THE GEOPOLITICAL ECONOMY OF THE GLOBAL INTERNET INFRASTRUCTURE

Dwayne Winseck

ABSTRACT

According to many observers, economic globalization and the liberalization of telecoms/internet policy have remade the world in the image of the United States. The dominant roles of Amazon, Apple, Facebook, and Google have also led to charges of US internet imperialism. This article, however, argues that while these internet giants dominate some of the most popular internet services, the ownership and control of core elements of the internet infrastructure—submarine cables, internet exchange points, autonomous system numbers, datacenters, and so on—are tilting increasingly toward the EU and BRICS (i.e., Brazil, Russia, India, China, and South Africa) countries and the rest of the world, complicating views of hegemonic US control of the internet and what Susan Strange calls the knowledge structure.

Keywords: global internet infrastructure, global political economy of communication, submarine internet cables, telecoms and internet policy, geopolitics, role of the state

The idea that US-based internet giants like Amazon, Apple, Facebook, Google, Netflix, and Microsoft dominate the internet the world over is common—in academic writing across disciplines, the popular press, and everyday conversation. Derisory acronyms like FANG—Facebook, Apple, Netflix, and Google—capture the spirit of this idea. The US State Department's "internet freedom" agenda lends itself to the idea that US internet hegemony is promoted and girded by US foreign policy. For some, this is not surprising. It is the end result of neoliberal economic globalization and the liberalization of global telecoms and internet policy that have been remaking the world in the US image since the 1980s. The upshot is that the multilateral, "old world communications order" that had developed under the auspices of the International Telecommunication

Dwayne Winseck: School of Journalism and Communication, Carleton University

JOURNAL OF INFORMATION POLICY, Volume 7, 2017

Union (ITU) for a century and a half was bypassed by the end of the twentieth century in favor of a global free trade regime in which the World Trade Organization and country-to-country trade deals, flanked by the multi-stakeholder model of Internet Governance, carried the day. Edward Snowden's disclosures about the US National Security Agency–led internet surveillance program have only galvanized claims about the extent of US dominance of the internet.[1]

This article takes a different tack. It argues that while US-based internet giants *do* dominate some of the middle and top layers of the internet—for example, operating systems (iOS, Windows, Android), search engines (Google), social networks (Facebook), online retailing (Amazon), over-the-top TV (Netflix), browsers (Google Chrome, Apple Safari, Microsoft Explorer), and domain names (ICANN)—they do not rule the hardware, or material infrastructure, upon which the internet and daily life, business, governments, society, and war increasingly depend. In fact, as the article shows, ownership and control of many core elements of the global internet infrastructure—for example, fiber optic submarine cables, content delivery networks (CDNs), autonomous system numbers (ASN), and internet exchange points (IXPs)—are tilting toward the rest of the world, especially Europe and the BRICS (i.e., Brazil, Russia, India, China, and South Africa). This reflects the fact that the United States' standing in the world is slipping while an ever more multipolar world is arising.[2]

Such trends complicate the dominant conception of hegemonic US control over what the influential political economist Susan Strange refers to as the knowledge structure.[3] Rather than American internet imperialism, a "Federated Internet" seems increasingly realistic as power and control become more multipolar in nature.[4] This outcome would likely redraw what we know as the internet and erode support for the current multi-stakeholder

1. The scholarly literature across disciplines, regulatory interventions in Canada, the EU, and elsewhere, and the popular press are filled with examples of charges of US internet "hegemony" or, less so, US internet imperialism. Carr (especially pages 118–20) stresses hegemony from an international relations stance. Powers and Jablonski review claims to this effect from Chinese and Russian government leaders, while adding their own details on the extent to which United States interests dominate the internet (see, especially, pages 14–16 and 109–10). Others have updated theories of cultural and media imperialism in relation to US dominance of the internet: Jin; Fuchs; McChesney. Hill draws on his experience at the ITU to make a similar point. Some journalists also frame the issues similarly; for example, Kiss.

2. Arrighi; Desai.

3. Strange.

4. Noam, "Who Owns the World's Media?"

model of internet governance, a model that many commercial interests, technical experts, nongovernment organizations as well as the United States, and Western capitalist democracies support. It is pitted, however, against a more state-centered, multilateral model promoted by those who are critical of the unaccountable power of business interests as well as countries like India, China, Russia, and Brazil, which—each in their own way—seek to counter what they see as the United States' and Western capitalist countries' dominance of internet governance. As the locus of the material infrastructure of the internet tilts toward these countries, it stands to reason that they will gain more influence over the policies and practices that shape it.

The approach of this article follows Strange's focus on structural power, but emphasizes the changing relationship between markets and states—or the "market-authority nexus"[5]—over time *and* how hegemonic states act both on their own *and* in concert with others to structure the conditions under which other state and non-state actors operate. It draws on David Harvey's concept of Capitalist Imperialism as well to help highlight the changes taking place, and to counteract the dominant instrumentalist view in much of the literature to see communications media primarily as "weapons of politics" and "tools of empire" at the expense of market, technological, and other considerations.

The article begins with a brief reprise of how the global internet infrastructure of today possesses some similarities to its predecessors in the nineteenth and twentieth centuries but is *radically different* from them nonetheless. The second section examines the question of US internet dominance and the balance between states and market forces. The article concludes with some comments on why we must focus on how markets and states always interact to fundamentally shape the kinds of communications media that define an era.

Theorizing Global Media History[6]

News and information have followed channels of trade, migration, and cultural contact for millennia, but media historians often take the second half of the nineteenth century to the turn of the twentieth as the moment

5. Strange.

6. The following two sections draw extensively from Winseck and Pike; Winseck, "Submarine Telegraphs."

when modern global communication and media systems took shape. The dominant interpretation in the literature tends to adopt an instrumentalist view of communications media as "tools of empire" and "weapons of politics,"[7] however, or what Harvey calls "territorial imperialism."[8] To be sure, control over the medium and the message conferred commercial and strategic advantages to Great Britain, the dominant power of the era, and its free trade policy overall and in submarine telegraph cables in particular was specifically designed to attract cables and capital in a bid to maintain London as the hub of the world economy and communication. Kelley Lee also crystallizes this view by emphasizing how "the integration of . . . European imperialism . . . was reinforced by telegraph (and later radio and telephone) networks *whose reach was historically defined by the boundaries of empire*."[9] The rapid ascent of US commercial, political, and military interests from World War I on is also usually cast as having allowed it to displace Britain and Europe as the center of world communication, and more fully after World War II when Pax Americana overtook Pax Britannica.[10] Some claim that this is where things still stand today, especially in relation to America's imperial—or at least hegemonic—hold over the global internet.[11]

This view is deeply problematic, however. For one, it gives far more attention to politics than economics. It also emphasizes territorial imperialism at the expense of Harvey's second understanding of imperialism, Capitalist Imperialism, which he defines as a system of power that aims to allow capital accumulation and "economic power to flow across and through continuous space," and where models of development are emulated and consent preferred to coercion.[12] Harvey also suggests that while power is mainly the preserve of single hegemonic states under territorial imperialism, capitalist imperialism relies upon "the *collective accumulation of power* as the . . . basis of hegemony."[13] He also does not view corporate interests as subordinate to state interests, or see nation-states as the simple handmaidens of capital. This view captures the essence of the global

7. Headrick.

8. Harvey.

9. Lee, 60.

10. For example, Schiller.

11. Exemplars of this tendency can be seen, for instance, in Carr, 118–20; Powers and Jablonski, 14–16, 109–10; Jin; Fuchs; Hill; Kiss.

12. Harvey, 26.

13. Ibid., 37.

cable systems of the nineteenth and twentieth centuries remarkably well and is a better, even if incomplete, explanation of the global internet in the twenty-first century than the more one-dimensional views recounted a moment ago.

Communication history should start with the point that capitalism has been a globalizing force since its inception, and this motive force has been inextricably tied to developments in communication.[14] As Karl Marx famously observed,

> Capital by its nature drives beyond every spatial barrier. Thus the creation of the physical conditions of exchange—of the means of communication and transport—*the annihilation of space by time*—becomes an extraordinary necessity for it. . . . [T]he production of cheap means of communication and transport is a condition for production based on capital, and promoted by it for that reason.[15]

The dynamic expansion of capitalism helped to call forth a worldwide market during the second half of the nineteenth century. This was not a smooth process, however, and obstructions and setbacks were confronted all along the way, including financial crises,[16] the most famous of which erupted in 1873 and was inextricably bound up with the "revolution in communication" then taking place.

The advent of the global communication system and media played key roles in these events. Initially, ventures to build international submarine cable telegraph links before 1866 from Britain across the Atlantic as well as to India and the Far East failed, but in the next decade the technology became reasonably well understood and financed. Ultimately, the consolidation of domestic telegraph industries in Britain, Europe, and North America by the mid-1860s yielded enormous corporate entities with pockets deep enough to "wire the world." The British government's takeover of domestic telegraph systems in 1868 transferred £6 million ($40m USD) into the coffers of those, notably John Pender and Julius Reuter, who parlayed their early domestic experience into the conquest of global markets. By 1885, telegraph lines and submarine cables linked Britain and Europe to India, followed by the crossing of the North Atlantic in 1866.

14. Arrighi.
15. Marx, 459.
16. Kindleberger, 118; Winseck, "Submarine Telegraphs."

In the North Atlantic market, the Anglo-American Telegraph Company was rewarded with revenues of approximately $2,900 per day in its first year, paying out dividends of over 25 percent from the start, and recovering the cost of its venture in two years—well in advance of its backers' expectations. This amply offset the losses associated with the earlier failed ventures. Five years later, transatlantic revenues had climbed to over $12,000 per day, although by this time they were split between two rival firms: The Anglo-American Telegraph Company and the Direct United States Cable Company.[17] The resulting boom led to an explosion in submarine cable systems across the North Atlantic, and subsequently extended to China, Japan, South America, and Australasia (Figure 1). Alongside this boom, the Reuters news wire service created bureaus in major world cities as soon as they were connected to the cable system, as in Bombay (1870), Hong Kong (1872), Shanghai (1873), and Buenos Aires (1874).[18] Similarly, many new companies were launched, several of which aimed to compete in the South American market.[19] Several ventures put into motion during this boom phase ultimately did become leading lights in the industry. Indeed, the eight largest of these firms accounted for over

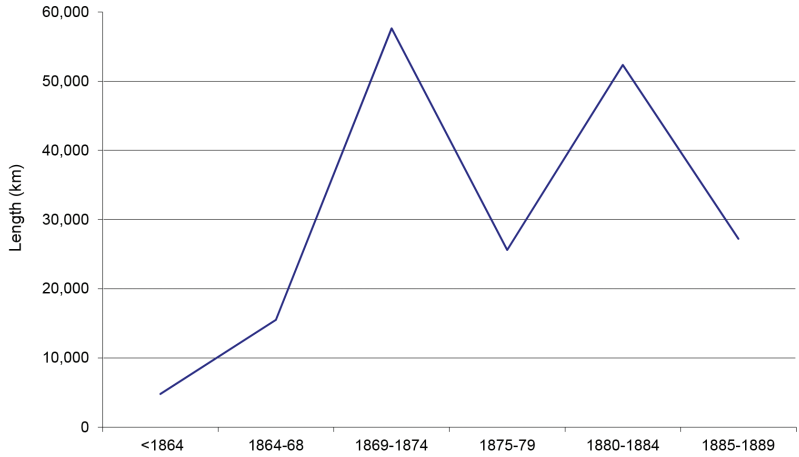

FIGURE 1 Submarine cable construction, 1864–1889.

Source: U.S. Hydrographic Office.

17. Winseck and Pike; United States House of Representatives, 11; "The Ocean Telegraph and Finance," 4.

18. Read, 50–58.

19. Ahvenainen.

four-fifths of the capital of the industry in 1874—about £18.3 million ($100m USD).[20]

Mirroring the later dot-com boom, they dominated the London Stock Exchange: of the £16.6 million in new capital issued on the London Stock Exchange in 1870, for example, nearly a third went to submarine telegraph companies.[21] Echoing further the dot-com boom, this earlier bubble also burst. The fact that enterprises at the heart of the industry had been recapitalized far beyond their original values, and for no obvious reason, was a main contributing factor. Between May and July of 1873, the Anglo-American Telegraph Company and the Globe Trust, for example, had conjured up £7,825,000 ($42.7m USD) in new capitalization out of thin air (i.e., without having added any new assets). After this rapid inflation of their market capitalization, the two enterprises represented over 40 percent of the total capital invested in the industry.[22] The bubble was marred by scandal and corruption as well. While a new cable from the United Kingdom to South America and another from Australia to New Zealand were completed in 1874 and 1876, respectively, the boom had burst, and the industry then went into a lull for the next decade.

Figure 2 depicts the cable system as it stood in 1876 (note the cosmopolitan, but racist, iconography).

Imperialism played a crucial role in the development of these cable systems, but modernizing economic forces within China, the Ottoman Empire, Persia, and the post-imperial nation-states of South America were also important sources of demand. Moreover, while rickety telegraph cables had been developed in some of the imperial territories of the Caribbean and Southeast Asia in the 1860s and 1870s, they only encircled the continent of Africa much later and in the mid-1880s. In other words, the British, European, Japanese, and American empires—with the big exception of India—were tied into the world communication system only a decade or more later than the rest of the world. And this typically happened only after large state subsidies were granted, mostly to private firms, and occasionally by several governments at once. This was the case, for example, when a subsidiary of the Eastern Telegraph Company laid, owned, and operated the cables to and around Africa after receiving substantial subsidies from

20. United States Hydrographic Office.

21. "Money-Market and City Intelligence," 6.

22. United States House of Representatives, 9; United States House of Representatives Committee of Interstate and Foreign Commerce.

FIGURE 2 Cable system as of 1876.

Source: Cable & Wireless Archives, Porthcurno, United Kingdom.

Britain, France, Germany, and Portugal.[23] Private enterprise generally ruled the industry. Even at the height of the new imperialism (1880–1910), less than 20 percent of cables were state-owned. Even then, however, the areas that they served were still among the least connected, worst served places in the world, in contrast to the conditions assumed by the "struggle for control" model of communication outlined previously. Moreover, the international institutional arrangements for governing the world's communication infrastructure were also put into place during the late nineteenth century, primarily via the creation of the International Telecommunication Union (ITU).[24]

Foreshadowing the Future

The portrait sketched previously is also consistent with the "anatomy of a typical [financial] crisis," a phase that often attends the "widespread adoption of a recent invention with pervasive effects."[25] The scale of

23. Britain, Appendices J and G.

24. See the collection of founding conventions, constitutions, and regulations of the ITU at the International Telecommunications Union, "Collection of the Basic Texts."

25. Kindleberger, 15; Perez.

submarine telegraph cable construction in the late 1860s and first half of the next decade was not matched again until more than a century later when, from 1997 until the turn of the millennium, a frenzy of speculative investment led to a hundred fold rise in telecommunications capacity before the dot-com bubble crashed in 2000–2001—a point we return to below.[26]

Submarine telegraphs were a general-purpose technology with pervasive effects. They were the critical communications infrastructure underpinning the then new world order, one that Paul Reinsch, a University of Wisconsin Political Science professor and future minister to China in Woodrow Wilson's second administration, described as follows:

> Our age is realistic and practical. . . . We are building up cooperation in constantly widening circles, so that it transcends national bounds to become a universal joint effort. . . . Universal cooperation is the watchword which stands for positive action, for the development of concrete facts in human life corresponding to the actual needs of our economic and social order. . . . The great economic and financial system . . . is being centralized. The psychological unity of the world is being prepared by the service of news and printed discussions, by which in the space of one day or week the same events are reported to all the readers from Buenos Aires to Tokyo, from Cape Town to San Francisco.[27]

None of these developments took place outside of a set of conventional and formal political and legal frameworks. Cables were regulated by all states in terms of landing licenses. The monopoly landing rights that they typically gave in the early years of development varied considerably, as did the terms of service they demanded with respect to privileges to be provided to local state officials and interconnection with local telegraphs, as well as their need to monitor (surveillance) and block (censorship) messages perceived as threats to public morality or national security. These landing licenses typically reflected the strength of the state that negotiated them. The stronger the state, the less likely it was to grant monopoly rights, as was the case in Britain and the United States, whereas the weaker the state, the longer the right to a monopoly,

26. FCC, "Cable Landing Licenses," 5.

27. Reinsch, 3–4.

the more restrictive the terms of service obligations, and the less likely companies were to cooperate in ways other than those that advanced their business interests. In the United States, by convention, the president had the authority to grant or withhold cable landing licenses before 1921, after which that authority was put on a formal footing with the passage of the *Cable Landing Licenses Act*—a measure that ensured that the exercise of such authority took place at the highest level of authority *and* outside Congressional oversight and, thus, steeped in secrecy—as it has remained until this day.[28]

From Copper Cables and the Empire of Capital to the Geopolitical Economy of the Global Internet Infrastructure

The development of the internet possesses many similarities with the past while being *radically different* from it nonetheless. The basic geography, for instance, remains similar, as we can see by comparing the depiction of the world's optical fiber submarine cable system in Figure 3 with the 1876 map shown earlier in Figure 1. Comparing the two maps gives a sense of the extent to which the routes laid down in the nineteenth century are still the dominant routes now, even if under very changed conditions. Communication paths, in fact, link many of the same "world cities" now as they did then and some of the same old ornate cable telegraph buildings of the nineteenth century in London and New York have even been retrofitted for fiber optic cables today. But here is where the similarities stop.

All the copper cables previously used to support telegraphy and then telephony have been decommissioned and a wholly new infrastructure of optical fiber cables put into place since 1988, most notably in a frenzy of activity that took place in a few years at the turn of the twenty-first century for reasons that will be examined shortly. As of the end of 2016, the global internet's backbone consisted of 356 international submarine cables with a total length of about 1.3 million kilometers.[29] Currently, 99 percent of all international internet traffic travels through these cables:[30] a single fiber pair in a submarine cable (which typically has a dozen or so fiber pairs)

28. United States Congress.

29. TeleGeography, "Global Bandwidth Research Service, Submarine Cable." Recall, there were 80,000 kilometers after the first submarine cable construction boom in 1875.

30. TeleGeography, "Global Bandwidth Research Service."

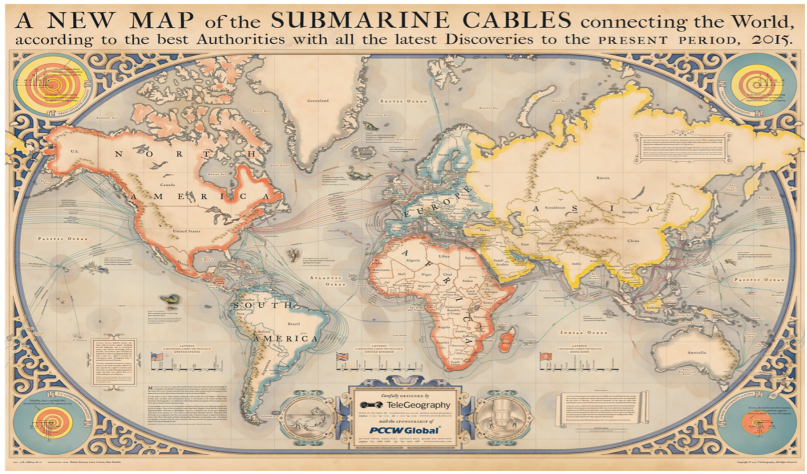

FIGURE 3 Submarine cables, 2015.

Source: TeleGeography, "Global Bandwidth Research Service."

can carry as much traffic as all the geosynchronous satellites orbiting the planet combined.[31] Within North America, for example, mobile wireless traffic equals 1 percent of all internet traffic; the rest is carried by fiber optic cables and copper line infrastructure.[32] The transmission capacity of the world's cable system is massive whereas it was extremely limited in the past: today one exabyte of data transits the internet every day, the equivalent of 212 million DVDs or the contents of the British Library or the US Library of Congress several hundred times over.[33]

Just as the speculative mania in the 1870s burst but still left behind the copper cables that really did serve the world for decades to come, so too have the sixteen new transatlantic cables laid during the global boom in submarine cable construction between 1998 and 2003 become the arteries of commerce and communication between North America and Europe ever since. In the last three years of the twentieth century alone, the carrying capacity of the transatlantic cables multiplied 100-fold.[34] Similar patterns took place within countries as well. $90 billion of new investment

31. OECD, "International Cables."
32. Sandvine, 5–7.
33. van der Berg.
34. FCC, "Cable Landing Licenses"; Terabit, 21.

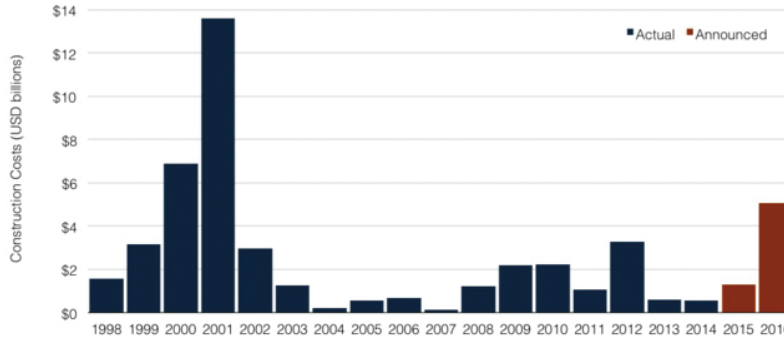

FIGURE 4 Construction costs of submarine cables, 1998–2016.

Source: TeleGeography, "Global Bandwidth Research Service."

was injected into the internet backbone and 36,000 kilometers of optical fiber laid in the United States, most notably, at the height of the boom.[35]

The speed and magnitude of the boom—and bust—of the dot-com bubble can be seen in the spike of capital investment in submarine cables from 1998 to 2001, and the plunge in investment thereafter (Figure 4).

The boom years were fueled by a confluence of forces. Investment surged from an average of $1–2 billion per year in the early 1990s to over $14 billion in 2000.[36] Nearly a quarter of the new stock of cables was built in just one year and on the eve of the dot-com crash in 2001, as Figure 5 illustrates.

The composition of the capital investment in the transoceanic cables also changed. During the first decade when new fiber-optic systems were built (1988–1998), the industry still revolved around the consortia of national telecoms carriers, including many state-owned monopolies. This changed after a series of big bangs in the late 1990s changed the global telecoms industry and the internet. In 1996, the United States passed the *Telecommunications Act*, for example, and a year later ninety countries that accounted for 90 percent of the world's telecoms revenues embraced the WTO's *Basic Telecommunications Agreement*.[37] While this vastly expanded the role of the market in telecommunications, it also represented a fundamental transition from regulated monopoly to regulated competition—*not*

35. Troainovski.
36. TeleGeography, "Global Bandwidth Research Service: Executive Summary."
37. Noam and Drake.

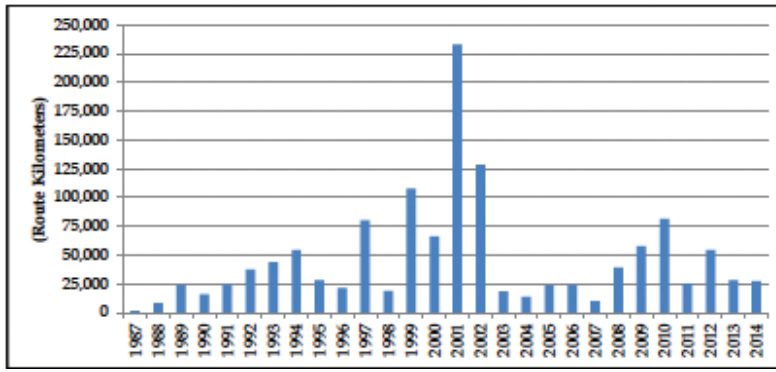

FIGURE 5 Deployment of new submarine cables by length, 1987–2014.

Source: Terabit, 14.

deregulation. This could be seen most visibly as the number of telecoms and media regulators around the world soared from 14 in 1990, to 90 by 2000, to 166 today. This major growth spurt took place mostly because almost all the countries that adopted the WTO's telecoms agreements also adopted its *Regulatory Reference Paper*, which obliged them to create national regulatory agencies whereas before they had none.[38] The internet was also swiftly becoming popular, and as it did, popular demand began to play a more significant role in investment decisions than ever. New sources of private capital with little experience also poured into the industry. Indeed, between 1997 and 2002, 21 percent of capital investment in submarine cables came from such sources. Government and development bank funding at the time was puny in comparison, accounting for only 1 percent of the total.

The dot-com bubble burst in the early 2000s. Of the $7 trillion lost at the time, $2 trillion could be laid at the feet of telecoms companies.[39] Watered stock market capitalization and fictitious capital hung about the industry. Repeating the events of more than a century earlier, many of the new operators collapsed, their assets acquired cheaply by well-established telecoms carriers as well as an emergent class of international internet traffic wholesalers, such as Level 3, Cogent, XO, Reliant, Zayo, and CDNs. Bandwidth was "dumped" onto the market.

38. International Telecommunication Union, "Statistics."

39. Starr.

So much new fiber optic cable was laid at the time that 90 percent or more of the capacity across the Atlantic was never "lit up" during the next decade. Instead, cable capacity has been stockpiled as "dark fiber" that has not been outfitted with the electronics needed to transmit traffic to avoid compounding the glut of bandwidth already in the market. No new transatlantic cables have been laid since the "Great Crash."[40] Consequently, "the transatlantic market continues to be served exclusively by the cable systems that were deployed between 1999 and 2003."[41]

There has been a resurgence of capital investment in new submarine cables since 2008, however, but on the other side of the world, in the Asia-Pacific region initially but also spreading to Africa, South America, and the Middle East in recent years. Total estimated investment between 2008 and 2015 was around $11.8 billion. Most of the investment involved the BRICS ($6.7b, or 57 percent), largely due to four ambitious Asia-Pacific region cable projects: UNITY (2010), the South-East Asia Japan Cable (SJC) (2013), the Asia Pacific Gateway (APG) (2016), and FASTER (2016).[42] As in the past, Africa and some of the most downtrodden economies of the world have been the last to be tied into the internet infrastructure and are among the least competitive, worst served, most expensive places for internet bandwidth on the planet, but this too is changing fast.[43] In fact, a quarter of the investment since 2008 ($2.9 billion) has been in new cables to and around Sub-Saharan Africa, four along the west coast, three along the east. There are four new cables linking India together with the Mid-East and Europe in various stages of development ($1.7 billion) as well, and two more between North and South America also on the drawing board.[44]

Government ownership and financing of fiber optic submarine cables remains modest but is on the upswing, rising from just 1 percent of cable investment between 1987 and 2014 to nine times that amount in the past six years. Now, however, it is not the "new imperialists" making the capital investments, but nation-states in the Global South, especially in Asia, sometimes in tandem with international development banks, but typically with capital from national and regional telecoms carriers, many of which are government-owned, but also with sizeable investment and ownership

40. TeleGeography, "Global Bandwidth Research Service: Executive Summary."

41. Terabit, 21–22.

42. Dates are for when the cables began service. TeleGeography, "Global Bandwidth Research Service, Submarine Cable."

43. Weller and Woodcock; OECD, "International Cables."

44. TeleGeography, "Global Bandwidth Research Service, Submarine Cable"; Terabit, 14–22.

stakes from Google, Facebook, and Microsoft—as is the case in each of the major Asian projects outlined earlier and discussed in greater detail in the following sections.[45]

New Builders and Owners of the Global Internet Infrastructure

The number and type of submarine cable system owners and operators has expanded, and continues to become more diverse. In addition to the consortia of incumbent telecoms carriers, there are two relatively new groups of players that own and operate around 50 fiber optic cable systems. The first group consists of telecoms companies that have arisen in the last 20 years or so alongside the turn to regulated telecoms competition worldwide; the second group includes the US-based internet giants such as Google, Facebook, and Microsoft, which have joined with others to build international submarine cable systems, and in some instances struck out on their own, to meet their needs—as shown in further detail hereafter.

Among the first group, three companies stand in a league of their own: Level 3, Global Cloud Xchange, and Tata.[46] They are also among the biggest nontraditional carriers that sell capacity on a wholesale basis. Other members of this group include Cogent, PCCW, XO, Global Transit, Globe Transit, and Hurricane Electric.[47] Another group of relative newcomers is building (or leasing) and operating content delivery networks (CDNs) that carry traffic for large corporate and government users, media and entertainment companies, and the biggest internet companies. Seven such companies stand out worldwide: Amazon, Akamai, China Cache, Level 3, Verizon,[48] Limelight, and Highwinds.[49] The top four such firms account for 93 percent of all CDN traffic. While this suggests that the sector is highly concentrated, the large CDNs compete in a wider market that includes the global bandwidth wholesalers, incumbent carriers, and, increasingly in recent years, the world's biggest internet companies such as Google, Facebook, Amazon, and Microsoft as they begin to build their own networks or join other consortia to do so as well.

45. TeleGeography, "Global Bandwidth Research Service, Submarine Cable"; Terabit, 14–22.

46. TeleGeography, "Global Bandwidth Research Service, Submarine Cable."

47. Zmijewski.

48. Verizon, of course, is not a new company, but it entered the CDN business after acquiring Edgecast in 2013.

49. Rayburn.

Regardless of these variations, however, the consortia approach, with its deep historical roots in the cartels of the nineteenth and twentieth centuries, is still a mainstay of the universe. Today's consortia are more heterogeneous, however, and that undoubtedly underpins why incumbent national carriers see international markets as being highly competitive.

International internet backbone providers, internet content companies, and CDNs interconnect with local ISPs and at one or more of the nearly 2000 IXPs around the world. The largest IXPs are in New York, London, Amsterdam, Frankfurt, Seattle, Chicago, Moscow, Sao Paulo, Tokyo, and Hong Kong. They are core elements of the internet that switch traffic between all the various networks that comprise the internet system, and help to establish accessible, affordable, fast, and secure internet service.

In developed markets, internet companies such as Google, Baidu, Facebook, Netflix, Youku, and Yandex use IXPs to interconnect with local ISPs such as Deutsche Telecoms in Germany, BT or Virgin Media in Britain, or Comcast in the United States to gain last-mile access to their customers—and vice versa, back up the chain. Indeed, 99 percent of internet traffic handled by peering arrangements among such parties occurs without any money changing hands or a formal contract.[50] Where IXPs do not exist or are rare, as in Africa, or run poorly, as in India, the cost of bandwidth is far more expensive. This is a key factor that helps to explain why internet service is so expensive in areas of the world that can least afford it. It is also why the OECD and EU encourage developing countries to make IXPs a cornerstone of economic development and telecoms policy work.[51]

In contrast to the late 1990s, when just 3,212 ASN were stitched together to create the network of networks that comprised the internet, in 2014 there were 48,643 ASN, of varying sizes, ownership, and purposes.[52] Moreover, the geography of these networks is changing significantly. In 1997, 56 percent of ASN were located in the United States. Adding Europe and Japan raised the total share of the three core regions of the global economy to 79 percent, while the BRICS accounted for 5 percent. A decade later, the United States' share of ASN had slid to 39 percent, and that of the

50. van der Berg; Weller and Woodcock.

51. TeleGeography, "Global Bandwidth Research Service, Submarine Cable, "Global Bandwidth Research Service"; Packet Clearing House; van der Berg; Weller and Woodcock.

52. OECD, "Digital Economy Outlook." ASN is the number assigned to each independent (autonomous) network that is linked up with one or more *external* networks that make up the internet. See Hawkinson and Bates.

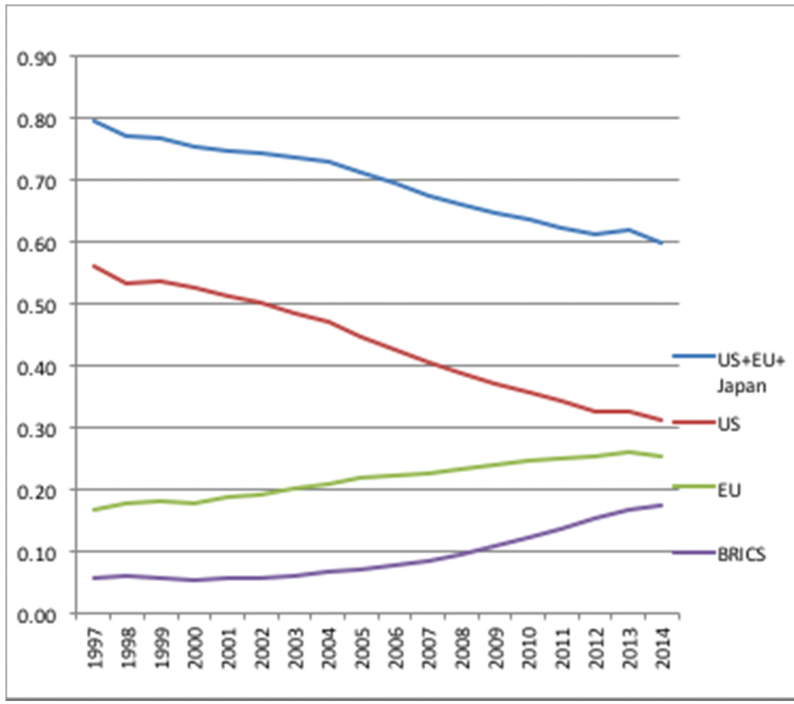

FIGURE 6 Country and region share of autonomous system numbers, 1997–2014.

Source: OECD, "Digital Economy Outlook."

transnational core countries fell to two-thirds. The BRICS now accounted for double what they had 10 years earlier. In 2014, the trend continued: the United States' share had dropped to 31 percent, and of the United States, Europe, and Japan combined to 60 percent. The BRICS' share stood at 17 percent (Figure 6).[53]

Just as the geography of ASN has become less and less US-centric over time, so too has the United States' share of global internet traffic declined. Indeed, while the United States undoubtedly did dominate internet traffic worldwide during its first decade of commercialization—which also put it at the nexus of the commercial internet worldwide—its position has declined steadily ever since. Thus, in 2004, half of all internet traffic worldwide flowed through the United States but by 2016, that number had fallen to just over one quarter (i.e., 27 percent) (TeleGeography, "Global

53. Packet Clearing House.

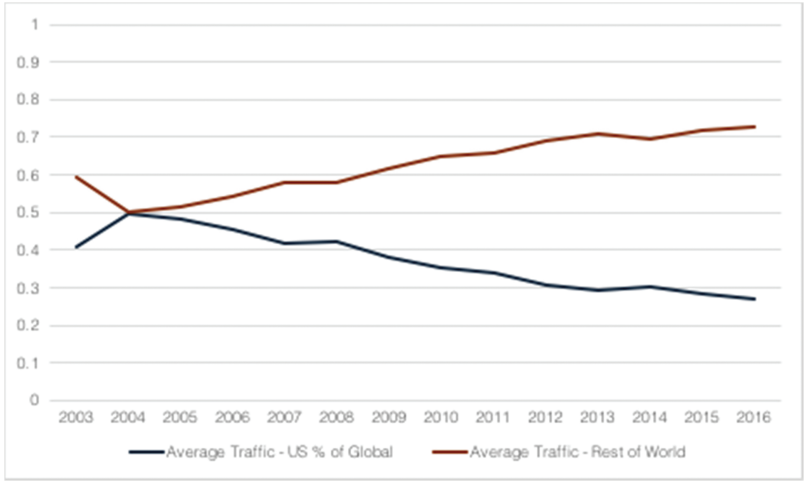

FIGURE 7 US share of international internet traffic, 2003–2016.

Source: TeleGeography, "Global Internet Geography—Figure 8"; TeleGeography, "Global Internet Geography—Country Profiles."

Internet Geography—Country Profiles"; "Global Internet Geography—Figure 8). Figure 7 illustrates this point.

Similar trends characterize the broader telecoms, internet, and media economic landscape. The US share of all revenues across the 12 largest sectors of the telecom, media, and internet industries dropped from 40 percent in 2000 to a little over a quarter in 2012.[54] The share of the United Kingdom, France, and Germany fell by similar amounts while China's share nearly doubled from 3.5 percent to 6.5 percent over the same time, as did Brazil's, from 1.2 percent to 2.6 percent.[55] These meso-level changes are an index of trends at the macro level, and have implications for the political economy of everything.

Cable landing licenses continue to be a mainstay of the industry. They are the switching points between national internet-media systems and the global internet. As the Snowden disclosures and many studies of the internet around the world reveal, while the ideals of the open internet and "internet freedom" might tout citizens' right to communicate as a universal

54. These sectors include wired-line telecoms, mobile wireless, internet access, TV, newspapers, books, internet advertising, film, magazines, video games, music, and radio.

55. Winseck, "The Network Media Economy."

right, countries have not only reserved the right to monitor, intercept, and block internet traffic for opaque reasons of state and national security, and for reasons of public morality, they are exercising those powers vigorously, and often in ways that play fast and loose with the rule of law, if not falling outside of it entirely.[56] The Snowden disclosures suggest that the UK government's communications headquarters is directly tapping into 200 of the 277 cables that were operating at the time the records disclosed were produced—although how it does so is not as clear as it might be, given the dispersed nature of who owns the world's fiber optical submarine cables, and where they are located.

The ITU continues to play a role in the international dimensions of internet technical standards, some aspects of pricing, interconnection policies, spectrum, development issues, research, and a few other matters. Its role, however, has been diminished and that which does remain is hotly contested. Indeed, 90 percent of the world's internet traffic falls outside the ITU's interconnection and pricing rules, and nearly 100 percent of those arrangements are done through IXPs without any formal legal agreement.[57] The European Telecommunications Network Operators (ETNO) and some telecoms operators in the Global South, with backing from their respective governments, are having second thoughts about this, however. This is mostly because they see the traffic from internet giants such as Google, Facebook, Amazon, Apple, Baidu, Netflix, and so on as bypassing the traditional international revenue settlement agreements they have relied on in the past for profits and to finance their network investments. Not surprisingly, ETNO and some developing countries want to bring these arrangements back inside the multilateral regime and thus the ITU's purview, to obtain a bigger slice of the revenue from internet traffic. As a matter of fact, all telecommunications operators would like a bigger cut of the revenue, including in North America as well, although the latter are more inclined to achieve those goals by watering down common carrier (often loosely called net neutrality) rules instead of through the ITU.[58]

56. Deibert; European Parliament. An archive of the Snowden documents thus far disclosed can be accessed at https://snowdenarchive.cjfe.org.

57. van der Berg; Weller and Woodcock.

58. Weller and Woodcock; Mueller; Winseck, "Big New Global Threat"; Hill.

Drivers behind Internet Infrastructure Development: From Institutional Demand to the Age of Mass Self-Expression

Finance and Military Needs

The network of networks that make up the internet constitute a sprawling, general purpose platform upon which financial markets, business, and trade, as well as diplomacy, spying, national security, and war depend. The world's largest electronic payments system operator, the Society for Worldwide Interbank Financial Telecommunications' (SWIFT) secure messaging network carries over 25 million messages a day involving payments that are believed to be worth over $7 trillion USD.[59] Likewise, the world's biggest foreign currency settlement system, the CLS Bank, executes upward of a million trades a day worth between $1.5 and $2.5 trillion over the global cable systems—although that is down by half from its high point in 2008.[60] As Stephen Malphrus, former chief of staff to the US Federal Reserve Chairman Ben Bernanke, observed, when "communications networks go down, the financial services sector does not grind to a halt, rather it snaps to a halt."[61]

Governments and militaries also account for a significant portion of internet traffic. Indeed, 90 to 95 percent of US government traffic, including sensitive diplomatic and military orders, travels over privately owned cables to reach officials in the field.[62] "A major portion of DoD data traveling on undersea cables is unmanned aerial vehicle video," notes a study done for the Department of Homeland Security by MIT scholar Michael Sechrist.[63] Indeed, the Department of Defense's entire Global Information Grid shares space in these cables with the general public internet.[64]

Fiber optic cables and the overall mobile wireless and internet system of which they are an integral part, however, are no longer the rich man's post as during the days of international telegraphy and telephony. Indeed, the cost of internet transit has plunged, as a recent OECD study shows, to "about $0.0000008 per minute—or 100,000 times lower than typical

59. Society for Worldwide Interbank Financial Telecommunication.
60. CLS, 4; Rauscher, 179.
61. Rauscher, ix.
62. Sechrist, 4.
63. Ibid., 5.
64. Ibid., 8.

voice rates."[65] As prices have dropped, internet and mobile wireless use has exploded. While the number of people who used the international telegraph could be counted in the thousands in the late nineteenth century and the hundreds for the biggest users, there were around 400 million regular internet users (5 percent of the world's population) and 800 million mobile wireless subscriptions by the turn of the twenty-first century. As of the end of 2016, there were an estimated 3.7 to 5 billion unique mobile wireless subscribers, and 3.6 billion regular internet users.[66]

The People's Needs and Uses/Users of the Internet

To be sure, great inequality persists. Four billion people, or 53 percent of the world's population, still lack internet access, and the gender divide continues to be stubbornly difficult to bridge.[67] The number of people with regular internet access is just 1-in-10 in the four dozen least developed countries. Honing in further yet to examine broadband internet access (even by the laughably low criteria of broadband used by the ITU, i.e., above 256 kbps), people in the world's 10 richest countries are *350 times* as likely to have fixed broadband access at home than those in the 50 poorest nations.[68] Nonetheless, the composition of who does and does not use the internet has shifted decisively to the BRICS countries and the Global South. Whereas two-thirds of internet users lived in the United States in 1996, by 2016 11 percent did, while China accounts for 20 percent of the total (Figure 8).

The 3.6 billion people as of early 2016 who use the internet to communicate, share music, ideas and knowledge, browse, upload videos, tweet, blog, organize social events and political protests, watch pornography, read sacred texts, and sell stuff are having the greatest influence on the current phase of internet infrastructure development. Video currently makes up an estimated two-thirds of all internet traffic, and is expected to grow to 80 percent in the next five years,[69] with US firms leading the way.

---

65. van der Berg.

66. Broadband Commission, *The State of Broadband 2016*, 6; International Telecommunication Union, "Statistics"; Internet World Stats; GSMA Intelligence.

67. Broadband Commission, *The State of Broadband 2016*, 41; International Telecommunication Union, "Statistics."

68. Broadband Commission, *The State of Broadband 2014*, 82–83.

69. Cisco.

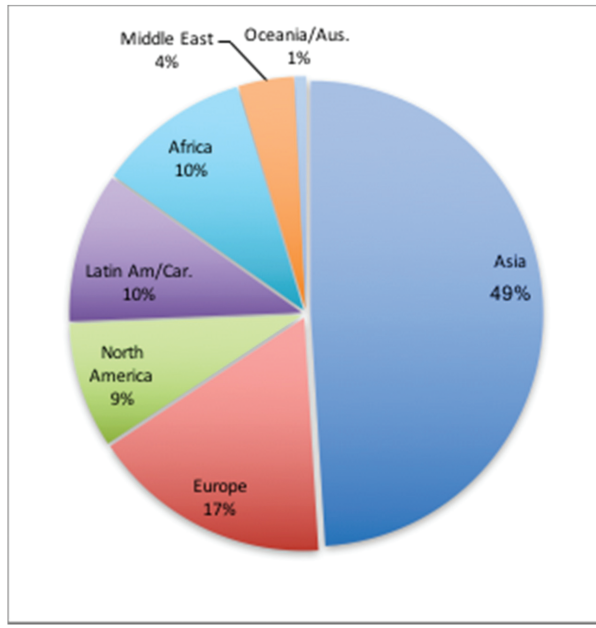

FIGURE 8 Global distribution of internet users by region, 2016.
Source: Internet World Stats.

Netflix single-handedly accounts for a third of all internet traffic. YouTube is the second largest source of internet traffic on fixed and mobile networks alike the world over. Altogether, the big five internet giants account for roughly half of all "prime-time" internet traffic, a phrasing that deliberately reflects the fact that internet usage swells and peaks at the same time as the classic prime-time television period, that is, 7 p.m. to 11 p.m.

Usage trends (Figure 9) are fundamentally shaping the *evolution* of the internet. Incumbent telecoms carriers have been the primary sources of bandwidth demand in the past, but the mantle has now fallen to internet giants Netflix, Google, Amazon, Apple, and so on, which are building their own CDNs, paying for CDN services from others, and buying bandwidth wholesale to bring services as close to end customers as possible. They are driving the largest network development projects in the world, and the populist nature of the demand underpinning their efforts marks a significant break with previous times when the needs of armies, big business, and governments pressed most urgently on "the creation of the media."[70]

70. Starr.

	Upstream		Downstream		Aggregate1	
Rank	Application	Share (%)	Application	Share (%)	Application	Share (%)
1	BitTorrent	25.49	Netflix	34.89	Netflix	32.39
2	Netflix	9.48	YouTube	14.04	YouTube	13.25
3	HTTP	7.18	HTTP	8.62	HTTP	8.47
4	SSL	7.05	Facebook	2.98	BitTorrent	5.03
5	YouTube	6.14	BitTorrent	2.8	Facebook	2.94
6	iCloud	4.41	iTunes	2.77	SSL	2.63
7	Skype	2.77	MPEG-Other	2.66	iTunes	2.55
8	Facebook	2.6	Amazon Video	2.58	MPEG-Other	2.44
9	FaceTime	2.38	SSL	2.14	Amazon Video	2.37
10	Dropbox	1.48	Hulu	1.41	Hulu	1.2
		68.98		74.89		73.27

FIGURE 9 Prime time internet traffic composition—North America, 2014.

Source: Sandvine, 6.

Worldwide, the public internet is being eclipsed by private internets built, owned, and operated by several of the world's largest internet companies, traditional telecoms carriers, and a relatively new class of internet bandwidth wholesalers (Level 3, Tata, Global Cloud Xchange, Cogent, XO, Hurricane Electric) and CDNs (Amazon, Akamai, China Cache, Limelight, etc.). These trends may also be altering these companies' stance on network neutrality/common carriage and other internet and public policy issues as well, as appears to be the case with Google given its relative withdrawal from the policy scene on the network neutrality/common carriage issue since 2010 or so, just as its own infrastructure building efforts were quickly ramping up.[71]

The internet giants generally are taking two different approaches to internet infrastructure: one based on direct investment and ownership stakes in fiber optic submarine cables, the other based on buying or leasing access to bandwidth from carriers and CDN providers while building data centers at each end of the networks they use. Google and Facebook, for instance, are pursuing the first strategy with respect to new cables across the Pacific and along the Asian coastline from Korea to Thailand. In the transatlantic regions, however, they do not yet own any cables, but are constructing enormous data factories on either side of the ocean while obtaining bandwidth wholesale from CDN providers and internet backbone carriers.

71. Stevenson.

Understanding this difference brings us "back to the future": the speculative bubble and stock market crash that attended the dot-com era at the turn of the twenty-first century, similar to 1873, when the first generation cable infrastructure was caught up in similar events. Like its predecessor, the dot-com crash ultimately left a legacy. As observed earlier, no new transatlantic cables have been built since 2003 and 90 percent or more of the capacity across the Atlantic was never "lit up" for much of the next decade to avoid compounding the woes of the bandwidth glut already in the market.[72]

Some operators have installed state-of-the-art electronics to the stockpile of "dark fiber" since 2008 and this has brought some of the unused capacity online since 2008, but by 2015 two-thirds of the north Atlantic capacity remained unused.[73] A few new projects are on the drawing board, however, notably the $640 million Arctic Fiber cable—led by the revived Ledcor of 360 Networks infamy from the dot-com era—which aims to string fiber optic cables from the United Kingdom across the Arctic Ocean and to Japan, with a spur to Seattle. Several other transatlantic cables are slated to begin service in the next year or two as well, for example the MAREA cable between the United States and Europe (with ownership shared between Telefonica [50 percent], Facebook [25 percent], and Microsoft [25 percent]); Google's efforts to build two cables—Junior and Tannat—between cities in Brazil and Uruguay; and the Brazil–United States (BRUSA) cable (Telefonica).[74] Demand is beginning to catch up to capacity, and with that a flurry of new investment is taking place.

Given the large stock of bandwidth available and the high levels of competition that have kept bandwidth costs down, Google, Facebook, Microsoft, Amazon, and Apple have typically bought or leased capacity from others while constructing their own data centers at each end of the cables to meet their needs. In turn, these great "digital factories"—that is, the industrial like facilities used to process, store, and serve the torrents of data upon which the internet runs—enable Google, for instance, to

72. TeleGeography, "Global Bandwidth Research Service: Executive Summary"; Terabit, 21–22.

73. TeleGeography, "Global Bandwidth Research Service: Executive Summary"; Terabit, 21–22.

74. TeleGeography, "Global Bandwidth Research Service: Executive Summary"; Terabit, 21–22. In 2016, however, Facebook and Microsoft announced that they had joined forces with the Spanish and South American telecoms giant, Telefonica, to lay a cable across the North Atlantic, with a spur from the United States to Brazil. The plan is to have the cable in service by 2018. See TeleGeography, "MAREA, Submarine Cable Profiles."

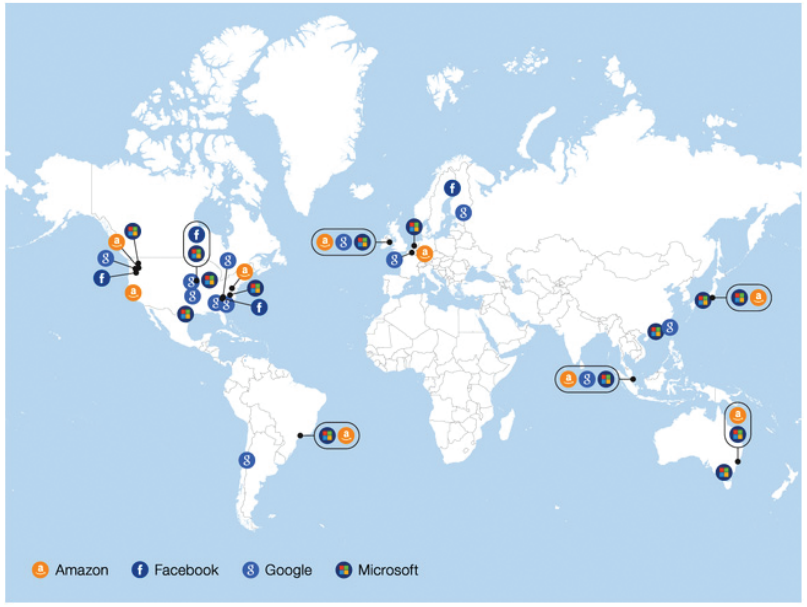

FIGURE 10 Location of the big four US internet companies' data centers, 2015.

Source: TeleGeography, "Global Bandwidth Research Service" (Figure 16). Smaller data centers omitted.

process an estimated 20 billion web pages and 400 billion searches a day, and the 100 hours of video that are uploaded to YouTube every minute, and to support its Android operating system, Chrome browser, Google Play, Google Maps, and so forth. Amazon is in a class of its own because it has its own CDN service *and* has built data centers in locales around the world matched to the scale of its online retail and Prime TV services as well as Amazon Web Services, the world's largest CDN (Figure 10).[75]

Conditions in the Asia-Pacific region have been very different. Bandwidth has been scarcer and, therefore, the need for new cables much greater. Given their significant presence in parts of Asia, notably the Philippines, Hong Kong, and India, Google and Facebook have sought to rectify this lack of bandwidth by taking ownership stakes in four major undersea cable projects that have been launched in the last decade, that is, UNITY (2010), SJC (2013), APG (2016), and FASTER (2016)—as well as two more that are currently on the drawing board: the New Cross Pacific Cable (NCP) and the Pacific Light Cable Network (PLCN) slated to be put into service

75. Amazon; Rayburn.

this year and next.[76] In this region, they have, thus, done two things: built their own data centers, as Figure 9 shows, and invested directly in building cable systems that they own in concert with regional and national telecoms operators. Not counting the last two projects because they have yet to be built, there has been a large resurgence of investment in submarine cables since 2008, with $11.8 billion in new investment and new connections of 45,000 kilometers having been pressed into service each and every year since then (on average).

Google took the lead in such ventures in 2008 when it acquired a substantial ownership stake in the $300 million (USD) UNITY Cable, a cable that runs from California to Japan. The lead role in the consortia that owns and operates the UNITY cable, however, is Vodafone (40 percent), followed by the regions' major national carriers, many of which are either state-owned or have significant stakes in them owned by governments. How much of this venture each carrier and Google own, respectively, however, is unknown.[77]

Three years later, in 2011, Google acquired an ownership stake in the SJC, a $400 million system consisting of a series of spurs from the transpacific cables to Brunei, China, Hong Kong, the Philippines, Japan, and Singapore, with a second phase of the project slated to extend the network to Thailand.[78] The make-up of the ownership group behind this cable is larger than in the UNITY project but still includes many of the same players in the region and, in several cases, the national governments that back them: China Telecom, China Mobile, SingTel, Singtel Optus, Chungwa Telecom, KDDI, Google, Globe Telecom, Telkom Indonesia, the Telephone Organization of Thailand, Brunei International Gateway, and Airtel. Again, we have little insight into how much of this venture is owned by Google and the others involved, but state-owned telecoms operators appear to dominate the consortia given the role of China's two biggest government-owned telecoms operators (China Telecom and China Mobile), Singtel and its affiliate Singtel Optus, and incumbent national carriers from Taiwan, Brunei, and Thailand. KDDI, Globe Telecom, and Airtel are from the relatively new category of competitive telecoms and/or mobile network operators from Japan, the Philippines, and India, respectively, that also have ownership stakes in this system.

76. TeleGeography, "Global Bandwidth Research Service"; Terabit, 14.
77. TeleGeography, "Global Bandwidth Research Service"; Chowdhry.
78. TeleGeography, "Global Bandwidth Research Service, Submarine Cable."

Facebook followed Google's lead in 2013 when it took a $450 million ownership stake in the APG project with 11 partners: Chunghwa Telecom (10.2 percent), China Mobile, China Telecom, China Unicom, Korea Telecom, NTT, Vietnam Posts and Telecoms, Viettel, StarHub, LG Uplus, and Time dot Com (since acquired by Global Transit). The 10,400-kilometer system will link together China, Hong Kong, Japan, South Korea, Malaysia, Taiwan, Thailand, Vietnam, and Singapore and began service in 2016.[79]

In 2014, Google invested another $300 million along with China Mobile, China Telecom, SingTel, KDDI, and Global Transit to build the transpacific FASTER cable system between the United States and several cities in Japan, China, Korea, and elsewhere in Asia. The effort was spurred on by the rapid growth in demand for broadband media and mobile content in the region. The FASTER cable will operate with an initial capacity of 60Tb/s—which, to give a sense of scale, is roughly 10 million times faster than a typical North American's cable modem.[80]

Two more projects are planned in the next two years. In the first, Microsoft alongside China Telecom, China Unicom, China Mobile, Chunghwa Telecom, Korea Telecom (each with 16.7 percent ownership), and Softbank (with a 2 percent stake) jointly own the NCP that is slated to begin service between the United States, China, Korea, and Taiwan in 2017. The second project, the PLCN, is jointly owned by Google, Facebook, and China Soft Power Technology. It plans to begin service between Hong Kong and California in 2018, and will have twice the capacity of the FASTER cable laid just a few years earlier, illustrating both the massive increase in bandwidth taking place and the fast pace of technological innovation.[81]

Several things stand out from this analysis. First, in less than a decade, Google has carved out a very large place for itself through its ownership role in four of the six projects (the SJC, Faster, Unity, and Pacific Cable Light initiatives), while Facebook has stakes in two of them (APG and PLCN) and Microsoft in the PLCN project. This is a relatively new trend and one that should be watched in the years ahead.

Second, while the evidence is not as complete as one would like (ownership details are a tightly guarded secret in the industry), it strongly appears

79. TeleGeography, "Global Bandwidth Research Service"; Chowdhry.

80. Chowdhry.

81. TeleGeography, "Global Bandwidth Research Service, Submarine Cable."

that the US-based internet companies do *not* dominate the Asian internet infrastructure. To the extent that interests from any single country do dominate, that pride of place appears to go to China. Two of its big three telecoms operators—China Telecom and China Mobile—are involved in five out of the six projects (i.e., SJC, Faster, Unity, APG, and NCP), while the country's third major operator, China Unicom, is involved in the APG and NCP ventures. The big three Chinese telecoms operators, in short, cut the most prominent figures in the region. Their fast expanding interests also extend beyond Asia to include cable links from Asia to Europe and from there to South America.

Third, telecoms operators from Japan—the incumbent carrier NTT and the competitive telecoms and internet operators, KDDI and Softbank—also have sizeable ownership interests in the APG, SJC, Faster and Unity, and NCP cables, respectively. Singaporean-based SingTel and two of its affiliates, Starhub and Optus, also have substantial ownership stakes in all four existing ventures but not in the pending NCP and PLCN cables. Taiwan's incumbent national carrier, Chunghwa Telecom, is also active in half of the ventures, that is, SJC, APG, and NCP. State-owned carriers in several other countries are also significant players (e.g., Korea Telecom, Telephone Organization of Thailand, Telkom Indonesia, Brunei International Gateway, Vietnam Posts and Telecoms, and Viettel). Fourth, a couple of competitive telecoms companies like Global Transit, Globe Telecom, and Airtel Bharti from Malaysia, the Philippines, and India, respectively, have carved out sizeable stakes for themselves in one or more of the Asia-Pacific cable systems built over the last decade. Their emergence is an index of the growing clout of a wider range of countries in the region and the rise of competition within them.

A preliminary view based on the publicly available information is that the US internet companies are important but subordinate players in consortia dominated by state-owned national carriers and a few relatively new competitors. Keen to wrest control of core elements of the internet infrastructure that they perceive to have been excessively dominated by United States interests in the past, Asian governments and private investors have joined forces to change things in their favor. In terms of the geopolitical economy of the internet, there is both a shift toward the Asia-Pacific region *and* an increased role for national governments. A similar phenomenon extends beyond Asia insofar that state and development bank investment, while miniscule at just 1 percent between 1987 and 2010, has soared to 9

percent since then.[82] These changes in ownership and control of the material infrastructure of the internet point to much bigger geopolitical and economic changes afoot that are reshaping how the internet will develop in the decades ahead, much along the lines that Ronald Deibert has suggested as the next billion internet users—mostly from the "global south"—come online.[83]

The Strange Non-Death of Telecoms (Internet-Access) Regulation

The juxtaposition of states versus markets in general and for communications specifically has long been a red herring.[84] The state still plays an influential role in the twenty-first century—in different ways in different places—despite supporters and critics alike who imagined that liberalization and deregulation would flatten out these differences and reduce state intervention in the market. We can see this in at least four ways: the tenfold expansion in the number of telecoms regulators worldwide since the 1990s and as outlined earlier, the greater recent willingness of regulators to address market concentration, the adoption of national broadband initiatives, and the rising role of national security and intelligence services in the mix of factors shaping the development of the global internet. The last few pages of this article take up these points.

The vast increase in the number of telecoms and media regulators worldwide has been driven, first and foremost, by the WTO telecoms agreement of 1997, and an appendix to the deal—the *Regulatory Reference Paper*—that provided a blueprint for how to create a national regulator that would serve primarily to develop and maintain reasonably competitive telecoms and internet access markets. The shift was to "regulated competition" from the previous model of "regulated monopoly."

Another marker of state intervention is the remarkable growth in the number of national broadband plans, especially after the onset of the global financial crisis in 2008. The number of national broadband plans has soared from 38 at that time to 151 last year.[85] These plans have also been accompanied by a surge in government investment in telecoms infrastructure,

82. Terabit, 20–28.
83. Deibert, 101.
84. Strange.
85. Broadband Commission, *The State of Broadband 2016*, 32.

specifically broadband internet. An early tally of such efforts indicated that governments had committed $71 billion in capital investment in national broadband projects between 2008 and 2020.[86] This large increase, again as we have seen earlier, was paralleled by a corresponding large increase in state and development bank investments in new international submarine cables over the same period.

Return of the State as Regulator of Concentrated Markets

In addition to the expanded role of the state as market builder, regulator, and information infrastructure policy maker, many regulators have also rediscovered the reality of significant market concentration in the telecom-internet and media industries. Indeed, the US government has rejected several high-profile telecoms mergers in recent years, such as AT&T's proposal to take over T-Mobile in 2011, T-Mobile's bid for Sprint in 2014, and Comcast's attempt to acquire Time Warner Cable last year. Even the approval of Comcast's blockbuster takeover of NBC Universal in 2011, and Charter Communications acquisition of Time Warner Cable last year, respectively, came with important strings attached and ongoing conduct regulation designed to constrain the companies' ability to abuse their dominant market power.[87] The FCC's landmark 2016 ruling to reclassify broadband internet access as a common carrier further indicated that US regulators have been alert to the realities of market concentration and telecoms-internet access providers' capacity to abuse that power, and the need to maintain a vigilant eye to ensure that their practices do not swamp people's rights to freely express themselves, maintain control over the collection, retention, use, and disclosure of their personal information, and to access a diverse range of services over the internet.[88] The 28 members of the European Union, along with Norway, India, and Chile, have adopted similar "common carriage/network neutrality/open network"[89] rules to

86. Benkler et al., 229–31.

87. United States Department of Justice; FCC, "Memorandum Opinion."

88. FCC, "Protecting and Promoting."

89. These concepts are not synonymous, but they have enough overlapping values that it is useful to treat them as close cousins: for example, control over communications should be at the ends of the network and in "users'" hands versus under the control of the telcos; telcos are gateways versus gatekeepers; antitrust concerns are key but not sufficient to address the values represented by free speech, freedom of the press, privacy, autonomy, universality. The concepts listed here—each in their own way—touch upon on these points.

offset the reality that concentration in core elements of these industries is "astonishingly high"[90] on the basis of commonly used indicators (e.g., concentration ratios and the Herfindahl–Hirschman Index).

In Canada, the Canadian Radio-television and Telecommunications Commission (CRTC) also implemented mandatory wholesale access rules and regulated rates for wireline and mobile wireless markets after finding both of these industries to be characterized by (1) persistently high levels of concentration; (2) high barriers to market entry; (3) little evidence of rivalrous behavior between the incumbents; and (4) the companies' use of their market power to deter new rivals from entering the market.[91] The Canadian government has also used spectrum policy and turned back some proposed mergers in order to induce greater competition.[92] These moves have been replicated elsewhere. The US internet giants have also come under growing scrutiny for reasons of antitrust, privacy, and cultural policy around the world, including the United States, Canada, the European Union, South Korea, France, Germany, and Russia. Regulators, in sum, appear to be actively serving as a countervailing force to dominant market power.

The upshot of these observations is that the "free market" orthodoxy that many associated with the 1990s and early 2000s phase of neoliberal globalization no longer reigns supreme, if it ever did. Indeed, the whole idea that "deregulation/liberalization" would lead to the withdrawal of the state, or a general model of limited state intervention in the economy in line with the US-driven approach to globalization (which itself is something of a caricature), has long been at odds with the reality that, rather than stepping back from the market tout court, governments the world over have taken on the role, more or less, of being the handmaidens of market development.

The Mass Surveillance of Digital Communications and the Challenge to US Hegemony

While the preceding discussion suggests a world in which the primary competition is between what Strange would call the market and state authority, it is in Snowden's disclosures of mass internet surveillance by the NSA and its five-eyes partners (e.g., the United States, Australia,

90. Noam, "Who Owns the World's Media?," 8.
91. CRTC, "Regulatory Framework," "Review of Wholesale Wireline Services."
92. Industry Canada.

Britain, Canada, and New Zealand) and European intelligence services (e.g., Germany, France, Spain, and Sweden) that we can see the other tension in this story, namely that the stature of US structural power in the geopolitical economy of the internet is shrinking.[93] The extent of state surveillance revealed by Snowden, in fact, reveals not so much US hegemony, but rather that changes in the geopolitical economy of the internet have eroded the US-centric model of the internet and, as a consequence, required the US government to work in league with others to carry out its mass internet surveillance programs. Although the United States and key American internet companies are still dominant in some core elements of the internet like operating systems, internet content, social networks, and search engines, the influence of US capital and the US government is receding when it comes to hardware. Claims of US internet imperialism, however, obscure the complex global alliances and transactions that underpin the global internet infrastructure in the "real world," however.

These developments indicate a new phase in internet governance and control. In the first phase, circa the 1990s, technical experts and organizations such as the Internet Engineers Task Force played a large role, while the state sat relatively passively on the sidelines. In the second phase, circa the early to mid-2000s, commercial forces surged to the fore, while internet governance revolved around the ICANN and the multi-stakeholder model. Finally, the revelations of mass internet surveillance by many states and ongoing disputes over the multi-stakeholder, "internet freedom" agenda on the one side, versus the national sovereignty, multilateral model where the ITU and UN system would play a larger role in internet governance all indicate that significant moves are afoot where the relationship between states and markets is now in a heightened state of flux.[94]

An even fuller response in terms of this "return of the state" idea can also be seen in the efforts being taken by some countries to build semiautonomous, national Web 3.0 spaces based on (1) systematic filtering and blocking of certain kinds of internet content and websites; (2) fostering national champions (Alibaba, Baidu, and Tencent in China; Yandex and Vkontakte in Russia); and (3) turning to large internet-media-communication campaigns (propaganda) to shape national information spaces.[95] Russia

93. European Parliament.

94. Schackelford et al.; Powers and Jablonski.

95. Deibert and Rohozinski, chapter 2; Noam, "Towards the Federated Internet"; Powers and Jablonski.

and China are also trying to add international legal norms steeped in nineteenth-century views of state security that would further entrench the semiautonomous, national web 3.0 model in a multilateral model of internet governance. The US declaration a decade and a half ago that cyberspace is the fifth frontier of war (in addition to land, sea, air, and space) has not helped in the least in this regard.[96] Finally, Russia, China, South Africa, and Brazil have responded with plans to build their own submarine cable network—the BRICS Cable—in a bid to bypass what they still perceive to be the US-dominated internet. These are the nascent lines in the struggle for control over the global internet in the twenty-first century.

Conclusion

In seeking to understand the exercise of power, Strange advocated focusing on structural power—that is, the ability to set the context within which other actors operate—and the balance between state and non-state/market actors. An examination of both issues raises questions about hegemony, and who will win and lose from a particular set of rules. In this case, by examining the development of, first, submarine cable telegraph networks, and, later, internet infrastructure, we can gain insight into the question of the extent of US hegemony in this area and, critically, the scope and direction of changes over time.

As discussed in this article, the end-of-the-twentieth-century idea that the world was being remade in the image of the US model of economic globalization has not panned out. The liberalization of global telecoms and internet policy has not led to a much-diminished role for state intervention either. US-based internet giants like Google, Apple, Facebook, Microsoft, Amazon, and so on do dominate several core internet *services* (e.g., search, devices, social networking, online retailing), and their position has been buttressed by the US State Department's "internet freedom" agenda and the multi-stakeholder model of internet governance. The revelations by Snowden of the worldwide internet surveillance program led by the NSA and the United Kingdom, with much help from Australia, Canada, and New Zealand, and some European governments, has reinforced the view

96. United States Department of Defense.

of a US-centric internet and given sustenance to charges of US internet imperialism.[97]

Such claims, however, are overdrawn. They rely too heavily on the same old "realist," "struggle for control" model where conflict between nation-states has loomed large and business interests and communication technologies served mainly as "weapons of politics" and the handmaidens of national interests from the telegraph in the nineteenth century to the internet today. Yet, nation-states and private business interests, then and now, not only compete with one another but also cooperate *extensively* to cultivate a common global space of economic accumulation. Communication technologies and business interests, moreover, often act independent of the nation-state and via "private structures of cooperation," that is, cartels and consortia, as the history and contemporary state of the undersea cable networks illustrate. In fact, the internet infrastructure of the twenty-first century, much like that of the industrial information infrastructure of the past 150 years, is still primarily financed, owned, and operated by many multinational consortia, although more than a few submarine communications cables are now owned by a relatively new roster of competitive players, such as Tata, Level 3, Global Cloud Xchange, and so forth. They have arisen mostly in the last 20 years and from new quarters, such as India in the case of Tata, for example.

Like the world economy overall,[98] the geography of the internet is tilting away from the United States and toward Europe, the BRICS, and the "rest of the world." The US internet giants do dominate the "code" and "content layers" of the internet: that is, operating systems (iOS, Windows, Android), search (Google), social media (Facebook), and online retailing (Amazon), as well as over-the-top TV services (Netflix), although in some countries they hardly figure at all: China, Russia, Korea, and Japan. The United States, however, does *not* rule the "guts and the gears"—the material infrastructure, in the fashionable parlance of communication and media studies, among other social sciences and the humanities—of the internet (hardware): for example, optical fiber submarine cables, ASN, bandwidth wholesalers, CDN, and IXP. These core components of the internet are becoming more plentiful outside of, and less dependent on, the United States. The four biggest submarine optical fiber cable projects of the past decade have all been in the Asia-Pacific regions, for example.

97. Fuchs; Hill; Jin; Kiss.
98. Arrighi; Desai.

Google is involved in three of these four projects that are already up and running, and two more that will be pressed into action within the next year or so. Facebook is also a partner with Google and the Hong Kong investment firm China Soft Power Technology in the PLCN. Microsoft has joined the fray, too. Other than the latter cable (PLCN) where Google and Facebook's interests do appear to dominate, the US internet giants' stakes do not appear to be dominant. Instead, a mixture of telecoms carriers, governments, competitive telecom and mobile network operators, and investment funds from the Asia-Pacific region loom large. The outsized role of China stands out in each case, with China Mobile, China Telecoms, and China Unicom having ownership interests in five of the region's six major, recent cable projects. The fact that there have been no new north Atlantic cables laid since 2003 also illustrates the point about how the global internet's center of gravity is shifting to the Asia-Pacific region. The fact that much of the transatlantic capacity that does exist remains to be unlit dark fiber also strikes one as an effort to hold back the extraordinary carrying capacity that already exists in the name of profit over access to affordable communications.

Lastly, parallel private internets are being built by bandwidth wholesalers (Level 3, XO, Cogent, etc.), CDNs (Amazon, Akamai, Level 3, China Cache, etc.), and others to serve the needs of the internet giants and voracious appetites of those they serve. The private internets that they are laying over top of the public internet are meant to bring the services of Google, Baidu, Facebook, Netflix, Youku, and so on as close to the doorsteps, desktops, and devices of these services' users as possible. By 2014, these private internets carried more internet traffic than the public internet in the Euro-American zone, with similar results expected to take place in Asia and the rest of the world in the next few years. The internet is not only fragmenting along geopolitical and regional lines, in other words, but between public and private internets as well.

In sum, there is no longer a single, universal internet—if there ever was—but a multitude of internets. The centripetal forces nudging things in this direction are also fortifying the push for national internets in China, Russia, and Iran as well, among others. In this light, perhaps we are at another critical juncture, equivalent to the "big bangs" of the late twentieth century that brought about regulated telecoms-internet competition, or similar to the development of the "industrial communications infrastructure" in the late nineteenth and early twentieth centuries. The question that hangs in the balance now is whether will we see the triumph

of the "federated internet," as Eli Noam[99] suggests, or redoubled efforts to build on the two-decade-old dream of a universal internet based on a common commercial model and cultural values of liberal democracy, without becoming too closely connected to the US "internet freedom" agenda, or any other particularistic agenda.

BIBLIOGRAPHY

Ahvenainen, Jorma. *The European Cable Companies in South America*. Helsinki: Finnish Academy of Science and Letters, 2004.

Amazon. *2014 Annual Report*. Accessed December 12, 2016. http://phx.corporate-ir.net/phoenix.zhtml?c=97664&p=irol-sec.

Arrighi, Giovanni. *The Long Twentieth Century: Money, Power and the Origins of Our Time*. London: Verso, 1994.

Benkler, Yochai, Robert Faris, Ura Gasser, Laura Miyakawa, and Stephen Schultze. "Next Generation Connectivity: A Review of Broadband Internet Transitions and Policy from around the World." *Berkman Center for Internet & Society*. February 15, 2010. Accessed December 12, 2016. http://cyber.law.harvard.edu/publications/2010/Next_Generation_Connectivity.

Britain. "Second Report of the Interdepartmental Committee on Cable Communications." 1902.

Broadband Commission. *The State of Broadband 2014*. Accessed December 12, 2016. http://www.broadbandcommission.org/documents/reports/bb-annualreport2014.pdf.

———. *The State of Broadband 2016*. Accessed December 12, 2016. http://www.broadbandcommission.org/Documents/reports/bb-annualreport2016.pdf.

Canadian Radio-television and Telecommunications Commission (CRTC). "Regulatory Framework for Mobile Wireless Wholesale Services." May 5, 2015. Accessed December 12, 2016. http://www.crtc.gc.ca/eng/archive/2015/2015-177.pdf.

———. "Review of Wholesale Wireline Services and Associated Policies." July 22, 2015. Accessed December 12, 2016. http://www.crtc.gc.ca/eng/archive/2015/2015-326.pdf.

Carr, Madeline. *US Power and the Internet in International Relations*. Basingstoke, UK: Palgrave Macmillan, 2016.

Chowdhry, Amit. "Google Invests in $300 Million Underwater Internet Cable System to Japan." *Fortune*, August 12, 2014. Accessed December 12, 2016. http://www.forbes.com/sites/amitchowdhry/2014/08/12/google-invests-in-300-million-underwater-internet-cable-system-to-japan/#42d0004e8f73.

Cisco. "Visual Networking Index." Accessed December 12, 2016. http://www.cisco.com/c/en/us/solutions/service-provider/visual-networking-index-vni/index.html.

CLS. "Monthly Market Report—December 2015." London: CLS. Accessed December 12, 2016. https://www.cls-group.com/MarketInsight/Pages/MarketReports.aspx.

Deibert, Ronald. *Black Code: Inside the Battle for Cyberspace*. Toronto: McClelland Stewart, 2013.

Deibert, Ronald, and Rafal Rohozinski. "Control and Subversion in Russian Cyberspace." In *Access Controlled: The Shaping of Power, Rights, and Rule in Cyberspace*, edited

99. Noam, "Towards the Federated Internet."

by Ronald Deibert, John Palfrey, Rafal Rohozinski, and Jonathan Zittrain, 15–34. Cambridge: MIT Press, 2010.

Desai, Radhika. *Geopolitical Economy: After US Hegemony, Globalization and Empire*. London: Pluto Press, 2013.

European Parliament. "Draft Report on the US NSA Surveillance Programme, Surveillance Bodies in Various Member States and Their Impact on E.U. Citizens' Fundamental Rights and on Transatlantic Cooperation in Justice and Home Affairs." 2014. Accessed December 12, 2016. http://www.europarl.europa.eu/meetdocs/2009_2014/documents/libe/dv/moraes_101470_/moraes_1014703_en.pdf.

FCC. "Cable Landing Licenses." www.fcc.gov.org.

———. "Memorandum Opinion and Order in the Matter of Applications of Comcast Corporation, General Electric Company and NBC Universal." Washington, DC: FCC, 2011. Accessed December 12, 2016. http://transition.fcc.gov/transaction/comcast-nbcu.html.

———. "Protecting and Promoting the Open Internet." Washington, DC: FCC, 2015. Accessed December 12, 2016. https://apps.fcc.gov/edocs_public/attachmatch/FCC-15-24A1.pdf.

Fuchs, Christian. "New Imperialism: Information and Media Imperialism?" *Global Media and Communication* 6, no. 1 (2010): 33–60.

GSMA Intelligence. "Unique Mobile Subscribers." GSMA Intelligence, n.d. Accessed December 12, 2016. https://gsmaintelligence.com.

Harvey, David. *The New Imperialism*. London: Oxford, 2003.

Hawkinson, J., and T. Bates. "Guidelines for Creating, Selection and Registration of an Autonomy's System (AS). Request for Comments 1930." *Internet Engineering Task Force*. March 1996. Accessed May 20, 2017. https://www.ietf.org/rfc/rfc1930.txt.

Headrick, Daniel. *The Invisible Weapon*. London: Oxford, 1991.

Hill, Richard. *The New International Telecommunications Regulations and the Internet*. Zurich: Springer, 2013.

Industry Canada. "Framework Relating to Transfers, Divisions and Subordinate Licensing of Spectrum Licences for Commercial Mobile Spectrum." Ottawa: Industry Canada, 2013. Accessed December 12, 2016. https://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/dgso-003-13-transfer.pdf.

International Telecommunications Union. "Collection of the Basic Texts of the International Telecommunications Union Adopted by the Plenipotentiary Conference." Geneva, Switzerland: ITU, 2011. Accessed December 12, 2016. http://www.itu.int/dms_pub/itu-s/oth/02/09/S02090000115201PDFE.PDF.

———. "Statistics." Geneva, Switzerland: ITU, 2011. Accessed December 12, 2016. https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx.

Internet World Stats. "Internet Usage Statistics." http://www.internetworldstats.com/stats.htm. Accessed December 12, 2016.

Jin, Dal. *Platform Imperialism*. New York: Routledge, 2014.

Kindleberger, Charles. *Manias, Panics, and Crashes: A History of Financial*. New York: Basic Books, 1978.

Kiss, Jemima. "NSA Furore Has Roots in US Internet Imperialism." *The Guardian*. November 13, 2013. Accessed December 12, 2016. http://www.theguardian.com/technology/2013/nov/01/nsa-furore-roots-us-internet-imperialism.

Lee, Kelley. *Global Telecommunications Regulation*. London: Cassell/Frances, 1996.

Marx, Karl. "Capital: Volume One. A Critical Analysis of Capitalist Production." (Orig. 1867). Reprinted in *The Marx-Engels Reader*, edited by Robert Tucker, 294–361. London: W. W. Norton & Co., 1972.

McChesney, Robert. *Digital Disconnect*. New York: New Press, 2014.

"Money-Market and City Intelligence." *The Times*, January 2, 1871.

Mueller, Milton. Internet Governance (blog). Accessed December 12, 2016. http://www.internetgovernance.org/2012/05/24/threat-analysis-of-itus-wcit-part-1-historical-context/.

Noam, Eli. "Towards the Federated Internet If One Internet Has Been Good, Multiple Internets Will Be Even Better." New York: Columbia University, 2013. Accessed December 12, 2016. http://www.citicolumbia.org/publications/Federated%20internet.pdf.

———. "Who Owns the World's Media?" Arlington, VA: George Mason University School of Law, 2013. Accessed December 12, 2016. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2242670.

Noam, Eli, and William Drake. "The 1997 WTO Agreement on Telecommunications: Big Bang or Little Bang?" *Telecommunications Policy* 21, no. 9–10 (1997).

"The Ocean Telegraph and Finance." *New York Times*, August 21, 1866.

OECD. "Digital Economy Outlook." Paris: OECD, 2015. Accessed December 12, 2016. http://dx.doi.org/10.1787/9789264232440-en.

———. "International Cables, Gateways, Backhaul and International Exchange Points." Paris: OECD, 2014. Accessed December 12, 2016. http://dx.doi.org/10.1787/5jz8m9jf3wkl-en

Packet Clearing House. "Internet Exchange Directory." San Francisco: PCH, 2015. Accessed December 12, 2016. https://prefix.pch.net/applications/ixpdir/?new=1&show_inactive=1&sort=Traffic&orde=desc.

Perez, Carlota. *Technological Revolutions and Financial Capital*. Northampton, MA: Edgar Allan, 2002.

Powers, Shawn, and Michael Jablonski. *The Real Cyberwar: The Real Cyber War: The Political Economy of Internet Freedom*. Chicago: University of Illinois, 2015.

Rauscher, Karl F. "Reliability of Global Undersea Cable Communications Infrastructure (The ROGUCCi Report)." Hoboken, NJ: IEEE, 2010. Accessed December 12, 2016. http://www.ieee-rogucci.org/files/The%20ROGUCCI%20Report.pdf.

Rayburn, Dan. "The State of the CDN Market." Content Delivery Summit (blog). Accessed May 20, 2017. http://blog.streamingmedia.com/wpcontent/uploads/2015/08/2015CDNSummit-Rayburn-Pricing.pdf.

Read, Donald. *The Power of News: The History of Reuters*. 2nd ed. New York: Oxford University Press, 1999.

Reinsch, Paul. *Public International Unions*. Boston: Ginn, 1911.

Sandvine. *Global Internet Phenomenon 2nd half 2014*. Toronto: Author, 2014. Accessed December 12, 2016. https://www.sandvine.com/downloads/general/global-internet-phenomena/2014/2h-2014-global-internet-phenomena-report.pdf.

Schackelford, Scott, Enrique Oti, Jaclyn Kerr, Elaine Korzak, and Andreas Kuehn. "Spotlight on Cyber V: Back to the Future of Internet Governance?" *Georgetown Journal of International Affairs* (Fall 2015): 83–97. Accessed December 12, 2016. http://journal.georgetown.edu/back-to-the-future-of-internet-governance/.

Schiller, Herbert. *Mass Communications and American Empire*. Boston: Beacon, 1969.

Sechrist, Michael. "Cyberspace in Deep Water: Protecting Undersea Communication Cables." Prepared for Department of Homeland Security, 2010. Accessed December 12, 2016. http://belfercenter.ksg.harvard.edu/files/PAE_final_draft_-_043010.pdf.

Society for Worldwide Interbank Financial Telecommunication (SWIFT). "SWIFT in Figures—December 2015." La Hulpe, Belgium, 1. Accessed December 12, 2016. https://www.swift.com/about-us/swift-fin-traffic-figures/monthly-figures#topic-tabs-menu.

Starr, Paul. "The Great Telecom Implosion." Princeton, September 2002. Accessed December 12, 2016. http://www.princeton.edu/~starr/articles/articles02/Starr-TelecomImplosion-9-02.htm.

Stevenson, H. John. "The Master Switch and the Hyper Giant: Google's Infrastructure and Network Neutrality Strategy in the 2000s." Accessed December 12, 2016.

Telecommunications Policy Research Conference, Arlington, Virginia. http://ssrn.com/abstract=2418784.

"Stocks and Railway and Other Shares (Stock Exchange Tables)." *The Times*, 1869–1890.

Strange, Susan. *States and Markets*. 2nd ed. London: Pinter, 1994.

TeleGeography. "Global Bandwidth Research Service." 2015.

———. "Global Bandwidth Research Service: Executive Summary." 2016.

———. "Global Bandwidth Research Service, Submarine Cable and Carrier Profile Exports." 2016.

———. "Global Internet Geography—Country Profiles: US." 2016. Accessed May 20, 2017. https://www.telegeography.com/products/global-internet-geography/capacity-and-pricing-data/country-profiles/united-states/index.html (subscribers only).

———. "Global Internet Geography—Figure 8: Global International Internet Traffic, 2012–2016 (Gbps)." 2016. Accessed May 20, 2017. https://www.telegeography.com/products/global-internet-geography/analysis/capacity-and-traffic-trends/index.html (subscribers only).

———. "MAREA, Submarine Cable Profiles, Global Bandwidth Research Service." 2016. Accessed February 9, 2017. https://www.telegeography.com/products/global-bandwidth-research-service/data/submarine-cable-profiles/marea/index.html.

Terabit. *Submarine Telecoms Industry Report*. Cambridge, MA: Author, 2014. Accessed December 12, 2016. http://www.terabitconsulting.com/downloads/2014-submarine-cable-market-industry-report.pdf.

Troainovski, Anton. "Optical Delusion: Fibre Booms Again, Despite Bust." *Wall Street Journal*. Accessed December 12, 2016. http://www.wsj.com/articles/SB10001424052702303863404577285260615058538.

United States Congress. 66th Congress, 3rd Session. *Cable-Landing License Hearings*. Washington, DC: Government Printing Office, 1921.

United States Department of Defense. *Information Operations Roadmap*. Washington, DC: DOD, 2003. Accessed December 12, 2016. http://nsarchive.gwu.edu/NSAEBB/NSAEBB177/info_ops_roadmap.pdf.

United States Department of Justice. *United States and Plaintiff States v. AT&T Inc. and Deutsche Telecom AG (Amended Complaint)*. Washington, DC: Author, September 2015. Accessed May 22, 2017. https://www.justice.gov/atr/case/us-and-plaintiff-states-v-att-inc-et-al.

United States House of Representatives. 43rd Congress, 1st Session. "Submarine Cable Telegraphs Statement of Facts Relating to Submarine Cable Telegraph Companies." Washington, DC, 1874.

United States House of Representatives Committee of Interstate and Foreign Commerce. "Pacific Cable." Washington, DC, 1902.

United States Hydrographic Office. *Submarine Cables*. Washington, DC: Government Printing Office, 1892.

van der Berg, Rudolf. "Internet Traffic Exchange: 2 Billion Users and It's All Done on a Handshake." *OECD Insights*. 2012. Accessed December 12, 2016. http://oecdinsights.org/2012/10/22/internet-traffic-exchange-2billion-users-and-its-done-on-a-handshake/.

Weller, Dennis, and Bill Woodcock. *Internet Exchange: Market Developments and Policy Changes*. Paris: OECD, 2012. Accessed December 12, 2016. http://www.oecd-ilibrary.org/science-and-technology/oecd-digital-economy-papers_20716826.

Winseck, Dwayne. "Big New Global Threat to the Internet or Paper Tiger: The ITU and Global Internet Regulation." June 10, 2012. Accessed December 12, 2016. https://dwmw.wordpress.com/2012/06/10/big-new-global-threat-to-the-internet-or-paper-tiger-the-itu-and-global-internet-regulation-part-i/.

———. "The Network Media Economy: Triumph of the Media Infrastructure Industries, or Crisis of Media?" In *New Approaches to Media and Communication Studies*, edited by Junhao Hong (in press, in Chinese). Beijing: Xinhua University, 2014.

———. "Submarine Telegraphs, Telegraph News, and the Global Financial Crisis of 1873." *Journal of Cultural Economy: Special Issue on Financial Crises edited by M. Poovey* 5, no. 4 (2011): 197–212.

Winseck, Dwayne, and Robert Pike. *Communication and Empire: Media Power and Globalization, 1860–1930*. Durham, NC: Duke University Press, 2007.

Zmijewski, Earl. "A Baker's Dozen, 2014." *Dyn Research*. February 4, 2015. Accessed December 12, 2016. http://research.dyn.com/2015/02/bakers-dozen-2014-edition/.