No.ICP-2007-002

日米の意外な IP 電話市場発展の政治経済:
イノベーターがインプレメンターではないとき

When Innovators are not Implementers: The Political Economies of IP Telephony in the United States and Japan

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IP 電話の発展を考えると、二つの疑問点が浮かび上がる。それは VoIP が当初、既存事業者にとって破壊的な技術であるとされていたにもかかわらず、既存事業者を脅かすものではない現実と、アメリカのベンチャーが開発した技術にもかかわらず、日本での（新規企業の影響で）浸透が著しく広いこと、である。

この論文での発見は、アメリカ政府が通信政策の枠組みにきれいに収まらない VoIP ビジネスをすぐに規制せずに、実験やイノベーションを促すために保留したことと、アメリカの政治経済システムには既存事業者が新規事業者を妨害させることに役立つ「政策アリーナ」が多数あったことが挙げられる。これに対し IP 電話は日本の規制の枠組みにきれいにはまり、政府はすばやく IP 電話を定義付けることによって浸透を促し、日本の政治経済システムには既存事業者が VoIP を展開する事業者を妨害する複数の「政策アリーナ」が無い。

この論文のインプリケーションには、「破壊的な技術」は実は技術のみの話ではなく、「破壊的なビジネスモデル」に取り込まれることによって始めて既存の企業にとって破壊的である場合があると言うことと、サービスにすばやく規制を掛けることで浸透を促すことが出来る一方、市場を使った実験やイノベーションのポテンシャルとの駆け引きが存在する可能性がある、ということが挙げられる。

This paper explains two puzzles that become immediately apparent when considering VoIP (Voice over IP). First, despite being hailed since the mid-1990s as a disruptive technology that promised to undermine the business models of incumbent telecom firms, VoIP has yet to do so. Second, despite being innovated in the US, VoIP spread more quickly in Japan, with startups firms playing a significant role despite Japan's economic environment which is considered difficult for startups.

We find that the US government's orientation to delay extending the regulatory framework over VoIP to allow for experimentation and innovation, combined with the US institutional structure that offered incumbent telecom carriers a larger array of regulatory arenas to oppose VoIP providers, allowed US incumbents to hinder VoIP service providers that threatened their business models. In Japan, the regulatory area easily accommodated VoIP, and the government was quick to define VoIP services, facilitating the spread of VoIP services offered by startups. Japan's institutional structure did not give incumbents a multitude of regulatory arenas with which to oppose VoIP services, and incumbents shifted their business strategies to quickly adopt VoIP to compete rather than to focus on erecting regulatory barriers.

As implications, we assert that in many cases, disruptive technology is only disruptive when contained within disruptive business models, and that a tradeoff can exist between facilitating rapid spread of services by defining them, and leaving definitions open to enable experimentation and potential innovation.

March 14, 2008

情報通信政策研究プログラム

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Introduction:

Two puzzles immediately present themselves when one examines the spread of "Voice over IP" (VoIP, or IP telephony), a technology that sends voice signals as data, which can travel across the Internet.

The first is that, despite the technology's potential to undermine the core businesses of incumbent telephone operators by circumventing their traditional telephone networks, incumbent operators do not seem to be in imminent danger. When the technology made headlines in the late 1990s and again in the early 2000s, it promised to replace conventional telephones as a dramatically cheaper alternative, and many predicted that incumbents would face a serious threat, if not forced into sudden demise, from new VoIP service providers. Yet, instead of the rapid spread of telephone-replacement VoIP services, Skype, the online-based service more reliant on one party calling from a computer, grew rapidly to gain the center of attention. Why did VoIP not have a catastrophic and relatively immediate disruptive effect on incumbent carriers' business models, despite being hailed as a potentially "disruptive" technology?

The second puzzle is that the US, where the technology was innovated, was not the country in which telephone replacement VoIP services spread the most rapidly. Instead, the technology spread much more rapidly in Japan. In March 2004, North America had roughly

330 thousand subscribers to VoIP services as replacements to conventional telephones. Rapid growth in the subsequent two years led to the US having 6.8 million subscribers by the end of 2006, but this is still a small number given the population of approximately 300 million, with approximately 50% of households connected to the Internet.[1] In March 2004, Japan had approximately 5.2 million VoIP subscribers to services that replaced telephones, which grew to 11.5 million by 2006 – almost double the number in the US, despite having less than half the population and half the number of broadband subscribers.[2]

To understand why the fast spread of VoIP in Japan rather than in the US is a puzzle, we must first recognize that the world's two largest economies[3] are remarkably different in their relative technological strengths and weaknesses. The US dominates in basic science, software design, IT applications, biotech, financial services and the like, while Japan excels in manufacturing processes, mechanical design-heavy areas such as robotics, and its domestic wireless services. The underlying reasons for these differences in technological

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[1] Half of Households in the United States Now with Broadband Internet. *Internet World Stats.* http://www.internetworldstats.com/usage/use011.htm [Last accessed Sept 14, 2007.]

[2] Japan had 16.5 million broadband subscribers in June 2004, and 24.2 million in June 2006, while the US had 30 million in June 2004 and 50 million in June 2006. Ministry of Internal Affairs and Communications data http://www.soumu.go.jp/s-news/2006/060412_1.html#bs; http://www.johotsusintokei.soumu.go.jp/field/data/gt010103.xls, [last accessed June 1, 2007.]; Federal Communications Commission data http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-270128A1.pdf [last accessed June 1, 2007.]

[3] As measured by GDP according to official exchange rates (not purchasing power parity), as of 2006 Japan's was approximately double that of the third largest, Germany. CIA World Factbook https://www.cia.gov/library/publications/the-world-factbook/ [last accessed Sept 14, 2007.]

strengths is essentially a political economy issue, stemming from the differences in national institutions and markets, which allow each country to excel in a particular pattern of economic activity.[4] Thus, while the US is better at fostering start-up firms, labor mobility, competition, and breakthrough technology, Japan excels at providing stable capital, labor-management cooperation, managing competition, and incremental production improvements.[5]

At first glance, VoIP seems to be a perfect match for activities in which the US excels: the first innovations were from start-up firms; it is based on software and is not capital intensive; it offers strong competition against local telephony carriers who faced relatively little competition, while enjoying the "network effects" of conventional telephony if VoIP subscribers are assigned conventional telephone numbers.

However, it was in Japan where a startup firm offered IP telephony services that became extremely popular, challenging incumbent carriers to the point of forcing them to

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[4] Herbert Kitschelt argues that Japan excels at incremental production improvements with medium to long term production runs. Kozo Yamamura argues that market-based capitalist countries such as the US excel when "technology is changing fundamentally and rapidly," while the advantages of Japan and Germany lie in implementing those innovations, when "technological change is adaptive and gradual." Kitschelt, Herbert. 1991. Industrial Governance Structures, Innovation Strategies, and the Case of Japan: Sectoral or Cross-National Comparative Analysis? *International Organization* Vol 45 (4):453-493. Yamamura, Kozo. 2003. Germany and Japan in a New Phase of Capitalism: Confronting the Past and the Future. In *The End of Diversity? Prospects for German and Japanese Capitalism*, edited by K. Yamamura, and Wolfgang Streeck. Ithaca, NY: Cornell University Press. p. 115

[5] Vogel, Steven, and John Zysman. 2002. Technology. In *U.S.-Japan Relations in a Changing World*, edited by S. K. Vogel. Washington DC: Brookings Institution Press. p. 242.

offer their own VoIP services. In the US, startup firms offering IP telephony did not enjoy the same type of success, and incumbent telecom firms were slow to adopt the technology. Instead, US incumbents waged instead waging numerous, but ultimately unsuccessful regulatory battles to hinder the growth of VoIP service providers. How do we explain this seemingly reversed pattern of technology diffusion?

As a research design, taking this common technology, VoIP, and examining how it interacted with national institutions and existing market structures of each country, provides us with something akin to a natural experiment. In both countries, the core technologies and business models of incumbent telecommunications carriers were similar, and VoIP, widely regarded as a "disruptive" technology, was an exogenous shock.[6] Tracing how the new technology "hit" the two countries reveals the exact mechanisms by which differences in regulatory and institutional contexts and market structures affected how market players interacted with policy processes.

Our findings are as follows. We find that in the US, incumbent telecom carriers had relatively more power to alter their policy environment to block the potentially disruptive

[6] There have been many conceptions of discontinuous, or disruptive technology, but let it suffice here to refer to Clayton Christensen's conception, in which technology can be sustaining or disruptive. If it is disruptive, the "value propositions," essential the mix of suppliers, consumers, and the company's business model, do not conform to previous generations of technology. Firms with disruptive technology take advantage of new "value propositions" to benefit from new market segments, while incumbent firms that cannot adjust find themselves rendered obsolete. Christensen, Clayton. 2000. *The Innovator's Dilemma*: Harper Business.

VoIP service providers. The US VoIP service providers did not offer their own broadband services, having to rely on leasing incumbents' networks. This placed them at the mercy of regulations. When VoIP service providers began offering services that bypassed incumbent carriers' telephone networks entirely, incumbents used the multiple regulatory arenas available to them to influence the terms of competition through policy pressures. Their efforts were aided by the lack of decisive federal government policy regulating VoIP. Only when faced with increased competitive pressures from cable companies who owned their own infrastructure and were not susceptible to the same regulatory challenges, did the incumbents shift towards more market-based competition, offering their own VoIP services.

In Japan, the incumbent's strategy was limited to market responses because the Japanese regulator, relatively more autonomous and strategic (in the sense of being willing to promote particular technologies) than the US regulators, government was quick to establish a regulatory framework over VoIP. The most significant Japanese VoIP competitors also offered broadband services and often possessed their own network infrastructure, and the Japanese regulator was in the midst of expanding regulatory advantages enjoyed by broadband competitors. Japan's incumbent was therefore deprived of the type of policy levers available to US incumbents. As a result, Japan's incumbent

had little choice but to engage in market-based competition by offering their own VoIP services to maximize market share.

As an implication of this study, we contend that notion of "disruptive technology" depends not only on the nature of the technology, but largely on whether the *business models* based on the new technology undermine prevailing business models – whether the *potentially* disruptive technology is contained in a *disruptive* business model. Furthermore, we propose that in telecommunications, the relative dependence of a new, promising technology on particular infrastructure – infrastructure being usually heavily regulated – can affect the range service business model options. Thus, countries with different regulatory regimes offer a different range possible business models. The less the technology is dependent on particular infrastructure, the more easily a potentially disruptive technology can be incorporated into a disruptive business model.

This paper first provides an overview of VoIP as a technology, differentiating between several types. It then traces the development of IP telephony markets in each country. For each country, we first survey the market developments, dividing them into distinct phases. Then we trace regulatory developments, followed by a close examination of how VoIP challenged incumbent business models.

What is VoIP, and why is it potentially "disruptive"?

Voice over IP, in its simplest form, refers to voice signals sent as data, riding on top of Internet protocols. This data usually travels through the public Internet or dedicated IP networks rather than conventional circuit-switched telephony lines.[7]

It is generally cheaper for all parties involved to send voice signals over data networks than over conventional telephone lines. This is partly because conventional "circuit switched" telephony equipment requires much more "intelligence," in the network, since switches must directly connect two telephones or devices from any origin to any destination in an instant. Circuit-switched network equipment is therefore quite costly. In contrast, Internet data traffic does not require as much "intelligence" in the networks, since data is broken up at the sending end and reassembled at the receiving end. Rather than "direct" connections, different packets of data can take different routes to arrive at their destinations. Equipment handling data using Internet Protocols, such as routers, is therefore much cheaper.

Packet-switched data networks also require less overall capacity. Circuit switched conventional networks, by creating dedicated connections for the duration of each connection, tie up the line even if no voice or data is being sent. In contrast,

[7] This paper restricts itself to simple explanations to broaden accessibility. Most general statements need qualification, but the aim of this paper is to avoid an overly technical discussion, aiming instead to characterize the technology and network properties at just the sophistication to allow analytical leverage.

"packet-switched" networks route data packets through the most efficient route as soon as they are generated and do not tie up lines when data is not being sent; they are therefore vastly more efficient in utilizing capacity.

IP telephony of an acceptable quality for most household users requires data communications speeds provided by broadband.[8] There are many physical infrastructures capable of carrying data at broadband speeds, including DSL (which uses existing copper wires), cable, 3rd generation wireless, satellite, FTTH (Fiber-to-the-Home) and next generations of WiFi (The wireless internet technology currently used by most laptops). In other words, IP telephony *decouples* voice-based communications from conventional telephony (and cellular) networks. This is the main reason that IP telephony is usually considered a disruptive technology – disruptive to incumbent telephone carriers relying on circuit-switch telephone networks.

There are several types of VoIP in a technological sense. These need to be separated analytically, since their services are incorporated into different business models, which pose different challenges to incumbent telecommunications carriers.

[8] Following the OECD, we refer to "broadband" as services offering more than 256Kbps downstream. See OECD, *The Development of Broadband Access in OECD Countries* (Organization for Economic Co-operation and Development, 2002), p.6.

IP-to-IP

The first form of VoIP, which we label IP-to-IP, is when both ends of the transmission are connected via the Internet, and at no point does the transmission enter conventional circuit-switched telephony networks. Consumers experience two main forms of IP-to-IP telephony.

The most popular form is when both ends of the transmission are PCs, with software such as Skype, or Microsoft's MSN (now Windows Live) voice/video chats.[9] In the second form, users on both ends use conventional telephones plugged into adapters connected to broadband modems, which are connected to each other via the Internet rather than conventional telephony lines. These are mostly subscription-based services, in which service providers such as Vonage in the US, and Softbank in Japan, offer callers functional substitutes of their telephones.

The main threat from IP-to-IP services to conventional telephone carriers is that the call never passes through their conventional telephony network – they are therefore completely cut out of carrying the voice traffic on their core networks.

[9] In strictly technical terms, there are several variations within this type of VoIP. For example, Skype uses a "peer to peer" architecture, in which computers connect to each other to alert each other when "contacts" are online, while MSN uses its own servers to send and receive this data, thereby limiting the number of contacts a user can store.

IP-to-PSTN

The second form of VoIP involves one end originating or terminating in an IP connection, and the other end connecting to a circuit switched conventional telephone, commonly known as PSTN (Public Switched Telephone Network). The Skype-Out service offered by Skype, allowing people using a computer to place a call to an ordinary telephone, is an example. Another example is somebody using a Vonage (US) or YahooBB! (Japan) service, dialing a conventional telephone number to reach a regular telephone.

The other direction, PSTN to IP, involves somebody on an ordinary telephone dialing a number that connects to an IP telephone on the other end. A example of this would be when somebody dials a phone number that connects to a Vonage subscriber's VoIP phone (US), or a Softbank YahooBB! Phone (Japan).

IP-to-PSTN services are somewhat of a threat to telecom carriers, but do not cut them out completely. Local carriers can charge access fees to IP telephony carriers from the point at which the signal is handed off to their conventional PSTN network. Therefore, most IP telephony services require subscribers to pay for calls to PSTN numbers to offset the costs they incur when connecting to local carriers' networks.

On the other hand, IP-to-PSTN allows IP telephony subscribers to use their services as more or less substitutes to conventional phones, capable of calling and receiving calls

from anybody. By cutting out charges from long distance carriers, and by connecting to PSTN networks at hand-off points as close as possible to the destination, IP telephony service providers offering IP-to-PSTN services can charge subscribers far lower fees than do conventional telephone services.

PSTN-IP-PSTN

The third form of IP telephony, which this paper does not examine in depth, involves both ends being PSTN, with only the intermediate section traveling over IP networks. With this arrangement, the end user can be unaware that their phone call is converted into data, then back to conventional telephony again. People who are knowledgeable about IP telephony often do not consider this form of VoIP to be IP telephony per se. Consusion over these various types of VoIP is prevalent, and sometimes even encouraged by companies. When AT&T offered such as service around 2000, labeling it VoIP and asking for regulatory relief, it was playing on this confusion -- simply reducing costs in its long distance transmission while acting as though it was embracing new technology, and attempting to win favorable regulatory treatment, without adopting a new business model.[10]

Table 1: Varieties of VoIP

Type of VoIP	Origin	Transit	Destination	Example

[10] Nuechterlein, Jonathan, and Philip Weiser. 2005. *Digital Crossroads: American Telecommunications Policy in the Internet Age*. Cambridge, MA: MIT Press.

IP-to-IP	IP	Internet*	IP	Skype
IP-PSTN	IP	Internet → PSTN	PSTN	Skype-Out, Vonage to regular phone
PSTN-IP	PSTN	PSTN → Internet	IP	Skype-In, regular phone to Vonage
PSTN-IP-PSTN	PSTN	PSTN + Internet	PSTN	AT&T's VoIP service around 2000

* depending on the service, "Internet" can also be a carrier's private IP network

VoIP in Corporate Networks

IP telephony is extremely attractive to corporations, since they can remove their telephone switching infrastructure entirely, consolidating all communication services to their data networks. By allowing new, more flexible services such as consolidated voicemail boxes, location-free numbers, the ability for one person to leave the same voicemail to multiple people, and of course reducing telephone costs, the benefits of IP telephony are numerous.[11] Therefore, in terms of the total number of VoIP lines adopted, business use far outweighs residential adoption. In one estimate cited by *The Economist*, 63% of North American companies had adopted VoIP to some degree by late 2004.[12] In a poll of approximately 1350 Japanese firms, Japan's Ministry of Internal Affairs and Communications (MIC) reports that in 2005, 33% of firms had already implemented VoIP services, approximately 9% had plans to, and 18% were considering it. In 2003, in a survey of approximately 800 firms, only 17% had implemented VoIP.

[11] For example, see Survey: Hearing voices. 2004. *The Economist*, Oct 30, 23.

[12] Ibid.

However, in this paper we concentrate on residential IP telephony services for two main reasons. The first is that the intersection between technology and policy is much greater for residential IP telephony markets; the markets are much more strongly shaped by government policy. This is largely because there is much more competition for providing businesses with infrastructure than for providing residential services. Since the last-one-mile of infrastructure to households is owned by a very small number of incumbent firms, rules over who gets to use incumbent's infrastructure, and at what terms, is at the core of policies required to create and sustain competitive markets. The nature and outcomes of battles over these rules differ between countries. Second, the business models of incumbent telecom firms in both countries are quite similar despite the differences in regulatory and market actors, while the business models for corporate VoIP solutions differ widely within each country, as well as between them.

Overview of the US IP Telephony Market

First, we provide a historical overview of IP telephony market in the US, which may be divided into four phases. The market dynamics in each phase differed

significantly, with IP telephony services and service providers posing different challenges to incumbent carriers in each phase, eliciting a different set of responses.

Phase 1 (mid-1990s): The development of VoIP

Early VoIP applications developed in the US. One of the notable early players, net2phone, by a company called IDT, began services in 1996. They were designed as PC-to-PC and PC-to-PSTN phone applications, running on slow Internet connections (say, 28.8kbp/s versus at least 1 to 3 mbp/s with the advent of broadband and higher speed corporate private lines). Sound quality was lower than that of conventional telephony, with significant lag times. [13] It offered PC-to-PC communications for free, charging low per-minute fees for PC-to-PSTN calls.

IDT gained attention when it introduced a service allowing consumers to bypass the use of a PC, calling from PSTN to PSTN, using net2phone's VoIP over the Internet as the long distance link. Consumers could call a toll free number, which connected to a net2phone server, which then called the number entered by the user. [14] Since the long distance portion of the call was bypassed, upon its introduction in 1997 IDT could offer long distance domestic rates of 8 cents per minute and low international rates, such as 18 cents to

[13] Briere, Daniel, Christine Heckart. 1996. Internet/PSTN: The shape of things to come. Network World, August 12, 22.

[14] Niccolai, James. 1996. IDT to offer phone-tophone service via the Internet. *Computerworld*, Oct 21, 82.

London and 29 to Japan.[15] At this stage in the evolution of IP telephony, it essentially became the equivalent of a low-priced long distance calling card.

Phase 2 (late 1990s): Large Company Interest during the Tech Boom

In the late 1990s, as the dot-com boom was reaching its peak, IP telephony companies proliferated, with service names such as Dialpad, iccoecthere, PhoneFree.com. Among these, net2phone made the most headlines by attracting the attention of major technology companies. In 1999, Netscape, still a contender in the browser wars, picked net2phone, which reported it had 250,000 regular users at the time, to include in its Communicator browser.[16] In mid-2000, Microsoft incorporated net2phone in its MSN Instant Messenger services, allowing members to engage in voice communications with each other, and to conduct IP-PSTN calls for approximately 1 cent per minute for domestic calls.[17]

A battle over control and ownership of Net2Phone broke out in mid-2000, with America Online and Yahoo! announcing $150 million investments in the company. AT&T, which had also been courting Net2Phone, then estimated to carry approximately 40% of calls routed over the Internet (according to the New York Times) stepped in with a $1.4 billion cash offer, leading a consortium of investors including Liberty

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[15] Maney, Kevin. 1997. Internet Long-distance no longer needs a PC. *USA Today*, September 8, 1.B.

[16] Mehta, Stephanie N. 1999. Netscape to Include IDT Phone Icon on Web Browser. *The Wall Street Journal*, March 10, 1.

[17] Buckman, Rebecca. 2000. Microsoft to Offer Free Calls Through Net2Phone. *The Wall Street Journal*, July 20, B.14.

Media Group to hold approximately 40 percent of its voting stock.[18] While AT&T contended that it would use Net2Phone's technology for its own services, many analysts understood AT&T's actions as a move to prevent AOL, one of its biggest perceived threats at the time, from obtaining the company and its technology.[19]

Phase 3 (early 2000s): Rise in Popularity, Emergence of Vonage and Assigned Numbers

Vonage, incorporated in 2001, and commencing service around late 2002, has gained the most attention for changing the terms of competition in IP telephony. It was able to take advantage of the nascent Session Initiation Protocol (SIP), which could run on top of any physical infrastructure to simulate the function of PSTN lines,[20] as well as the fast-growing broadband markets, to deliver higher quality service than most of its predecessors. As mentioned above, its business model consisted of bypassing PCs by sending subscribers a box they could plug into their broadband modem, into which an existing telephone could be plugged.

Perhaps the most significant business innovation, however, was that Vonage succeeded in getting conventional telephone numbers allocated to its subscribers. This enabled other conventional telephones to dial Vonage IP telephony subscribers just as if they were dialing other telephone users. Moreover, Vonage could allocate not only one, but multiple telephone numbers, and from different area codes, to one IP

[18] AT&T and Allies Invest in Net Concern. 2000. *The New York Times*, April 1, C.2.

[19] Quinton, Brian. 2000. AT&T finds its IP voice. *Telephony*, April 10, 12.

[20] Functions simulated included dial tones, ring tones, etc, and it also went beyond simulating PSTN, enabling many of the additional features as well.

telephony account. Therefore, if a subscriber expected to receive frequent calls from Maine and Hawaii, they could have one number of each allocated to their account, allowing each of the callers to be charged only for making a local call, when the receiver could be anywhere in the world. Likewise, the Vonage account holder could use a PC to make calls from anywhere in the world, but only needed to be making "local calls" if their allocated number was of the same area code. To illustrate this potential taken to it extremes, the *Economist* notes that many Indian mothers in India whose children worked in Silicon Valley had Vonage accounts with a 650 area code, enabling them to make "local" calls to the Bay Area.[21]

Vonage was probably not the first firm to receive number allocations, since Net2phone and other companies also received number allocations, but it became the largest by far. The North American Numbering Council (NANC), an industry group chartered by the FCC, and the North America Numbering Plan Administrator (NANPA) are responsible for distributing phone numbers in the US. They allocate blocks of numbers to "incumbent local exchange carriers," (ILECs – local telephone carriers such as SBC, Quest, that possess infrastructure), which transfer some to "competitive local exchange carriers" (CLECs) – carriers using their infrastructure to provide service. Vonage receives its telephone numbers from CLECs, though it was not keen to reveal which CLECs, or the contractual terms.[22] Vonage then maps the telephone numbers to IP

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[21] Business: The phone call is dead; long live the phone call: telephony. 2004. *The Economist*, December 4, 69.

[22] Charny, Ben. 2007. *Net phone hang-ups looming?* January 27 2003 [last accessed May 15 2007]. http://news.com.com/2100-1033-982130.html.

addresses allocated to its subscribers.[23] Local telephone companies, such as Verizon and Qwest, were understandably concerned about this number allocation in a presentation to NANC, but the FCC did not make it an immediate issue.[24]

Phase 4 (2004 -): IP Telephony in the Cable vs Telecos Battle

The next shift in the terms of competition for IP telephony was when the major cable companies began offering IP telephony over their cable infrastructure in a bid to replace local telephone companies.[25] Vonage had been offering IP telephony services to second-tier cable companies, but from around 2004, the major cable companies began their own services.[26] In 2004, Comcast, the largest cable operator, began testing VoIP in limited markets, beginning to expand nationwide in early 2005.[27] Cablevision, a smaller company, was one of the first to offer IP telephony. Time Warner also began offering IP telephony in all its markets by the end of 2004. [28]

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[23] Cite Vonage presentation

[24] Charny, 2007. Later, in late 2004, A subsidiary of SBC petitioned the FCC to receive number allocations directly from NANC, to which FCC granted permission. (cite FCC statement). In February, 2005, the FCC ruled on a request from a subsidiary of SBC that it could obtain numbers for its VoIP services directly from NANC. FCC. 2005. In the Matter of Administration of the North American Numbering Plan: Federal Communications Commission.

[25] They aimed for a "triple play" in which they could provide cable TV, broadband, and telephony over the same cable.

[26] Charney, 2007.

[27] Grant, Peter. 2004. Comcast Pushes into Phone Service; Rollout of a VOIP Product Heats Up Cable's Turf War with Telephone Companies. *The Wall Street Journal*, May 26, A.3.; Wilson, Carol, and Vince Vittore. 2005. SBC, Comcase Enliven Convergence. *Telephony*, Jan 17, 8-10.

Decisive figures for IP telephony subscribers in the US are difficult to find. We provide a composite picture by including two sets of data: the market shares of the top ten VoIP service providers in the US, excluding cable companies, and the number of subscribers for major North American companies.

Table 1: Market Shares of Top 10 US VoIP Service Providers (excluding cable)

Name	market share (%)
1. Vonage	53.9
2. Verizon Voice Wing	5.5
2. AT&T CallVantage(SBC)	5.5
3. SunRocket	4.0
4. Lingo	2.6
5. NetZero Voice	2.5
6. .Broadvoice	2.2
7. America Online (AOL)	1.6
8. 8x8 (Packet8)	1.1
9. Earthlink	0.9
Other	20.5

Source: Telephia Total Communications Survey, Q2 06

*Note: Data in table includes subscription VoIP providers who actively promote their service as Internet Telephony. It excludes cable companies

**Note: Data in the table measures pure-play subscription VoIP services and excludes providers offering free or pay-per-call VoIP services (e.g. Skype)

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[28] Cablevision press release http://www.cablevision.com/index.jhtml?id=2003_11_11a [last accessed May 20, 2007], Times Warner press release http://www.timewarnercable.com/Investorrelations/pressreleases/TWCPressReleaseDivDetail.ashx?PRID=881&MarketID=52 [last accessed May 20, 2007]

Grant, Peter. 2004. Comcast Pushes into Phone Service; Rollout of a VOIP Product Heats Up Cable's Turf War with Telephone Companies. *The Wall Street Journal*, May 26, A.3.

Table 2: VoIP Subscribers in North America (thousands)

	Q1 04	Q2 04	Q3 04	Q4 04	Q1 05	Q2 05	Q3 05	Q4 05	Q1 06	Q2 06	Q3 06
Vonage	131	194	276	391	640	848	1,062	1,269	1,597	1,853	2,058
Time Warner	-	-	104	220	372	614	854	1,079	1,370	1,604	1,649
Comcast	-	-	-	-	72	87	159	328	539	865	1,384
Cablevision	60	125	189	273	364	478	601	731	865	988	1,101
Videotron	-	-	6	10	15	42	75	163	227	283	344
Charter	-	-	6	45	55	68	90	122	191	258	340
Cox	-	-	-	-	60	90	140	170	200	220	245
Rogers	-	-	-	-	-	-	18	48	97	165	271
Shaw	-	-	-	-	-	22	57	91	119	169	210
SunRocket	-	-	-	-	4	-	-	-	-	130	170
8x8	11	17	26	40	57	73	93	113	133	151	165
Mediacom	-	-	-	-	-	-	2	22	46	66	83
Total Subs	202	336	601	978	1,639	2,322	3,151	4,135	5,384	6,751	7,983

Source: PiperJaffray

US Debates over Regulatory Framework for IP Telephony

Now, let us examine developments in the US regulatory framework. IP telephony in the US posed several challenges to the existing regulations over telephony. The process of settling the regulatory framework for IP telephony, though yet to be completed as of this writing, has so far involved debates by a variety of regulatory and market actors over several issues, in several policymaking arenas. The main issues debated include: whether the FCC classified IP telephony services as “telecommunications” or “information” services;

rules over interconnection; universal service and 911 emergency obligations. These issues were contested in multiple regulatory arenas, including the federal government, the judicial system, and state governments.

Issue 1: PC-to-PC IP Telephony as Not "Telecommunications"

Telecommunications carriers are subject to a host of regulations, such as universal service obligations (in which local carriers must provide telephone service to anybody who asks, even if they are in remote and therefore costly areas, charging the same fees as urban, and therefore cheaper to access, customers), emergency communications (the ability for 911 emergency calls to be able to locate the origin of a call), minimum quality requirements, and the like. These obligations are required for services which the FCC defines as "telecommunications" services. The question was whether IP Telephony should be subject to the same rules or not, since part of their ability to offer low fees was their exemption from these rules.

In early 2004, in response to a petition, the FCC made a declaration regarding a PC-to-PC style IP-to-IP telephony service provided by pulver.com, called Free World Dialup. The Commission ruled that the service was an "unregulated information service," rather than a "telecommunications" service, and therefore exempt from universal service obligations.[29] The FCC went on to assert that it had sole jurisdiction over

[29] F.C.C. 2004. In the Matter of Petition for Declatory Ruling that pulver.com's Free World Dialup is Neither Telecommunications Nor a Telecommunications Service.

pulver.com's service, excluding it from state-level regulation on the grounds that with IP telephony, the service cannot be effectively divided into "interstate" and "intrastate" components.[30]

This settled the regulatory structure for PC-to-PC style IP telephony. However, for services such as Vonage, which can effectively act as substitutes to conventional telephones, the classification and jurisdiction become a contentious issue, as we will see in the next section.

Issue 2: Battling for Jurisdiction: States, Courts, and Feds

A battle initiated by states, most likely in response to local carriers, attempted to assert state-level regulatory authority over Vonage-style IP telephony, which led to a battle involving the judicial system and the FCC.

In October 2003, the Minnesota Public Utilities Commission responded to a complaint filed by the Minnesota Department of Commerce, ordering Vonage to cease its DigitalVoice services within the state until it obtained state certification. Similar moves were undertaken by state-level organizations in California and Wisconsin. The states essentially wanted to subject the IP telephony firms to universal service and emergency dial obligations.[31]

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[30] Nuechterlein and Weiser p. 198-199

[31] Charny, Ben, and Evan Hansen. 2003. Court's call: Hands off VoIP. *CJNet News*, October 8. <http://news.com.com/2100-7352_3-5088158.html> [Last accessed June 1, 2007.] ; Charny, Ben. 2003. Minnesota: Phone rules apply to VoIP. *CJNet News*, August 21. <http://news.com.com/2100-1037_3-5066652.html> [Last accessed June 1, 2007.]

Vonage responded by filing a petition with the FCC, as well as a suit in the federal district court in Minnesota. Vonage argued that it provided an "information service," that it was not a "telecommunications carrier," and that it should be exempt from state regulations. The district court of Minnesota responded in late October 2003 by agreeing with Vonage – that Vonage did indeed provide an "information service," ordering an injunction to bar Minnesota's Public Utilities Commission from forcing Vonage to get a state license. Receiving this, the Minnesota Public Utilities Commission appealed to the next higher level of court, the Eighth Circuit court.[32]

In March 2004, the FCC invited industry input in order to create a comprehensive set of regulations for VoIP.[33] In November 2004, before it completed such regulations, and before the Eighth Circuit reached a decision, the FCC issued an order contending that states had no authority to regulate VoIP services, since it is impossible to separate "interstate" from "intrastate" portions of the service. However, the FCC did not rule whether or not Vonage's service was indeed an "information service," preferring a slower and more careful deliberation of the issue.[34]

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[32] Vonage v. Minnesota Public Utilities Commission. 2003. United States Court of Appeals for the Eighth Circuit. <http://www.nysd.uscourts.gov/courtweb/pdf/D08MNXC/03-08475.PDF> [Last accessed June 1, 2007.]

[33] FCC. 2004. Notice of Proposed Rulemaking: In the Matter of IP-Enabled Services, Federal Communications Commission.

[34] Nuechterlein and Weiser. pp. 204-205

In the meantime, several petitions were filed by various states in several Circuits, which were consolidated to the Eighth Circuit.[35] In March 2007, it affirmed the FCC's order, and denied the petitions.[36] Thus, the state-initiated battle over regulatory jurisdiction over Vonage-style IP telephony was decided by the judicial system to be in the hands of the FCC, though the FCC had yet to formulate a clear regulatory structure to govern them.

Issue 3: AT&T's Ploy: IP-VoIP-IP as an "Information Service"

In a somewhat bizarre regulatory experiment, AT&T attempted to get its IP-VoIP-IP service exempt from designation as a "telecommunications service." From around mid-2002, AT&T had refused to pay local carriers such as SBC, Verizon, Qwest, and BellSouth the access charges AT&T incurred for connecting calls from its long distance VoIP network to their local PSTN networks. In October 2002, AT&T petitioned FCC to declare that its service was an "information service," and therefore exempt from paying local telephony companies. AT&T contended that since its traffic came from the Internet, it should only have to pay local telephony charges rather than the higher long distance interconnection rates.[37]

However, since AT&T's service was a PSTN-IP-PSTN service, only using VoIP during the long distance portion of a call, users were unaware that their voices were transferred to the Internet along the way.

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[35] Vonage v. Minnesota

[36] ibid.

[37] Squeo, Anne Marie. 2004. FCC Is Poised to Clarify Future of Internet Phone Calls. *The Wall Street Journal*, Jan 22, B.1.

There was simply little service differentiation from conventional long distance services. In other words, their business model was the same, but they simply substituted IP networks for carrying long distance traffic. In April 2004, the FCC rejected AT&T's claim.[38]

This episode illustrates the regulatory experimentation that US market players could engage in, given the lack of a tightly formulated regulatory structure over different types of IP telephony services. As we will see, this type of experimentation is in stark contrast with the behavior of Japanese firms, which had little avenue for such experimentation because the government stepped in early to comprehensively regulate VoIP services.

Issue 4: Emergency and Universal Service Obligations – Towards Becoming a Substitute

In May 2005, the FCC moved to clarify the regulatory structure governing IP-to-PSTN services. It ruled that IP-to-PSTN VoIP providers, excluding PC-based services, such as Skype, were obligated to offer emergency 911 service. The intent was for consumers to be able to use services from firms such as Vonage as substitutes for conventional telephony.[39]

[38] Nuechterlein and Weiser pp. 200-201

[39] FCC. 2005. In the Matters of IP-Enabled Services, E911 Requirements for IP-Enabled Service Providers, edited by F. C. Commission: Federal Communications Commission.

In June 2006, the FCC went further in expanding the regulatory umbrella by announcing that it would require VoIP service providers such as Vonage to contribute to universal service funds. [40] Rates were calculated by the FCC, which considered VoIP services to be "interstate telecommunications services," amounting to approximately $2 per service subscription. This was higher than conventional local telephones and cellular services, though FCC members referred to it as an "interim" solution.[41]

Thus, in the US, IP telephony did not automatically fall into a particular category of existing regulation. Mostly in response to petitions by service providers, the FCC extended regulations over IP telephony in a piecemeal and incremental fashion. This opened up possibilities for political strategies by incumbents which took advantage of state governments and the judicial system.

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[40] FCC. 2006. Fcc updates approach for assessing contributions to the federal universal service fund, edited by F. C. Commission.

[41] Broache, Anne. 2006. FCC approves new Internet phone taxes. *CNET News.com*, May 28, 2007. In press releases, FCC members stated that this was an interim solution, in place until they created a fundamental regulatory framework for IP telephony. This price was determined partly due to the fact that DSL was classified as an "information service" and did not have to contribute to the universal service fund, and because the fund's expenditures were rising, and needed to be covered. Assorted FCC member press releases. http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-06-94A2.pdf (Martin) http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-06-94A4.pdf (Adelstein) http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-06-94A5.pdf (Tate) http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-06-94A6.pdf (McDowell) http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-06-94A3.pdf [last accessed June 1, 2007.]

Regulations and Markets

Here we focus on how IP telephony threatened the business models of incumbent carriers in each phase of market development, and how incumbent carriers responded. We find that it was only when the business models of local carriers were threatened by IP telephony services becoming a functional substitute – by obtaining getting conventional telephone numbers allocations, thereby tapping into the network effects of PSTN telephony but bypassing local carriers' infrastructure completely – that local carriers began using the multiple policy areas available in the US to challenge IP telephony service providers.

The Original Incumbent Carrier Business Models

Until AT&T was split-up in 1984, it owned approximately 75 percent of all local lines, with almost compete dominance of long distance services. In essence, it kept local service prices low by charging high long distance rates, and internally subsidizing local service. Large corporations therefore often relied on private lines that minimized reliance on AT&T's long distance network. After the breakup of AT&T, the FCC cooperated with federal and state regulators to implement a set of pricing policies that reduced the ability of

long distance services to subsidize local service. The FCC continued to reform access charges in the 1996 Telecommunications Act, and again in 2000.[42]

The typical business models were as follows. Local carriers, which owned the physical infrastructure to households, charged subscribers monthly fees (usually flat-rate) for connecting to their local network, with unlimited local calls included. When consumers made long distance or international calls, the long distance/international carriers charged them by the minute, paying local carriers at both the origin and destination locations. Universal service obligations are usually interpreted to mean that local carriers are required to serve all customers in their geographic area at a similar price, regardless of the actual cost incurred by carrier to provide that service.[43]

First Phase of IP Telephony: Small-scale IP-to-IP not a Threat

Early in the first phase of IP telephony, when the technology was in its infancy and capable only of PC-to-PC connections, VoIP services were not a threat to either local or long distance/international telecom carriers. The early VoIP applications could not tap into the network effects of connecting to the conventional telephone network. Network effects,

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[42] FCC. 2007. *Trends in Telephone Service* (February). Industry Analysis and Technology Division, Wireline Competition Bureau 2007 http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-270407A1.pdf. [last accessed May 23 2007].

[43] The precise language in the statute reads: "quality service should be available at just, reasonable, and affordable rates" not necessarily the "same price". Communications Act Section 254 (b) (1)

put simply, refer to the phenomenon whereby the value of a particular network for an individual increases when more people join the network, which in turn increases the value of the entire network for everybody. Since the sound quality for early VoIP applications was low, they were far from being a substitute for telephone calls among average PC users.

The FCC essentially segmented out PC-to-PC VoIP as separate from existing telecommunications services in its ruling on Pulver.com by classifying it as an "information service," which did not incur universal service fund obligations, nor substantial taxes that would have been incurred had it been classified as a "telecommunications service." [44]

Late First and Second Phases: PC-to-PSTN Challenging Long Distance

Later in the first phase and in the second phase, as PC-to-PSTN connections became possible, IP telephony contributed to the challenges facing long distance carriers, since carriers' long distance, metered networks could be completely bypassed. Long distance carriers, already pressured by competition from cellular services offering flat-rate long distance, found their business models unsustainable in the face of downward pressure to long distance/international prices. See table below, and note the contrast between local services, the rates of which actually rose over the same time period.

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[44] McCullagh, Declan, and Ben Charny. 2004. FCC: 'Pure' VoIP not a phone service. *CJNet News.com*, February 12.

Table 3: Average Revenue per Minute for Interstate Toll (Long Distance) Servce Calls

Year	Revenue per Minute (USD)
1996	0.12
1997	0.11
1998	0.11
1999	0.11
2000	0.09
2001	0.08
2002	0.07
2003	0.07
2004	0.06

Source: FCC Telecommunications Industry Revenues (March 31, 2006)

Table 4: Average Residential Rates for Local Service in Urban Areas (1996-2005)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Representative Monthly Charge	13.71	13.67	13.75	13.77	13.64	14.49	14.38	14.54	14.57	14.75
Subscriber Line Charge	3.54	3.53	3.52	3.58	4.5	5.05	5.74	5.86	5.81	5.81
Additional Monthly Charge (touch tone)	0.3	0.25	0.1	0.09	0.06	0.04	*	*	*	*
Taxes, 911, and other Charges	2.4	2.42	2.39	2.48	2.57	3.03	3.94	4.12	4.14	4.19
Total Monthly Charge	19.95	19.88	19.76	19.93	20.78	22.62	24.07	24.52	24.52	24.74

Note: Rates are based on flat rate service where available and measured/message service with 100 five-minute, same-zone, business-day calls elsewhere. Beginning in 2001, all rates reflect flat-rate service.

Source: FCC Reference Book of Rates, Price Indices, and Household Expenditures for Telephone Service

However, local carriers were only partly bypassed, since the IP telephony services needed to connect to local telephony networks at the destination, therefore paying

interconnection charges. IP telephony at this stage only tapped into some of the network effects of PSTN, since one side needed to be a PC, and it could not receive calls.

The development of calling card-style IP telephony services (in which users dialed a toll free number, which connected them to an IP telephony server, which then connected their call to the destination) was more of a direct competitor to long distance and international carriers' services. Local carriers still received revenue -- from the origin in connecting to the toll-free number, and at the destination where calls patched into their network. IP telephony services effectively took a step further in tapping into the network effects of conventional telephony by allowing the caller at the origin to use their existing telephone equipment and lowering the costs to switch/use IP telephony services.

Third Phase: Conventional PSTN Numbers Challenge Local Carriers

In the third phase, when IP telephony service providers such as Vonage obtained conventional telephone numbers, IP-to-IP telephony could completely bypass both local and long distance/international carriers' PSTN networks *and* take full advantage of the network effects of PSTN telephony on both ends. Moreover, they could go beyond simply becoming low-cost substitute telephones by taking advantage of the numbering schemes to get multiple "local" numbers assigned to get local calling rates from anywhere in the world. This was possible in the US because of the technical setup of the network equipment. US local carriers charged interconnection fees on the basis of the number from which the call originated. Therefore, no matter

where the call came from on the network, if the number of original was local, it was recognized and charged as a local call.

Local telephony companies could only get revenue from the broadband underlying IP telephony. Moreover, they were extremely unwilling to provide only DSL service without the subscriber also being required to sign up for local telephone service – the unbundled service known as "naked" or "standalone" DSL. For example, only in 2006 did AT&T (formerly SBC) quietly allow subscribers to enroll in standalone DSL, but it set the price at $44.99 per month, while subscribing to telephone service was about $16, and when adding DSL, the DSL only cost $29.99, totaling about $46.[45]

Fourth Phase: Challenge by Cable Carriers to Local Incumbent's Lock-in Effects

However, in the fourth phase, after cable companies began offering IP telephony in earnest, local carriers did not enjoy the same type of lock-in network effects from broadband services as they had enjoyed for telephony, since consumers could easily switch to broadband subscriptions provided by cable companies.

Since local carriers were more closely tied to state governments, it was this threat to local carriers that precipitated the regulatory disputes over VoIP. The nature of US policymaking, in which actors can engage in "regulatory arbitrage," or shop for different policymaking arenas that may give them the most

[45] Kim, Ryan. 2007. *AT&T Offers Broadband by Itself: Unpublicized DSL Service Won't Save Subscribers Much*, June 17 2006 [cited May 25 2007]. Available from http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2006/06/17/BUGA2JFMBL1.DTL.

advantage, allowed local carriers to use state regulatory authorities and the judicial system to mount challenges to VoIP.

Thus, despite VoIP posing a threat to both long distance and local carriers' business model by bypassing their PSTN networks, it was local carriers that had more regulatory mechanisms available to challenge IP telephony services and service providers.

Table 5: VoIP Incumbent Market Challenges and Regulatory Developments – US

Phase	Challenge to Incumbent Carriers' Business Model	Incumbents' Responses	Regulatory Developments
1 - Early PC-to-PC (mid-1990s)	Little challenge	-	-
2 - IP-to-PSTN (late 1990s)	Price pressure on Long Distance/International	Buy startups, look for regulatory loopholes (AT&T)	
3 - IP-to-IP with PSTN numbers (Early 2000s)	Functional substitutes bypassing Local, Long Distance/International networks entirely	Regulatory challenges to VoIP providers	State challenges to VoIP
4 - IP-to-IP with Cable (2004 –)	Bypass Local, Long Distance/International, and Broadband	Offer own services	Incremental steps to clarify regulatory structure

Overview of Japan's IP Telephony Market

The development of Japan's IP telephony market is most notable for the price shocks delivered by the new entrant Softbank, and quick regulatory support by the government which created a comprehensive regulatory structure for IP telephony.

Phase 1: Early Commercial IP Telephony

The very early IP telephony in Japan, as in the US, utilized PC-to-PC connections. However, unlike in the US, where VoIP service providers became the targets of acquisition by larger companies, IP telephony service companies in Japan did not make headlines until several years later than in the US. PC penetration in Japan was lower than in the US in the late 1990s and early 2000s, limiting the potential market for PC-based IP telephony, and broadband, on top of which IP telephony ran best, was slow to spread until around 2002.[46]

The first notable commercial IP telephony service began in 2001, when Fusion Communications offered a PSTN-IP-PSTN service. It basically acted as a long distance carrier that used VoIP to provide the long distance connection between two local NTT networks.

In February 2002, eAccess, one of the start-up firms which had pioneered in offering DSL services, began a PC-to-PSTN service utilizing Windows Messenger. It offered domestic flat rates of 10 yen for 3 minutes (far cheaper than the approximately 80 yen per 3 minutes from Tokyo to Osaka, with higher fees for further destinations), and 7 yen per minute to the US, considerably lower than conventional carriers.[47] However, due to the

[46] The late spread of broadband was partly because NTT actively suppressed the spread of DSL until regulatory changes forced it to alter its stance. (Kushida and Oh 2007)

[47] ii Akusesu ga PC to Phone no ryoukin wo happyou, raishuu kaishu e [eAccess reports pricing for PC to Phone, to begin service next week]. IT Media News, May 15, 2007 2002 [cited. Available from

aforementioned infancy of broadband and low PC penetration, these services did not attract much attention.

Phase 2: The Softbank Shock and the Explosion of IP Telephony

IP telephony made headlines in Japan when Softbank, a startup firm, launched its IP telephony service, *BB!phone*, as a free bundle with its DSL services in April 2002. Its aggressive business strategy strongly shaped the terms of competition in Japan's IP telephony market. Softbank's focus was first and foremost to spread broadband usage in Japan, even at a loss, since it held a large portfolio of companies that were positioned to capitalize on applications and services enabled by broadband. Taking advantage of new regulations that greatly facilitated new firms using NTT's infrastructure to offer DSL services, Softbank delivered a major price shock in broadband subscription prices. It set rates at half the level of prevailing market rates for DSL subscriptions, and gave away DSL modems worth over $100 for free at train stations to lure prospective consumers to give DSL a try. *BB!phone* was an extra enticement to get people further interested in DSL.

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http://plusd.itmedia.co.jp/broadband/0202/04/pctophone.html. International callback services, in which users would call a domestic number, which connected to a computer that would contact a server in the US, which would in turn call back the Japanese subscriber, enabling a connection at lower US rates those of Japanese international calling firms, had put pressure on international service prices. However, usage was not mainstream among consumers, and several forms for callback services were deemed illegal.

Hardware for *BB!phone* allowed consumers to plug their existing telephones directly into a box connected to their DSL modem. When receiving calls, the phone acted as a regular NTT telephone, but it could place outgoing calls as an IP phone.

Softbank delivered a price shock to communications by allowing calls between *BB!phone* users to be free, and making calls within anywhere in Japan to be 7.5 yen per three minutes. Even more shocking was its price to the US, 8 yen per minute compared to the prevailing rate of 200 to 300 yen, which Softbank delivered at below costs. This pricing attracted headlines, and combined with the low price of Softbank's broadband service, catapulted the number of Softbank's DSL and *BB!phone* subscribers to approximately 3.5 million by December 2003 – at a time when all other IP telephony subscribers combined were estimated at 470 thousand.[48] In this early phase, since Softbank did not have any phone numbers to allocate to their IP telephony subscribers, calls could only be placed from IP telephones to PSTN phones, but not vice versa. NTT regional companies were therefore not completely cut out of the loop. A series of regulatory decisions then boosted the popularity of IP telephony.

[48] MIC. 2005. Soumusho Heisei 17nendo ikou no setsuzoku ryou no santei no arikata ni tsuite; Setsuzoku iinkai dai ikkai shiryou "IP denwa no kongo no tenkai ni tsuite" [Regarding the Calculation of Interconnection Charges by MIC from 2005; Material for 1st meeting of Interconnection Committee "Concerning the Present and Future of IP Telephony]: Ministry of Internal Affairs and Communications.

Phase 3: Regulatory Support: A Dedicated Array of Numbers to IP Telephony

Very soon after Softbank's headline-grabbing *BB!phone* service made its debut, the Japanese government stepped in to help actively foster the spread of IP telephony. In September 2002, less than six months after Softbank grabbed headlines with its *BB!phone* service, the Ministry of Internal Affairs and Communications (MIC) announced that it would allocate a dedicated array of telephone numbers (with the prefix "050") to IP telephones. This policy change was relatively easy – numbering schemes were under MIC's authority, and it was able to promulgate this legislation with revisions of Ministerial Ordinances, which did not require policy coordination with, or approval from, any other part of the government.[49] Part of the rationale for a dedicated array of numbers was that the public would recognize that they were calling, or being called by an IP telephone, the quality of which may not be as good as that of a conventional telephone.

By stipulating quality requirements for service providers to recieve 050 numbers allocations, the government actually extended its control over a previously unregulated portion of the market – a classic example of increasing the scope of regulation over

[49] For the list of Ministerial Ordinances revised, see MIC press release. MIC. 2007. *IP Denwa Saabisu no Honkakuteki na Fukyu ni Mukete [Towards the substantial diffusion of IP Telephony Services]*. Ministry of Internal Affairs and Communications 2002 [last accessed May 15 2007]. Available from http://www.soumu.go.jp/s-news/2002/020614_4.html.

particular markets to facilitate their function.[50] The idea of allocating a dedicated array of numbers to IP telephones was first raised in a study group in the Ministry of Posts and Telecommunications (MPT), predecessor to MIC. This study group raised the idea of allocating conventional numbers to IP telephones of high enough quality to be considered substitutes for conventional telephones, while creating a dedicated array of numbers to IP telephones that did not meet those criteria – along the lines of cellular services and another wireless service, PHS, which were allocated the "090" and "070" prefixes, respectively.[51]

Many firms took advantage of the allocation of "050" numbers to begin IP telephony services. They included NTT Communications – commencing services in March 2003 through its Internet Service Provider, OCN and many incumbent telephone competitors as well as startup firms.[52] By May 2005, 25 firms had received "050" number allocations. [53]

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[50] Steve Vogel makes the distinction in the concept of liberalization, an increase in the level of competition, between deregulation, a relaxing of rules, and reregulation, an strengthening of rules. Vogel, Steven K. 1996. *Freer Markets, More Rules: Regulatory Reform in Advanced Industrial Countries*. Ithaca, NY: Cornell University Press.

[51] MPT. 2000. Heisei 11 nendo Denki Tsushin Bangou ni Kansuru Kenkyukai [Study group on Telecommunications Numbers, 2000]: Ministry of Posts and Telecommunications.

[52] NTT Press Release: http://www.ntt.com/release/2003NEWS/0002/0205_3.html [last accessed May 15, 2007]

[53] For details, see MIC. 2005. 2005 Nendo Denki Tsushin Jigyoubunya ni Okeru Kyousou Joukyou no Hyouka [Evaluation of Status of Competition in the Telecommunications Business 2005]: Ministry of Internal Affairs and Communications. pp.34-35.

Phase 4: Allocating Conventional Numbers and Allowing Number Portability

In late September of 2003, MIC clarified its position on allocating conventional Japanese telephone numbers to IP telephony.[54] While IP telephony services based on DSL had difficulty meeting these quality requirements, IP telephony over fiber optic cables to homes had sufficient throughput speeds, regardless of distance from switching stations, to meet them. As importantly, IP telephony services meeting these quality requirements were also eligible for number portability, meaning users could keep their existing numbers. For numbers which were granted number portability, unlike "050" numbers, the government required compatibility with emergency call services.

Competitors to NTT, including KDDI and subsidiaries of power electric companies, had been focusing on FTTH services. These firms had begun services that connected their own fiber lines to apartments and households, offering up to 100mbps connection speeds at prices of about double that of DSL, which offered on average 15 to 30 mbps.[55] In October of 2003, one month after MIC clarified the rules for receiving conventional phone numbers,

[54] MIC. 2002. Heisei 14 nendo Denki Tsushin Bango ni Kansuru Kenkyukai Houkokusho Gaiyou [2002 Report Abstract of Study Group on Telecommunications Numbers]: Ministry of Internal Affairs and Communications. Requirements included 1) provider owns or has stable, contractual access to last-one-mile of infrastructure, 2) provide stability and voice quality equivalent to landline telephony, 3) submit operating plan to relate number with call origin, 4) submit an operating plan that is based on demand for numbers, and 5) be compatible with emergency call services if replacing conventional telephones. For a summary, see RBB Today news update (Japanese), <http://www.rbbtoday.com/hikari/ipphone/051117/> [last accessed June 1, 2007.]

[55] For more on the FTTH buildouts, see Kushida and Oh 2007.

KDDI began IP telephony services targeted apartment buildings, aimed squarely at getting people to switch from their existing telephone lines. KDDI expanded this service to cover ordinary households in January 2005.[56] NTT began its IP telephony service utilizing FTTH, "Hikari Denwa" after receiving approval that the service plan was in accordance with the NTT Law governing its activities, in August 2004 for apartments, and June 2005 for households. [57]

Unlike in the US, where Vonage was able to use numbers allocated to them to assign to any user regardless of location, Japanese carriers to whom conventional numbers were allocated were obligated to provide them according to the same geographic scheme as regular telephones.

Japan's Regulatory Framework for IP Telephony

We have already seen how the Japanese government's regulatory support for IP telephony decisively shaped the market. The same issues facing the US, including classification of IP telephony services, interconnection, universal service and emergency

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[56] KDDI press release: <http://www.kddi.com/corporate/news_release/2003/1008/index.html> [last accessed May 18, 2007]

[57] See MIC Telecommunications Competition Policy portal site, and NTT Press releases http://eidsystem.go.jp/competition_policy/NTT/expanding_relief/; http://www.ntt-east.co.jp/release/0408/040830c.html; http://www.ntt-west.co.jp/news/0505/050523.html [last accessed May 15, 2007] The NTT Law stipulates that NTT receive permission from the Minister of Internal Affairs and Communications to commence local services. NTT Law Secton 2(3)-(5).

obligations were present in Japan, but the existing regulatory framework was able to incorporate IP telephony quite easily.

First, while classification of IP telephony as a "telecommunications" or "information" service was a major issue in the US, MIC did not have a classification issue. By 2002, MIC had abolished most of the registration scheme for carriers, and by [date], it abolished the classification scheme altogether.

Second, despite the increase of regulatory actors after around 2001, including the Fair Trade Commission and the Dispute Resolution Commission, MIC was still very much the focal point of policymaking. The judicial system was not known to support carriers' claims against the government, and there was no precedent for NTT to attempt mobilizing the judicial system against the government.

Third, Japan's interconnection charges to NTT's network were determined on the basis of the connection point for the incoming call. Therefore, unlike in the US, where charges were determined based on whether the calls were from outside the state, within the state but from a different locality, or the same locality, allowing creative number allocations to take advantage of the interconnection charge regime, Japan's VoIP services were charged according to where they connected. If they connected into a "higher" level switch, covering

more area, then prices were higher than if they connected into a "lower" level switch that covered fewer people.

In terms of universal service, until 2007, Japan's regulatory system relied mainly on internal subsidies within NTT. A universal service fund existed, but it had never been put to use, since it was designed to receive contributions from other carriers only when NTT was unable to internally subsidize unprofitable areas. [58] Beginning in 2007, 7 yen per phone number was charged to carriers to contribute to the fund. [59]

[58] MIC. 2005. Unibasaru Sabisu Kikin Seido no Arikata [Regarding the form of the universal service fund]: Information Communications Deliberation Council. <http://www.soumu.go.jp/s-news/2005/pdf/051025_5_2.pdf> [last accessed June 1, 2007]

[59] TCA. 2007. Unibasaru Sabisu (kihonteki denki tsushin yakumu) seido ni kakawaru shusei bangou tanka no kohyo ni tsuite [Regarding the publication of revised number units regarding universal service obligations]: Telecommunications Carriers Association. <http://www.tca.or.jp/japan/news/070426.pdf> [last accessed June 1, 2007] Japan's universal service was also narrow in scope than the US, covering only fixed telephony, public telephones, and emergency services. See also ibid.

Table 6: VoIP Incumbent Market Challenges and Regulatory Developments – US

Phase	Challenge to Incumbent Carriers' Business Model	Incumbent Responses	Regulatory Developments
1 – Early IP Telephony	Little competition	-	
2 – Softbank Shock IP-PSTN	Undermine Long Distance/International	-	Regulatory support with "050," conventional numbers
3 – IP-to-IP	Bypass Local, Long Distance/ International	Begin offering own VoIP services via DSL	
4 – IP-to-IP over FTTH	Bypass Local, Long Distance/International, and Broadband	Begin offering own services via FTTH	

Business Models

Local and Long Distance Markets Dominated by NTT

In Japan, the contours of the telephony market looked as follows. NTT, formerly the state-owned monopoly carrier, was partially privatized in 1985, and until the late 1990s, the government carefully orchestrated the introduction of competitors into the long distance and local telephony markets.[60] NTT owned the physical last-one-mile of infrastructure, and most competitors entered by offering long distance services. Under a regulatory regime of "controlled competition," in which carriers owning facilities had to receive approval for

[60] See Kushida 2006.

price changes, new competitors helped bring down long distance prices to a degree, in lock-step with NTT.

In 1998, NTT was reorganized into a holding company, with NTT East and NTT West offering local telephony services to their respective geographic regions, and NTT Communications was given long distance. While some subsidiaries of power electric companies and cable companies began offering local telephony service, the NTT regional companies were close to owning monopolies over local telephony. The business models for these regional companies included charging per minute for local telephone calls, and receiving interconnection fees for incoming and outgoing calls to and from long distance/international, and cellular calls.[61] For NTT Communications and long distance competitors, the business model was to charge consumers per minute for long distance, according to the distance the call traveled, paying local carriers according to the level of infrastructure to which they connected.

First and Second Phases: Rise of Softbank's Challenge

In the first phase, as with the US, Japanese carriers received little threat from PC-to-PC based IP telephony. In the second phase, however, Softbank's drastically lower

[61] NTT charged different prices for access to different levels of switches – so for some competitors, connecting to higher-end (covering larger areas) cost them more in interconnection fees, but the did not have as much infrastructure investment requirements of their own.

long distance and international prices challenged long distance carriers, as IP telephony users could take advantage of the network effects of PSTN telephony. Indeed, it was Softbank's intent to create network effects of its own, by allowing its subscribers to call each other for free. Long distance carriers, however, did not attempt to mount regulatory challenges to VoIP services.

Third Phase: Regulatory Support to Create PSTN Substitutes

In the third phase, after regulatory support was offered for DSL-based IP telephony, allocating a dedicated array of numbers, local carriers (in Japan's case, mainly NTT East and NTT West) were threatened. Compared to US local carriers, who charged flat fees for local calls, NTT charged per minute fees even for local calls. Thus, while American consumers, who could also find flat-rate long distance calling plans and calling cards, did not face strong cost incentives to switch to VoIP services, IP telephony for Japanese consumers promised dramatically cheaper calling across the board – long distance/international and local. NTT's revenue streams were all the more threatened. This was compounded by the fact that strong regulations forced NTT to allow competitors offering DSL to use NTT's last-one-mile facilities and unused fiber optic backbone for low

prices. Yet, unlike the US, when Japan's local carriers were challenged, they did not mount regulatory challenges.

Understand The Lack of Regulatory Challenges in Japan

A comparison between the regulatory and market structures of the two countries goes a long way to understanding why NTT regional companies could not and did not mount political challenges to the regulatory legitimation of, and therefore the increase in the level of threat posed by, IP telephony services.

First, unlike the US, where Vonage and other companies used regulatory "gray" areas – means that were not stipulated as legal, but not illegal either – to obtain their numbers, the Japanese government explicitly extended its regulation over IP telephony services by offering numbers. Moreover, the relative clarity of regulatory over interconnection charges in Japan, based on infrastructure, made the task of extending existing regulation over IP telephony easier.

Second, while US IP telephony service companies took advantage of the technological trait of American switching facilities – of charging interconnection fees based on the number of origin – to decouple location and numbers, the Japanese government's scheme for allocating numbers placed VoIP services within the existing realm of numbering.

The dedicated array of “050” numbers clearly identified for the caller and receiver that a geographically indeterminate IP telephone was being used, and IP telephones receiving conventional 0AB~J numbers were required to stay true to the conventional geography-based numbering scheme. Thus, the Japanese IP telephony services, while receiving explicit, and therefore legitimating, policy support, were limited in flexibility. To incumbent telephone carriers, they became more of a legitimate low cost competitor rather than a competitor seen as exploiting the regulatory system.

Third, Japanese local carriers had far fewer means to mount regulatory challenges. As long as MIC followed proper procedures according to the Administrative Procedures Act, and the numbering scheme was under the discretionary authority of MIC, there was little means for contention. Unlike regions in the US, which offered several regulatory arenas, Japan’s prefectures do not have their own regulatory authorities for telecommunications that are independent of MIC, and the judicial system was known to evaluate legal to ministerial actions based on procedural legitimacy. While challenges to Ministerial policies have been mounted in courts for the first time in recent years, they were by NTT’s competitors and start-ups, rather than NTT itself.

Fourth, in terms of market structure, Japan’s local carriers consisted mainly of the two NTT regional companies, who were under the same holding company.

Finally, some MIC officials (not the co-author) speculate that NTT's lack of resistance to allocating numbers to IP telephones was simply because noone expected IP telephony to become as successful as it did.

Conclusion

Explaining the Growth of IP Telephony Services

In answering the narrow question of why VoIP services, which seemed to favor the US institutional context, actually spread more quickly in Japan, we offer a number of propositions. However, since these propositions are derived by looking at the differences between the institutional and market structures of the two countries, without a broader cross-national sample we do not claim to be able to weigh exactly how much each factor mattered in the outcome. Furthermore, each of these factors is interrelated with the others.

First, regulatory support by Japan, facilitated by its relative ease in incorporating IP telephony into the existing regulatory framework, accelerated deployment. Since there was little regulatory ambiguity once MIC allocated numbers and placed IP telephony services within the context of existing regulations for universal and emergency services, startup providers got access to the network effects of PSTN networks, and it seemed a natural technological progression for incumbents to offer them.

Second, the number of regulatory arenas available to those whose business models were most threatened, affected the speed with which policy facilitating the rapid spread of IP telephony was promulgated. While the US long distance and international firms were clearly under the jurisdiction of the federal FCC, local carriers mobilized state governments and the judicial system to try to suppress VoIP technology offered by start-ups. In contrast, Japanese local carriers had very little choice but to follow MIC's regulatory support of VoIP, which was the locus of regulatory power.

Third, Japan's active policy support for DSL, an "enabling" technology for VoIP, allowed new firms without telecommunications infrastructure to offer *both* broadband, the "pipe" required by VoIP, *and* IP telephony services themselves. In contrast, in the US, regulatory support for DSL by startups was hampered by local carriers, which effectively denied startups access to their networks. American startup VoIP providers were therefore not providers of the broadband "pipes" until cable companies begin offering IP telephony. Since incumbent owners of telephone networks stood to lose their lucrative conventional phone business by offering VoIP themselves, they had every incentive to battle the adoption of IP telephony, as well as regulations supporting them – a task made easier by the point above.[62]

[62] Cable companies with existing investments into circuit switched telephony were also slow to embrace IP telephony, which cannibalized their telephony infrastructure.

Fourth, the market structure of Japan's local carriers was much more concentrated than that of the US, decreasing the number decision-making loci in the market, whether to experiment in trying new business models or finding regulatory arenas to block services. The two overwhelmingly dominant Japanese local carriers, NTT East and West, were part of a holding company structure that included a long distance carrier. Each actor's autonomy in strategic business decision is limited, with coordination provided by the Medium-Term Strategy Department in the NTT Holding Company. In contrast, US local carriers made independent business decisions, and while some in financial difficulty, such as Qwest, were quick to adopt IP telephony, while other local carriers tried to block startup IP telephony providers, as they had done with DSL providers, through state governments and the judicial system.

Reconsidering "Disruptive" Technology: Business Models vs. Technology, Product vs. Service

Let us now return to the question of whether VoIP was a disruptive technology or not. If it was fundamentally disruptive, we would have expected new firms to bring fundamentally new business models, supplier networks, consumers, and other "value propositions," altering the terms of competition to the point that incumbent firms that could

not adjust would be rendered obsolete and insignificant. Indeed, this is what some observers argued would happen – sooner or later. If VoIP was fundamentally not a disruptive technology, we would have expected incumbent firms to incorporate it into their existing business models and "value propositions," perhaps with some adjustment.

If we used this set of criteria, noting the status of incumbent firms now, and how most IP telephony services are being used as a substitute for conventional telephones, we would have to conclude that VoIP was not fundamentally disruptive. Yet, as services with business models other than charging users for subscriptions and use, such as Skype, continue to enlarge its network effects as increasing numbers of people join, and given its potential to run on any network, including cellular or next generation wireless broadband networks, it seems foolish to dismiss VoIP as fundamentally not disruptive.

This leads us to a significant point about the notion of "disruptive" technologies – the difference between technology and business models. The initial conceptual difficulty in identifying a disruptive technology *ex ante*, before it has disrupted incumbent firms, is that the definition hinges on whether or not existing firms relying on existing technology have been undermined by a technology. This brings us to the assertion that *disruptive technology is more about the business models of incumbents than the technology itself*.[63]

[63] Weber, Steve. 2005. Christensen right and wrong. *QED* (1).

We take it a step further, to argue that for *products* in competitive markets, such as hard disks, from which the conception originated, a new, "disruptive" technology can quickly undermine existing products, firms, and markets. However, for *services* in which regulations matter in shaping the terms of competition, *potentially* disruptive technology may not translate into a disruption of existing firms and markets because market actors, business models, and the terms of competition may be shaped by these regulations.

Technology and Innovation in Telecommunications: The Significance of Regulations, Infrastructure, and Network Effects

Telecommunications is perhaps the most extreme case in which this proposition holds true. *Regulations matter* strongly, since as long as IP telephony services wanted access the network effects of PSTN networks, regulations shaping the actors, terms of access, and therefore business models of both incumbents and new entrants.

Pipes also matter, because VoIP requires broadband of some form. Ownership and competition among "pipes" played a major role in shaping IP telephony markets. In Japan, firms such as Softbank also provided DSL service, bundling VoIP service with access to the broadband "pipe," and FTTH providers, such as KDDI, bundled VoIP with their fiber optic "pipes." On the other hand, US VoIP companies such as Vonage could not provide "pipes,"

by themselves, since incumbent carriers had won regulatory protection from start-up DSL firms providing pipes. In both countries, cellular providers have largely been successful in blocking VoIP services over their cellular networks – in Japan because major cellular carriers have created "walled gardens" for their high speed, cellular Internet services, and in the US because networks are relatively slow, and most are not packet-switched.

Second, we find that IP telephony services markets were strongly influenced by the "*enabling" technologies* of broadband. Since broadband markets involved infrastructure, and markets were therefore highly affected by regulations, which differed across countries, IP telephony markets were pulled in different directions as well. In Japan, strong regulatory support for DSL allowed the new entrant Softbank to engage in its aggressive business strategy. In contrast, incumbent carriers in the US won a series of regulatory battles to smother start-up firms offering DSL, with IP telephony instead becoming a tool for cable companies to displace local carriers in both broadband and telephony.

The proposition that can be derived from these findings are that, for many Internet-based services and applications, the more closely they are dependant on "enabling" technologies that are specific to particular types of networks, regulations shaping those "enabling" markets matter. For example, Japan's cutting-edge electronic money embedded in cellular services is highly dependant on the deployment of high speed, third generation

(3G) cellular networks, which have not been adopted in much of the rest of the world. If particular applications or services required next generation networks (NGNs), then regulations shaping NGNs in different countries will matter all the more. Japan's NGN plans are currently being driven by NTT, which is attempting to place more intelligence in the network, and Great Britain's British Telecom has somewhat similar plans, while US carriers do not.

Put another way, if we conceive of IT layers in simplified form as the infrastructure, control, and applications layers, we propose that the implementation of innovations in the applications layers, such as Google experimenting and revolutionizing advertising business models, is much easier than technologies requiring particular "enabling" technologies at the infrastructure layer.

Technology and Comparative Institutional Advantages: US and Japan

Let us now return to our point of departure, understanding IP telephony in the context of the "comparative institutional advantages" of the US and Japan. The picture we end up with, especially if adding DSL to our comparison, is that the US excels at generating innovative technologies and allowing firms to experiment in new markets, but if the technology is a service requiring regulatory support, the implementation of those

technologies can be politically messy and influenced by vested interests. Japan can provide regulatory support of particular technologies to facilitate their rapid implementation in markets. However, it can be misguided when broader, international competition is considered.

How is this different from the existing list of comparative strengths? We emphasize that for technologies in which regulations matter, Japan can shape the trajectories of technology by influencing the terms of competition. This may be considered a particular subset of "managing competition," though in the case of telecommunications, control of market players is more subtle than the classic licensing and price management. The US, on the other hand, is not necessarily good at facilitating competition in areas where heavy regulation is involved, since incumbent players have several regulatory arenas to attempt to smother competition.

Implications for Next Generation Networks

We end with some implications for Next Generation Networks (NGN). Current debates over how to configure NGNs in both Japan and the US focus on giving more "intelligence" to core networks to allow some applications or content to be prioritized over others. Japan has been actively promoting a specific vision for NGNs, and NTT has been

moving aggressively to invest in new core networks. This study provides further evidence that Japan has the ability to rapidly implement a particular technology, or run in a particular technological trajectory. However, as recent experiences in telecommunications have shown, Japan is quite capable of running quickly, but in a direction that isolates them from rest of the world – examples such as ISDN, rendered obsolete by DSL, ATM, rendered irrelevant with the advent of TCP/IP, PDC, Japan's proprietary domestic cellular standard that isolated them from global markets, and PHS, a domestic alternative to cellular services, are but a few.

In the US, more intelligence in the core networks leads to more control by incumbent telecom firms of not only the infrastructure, but of the applications layers as well. America's experience with VoIP, as well as DSL, suggest that the more that applications are dependant on particular features of physical networks, and the more that regulatory involvement is possible in their interface, the more difficulty startup firms have in implementing their breakthrough innovations and technology in service offerings. In other words, if not careful, Japan can run in the wrong direction, and the US cannot profit from its own innovations.