0	3.0%
Australia	84.0	3.1%
Spain	114.0	4.2%
Netherlands	115.0	4.3%
Italy	129.0	4.8%
Ireland	187.0	6.9%
France	250.0	9.3%
Germany	306.0	11.4%
U.S.	522.0	19.4%
Other	371.0	13.8%

National Traffic Balance

*MiTT	1989FY	1990FY	1991FY
Total In / Out	4583.0	N/A	N/A
Incoming	2330.0	N/A	N/A
Outgoing	2253.0	N/A	2692.0
Surplus / (Deficit)	(77)	N/A	N/A

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

Table 29a

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

	OUTGOING MiTT (X10^6)*															
INCOMING MiTT		B	D	FRG	G	S	F	IR	IT	L	N	P	U.K.		Total		Surplus (Deficit)
	BELGIUM	--	8	108	7	25	179	3	40	38	172	6	76		662		(30)
	DENMARK	7	--	69	4	7	19	2	8	3	15	2	42		178		(1)
	GERMANY	110	69	--	55	103	265	11	200	33	238	10	306		1400		(107)
	GREECE	8	2	78	--	3	15	--	19	1	7	2	46		181		25
	SPAIN	30	8	108	4	--	142	4	48	3	25	14	114		500		15
	FRANCE	203	18	295	15	130	--	9	183	32	77	37	250		1249		(38)
	IRELAND	4	2	12	3	7	11	--	4	1	7	2	187		240		13
	ITALY	48	10	267	22	47	202	3	--	8	33	4	129		773		124
	LUXEMBOURG	30	2	29	3	1	16	0	5	--	6	2	10		104		(41)
	NETHERLANDS	169	15	234	7	29	75	5	29	6	--	4	115		688		(35)
	PORTUGAL	8	2	31	3	27	105	0	7	10	7	--	33		233		137
	UNITED KINGDOM	75	43	276	33	106	258	190	106	10	136	13	--		1246		(62)
	TOTAL EC	692	179	1507	156	485	1287	227	649	145	723	96	1308		7454		

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

Table 29b

Cross-Border Traffic Between the Nations Of The European Communities: A Statistical Matrix (1990)

O U T G O I N G M i T T (X10⁶)*

		B	D	FRG	G	S	F	IR	IT	L	N	P	U.K.	Total	Surplus (Deficit)
I															
N	BELGIUM	--	7	98	6	22	186	3	34	34	154	5	60	609	(2)
C	DENMARK	6	--	60	3	9	15	1	6	3	14	2	40	159	(13)
O	GERMANY	100	63	--	48	93	265	9	176	31	218	16	250	1269	(116)
M	GREECE	7	3	70	--	3	16	--	16	1	6	2	25	149	14
I	SPAIN	20'	8	102	3	--	132	3	40	2	22	21	100	453	8
N	FRANCE	185	17	271	14	119	--	8	165	29	69	33	230	1140	(93)
G	IRELAND	4	3	10	2	7	12	--	3	1	6	2	180	230	11
	ITALY	38	9	248	20	45	192	3	--	8	30	6	100	699	129
M	LUXEMBOURG	27	3	28	2	3	13	0	5	--	5	2	10	98	(35)
I	NETHERLANDS	151	14	213	6	25	70	5	25	6	--	5	110	630	(24)
T	PORTUGAL	7	3	25	2	21	95	0	5	8	6	--	20	192	78
T	UNITED KINGDOM	66	42	260	29	98	237	187	95	10	124	20	--	1168	43
	TOTAL EC	611	172	1385	135	445	1233	219	570	133	654	114	1125	6796	

* MiTT is Minutes of Telecommunication Traffic. Matrix shows millions of MiTT. Data based on survey of operators and are for public voice circuits only. U.K. and Ireland outgoing traffic are for 1990 FY ending 31 March 1991.

Table 29c

Cross-Border Traffic Between the Nations Of The European Communities: A Statistical Matrix (1989)

		O	U	T	G	O	I	N	G		M	i	T	T	(x10⁶)*	
I		B	D	FRG	G	S	F	IR	IT	L	N	P	U.K.		Total	Surplus (Deficit)
N	BELGIUM	--	6	89	6	21	158	3	32	30	136	4	55		540	0
C	DENMARK	5	--	59	2	7	11	1	8	3	12	1	34		143	(11)
O	GERMANY	88	59	--	44	85	233	8	165	27	197	13	221		1140	(148)
M	GREECE	4	2	57	--	2	13	0	15	1	6	1	23		124	0
I	SPAIN	18	7	110	2	--	119	2	32	2	20	16	74		402	8
N	FRANCE	165	15	249	15	103	--	7	143	25	62	27	209		1020	(57)
G	IRELAND	3	2	11	1	5	10	--	2	1	5	1	162		203	18
	ITALY	34	8	233	21	38	170	2	--	7	26	4	86		629	113
M	LUXEMBOURG	24	2	27	1	2	11	0	7	--	4	1	9		88	(28)
I	NETHERLANDS	136	12	193	5	22	62	4	22	5	--	4	99		564	(19)
T	PORTUGAL	5	2	20	1	17	85	0	4	6	5	--	16		161	73
T	UNITED KINGDOM	58	39	240	26	92	205	158	86	9	110	16	--		1039	51
	TOTAL EC	540	154	1288	124	394	1077	185	516	116	583	88	988		6053	

* MiTT is Minutes of Telecommunication Traffic. Matrix shows millions of MiTT. Data based on survey of operators and IIC estimates. Data are for public voice circuits only.

Table 30

Austria
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Spain	5.5	0.9%
Belgium	6.6	1.0%
Sweden	7.1	1.1%
Poland	13.7	2.1%
Netherlands	16.5	2.6%
France	17.8	2.8%
Turkey	18.6	2.9%
Czechoslovakia	18.8	2.9%
U.S.	20.1	3.1%
Hungary	20.6	3.2%
U.K.	20.9	3.2%
Italy	36.6	5.7%
Switzerland	51.2	8.0%
Yugoslavia	54.0	8.4%
Germany	277.4	43.2%
Other	56.5	8.8%

National Traffic Balance

*MiTT	1988	1990	1991
Total In / Out	N/A	1071.9	1215.9
Incoming	N/A	513.3	574.0
Outgoing	401.0	558.6	641.9
Surplus / (Deficit)	N/A	(45.3)	(67.9)

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

Table 31

Finland
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Spain	4.0	1.9%
Italy	4.0	1.9%
Netherlands	4.0	1.9%
Switzerland	4.0	1.9%
France	6.0	2.8%
Norway	7.0	3.3%
Denmark	7.0	3.3%
U.S.S.R.	12.0	5.6%
U.K.	13.0	6.0%
U.S.	14.0	6.5%
Germany	19.0	8.8%
Sweden	89.0	41.4%
Other	32.0	14.9%

National Traffic Balance

*MiTT	1986	1990	1991
Total In / Out	N/A	400.0	N/A
Incoming	N/A	213.0	N/A
Outgoing	N/A	187.0	215.0
Surplus / (Deficit)	N/A	26.0	N/A

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

Table 32

Hungary
Largest Telecommunication Routes (1990)

Destination	*MiTT	Percent of Outgoing Traffic
Canada	2.0	1.6%
Netherlands	2.8	2.3%
Poland	3.1	2.5%
Yugoslavia	3.4	2.8%
Sweden	3.7	3.0%
France	3.8	3.1%
Czechoslovakia	4.2	3.4%
U.S.S.R.	4.5	3.7%
Switzerland	4.7	3.9%
U.K.	5.2	4.3%
Romania	5.7	4.7%
Italy	6.0	4.9%
U.S.	7.1	5.8%
Austria	17.3	14.2%
Germany, FR	31.6	25.9%
Other	16.8	13.8%

National Traffic Balance

*MiTT	1986	1990	1991
Total In / Out	N/A	231.3	N/A
Incoming	N/A	109.4	N/A
Outgoing	N/A	121.9	N/A
Surplus / (Deficit)	N/A	(12.5)	N/A

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

Table 33

Sweden
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Netherlands	12.0	1.8%
Italy	13.0	2.0%
Switzerland	16.0	2.4%
France	21.0	3.2%
U.S.	52.0	7.9%
U.K.	54.0	8.2%
Germany	67.0	10.2
Denmark	81.0	12.3%
Norway	92.0	14.0%
Finland	94.0	14.3%
Other	157.0	23.8%

National Traffic Balance

	1989	1990	1991
*MiTT	N/A	N/A	N/A
Incoming	N/A	N/A	N/A
Outgoing	545.0	616.0	659.0
Surplus / (Deficit)	N/A	N/A	N/A

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

Table 34

Switzerland
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Czechoslovakia	9.6	0.7%
Canada	11.1	0.8%
Sweden	15.3	1.1%
Belgium	25.7	1.8%
Turkey	31.0	2.2%
Netherlands	34.5	2.4%
Spain	51.1	3.6%
Portugal	54.9	3.8%
Austria	59.6	4.2%
U.S.	62.6	4.4%
Yugoslavia	70.1	4.9%
U.K.	79.0	5.5%
Italy	216.4	15.1%
France	240.7	16.8%
Germany	331.6	23.2%
Other	136.1	9.5%

National Traffic Balance

*MITT	1989	1990	1991
Total In / Out	2074.1	2372.0	2553.4
Incoming	892.0	1015.7	1124.0
Outgoing	1182.1	1356.3	1429.4
Surplus / (Deficit)	(290.1)	(340.6)	(305.4)

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

Table 35

Israel
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Argentina	1.5	1.1%
Romania	1.8	1.3%
Turkey	2.0	1.4%
South Africa	2.5	1.8%
Australia	2.5	1.8%
Belgium	3.5	2.5%
Netherlands	3.6	2.6%
Switzerland	4.2	3.0%
Canada	4.2	3.0%
Italy	4.9	3.5%
U.S.S.R.	5.9	4.2%
Germany	9.9	7.1%
France	11.0	7.9%
U.K.	14.2	10.2%
U.S.	46.1	33.1%
Other	22.0	15.8%

National Traffic Balance

*MiTT	1988	1990	1991
Total In / Out	139.0	320	386.4
Incoming	98.0	202	247.0
Outgoing	41.0	118	139.4
Surplus / (Deficit)	57.0	84	107.6

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

Table 36

Saudi Arabia
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Germany	7.3	1.8%
Sudan	7.8	1.9%
Syria	7.9	1.9%
France	9.3	2.3%
Turkey	9.8	2.4%
Bahrain	11.4	2.8%
Philippines	13.5	3.3%
Jordan	13.9	3.4%
Yemen	16.2	3.9%
UAE	18.3	4.5%
India	19.7	4.8%
U.K.	22.5	5.5%
Pakistan	38.9	9.5%
U.S.	40.7	9.9%
Egypt	103.7	25.3%
Other	69.7	17.0%

National Traffic Balance

*MiTT	1986	1990	1991
Total In/out	N/A	N/A	677.3
Incoming	N/A	N/A	266.7
Outgoing	N/A	N/A	410.6
Surplus/(Deficit)	N/A	N/A	(143.9)

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

Table 37

Turkey
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Saudi Arabia	2.8	1.4%
Romania	2.9	1.5%
Iran	3.0	1.5%
Greece	3.2	1.6%
Bulgaria	3.4	1.7%
Belgium	3.8	1.9%
Australia	3.9	2.0%
Austria	5.9	3.0%
Italy	6.2	3.1%
Switzerland	7.9	4.0%
Netherlands	8.9	4.5%
U.S.	12.3	6.2%
France	12.4	6.3%
U.K.	17.4	8.8%
Germany	78.5	39.6%
Other	25.5	12.9%

National Traffic Balance

*MiTT	1986	1990	1991
Total In / Out	N/A	559.7	668.1
Incoming	N/A	441.2	470.0
Outgoing	N/A	158.5	198.1
Surplus / (Deficit)	N/A	282.7	271.9

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

Table 38

South Africa
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Switzerland	3.4	1.7%
France	3.6	1.8%
Italy	3.7	1.8%
Portugal	3.8	1.9%
Israel	3.9	1.9%
Mozambique	6.3	3.1%
Lesotho	6.7	3.3%
Australia	6.9	3.4%
Swaziland	9.5	4.7%
Germany	10.9	5.4%
Botswana	11.3	5.6%
U.S.	16.5	8.1%
Zimbabwe	17.8	8.8%
Namibia	27.2	13.4%
U.K.	32.7	16.1%
Other	38.2	18.9%

National Traffic Balance

*MiTT	1986	1990	1991
Total In / Out	N/A	N/A	N/A
Incoming	N/A	N/A	N/A
Outgoing	N/A	N/A	202.6
Surplus / Deficit	N/A	N/A	N/A

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

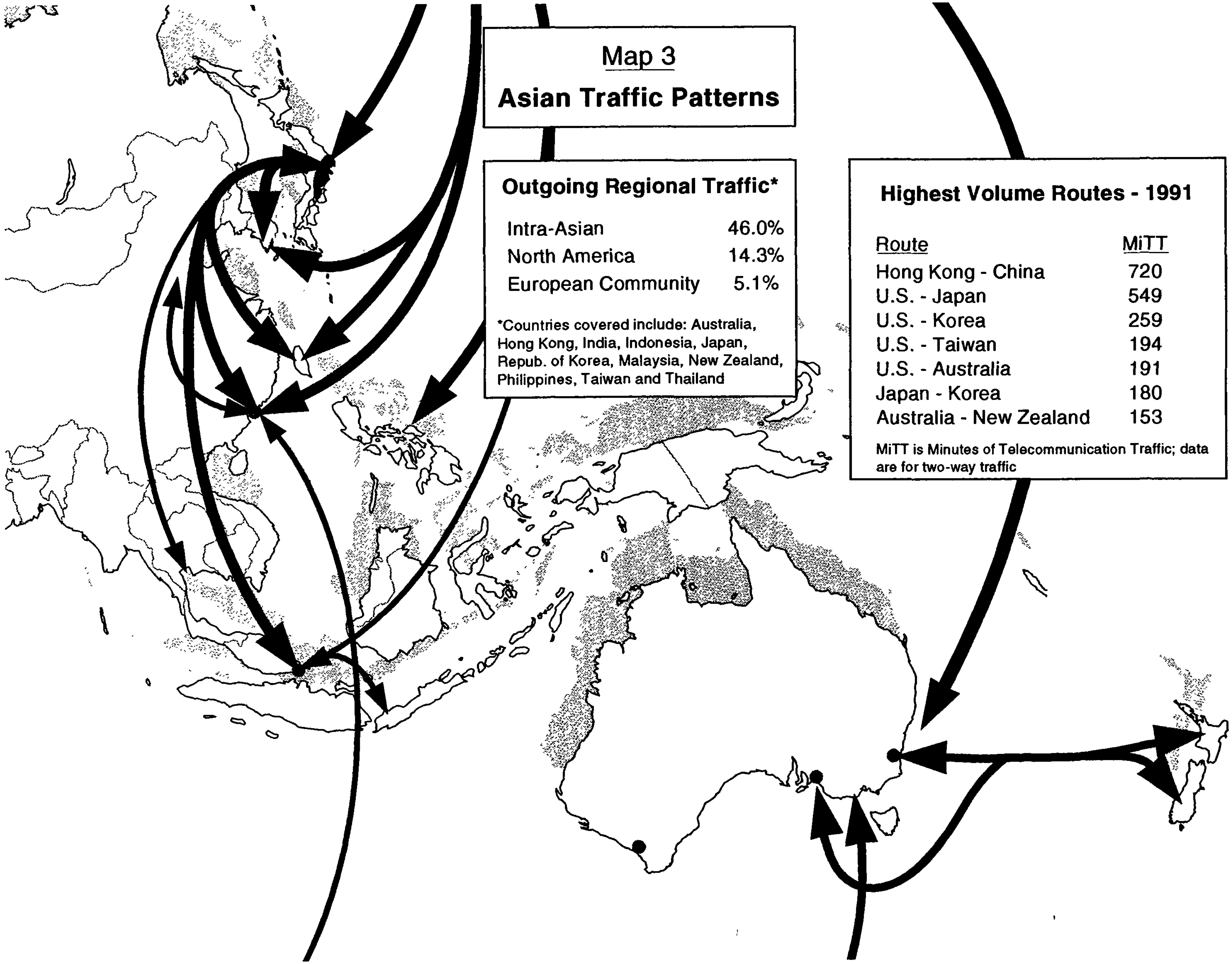

Map 3
Asian Traffic Patterns
Outgoing Regional Traffic*
Intra-Asian 46.0%
North America 14.3%
European Community 5.1%
*Countries covered include: Australia, Hong Kong, India, Indonesia, Japan, Repub. of Korea, Malaysia, New Zealand, Philippines, Taiwan and Thailand
Highest Volume Routes - 1991
Route MiTT
Hong Kong - China 720
U.S. - Japan 549
U.S. - Korea 259
U.S. - Taiwan 194
U.S. - Australia 191
Japan - Korea 180
Australia - New Zealand 153
MiTT is Minutes of Telecommunication Traffic; data are for two-way traffic

Table 39

Australia
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
PNG	10.0	1.6%
Canada	15.0	2.5%
Germany	16.0	2.6%
Italy	18.0	3.0%
Singapore	18.0	3.0%
Hong Kong	26.0	4.3%
Japan	29.0	4.8%
New Zealand	85.0	13.9%
U.S.	92.0	15.1%
U.K.	103.0	16.9%
Other	198.0	32.5%

National Traffic Balance

*MiTT	1988FY	1990FY	1991
Total In / Out	744.6	1013.7	N/A
Incoming	330.1	439.0	N/A
Outgoing	414.5	574.7	610.0
Surplus / (Deficit)	(84.4)	(135.7)	N/A

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

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

Table 40

China
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Canada	2.0	0.3%
Germany	3.0	0.5%
Australia	3.0	0.5%
Singapore	4.0	0.7%
Korea	5.0	0.8%
U.S.	17.0	2.9%
Taiwan	25.0	4.2%
Macao	30.0	5.1%
Japan	40.0	6.7%
Hong Kong	340.0	57.2%
Other	125.0	21.0%

National Traffic Balance

*MiTT	1988	1990	1991
Total In / Out	N/A	N/A	N/A
Incoming	N/A	N/A	N/A
Outgoing	N/A	N/A	594.0
Surplus / (Deficit)	N/A	N/A	N/A

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

Table 41

Hong Kong
Largest Telecommunication Routes (1991FY)

Destination	*MiTT	Percent of Outgoing Traffic
Australia	30.0	3.3%
Macao	35.0	3.8%
Canada	35.0	3.8%
U.K.	40.0	4.4%
Japan	45.0	4.9%
Taiwan	60.0	6.6%
U.S.	75.0	8.2%
China	380.0	41.6%
Other	213.0	23.3%

National Traffic Balance

*MITT	1986FY	1990FY	1991FY
Total In / Out	342.0	1375.0	1696.0
Incoming	182.0	646.0	783.0
Outgoing	160.0	729.0	913.0
Surplus / (Deficit)	22.0	(83.0)	(130.0)

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

Table 42

India
Largest Telecommunication Routes (1991FY)

Destination	*MiTT	Percent of Outgoing Traffic
Japan	3.3	1.8%
Australia	3.3	1.8%
Hong Kong	4.2	2.3%
Germany	4.8	2.6%
Canada	5.5	3.0%
Singapore	5.6	3.0%
U.K.	18.5	10.0%
UAE	19.1	10.3%
Saudi Arabia	26.9	14.5%
U.S.	42.4	22.8%
Other	52.2	28.1%

National Traffic Balance

*MiTT	1986FY	1988FY	1991FY
Total In / Out	N/A	235.3	N/A
Incoming	N/A	144.6	N/A
Outgoing	N/A	90.7	185.8
Surplus / (Deficit)	N/A	53.9	N/A

*MiTT is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits
and exclude traffic to Pakistan.

Table 43

Indonesia
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Thailand	1.3	1.3%
Philippines	1.5	1.5%
Italy	1.7	1.7%
France	2.1	2.1%
Netherlands	2.8	2.8%
Germany	3.1	3.1%
Malaysia	3.6	3.6%
U.K.	4.1	4.1%
Republic of Korea	4.2	4.2%
Taiwan	5.3	5.3%
Hong Kong	7.4	7.4%
Australia	8.2	8.2%
Japan	11.5	11.5%
U.S.	12.0	12.0%
Singapore	24.4	24.4%
Other	6.8	6.8%

National Traffic Balance

*MiTT	1986	1990	1991
Total In / Out	N/A	N/A	235.7
Incoming	N/A	N/A	135.7
Outgoing	N/A	N/A	100.0
Surplus / (Deficit)	N/A	N/A	35.7

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

Table 44

Japan
Largest Telecommunication Routes (1990FY)

Destination	*MiTT	Percent of Outgoing Traffic
Netherlands	4.9	0.5%
Switzerland	6.0	0.6%
Italy	7.7	0.8%
Pakistan	9.7	1.0%
Indonesia	10.2	1.1%
Canada	11.9	1.3%
Malaysia	15.6	1.7%
France	16.5	1.8%
Brazil	20.3	2.2%
Australia	20.7	2.2%
Germany	21.8	2.3%
Singapore	24.2	2.6%
Thailand	29.4	3.1%
Hong Kong	34.4	3.7%
U.K.	39.3	4.2%
China	39.8	4.2%
Philippines	63.2	6.7%
Taiwan	67.3	7.2%
Republic of Korea	113.2	12.1%
U.S.	210.8	22.5%
Other	170.1	18.2%

National Traffic Balance

*MiTT	1989FY	1990FY	1991FY
Total In / Out	1355.0	1684.0	N/A
Incoming	654.0	747.0	N/A
Outgoing	701.0	937.0	1153
Surplus / (Deficit)	(47.0)	(190.0)	N/A

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

The Japanese Telecontinent

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

The Japanese TeleContinent: Data Base For Map

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

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

Map Concept: Gregory C. Staple and Evelyn M. Aswad.
Illustration: Maryland CartoGraphics

Table 45

Republic of Korea
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Thailand	2.3	1.0%
Italy	2.3	1.0%
Philippines	3.3	1.4%
France	3.9	1.7%
Canada	4.0	1.7%
Indonesia	4.3	1.9%
Singapore	4.4	1.9%
Australia	4.6	2.0%
China	5.2	2.3%
U.K.	5.5	2.4%
Taiwan	6.3	2.7%
Germany	6.9	3.0%
Hong Kong	11.7	5.1%
Japan	66.5	29.0%
U.S.	75.2	32.8%
Other	22.6	9.9%

National Traffic Balance

*MiTT	1988	1990	1991
Total In / Out	361.4	538.3	654.3
Incoming	230.3	350.2	425.1
Outgoing	131.1	188.1	229.2
Surplus / (Deficit)	99.2	162.1	195.9

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

Table 46

Malaysia
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
New Zealand	1.2	1.2%
Brunei	1.5	1.5%
Canada	2.0	2.0%
Germany	2.2	2.2%
Republic of Korea	2.4	2.4%
Philippines	2.5	2.5%
India	3.4	3.4%
Indonesia	4.4	4.4%
Thailand	6.6	6.7%
Taiwan	8.3	8.4%
Hong Kong	8.9	9.0%
U.K.	9.7	9.8%
U.S.	10.1	10.2%
Australia	10.2	10.3%
Japan	14.3	14.4%
Other	11.5	11.6%

National Traffic Balance

*MiTT	1986	1990	1991
Total In / Out	N/A	180.7	N/A
Incoming	N/A	100.7	N/A
Outgoing	N/A	80.0	99.2
Surplus / (Deficit)	N/A	20.7	N/A

***MiTT** is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits
and exclude traffic to Singapore.

Table 47

New Zealand
Largest Telecommunication Routes (1991FY)

Destination	*MiTT	Percent of Outgoing Traffic
W. Samoa	1.0	0.7%
Germany	2.0	1.4%
Singapore	3.0	2.1%
Japan	3.0	2.1%
Hong Kong	3.0	2.1%
Canada	3.0	2.1%
Figi	4.0	2.8%
U.K.	16.0	11.0%
U.S.	16.0	11.0%
Australia	68.0	46.9%
Other	26.0	17.9%

National Traffic Balance

*MiTT	1986FY	1990FY	1991FY
Total In / Out	N/A	N/A	N/A
Incoming	N/A	N/A	N/A
Outgoing	N/A	134.0	145.0
Surplus / (Deficit)	N/A	N/A	N/A

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

Table 48

Philippines
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
Germany	1.2	0.9%
Malaysia	1.3	1.0%
Italy	1.5	1.2%
Thailand	2.0	1.6%
U.K.	2.4	1.9%
Rep. of Korea	2.7	2.1%
Saudi Arabia	3.5	2.7%
Singapore	3.8	3.0%
Taiwan	3.8	3.0%
Australia	5.5	4.3%
Canada	5.9	4.6%
Hong Kong	11.4	8.9%
Japan	20.3	15.8%
U.S.	56.6	44.0%
Other	6.6	5.1%

National Traffic Balance

*MiTT	1986	1990	1991
Total In / Out	N/A	356.1	513.9
Incoming	N/A	255.4	385.4
Outgoing	N/A	100.7	128.5
Surplus / (Deficit)	N/A	154.7	256.9

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

Table 49

Taiwan
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
France	2.6	1.0%
U.K.	4.1	1.6%
Indonesia	4.5	1.8%
Korea	4.8	1.9%
Australia	4.9	1.9%
Germany	5.2	2.0%
Philippines	5.6	2.2%
Canada	5.7	2.2%
Thailand	6.7	2.6%
Malaysia	7.1	2.8%
Singapore	10.1	4.0%
China	17.1	6.7%
Hong Kong	42.3	16.6%
Japan	48.0	18.8%
U.S.	65.8	25.8%
Other	20.1	7.9%

National Traffic Balance

*MiTT	1988	1990	1991
Total In / Out	N/A	513.0	599.2
Incoming	N/A	301.0	344.5
Outgoing	123.0	212.0	254.7
Surplus/ (Deficit)	N/A	89.0	89.8

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

Table 50

Thailand
Largest Telecommunication Routes (1991)

Destination	*MiTT	Percent of Outgoing Traffic
China	1.6	1.6%
Spain	2.1	1.9%
Republic of Korea	2.1	1.9%
Sweden	2.3	2.1%
France	2.7	2.4%
Germany	3.4	3.1%
Italy	3.8	3.4%
Australia	4.3	3.9%
Taiwan (R.O.C.)	5.8	5.2%
U.K.	6.0	5.4%
Hong Kong	10.5	9.5%
Singapore	12.1	11.0%
United States	19.4	17.6%
Japan	21.8	19.7%
Other	10.9	9.9%

National Traffic Balance

*MiTT	1989	1990	1991
Total In / Out	N/A	N/A	N/A
Incoming	N/A	N/A	N/A
Outgoing	69.7	N/A	110.5
Surplus / (Deficit)	N/A	N/A	N/A

***MiTT** is Minutes of Telecommunications Traffic
Data are in millions of minutes for public voice circuits
and exclude traffic to Malaysia.

METHODOLOGY AND SOURCES

The statistics in this report were primarily compiled by the International Institute of Communications (IIC) from an independent survey of telecommunications service providers. In some cases, traffic data have been estimated based upon annual reports, government publications and industry interviews. The following publications were also consulted: Yearbook of Statistics (ITU, Geneva, 1991); International Fernsprechstatistik (Siemens, Munich, 1992); The World's Telephones January 1990, (AT&T, Indianapolis, IN, 1992); and The World's Telephones January 1989 (AT&T, Indianapolis, IN, 1990).

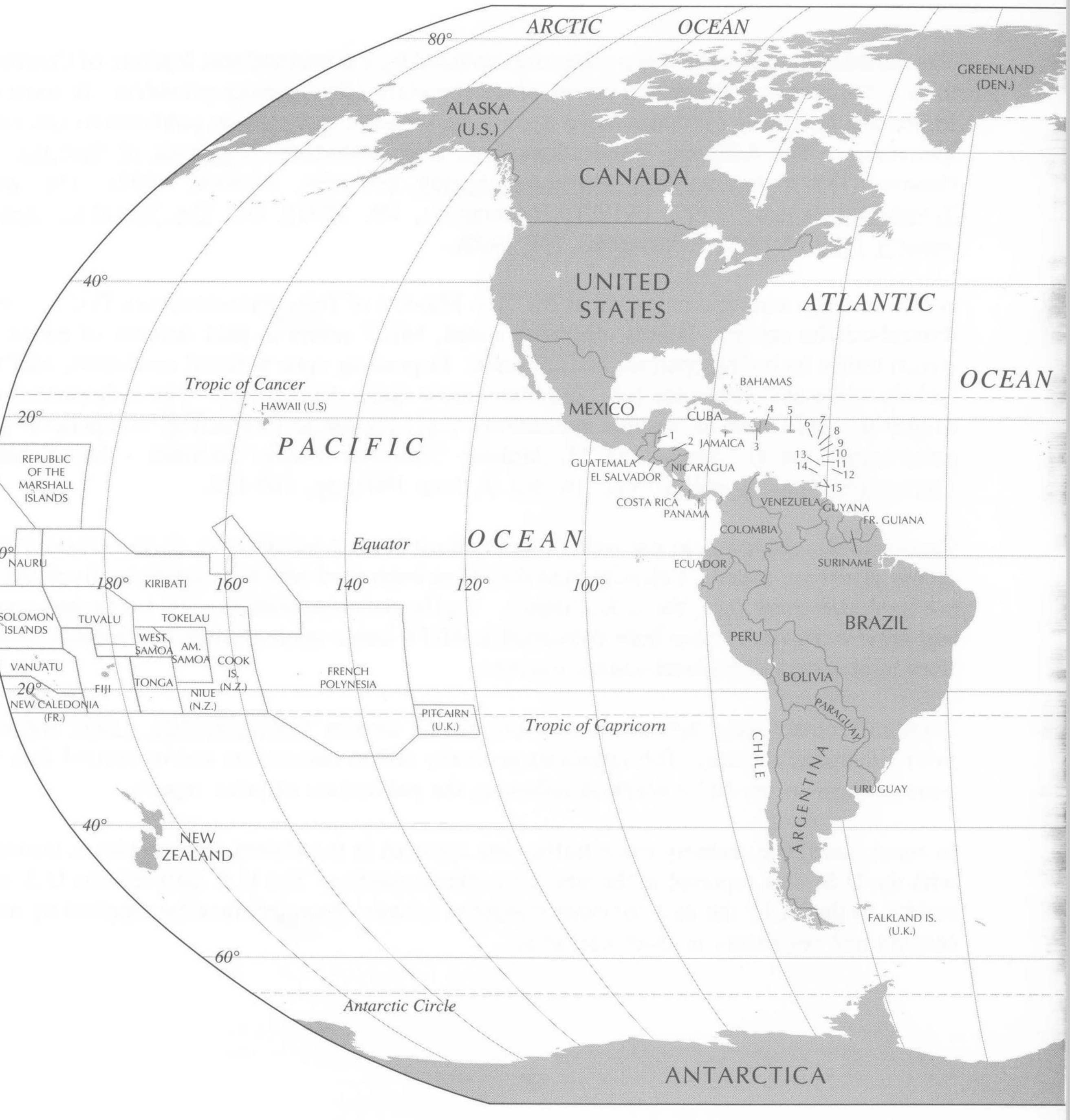
A common accounting unit known as MiTT -- Minutes of Telecommunications Traffic -- is used throughout the report. Unless otherwise stated, MiTT refers to paid minutes of public voice circuit traffic including operator assisted calls. Depending upon national conditions, MiTT may include voice and non-voice (eg., facsimile, slow speed data) traffic. For a discussion of the origins of MiTT and its various applications (eg., economic forecasting, competition policy, geography), see G. Staple and M. Mullins "Telecom Traffic Statistics - MiTT Matter", Telecommunications Policy, Vol. 14, No. 2, June 1989, pp. 105-128.

Carrier traffic statistics do not include traffic from foreign subsidiaries or investment interests, unless otherwise stated. Calendar year data have been used wherever possible; fiscal year data are used elsewhere (eg., the U.K., Japan). Traffic data compiled in calls for certain countries and service providers have been converted to MiTT based upon average call lengths, exchange lines in service and national calling patterns.

Some differences exist between the historic traffic data in TeleGeography - 1992 and data in prior IIC traffic reports. The variations generally reflect corrections and/or revised data which were brought to the IIC's attention following the publication of prior reports.

In some cases, the route-by-route traffic data reported in the United States tables is inconsistent with the U.S. data reported in the tables for other countries. The U.S. data reflects U.S. carrier reports to the FCC; the data for other countries is based upon information supplied by national carriers and regulators in those countries.

A POLITICAL



1. BELIZE
2. HONDURAS
3. HAITI
4. DOMINICAN REPUBLIC
5. PUERTO RICO (U.S.)
6. ST. KITTS-NEVIS
7. ANTIGUA AND BARBUDA
8. GUADELOUPE (FRANCE)
9. DOMINICA
10. MARTINIQUE (FRANCE)
11. ST. LUCIA
12. BARBADOS
13. ST. VINCENT AND THE GRENADINES
14. GRENADA
15. TRINIDAD AND TOBAGO
16. NETHERLANDS
17. BELGIUM
18. LUXEMBOURG
19. SWITZERLAND
20. LIECHTENSTEIN

GEOGRAPHY 1992

21. MONACO
22. VATICAN CITY
23. AUSTRIA
24. CZECHOSLOVAKIA
25. HUNGARY
26. YUGOSLAVIA*
27. ALBANIA
28. CYPRUS
29. LEBANON
30. ISRAEL
31. JORDAN
32. KUWAIT
33. QATAR
34. UNITED ARAB EMIRATES
35. DJIBOUTI
36. TOGO
37. BENIN
38. EQUATORIAL GUINEA
39. SAO TOME AND PRINCIPE
40. RWANDA
41. BURUNDI
42. MOLDOVA
43. GEORGIA
44. ARMENIA
45. AZERBAIJAN
46. UZBEKISTAN
47. TAJIKISTAN
48. KYRGYZSTAN

** In the process of breakup in 1992. The former republics of Slovenia, Croatia, and Bosnia-Hercegovina are now independent.*

NOTES

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