

# SpringerBriefs in Geography

For further volumes:  
<http://www.springer.com/series/10050>

Barney Warf

# Global Geographies of the Internet

 Springer

Barney Warf  
Department of Geography  
University of Kansas  
Lawrence, KS  
USA

ISSN 2211-4165                      ISSN 2211-4173 (electronic)  
ISBN 978-94-007-1244-7            ISBN 978-94-007-1245-4 (eBook)  
DOI 10.1007/978-94-007-1245-4  
Springer Dordrecht Heidelberg New York London

Library of Congress Control Number: 2012941426

© The Author(s) 2013

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Printed on acid-free paper

Springer is part of Springer Science+Business Media ([www.springer.com](http://www.springer.com))

# Contents

<b>1</b>	<b>Introduction</b>	1
1.1	Conceptions and Misconceptions About Information Systems	2
1.2	The Rise of the Networked Society	3
1.3	Outline of This Volume	5
	References	6
<b>2</b>	<b>Origins, Growth, and Geographies of the Global Internet</b>	9
2.1	Fiber Optic Networks and Satellites	9
2.2	Origins and Growth of the Internet	14
2.3	Digital Divides	19
2.4	Regional Geographies of the Global Internet	22
2.4.1	North America	23
2.4.2	Europe	27
2.4.3	Russia	30
2.4.4	Central Asia	31
2.4.5	East Asia	32
2.4.6	Southeast Asia	33
2.4.7	South Asia	35
2.4.8	Arab World	36
2.4.9	Sub-Saharan Africa	37
2.4.10	Latin America and the Caribbean	38
2.5	Conclusions	39
	References	40
<b>3</b>	<b>Global Internet Censorship</b>	45
3.1	Motivations and Mechanisms of Internet Censorship	46
3.2	Regional Configurations of Internet Censorship	50
3.2.1	China	51
3.2.2	Russia, Ukraine, and Belarus	53
3.2.3	South Asia	54

3.2.4	Southeast Asia . . . . .	55
3.2.5	Central Asia . . . . .	57
3.2.6	Middle East . . . . .	59
3.2.7	Subsaharan Africa . . . . .	62
3.2.8	Latin America . . . . .	63
3.2.9	Europe . . . . .	65
3.2.10	United States . . . . .	67
3.3	Discussion: A Habermasian Critique . . . . .	68
3.4	Conclusions . . . . .	70
	References . . . . .	71
<b>4</b>	<b>Global E-Commerce . . . . .</b>	<b>77</b>
4.1	Global Cities and the Limits to the Internet Economy . . . . .	78
4.2	Electronic Funds Transfer Systems . . . . .	81
4.3	Offshore Banking . . . . .	85
4.4	Back Office and Call Center Relocations . . . . .	87
4.5	VOIPocalypse Now . . . . .	89
4.6	E-tailing, Tourism, Distance Learning, and Internet Gambling . . . . .	93
4.7	Regional Geographies of E-Commerce . . . . .	95
4.7.1	North America . . . . .	95
4.7.2	Europe . . . . .	97
4.7.3	Russia . . . . .	99
4.7.4	East Asia . . . . .	100
4.7.5	Southeast Asia . . . . .	101
4.7.6	South Asia . . . . .	102
4.7.7	Latin America . . . . .	103
4.7.8	Middle East . . . . .	104
4.7.9	Sub-Saharan Africa . . . . .	105
4.7.10	Central Asia . . . . .	105
4.7.11	Oceania . . . . .	106
4.8	Conclusions . . . . .	106
	References . . . . .	107
<b>5</b>	<b>Global E-Government . . . . .</b>	<b>115</b>
5.1	A Multiplicity of E-Government Models . . . . .	117
5.2	E-Government and Digital Divides . . . . .	118
5.3	Global Variations in E-government . . . . .	119
5.3.1	North America . . . . .	120
5.3.2	Europe . . . . .	123
5.3.3	East Asia . . . . .	125
5.3.4	Southeast Asia . . . . .	126
5.3.5	South Asia . . . . .	127
5.3.6	Central Asia . . . . .	128

- 5.3.7 Middle East . . . . . 129
- 5.3.8 Sub-Saharan Africa . . . . . 130
- 5.3.9 Latin America . . . . . 130
- 5.3.10 Oceania . . . . . 131
- 5.4 Conclusion . . . . . 132
- References . . . . . 132
  
- 6 Social Media . . . . . 139**
- 6.1 Mobile Phones, the Internet, and the Networked Society . . . . . 140
- 6.2 Telemediated Networks and the Relational  
Ontology of the Self . . . . . 143
- 6.3 Progressive Political Uses of Social Media . . . . . 150
- 6.4 Conclusions . . . . . 158
- References . . . . . 160

# Chapter 1

## Introduction

In December, 2011, more than 2.25 billion people used the internet, making it a tool of communications, entertainment, and other applications accessed by roughly 32 % of the world's population ([www.internetworldstats.com/stats.htm](http://www.internetworldstats.com/stats.htm)). For most users these uses extend well beyond email, the most common internet use, to include: bill payments and electronic banking; job and housing searches; stock trading; “e-tail” shopping; searching for health information and news; online classes; digital gambling; online videogames; Voice Over Internet Protocol telephony; hotel and airline reservations; chat rooms; electronic tax payments; downloading television programs, movies, digital music, and pornography; and popular sites and services such as YouTube, Facebook, and Google. In all these ways, and more, cyberspace offers profound real and potential effects on social relations, everyday life, culture, politics, and other social activities. Indeed, for rapidly rising numbers of people around the world, the “real” and the virtual have become thoroughly interpenetrated. In this light, access to cyberspace is no longer a luxury, but a necessity. As its applications have multiplied, the internet is having enormous impacts across the globe, including interpersonal interactions and everyday life, identity formation, retail trade and commerce, governance, and is affecting the structure and form of cities, in the process generating round upon round of non-Euclidean geometries in the context of a massive global wave of time–space compression.

By now, digital reality and everyday life for hundreds of millions of people have become so thoroughly fused that it is difficult, if not impossible, to disentangle them. In this context, simple dichotomies such as “off-line” and “on-line” fail to do justice to the diverse ways in which the “real” and virtual worlds for hundreds of millions are interpenetrated. Yet for many others—the familiar litany of the poor, the undereducated, ethnic minorities, and the socially marginalized—the internet remains a distant, ambiguous world. Denied regular access to cyberspace by the inability to purchase a personal computer, the technical skills necessary to log on, or public policies that assume their needs will be magically addressed by the market, the information have-nots living in the economically

advanced world are deprived of many of the essential skills necessary for a successful or convenient life. While those with regular and reliable access to the internet drown in a surplus of information—much of it superfluous, irrelevant, or unnecessary—those with limited access have difficulty comprehending the opportunities it offers, the savings in time and money it allows, and the sheer convenience, entertainment value, and ability to acquire data from bus schedules to recipes to global news.

## 1.1 Conceptions and Misconceptions About Information Systems

There exists considerable confusion about the real and potential impacts of telecommunications on urban structure, in part due to the long history of exaggerated claims made in the past, particularly by those subscribing to “post-industrial” theory (e.g., Toffler 1970). Often such views, which are widespread among many academics and planners, hinge upon a simplistic, utopian technological determinism that ignores the complex, often contradictory, relations between telecommunications and local economic, social and political circumstances.

A cottage industry of geographers has artfully charted the origins and growth of cyberspace, its uneven social and spatial diffusion, and its multiple impacts, ranging from cyber communities to digital divides to electronic commerce (Dodge and Kitchin 2000; Castells 2001; Kellerman 2002; Crampton 2003; Zook 2005a, 2005b; Malecki and Moriset 2008). Such authors typically embed the internet within post-Fordist capitalism, and, drawing on the literature in critical cartography, view it as a power/knowledge constellation with decisive social roots and consequences. Zook and Graham (2007) note the internet’s “core and periphery” structure, as exemplified by the dominant role played by search engines such as Google, and voice concerns over the privatization of the digital commons. This literature offers a valuable means for spatializing the internet, demonstrating its rootedness in social relations and changing geographic relations of proximity, and serves as a necessary antidote to many prevailing utopian and technocratic interpretations such as those that proclaim the ostensible “death of distance” (Cairncross 1997), the “end of geography” (O’Brien 1992), and a “flat world” (Friedman 2005).

Often such views hinge on a simplistic, utopian technological determinism that ignores the complex relations between telecommunications and local economic, social, and political circumstances. Technological determinism is a widespread but erroneous interpretation of how new innovations are related to social structures: it portrays technologies as the driving force behind change, and thus having an autonomous, independent status, and views society as the passive recipient. This line of thought, which is alarmingly popular in analyses of the internet, often leads to simplistic erroneous interpretations of spatial change.



For example, repeated predictions that telecommunications would allow everyone to work at home via telecommuting, dispersing all functions and spelling the obsolescence of cities, have fallen flat in the face of the persistent growth in densely inhabited urbanized places and global cities. In fact, telecommunications are usually a poor substitute for face-to-face meetings, the medium through which most sensitive corporate interactions occurs, particularly when the information involved is irregular, proprietary, and unstandardized in nature. Most managers spend the bulk of their working time engaged in face-to-face contact, and no electronic technology can yet allow for the subtlety and nuances critical to such encounters. It is true that networks such as the internet allow some professionals to move into rural areas, where they can conduct most of their business online, gradually permitting them to escape from their long time reliance on large cities where they needed face-to-face contact. Yet the full extent to which these systems facilitate decentralization is often countered by other forces that promote the centralization of activity. For this reason, a century of telecommunications, from the telephone to fiber optics, has left most high-wage, white-collar, administrative command and control functions clustered in downtown areas. In contrast, telecommunications are ideally suited for the transmission of routinized, standardized forms of data, facilitating the dispersal of functions involved with their processing to low-wage regions. In short, there is no particular reason to believe that telecommunications inevitably lead to the dispersal or deconcentration of functions; by allowing the decentralization of routinized ones, information technology actually enhances the comparative advantage of inner cities for nonroutinized, high-value-added functions that are performed face to face. Thus, telecommunications facilitate the simultaneous concentration and deconcentration of economic activities.

Thus, popular notions that “telecommunications will render geography meaningless” are simply naïve. While the costs of communications have decreased, as they did with transportation, other factors have risen in importance, including local regulations, the cost and skills of the local labor force, government policies, and infrastructural investments. Economic space, in short, will not evaporate because of the telecommunications revolution. Exactly how telecommunications are deployed is a contingent matter of local circumstances, public policy, and local niche within the national and world economies.

## 1.2 The Rise of the Networked Society

One of the most fruitful interpretations of the internet, which avoids technological determinism, arises from the works of Manuel Castells (1996, 1997), who famously came up with the notion of the network society. Castells distinguished earlier *information* societies, in which productivity was derived from access to energy and the manipulation of materials, from later *informational* societies that emerged in the late 20th century, in which productivity is derived primarily from

knowledge and information. In his reading, the time–space compression of post-modernism was manifested in the global “space of flows,” including the three “layers” of transportation and communication infrastructure, the cities or nodes that occupy strategic locations within these, and the social spaces occupied by the global managerial class:

Our societies are constructed around flows: flows of capital, flows of information, flows of technology, flows of organizational interactions, flows of images, sounds and symbols. Flows are not just one element of social organization: they are the expression of the processes dominating our economic, political, and symbolic life.... Thus, I propose the idea that there is a new spatial form characteristic of social practices that dominate and shape the network society: the space of flows. The space of flows is the material organization of time-sharing social practices that work through flows. By flows I understand purposeful, repetitive, programmable sequences of exchange and interaction between physically disjointed positions held by social actors (1996:412).

He notes, for example, that while people live in places, postmodern power is manifested in the linkages among places and people, that is, their interconnectedness, as personified by business executives shuttling among global cities and using the internet to weave complex geographies of knowledge invisible to almost all ordinary citizens. This process was largely driven by the needs of the transnational class of the powerful employed in information-intensive occupations; hence, he writes (1996, p. 415) that “Articulation of the elites, segmentation and disorganization of the masses seem to be the twin mechanisms of social domination in our societies.” Flows thus consist of corporate and political elites crossing international space on transoceanic flights; the movements of capital through telecommunications networks; the diffusion of ideas through organizations stretched across ever-longer distances; the shipments of goods and energy via tankers, container ships, trucks, and railroads; and the growing mobility of workers themselves. In this light, the space of flows is a metaphor for the intense time–space compression of contemporary capitalism. Through the space of flows the global economy is coordinated in real time across vast distances, i.e., horizontally integrated chains rather than vertically integrated corporate hierarchies. In the process, it has given rise to a variety of new political formations, forms of identity, and spatial associations.

For Castells (1996), the space of flows and the new geometries that accompany it wrap places into highly unevenly connected networks, typically benefiting the wealthy at the expense of marginalized social groups. Ruggie (1993, p.141) likens such networks to the “economic equivalent of relativity theory.” However, the global space of flows is far from randomly distributed over the earth’s surface: rather, it reflects and reinforces existing geographies of power concentrated within specific nodes and places, such as global cities, trade centers, financial hubs, and corporate headquarters. Indeed, because the implementation of fiber lines reflects the powerful vested interests of international capital, these systems may be seen as “power-geometries” (Massey 1993) that ground the space of flows within concrete historical and spatial contexts.

## 1.3 Outline of this Volume

Given the enormity and rapid growth of the internet, there is no feasible way this slim volume can capture every detail of its geography and implications. Rather, it attempts to sketch some of the fundamental contours that define the internet, primarily at the global level. Much of the focus is on countries in which the internet is most heavily deployed, i.e., the economically developed world, although studious attempts are made to address its mounting implications in the developing regions of Asia, Africa, and Latin America. Central to the arguments presented here is the uneven geographical significance of the internet: if we are to avoid simplistic technological determinism, a social and spatial contextualization is necessary, which escapes the aspatial “one-size-fits-all” view so common in popular discourse.

**Chapter 2** notes the origins and development of the internet and its contemporary global geographies. Because its history has been abundantly explicated elsewhere (Hafner and Lyon 1996), there is no need to recapitulate this story in depth here. Rather, it begins with the infrastructure that makes the internet possible, the world’s grid of fiber optics and satellites. Then it turns to the rapid growth in internet users and their uneven distribution around the world. It delves into the complex issue of the digital divide, in which social inequalities are replicated in cyberspace. Finally, it offers a regional overview of internet usage around the world in the hopes of demonstrating that its geography cannot be understood independently of the varied local and national contexts in which it is embedded.

**Chapter 3** focuses on the political limitations of cyberspace, i.e., internet censorship, a topic that has received woefully inadequate attention (Warf 2010). Governments around the world vary greatly in the extent to which they limit freedom to access information over the web, ranging from North Korea, where it is essentially illegal, to almost unfettered access in Western Europe and North America. Because the internet is as much a political as it is an economic and social phenomenon, appreciating the nature and extent of censorship is vital to understanding its geography and uneven growth. It ends with the argument that the internet offers the possibility of a Habermasian free speech situation, one in which truth claims are adjudicated on the basis of persuasion and consensus rather than power.

**Chapter 4** looks at the economic implications of the internet in the form of electronic commerce, or e-commerce. Although the internet’s origins were largely military and academic in nature, it has become thoroughly commercialized. From “e-tailing” to the decentralization of back office functions, from web-based universities to Voice Over Internet Protocol, the internet has revolutionized how business is done, lowering transactions costs, enhancing competitiveness, accelerating product cycles, and facilitating the globalization of small businesses. The chapter also offers a region-by-region overview of the uneven geography of e-commerce around the world.

**Chapter 5** turns to electronic governance, or e-government. As with the market, the internet has helped to usher in a broad restructuring of the state. From simple on-line procurements of government documents and official information to the interactive facilities of web 2.0, e-government offers numerous possibilities to change the interactions between citizens and the state. As with e-commerce, and internet use and growth more broadly, e-government varies geographically. The chapter thus highlights regional differences in e-government in many domains across the planet.

**Chapter 6** concludes the volume with a survey of social media. With cell phones, e-mail, and sites such as Facebook, more people are more connected to one another today than at any time in human history. What does this process mean for the nature of the self in the digital age? After charting the geographies of mobile phones and Facebook, the chapter concludes that a new, deeply relational self is gradually displacing the traditional Western model of the subject, i.e., the autonomous Cartesian individual devoid of social roots and origins. The chapter concludes with a plethora of examples about how social media been harnessed to further progressive political movements.

Throughout the volume, emphasis is placed on regional and national variations in internet access and usage, government censorship, commerce, and e-government. There are no doubt large and important variations within countries as well, although we know much less about them. The point of this regional emphasis is to demonstrate that place still matters, that the internet hardly floats in some netherworld independent of real world politics, culture, and economics, and that any realistic understanding of cyberspace must take into consideration its geographic variations. These vignettes are not intended to be comprehensive: rather, they should be seen as indicators that all the world's enormous social diversity is recapitulated in the digital realm, with widely varying incentives, opportunities, constraints, and impacts of internet usage.

## References

- Cairncross, F. (1997). *The death of distance: How the communications revolution will change our lives*. Boston: Harvard Business School Press.
- Castells, M. (1996). *The information age, volume I: The rise of the network society*. Oxford: Blackwell.
- Castells, M. (1997). *The information age, volume II: The power of identity*. Cambridge: Blackwell.
- Castells, M. (2001). *The internet galaxy*. Oxford: Oxford University Press.
- Crampton, J. (2003). *The political mapping of cyberspace*. Edinburgh: Edinburgh University Press.
- Dodge, M., & Kitchin, R. (2000). *Mapping cyberspace*. London: Routledge.
- Friedman, E. (2005). The reality of virtual reality: The internet and gender equality advocacy in Latin America. *Latin American Politics and Society*, 47(3), 1–34.
- Hafner, K., & Lyon, M. (1996). *Where wizards stay up late: The origins of the internet*. New York: Simon and Schuster.

- Kellerman, A. (2002). *The internet on Earth: A geography of information*. Hoboken: John Wiley.
- Malecki, E., & Moriset, B. (2008). *The digital economy: Business organisation, production processes, and regional developments*. London: Routledge.
- Massey, D. (1993). Power-geometry and a progressive sense of place. In J. Bird (Ed.), *Mapping the futures: Local cultures, global change* (pp. 59–69). New York: Routledge.
- O'Brien, R. (1992). *Global financial integration: The end of geography*. New York: Council on Foreign Relations Press.
- Ruggie, J. (1993). Territoriality and beyond: Problematizing modernity in international relations. *International Organisation*, 47, 139–174.
- Toffler, A. (1970). *Future shock*. New York: Random House.
- Warf, B. (2010). Geographies of global internet censorship. *GeoJournal*, 76(1), 1–23.
- Zook, M. (2005a). *The geography of the internet industry*. Oxford: Wiley-Blackwell.
- Zook, M. (2005b). The geography of the internet. *Annual Review of Information Science and Technology*, 40, 53–78.
- Zook, M., & Graham, M. (2007). The creative reconstruction of the internet: Google and the privatization of cyberspace and digiplace. *Geoforum*, 38(6), 1322–1343.

## Chapter 2

# Origins, Growth, and Geographies of the Global Internet

To appreciate the complexity, implications, and geography of the internet, it is vital to understand where it came from and how it came to be. Toward this end, this chapter sketches the broad outlines of the world's internet in several stages. It opens with an overview of the seminal technologies that make the internet possible, fiber optics and satellites, which together comprise the infrastructure of cyberspace. Second it traces some of the highlights of the internet's history, from its origins with the U.S. military to its explosive growth and commercialization today. In the process, it charts the uneven geographies of growth over time and space. The third section addresses the digital divide, or sociospatial inequalities in internet usage, which are found to one extent or another across the planet. Finally, the chapter concludes with a brief regional survey of internet usage in various world regions to highly the spatially uneven character of its deployment and implications.

### 2.1 Fiber Optic Networks and Satellites

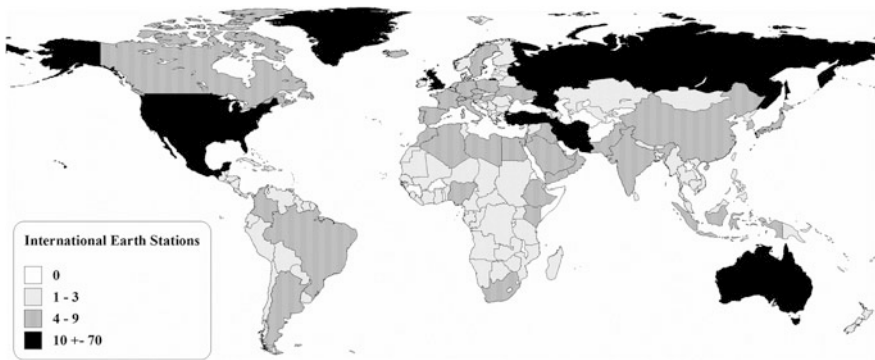
Two technologies—satellites and fiber optic lines—form the primary technologies deployed by the global telecommunications industry, including the internet. Although they overlap to a great extent, satellite and fiber optics carriers exhibit market segmentation. Economically, both reflect the typical cost structure of telecommunications, i.e., high fixed costs and barriers to entry and low marginal costs. However, firms offering these services serve overlapping, but slightly different markets: satellites overwhelmingly dominate mass media transmission, although fiber carriers have recently begun to invade this market (e.g., cable television). Fiber carriers are heavily favored by large corporations for data transmissions and by financial institutions for electronic funds transfer systems, in part because of the higher degrees of security and redundancy this medium offers.

The world's network of satellites and earth stations comprise a critical, often overlooked, element in the global telecommunications infrastructure. Since the late

1950s, the world has launched more than 5,500 satellites, the vast majority of which were sent into orbit by the U.S. and the USSR/Russia. In addition to military applications, satellites are used extensively by telecommunications companies, multinational corporations, financial institutions, and the global media to link far-flung operations, including international data transmissions, electronic funds transfer systems, telephone networks, teleconferencing, and media sales of television and radio programs. Satellites in orbit appear in a variety of sizes and degrees of technological sophistication. Large satellites capable of handling international traffic sit 35,700 km (22,300 miles) high in geostationary orbits, which are by far the most valuable orbital slots because only in that narrow sliver of space do satellites and the Earth travel at the same speed relative to each other, making the satellite a stable target for signals transmitted upward from earth stations. Because such orbital arcs are a scarce resource, their distribution is strictly controlled through international organizations. The cost of launching satellites and the fuel needed to maintain them in their proper orbit are also constraints to their economic viability. Satellites typically have a 10 year life span, primarily because they exhaust their available fuel, necessitating their eventual replacement by a new, frequently much improved, generation. From its vantage point, a broad-beam geostationary satellite can transmit to (i.e., leave a “footprint” over) roughly 40 % of the earth’s surface, creating instantaneous time–space convergence, so that only three or four are sufficient to provide global coverage. Because the cost of satellite transmission is not related to distance, it is commercially competitive in rural or low density areas (e.g., remote islands), where high marginal costs often dissuade other types of providers, particularly fiber optics providers (Warf 2006, 2007).

The terrestrial counterpart of the satellite is the earth station. There are tens of millions of earth stations located worldwide, ranging in size from one-half meter to 30 m. The vast majority, however, can only receive information, not transmit it (i.e., downlink only). When microwave signals are sent over great lengths and become broadly diffused, earth stations require large, powerful antennas to receive them. The distribution of the world’s 483 publicly-owned earth stations designed for international traffic (Fig. 2.1) reveals they are concentrated in the largest and wealthiest countries, particularly the U.S., which, with 70, has vastly more than any other state. Countries without these facilities (e.g., Afghanistan), or those with an insufficient number to satisfy domestic demand, must rely upon leased connections to other nations.

Although satellites are used for internet access in some parts of the world, increasingly the technology has been marginalized by the growth of fiber optics. Fiber optics are long, thin, flexible, highly transparent rods of quartz glass (or less commonly, plastic) about the thickness of a human hair that can transmit light signals through a process of internal reflection, which retains light in the core and transforms the cable into a waveguide. They can transmit voice, video, or data traffic at the speed of light (299,792 km/s); because light oscillates much more rapidly than other wavelengths (200 trillion times per second in fiber cables v. 2 billion per second in a cellular phone), such lines can carry much more information than other types of telecommunications. Modern fiber cables contain up to 1,000



**Fig. 2.1** Distribution of earth stations capable of international traffic. *Source* Compiled by author from CIA Factbook, <http://www.odci.gov/cia/publications/nsolo/factbook>

fibers each and are ideal for high-capacity, point-to-point transmissions. Moreover, fiber cables do not corrode or conduct electricity, which renders them immune to electromagnetic disturbances such as thunderstorms. The transmission capacities of fiber optics grew rapidly in the late twentieth century as the microelectronics revolution unfolded. Financial and producer services firms were at the forefront of the construction of a vast, seamless integrated network of fiber cable because they allowed the deployment of electronic funds transfer systems, which comprise the nervous system of the international financial economy, allowing banks to move capital around a moment's notice, arbitrage interest rate differentials, take advantage of favorable exchange rates, and avoid political unrest (Warf 1995). Fiber carriers are heavily favored by large corporations for data transmissions and by financial institutions for electronic funds transfer systems, in large part because of the higher degrees of security and redundancy this medium offers. Although their transmission costs have also declined, satellites have failed to match the latest leaps in fiber optics capacity and can compete with transoceanic submarine cables only with great and mounting difficulty; today, 94 % of all international telecommunications is transmitted via cables (Warf 2006). As their competitive edge has eroded, satellite providers have been steadily forced to serve markets in low-density regions, relatively low-profit arenas compared to the lucrative high-volume, corporate data transmissions market.

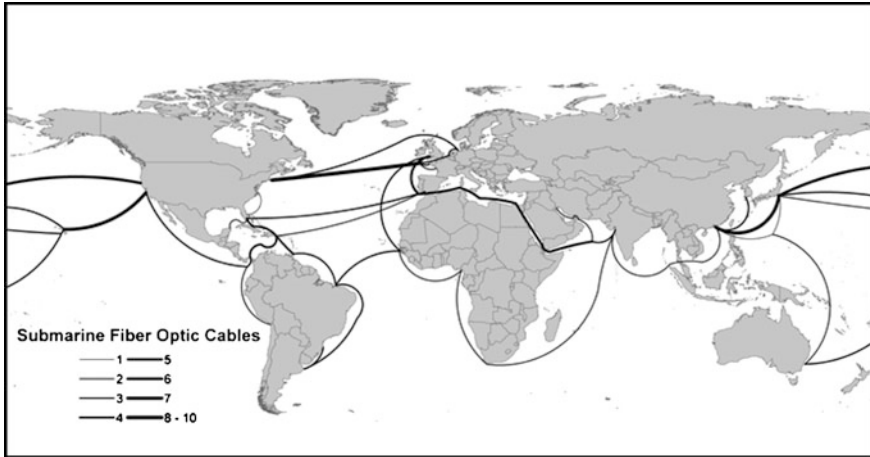
Large fiber networks are generally owned and operated by consortia of firms. Until the 1990s, all commercial fiber lines were built, used, and paid for by a handful of monopoly carriers such as AT&T, British Telecom, Japan's Kokusai Denshin Denwa (KDD), known informally in the industry as "The Club." The Club system allowed telecommunications carriers to construct and own undersea cables and to serve as their users or vendors. Typically, landing facilities are owned by carriers from the country in which the facility is located but the "wet links" (undersea cables) are jointly owned by club members. Under the club system, AT&T, for example, ventured aggressively into the international fiber optics market as it globalized in the face of declining market share in the U.S.,



often by entering strategic alliances that stretched across national borders. Similarly, Sprint affiliated with France Telecom and Deutsche Telekom to form Global One in 1996, and AT&T and British Telecom acquired a 30 % share of Japan Telecom. Under the Club system, capacity was allocated and payments made before or during construction of the network. Members were required by national regulators to sell capacity to non-members on a non-discriminatory basis close to cost. Allegations arose that Club members discriminated against new entrants by offering disadvantageous conditions of membership, such as capacity prices. However, as deregulation encouraged new entrants into the cable markets, the Club system began to fragment. Private systems, in which carriers invite non-carrier investors such as banks, emerged as an alternative system, and recently, non-carrier systems have also appeared.

The network of fiber lines linking the world constitutes the nervous system of the global financial and service economy, linking cities, markets, suppliers, and clients around the world, and the backbone of internet traffic (Fig. 2.2). The geography of global fiber networks centers primary upon two distinct telecommunications markets crossing the Atlantic and Pacific Oceans, connecting two of the major engines of the world economy, North America and East Asia. In 1988, in conjunction with MCI and British Telecommunications, AT&T initiated the world's first trans-oceanic fiber optic cable, Trans-Atlantic Telecommunications (TAT-8), which could carry 40,000 telephone calls simultaneously. The trans-Atlantic line was the first of a much broader series of globe-girdling fiber lines that AT&T erected in conjunction with a variety of local partners. Because large corporate users are the primary clients of such networks, it is no accident that the original and densest web of fiber lines connects London and New York, a pattern that extends historically to the telegraph and telephone (Hugill 1999). The next generation, TAT-9 and TAT-10, which began in 1992, could carry double the volume of traffic of TAT-8. The third generation, TAT-11 to TAT-13, was the first to use EDFA rather than older repeaters. Newer generations of cable were even more powerful. Starting with the Trans-Pacific Cable (TPC-3) in 1989 connecting New York and Tokyo, a growing web of trans-Pacific lines mirrored the rise of East Asian trade with North America, including the surging economies of the Newly Industrialized Countries. In 1996, the first all-fiber cable across the Pacific, TPC-5, was laid. In 2006, a consortium including Verizon and five Asian providers announced plans to lay an 11,000 mile U.S.–China link that would support 1.28 terabits of information—60 times the capacity of the next largest cable—in time for the Beijing Olympics in 2008. In 2007, Google announced the purchase of large quantities of trans-Pacific fiber cable with the aim of launching a multi-terabit Unity service in 2009.

The complex interplay of deregulation, globalization, and technological change increased the international transmission capacities and traffic volumes for fiber optics carriers explosively. Between 1988 and 2003, for example, trans-Atlantic fiber optic cable capacity increased from 43,750 voice paths to 45.1 billion (103,000 %), while across the Pacific Ocean, cable carriers' capacity rose from 1,800 voice paths to 1.87 billion (an astonishing 1.6 billion %).



**Fig. 2.2** The world's major fiber optic cables. *Source* After Staple (2007)

In addition to the two major markets, fiber lines have extended into several newer ones. In 1997, AT&T, NYNEX and several other firms (including, for the first time, non-telecommunications firms) opened the self-healing Fiberoptic Link Around the Globe (FLAG), a system that eventually expanded to 55,000 km connecting Europe and Southeast Asia. The world's longest submarine telecommunications network, FLAG, the world's longest submarine telecommunications cable, filled a void in undersea cable capacity between Europe, the Middle East, and Asia. It also hooked into regional systems such as the Asia Pacific Cable Network, a 12,000 km system linking Japan, South Korea, Taiwan, Hong Kong, the Philippines, Thailand, Vietnam, and Indonesia, as well as the Caribbean Fiber System (i.e., the Eastern Caribbean Fiber System, Antillas 1, Americas 1, and Columbus 2). Unlike earlier systems, FLAG allowed carriers to purchase capacity as needed, rather than compelling them to purchase fixed quantities.

Although they overlap to a great extent, satellite and fiber-optic carriers exhibit market segmentation. Fiber is heavily favored by large corporations for data transmission and by financial institutions for electronic funds transfer systems. Satellites tend to be used more often by international television carriers. Telephone and internet traffic use both. These two types of carriers are differentiated geographically as well: Because their transmission costs are unrelated to distance, satellites are optimal for low-density areas (e.g., rural regions and remote islands), where the relatively high marginal costs of fiber lines are not competitive. Fiber-optic carriers prefer large metropolitan regions, where dense concentrations of clients allow them to realize significant economies of scale in cities where frequency transmission congestion often plagues satellite transmissions. Satellites are ideal for point-to-area distribution networks, whereas fiber-optic lines are preferable for point-to-point communications, especially when security is of great concern. Historically, the primacy of each technology has varied over time. From

1959 to 1980 (i.e., before the widespread adoption of fiber optics), satellites enjoyed limited competition from transoceanic copper cable lines with low capacity rates. From the 1970s onward, the microelectronics revolution allowed fiber-optic lines to erode the market share of traffic held by satellites. New techniques of data transmission, such as the so-called frame delay format, raise speeds of transmission nearly 30-fold over the 1990s technology.

## 2.2 Origins and Growth of the Internet

The internet originated in the 1960s under the U.S. Defense Department's Agency Research Projects Administration (ARPA), which designed it to allow computers to communicate with one another in the event of a nuclear attack. Much of the durability of the current system is due to the enormous amounts of federal dollars dedicated toward research in this area (Hafner and Lyon 1996; Murphy 2002). ARPA grouped together several young, ambitious computer scientists, including Paul Baran, who invented packet switching, and related innovations such as neural networks, queuing theory, adaptive routing, and file transfer protocols. In the process, ARPA gave birth to a network quite different from the centralized system of the telephone company (i.e., AT&T), which relied on analogue information: rather, digitization facilitated a decentralized, then distributed network, which subsequently became a model for rhizomes, a popular trope in poststructuralist analyses. The nucleus of what would become ARPANET initially connected universities such as Stanford, UCLA, the University of California at Santa Barbara, and the University of Utah. The initial military goals were soon supplemented by civilian ones. In 1972, Ray Tomlinson adapted computer messages for personal use, inventing email.

From 1984 to 1995, the internet was administered by the National Science Foundation, which deployed it to connect academic supercomputers in a select series of campuses across the country. Simultaneously, some of the world's first cybercommunities began to take route, such as the WELL (Whole Earth Lectronic Link) in San Francisco. The famous European Particle Physics Lab (CERN) developed hypertext and Universal Resource Locators (URLs), the system of addresses used on what would become the World Wide Web, including file transfer protocol (FTP) and specifications of pages fetched using the HTTP protocol.

In the 1990s internet control was privatized via a consortium of telecommunications corporations. The internet emerged on a global scale through the integration of existing telephone, fiber-optic, and satellite systems, which was made possible by the technological innovation of packet switching, TCP/IP (Transmission Control Protocol/Internet Protocol), and Integrated Services Digital Network (ISDN), in which individual messages may be decomposed, the constituent parts transmitted by various channels, and then reassembled, virtually instantaneously, at the destination. In the 1990s, graphical interfaces developed in Europe greatly simplified the use of the internet, leading to the creation of the World Wide Web. Tim Berners-Lee, often

called the “father of the World Wide Web,” played a key role in this process. Soon thereafter private web browsers sprouted like mushrooms, including Netscape, Internet Explorer, and Firefox. The number of websites grew exponentially, from roughly 1 million in 1990 to more than 4 billion in 2011.

The microelectronics revolution initiated enormous decreases in the cost of computers and exponential increases in their power and memory. Of these, the continued decline in the price of personal computers (PCs) looms large. Following Moore’s Law, which speculates the cost of computers falls in half every 1½ years, PCs have become increasingly ubiquitous in many countries, and relatively fast, low-end machines are readily available for relatively modest sums. Indeed, fiber optics arguably transformed the internet from a communications to a commercial system, accelerating the pace of customer orders, procurement, production, and product delivery (Malecki 2002). Spurred by declining costs, deregulation, and an increasingly tech-savvy public, the growth of the internet has been phenomenal; indeed, it is arguably the most rapidly diffusing technology in world history. Global access to the internet is deeply conditioned by the density, reliability, and affordability of national telephone systems, which form the heart of the architecture of cyberspace. For this reason, the distribution of internet hosts also mirrors the enduring legacy of the superpower bifurcation during the Cold War: Soviet-backed regimes distrusted the telephone, which allows two-way communication, and preferred television, which allows only one-way flows of information.

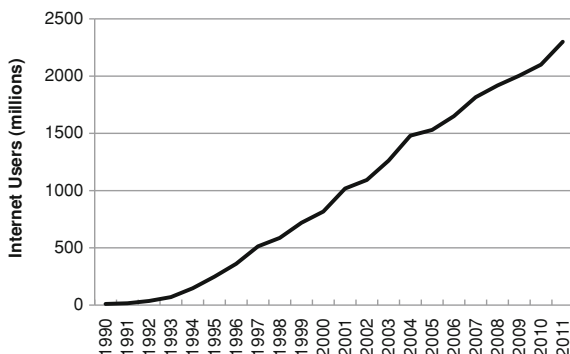
With rapid declines in the cost of computer technology, a glut of fiber optics that led to dramatic falls in communications prices, easy-to-use graphical interfaces, and the clear potential for all sorts of as-yet unheard of applications, it is no wonder that internet usage worldwide began to grow exponentially. The number of users soared from roughly 10 million in 1990 to more than 2.25 billion in December, 2011 (Fig. 2.3), an average rate of increase of almost 14 % per year. The distribution of the world’s internet users in 2011 (Fig. 2.4) reflects the size of different national populations and their internet penetration rates. Four countries—China, the U.S., India, and Japan—had more than 100 million users each, although with more than 513 million users China exceeds the next three largest countries combined. With other countries with significant pools of users such as South Korea and Indonesia, approximately 922 million internet users were located in Asia, or almost half of the world’s total (Table 2.1). In contrast, the world’s poorest region, sub-Saharan Africa, had relatively small populations of netizens. These broad regional differentials were reflected in the linguistic structure of the internet as well (Table 2.2). While English remains the premier tongue used today on the Web—the digital lingua franca of 536 million people—Chinese, spoken by 445 million netizens, is the second-most heavily used language, and growing rapidly, followed by Spanish (153 million users). Other languages such as Japanese, Portuguese, German, Arabic, French, and Russian are also significant.

Internet use (“penetration”) rates varied considerably by country in 2011 (Fig. 2.5). Whereas the vast bulk of the populations in economically developed countries use it, including near-universal rates in Scandinavia, penetration rates are markedly lower in the developing world (but growing by leaps and bounds).

**Fig. 2.3** Growth in world internet users, 1990–2011.

Source

internetworldstats.com



Internet penetration rates (percentage of people with access) among the world's major regions, ranging from as little as 0.2 % in parts of Africa to as high as 96 % in Scandinavia. By the end of 2011, penetration was 77 % of the U.S. population. Inequalities in access to the internet internationally reflect the long-standing bifurcation between the First and Third Worlds. While no country is utterly without internet access, the variations among and within nations in accessibility are huge. Given its large size, the United States—with more than 245 million users—dominates when measured in terms of absolute number of internet hosts. The world's highest penetration rates (Table 2.3) are found in Iceland (97.8 %), followed by Norway (97.2 %), Sweden (92.9), and Luxembourg (91.4 %); Eastern Europe lags considerably behind, and in Russia only 44 % of the population uses the internet. In Asia, access is by greatest in South Korea (82.7 %) and Japan (80 %); about 38 % of China is hooked up, although the numbers there are growing rapidly, and already amount to more than 513 million users. In Latin America, the largest numbers of users are found in Brazil (79 million, or 39 %) and Mexico (42 million, 36.9 %). The internet in the African continent is largely confined to South Africa, although it is growing explosively there. In all cases, per capita incomes are the key; the internet can only be used by people with resources sufficient to own computers and learn the essential software. Variations in the number of users is also reflected in the geography of internet flows (although flow data are much harder to come by than are place-specific attribute data): 75 % of all international traffic on the internet is either to or from the United States, fueling fears among some people that the internet is largely a tool for the propagation of American culture.

The most salient feature about the internet may be its exceedingly rapid rate of growth. Very few technologies in world history, with perhaps the exception of the mobile phone, have exhibited such explosive rates of adoption. As penetration rates soared around the planet, millions of new users have been brought on line. Figure 2.6 portrays national differentials in the growth of internet usage. Explosive growth is readily evident in sub-Saharan Africa and the Middle East, where growth rates between 2000 and 2011 exceeded 10,000 % (and sometimes reach absurdly high rates such as 182,900 %, albeit from a very small base). In contrast, growth



**Fig. 2.4** Distribution of world’s internet users, December 2011. *Source* internetworldstats.com

**Table 2.1** Internet users by major geographic region, December 2011 (millions)

Asia	922.3
Europe	476.2
North America	272.1
Latin America	215.9
Africa	110.9
Middle East	68.6
Oceania	21.3

*Source* Internetworldstats.com

**Table 2.2** Largest languages used on the Internet, December 2011 (millions)

English	536.6
Chinese	444.9
Spanish	153.3
Japanese	99.1
Portuguese	82.5
German	75.2
Arabic	65.4
French	58.8
Russian	59.7
Korean	39.4

*Source* Internetworldstats.com

rates in the entire Western Hemisphere, Europe, Russia, Japan, and Oceania were relatively modest by comparison. Thus, while the internet was largely confined to the developed world early in its history, it is growing the most rapidly in the developing world today, particularly in Africa and Asia. This growth brought 1.325 billion new users on-line during this period, who were unevenly distributed



**Fig. 2.5** Map of internet penetration rates, December 2011. *Source* internetworldstats.com

**Table 2.3** Internet penetration rates for 20 best-connected countries, December, 2011

Iceland	97.6
Norway	94.8
Sweden	92.5
Netherlands	88.6
Denmark	86.1
Finland	85.3
Luxembourg	85.3
United Kingdom	82.5
South Korea	81.1
Australia	80.1
New Zealand	79.7
Germany	79.1
Japan	78.2
Singapore	77.8
Belgium	77.8
Canada	77.7
United States	77.3
Switzerland	75.3
Estonia	75.1
Austria	74.8
Israel	71.6

*Source* internetworldstats.com

across the face of the planet (Fig. 2.7). Most (59 %) of the world's netizens, therefore, are relatively recent additions to the world's population of internet users. In China, for example, more than 490 million of its netizens, or 96 %, began after 2000, and the same proportion in India witnessed 116,000 new internet users log-in.

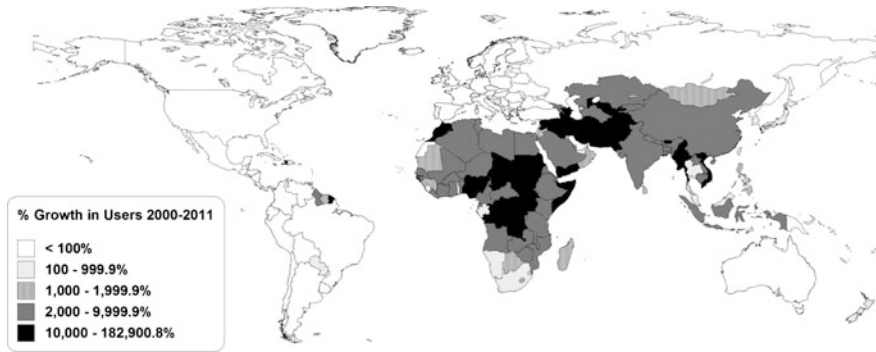


Fig. 2.6 Map of growth in internet users, 2000–2011. *Source* internetworldstats.com

## 2.3 Digital Divides

Clearly internet usage is highly uneven among and within countries. The digital divide, or social and spatial differentials in internet access, has been the subject of a growing body of literature (Norris 2001; Korupp and Szydluk 2005; Warf 2001), revealing how digital communications are enfolded in relations of wealth and power in ways that reproduce inequalities in cyberspace. Howard et al. (2010, p. 111) point out, “The causes and consequences of the digital divide have become a contested area of research. Understanding the digital divide is crucial to understanding the role of the Internet in contemporary social development.” Fundamentally this question is about who has access and can use the internet and who does not. “Access” and “use” are admittedly vague terms, and embrace a range of meanings, including the ability to log-on at home, school, cybercafé, or work (DiMaggio et al. 2001). Rather than a simple access/non-access dichotomy, it is more useful to think of a gradation of levels of access, although data of this subtlety rarely exist. Thus, it is increasingly common to speak of “digital differentiation” rather than a divide (Selwyn 2002, 2004).

The digital divide is a complex, changing, and multi-dimensional phenomenon that reflects the diverse channels through which social inequalities are reinscribed in cyberspace. Everywhere, class markers such as income and education are strongly correlated with internet access and use. Everywhere, age plays a key role: the elderly are inevitably the least likely to adopt the internet. In many places, gender is important too: in North America the gendered divide has disappeared, but in Europe it persists, and in the developing world it is pronounced. The digital divide is also a geographical phenomenon. Everywhere, large urban centers tend to exhibit higher rates of connectivity than do rural areas (Mills and Whitacre 2003; Warf 2001).

As the uses and applications of the internet have multiplied, the costs sustained by those denied access rise accordingly. At precisely the historical moment that contemporary capitalism has come to rely upon digital technologies to an





Fig. 2.7 Distribution of new internet users, 2000–2011. *Source* internetworldstats.com

unprecedented extent, large pools of the economically disenfranchised are shut off from cyberspace. As the internet erodes the monopolistic roles once played by the telephone and television, and as the upgrading of required skill levels steadily render information technology skills necessary even for lower wage service jobs, lack of access to cyberspace becomes increasingly detrimental to social mobility. Indeed, those excluded from the internet may be more vulnerable to social forces they do not and often cannot perceive than ever before.

Because personal computer ownership rates are relatively low in much of the developing world, and because Internet Service Provider (ISP) individual access charges are often high, many users rely upon privately-owned internet cafés for access rather than individual ISP accounts. Cafés are particularly important for those who lack dial-up access at home or at work or who simply cannot afford personal computers of their own. In the developing world, internet cafes tend to be most commonly found in commercial districts frequented by tourists, exhibit a range of ownership structures from sole proprietorships to international chains, and charge access prices that vary widely among and within countries. In addition to for-profit cybercafés, many non-profit and non-governmental organizations have established networks of neighborhood telecenters, which have played catalytic roles in community development in many areas.

In addition to international discrepancies in access, internet usage also reflects the power-geometries *within* countries (Massey 2005) through which the poor, elderly, ethnic minorities, and rural areas enjoy markedly less access (Chakraborty and Bosman 2005; Mills and Whitacre 2003). Unfortunately, relatively little is known about this issue, in large part due to lack of data on the topic. However, the enormous growth rates of the internet mean that digital divides are rapidly changing, and as access improves for many hitherto marginalized groups, may slowly decline over time.

The latest frontier in the digital divide is unquestionably the arena of broadband delivery services, which varies widely in availability among the world's countries (Fig. 2.8). Broadband applications include digital television, business-to-business linkages, internet gaming, telemedicine, videoconferencing, and internet



**Fig. 2.8** Map of broadband penetration per 100 inhabitants, 2010. *Source* International Telecommunications Union. *Note* Because an Internet subscription may be shared by many people, the penetration rate will not reflect the actual level of access to broadband Internet of the population

telephony. With large, graphics-intensive files at the heart of most internet uses today (e.g., downloading forms, reading on-line newspapers), broadband has become increasingly imperative for Web browsing. However, the geography of broadband access replicates the globe's geographies of wealth and power—it is largely confined to the economically developed world. There are strong reasons to believe that far from eliminating the digital divide, broadband reproduces it, gives it new form, and in some cases, accentuates it.

Claims that access to the internet is readily available to all, and therefore its effects cannot help but be beneficial and democratic, must be viewed with great skepticism. Technologies, including telecommunications, are never socially or spatially neutral in their impacts. There is a persistent and continuing need to link the understanding of cyberspace with very real spaces of class and power. All the existing social categories of wealth and power are replicated in cyberspace, at least in terms of access to the equipment and technical know-how necessary to gain entree. At the global level, the internet is likely to reinforce or even deepen existing divisions between the haves and have-nots, between the developed and developing worlds, as much as it is likely to eliminate them, connecting a global digerati with increasingly disconnected from the local environments of their own cities and countries. Castells (1997, p. 351) likens cyberspace to Athenian democracy:

While a relatively small, educated, and affluent elite in a few countries and cities would have access to an extraordinary tool of information and political participation, actually enhancing citizenship, the uneducated, switched off masses of the world, and of the country, would remain excluded from the new democratic core, as were slaves and barbarians at the onset of democracy in classical Greece.

Thus, the internet represents the Athenian vision of democracy writ large, an issue that figures prominently in debates about internet censorship (Chap. 3).

Rosy and premature predictions that the internet would unleash human potential in low income communities, level hierarchies and blur the lines of authority have given way to more realistic assessments that point to the exacerbated social and economic tensions that accompany the diffusion of this technology in many communities, enhancing the divisions between the information “haves” and “have nots.” This division mirrors the increasing polarization of Western societies in general, noting the disintegration of the public sphere and the commodification of private ones. In an age in which social life is not only increasingly mediated through computer networks but fundamentally altered by them, the annihilation of public spaces and their reconstruction around the increasingly commodified, privatized spaces of cyberspace has disturbing implications for those without the wealth and power to gain access to the internet. Participation in electronic communities reflects the social contexts that shape the adoption and diffusion of internet technology; thus, the definition of “access” must be broadened from simply owning a computer and logging into the internet to include the institutional and cultural forces that entice and encourage people to remain digitally connected. As the internet has diffused through progressively broader tiers of Western society, albeit unequally, new users frequently resemble the general population with greater frequency; fears that the “digital divide” will remain in perpetuity, therefore, may be exaggerated.

Lastly, it is abundantly evident that geography still matters. Access to the internet is deeply conditioned by where one is, which is in turn a reflection of relations of wealth and power. Long standing categories of core and periphery are all too apparent within cyberspace, such as the divisions between developed and less-developed nations or cities and rural areas. Thus, electronic systems simultaneously reflect and transform existing topographies of class, gender, money, and ethnicity, creating and recreating hierarchies of places mirrored in the spatial architecture of computer networks. Far from eliminating differences among places, systems such as the internet allow their differences to be exploited. As both a site of fixed investments and a space of flows, the internet in an age of hypermobile capital must be judged as much in terms of equality of access as efficiency of use, by the ways it generates benefits to those who need it most as well as to those who use it heavily.

## **2.4 Regional Geographies of the Global Internet**

Despite some proclamations that cyberspace is spaceless, that distance is dead, or that we live in a flat earth, the reality of internet usage is that it is thoroughly interpenetrated with regional, national, and local political systems, economies, and cultures. Thus, the geography of the internet is deeply conditioned by, and in turn shapes, the spatiality of the world’s socioeconomic systems. To shed more light on this topic, this section offers a brief tour of the regional dimensions of the internet in the world’s major regions.