5 The Political Economy of the Inflection Point

If the networked ICT industry is at an inflection point that challenges all major segments of this market, then it should be reflected in the political economy of market governance. Here we examine the evidence.

In this chapter we probe two dimensions of the political economy at the inflection point. We begin by arguing that the United States is and likely will remain for some time the pivot of this inflection point. (Although its agenda cannot determine global change, the US is likely to be the single largest influence on the global policy agenda.) Then we turn to the political economy of three major issues looming at this inflection point.

In chapter 4 we suggested that broadband is significant at the inflection point, which is prompting a major market-governance challenge. The debate over broadband competition policy and wireless networking in the United States reflects the politics of market entry today. The political agenda of Republicans tapped into the long-standing policy propensities built into the US political structure in a way that, after 2000, tilted the focus on broadband policy toward wireless. The ensuing debate over spectrum policy soon reflected the emerging impact of ICT modularity and smart terminals. New thinking about network use and pricing (multi-sided platform economics) further changed the assumptions for feasible entry. Moreover, all sides of the spectrum debate implicitly assumed that the vertical integration of networks was declining.

A second flash point for policy is the set of new interconnection challenges posed by the modularity of ICT. The power of market leverage from traditional platforms is declining just as the rise of the Personal Network Platform provides an incentive to mix and match content and network functionalities in novel ways. This led to the debate over network neutrality and a fragmentation of the traditional IT coalition powerfully influenced interconnection policies. New policy coalitions arose over network neutrality. One side argued that existing competition rules make creative

combinations of networks and content easy to transact. Others held that customization of network functionality required much more attention. This debate does not fit easily within the traditional political alliances on ICT. The terms of the debate are clarified by briefly comparing it to the Japanese and EU debates over competition involving network neutrality and information platforms.

A third challenge involves broadcast media and other forms of content. The inflection point changes the economics of production of content and also erodes market segmentation by geography or service (as in Internet transmission of broadcast programming). This provoked debates over broadcast and intellectual property policies that became the basis for major political clashes. But US political institutions channel these debates less into topics of content quotas than into issues over pricing and ownership of content. Again, the cleavages among stakeholders are volatile. Rupert Murdoch's News Corporation controls MySpace and also threatens to sue YouTube. NBC and the *Wall Street Journal* launch Hulu to provide free television shows, movies, and clips from them as a competitor to YouTube. CBS experiments with more permissive content licensing, and MTV (with more "YouTube-type" fare) plays hardball. Electoral politics lead both political parties to shy away from policies shifting away from IPR that favors traditional content owners.

As was discussed in chapter 3, related to content is the emergence of online advertising networks as a new economic engine underpinning both Web-based software and online content markets (including user-generated content (UGC). Google's Adsense and other ad networks "match" advertisers with websites to deliver targeted ads to consumers as they browse the Web. In addition some publishers sell their own ads instead of relying on a network to source ads). These ad networks are becoming another focal point for governance.

Overall, this chapter shows that a sea change in market governance is again at hand. Precise stakeholder interests and risks are in flux. The winning formula for political leaders still is shrouded in shadow. The full implications for the global market and its governance are murky. However, some areas where politics and good policy can be reconciled are coming into better focus. The United States is our initial focus to keep the analysis manageable.

The Global Market Context: The United States as Agenda Setter

Transition points do not signal a single outcome. A space for change opens and the equilibrium within the space could take several forms. The

ultimate equilibrium usually is set by the intersection of business strategy, technology potential, and public policies that influence market priorities and choices. Non-governmental organizations (NGOs), trade unions, and other interests sometimes tip the balance. Since 1945 the US market has been the most consistent agenda setter for the global market. Its policy choices shaped everyone else's strategic choices. This is not a uniform story; the challenge of Japan in the 1980s in IT and network hardware, the lead of Europe in mobile networking in 1990s, and the growth of mobile content markets all were important innovations that began outside the US market. Still, overall, on the economic, trade, and ICT issues that are of concern here the US was the dominant force.

We first argue that if the United States acts vigorously on the policy front, it can maintain its leadership position until about 2025. We are not predicting that the world will look the same then. Substantial policy missteps could markedly alter market paths. But especially before 2020 a combination of inertia and continuing American dominance in many arenas should guarantee that the US remains the pivot of the inflection point.

This view rests on five premises. First, the US has a large lead in its deployed ICT stock that is extremely difficult for other countries to overcome. This creates meaningful advantages in the ability of US buyers to deploy complex innovations, including a legacy of sophisticated users and buyers across the economy that have both the experience and the cumulative infrastructure investment to innovate rapidly and massively. Second, the US has the largest investment base and flows in the critical areas for innovation—national R&D spending, capitalization of the high tech industry, and private venture capital expenditure in IT and telecom. Third, the US will remain the leader for the foreseeable future in software, networked digital applications, high-value-added commercial content, and high end IT computing systems and solutions. Fourth, the US will continue to be among the top three global markets across the full range of ICT markets, from networking to software to services. In view of the breadth of the US position, the relative US position in any specific market segment (such as the world telecom service market or particular equipment markets) is less relevant than commonly claimed. Moreover, in view of the still sometimes fragmented nature of the "single" European market and the complexities tied to the less-than-transparent Chinese technology market, the effective market power of the US often is greater than the raw numbers suggest. The US is a single giant market that operates under relatively transparent rules and with a market framework that involves flexible capital and labor resources.[1] Fifth, the US is the leading producer of high value-added content

(movies, television, music, video games), a critical element at present. Further, US legal decisions related to content (DRM, IPR, sharing, and monetization issues) will set the stage for any global arrangements in this arena. Intersecting with these market segments are the market institutions and policy choices that shape their crystallization.

Two types of innovation drive "technological winners" in contemporary ICT markets. It helps to distinguish between "upstream innovation" involving raw technical advances and "downstream innovation" that translates technical advances into valuable products and services.[2] Early and continuing US leadership forced competition and entry in all networked ICT segments creating a deep advantage in downstream innovation that fuels upstream innovation. Value-added services and intense competition in terminals primed new entrepreneurs to provide networked-based Internet services once commercialization of the Internet began in the early 1990s. This spurred an earlier IP-based Internet services explosion in the US than elsewhere. The presence of cutting-edge customers and broader PC deployment, first at work and then at home, also mattered. The over-building of fiber-optic backbones and the upgrade of cable television networks then created rival access to households by independent network infrastructures.

Overall, broad deployment of ICT capital stock built competitive telecom services infrastructure. Large amounts of venture capital also provided deep investment in network-based services and business models. As these matured and evolved through the "dot com" bust and now the "Web 2.0"/Software as a Service (SaaS) phase, the US continues at the leading edge for innovative network-based consumer-driven applications. But stand-alone businesses resting on competitive network infrastructure would have been impossible without portals and online bookstores in this second era.

The main US political economy goal was to foster network competition to foster IT innovation. This competition promoted lower networking prices for large businesses and middle-class consumers. When the regional Bells proposed that Internet pricing be treated like phone service pricing, US regulators rejected the idea.[3] This pricing stimulated competition and innovation across consumer-focused network services and applications. This created an early advantage in innovation at "the edge" of the network for the US that continues.

These policy choices and subsequent market evolution helped the United States remain the global market linchpin. Among the major advantages of the US is its dominance of the market for network-based applications and

services, particularly in the consumer space and its leadership in melding business and consumer spaces into a seamless personal space on the Web.

Arguments that US Leadership Is Declining

Three distinct arguments suggest why the United States may not continue as the pivot point in the world market. In our view, two of them overlook the fundamental market changes created by the current inflection point, and one of them raises substantive policy choices for the US.

The first argument for decreasing US importance in world markets revolves around China. The increasing numbers of Chinese engineers, the emergence of Chinese firms as global leaders, and the sizzling Chinese domestic market are cited as evidence that China is assuming a global leadership position. Central to this argument is the ability of China to parlay the size of its domestic market (particularly investment in the domestic ICT infrastructure) into scale economies on the production side and the ability to leverage homegrown standards (e.g., TD-SCDMA) into leadership positions in adjacent market areas (e.g., handsets and applications).[4]

This reasoning assumes that China can develop a shrewd plan to implement this strategy. For familiar political reasons including corruption, huge labor displacement, changing demographics as the pool of younger rural workers available to industry shrinks, skyrocketing demand for natural resources, and environmental and health crises, China's continued economic boom is not a sure thing.[5] Even assuming sound strategy, the increasing modularity of ICT means that leveraging infrastructure standards into adjacent markets is getting more difficult. In a walled garden world, owning the network and the network standards opens the potential for building winning positions in applications and content. But this is a strategy with declining potential. If modularity increasingly rewards creative combinations, home grown standards and the size of local equipment markets cannot be easily leveraged to other markets.

The second argument that suggests the erosion of the US position stems from the continuing decline of US spending in major ICT market segments. We think these stories are overblown. Table 5.1 shows the Organization for Economic Cooperation and Development's 2000 to 2005 ICT market expenditures and forecast for the consolidated world ICT market through 2008. It is striking that the lowest share for the OECD is about 71 percent for hardware and the rest is comfortably in the upper 80 percent range.

Table 5.1

OECD ICT market expenditures 2000–2008 (millions of US dollars). Source: OECD Communications Outlook 2007, citing World Information Technology and Services Alliance. (Data for 2006–2008 forecast. CAGR: compound annual growth rate.)

										CAGR	
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2000–2005	2000–2008
Hardware											
Brazil	6,263	6,404	7,031	9,905	12, 407	15,946	17,316	17,454	17,861	20.6	14.0
China	12,507	16,639	20,357	27,027	39,057	47,927	57,813	68,303	81,739	30.8	26.4
India	2,257	2,764	3,457	5,013	7,204	10,264	13,630	17,910	23,938	35.4	34.3
Russia	1,816	2,107	2,345	2,881	3,900	4,852	5,574	6,078	6,650	21.7	17.6
South Africa	1,661	1,707	1,698	2,503	3,457	4,024	4,412	4,646	5,150	19.4	15.2
OECD	398,488	325,333	302,735	325,390	360,929	377,547	402,346	433,459	459,076	–1.1	1.8
World	440,912	374,883	359,311	396,603	455,255	493,164	537,523	588,246	639,756	2.3	4.8
Software											
Brazil	1,602	1,698	1,787	2,469	2,877	3,566	3,828	3,803	3,785	17.4	11.3
China	1,085	1,658	2,253	3,344	5,295	7,940	11,376	16,328	23,002	48.9	46.5
India	358	456	588	948	1,350	1,908	2,519	3,336	4,378	39.8	36.8
Russia	343	395	450	570	742	923	1,056	1,182	1,313	21.9	18.3
South Africa	627	724	800	1,328	1,965	2,369	2,781	3,159	3,716	30.4	24.9
OECD	169,439	177,463	182,760	211,061	241,381	261,653	283,672	313,539	346,173	9.1	9.3
World	178,086	187,792	194,634	226,734	262,304	288,807	317,567	356,211	400,295	10.2	10.7

Table 5.1
(continued)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	CAGR 2000–2005	CAGR 2000–2008
Services											
Brazil	4,937	4,792	5,101	7,353	9,040	11911	13,530	14,238	15,011	19.3	14.9
China	851	1,389	2,155	3,591	6,203	10,006	15,539	24,081	36,721	63.7	60.1
India	1,120	1,386	1,787	2,859	3,876	5,243	6,607	8,356	10,465	36.2	32.2
Russia	891	979	1,158	1,537	2,099	2,747	3,299	3,881	4,529	25.3	22.5
South Africa	1,293	1,351	1,486	2,440	3,632	4,408	5,206	5,951	7,046	27.8	23.6
OECD	453,777	462,018	466,182	525,938	587,996	621,625	661,820	729,732	795,838	6.5	7.3
World	472,814	482,679	489,766	557,614	630,025	676,656	730,407	815,394	904,296	7.4	8.4
Communications											
Brazil	20,609	17,691	17,757	21,491	24,006	30,642	33,996	34,240	34,748	8.3	6.7
China	29,917	32,129	37,612	41,437	47,102	51,759	57,586	63,668	70,138	11.6	11.2
India	12,841	12,239	14,166	16,873	23,734	29,023	32,549	35,978	39,864	17.7	15.2
Russia	6,064	7,508	9,134	11,566	14,798	18,806	21,695	24,017	26,381	25.4	20.2
South Africa	6,896	5,845	5,772	8,947	11,709	12,825	13,073	12,792	12,987	13.2	8.2
OECD	995,737	898,249	955,545	1,052,269	1,163,805	1,221,699	1,258,579	1,345,052	1,424,302	4.2	4.6
World	1,167,377	1,066,508	1,139,537	1,263,752	1,408,076	1,504,906	1,569,731	1,680,770	1,786,605	5.2	5.5

Table 5.1
(continued)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	CAGR 2000–2005	CAGR 2000–2008
Total ICT											
Brazil	33,410	30,585	31,675	41,217	48,330	62,065	68,670	69,734	71,405	13.2	10.0
China	44,359	51,815	62,376	75,400	97,658	117,632	142,313	172,380	211,599	21.5	21.6
India	16,575	16,844	19,997	25,692	36,164	46,438	55,304	65,580	78,644	22.9	21.5
Russia	9,114	10,989	13,088	16,554	21,539	27,327	31,624	35,158	38,872	24.6	19.9
South Africa	10,477	9,627	9,756	15,217	20,763	23,625	25,471	26,549	28,899	17.7	13.5
OECD	2,017,442	1,863,062	1,907,222	2,114,657	2,354,110	2,482,523	2,606,417	2,821,782	3,025,389	4.2	5.2
World	2,259,190	2,111,861	2,183,248	2,444,703	2,755,660	2,963,532	3,155,228	3,440,621	3,730,952	5.6	6.5

The US is the largest player in world ICT across the board. It ranks between first and third in world standings for most market categories. Inferring leadership for hardware is trickier because of hardware's global production model. The largest segment of the market is communications. The 2005 OECD communications services data placed total revenues at $1.22 trillion, about 39 percent of which was from mobile. The US accounted for about one-third of the OECD market and, perhaps surprisingly, was the largest revenue market for mobile in the OECD. Together, the US and Japan constitute 47 percent of the OECD mobile market.[6] The US also remains the dominant ICT market overall with between 30 and 40 percent of the $3 trillion services and equipment market, but European IT spending is approaching US levels.[7]

Table 5.2[8] focuses our attention on global computer markets. Two things are particularly notable from the data. First, computer services represent more than 45 percent of the total market in 2005—more than 1.5 times hardware and more than twice total software spending. This likely does not include "software as a services" data in a separate category, which

Table 5.2

The global computer market in 2000 and in 2005. Based on data from *Digital Planet 2004: The Global Information Economy* (for 2000) and *Digital Planet 2006: The Global Information Economy* (for 2005), published by World Information Technology and Services Alliance. CAGR: compound annual growth rate.

	2000		2005		
	Million $US	Share of total	Million $US	Share of total	CAGR, 2000–2005
Total computer spending	1,091,812.7		1,458,626.1		5.96%
Hardware	440,912.4	40.38%	493,164.1	33.81%	2.27%
Software	178,086.1	16.31%	288,806.5	19.80%	10.15%
Services	472,814.2	43.31%	676,655.5	46.39%	7.43%
Geographic breakdown					
North America	521,333.1	47.75%	603,333.6	41.36%	2.96%
Latin America	22,107.7	2.02%	46,795.3	3.21%	16.18%
Europe	305,321.7	27.96%	471,194.3	32.30%	9.07%
Asia, Pacific	232,701.1	21.31%	312,010.0	21.39%	6.04%
Middle East, Africa	10,349.1	0.95%	25,292.9	1.73%	19.57%
United States	492,203.0	45.08%	557,121.6	38.19%	2.51%
Japan	173,284.2	15.87%	149,897.7	10.28%	–2.86%

probably means that overall "services" are far above 50 percent of the total market today. The second major conclusion drawn from the data is that although Europe is growing faster, the US still dwarfs all other geographic regions in total ICT spending (more than 40 percent of the total in 2005).

In short, although the United States may grow less quickly relative to other market centers, it remains the dominant market across the full ICT landscape. Although the EU (with 27 member states in 2008) now exceeds the American market in overall size, it is a less perfectly integrated market. Still, its magnitude means that it is the logical starting point for US international policy negotiations about ICT.

Other leadership dimensions are not tied to market revenues. For instance, US leadership on research and development expenditures remains secure compared to China and the European Union. The only significant competitor in the scale of effort is Japan, which spends a larger share of its GDP on R&D, although not enough to overcome the lead imparted by a US economy that is double its size.[9] Moreover, the market-size figures cited so far miss the importance of the buyer landscape, particularly the installed ICT capital stock across the US economy. In this respect the US is widening its lead over Europe in the IT stock. (US growth was almost double the IT investment per hour worked than Europe in 2005). This stock is especially meaningful because leading-edge buyers can quickly and nimbly deploy incremental ICT infrastructure for competitive purposes. This is a function of the flexible and competitive US product and labor markets and is reinforced by the deep experience of American multinational firms.[10] These advantages are coupled with across-the-board strengths in the size and depth of the high tech sector that are documented in table 5.3. In addition, global investment patterns for venture capital in ICT are shown in table 5.4. More than 70 percent of these venture capital investments occur in the US.

Overall, the United States remains the leading market for a wide swath of ICT solutions, which advantages local US firms. An example is the US strength in both the enterprise and the consumer Internet services market (search engines, IM, and e-commerce). Table 5.5 shows this leadership in Websites. JETRO, the Japanese trade organization, estimates the US e-commerce market to be almost twice the size of Japan's.[11] A related strand of US leadership stems from the advertising data presented in chapter 4—which showed the US market accounting for more than 50 percent of total digital advertising spending in every digital category. If the Personal Network Platform emerges before 2020, US leadership in the enterprise

Table 5.3
IT and telecom venture capital investments, 2002–2006. Sources: *Venture Expert*, *Indian Venture Capital Journal*, *Asian Venture Capital Journal*.

	2002	2003	2004	2005	2006	5-year average
US	72.1%	74.1%	76.3%	75.4%	72.3%	74.1%
EU	15.7%	11.6%	11.5%	12.7%	12.6%	12.8%
Israel	3.9%	4.3%	5.3%	4.9%	4.9%	4.7%
China	0.7%	5.5%	2.8%	2.8%	5.2%	3.4%
India	1.6%	0.2%	0.3%	0.6%	1.1%	0.8%
Japan	0.5%	0.8%	0.4%	0.4%	1.0%	0.6%
Other	5.6%	3.5%	3.4%	3.2%	2.7%	3.7%
Total ($billion)	24.73	19.25	21.56	21.47	25.32	22.46

Table 5.4
Global tech company market capitalization as of December 31, 2005. Source: Morgan Stanley Global Internet Trends.

	% total market value	Market value (billions)	Year-to-year change
North America	63	$2,455	–1%
Japan	17	$665	3%
Asia	11	$421	39%
Europe	9	$361	–5%
Total	100	$3,902	3%

market and the Web application market will be guaranteed. The increasing importance of broadcast and copyrighted content for "individual-based platforms and services" also reinforces US leadership. In addition, as content and broadcast converges with telephony and IT, the centrality of the US content industry and associated intellectual property issues becomes more prominent in the global landscape.[12]

The third argument against US leadership rests on the current deployment and trajectory of both wireline and wireless broadband networks in the US relative to elsewhere. This is not an argument about big fiber backbone and the ultra-broadband where US dominance remains. The argument holds that since the US lags in broadband network build-out to homes and small and medium enterprises (SMEs), its space for innovative applications and value-added services on the network will decline. Over

Table 5.5
Top ten online properties worldwide (ranked by worldwide unique visitors age 15+, excluding traffic from public computers such as Internet cafes and access from mobile phones). Sources: comScore World Metrix, June 2006 and May 2007.

June 2006			May 2007	
Rank	Property	Thousands of visitors	Property	Thousands of visitors
1	Microsoft sites	499,540	Google sites	527,572
2	Yahoo sites	480,933	Microsoft sites	520,238
3	Google sites	453,963	Yahoo sites	467,642
4	eBay	256,653	Time Warner Network	266,890
5	Time Warner Network	219,868	eBay	248,006
6	Amazon sites	129,320	Wikipedia sites	208,906
7	Wikipedia sites	127,982	Fox Interactive Media	147,760
8	Ask Network	111,864	Amazon sites	136,655
9	Adobe sites	95,831	CNET Networks	119,865
10	Apple Inc.	92,211	Apple Inc.	115,262
Worldwide total		712,976		766,188

time this means that more cutting edge users and buyers will emerge outside the US. Although the situation is not clear cut, it is an appropriate area for US concern and will be addressed later.

Consumer and small enterprise broadband has evolved with leadership by Asia since the late 1990s, followed by Northern Europe, and trailed by the United States. OECD statistics show that at the end of 2006 the US ranked fifteenth among OECD countries in broadband penetration. The results of a broader survey ranked US household broadband penetration at 24th at the close of March 2007, up from 25th a quarter earlier.[13] (For an overview of broadband penetration across the OECD, see figures 2.1 and 2.2.) Moreover, broadband systems in these countries often have much higher speeds than in the US at lower prices. (We return to the reasons later in this chapter.) Nonetheless, at the end of 2006 the US had "the largest total number of broadband subscribers in the OECD at 58.1 million. US broadband subscribers now represent 29% of all broadband connections in the OECD."[14] Moreover, the US had gone further than most in creating a competitive national infrastructure for broadband through cable modems.

Another point of potential weakness is US dominance of the content industry. The growth of new content markets (e.g., gaming) and the growth of "long-tail" markets means that this leadership may slip faster than in other market segments. This risk increases if slow and expensive consumer broadband inhibits the growth of new content applications in the United States. An offsetting strength is American leadership on business content that could merge with consumer content as the Personal Network Platform emerges.

A similar story of the United States lagging has developed for mobile networks. In 2003 global mobile connections overtook fixed connections. About 1.4 billion devices were in use and 500 million new units were sold each year.[15] At the end of 2007 the number of cellular subscribers worldwide reached 3.1 billion. The worldwide mobile industry is expected to be worth more than a $1 trillion at the end of 2008. By 2012 the number of subscribers is expected to reach 5 billion, the vast majority of which will not be Americans. [16] Moreover, the traffic on mobile networks follows different patterns than wired traffic. Non-voice applications (especially SMS) took off on low bandwidth networks much more decisively in Asia, and the EU also leads the US on this count.[17] Vodafone reports that non-voice (data) revenues averages 17 percent of total revenue across its global holdings, but the US is only at 8.9 percent.[18] In addition, the US has lagged in experimenting with m-commerce compared to other countries and regions.

There are three complicating factors on mobile. First, after the EU-27, which is not yet a fully integrated market, the US remains the largest industrial market for mobile and has more room for growth than most.[19] Second, US price levels are among the lowest (about $\frac{1}{4}$ the EU average), and so the minutes of use per subscriber are among the highest (about twice EU levels).[20] In view of the pricing pressures at the inflection point this is a more realistic pricing position. Third, 3G and other technologies are opening the way to broadband wireless networks. By early 2008 almost 300 million subscribers connected using a 3G technology.[21] Korea and Japan have led the world in this deployment, but the US is competitive with all other major countries. Enormous amounts of experimentation are in progress in the US with other forms of wireless broadband systems. Moreover, as wireless becomes an extension of the Web, US influence increases because the salience of Web expertise rises for successful mobility ventures.[22]

In short, being pivotal to the dynamics of the world market does not mean being number one in all market segments. Being number one takes

strength across the board, global dominance in a number of segments, and a strong ecosystem of innovation. The US still fits this profile although its relative standing inevitably will change. But the inflection point's dynamics will be set off the momentum from current configurations of the marketplace. The activities and preferences of the EU, Japan, Korea, and increasingly China all play important roles. However, if the US exercises policy leadership, it almost certainly will remain the most important player shaping the global agenda as it adjusts to the inflection point. To understand this process, we next turn to a deeper examination of the political economy of initial American choices in response to modularity at the inflection point.

Policy Issues and the Inflection Point

The Political Economy of Entry and Spectrum Policy

When the Republicans captured the presidency in 2000, they controlled both the executive and legislative branches of government. This reduced the normal checks on policy imposed by divided powers between Congress and the Executive Branch. Although insufficient to overcome the normal obstacles to major new legislation because of a closely split Senate, it increased the Republicans' ability to exert coordinated pressure on the FCC and the Executive Branch to install leadership with more conservative views on economic intervention in ICT. Still, the FCC's considerable autonomy meant that wholesale policy reversals came slowly, especially because the FCC had to create a public record to justify policy changes that would stand up in court challenges. Furthermore, elements of the corporate competition coalition still strongly supported increased network competition, especially the provision of new broadband wired and wireless networks.

Republican policy makers set out to demonstrate that competition among network infrastructures was vigorous enough to allow regulatory relief for the Bells. They also needed a response that addressed a potential political embarrassment—the US deployment of broadband began to lag other major countries in 2000.

The new synthesis reflected the general Republican alignment with the Bells, conservative distrust of extensive government market supervision, and the increasing unrest among economic theorists about the efficiency of interconnection rules crafted by the Democratic FCC that many other countries subsequently emulated. Economists worried about regulatory requirements to "unbundle" the functional elements of a dominant

carrier's network and make it available on cost-based terms to competitors. Whatever the theoretical merits of the idea, there was a rising tide of opinion that this approach was overly regulatory especially in light of the US competitive circumstances.[23] Moreover, in view of the similarity of telecom and IT as platforms, competition policy on IT platforms also was skeptically received. Limited remedies in the Microsoft case were one example of this thinking.[24]

In the new political environment the shift in broadband policy had three main justifications. The first was the growth of competition in backbone fiber-optic networks for long-distance and the major metropolitan business centers.[25] Predictably, prices fell for long-distance and large business data customers. Second, in the two-thirds of US households where cable connections were available, cable television made a strong entry into telephone and broadband services for households and, to some extent, SMEs.[26] Third, mobile telephony emerged as a credible substitute for voice services, and the rise of VoIP services could arbitrage much of the power over pricing and service options for voice services.[27]

Policy makers then addressed some conspicuous remaining difficulties for proponents of weakening the Bells' network unbundling obligations. (Unbundling was the specific policy package adopted after the 1996 Telecommunications Act that implemented the long-standing norm of network sharing.) In the backbone fiber market, even for business services, the means and costs of originating and terminating traffic remained a barrier to entry controlled by the local Bell operator. The FCC and the Department of Justice ruled that large mergers of Verizon with MCI and SBC with AT&T and BellSouth (now renamed AT&T as a group) did not harm competition, but these combinations did not improve the options available to consumers. In addition, the broadband market for SMEs and households was, at best, a duopoly where economic theory predicted that there was a strong possibility for suboptimal competition.

ICT is a high-profile industry that serves as a marker of national technology prospects. Predictably, technology policy draws intense lobbying efforts and keen press scrutiny. Retreating from unbundling did not translate into a positive political message on broadband development issues. The Republicans needed a new formula with their own secret sauce to brand their efforts. In response, the FCC identified the potential opened by modular elements of the inflection point. Specifically, technological innovation could accelerate the deployment of new broadband wireless networks.[28] The FCC's pioneering work on introducing "spectrum flexibility" through 2004 dramatized this approach.

The idea was to promote more efficient allocation and assignment of spectrum to prompt innovation in wireless broadband networking. One goal was to increase available spectrum for all wireless services. This often required engaging in complicated and controversial plans to reallocate existing spectrum and move its current users to other bands. Intense effort went into finding more spectrum for unlicensed services so that new technologies including WiFi, WiMax, and low powered "smart terminals" could be leveraged into "bottom up" broadband networks.[29] A second goal was to release more spectrum for use and allow the free resale of spectrum to stimulate more flexible use of licensed spectrum. Then, market forces might redeploy spectrum, choose freely among technologies, and select services to be provided. For example, spectrum "band managers" might emerge that would treat large bands of spectrum like a commercial mall built by a developer who tries to lease it to achieve an optimal mix of stores. Third, this policy facilitated a political agreement to let licensees more freely monetize their holdings. Permitting the resale and recombination of valuable spectrum controlled by incumbents created incentives for more efficient spectrum use.

The promise of wireless broadband was a powerful rationale for allowing the FCC to relax regulation of the Bells' new broadband networks.[30] To spur more rapid investment, the FCC exempted the Bells from network-sharing obligations for fiber broadband networks. (This was parallel to the exemption for broadband use by the cable television networks.) The Bells promised that this mix would stimulate broadband deployment in rural areas because they would be able to earn higher returns on their new investments.

The political economy of this policy sequence reinforced the politics of the Republican majority. By 2001, most competitive local-exchange carriers had collapsed, eliminating a major rallying force against policy change. The corporate competition coalition based on the information industry and large users remained potent. Nonetheless, the inflection point induced a realignment of their interests in three ways.

First, as was previously noted, a recurring propensity of US political economy is to create compromises built around encouraging new technologies and entrants. The new spectrum policy followed in the tradition of market openings of the railroad expansion and westward farmsteads. The changing economics of ICT production eased new entry into specialized technology ventures for wireless networking. New ideas about wireless could more easily and cheaply be matched to production capabilities. Moreover, since network applications could substitute for each other,

gaining entry into wireless data was equivalent to gaining a vantage point in voice and multi-media. So business plans could dream of large end service markets served by a hybrid mixture of networks and technologies. The new spectrum policy also rallied support from equipment vendors intrigued by cross-entry from the wired to the wireless markets.[31] This attracted Cisco and Intel, which invested heavily in new wireless technology. Wireless also attracted big software and computer companies that wanted to increase competitive pressure on the major network operators to deploy faster networks.

Politically, this technological version of "supply-side" economics argued that lightening government control would stimulate growth and investment. This played to the Republican "brand" in national politics. Network-sharing policy required detailed government choices to redistribute advantages in the telecom market. Spectrum policy's similarity to opening new territory for expansion of the network appealed more to Republicans than the redistribution of advantages among established enterprises. Spectrum policy reform also attracted "geeks," who were important in ICT discussions. At the time, major players in spectrum policy reveled in the do-it-yourself entrepreneurial energy sparked by the idea of deploying unlicensed networks guided by technology enthusiasts. (By 2004, some of these same technology entrepreneurs, disheartened by the absence of alternative networks, began advocating for network neutrality rules.)

A second subtle advantage of spectrum policy was that it provided some help on the thorny issue of pricing policy in ICT networks. Pricing controls of various flavors are difficult to completely avoid in conventional phone services on traditional networks. Spectrum policy promised to produce "winners" outside these traditional boundaries. Thus, new networks might develop with fewer constraints imposed by legacy pricing and cross-subsidy policies than their predecessors. For example, it was predictable that VoIP delivered over the wired network ran into stakeholder demands for "parity" in the treatment of VoIP in universal service subsidies. They complained that municipal WiFi networks sponsored by companies hoping to generate search traffic and revenues offered free voice, which would further undermine pricing and subsidy regulations.[32] (In truth, Google and its searchers already must pay for bandwidth. Nothing is really free.) Expanding this wedge, the FCC ruled in March 2007 that broadband wireless access to the Internet was an information service.[33]

Third, as spectrum policy moved to the forefront, many ICT industry leaders and large corporate users pulled back their support for a strong set of network-sharing rules. This went beyond tacit or explicit acquiescence

to the roll back of interconnection rules that were originally spurred by the 1996 act. It surfaced when they hedged their bets on the debate over "network neutrality" rules that proposed to require pricing rules for data services. (The political economy of net neutrality is discussed shortly.)

The spectrum policy initiative rested on several aspects of modularity at the inflection point—smart terminals, multi-band and multi-protocol options for networking, the ravenous demand for bandwidth, and the possibility that convergence would fuel expectations of a larger addressable market for any new network. It was a Republican supply-side spin on the long-standing propensity in the US for policies favoring easier market entry. It did not, however, resolve the issues about the growth of broadband networks in the US. Two examples illustrate the issues.

First, a bitter debate rages between advocates of strengthening property rights for spectrum holders which favor auctions, rights of resale, and the ability to aggregate spectrum and the proponents of a "commons" approach to spectrum and wireless networks. The former suggests that profit incentives will lead to greater investments and innovation. The latter group emphasizes the innovative potential of bottom-up building of networks on unlicensed bands or "white space" and guard bands for licensed spectrum.[34] Two points that demonstrate the power of the inflection point are relevant here. (1) Both camps stress the importance of modularity and smart terminals. They differ over the incentive and control system for innovation. (2) Both groups envision a market where the control by vertically integrated carriers is declining. Indeed, advocates of commons approaches sometimes assert that this is their goal. Although its position is more ambiguous, the property rights movement envisions carriers in a larger, more complex ownership and technology universe. If carriers dominate, they may one day resemble managers of a spectrum "supply chain" more than an encapsulated, vertically integrated supplier. Both perspectives reflect the underpinnings of the inflection point, but they spring from different views of American political economy. The commons movement wraps its claims in an historical analogy to the political economy of the Internet's foundations. In particular, they analogize the use of regulation to support a new networking approach, the Internet. For wireless the most fervent voices in the commons movement want to assign, or condition the use of, spectrum to foster unlicensed uses such as WiFi. They favor setting high performance standards for the equipment that deploys and uses the network to avoid interference while agilely using the spectrum.[35] Government forfeits rents it might have gained by auctioning spectrum, but may unleash innovation and experimentation that creates major

benefits. As we have already noted, advocates of spectrum auctions persuaded governments to reform command and control licensing systems by making them money. This proposal falls short on that count; it creates potential winners, but not definite winners. In other words a tough political decision does not immediately create highly committed and organized winners that will promptly defend and endorse the decision. In contrast, licensing quickly creates such winners. Moreover, the other key to the success of the Internet was the emergence of e-commerce. As the Web and e-commerce burst into prominence without any dominant firm in control, the government kept its hands off and chose not to regulate it.[36] The US only had to stand aside and allow the Web to develop almost untouched, a relatively easy task in a political system susceptible to legislative deadlock.

The second unresolved issue is the adequacy of build-out of wired networks. There are doubts that wireless will provide sufficient and adequate infrastructure for ultra-broadband connectivity to residential and small- and medium-size businesses. So the technology community worries whether wired broadband has sufficient capacity, technical flexibility for applications, and quality of service. The re-introduction of unbundling, whatever its substantive merits, seems unlikely at the inflection point, because it is a policy reversal that is difficult to achieve when the competition coalition has grown deeply divided. The question, as a matter of policy and politics, is whether one or both of the major American political parties will try to claim credit by crafting a tax incentive to help build out new networks. Incentives always are attractive for politicians because they are less visible as direct budget expenditures.[37]

Network Neutrality

Net neutrality emerged as the flash point in a heated debate about how to promote innovation through networked ICT policy. This controversy revolved around how network infrastructure and services should intersect with Web services and terminals. We examine it mainly in the context of the US political economy, but also briefly probe the reasons that the debate looks so different in Europe and Japan.

In its purest form, the logic of net-neutrality proposals rested on two ideas. First, price controls on networked data transmission should create a single non-discriminatory price for data transmission for information services at a particular bandwidth. So some form of flat-rate pricing should guarantee that high-volume users are not charged more than low-volume users at any specific network speed. Second, except where legal

requirements exist, networks should not block or delay access to websites and their content. Non-discrimination rules regarding content and value-added services should be enforced. Network enhancements, such as network caching services, should be freely accessible to users.

The logic on pricing springs from the political economy of the early history of computer networking and the Internet when leverage was strong and modularity more limited. At the time there was enormous suspicion of vertical leveraging by incumbent telecom carriers. Also, flat-rate pricing for data transmission for information services when dealing with dominant carriers was a hallmark of FCC policy. So any retreat by this policy's traditional backers in the corporate competition coalition is noteworthy. Such reversals occurred in parts of the ICT industry for two reasons.

First, after the "dot com" bubble burst in 2000, hardware suppliers and other ICT producers wanted to revive the market for infrastructure from the doldrums. The Bells and some of their largest customers felt they too would benefit. Expanding broadband build-out also could increase demand for upgraded electronics and software, aiding companies that produced them. In some respects a two-tier network already existed, insofar as Akamai (a leading Web application acceleration and performance management firm) and other companies expedited traffic for large Web portals. Generalizing the precedent seemed a positive, incremental step to these ICT companies. Moreover, prioritizing and inspecting traffic (for security reasons) were important tools for building new equipment markets working from the router out through the rest of the network. Cisco, for example, is buying into service application companies that feature traffic prioritization and security schemes based on capabilities installed in Cisco routers.[38]

Second, many large users and ICT suppliers no longer believed that control of the network infrastructure provided carriers with much leverage over network applications or pricing. Their hunch was reinforced by economic studies on pricing logic that suggested that price controls on broadband (what net neutrality imposes) might perversely create a significant incentive for the carriers to discriminate upstream or downstream.[39] Carriers pleaded that their primary goal was to maximize the customers' experience by managing their networks to bolster their performance and make certain their networks were secure in the face of staggering growth in Internet traffic, especially of video traffic that threatened to jam networks.[40] However, when Comcast was found to be secretly filtering and degrading P2P traffic for those using BitTorrent (a bandwidth-gobbling video file-sharing program), it demonstrated that often-raised concerns

about net neutrality were justified.[41] This uproar grew when Comcast secretly packed an FCC hearing on the matter at Harvard by hiring people to take places that might otherwise have gone to net-neutrality activists.[42] In August 2008 the FCC sanctioned Comcast for its actions.

At the same time, a new tier of companies in the Web services market that concentrated on the mass consumer market for ICT (e.g., Google and eBay) became politically active. These newcomers were unlike the equipment companies and firms that traditionally focused on larger users. They are the leading edge of a new political economy coalition shaped by the economic engine that drives much of Web-based innovation. In short, ad syndication of the kind offered by Google and Yahoo is critical because it fuels a new economic engine for innovation built on top of the existing Internet standards-based infrastructure. Simultaneously, a wide variety of content producers and content owners now are deeply tied to an ICT infrastructure that rests on ubiquitous access to services and bandwidth that requires a heterogeneous, modular infrastructure. This alters the political calculus for any change that would disrupt the growth of the nascent marketplace that rests on these ICT foundations.[43]

Some players in the Web-based coalition continue to worry that differential broadband pricing for high and low bandwidth residential users within a bandwidth tier (e.g., 1 megabit per second) could hamper mass-market growth.[44] Others feared that some services (for example, music on demand) would be offered with quality of service and price packages that would be made available to some customers (perhaps users of a network provider's Web platform), but not to others.[45]

As large consumers with huge bargaining power, major software firms were less concerned about the precise price point for bandwidth than about the combination of price and functional discrimination. They feared having to wait for "permission to innovate" for new service packages because that could give carriers leverage over the modular redeployment of network capabilities. Lengthy negotiations over prices or functionality with networking could weaken business cases that require swift action, huge amounts of flexible bandwidth, and remote data storage.

The complaints of Web firms reflected the pinnacle of self-interest and innovation at the inflection point. Many of the Web companies foresee a Lego-like networked ICT infrastructure that is constructed from inexpensive standardized capabilities that can be mixed and matched. In short, net neutrality is a government program to promote modularity.

The mass consumer software companies found allies in the traditional Internet research community that saw flat-rate pricing as a spur to

technological innovation. In an imperfectly competitive world, researchers believed that large carriers would prefer to charge different prices rather than figure out how to build network capacity cheaply and make profits charging flat rates. These researchers also suspected that networks would discourage value-added functions that allowed network users to innovatively manipulate protocols and services. They favored simple and cheap solutions to increase bandwidth over elaborate schemes to prioritize narrower bandwidth.[46] Many advocates for consumer interests echoed these fears.

The software and research community won allies among Democratic political leaders who were wary of the Bells. The Democrats also sought a wedge issue that appealed to the technological community and reaffirmed their efforts to build allies with consumer action groups. So in 2006 the two Democrats on the FCC forced ATT to pledge to maintain net neutrality for at least 2 years as a condition for approval of its merger with BellSouth.[47] When the Democrats regained control of Congress in January 2007, their committee chairs promptly reintroduced legislation in support of net neutrality. However, since the US system is stacked against ambitious legislation on hotly contested issues, legislative deadlock on telecom issues remains likely.[48]

The remaining common ground was at least as intriguing as the new divisions among segments of the old corporate competition coalition. Agreement remained on rules governing network functionality. Three issues, corresponding to upstream, downstream, and horizontal leverage questions, reflect a combination of old and new. All of the rules facilitated modularity, but, except for disadvantaging traditional telecom carriers, did not tilt advantage to a particular strategy building on modularity.

First, all corporate competition coalition segments want to reaffirm modularity as a basic principle. They want to guarantee the right of users to choose the appliance and devices they attach to the network. This right is essential to innovation led by intelligence at the edge of the network.[49] This principle, in effect, bans upstream discrimination on terminal equipment.[50]

The other two issues, downstream and horizontal leveraging, involve what might be called rights of "value-added interconnection." Downstream, the coalition seeks clear rules that forbid discrimination against interconnection to content or websites.[51] Most innovatively, concern over horizontal leverage arises in terms of "next-generation interconnection" among networks and service applications. It focuses on the terms on which two networks connect and exchange traffic fundamentals (a form of inter-

connection that is usually called "peering"). Inter-networking relies on the rights for "peering." The coalition wants major networks to prevent discriminatory peering, especially on quality of service and security. They also want to prevent discrimination against value-added services (e.g., network caching services for e-commerce firms) using proprietary software architectures or VoIP. This recognizes that the general network architecture and capacity is, as always, a step behind on innovation because customization is critical to customers.[52]

The December 2006 merger of BellSouth and AT&T was sealed by a voluntary corporate pledge to embrace these network peering principles and a commitment to provide a $19.95 per month broadband service for 30 months.[53] This concession suggested three things. First, the bargain allowed the Democratic FCC commissioners to keep alive the peering issues until after the next election when Democrats might win control of the White House and Congress, and permanently change policy. Second, AT&T implicitly admitted that its network build-out and revamped billing system would not be ready until 2008 or 2009. Third, the principles were so general that AT&T did not yet have to commit to firm positions about next-generation issues. These peering issues go to the heart of network management and value added. So consensus at this level of generality does not constitute a hard test of what they really mean.[54]

The evolution of corporate coalition positions in regard to mobile wireless carriers was more convoluted. For example, Google and Yahoo initially courted these carriers in order to be preferred portals or advertising partners. Later, consumer Web companies challenged the wireless carriers by advocating changes in spectrum policy to get more new devices into the marketplace to fuel demand for their services. This became a challenge to wireless carriers in regard to net neutrality for their networks.[55] The prospect of multi-band, multi-protocol networks, part of modularity at the inflection point, gave the Web firms greater confidence when challenging the carriers.

The first challenge to wireless policy was the effort by Skype (now owned by eBay) to open the mobile market by demanding freedom of attachment of consumer devices to the wireless networks.[56] Telecom handset suppliers may eventually align with Skype because modularity increases competitive pressure on these equipment suppliers. For their part the carriers are experimenting with upgrading the role of original design manufacturers (ODMs) to more tightly control branding linked to their networks. They plan to take greater control over design and innovation, thereby reducing the value of branded handset suppliers.[57]

The Carterfone analogy went to the core of the US politics of open entry. It intrigued Democrats seeking a distinctive position on ICT largely at the expense of the Bells' wireless carriers and eventually persuaded some Republicans. But the broader issue of net neutrality for wireless remained unresolved in 2008. Still, the early policy struggles suggested how political entrepreneurship might be married to commercial advocacy to create policy "work-arounds."

One suggestive example of how the political economy of the inflection point could unfold was the ultimately unsuccessful bid by Frontline Wireless, a company with a bipartisan team of Republican and Democratic leaders in telecom and IT policy.[58] Frontline responded to the FCC proceeding to set the rules for auctioning in the 700-MHz band (the television spectrum to be relinquished when the US switches over to all-digital television in February 2009). It proposed that the FCC auction the public safety spectrum to a private network to meet the FCC's goal of building a national public safety network in that band. The private network would have 10 MHz for its own commercial use and 12 MHz to serve the public safety community. Frontline dreamed of building an open standard network with 4G capabilities (uploads of 50 megabits per second and downloads of 100 megabits per second) that would have served public safety and private users. It proposed that any licensee would be required to offer its network capacity on a wholesale basis to all takers.[59]

This proposal sought to leverage modularity and open standards to fashion a new business model for broadband. It promised spectrum revenues to the government and a subsidized network for the public safety community. It also embraced network neutrality by creating a broadband network to provide resale capacity, open standards, and freedom to select terminal equipment. But, to appeal to Republicans, it did not force existing carriers to accept these policies. Eventually the FCC set aside spectrum for auction for a network requiring commitments similar to the Frontline proposal. The FCC rules, however, had some liabilities from the viewpoint of ventures such as Frontline. For example, the FCC rules required the winner of this spectrum to reach agreement with the public safety community on implementation after putting its auction bid (perhaps one billion dollars) on deposit. It was possible for the public safety community to demand additional expensive features and argue to the FCC that the failure to provide them meant that the bidder should forfeit the auction bid as a penalty. This kind of commercial risk (unexpected costs of build-out or forfeiture) discouraged financial investors.[60]

If Frontline had succeeded it would have provided a different form of competitive discipline for incumbent carriers and a new way to fund public infrastructure. From our perspective this sequence shows how modularity enables new approaches to networking and policy compromises that promote diversity of business approaches rather than detailed regulations of the conduct of all licensees. However, simply the potential for new models is not enough. It still takes crafting adroit political compromises for policy to enable them.[61]

Meanwhile, Google entered the debate over how to license the 700-MHz spectrum.[62] It proposed that the auction set aside about a third of the spectrum for licensees that agreed to resell capacity on a wholesale basis and to allow terminals and software packages that would not harm the network to freely attach to it. (Google promised to issue specifications for anyone who wished to produce "Google mobile terminals," which eventually became Google's "Android" blueprint for mobile networks.) If the FCC would agree to these rules for all bidders on these licenses, Google pledged, it would bid more than $4 billion. (Google objected to bidding against networks that might pay a premium to keep spectrum out of the hands of innovative newcomers.)

Predictably, the carriers complained that Google's conditions would favor one business plan over others. They argued that auctions ought to make money for the government and also yield information to market participants to help them to rationally value the radio resource. The auction should not specify a business plan.

The ultimate FCC bidding rules split the difference. It granted consumers freedom to select their terminals and software, but network resale was not required. In the 2008 auctions, Google reportedly fulfilled its bidding pledge and then quickly withdrew from the auction, leaving incumbent carriers with the licenses but an obligation to embrace open terminals and user software choices.

The 700-MHz debate revealed other policy tensions at the inflection point. In the 1990s it was assumed that if enough strong competitors would allow the government could to step back from detailed regulation. The US mobile wireless market boasts at least four national competitors (Verizon, AT&T, T-Mobile, and Sprint-Nextel) and several regional and local entrants. Yet the software coalition and many users concluded that these firms still impede innovation by running walled gardens. As expected, many economists responded that competition would eventually force the carriers to change.

What explains these divergent views? Was it typical self-serving posturing by firms seeking a better deal as users or a piece of the supply-side action? Obviously self-interest was involved, but more fundamentally a deep chasm emerged. On one side were large firms whose business practices and "corporate culture" sprouted from the world of regulation. Opposing them were firms that emerged from intensely competitive, rapidly changing markets where government played only a marginal role in pricing, entry, or detailed regulation of conduct. Whatever the market incentives, industries often respond in ways shaped more by their previous market environments than by present market conditions. They may put a higher premium on foreclosing future competition than standard economic models suggest.[63]

Other factors may induce strategies not predicted by standard competition models. For example, many of the pricing eccentricities rooted in the monopoly telecom system still linger. Their complete reform is unlikely. Contemporary economics argues that temptations for anti-competitive behavior arise from perverse incentives created by regulated prices. Those with potential market power are blocked from framing profitable, efficient schemes to share the use of their networks. So they choose schemes that are permissible but not conducive to maximizing economic welfare for society.[64]

Even without pricing disincentives, the Bells and the cable television network operators (as effective duopolists) may be in a strategic game of mutual forbearance to avoid stumbling into an "arms race" with unpredictable results. Even the wireless broadband market has lost some of its disruptive potential as Verizon and AT&T built much larger spectrum holdings than their rivals. These concerns are at the core of this political economy debate—parts of the ICT industry are deeply suspicious that the carriers will not change enough in a timely way.

Network neutrality also spills over to the inflection point's innovation model. The high-end innovation in the Grid is following the traditional US commitment to technology neutrality on network development. Economic policy scholars still see picking winners as politically difficult and intellectually suspect. Still, these new uses of wired and wireless networking for novel vertical and horizontal applications will require considerable care in regard to quality of service, security, and privacy. They also will involve huge flows of traffic and generate new tools for managing large-scale applications of networked ICT that will be beyond the proprietary control of any group.[65]

Continued strong support for national R&D policies that are deploying experimental ultra-broadband networks and work on massive radio sensors

deployment will continue to be important. The US R&D expenditures on communication and information technology are considerably above those of the EU.[66] However, Bill Gates and others worry that "federal research spending is not keeping pace with our nation's needs." He noted to "the Task Force on the Future of American Innovation" that "[a]s a share of GDP, the US federal investment in both physical sciences and engineering research has decreased by half since 1970. In inflation-adjusted dollars, federal funding for physical sciences research has been flat for two decades." This stagnation in spending comes at a time when China and the EU are increasing their public investments in R&D.[67]

Net Neutrality in Japan and in the European Union

Technological shifts pose a challenge to political and economic interests that may lead to policy changes. But technology does not dictate the response. Political and market institutions and legacies shape the path of transformation. We briefly sketch the major differences among the United States, Japan, and the European Union on net neutrality in order to reinforce this point.

Throughout the 1990s Japan lagged behind the United States in Internet adoption because of the continuing effects of a political bargain underlying NTT's market dominance. Even though Japan allowed competitive telecom carriers for long-distance and local telecom services (plus data networking) in the same time frame as the US, it never permitted open entry. Moreover, the government strictly managed a complex price and service system. As a result, prices remained high in Japan and Internet connectivity took off slowly. Only NTT, the former monopolist, and the Japanese equipment industry that supplied its unique network standards earned huge profits.

Japan's decade-long economic downturn and accompanying political reforms began to rebalance the policy game. In the late 1990s, the Japanese government ministry charged with telecom policy pushed for the breakup of NTT into two local service companies (NTT East and NTT West) and a national NTT Long Distance company. (There was a single holding company for the units, but structural separation of accounts.) The Ministry also advocated US-style interconnection and unbundling policy in 2000 as a way to accelerate broadband connectivity to the home and stimulate new services from Japanese information services industry. Further, it suggested that broadband competition would open the door to Japanese electronics firms reorganizing their strategies around global standards favored by new entrants.[68]

Unbundling achieved its purpose. The dramatic rise of Softbank/Yahoo and eAccess symbolized the ensuing race to lower DSL prices and pump

up DSL speeds. In 2006 the price in Japan for ADSL was one-seventh (per 100 KB/s of capacity) that of the US, and the average speed was more than 10 times higher.[69] The new competitors relied on the interconnection regime's inexpensive pricing of network capabilities and on the retail pricing umbrella provided by NTT's reluctance to make big price cuts.

In response to government prodding NTT adopted the world's most aggressive plans for fiber to the home. (In 2007 there were roughly 14 million ADSL subscribers, 10 million fiber to the home subscribers, and 4 million cable modem subscribers.[70]) With ADSL providing more than 50 megabits per second at low prices the short-term economics of the NTT fiber build-out is highly uncertain. But this approach provides NTT with its best chance to escape unbundling and create differentiation on service capabilities. However, the government is concerned that NTT could try to use its dominant control of the fiber infrastructure to push Japanese IT service and equipment makers into an architecture that would not serve Japan well in world markets. So it seeks unbundling for fiber to the home for NTT East and NTT West and the creation of rules that resemble American value-added interconnection concepts.[71]

The third major player is Europe. Like the United States, the EU-27 requires a complex system of governance with strong elements of federalism. The legacy of regulatory nationalism and the continuing powers of the national regulatory authorities made the transition to competition complicated.[72] Unlike the US, a strong nascent alternative to ADSL in the cable television network was absent in most EU countries.[73] In addition, over-building of fiber for larger establishments was less common in the EU than in the US. This was the case because in most of Europe actions against market dominance by old state enterprises (many of which still had partial government ownership) was slower to materialize. The telecom boom and bust of the US in the late 1990s did not transform European infrastructure to the same degree.

The EU adopted a technology neutral and comprehensive approach to services in its 2003 directive on Electronic Communication Services. As the EU clarified the elements to be used in the analysis of risks from significant market power by a carrier, and its remedies, many EU members adopted extensive unbundling rules for dominant carriers. This spurred rapid deployment of inexpensive ADSL for consumers in most major markets and significantly curtailed the risk of anti-competitive behavior at the wholesale market level for either smaller rival carriers or ISPs independent of the dominant carrier. A debate remains in the EU on the risks of non-price discrimination by carriers with significant market power. This may

lead to more use of imposing structural separation of the wholesale network and the retail services. Still, unbundling has defused much of the controversy over net neutrality in Europe at the EU level.[74]

There are two reasons that a version of net neutrality may reappear on the EU screen. First, extensive variation at the national level in broadband competition may keep the issue alive. Second, the EU's mission in telecom is rooted explicitly in its mandate to strengthen EU market integration in order to advance EU competitiveness in world ICT markets.[75] The continuing weaknesses of European ICT may trigger broader reconsideration of policies for value-added interconnection. However, the EU may conclude that the risk to net neutrality is more on the information side of the ICT infrastructure.[76] The EU's worry is that suppliers of dominant platforms on the information side of the infrastructure can leverage the market for networked services (such as media players) or the intersection of ICT capabilities. This concern goes directly to fears of EU suppliers about their global competitive position, as discussed in the next chapter.

Content and Media

Content, a third issue, is an expanding fault line for policy and politics. Broadcast regulation and programming is one phase. Copyright management is the other.[77] Unlike most of Europe, US broadcasting and multimedia policies do not face the double burdens of divided regulatory authorities and explicit cultural protection policies. Although US spectrum policy requires coordination between the FCC and the Executive Branch on spectrum used by government agencies, there is no split between telecommunications and broadcast authorities to hinder the development of spectrum and competition policies. This unified regulatory authority permits coherence in the treatment of multi-media and traditional movie and broadcast content on broadband networks.[78] The British also are well organized for this task. Moreover, the FCC has no mandate to protect American culture.[79] Even though it debates the merits of policies to encourage children's programming, public decency, and news programs on television and radio, the FCC is indifferent to the source of programming (or languages).[80] This reflects the international dominance of English-language programming as well as the economics of 100-channel broadcast systems that provide all forms of niche programming.[81]

The ability to inspect packets on the new IP networks makes it plausible for governments to promote media content they support and restrict media content that they find objectionable. Policy discrimination comes in different flavors. For instance, stated US broadcast policy eschews cultural

protection.[82] No US president would declare, as the president of France has, that the government must subsidize a national search engine to protect its national culture.[83] But US lawmakers opted to limit Internet gambling and restrict pornography on mobile and Internet Protocol television (IPTV).[84] Countries also differ over whether and how to support public media. Although our main focus is on the build-out and operation of robust global networks (the conduit), the rise of modularity at the inflection point also raise important conflicts over the treatment of content. The issues noted here are but the tip of the iceberg.

Until about 2020, three policy decisions will especially influence how modularity plays out in the content market: intellectual property rights (IPR) decisions will influence the mix and match capabilities for content, rules governing ad networks will be critical because these revenues fuel many new business models, and the rules governing how one can mix personal data with commercial sites will set a path for the Personal Network Platform.

The most publicized content issue at the inflection point concerns intellectual property rights. The economics and technology of the inflection point make oversight of content difficult and instability more likely. As we noted in previous chapters, illegally copied content is becoming a convenient close substitute for copyrighted material. The options for producers of copyrighted material are to substantially change pricing schemes, reduce the availability and dissemination of material, or move to an entirely different revenue stream.[85] Online user communities now provide huge amounts of original music and programming. For example, a significant amount of the content on "user community" networks involves elements of "remixing" fragments of content that already is copyright protected. Perhaps most tellingly, well-known producers and artists are creating music that builds on remixing and often intentionally probes the limits of copyright.[86] The immense consequences of such "horizontal networking" for innovation and creative use of content are only now becoming clearer.

In the United States it is a challenge to find a political formula that allows for easy clearance of digital rights, reasonable fair use, and efficient charging and disbursement of fees for uses of copyright. The politics of networked ICT limit the solution set. The entertainment industry mounts skillful, high-profile campaigns to argue for copyright protection. Republicans will not go against their brand by aligning with IPR critics. Democrats listen to consumer groups that equate traditional copyright with anti-consumer tendencies, but no Democrat can win the presidency without carrying New York and California, the two largest content-creating

states. And there are large numbers of congressional Democrats from states and districts with high tech aspirations that support strong IPR. So critics of the existing copyright system confront stiff political constraints. However, wrangling by content owners over such sites as YouTube and Hulu (owned by two large content companies, NBC and the *Wall Street Journal*) suggests that bargaining within the private sector will lead to significant changes. Smaller stakeholders can abet this ferment through legal and political challenges.

Implementing solutions, including DRM schemes, will be difficult even if there is an agreement on the underlying bargain. For example, the great diversity of the US media industry produced a major and difficult-to-manage tangle of intellectual property.[87] Moreover, practitioners in the IPR field note that copyrights are domestically granted, often are interlocking (involving more than one IPR claim), and are not easily uncovered. Yet they have global implications. There are significant challenges to enforcing rights over diverse national jurisdictions even without the challenge of digital copying, sharing, and remixing. So DRM schemes face enormous difficulties even if hackers could not break the control software. On roaming global phones that also download music and video there will be many questions on how to sort out licensing rights on the digital content because many licenses are currently limited to specific geographic regions. And even if a DRM system can sort out these challenges there is the issue of whether or not the management system for the DRM might not open the way to collusion among content providers in ways that violate competition laws.[88] Achieving balance, cooperation, and accountability for content may be one of the hardest challenges at the inflection point.

Although IPR for content gets the spotlight in the blogging world, ad networks are going to be important for governance because they are characterized by economies of scale and scope. Larger ad networks can capture more data about users behavior. This can translate into a greater ability to target ads effectively, making it more attractive to advertisers. This possibility raises governance questions about competition in the online ad market, because the potential for anti-competitive behavior may increase as the market consolidates around a small number of large ad networks.

The importance of scale and scope (measured by the size of a publisher network) was reflected in Microsoft's early-2008 bid for Yahoo. In 2007 Google's online advertising revenues grew by 44 percent, versus 15 percent for Yahoo, Microsoft, and AOL.[89] However, the same data shows that a combined Microsoft-Yahoo would be the third largest online ad provider (by revenue) after Google and News Corp. As Microsoft CEO Steve Ballmer

remarked in March 2008, online advertising, already a "big thing," is poised to be the next "super-big thing."[90]

From the perspective of political economy, Microsoft's bid for Yahoo shows how coalitions are shifting as IT, media, advertising and all things "online" (e-commerce, software, social networking, etc.) blur together in a rapidly changing market landscape. The dispute will be over how to share the returns from information. Already, some newspaper publishers are pushing back against horizontal search engines that allow users to reach their content without going through their news portal. As we noted in chapter 4, vertical search engines, often tied to specific producers of information applications, will contend more strongly with the search giants Yahoo and Google.

Although the size of the traditional media market makes it the obvious starting point for a discussion of content, it is only the start. The inflection point is closely linked to the new ability to organize data inexpensively and powerfully for totally new applications. The best policy bargains for content may look different than for data. The potential of "Web 2.0" may be that data becomes the "Next Intel Inside." Races to win control of lucrative database content such as location or product identifiers are likely.[91] As the Personal Network Platform takes off, people will co-invest with Web service firms in building personal profiles of data that are of mutual interest—such as health data profiles or detailed documentations of investments in upgrading their homes (to improve credibility when selling the house). Who owns this data? Is the analogy to "number portability" in competitive telephone markets? Or is it, like many forms of insurance data, locked with the insurer? This issue goes beyond the boundaries of traditional privacy debates because users may have voluntarily disclosed their information-to-information application providers. The question is: Who owns the information?