Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Skype Communications S.A.R.L.	)	
	)	
Petition to Confirm A Consumer's Right to Use Internet Communications Software and Attach Devices to Wireless Networks	)	RM-11361

OPPOSITION OF CTIA – THE WIRELESS ASSOCIATION®

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EXECUTIVE SUMMARY

Skype Communications S.A.R.L. ("Skype") has filed a Petition asking the Federal Communications Commission ("FCC" or "Commission") to over-regulate an industry that, according to the Commission, is the picture of competitiveness. Skype asks the Commission to adopt regulations that would choose Skype's business model over the benefits consumers derive from the competitive market. This is not a market that is broken. There are about 160 licensees providing mobile wireless services and more competitors are on the way as a result of the Advanced Wireless Services ("AWS") auctions. There are numerous handset manufacturers and network equipment providers. There are also countless content providers. As evidence of this competition, CTIA hosted nearly 1,100 exhibitors at its most recent convention. These entities and more are competing to serve the over 230 million U.S. mobile wireless subscribers.

Over the last 15 years, the United States mobile wireless industry has invested more than $214 billion in expanding and improving mobile wireless services for consumers. Over this period, competition among mobile wireless providers has intensified to the benefit of consumers. Prices have fallen, service quality has improved, and new and innovative services are constantly being introduced. Consumers also have more options – with hundreds, if not thousands of mobile wireless service plan and handset combinations available to American consumers.

There are now approximately 230 million mobile wireless subscribers in the U.S., who use their mobile devices an average of 726 minutes per month. That's 88% more minutes than just five years ago, and an incredible 376% more minutes than the average European wireless consumer. Growing faith in mobile wireless services is reflected in

the growing percentage of households that are becoming wireless only and in independent surveys and government reports that show increasing consumer satisfaction with mobile wireless services.

The U.S. mobile wireless industry's astonishing rate of growth and investment continues today as existing and prospective mobile wireless providers are delivering the next generation of mobile broadband voice, data, and video services to consumers. Wireless carriers are not only bringing much needed competition to cable and DSL broadband services, but in some cases are bringing the only broadband services to rural areas. As the FCC reported earlier this year, in the first half of 2006, total broadband connections grew from 51.2 million to 64.6 million lines, and 59% of all additions were mobile wireless subscriptions. In addition, last year, new and existing licensees spent $13.9 billion in the Advanced Wireless Service ("AWS") auction. That auction created three more nationwide licensees that will compete with the existing four nationwide licensees, as well as the long list of regional licensees. Yet more competition will be created as a result of the upcoming auction of 60 MHz of 700 MHz spectrum.

The U.S. mobile wireless industry's success has been made possible, in part, by an environment of minimal regulatory intervention that has allowed licensees to manage their spectral environment and maximize innovation and efficiency both in the network and in handsets at network edges. This level of oversight is so critical because mobile wireless services are radio-based – utilizing a shared and finite resource that can be degraded by a single consumer's harmful use.

Against this backdrop, Skype is now asking the FCC to upend a regulatory model that has worked so well to date – because it does not fit into Skype's business model.

While painting a completely inaccurate picture of the wireless industry and radio-based technologies to mandate open access standards for handsets and applications, Skype asks the FCC to apply *Carterfone* regulations to the wireless industry and to inquire into the policy of bundling wireless customer premises equipment ("CPE") with wireless service. Skype makes this request even as U.S. consumers are able to download and use Skype software on wireless devices sold by major wireless carriers and as Skype has implemented the very network security practices it complains of. According to Niklas Zennström, Founder and CEO of Skype, Skype's network security practices are necessary "to protect the integrity of the network." We agree.

Skype's request to apply Carterfone regulation to the wireless industry is completely misplaced. Unlike the Bell System at the time of the *Carterfone* decision, the wireless industry is not dominated by a rate-regulated monopoly provider, wireless carriers do not manufacture the handsets they sell, and carriers and manufacturers do not invest in each others companies. The market for mobile wireless handsets is both competitive and innovative without regulatory intervention. Indeed, the vast majority of Americans have four or more wireless carriers competing for their subscription. And, wireless consumers have their choice of about 700 handsets with differing features, form factors, and operating systems. In this environment, it is consumers, not carriers or manufacturers, who drive service and handset decisions.

The Commission similarly should reject Skype's short-sighted and dangerous request for the FCC to regulate open access standards for handsets and applications. Skype asks the Commission to mandate handset hardware requirements and force carriers to accept any compliant handset on their network. Skype's request claims to promote

greater innovation in the handset market. CTIA disagrees, and argues that implementation of Skype's suggestion would significantly limit investment and innovation in new network infrastructure and services. Moreover, Skype's Petition ignores the critical role handsets play in network management and is inconsistent with the FCC's E-911 and hearing aid compatibility ("HAC") rules that impose obligations on wireless carriers with regard to handsets.

If granted, Skype's Petition would remove many of the practices carriers use to ensure that the handsets that operate on their networks are running software that protects the network and consumers' information. Skype is asking the Commission to mandate application interfaces and to regulate carriers' ability to prevent certain applications from being run on their network. Opening handsets to run any software potentially exposes wireless subscribers to a host of quality and security problems.

Lastly, Skype's Petition urges the Commission to overturn a policy that has brought consumers incredible benefits over the last 15 years. The practice of bundling wireless handsets with wireless service has lowered consumer handset costs and brought new and innovative handsets to market more quickly. In 1992, the Commission concluded that the consumer benefits of bundling services with handsets, such as lower handset costs and increased ability for carriers to more rapidly roll out advanced services and features, far outweighed any potential negative effects. Despite Skype's contentions to the contrary, the Commission's conclusions about the consumer benefits of bundling mobile wireless services with handsets remain as apt today as they were 15 years ago.

Ultimately, Skype's Petition presents solutions to problems that don't plague the wireless industry and suggests remedies that would neither benefit consumers nor the

market, but rather are designed to benefit Skype. The Commission should dismiss Skype's self-serving Petition as it not only fails to cite a legitimate market failure in the wireless market, but also fails to consider the true demands and interests of wireless consumers.

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OPPOSITION OF CTIA – THE WIRELESS ASSOCIATION®

CTIA – The Wireless Association® ("CTIA")[1] files this opposition to the Petition for a Declaratory Ruling filed by Skype Communications S.A.R.L. ("Skype" or "Petitioner") to establish regulations requiring competitive wireless carriers to cede management over the design, operation, and management of their networks and services.[2] Skype's Petition should be dismissed. At best, Skype's Petition is a solution in search of a problem – seeking to apply monopoly regulation to vibrantly competitive wireless markets in an attempt to use regulation to facilitate Skype's service and specific business model. At worst, the re-regulation that Skype calls for would seriously impair wireless carriers' ability to meet the demands of consumers.

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[1] CTIA – The Wireless Association® is the international organization of the wireless communications industry for both wireless carriers and manufacturers. Membership in the organization covers Commercial Mobile Radio Service ("CMRS") providers and manufacturers, including cellular, broadband PCS, ESMR, and AWS, as well as providers and manufacturers of wireless data services and products.

[2] Petition to Confirm a Consumer's Right to Use Internet Communications Software and Attach Devices to Wireless Networks, Skype Communications S.A.R.L., RM-11361 (filed Feb. 20, 2007) ("Skype Petition").

I. INTRODUCTION

CTIA asks the Federal Communications Commission's ("FCC" or "Commission") to deny Skype's Petition. Skype's request has no basis in fact, economics, policy, or law, and the regulations Skype seeks to impose on the wireless industry are completely incompatible with the vision and track record of the competitive, consumer-oriented marketplace that has allowed wireless to quickly become the most popular form of American telecommunication.

Despite overwhelming evidence that the wireless industry is vibrantly competitive, Skype asks the Commission to adopt regulations that would choose Skype's business model over the benefits consumers derive from a competitive market. Skype's proposed regulation is a solution in search of a problem. In reality, the wireless industry has shown time and again that its success is due not to restrictions on consumers, but rather through constant innovation to meet consumer expectations.

Section II of this Opposition details the history and success of the competitive wireless market in which consumers drive carrier offerings. This section details the level of intercarrier competition for consumers both in economic terms as well as on quality of service and services offered. Section II also details the high level of competition between handset manufacturers to meet consumers' expectations and bring new and innovative handsets to market.

Section III refutes Skype's claims that carrier practices preventing unapproved applications from being run on some handsets are thwarting innovation. Skype's criticism of this practice is particularly curious given their use of application control on their own network. Consumers are not being denied access to the applications they

desire, and are free to purchase handsets capable of running the applications they desire, so long at they are not harmful to the network in violation of their terms and conditions of service. The services and applications that consumer desire change regularly, and the competitive wireless industry changes to match those desires.

Section IV explains why network development is so important to wireless consumers. Far from being a set of "dumb pipes," wireless networks are intelligent, innovative, and constantly evolving to meet existing consumer demand, and anticipate future advances. From analog to digital, to third- and fourth-generation, the networks constantly are being upgraded. These changes are necessary to address any development that happens at the edge of the networks. Application of the open standards that Skype requests will remove incentives for carriers to invest in networks, denying consumers the new technologies and services they desire.

Section V highlights the many differences between the wireline market of 1968, whose regulations Skype would like the Commission to adopt for wireless, and the competitive wireless market of 2007. Regulations designed to remedy a vertically integrated rate-regulated monopoly's control over adjacent markets are inappropriate for an industry without vertical integration and characterized by strong horizontal competition in all segments of the market.

Section VI reminds everyone of the purpose of the FCC's decision to allow bundling of wireless service with CPE and assesses the empirical evidence regarding the result of the FCC's decision. The FCC foresaw, and history has borne out, that CPE bundling enables network builders to more quickly bring next generation networks to the public and lowers handset costs for consumers through economies of scope and scale.

The regulation Skype requests would drive up the cost of handsets to consumers and potentially freeze network innovation.

The appendices to this Opposition detail the economic, technical and policy reasons that Skype's request is wrong for consumers and ill-suited to the wireless marketplace. Appendices A and B detail the many wireless devices that currently offer consumers the options that Skype seeks to mandate through regulation. Appendix C, a technical analysis of wireless networks by Charles Jackson, shows the critical role that handsets play in wireless network efficiency and in bringing new and innovative services to consumers. Appendix D, an antitrust analysis of the claims made in the Skype Petition is provided by Willkie Farr & Gallagher. Appendices E and F focus on an economic analysis of the wireless marketplace with regard to Skype's Petition. Appendix E is provided by Robert Hahn, Robert Litan and Hal Singer of the American Enterprise Institute/Brookings Joint Center for Regulatory Studies and Appendix F is a paper released by the Phoenix Center for Advanced Legal & Economic Public Policy by George S. Ford, Thomas M. Koutsky and Lawrence J. Spiwak. Both papers address Skype's misplaced request that a net neutrality regime should be applied to wireless services.

Consumers have benefited over the last 15 years from the deregulatory environment the Commission and Congress have afforded the commercial wireless industry. Reversing course on these policies may serve Skype, but it certainly will not benefit consumers.

II. SKYPE'S PETITION FUNDAMENTALLY MISCHARACTERIZES THE STATE OF THE WIRELESS MARKETPLACE

In its Petition, Skype portrays the wireless market as closed, open only to those who are willing to "play ball with the largest wireless carriers."[3] Skype's characterization not only belies the high level of competition between and among wireless carriers and handset manufacturers, but ascribes to carriers a level of power and control over handset design that simply doesn't exist.

A. Wireless Carriers Compete With Other Media and Each Other for Subscribers

Over the last 15 years, the wireless industry has evolved to a highly efficient, competitive industry, and that competition has produced incredible consumer benefit. Wireless has come a long way since its days as a cellular duopoly.[4] Currently, there are four carriers that compete nationally for wireless subscribers.[5] Beyond the four nationwide carriers, there are more than five regional carriers and more than 140 carriers that compete in smaller markets. Carriers competing for customers include: Aeronautical Radio Inc. (ARINC), Airadigm / Einstein PCS, Airpeak (Nevada Wireless), Airtel Montana, Alaska Communications / ACS Wireless, Alaska Digitel, Alaska Wireless, All West Communications / All West Wireless, ALLTEL Communications,

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[3] Skype Petition at 22.

[4] *See Bundling of Cellular Customer Premises Equipment and Cellular Service*, Report and Order, CC Docket No. 91-34, FCC 92-207, 7 FCC Rcd 4028 ("CPE Bundling Order").

[5] *Eleventh Annual CMRS Competition Report*, Federal Communications Commn., at ¶ 41, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-06-142A1.pdf (last accessed Apr. 7, 2007) ("FCC Competition Report").

American Samoa Telecommunications Authority, American Wireless License Group, AmeriLink PCS / Choice Wireless, Appalachian Wireless / East Kentucky Cellular Network, Arctic Slope Cellular (ASTAC), AT&T Mobility, Baldwin Nashville Telephone Company, Benton Linn Wireless, Blanca Telephone Company, Blue Sky Communications / American Samoa License Inc., Bluegrass Cellular, Brazos Cellular, Bristol Bay Cellular Partnership, C.C. Communications – Cellular Caprock Cellular, Carolina West Wireless, Cascade Communications, CellCom / Northeast Communications of Wisconsin, Cellular 29 Plus, Cellular One of East Texas, Cellular One of Elkins WV / Douglas Telecommunications / Easterbrooke Telecom., Cellular One of NE Arizona / Smith Bagley, Cellular One of NE Pennsylvania / South Canaan Cellular, Cellular One of San Luis Obispo, CA / Entertainment Unlimited, Cellular Properties Inc. dba Cellular One of East Central Illinois, Cellular South, Centennial Communications, Chariton Valley Wireless Services, Chinook Wireless, Cincinnati Bell Wireless, ClearTalk / NTCH / GLH Communications, Coastel Communications Company, Commnet Wireless, Community Digital Wireless, ComScape / Kiwi PCS, Copper Valley Wireless, Cordova Wireless, Corr Wireless Communications, Cross-Valliant Cellular Partnership, CTC Wireless / CT Communications, Custer Telephone Company, Danville Mutual Telephone Company, Dobson Cellular Systems, DoCoMo Guam / SaipanCell / Guam Wireless / Hafatel, DTC Communications formerly Advantage Cellular / DeKalb Telephone Coop., Dumont Telephone Company, Edge Wireless, EPIC PCS, Etex Cellular, Extend America, Farmers Mutual Cooperative Telephone Company of Harlan, IA, Farmers Wireless / Farmers Cellular Telephone, Filer Mutual Telephone Company, Five Star Wireless /

Texas RSA 15B2 Partnership, GCI Cellular, Golden State Cellular, GTE Pacifica / Pacific Telecommunications, Guam Telephone Authority / TeleGuam Holdings / Pulse Mobile, Hargray Communications, Illinois Valley Cellular, Immix Wireless / Keystone Wireless, Indigo Wireless of Pennsylvania and Nebraska, Innovative Wireless (formerly Vitel Cellular of the U.S. Virgin Islands), iPCS Wireless / Illinois PCS, IT&E Wireless, i-wireless / Iowa Wireless, Lamar County Cellular, LaMotte Telephone Company, Leaco Wireless, Leap Wireless / Cricket, Long Lines Wireless, Lyrix Wireless / Iowa RSA No. 2, MBO Wireless / Cross Telco / Sprocket PCS, Metro PCS, Micronesia Telecommunications / FSM Telecommunications Corp, Mid-Rivers Communications, Mid-Tex Cellular, Mobi PCS, Mobile Satellite Ventures, Mohave Wireless / Citizens Mohave, MoviStar of Puerto Rico, MTA Wireless / Matanuska Telephone Association, NEP Wireless / The North-Eastern Pennsylvania Telephone Company, Nex-Tech Wireless, Northern PCS , Northwest Missouri Cellular, NTELOS, Ogden Telephone Company, Oklahoma Western Telephone Company, Olin Telephone Company, Omnitel Communications, Onslow Telephone Company, OTZ Telephone Coop., Pace Communications / Kaplan Telephone Co., Pacificom Holdings, Panhandle Telecommunications (PTSI), Peoples Telephone Cooperative. / Peoples Wireless, Petroleum Communications Inc. / PetroCom, Pine Belt Cellular / Pine Belt Wireless, Pine Cellular Phones / Pine Telephone Company, Pinpoint Digital Phone Service, Pioneer / Enid Cellular, Plateau Wireless / ENMR, Pocket Communications, Proxtel Wireless / North Sight Communications, PVT Wireless / Penasco Valley Telecom, Radcliffe Telephone Company, Ramcell dba Cellular Phone of Kentucky, Revol Wireless / Cleveland Unlimited, Rockwell Cooperative Telephone Association, Sagebrush Cellular,

Sharon Telephone Company, Shenandoah Personal Communications Company, Silver Star PCS aka Gold Star Communications, Simmetry Communications, Snake River PCS, South Central Utah Telephone Association / South Central Communications, South Slope Cooperative Telephone Association / South Slope Wireless, Southern LINC Wireless, Sprint Nextel, SRT Wireless / Souris River Telephone, SunCom, SureWest Wireless, Swiftel / Brookings Municipal Utilities, Taylor Telecommunications, Telemetrix / Tracy Corporation, Thumb Cellular / Agri-Valley Communications, T-Mobile USA, Triangle Telephone Company / Montana Communications, U.S. Cellular Corporation, Uintah Basin Electronic Telecommunications / UBET Wireless, Unicel / Rural Cellular Corporation, Unicom (of Alaska), Union Telephone / Union Cellular, United Telephone Association / United Wireless, Van Buren Telephone, Verizon Wireless, Viaero Wireless, Wellman Cooperative Telephone Association, West Central Wireless / CT Cube, WestLink Communications of Kansas, Wilkes Cellular, Winnebago Cooperative Telephone Association, and XIT Wireless / XIT Communications.

These carriers are widely dispersed throughout the country, and according to the FCC, 98% of all Americans live in counties where at least three wireless carriers compete for subscribers and 94% of Americans live in counties with four or more wireless competitors.[6] In addition, a new company, SpectrumCo., is poised to enter the market having been the high bidder for a national footprint in the AWS auction. Mobile virtual network operators ("MVNOs") also compete with facilities-based carriers for customers.

[6] FCC Competition Report at ¶ 41.

Despite these numbers, Skype attempts to show that the wireless market is concentrated by citing the Herfindahl-Hirschman Index ("HHI") for the industry.[7] Skype cites the HHI for the industry at 2,706, which is higher than the 1,800 that the U.S. Department of Justice considers to be an indicator that the market is "highly concentrated."[8] However, Skype neglects to consider the competitive evolution of the industry.[9] As the Department of Justice and the FCC have concluded in approving the license transfers that have resulted in the current market structure, the HHI is not a rote rule, but rather the starting point of an inquiry into how a market is functioning.[10]

In any one geographic area, the number of providers has increased from two – as of 1992, during the cellular duopoly – to three, four or more providers as

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[7] The HHI is a commonly accepted measure of market concentration, calculated by squaring the market share of each firm competing in the market and them summing the resulting numbers. *See* Horizontal Merger Guidelines, U.S. Dept. of Justice and Fed. Trade Commn., at 1.5, *available at* http://www.usdoj.gov/atr/public/guidelines/hmg.pdf (last accessed Apr. 7, 2007) ("DOJ Merger Guidelines").

[8] Skype Petition at 21; DOJ Merger Guidelines at 1.5.

[9] DOJ Merger Guidelines at 1.5.

[10] "The Agencies' joint publication of Merger Challenges Data, Fiscal Years 1999–2003 (issued December 18, 2003), and the Commission's publication of Horizontal Merger Investigation Data, Fiscal Years 1996–2003 (issued February 2, 2004 and revised August 31, 2004), document that the Agencies have often not challenged mergers involving market shares and concentration that fall outside the zones set forth in Guidelines section 1.51. This does not mean that the zones are not meaningful, but rather that market shares and concentration are but a "starting point" for the analysis, and that many mergers falling outside these three zones nevertheless, upon full consideration of the factual and economic evidence, are found unlikely substantially to lessen competition. Application of the Guidelines as an integrated whole to case-specific facts--not undue emphasis on market share and concentration statistics--determines whether the Agency will challenge a particular merger. As discussed in section 1.521 of the Guidelines, historical market shares may not reflect a firm's future competitive significance." "Commentary on the Horizontal Merger Guidelines", U.S. Dep't of Justice & Fed. Trade Comm'n, at "Significance of Concentration and Market Share Statistics", *available at* http://www.usdoj.gov/atr/public/guidelines/215247.htm (last accessed Apr. 24, 2007).

of 2006.[11] Far from being a more concentrated market than existed in 1992, the wireless industry as of 2006 has more operational wireless licensees in each market.

Although Skype condemns the industry because the average HHI value in the mobile telephony market is 2,706, Skype fails to note that this HHI value is sharply less than that which existed in 1992. The HHIs during the duopoly market can be calculated at either 5,000 (based on the share each operator had of the 50 MHz of spectrum allocated for cellular service in each Cellular Geographic Service Area ("CGSA")) or in a range from 5,050 to 6,800 (depending on the presumed market share held by each operator in each CGSA – assuming a split of subscriber market shares from 45-55 to 80-20).

In an effort to differentiate themselves in the telecommunications market, wireless carriers have been at the forefront of innovation with new services and market offerings. Following rate deregulation, and the entry of PCS competition in 1996, plan prices fell.[12] Innovation in pricing plans accelerated, with cellular and PCS companies experimenting with the bundling of inexpensive minutes, offering low mobility wireline substitution

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[11] FCC Competition Report at ¶ 41.

[12] *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services*, Third Report, 13 FCC Rcd 19746,19766 (1998); *See also* Elizabeth V. Mooney, "Prices down 6 percent as PCS and cellular fight for customers," *RCR News*, Dec. 1, 1997 at p.23 (noting average decline of six percent, with "some carriers slashing prices by more than a third" as "PCS operators are moving quickly into metropolitan areas, offering very attractive rates and significant long-term promotions to try to capture enough market share to turn a profit, according to Kagan Associates. In response, many cellular carriers are loading more minutes into their rate plans, slashing roaming rates and accelerating digital offerings.").

plans, and prepaid service.[13] Other carriers began to follow suit, testing new pricing structures and incentives in an attempt to gain market share. Some PCS plans offered the "first incoming minute free" in 1997.[14] AT&T introduced its Digital One Rate Plan in 1998, followed by the introduction of competing national and regional One Rate-like plans by their rivals.[15] In 1999, competing Family Plans were introduced by a number of wireless companies.[16]

Others still began offering plans with periods of unlimited use. In 2000, Leap Wireless, U.S. Cellular, and ALLTEL were offering or experimenting with unlimited

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[13] *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services*, Third Report, 13 FCC Rcd 19746,19771 (1998).

[14] *See* "Sprint PCS Launches Advanced Wireless Service in San Diego," Press Release, Dec. 27, 1996, *available at* http://www.qualcomm.com/press/releases/1996/press579.html (last accessed Apr. 17, 2007) (announcing the terms to be offered in Sprint PCS' markets in 1997, including "The first minute of incoming calls is free in customers' home service areas.").

[15] *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services*, Fourth Report, 14 FCC Rcd 10145, 10155-56 (1999); *See also, Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services*, Sixth Report, 16 FCC Rcd 13350, 13377-78 (2001); *and* "Long Distance: Sprint PCS Unveils All-Inclusive Nationwide Service Plans with Prices as Low as a Dime a Minute, Anytime, Anywhere," *Edge*, Oct. 5, 1998, *available at* http://findarticles.com/p/articles/mi_m0UNZ/is_1998_Oct_5/ai_53058236 (noting nationwide calling plans, and first incoming minute free practice).

[16] *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services*, Fifth Report, 15 FCC Rcd 17660, 17676 (2000) (noting introduction by AT&T in the third quarter of 1999, and SBC's introduction of its "FamilyTalk" plan); *See also, Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services*, Tenth Report, 20 FCC Rcd 15908, 15946 (2005) (noting that "Since 2003, U.S. providers have stepped up efforts to take on more customers through 'family plan' packages.").

flat-rate local calling plans.[17] Free nights and weekends plans were first introduced in 2001 and competing "On-Net" calling plans were introduced in 2002.[18]

Unlimited calling plans became extremely popular with customers and unlimited "in-network" calling plans were expanded in 2004 to respond to consumer demand. A number of wireless providers also launched or re-launched prepaid service offerings in response to an ever increasing segment of the market unable or unwilling to sign a post-paid wireless contract.[19]

Most recently, "Mobile to Anyone" calling plans were introduced in 2006, allowing customers to choose a fixed number of "friends" to whom the subscriber could make unlimited calls, day or night.[20] Pricing innovation also continues in areas other than voice. For example, in April 2007, Verizon Wireless introduced a number of unlimited messaging options.[21] According to the Bureau of Labor Statistics' Consumer

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17 *See* Sixth Report, 16 FCC Rcd at 13382-83.

18 Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services, Eighth Report, 18 FCC Rcd 14783 (2003) at 14828-29 (noting on-net calling plans' introduction by Verizon Wireless, AT&T Wireless, and Cingular in 2002, and distinguishing them from Digital One-Rate type plans).

19 *See e.g.*, Ninth Report, 19 FCC Rcd at 20645-46 (re expansion of in-network or mobile-to-mobile calling in early 2004); *see also* Tenth Report, 20 FCC Rcd at 15946-47 at paras. 99-100 and n.223 (re: prepaid launches and re-launches).

20 FCC Competition Report at ¶ 91 (noting ALLTEL and SunCom offerings).

21 *See* Kelly Hill, "Verizon Wireless confronts rivals with unlimited messaging service," RCR News, Apr. 17, 2007, *available at* http://www.rcrnews.com/apps/pbcs.dll/article?AID=/20070416/FREE/70416003/1002/SUB (last accessed Apr. 17, 2007).

Price Index for "wireless telephone services," the cost of wireless service has declined 35.4 percent since December 1997.[22]

The utility generated by each dollar of the paid monthly subscription is as important as total price to the value of wireless service. Thanks to lower prices, use of wireless devices has seen a commensurate increase. American consumers average 726 minutes of use ("MOUs") per month.[23] That's 88% more than just 5 years ago, and incredibly 376% more than the average European wireless consumer.[24]

Finally, the Commission has recognized the wireless industry's long standing record of effective competition. Recently, the Commission's *Eleventh Annual CMRS Competition Report* found that competitive pressure continues to drive carriers to introduce innovative pricing plans and service offerings yielding significant benefits to consumers.[25] Chairman Martin has characterized competition in the wireless marketplace as "fierce," which "has resulted in billions of dollars in infrastructure investment as well as in significant price decreases for consumers."[26] It is these results,

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22 *See* "Consumer Price Index – Wireless Telephone Services", U.S. Bureau of Labor Statistics, available at http://data.bls.gov (last accessed Apr. 24, 2007) (Data current through March 2007).

23 Semi-Annual Wireless Industry Indices Report, CTIA – The Wireless Association, at 134, (2006) ("CTIA Indices Report").

24 Global Wireless Matrix 4Q06, Merrill Lynch, at 2, Mar. 26, 2007.

25 *In re* Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services, *Eleventh Report*, WT Docket No. 06-17, FCC 06-142, para. 2-5 (Sept. 29, 2006) ("*Eleventh Report*").

26 FCC Chairman Kevin J. Martin, Regulation, Competition, Telecommunications and Content, Remarks before the Portuguese Association for Communications Advancement (Nov. 16, 2006).

Chairman Martin remarked, that "demonstrate how a competitive marketplace–rather than economic regulation–provides the greatest benefits to the American consumer."[27] With a light regulatory touch, Commissioner Tate encouraged the wireless industry to continue to innovate and clarified that the "FCC should be concerned with ensuring fair competition and allowing the market to work effectively."[28] Commissioner McDowell also touted the flourishing competition among wireless providers as he recounted the FCC's record of accomplishments before the House Telecom Subcommittee:

> "Wireless growth is rising rapidly due to robust competition and technological innovation…advanced technologies allow customers to use new multimedia phones to watch TV, download songs, receive information and access content, such as sports, news and weather, at broadband speeds…wireless subscriber growth has grown exponentially, and competition among numerous providers has flourished."[29]

Commissioner Adelstein also expressed his support for the competitive policies that have shaped the wireless industry and continue to allow it to thrive:

> "Competition has been the driver of CMRS industry growth over the past decade. To maintain that growth, we are best served by ensuring that competition is alive and vibrant. The Commission

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27 *See* Statement of Chairman Kevin J. Martin, *Eleventh Report* at 114.

28 FCC Commissioner Deborah Taylor Tate, Remarks to the Rural Cellular Association (May 9, 2006).

29 FCC Commissioner Robert M. McDowell, Before the Subcommittee on Telecommunications and the Internet Committee on Energy and Commerce, United States House of Representatives (Mar. 14, 2007).

must always be looking for opportunities to promote the deployment of new, competitive CMRS services – whether through spectrum management or other types of policymaking. We are starting to see increased market penetration by newer CMRS carriers that are focused on traditionally underserved consumer markets like lower-income Americans. This is a very positive trend, and one that we should support through our policy making."[30]

These statements provide a true illustration of a competitive market – certainly a more accurate picture than the single, mischaracterized HHI measurement provided by Skype.

B. Wireless Carriers Also Compete on Services and Quality of Service

In addition to price, carriers compete on quality of service and customer satisfaction and, overall, consumers are increasingly happy with their wireless providers. According to J.D. Power and Associates 2006 Wireless Call Quality Survey, the overall rate of customers experiencing a wireless call quality problem declined for a second year in a row, and reached its lowest level since the study began in 2003.[31] Ironically, the high level of customer satisfaction may be a result of the network management principles that Skype complains of.[32] Complaints to the FCC about wireless carriers have been

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30 FCC Commissioner Jonathan Adelstein, Pre-Hearing Questions from the Committee on Energy and Commerce, United States House of Representatives (Feb. 7, 2007).

31 FCC Competition Report at 5.

32 Robert W. Hahn, Robert E. Litan & Hal J. Singer, *The Economics of "Wireless Net Neutrality"*, April 2007, *infra* app. E at 28 ("Wireless Net Neutrality").

declining as well. According to the Commission's own data, the total number of wireless complaints per quarter fell 40% from the third quarter of 2005 to the third quarter of 2006. During that same time period, the number of complaints per million subscribers fell 47% from 34 complaints per million to 18 complaints per million subscribers – less than two-thousandths of one percent of subscribers.[33]

One catalyst for a number of innovative new services is the rise of the Mobile Virtual Network Operators ("MVNOs"). MVNOs are non-facilities based wireless carriers who lease capacity from existing facilities-based networks.[34] Because of their leasing arrangements, MVNOs have been able to tailor their service offerings to serve more niche markets than large national carriers, who appeal to the broadest number of subscribers. Some examples are Disney Mobile, which caters to families with young children, Jitterbug,[35] which caters to older Americans, Amp'd Mobile,[36] offering unique music and video content targeted at the youth market, and Movida Cellular,[37] targeting Hispanic consumers. The MVNO market has experienced rapid growth since it began in 2003, nearly tripling its total subscribership from 4.7 million to 13.4 million subscribers.[38]

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33 "Quarterly Inquiries and Complaints Reports", FCC, *available at* http://www.fcc.gov/cgb/quarter/welcome.html (last accessed Apr. 26, 2007).

34 FCC Competition Report at ¶ 27.

35 *See* http://www.jitterbug.com.

36 *See* http://www.ampd.com.

37 *See* http://www.movidacelular.com/movida_english/movida.html.

38 FCC Competition Report at ¶ 27.

C. Consumers Also Benefit From Robust Competition Between Handset Providers

The Skype Petition characterizes the handset market as one where "manufacturers are forced to design equipment based on what carriers will allow, not necessarily what consumers want and the state-of-the-art will permit."[39] "State-of-the-art" technology certainly may allow handset features that consumers do not currently receive, but that hardly matters because consumers are driving the handset market. Given our market driven economy and the number of competitors,[40] consumers ultimately drive carrier handset decisions. Some consumers want handsets that offer the most number of new and innovative features that the technology will bear. Others may prefer to receive a handset with a minimal set of features.[41] Ultimately, it should be up to consumers to determine what features they want and carriers should have the freedom to give them what they ask for.[42] Indeed, with approximately 700 mobile wireless handsets on the market in the United States, mobile wireless carriers clearly are making every effort to ensure that consumers receive desired features.

As with the rest of the points it raises, Skype offers no actual proof that consumers are being foreclosed from obtaining desired handset features. Skype offers the Nokia E62/E61 as an example of a carrier – Cingular Wireless (now AT&T Mobility)

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39 Skype Petition at 13.

40 Including MVNOs who compete by offering innovative, exclusive handset tailored to their customers needs. *See e.g.,* Jitterbug, http://www.jitterbug.com; Disney Mobile, http://disneymobile.go.com; Helio, http://www.helio.com; and Amp'd, http://www.ampd.com.

41 *See* Jitterbug, http://www.jitterbug.com; Firefly, http://www.fireflymobile.com.

42 Wireless Net Neutrality at 34.

– exercising control over a handset manufacturer to prevent the inclusion of a feature – in this case, Wi-Fi access.[43] Skype claims that this example is illustrative of the lengths to which wireless carriers in the United States will go to control the handset. While Skype conveniently chose a handset that does not offer Wi-Fi, their argument proves incomplete when the wide variety of Wi-Fi and non-Wi-Fi enabled handsets available in both carriers' stores and independent retailers are examined.

A host of carriers – including AT&T Mobility – offer other phones with integrated Wi-Fi access.[44] Moreover, at least one national carrier is currently testing hybrid CMRS/Wi-Fi switching technology in select markets, allowing for the seamless transition of calls from a mobile wireless network to Wi-Fi networks when available.[45]

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[43] Skype Petition at 14-15 (stating that Cingular Wireless contracted to be the exclusive United States vendor for a version of a Nokia smartphone that lacked the Wi-Fi connectivity of its European counterpart).

[44] *See e.g.,* Samsung SCH-i730, VERIZONWIRELESS.COM, *available at* http://www.verizonwireless.com/b2c/store/controller?item=phoneFirst&action=viewPhoneDetail&selectedPhoneId=1780 (last accessed Mar. 27, 2007); T-Mobile Dash, T-MOBILE.COM, *available at* http://www.t-mobile.com/shop/phones/Detail.aspx?device=f164419f-eee9-4cf6-a1bd-070dbe4b5023 (last accessed Mar. 27, 2007); Cingular 8125 Pocket PC, CINGULAR.COM, *available at* http://www.cingular.com/cell-phone-service/cell-phone-details/?q_list=true&q_phoneName=Cingular+8125+Pocket+PC&q_sku=sku1000007-1 (last accessed Mar. 27, 2007); Sprint PCS Vision Smart Device PPC-6700, SPRINT.COM, *available at* http://www1.sprintpcs.com/explore/PhonesAccessories/PhoneDetails.jsp?navLocator=%7Cshop%7CphonesAccessories%7CallPhones%7C&selectSkuId=sprintppc6700&FOLDER%3C%3Efolder_id=1476015&CURRENT_USER%3C%3EATR_SCID=ECOMM&CURRENT_USER%3C%3EATR_PCode=None&CURRENT_USER%3C%3EATR_cartState=group (last accessed Mar. 27, 2007); UTStarcom PPC-6700, ALLTEL.COM, *available at* http://www.alltel.com/phones/audiovox/6700.html (last accessed Mar. 27, 2007); *see also infra* app. A.

[45] *See* "T-Mobile @ Home", T-Mobile, *available at* http://www.theonlyphoneyouneed.com (last accessed Apr. 7, 2007) (marketing T-Mobile's integrated service combining HotSpot access, wireless voice and data service, and seamless call switching between their CMRS network and CPE routers).

So although one particular handset may have had a capability disabled, many other devices with that same capability are available on the market from the major wireless carriers, including the same carriers highlighted by Skype.

Moreover, three of the four national carriers offer "air cards" – that add wireless Internet functionality to laptop computers – for wireless broadband Internet access, and the fourth offers a package of Wi-Fi hotspot access to accommodate subscribers with Wi-Fi enabled laptops and PDAs.[46] Importantly, none of this discussion includes the numerous offerings available from Tier-II and Tier-III wireless carriers. Additionally, none of these handset offerings were mentioned when Skype filed complaining of the lack of Wi-Fi handsets.

III. SKYPE'S DEMAND FOR OPEN HANDSET ACCESS FOR APPLICATIONS IS NEITHER SUPPORTED BY MARKET CONDITIONS NOR REQUIRES REGULATORY ACTION

Skype bemoans the inability of developers to bring wireless applications to market due to carrier practices. However, Skype's characterization of the market for applications is inaccurate, particularly given the availability of Skype Mobile software for handsets on all four national carriers.[47] Developers are free to choose from a variety of programming environments to code potential applications and have the ability to either bring these applications to carriers for approval and incorporation in their portal, to

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[46] Wireless Net Neutrality at 36.

[47] *See* "Skype 2.1 for Pocket PC," SKYPE.COM, *available at* http://www.skype.com/download/skype/mobile/download.html (last accessed Mar. 27, 2007); "Skype 2.2 Beta for Windows Mobile," SKYPE.COM, available at http://www.skype.com/download/skype/mobile/download_beta.html (last accessed Mar. 27, 2007) (Skype client software is installed on carrier handsets through Microsoft's ActiveSync software, which is provided with all Windows Mobile handsets. The process of installing Skype for Mobile is largely automated and can be accomplished on Windows Mobile and PocketPC handsets from all major carriers in a matter of minutes.)

market them directly to handset manufacturers, as the Google example illustrates, or to make them available on the Internet for download to handsets, as the Skype example illustrates.

Contrary to Skype's contentions, the market for wireless handset applications is vibrant, competitive, and open to any developer willing to program within a handset's limitations. Regulatory action in such an environment is neither warranted, nor proper.

A. Wireless Consumers Are Not Foreclosed From Running Software Applications of Their Choosing

Although wireless carriers oversee the applications that come pre-loaded on the handsets they sell, there are existing platforms and methods for users to run applications that are not provided through their carriers' application process. Most notable is the increasing prevalence of Windows Mobile as a platform for "Pocket PCs" and "Smartphones." Skype software runs on these handsets utilizing Windows Mobile.

Windows Mobile, an operating system for mobile handsets, adapts the popular Microsoft Windows operating system and Microsoft Office suite of productivity applications to the handset market.[48] Developers are free to write programs to run on Windows Mobile handsets using Microsoft's Windows Mobile Development Kit, which allows programmers to use the existing Windows Mobile Application Programming Interface ("API") to develop applications for this mobile operating system.[49] Cutting-

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[48] *See* "What is Windows Mobile?" Microsoft Corporation, *available at* http://www.microsoft.com/windowsmobile/about/default.mspx (last accessed Mar. 27, 2007).

[49] *See* "Windows Mobile for Developers," Microsoft Developers Network, *available at* http://www.microsoft.com/windowsmobile/developers/default.mspx (last accessed Mar. 27, 2007). *See also* "Visual Studio: Learn More," *available at* http://msdn2.microsoft.com/en-us/vstudio/aa973782.aspx (containing a partial list of the

edge mobile applications can be, and have been, written for use on this platform and are allowing mobile users to use their existing wireless data service to stay better connected. In fact, Skype's own developers have already taken advantage of the open programming environment afforded under the Windows Mobile family of operating systems, developing Skype client software for use on both the Pocket PC and Smartphone variations of the operating system.[50]

Although users are free to install software on their handsets, some carriers set limitations on what users can do with their handsets.[51] While some carriers have opted to define a set of services for use on their wireless data network, others have maintained a liberal policy allowing customers some flexibility to use the network moderately as they see fit. For example, Verizon Wireless and AT&T choose to explicitly define the Internet services for which they are providing access to their network.[52] By way of contrast, Sprint's terms and conditions are somewhat less restrictive and T-Mobile's terms and conditions of use contain no such restrictions.[53] Determining the relative merits of the

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available programming languages available under Visual Studio.) (last accessed Mar. 27, 2007).

50 *See* "Skype 2.1 for Pocket PC," *supra,* note 44.

51 Skype Petition at 18-19.

52 *See* http://www.verizonwireless.com/b2c/store/controller?item=planFirst&action=viewPlanList&sortOption=priceSort&typeId=5&subTypeId=13&catId=409 (last accessed Mar. 27, 2007); http://www.cingular.com/b2b/downloads/terms_wirelessDataService.pdf (last acessed Feb. 12, 2007).

53 *See* http://www.sprintpcs.com/common/popups/popLegalTermsPrivacy.html; http://www.t-mobile.com (Terms and Conditions, Term Number 7 (Use of Service)).

different models of wireless broadband should be judged by consumers, not by regulators ill-suited to choosing winners and losers in a competitive market.

In short, Skype's contention that consumers have been harmed by the efforts of wireless carriers to ensure quality of service is disputed by existing market conditions that allow consumers the freedom to choose the set of wireless broadband features they value most.

B. Skype Users Are Not Prevented From Communicating With Wireless Users

Despite Skype's claims, Skype users are not being denied connection with CMRS users. [54] Skype users can connect with CMRS customers and vice versa. Skype cites no examples of "harm" to consumers in their Petition other than the fact that their software is not pre-loaded onto handsets, distributed by carriers through existing distribution channels, or approved to run on some handset operating systems. This argument is allegedly offered to enable Skype's customers to have access to mobile wireless networks. However, there is nothing foreclosing Skype customers from doing so without regulatory intervention.

First, Skype's own premium services give its users the ability to contact users of commercial wireless networks. Skype users, unlike some other varieties of voice over IP service, have the ability to interconnect with the public switched telephone network ("PSTN") from their existing Skype service. Subscribers to these services are able to both place calls to the PSTN from their Skype client, and to receive calls from the PSTN

[54] Skype Petition at 19-20.

via a traditional phone number.[55] The only thing stopping users of the Skype service from being connected with their friends who are using CMRS is their willingness to pay Skype for optional services.

Second, CMRS users who would like to be able to interconnect with the Skype world are similarly not being stopped by the practices of the wireless industry. The SkypeIn service, a premium Skype service, allows Skype users to interconnect with the PSTN for purposes of receiving calls. Subscribers to this service, available in a number of domestic area codes and foreign countries, are given a traditional phone number which any other interconnected service can then connect to as though the Skype user were using traditional telephony.[56]

C. Skype Employs the Very Practices It Argues Against

In the height of hypocrisy, Skype complains about carriers' use of application locks and approval of handset applications as anti-consumer to protect network security, yet Skype employs similar network security practices on its network.

Although Skype's network is software based, and uses hardware of its users to form the backbone of its service, the way in which the elements of the Skype network operates is not unlike facilities-based wireless networks. Skype claims that CMRS carriers use of application management is stifling to competition and anti-consumer.

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[55] *See* "SkypeIn" SKYPE.COM, *available at* http://www.skype.com/products/skypein/ (last accessed Apr. 19, 2007); "SkypeOut" SKYPE.COM, *available at* http://www.skype.com/products/skypeout (last accessed Apr. 19, 2007).

[56] Skype offers SkypeIn numbers in "most area codes and many foreign countries." *See* "SkypeIn" SKYPE.COM, *available at* http://www.skype.com/products/skypein/ (last accessed Apr. 19, 2007).

However, Skype also uses a closed-source network for application development and for the same reason carriers have employed such a policy.

Niklas Zennström, Founder and CEO of Skype, stated at the VON Conference last March:

> "In terms of open-sourcing, what we're doing is that we have [been] gradually opening more and more APIs to the Skype software. We are, from time to time we [are] having more discussions how more we can open up, it's always a trade-off between how well we can protect not so much the IP rights but to protect the integrity of the network because if we would open-source, for example, Skype you would see a lot of bots, a lot of spamming, spoofing and all those kinds of nasty things that you have on e-mail that you don't have on Skype because we have a secure network."[57]

These same concerns are the rationale for maintaining the policies that carriers have for managing the applications that run on their networks and can be run on the handsets they subsidize.

IV. OPEN ACCESS HARDWARE STANDARDS FOR WIRELESS NETWORKS WILL STIFLE INNOVATION AND HARM CONSUMER WELFARE

The wireless industry is constantly innovating at the core of the network and in handsets at network edges. Skype claims that allowing consumers to attach any device to wireless networks will bring more innovation to the handset market and therefore will

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[57] Statement of Niklas Zinnström, Founder and CEO, Skype Communications S.A.R.L., given at the VON Conference, March 2007, *available at* http://www.tvworldwide.com/events/videoonthenet/070319/default.cfm?id=8038&type=wmhigh (last accessed Apr. 19, 2007).

benefit consumers.[58] Skype's short-sighted request will result in degraded service quality for consumers, and in effect, leaves consumers with the burden of ensuring the quality of their mobile service and carriers without the ability to manage and improve service quality.

Skype cites the *Carterfone* principles as a success story for consumers, which led to such technological advances as the "Hayes-compatible modem" and the traditional phones users could attach to the RJ-11 jack in their homes.[59] The *Carterfone* decision did facilitate many new phones from a number of manufacturers. However, while the *Carterfone* decision may have brought new wireline devices to the market, these developments pale in comparison to the innovation that has occurred and continues to occur in the competitive wireless industry – without any regulatory intervention.

Because of their ability to continually change elements of their networks, including the handsets, wireless carriers have been able to revolutionize the way Americans think about being connected to the telecommunications infrastructure. Even while ignoring mobility – arguably the most important innovation in telecommunications – the wireless industry has revolutionized its service offerings, its handset capabilities, and the way wireless networks interact with handsets. Air interface standards alone have seen 12 iterations between 1988 and today,[60] with fourth generation end-to-end IP networks currently in the standardization process.[61]

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58 Skype Petition at 13-15.

59 Skype Petition at 9-11.

60 *See* Jackson, Charles, "Handsets are Part of the Network", *infra* app. C at 9 ("Jackson Paper").

61 *See generally* 3GPP, http://www.3gpp.org.

Despite Skype's claims that developers must get carrier permission to innovate and that carrier practices restrict the availability of innovative new services, carriers are enabling innovations within the network and offering handsets that require carrier specific network compatibility. Innovations by Microsoft and Research in Motion have enabled wireless users to have real-time access to personal information and the ability to sync with their personal calendars and email accounts on their handheld devices.[62] Neither of these innovations, now widely used by both business and personal mobile users, would be possible without both hardware and software based solutions at the network edge and within the network.[63] Importantly, these innovations are available from multiple wireless carriers due to the demands of the competitive market.

This ability to continue improving and adding intelligence to the network itself, in addition to the handset, has allowed the wireless industry to continue to push the envelope of innovation and to better serve customers. Examples of network intelligence enabling new features and optimizing others are abundant in the wireless space, including Internet access and assisted global positioning systems ("AGPS").

AGPS chips utilize wireless network intelligence to provide faster, more accurate locating capabilities than traditional GPS alone. AGPS "creates a synergistic relationship between wireless networks and GPS satellites to create a precise positioning service that

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[62] *See* Microsoft Outlook Mobile, MICROSOFT.COM, *available at* http://www.microsoft.com/windowsmobile/microsoftprograms/outlookmobile.mspx (last accessed Apr. 7, 2007); Discover BlackBerry, DISCOVERBLACKBERRY.COM, *available at* http://www.discoverblackberry.com/discover (last accessed Apr. 7, 2007).

[63] BlackBerry devices rely on both handsets capable of using the BlackBerry service and a backend BlackBerry server to handle the exchange of information between the customers' calendar and email server and the wireless network. Windows Outlook Mobile relies on customers with handsets running Windows Mobile 5 or 6, and the use of a Microsoft Exchange Server for email and calendar management.

is available even in traditionally 'invisible' areas."[64] Without intelligence both in the network and at the edge of the network, this potentially life-saving technology would not be possible.

Intelligent networks have also enabled better access to telecommunications services by Americans with hearing disabilities. Vocoder technology used in both handsets and base stations enable telecommunications-devices-for-the-deaf ("TDD") users to benefit from the mobility offered by the wireless industry.[65]

Skype derides carriers for managing the handsets that access their networks, and in some cases, the applications that run on the handsets, aspiring instead to a market model in which carriers have no oversight of the equipment and applications that take advantage of their networks.[66] Rather than allow consumers to pick and choose the features and services they find most appealing on the open market, Skype seeks to replace carriers' and consumers' judgment with regulatory mandate. A prime example of this type of concern in the wireless space is the prevalence of Bluetooth and the phenomenon of "Blue Snarfing."[67]

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64 *See e.g.,* gpsOne, QUALCOMM, *available at* http://www.cdmatech.com/products/gpsone.jsp (last accessed Apr. 13, 2007) (Describing gpsOne by Qualcomm, an Assisted GPS solution that "creates a synergistic relationship between wireless networks and Global Positioning System ("GPS") satellites to create a precise positioning service that is available even in traditionally 'invisible' areas."); *see also* Wireless Net Neutrality at 15.

65 *See e.g.,* "13K Vocoder TTY/TDD Extension", 3rd Generation Partnership Project 2, *available at* http://www.3gpp2.org/public_html/specs/C.S0020-0-2.pdf (last accessed Apr. 26, 2007).

66 A view that is wholly inconsistent with the Commission's E-911 and HAC rules, *See* 47 C.F.R. § 20.18-.19; *See also* Jackson Paper at § 6.2.

67 *See* Munir Kotadia, "Bluetooth phones at risk from 'snarfing'", ZDNET.CO.UK, Feb. 9, 2004, *available at*

Bluetooth, a short range wireless standard, is incorporated into many wireless devices, enabling the use of Bluetooth enabled earpieces among others. Improperly configured phones and inexperienced users could be exploited through the use of Bluetooth to give out all of the personal data contained within the handset. Different American carriers have taken different approaches to addressing this problem. Most have taken the step of disabling Bluetooth by default and forcing users to affirmatively enable the hardware through the operating system software. However, Verizon Wireless went a step further and removed one of the Bluetooth profiles capable of betraying the users' data from the phones, thus also removing some of the features of Bluetooth.[68] In either case, a customer seeking Bluetooth capabilities has competitive options, which further illustrates that the competitive marketplace is working.

Another area in which Skype claims wireless carriers are stifling innovation is wireless Internet access.[69] Skype criticizes the wireless industry for creating a "walled garden". The "walled garden" approach, which limits subscribers to wireless Internet access on handsets to pages either designed by the carrier or to those that had been pre-authorized and optimized for delivery to wireless handsets, is not a new practice, nor is it unique to wireless. Prodigy and America Online, pioneers of dial-up access to the Internet and information services generally, both began with a walled garden approach to

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http://news.zdnet.co.uk/communications/0,1000000085,39145881,00.htm (last accessed Apr. 19, 2007).

[68] *See* Opperman v. Cellco Partnership, Los Angeles Superior Court, Case No. BC326764, Notice of Class Action Settlement and Approval Hearing, Jan. 6, 2005, *available at* http://www.verizonwireless.com/pdfs/v710settlement/Second%20Notice%2001-4-06%20FINAL.pdf.

[69] Skype Petition at 18.

the Internet, tailoring content to be more easily used by the customers. However, both companies abandoned their walled garden policies when faced with competition from other access providers that provided customers more access to the Internet and technologies were developed allowing easier access to information.

The same trend has occurred in the wireless space, where wireless carriers have largely abandoned a "walled garden" approach as the exclusive means of obtaining Internet access, due in part to the ability of carriers to use intelligent networks to optimize data streaming to handsets from the Internet. Network elements dynamically convert Internet headers and content to better accommodate handset capabilities and spectrum availability. Although some wireless carriers continue to offer secured access to specific content, wireless Internet access is broadly available on numerous devices, further illustrating the responsiveness of the wireless carriers to meeting consumer demands.

Despite the incentive to respond to consumers, Skype cites Professor Tim Wu's paper in its Petition as evidence of its assertion that wireless consumers would be better off with a regulated open access standard. Professor Wu and Skype cite a list of features they claim the wireless market has denied consumers, to their detriment.[70] Even if Professor Wu and Skype's assertions are taken at face value and wireless carriers did actively convince handset manufacturers to leave those features out of handsets, the proffered list should serve instead as proof that the wireless market *is* dynamic and

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[70] Skype Petition at note 22; Wu, Tim, *Wireless Net Neutrality: Cellular Carterfone and Consumer Choice in Mobile Broadband*, New America Foundation, *available at* http://www.newamerica.net/files/WorkingPaper17_WirelessNetNeutrality_Wu.pdf (last accessed Apr. 12, 2007) ("Wu Paper").

responds to the will of the consumers, as most of those features are now prevalent because consumers demanded them.[71]

V. APPLICATION OF THE CARTERFONE PRINCIPLES TO WIRELESS IGNORES BOTH MARKETPLACE AND TECHNOLOGICAL REALITIES

Skype's Petition asks the Commission to consider the application of the principles espoused in the *Carterfone* decision to the wireless industry. In *Carterfone*, the Commission concluded that AT&T – then a vertically integrated rate-regulated monopoly – should not be permitted to stifle competition in the market for CPE by prohibiting the attachment of non-Bell devices to the wireline telephone network.[72] Unlike the Bell System at the time of the *Carterfone* decision, the wireless industry is not dominated by a rate-regulated monopoly provider, wireless carriers do not manufacture the handsets they sell, and the market for mobile wireless handsets is both competitive and innovative without regulatory intervention, and wireless is a shared resource which could be degraded as a result of even one consumer's harmful use. Skype's request to apply *Carterfone* regulation to the wireless industry is completely misplaced.

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[71] Professor Wu cites call timers, photo sharing, web access, Bluetooth, and Wi-Fi as features that wireless carriers deny their consumers. Wu Paper at 9-11. Call timers are now on virtually every phone currently offered at market; photo sharing can be accomplished through the MMS service on most phones and by connecting to a PC by USB on Windows Mobile equipped devices; web access is a prime example of consumer demand shifting carrier offerings (*See* Section IIIA, *supra*); Bluetooth, in differing forms is offered on phones from all major carriers (*See* Section VIIA, *supra*); and Wi-Fi is available on at least one phone offered by each nationwide carrier (*See* app. A, *infra*). *See also* Wireless Net Neutrality at 34-41.

[72] *See In re Use of the Carterfone Device and Message Toll Telephone Service*, Decision, 13 FCC 2d 420 (1968).

A. The "*Carterfone* Principles" Do Not Apply to Today's Regulatory Structure

Skype's Petition cannot be supported through an analogy to *Carterfone*. As with all jurisprudence, *Carterfone* arose in the context of particular circumstances that constituted both the requirement for and the basis of the decision. Those circumstances were fundamentally unlike those that prevail in the contemporary wireless industry. The regulatory structure and the competitive dynamics of the wireless market bear no resemblance to the wireline market at the time of *Carterfone* – a decision, seminal as it was, that properly is consigned to history.

Thomas Carter's issue with AT&T was, at its core, an antitrust complaint. Carter alleged that AT&T was extending its monopoly over telephone communications into the market for CPE.[73] The Carterfone was a device that enabled a wireline telephone call to be transferred by induction to or from a two-way radio[74] such that, for example, an offshore worker on an oil platform might be remotely connected to AT&T's system. AT&T, through a subsidiary, manufactured a similar product.[75] AT&T allegedly required its buyers and lessees "not to deal with the Carterphone [sic] unit."[76] It did so in part through enforcement of Tariff FCC No. 132, which prohibited the attachment of devices like the Carterfone to its network, potentially on pain of termination of service.[77]

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73 Carter v. AT&T, 250 F. Supp. 188, 189 (N.D. Tex. 1966) ("Carter I").

74 *Id.*

75 *Id.* at 192.

76 Carter v. AT&T, 365 F.2d 486, 490 (5th Cir. 1966), *cert. denied*, 395 U.S. 1008 (1967) ("Carter II").

77 *Id*. at 491 & n. 5.

Carter's initial complaint, before the courts directed the matter to the FCC, was purely an antitrust action, without regard to the validity of the tariff *per se*.[78] Carter made a point of not attacking the tariff directly; rather, he used the tariff as evidence of AT&T's purpose to exclude competition.[79] The Fifth Circuit affirmed the district court's decision that the validity or invalidity of the tariff — including an antitrust analysis — was both critical to resolution of the claim,[80] and, in the first instance, under the primary jurisdiction of the FCC.[81]

The FCC subsequently invalidated the tariff, concluding that the Carterfone "had no material adverse effect upon use of the telephone system."[82] The FCC also found the tariff was "unduly discriminatory" in that it prohibited use of the Carterfone while allowing use of the telephone companies' own "interconnecting devices," but this was confined to the Act's definition of "discriminatory" rather than in any antitrust sense. [83]

There are numerous, critical differences between the competitive conditions in the wireless and wireline markets as well as in the business of AT&T at the time of *Carterfone* and that of the wireless carriers today. These differences make any theory of anticompetitive conduct or consumer harm in the wireless market untenable under accepted economic principles.

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78 Carter II, at 490-91.

79 *Id.* at 491.

80 Carter II at 498

81 *Id*. at 499-500.

82 Carterfone at 423.

83 *Id.* at 424.

B. The Wireless Market Is Not Dominated by a Monopoly Provider

In 1968, the provision of telecommunications transmission service was a thoroughgoing monopoly. AT&T was a rate-regulated monopolist in the telephone communications market and it was vertically integrated, selling CPE in competition with other downstream firms. If consumers didn't like the price or performance of the terminal equipment that the old Bell System provided, they had no recourse. In that sense, consumers were captive. *Carterfone*, and nearly ten additional years of industry-government skirmishing to implement *Carterfone*, changed that to the benefit of consumers.

In contrast, today's wireless industry consists of four national carriers, three additional carriers with nationwide footprints after the AWS auction, additional regional carriers, some quite significant in size, and the prospect of additional entry by other entities that have begun making large investments in spectrum. With the largest telecommunications carrier possessing only a 27% market share,[84] it is clear that no telecommunications carrier possesses market power in the antitrust sense.[85]

Obviously, the situation of today's wireless consumers in terms of choice is different and dramatically better. In a telecommunications market without a monopolist, no firm has either the incentive or the market power to impose anticompetitive effects on

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[84] FCC Competition Report at Appendix A, Tables 1 & 4; *See also* Nigro, Bernard A. & Trahar, Michael, "An Antitrust Perspective in Response to Skype's Petition", App. D at 3-5 ("Antitrust Perspective").

[85] *See Image Technical Servs. v. Eastman Kodak Co.*, 125 F.3d 1195, 1206 (9th Cir. 1997) ("Courts generally require a 65% market share to establish a *prima facie* case of market power."); While market power also depends on factors other than market share alone, the market share threshold for market power generally exceeds 70% and is almost never less than 50%. ABA Section of Antitrust Law, *Antitrust Law Developments* (6th ed. 2007) at 231-32 & ns. 35, 38 (compiling cases); *see also* Wireless Net Neutrality at 18.

the downstream CPE market.[86] The wireless market, as discussed above is a highly competitive industry.[87] Carriers compete at all levels for customers on the basis of price, service offerings, and network reliability, and consumers can, and do, change providers based upon individual needs. Indeed, the wireless industry is robustly competitive, as the Commission has repeatedly noted, and no provider has market power in the provision of wireless service.[88]

Skype's request for regulation is particularly untimely given the recent completion of the Advanced Wireless Services ("AWS") auction, and other upcoming auction of spectrum in the 700 MHz bands.[89] In an industry already marked by intense competition, the licenses being granted by the Commission as a result of the AWS auction will not only aid several of the nation-wide carriers to continue to roll out their third-generation data network, but will allow three new entrants to the national market to begin providing broadband service.[90]

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[86] Wireless Net Neutrality at 30 ("All theories of vertical foreclosure begin with the premise that the firm has monopoly power in the 'primary' or 'tying' market.") (citation omitted); *accord* George S. Ford, Thomas M. Koutsky & Lawrence J. Spiwak, "Wireless Net Neutrality: From Carterfone to Cable Boxes", Phoenix Center for Advanced Legal & Economic Public Policy Studies, April 2007.

[87] *See* Section II, ***supra.***

[88] *See generally* FCC Competition Report.

[89] *See* Auction No. 66: Advanced Wireless Services, Fed. Communications Comm'n., *available at* http://wireless.fcc.gov/auctions/default.htm?job=auction_summary&id=66 (last access Apr. 17, 2007); *See generally, In re Service Rules for the 698-746, 747-762 and 777-792 MHz Bands,* Notice of Proposed Rulemaking, WT Docket No. 06-150 (rel. Aug. 10, 2006).

[90] T-Mobile USA, Leap Wireless, SouthernLINC Wireless, and SpectrumCo. all won nationwide licenses in the AWS auction. *See generally,* Auction No. 66: Advanced Wireless Services, Fed. Communications Comm'n., *available at* http://wireless.fcc.gov/auctions/default.htm?job=auction_summary&id=66 (last access Apr. 17, 2007).

Given that the wireless market continues not only to remain competitive, but also is becoming more competitive with new entrants, Skype's contention that the wireless market is in need of adjustment is incorrect.

C. Wireless Carriers Do Not Manufacture Handsets

Unlike with AT&T in 1968, wireless carriers are not engaged in the manufacturing of wireless handsets. The economic analysis underpinning the decision in *Carterfone* is premised on promoting a competitive industry by preventing a monopolist from exercising power in an adjacent market. In *Carterfone*, AT&T, a government regulated monopoly, exercised its power in the service market to force consumers to lease CPE from Western Electric.[91] Customers looking for an alternative were forced to pay a tariff to use "equipment known to the Bell Telephone-Western Electric complex as 'foreign attachments.'"[92] *Carterfone* was a critical step in the Commission's efforts to increase competition in the CPE market to remedy an underlying market failure. The market for wireless handsets, however, suffers from no such market failure because wireless carriers are not in the handset business.

The competitive concerns that led to the *Carterfone* decision discussed above – that AT&T, through its manufacturing arm, was charging excessive rates for CPE, and was

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91 Carterfone at 420-23.

92 *In re Applications of Microwave Communications, Inc. (MCI),* Decision, 18 FCC 2d 953, 978 (1969) (statement of Johnson, Comm'r). The Commission continued its efforts to promote competition in the CPE market by rejecting the Primary Instrument Concept (PIC), which would have required each subscriber with a single basic telephone line to lease one telephone set from the incumbent telephone carrier. *In re Implications of the Telephone Industry's Primary Instrument Concept*, Report and Order, 68 FCC 2d 1157, 1158 ¶ 4 (1978). According to the Commission, the PIC was "fundamentally inconsistent with the principles" articulated in *Carterfone* & Part 68 and would have undermined the "public benefits from diversity in the supply of terminal equipment …." *Id.* at 1176 ¶ 48.

stifling competition in the CPE market[93] – are not present in the wireless market. Further, even if a network carrier had monopoly power in the telecommunications market, "without having an affiliated supplier in the secondary market, the 'monopolist' lacks the incentive to steer [a] customer towards one vendor over another."[94]

Furthermore, in contrast to the Bell System at the time of *Carterfone*, wireless consumers aren't being forced to pay more for devices. In fact, due to the nature of handset offerings by carriers, they are paying significantly less than cost. Handset prices are heavily subsidized, and customers would pay considerably more for their wireless handsets if carriers were prohibited from bundling such devices with wireless service. Robust competition for wireless handsets, which was not the case in the wireline CPE market at the time of the *Carterfone* decision, ensures consumer benefit.[95]

D. The Market for Handsets Is Both Competitive and Innovative Without Regulatory Intervention

The Commission's policy objective underlying *Carterfone* was to stimulate innovation in the wireline CPE market and increase customer choice of terminal equipment at lower cost. Those objectives have already been accomplished in the wireless market without the need for regulatory intervention. Customers currently enjoy a variety of handset options from numerous carriers, including free handsets, and handset manufacturers vigorously

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93 *See* Jonathan E. Neuchterlein and Philip J. Weiser, Digital Crossroads: American Telecommunications Policy in an Internet Age at 58 (2005).

94 Wireless Net Neutrality at 30.

95 *See* Section II, *supra*.

compete to offer the most innovative and cutting edge products and services to wireless customers.[96]

Unlike manufacturers of the *Carterfone* and other wireline CPE seeking to compete against AT&T and Western Electric, handset manufacturers do not require government intervention in order to compete or innovate. In fact, the wireless industry has been at the forefront of bringing new and innovative services to the market. Carrier innovations have occurred in the services that carriers offer to customers and within carriers' networks. Innovations like T-Mobile's test marketing of an integrated voice solution using both CMRS networks and Wi-Fi exemplify this type of network based innovation.[97] Integration of CMRS and another communication network is nothing new to Skype. Last year, Skype entered into a commercial agreement with Hutchison 3 Group to offer Skype services on mobile devices in several countries in Europe and the Far East.[98] The service, supported by both Skype and Hutchison 3, is provided over the carriers' existing architecture in a way that benefits both the carrier and Skype. There is simply no reason that a wireless carrier in this country could not enter into a similar commercially-beneficial arrangement with Skype. In

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96 For example, LG Electronics, a leading manufacturer of wireless handsets, recently announced a "global collaboration" with Google by which Google service, including Google Maps, Gmail, and Blogger Mobile, will be preloaded on LG's handsets. Press Release, LG Electronics and Google Team Up to Enhance the Mobile Experience (March 28, 2007) *available at* http://www.lge.com/about/press_release/detail/PRO|NEWS^PRE|MENU^PRER|MENU_20357_PRE|MENU.jhtml.

97 *See* "The Only Phone You Need," *supra,* note 18.

98 Press Release, *Skype and Hutchison 3 Group Join Forces to Offer Skype of Mobile Devices* (Feb. 14, 2006), *available at* http://skype.com/company/news/2006/skype_hutchison.html.

fact, even in the absence of such an agreement, Skype's software runs on multiple wireless devices in the United States.[99]

E. Wireless Is a Shared Resource and Therefore Falls Into a Category of Service That Part 68 Excludes From Connection Rules

Another critical difference between the wireless market and the traditional wireline world is the fact that wireless spectrum is a shared resource. In *Carterfone* the Commission allowed users to connect equipment of their choosing to AT&T's network – so long as it does not harm the network at large. This decision was premised on the conclusion that consumer use of CPE would only risk degradation of their own service and not the services received by other subscribers on the network.

However, wireless is a shared network medium. Thus, unlike traditional wired broadband where each user has a dedicated pipe to their home, the wireless user must share the available bandwidth with all other users – both voice and data users – in their vicinity.[100] Poor handset performance, both in terms of voice and data service, can result in fewer connections per cell, or the need for increased cells to maintain system capacity.[101]

In its Petition, Skype lauds the era of innovation at the network edge brought about by the adoption of the *Carterfone* principles and the subsequent Part 68 rules.[102] Allowing users to connect equipment of their choosing – so long as it doesn't harm the

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99 *See* "Go mobile with Skype," SKYPE.COM, *available at* http://www.skype.com/download/skype/mobile (last accessed Apr. 24, 2007).

100 *See* Jackson Paper at § 3.1.1.

101 *Id.*

102 Skype Petition at 9-10.

network at large – enabled AT&T subscribers to use the CPE of their choosing. This decision was premised on the conclusion that consumer use of CPE would only risk degradation of their own service and not the services received by other subscribers on the network. Wireless, however, is a shared resource, and as such should not be considered to be analogous to the wireline world.

Part 68 of the Commissions' rules state, in relevant part:

> [T]he [Part 68] rules and regulations apply to direct connection of all terminal equipment to the public switched telephone network for use in conjunction with all services *other than party line services.*[103]

In excluding party lines from the rules relating to connection of devices, the Commission implicitly recognized the restrictions on connection contained in the *Hush-a-Phone* and *Carterfone* cases, that connecting devices be privately beneficial without being publicly detrimental.[104]

Wireless service is similar to "party line" service in that the resource being used – then, a wireline circuit, now, radio spectrum – is shared by all those using the service simultaneously. Wireless consumers use spectrum in a complex shared environment where the elements of the network dynamically allocate resources based upon a number of factors including spectral efficiency of the handset, the number of users connected to a cell site, and the particular application for which the handset is requesting spectrum.[105]

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103 47 C.F.R. § 68.2(a) (emphasis added).

104 Hush-a-Phone Corp. v. U.S., 238 F. 2d 266, 268-69 (DC App. 1956); *In re Use of the Carterfone Device and Message Toll Telephone Service*, Decision, 13 FCC 2d 420 (1968) ("Carterfone").

105 *See* Jackson Paper at 3.1.

Although wireless users are not actually sharing a call, the resource is shared, and when one wireless user has a less efficient handset than the rest of the network, the entire network suffers. By subjecting all wireless users to the experimentation of the few subscribers interested in alternative devices, application of the Part 68 connection rules to the wireless world acts to the detriment of all users.

In order to maintain maximum efficiency over a wireless connection, some carriers prevent their consumers from using applications that require abnormally large amounts of bandwidth or near-constant connections to the network, such as streaming media and peer-to-peer ("P2P") services. Streaming media, be it audio or video, require large amounts of bandwidth over potentially long periods of time. P2P services also require large amounts of bandwidth to transfer information but are particularly troublesome because peer-to-peer services need to use the connection to the Internet when they are idle as well as when they are active.

Since the Napster decision, P2P services have increasingly relied upon distributed databases to maintain the presence of users and material on their networks.[106] Distributed databases use all of the connected users as nodes of the network and send each other signals to indicate when users "near" them in the network have logged-in, logged-out, or have initiated a transfer of some sort.[107]

Skype's particular brand of VoIP makes use of a similar distributed database. A study of the Skype protocols was done by the Computer Science department of Columbia

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[106] *See* A&M Records, Inc. v. Napster, Inc., 284 F. 3d 1091 (C.A.9 2002).

[107] *See e.g.,* Salman A. Baset and Henning Schulzrinne, "An Analysis of the Skype Peer-to-Peer Internet Telephony Protocol", Columbia University, Sept. 15, 2004 ("Skype Technical Analysis").

University to determine how the Skype network operates.[108] Skype's network maintains a series of "supernodes" with nodes attached to each supernode. In this type of network architecture, nodes (all hardware running the Skype client) are automatically promoted to supernodes if the network resources exist to support the promotion.[109] Supernodes are the backbone of the Skype network, constantly exchanging data to maintain Skype's database of network presence and status. This exchange of data occurs without interaction with the user, and is near constant if the client is a supernode.

It is unknown if the Skype mobile client contains similar code mandating supernode status for clients with sufficient network resources. However, regardless of whether the code exists or not, this type of network use is precisely why carriers maintain a review process for handset applications. The Skype client, without the provisions for making handsets supernodes, might be an acceptable use of network resources to some carriers. Skype is free to partner with American wireless carriers to do just that, but offers no evidence that it has even tried to work with carriers. Instead, Skype seeks to bypass legitimate, reasonable carrier practices in the name of its own particular model of how mobile voice service should work.

This situation is exemplified by the ongoing problem that wireless subscribers have with illegal repeaters and jammers.[110] CTIA has long held that the use of devices not tested and approved by carriers is potentially detrimental to all consumers.[111] The

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108 *Id.*

109 *Id.* at 1.

110 *See generally* WT Docket No. 03-264.

111 *See* Letter from Paul W. Garnett, Assistant Vice-President, Regulatory Affairs, CTIA, to Ms. Marlene Dortch, Secretary, Federal Communications Commission, WT

CTIA White Paper specifically documented the widespread availability of cellular repeaters, documented cases of interference caused by the unauthorized use of repeaters, and identified potential problems that repeaters can cause with E-911 location positioning.[112]

The problems that CTIA cites with respect to illegal repeaters are potential problems with handsets that do not meet carriers' standards. Carriers spend billions of dollars on network investment, ensuring that the network elements work in tandem with handsets to provide not only the highest quality of voice and data service, but also to ensure that handsets will work most efficiently when it matters most.

Network-based E-911 location systems require precise calculations of field strength and signal timing in the network to accurately estimate the location of subscribers. By operating unknown and uncontrolled devices on a wireless network, this delicate network balance is disrupted and disables the ability of the network provider to ensure that it can locate subscribers with the specified degree of accuracy. Therefore, more than simply disrupting routine wireless communications, untested and unapproved devices that are not managed by carriers can adversely affect the public safety of wireless subscribers regardless of whether the device is operating as intended or if it is malfunctioning.[113]

Docket 03-264 (dated May 15, 2006); "White Paper On The Harmful Impacts Of Unauthorized Wireless Repeaters," CTIA, (filed in WT Docket 03-264 on May 15, 2006) ("CTIA White Paper").

112 *Id.*

113 *See* Jackson Paper at § 6.2.

Skype argues that handset standards will allow manufacturers to build to a specific standard and innovate "without permission" from the carriers.[114] However, standards setting only ensures the minimum level of efficiency, removing incentives for handset manufacturers to increase either spectral efficiency or network management features. For example, in late 2004, CTIA filed tests performed by independent laboratories on PCS handsets being sold in the marketplace.[115] The handsets tested, on average, were able to pick up signals half as strong as the standards mandated. These more efficient handsets enable carriers to serve more customers per cell site, which in turn benefits consumers through better service and lower costs.

VI. NON-DISCRIMINATORY BUNDLING OF CPE WITH WIRELESS SERVICE HAS HELPED, NOT HARMED, CONSUMERS

Skype urges the Commission to revisit its 1992 decision allowing wireless carriers to bundle handsets with plans for wireless service, citing changes in the marketplace and harm to consumers.[116] In 1992, the wireless industry had 10 million customers and was still a duopoly. In response to a petition filed by cellular resellers, the Commission considered a number of factors and the ability of carriers to bundle service. The Commission's well reasoned conclusion after analyzing the handset market in 1992 was that the benefits to consumers far outweighed the potential for anticompetitive

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114 Skype Petition at 13.

115 *See* Comments of CTIA – The Wireless Association, ET Docket No. 00-258, at Attachment (filed Dec. 8, 2004).

116 Skype Petition at 20-24.

effects.[117] Despite Skype's contentions to the contrary, the Commission's analysis is as apt a description of the economic benefits to consumers today as it was 15 years ago.

A. Bundling Handsets With Wireless Service Allows All Consumers to More Quickly Benefit From New and Improved Service Offerings

In its analysis of the state of the marketplace in 1992, the Commission looked at both the handset market and the market for service. The Commission concluded that it was "uncontroverted" that the market for wireless CPE was "extremely competitive" in 1992.[118] Since then, the market for CPE has continued to evolve, and currently there are now more handset manufacturers and more models available.[119] Indeed, there now are about 700 mobile wireless handsets available to consumers in the U.S. When it looked at the market for service, the Commission tentatively concluded that the market was "sufficiently competitive" to prevent any carrier from exercising undue market power over handset manufacturers.[120] This finding is especially significant when put into the context of the wireless market at the time. Even in the federally mandated duopoly, where government regulation represented a complete entry barrier, the Commission found that carriers were unable to exercise effective control over handset manufacturers. With twice as many carrier competitors now present in almost every county in the United

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117 *See generally* CPE Bundling Order.

118 *Id.* at ¶¶ 8-9.

119 *See* Section II, *supra.*

120 CPE Bundling Order at ¶¶ 10-11.

States, wireless carriers are now less, not more, likely to exercise control over handset manufacturers.[121]

Skype's claims that companies that want to produce handsets in the wireless space must "play ball" with major wireless carriers is disproved by the Apple and AT&T iPhone announcement.[122] Apple, a computer and media company with no existing telecommunications properties, decided to enter the wireless handset market and began negotiations with Verizon Wireless to be the exclusive carrier of its product.[123] Introduction of Apple's iPhone required changes to existing wireless networks to support services that Apple intended to include in its handset offering, particularly changes with respect to how wireless networks handle voicemail.[124]

However, in a complete inversion of the description Skype offers of the wireless handset market, Apple placed conditions on the licensing of its handset. Apple, a non-player in the wireless telecommunications market, demanded an unprecedented amount of control over nearly every aspect of the handset, including the retail price.[125] If

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121 Manufacturers also have a number of MVNOs available as a vehicle for entering the U.S. handset market.

122 *See* iPhone Exclusively from Apple and Cingular, CINGULAR.COM, *available at* http://www.cingular.com/cell-phone-service/specials/iPhone.jsp?source=IC9801j02R00n300&WT.mc_id=IC9801j02R00n300 (last accessed Apr. 7, 2007).

123 *See* Musgrove, Mike, "Apple Seeks to Muscle Into Telecom With iPod Phone", Washington Post, at D1 (Jan. 10, 2007).

124 "Apple Chooses Cingular as Exclusive US Carrier for Its Revolutionary iPhone", APPLE.COM, *available at* http://www.apple.com/pr/library/2007/01/09cingular.html (last accessed Apr. 19, 2007).

125 Amol Sharma, Nick Wingfield & Li Yuan, *Apple Coup: How Steve Jobs Played Hardball in iPhone Birth*, Wall St. J., Feb. 17, 2007, at A1; "Cingular: The iPhone Price

one believes Skype's characterization of the wireless handset market, Verizon Wireless's unwillingness to meet Apple's terms for distribution of the iPhone should have resulted in Apple's capitulation to Verizon Wireless's demands or the iPhone never coming to market. However, rather than accept Verizon Wireless's terms, Apple took its ideas to Cingular Wireless, a party which – even though the largest wireless carrier in market share – was willing to accept Apple's terms. Cingular is now the exclusive distributor of Apple's iPhone. This situation is the antithesis of Skype's contentions.

B. Prohibiting CPE Bundling Removes Carrier Incentives to Upgrade Networks, Stifling Innovation

One key to wireless carriers' innovation has been their ability to make systemic changes to their networks, thereby enabling new and innovative services to be brought to market more quickly. Skype's Petition incorrectly characterizes a number of wireless carrier practices – handset locking, CPE bundling, application oversight – as preventing consumers from realizing the maximum benefit of continued network innovation. The reality is that these practices not only ensure that consumers benefit from advances in handset development, but they also enable the carriers – and all of the entities with which they do business – to continue to benefit from investment in their networks.

As carriers bring more and more services to their consumers, it is important that the carriers' networks be able to not only carry the load generated by each new service, but to do so in a timely, efficient way that ensures consumers the quality of service

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Is Right", UNSTRUNG.COM, Jan. 11, 2007, *available at* http://www.unstrung.com/document.asp?doc_id=114442 (last accessed Apr. 19, 2007).

they've come to expect from their wireless providers.[126] To that end, carriers continually invest in their network infrastructure. Carriers have invested more than $223 billion in state-of-the-art communications networks and continue to do so to improve coverage, service quality, and speeds available to their consumers.[127]

Other innovations in wireless that have occurred in both handsets and in the network have enabled Americans to have unprecedented access to their personal data and to connect to others. As discussed above, technological innovations by carriers include location based services,[128] messaging services,[129] and mobile Internet access to name a few. None of these features would be possible without network elements working together with handsets to provide these advanced services to the consumer.

The Commission also recognized the importance that bundling CPE with service has on carriers' ability to transition from one technology to the next. At the time of the CPE Bundling Order, the wireless industry was in the midst of the transition from all analog to hybrid analog/digital networks.[130] The CPE Bundling order recognized both

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126 *See* Wireless Net Neutrality at 24 ("Because the operator manages [the equipment] relationship with the customer, the operator should be able to impose requirements on upstream suppliers that ensure high quality of service.").

127 CTIA Wireless Quick Facts: December 2006, CTIA – The Wireless Association®, *available at* http://www.ctia.org/media/industry_info/index.cfm/AID/10323 (last accessed Apr. 18, 2007) (combining "Total Cumulative Capital Investment as of Year-End 2005" with "Incremental Capital Investment in 2006").

128 *See e.g.,* "Buddy Beacon", Helio Wireless, *available at* http://www.helio.com/#services_gps (last accessed Apr. 19, 2007).

129 Short Message Service, Multimedia Message Service and Common Short Codes to name a few.

130 CPE Bundling Order at ¶¶ 20-21.

the value of promoting the evolution of wireless standards, and the necessity of ensuring that consumers have access to the CPE needed to access digital networks.[131]

Bundling of CPE is particularly beneficial to lower income customers. CPE bundling has allowed carriers to subsidize the cost of handsets, making new technology available to those consumers who otherwise would not be able to afford the up-front costs of new handset technology. The Commission recognized this important fact in the context of the transition from analog technology to dual-mode and all-digital technology at the time of the CPE Bundling Order.[132] Skype recognizes the high cost of wireless CPE in its Petition, as well. Skype cites the high cost of investment in handsets as a reason to prevent CPE Bundling, when in reality CPE Bundling and other carrier practices that enable bundling have dramatically reduced the cost of handsets for consumers, including low-income consumers.[133]

Skype derides early termination fees and handset locking as anti-consumer, alluding to these practices as a market failure necessitating regulatory intervention.[134] However, rather than harming consumers by preventing them from "retain[ing] their handsets from one service to another[,]" these practices enable consumers to purchase more advanced CPE at a lower cost.[135] Carriers that subsidize the cost of CPE expect to recoup the cost of the handset over the course of the customer contract. By spreading the

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131 *Id. See also* Antitrust Perspective at 6.

132 CPE Bundling Order at ¶ 20.

133 Skype Petition at 16.

134 *Id.* at 16-17.

135 *Id.* at 16.

true cost of the device over the term of the contract – typically one to two years – consumers enjoy much lower up-front CPE costs and, at times, no up front charge for the CPE at all.

These practices also enable consumers to take advantage of the newest technologies earlier by providing incentives for them to upgrade their handsets. According to J.D. Power and Associates, the average replacement time for a wireless handset is 16.6 months.[136] Although Skype claims that many consumers would like to be able to take their handsets with them, many – some would argue the majority of – consumers don't keep their phones beyond their contract period. In short, CPE bundling accelerates, not stifles, the pace of technological change.

VII. CONCLUSION

Skype's Petition self-servingly attempts to make the case that wireless is an anti-competitive, anti-consumer industry in need of regulatory action. However, Skype offers no evidence that wireless is failing to react to the demands of the competitive market, only that the wireless industry fails to share Skype's vision of what the industry should be. Rather than attempt to compete with its version of voice service on the open market, Skype seeks to have the Commission mandate that the market give its model a chance where consumers seemingly aren't interested.

Skype presents solutions to problems that don't plague the wireless industry and suggests remedies that would neither benefit consumers nor the market, but rather inure their benefit to Skype. The Commission should dismiss Skype's self-serving Petition as

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136 "J.D. Power and Associates Reports: Sony Ericsson Ranks Highest in Mobile Phone Customer Satisfaction", JDPOWER.COM, *available at* http://www.jdpower.com/corporate/news/releases/pressrelease.asp?ID=2006251 (last accessed Apr. 18, 2007).

it not only fails to cite a legitimate market failure in the wireless market, but also fails to consider the true demands and interests of wireless consumers.

Respectfully submitted,

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Dated: April 30, 2007

CERTIFICATE OF SERVICE

I, Korto Dunbar, do hereby certify that on this 30th day of April 2007, I caused copies of the foregoing "CTIA – The Wireless Association® Opposition" to be delivered to the following via First Class U.S. mail or email:

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ATTACHMENT A

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Included Features

Cingular Exclusive - Ultra fast 3G UMTS/HSDPA Pocket PC
Single integrated device for simultaneous voice, data, and email
Microsoft Windows® Mobile 5.0 Pocket PC with Messaging & Security Pack
Microsoft Direct Push Technology - Email, calendar, contacts & tasks
Go global with Tri band UMTS/HSDPA and Quad band GSM/GPRS/EDGE
Good Mobile Messaging, ActiveSync, & Xpress Mail
Music, MP3 and video support - Windows Media Player 10 Mobile
Mobile Instant Messaging - Yahoo!® Messenger, AOL® Instant Messenger, & Windows Live (TM) Messenger (available via download)
Sliding QWERTY keyboard with trackwheel for easy navigation
Microsoft Office® Mobile - Access Word, Excel, PowerPoint files
Bluetooth 2.0® wireless connectivity -use multiple accessories simultaneously
2 MP camera with video and flash
Tethers to your laptop as a high-speed modem
Multimedia, text and instant messaging
Integrated Wi-Fi (802.11 b,g) and infrared connectivity
Voice command and voice dialing

FREE SHIPPING
with online activation

Cingular 8525	
Price	$599.99
2-yr Contract Price	$449.99
Mail-In Rebate	- $50.00
*Online Price	$399.99
Total Savings	11.11%

*2 yr contract New service price

Qty. 1 ADD TO CART

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Take advantage of our web-only offers. Order now and start saving today. As always, Free Shipping is included.

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  - Power Vision phones
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  - Multimedia phones
  - Video phones
  - Picture phones
  - Ready Link phones
  - PDA phones
  - Mobile Broadband Cards
  - Accessories
- Packages
- Services & Features
- Special Offers
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Sprint PCS Vision℠ Smart Device

PPC-6700

How to get it

$549.99 regular price
- $150.00 instant savings
$399.99 new price

Add to order >

Receive a $100 manufacturer's mail-in rebate

Have a sales rep call you

Locate a store near you

View Demo | View 360° | View Gallery

Overview | Sprint PCS Vision | More Features

Built-in Wi-Fi Capability
High-speed data connection between the device and nearby Wi-Fi access points for the ultimate in mobile connectivity. For a list of Sprint-compatible domestic and international Wi-Fi ZONES℠, visit www.sprint.com/wifi and click on Wi-Fi ZONE Locator. Customers can also connect in other public, enterprise and residential Wi-Fi venues.

Large Full-Color Screen
Vivid 2.88" 64K color TFT Touch-Screen for easy reading and a rich, full-color experience.

External miniSD Card Slot
Add memory and selected peripherals or load additional games, applications, and video clips.

Supports SMS Text Messaging
Instantly send and receive SMS Text Messages across the room or across the country. It's the coolest way to talk, without the talk.

Built-in Speakerphone
Hands-free operation of your phone is made easy with the built-in speakerphone, allowing you to take a conference call virtually anywhere!

Phone as Modem Capable
Use the included USB cable and your Sprint Power Vision · to connect to a PC, allowing Internet and email access.

For Sprint Customers

Add a Phone
Starting at $9.99 a month!

Upgrade Your Phone
Special Discounts for you!

Shop for accessories

Guides & Tutorials

User Guide

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Home › Phones › T-Mobile SDA

T-Mobile SDA

Stay connected while staying organized. Features a 1.3 megapixel camera with video capture, Bluetooth® connectivity, plus EDGE, Wi-Fi, and the extra speed you need to take advantage of the T-Mobile Total Internet network.

Suggested retail	$279.99
Instant discount	-$80.00
Mail-in rebate	-$50.00
	$149.99

BUY NOW

Enlarge
3D view
Phone Demo

Overview | Features | Services | Setup

Basics

Size:	4.53 x 1.82 x 0.69 inches
Weight:	3.74 ounces
Included battery:	Li-Ion
Talk time:	Up to 4.5 hours
Standby time:	Up to 8 days
Band (frequency):	850 MHz;900 MHz;1800 MHz;1900 MHz

Included Accessories

AC Adaptor
Stereo headphones
USB Cable
Carrying case

Top Phone Features

Messaging
Instant messaging: Yahoo!®, MSN®, and AOL®

Fun
1.3 Megapixel camera
Video camera
Windows Media® Player
Expandable mini SD memory slot

Communication
Bluetooth® wireless technology
Speakerphone
E-Mail integration options
Quad band GSM (850/900/1800/1900 MHz)

Information
T-Mobile Internet ready (GPRS & EDGE)
Wi-Fi (802.11b) ready*

Assistants
Organizer with PC synchronization
Windows Mobile®

*Additional fees may apply
See all the features for this phone ›

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Phones
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Services & Accessories
Checkout

Online exclusive prices!

FREE SHIPPING on ALL phones!

FAQ

Can I use any phone with any plan?

Does the device I choose effect whom I can communicate with?

What other charges apply besides the cost of the phone(s)?

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Home › Phones › T-Mobile Dash™

T-Mobile Dash™

T-Mobile Exclusive

A sleek Windows Mobile® Smartphone to keep you connected and is comfortable to hold. Connect with all your e-mail easily. View and share photos, videos, and attachments or browse the Web.

Free 512MB Card

Suggested retail	$349.99
Instant discount	$100.00
Mail-in rebate	-$50.00

$199.99

BUY NOW

Enlarge
Phone Demo
myFaves Demo

Overview | Features | Services | Setup

Basics

Size:	4.4 x 2.3 x 0.8 inches
Weight:	4.2 ounces
Included battery:	Li-Ion
Talk time:	up to 5 hours
Standby time:	up to 6 days
Band (frequency):	850 MHz/900 MHz/1800 MHz/1900 MHz

Included Accessories

Hands-Free Headset
Case
USB Cable
AC Adaptor
Battery

Top Phone Features

Messaging
Text messaging*
Instant messaging: Yahoo!®, MSN®, and AOL®*

Fun
1.3 Megapixel camera
Windows Media® Player
Video camera/playback

Communication
Easily synch w/ Microsoft Outlook
Built-in QWERTY Keypad
myFaves capable*
Stereo Bluetooth® wireless technology

Information
Real web browsing*
GPRS/EDGE and Wi-Fi enabled*
Micro SD memory slot
Voice-activated dialing

Assistants
Windows Mobile®
Speed dial

*Additional fees may apply
See all the features for this phone ›

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FAQ

Can I use any phone with any plan?

Does the device I choose affect whom I can communicate with?

What other charges apply besides the cost of the phone(s)?

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ATTACHMENT B

Handsets Available from National Carriers Running the Windows Mobile Operating System

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T-Mobile SDA

Stay connected while staying organized. Features a 1.3 megapixel camera with video capture, Bluetooth® connectivity, plus EDGE, Wi-Fi, and the extra speed you need to take advantage of the T-Mobile Total Internet network.

Suggested retail	$279.99
Instant discount	-$80.00
Mail-in rebate	-$50.00
	$149.99

BUY NOW

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3D view
Phone Demo

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FAQ

Can I use any phone with any plan?

Does the device I choose affect whom I can communicate with?

What other charges apply besides the cost of the phone(s)?

Overview | Features | Services | Setup

Basics

Size:	4.53 in x 1.92 x 0.69 inches
Weight:	3.74 ounces
Included battery:	Li-Ion
Talk time:	Up to 4.5 hours
Standby time:	Up to 8 days
Band (frequency):	850 MHz/GSM MHz/1900 MHz/1800 MHz

Included Accessories

- AC Adaptor
- Stereo headphones
- USB Cable
- Carrying case

Top Phone Features

Messaging
Instant messaging: Yahoo!®, MSN®, and AOL®*

Fun
1.3 Megapixel camera
Video camera
Windows Media® Player
Expandable mini SD memory slot

Communication
Bluetooth® wireless technology
Speakerphone
T-Mobile Integration options
Quad band GSM (850/900/1800/1900 MHz)

Information
T-Mobile Internet ready (UMTS & EDGE)
Wi-Fi (802.11b) ready*

Assistants
Organizer with PC synchronization
Windows Mobile®

*Additional fees may apply
See all the features for this phone ›

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T-Mobile Dash™

T-Mobile Exclusive

A sleek Windows Mobile® Smartphone to keep you connected and is comfortable to hold. Connect with all your e-mail easily. View and share photos, videos, and attachments or browse the Web.

Free 512MB Card

Suggested retail:	$349.99
Instant discount	-$100.00
Mail in rebate	-$50.00
	$199.99

BUY NOW

Enlarge
Phone Demo
myFaves Demo

Overview | Features | Services | Setup

Basics

Size:	4.4 x 2.5 x 0.5 inches
Weight:	4.2 ounces
Included battery:	Li-Ion
Talk time:	up to 5 hours
Standby time:	up to 9 days
Band (frequency):	850 MHz/900 MHz/1800 MHz/1900 MHz

Included Accessories

- Hands-Free Headset
- Case
- USB Cable
- AC Adaptor
- Battery

Top Phone Features

Messaging
Text messaging*
Instant messaging: Yahoo!®, MSN®, and AOL®*

Fun
1.3 Megapixel camera
Windows Media® Player
Video capture/playback

Communication
Easily sync w/ Microsoft Outlook
Built-in QWERTY Keypad
myFaves capable*
Stereo Bluetooth® wireless technology

Information
Real web browsing*
GPRS/EDGE and Wi-Fi enabled*
Micro SD memory slot
Voice activated dialing

Assistants
Windows Mobile®
Speed dial

*Additional fees may apply
See all the features for this phone »

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FAQ

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What other charges apply besides the cost of the phone(s)?

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  - PDA phones
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  - Accessories
- Packages
- Services & Features
- Special Offers
- Shopping Cart

Sprint Mobile Broadband Smart Device

MOTO Q™ by Motorola®

How to get it

$449.99 regular price
- $250.00 instant savings
- $100.00 mail-in rebate
$99.99 new price

Add to order

View 360° | View Gallery

Overview | More Features

About this Phone

The MOTO Q™ brings you forward-thinking technology in a cutting-edge design. Add the power of Sprint's high-speed network, affordable monthly data plans and special features available only from Sprint, and you've got everything you need to stay in touch and stay entertained - all in one pocket-sized device.

- Digital Dual Band
- Up to **4 hours** continuous digital talk time.
- 4.6" x 2.5" x 0.45" (free comparison)
- 4.1 oz

Thinnest QWERTY device ever at just 0.45 inches

Full, ergonomic QWERTY keyboard, 5-way navigation button and thumb wheel for one-handed operation

Sprint Mobile Broadband enabled

Where it's available, experience high data speeds over the EVDO network. Retrieve customized, up-to-date Web content such as News, Sports and Weather. Download large attachments and access data on the go!

For Sprint Customers

Add a Phone
Starting at $9.99 a month!

Upgrade Your Phone
Special Discounts for you!

Shop for accessories

http://www1.sprintpcs.com/media/Assets/ueContent/include/l-pt-MOTQKIT-overview.html

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- Services & Features
- Special Offers
- Shopping Cart

Sprint Mobile Broadband Smart Device

Treo™ 700wx by Palm®

Work Smarter & Faster

With Mobile Windows 5.0 at Broadband Speeds

How to get it

$649.99 regular price

- $250.00 instant savings

- $100.00 mail-in rebate

$299.99 new price

Add to shopping cart

Have a sales rep call you

Locate a store near you

View 360° | View Gallery

Overview | **More Features**

About this Phone

Manage work and play more easily with the versatile Sprint Mobile Broadband Smart Device Treo™ 700WX by Palm®. This go-anywhere Windows Mobile® device combines a smarter phone with wireless email, web browser, rich media capabilities and familiar Microsoft® applications.

- Digital Dual-Band
- Up to **5 hours** continuous digital talk time.
- 5.1" x 2.3" x 0.9" (size comparison)
- 6.4 oz

Wireless High-Speed Data Capable

Where coverage is available, experience broadband-like download speeds using EV-DO technology. The average download speeds range from 400 to 700 Kbps with peak rates up to 2 Mbps.

Microsoft® Windows Mobile™ 5.0

With great productivity tools for mobile professionals, Windows Mobile 5.0 allows fast access to email; easily transfer your digital multimedia from your Windows-based PC to your device, allowing you more ways to personalize

For Sprint Customers

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- Special Offers
- Shopping Cart

Sprint PCS Vision℠ Smart Device

PPC-6700

$549.99 regular price
- $150.00 instant savings
$399.99 new price

Add to basket >

Receive a $100 manufacturer's mail-in rebate

Have a sales rep call you

Locate a store near you

View Demo | View 360° | View Gallery

Overview | Sprint PCS Vision | More Features

About this Phone

The Sprint PCS Vision℠ Smart Device PPC-6700 features the new Microsoft Windows Mobile 5.0 operating system. This combination of design, functionality, and speed will keep you in the know while on the go.

- Digital Dual-Band
- Up to **3.5 hours** continuous digital talk time.
- 4.25" x 2.3" x 1.0" (size comparison)
- 6.1 oz

Wireless High-Speed Data Capable

Where coverage is available, experience broadband-like download speeds using EV-DO technology. The average download speeds range from 400 to 700 Kbps with peak rates up to 2 Mbps.

Microsoft® Windows Mobile™ 5.0 for Pocket PC

With great productivity tools for mobile professionals, Windows Mobile 5.0 allows fast access to email; easily transfer your digital multimedia from your Windows-based PC to your device, allowing you more ways to personalize

For Sprint Customers

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Starting at $9.99 a month!

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Special Discounts for you!

Shop for accessories

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User Guide

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  - Ready Link phones
  - PDA phones
  - Mobile Broadband Cards
  - Accessories
- Packages
- Services & Features
- Special Offers
- Shopping Cart

Sprint International Smart Device

IP-830W by Samsung®

View 360° | View Gallery

Overview | **More Features**

About this Phone

Travel around the world and stay connected with this versatile device. This world phone uses the Sprint CDMA/EV-DO networks in the U.S., Canada and Mexico, and roams on CDMA and/or GSM networks (voice) and GPRS networks (data) outside of North America.

- Digital Quad Band International Device
- Up to **3.5 hours** continuous digital talk time.
- 2.29" x 4.53" x 0.96" (size comparison)
- 6.4 oz

Wireless High-Speed Data Capable

Where coverage is available, experience broadband-like download speeds using EV-DO technology. The average download speeds range from 400 to 700 Kbps with peak rates up to 2 Mbps.

Microsoft® Windows Mobile™ 5.0

With great productivity tools for mobile professionals, Windows Mobile 5.0 allows fast access to email; easily transfer your digital multimedia from your Windows-based PC to your device, allowing you more ways to personalize your experience.

How to get it

$649.99 regular price

- $150.00 instant savings

$499.99 new price

Add to order >

For Sprint Customers

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Starting at $9.99 a month!

Upgrade Your Phone

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Shop for accessories

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User Guide

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Special Offers

Online Exclusive Pricing - Strawberry Chocolate!

It's part MP3 player, part phone and totally sweet! Get a taste.
→ Buy Now

Exclusive Accessories

Great offers on Bluetooth Headsets & Exclusive Online Offers
→ Buy Now

Free Shipping

Order your phone and accessories online and shipping is free
→ Details

Samsung SCH-i730

View Front
View 360°
View Size

	2-yr contract
2-yr contract price	$199.99
Online Discount	-100.00
You Price	199.99

Free Phone Offer

Buy the Samsung SCH-i730 and Get a Samsung SCH-i730 for FREE!

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« Back to all phones

Bluetooth
Go wireless and use a hands-free headset to place and receive calls

QWERTY Keyboard
Quickly and accurately compose messages, with a familiar keyboard layout

Windows Mobile OS
Brings much of the power of your personal computer to your mobile device

For existing customers

Log in to My Account to order this phone for your Verizon Wireless number.
Get the Details | Login

Overview | Phone Details | Features | Accessories | Capabilities

The **Samsung SCH-i730** is a Pocket PC Phone featuring Windows Mobile® 2003 Pocket PC Phone 2nd Edition software. It's equipped with 1xEV-DO digital download capabilities, has Bluetooth® wireless technology and Wi-Fi capabilities. The i730 also has a built-in sliding QWERTY keyboard, dual speakers, SD I/O slot and speakerphone. It's built for people who mean business.

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Special Offers

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→ Buy Now

Exclusive Accessories

Great offers on Bluetooth Headsets & Exclusive Online Offers
→ Buy Now

Free Shipping

Order your phone and accessories online and shipping is free
→ Details

For existing customers

Log in to My Account to order this phone for your Verizon Wireless number.
Get the Details | Login

Verizon Wireless PN-820 Smartphone

	2-yr contract
2-yr contract price	$249.99
Online Discount	-100.00
Your Price	$149.99

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Bluetooth
Go wireless and use a hands-free headset to place and receive calls

Windows Mobile OS
Brings much of the power of your personal computer to your mobile device

Music Player
Play your favorite music on your phone with a built-in Music Player. See Phone Details for supported file types.

Overview | Phone Details | Features | Accessories | Capabilities

Save an additional $50 with a mail-in rebate! (Rebate not reflected in shopping cart price).

The **PN-820** gives you smartphone functionality with the elegance and convenience of a flip-style design. You can send email, browse the Internet and play tunes/videos with Microsoft® Windows Media™ Player all on the Windows Mobile® 5.0 OS for Smartphone. In addition, you can sync up to your PC with Wireless Sync or Activesync. Add to all this a miniSD card slot, Advanced Voice Command and Broadband**Access** Connect capabilities, **Bluetooth®** technology and take pictures and videos with the 1.3 megapixel camera. You will be sure to have attained complete mobile freedom with this small, yet powerful smartphone.

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Special Offers

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It's part MP3 player, part phone and totally sweet! Get a taste.
→ Buy Now

Exclusive Accessories

Great offers on Bluetooth Headsets & Exclusive Online Offers
→ Buy Now

Free Shipping

Order your phone and accessories online and shipping is free
→ Details

For existing customers

Log in to My Account to order this phone for your Verizon Wireless number.
Get the Details | Login

Motorola Q™

View Front
View 360°
View Size

	2-yr contract
2-yr contract price	$299.99
Online Discount	-100.00
Your Price	$199.99

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« Back to all phones

Bluetooth
Go wireless and use a hands-free headset to place and receive calls

QWERTY Keyboard
Quickly and accurately compose messages, with a familiar keyboard layout

Video Messaging
Share life's most memorable moments with your friends and family

Overview | Phone Details | Features | Accessories | Capabilities

Save an additional $50 with a mail-in rebate! (Rebate not reflected in shopping cart price).

$299.99 2-yr Retail Price
–$50.00 Mail-In Rebate
–$100.00 Advanced Device Credit*

$149.99 Price with new 2-yr activation on Voice and Data Choice Bundle $79.99 or higher.

*Advanced Device online discounts for PDAs and Smartphones are only available with the purchase of a new 2-yr agreement on Voice and Data Choice Bundle plans $79.99 or higher. This online discount cannot be combined with other discounts, including New Every Two.

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Special Offers

Online Exclusive Pricing - Strawberry Chocolate!

It's part MP3 player, part phone and totally sweet! Get a taste.
→ Buy Now

Exclusive Accessories

Great offers on Bluetooth Headsets & Exclusive Online Offers
→ Buy Now

Free Shipping

Order your phone and accessories online and shipping is free
→ Details

For existing customers

Log in to My Account to order this phone for your Verizon Wireless number.
Get the Details | Login

Verizon Wireless XV6700

View Front
View 360°
View Size

2-yr contract

2-yr contract price	$399.99
Online Discount	-100.00
Your Price	$299.99

0 Add to Cart

« Back to all phones

Bluetooth
Go wireless and use a hands-free headset to place and receive calls

QWERTY Keyboard
Quickly and accurately compose messages, with a familiar keyboard layout

Windows Mobile OS
Brings much of the power of your personal computer to your mobile device

Overview | Phone Details | Features | Accessories | Capabilities

The **XV6700** is loaded with **Microsoft® Windows Mobile® 5.0, Bluetooth® technology**, built-in **Wi-Fi™**, and the speed of Broadband. It also boasts a 1.3 megapixel camera/camcorder with flash and Windows Media® Player 10 and a cleverly hidden, side-out QWERTY keyboard.

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It's part MP3 player, part phone and totally sweet! Get a taste.
Buy Now

Exclusive Accessories

Great offers on Bluetooth Headsets & Exclusive Online Offers
Buy Now

Free Shipping

Order your phone and accessories online and shipping is free
Details

For existing customers

Log in to My Account to order this phone for your Verizon Wireless number.
Get the Details | Login

Palm® Treo™ 700wx Smartphone

	2-yr contract
2-yr contract price	**$499.99**
Online Discount	-100.00
Your Price	$399.99

0 Add to Cart

« Back to all phones

Bluetooth
Go wireless and use a hands-free headset to place and receive calls

QWERTY Keyboard
Quickly and accurately compose messages, with a familiar keyboard layout

Windows Mobile OS
Brings much of the power of your personal computer to your mobile device

Overview | Phone Details | Features | Accessories | Capabilities

Save an additional $100 with a mail-in rebate! (Rebate not reflected in price).

The **Palm® Treo™ 700wx Smartphone** delivers without compromise! It combines a smarter phone with broadband-like speeds, wireless email and rich media capabilities. With added RAM, the Treo 700wx is for the on-the-go person who uses a more robust set of applications on a more regular basis.

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Cell Phone Details - Cingular Wireless - Microsoft Internet Explorer, provided by CTIA - The Wireless Association

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Windows Media® Player 10 Mobile for music and video
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ATTACHMENT C

Wireless Handsets Are Part of the Network

Charles L. Jackson
27 April 2007

An earlier version of this report was presented at the 16th ITS Biennial Conference held in Beijing, China, in June 2006. I wish to thank CTIA for support in developing this report.

Table of Contents

1. Overview and Summary

Regulators, competition policy authorities, professed competitors, and class-action plaintiffs have all attacked the joint provision of wireless service and wireless handsets as well as the use of various contractual and technical arrangements that bond a handset to a specific service provider. The arguments raised against these practices often are the usual objections to the tying or bundling of a monopoly product with a competitive product.[1] Many of the discussions of such tying focus on purely economic issues—such as consumer preferences for time payments for equipment purchases.[2]

However, discussions of the wireless industry have failed to examine all dimensions of the handset–network relationship. In particular, discussions of handset tying and bundling have not addressed the extent to which handset capabilities are a substitute for investment in the network. It is well understood that wireless handsets can be regarded as complements to the network. However, it is not generally understood that handset capabilities can also be a substitute for network investment. In practice in today's wireless networks, the handset and the network are not two separate products—as are automobiles and gasoline or shoes and shoe polish—but are aspects of a single product. Most important, purchase of improved equipment by one subscriber can improve service for other subscribers. Handsets are part of the wireless network, and the performance of handsets has substantial static and dynamic efficiency implications for the operation of the network as a whole. Investments in handsets can reduce the investment needed in the rest of the network. Hence, a wireless service provider has strong incentives to control the technology used in handsets in order to create an efficient network as well to manage network evolution. Handset subsidies and various forms of tying and bundling are reasonably efficient tools for such control.

Closely related to efficiency concerns are social concerns. Earlier analyses of handset sales practices have not addressed the extent to which handset supply by service providers is helpful or even necessary for meeting social goals such as supporting

---

1 Such concerns are raised even though wireless service is not a monopoly.

2 See, for example, "Bundling, Tying, and Portfolio Effects, Part 2 - Case Studies," DTI Economics Paper No. 1, Barry Nalebuff and David Majerus, February 2003.

emergency services, deterring theft, or providing service to persons with disabilities. In the United States, the FCC has required wireless service providers to meet certain social goals—goals that can only be met if the handsets used on the service provider's networks have specific capabilities. Bundling handsets with wireless service is a simple and efficient mechanism for ensuring that handsets have the technical characteristics needed to meet the regulatory requirements. For example, the incentives for handset theft are substantially reduced if it is difficult or impossible to activate a stolen handset.

This paper reviews wireless network technology and discusses the various ways in which handset capabilities affect overall network efficiency and network evolution. It focuses on the wireless industry in the United States but also considers the general case. It also discusses social concerns, such as support for E911 service and the issue of handset theft. Finally, it considers alternative approaches to ensuring that handsets are efficient matches with the network and offers some concluding thoughts.

1.1. Efficiency

Wireless handsets interact with the network in a fashion quite different from the way that wired telephone handsets do. Unlike the case in wired telephony, in modern wireless telephony the features and quality of the handsets used on the network have a substantial impact on the cost and quality of the wireless service, not only for the individual subscriber but for all consumers. If John uses an inferior wireless phone—even if that inferior phone was state-of-the-art five years ago—he may deny service to Mary who is sitting next to him or may degrade service for other users a mile away. In contrast, if one uses a poor quality wireline handset, it does not degrade one's neighbor's wireline telephone service.[3] In the economist's jargon, poor-quality wireless handsets can easily create substantial negative externalities but poor-quality wireline handsets are extremely

[3] The nature of harms to the network from consumer provided terminal equipment in the wired telephone network was extensively investigated in the early 1970s. The conclusion of those investigations was that, in the vast majority of typical instances, the harms from inferior terminal equipment were imposed on the user of that equipment and on those who wished to call him or her. With a few exceptions, such harms did not impact others using the network. Furthermore, relatively simple protective connecting arrangements or certification of equipment could provide substantial protection against harms to the network. However, in the case of party lines—in which the telephone line is shared as is a wireless link—there are additional potential harms with no easy solution. Consequently, the FCC has never ordered that customer-owned equipment can be connected to party lines. See 47 CFR 68.2(a).

unlikely to do so. Widespread use of inferior handsets would substantially degrade wireless service—such as by increasing the number of coverage holes and dropped calls—or would require a significant increase in the capital plant used by wireless carriers. In either case, consumers—even consumers with superior handsets—would suffer. Wireless carriers have strong incentives to ensure that consumers use handsets that economize on the total costs (capital costs and handset costs combined) of the network.

1.2. Innovation

The wireless industry has seen enormous innovation and technical advancement over the last two decades. Many of these innovations have made the networks more efficient—expanding capacity and avoiding the otherwise rigid limits on capacity imposed by the finite spectrum made available for wireless service. Innovations have also made new service capabilities, including data applications, available to consumers. Implementing such innovations requires interaction between the network and handsets to an extent that is unparalleled in wireline telephony. Seeding the market with handsets providing expanded capabilities is an essential step in fostering the rapid adoption of more efficient or more capable wireless services. Adoption of capacity-expanding innovations would be far slower if carriers did not provide and subsidize handsets supporting new capabilities. Similarly, the adoption of new services would also take longer absent carrier support of handset supply.

The contrast to the wired telephone network is striking. The wired telephone industry adopted a standard interface between telephone instruments and the network no later than 1950. When new technologies, such as electronic central offices or digital loop carrier, were introduced into the telephone network, the new equipment was built to work with the existing wires and telephone instruments. When new telephone equipment was designed, it was built to work with the existing network. The only significant change to the wired telephone interface since 1950 that I am aware of was the introduction of touch-tone dialing. Although extensive innovation occurred both inside the network and in the terminal equipment, the standard interface remained in place for telephone instruments. For example, in the long-distance network microwave replaced copper,

fiber replaced microwave, digital replaced analog, and so on. All the same, a telephone that was new in 1957 can be connected to the network today and will work fine.[4]

1.3. Security

Various security features built into modern wireless handsets make cloning, fraud, and activation of stolen handsets far more difficult than was the case with earlier technologies. In particular, locking a handset to a network makes theft almost pointless. One reason for adopting such features was the request by responsible law enforcement agencies, including the Federal Bureau of Investigation and the British government, that wireless handsets be resistant to cloning and to easy activation after theft or robbery.

1.4. 911, E911, and TTY Support

The FCC imposes several requirements on wireless carriers to support 911 calls. For example, wireless carriers must deliver all 911 calls—even calls placed by nonsubscribers. The FCC also requires wireless carriers (1) to provide the location of wireless callers to 911 to the affected public safety access point (a capacity generally referred to as E911) and (2) to support communications from TTY devices used by the deaf. For many carriers, meeting these two requirements is possible only if handsets contain specific features and meet minimum performance standards. As is more generally true, there is a tradeoff between handset performance and network performance in providing the location information capability. Widespread consumer use of handsets that perform the E911 functions better than industry standards may be necessary for a carrier to meet its legal obligations under the FCC's E911 accuracy requirements.

1.5. Help Desk Support

Wireless carriers provide helpdesk support to their subscribers. Some modern handsets rival a personal computer of a few years ago in complexity and features. Providing helpdesk support to unfamiliar or unknown handsets is difficult and costly.

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[4] Ultimately, new technologies that did not use the POTS interface, such as ISDN and DSL were introduced into the loop.

1.6. Summing Up

Multiple technical factors—with the most important probably being the fundamental role of handsets in determining overall system efficiency and capital costs—create strong, efficiency-serving incentives for wireless carriers to control the nature and characteristics of the handsets used by their subscribers.

2. Development of the Modern Wireless Industry

The rapid growth of the wireless industry has created today's wireless economy in which more than 230 million wireless phones are in use in the United States today—slightly more than two wireless phones for every three Americans.

Wireless calls require both a wireless handset and a matching wireless network. Wireless networks consist of cell sites that contain antennas, radios, and communications connections to a switching center where calls are processed and sent on to other subscribers, and a local telephone company or a long-distance company. Figure 1 shows these basic elements of a wireless system.

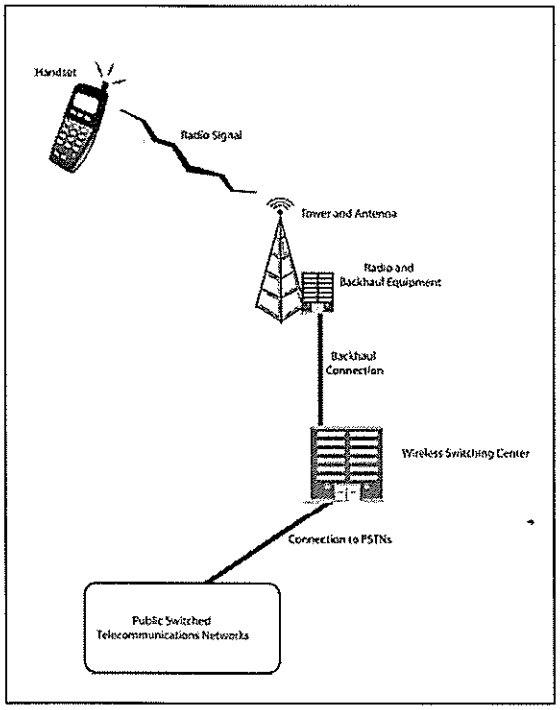

Figure 1. Elements of a Wireless Network

The modern U.S. wireless industry began in the early 1980s with the first cellular systems. These systems used an analog technology, called AMPS, that the FCC required that all cellular operators use. Cellular service turned out to be more popular than most people had forecast. Within a few years, the capacity available on the two cellular licenses was close to exhaustion in some large cities. There were two responses to this pending exhaustion: (1) the industry pressed efforts to develop technologies that could fit more calls into the spectrum available under the existing radio licenses and (2) the FCC looked for additional radio spectrum (radio channel space) that could be made available for wireless services.

Recognizing the need to permit the industry to move to more efficient technology, the FCC dropped its requirement that cellular operators use only the AMPS technology and adopted a policy of "technical flexibility" that allowed cellular carriers to use any radio technology provided it did not create harmful interference.[5] The industry responded by funding the development of new radio technologies that were more spectrally efficient—that is, these technologies enabled carriers to serve more subscribers in the same limited radio spectrum by fitting more calls into a given spectrum block. And, for business reasons, any new technologies also had to be compatible with the existing AMPS service in the sense that cellular operators had to be able to operate mixed systems—part new technology and part the old AMPS technology— during a transition period.[6]

Two system designs denoted TDMA and CDMA were developed to meet these needs.[7] TDMA was the less complex of the two systems and was developed first. CDMA was more complex but promised significantly greater spectrum efficiency. When the technologies entered the market, some cellular carriers chose TDMA, some chose CDMA, and some first chose TDMA and later converted to CDMA. Roughly speaking, TDMA increased the maximum number of subscribers that a cellular system could serve

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5 Report and Order in Gen. Docket 87-390, 3 FCC Rcd 7033, October 13, 1988.

6 In addition, the FCC required cellular carriers to continue to support analog AMPS users. *See* 47 C.F.R. 22.901.

7 TDMA is the acronym for time-division multiple access; CDMA is the acronym for code-division multiple access. Both these acronyms are misleading in that TDMA and CDMA refer to basic technologies not specific system designs. For example, the GSM system uses TDMA technology.

by a factor of three over the AMPS standard; CDMA (as it was first introduced) increased that number by a factor of six.

As these technologies were being developed to relieve the spectrum shortage, the FCC was working to make more spectrum available for wireless service. As a first step, it made available 10 MHz of additional spectrum by increasing the two original cellular licenses from 20 to 25 MHz each—a 25% increase in capacity.[8] Later, the FCC created a new radio service, called PCS, and allocated 120 MHz (three times the original cellular allocation) of spectrum to the PCS service. PCS carriers were also given technical flexibility to choose the radio system technology that they wished to use. The first PCS system began operating in 1995, and others followed over the next few years.

Wireless was growing outside the United States as well. Initially, several service providers in Europe operated wireless systems using different, incompatible technologies. The incompatibility of these systems created great barriers to using wireless phones as one traveled around Europe. Consequently, in 1987 the European Union directed its member states to clear a common spectrum band for use by a digital cellular service and to move to adopt a single European technical standard.[9]

That standard, now known as GSM, was developed by the European Telecommunications Standards Institution (ETSI).[10] The first GSM systems went into operation in 1992 and GSM quickly became a commercial success.

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[8] Actually, the 25% increase in spectrum for cellular carriers increased capacity by more than 25% due to trunking efficiencies made possible by having more channels.

[9] "Council Directive 87/372/EEC of 25 June 1987 on the frequency bands to be reserved for the coordinated introduction of public pan-European cellular digital land-based mobile communications in the Community," Council of the European Community. Official Journal L 196, 17/07/1987 P. 0085 - 0086: Council of the European Community, 1987.

[10] The acronym GSM stands for Global Standard for Mobile Communications. Originally, GSM stood for Groupe Spéciale Mobile—the name of a committee formed by the Conférence des Administrations Européenes des Postes et Télécommunications (CEPT). CEPT was the pan-European intergovernmental agency dealing with telephone, wireless, and postal issues. With the massive changes in Europe, including privatization of many communications administrations, the expansion of the EU, and the fall of the Soviet Union, CEPT has been reorganized since the time of the original GSM committee. CEPT's standards activities have been moved to ETSI, and the service providers are no longer members, but the Russian Federation and several other nations that were part of the former Soviet Union are now members. The founding document for GSM, the *GSM Memorandum of Understanding*, was drafted by an official of the British government, and 13 of the 15 signatories were national governments.

As they began to design systems to operate in the new PCS spectrum made available by the FCC, firms could choose from three basic system designs—TDMA, CDMA, and GSM. Naturally enough, firms that were already operating cellular systems using TDMA or CDMA tended to choose to use their current cellular technology on their PCS systems. Recognizing limitations of TDMA, PCS firms that were new entrants to the wireless industry restricted their choices to CDMA and GSM.

Of course, technological progress and market growth did not stop when the PCS systems started operating in 1995. Rapid growth in the demand for wireless service continued to make the capacity constraints of limited spectrum a significant problem for some carriers. Demand for improved data services also prompted innovation. Both the GSM and CDMA sectors responded to these pressures with new technologies. The CDMA camp developed systems with names like IS-95B, 1xRTT, EV-DO, Rev-A, and Rev-B and is developing a new architecture known as UMB.[11] The GSM world used names like GPRS, EDGE, WCDMA, and HSPA for the systems they have deployed; they are currently developing a new system standard known as LTE.[12]

Figure 2 illustrates the family tree of the major wireless standards. Earlier systems are shown at the top; later ones below. The GSM and CDMA timelines are not intended to indicate that systems at the same level were introduced at the exact same date. Similarly, I have not tried to describe all the various quality and service innovations or to describe changes that occurred without a change in the name of the standard. It is important to note that these three technologies—CDMA, GSM, and TDMA—are mutually unintelligible; a CDMA receiver cannot pickup a GSM call and vice versa.[13]

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[11] Press Release, "Ultra Mobile Broadband (UMB) Selected to Describe Next Major Advancement in Mobile Communications," CDG, Hong Kong, December 5, 2006.

[12] See http://www.3gpp.org/Highlights/LTE/LTE.htm.

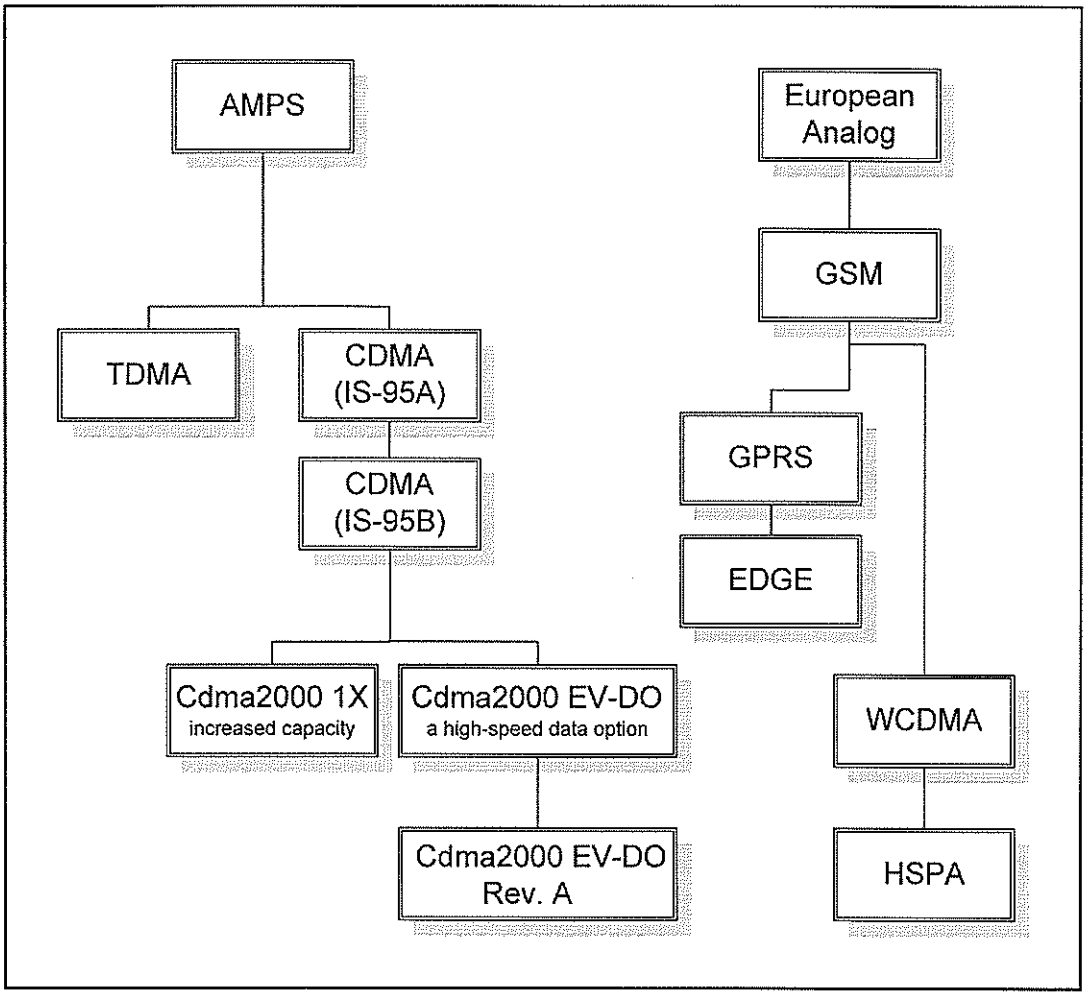

Figure 2. A Family Tree of Wireless Standards

As one moves down the family tree, one repeatedly finds an increase in voice capacity. IS-95 supports 6 to 10 times more subscribers than can AMPS in a given block of spectrum. The later-developed cdma2000 1X can support around twice as many subscribers as can IS-95. Thus, cdma2000 1X is from 12 to 20 times more efficient than AMPS. The early GSM systems were about 3 or 4 times more spectrum efficient than the earlier analog systems—current GSM systems are about 10 times more spectrum

[13] As integrated circuit technology has progressed, it has become possible to build chips that support multiple standards. For example, the QUALCOMM MSM7600 handset chip can communicate using CDMA, GSM, or WCDMA standards.

efficient. WCDMA is perhaps twice as spectrally efficient as later versions of GSM. The issue of spectral efficiency is terribly important to system operators—it determines the ultimate limit on the number of subscribers, and it is closely tied to the number of cell sites required—and thus to total network investment. Because spectral efficiency is so commercially important, it is hard to find objective measures of the capacity increases associated with a specific technology—nevertheless, the substantial growth of capacity over time is undisputed.

Handsets with cdma2000 1X capabilities can also operate on network equipment using the earlier CDMA technology, but the converse is not true—the earlier CDMA handsets cannot communicate using the 1X signals. Consequently, a wireless carrier that wants to exploit the superior efficiency of cdma2000 1X must undertake a complex transition of phasing in cdma2000 1X and phasing out the earlier version of CDMA.

I should note that another important standard wireless standard is used in North America. That is iDEN—the standard that was used by Nextel before the Nextel/Sprint merger and is now used by Sprint. This standard arose from a technical and regulatory history different from the others I have discussed. However, Nextel's network also evolved through generations of technology. That network began as an analog FM system. Later, Nextel expanded capacity by converting to the digital iDEN system. Improvements to iDEN, such as new vocoders, have further expanded capacity and improved quality.

One tool for phasing in new handsets is carrier provision of handsets with the new capabilities—the tying or bundling of handsets with service and carrier prohibitions on activating older technology handsets.

3. Handset Performance and Operating and Capital Costs

All wireless handsets use two shared resources to connect to the switched telephone network. These shared resources are the radio spectrum and the radio base station. So, for the reasons that I explain below, one person's use of a poor-quality wireless handset can impair the wireless service delivered to many others. Indeed, many shortcomings in wireless handsets affect the coverage and capacity of the wireless system. One subscriber's use of a poor-quality handset may cause another subscriber's call to be

blocked or dropped. It would be difficult or impossible for the typical consumer to see that such shortcomings were caused by faults in another subscriber's handset, rather than by faults in the network. At the same time, a consumer may not know or care if his or her handset creates external harms if that handset costs the consumer a few dollars less. That is, a consumer may not make the efficient tradeoff between the external costs created by his or her handset and the lower handset cost.

Wireless carriers are well aware of the tradeoff between handset and network capabilities. A senior manager with responsibility for handsets at Sprint told me, "We [the handset team] meet with network guys every three months just to look for network optimization possibilities."[14] Similarly, a senior manager at Cingular described the process whereby Cingular arrived at its "pretty stringent requirements on RF [radio subsystem] performance" saying "a lot of analysis went into the service calculation."[15] He described Cingular's explicit consideration of the tradeoff between investment in cell sites versus investment in handsets. The categories of handset performance that he mentioned in this context were receiver sensitivity, handset power, and use of the AMR vocoder.

3.1. Handset Attributes that Affect System Capacity

3.1.1. Receiver Sensitivity

The sensitivity of the radio receiver in the consumer handset is a good example of a handset feature that, if impaired, imposes costs on others. In CDMA systems, a base station transmits telephone calls to multiple subscribers using a single complex signal. That signal has fixed maximum power—typically near 20 watts. The base station divides that power among the various subscribers—transmitting to each subscriber at just above the minimum power needed to communicate with that subscriber. Base stations transmit at lower power to subscribers near the base station and at higher power to subscribers who are more distant or who are in hard-to-reach locations—such as deep inside

[14] Telephone conversation, 14 December 2004, Sprint.
[15] Telephone conversation , 15 December 2004, Cingular.

buildings.[16] The base station power assigned to each subscriber varies over time as the subscriber moves to locations with better or poorer reception.

The sensitivity of a handset is defined by the minimum power needed to receive an acceptable signal. Consider two handsets, A and B, identical in all respects except that handset B is less sensitive than handset A—specifically, handset B requires twice as much received power to perform acceptably. A CDMA base station designed to serve 20 simultaneous conversations to type-A handsets could serve only 10 simultaneous conversations to type-B handsets.[17] Looking at the problem another way, such a base station could serve 20 simultaneous conversations to type-B handsets only if those handsets were, on average, located closer to the base station. If one analyzes coverage using a simple and widely accepted model of radio propagation, one finds that a base station that could serve 20 type-A handsets spread over the area within 1 mile from the base station would be able to serve the same number of type-B handsets spread over an area about 30% smaller—the area within only 0.85 miles of the base station.[18] A wireless carrier could compensate for such a reduction in range by installing more base stations—in this case, approximately a 30% increase in base stations would be needed. Base stations, the backhaul equipment needed for each base station, and the termination of backhaul at the wireless switch comprise the bulk of the capital cost in modern wireless systems.[19] A 30% increase in the number of required base stations would, to a first approximation, result in a 30% increase in the capital cost of a wireless system and consequently would significantly increase the cost of wireless service.

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[16] Handset sensitivity in CDMA systems provides a particularly clear example of a handset feature that, if poorly implemented, reduces the network performance for other subscribers. However, in the GSM standard there are handset options, such as the AMR vocoder and SAIC, that if present and activated, permit a base station to serve more subscribers or subscribers at greater distances from the base station than would be the case otherwise.

[17] This example is simplified. Many CDMA systems are limited by capacity on the reverse (mobile-to-base) link not by forward link capacity. However, were the sensitivity impairments significant, forward-link capacity would become limiting. In the high-speed data service EVDO forward link capacity is often limiting.

[18] The analysis is based on using an inverse fourth-power propagation law. The reduction in spacing is actually by a factor of 0.8409.

[19] "Backhaul" is the transportation of wireless traffic from the cellular station to a mobile switching office from which it can be sent on to its destination.

The factor of two difference in sensitivity between the two handsets discussed above is not an unreasonable difference from the point of view of practical receiver engineering. In late 2004, CTIA, the wireless industry association, filed with the FCC reports of recent tests of PCS handsets performed by independent laboratories. These tests showed, among other things, that the tested handsets were on average, able to pick up signals a factor of two weaker than the weakest signals that could be picked up by a handset just meeting the requirements of the industry standard.[20]

Closely related to sensitivity is the quality of the antenna on a handset. A poor antenna degrades handset performance in much the same way as does reduced sensitivity. Similarly, given that retractable antennas often fail, a service provider requirement that retractable antennas be field replaceable would make it easier for consumers to repair handsets with broken antennas. Easier repair would mean that fewer consumers will have handsets with defective antennas that consume excessive network resources.

3.1.2. Vocoder Performance

Another handset feature that has a major impact on network capacity is the performance of the voice compression subsystem in the handset. This subsystem, known as the voice coder or vocoder, determines how many bits per second are generated to represent a speech signal. Continuing research has resulted in the development of vocoders that perform adequately using fewer bits per second than those originally used in CDMA and GSM. These better vocoders permit more subscribers to be served over a given number of radio channels. Better vocoders expand system capacity and, if better vocoders are sufficiently low cost, the widespread use of better vocoders would lower the total cost of wireless service. Alternatively, better vocoders can be used to deliver better voice quality without requiring increased network capacity. Matching vocoders are needed in handsets and the network—a new vocoder cannot be deployed in either the handset or the network alone.

[20] Test reports of WINLAB and PCTEST attached to the comments of CTIA in Docket ET 00-258, December 8, 2004.

The CDMA standard now includes vocoders called the Enhanced Variable Rate Coder (EVRC) and the Selectable Mode Vocoder (SMR).[21] Because these are variable-rate vocoders, the network can command the handset to reduce the number of bits that are used to encode speech. The widespread use of EVRC and SMR vocoders in consumer handsets gives network operators several valuable options. First, the network operator can expand network capacity in times of emergency or sudden overload, albeit at the cost of reduced voice quality. Second, the network operator can compensate for delays in network expansion, such as might be caused by difficulty obtaining the proper zoning for a new cell site or by extended bad weather. In an area of limited coverage, such as might develop after a brush fire destroyed the equipment at a cell site, the network could command subscriber handsets to reduce the network capacity each handset uses—thereby providing more capacity for others. The industry claims that the SMR vocoder increases system capacity by 34% while delivering the same quality as the EVRC vocoder.

The GSM world has a similar variable rate capability called the adaptive multirate (AMR) vocoder. The AMR vocoder permits a carrier to serve mobiles at greater distance from a cell site or deeper inside office buildings than would otherwise be possible. The outcome is, all other things being equal, that use of the AMR vocoder expands capacity of a GSM system.[22]

A Cingular manager told me, "The transformation from TDMA [to GSM] required less investment in the network than it would have had we not incorporated AMR." He characterized an operating environment without AMR as generating "a huge hit on capacity."[23]

Closely related to the variable rate concept is the discontinuous transmission concept—the engineer's way of referring to handsets that turn off the transmitter when the user is in a conversation and is only listening but not talking. Shutting off the handset transmitter in such situations not only extends battery life but reduces the interference that the

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21 See http://www.cdg.org/technology/cdma_technology/vocoder/index.asp.

22 Nortel claims that use of AMR gives a 100% increase in spectrum efficiency in dense urban deployments. See http://www.nortel.com/solutions/wireless/collateral/nn114180.pdf at p. 2.

23 Cingular conversation cited above.

handset generates to other users on the system. GSM handsets with discontinuous transmission expand system capacity.

3.1.3. Concluding Thoughts

Receiver sensitivity and vocoder performance are two handset attributes that directly substitute for network investment. Reduced receiver sensitivity reduces the transmission range from base stations—and requires more base stations for equivalent coverage. Vocoders that squeeze a conversation into half as many bits per second double the number of conversations that can fit into a wireless system—or cut in half the electronics required at the base station. Investments in improved receiver sensitivity and vocoder performance are direct substitutes for investment in network physical infrastructure.

3.1.4. Other Handset Attributes that Affect System Capacity

Handset sensitivity is not the only handset characteristic that affects the amount of system resources that a handset will consume.

Tables 1 and 2 list some handset attributes (including receiver sensitivity, which I discuss above) that, if less than optimum, cause the handset to consume excessive system resources and thereby to reduce the wireless system's capacity or coverage. Table 1 considers attributes that affect capacity on the base-to-mobile communications link—what is often called the *downlink path*. Table 2 lists attributes that affect capacity in the reverse direction—the mobile-to-base or uplink path. These lists are not exhaustive—other attributes affect capacity as well—but these lists highlight major capacity-related attributes.

Table 1. Handset Attributes that Consume Base Station Downlink Resources

Attribute	Observations
Receiver sensitivity	A receiver's sensitivity is a measure of the minimum signal strength required to operate effectively. The transmitted power required at the base station is directly related to the sensitivity of the receivers in the handsets.
Immunity to adjacent channel interference	Wireless handsets must distinguish the desired signal from others on nearby frequencies. For example, a Verizon Wireless subscriber may operate her handset near a Sprint base station. When handsets with poor adjacent channel immunity are in the presence of a strong adjacent channel, they require more of the limited downlink power from the base station.
Immunity to co-channel interference	Multi-user detection (MUD) and smart antenna technologies permit radio receiving systems to reduce the impairments caused by interference. Pilot-interference cancellation (PIC) in EV/DO and single-antenna interference cancellation (SAIC) in GSM are such technologies.
Ability to withstand inband overload	This problem is similar to the adjacent channel problem.
Intermodulation	Radio receivers can degrade or fail when multiple unwanted signals are present. The unwanted signals combine, through a process call nonlinearity, to create an interfering signal. A handset that was abnormally prone to intermodulation problems could fail to work properly when being operated near other handsets. A perceptive user might notice that the problem occurs when near other handsets and consider those handsets the source of interference when, in fact, the true cause of the interference arose was the poor performance of the user's own equipment.
Handoff performance	Wireless handsets automatically switch from one cell to another cell as the handset is carried from the service area of one cell to that of a second cell. A handset that does not perform its tasks in the handoff process will require excessive power from one or the other of the base stations.
Out-of-band emissions	Wireless handsets contain both transmitters and receivers. The transmitters in wireless handsets generate relatively strong signals in the band of frequencies used for mobile to base communications. But, handset transmitters also emit weak signals in the bands that are used for communication from the base to the mobile unit. If such unwanted emissions were sufficiently strong, operation of a handset would degrade or prevent operation of other handsets nearby. The FCC's rules for such emissions permit signals a million times stronger than are permitted by the relevant industry standard

Table 2. Handset Attributes that Consume Base Station Uplink Resources

Attribute	Observations
Power control accuracy	CDMA-based wireless systems require that mobile handsets control their transmitted power with great care. Indeed, the highly accurate power control needed for CDMA was once regarded as an insurmountable barrier to the development of practical CDMA systems. If handsets exhibit poor power control, the capacity of the base station is reduced.
Power control range	Handsets that operate near base stations must be able to turn their transmitted signal down so that it does not create excessive interference to the signals of other handsets transmitting to the same base station. One large CDMA carrier requires that handsets be able to reduce the transmitted power to 10 billionths of a watt. A less capable handset would reduce the uplink capacity of a wireless system when it was operated close to a base station.
Modulation quality	If a handset generates a poor quality signal—one that does not clearly separate the ones and zeros transmitted—the handset will have to transmit at a higher power to compensate for the signal quality impairment. But, that handset's higher power will require other handsets to transmit at a higher power as well. Handsets near the edge of the cell, already operating near or at maximum power, will be unable to raise their power high enough to maintain contact with the base station. So such calls will be dropped or never completed.
Frequency accuracy	The effects of poor frequency accuracy in handsets are similar to those caused by poor modulation quality.
Timing accuracy	The effects of poor timing accuracy in handsets are similar to those caused by poor modulation quality.

One should note that the first cellular technology used in the United States, AMPS, did not have as tight a link between handset quality and system capacity as do current systems. Indeed, to a first approximation, in that early technology system capacity was independent of handset quality. Unlike modern CDMA systems that serve multiple subscribers from a single transmitter/receiver pair, those early systems used a separate transmitter and receiver for each conversation. Transmitting more power to one handset did not diminish the power available to other handsets.

Modern wireless handsets often support web browsers and other connections to the Internet. Many of the standard rules for communicating over the Internet were designed

under the assumption that communications capacity was relatively plentiful and inexpensive—consequently, standard Internet communications often contain substantial redundancy. Recognizing that this assumption is not always appropriate, the Internet standards community developed add-on capabilities that permit more efficient use of the communications links at the expense of additional processing in the handset and the network. Probably the most well-known of these is Van Jacobson header compression, but there are several others.[24] Requiring these features in a handset lowers the handset's use of network resources.

3.2. Handset Attributes that Affect Service Quality

Many of the capabilities or attributes of handsets affect not only the efficiency of the network but also the quality of the service delivered to subscribers. For example, a handset with poor sensitivity will lose calls at locations where a phone with better sensitivity could continue the conversation. Similarly, speech delivered by a handset with a poor voice coding subsystem (vocoder implementation) or a low-quality speaker will not sound as good as speech delivered by a higher quality handset.

[24] V. Jacobson, "RFC 1144 - Compressing TCP/IP headers for low-speed serial links," IETF 1990.

Table 3 lists some handset impairments that consumers would find difficult or impossible to separate from network shortcomings.

Table 3. Handset Impairments that Mimic Network Shortcomings

Handset Impairment	Observations
Reduced sensitivity Poor immunity to adjacent channel interference Insufficient ability to withstand inband overload Excessive intermodulation Poor handoff performance	These impairments reduce the handset's ability to receive signals from the base station.
Limited output power Poor modulation quality Reduced frequency accuracy Reduced timing accuracy	These impairments reduce the handset's ability to send signals to the base station.

The entries in Table 3 are based on those in Tables 1 and 2. Note that some of the handset impairments listed in Tables 1 and 2, such as out-of-band emissions, do not have a counterpart in Table 3. That is, some handset impairments that harm other consumers or consume system resources have no direct negative impact on the user of the impaired handset. Table 3 provides examples, not a comprehensive list, of possible impairments in handsets that can affect the quality of the service delivered to the user of that handset.

3.3. Difficulties Distinguishing Poor Handsets from Poor Networks

Consumers are unable to distinguish between many handset limitations (such as poor sensitivity or weak uplink power) and related network limitations (such as poor coverage). The symptoms of these particular network and handset impairments are

exactly the same—dropped calls, regions of poor or no service, and poor voice quality on a call. Because consumers cannot readily distinguish between network weakness and handset shortcomings, consumers with poor handsets may mistakenly blame service providers for the resulting poor service. Wireless carriers concerned with protecting their reputation have an incentive to control the handset used by their subscribers.

Wireless service is a new service—still in the process of rapid technical evolution. Furthermore, because the number of subscribers and their use of the service continue to grow at a rapid rate, wireless service providers are constantly building out and upgrading their networks. The wireless transmission facility—the radio paths to and from the base station—is created, in part, by the handset. Unlike the case in wired telephone service, the consumer cannot replace a handset with different handset in order to test the line. With wireless, the handset and the line are physically integrated—the handset is a fundamental part of the line.

Handsets affect service quality in another way as well. Customers often call their wireless carrier for assistance in configuring their handsets or in dealing with service features. A customer using a handset that the helpdesk staff is not familiar with or does not have information on in their databases would pose unusual and difficult challenges—especially if the customer were trying to use one of the less-common features. As I recount in Section 10 below, experience shows that carriers have encountered substantial difficulties providing support to unfamiliar handsets.

4. A Large Carrier's Handset Qualification Process

The impairments listed above are not just theoretical. Wireless carriers test handsets before approving them for use on their networks. For example, one large carrier disclosed to me their extensive (and expensive) process for testing new handsets. That process consists of four phases plus a preapproval workup by the manufacturer.[25] *Phase I* is parametric testing. The handset is tested in a lab to ensure that it conforms to the industry standard or to the carrier's own standards. For example, the carrier subjects the GPS portion of handsets to a standard that is somewhat more exacting than the industry

[25] Telephone call, 3 November 2004.

standard. I was informed that the carrier, for example, "move[s] the benchmark when we know it is achievable on a routine basis."[26] Handsets are also tested to ensure that they work properly with base station equipment from the carrier's primary suppliers.

Phase II is the testing of the advanced features—such as web browsers, short message service (SMS or text messaging), multimedia messaging service (sending photos from a handset), and measuring data throughput.

Phase III is field interoperability testing. Handsets are operated in the field in the coverage area of base station equipment from each vendor in areas of good coverage and bad. All features are exercised.

Phase IV is selected user testing. Around 30 to 40 handsets are sent to various employees. The employee uses the handset and notes problems and useful features. The handset acceptance team then reviews these staff member comments.

Summing up, this carrier puts substantial effort (and makes its vendors engage in comparable effort) to ensure that the handsets it provides to its subscribers perform properly. The tested attributes include various tests of all of the handset attributes listed in Tables 1 and 2.

5. Network Standards Evolution

As described above, wireless service providers have used multiple standards—AMPS, TDMA, CDMA, iDEN, and GSM—and have had to upgrade their systems as the standards have adopted new features. In several cases, carriers have had to transition their systems from one standard to another.

5.1. AMPS–TDMA–GSM–WCDMA–HSPA Evolution in the United States

Between 1993 and 1996, a U.S. wireless carrier that faced capacity constraints requiring a digital solution had only one choice—TDMA. Consequently, several wireless carriers, most notably SBC and AT&T, adopted the TDMA technology and spent billions of dollars on TDMA network equipment in order to expand capacity and service.

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[26] Ibid.

As time passed, it became clear that TDMA would soon turn into a technological dead end. It possessed no clear advantages over the somewhat similar GSM standard or over the CDMA standard. On a global basis, GSM was far more widely used. The legal requirement in the European Union limiting cellular to GSM had, naturally enough, led to widespread use of GSM in Europe. That widespread use helped push the cost of equipment down. Other nations around the world also adopted GSM—in 1997, about 60% of all digital wireless users in the world were using GSM, and there were 70 million GSM users versus 6 million TDMA users.[27] Clearly, the combined effects of economies of scale in handset and infrastructure production along with the much stronger incentives for manufacturers to invest in research and development for GSM gear made it clear that GSM would continue to run away from TDMA.

Given both the similarities between TDMA and GSM and the fact that a multiband GSM handset could be used around the world, it was quite reasonable for wireless firms using TDMA to decide that they would convert their networks to GSM. Certainly, it would have been unreasonable to decide to stay with TDMA indefinitely. Consequently, the major TDMA carriers in the United States decided to transition their networks to GSM.

Obviously, changing a network from one technical standard to a different standard is a difficult and massive activity. At the beginning of the change from TDMA to GSM, service to current customers, with their TDMA-only handsets, has to be maintained, but new customers must be provided with handsets that can operate properly after the switchover is complete. TDMA network infrastructure must be phased out, and GSM network infrastructure phased in. Such changes are made more complicated by the limited radio spectrum available to wireless carriers. In most communities, a wireless carrier would have lacked the radio channels needed to build a complete new GSM system that could be run in parallel with the existing TDMA system. Rather, it would have been necessary to fit the new GSM system into the same spectrum used by the TDMA system. Then, over time the GSM system would have grown and the TDMA

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[27] *GSMA Statistics Q2 2004*: GSM Association, 2004.

system would have shrunk. Finally, at some date, perhaps long after the transition had begun, the remaining elements of the TDMA system could be turned off.

The TDMA carriers faced a difficult transition. A key building block in such a transition was a dual-mode phone that could operate under both the TDMA and GSM standards. Such a phone could be sold to new subscribers in TDMA markets. It would immediately allow TDMA subscribers to roam into both GSM and TDMA markets. And, once a significant fraction of subscribers in a TDMA market had such handsets, that market could be partially converted to GSM operation and those subscribers with dual-mode handsets could be switched to the new GSM equipment. When the carrier had sufficient GSM capacity, new subscribers could be provided with GSM-only handsets. In a few more years, when the bulk of subscribers had GSM-capable handsets, the use of the TDMA network could be phased out altogether.

A wireless carrier facing such a transition must put in place a mechanism that ensures that new subscribers buy dual-mode TDMA/GSM handsets. Such handsets would necessarily be more complex and expensive that TDMA-only handsets of comparable capability.[28] During the transition, a carrier would be technically capable of activating a TDMA-only handset. But activating a TDMA-only handset would often create problems for the consumer and the carrier at a later time.

In the United States, the carrier-assisted transition from TDMA to GSM has generally been a success—and has now entered the endgame. In July 2006, Cingular announced that it would impose a fee of $5 per month on subscribers who use the older TDMA and analog handsets.[29] By the time that Cingular made this announcement, more than 90% of their users used GSM handsets.

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[28] Note that the expense of such dual-mode phones would not only be driven by the additional complexity—it would also be driven by the limited demand because the only customers needing a dual-mode capability would be carriers transitioning from TDMA to GSM.

[29] See "Cingular Adds Surcharge For Old Phones: Monthly Bill to Increase by $5 for Customers without GSM Signal," CBS News, August 1, 2006. Downloaded from http://www.cbsnews.com/stories/2006/08/01/business/main1854442.shtml.

5.2. The General Case

The transition from TDMA to GSM is a case study of a more general problem that is continuously faced by all U.S. wireless carriers—that problem is the need to manage the transition from one generation of technology to the next generation. All cellular carriers had to shift from analog to digital (a process that is not yet quite complete). Today, wireless carriers face the problem of moving from second-generation systems (GSM, CDMA) to third-generation systems (UMTS/WCDMA, cdma2000). And, fourth-generation system designs (LTE, UMB) are on the horizon. Providing customers with a mix of dual-mode handsets is an important tool in such a transition.[30]

Consider a hypothetical network technology upgrade with the following characteristics:

- The new technology doubles the capacity (number of simultaneous calls) that can be served at each cell but does not otherwise affect service—consumers see no difference is call quality, coverage, or any other service feature if they use a new-technology handset.
- The new technology is backwards compatible with the existing network.
    - Old-technology handsets work with new technology cell sites but without the efficiency gain.
    - New-technology handsets work with old technology cell sites.
- The new technology can be installed one cell at a time.
- The new technology requires new handsets.

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[30] It should be noted that some nations have not permitted wireless carriers to move from one generation of technology to the next within their licensed spectrum. Rather, carriers in a specific band are locked into a specific technology. See http://www.ofcom.org.uk/radiocomms/ifi/licensing/classes/broadband/cellular/celltelinfo.pdf for a statement of the U.K. policy limiting technology in the bands used for GSM. That U.K. policy derives from an E.U. policy directive which is now being questioned. For example, in February 2007 the Commission of the European Communities referred to the restrictions on the GSM bands saying "issues surrounding the introduction of 3rd generation mobile services and the continuing restrictions in the GSM Directive call for action." (CEC COM(2007) 50 at p. 11)

The more rigidly a nation controls the technology used in wireless, the weaker become the arguments for carrier control of handsets used with the carrier's network. At the same time, such rigid controls undercut the innovation process. It should be no surprise that the CDMA technology underlying all 3G system designs was developed under the flexible regulatory regime in the United States. Part of the funding for the original development of CDMA came from Pacific Telesys (PacBell mobile), a wireless carrier that was facing capacity limits in its Los Angeles system. See *Irwin Mark Jacobs Oral History*, Computerworld Honors Program, March 24, 1999 at p. 27. Available at http://www.cwhonors.org/archives/histories/Jacobs.pdf.

This technology will allow a carrier to expand its network without building additional cell sites or purchasing more spectrum. Rather, the carrier can install the new technology in cells that are congested at the busy hour and can migrate the customers who use those cells to new-technology handsets.

But, note that individual consumers have no incentive to buy new-technology handsets—the service delivered to new-technology and old-technology handsets is exactly the same. If it is the case that (1) the adoption of new-technology base stations and handsets is the efficient way to expand network capacity and (2) new-technology handsets are more expensive than old-technology handsets, the efficient network/handset choice will not be made unless the carrier provides an incentive to consumers to use the more efficient handset technology. The usual theory of congestion pricing teaches that service price is one such incentive—the carrier could offer discounts to users who used the new-technology handsets in locations served by new-technology base stations during peak times.[31]

A far simpler approach is for the carrier to subsidize the sale of new-technology handsets to those who are likely to make many calls in the areas served by the new-technology base stations. This allows the carrier to avoid any feeling of unfairness—new and old subscribers pay the same for their calls—but the carrier and its customers reap the benefits of the new technology.[32] Handset subsidies together with the refusal to activate handsets from other sources are effective tools carriers can use to ensure rapid consumer adoption of new-technology handsets.

5.3. Better Quality Voice Connections

The quality of a voice call consists of two major elements—how good the call sounds and how likely it is that the call will suffer an interruption or be dropped by the network. The first generation of CDMA did not improve speech quality significantly over the earlier

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[31] For an overview of congestion pricing in a communications network see "Pricing congestible network resources," MacKie-Mason, J. K., and Varian, H. R., *IEEE Journal on Selected Areas in Communications*, Sept. 1995, Vol. 13, No. 7, pp. 1141–1149.

[32] Note that, when the new technology reduces network congestion or permits service at lower cost than would otherwise be the case, even the users of the old technology can benefit. That is, a subsidy for

analog AMPS system. CDMA eliminated problems with hearing a second conversation in the background but, in some circumstances, CDMA voice quality was slightly inferior to that of the AMPS system. However, CDMA introduced a new technology, called *soft handoff,* that improved coverage at the edge of cells and substantially reduced the chances that voice quality would be degraded or the call lost as calls were handed off from one base station to another. An improved version of CDMA (known as IS95B) introduced higher-quality voice processing. Some years after the initial deployment of GSM, GSM adopted new vocoders that provide both better speech quality and important coverage and capacity options.

Most such system innovations, for example, improved voice processing, can be put in place only when new handsets embodying the new technology are in use by consumers and when carriers make matching investments in the network. But, consumers have little or no incentive to buy handsets with these capabilities until the matching investment is in place. However, a carrier—concerned about competitiveness and brand value—may wish to subsidize handset capabilities today in order to gain future benefits.

Similarly, introducing a new network service creates a dilemma for the service provider. No one will spend extra money to buy terminals with the capability of using that service until they understand the service and it is available. No single subscriber has the incentive to go first on networked services such as text messaging. Tying, bundling, and handset subsidies are a tool for speeding the adoption of such innovations.[33]

5.4. Handset Evolution and Network Evolution

Although handsets and wireless networks are tightly linked elements of a single system, they have quite different cost characteristics. Handsets are electronic systems—made up of a display, enclosure, battery, keyboard, antenna, and electronics. Such systems can follow the cost/performance curves made possible by Moore's Law. Figure 3 shows the

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Alice's phone which induces her to adopt more efficient technology can lower the cost of service to Bob or increase the quality of Bob's service.

[33] The classic reference on the adoption of technologies and services with such network effects is "A Theory of Interdependent Demand for a Communications Service," Jeffrey Rohlfs, *Bell Journal of Economics*, The RAND Corporation, vol. 5(1), pages 16-37, Spring.1974. Since then a substantial literature has grown up analyzing such problems.

drop in the cost of a low-end GSM handset from 1995 to 2007. In contrast, wireless networks include major cost elements, most importantly the towers and enclosures at cell sites and the cost of cell-site rental, which do not follow Moore's Law. Data collected by CTIA shows that the cost of wireless network infrastructure has stayed relatively steady over time. Figure 4 shows the capital investment per subscriber in the United States wireless industry for the period 1994 to 2004.[34]

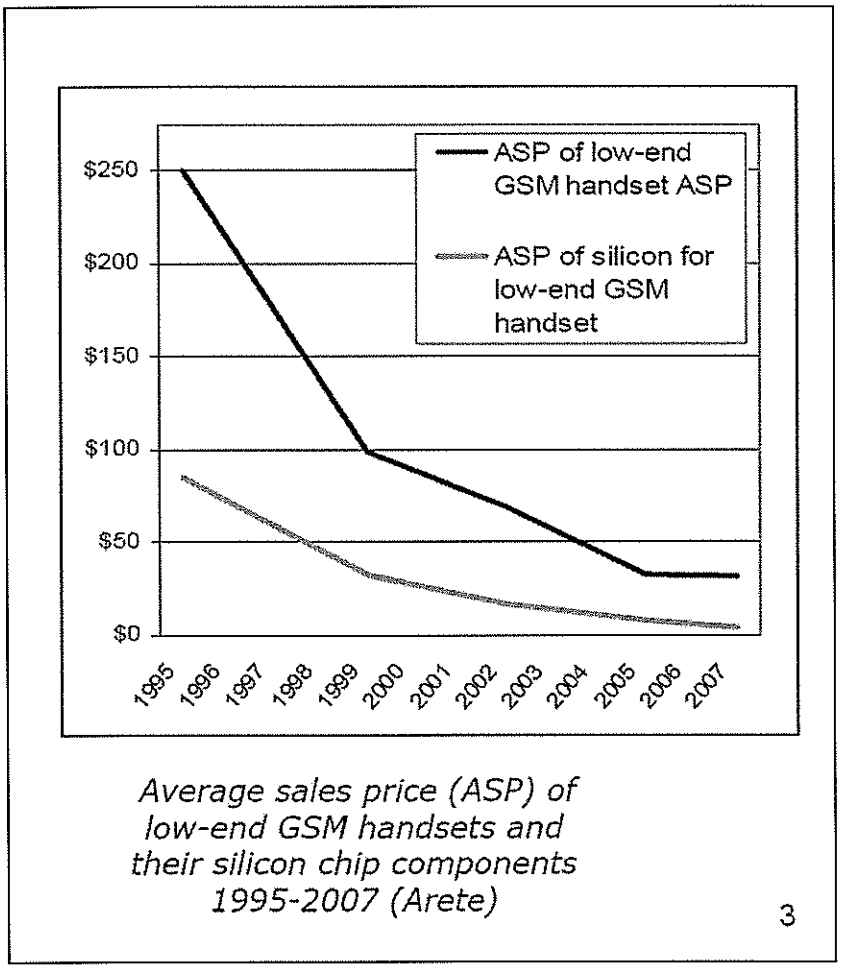

Figure 3. GSM Handset Price Evolution[35]

[34] The data for this chart were taken from Table 81 of *CTIA's Wireless Industry Indices*, Mid-Year 2006 Results, R. F. Roche and J-P Edgette, CTIA, November 2006.

[35] Source, "Benefits of Frequency Harmonization," presentation by Fred Christmas to the ITU Workshop on Market Mechanisms for Spectrum Management, January 2007, Geneva. Available at

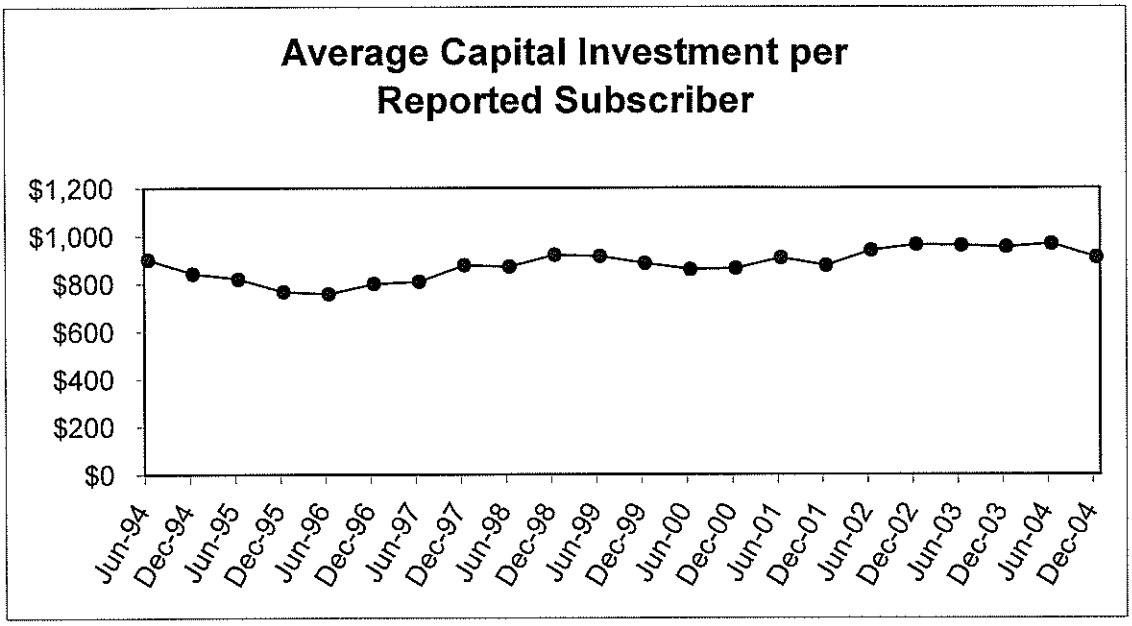

Figure 4. Average Wireless Capital Investment per Subscriber over Time

But, Moore's Law works in two ways in wireless handsets. Improvements in electronics push down the cost of building a handset meeting any given standard. But, such improvements in electronics also make possible the use of more complex signal processing in handsets—thereby permitting more efficient use of the radio channel. Increases in complexity lie at the heart of the spectrum efficiency gains that have occurred as each new standard has been adopted.

Even though the radio electronics in the handset account for only a small portion of the total cost of wireless service, those electronics control the productivity of the parts of the network that do not follow Moore's Law. Evolution of the handset is an essential element in the evolution of wireless service. Efficiency is served when some of the

http://www.itu.int/osg/spu/stn/spectrum/workshop_proceedings/Presentations_Abstracts_Speeches_Day_1_Final/ITU%20worshop%20jan%2007%20v2%201+%20FAC%20comments%203.pdf

Moore's Law progress in the handset is used for capacity and quality expansion of the entire network, not just for lower handset costs.

6. Supporting Complex New Service

6.1. The Complexity of Modern Handsets

As wireless handsets become more complex, they begin to rival personal computers in capability and complexity—some handsets have full keyboards, built-in cameras, and voice control options, and can run Microsoft Word and Outlook.

Providing customer support to such complex devices is substantially more difficult than providing comparable support to simpler handsets. Expecting a wireless carrier to be able to provide customer support to unknown wireless handsets is no more reasonable than expecting the help desk at Apple Computer to be able to support Dell and HP computers. Sprint informed me that they work to put in place handsets containing a standardized user interface.[36] Such a standardized interface would simplify consumer difficulties with new handsets, reduce help-desk costs, and might create a differentiated product attached to the Sprint brand name.

An incident related to me by a CDMA carrier illustrates the nature of the difficulties that can be created by such devices.[37] A customer had a Kyocera 3250 handset originally used on ALLTEL's wireless network. The customer brought that handset to one of another carrier's retail outlets, and the handset was activated for use on that carrier's network. The carrier soon discovered that this handset was generating an abnormally large volume of text messages. The information provided to me by the carrier did not explain how the carrier discovered the high traffic volume from this handset—perhaps the carrier noticed an abnormal traffic pattern or perhaps the user complained about an abnormal bill! Investigation showed that the handset had originally been set up to use ALLTEL's "touch-to-talk" service. As part of designing that service on its network, ALLTEL had programmed the handset to regularly send text messages to a computer that provided part of the service. Activating this handset on the other carrier's network created unexpected

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36 Personal communication, April 18, 2007.

37 Telephone call, November 2004.

side effects that burdened both the subscriber and the new carrier—imposing costs all around.

Wireless web browsers provide a second illustration of the types of problems that are created when handsets optimized for one network are activated on a different network. The senior manager at Cingular told me details of two instances in which problems created by the activation of such outside handsets had come to his attention, the first of which involved the wireless web. There is a standard form of simplified web browsing capabilities optimized for wireless called the wireless application protocol (WAP). Cingular has encountered major problems with the WAP settings on handsets from other networks. In some cases, key IP addresses were embedded in the software and could not be changed under any circumstances. The problem was sufficiently complex and hard to deal with that it was brought to the senior manager responsible for handsets. The costs that such difficulties impose on both the subscriber and the carrier are obvious.

The other matter that manager recounted involved T-Mobile handsets that had been activated on the Cingular network. Because T-Mobile's network operates exclusively on radio channels in the PCS band, most T-Mobile handsets operate only in the PCS band (1900 MHz). In contrast, Cingular's network uses radio channels in both the PCS (1900 MHz) and cellular (850 MHz) bands. Former T-Mobile handsets operating on the Cingular network are restricted to the PCS band (1900 MHz) and incur roaming charges in circumstances in which a typical Cingular handset would not. This occurs because there are areas of the country where Cingular operates on only the cellular band (850 MHz). Thus, Cingular customers who activated T-Mobile handsets that work on PCS band (1900 MHz) are forced to roam when they are in areas where Cingular only offers cellular band (850 MHz) service. Such unexpected roaming charges lead either to customer dissatisfaction or to significant unwanted costs for the carrier—sometimes both. No matter what the final outcome, the mismatch of the T-Mobile-handset with the Cingular network imposes costs on both the consumer and Cingular.

These examples show how simple differences in the way that two different networks use the same handset model as well as mismatches between a handset's capabilities and a

network's capabilities create problems that impose significant costs on subscribers and service providers. Bundling and tying are tools to avoid such costs.

6.2. Meeting the FCC's 911 Rules

The FCC's 911 rules require wireless carriers (1) to provide the location of wireless callers to the public safety agency receiving the 911 call and (2) to permit speech and hearing-impaired persons to use text communications devices, such as the TTYs that are often used by the deaf, to make 911 calls.[38]

The rule requiring such text communication capabilities arose from experience. The analog AMPS system was able to carry the tones generated by TTYs. Unfortunately, the early digital voice coders did not do so. This shortcoming spurred development of the FCC's current rules requiring such capabilities. Carrying such signals required compatible changes in the standards applying to both the network and the handset equipment. Existing handsets could not be easily changed to accommodate TTY signals, but new handsets could be built to support this important capability.

The FCC's 911 rules also require wireless carriers to be able to provide the location of the caller to the E911 public service access point. The regulations impose accuracy requirements on that location information. The FCC permits two alternative approaches to E911 location determination—network based and handset based. The largest CDMA carriers (Verizon Wireless, Sprint) use a handset-based technology, whereas the largest GSM carriers (T-Mobile, Cingular) use a network-based technology. The systems used by Sprint and Verizon Wireless are hybrid systems that combine network information with GPS data from the handsets to derive a location estimate. Higher-quality GPS receivers in consumer handsets reduce the need for network measurement capabilities. Higher-quality network measurement capabilities would reduce the need for handset GPS receiver capabilities.

From a technical point of view, E911 is another example of the tradeoff between network infrastructure and handset investment. Handsets with built-in GPS receivers are more

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[38] See 47 CFR 20.18.

expensive than handsets without GPS, but they provide useful location information—information that supplements whatever network measurements are made. I note that one large carrier requires handset manufacturers to provide handsets with GPS receiving capabilities that are better than those specified in the relevant industry standard.[39] Such higher performance handsets could compensate for other elements in the carrier's network design—and would be a factor in allowing the overall system comprised of the base-station radio equipment and the handsets to meet the E911 performance requirements that the FCC has imposed on wireless carriers.

The FCC rules prohibit a wireless carrier that has elected to use a handset-based solution from activating a handset that lacks a GPS receiver.[40] The FCC has made clear that wireless carriers, including resellers, are obligated to ensure that handsets offered to their customers support the relevant E911 location technology.[41]

In their 2004 SEC 10K, Verizon Wireless describes these FCC requirements saying,

> We must also meet separate Enhanced 911 rules that require us to sell new handsets that are capable of providing location information, and also to ensure that, by December 31, 2005, 95% of our "embedded base" of handsets have this capability. We may be required to subsidize the higher costs of Enhanced 911 capable handsets in order to achieve mandated penetration levels among our customers.[42]

Note that these 911 requirements for location capability and TTY compatibility are requirements imposed on the carrier and on the performance of the wireless carrier's service. But the carrier cannot meet these requirements unless the handsets used in its network have the necessary capabilities.

7. Fraud and Other Crimes

Weak security design and incomplete consideration of the various security threats to wireless systems have led to a variety of problems, including fraud, robbery, and widespread eavesdropping on wireless calls.

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39 Conversation cited above.
40 *See* 47 CFR 20.18(g)(iv).
41 See 47 CFR 20.18(h).
42 Cellco Partnership, SEC Form 10K, March 10, 2004 at p. 15.

7.1. Fraud

Fraud was a major problem in the early days of wireless.[43] The designers of the original first-generation analog wireless system in the United States omitted antifraud controls. Consequently, there were several relatively simple techniques for theft of service. In addition to the loss of revenue to the carriers and the problems created for consumers when fraudulent charges appeared on their bills, such fraud created significant problems for law enforcement because these theft-of-service technologies allowed organized crime to make telephone calls that law enforcement found were impractical or impossible to intercept. A few quotations show the extent of the problem that the susceptibility of AMPS phones to theft of service created for law enforcement. An article in the *United States Attorneys' Bulletin* states,

> *Cloned Cellular Telephones*
> A problem reaching epidemic proportions in South Florida, as well as in many other areas, is that of individuals cloning cellular telephones. Many times those individuals are involved in other illegal activities and the "cloned" phone might be the one you want to intercept. The problem arises where you are intercepting calls over a cellular telephone and, after your interception has begun, the phone usage changes and you believe the target telephone has been cloned. All of a sudden, you are intercepting persons who are not your targets. This may be heralded by a dramatically increased volume of calls. If your targets themselves generate a large volume of calls, or if several targets use the same telephone, the situation can become confusing.[44]

In 1997, the FBI's John Navarrete testified to the House Judiciary Committee,

> First, the cloning problem could be dramatically reduced if cellular telephone manufacturers were required to produce cellular telephones that are not so easily reprogrammable. If one considers the matter, there is no need for cellular telephones to be reprogrammable outside of authorized company service centers. Law abiding cellular telephone users are not constantly reprogramming their cellular telephones nor do they want to; it is only the criminal community that is engaged in this activity.[45]

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[43] D. G. Park, M. N. Oh, and M. Looi, "A fraud detection method using IS-41C protocols and its application to the third generation wireless systems," IEEE Globcom1998 Conference Proceedings, pp. 1984-1989. D. E. Denning and W. E. Baugh, "Hiding Crimes in Cyberspace," Information, Communication and Society, vol. 2.

[44] *United States Attorneys' Bulletin,* September 1997.

[45] Statement by John Navarrete, Deputy Assistant Director Federal Bureau of Investigation, Sept 11, 1997. House Judiciary Committee.

During the question and answer after his prepared testimony, Mr. Navarrete responded to a question from Crime Subcommittee Chairman McCollum by stating that the technology was available to prevent such behavior. Here are Mr. Navarrete's answer and the follow-up from Chairman McCollum:

> Mr. NAVARRETE. Well, I concur with my colleague and I would like to maybe put—because of the advances in technology, I would like to put the onus maybe on the manufacturers because they are the ones that I think ultimately control it and I think that the technology is there today that we can make these new phones where they could not be cloned.
> Mr. MCCOLLUM. Right. What you are saying is that you believe the phones themselves could be manufactured in a way that they could not be cloned. Does the FBI, Secret Service, of DEA have any scientific studies that would provide a basis for that assertion?
> Mr. NAVARRETE. Yes. We have those studies and, if you like, I can get the information to you.[46]

About the same time, two academics wrote,

> *Cellular Phones and Cloning*
> Drug lords, gangsters, and other criminals regularly use "cloned" cell phones to evade the police. Typically, they buy the phones in bulk and discard them after use. A top Cali cartel manager might use as many as 35 different cell phones a day (Ramo 1996). In one case involving the Colombia cartel, DEA officials discovered an unusual number of calls to Colombia on their phone bills. It turned out that cartel operatives had cloned the DEA's own number! Some cloned phones, called "lifetime phones," hold up to 99 stolen numbers. New numbers can be programmed into the phone from a keypad, allowing the user to switch to a different cloned number for each and every call. With cloning, whether cellular communications are encrypted may have little impact on law enforcement, as they do not even know which numbers to tap.[47]

Thomas A. Constantine, Administrator of the Drug Enforcement Administration, testifying before the Senate on International Organized Crime, stated,

> Colombian drug traffickers continually employ a wide variety of counter-surveillance techniques and other tactics, such as staging fake drug transactions, using telephones they suspect are monitored, limited-time use of cloned cellular telephones (frequently a week or less), limited-time use of pagers (from 2 to 4

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46 Ibid.

47 "Hiding Crimes in Cyberspace," Dorothy E. Denning and William E. Baugh, Jr. July 1999 *Information, Communication and Society,* Vol. 2, No 3, Autumn 1999, also in *Cybercrime,* B. D. Loader and D. Thomas (eds.), Routledge, 1999.

weeks), and the use of calling cards. Colombian organized crime groups continue to show an active interest in acquiring secure communications capabilities.[48]

7.2. Antifraud and Anticloning Options

The lack of security in early wireless handsets created significant problems for both the carriers and law enforcement. However, wireless subscribers strongly prefer security solutions that are user friendly—nobody wants to enter in a password after dialing each call. In the mid- to late 1990s, manufacturers and service providers, working by themselves and working together in industry standards groups, developed a variety of antifraud and anticloning methods that are both effective and reasonably user friendly.

These methods were developed in the context of substantial fraud and law enforcement's concern regarding cloned wireless handsets. Uniform standards were required in order to support roaming services and to permit efficient mass production. Three problems were of significant concern to the industry: (1) preventing cloning, (2) providing simple yet secure service and call authorization, and (3) providing a mechanism to permit handsets to be used only with specific networks. In addition, there was concern about providing secure voice and data communications for users.

Developing good security for wireless has turned out to be a difficult task. Such systems are subject to substantial attacks. The attackers are not just teenage hackers with nothing else to do. The security of a widely used public system is often subject to scrutiny from academics and other security professionals.[49] In 2000, two computer science professors from the Weizmann Institute and one from the University of California published an article describing how to break a major wireless security system.[50] Similarly, in 2002, three IBM researchers, together with a scientist from the Swiss Federal Institute of Technology, published an article titled, "Partitioning Attacks: Or How to Rapidly Clone

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[48] Statement by Thomas A. Constantine Administrator, Drug Enforcement Administration, Before the Senate Foreign Relations Committee, Subcommittee on the Western Hemisphere, Peace Corps, Narcotics, and Terrorism Regarding International Organized Crime Syndicates and their Impact on the United States, February 26, 1998.

[49] For example, consider the analysis of voting machines by security professionals. See "Analysis of an Electronic Voting System," T. Kohno et al., *IEEE Symposium on Security and Privacy 2004,* IEEE Computer Security Press, 2004.

[50] A. Biryukov, A. Shamir, and D. Wagner, "Real Time Cryptanalysis of A5/1 on a PC," presented at Fast Software Encryption'00, New York, New York, 2000.

Some GSM Cards."[51] At the same time that academics were studying these systems from the point of view of security engineering, others were attempting to penetrate these systems in order to engage in various forms of illegal behavior.

7.3. SIM Cards

The GSM standard includes a feature called the *subscriber identity module card* (SIM card), which is a small printed circuit card that contains the information specific to the subscriber's account such as the subscriber's phone number and the identification codes needed to access the network. The SIM card can be removed from one handset and inserted into a different handset. A subscription to GSM wireless service is linked to the SIM card, not the handset. If Alice puts her SIM card in Bill's handset and makes a call, Alice is charged for the call. If Carl steals Diane's handset and puts his SIM card in it, Carl can make calls on his account with no further action.

I believe that the concept of the SIM card originated early in the development of the GSM standard at a time when portable handsets were not yet feasible for GSM. In a world without portable wireless phones, such a card would be a useful tool for travelers. For example, a SIM card would permit a traveler to use a wireless phone built into a taxicab or train or to use a wireless payphone as if it were the traveler's own phone. In today's world of portable handsets, the SIM concept offers less value than it would in a world in which wireless phones are built into automobiles.

The experience in Great Britain, where for several years essentially all handsets have been GSM handsets with SIM cards, gives further insight into the role of handset locking and related techniques in crime prevention and law enforcement. By the late 1990s or early 2000, handset robbery had become a significant problem in Great Britain. A 2003 study by the Home Office of robbery in Great Britain contained the text shown below.[52]

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[51] J. R. Rao, P. Rohatgi, H. Scherzer, and S. Tinguely, "Partitioning attacks: or how to rapidly clone some GSM cards," Proceedings. 2002 IEEE Symposium on Security and Privacy, 2002, pp. 31- 41.

[52] J. Smith, "The nature of personal robbery," Home Office Research, Development and Statistics Directorate, London, UK January 2003.

Mobile phones and personal robbery

Mobile phones have become a staple of modern day living and it was perhaps inevitable that they would become an attractive target for theft and personal robbery. A separate report has already been published (Harrington and Mayhew, 2002), which examined the problem of mobile phone theft and robbery, using a combination of police force data and some of the local level BCU data gathered from this research.[26] As the authors point out, unravelling the contribution of mobile phones to robbery is a complicated task.

Figure 5. Quotation from a Home Office Research Study 2003

That study demonstrated that theft of mobile phones was a pervasive problem. Figure 6, also taken from that study, shows that on average 43% of personal robberies in Great Britain involved a mobile phone, with the fraction rising to over 60% in two areas.

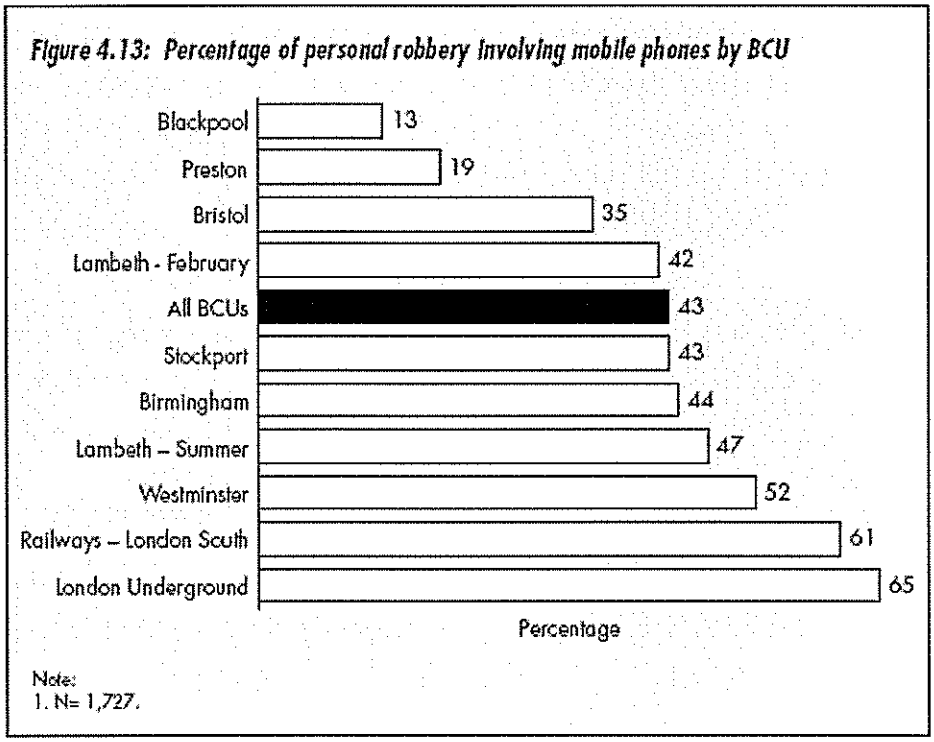

Figure 6. Percent of Robberies Involving Mobile Phones by Basic Command Units (BCU)

The robbers used deadly force in some of these robberies. A BBC story, headlined "Woman Shot for Mobile Phone," recounts one such incident.[53] A 2002 article in *Time*

[53] See http://news.bbc.co.uk/1/hi/england/1738659.stm

Europe overviewed the status of mobile phone theft and resale in several European countries. That story claimed that statistics show that "cell-phone theft is not only rising, it also is becoming more violent."[54]

In 2002, Great Britain enacted the Mobile Telephones (Reprogramming) Act (2002 Chapter 31) to close a loophole in the existing law that allowed the sale of equipment that permitted the easy activation of stolen wireless handsets in the UK.

Programming the phone so that it will work only on a single network or only with a specific SIM card (called a SIM lock) makes it difficult for a thief to pass off stolen property as legitimately acquired. More generally, it is clear that SIM locks are a tool that prevents or make more difficult the sale or reactivation of stolen handsets. An earlier U.K. Home Office study of the mobile phone theft problem noted, "one strategy for thieves is simply to insert a new SIM card. They can be easily and legitimately obtained for about £20, and the Feltham offenders spoke of 'dodgy' markets where they could be picked up for £5 or less."[55] SIM locks deny thieves this strategy.

In the debate in Parliament on the [anti-]Reprogramming Act, MP Michael Fabricant, in response to a question, explained the benefits of SIM locking saying,

> The hon. Gentleman is right to a certain extent. Yes, it would not be possible to take out the SIM card—although if the phone were stolen, the SIM card would be gone, too—and put it in another phone. Instead, owners would have to register with the company the fact that they now had a new phone. However, that is the only thing that they would have to do; they would still have portability. The trade-off would be having to make a telephone call, set against the advantage of its being less likely that one's phone would be nicked. Personally, I think that people would be happy to accept that.[56]

The research for the above part of this subsection was conducted a little more than two years ago. More recent data confirm that handset theft is still a problem in Great Britain. An October 2006 report by the British Ministry of Justice stated

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54 http://www.time.com/time/europe/magazine/article/0,13005,901020311-214207,00.html

55 P. M. Victoria Harrington, "Mobile phone theft," Home Office Research, Development and Statistics Directorate, London 2001.

56 Hansard 22 Jul 2002: Column 722-3.

> In the UK it is clear that mobile phones are a significant factor in many offences of robbery and theft. Studies suggest that mobile phones are stolen in around half of all robberies and are the only item taken in around 20% of incidents. Young people, especially those of school age, are proportionately more likely to be victims of this type of crime. It is likely that mobile phone crime is increasingly becoming a problem in many other European countries too. The UK police have been contacted by numerous European countries including Poland, Germany, Portugal, France and the Netherlands regarding best practice in tackling mobile phone crime. The approach in the UK, in conjunction with the GSM Association, has been to remove the market for stolen phones, by ensuring that stolen mobiles are blocked and no longer work on UK networks. Many of the handsets that are stolen in the UK, however, are now being trafficked to certain other European countries where they are sold on the black market. It is clear that effective action needs to be taken across Europe to close down these illegal markets.[57]

In contrast, recent statistics from the U.S. Department of Justice indicate that the fraction of all thefts that are handset thefts must be much lower in the United States than in Great Britain—with no more than 8.3% of personal thefts resulting in the loss of "portable electronic, photographic gear."[58] The proportion of all thefts in the United States that are handset thefts can be no more than one-sixth that in Britain. In fact, it is probably significantly less because the statistics for the United States count camera thefts and iPod thefts in the same category as mobile handset thefts. Anyone comparing absolute crime rates in the United States and Great Britain faces difficulties arising from differences in the definitions and the study methods used in the two countries. That said, the national statistics indicate that the rate of personal theft is substantially higher in England and Wales (about 12 in every 1,000 persons being a victim in each year) than in the United States (about 4 in every 1,000).[59] If this three-to-one disparity in rates is correct, then the rate of handset thefts in two countries differs by almost a factor of 20.

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[57] Report of the Ministry of Justice of Great Britain to the 27th Conference of European Ministers of Justice, MJU-27(2006) 10. Available at http://www.coe.int/t/dg1/legalcooperation/minjust/mju27/MJU-27(2006)10E-UK.pdf.

[58] Criminal Victimization in the United States, 2005 Statistical Tables National Crime Victimization Survey, December 2006, NCJ 215244, at Table 84.

[59] The personal theft rate for England and Wales was taken from *Crime in England and Wales*, Alison Walker et al., Home Office Statistical Bulletin, July 2006 at p. 94. See also Table 6.06. The personal theft rate for the United States was taken from *Criminal Victimization in the United States, 2005 Statistical Tables*, U.S. Department of Justice, NCJ 214244, December 2006. Table 1 of that report shows a robbery rate of 2.6 per thousand persons of age 12 and over. It also shows the rate of purse

A pan-European survey, conducted in 2002 for the European Union, showed that 18% of Europeans felt at risk of being mugged or robbed by someone seeking to steal their handset.[60] The report on that survey stated,

> Across the EU-15, 18% of respondents expected to be at risk over the next year of a mugging or robbery in order to steal a mobile phone. The Greeks, again, headed the poll at 37% followed by the French (30%), the Luxembourgers (28%) and the Portuguese (27%). A pattern is emerging at the other end of the scale with Austrian and German respondents recording scores of 6% and 8% respectively.[61]

Why is handset robbery a radically different problem in Great Britain, indeed in Europe generally, than in the United States? The difference in incentives—it is far easier to resell or reuse a stolen handset in Europe than in the United States—may well be a contributing factor.

7.4. The Effectiveness of Handset Security Tools

Multiple technical standards and multiple radio bands are used to provide wireless service around the world. Some handsets, most notably those conforming to the GSM 900 and GSM 1800 standards, can be used in more than 100 countries. A GSM 900 handset stolen in London can be shipped to Syria or Pakistan and activated there. In contrast, handsets operating on other standards have a far smaller global market. Consequently, the incentives for theft and trade in stolen handsets vary from technology to technology and country to country. Thus, it should not be surprising that some carriers choose to lock handsets to their network and others do not.

To sum up, many of the current tools for wireless handset security were developed in the 1995–2002 timeframe. The economic incentives for evading these security tools are enormous—there are roughly 2.5 billion wireless handsets in the world today worth in the neighborhood of $250 billion, and wireless service generates worldwide revenues of more than one-half trillion dollars annually. The carriers adopted their security policies

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snatching/pocket picking to be 0.9 per thousand. Combining these numbers gives a total rate of personal theft of 3.4 per thousand.

[60] *Public Safety, Exposure to Drug-Related Problems and Crime,* Report prepared for the European Commission, the European Opinion Research Group, 2003.

and procedures in the context of massive fraud, the threat to human life from handset robberies, and the concern of law enforcement regarding handset cloning.

Today, those security technologies have substantially reduced the incidence of wireless fraud and cloned phones in the United States. Locking handsets to networks and preventing reprogramming is a tool that makes fraud and resale of stolen handsets more difficult. Although such locking is often viewed as merely a tool to protect handset subsidies, it has other important effects.

8. Fundamental Differences Between Wired and Wireless Handsets

Ordinary wired telephones might appear to offer a natural analogy to wireless handsets. However, that is wrong—wireless handsets present a great contrast to traditional telephone service and telephone instruments. Wired telephone service is a familiar, well-established service. Consumers know what quality to expect. Most consumers of wired telephone service take that service from an established carrier that is subject to public utility regulation. The transmission facility, the wires to the home, is separate from the instrument. Just as it is easy to tell the difference between a power failure and a burnt-out light bulb, it is relatively easy to distinguish between problems in the wired network and problems in the wired telephone instrument—one can just unplug the instrument and plug in a second instrument that is known to work well. If the second instrument works when plugged into the problematic network connection, then the problem is in the first instrument. If the second instrument also fails, then the problem is in the network.

One might conclude from the apparent analogy between wired handsets and wireless handsets that wireless handsets can and should be offered completely separately from wireless service, as is the case with wired telephones today. But the analogy, and thus any conclusion based on the analogy, is wrong. As described in some detail above, wireless handsets use shared resources to provide service, and thus one's use of an inferior wireless handset can degrade someone else's ability to get quality service.

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[61] Ibid at p. 34.

On the landline side, in situations in which there is little or no possibility that use of a handset will interfere with someone else's use of the wired network, consumers can purchase telephone instruments that meet the FCC's Part 68 rules and connect those instruments to the wired telephone network via any standard jack. Home telephone instruments are connected to the larger telephone network by a pair of wires that runs from the home to the telephone company's central office.[62] For most telephone connections, that wire pair is a dedicated resource—used only by that one subscriber. If a subscriber's handset fails, say by shorting out the line or by creating terrible static on the line, only the subscriber's other extensions lose service. The harms created by a substandard instrument flow to the subscriber who purchases and controls that instrument but not to other subscribers.

But even on the landline side, in the case in which the potential for interference exists because of use of a shared resource, no unbundling was ordered by the FCC. Party lines, rare today but once common in residential service, use a single pair of wires to serve two or more subscribers.[63] Thus, only one subscriber on a party line can make a call at any moment, and eavesdropping on the calls of others sharing the same line is easy. In 1981, the FCC initiated an inquiry into the feasibility applying its registration program to telephone instruments connected to party lines.[64] That inquiry concluded that it was not practical to require telephone companies to allow consumers to supply their own telephone instruments for use with party lines.[65] The FCC summed up its analysis saying,

> With as many as eight parties sharing a party line, improperly installed or malfunctioning terminal equipment could affect many more people than just the

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62 This account is illustrative of the structure of modern wired telephone networks. Complicating elements, such as the use of remote terminals or load coils, that are inessential to the main point are omitted.

63 The current FCC terminal equipment interconnection rules read "Except as provided in paragraphs (b) and (c) of this section, the rules and regulations apply to direct connection of all terminal equipment to the public switched telephone network for use in conjunction with all services *other than party line services*. 47 CFR 68.2(a) emphasis added.

64 FCC, "CC Docket No. 81-216. Commission invites comments on Notice of Proposed Rule Making amending Telephone Registration Program (Part 68) and institutes an inquiry into standard for business and residential wiring and party line service under Part 68.," 85 FCC 2d 868, 1981.

65 FCC, "CC Docket No. 81-216. Second Notice of Proposed Rulemaking and Order," 92 FCC 2d 1, 1982.

> user of the equipment. Automatic answering machines, like telephones, would have to be designed to respond only to calls addressing the user of the machine. Otherwise, they would operate whenever any party on the line were called, infringing on that other party's privacy and possibly causing the caller unnecessary billing. Automatic dialers, which present a slightly different but equally significant problem, would require special circuitry to automatically relinquish the line on demand of another party. Such circuitry would be critical in emergency situations. Any damage by any such automatic device to a party other than the user could subject the user and/or manufacturer to considerable financial liability. These risks of third party harm, in addition to those associated with ANI failures and other network related faults, constitute a substantially increased array of potential harms than those generally associated with single party service. Our concern, then, is not only with the feasibility of developing, administering and implementing new rules, but with public safety as well.[66]

The fundamental difference between single-line and party-line phones is that, under most reasonable conditions, failures or impairments in a single-line telephone instrument will harm only the user of that telephone but failures or impairments in party-line instruments can readily harm the others who share that party line.

The mistaken analogy of wireless handsets to ordinary single-line telephones equipment is natural enough. However, such an analogy is deeply flawed, could easily mislead, and should be rejected.

9. Lessons for Competition Policy Analysis

The features and quality of a handset are inextricably intertwined with the quality of the wireless service. If John uses an inferior wireless phone—even if that inferior phone was state-of-the-art 5 years ago—he may deny service to Mary who is sitting next to him or may degrade service for other users within about mile around him. Widespread use of inferior handsets would either substantially degrade wireless service—such as by increasing the number of coverage holes and dropped calls—or would require a substantial increase in the capital plant used by wireless carriers. In either case, consumers would suffer.

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[66] 92 FCC 2d 37, footnote omitted.

Economists have studied tying and bundling for decades and have identified circumstances in which such bundling serves efficiency and circumstances in which such bundling is anticompetitive and may harm consumers.[67] Most consumers find it convenient that right and left shoes are sold in pairs.[68] However, the usual analyses of tying are inappropriate for wireless handsets. Handsets are both a complement to the network and a *substitute* for network investment.

Arguments that handsets can be competitively supplied—independent of the preferences of the network service supplier—fail to take into account (1) the tradeoff between handset capabilities and network capacity, (2) the co-evolution of the network and the handsets, and (3) the security needs that are served by locking handsets to networks.

9.1. Alternative Approaches to Handset Qualification

Of course, tying is not the only possible mechanism that carriers could use to ensure that their customers use appropriate handsets. Possible alternative strategies include: (1) a list of acceptable handsets, (2) testing consumer-supplied handsets for conformity to the carrier's handset quality standards, (3) pricing network services to reflect a fine-grained measure of the relative network resource consumption of each handset, and (4) government regulation of handset technology to ensure that all handsets in the market were "acceptable." However, each of these alternative strategies poses substantial practical difficulties.

Consider first the difficulties of creating a list of acceptable handsets. Public disclosure of the criteria for making the list could disclose sensitive competitive information—particularly information regarding network engineering, new services, and planned network evolution. A carrier's decision to remove a product from the list could become

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[67] See Tirole, Jean, "The Analysis of Tying Cases: A Primer" . Competition Policy International, Vol. 1, No. 1, pp. 1-25, Spring 2005 http://ssrn.com/abstract=702641, Carlton , Dennis W. and Waldman, Michael, "How Economics Can Improve Antitrust Doctrine towards Tie-In Sales: Comment on Tirole's 'An Analysis of Tying Cases: A Primer'" . Competition Policy International, Vol. 1, No. 1, pp. 27-40, Spring 2005 http://ssrn.com/abstract=702645

[68] However, the policy of bundling right and left shoes harms some consumers. I know of family with a child whose feet were, due to a birth defect, different sizes. Consequently, purchasing a useful pair of shoes often required purchase of two bundled same-size pairs—one pair to get the shoe for the child's left foot and one pair to get the shoe for the child's right foot.

contentious and the subject of allegations of abuse. Some criteria for making such a list, such as the ease of helpdesk support, are subjective and could also become contentious. And, of course, such a list could itself be regarded as a form of tying.

The second alternative, testing customer-supplied handsets for conformity to the carrier's quality standards, would be impractical. Such testing requires specialized equipment and trained test technicians, and takes hours not seconds. Such testing would impose substantial transactions costs. And, of course, the quality standards and the criteria for determining whether a product meets those standards could easily become contentious.

Pricing network services to reflect handset consumption of network capabilities would require adopting a different pricing model for wireless service—a pricing model that would be far more difficult for consumers to understand than the current pricing models that base prices on minutes of use, time of day, and gross variations in location.[69] Such pricing models would also introduce wide variations in service prices in a fashion beyond user control.[70] Even if such reformed prices were acceptable to consumers and could be shown to serve efficiency, there would still be the potential for contention over the pricing mechanism. One can easily imagine the suppliers of handsets that incurred higher network charges complaining that level or form of such charges were anticompetitive.

To sum up, each of the first three alternative strategies that I identified would impose substantial transactions costs and would be subject to complaints that the particular elements of the implementation of such strategies, such as inclusion on a list of acceptable handsets, were anticompetitive.

The fourth alternative, regulating handset technology, would solve one problem, but at the expense of imposing substantial constraints on the dynamic evolution of the industry. The FCC explicitly abandoned this approach when they adopted their policy of technical flexibility for wireless standards. That policy is regarded by many as an enormous success. In contrast and as noted above, the technical rigidity in the GSM bands in

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69 See Odlyzko, op. cit., for a discussion of consumer preferences for simple pricing structures.

70 For example, CDMA users located close to a base station would pay less than users at greater distances.

Europe is now regarded as hampering innovation and evolution of the wireless market in Europe.

9.2. Concluding thoughts

The efficiencies of the joint supply of handsets and network services identified here do not appear to have been discussed in the competitive policy arena even though handset tying and bundling has been a contentious issue for about two decades.

The various joint economies between handsets and networks described above should be considered in any competitive policy analysis of the costs and benefits to consumers of handset bundling or tying.

About the Author

Dr. Charles L. Jackson is an electrical engineer who has worked extensively in telecommunications and wireless. He has been both a digital designer and a system programmer. He works as a consultant and is also an adjunct professor of electrical and computer engineering at George Washington University, where he has taught graduate courses on mobile communications, wireless networks and the Internet. Dr. Jackson is a well-know expert on spectrum management and spectrum policy issues. He has consulted for several governments on spectrum policy and radio licensing issues including New Zealand, Panama, Jamaica, United Kingdom, Germany, Latvia, and the United States. He has also consulted for major corporations and industry associations on those issues. He has written extensively on spectrum management and spectrum policy. He was the first to invent combinatorial auctions—formulating them in the context of radio license auctions.

Dr. Jackson is also familiar with spectrum policy issues from inside government—having worked on spectrum issues at both the FCC and for the U.S. Congress.

Dr. Jackson served three terms on the FCC's Technological Advisory Council. He holds two U.S. patents, and has one other patent pending. Dr. Jackson received his PhD from MIT.

ATTACHMENT D

BEFORE THE FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

In the Matter of	:	
Skype Communications S.A.R.L.	:	
	:	RM-11361
Petition to Confirm A Consumer's Right to Use Internet Communications Software and Attach Devices to Wireless Networks.	:	
	:	

AN ANTITRUST PERSPECTIVE IN RESPONSE TO SKYPE'S PETITION

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April 26, 2007

"Experience has shown that government-imposed restrictions are among the most effective and durable restraints on competition."[1]

Skype's petition asks the Commission to intervene in a vibrantly competitive marketplace by resurrecting the visage — and vestige — of a hidebound monopoly. The contractual relationships among wireless providers, handset manufacturers and, most importantly, consumers have fostered an environment today that Tom Carter would not recognize: it is dominated by no one, it is replete with technical innovation, and it achieves ever broadening use and declining prices.

The application of antitrust principles to today's wireless market supports no theory on which Skype can contend that the wireless carriers have engaged in anticompetitive conduct. Indeed, it supports the opposite — that relationships among carriers and handset manufacturers generate efficiencies that promote competition.

In addition, the wireless carriers do not have unlimited capacity and ability to accommodate all technologies. If Skype's request is granted, it will not be without consequence. To the extent regulation requires carriers to adapt their businesses in ways that increase their costs or compromise their service, Skype may be happy but consumers will either pay more or get less. That is because, fundamentally, Skype wants the Commission to intervene to correct what it believes are bad business decisions by the wireless carriers; it wants the Commission to give priority to what Skype thinks the market desires and how Skype thinks the wireless carriers should manage their businesses, rather than let the competitive process determine the direction the market will take.

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[1] FTC, Prepared Statement to Congress: *An Overview of Federal Trade Commission Antitrust Activities*, March 7, 2007 at 24-27 (describing instances where the FTC has urged state and federal lawmakers to refrain from or limit regulation), available at http://www.ftc.gov/os/2007/03/index.shtm (last visited April 23, 2007).

The Current Market Structure Makes Anticompetitive Harm Unlikely

The root complaint of Skype's petition appears to be that wireless carriers are using their influence "to maintain an inextricable tying of applications to their transmission networks and are limiting subscribers' rights to run applications of their choosing." Petition at 2. Skype thus implicates two markets for consideration: the wireless network operators (the "primary" market) and the handset market (the "secondary" market). Petition at i.[2] This relationship consists of bundling handsets together with the wireless service that makes them useful and can be characterized as a "vertical" relationship.

Consumer harm in vertical cases is measured by the degree of foreclosure in a defined market that the dominant firm can effect through its market position. As shown below, there is no such foreclosure, nor can there be. As an initial matter, *any* consumer harm in a vertical case requires market power in at least one market. *See, e.g.,* IIIA Phillip E. Areeda & Herbert Hovenkamp, *Antitrust Law* ¶ 756a, at 8 (2d ed. 2002) ("Without substantial market power at any relevant production or distribution stage, vertical integration lacks antitrust significance. It is either competitively neutral or affirmatively desirable because it promotes efficiency."); *id.* at 9 ("In the absence of market power, 'foreclosure' is inapt.").

Moreover, even in the presence of a monopoly, "[w]hen the primary market monopolist integrates into a competitive secondary market, no injury to competition is ordinarily apparent … [this] is a clear candidate for a rule of absolute legality." *Id.* ¶ 759c, at 36. Today, no monopoly

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[2] Elsewhere in its petition, Skype describes a "'permission-based' approach to innovation," at 13; and points to "handset locking," "terms of service limitations" and "lack of open development platforms," *id.* at 16-20. The thrust of Skype's petition seems to be that wireless carriers are using their position in the primary wireless market in order to restrain handset design, including handsets' compatibility with certain software applications. While it is not clear from Skype's petition whether handsets are a distinct market from the applications that run on them, the antitrust implication remains the same: absent market power in either market, as is the case, how the wireless carriers choose to compete should be left to their judgment and market forces, not dictated by the judgment of Skype and others.

exists in either the market for network services or the market for handsets. As such, anticompetitive harm *cannot* stem from vertical relationships among such firms.

The FCC's eleventh *Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Radio Services* ("*Eleventh CMRS Report*") to Congress finds a robust and increasingly competitive landscape:

> "[T]here is effective competition in the CMRS marketplace." FCC, *Eleventh CMRS Report*, 21 FCC Rcd 10947 at 4 (2006), *available at* http://wireless.fcc.gov/crmsreports.html.
>
> "[C]ompetitive pressure continues to drive carriers to introduce innovative pricing plans and service offerings, and to match the pricing and service innovations introduced by rival carriers." *Id.*
>
> "Consumers continue to pressure carriers to compete on price and other terms and conditions of service by freely switching providers in response to differences in the cost and quality of services." *Id.* at 5.
>
> "In addition to the nationwide operators, there are a number of large regional players ...." *Id.* at 14.

The Commission found that 268 million people, or 94 percent of the U.S. population, "live in counties with four or more mobile telephone operators competing to offer service;" 145 million people, or 51 percent of the U.S. population, live in counties with "five or more mobile telephone operators competing to offer service;" and fifty million people, or 18 percent of the U.S. population, "live in counties with six or more mobile telephone operators competing to offer service." *Id.* at 20.

At year-end 2005, the top five wireless network operators together constituted approximately 89% of the market for wireless telephone services: AT&T/Cingular represents roughly 26%; Verizon has 25%; Sprint/Nextel has 22%; T-Mobile has 11%; and Alltel has 5%. *Eleventh CMRS Report*, app. A, tbls. 2 & 4. Twenty other providers, seven of which each served more than one million subscribers, constitute the remainder of the market. *Id.* In its petition at

21, Skype notes the U.S. market concentration in wireless had an average HHI of 2706.[3] However, this level of concentration, in its proper context, indicates no potential for anticompetitive harm to consumers.[4]

Finally, irrespective of the level of concentration, the fact that effective competition exists is shown by dramatically increased usage rates and declining prices. The average minutes of usage per month among wireless subscribers has increased from 140 to 740 since 1993. *Eleventh CMRS Report*, tbl. 10. In the same period, the average revenue per minute has declined from $0.44 to $0.07. *Id.*

Wireless Carriers' Relationships With Handset Manufacturers Promote Efficiency

In today's wireless marketplace, as in other vertical arrangements, bundling clearly has a *pro-competitive* effect. As discussed above, vertical relationships do not run afoul of antitrust laws where the integrating firms lack market power in their respective markets. Rather, it may be "affirmatively desirable because it promotes efficiency." Areeda & Hovenkamp, *supra*, ¶ 756a(1), at 8. This is especially true "as products become more technical and specialized and as an ongoing relationship between bargaining opposites requires increasing amounts of coordination ...." *Id.* ¶ 757c, at 26-27 (discussing transactional efficiencies). In this context it is widely recognized that:

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[3] Skype acknowledges that "applications like Skype have been uncoupled from the underlying Internet access network and can operate across heterogeneous broadband platforms." Petition at 2. This suggests that a more appropriate market definition includes all broadband providers, which yields a much lower HHI of approximately 1110. Christopher S. Yoo, *Network Neutrality and the Economics of Congestion*, 94 Geo. L.J. 1847, 1893 (2006). The courts endorse this approach. *See, e.g., United States Telecom Ass'n v. FCC*, 290 F.3d 415, 428 (D.C. Cir. 2002) (finding the Commission "completely failed to consider the relevance of competition in broadband services coming from cable (and to a lesser extent satellite)."). However, as this memorandum shows, there is no problem even under the narrower market on which Skype's petition is based.

[4] It is significant that in 1992, when the Commission clarified its policy allowing bundling of cellular service and CPE, the wireless HHI was *5000*; the market constrained by a duopoly. *Bundling of Cellular Customer Premises Equipment and Cellular Service*, Report & Order, CC Docket No. 91-34, FCC 92-207, 7 FCC Rcd 4028 at ¶ 11 & n.21 ("*CPE Bundling Order*"). Moreover, even with an average HHI of 2706, the Commission noted the North American market is less concentrated than, for example, in Western Europe, excluding the United Kingdom. *Eleventh CMRS Report* at 23.

> "In the absence of any purpose to create or maintain a monopoly, the [Sherman Act] does not restrict the long recognized right of trader or manufacturer engaged in an entirely private business, freely to exercise his own independent discretion as to parties with whom he will deal."

United States v. Colgate & Co., 250 U.S. 300, 307 (1919).

The critical efficiency of bundling is that it provides easy access to Customer Premises Equipment (CPE). Skype points to the low, "highly subsidized" cost of CPE as a "consumer harm," Petition at 13, without specifying what that harm may be. In fact, the FCC already has endorsed this efficiency, finding the low cost of CPE that results from bundled services only benefits consumers: "[T]here appear to be significant public interest benefits associated with the bundling of cellular CPE and service [because] *the high price of CPE represents the greatest barrier to inducing subscription to cellular service*." *CPE Bundling Order* ¶ 19 (emphasis added). Nor did the Commission limit its endorsement based solely on the absence of harm to competition: "[O]ur policy to allow the bundling of cellular CPE and cellular service furthers the Commission's goal of universal availability and affordability of cellular service and thus promotes the continued growth of the cellular industry." *Id.* at ¶ 20.

An equally important effect of bundling is that it allows the wireless carriers more effectively to compete with each other. "Vertical restrictions promote interbrand competition by allowing the manufacturer to achieve certain efficiencies in the distribution of its products." *Continental T.V., Inc. v. GTE Sylvania, Inc.*, 433 U.S. 36, 54 (1977). The Supreme Court in *Continental T.V.* also recognized that, even where market power exists, interbrand competition "provides a significant check on the exploitation of intrabrand market power because of the ability of consumers to substitute a different brand of the same product." *Id.* at 52 n.19. As noted above, the FCC recognized in the *Eleventh CMRS Report*, at 5, such interbrand competition is vigorous, driven by consumers "freely switching providers."

Another pro-competitive justification of bundling is the elimination of "free riders," those firms — either upstream or downstream — that seek to capitalize on the infrastructure investments made by others.[5] Here, the development of the wireless infrastructure has cost, and continues to cost, tens of billions of dollars. To the extent the networks are able to manage applications like Skype from consuming scarce network capacity and bandwidth without paying, competition law allows such a return on investment. *United States Telecomm. Ass'n v. FCC*, 290 F.3d 415, 424 (D.C. Cir. 2002) ("If parties who have not shared the risks are able to come in as equal partners on the successes, and avoid payment for the losers, the incentive to invest plainly declines.").

Free riders do not merely discourage investment by individual firms competing with the free rider, they undermine the existence of the infrastructure itself. Investment disincentive produces "a deterioration of the system's efficiency because the things consumers desire are not provided in the amounts they are willing to pay for. In the extreme case, the system as a whole could collapse." *Rothery Storage & Van Co. v. Atlas Van Lines*, 792 F.2d 210, 221 (D.C. Cir. 1986) (citing the elimination of free riders as the "chief efficiency" that justified purportedly anticompetitive conduct), *cert. denied*, 479 U.S. 1033 (1987).

The explosive growth of technology is another efficiency that the relationships between network providers and handset manufacturers has fostered. This growth cannot be squared with Skype's bald assertion that wireless carriers' influence with handset design creates an "innovation bottleneck." Petition at 13. At least one court has found the notion logically

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[5] These infrastructure investments are not limited to wireless technology, but are an important component of the larger broadband infrastructure. In that context, the FCC has expressly recognized the procompetitive efficiencies of limiting free-riders and allowing business arrangements that ensure a return on investment: "The record shows that the additional costs of an access mandate diminish a carrier's incentive and ability to invest in and deploy broadband infrastructure investment." *Appropriate Framework for Broadband Access To the Internet Over Wireline Facilities*, Report & Order, CC Docket No. 02-33, FCC 05-150, ¶ 44 ("*Appropriate Framework for Broadband Access*").

unsound. In *In re Wireless Telephone Services Antitrust Litigation*, 385 F. Supp. 2d 403, 429 (S.D.N.Y. 2005), which is discussed further below, the court pointed out that "[s]ince the defendants do not manufacture handsets, and compete with each other through offering handsets with service, it is against each defendant's self-interest to discourage competition among handset manufacturers . . . ." The same court found that terms of service limitations, which Skype complains "go beyond a carrier's reasonable business interests," Petition at 19, also foster innovation in the handset market:

> "As a matter of logic, the need for consumers to buy new handsets when they switch plans should increase competition in the handset market. Defendants contend and plaintiffs do not disagree that the defendants use their offers of handsets at the lowest possible prices to compete with each other. The increased sales of handsets that result from this practice and *the incentive to use handset innovations as a draw* to bring new customers to a new service provider foster competition in the tied product market."

385 F. Supp. 2d at 430 n.40 (emphasis added).

Assuring the quality of the network is perhaps the most practically significant efficiency of a close relationship between network operators and handset makers or, for that matter, applications writers. Wireless carriers' ability to constrain or restrain certain design characteristics in handsets benefit the network at both ends of the technology spectrum. At the low end, mandating certain capabilities insures that handsets are of high quality and do not burden the network with inferior connectivity or capability. At the high end, restricting the use of certain bandwidth-intensive features insures that "one customer's usage of the network [does not] degrade the quality of service that other customers receive." Yoo, *supra* note 2, at 1852. Indeed, *Carterfone* itself supported this efficiency of vertical integration, as the FCC relied primarily on the *absence* of harm to the network in invalidating the tariff. *In re Use of the Carterfone Device in Message Toll Tele. Serv.*, 13 F.C.C.2d 420, 423 (June 26, 1968).

In today's wireless marketplace, mandating or restricting the applications that run on handsets is the most economical means of managing the network. Yoo, *supra* note 2, at 1852-53. This is because, with certain applications, there is no effective way to meter bandwidth usage to insure that low-bandwidth users are not in effect subsidizing high-bandwidth users. This efficiency is particularly apt concerning Skype. First, Skype's applications (including video teleconferencing, file transfers, and "Skypecasts," or "*live, moderated conversations with up to 100 people*," eBay Inc., 2006 Annual Report (2007) ("eBay 2006 Annual Report") at 8, are inherently bandwidth intensive. Second, Skype's peer-to-peer methodology has succeeded without significant infrastructure investments through its model of creating "supernodes." A supernode uses its subscribers' bandwidth even when that particular user is not actively using the network, *i.e.* the user is an unwitting host to other Skype users' calls. Saikat Guha, et al., *An Experimental Study of the Skype Peer-To-Peer VoIP System* (2006).[6]

Together, these characteristics hinder the ability of a network operator economically to meter the usage of a finite resource, bandwidth, for purposes of tiered pricing.[7] As Professor Yoo summarizes:

> "[T]ransaction costs associated with a usage-sensitive pricing system can consume all of the economic benefits associated with a shift to usage based pricing .... The indeterminacy of the problem justifies adopting policies that do not foreclose network operators from experimenting with

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[6] *Available at* http://209.85.165.104/search?q=cache:zImPT-SK_jcJ:iptps06.cs.ucsb.edu/papers/Guha-skype06.pdf+%22Experimental+Study+of+the+Skype%22&hl=en&ct=clnk&cd=1&gl=us (last visited April 21, 2007).

[7] The Commission has acknowledged the metering problem in another context, by exempting VoIP communications from state regulation on the grounds that complying with a state's requirements to identify a VoIP call's geographic end-points is impossible. *See Minnesota PUC v. FCC*, No. 05-1069, No. 05-1122, No. 05-3114, No. 05-3118, 2007 U.S. App. LEXIS 6448, at *14 (8th Cir. Mar. 21, 2007) (citing *In re Vonage Holdings Corp.*, 19 F.C.C.R. at 22418 ¶ 23 ("the significant costs and operational complexities associated with modifying or procuring systems to track, record and process geographic location information as a necessary aspect of the service would substantially reduce the benefits of using the internet to provide the service, and potentially inhibit its deployment and continued availability to consumers.")).

> any particular institutional solution absent the demonstration of concrete competitive harm."

Yoo, *supra* note 2, at 1852-53.

Faced with Skype's disproportionately high bandwidth usage and elusive, transitory system of supernodes — both of which may adversely affect other users' use of the network — a business arrangement that limits[8] Skype's access to the network through handset design or terms of service limitations is an efficiency that inures to the benefit of all network users. Finally, while addressing the security concerns posed by applications like Skype is beyond the focus of this response, a brief survey of Skype's security bulletins indicates that the question of "what harms the network?" is significantly more complex today than it was in 1968.[9]

In sum, Skype's model of bandwidth usage is perhaps the best illustration of the need for limiting the functionality of handsets, a limitation without which the wireless networks and the service that they provide would be degraded.

Without Question, Such Efficiencies Have Been Passed On To Consumers

It is important to highlight that even Skype acknowledges the fact that there have yet been no anticompetitive effects caused by the conduct alleged in its Petition. Petition at 5 ("*Before* anti-consumer practices take root and innovation suffers, the Commission should examine the policies that have guided the industry to date … to *keep* wireless communication

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[8] It bears emphasis that a network operator, by limiting the capability of its own handsets, only restricts Skype's access to the network; it does not prevent it. Skype itself markets Wi-Fi capable handsets and any consumer who wishes may choose a Skype phone and calling plan. *See* Marguerite Reardon, "Skype Intros New Wi-Fi Phones," CNET News.com (July 20, 2006), *available at* http://news.com.com/Skype+intros+new+Wi-Fi+phones/2100-7351_3-6096681.html (last visited Apr. 18, 2007).

[9] *See, e.g.,* SKYPE-SB/2006-002 (Oct. 3, 2006), *available at* http://www.skype.com/security/skype-sb-2006-002.html ("In some circumstances, a Skype URL can be crafted that, if followed, could cause the execution of arbitrary code on the platform on which Skype is running.") (last visited Apr. 21, 2007); SKYPE-SB/2006-001 (May 19, 2006), *available at* http://www.skype.com/security/skype-sb-2006-001.html ("In some circumstances, a Skype URL can be crafted that, if followed, initiates the transfer of a single named file to another Skype user.") (last visited Apr. 21, 2007); SKYPE-SB/2005-003 (Oct. 27, 2005), *available at* http://www.skype.com/ security/skype-sb-2005-03.html ("Skype can be remotely forced to crash due to an error in bounds checking in a specific networking routine.") (last visited Apr. 21, 2007).

open to innovation and competition.") (emphasis added). This is no slip — Skype must acknowledge that these efficiencies and resulting cost savings to consumers are the direct result of what can only be described as a dynamically competitive marketplace.

As the discussion above establishes, there is little or no likelihood of consumer harm that *could* follow vertical arrangements between non-dominant carriers and non-dominant handset manufacturers. The theory has been borne out in practice in two fora that have applied specific facts — one in the courts, the other in the marketplace itself.

Skype asserts, citing no authority, that "[t]he wireless industry remains the only widely-used communications network in which the network operators exercise effective control over the devices used by consumers." Petition at 8. Providing a specific rebuttal of this contention, in a case on all fours with Skype's petition, is *In re Wireless Telephone Services Antitrust Litigation*, 385 F. Supp. 2d 403 (S.D.N.Y. 2005). In *Wireless Telephone*, plaintiff consumers sued AT&T, Cingular, Sprint, Verizon and T-Mobile, complaining that "the practice of requiring customers to purchase an approved handset in order to subscribe to [each] defendant's wireless telephone services constitutes an unlawful tying arrangement." Granting summary judgment for defendants, the court found no evidence "that any one of the defendants had sufficient power in the market for wireless service to 'force' consumers, within the meaning of the antitrust laws, to purchase unwanted handsets." 385 F. Supp. 2d at 417.[10]

First, the court found that no wireless carrier possessed a market share of 30%, "the minimum sufficient by itself to confer market power." 385 F. Supp. 2d at 418. Second, even assuming that "all handset sales flow through the carriers' distribution system," the court found, as a matter of law, that this was a choice of handset manufacturers, not a condition imposed upon

[10] The court also expressly found that "the use of term contracts cannot be said to exclude competition," *id.* at 423 (addressing another of Skype's concerns); *see* Petition at 18-19.

them. 385 F. Supp. 2d at 426 ("To find that such a choice is not a choice at all but instead proves an anticompetitive impact defies logic."). The court also considered the absence of entry barriers in either the network market, *id.* at 420, or the handset manufacturing market, *id.* at 424, in granting summary judgment for defendants.

Finally, the court noted the amount of "churn," or turnover from one carrier to another, as evidence that anticompetitive conduct, if possible, was unavailing in the marketplace: "The enormous amount of churn in this industry eviscerates the suggestion that consumers do not view these brands and the services underlying them as essentially interchangeable." *Id.* at 420.

A more practical illustration, provided by the marketplace itself, lies in Skype's own cited authority. Skype, in passing, points to the exclusive relationship between Apple and AT&T/Cingular to show the influence of network providers over handset manufacturers. Petition at 16 & n.30 (noting "the extraordinary effort that Apple made to break the hold of wireless carriers in order to develop the iPhone.").[11] An examination of that relationship, however, shows that Skype has the balance of power backward. In fact, Apple's effort is illustrative both of the level of competition that prevails in the wireless marketplace and the influence that handset makers — those who invest in a compelling product — have over sometimes captive network operators.

While Skype accurately points out the iPhone works only on AT&T's Cingular wireless network, it overlooks the fact that this is at *Apple's* insistence, not Cingular's. Sharma, et al., *supra* note 11, at A1. Apple imposed other conditions as well: Cingular had to agree not to place its brand on the body of the phone; it had to abandon "its usual insistence" that its software be installed on the phone; and it agreed "to share with Apple a portion of [its] monthly revenue

[11] Skype quotes, but does not cite the article by Amol Sharma, Nick Wingfield & Li Yuan, *Apple Coup: How Steve Jobs Played Hardball in iPhone Birth*, Wall St. J., Feb. 17, 2007, at A1.

from subscribers." *Id.* Moreover, Cingular agreed to these terms before more than three people at the company even got to see the iPhone — throughout development, Cingular teams were isolated to specific tasks "without knowing what the other teams were up to." *Id.* At least one other network provider was approached by Apple but decided not to "play ball" under such restrictive terms. *Id.* (Verizon "balked at the notion of cutting out its big retail partners, who would *not be allowed* to sell the phone.") (emphasis added).[12]

Under Skype's theory that "network operators exercise effective control over the devices used by consumers," Petition at 8, such influence by a handset manufacturer over the largest network operator should be impossible. Indeed, the reality negates Skype's entire proposition and shows the marketplace operated exactly as it should — Apple, a firm new to both the handset and network markets, invested a great deal of time and money to develop a product it thought consumers would demand.[13] The product was compelling enough that it caused Cingular to scuttle any semblance of "effective control" over its development.[14]

Will Apple's Steve Jobs someday stand along Tom Carter as a giant in the telecommunications industry? The question may be irrelevant to Skype's petition, but the answer will speak volumes because of the forum from which it stems: Tom Carter depended on the courts and the FCC for the Carterfone's acceptance; the success of the iPhone will be

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[12] *See also* Leslie Cauley, "Verizon Rejected Apple iPhone Deal," *USA Today* (Jan. 29, 2007) ("balking at Apple's rich financial terms and other demands," Verizon declined "to be the exclusive distributor of the iPhone."), *available at* http://www.usatoday.com/tech/news/2007-01-28-verizon-iphone_x.htm (last visited Apr. 13, 2007).

[13] While no doubt the iPhone was expensive to develop, such start-up costs are universal characteristics and not "impairment" in the antitrust sense. *See United States Telecomm. Ass'n v. FCC*, 290 F. 3d 415, 427 (D.C. Cir. 2002).

[14] The iPhone also was compelling enough that, even before it has become available, competitors are answering the call with their own next generation, multifunction wireless devices. *See, e.g.*, Gary Krakow, "iPhone Has a Two-Faced Challenger," MSNBC.com (April 23, 2007) (announcing Samsung's aptly-named "UpStage" handset), *available at* http://www.msnbc.msn.com/id/18091591/wid/11915829 (last visited April 24, 2007).

determined solely by the *marketplace*. Today, unlike 1968, any firm has the same opportunity to leverage the fruits of its innovation.

There Is No Risk of Competitive Harm on Which to Justify Government Regulation

The above analysis shows that Skype, in the guise of consumers, has chosen the FCC as its forum precisely because it cannot show that there has been any anticompetitive harm to consumers. The proposition that regulation should not lead where no harm to competition exists is well established by the courts. *See, e.g., Verizon Comms. Inc. v. Law Offices of Curtis V. Trinko, LLP*, 540 U.S. 398, 407 (2004) ("just as the 1996 [Telecommunications] Act preserves claims that satisfy existing antitrust standards, it does not create new claims that go beyond existing antitrust standards."); *United States v. Visa U.S.A., Inc.*, 344 F.3d 229, 242 (2d Cir. 2003) ("the proper inquiry is whether there has been an *actual* adverse effect on competition as a whole in the relevant market." (citation and internal quotation marks omitted)); *In re Wireless Tel.*, 385 F. Supp. 2d at 424 (citing *Roy B. Taylor Sales, Inc. v. Hollymatic Corp.*, 28 F.3d 1379, 1385 (5th Cir. 1994) ("Speculation about anticompetitive effects is not enough.")).

The maxim has been repeated by regulators, too: "While interested parties will always lobby for policies that benefit them, we do consumers the best service when we ensure that markets are competitive and do not impose unnecessary barriers or restrictions on free competition through our own policies." *Protecting Consumers in the Next Tech-Ade, Hearing Before the Federal Trade Comm'n*, No. P064101 (Nov. 6, 2006) (testimony of Deborah Platt Majoras, Chairman of the Federal Trade Comm'n) at 13. As the Federal Trade Commission has recognized: "Experience has shown that government-imposed restrictions are among the most effective and durable restraints on competition." *See supra*, n. 1.

The FCC expressly endorses — and should continue to espouse — the theory. Indeed, the FCC's "guiding principle" is to "allow[] competitive markets to be driven by market forces,

rather than unnecessary regulatory requirements." 1998 *Biennial Regulatory Review*, FCC 98-258 at 4. The Commission also has stated that "[w]e agree with the FTC Staff and the DOJ that the most efficient government policy is to allow firms the ability to choose how to distribute their own products ... the possibility that one type of retailer may be harmed does not provide a basis for a rule that limits the use of a potentially efficient contract or retail distribution system." *CPE Bundling Order* ¶ 28 (internal quotations and citation omitted).

It is axiomatic that "there is no duty to aid competitors." *Trinko*, 540 U.S. at 411. In this context it is important to distinguish harm to a competitor from harm to competition. Even if Skype's business opportunities are foreclosed by the relationships between network providers and handset manufacturers (despite no evidence that this is so), it does not follow that consumers will suffer any harm. *See* Areeda & Hovenkamp, *supra*, ¶ 756a(2), at 10. Indeed, nothing prevents Skype from competing for its own sake. "If competitors can reach the ultimate consumers of the product by employing existing or potential alternative channels of distribution, it is unclear whether such restrictions foreclose from competition *any* part of the relevant market." *Omega Envtl., Inc. v. Gilbarco, Inc.*, 127 F.3d 1157, 1163 (9th Cir. 1997). Or, like Apple, a firm may simply force open the channels of distribution by making network providers an offer they can't refuse.

Skype has available to it the tools it needs to compete in the marketplace, but it would rather ride for free.[15] Its place at the table has been confirmed by the Commission's recent order, granting wholesale telecommunications carriers the right to interconnect and exchange traffic

[15] Moreover, Skype's business model suggests not that it may be harmed by network operators' practices, but that it seeks to extend an already unfair advantage. First, Skype already plays on an unlevel field, as shown in the public documents of its parent company, eBay: "Skype's voice communications products are currently subject to very few, if any, of the same regulations that apply to traditional telephony and to VoIP-based telephone replacement services." eBay 2006 Annual Report at 19. Moreover, "[s]uch regulations could result in substantial costs depending on the technical changes required to accommodate the requirements, and any increased costs could erode Skype's pricing advantage over competing forms of communication." *Id.* at 19-20.

with incumbent local exchange carriers, specifically for VoIP applications. Memorandum Opinion & Order, DA 07-709, FCC Docket No. 06-55, Mar. 1, 2007. The court in *Wireless Telephone* noted the same fact. 385 F. Supp. 2d at 420 ("to compete with [the five largest wireless carriers], a seller of wireless services does not even need an FCC spectrum license, as the growth of the mobile virtual network operator has shown.").[16] Finally, we have found no indication that Skype, its parent company eBay, or any company affiliated with it chose to participate in the Commission's recent Advanced Wireless Services Auction.[17]

Conclusion

From an antitrust perspective, this response assumes that bundling exists in the wireless marketplace, as Skype's petition implies. The foregoing shows that even with the benefits of a relationship between network operators and handset manufacturers, the future harm about which Skype is worried is not likely to follow. Unlike the days of *Carterfone*, in a marketplace for contractually bundled products, firms today compete at both levels to be part of the "bundle." Such competition is vigorous and it ought not be replaced by premature regulation, however well-intended.

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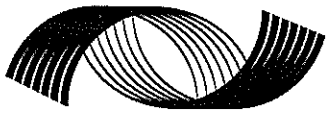
[16] "A mobile virtual network operator orders handsets from a large handset manufacturer and resells network capacity leased at wholesale rates from a major wireless service provider." 385 F. Supp. 2d at 420 n.23.

[17] FCC, *Auction 66 Advanced Wireless Services (AWS-1)*, All Bidders Spreadsheet, *available at* http://wireless.fcc.gov/auctions/66/charts/66bidder.xls (last visited Apr. 13, 2007).

ATTACHMENT E



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The Economics of "Wireless Net Neutrality"

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THE ECONOMICS OF "WIRELESS NET NEUTRALITY"

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Network neutrality issues have been vigorously debated worldwide over the past few years. One major aim of network neutrality proponents is to prevent high-speed Internet service providers from charging content providers for priority delivery. Recently, proponents have turned their attention to the regulation of wireless networks, such as those for cellular phones, which provide increasing numbers of consumers access to Internet services. Some application providers have relied on a recent academic paper to support greater regulation of wireless operators. Although the proposals to regulate these networks use the phrase "net neutrality," the regulations they seek to impose on wireless operators have little in common with those being sought for other Internet service providers. In this article, we provide a framework for determining whether certain kinds of regulations should be imposed on the owners of wireless networks. We also consider the benefits and costs of specific proposals for the regulation of these networks. Our principal conclusion is that the costs of most of these proposals are likely to exceed the benefits.

I. INTRODUCTION

"Network neutrality" has become a shorthand description of a policy that would regulate how network providers design, manage, and price the use of their networks. Depending upon the industry in which it is applied, however, the net neutrality concept has taken different forms. In the wireline context, net neutrality regulation primarily seeks to prevent a high-speed Internet service provider, such as cable modem provider or a DSL provider, from charging a fee for enhanced quality of service to content providers. By contrast, requests for "wireless net neutrality" regulation primarily seek to prevent a wireless operator

from imposing certain limitations on equipment manufacturers and application providers. They also seek to prevent wireless operators from imposing usage limits on end-users.

Net neutrality regulation is important from a policy perspective because it is likely to have a significant effect on the development and use of future wireline and wireless broadband networks. In particular, broadband operators face capacity problems as the demand for bandwidth-intensive applications, such as streaming videos and online games, accelerates. Network operators have limited options for addressing this demand, including rationing existing capacity in the short term, and building more capacity and more intelligent networks over the long term. If network neutrality regulations are implemented, it could have a dramatic effect on the future of the Internet, which may help to explain why the issue has received a great deal of attention from scholars and the broader policy community.

Scholars have offered up a diverse range of views on the subject of net neutrality, with some supporting regulation[1] and some opposing it.[2] Most scholarship until now has focused on the merits of different approaches for regulating wireline broadband operators. In this paper, we address recent regulatory efforts to subject U.S. wireless operators to net neutrality regulation. We provide an economic framework for analyzing whether specific practices identified by proponents of wireless net neutrality should be regulated. We identify and estimate the likely costs and benefits of preventing wireless operators from imposing certain limitations on suppliers and end-users that are alleged to be anticompetitive.

1. Jon M. Peha, The Benefits and Risks of Mandating Network Neutrality, and the Quest for a Balanced Policy, Carnegie Mellon University Working Paper, Sept, 2006; Rob Frieden, Network Neutrality or Bias? Handicapping the Odds for a Tiered and Branded Internet, Pennsylvania State University Working Paper, Sept. 2006; Barbara van Schewick, *Towards an Economic Framework for Network Neutrality Regulation,* Journal of Telecommunications and High Tech Law (forthcoming 2007).

2. *See, e.g.*, Christopher S. Yoo, *Network Neutrality and the Economics of Congestion*, 94 GEORGETOWN LAW J. 1847 (2006); Bruce Owen, The Net Neutrality Debate: Twenty Five Years after United States v. AT&T and 120 Years after the Act to Regulate Commerce, AEI Brookings Joint Center Working Paper 07-03, Feb. 2007; Alfred E. Kahn, Network Neutrality, AEI Brookings Joint Center Related Publication 07-05, Mar 2007; J. Gregory Sidak, *A Consumer-Welfare Approach to Network Neutrality Regulation of the Internet*, 2 JOURNAL OF COMPETITION LAW & ECONOMICS (2006); Robert W. Hahn & Robert E. Litan, *The Myth of Network Neutrality and What We Should Do About It*, AEI-Brookings Joint Center Working Paper No. RP06-33 (Nov. 2006); Robert E. Litan & Hal J. Singer, *The Unintended Consequences of Net Neutrality,* 5 JOURNAL ON TELECOMMUNICATIONS AND HIGH TECH LAW (forthcoming 2007); Hal J. Singer, *Net Neutrality: A Radical Form of Non-Discrimination,* REGULATION (forthcoming 2007); William J. Baumol, Martin E. Cave, Peter Cramton, Robert W. Hahn, Thomas W. Hazlett, Paul L. Joskow, Alfred E. Kahn, Robert E. Litan, John W. Mayo, Patrick A. Messerlin, Bruce Owen, Robert S. Pindyck, Vernon Smith, Scott J. Wallsten, Leonard Waverman & Lawrence J. White, *Economists' Statement on Network Neutrality Policy*, AEI-Brookings Joint Center Working Paper No. RP07-08, Mar. 28, 2007.

To make matters concrete, consider the following practice of one wireless operator, Verizon Wireless, as of March 2007. If a Verizon Wireless subscriber commits to a two-year contract, then the price of her LG Strawberry Chocolate handset is $99.99; if she commits to a one-year contract only, then the price of the same handset increases to $199.99; if she does not commit to a contract, then the price increases to $269.99.[3] According to proponents of wireless net neutrality, this practice "distorts" the market for wireless handsets.[4] Using an economic framework, we can examine whether such a strategy is likely to lead to higher prices of handsets for end-users in the long-run, or whether there is some efficiency justification that explains the practice.

The intellectual support for wireless net neutrality regulation is provided in a provocative paper by Professor Tim Wu.[5] Wu's paper seeks to identify carrier practices that may be harmful to consumers. Wu cites several restrictions that wireless operators have imposed on their customers or suppliers, including a requirement that all handsets be sold by the wireless operator. Economists refer to such restrictions as "vertical restraints." There is a large literature on the economic impacts of such restraints. In some cases such restraints can reduce economic welfare, while in others they increase economic welfare.[6] Most, but not all, of the allegedly anticompetitive conduct identified by Wu can be characterized as a vertical restraint.[7]

To appreciate the controversy raised by proponents of wireless net neutrality, one needs a basic understanding of the structure of the wireless market. Consider, for example, the relationship between an applications provider and a wireless customer. Because the transaction between those two entities flows over the

3. *Id.*

4. In the Matter of Skype Communications S.A.R.L. Petition to Confirm A Consumer's Right to Use Internet Communications Software and Attach Devices to Wireless Networks, Dkt. No. RM-11361, Feb. 20, 2007, at 13 [hereinafter *Skype Petition*] ("For the vast majority of U.S. wireless consumers, carriers sell phones that are highly subsidized and mask the true cost of the device. Consequently, the market for wireless devices is unusual and distorted. This market distortion is of increasing concern as handsets become more versatile and are used to access a broader array of functions and services.") (citation omitted).

5. *See* Tim Wu, Wireless Net Neutrality: Cellular Carterfone on Mobile Networks, New America Foundation Wireless Future Program Working Paper No. 17, Feb. 2007, *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=962027&high=%20net%20neutrality. By March 11, 2006, a little over one month after its initial posting, Wu's paper had been downloaded over 1,700 times, making it the second most popular paper among all SSRN postings between January 10, 2007 and March 11, 2007. By April 2, 2007, the paper had been downloaded 1,961 times. *See Skype Petition* at 12 n.21, 13 n.22 (citing Wu).

6. We define economic welfare as the sum of producer surplus and consumer surplus. Profits are a good proxy for producer surplus. Consumer welfare is equal to the difference between a consumer's willingness to pay for a good and the price summed across all consumers. Economists may disagree on whether regulatory policy should focus on consumer surplus only. We focus on consumer surplus here because that seems to be a concern of Wu.

7. Wu identifies some other practices that he also finds objectionable, such as failing to disclose key information to consumers. These other practices are considered here as well.

network of a wireless operator, the operator can be thought of as the "downstream" provider—that is, the entity that interfaces with the customer. The applications provider is referred to as the "upstream" provider because it is removed from the end-user. The wireless operator may have the ability to impose certain restraints on the behavior of upstream suppliers as a condition for gaining access to the operator's customers.

Some upstream applications suppliers have relied on the Wu paper to support an agenda of greater regulation of wireless operators. Shortly after Wu's initial paper was released, Skype, a voice over Internet protocol (VoIP) provider that generally relies on wireline broadband networks, filed a petition at the Federal Communications Commission (FCC) asking the agency to "confirm a consumer's right to use Internet communications software and attach devices to wireless networks."[8] The petition alleges that wireless operators are engaging in restrictive practices at both the "device layer"—at the point of handset purchase—and the "application layer"—at the point of installing applications on their chosen handset—that are harming consumers. The petition requests that the FCC should apply a *Carterfone*-style rule to wireless networks[9]—a rule imposed by the FCC in 1968 that required AT&T to allow devices to be connected directly to the AT&T wireline network so long as they did not cause damage to the network. Skype also asks the FCC to "initiate a proceeding to evaluate wireless carrier practices in light of *Carterfone*, and to create an industry-led mechanism to ensure the openness of wireless networks."[10] In this paper, we also provide an economic analysis of the Skype petition.

The paper is organized as follows. In Part II, we provide an analytical framework for determining whether government intervention, both generally and of the particular kind sought here, is warranted in the U.S. wireless industry. We lay out four general principles for regulatory intervention:

(1) There should be clear evidence of a significant market failure;
(2) There should be clear evidence that the proposed intervention is likely to be better than the status quo;
(3) The intervention should take into account all important benefits and costs; and
(4) The proposal should draw constructive lessons from earlier attempts at regulation.

In the absence of direct or indirect evidence of a market failure, it is generally not prudent to interfere with a well-functioning market.[11] We demonstrate here that there is a high degree of competition in the wireless industry, and thus little reason to believe that there is a significant market failure. According to the FCC, the price of a wireless call, as measured by the revenue per minute for the operator or cost per minute from the end-user, declined from $0.43 in 1995 to $0.07 in 2005.[12]

8. *Skype Petition* at 1.
9. *Id.* at 25-28.
10. *Id.* at 28-30.
11. *See, e.g.*, Kenneth J. Arrow et al, *Is There a Role for Benefit-Cost Analysis in Environmental, Health, and Safety Regulation?*, 272 SCIENCE 221-222 (1996)
12. FCC, Eleventh Annual Report to Congress on the State of Competition in the Commercial Mobile Radio Services (CMRS) Industry, WT Dkt. No. 06-17, released

We also demonstrate that the proponents of wireless net neutrality have failed to specify a clear benchmark (or counterfactual) from which to judge success. Notwithstanding Wu's assertion to the contrary, we demonstrate that U.S. wireless customers enjoy great diversity in their wireless telephones. Moreover, innovation at the application level is thriving. A survey of FCC competition reports and the operators' websites reveals that there have been more than 50 significant innovations in wireless applications since 1999. A separate review of the operators' websites reveals that there are more than 150 unique models of handsets directly available from the five largest operators. It is incumbent on proponents of regulation to explain why that seemingly high level of product diversity is not adequate.

Next, we specifically examine the costs and benefits of Wu's proposal to prevent wireless operators from imposing certain restraints on upstream suppliers.[13] We demonstrate that banning these restraints would not likely generate significant benefits for consumers. The reason is that the market structure of the U.S. wireless industry is simply not conducive to engaging in anticompetitive strategies aimed at weakening upstream equipment or applications providers. Moreover, the wireless market is constantly evolving, which makes regulation even less likely to achieve its objective. We also explain why allowing wireless operators to impose certain limitations on both suppliers and end-users would preserve significant efficiencies that redound to the benefit of wireless consumers. Common limitations imposed by wireless carriers include offering discounts on handsets in exchange for term commitments, using exclusive distribution agreements between operators and handset makers, and imposing limits on foreign attachments or the type of content downloaded. We demonstrate clear efficiency justifications for each of these limitations. In particular, these strategies can be shown to (1) encourage wireless operators to promote handsets aggressively, (2) permit the wireless operator to discount the price of the handset, (3) ensure a high quality of service for wireless customers, or (4) enable the wireless operator to manage a scarce resource. Regarding other practices identified by Wu, such as requiring that a handset be sold by the operator or disabling certain features of the handset, we find that those strategies are *generally not employed by wireless operators*. Where a network operator vigorously polices usage by its customers, the quality of service and thus customer satisfaction tend to be higher. We find that the network that engages in the "worst practices" identified by Wu ranks highest according to customer satisfaction surveys. Given the high level of competition in the wireless industry, an individual operator should be entitled to experiment with different business models, especially where there is unlikely to be any anticompetitive effect.

In Part III, we address specific problems in Wu's analysis and Skype's proposal to apply *Carterfone* rules to the wireless industry. We explain that, for

Sept. 29, 2006, Appendix A Table 10 [hereinafter *Eleventh CMRS Report*]. The numerator in the average price per minute is average revenue per subscriber, which is collected by CTIA. These values are given in nominal terms rather than real terms. The FCC shows that the "Cellular CPI," as recorded by the Bureau of Labor Statistics, declined by 35 percent from December 1997 to December 2005. *See id.* at Appendix A Table 9. Thus, cellular prices have declined in real terms.

13. Skype basically proposes Wu's policies in its FCC petition. Thus, our analysis of Skype's proposal would be no different from our analysis of Wu's proposal.

at least four reasons, the market and regulatory conditions that potentially justified *Carterfone* regulation in the late 1960s do not exist in the current U.S. wireless industry. First, unlike AT&T's control of the supply of wireline voice services nearly forty years ago, U.S. wireless operators today lack monopoly power in the downstream market for wireless services. Second, unlike wireline voice services in the 1960s, U.S. wireless operators have not integrated into the upstream applications or equipment markets. Third, a wireless operator lacks the ability to exercise buying power over an upstream handset supplier like Apple, which wields significant countervailing seller power. Fourth, wireless operators are not subject to price regulation in the market in which they are alleged to have market power, which might encourage them to seek profits in complementary markets.

Wu asserts that several "obvious" wireless applications seem to be missing, such as uploading photos or printing address labels. Wu cannot, however, reject the hypothesis that certain applications are not offered by wireless operators because they are not in sufficient demand. The power of well-functioning markets ensures that consumer needs that are not currently met will likely soon be addressed. As of 2007, a Blackberry could do many things a laptop could not and vice versa. If a laptop maker could shrink its device to the size of a Blackberry, it would. Likewise, if a Blackberry could perform all of the applications of a laptop, it would. The fact that a Blackberry cannot perform a certain function today is not evidence of a conspiracy among wireless operators. If that function is demanded by a sufficient number of wireless subscribers, it is likely to be available on the next generation of wireless handsets.

Next, we explain why exclusive contracts between wireless operators and content providers are unlikely to harm consumers in the wireless market. In particular, the type of content that has become exclusive to a particular wireless operator, such as an online music library, is generally interchangeable with a music library carried by a rival operator. This stands in sharp contrast to certain exclusive contracts used by video distributors—for example, an exclusive agreement to carry National Football League games. Such exclusive content cannot be replicated by a rival distributor, which means that the end-user may be forced in the case of video service (but not wireless services) to purchase multiple subscriptions to access exclusive, *non-replicable* content on two different systems.

In Part IV, we explain why Wu's proposed remedies do not flow from his theory of competitive harm. In particular, Wu makes four major policy recommendations:

(1) Wireless operators should be compelled to allow customers to attach any safe device to their wireless handsets;
(2) Wireless operators should be compelled to allow customers to use the applications of their choice and view the content of their choice;
(3) Wireless operators should be compelled to disclose any limits placed on devices and on bandwidth usage;
(4) The wireless industry should work together to create clear and unified standards for developers.

We assess each of these recommendations in turn. We conclude that the best policy for the U.S. wireless industry is maintaining the current light-handed

approach to regulation, which generated by our estimates roughly $50 billion in consumer welfare in 2005 alone.[14] Additional government regulation of the wireless market could put these substantial consumer benefits at risk.

II. A FRAMEWORK FOR DETERMINING WHETHER GOVERNMENT INTERVENTION IS WARRANTED IN THE U.S. WIRELESS INDUSTRY

A dynamic market is one in which technology is constantly changing, where today's market leader can be upstaged by an unforeseen competitor or technology. In dynamically competitive markets, such as the U.S. wireless industry, the government should be very reluctant to regulate.[15] The problem for regulators is that dynamic incentives to invest are important to wireless operators. Inefficient regulation threatens to jeopardize the investment needed to upgrade the existing third generation (3G) wireless platform to support broadband services and to launch the fourth generation (4G) network to support real-time applications such as mobile video, remote monitoring, and mobile commerce. Indeed, regulation in network industries generally and in the wireless industry in particular does not have a very positive history.[16] In this section, we provide some general principles for regulatory intervention of any kind in the U.S. wireless industry. We demonstrate that the costs that would result from banning certain limitations currently imposed by wireless operators would likely exceed the benefits created by allowing those limitations.

A. General Principles for Regulatory Intervention in the U.S. Wireless Industry

When considering regulatory intervention of any kind, at least four overarching principles should be considered. We outline these principles below, and then apply each principle to the U.S. wireless industry. Our approach does not rule out all forms of regulation in the wireless industry. For example, it is conceivable that certain wireless applications with positive externalities or

14. Consumer welfare is equal to the area under the demand curve bounded from below by price. Assuming linear demand, that area is equal to one half the product of the quantity of wireless subscriptions and the difference between the average monthly price and the monthly "choke price" or price at which the demand for wireless service would be zero. For example, using an elasticity of demand of -1.2, an average monthly price of roughly $50, and 213 million wireless subscribers, the monthly choke price for wireless service is roughly $91. Thus, the monthly consumer welfare is roughly $4.4 billion and the annual consumer welfare is roughly $53.2 billion. For an estimate of the elasticity of demand for wireless service, see Allan T. Ingraham & J. Gregory Sidak, *Do States Tax Wireless Services Inefficiently? Evidence on the Price Elasticity of Demand*, 24 VIRG. TAX REV. 249, 257 (2004) (generating estimates of -1.12 and -1.29). For average monthly prices and total number of wireless subscribers, see *Eleventh CRMS Report*, *supra* note 12, ¶¶5, 155.

15. *See, e.g.*, Dennis Carlton, *Antitrust Policy Toward Mergers When Firms Innovate: Should Antitrust Recognize the Doctrine of Innovation Markets?*, Testimony before the Federal Trade Commission Hearings on Global and Innovation-based Competition (Oct. 1995).

16. *See, e.g.*, Bruce Owen, The Net Neutrality Debate: Twenty Five Years after United States v. AT&T and 120 Years after the Act to Regulate Commerce, AEI Brookings Joint Center Working Paper 07-03, Feb. 2007.

spillovers might be undersupplied by the market. The key issue here, however, is whether proposals to implement wireless net neutrality make good economic sense.

1. There Should Be Clear Evidence of a Significant Market Failure

Markets generally can be counted on to allocate resources efficiently and to ensure that goods and services are supplied at the lowest cost possible.[17] In the presence of externalities (benefits or costs that cannot be fully captured by the parties to a transaction), however, markets may fail by providing too much (in the case of negative externalities) or too little (in the case of positive externalities) of a good. There are externalities in network industries like communications services,[18] which implies that the market-determined size of a network might be less than the socially optimal level. The existence of positive externalities has been used to justify subsidies for customers living in high-cost areas, which increase the number of subscribers to the network and thereby generate benefits for existing subscribers. To the extent that these externalities are significant, they would not be addressed by any of the proposed remedies sought by proponents of wireless net neutrality.[19]

Proponents of any regulation must first demonstrate the existence of a significant failure in the wireless market. Direct evidence of a market failure could include proof that (1) prices are significantly above or below the relevant measure of costs, or (2) output is significantly above or below socially efficient levels. Economists often subscribe to a version of the Hippocratic oath—first, do no harm. In the absence of large positive externalities or high entry barriers, they believe that markets generally do a pretty good job in allocating resources.

Although Wu is concerned about innovation in the upstream applications market, he provides no quantitative evidence of a particular market failure in the U.S. wireless industry. In particular, he provides no direct evidence (for example, output being significantly below efficient levels) and no indirect evidence (for example, the existence of strong positive externalities or high entry barriers). We believe that such a demonstration is difficult precisely because of the robust competition among U.S. wireless operators.

By almost any measure, the U.S. wireless market is highly competitive. Consumer choices are expanding and prices are declining. In its series of annual *Commercial Mobile Radio Services (CMRS) Competition Reports*, the FCC has documented the concurrent increase in wireless usage and decrease in wireless prices over the past decade. Table 1 summarizes these statistics from 1993 through 2005.

17. Of course, there are other important concerns, such as equity. We do not consider such concerns in the interest of brevity, though they can be important in selected instances.

18. *See* Carl Shapiro & Hal R. Varian, INFORMATION RULES: A STRATEGIC GUIDE TO THE NETWORK ECONOMY, Harvard Business School Press (1999).

19. Even where positive externalities exist, it may be difficult to implement regulation or subsidies that improve on the status quo.

TABLE 1: WIRELESS TELEPHONY PRICES AND USAGE 1993-2005

	Average Monthly Wireless Bill (A)	*Average Minutes of Use Per Month (B)*	*Average Revenue Per Minute (A / B)*
1993	$61.49	140	$0.44
1994	$56.21	119	$0.47
1995	$51.00	119	$0.43
1996	$47.70	125	$0.38
1997	$42.78	117	$0.37
1998	$39.43	136	$0.29
1999	$41.24	185	$0.22
2000	$45.27	255	$0.18
2001	$47.37	380	$0.12
2002	$48.40	427	$0.11
2003	$49.91	507	$0.10
2004	$50.64	584	$0.09
2005	$49.98	740	$0.07

Source: FCC, Eleventh Annual Report to Congress on the State of Competition in the Commercial Mobile Radio Services (CMRS) Industry, WT Dkt. No. 06-17, released Sept. 29, 2006, at tbl. 10.

Table 1 shows that the price of a wireless call, as measured by the revenue per minute for the operator or cost per minute from the end-user, has declined from $0.43 in 1995 to $0.07 in 2005—a decline of roughly 84 percent in one decade. There are few services consumed in the United States that have experienced such a rapid decrease in prices. Table 1 also shows that wireless usage has exploded over the same period, from 119 to 740 minutes per month.

In addition to falling prices and higher usage, the quality of wireless service appears to have improved significantly. According to a J.D. Power and Associates survey released in March 2007, the overall rate of customers experiencing a wireless call quality problem declined for a third consecutive year.[20] One explanation for the higher satisfaction is the digitization of the wireless networks. Digital technology provides better sound quality than analog technology. According to the FCC, digital technology is now dominant in the mobile telephone sector, with approximately 97 percent of all wireless subscribers using digital service.[21] Digital technology also allows for more efficient use of the spectrum. By improving network performance, these upgrades improved the quality of service in terms of (1) better voice quality, (2) higher call-completion rates, (3) fewer dropped calls and deadzones, (4) additional calling features, (5) more rapid data transmission, and (6) advanced data applications.[22]

The most likely explanation for falling prices is an increase in the number of wireless operators, which generates more intense price competition. The FCC's *Eleventh Annual CMRS Report* reports that, as of 2006, roughly 94 percent of the

20. J.D. Power and Associates Reports: Wireless Call Quality Problems Continue to Decline as the Transition to 3G Networks Takes Hold, Mar. 15, 2007, *available at* http://www.newscom.com/cgi-bin/prnh/20050527/LAF028LOGO-a.

21. *Eleventh CMRS Report*, *supra* note 12, ¶105.

22. *Id.* ¶131.

U.S. population had a choice of at least four wireless operators.[23] That represents an increase from the roughly 80 percent of the population that had a choice of four or more operators in 2000.[24] The fact that 14 percent of the population (equal to 94 percent less 80 percent) experienced one extra choice in just the past five years implies that the supply of wireless service is increasing and that there are few barriers to entry.

Entry into wireless services can occur through expansion of regional wireless networks or through new entry or both. Both kinds of entry occurred in the FCC's recent Advanced Wireless Services spectrum auction, which closed in September 2006 after raising roughly $13.7 billion for the U.S. Treasury.[25] Regional operators like MetroPCS (the fourth biggest winner) and Cricket (the sixth biggest winner) expanded their existing wireless footprints and acquired sufficient spectrum to offer broadband services.[26] Cable operators Comcast, Cox, and Time Warner also acquired spectrum in the auction.[27] According to FCC Chairman Kevin Martin, "more than half of the winning bidders were small business."[28] And the entry process is nowhere near complete. In addition to spectrum acquisition,[29] firms such as Disney Mobile, Microsoft Media Mobile-Zune, Wal-Mart, and Virgin Mobile have entered the market as mobile virtual network operators (MVNOs), which involves reselling wireless capacity of an incumbent operator under a different brand name.[30] The variety of categories of MVNOs, which range from "Prepaid" to "Ethnic" to "Youth," demonstrates the niche markets that are now being served by entrants.[31] Thus, applications developers, including Skype, could make use of unused spectrum—either by acquiring it from the FCC or by purchasing it from wireless operators—as a way of resolving their concerns with the alleged buying power of incumbent wireless operators.

2. *There Should Be Clear Evidence That the Proposed Intervention Is Likely to Do More Good than Harm*

Proponents of regulation should also demonstrate that the proposed intervention will improve efficiency relative to the status quo. The efficiency

23. *Id.* at tbl. 11.

24. *Id.*

25. FCC, Auction 66 Advanced Wireless Services (AWS-1), All Bidders Spreadsheet, *available at* http://wireless.fcc.gov/auctions/66/charts/66bidder.xls.

26. *Id.*

27. *Cable Consortium Acquires Spectrum Licenses Covering National Foot*, PR NEWSWIRE, Oct. 5, 2006, *available at* http://sev.prnewswire.com/entertainment/20061005/PHTH01505102006-1.html.

28. *FCC Spectrum Auction Closes, T-Mobile Among Top Winners*, XCHANGEMAG, Sept. 19, 2006, *available at* http://www.xchangemag.com/hotnews/69h198599.html.

29. The FCC's Broadband Personal Communications Services auction (auction #71) is scheduled to begin in May 2007. *See* FCC, Scheduled Auctions: Auction 71 Broadband PCS, *available at* http://wireless.fcc.gov/auctions/default.htm?job=auction_summary&id=71.

30. *See* THOMAS WINTER AABO, US MOBILE VIRTUAL NETWORK OPERATORS 2007: THE DEFINITIVE GUIDE AND CRITICAL ANALYSIS OF THE US MVNO MARKET, Mind Commerce, Mar. 2007.

31. *Id.* at 11.

criterion considers the welfare of consumers and producers in both a static and dynamic sense. Wu does not provide any quantitative evidence that his proposed remedies are likely to be more efficient than the status quo. Instead, he simply asserts that the conduct in question "may be harmful for consumers and society."[32] Skype similarly asserts without empirical proof that "consumers are worse off as competition . . . is diminished."[33] The problem with this argument is that, even if it were true, it is not clear that a change in conduct would represent a net improvement for consumers and producers. Given the lack of evidence of any significant market failure, and given the rapid change in wireless technology, we think that the efficiency associated with the status quo cannot be easily improved upon.

The prospects of improving welfare through regulation of industries characterized by rapidly changing technology are even more difficult. Wireless services are evolving rapidly, from analog voice to digital voice (2G) to data (3G) to video (4G). This remarkable progress occurred in the span of one decade. As explained by the late William Baxter, who headed the antitrust division of the U.S. Justice Department, it would be dangerous to interfere with this kind of dynamic industry.[34] For example, who in the later 1990s would have foreseen Google's rise to Internet prominence in just a few short years?[35]

In assessing specific regulatory proposals, researchers should clearly identify the benchmark for comparison, or counterfactual. In this example researchers should identify what the world would look like with and without the alleged anticompetitive conduct. Wu implicitly assumes that innovation at the "edges" of the network (that is, application developments) would occur at a faster pace in the absence of wireless operators' conduct, but the evidence from the marketplace suggests that innovation at the edges has been flourishing. A review of FCC annual competition reports and the wireless operators' websites reveals that there have been over 50 significant innovations in wireless applications since 1999 (see Appendix 1).

Wu also notes the lack of diversity in wireless handsets.[36] Table 2 shows the number of unique brands and models of handsets sold by the top five U.S. wireless operators as of March 2007. Our estimate is conservative because it does

32. Wu at 6.

33. *Skype Petition* at 23.

34. According to Baxter, regardless of the evidence of consumer harm, if "there is no assurance that appropriate relief could be obtained," then the government must question the value to consumers of imposing a remedy. *In re International Business Machines Corp*, 687 F2d 591, 594 (2d Cir 1982) (quoting William F. Baxter, Assistant Attorney General, U.S. Department of Justice); Russ Mitchell and Marianne Lavelle, Road Runner v. Coyote: As Microsoft Case Shows, Markets Move Faster than Justice, US NEWS & WORLD REP 58, 59 (Dec 15, 1997) (quoting Baxter as saying that in dynamic industries "companies will compete for markets, rather than in markets.").

35. For the seminal treatment of the role of innovation in the economy, see JOSEPH A. SCHUMPETER, THE THEORY OF ECONOMIC DEVELOPMENT (Oxford University Press 1949) (explaining how innovations by entrepreneurs disturb the static equilibrium and are the cause of all economic development).

36. Wu at 13 ("Two sets of consequences flow from the control that carriers exert on the marketing and attaching of mobile devices in the United States. One is a loss of product diversity. Of the many mobile devices sold even by major providers like Nokia and Motorola, only a fraction effectively make it to the U.S. market.").

not include models that are purchased from a third party, such as Amazon.com, that does not provide the wireless service. Nor does it include models offered by MVNOs, which offer branded handsets that are unique to their network.

TABLE 2: NUMBER OF UNIQUE BRANDS AND MODELS SOLD BY THE TOP FIVE U.S. WIRELESS OPERATORS

Wireless Carrier	Number of Brands*	Number of Handsets
Verizon	7	36
Cingular/AT&T	9	45
Alltel	9	23
T-Mobile	4	27
Sprint/Nextel	6	41
Total	**12**	**154****

Source: Verizon Wireless, www.verizonwireless.com (last visited Mar. 13, 2007), T-Mobile, www.t-mobile.com (last visited Mar. 13, 2007), Alltel Wireless, www.alltel.com (last visited Mar. 13, 2007), AT&T Wireless, www.cingular.com (last visited Mar. 13, 2007), Sprint, www.sprint.com (last visited Mar. 13, 2007).

Note: * The brands represented include Blackberry, Firefly, Kyocera, LG, Motorola, Nokia, Palm, Pantech, Samsung, Sanyo, Sony Ericsson, and UTStarcom. ** The total figure eliminates any redundant phones (for example, the Palm 700p is offered by Alltel, Sprint, and Verizon, but is only represented once in the total). Several carriers, including Verizon, Sprint, AT&T, and T-Mobile, have devices with no easily ascertained brand (for example, the T-Mobile Sidekick). These fifteen handsets are captured in the total number of handsets. Therefore, the total figure comprises all unique handsets available.

Table 2 reveals that a wireless customer has more than 154 unique handset options before committing to a particular wireless operator. Conditional on choosing an operator, the customer has on average 34 choices. This estimate is highly conservative because it does not include handset options that are not sold by the issuing operator. It is incumbent upon those seeking regulation to demonstrate that, in the absence of the alleged anticompetitive conduct identified here, wireless consumers would currently enjoy more application innovation and more choices in handsets. Moreover, even if one could demonstrate greater application innovation from the regulation, it is not clear that the benefit of the additional application innovation exceeds the additional cost. For example, achieving more innovation at the "edges" may come at the expense of less innovation at the "core" of the network.

3. *The Intervention Should Take into Account All Important Benefits and Costs*

The third principle is that those seeking intervention must account for the regulatory impact on *all* important benefits and costs. There is no economic rationale for giving more weight to one type of benefit from innovation than another. But that tunnel vision is exactly what proponents of wireless net neutrality are inclined to do. In particular, Wu elevates "edge" innovations by applications developers above innovations at the "core" of the network by

wireless operators.[37] It is not clear that innovations at the edges of the network are more valuable than innovations at the core.[38] Without innovations at the core of the network, it is difficult to support innovation at the edge. The two areas of innovation are generally complementary. For example, a video-enabled handset is useless on a network with analog spectrum; telecommunication-devices-for-the deaf handsets cannot work effectively if there are no corresponding capabilities in the network; and GPS-enabled handsets depend on specific capabilities in the network.[39] Any attempt to favor producers at the edges could undermine the incentives of producers at the core, which could decrease overall welfare.

4. The Proposal Should Draw Constructive Lessons from Earlier Attempts at Regulation

Price and entry regulation in competitive industries do not generally make for good public policy.[40] While it is true that regulation is sometimes warranted, the history of regulatory intervention is replete with examples of good intentions gone awry.[41] This is especially true in wireless telephony. The wireless industry has been subjected on several occasions to regulation[42] and taxation,[43] and the inefficiency of such reforms should not be ignored by proponents of wireless net neutrality. On other occasions, regulatory proposals for the wireless industry have been rejected by federal agencies.[44] In what follows, we briefly review one such experience.

37. Wu at 25 ("A more plausible explanation for the behavior seen here is this: carriers believe it makes sense to block a feature to protect an existing revenue source, or to keep their own costs low, even if that behavior is bad for actors in the equipment and application markets and hurts innovation."). Wu fails to consider innovation by wireless network operators in his objective function.

38. Hahn & Litan, *supra* note 2.

39. For more examples of the interdependency between application innovation and network innovation, see Charles Jackson, Wireless Handsets Are Part of the Network, Apr. 24, 2007.

40. *See, e.g.*, Paul L. Joskow, Incentive Regulation in Theory and Practice: Electricity Distribution and Transmission Networks, AEI Brookings Joint Center Working Paper 05-18, Sept 2005.

41. *See* Paul L. Joskow & Robert Noll, *Regulation in Theory and Practice: An Overview*, in STUDIES IN PUBLIC REGULATION 1-65 (Gary Fromm, ed., MIT Press 1981); George Stigler, *The Theory of Economic Regulation,* 2 BELL J. ECO. & MGMT. SCIEN., 3-21 (1971); Sam Peltzman, *Toward a More General Theory of Regulation,* 19 J. L. & ECON. 211 -240 (1976); Richard Posner, *Theories of Economic Regulation,* 5 B ELL J. ECON. & MGMT. SCIEN. 335-358 (1974).

42. *See* J. Gregory Sidak, Hal J. Singer & David Teece, *A General Framework for Competitive Analysis in the Wireless Industry*, 50 HASTINGS LAW REVIEW 1639 (2000).

43. *See* Allan T. Ingraham & J. Gregory Sidak, *Do States Tax Wireless Services Inefficiently? Evidence on the Price Elasticity of Demand*, 24 VIRGINIA TAX REVIEW 249-261 (2004) (showing that we find that reducing the taxation of wireless services by one dollar would improve economic welfare by between $1.23 and $1.95).

44. *See* Thomas W. Hazlett, *Is Federal Preemption Efficient in Cellular Phone Regulation?*, AEI Brookings Joint Center Related Publication 03-21, Sept. 2003 (explaining that contrary to arguments made by the California PUC, wireless rates did not rise with the elimination of state rate controls); Jerry Hausman, Expert Declaration, in CTIA Petition for Expedited Declaratory Ruling on Early Termination Fees (explaining

Before 1993, states had the power to regulate prices and terms of service of wireless providers. The Omnibus Budget Reconciliation Act of 1993 preempted state authority over rate and entry regulation in wireless telephony. The FCC chose to waive its right to regulate rates and entry. The states retained some authority to regulate wireless service under the general rubric of consumer protection wherever state regulation did not interfere with rates and terms.

For example, the California Telecommunications Bill of Rights sought to limit wireless operators' discretion in a wide range of activities, with the focus on disclosure of contract terms and redress in cases in which customers are not satisfied with service. In particular, the Bill of Rights, which was approved by the California Public Utilities Commission (CPUC) in May 2004, required that wireless operators (1) supply detailed service agreement information when customers sign up, (2) produce bills that are "clearly organized," containing only charges for products and services the customer has authorized, (3) adds thresholds for charging late fees, and (4) requires wireless carriers to separately list all federal, state and local taxes, surcharges, and fees.[45]

Because many wireless operators use the same billing system to cover multiple states, the Bill of Rights forced wireless operators to decide how to generate one bill type for the California customers and another for their customers elsewhere. A second cost of the regulation was the requirement that wireless operators obtain subscribers' authorization for charges, which adversely affected the market for wireless downloads. While traditional billing systems can track content charges and render them on a bill, it was not clear how to efficiently track customer authorization that often takes the form of printed approvals and voice recordings.

Recognizing these burdens were "too onerous for the cell phone industry," in January 2005, the CPUC voted to suspend and redraft the legislation.[46] In March 2006, the CPUC approved a revised form of the original "Bill of Rights," which created a fraud unit to investigate sellers who mislead customers about fees and services and called for greater state intervention in educating consumers to prevent contract abuses.[47]

In addition to demonstrating how regulation of a competitive industry imposes unforeseen costs on society, the California Bill of Rights undermines Wu's suggestion that wireless consumers lack "meaningful information regarding their service plans."[48] There is little theoretical basis for thinking that the U.S. wireless industry will produce something less than the efficient level of information for wireless customers. For example, Sprint recently announced a

that such fees are part of a carrier's pricing structure for recovering revenues to offset costs.)

45. Karen Brown, *Breaking Down The Bill: New California regulations require carriers to beef up wireless bill information and that may cause them more than a few headaches*, WIRELESS WEEK, Aug. 15, 2004, *available at* http://www.wirelessweek.com/article/CA445086.html?text=bill+audit.

46. Jordan Robertson, *California Regulators Pass 'Wireless Bill of Rights'*, Sacramento Uniion, Mar. 2, 2006, *available at* http://sacunion.com/pages/state_capitol/articles/7879.

47. *Id.*

48. Wu at 32.

new billing format for its wireless customers,[49] which suggests that carriers pay attention to these matters. There are many places where a wireless consumer can obtain information. And aggressive state public utility commissions, like the CPUC, will be quick to intervene whenever they believe such intervention would serve their constituency. Thus, calls for federal intervention to produce more information are unwarranted.

B. Assessing the Benefits and Costs of the Proposal to Prevent Wireless Operators from Imposing Certain Limitations on Suppliers

When evaluating whether to prevent a certain type of contracting between a distributor and its suppliers, one must carefully weigh the benefits against the costs. Economists describe the constraints imposed on a supplier (by a distributor) or on a distributor (by a supplier) as "vertical restraints." There is a large economic literature on the efficiency rationales for imposing vertical restraints on suppliers or distributors. The most common rationale for imposing a restraint on a distributor is to avoid what economists call the "double marginalization problem," in which the distributor marks up the price a second time above the wholesaler's markup.[50] In his textbook on industrial organization, Jean Tirole explains that "[r]estraints that correct this externality tend to be welfare improving."[51] A second efficiency justification for vertical restraints is to promote pre-sale information by retailers, which is costly to produce and therefore invites free-riding.[52] Tirole concludes that these and other "vertical restraints can increase or decrease welfare, depending on the environment."[53] Failing to recognize this literature, Wu considers and rejects only one efficiency rationale that could explain the wireless operators' conduct—namely, price discrimination.[54] He then concludes incorrectly that the operators' conduct is

49. Press Release, Sprint Nextel, Wireless Customers Now Have The Power Of Simplicity (Apr. 03, 2007) (on file with author).

50. Because the cost faced by the retailer (the price charged by the wholesaler) is higher than the true cost to the wholesaler, the retailer's profit-maximizing calculus will cause it to purchase a quantity of the intermediate good from the wholesaler that is too low. The sum of the profits of the wholesaler and the retailer will be lower than the profit that would accrue to a hypothetical vertically integrated firm that fulfilled the roles of both wholesaler and retailer. By placing vertical restraints on retailers, a wholesaler can capture the benefits of a vertically integrated firm and thus obtain the largest possible profit.

51. JEAN TIROLE, THE THEORY OF INDUSTRIAL ORGANIZATION 186 (MIT Press 1993).

52. *Id.* at 183. For example, consider the case of an intermediary that invests a significant amount of money educating end-users in a particular geographic market about a particular brand. If, as a result of these efforts of that intermediary, demand for that brand increases in the geographic market, the benefits from that increased demand would accrue to both that intermediary and to all other intermediaries that offer that brand but engaged in no efforts to develop the brand. Thus, intermediaries would have little incentive to engage in product development in the absence of exclusivity, which is why suppliers grant exclusive contracts.

53. *Id.* at 186.

54. Wu at 35 ("In other words, the other half of the price discrimination strategy is missing. Out of Superman is made Clark Kent, but without retaining Superman. That fact

most likely explained as an anticompetitive attempt to "protect an existing revenue source."[55] As we demonstrate below, Wu failed to consider other plausible efficiency justifications.

1. *Banning Certain Limitations Imposed by Wireless Operators Would Not Generate Any Benefits for Consumers*

Before considering the costs of banning the alleged anticompetitive conduct by wireless operators, we examine the asserted benefits of the proposal. A nearly identical anticompetitive theory that is being offered to the FCC in support of wireless net neutrality was considered and rejected by an antitrust court in 2005. In her opinion in *Wireless Telephone Service Antitrust Litigation*, Judge Denise Cote of the Southern District Court of New York ruled that no individual wireless provider had sufficient market power to foreclose an unaffiliated handset maker by tying the purchase of the handset to the wireless subscription.[56] The plaintiffs, a class of wireless subscribers, argued that the defendants (the wireless operators) threatened to foreclose a number of handset makers by leveraging their wireless networks to act as a gatekeeper for handsets.[57] In rejecting the plaintiffs' theory, Judge Cote relied on testimony by representatives from some of the handset makers to show that the wireless providers did not have the requisite market power to foreclose handset makers.[58] She explained that the fact that the majority of handsets were sold through the wireless carriers did not imply that handset makers could not sell through an outside distributor or that they have not done so already.[59]

In what follows, we provide an economic analysis that is consistent with the framework used in that litigation. Although it is conceivable that regulation is needed to fill some gaps in antitrust enforcement, we conclude that regulatory

seems to raise doubts as to whether what the carriers are engaged in what can properly be called a price discrimination strategy."). Skype does not appear to consider efficiency justifications at all.

55. *Id.*

56. *In re Wireless Telephone Services Antitrust Litigation*, Opinion and Order, 02 Civ. 2637 (DLC) (2005).

57. *Id.* at 47.

58. For example, a Kyocera representative explained that a number of new manufacturers have entered the market by selling their products through an alternate distributor rather than a wireless carrier and by developing products that they then sold to other manufacturers that work with the wireless carriers such as Motorola or Nokia who could then provide it to the wireless carrier. *Id.* at 49. In addition, the representative testified that the wireless carriers, when presented with an interesting product made by a manufacturer not under contract with that particular carrier, often encourage these handset makers to work through an existing supplier. *Id.*

59. In fact, an LG representative testified that there is nothing that would stop his company from selling directly to consumers in the United States rather, his company simply chose not to. *Id.* at 52. In 2006, Nokia opened a few retail stores in New York and Chicago, and it is experimenting with direct sales. *See* Press Release, Nokia, Start spreading the news: Nokia Flagship Store makes its debut in New York City (Aug. 1, 2006) (on file with author); Press Release, Nokia, Nokia Flagship Stores to offer unique wireless shopping experience for US customers (Jun. 19, 2006) (on file with author).

intervention is not warranted here. We begin by defining the relevant geographic market for analyzing the competitive effects of the alleged conduct.

a. Antitrust Analysis Should Start by Defining the Relevant Market

When evaluating whether a particular type of conduct is anticompetitive, antitrust analysis begins with a definition of the relevant product and geographic market, which serves as a proxy for the scope of the alternative paths that are available to the alleged harmed party. The ability of a wireless operator to inflict harm on a handset maker or applications provider depends critically on the buying power of the wireless operator. This power depends, in turn, on the availability of alternatives for wireless customers. If there are few alternative paths, then the operator may have the ability (but not necessarily the incentive) to harm rivals. When a buyer controls all of the available paths to the end-users, it is said to have "monopsony" power.

Although there is little dispute as to the relevant product here (the sale of wireless handsets or the sale of wireless applications), the relevant geographic market may not be as obvious. One possibility is the geographic territory covered by a regional U.S. wireless operator that is engaging in the alleged anticompetitive conduct. The *Horizontal Merger Guidelines* provide the relevant question for determining the relevant geographic market: Could a hypothetical monopsony buyer of wireless handsets in that region profitably decrease its offer price below the competitive rate?[60] If handset suppliers constituting a critical share of the market shifted their sales to wireless operators outside of that region, then the attempted price cut would be defeated, in which case the geographic market would have to be expanded to the entire United States. Of course, a monopsony in the purchase of handsets throughout the United States might not be sufficient to exercise market power over handset makers (by imposing a price cut below competitive rates), in which case the geographic market might have to be expanded beyond the United States, and perhaps to the world.

Indeed, Wu acknowledges that the relevant geographic market for assessing the market for the purchase of wireless handsets may be worldwide: "First, the cellular phones widely available in the United States are just a small fraction of the phones available in the world. As Marguerite Reardon of C-Net points out, 'even though Nokia introduced roughly 50 new products into the market last year, only a handful were offered by operators in the U.S.'"[61] If a U.S. wireless operator refuses to carry one of Nokia's telephones—the most extreme form of foreclosure that is not even contemplated by Wu—then Nokia is free to sell its handsets to hundreds of non-U.S. operators. The larger the relevant geographic market, the smaller are the likely benefits of restricting the contracting practices of U.S. wireless operators.

60. The Department of Justice and Federal Trade Commission Horizontal Merger Guidelines, revised Apr. 8, 1997, § 1.2

61. Wu at 10. The likely reason why Nokia does not sell its entire line of handsets in every geographic market is that the frequency bands and consumer preferences differ across markets.

b. The Market Structure of the U.S. Wireless Industry Is Not Conducive to Foreclosure of Unaffiliated Equipment or Applications Providers

In the previous section, we explained that the relevant geographic market for assessing the conduct identified by Wu is conservatively the United States, and more realistically, the world. To assess a wireless operator's ability to harm upstream suppliers, one must next examine the degree to which any single operator possesses buying power in the relevant geographic market.

Wireless operators are alleged to have imposed certain restrictions on handset makers, such as requiring that all handsets be sold through the wireless operator. A more extreme form of foreclosure, and one that is useful for clarifying the potential benefits of banning the alleged anticompetitive conduct, is complete foreclosure, in which case the wireless operators refuses to deal entirely with a given handset maker. Table 3 shows the maximum foreclosure of the wireless market that a single operator could impose assuming conservatively that the relevant geographic market is the United States.

TABLE 3: MARKET SHARES OF TOP TEN U.S. WIRELESS OPERATORS AS OF DECEMBER 2005

Operator	*Subscribers (thousands)*	*Share*
Cingular/AT&T	54,144	26.8%
Verizon Wireless	51,337	25.4%
Sprint Nextel	44,815	22.2%
T-Mobile	21,690	10.7%
Alltel	10,662	5.3%
US Cellular	4,945	2.4%
Nextel Partners	2,018	1.0%
MetroPCS	2,000	1.0%
Leap	1,668	0.8%
Dobson Comm.	1,543	0.8%

Source: FCC Eleventh CRMS Report, tbl 4.

As Table 3 shows, the largest possible foreclosure share of any single wireless carrier is roughly 27 percent (by Cingular/AT&T). This implies that Cingular/AT&T, if it were so inclined, could prevent an equipment provider[62] or applications provider from reaching *at most* 26.8 percent of all U.S. wireless customers under the most extreme form of foreclosure. Of course, Cingular/AT&T does not appear to be considering such a strategy.

The relevant question for antitrust economists is whether an unaffiliated handset maker could achieve the lowest point of its cost curve by serving the remaining 73.2 percent of all U.S. wireless operators (not to mention the millions of non-U.S. subscribers). If the answer is "yes," then Cingular/AT&T lacks the ability to foreclose an upstream supplier. Because Cingular/AT&T is the largest provider, it follows that, if the answer is "yes," then any other U.S. wireless

62. This assumes that the equipment provider sells handsets that can operate on both GSM and CDMA networks. If the equipment provider sold handsets that worked on one technology only, then the foreclosure share in the United States would be larger.

operator lacks the ability to foreclose an unaffiliated handset maker. Recognizing this lack of buying power, and excluding the possibility of collusion among providers, it is unlikely that Cingular/AT&T (or any other provider for that matter) would attempt to foreclose a handset maker.[63]

c. There Can Be No Significant Anticompetitive Effects without Foreclosure

Antitrust economists focus on price as a proxy for short-term consumer welfare. Any conduct that undermines the price-disciplining ability of a rival can be considered anticompetitive.[64] Forcing a rival to exit the industry entirely (that is, "complete foreclosure") is not necessary to establish consumer harm. Rather, anything that undermines a rival's ability to discipline prices, including raising a rival's cost, is sufficient to generate consumer harm via the price channel. While it is possible that a certain type of conduct may harm a *competitor* (for example, by having a smaller incentive to invest), the only mechanism through which the conduct can have an anticompetitive price effect on *consumers* is by undermining a rival's ability to discipline price. Stated differently, some foreclosure is not anticompetitive foreclosure.

As we demonstrated above, complete foreclosure by a single wireless operator would not likely prevent a handset maker from achieving the requisite economies of scale (that is, the cost of making the handset would be no higher). Because the targeted handset maker could supply at a minimum the other U.S. wireless operators', there would be no foreclosure. And without foreclosure, there is no prospect of higher prices for consumers, as higher prices require higher costs of rival handset makers. Thus, without foreclosure, there can be no anticompetitive harm.

Wu fails to connect his theory of *competitor* harm with *consumer* welfare: "Yet at the same time, we also find the wireless operators aggressively controlling product design and innovation in the equipment and application markets, to the *detriment of consumers*."[65] It is one thing to claim that such conduct will redound to the harm of consumers. It is quite another to explain the mechanism by which the harm is transmitted to consumers in the absence of foreclosure. Because the anticompetitive harm under this extreme form of foreclosure is zero, it follows that the anticompetitive harm under a less restrictive form of foreclosure (such as the alleged product crippling) is zero as well.

2. Limitations Imposed by Wireless Operators Likely Generate Significant Efficiencies

Although many of Wu's allegations regarding the nature of restraints are exaggerated, wireless operators do exert some influence over upstream suppliers in several dimensions. For example, Cingular/AT&T requires device certification

63. It is not clear why operators would want generally to foreclose the development of new handsets that could enhance the value of their networks.

64. Einer Elhauge, *Defining Better Monopolization Standards*, 56 STAN. L. REV. 253-344 (2003).

65. Wu at 1 (emphasis added).

for Cingular/AT&T-sold devices activated on its network to help ensure that customers have an optimal experience when using a device with Cingular/AT&T service. Several operators, including Verizon and Cingular/AT&T, impose usage restrictions through the terms and conditions on the service contract. In this section, we analyze the efficiencies that would be sacrificed by banning the conduct identified by Wu.

The goal of vertical restraints generally is to align the incentives of the retailer with those of its suppliers. One way to think about such restraints is to imagine how a vertically integrated firm would behave in the same circumstances.[66] In the case of wireless service, vertical restraints are used to encourage wireless operators to promote the handset aggressively and discount the price of handsets. Operators impose limitations on customers relating to the types of attachments and types of applications to ensure a high quality of service. The demand for bandwidth-intensive applications is growing significantly, and will soon outstrip the capacity of existing wireline and wireless networks. Because (1) the capacity constraints facing wireless operators are more stringent than those facing their wireline counterparts, (2) wireless networks are shared networks, and (3) some features are not supported by the core network, it is not a coincidence that wireless operators are imposing more limitations to manage a relatively scarcer resource.

a. Use of Exclusive Distribution Contracts Encourages Wireless Operators to Promote the Handset Aggressively

Suppliers in many industries employ exclusivity provisions to induce intermediaries to invest in brand development and promotion.[67] The same is true in the wireless industry. For example, Wu notes that "in the United States, AT&T is the exclusive vendor of the [Nokia] e62. . . ."[68] Handset makers like Nokia and Samsung enter into exclusive contracts with wireless operators to ensure that the operators are properly motivated to market the handset. In the absence of exclusivity, a wireless operator might lack the incentive to invest sufficiently in brand development because other operators would free-ride on the efforts of the investing operator. That is, the benefits from investment would have to be shared with other, non-investing operators.

The exclusive contract between Samsung and Cingular relating to the *BlackJack* handset is an illustrative example of the benefits of exclusive deals in the wireless industry. As of March 2007, Cingular/AT&T was the exclusive provider of the Samsung *BlackJack* smart phone.[69] As a result of this exclusivity, Cingular/AT&T featured the *BlackJack* prominently in television advertisements.[70] The exchange of exclusivity for promotional efforts has

66. *See* Ronald Coase, *The Nature of the Firm*, 4 ECONOMICA 386-405 (1937).

67. Continental T.V., Inc. v. GTE Sylvania, 433 U.S. 36, 55 (1977) (asserting that vertical restraints have "redeeming virtues" in that they can induce downstream firms to engage in promotional marketing efforts that would otherwise be precluded by the free-rider effect).

68. Wu at 17.

69. Eric Benderoff, *White Pearl added at T-Mobile*, CHI. TRI., Jan. 16, 2007, at 2.

70. Eric Benderoff, *Cingular Places its Bet on BlackJack as Smart Phone Sales Increase,* CHI. TRI., Nov. 14, 2006.

become common in the wireless industry.[71] Other examples include the *Blackberry Pearl*, offered exclusively by T-Mobile, and the *Motorola Q*, offered exclusively through 2006 by Verizon.[72] Both of these models were promoted aggressively. Finally, as we demonstrate below in the case of Apple's iPhone, the exclusive contracts are often imposed by handset makers, not the wireless operator, which undermines Wu's central claim that wireless operators wield significant bargaining power vis-à-vis handset makers.

b. Eliminating Uncertainty with Contract Duration Allows the Wireless Operator to Discount the Price of a Handset

Requirements that customers purchase their handsets in conjunction with wireless service—that is, pursuant to a bundled rebate—allow wireless operators to discount the price of the handset. In exchange for purchasing a handset at a discounted price, wireless customers are expected to use that handset with the operator's service for a fixed duration. This fixed duration guarantees the wireless operator a stream of revenues, which can be used to discount the price of the handset. Customers can typically choose between buying handsets at one price with no term commitment or buying handsets at a lower price with one or two-year commitments. For example, in March 2007, Verizon Wireless sold a LG Strawberry Chocolate handset for $99.99 if purchased with a two-year contract for wireless service. If purchased with a one-year contract for wireless service, the price of handset increased to $199.99.[73] If purchased without a wireless service contract, the price increases to 269.99.[74] Thus, the price of the LG Strawberry Chocolate handset under a two-year commitment is roughly 37 percent of the uncommitted price. This long-term agreement is like an "installment contract"[75]

Wu acknowledges this efficiency justification for restraints imposed on customers without recognizing that, by doing so, he undermines his call for greater regulation: "The primary reason is very well known, and even beloved by consumers: the practice of subsidizing equipment purchases with subscription fees."[76] Wu admits that it is the discounted price of the handset, not the restraint imposed on the customer *per se*, that limits entry by unaffiliated vendors: "It is possible to buy handsets from unaffiliated vendors in the United States, but they

71. *See, e.g.* David Pringle, *Cell Division: After Long Peace, Wireless Operator Stirs Up Industry—U.K.'s Vodafone Is Dictating Handsets' Look and Feel; Nokia Tries Resistance—Hiding the Logo on the Back*, WALL ST. J., Nov. 12, 2004, at A1.

72. Benderoff, *White Pearl*, *supra* note 69.

73. Phone interview with Verizon Wireless representative Sharine (ext. 5545) on March 21, 2007.

74. *Id.*

75. In its petition to the FCC, Skype notes that an installment contract is a legitimate reason for phone locking. *See* Skype Petition at 17 ("While regulators in most countries do not prohibit handset locking outright, they typically ensure that locking is done for legitimate purposes only—such as to prohibit theft or fraud and the enforcement of a rental or installment contract, rather than for anti-competitive reasons—and that consumers are made aware of handset locks and how to unlock them.").

76. Wu at 10.

cost far more because of the lack of the subsidy."[77] Remarkably, Wu dodges the very issue that is critical in determining whether regulation would impose net benefits on society: "Whether the phone subsidies and other barriers to network attachments are ultimately a pro- or anti-consumer practice we do not address in this paper."[78] This admission is highly significant: It reveals that his analysis on its own cannot justify regulation of wireless operators.

c. Restrictions on Certain Attachments Help to Ensure the Quality of Service for Wireless Customers

Wireless operators impose certain performance requirements on equipment and applications suppliers to ensure that the attachments perform properly. If a customer is dissatisfied by the performance of a new feature, the complaint will be directed to the operator, not to the upstream supplier. Because the operator manages this relationship with the customer, the operator should be able to impose requirements on upstream suppliers that ensure high quality of service. Preventing it from doing so could give rise to the kind of complaints about service quality that Wu raises elsewhere.[79] New equipment needs to be tested to ensure that the features function properly on the operator's network without causing interference. The operator's requirements are likely motivated by the requirements imposed by the FCC on device makers relating to power limits and out-of-band emissions. Wu fails to distinguish between restrictions motivated by FCC compliance or by anticompetitive intent. Because the operator expects to earn a steady flow of revenues from satisfied customers, a wireless operator is willing to devote significant resources to handset testing. The devices that a particular operator sells are designed to be fully compatible with its network. It is reasonable for an operator to require the same level of compatibility for a foreign attachment.

d. Restrictions on Customer Usage Can Be an Important Tool for Efficient Resource Management

In addition to imposing performance requirements on equipment and applications suppliers, at least one wireless operator imposes usage limitations on customers even in an "unlimited" plan. As we demonstrate in Part II.B.3 below, Sprint-Nextel, T-Mobile, and Cingular/AT&T place no limitations on data usage with the appropriate wireless mobile phone plan. Like any network operator, a wireless operator has limited tools to manage its scarce resource. A wireless operator must manage network resources so that all customers sharing those resources receive a reasonable quality of service. Placing direct restrictions on

77. *Id.* at 11.

78. *Id.*

79. *Id.* at 4 ("In Washington, D.C., the wireless world is sometimes described as a nirvana for consumers brought on by competition and enlightened government policy. Some consumers and groups depict a very different story: a "cell hell" of "dropped calls, dead zones, billing errors, and unexpected fees and charges." The truth lies somewhere in the middle.").

usage can actually increase economic welfare when metering usage is costly.[80] For example, restricting certain bandwidth-intensive applications, such as streaming video or audio, webcam posts, automated data feeds, or VoIP,[81] can help ensure that all customers receive a high quality of service on today's primary services—namely, wireless voice and data transmission.

Resource management is a significant issue for network owners generally, but they are especially important for wireless networks. For example, DSL can offer to a home or business data rates up to 6.1 megabits per second (Mbps), which will support applications that require continuous transmission of video and audio. In contrast, wireless technologies like general packet radio service (GPRS) offer peak achievable user rate of 56 kilobits per second (kbps),[82] while EDGE technologies offer average speeds of 70 to 135 kbps uplink and downlink stream, with maximum speeds of 240 kbps.[83] Wireless 3G technologies like universal mobile telecommunication system (UMTS) offer average downlink speeds of 400 to 700 Kbps.[84] Current High-Speed Downlink Packet Access (HSDPA) devices average 600 kbps to 1.4 Mbps downlink with peak rates of 3.1 Mbps and average 350 to 500 Kbps uplink data rate per user.[85] Thus, the *fastest* wireless broadband systems do not exceed 3.1 Mbps, which implies that the capacity constraint could bind more often for a wireless operator than a wireline operator. Accordingly, wireless operators should be given great flexibility to impose usage restraints to manage the resources of the network.

80. *See* Yoo, *supra* note 2 (showing that when transaction costs render metering network-usage uneconomical, imposing restrictions on bandwidth-intensive activities may well enhance economic welfare by preventing high-volume users from imposing uncompensated costs on low-volume users.).

81. Although VoIP may not be considered a bandwidth-intensive application, unless all related network components (for example, the compression settings) are optimized to handle VoIP, VoIP traffic can consume significant bandwidth. Thus, for all intents and purposes, VoIP can be fairly characterized as a bandwidth-intensive application.

82. T-Mobile Website, Feature Summary, http://support.t-mobile.com/knowbase/root/public/tm22892.htm#top. "GPRS speeds up to 56 kbps."

83. *See, e.g.,* AT&T Wireless Website, Laptop Connect, http://business.cingular.com/businesscenter/solutions/wireless-laptop/laptop-connect.jsp. "BroadbandConnect compatible devices that are backward compatible with EDGE Network, Average download speeds of 70-135 kilobits per second."; T-Mobile Website, Feature Summary, http://support.t-mobile.com/knowbase/root/public/tm22892.htm#top. "EDGE speeds up to 240 kbps."

84. Verizon Wireless, BroadbandAccess/NationalAccess, *available at* http://support.vzw.com/capability/broadband_access_popup.html. "Using one of our wireless PC cards or BroadbandAccess Connect capable wireless devices with your laptop, you can connect to the Internet, corporate intranet, check your email and download attachments with average download speeds of 400 - 700 Kbps."; Sprint Website, *What is Mobile Broadband, available at* http://support.sprint.com /doc/sp9807.xml?id16=kbps. "EV-DO Rev 0: Download: 400-700 Kbps average, 2.4 Mbps peak; Upload: 50-70 Kbps average, 153 Kbps peak".

85. Sprint Website, *What is Mobile Broadband, available at* http://support.sprint.com/doc/sp9807.xml?id16=kbps. "EV-DO Rev A:Download: 600-1400 Kbps average, 3.1 Mbps peak; Upload: 350-500 Kbps average, 1.8 Mbps peak."

3. *Other Limitations on Service Identified by Wu Are Generally Not Used by Wireless Operators*

Wu identifies other limitations that are generally not used by wireless operators. Yet by identifying these practices in his article, Wu appears to suggest that these practices are widespread.[86] In some instances, Wu is careful to note that not all operators are engaged in the allegedly anticompetitive conduct. For example, regarding the requirement that handsets be sold by the operator, Wu admits that Sprint-Nextel allows wireless telephones that are not sold by that operator to function on its network.[87] Wu is silent about the relevant policies of two other carriers (Cingular/AT&T and T-Mobile), saying only that those carriers do not allow their telephones to work on other operators' networks.[88] A survey of the four largest wireless operators reveals that Cingular/AT&T and T-Mobile both allow their customers to purchase a handset from an unaffiliated vendor. See Table 4. Indeed, with one exception (preventing the use of a handset on a rival operator's network),[89] the survey reveals that Cingular/AT&T, T-Mobile, and Sprint-Nextel do not impose *any* of the other restraints identified by Wu.

TABLE 4: OTHER RESTRAINTS IDENTIFIED BY PROFESSOR WU

Restraints	**Page in Wu**	**Verizon**	**Cingular/ AT&T**	**T-Mobile**	**Sprint Nextel**
ON SUPPLIERS					
Require handset be sold by operator (or agent of operator)	11, 12	Yes[1]	No[2]	No[3]	No[4]
Prevent use of handset on rival's network	12,13	Yes[5]	No[6]	No[7]	Yes[8]
Require manufacturers to remove or limit call timers	13, 14	No[9]	No[10]	No[11]	No[12]
Disable certain Bluetooth functionality	16	Yes[13]	No[14]	No[15]	No[16]
Disable Wi-Fi	17	Yes[17]	No[18]	No[19]	No[20]

86. Wu at 13-14 ("Developers report that *carriers* have often forced them to remove or limit 'call timers' from their phones. Call timers can keep track of the length of individual phone calls, and can also keep track by month, year, or in total. The carriers, reportedly, are concerned that consumers might easily develop an independent and possibly different record of their mobile phone usage.") (emphasis added).

87. *Id.* at 12.

88. *Id.*

89. Preventing a handset from functioning on a rival's network does not likely harm customers due to the relatively short useful life of a handset. Consumers tire of their handset models roughly every 18 months with improvements in battery life, weight, and additional features prompting them to buy newer models. Indeed, consumers likely perceive the contract's expiration as an opportunity to purchase a new handset and dispose of their outdated version. Thus, preventing customers from keeping their outdated handsets is akin to preventing them from exercising an option that is out of the money at expiration.

Must use additional service to transfer photos	14	Yes[21]	No[22]	No[23]	No[24]
ON END-USERS					
Prevent users from downloading music from certain websites	18, 19	Yes[25]	No[26]	No[27]	No[28]
Prevent users from downloading videos from certain websites	18, 19	Yes[25]	No[26]	No[27]	No[28]

Sources: (1) Section 7, Customer Agreement, *available at* http://www.verizonwireless.com/b2c/globalText?textName=CUSTOMER_AGREEMENT&jspName=footer/customerAgreement.jsp. (Though the Customer Agreement reads "Whether you buy your wireless phone from us or someone else is entirely your choice," Customer Service representatives make clear that "someone else" refers to an agent of Verizon's; for example, a Verizon customer can buy a Motorola Phone directly from Motorola, but she must get the Verizon version, which will not work for any other carriers.); (2) Cingular uses GSM-type phones (http://www.cingular.com/about/our-technology.jsp). Cingular representatives verified that an unlocked GSM-type phone can be used with the Cingular network; (3) Paragraph 8, "Terms and Conditions," *available at* www.t-mobile.com. ("You may buy a Phone from us, or from someone else, but it must be GSM/GPRS equipment that is compatible and approved for use with our network and Services and we do not guarantee that all T-Mobile features will be available with such equipment. A T-Mobile Phone may be programmed to accept only a T-Mobile SIM card."); (4) Terms and Conditions, *available at* http://coverage.sprintpcs.com/IMPACT.jsp. ("Our services will only work with our phones"); (5) Verizon phones cannot be used with other carriers; (6) Cingular phones can be "unlocked" from the Cingular newtwork. Cingular customer service representatives report that Cingular will do this upon request after 3 months of use of a Cingular contract or if the customer claims she is traveling internationally. Additionally, there are third-party firms that offer unlocking services, such as www.gsmliberty.com; (7) T-mobile's policy is similar to Cingular's (see previous footnote), *available at* http://search.t-mobile.com/inquiraapp/ui.jsp?ui_mode=question&question_box=unlock.; (8) "Terms and Conditions," linked to at the bottom of http://coverage.sprintpcs.com/IMPACT.jsp. ("Your Device is designed exclusively for use on our network and in other coverage areas we make available to you. It will not accept wireless service from another carrier."); (9) While Verizon may have asked some manufacturers to disable call timers, they did not require it of all. The Verizon Motorola RAZR v3m, for example, has a call timer. See the user manual for the Motorola RAZR v3m *available at* www.motorola.com/mdirect/manuals/v3m_9501A90O.pdf. Also see the answer to the question "Why does my call timer differ from my bill?" on Verizon's FAQ, *available at* http://support.vzw.com/faqs/Account%20Management/faq_billing.html; (10) Some phones have call timers; (11) Some phones have call timers; (12) Some phones have call timers; (13) Verizon's Bluetooth Functionality Chart shows that the functionality of many of their Bluetooth phones is limited. The chart is available at http://support.vzw.com/pdf/BT_Chart_Handsets.pdf. This can also be seen by comparing Verizon's Motorola RAZR V3m to Sprint's Motorola RAZR V3m. Though the hardware is the same, Verizon's does not support file transfer profiles while Sprint's does. *See* V3m User Manual, at 32, *available at* www.motorola.com/mdirect/manuals/v3m_9501A90O.pdf; Sprint's Motorola RAZR V3m Feature Summary page, *available at* http://support.sprint.com/doc/sp9444.xml?id16=razr_v3m_bluetooth_profile.; (14) The Cingular version of the popular Motorola RAZR is able to transfer files, whereas the Verizon version is not. Source: Cingular Customer service; (15) T-Mobile RAZR V3 Product Page, *available at* http://www.t-mobile.com/shop/phones/detail.aspx?tp=tb2&device=dfb10fd8-c36d-4e2b-a440-6d2a92b2cdb6 ("Bluetooth lets you connect your phone to your headset or computer wirelessly."); (16) Sprint's Motorola RAZR v3m has more Bluetooth functionality than Verizon's. Sprint's allows the user to "[t]ransfer addresses to other Bluetooth-compatible devices and use it as a dial-up modem for Internet access," which Verizon's does not, as discussed in footnote 13; (17) Verizon does not currently offer a standard handset, Smartphone or PDA with WiFi capabilities. This can be seen by looking through Verizon's catalog. While this does not mean they disable WiFi technology on devices, it does suggest Verizon is careful to not sell any devices with WiFi capability; (18) Like Verizon, Cingular itself does not sell a handset, PDA or Smartphone with WiFi capabilities. One could, however, buy a phone with WiFi capability and use it on Cingular; (19) T-mobile sells the MDA and SDA handhelds (those are model names), which are WiFi-enabled; (20) Sprint also does not sell WiFi capable devices on its website, however one can buy a WiFi capable phone for use on Sprint (such as the UTStarcom PPC-6700). *Available at* UTStarcom phones, *available at* http://www.utstar.com/pcd/view_phone_details.aspx?mcode=PPC6700&sAct=0; (21) Though users with a little technical savvy can figure out a way to transfer pictures without using Verizon's services, Verizon does not support a workaround. A Customer Service representative confirmed this; (22) Pictures can be transferred using a data cable or Bluetooth. Customer Service Rep; (23) Same as Cingular; (24) Same as Cingular; (25) Contractually user is forbidden from using data plans to download music, videos and the like. The data use is intended for basic browsing and checking and downloading emails. *See* Additional Calling Plan Information,

available at http://www.verizonwireless.com/b2c/store/controller?item=planFirst&action=viewPlanList&sortOption=priceSort&typeId=3&subTypeId=4&catId=448; (26) With the appropriate plan, there are no limitation placed on data usage. *See, e.g.*, Shop for Phones, Plans and More, *available at* http://www.cingular.com/cell-phone-service/cell-phone-plan-details/?q_sku=sku1030031&q_planCategory=cat1460005. Wu's cite was from October 16, 2006.; (27) With the appropriate plan there are no limitations placed on data usage. *See* Sidekick Data, *available at* http://t-mobile.com/shop/plans/detail.aspx?tp=tb1&id=90ff4d79-019c-43a6-89f8-c2bb14781ce9; (28) With the appropriate plan there are no limitations placed on data usage. *See* Sprint Service Plans, *available at* http://www1.sprintpcs.com/explore/servicePlansOptionsV2/FreeClearFairFlexiblePlans.jsp?FOLDER%3C%3Efolder_id=1477387&CURRENT_USER%3C%3EATR_SCID=ECOMM&CURRENT_USER%3C%3EATR_PCode=None&CURRENT_USER%3C%3EATR_cartState=group.

Table 4 shows that no operator requires manufacturers to remove or limit call timers.[90] More importantly, many of the practices challenged by Wu are attributed to the carrier that a 2006 survey by J.D. Powers ranked the highest in call quality performance in five of six U.S. regions.[91] Ironically, this high level of customer satisfaction may very well be a function of a more vigorous policing of network management. Wu fails to consider the tradeoffs between certain limitations imposed by network operators on their subscribers and higher quality of service. Indeed, to the extent that consumers do not value the "freedoms" that Wu seeks, the tradeoffs cut strongly in favor of greater policing and higher quality of service. The network that ranks lowest according to Wu's idiosyncratic preferences ranks highest with consumers.

Finally, given the level of competition in the wireless industry, an individual operator should be entitled to experiment with different business models. Wireless consumers' preferences are evolving, thereby compelling network owners to change their offerings. AOL's "walled garden" approach was very successful with consumers at one point in time. As expectations evolved, however, this approach, which was mimicked by Prodigy, ultimately proved to be a failure. To the extent that competition and changes in demand undermine the "walled garden" approach of a single firm,[92] as it has in other industries, regulation would not be necessary and, in fact, would likely be counter-productive.

90. Wu at 13 ("Developers report that carriers have often forced them to remove or limit "call timers" from their phones. Call timers can keep track of the length of individual phone calls, and can also keep track by month, year, or in total. The carriers, reportedly, are concerned that consumers might easily develop an independent and possibly different record of their mobile phone usage. While it is clear that destroying an independent record simplifies billing practices for carriers, it is less clear how that serves the interests of consumers.").

91. J.D. Power and Associates Reports: The Number of Call Quality Problems Experienced with a Wireless Service has Declined for a Second Consecutive Year, Mar. 16, 2006, *available at* http://www.jdpa.com/pdf/2006037.pdf.

92. A walled garden refers to providing access to content from affiliated providers only, in contrast to content from both unaffiliated and affiliated content providers. The classic case in dial-up Internet access was America Online. *See* Robert W. Crandall & Hal J. Singer, *Life Support for ISPs*, REGULATION (Fall 2005).

III. SPECIFIC PROBLEMS WITH PROFESSOR WU'S ANALYSIS

In this section, we identify other problems with Professor Wu's analysis. Based on that analysis, Skype has petitioned the FCC to extend *Carterfone* rules to the wireless industry.[93] We explain why the market and regulatory conditions that potentially justified *Carterfone* regulation in the late 1960s do not exist in the current U.S. wireless industry. Next, we demonstrate that Wu and Skype cannot reject the hypothesis that certain services, such as making the phone operate like a fully functional camera, are not offered by wireless operators because they are not demanded by a sufficient number of wireless customers. We also explain why exclusive contracts between wireless operators and content providers are unlikely to harm consumers in the wireless market.

A. *The Market Conditions That Supported* Carterfone *Do Not Exist in the Current U.S. Wireless Industry*

In 1968, Carterfone filed a complaint with the FCC regarding AT&T's refusal to allow a device that directly connected a mobile radio to the landline network.[94] The FCC concluded that AT&T had not adequately demonstrated that Carterfone's device would harm AT&T's network.[95] In a subsequent rulemaking, the FCC expanded *Carterfone* by allowing users to connect any type of customer premise equipment to the telephone network as long as the equipment meets certain technical criteria.[96] Wu laments the fact that, "like in the pre-Carterfone world, innovative [wireless applications] companies must seek the permission and cooperation of the carrier oligopoly. Consequently, the market for consumer devices is unusual and distorted."[97] He credits *Carterfone* for fostering the creation of the fax machine and the answering machine,[98] both of which are now obsolete technologies.[99] The proponents of wireless net neutrality fail to note four critical differences between the competitive and regulatory environment that existed when *Carterfone* was enacted and the wireless industry of today.[100]

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93. *Skype Petition* at i ("The Commission should act now to enforce *Carterfone* and unlock the full benefits of wireless price competition and innovation.").

94. Use of the Carterfone Device in Message Toll Telephone Services; Thomas F. Carter v. AT&T, Dkt. Nos. 16942 and 17073, 14 F.C.C.2d 571 (1968).

95. *Id.* at 571.

96. 47 C.F.R. 68.3. To be classified as customer premise equipment—and to attain the associated rights of network attachment—the equipment must not present a risk of any one of four specified harms: (1) electrical hazards to operating company personnel, (2) damage to network equipment, (3) malfunction of billing equipment, and (4) degradation of service to customers other than the user of the customer premise equipment and that person's calling and called parties.

97. Wu at 9-10.

98. *Id.* at 9.

99. The functionalities of the fax machine and the answering machine have moved to the network. Skype also refers to the "celebrated *Carterfone* decision." See *Skype Petition* at 4.

100. The closest Wu comes to making this comparison occurs on page 9: "Carterfone freed innovators to invent the personal modem, and then ever faster versions of the personal modem, without seeking approval from the owners of the telephone lines. In the wireless world, the Carterfone rule does not exist. Instead, like in the pre-

1. There Is No Monopoly Provider

All theories of vertical foreclosure begin with the premise that the firm has monopoly power in the "primary" or "tying" market.[101] Monopoly power in one market can be leveraged into a "secondary" or "tied" market. For example, the relevant case law for refusals to deal with upstream rivals discourages a *monopolist* from engaging in such conduct where denying access to rivals enhances *monopoly* power.[102] Because AT&T was a monopolist in the supply of voice service in the United States in the late 1960s,[103] the FCC's case against AT&T fit the mold of a classic anticompetitive foreclosure.

AT&T's monopoly power in voice service in the late 1960s stands in sharp contrast to what Wu and Skype refer to as the wireless "carrier oligopoly" of today,[104] as if the phrase "oligopoly" had some negative connotation in economics.[105] As Table 3 indicates, the *largest* U.S. wireless operator supplies about 27 percent of all wireless customers. It is highly unlikely that a provider with such a small share could leverage its alleged power in the "tying" market into the "tied" market. Given this fact pattern, it would be unlikely that a plaintiff could bring a successful antitrust case against a single wireless operator. Indeed, an antitrust complaint brought against *several* U.S. wireless operators in 2005 was denied because other critical components of an anticompetitive foreclosure case were missing.

2. Lack of Vertical Integration into Applications or Equipment

A second critical component of any foreclosure theory is vertical integration or affiliation. Without having an affiliated supplier in the secondary market, the "monopolist" lacks the incentive to steer customers towards one vendor over another. To make matters concrete, consider a vertically integrated cable operator that (1) supplied video service to over 80 percent of video subscribers in a given locality and (2) supplied its own local sports programming. Given this conflict of interest, the vertically integrated cable operator is not indifferent between its

Carterfone world, innovative companies must seek the permission and cooperation of the carrier oligopoly."

101. *See generally* Dennis W. Carlton, *A General Analysis of Exclusionary Conduct and Refusal to Deal—Why Aspen and Kodak Are Misguided*, 68 ANTITRUST L.J. (2001)

102. *See e.g.*, Einer R. Elhauge, *Defining Better Monopolization Standards*, 56 STAN. L. REV. 253 (2003).

103. *See* ROBERT W. CRANDALL, AFTER THE BREAKUP: THE U.S. TELECOMMUNICATIONS INDUSTRY IN A MORE COMPETITIVE ERA 17 (Brookings Institution 1991) ("After Congress liberalized the antimerger law for telephone mergers in 1921, AT&T increased its share of the local exchange business to 80 percent of the country's telephones.").

104. Wu at 9; Skype at 21 ("One basic change has been in the structure of the wireless marketplace; following consolidation, there are a smaller number of carriers in the market, a market many regard as oligopolistic.").

105. Oligopoly simply means an industry that is supplied a small group of firms, often characterized by entry barriers. *See, e,g.*, DENNIS CARLTON & JEFFREY M. PERLOFF, MODERN INDUSTRIAL ORGANIZATION 7 (Addison-Wesley 3rd ed. 2000). Given the significant fixed costs in wireless telephony (acquiring spectrum and building a network), marginal-cost-based pricing—a result of perfect competition—could not be maintained.

video subscribers watching its affiliated sports programming and watching unaffiliated sports programming, as it profits from higher advertising from the affiliated programming only.[106] The same was true for AT&T in the late 1960s. At that time, AT&T owned an equipment company, Western Electric, which manufactured all of the customer premises equipment for AT&T's customers, including telephone sets and other terminal equipment.[107] Indeed, AT&T's local services operating companies were separated from its equipment division under a settlement with the Department of Justice in 1982.[108] Before this mandatory divestiture, AT&T had strong incentives to favor its own equipment division over unaffiliated equipment makers like Carterfone.

Once again, this vertical integration in the wireline voice market of the late 1960s stands in sharp contrast to the modern wireless industry. None of the wireless operators owns equity in any of the major handset manufacturers, including Blackberry, Kyocera, LG, Motorola, Nokia, Palm, Samsung, Sanyo, and Sony Ericsson.[109] Thus, the wireless operators lack a financial interest in steering their customers to one handset maker over another. Similarly, the wireless operators have not significantly integrated into wireless applications markets. For example, none of the top content sites as ranked by visits, including Google, eBay, ESPN, and Amazon, are subsidiaries of the major wireless operators. The lack of vertical integration—a prerequisite for extending market power in an adjacent market—is a key ingredient that is missing from Wu's case that *Carterfone* rules are needed here.

The only possible upstream application that represents a threat to the profits of wireless network operators is VoIP. Even here, however, regulation to protect VoIP providers is not necessary. Given the lack of market power of any individual wireless operator, any duty to support VoIP will not likely come from antitrust enforcement. One could reasonably ask whether regulation is needed to fill the potential gap from antitrust enforcement in a case of collective foreclosure, in which each wireless operator unilaterally chooses not to support VoIP. Because VoIP providers could achieve the requisite economies of scale by selling to wireline broadband customers (cable modem and DSL providers), even

106. *See* Hal J. Singer & J. Gregory Sidak, *Vertical Foreclosure in Video Markets*, REV. NETWORK ECONOMICS (forthcoming 2007).

107. CRANDALL, *supra* note 103, at 33-34 ("All telephone sets, private branch exchanges, and other standard equipment used by residences or businesses were owned and leased by the telephone company. Nearly all of AT&T's customer premises equipment was manufactured by Western Electric and sold to the operating prices not subject to competitive bid.").

108. *Id.* at 38 ("After several months of deliberation, the Justice Department and AT&T announced their agreement to settle the case. AT&T would divest itself of all [local service] operating companies but retain its Western Electric and long lines Divisions.").

109. Among the major equipment vendors, the only "cross-ownership" issue that we could identify was between Motorola and Sprint. Motorola owned shares in Sprint, but according to Motorola's SEC filing, Motorola sold its remaining shares in late 2006. *See* MOTOROLA INC., 2006 ANNUAL REPORT (SEC Form 10-K), at 41 (Feb. 28, 2007) ("In 2006, the $41 million of net gains primarily reflects a gain of $141 million on the sale of the Company's remaining shares in Telus Corporation, partially offset by a loss of $126 million on the sale of the Company's remaining shares in Sprint Nextel Corporation ("Sprint Nextel").").

the collective foreclosure that would ensue in this example would still not require regulatory action.[110]

3. *Existence of Countervailing Bargaining Power Among Applications and Equipment Suppliers*

A third factor that distinguishes the current wireless industry from the wireline industry circa 1968 is the existence of countervailing market power among equipment and applications providers. Wu suggests that "it is de facto necessary to obtain the *permission* of the carrier to market a wireless device in the United States,"[111] as if the wireless operators had all the bargaining power. Similarly, Skype claims that "[s]uch a 'permission-based' approach to innovation creates an innovation bottleneck. . . ."[112] Wu cites Apple's iPhone as an example of wireless operators exercising market power:

> Most importantly, to the surprise of many, the iPhone only works on the network of a single carrier, AT&T Wireless. The hundreds of millions of consumers who are not AT&T Wireless customers cannot make use of the iPhone unless they become AT&T customers. The question is, why? Why can't you just buy a cell phone and use it on any network, like a normal phone? The main reason is the lack, in the wireless world, of basic network attachment rules.[113]

Contrary to Wu's characterization of how the industry operates, Apple did not need the "permission" of a wireless operator to market the iPhone. Indeed, this anecdote suggests the exact opposite—namely, that unaffiliated equipment suppliers can wield significant market power over the wireless operators. It was Apple, not the wireless carriers, who insisted on an exclusive contract. The story of the iPhone illuminates who wields the power in these negotiations.

As the *Wall Street Journal* reported in February 2007, Apple offered Cingular/AT&T a five-year exclusive deal as an incentive to accept the heavy and unprecedented demands made by Apple.[114] In particular, Apple demanded, among other items, that (1) Cingular/AT&T leave its brand off the phone, (2) Cingular/AT&T share with Apple a portion of monthly subscriber revenues, (3) the iPhone only be sold through Apple and Cingular/AT&T stores and not through other stores with which Cingular usually works, and (4) Apple have sole power to decide whether to repair or completely replace a malfunctioning

110. Even if all wireline broadband providers opted not to support VoIP applications, the collective foreclosure across wireline and wireless network owners would still not be anticompetitive foreclosure: Although VoIP providers may be harmed, the price of voice service in the United States would not likely be affected by the elimination of VoIP providers. In conclusion, in the single application in which wireless network owners could be said to compete with unaffiliated upstream suppliers, there is no need for regulation.

111. Wu at 10 (emphasis added).

112. Skype Petition at 13.

113. Wu at 7.

114. Amol Sharma, Nick Wingfield & Li Yuan, *Apple Coup: How Steve Jobs Played Hardball In iPhone Birth*, WALL ST. J., Feb. 17, 2007, at A1.

iPhone.[115] Apple also demanded complete secrecy on the project, allowing only three Cingular/AT&T executives to see the phone before its release and severely limiting the role of Cingular/AT&T technicians on the project.[116] Moreover, the exclusive deal with Cingular/AT&T pertains to the United States only, allowing Apple to sell its phone to wireless operators around the world.[117]

Citing Apple's demands as problematic, Verizon declined Apple's exclusive offer two years before the Cingular deal was announced.[118] For example, Apple would not allow Verizon to use its V CAST technology on the iPhone. Second, Verizon refused to exclude its outside distributors such as Wal-Mart and Circuit City from the iPhone deal. Third, Verizon did not want to allow Apple to intervene between Verizon and its customers when making decisions on phone maintenance.[119] The iPhone anecdote on which Wu relies seems to undermine his claim that upstream suppliers require the "permission" of a wireless operator.

4. *Wireless Operators Are Not Subjected to Price Regulation That Could Allow Them to Benefit from Tying*

Anything that prevents a single-product monopolist from extracting 100 percent of the consumer surplus (another name for consumer welfare), including price regulation, can motivate that firm to look to other markets to increase profits. Unlike AT&T in the late 1960s, wireless carriers of today are not subjected to price regulation. Thus, wireless carriers lack a powerful incentive (possessed by AT&T in the late 1960s) to seek profits in other markets such as equipment or applications.

Antitrust scholars recognized that a monopolist generally lacks anticompetitive motives to engage in vertical restraints. They concluded that such restraints were motivated for efficiency reasons only. So long as the monopolist can extract the entire consumer surplus from the "tying" market, there is no incentive to earn more than "one monopoly profit." Of course, there are some exceptions to this rule, such as when the monopoly must charge a single price for the tying product, consumers purchase multiple units of the product, and their demand is downward sloping.[120] Another impediment to extracting the entire consumer surplus is price regulation. When the FCC imposed *Carterfone*, AT&T was subjected to price regulation in the provision of local service.[121] Thus, AT&T

115. *Id.*; Leslie Cauley, *Verizon Rejected Apple iPhone Deal*, USA TODAY, Jan. 29, 2007.

116. Sharma, Wingfield & Yuan, *supra* note 114, at A1.

117. Cauley, *supra* note 115.

118. *Id.*

119. *Id.*

120. *See, e.g.*, Patrick Greenlee, David S. Reitman & David S. Sibley, *An Antitrust Analysis of Bundled Loyalty Discounts* (Economic Analysis Group, Discussion Paper No. 04-13, Oct. 30, 2006), *available at* http://ssrn.com/abstract=600799.

121. CRANDALL, *supra* note 103, at 24-25 ("The formula—the subscriber plant factor—used in allocating the local loop costs was changed twice more, in 1965 and 1969, in each case raising the interstate share of local costs."); Nicholas Economides, Telecommunications Regulation: An Introduction, Sept. 2003, *available at* http://www.stern.nyu.edu/eco/wkpapers/workingpapers03/03-22Economides.pdf ("In the 1960s regulators did not let prices of basic local service rise in their attempt to achieve

had an anticompetitive motive to tie its customer premise equipment with its telephone service—namely, to extract additional consumer surplus in the "tying" market.

This price regulation faced by AT&T in the late 1960s stands in sharp contrast to today's wireless industry. The pricing by a wireless operator is constrained by the prices of its rivals. There is nothing that prevents a wireless operator from customizing its offering for wireless customers. Thus, wireless operators lack an anticompetitive motive to engage in vertical restraints that motivated the *Carterfone* rules.

B. Certain Services May Not Be Offered by Wireless Operators Because They Do Not Pass a Market Test

Wu is concerned that wireless operators have failed to supply what he thinks are obvious wireless applications. In a well-functioning market, however, there is little reason to believe that suppliers will not respond to consumer demand. One assumption under which the market will undersupply wireless applications is that the marginal private benefits of developing such applications are less than the marginal social benefits (the classic positive externality). However, Wu does not offer examples of spillovers in use or development of an application, which might make a wireless operator reluctant to invest in that application.

Wireless operators have strong incentives to attract new customers and please their current customers. One of the ways to do that is by offering the latest technology. As we demonstrate below, many of the allegedly missing applications identified by Wu are, in fact, available in the marketplace. Moreover, we explain that many of these applications are not prevalent because they do not pass a market test. Stated differently, Wu's preferences over wireless applications may not reflect the general preferences of wireless customers.

1. Printing Phone Numbers or Addresses from a Wireless Telephone

Wu suggests that wireless consumers seek to print address contacts directly from their wireless handsets but are prevented from doing so by wireless operators: "Obvious uses of the [Bluetooth] technology might include transferring photos off of camera-phones, printing information from a telephone, or backing up address books."[122] As it turns out, wireless customers can print from some handsets. To determine whether such applications are "obvious," however, one must access the demand for printing address books from handsets.

As of March 2007, there were a handful of wireless phones that allowed direct communication with printers. For example, Verizon offered the Samsung SCH-a990, which can print directly to a Bluetooth enabled printer.[123] Online

"universal service," i.e., including as many households as possible in the telecommunications network, on the basis that this was desirable even if it were allocatively efficient.").

122. *Id.* at 16.

123. Verizon Wireless Website, Samsung SCH-a990, *available at* http://www.verizonwireless.com/b2c/store/controller?item=phoneFirst&action=viewPhoneDetail&selectedPhoneId=2406. The functionality of the Bluetooth printing is confirmed in a Cnet review. "Alternatively, you can take advantage of the SCH-A990's

reviews confirm the functionality: "Alternatively, you can take advantage of the SCH-A990's TV-out capability to display photos on your TV, or you can send them to a Bluetooth-enabled printer right from your phone."[124] Sprint offers the M610 by Samsung, which supports the Basic Printing Protocol, an emerging Bluetooth standard for connecting with printers.[125] Thus, any suggestion that wireless printing capabilities are completely absent from the marketplace is factually inaccurate. Wu also ignores the complexity at issue in getting a wireless device to work with a printer—namely, the printer must be Bluetooth-ready to receive signals from a wireless device. Until printer manufacturers equip their printers with Bluetooth receivers, wireless network owners will be reluctant to make the necessary investments.

Wu cannot reject the hypothesis that such functionality is not readily available because it is not generally demanded by wireless consumers. Indeed, this functionality has been introduced and subsequently abandoned by operators. In late 2002, Research in Motion, the maker of the Blackberry, allowed users to print directly from their wireless device.[126] As of March 2007, however, this feature was no longer listed on its website. This should come as no surprise for those who take part in the "digital economy." The need to print documents appears to be diminishing for most workers, including workers with wireless devices.[127] The same trends would compel a wireless customer *not* to print a document.

Moreover, there are likely to be superior alternatives to printing contacts from a cell phone. With respect to a single phone number, it is more convenient to write a number on a Post-It note rather than printing it on an 8.5 x 11 inch piece of paper. With respect to an entire contact list, the same address book that resides in a wireless device also resides in a user's desktop with the help of automatic "syncing." Syncing can be accomplished through a wireless connection, Bluetooth, or a USB cable.[128] The cables and software needed to sync a handset with a desktop come standard with most phones and are readily available in the after-market.[129] Thus, printing an address book from one's cell

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TV-out capability to display photos on your TV, or you can send them to a Bluetooth-enabled printer right from your phone."

124. Bonnie Cha, Samsung SCH-A990, CNET.com Review, Jul. 20, 2006, *available at* http://reviews.cnet.com/Samsung_SCH_A990/4505-6454_7-31968249.html.

125. *Sprint Power Vision Phone M610 By Samsung Not Your Average Mobile Phone*, PC TODAY.COM, Vol. 5, Is. 5, *available at* http://www.pctoday.com/Editorial/article.asp?article=articles/2007/t0505/30t05/30t05.asp&guid=.

126. RIM PRESS RELEASE, *NeedTEXT Attachment Opener Chosen by Leading Law Firms for Wireless Users on RIM BlackBerry*, (May 2, 2002), *available at* http://www.rim.net/news/partner/2002/pr-02_05_2002.shtml.

127. *See, e.g.* Jaclyne Badal, *Technology (A Special Report): Office Technology – Goodbye Briefing Book; A Paperless Board Meeting? It's Starting to Happen*, WALL ST. J., Oct. 23, 2006, at R11.

128. Detailed instructions on printing an address book can be downloaded from Microsoft's website, *available at* http://office.microsoft.com/en-us/outlook/HP030656981033.aspx.

129. Cingular sells cables to sync phones, such as the LG C2000, with computers.Cingualr Website, (last accessed March 26, 2007), *available at*

phone can be easily accomplished by printing from one's desktop. To the extent there is very limited demand for printing directly from a wireless device, it is no surprise that such functions are not available in the marketplace.

2. *Using a VoIP Phone with a Laptop That Connects to the Internet via a Wireless PC Card*

Wu complains about the lack of mobile VoIP options.[130] In particular, he is concerned that wireless customers cannot cancel their voice plan and instead use a VoIP-enabled device in conjunction with (1) a laptop that connects to the Internet via a wireless PC card[131] or (2) a nearby "friendly wireless network."[132] He cites handsets like the Netgear SPH101 that "do not work on the cellular networks operated by the commercial wireless carriers" but "are Wi-Fi phones only—typically only allowing a user to make phone calls using Skype or other VoIP providers within range of a local area or public Wi-Fi network."[133] Similarly, Skype complains in its petition of restrictions placed on consumers using data packages for VoIP calls.[134]

The availability of VoIP-enabled wireless cards is likely to be determined by the simple economics facing end-users. A comparison of the monthly cost of a VoIP plan *plus* an unlimited mobile data plan ("mobile VoIP option") versus a standard wireless voice plan is illustrative. The cost of a monthly unlimited data plan from either Cingular/AT&T or Verizon is $79.99.[135] The cost of a VoIP service that allows users to make unlimited calls from Vonage is $24.99.[136] The

http://cingular.scp4me.com/ItemDetail.aspx?ItemNo=81571CW&make=LG&model=C2000&ProductClass=DATA. See also, Kent German, Weekend Project, Sync your cell phone with your computer, ZDNet.com, Jan. 23, 2006, *available at* http://review.zdnet.com/4520-11400_16-6416968-1.html?tag=bnav.

130. Wu at 17.

131. *Id.* at 19.

132. *Id.* at 19. By advocating a "friendly wireless network," Wu appears to demand a network that allows users to do virtually anything they want. This would include downloading any bandwidth-intensive content, attaching any foreign device, and making phone calls—the lynchpin of any wireless service—for free. In the absence of market failure, the interests of wireless carriers generally coincide with the interests of their customers. It is not necessary to seek regulation that would alter the behavior of wireless operators for the sake of promoting the interests of VoIP providers only.

133. *Id.* at 17.

134. Skype points to the terms of service for Verizon and AT&T, arguing that their terms go beyond prohibiting activities that might harm the network. *See Skype Petition* at 19.

135. Verizon Website, *available at* http://www.verizonwireless.com/b2c/store/controller?item=planFirst&action=viewPlanList&sortOption=priceSort&typeId=5&subTypeId=13&catId=409. *See* also, Cingular Website, *available at* http://www.cingular.com/ cell-phone-service//cell-phone- plans/laptop-connect-plans.jsp.

136. Vonage Website, http://www.vonage.com/services.php?lid=nav_services. Vonage also offers a plan with 500 minutes, but this is not economically viable at any usage level. *Id.*

cost of unlimited calls from Skype is $2.50 a month.[137] These combined costs exceed the cost of a traditional wireless voice plan, which begin at roughly $40 per month. To be indifferent between the two options, a consumer would have to consume 1350 minutes (using Skype) or 2010 minutes (using Vonage). According to the most recent FCC report, however, the *average* mobile user consumed 740 cellular minutes a month.[138] At this level of usage, a subscriber would clearly be better off using a standard wireless voice plan.[139] The same calculus applies for a customer who wants to use VoIP in conjunction with a T-Mobile account in a "friendly wireless network" such as Starbucks. Because the very consumers who would be interested in mobile VoIP are "the more frugal who may be limiting their usage and spending",[140] it is highly unlikely that they would be willing to incur the high cost for mobile VoIP calling.

3. Using Wi-Fi Connectivity to Write Emails and Browse the Internet with a Wireless Telephone

Wu claims that "with a few notable exceptions, it is difficult today to find a Wi-Fi capable cell phone."[141] He also claims that "[m]ost carriers will not sell a

137. Skype Website, *available at* http://www.skype.com/ ($29.95 yearly cost divided by 12).

138. *Eleventh CMRS Report*, *supra* note 12, at 106.

139. The numbers used in this example are likely to be conservative for several reasons. First, by removing restrictions on usage, the cost of data services would almost surely increase, raising the cost of the mobile VoIP option relative to a standard wireless voice plan. Second, this example ignores the free nights and weekends offered under standard wireless voice plans. Third, it ignores the upfront cost of VoIP phones and wireless PC cards. Phones that can be attached to a computer for VoIP services cost anywhere from $19.95, to $149.95, and low end data connection cards cost $49.99. *See* Skype Shop, *available at* http://us.accessories.skype.com/store/skype/DisplayHomePage; Cingular Website, Phones and Devices, *available at* http://www.cingular.com/cell-phone-service/cell-phones/pc-cards.jsp?zipPass=true. Fourth, Vonage's unlimited plan states that Vonage can discontinue service for usage above acceptable levels: "We reserve the right to immediately disconnect or modify your Service if we determine, in our sole and absolute discretion, that your use of the Service or the Device is, or at any time was, inconsistent with normal residential usage patterns." *See* Vonage Terms of Service, *available at* http://www.vonage.com/features_terms_service.php. It is not clear whether Vonage would consider three times the average cell phone usage to be "inconsistent with normal residential usage patterns."

140. *In-Depth Analysis: Consumer Demand for Cellular/Wi-Fi Services*, Mindbranch Research Summary, Dec. 2006, *available at* http://www.mindbranch.com/Consumer-Demand-Cellular-R97-2670/ ("Instead, the more frugal customers who may be limiting their usage and spending to avoid unexpected bills are a more important—but difficult to identify—market."

141. Wu at 17. Wu notes two exceptions in his footnotes, saying that the iPhone and the Dash will both feature Wi-Fi. *Id.* ("AT&T will soon offer the Apple iPhone, which has Wi-Fi capabilities. Also, since October 2006, T-Mobile has offered a plan in the city of Seattle whereby consumers can use a hybrid telephone, sold by T-Mobile, in T-Mobile's 'hotspots,' although this feature also entails an extra monthly fee. In addition, also in October 2006, T-Mobile began to make available the 'Dash' smartphone with Wi-Fi capabilities. Users can also buy Wi-Fi phones in Europe or Asia and import them.")

Wi-Fi phone at any price."[142] Using a Wi-Fi connection, Wu asserts, a wireless handset operating on a "friendly wireless network" could be used to write emails and browse the Internet without having to subscribe to a traditional mobile data plan.[143]

There are numerous explanations (unrelated to protecting an ancillary revenue stream) for why a wireless operator would limit Wi-Fi capabilities in a handset. The most obvious is battery life. Batteries are one of the chief limiting factors for handsets,[144] and consumers often make choices among handsets based on battery life.[145] Accordingly, operators evaluate features, including Wi-Fi, on the basis of power consumption. Wi-Fi consumes more power in both transmit/receive mode and standby mode. In transmit/receive mode, Wi-Fi requires between 12 and 16 percent more power than cellular radios.[146] The disparity is even greater in standby mode, where Wi-Fi uses between 130 and 150 milli Amperes per hour (mAh). A standard cellular connection requires between 2 and 4 mAh. Thus, a Wi-Fi connection requires between 37 and 75 *times* the power required by a standard cellular connection.

Wu's example of the Nokia e61 and e62 underscores the trade-off between advanced features and battery life. In standby mode, the e61 can operate up to 9.5 days with Wi-Fi activated;[147] the 362, which lacks Wi-Fi capabilities, can operate up to 14 days.[148] Given the choice between extending battery life and enabling Wi-Fi functionality, it is perfectly reasonable for a wireless operator to choose not to include Wi-Fi functionality in some of its handsets.

Wu's claim that it is difficult to find Wi-Fi enabled phones in the United States is false. As of March 2007, all five nationwide service providers offered at least one Wi-Fi enabled phone. In addition to the examples provided by Wu, the following Wi-Fi phones are available in the United States: Cingular's 8525,[149] T-

142. *Id.* at 35.

143. Wu at 17 (Wu cites an MSN columnist saying that "What some carriers fear most is the e61's ability to handle VoIP calls when you're near a *friendly wireless network*. That's why we won't see Wi-Fi on the e62.") (emphasis added).

144. Mike Hughlett, *Batteries Hit Their Boundaries; Engineers are Working To Make Fuel Cells Fit in Cell Phones, Laptops and More, Giving Users More Juice and Time,* CHI. TRIB., Nov. 3, 2006, at 1 ("The battery craftsman is the cold voice of reality, reminding gadget designers that there are limits. 'There's an old maxim that engineers will consume all the energy you give them and scream for more,' Howard said.")

145. *See, e.g.* Walter Mossberg, *BlackJack Beats Out Palm 750, but iPhone May Well Top Both*, WALL ST. J., Jan. 11, 2007, at B1 ("Also, the BlackJack claims 38% better battery life than the Treo, and it runs on a faster data network than the Treo.")

146. Arjun Anand, et al., A Quantitatvie Analysis of Power Consumption for Location-Aware Applications on Smart Phones, Dept. of Computer Science, Electrical and Computer Engineering, and Information Systems, New Jersey Inst. Of Tech, at 4, *available at* http://web.njit.edu/~borcea/papers/isie07.pdf.

147. Nokia UK Website, e61 Page, *available at* http://www.nokia.co.uk/A4221032 (last accessed Mar. 28, 2007).

148. Nokia US Website, e62 Page, *available at* http://www.nokiausa.com/phones/E62/0,7747,feat:1,00.html. (last accessed Mar. 28, 2007).

149. Cingular Website, Cingular 8525, *available at* http://www.cingular.com/cell-phone-service/cell-phone-

Mobile's MDA,[150] Verizon Wireless's XV6700,[151] Sprint's PPC-6700,[152] and Alltel's UTStarcom PPC6700.[153] These Wi-Fi models were identified using a simple search on the operators' websites.

Finally, Wu cannot reject the hypothesis that Wi-Fi capabilities in handsets are generally limited because consumers do not demand those features. Market research indicates that there is little consumer interest in the actual technology requirement for special mobile phones.[154] Market research also indicates that the market for Wi-Fi phones is difficult to identify, or else it would be served already.[155] Given this market research, the most likely explanation for the lack of Wi-Fi functionality in wireless handsets is insufficient demand.

4. Uploading Pictures Taken from a Wireless Telephone

Wu claims that "when camera capabilities began appearing in telephones, equipment developers and carriers came into conflict."[156] He argues that "many carriers successfully forced equipment developers to make photo-sharing services the only way to get photos off of a camera-equipped phone."[157] He concludes that "it seems hard to see how consumer interests are served by making it harder for consumers to send photos to themselves."[158]

details/?q_list=true&q_phoneName=Cingular+8525&q_sku=sku310005 (last accessed Mar. 27, 2007).

150. T-Mobile Website, T-Mobile MDA, *available at* http://www.t-mobile.com/shop/phones/Detail.aspx?device=8802ddeb-1ee4-477a-9608-d9cd1e2a903f (last accessed Mar. 27, 2007).

151. Verizon Wireless Website, Verizon Wireless XV6700, *available at* http://www.verizonwireless.com/b2c/store/controller?item=phoneFirst&action=viewPhoneDetail&selectedPhoneId=2200&changingCompletedOrder= (last accessed Mar. 27, 2007).

152. Sprint Website, Sprint PCS Vision Smart Device: PPC-6700, *available at* http://www1.sprintpcs.com/explore/PhonesAccessories/PhoneDetails.jsp?navLocator=%7Cshop%7CphonesAccessories%7CpdaPhones%7C&selectSkuId=sprintppc6700&FOLDER%3C%3Efolder_id=1476427&CURRENT_USER%3C%3EATR_SCID=ECOMM&CURRENT_USER%3C%3EATR_PCode=None&CURRENT_USER%3C%3EATR_cartState=group (last accessed Mar. 27, 2007).

153. Alltel Wireless Website, UTStarcom PPC6700, *available at* http://www.alltel.com/phones/audiovox/6700.html (last accessed Mar. 27, 2007).

154. *In-Depth Analysis: Consumer Demand for Cellular/Wi-Fi Services*, Mindbranch Research Summary, Dec. 2006, *available at* http://www.mindbranch.com/Consumer-Demand-Cellular-R97-2670/ ("There is strong consumer interest in the types of billing and service plans that VoWLAN/cellular converged services could provide. However, there is little interest in the actual technology requirement for special mobile phones and a Wi-Fi connection to an existing broadband service."). *See* also, *In-Depth Analysis: Consumer Demand for Cellular/Wi-Fi Services*, In-Stat Mobile Consumer Catalog, Dec. 2006, *available at* http://www.instat.com/catalog/wcatalogue.asp?id=231.

155. *Id.*

156. Wu at 14.

157. *Id.* at 14.

158. *Id.* at 15.

In contrast to Wu's characterization, many handsets allow users to transfer photos through a memory card.[159] This method is identical to the way that photos are transferred from dedicated digital cameras.[160] Service providers such as Verizon are making it easier to transfer photos directly to Internet video sharing sites such as YouTube and Revver.[161] Wu's observation that Bluetooth transfers are unavailable can likely be explained by the fact that such transfers are more complicated than other methods.[162]

Furthermore, the availability of photo transfer capabilities is also likely to be determined by the demand for such services. As of March 2007, most handsets did not easily transfer photographs to the Internet because most wireless consumers did not demand that service. According to Forrester Research, only 28 percent of cellular subscribers use their phone to take digital photos.[163] Moreover, only 15 percent of cellular subscribers ever transfer photos from their handset to another device.[164] Most consumers prefer to use dedicated digital cameras, especially for travel.[165] While the demand may vary around the world, the

159. Terry Mason, *Smile! Phone Takes Nice Pix,* SEATTLE TIMES, Aug. 28, 2006, at E2 ("On the bottom, there's a slot for a micro SD card to store images, which can also be stored on the phone. You'll want to use that memory card to transfer the photos to your computer.").

160. Sascha Segan, *Camera Phone; We take our Best Shot at Helping You Pick the Right Camera Phone,* PC MAGAZINE, Jun. 20, 2006 ("If you intend to use your phone's camera frequently, make sure it has removable memory. That way, you can pop a mini-SD or micro-SD card into your phone, take some pictures, pull it out and drop it into a PC card reader-just as you would with a 'real' digital camera.").

161. Jessica Vascellaro, *News Picture Changes With Cellphone Video,* WALL ST. J., Jan. 3, 2007, at D4 ("Carriers also are making it easier for customers to send videos straight to Web video sites. For example, Verizon Wireless recently announced that subscribers to its $15 a month V CAST service will soon be able to upload their video clips directly to video-sharing sites YouTube and Revver Inc. from their phone. Doing so is expected to cost 25 cents a clip, unless photo and video messages are covered by their messaging plans.").

162. *Id.* ("Bluetooth file transfer, though, is overrated; it's more complicated to use than either of the other two options.").

163. James Granelli, *Picture Gets Clearer for Cellphone Camera Users; The Industry Improves Photos' Quality and Makes It Easier to Move Them to a PC or Printer,* L.A. TIMES, Dec. 28, 2006, at C1 ("About 40% of cellphone customers have cameras in their handsets, according to a survey by Forrester Research Inc. But 30% of them never use the camera and 46% say the photos they take have never left their phones."). Multiplying the percentage of subscribers *with camera phones* (40 percent) by the percentage of those users who use their camera phones (70 percent) equals 28 percent.

164. *Id.* Multiplying the percent of users *who use their camera phones* (28 percent) by the percent of those users who transfer photographs from their camera (100 – 46 = 54 percent) equals 15 percent.

165. Sarmad Ali, *Three Phone Makers Point to Advances in Camera Cellphones,* WALL ST. J., May 25, 2006 ("Camera phones are steadily improving, but my guess is that most consumers use them as backup cameras. They prefer digital cameras for big events, such as weddings and vacations.").

segment of the U.S. market that is potentially interested in such services is probably too small to justify more advanced camera capabilities.[166]

Finally, a "hedonic" valuation approach can be used to estimate a consumer's willingness to pay for advanced photography features on a wireless handset. By comparing two handsets that differ only in a single dimension (photo capabilities), one can infer the incremental price or value of that feature. Of course, the incremental price serves as a lower bound for the value of that feature for those customers who elect that option. Nevertheless, it provides a crude estimate of the value for wireless customers. Consider the Samsung D347, which is identical to the Samsung D407 in features, size, and standby time with the exception that the D407 has a camera. Without a contract, the D347 retails for $199.99, while the D407 retails for $219.99.[167] Using this example, a camera increases the value of a phone across all wireless customers by roughly 10 percent. (Of course, those customers who select that option value the photo capabilities by more than the incremental price or $20.) Wireless operators and their handset vendors cannot increase photo capabilities, and thereby increase the cost of a handset, by more than what consumers are willing to pay for those enhancements.

5. Transferring Ringtones from a Laptop to a Wireless Telephone

Wu argues that wireless customers should be able to transfer files downloaded from a laptop or a desktop to a wireless handset. Although such a transfer sounds plausible, most customers are not willing to incur the aggravation of getting two electronic devices to communicate. Wu is particularly critical of the apparent difficulties in transferring ringtones to a wireless device:

> For example, again, many carriers cripple Bluetooth's media transfer capabilities. Bluetooth makes it easy to communicate between a computer and cell phone, so blocking helps preserve an existing revenue source—the prices the companies can charge for songs, ringtones, wallpapers, and other content. In other words, with a more open system, a consumer could get what she wanted without passing the carrier's "tollbooth."[168]

According to Wu, operators prevent such transfers to compel subscribers to download the ringtones using the operator's preferred service. But if subscribers prefer to download ringtones directly to their handsets, which makes infinite sense, then "preventing" them from involving an intermediate step does not amount to a binding constraint. Once again, Wu seemingly ignores a widespread demand by consumers to simplify life in the digital age. Even if one could save

166. One important impediment to transferring other types of content from a wireless handset relates to intellectual property rights. For example, if a network owner can demonstrate to a music label that a song can be listened to only once, then the network owners can negotiate a lower royalty rate. Wu fails to consider the role of property rights in the transfer of content from wireless devices.

167. Cingular Website, Phones and Devices, *available at* http://www.cingular.com/cell-phone-service/cell-phones/cell-phones.jsp?startFilter=false&typcat1000=cat1000&allFeatures=on&mansamsung=samsung. Confirmed with call to Eric at Cingular Customer Service on March 23, 2007.

168. Wu at 35-36.

money by involving a laptop in the ringtone purchase, it is not clear that the monetary savings could offset the added time invested, not to mention the mental anguish of getting multiple devices to communicate.

C. *The Blocking of Bandwidth-Intensive Applications such as Videos or Games Is Not Discriminatory and Therefore Is Not Anticompetitive*

According to modern antitrust law, a refusal to deal with a rival or upstream supplier is anticompetitive only if it is done (1) by a firm with monopoly power (2) on a discriminatory basis.[169] Clearly, the first condition is not satisfied here, which makes the following explanation (of why a wireless operators refusal to support a particular bandwidth-intensive application is not anticompetitive) largely academic. It is perfectly legal under the antitrust law for a firm—even a monopolist—to deny a supplier from accessing the firm's customers so long as the denial is uniformly imposed across all suppliers. When a network operator chooses to limit certain bandwidth-intensive applications, it limits such content on a non-discriminatory basis. That is, it does not permit the use of bandwidth-intensive applications from preferred content providers while blocking bandwidth-intensive applications from others. Such treatment, if it were to occur, would constitute a "discriminatory refusal to deal" under the antitrust laws.

Professor Einer Elhauge argues that duty-to-deal claims should be limited to cases in which a monopolist discriminates against rivals by refusing to deal with them on the same terms that it deals with others.[170] Discriminatory refusals to deal with rivals are considered anticompetitive because they cannot be justified by any effect on investment incentives.[171] Moreover, discriminatory refusals to deal with rivals are easier to remedy because the remedy does not require courts to set prices but only to require the defendant to charge rivals the same rates as it voluntarily charges others.

These insights of modern antitrust law could, in principle, be applied to the question of whether wireless operators would have a duty to deal with content providers (assuming counterfactually that the operators are somehow monopolists). Wireless operators generally have *not* discriminated against bandwidth-intensive content providers. In the rare exceptions,[172] the apparent

169. *Verizon Communications Inc. v. Law Offices of Curtis V. Trinko* is the most recent Supreme Court case on the duty to deal. It involved a claim against Verizon, an incumbent local exchange carrier, for failing to treat customer orders filed by a competitive local exchange carrier as well as it treated its own customers' orders. The Court held that Verizon did not have a duty to deal with its rivals because, as explained further below, Verizon did not discriminate against its rivals in favor of non-rivals but rather discriminated against everyone else in favor of itself. For a more detailed review of the implications of *Trinko* in broadband markets, see Sidak, *supra* note 2.

170. *See* Einer Elhauge, *Defining Better Monopolization Standards*, 56 STAN. L. REV. 253, 308-10 (2003).

171. *Id.* For an example of a discriminatory refusal to deal in broadband, see Hal J. Singer, *The Competitive Effects of a Cable Television Operator's Refusal To Carry DSL Advertising*, 2 J. COMPETITION L. & ECON. 301-31.

172. For example, Verizon Wireless's customers who sign up for V CAST wireless Internet service are able to access "a sampling of the most popular videos" from YouTube. *See Verizon to Offer YouTube Videos*, THE CONSUMERIST, Nov. 28, 2006,

discrimination—that is, preference for one content provider over another—appears to be a byproduct a policy designed to manage a scare resource, which we explain in greater detail below. In general, the limitations apply equally to *all* bandwidth-intensive applications. It is thus reasonable to infer that these limitations are motivated by technological considerations, most likely relating to capacity constraints on wireless networks that were originally designed to carry voice signals only.

D. Professor Wu's Claim Regarding Application Innovation Is Based on a Handful of Quotes from Anonymous Vendors Who Were Rejected by Operators

Wu offers a pessimistic assessment of the current state of wireless applications: "Application development for mobile devices is stalled, and it is in the carriers' own interest to try and improve the development environment."[173] To support this assessment, he points to a handful of anonymous quotes from applications developers who were presumably rejected by a wireless operator. Six of the quotes are reproduced below:

- As *one* developer put it, "You just can't sell in this market like you do in others. The carriers have ultimate control over what products reach the market. If they don't like what you're doing, that's too bad."[174]

- "We were used to selling PDAs (personal digital assistants). But the wireless market was like night and day. Basically, the carriers have all the power,' said the former wireless marketing director of *a* PDA manufacturer."[175]

- As *one* developer said, "The first thing you want to do with a photo is get it off your phone [and] email it, right? But the carriers wouldn't let us make it that easy."[176]

- As *one* consumer wrote about Sprint's offering: "so.. wtf i pay $5/month just for the service and i also the .2/.3 cents/kb for a data transfer?? for every single picture?? wtf kind of bull**** is this?"[177]

- In the words of *a* Verizon customer: "Verizon's greed hurts its customers…One phone call to Motorola's dedicated V3C support line (800-657-8909, for those who want that number) verified that the problem was Verizon's own limit of 300 Kb on MMS and email attachments — and led to the Motorola tech expressing extreme exasperation that his company was willing to put its products in the hands of customers via a middleman (Verizon) who crippled those products before passing them on."[178]

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available at http://www.consumerist.com/consumer/youtube/verizon-to-offer-you-tube-videos-217818.php.

173. Wu at 3.
174. *Id.* at 9.
175. *Id.* at 13.
176. *Id.*
177. *Id.*
178. *Id.*

- In the words of another commentator: Developing any kind of mobile application is a tarpit. A tarpit of misery, pain and destruction.[179]

Such evidence may be suggestive, but it is hardly persuasive. It is almost always possible to identify one spurned vendor who believes his product was rejected by incumbent buyers for the wrong reasons—that is, unrelated to economic merit. Even under a completely merit-based procurement system without any favoritism towards preferred developers, there will be winners and losers. Thus, Wu's quotes from anonymous developers who may represent the losers should be viewed with a healthy skepticism. It would be just as easy to supply quotes from a handful of successful applications providers, which should also be viewed with skepticism.

E. So Long as the Content Is Easily Replicable, There Can Be No Harm from Exclusive Contracts

The consumer welfare effects of exclusive contracts for programming, whether it is video or audio in nature, depend on the availability of substitutes for the exclusive content. In some cases, the content can be easily replicated; in other cases, it cannot. Regulators should focus more on those cases where the content is difficult to replicate because it is in these cases where the possibility of consumer harm is most likely. Fortunately, it appears that content that is subject to exclusives in the wireless industry, such as music libraries and ringtones, is relative easy to replicate. Thus, regulators should permit the use of exclusives, as they are likely motivated by efficiency justifications.

A simple example can help to illustrate the idea. If Verizon Wireless exclusively uses V CAST for its music library, and if Cingular/AT&T exclusively uses iTunes for its music library, then, to the extent that the two libraries are overlapping, a Verizon subscriber does not need to subscribe to Cingular/AT&T to access songs for her handset. Contrast this situation with the use of exclusive contracts for content by multi-video programming distribution (MVPD) providers. If DIRECTV enters into an exclusive contract with Major League Baseball (MLB), and if Comcast enters into an exclusive with the National Basketball Association (NBA), then an MVPD subscriber who wanted to watch both professional baseball (MLB) and professional basketball (NBA) would have to subscribe to both DIRECTV and Comcast. Although such a scenario may not invoke much sympathy among economists (who subscribe to "no free lunch" ethic), it is reasonable to argue that such customers would be better off if exclusives were banned.

Such arguments have no merit in the wireless industry. Yet Wu suggests that regulators should "scrutinize" these practices:

> At a minimum, regulators should use the same basic general scrutiny for the broadband services of wireless carriers. At issue, in particular, are the contractual bans on the use of wireless connections for perfectly legitimate

179. *Id.* at 21.

> purposes, such as buying music from iTunes or downloading videos from YouTube.[180]

Wu fails to appreciate the fact that capacity limitations may prevent an operator from allowing subscribers to download bandwidth-intensive applications from multiple sources.[181] For these reasons, his call for greater regulatory scrutiny of wireless operators should be rejected.

IV. BECAUSE WIRELESS NET NEUTRALITY IS UNLIKELY TO PASS A COST-BENEFIT TEST, THERE IS NO APPARENT ECONOMIC JUSTIFICATION FOR REGULATION

We have argued that Wu has failed to satisfy the relevant economic criteria for wireless net neutrality regulation. In this section, we briefly review the specific policies that he and other proponents of wireless net neutrality advocate.

A. Should Wireless Operators Be Compelled to Allow Customers to Attach Any Safe Device to the Wireless Network?

In competitive markets like wireless services, a network operator has an incentive to make reasonable economic decisions concerning the devices that can be attach to its network. In the absence of market power and vertical integration, it is not appropriate for a regulator to second guess a wireless operator regarding decisions that affect network performance. If a device increases a consumer's willingness to pay for the service, and if the device does not unduly strain network capacity, then the operator will be inclined to allow that device to be attached to the network so long as the transaction is profitable. The only potential for conflict is a device that threatens ancillary revenues; however, the consumer welfare implications of those incentives are not likely to be significant here because VoIP providers can achieve the requisite economies of scale from wireline broadband providers. Because a VoIP phone connected to a laptop connected to a wireless card (three devices) is a poor substitute for a traditional mobile telephone (one device), any restrictions on attachments are more likely motivated by legitimate operational concerns, and should therefore be allowed.

B. Should Wireless Operators Be Compelled to Allow Customers to Use the Applications of Their Choice and View the Content of Their Choice?

Before embracing a proposal to compel wireless operators to allow customers to use any application of their choice, regulators should carefully consider how such rules would affect the operation of wireless networks. In the

180. *Id.* at 32.

181. The same arguments justify a DSL provider that offers high-definition video signals over a broadband connection—there is not sufficient capacity for the DSL provider to allow its customers to download multiple streams of HD video from multiple sources. Indeed, HD video over broadband was exempted from the net neutrality provisions in the AT&T-BellSouth merger agreement for this reason. *See* FCC Approves Merger of AT&T Inc. and Bellsouth Corporation, released Dec. 29, 2006, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-269275A1.pdf.

absence of a market failure, a network provider is likely to make all Internet content available to customers, subject to capacity constraints, because it is in its interest to do so. Thus, we observe that non-bandwidth-intensive content is available to customers. No operator would prevent a customer from accessing a text-based website because it contained inflammatory content. By contrast, a network operator may prevent its customers from continuously accessing bandwidth-intensive applications such as webcam posts, streaming video, or VoIP for extended periods. In general, these restrictions apply equally to all bandwidth-intensive applications. In the rare exceptions in which a wireless operator allows a single bandwidth-intensive application, the restrictions are likely motivated by a concern for spectrum management. Forcing a wireless operator to accept bandwidth-intensive applications would be akin to forcing a DSL operator to accept streaming video signals in high definition from multiple sources. There is simply insufficient capacity to allow such freedom.

C. *Should Wireless Operators Be Compelled to Disclose Any Limits Placed on Devices and on Bandwidth Usage?*

Greater disclosure generally has benefits, but the costs of such disclosure can outweigh those benefits. Before considering disclosure regulation, analysts should examine whether (1) there is a demonstrated market failure and (2) the economic benefits of mandatory disclosure outweigh the costs. Wu does not identify a clear market failure. Instead, he simply asserts that: "Competition depends on information to work. Consumers cannot make wise decisions unless they know, for example, the daily or monthly bandwidth limits on wireless broadband services."[182] But in fact, there already are multiple information resources, including the Internet and consumer surveys, to help consumers make decisions in the wireless market. The availability of this information makes any disclosure mandate unnecessary.

Thus, recognizing the power of the Internet to shape opinions, wireless operators are quick to respond to anything that could undermine their images. Verizon's recent announcement to phase out the use of the term "unlimited" for its data plans is a case in point.[183] Verizon's terms and conditions of its largest data plan now clearly states that using more than 5 GB of bandwidth during the course of a month will result in service termination.[184] According to a Verizon Wireless spokesman, the 5 BG limitation is not new: "The terms and conditions remain the same. We are changing graphically how we explain it to customers and providing more information to help customers decide if this is the right plan for them."[185] The announcement is significant *because it occurred in the absence of regulation.* Although proponents of wireless net neutrality may claim that the decision was motivated by the threat of regulation, another explanation is that

182. Wu at 32.

183. Verizon clarifies limit on "unlimited" data plan, Apr. 4, 2007, *available at* http://www.uptilt.com/c.html?rtr=on&s=69l,rejj,8mg,rsv,cby1,27i2,k82z.

184. The exact language reads as follows: "Anyone using more than 5 GB per line in a given month is presumed to be using the service in a manner prohibited above, and we reserve the right to immediately terminate the service of any such person without notice." *Id.*

185. *Id.*

consumer sentiment—likely informed by web postings and surveys—pressured Verizon into voluntarily making the disclosure clearer. There is no compelling case for imposing an additional layer of regulation for mandatory disclosures, which can become inflexible in the face of continuing technological change.[186]

D. Should the Wireless Industry Work Together to Create Clear and Unified Standards for Developers?

Wu's final recommendation is that wireless operators adopt uniform standards for developers. This could take the form of regulation, but could also result from a voluntary agreement. It is not clear that the benefits of embracing a single standard outweigh the costs. Again, Wu does not offer any empirical evidence on the likely costs and benefits. Given the fact that there are five national providers, it may not be difficult to select a standard if the net benefits of doing so were large. However, there are clear costs to standardization, one of which is that it has the potential to lock in inefficient technologies. We are not persuaded based on the evidence that a uniform standard should be required.

Finally, any proposal for standardization should be cognizant of prior attempts to use standards in the industry. The most notable experience was the Wireless Application Protocol (WAP), an example that Wu himself cites in his paper:

> The carriers, however, supported a different approach, embodied in the WAP protocol. As opposed to adapting the Internet to the technical constraints of mobile phones, WAP created an entirely new set of protocols, and contemplated, in essence, the creation of an alternative, cell-phone only Web. The carriers *pressured* manufacturers to offer WAP-compatible browsers only, and then, at least initially, a 'walled garden' of WAP-compatible sites. . . . Eventually the carriers relented, demanding only that their site be the first site available on any browser. Ultimately, WAP proved a *commercial failure* and has been abandoned in the United States.[187]

Given what Wu describes as the "commercial failure" of WAP, it is not clear that standardizing around a new technology would produce better results. Moreover, once they adopt a new standard and make standard-specific investments, the operators would again have incentives to "pressure" manufacturers, which Wu apparently dislikes. By embracing an inefficient standard, wireless operators could undermine innovation at all levels of the network. If experience is any guide, standardization for the sake of standardization could decrease social welfare.

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186. For example, mandatory disclosure has proven inadequate in the credit card industry. *See* General Accounting Office, Credit Cards: Increased Complexity in Rates and Fees Heightens Need for More Effective Disclosures to Consumers GAO-06-929, Sept. 12, 2006, 2006, *available at* http://www.gao.gov/new.items/d06929.pdf (explaining that "These weaknesses may arise from issuers drafting disclosures to avoid lawsuits, and from federal regulations that highlight less relevant information and are not well suited for presenting the complex rates or terms that cards currently feature.").

187. Wu at 15 (emphasis added).

CONCLUSION

This is the first paper to rigorously analyze the concept of wireless net neutrality as defined by Professor Wu. Although it is hard to resist policies that allegedly may be associated with the phrase "net neutrality," when applied to the wireless industry, there is a strong economic basis for doing so. Our principal conclusion is that the costs of implementing proposals to promote wireless net neutrality are likely to exceed the benefits. Given the lack of market power among wireless operators, the likelihood that any particular applications provider or equipment provider could be foreclosed by the conduct of a single wireless network owner is remote.

Our analysis suggests that technological change occurs at a very rapid rate in the highly competitive market for wireless services. We believe that regulators should take particular care in regulating such markets. Regulation is typically a very crude instrument that could easily do more harm than good if, for example, it blunts the incentive for technological innovation. Given the rapid pace of innovation in the wireless industry, combined with the rapidly decreasing prices, it is hard to imagine that a regulatory elixir could actually improve on the status quo. For that reason, Wu's calls for wireless regulation should be rejected.

APPENDIX 1: EXAMPLES OF WIRELESS APPLICATION INNOVATION, 1999-2006

Application	Description	Date	Source
Wireless Application Protocol ("WAP")	Allows mobile phones to access the Internet. Shipped originally by Nokia in 1999, the "7110."	1999	Fifth CMRS Report, p.47
Bluetooth-enabled wireless headset	Allows people to answer their wireless phones from up to 30 feet away. Unveiled by Ericsson.	1999	Fifth CMRS Report, p.48
Sprint Wireless Web	Nationwide wireless web service offering connectivity up to 14.4Kbps through an Internet-ready handset.	1999	Fifth CMRS Report, p.51
Two-way text messaging	Introduced by T-Mobile in the US, Verizon and AT&T followed later in 2000.	2000	Eighth CMRS Report, ¶144
Alltel "Web-Unwired"	Wireless web services.	2000	Sixth CMRS Report, p.61
MyBiz Interactive	Cingular and RIM Blackberry service that offers messaging and e-mail services.	2000	Sixth CMRS Report, p.70
Nextel Online	Wireless Internet service offered data speeds up to 19.2 Kbps for business customers. Partnered with Microsoft for access to MSN Hotmail, Money, and Expedia.	2000	Fifth CMRS Report, p.52
Cross-carrier SMS capability	Allowed subscribers to exchange text-messages with subscribers in other services.	2001	Ninth CMRS Report, ¶157
Pocket PC 2002 PDA Operating System (Phone Edition)	Operating system for phones and PDAs that allows establishment of a secure VPN connection to corporate servers.	2001	Eighth CMRS Report, ¶167

Application	Description	Date	Source
Instant Messaging ("IM") services	Services such as AIM and MSN Messenger offered on mobile devices, enabling users to send and receive messages from a community of users, creating a chat-style atmosphere, versus the one-on-one style of SMS.	2001	Seventh CMRS Report, p.69
cdma2001 1X	First phase of 3G technology rollout – Verizon and Sprint.	2001	Sixth CMRS Report, p.49
Enterprise Solution	Arch Wireless product that allows employees to access firewall protected files, e-mail, calendar functions, and enterprise applications on a variety of devices.	2002	Seventh CMRS Report, p.75
cdma2000 1xEV	Second phase of 3G rollout – boosting network data speeds up to 2.4Mbps.	2002	Sixth CMRS Report, p.49
MobiTV	Real-time video programming service with 15 cable news, sports, and entertainment channels – powered by Idetic, Inc., which streams the programs onto the phones via the Internet. Also includes radio channels, notable Yankees games.	2003	Ninth CMRS Report, ¶154
Multimedia Messaging Services ("MMS")	Exchange of photo, video, animation, and audio files using mobile phone.	2003	Eighth CMRS Report, ¶155
AT&T mMode	AT&T data service that also incorporated MobiTV services.	2004	Tenth CMRS Report, ¶140
T-Mobile CallerTunes	Allows user to select ringtones for caller to hear, including downloadable songs.	2004	Press Release, T-Mobile, T-Mobile USA Launches CallerTunes; The Nationwide Ringback Tone Service That Lets Users "Represent Their Style," Dec. 8, 2004.
Sprint Music Store	Enables purchase and downloads of full-length songs over a wireless telephone network directly onto cell phones.	2005	Eleventh CMRS Report, ¶137

Application	Description	Date	Source
Verizon V CAST	Purchase and download full-length songs over a wireless telephone network directly onto cell phones. Access to video clips and unlimited browsing of Verizon's "Mobile Web" news and information service. Additionally, 3-D games, music videos, and other premium channels are available payment.	2005	Eleventh CMRS Report, ¶137
Cingular ROKR	Cell phone that plays songs downloaded from Apple iTunes.	2005	Eleventh CMRS Report, ¶137
Sprint Power Vision	Package that allows a cell phone user to watch TV, download songs, receive information, and access other content at broadband-like speeds.	2005	Eleventh CMRS Report, ¶138
Sprint TV	Provides specially produced short clips from major networks.	2005	Tenth CMRS Report, ¶140
Handsets with EV-DO access	3G handsets introduced by Verizon that can access the EV-DO highspeed network. Allows use of V CAST services.	2005	Tenth CMRS Report, ¶141
Sprint EV-DO	Sprint rolling out EV-DO service to at least 60 metropolitan, covering over 150M people.	2005	Press Release, Sprint, Sprint Begins Launch of EV-DO Wireless High Speed Data Service, Jul. 7, 2005.
Sprint Game Lobby	Mobile access to Yahoo multiplayer games. Allows playing of multiplayer games such as poker or chess against users on PCs or other mobile handsets.	2005	Press Release, Sprint, Yahoo! And Sprint Team to Offer Multiplayer PC-to-Mobile Games, May 16, 2006.
Axcess Web	Wireless Web service introduced by Alltel that allows quick access to the latest weather, news, and sports.	2005	Press Release, Alltel, Alltel Introduces New Web Service for Wireless Customers, Jan. 4, 2005.
Cingular Video	Watch video clips of television shows, sports, news, weather, and other content on advanced handsets.	2006	Eleventh CMRS Report, ¶138

Application	Description	Date	Source
ESPN Mobile	Sports news and information services running on an EV-DO network with capacity leased from Sprint.	2006	Eleventh CMRS Report, ¶138
Helio	Service to bring advanced cellphone technology to the US, bringing games, video clips, and other forms of entertainment.	2006	Eleventh CMRS Report, ¶138
YouTube services	Select video content from YouTube will be allowable on Verizon handsets.	2006	Mark Rockwell, Verizon Goes YouTubing, WirelessWeek, Nov. 28, 2006.
GPS tracking technology	Wireless providers introduced GPS tracking services for mobile handsets. Mologogo is one such application developed that works on Nextel handsets.	2006	Daniel Charles, GPS is Smartening Up Your Cell Phone, NPR – Technology, Sep. 25, 2006.
Smarter Agent	Service that utilizes GPS and mobile handsets to assist in real estate sales by showing houses for sale on a users handset.	2006	Daniel Charles, GPS is Smartening Up Your Cell Phone, NPR – Technology, Sep. 25, 2006.
Sprint EV-DO Update	By year end 2006, Sprint EV-DO network covered more than 188M people and 8,700 cities. Average download speeds increased to 450-800 Kbps.	2006	Press Release, Sprint, Sprint Sets Sights on 2007 After Continuing to "Power Up" Networks in 2006, Dec. 20, 2006.
Gmail Mobile	Gmail, the popular e-mail service offered by Google, will be available on Sprint handsets.	2006	Press Release, Sprint, Sprint and Google Team to Offer New Gmail Mobile Application, Nov. 2, 2006.
Sprint Power View	First made-for-mobile sports and entertainment video programming network for mobile devices.	2006	Press Release, Sprint, Sprint Power View Launches Today: Free, First-of-its-Kind, Made-for-Mobile Sports/Entertainment Programming Network, Sep. 12, 2006.
Sprint Movies	First "pay-per-view" service that streams full length movies onto mobile handsets.	2006	Press Release, Sprint, Sprint is First to Offer Full-Length "Pay-Per-View" Movies on Mobile Phones in the US, Sep. 9, 2006.
BiM Interactive	Fitness application that uses GPS-enabled Sprint phones for feedback for runners, walkers, and cyclists involving	2006	Press Release, Sprint, Sprint and Bones in Motion Launch Mobile Fitness Application, Feb. 2, 2006.

Application	Description	Date	Source
	performance summaries, maps, and more.		
Cingular 3G Coverage	Cingular 3G Mobile Broadband network now services over 160 markets, including most of the top 100 major cities in the US.	2006	Press Release, Cingular, Cingular 3G Coverage in More than 160 Markets, Dec. 20, 2006.
TeleNav GPS Navigator	Allows GPS navigation with a "birds-eye view" moving map. PDA-based and first offered by Cingular.	2006	Press Release, Cingular, Cingular Unveils PDA-Based Wireless GPS Navigation System with 3D Moving Maps, Nov. 20, 2006.
Pocket Express	Application that delivers news, sports, weather, stock quotes, street maps, directions, and more for smart phones.	2006	Press Release, Alltel, Alltell Wireless Offers Handmark Pocket Express on Smart Phones, Oct. 16, 2006.
Mobile XM Radio	XM Radio available through Alltel handsets. Application developed by MobiTV.	2006	Press Release, Alltel, Alltel Wireless First US Carrier to Launch XM Satellite Radio, Aug. 10, 2006.
Fleet Tracking GPS Technology	Business customers will be able to track their vehicles and other equipment using GPS technology and Alltel handsets.	2006	Press Release, Alltel, Alltel Offers Wireless GPS Vehicle Tracking for Business Customers, Feb. 20, 2006.
V CAST Mobile TV	First "true" mobile TV service, with streaming content.	2007	Press Release, Verizon Wireless, Verizon Revolutionizes TV at Home and On Mobile Phones, Jan. 7, 2007.
Sprint iX-3	GPS-technology that allows real-time tracking of school busses.	2007	Press Release, Sprint, Sprint Certifies New GPS-Based School Bus Tracking Technology, Jan. 11, 2007.
Mobile TiVo program scheduling	Verizon Wireless now offers service where the TiVO DVR box can be programmed from a mobile handset.	2007	Verizon Wireless, TiVo Connect for Mobile Program Scheduling, CTIA SmartBrief, Mar. 16, 2007.
AskMeNow	Intelligent mobile search, with the ability to ask questions and quickly receive answers via mobile handset. Alltel is first US carrier to introduce this service.	2007	Press Release, Alltel, Alltel Wireless First US Carrier to Offer AskMeNow Across All Handsets, Mar. 1, 2007.

ATTACHMENT F

PHOENIX CENTER POLICY BULLETIN NO. 17

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WIRELESS NET NEUTRALITY: FROM *Carterfone* TO CABLE BOXES

Abstract: Over the past few months there have been calls to impose "wireless net neutrality" rules on the burgeoning United States wireless industry. These critics assert that certain practices by the wireless industry—such as handset "locking" practices, data bandwidth limitations, and control over features included on handsets—unduly hamper the ability of consumers to access and use advanced data communications services and, therefore, require severe regulatory intervention to protect consumers. To correct this perceived market defect, wireless network neutrality advocates essentially seek to turn highly sophisticated wireless telecommunications networks into commodity-based networks. In support of this proposal, wireless network neutrality advocates point to the Federal Communications Commission's 1968 *Carterfone* decision and the more recent *Cable Navigation Devices* rules as examples in which the Commission has taken what they allege to be a similar regulatory approach for both the landline telephone and video programming distribution market. In this BULLETIN we show that neither the mandates of, nor conditions relevant to, *Carterfone* and the *Cable Navigation Devices* decisions appear to support the regulatory intervention sought by the wireless network neutrality advocates. Indeed, the *Carterfone* and *Cable Navigation Devices* decisions appear to decidedly call for a rejection of the recent proposals for wireless network neutrality. We also discuss the substantial risks that *Carterfone*-type regulation would commoditize wireless network services in a way that could substantially harm the prospects for entry and competition in the industry.

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I. Introduction and Background

Over the past few months there have been calls to impose "wireless net neutrality" rules on the burgeoning United States wireless industry.[1] While conceding that the nation's wireless industry is a "wonder,"[2] these critics assert that certain practices by the wireless industry—such as handset "locking" practices, data bandwidth limitations, and control over features included on handsets—unduly hamper the ability of consumers to access and use advanced data communications services and, therefore, require severe regulatory intervention to protect consumers.[3] To correct this perceived market defect, wireless network neutrality advocates essentially seek to turn highly sophisticated wireless telecommunications networks into commodity-based networks.[4]

At the core of the "wireless net neutrality" argument is an appeal to the Federal Communications Commission's 1968 *Carterfone* decision, wherein the agency required the Bell System local phone monopoly to allow telephone devices from unaffiliated manufacturers to be connected to the local phone network.[5] The national phone monopoly at the time, the old Bell System, refused to allow any "foreign attachment" to their network. The Bell System's incentives to sabotage the evolution of a competitive equipment market are well understood as a consequence of the presence of market power, vertical integration, and regulation. The

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1 *See, e.g.*, T. Wu, *Wireless Network Neutrality: Cellular Carterfone on Mobile Networks* (Feb. 2007) (available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=962027); Petition of Skype Communications S.A.R.L. to Confirm a Consumer's Right to Use Internet Communications Software and Attach Devices to Wireless Networks, RM-11361, filed February 20, 2007 ("Skype Petition"); Testimony of Ben Scott, Policy Director—the Free Press, before United States Senate Committee on Commerce, Science and Transportation (April 24, 2007)(available at: http://commerce.senate.gov/public/_files/UPDATEDTESTIMONYScottCommerceTestimony424.pdf) ("Scott Testimony").

2 Wu, *supra* n. 1 at 1 ("devices that were science fiction thirty years ago are now widely available" and the wireless industry "has succeeded in bringing wireless telephony at competitive prices to the American public").

3 *See, e.g.*, Skype's allegation that "carriers are using their considerable influence over handset design and usage to maintain an inextricable tying of applications to their transmission networks and are limiting subscribers' rights to run applications of their choosing." Skype Petition, *supra* n. 1 at 2.

4 On the dangers of commoditization, *see* G. S. Ford, T. M. Koutsky and L. J. Spiwak, *Network Neutrality and Industry Structure*, PHOENIX CENTER POLICY PAPER NO. 24 (Apr. 2006) (available at: http://www.phoenix-center.org/pcpp/PCPP24Final.pdf); *a revised version is printed in* 29 HASTINGS COMMUNICATIONS AND ENTERTAINMENT LAW JOURNAL 149 (2007).

5 Wu, *supra* n. 1 at 5-7; Skype Petition, *supra* n. 1 at 25-30 (calling on FCC to "declare that wireless carrier services are fully subject to *Carterfone*" and to "enforce the mandate of *Carterfone* in the wireless industry"); Scott Testimony, *supra* n. 1 at 19 ("*Carterphone* [sic] rules should apply to the wireless broadband platform").

Commission's decision,[6] along with related subsequent decisions and rules, created the competitive telephone equipment market we enjoy today. As another point of precedent, proponents of wireless network neutrality cite the more recent *Cable Navigation Devices* decisions,[7] in which the Commission implemented rules to satisfy the Communications Act's Section 629 mandate, to support the imposition of new and stringent regulation on the wireless industry.[8]

We explain in this BULLETIN that neither the mandates of, nor conditions relevant to, *Carterfone* and the *Cable Navigation Devices* decisions appear to support the regulatory intervention sought by the wireless network neutrality advocates. Indeed, viewed correctly, both the *Carterfone* and *Cable Navigation Devices* decisions are precedent for *rejecting* the recent proposals for wireless network neutrality regulation.

Section II discusses the Commission's *Carterfone* rules, and notes that they were designed to mitigate and control market power by regulated network providers (at that time, principally, the old, vertical integrated Bell System). But in comparison to the vertically-integrated Bell System monopoly monolith of 1968, the Commission has determined that the wireless communications industry in the United States today is robustly competitive and the industry is not price regulated.[9] Indeed, about 98% of households have the option to purchase wireless

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6 *In re Use of the Carterfone Device in Message Toll Telephone Service*, 13 FCC 2d 420 (1968) , 14 FCC 2d 571 (1968) (hereinafter "*Carterfone*"); *see also Hush-A-Phone Corp. v. American Tel. & Tel. Co.*, 20 FCC 391 (1955), *rev'd, Hush-A-Phone Corp. v. U.S.*, 238 F.2d 266 (D.C. Cir. 1956) (*per curiam*), *on remand, Hush-A-Phone Corp. v. American Tel. & Tel. Co.*, 22 FCC 112 (1957).

7 *See* 47 U.S.C. § 549; *Implementation of Section 304 of the Telecommunications Act of 1996, Commercial Availability of Navigation Devices*, 13 FCC Rcd 14775, 14775, ¶1 (1998) (*Navigation Devices Order*), *aff'd, General Instrument Corp. v. FCC*, 213 F.3d 724 (D.C. Cir. 2000). The FCC extended the implementation deadline of these requirements in 2003 *Implementation of Section 304 of the Telecommunications Act of 1996, Commercial Availability of Navigation Devices*, 18 FCC Rcd 7924 (2003), and again in 2005, *Implementation of Section 304 of the Telecommunications Act of 1996, Commercial Availability of Navigation Devices*,20 FCC Rcd 6794 (2005), *aff'd Charter Communications, Inc. v. FCC*, No. 05-1237, slip op. (D.C. Cir. Aug. 18, 2006) (available at: http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-267179A1.pdf).

8 Skype Petition, *supra* n. 1 at 11 (noting that while "the context was different" for the cable navigation device rules, "the principle was pure *Carterfone*").

9 Over the past five years, the average price for a wireless telephone service has declined nearly 20% annually in real terms (on a per minute basis). Subscribership has risen 14% annually, with nearly 100 million subscribers added from 2001 to 2005. Usage has nearly doubled over the past five years, with an annual growth of 24%. Productivity, measured as dollars generated per industry employee, has risen by an average of 12% per year over the last half decade. *In the Matter of Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services*, WT Docket 06-17, ELEVENTH REPORT, 21 FCC Rcd 10947 (2006) ("*11th CMRS Competition Report*") at App. A, Tables. 1, 9 and 10.

service from one of three (or more) providers, a near-ubiquitous competitive choice unsurpassed by any other developed nation.[10] Moreover, rather than expand the application of *Carterfone* over the years, the Commission has in fact reduced its significance, consistently setting aside the principle in markets it deems competitive.

In Section III, we turn toward the Commission's *Cable Navigation Devices* decisions, which were motivated by a very specific statutory mandate to promote a competitive equipment market for cable set-top converter boxes. Importantly, the provision of the Communications Act that mandates these Commission rules allows for the elimination of such regulation in the presence of competition at both the platform and equipment stages of the market. As discussed above, there is ample evidence that both conditions exist in the wireless industry, and the Commission has formally concluded as much. Like *Carterfone*, the exceptions to the rule are also important—for example, the Commission has refused to apply the mandates to the satellite television industry due to the presence of competition and the widespread availability of equipment. Understanding this background is relevant when assessing whether to apply this precedent and its attendant regulations on the wireless industry.

Finally, Section IV briefly discusses the substantial risks that *Carterfone*-type regulation would present to the wireless industry. Product and service differentiation are critical to how wireless carriers compete to obtain and retain subscribers. As a result, the Commission has eschewed policies that would commoditize wireless services and instead has moved toward policies that give wireless licensees flexibility to develop and deploy services with much less government command-and-control than other nations. Changing that policy in favor of one that would deliberately commoditize wireless network services could substantially retard the prospects for entry and competition in the industry.

II. Applying *Carterfone* Principles to the Wireless Industry

As noted above, proponents of wireless network neutrality essentially wish to turn wireless service networks into a commodity industry. To support this position, they wave the flag of the Commission's *Carterfone* precedent.[11] We demonstrate below, however, that this historical

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[10] *Id.* at Table 11; Table 1, *infra.*

[11] *See, e.g.*, Wu *supra* n. 1 at 21-22 ("The industry or the FCC should, as in the Part 68 rules, define a basic interface to which any equipment manufacturer could build a mobile device and sell it to consumers. . . . The wireless world already has standardized interfaces. . . . A standardized interface would work like any other in the phone or electric industry. Spectrum bandwidth is a commodity, and the interface would provide the user with a fixed maximum bandwidth and, like an electric meter, bill the consumer for the amount of bandwidth actually used. . . The full implementation of *Carterfone*, would, over time, transform the wireless industry."); Skype Petition, *supra* n. 1 at 30 ("[T]he Commission should create a mechanism to establish similar [Part 68] technical standards updated to take into

(Footnote Continued....)

analogy is being grossly misapplied by these advocates. The *Carterfone* rules were promulgated to prevent the leveraging of market power from a dominant, regulated, vertically-integrated telephone service provider into the telephone equipment market (or consumer premises equipment or "CPE" market). The obvious question is whether these conditions are present in the wireless industry in 2007. If not, then while intervention may have an appropriate remedy in 1968 in the *Carterfone* case, the same intervention would be entirely unnecessary and counterproductive in the wireless industry.

To even the most casual observer, the vertically integrated, monopoly nature of the telephone network in the late 1960's in no way parallels that observed in the wireless communications industry today: (i) 98% of the country has a choice of at least three wireless providers; (ii) the wireless carriers are not vertically integrated into the equipment market; and (iii) neither the wireless carriers nor the equipment vendors are price regulated. In the absence of these features, it is impossible to link *Carterfone* sensibly to the modern wireless telecommunications industry in the United States. Indeed, the primarily principle drawn from *Carterfone* is that that *regulation* can create incentives counter to consumer welfare, leading to low quality products and services and the sabotage or crippling of competitors by the regulated and dominant firm. As we explain below, it was the *presence* of regulation—not its absence—that made *Carterfone* regulation necessary.

A. *The Carterfone Decision*

The Commission's 1968 *Carterfone* decision was, without question, an important regulatory watershed in communications history. To a large extent, the ability to purchase phones made by a variety of manufacturers at any number of retailers is a result of that decision, though its full influence was not felt until it was commingled with some later, related decisions and rulemaking proceedings. The Commission's decision effectively allowed manufacturers unaffiliated with the Bell System to manufacture telephones, under strict technical standards, that consumers could purchase and connect to the telephone network without restriction or additional fees levied by the phone company. At that time, the Bell System's affiliate, Western Electric, was the exclusive and only manufacturer of telephones for the Bell System, and the Commission's decision to mandate a standard technical interface to the telephone network allowed for the emergence of competition in the manufacture and sale of telephone equipment.

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account the unique environment of the mobile Internet. The goal should be to create transparent and neutral standards under which consumers can exercise their right to run the Internet communications applications of their choice. . .")

When considering the implications of *Carterfone* for the mobile handset industry, it is important to understand the environment, including the presence of regulation, in which the original decision was made. At the time of *Carterfone*, the Bell System had a virtual monopoly over the entire telephone network, stretching from telephone to telephone and everything in between. The firm was regulated at all levels, a consequence of its bargain with the government in the Kingsbury Commitment of 1913, where the government countenanced its monopoly in return for its regulatory durance.[12] The only source of supply of telephone equipment was Western Electric, a wholly-owned subsidiary of the Bell System.[13]

So, at the time of *Carterfone*, the nation had a phone company with the following traits: (i) it was a monopoly; (ii) it was vertically integrated into nearly all stages of its industry; and (iii) it was regulated at nearly every level of its business. This setting is very much different than that found in the mobile telecommunications industry today. In today's wireless industry, the carriers are obviously not monopolists, and the Commission acknowledges that they compete aggressively on service quality, features, and prices.[14] As stated above, 98% of the country lives in areas with three or more mobile carriers offering service. The Commission, therefore, has repeatedly concluded that "there is effective competition in the [wireless] marketplace," and this position is unchanged even after the recent mergers of several large wireless carriers.[15]

Second, the wireless industry is not vertically integrated into the manufacture of telephone equipment. Thus, the potential for the sabotage of competing equipment manufacturers to protect an equipment affiliate is entirely absent in the wireless industry. Since the *Carterfone* decision was essentially about actions aimed to protect the position of an affiliated equipment manufacturer, how exactly the decision applies to the wireless industry is a bit of a mystery.

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12 S. M. Benjamin, D. G. Lichtman & H. A. Shelanski, TELECOMMUNICATIONS LAW AND POLICY, 624-28 (2001); S. McMaster, THE TELECOMMUNICATIONS INDUSTRY (2002).

13 While the Bell System is often criticized for its lack of innovation in telephone equipment, this lack of innovation may have been due, at least in part, to the price regulation of the equipment. For the role of regulation in communications markets on quality, *see* D. J. Boudreaux and R. B. Ekelund Jr., *The Cable Television Consumer Protection and Competition Act of 1992: The Triumph of Private over Public Interest*, 44 ALA. L. REV. 355 (1993) and T. Hazlett and M. Spitzer, PUBLIC POLICY TOWARD CABLE TELEVISION: THE ECONOMICS OF RATE CONTROLS (1998).

14 Even Professor Wu admits that wireless services are available at "competitive prices to the American public." Wu, *supra* n. 1 at 1.

15 *11th CMRS Competition Report*, *supra* n. 9 at ¶ 2; *In the Matter of Applications of Nextel Partners, Inc., Transferor, and Nextel WIP Corp. and Sprint Nextel Corporation, Transferees For Consent To Transfer Control of Licenses and Authorizations*, MEMORANDUM OPINION AND ORDER, 21 FCC Rcd 7358 (2006), Separate Statement of Commissioner Copps ("But in most of [U.S. wireless] markets four or more substantial competitors will continue to compete post-merger.").

Finally, and most importantly, the wireless industry is not subject to price regulation.[16] The presence of regulation is critical to the *Carterfone* decision, since without regulation, a firm would have little incentive to sabotage and the decision likely would have been unnecessary in the first instance. As noted by Beard, Kaserman and Mayo, the factors necessary for sabotage—as defined as the ability to increase or raise the cost of a rival's key input of production by non-price behavior (e.g., blocking)—include (but are not limited to): (a) significant monopoly power in one or more markets and (b) the presence of price or profit regulation.[17] This approach is consistent with more general and well-accepted economic treatments of leveraging.[18] Or, as summarized by Ordover, Sykes and Willig:

> In sum, when a regulated firm is subject to a binding rate-of-return ceiling that exceeds its true marginal cost of capital, it has a profit incentive to expand in to the production of vertically related services. . . . If, however, the regulated firm is comparatively inefficient in producing vertically related services, it may still endeavor to extend its monopoly by means of such tactics as below-cost pricing, tie-ins, and predatory systems rivalry—all to the detriment of economic welfare.[19]

The explicit and primary role regulation played in the *Carterfone* decision is well established. As noted in a paper by Farrell and Weiser, the Bell System's entry deterring behavior in telephone

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16 *See* 47 USC § 332(c); *see also In Re Petition Of The Connecticut Department Public Utility Control To Retain Regulatory Control of the rates of Wholesale Cellular Service Providers in the State of Connecticut*, 10 FCC Rcd 7025, FCC 95-199 (1995), *aff'd sub nom. Connecticut Department Of Public Utility Control v. FCC*, 78 F.3d 842 (2nd Cir 1996).

17 T. R. Beard, D. Kaserman and J. Mayo, *Monopoly Leveraging, Path Dependency, and the Case for a Local Competition Threshold for RBOC Entry into InterLATA Toll*, in M. Crew, ed., REGULATION UNDER INCREASING COMPETITION (2003); *see also Olympia Equipment Leasing Co. v. Western Union Telegraph Co.*, 797 F.2d 370, 374 (7th Cir. 1986) at 374 ("There are, however, special circumstances in which a rational monopolist may want to restrict competition in an input market; as it happens, one of those circumstances is where the monopolist's rates are regulated."). Likewise, we have demonstrated the role of regulation in sabotage in earlier work. *See, e.g.*, T.R. Beard, G.S. Ford, and L.J. Spiwak, *Why ADCo? Why Now? An Economic Exploration into the Future of Industry Structure for the "Last Mile" in Local Telecommunications Markets*, 54 FED. COM. L. J. 421 (May 2002).

18 Useful general discussions of leveraging can be found in the following: T. R. Beard, D. Kaserman and J. Mayo, *Regulation, Vertical Integration and Sabotage*, 49 JOURNAL OF INDUSTRIAL ECONOMICS 319-333 (2001); J. Farrell and P. Weiser, *Modularity, Vertical Integration, and Open Access Policies: Towards a Convergence of Antitrust and Regulation in the Internet Age*, 17 HARVARD JOURNAL OF LAW & TECHNOLOGY 85-134 (2003); D. Mandy and D. Sappington, *Incentives for Sabotage in Vertically Related Industries*, 31 JOURNAL OF REGULATORY ECONOMICS 235-260 (2007); D. Sappington and D. Weisman, *Self-Sabotage*, 27 JOURNAL OF REGULATORY ECONOMICS 155-175 (2005); J. Farrell, *Integration and Independent Innovation on a Network*, 93 AMERICAN ECONOMIC REVIEW: PAPERS AND PROCEEDINGS 420-424 (2003).

19 J. Ordover, A. Sykes, and R. Willig, *Nonprice Anticompetitive Practices by Dominant Firms Toward the Producers of Complementary Products*, in F. Fisher, ed., ANTITRUST AND REGULATION, 125 (1985).

equipment was "because of the price regulation of local telephone service."[20] Economists recognize that it was combination of market power at the downstream level plus classic public utility-type regulation that created the incentive for the Bell System to leverage and exclude entry in the equipment sector (neither factor being present in today's wireless industry). Accordingly, *it was the firm's efforts to evade regulation*, not simply a monopolist's inherent desire to protect revenue and profits, which created the incentive to sabotage and necessitated the *Carterfone* decision.

B. *Recent Applications of Carterfone*

Rather than expand the scope of *Carterfone* regulation, as recently proposed by network neutrality advocates, the Commission has continually reduced the applicability of the decision in the communications industry, based primarily on the argument that such intervention is not required in competitive industries. Since market power is a relevant condition for sabotage, the agency's decisions have an analytically-sound foundation.

The *Carterfone* and subsequent decisions eventually became part of a series of decisions, including the *Computer Inquiries*, that evolved into various Commission rules, including the "no bundling" rules in 47 C.F.R. §64.702. In 1992, the Commission stopped applying this rule to the cellular industry. In regulatory parlance, the "incentive to cross-subsidize" is shorthand for the economic theory of sabotage discussed above, and the Commission found that motive to be reduced in the wireless industry given "the lack of regulation based on rate-of return principles, combined with the absence of monopoly status for cellular carriers."[21] The Commission later observed that this decision helped consumers, giving them "the option of avoiding high up-

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[20] Farrell and Weiser, *supra* n. 18 at 104-05 ("This exception to [the economics theorem that firms vertically integrate to "internalize complementary efficiencies" or "ICE"] has figured prominently in telecommunications policy. In particular, the Bell System allegedly leveraged its way to market power in complementary markets, denying equal access to its network to competitors in long distance and equipment manufacturing. By excluding such competitors, AT&T could rent telephones to its customers and sell equipment from its Western Electric affiliate to its operating companies or telephone subscribers at inflated rates. Such a strategy was available to AT&T because of its network-level market power, but ICE would claim the option should be unattractive because it would decrease demand for telephone subscription. But that decrease did not deter AT&T because of the price regulation of local telephone service"). As a result, a regulated monopoly will have an inexorable incentive to seek to collect that monopoly rent from adjacent markets.

[21] *Bundling of Cellular Customer Premises Equipment and Cellular Service*, CC Docket No. 91-34, Report and Order, 7 FCC Rcd 4028, ¶ 25 (1992) (*Cellular Bundling Order*). This decision was made when consumers only had a choice of two cellular phone operators, before entry by PCS carriers.

front expenditures by bundling service and equipment was one of the factors that contributed to the significant growth in the cellular market."[22]

The Commission has also removed application of the "no bundling" rule in the interstate, inter-exchange market and for non-dominant local telephone companies.[23] An examination of whether the carrier had market power was central to the Commission's analysis. As the Commission observed: "It is a well established economic principle, however, that in order for a buyer to be harmed by such an arrangement, the seller must have market power over the desired product such that the buyer has no choice but to purchase it from the seller."[24] The economic rationale for the "no bundling" rules are similar to the proposed *Carterfone* regime for the wireless industry. By that logic, since the Commission has determined the wireless industry is competitive and buyers do have choices among numerous equipment vendors, such regulatory intervention would be unwarranted.

Further, consumers can switch between mobile carriers and there are ample sources of supply of both locked and unlocked mobile handsets, and the buying, selling, and trading of used equipment is nearly costless due to markets such as eBay.[25] "Churn"—the number of wireless customers that a carrier loses in a time period—is considerable in the wireless industry.[26] Even carriers attempts to limit churn, such as long-term contracts, can be circumvented: the website CelltradeUSA.com actually gives customers seeking to leave one service provider for another the ability to exchange long-term contracts with customers seeking to do the opposite. In the presence of arbitrage, consumers are well protected from efforts to extract consumer surplus through various tactics.

In sum, the wireless industry is not a monopoly, wireless carriers are not vertically integrated into equipment, and the prices of wireless carriers and equipment manufacturers are

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22 *In the Matter of Policy and Rules Concerning the Interstate, Interexchange Marketplace, Implementation of Section 254(g) of the Communications Act of 1934, as amended, 1998 Biennial Regulatory Review—Review of Customer Premises Equipment and Enhanced Services Unbundling Rules In the Interexchange, Exchange Access and Local Exchange Markets*, CC Docket No. 96-61, REPORT AND ORDER, FCC 01-98, 16 FCC Rcd 7418 (2001) at ¶ 35.

23 *Id.*

24 *Id.* at ¶ 23, *citing* Phillip E. Areeda, 9 ANTITRUST LAW ¶ 1700(d)(3) (1991).

25 *See* http://cell-phones.ebay.com/.

26 The FCC reports that most wireless providers have a churn of between 1.5% and 3.0% per month. *11th CMRS Competition Report, supra* n. 9 at ¶ 145. For example, according to 2006 SEC Form 10-K Annual Reports, Sprint reported a monthly churn rate of 2.6%, and Alltel reported a monthly churn rate of 1.57%. As the FCC notes, "[a] carrier with a typical monthly churn of 2.5% will lose 30% of its customers each year," *id.* at ¶ 145, or the rate of nearly a complete turnover in just over three years.

not regulated. As a result, we are unable to establish a nexus between *Carterfone* and the modern wireless communications industry that can be drawn by even a casual analysis of the facts.

III. The Faulty Analogy to Cable Set-Top Boxes

Proponents of wireless net neutrality regulation also cite the Commission's policy and rules regarding cable set-top "navigation devices" serve as the template for regulating wireless carriers.[27] Again, the distinctions between conditions giving rise to these rules and the wireless marketplace are readily apparent, rendering the Commission's policy and rules regarding cable set-top "navigation devices" another useless precedent for regulating the wireless industry.

The Commission's role in set-top box interoperability was mandated by the Communications Act in order to promote retail competition in a marketplace where there was little if any such competition.[28] Specifically, Section 629 of the Communications Act mandates that television "navigation devices" be interoperable so that consumers would have the ability to purchase those devices from independent sources (*i.e.*, not their video services provider).[29] Section 629 of the Act states:[30]

> The Commission shall, in consultation with appropriate industry standard-setting organizations, adopt regulations to assure the commercial availability, to consumers of multichannel video programming and other services offered over multichannel video programming systems, of converter boxes, interactive communications equipment, and other equipment used by consumers to access multichannel video programming and other services offered over multichannel video programming systems, from manufacturers, retailers, and other vendors not affiliated with any multichannel video programming distributor.

In response to this mandate from Congress, the Commission's *Navigation Devices Order* requires the cable television industry to develop and support a CableCARD technology, where the tuning, descrambling and security features are effectively severed from the cable set-top box.[31] This CableCARD technology allows electronic manufacturers to build television sets that are

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27 Skype Petition, *supra* n. 1 at 11.

28 *See Navigation Devices Order, supra* n. 7 (noting that the rationale for the rule was to "ensure the movement of navigation devices toward a fully competitive market").

29 *Id.* at ¶ 1.

30 47 U.S.C. § 549.

31 *Navigation Devices Order, supra* n. 7 at ¶ 1

fully compatible with the cable system without the need for a cable converter box, though the CableCARD must be acquired and programmed by the cable operator.

There are a number of important and interesting facets to this policy of promoting competitive availability of cable navigation devices. Like *Carterfone*, the *Navigation Devices* rules are aimed at promoting competition in the equipment markets by giving consumers the right to purchase CPE from manufacturers, retailers, and other vendors not affiliated with their video programming provider (usually the dominant incumbent cable company).[32] At the time of the decision, all converter and security technology was available from the dominant cable operator only, so the lack of equipment from retail outlets and from different manufacturers was apparent and unquestioned. In the wireless industry, by stark contrast, equipment is manufactured by numerous manufacturers and can be purchased not only in the carrier's stores, but at a large number of independent retailers including electronics stores such as BestBuy and Circuit City, shopping mall vendors, wireless resellers, eBay, and even Wal-Mart.[33] In effect, the primary purpose of the legislation and Commission decision—widespread availability of devices for end-users—is already realized in wireless communications.

In addition, Section 629(e) terminates the application of the cable navigation devices rules when the Commission determines: (1) the market for the multichannel video programming distributors is fully competitive; (2) the market for converter boxes, and interactive communications equipment, used in conjunction with that service is fully competitive; and (3) elimination of the regulations would promote competition and the public interest. Since the Commission has already determined the wireless market is competitive, and the mobile handset market appears robustly competitive, the grounds for removal of such a regulatory mandate had it been applied to wireless are clearly in place.[34]

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[32] The Commission recognized the common goal of the two decisions, but noted "The parallel to the telephone has limitations. When customer ownership of telephone CPE became available, the telephone network was effectively a national monopoly. Well developed technical standards existed throughout an almost ubiquitous network. CPE compatible with the telephone network was part of this environment. In contrast, cable networks do not reflect universal attributes, and have substantially different designs. Nor do satellite systems share commonality beyond the most basic elements. Additionally, as Section 629 recognizes, preventing interference to other network users and maintaining the integrity of the system signal is of greater concern for video delivery systems than for telephone systems." *Id.* at ¶12.

[33] A quick review of carrier websites revealed more than 10 different manufacturers of mobile CPE.

[34] Indeed, the poor performance of cable industry stands in stark contrast to that of the modern wireless industry. *In the Matter of Implementation of Section 3 of the Cable Television Consumer Protection and Competition Act of 1992, Statistical Report on Average Rates for Basic Service, Cable Programming Service, and Equipment*, MM Docket No. 92-266, REPORT ON CABLE INDUSTRY PRICES, FCC 06-179, 21 FCC Rcd 15,087 (2006).

Finally, there is one other important distinction that renders the cable navigation devices policy inapplicable to the wireless communications industry. In particular, the Commission has affirmatively decided that satellite video providers, like DirecTV and Echostar, need not comply with the Section 629 rules. The Commission's rationale is particularly important to review in detail, as it could easily be applied to the wireless industry. The Commission reasoned:

> [D]ifferences in the marketplace for DBS equipment, where devices are available at retail and offer consumers a choice, as compared to equipment for other MVPD services, particularly cable operators, provide justification for not applying the rule requiring separation of security functions to DBS service. We are reluctant to implement a rule that could disrupt an evolving market that is already offering consumers the benefits that derive from competition. In the DBS environment, *there are three service providers and at least ten equipment manufacturers competing to provide programming and equipment to consumers. The equipment is available at retail stores*. The result, over a relatively short time frame, has been lower equipment prices, enhanced options and features. Requiring DBS providers to [comply with the 629 rules] would serve a limited purpose and disrupt technical and investment structures that arose in a competitive environment.[35] (Emphasis supplied.)

If one were to apply this same screen for regulation to the wireless industry, then interoperability requirements like the navigation devices rules would not pass muster. The wireless communications industry in the United States contains far more than the three providers and ten equipment manufacturers noted by the Commission in the DBS waiver. Indeed, mobile handsets are available in many of the same retail stores that DBS boxes are sold, like BestBuy and Circuit City, in addition to a myriad of other distribution outlets.[36] Moreover, the Commission's decision to exempt DirectTV and Echostar from Section 629 requirements also indicates that the Commission explicitly was *not* interested in a policy that would give consumers the right to use the same navigation device across different multichannel video programming distributors. In sum, based on the rationale for excluding DBS providers from the set-top rules, the Commission would have a difficult time applying the requested regulatory mandates on the wireless industry based on its decisions in the *Cable Navigation Devices* rules.

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35 *Navigation Devices Order, supra* n. 7 at ¶64.

36 Indeed, on the Best Buy website, www.bestbuy.com, twelve different brands of mobile handsets are available for sale, as opposed to eleven different brands of traditional, land-line telephones subject to Part 68 rules (visited on April 17, 2007).

IV. Balancing the Costs and Benefits of Regulatory Intervention

There is no mistaking the fact that "wireless net neutrality" proposals seek to render a substantial restructuring of the nation's wireless industry, from one in which carriers are granted flexibility in deploying diverse technology and services to one that would transform the wireless carriers into commodity network service providers. While we should never aspire to limit ourselves to little dreams, a proper understanding and showing of the costs and benefits of any significant change in policy is always advisable. And in this the proponents of wireless net neutrality have failed. In this Section IV, we discuss several the potential sizeable harms to industry structure that could result from regulatory intervention in the name of "wireless net neutrality." This impact on industry structure includes harm to the prospects for entry and competition in the industry, and thus a real threat to consumers. For a proposal that would radically restructure the wireless industry, it is probably not unreasonable to expect proponents to provide at least crude estimates of the potential costs and benefits before requesting the Commission to initiate what inevitably will be a multi-million dollar proceeding with multi-billion dollar consequences.

A. *Commoditization and Wireless Carterfone Regulation*

We have written elsewhere that commoditization of broadband networks would lead to increased industry concentration, produce higher prices, and potentially less innovation.[37] Moreover, the current diversity of wireless services in the United States today reduces the possibility of oligopolistic coordination.[38] Yet the leading wireless net neutrality proponent

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[37] *See generally,* Ford, Koutsky and Spiwak, *Network Neutrality and Industry Structure, supra* n. 4.

[38] *In re Implementation of Sections 3(n) and 332 of the Communications Act, Regulatory Treatment of Mobile Services,* Second Report & Order, FCC Docket No. 94-31 (rel. Mar. 7, 1994) at ¶ 149 ("[c]omplex pricing structures, such as are used in the cellular industry, make it difficult for a carrier to sustain collusive pricing."). Indeed, economic theory suggests that product differentiation often impedes oligopolistic coordination. As observed by Kaserman and Mayo:

> [W]here firms in the market produce a product whose differences are either nonexistent or so minor that the only dimension of competition between firms is price[,] it is relatively easy for firms to agree to establish an anticompetitive price. Where firms compete in many dimensions (for example, price, quality, and new service or product innovations), however, it becomes more difficult to successfully collude because firms will need to establish limits on competition in each of the relevant dimensions.

D. Kaserman and J. Mayo, GOVERNMENT AND BUSINESS: THE ECONOMICS OF ANTITRUST AND REGULATION (1995) at 159; *see also,* F.M. Scherer & David Ross, INDUSTRIAL MARKET STRUCTURE AND ECONOMIC PERFORMANCE (1990) at 279 ("When products are heterogeneously differentiated, the terms of rivalry become multidimensional, and the coordination problem grows in complexity by leaps and bounds."); P. Areeda and H. Hovenkamp, ANTITRUST LAW: AN ANALYSIS OF ANTITRUST PRINCIPLES AND THEIR APPLICATION (2d Ed. 2002) at ¶ 404a (product complexity, differentiation, or variety "multiplies avenues of rivalry and hence the decisions that must be coordinated, because even if firms reach a coordinated price, they may continue to compete by improving product quality."); *see also, In re*

(Footnote Continued....)

states plainly and approvingly that commoditization of wireless network services would be the ultimate result of applying *Carterfone*-like regulation to the industry.[39] Because of the presence of large fixed and sunk costs, the commoditization of wireless network services likely would result in increased industry consolidation, just as it would for wireline communications networks.[40]

We can begin to see the risk of industry consolidation that is possible by comparing the current United States wireless industry with those of other nations, especially those that have adopted technical specifications for 2G or 3G wireless network deployment. For example, providers of mobile 2G services in Europe must comply with the GSM Standard and 3G broadband service providers in Europe must comply with the Universal Mobile Telecommunications System ("UMTS"). Moreover, in Europe, it is not possible to operate 3G broadband services on 2G spectrum bands, so 3G service providers have been required to construct new networks entirely.

In contrast, carriers in the United States have deployed analog and digital networks using an array of technologies based on the carrier's plans for the devices it wants to support and services it wants to provide and the markets it services. The "air interface" technologies have included GSM, iDEN, EDGE, UMTS, CDMA, EVDO, EVDO-RevA, TDMA and more. The Commission specifically leaves to the carriers the decision about what technology to deploy, with the view that carriers looking to maximize a return on their investment in spectrum and infrastructure are best suited to decide the fastest way to do so. This policy facilitates competition between network providers and encourages the most rapid deployment of new technology, in part because new technologies can be deployed incrementally. According to Cowhey and Aronson, due to this policy, "[f]ragmentation in standards resulted, but so did

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Implementation of Sections 3(n) and 332 of the Communications Act, Regulatory Treatment of Mobile Services, Second Report & Order, FCC Docket No. 94-31 (rel. Mar. 7, 1994) at ¶ 149 ("[c]omplex pricing structures, such as are used in the cellular industry, make it difficult for a carrier to sustain collusive pricing."); *but cf.*, S. Martin, ADVANCED INDUSTRIAL ECONOMICS (1993) at 116-7 ("[p]roduct differentiation reduces the incremental profit to be gains by departing form a joint-profit-maximizing configuration because product differentiation insulates rivals' markets and reduces the extent to which a single firm can lure rivals' customers into its own market.").

[39] Wu, supra n. 1 at 21 ("Spectrum bandwidth is a commodity, and the interface would provide the user with a fixed maximum bandwidth and, like an electric meter, bill the consumer for the amount of bandwidth actually used").

[40] *See generally*, Ford, Koutsky and Spiwak, *Network Neutrality and Industry Structure*, *supra* n. 4 at 2-3 ("given the economic characteristics of local communications networks, policies that promote commoditization of broadband access could lead to the monopoly provision of advanced broadband services in many markets. This outcome would harm consumers substantially.").

innovation, especially in CDMA deployment."[41] Moreover, according to Cowhey and Aronson, this flexible use policy "made the transition to 3G easier in the United States because incumbents could simply upgrade their existing networks rather than switch to new spectrum as was required by the European Union."[42]

It appears that as a consequence of a spectrum policy regime different than those adopted in Europe, the United States has a much broader diversity of wireless network platforms and more competition among network providers than markets where governments have taken much stronger command-and-control approaches to technical matters. Table 1 demonstrates that even after recent mergers, the United States, in contrast to other OECD countries (the exception being Denmark), has a substantial diversity among competing wireless service providers. This implies that the commoditization of wireless spectrum, as is more likely in countries with a mandated common technical standard, can significantly impact industry structure and concentration. Indeed, over a quarter of wireless subscribers in the United States receive service from a firm other than one of the top three providers nationwide.

Furthermore, the United States wireless market has in most cases more competitors than most other industrialized countries, higher usage rates of wireless networks, and significantly lower prices.[43] This superior market performance indicates that the current government policy of promoting network-to-network competition between wireless service providers on all possible levels, including technology and standards, is benefiting United States consumers. Restructuring the industry through the regulation that proponents of wireless net neutrality are urging, a manner that would sacrifice network-to-network competition for the sake of promoting a concept that proponents term "openness," could likely impact the quantity, quality and prices of wireless network services.

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41 P. F. Cowhey and J. D. Aronson, *Wireless Standards and Applications: Industrial Strategies and Government Policy*, Annenberg Research Network on International Communication, 27 (2004) (available at: http://arnic.info/workshop04/Cowhey_Aronson.pdf).

42 *Id.*

43 *11th CMRS Competition Report, supra* n. 9 at App. A, Table 12.

Table 1. Mobile Operator Market Share According to Number of Operators, Percentage (2003)

Number of operators	1	2	3	4	5	Others
Australia	46.6	30.6	19.7	3.1		
Austria	43.9	28.7	19.4	7.8	0.2	
Belgium	49.9	35.8	14.3			
Canada	36.9	28.3	25.5	9.3		
Czech Republic	43.4	40.7	15.9			
Denmark	35.1	23.8	12.9	11.1	10.2	6.9
Finland	51.4	28.7	16.4	3.5		
France	48.8	35.3	15.9			
Germany	40.6	38.1	12.7	8.6		
Greece	37.8	35.5	23.2	3.5		
Hungary	47.4	35.8	16.8			
Iceland	66.8	32.9	0.3			
Ireland	55	40	5			
Italy	46.1	36.4	16.9	0.6		
Japan	53.9	19.6	17.3	4.2	3.3	2.5
Korea	54.4	31.1	14.4			
Luxembourg	62.7	37.3				
Mexico	77.8	11.5	6.6	4.1		
Netherlands	39.1	25	15.6	10.9	9.4	
New Zealand	52.3	47.7				
Norway	58.3	29.9	6.2	3.6	2	
Poland	35.7	32.8	31.5			
Portugal	52.3	30.2	17.5			
Slovakia	56.2	43.8				
Spain	52.4	25.8	21.8			
Sweden	43.6	38	15.1	3.3		
Switzerland	61.4	20.4	17.6	0.6		
Turkey	68.1	18.3	7.2	6.4		
United Kingdom	24.5	23.9	25.6	25.6	0.4	2
United States (2003)	23.6	13.9	13.8	10.0	8.1	30.6
United States (2006)*	26.6	25.2	22.0	10.7	5.2	10.3

1. Three operators in Norway are resellers.
2. There are 150 cellular mobile operators in the United States.

Sources: OECD, OECD COMMUNICATIONS OUTLOOK, Table 2.6 (2005); (*) *11th CMRS Competition Report*, App. A., Tables 2, 4 (for United States)

In addition to these harms from commoditization are the harms that would result from the dizzying complexity of applying *Carterfone* to the diverse wireless industry. While Skype blithely states that it "approaches these issues with humility,"[44] the fact is that standard-setting in the wireless business is a perilous, very technical and dynamic undertaking that the government should not trod into lightly. Carriers have deployed 2G and 3G networks using a myriad of competing and evolving technologies. There is no evidence that it would be possible to have a single, technical standard interface that would permit a handset to operate on all of the AMPS, D-AMPS, CDPD, GSM, iDEN, WIDEN, CDMA, GPRS, EDGE, W-CDMA, and EVDO (not to mention other 3G and 4G technologies that are in development) networks that are deployed today.[45] Moreover, these technologies have been developed by companies and standards bodies that are rife with different decision-making procedures that are intermeshed with corporate and even mercantilistic interests.[46]

The challenge would be daunting. The Commission's Part 68 rules, which are the end result of *Carterfone* regulation of the wireline public switched telephone network, take up 164 pages in the Code of Federal Regulations and contain 77 separate diagrams. And those regulations apply to the design of the familiar, plug interface for a telephone to a telephone network that was a local monopoly and already relatively standardized on a national basis.[47] The level of complexity involved in a regulator trying to micromanage the technical interface between hundreds of kinds of mobile devices and multiple wireless networks across the United States is hard to imagine.

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44 Skype Petition, *supra* n. 1 at 30.

45 In advancing his proposal, Wu (incorrectly) notes that much of "[t]he wireless world already has standardized interfaces," citing the GSM standard requirement of SIM cards that has been implemented in Europe. Wu, *supra* n. 1 at 21. But the mere presence of standards does not mean that navigating them is easy: Cowhey and Aronson describe a "standard's maze" of no fewer than 37 standards "that must be traversed to achieve" the future generation of wireless networks. *See* Cowhey and Aronson, *supra* n. 41 at 4-5.

46 For example, the European Telecommunications Standards Institute, ETSI, maintains the GSM and other European standards, and it makes decisions based on the European revenues of the member companies. In the United States, the IEEE operates by requires 75% support for a standard, following principle of one company, one vote. The Korean government selected CDMA as its 2G standard with the intent of subsidizing the construction of handsets so as to create an export market. According to Cowhey and Aronson, in Korea, Samsung Electronics and SK Telecom are essentially in charge of standard-setting for 4G services. *Id.* at 54.

47 *See Revision of Part 68 of the Commission's Rules to Specify Standard Plugs and Jacks for the Connection of Telephone Equipment to the Nationwide Telephone Network*, 62 FCC 2d 735, ¶¶ 2-3 (1976).

V. Conclusion

As we show in this BULLETIN, the *Carterfone* analogy to today's wireless industry handset practices simply do not hold water. The wireless communications industry in the United States is not the vertically-integrated, fully-regulated Bell System of old. The *Carterfone* decision and subsequent Commission regulation was concerned about quarantining a regulated, vertically-integrated monopoly service provider from leveraging its market power into an adjacent equipment market. The need for intervention in those cases was important and unquestionably motivated by market power and presence of (and the firm's concurrent efforts to evade) price regulation.

In the absence of price regulation and/or market power, the *Carterfone* decision would probably not have been needed, because the economic incentives to engage in the observed behavior would be absent. Indeed, the Commission has repeatedly diminished the influence of *Carterfone* on the communications industry over the years and explicitly removed the mandate in markets that are workably competitive. Similarly, the Commission's cable navigation device rules are no more helpful to the pro-regulatory arguments; in fact, the Commission's justification for applying and not applying those rules to different video providers starkly conflicts with the interventionist proposals.

Important to consumers is that both the *Carterfone* and cable navigation device rules were designed to create a competitive equipment market where consumers could purchase communications equipment from numerous manufacturers at a variety of retail outlets. Today, the wireless equipment market is substantially competitive: not only can consumers purchase communications equipment from numerous manufacturers at a variety of retail outlets, but both new and used mobile handsets manufactured by numerous electronics firms are available at a wide range of commercial outlets without any requirement to purchase wireless services from any particular wireless provider.

Like the rest of the network neutrality debate, the discussion of applying *Carterfone* to the wireless industry seems to have taken on an emotional tone, which is regrettable because emotion can get in the way of rigorous analysis. Consumers certainly would prefer to have a lot of things, and a mobile handset that can work on any wireless network in the nation (and the world) might rank highly for a select few affluent, well-heeled mobile professionals. But it is telling that given all the advocacy noise that has surrounded this issue, not a single meaningful anticompetitive or anti-consumer incentive to discriminate in the mobile handset market has been demonstrated by the proposals.