# EXHIBIT A

# WIRELESS *CARTERFONE*: AN ECONOMIC ANALYSIS

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## I. Introduction

Skype/eBay has filed a petition[2] with the Federal Communications Commission requesting that the government impose rules on wireless telephone networks analogous to those levied on the pre-divestiture AT&T in *Carterfone* (1968).[3] The request is based on the claim that U.S. mobile phone carriers impose anti-competitive restrictions on the way their networks are used, limiting subscribers' choices of content, applications, and devices. The petition argues that consumers would be better off if a wide range of contractual arrangements – now routine – were prohibited. Skype proposes that the FCC impose rules mandating that subscribers be permitted to use whatever devices, content, or applications they desire, and to do so while receiving full access to the carrier's wireless network.

This paper offers theory and evidence to show that the proffered policy would undermine economic efficiency and is strongly anti-consumer. Specifically, it demonstrates how vertical integration (including vertical restraints) is both inevitable and productive, that regulators cannot usefully prescribe the extent to which wireless carriers integrate service into bundles, and that competitive rivalry between service providers efficiently guides and constrains carriers. Each firm weighs the benefits of integration against its costs. This classic trade-off, which defines the scope of firms, does not generally improve with mandates to narrow internal supply so as to expand the use of the "price system." Rather, efficient boundaries must continually be discovered via trial and error in the market.

The market that provides wireless choices for over 230 million U.S. subscribers is highly competitive – a conclusion repeatedly rendered by the Federal Communications

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[2] *Petition to Confirm a Consumer's Right to Use Internet Communications Software and Attach Devices to Wireless Networks* (Feb. 20, 2007).

[3] *Use of the Carterfone Device in Message Toll Telephone Service*, 13 FCC 2d 420 (1968).

Commission itself. In jockeying for new customers, and in striving to reduce churn – a profit-killing "Dear John letter" a dissatisfied customer writes to their carrier – networks must fully account for the costs their subscribers incur when their choices are truncated. Only if restricting such options leads to greater efficiencies in terms of cost reductions or quality enhancements will such proprietary solutions prove profitable.

This competitive process governs the rapid development of innovative content available to wireless users. Carriers are free to offer customers packages that include liberal or conservative "acceptable use policies," and to price customers' options for accessing non-carrier applications. With substitutes widely available, carriers profit by providing platforms that are attractive both with respect to price and quality – which encompasses the ability to utilize complementary services, devices, and networks. A blanket rule to impose "open access" would eliminate rivalrous outcomes that reveal the efficient suite of in-network services. That market process includes both pricing, where metering costs are reasonable, and governance limiting behavior, where metering costs are not.

Any claim that such restrictions are always or even usually anti-competitive is contrary to economic theory and to market evidence. Service providers with no conceivable anti-competitive motive, including non-profit organizations and firms lacking market power, routinely restrict customers' devices and use of the network in their "acceptable use policies" (AUPs). For example, Virginia Broadband (VBB), a wireless Internet Service Provider (WISP) serving fewer than 4,000 subscribers[4] both requires that subscribers use only the modems that are installed by VBB and that they refrain from "excessive" use of the network. VBB, in competing for subscribers, has evidently determined that the losses associated with the proscribed options are exceeded by the value of improved opportunities for network users overall. These limits help VBB create a competitive network; indeed, their rules are *productive inputs* into the supply of new broadband options.

An even starker example of usage restrictions is observed with respect to the (fixed) local area network owned by Ohio University. In a policy that went into effect in April 2007, students and faculty were prohibited from using any peer-to-peer application. The intent is clearly not to suppress competition. According to Chief Information Officer Brice Bible, "The network is a shared resource, and we must ensure that it is available to all users. Peer-to-peer file-sharing consumes a disproportionate amount of resources, both in bandwidth and human technical support."[5]

To cite still another example, NTT-DoCoMo thrives in the Japanese wireless phone market by offering a suite of favored applications and content, excluding others. Their

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[4] Virginia Broadband does not make BROADBAND EXCHANGE MAGAZINE'S "Top Ten" List of wireless ISPs for 2006. The subscriber count given for No. 10 (Camvera Wireless) is 3,851. *Broadband Wireless Exchange's 2006 "Top 10" Wireless Internet Service Providers (based on wireless subscriber counts),* BROADBAND EXCHANGE MAGAZINE; http://www.bbwexchange.com/wireless_isp/ .

[5] Notice, *Ohio University Announces Changes in File-sharing Policies*, Ohio University website (April 25, 2007); http://www.ohio.edu/students/filesharing.cfm.

innovative platform was a hit with customers and content providers, sparking rivalry by other networks.

These examples do not establish that *all* such arrangements are efficient. What is demonstrated, however, by these and myriad other instances of vertical restrictions and bundled packaging, is that a blanket rule barring such arrangements would deter efficiencies and cannot be justified by claiming that such arrangements are inevitably anti-competitive. In light of wireless market competition and the available antitrust-law backstop,[6] the call for regulatory intervention in this arena is unjustified and misguided.

This paper is organized as follows. Section II reviews how markets define the scope of firms, extending the classic analysis offered by Ronald Coase. Suppliers' choices about product attributes are constrained by the efficiencies realized via internal production versus opportunities to transact with outside firms. Section III then examines how the *Carterfone* regulatory analogy, lifted from a market in which a rate-of-return regulated monopolist was ordered to permit interconnection, applies to the current U.S. wireless market, where multiple, unregulated firms compete by offering rival service packages. Section IV details a notable example of such rivalry in the case of Japan's DoCoMo, network provider of the iMode wireless web platform. This innovative service has dramatically expanded Internet access for millions of subscribers and the content providers who wish to reach them, relying on a "walled garden" which carefully cultivates the content provided by third party providers. A summary and conclusion are then offered in Section V.

## II. THE SCOPE OF FIRMS AND THEIR PRODUCTS

The essential contention of the Skype petition is that wireless services are efficiently provided under rules that permit customers to use networks without restriction. Limits imposed by carriers are ascribed to anti-competitive motives and remedied by "open access" regulations. The network operator may vertically integrate into the supply of various complements, but only on a non-bundled basis where independent suppliers have equal access to network customers as determined by regulators.

The purpose of this section is to demonstrate how ill-formed is the basic assertion that limits imposed by carriers are categorically anti-competitive. Once that is seen, it will be clear that the policy suggested is not welfare-enhancing.

I start with the standard analytical framework developed by Ronald Coase in his 1937 article, "The Nature of the Firm."[7] Every supplier of goods or services must make basic choices about the scope of its enterprise. How much of the final product it seeks to

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[6] See Alfred E. Kahn, *Presentation for FTC Workshop on Broadband Connectivity Competition Policy* (Feb. 13, 2007); J. Gregory Sidak, *A Consumer-Welfare Approach to Network Neutrality Regulation of the Internet,* 2 JOURNAL OF COMPETITION LAW & ECONOMICS 3 (2006).

[7] R.H. Coase, *The Nature of the Firm*, 4 ECONOMICA 16 (Nov. 1937); reprinted in R.H. Coase, The Firm, the Market and the Law 33 (Univ. of Chicago Press, 1988).

create, and what components it purchases from other suppliers, entail complex trade-offs that lie at the heart of economic organization. This choice-making process applies with equal force to contracts that define options for consumers to substitute other components in place of those selected or produced by the firm.[8]

The analysis produced by Coase was simple but powerful. In terms of the regulatory request put forth by Skype, its important implications are directly relevant. These can be summarized as follows:

- there is no obvious boundary to the scope of a given firm;
- all firms produce some components, allowing the market to supply others;
- firms compete by offering customers efficient product packages;
- profits flow to firms discovering efficiencies in packaging and firm structure

Coase modeled the firm's decision process as one in which a company sought the efficient result. It would produce internally whenever it could do so at a lower cost than outsourcing. In the first instance, production was organized by an "entrepreneur," and in the latter, by "the price system." Firms would expand until the cost of using the price system fell to a level lower than using the firm's own entrepreneurial skills.

A. Vertical Integration Everywhere

The Skype petition evinces the categorical view that more consumer choices are preferred to fewer, and that consumers should always be given opportunities to purchase components alone rather than in bundles. This clashes with the nuanced balancing test conducted in actual markets. Coase's analysis establishes that wireless carriers' strategies reflect scope-of-the-firm decisions that are ubiquitous throughout the economy. Every firm must decide, for literally each and every aspect of its business, whether to supply the associated inputs or to have other firms supply them.

When a wireless carrier constructs its business plan, it must determine what technologies to use, which hardware and software to deploy, how to build its network and how to deploy its services. In constructing its fixed facilities it supplies the capacity to host a range of anticipated (and, perhaps, unanticipated) applications, and thereby coordinates (implicitly and explicitly) its long-run offerings. Every element of decision-making entails choices about what the relevant inputs will be and where they will be garnered. And these choices critically shape – some might say *limit* – the choices consumers will be usefully offered in opting to use complements or substitutes.

Firms create in-house capabilities to supply some services and outsource others. In wireless, carriers generally depend on the price system when buying technologies, as standardized systems benefit from global economies, even as carriers also – in some

[8] See, e.g., Stephen N. S. Cheung, *The Contractual Nature of the Firms*, 26 JOURNAL OF LAW & ECONOMICS 1 (Apr., 1983).

cases – provide their own research & development to develop new technologies.[9] The Nextel network, using proprietary iDEN technology from Motorola, is an example of vertical integration (as Motorola took an equity stake in Nextel).[10] That other carriers have generally chosen to purchase their technologies from independent firms does not make them more or less "pro-consumer," and firms that produce their technology in-house do not "force" their subscribers to use it. Competitive options are available, and only by supplying service packages customers view as competitively superior can they be enticed to subscribe, such that a firm may "force" its in-house technology upon them.

Suppose that an "open access" rule mandated that carriers not impose a choice of technology, but permit customers to – at all times – select between CDMA or GSM technologies. The mandate is technically possible; there are dual-mode phones yielding access to these technologies (and more, including AMPS, iDEN, WiFi and TDMA). The choice of multiple technologies and extra networks would yield some level of consumer benefit, in that customers could obtain preferred solutions (clearer signal, better pricing) by selecting among technological options at each instance of use.

But customers would clearly, on balance, be hurt by such rules. In depriving them of choices, it would pre-empt their opportunity to capture efficiencies gained by adopting one technology to the exclusion of others. Imposing "openness" via multi-mode phones adds expense and limits the ability of consumers to evaluate the relevant trade-offs between costs and service options.[11] Indeed, carriers have made multi-mode phones and services available.[12] But the business they generate constitutes a small niche; the great majority of customers believing that their needs are better met using less expensive approaches. Carriers do not "force" a technology on their subscribers; rather, they cater to their interests by offering cost-effective handsets. Forcing "openness" would override these choices and reduce consumer welfare.

The Skype analysis assumes that consumers inevitably prefer more choices to fewer, and that when services are bundled by the supplier consumers are harmed. In fact, the basic role of business enterprises, as economic units, is to *reduce* customers' production efforts. Firms earn profits by *themselves* re-arranging inputs in productive ways. Firms compete to offer bundles, not the tiniest increments of individual inputs, and consumers willingly pay to choose among the rival packages created – by which they avoid vertical integration themselves.

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[9] Pac-Tel Cellular, an operator now owned by Verizon, was an early investor in Qualcomm's CDMA trials, helping to develop a new wireless technology it would later adopt. See David Mock, The Qualcomm Equation (New York: Amacom; 2005), pp. 76-81.

[10] Dan O'Shea, *How Nextel Beat the Heat Only to Face the Inferno,* TELEPHONY ONLINE (May 1, 2003); http://telephonyonline.com/wireless/business/wireless_nextel_beat_heat/.

[11] Multi-mode designs "can increase the number of components from 350 to 400 (for 2 or 2.5G) to almost 500. This leads to increased raw material, supply chain and manufacturing costs. It also makes building the phone more complicated, tends to make the device bigger and shortens battery life. A lot of the extra components are due to the need to install separate radio frequency transceivers and amplifiers for each mode." *Features Cut Phone Margins,* RED HERRING (Aug. 5, 2005). http://www.itbusinessedge.com/item/?ci=4322.

[12] Ben Charny, *New Phones Put World in Palm of the Hand,* CNET NEWS.COM (Sept. 14, 2004); http://news.com.com/New+phones+put+world+in+palm+of+the+hand/2100-1039_3-5364524.html.

Skype/eBay itself relies heavily on bundling. While on the eBay web site, users have access to all eBay auctions – and none of those occurring on the Yahoo! site or elsewhere. Those links could be presented to eBay visitors, but the firm's business model steers visitors to eBay content. Indeed, eBay's purchase of Skype in 2005 was undertaken to bundle additional services, and Skype calls are given preference on the eBay website over competitors. The incentive for eBay to improve visitors' experiences, and so return to the site to spend money, constrains the ability of eBay to "force" its customers to stick around. This is in every respect analogous to the wireless carriers' competitive position, including the length of contract terms – set with respect to efficient utilization of network resources.

B. Optimal Contract Terms

The basic economics also reveal that there is no logic to the rationale that choices made separately per each transaction yield more favorable outcomes for consumers than choices fixed by contracts covering longer periods. For instance, post-paid cellular contracts routinely span one to two years, and include handset subsidies (the carrier pays some or all of the cost of the phone) and early termination fees. Skype sees such contractual devices as "one more way in which the wireless industry restricts the ability of consumers to choose among available wireless services…"[13] Yet, to the extent that such terms create gains for cellular providers, networks predictably compete to attract such profitable customers. This rivalry competes away the gains in handset subsidies, favorable pricing terms ("free weekend minutes," "free on-net minutes," "free long-distance," etc.), trial periods, and network upgrades.

Customer acquisition expenditures, averaging about $350 per new customer for U.S. cellular carriers,[14] could be reduced by a network that expected that simply offering consumers more choices (fewer products in the standard service bundle) would be preferred by users and more efficient (considering the costs of uncoordinated choices for handsets, technologies, and applications) for the network. But the evidence is that such business models are neither preferred nor efficient. Instead, carriers compete vigorously, and expensively, to attract customers to ever more attractive service bundles.

Economic logic confirms that there is no reason to suppose that smaller increments of service – leaving more choices for consumers to make 'on their own' – are categorically superior to larger service bundles. Where a consumer does not want to absorb the cost of additional transactions, it will rationally opt for contract terms that span months or years and hundreds or thousands of transactions (phone calls); it will then re-evaluate the relationship and choose to re-subscribe if it appears superior to alternatives. This is exactly how cellular markets operate, where cellular carriers are typically evaluated by consumers at contract renewal time, and networks compete to retain customers.

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[13] Skype Petition, p. 13.

[14] Robert W. Crandall (2005), Competition and Chaos (Washington, DC: Brookings Institution Press; 2005), p. 106.

To do so, carriers not only extend favorable pricing terms (including handset subsidies), but contract with equipment suppliers to produce handsets embedding the network's technology, arrange roaming agreements so subscribers will be able to seamlessly access other carriers' networks (and airwaves) when traveling, actively organize a multitude of applications customized for the cellular network, and coordinate wireless traffic to reduce blocked/dropped calls. This latter effort involves enormous expenditures in fixed investment; since the beginning of the U.S. cellular industry, carriers have constructed about 195,000 base stations and sunk more than $220 billion in capital expenditure.[15]

These efforts aim to attract customers who will be "locked in" – for as long as they choose to be. Wall Street investors are keenly tuned to quarterly "churn" rates (the percentage of a carrier's subscriber base that drops its subscription in a given month). These data describe how customers – experts in how the particular network functions when and where they demand to use it – evaluate a cellular carrier's prices and services (including contractual terms). It is this information that propels investors to buy or sell the shares of companies owning wireless networks, and which therefore motivates the managers of these firms to reduce churn. This market competition effectively accommodates the desires of demanders and suppliers, and would be disrupted by ad hoc rules to force transactions into arbitrarily smaller increments.

C. Competition for Efficient Packages and Structures

Understanding the limitless nature of scope-of-firm choices brings us to another major implication: firms select their scope of activities to achieve efficiency. In the complexity of organizing economic activity, where firms bring together investors, workers, managers, suppliers, and consumers to coordinate myriad activities designed to produce value, every input is a variable. To see the outcome of a given pattern of market organization, and to see only that regulation can improve choices for some consumers on some margins, is to ignore the process that created the array of product bundles observed.

Firms arrange their operations to maximize profits. Each choice of input into the service bundles they offer customers is subjected to a cost-benefit test: will the gain in increased sales more than compensate for the expense in using this input? This is a simple economic calculation when broken down to its essential elements, but the number of input decisions even a small firm makes is large, and further complicated by the connectedness of the choices. When one type of product, production facility, technology, or communications network is selected, innumerable input choices down the road are implicated. Economies of scale can be created by narrowing input selections, which must be weighed against the gains from expanding product lines or diversifying suppliers; cheaper inputs may reduce demand, but will also reduce costs; internal production may

[15] CTIA-The Wireless Association, Top-line *Semi-Annual Wireless Industry Survey* Results (Dec. 2006); http://files.ctia.org/pdf/CTIA_Survey_Year_End_2006_Graphics.pdf . See also CTIA-The Wireless Association, *Wireless Quick Facts* (Dec. 2006); http://www.ctia.org/media/industry_info/index.cfm/AID/10323 .

reduce the risk of market disruption or hold-ups, but require higher fixed costs, raising the cost of capital for the firm. Trade-offs abound.

Where the pro-consumer argument for regulation enters is where competition in the market fails to sufficiently constrain firms which may then have incentives to inefficiently bundle products in order to block entrants. Even with monopoly power this is a special case; lacking monopoly power the special case collapses. The idea that regulators can effectively substitute their judgment for the collective wisdom of a competitive market does not pass the plausibility test. By the FCC's own regulatory standards, it is not a credible policy conclusion.

## III. *CARTERFONE* NOT

The analogy drawn to *Carterfone* lies at the heart of the Skype request for regulatory intervention:

> Skype respectfully requests that the Commission declare that *Carterfone* applies fully to wireless networks, to initiate a rulemaking proceeding to evaluate wireless carrier practices in light of *Carterfone* and to enforce *Carterfone*, and to create an industry-led mechanism to ensure the openness of wireless networks. Doing so will ensure both that consumers retain a right to run the applications of their choosing and a right to attach all non-harmful devices to the wireless network. These essential rights will prevent carriers from using illegitimate network management practices as an excuse for otherwise anti-consumer behavior.[16]

As I explain below, (1) the premises of the *Carterfone* policy – that new rules were required to deal with a rate-of-return regulated monopoly – are wholly absent in the wireless markets Skype seeks to apply this policy to today; (2) absent monopoly and rate of return regulation, market incentives best determine, from the standpoint of consumer welfare, what terms and conditions for network access a carrier offers.

As an initial matter, the thrust of the Skype petition is misdirected. That petition attempts to show how wireless telephony markets pervasively fail and how government mandates are widely needed to improve them. In using *Carterfone* as its model, the analysis is upside down. *Carterfone* was not an intervention into an unregulated market, but a change in policy with respect to a regulated monopolist. Since the 1934 Communications Act, AT&T's network had been extensively regulated by the FCC and state public service commissions. That this regime resulted in a network that was closed, inefficient, and anti-competitive was an outcome of that *regulated* market. That regulators initially sought to keep it closed to non-AT&T devices or applications is undeniable; the FCC determined in the 1950s, for instance, that Hush-a-Phone devices were "deleterious to the telephone system and injures the service rendered by it" and

[16] Skype Petition, p. 2.

could not be attached to the network.[17] This regulatory determination was overturned by the D.C. Circuit Court of Appeals in 1956. Over a decade later, the FCC, citing *Hush-a-Phone*, overturned regulated tariffs in its *Carterfone* decision. It is a non sequitur to advance *Carterfone* as a solution to "market failure." Its mandates did not reverse unregulated outcomes but were themselves a change in regulatory strategy, rejecting the policy the FCC had pursued to harshly suppress competitive, or even complementary, applications.[18]

A. The Importance of Regulation and Market Structure

Skype's petition rests on the premise that, prior to regulation, the old AT&T telephone network did not allow competitive devices or applications, and that government rules to promote access to such options jump-started telecommunications competition. For this analysis I will accept that explanation, abstracting from all complications and caveats. The rationale for imposing the requirements that forced AT&T to allow users of its telephone network to connect to "foreign" devices or networks was based on two primary considerations:

(a) the AT&T network was a monopoly,
(b) the network was rate-of-return regulated.

Each factor is crucial to understanding *Carterfone*, and its absence eliminates the logic underlying the policy.

*Monopoly*. Not only did AT&T enjoy market power, it was protected by franchise monopoly. No firm was authorized to offer service in rivalry with AT&T for local or long distance telecommunications. (The 1996 Telecommunications Act pre-empted state monopoly in local telecommunications service.[19] In long distance, MCI received limited authority to offer private line long distance services in 1969.[20] This authority was expanded in subsequent years, allowing for competition in long distance markets.) A monopolist may have incentives to inefficiently pre-empt independently-supplied vertical services which could develop into competitive platforms. Hence, the AT&T monopoly might have refused to interconnect with wireless phone services (in the *Carterfone* dispute in 1968), to stifle a new communications system that – while complementary at its inception – might turn into a substitute over time.

*Regulation*. Being subject to rate-of-return regulation, AT&T was limited in the prices it charged and profits it earned by supplying standard fixed line services. Price controls were set at levels determined by AT&T's costs. A means for AT&T to relax its

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[17] *Hush-a-Phone Corporation and Harry C. Tuttle, Petitioners, v. United States of America and Federal Communications Commission, Respondents, American Telephone and Telegraph Company et al., and United States Independent Telephone Association, Intervenors*, 238 F.2d 266 (DC Cir. 1956)

[18] *See* Peter W. Huber, Michael K. Kellogg & John Thorne, Federal Telecommunications Law (Aspen Law & Bus. 2d ed. 1999 & Supps. 2004 & 2005).

[19] Crandall (2005), p. 7

[20] IEEE Communications Society, *History of the Technology, 1952-2002* (Chapter 3); http://www.ieee.org/web/aboutus/history_center/conferences/comsoc/chapter3.html (visited Apr. 25, 2007).

profit constraint was potentially available via unregulated vertical services. If the firm invested in these services with funds that raised its fixed line costs, it would be able to increase its regulated prices. While accounting profits in the regulated market would remain constant, profits in the unregulated market would increase. This cross-subsidy strategy, enabled by regulators' difficulty in apportioning common costs of the network, made AT&T's vertical integration[21] problematic.

Competitive, unregulated markets eliminate the *Carterfone* rationale. An unregulated firm cannot subsidize inefficient vertical integration, for instance, by increasing costs. If it attempted to do so, it would simply reduce its profits, dollar for dollar. Not being rate-of-return regulated, it has no opportunity to stick customers with rate increases so as to maintain returns. Vertical integration must pay for itself.

Hence, vertical integration will generally be efficient, absent regulation. Even when undertaken by a monopolist, inefficient bundling decisions would be constrained by the complementarities between vertical products: firms profit by the availability of desirable complementary products, which raise demand for their goods and services. The notable exception is where the firm sees the complement as a potential competitive threat. That is why antitrust law is sometimes applied to vertical activities by firms with monopoly power.[22] Yet, lacking monopoly power,[23] attempts to thwart consumers' use of efficient vertical services will fail, as competitive providers profit from supplying what a firm unreasonably limiting consumers' choices will not. Indeed, these valued complements make the service in question more in demand, yielding competitors incentives to offer terms that include them, gaining market share from less accommodating suppliers.

In short, profit incentives align with consumers' interests, such that firms are driven to provide packages that feature the efficient level of access to vertical services – or firm scope, in the Coasean analysis. This straightforward logic largely explains why, when the FCC authorized personal communications service (PCS) licenses in 1992, the Commission determined that regulation was inappropriate. To wit:

> [W]e expect PCS to be a highly competitive service. We anticipate that PCS licensees will develop and offer a wide variety of services, some narrowly targeted to specific customer groups or niche markets, others more broadly targeted. These services will be subject to substantial competition, both from other PCS services offered under the rules we adopt in this proceeding and from the wide range of radio-based services currently offered: cellular services, specialized mobile radio services, paging services, wireless in-building services, cordless phones, and others. Service providers will have a strong incentive to offer attractive services

[21] Vertical integration is achieved by ownership or contract. See Cheung (1983), op cit.

[22] As in the *U.S. v. Microsoft* case, where Microsoft's tactics in competing with Netscape's browser (a complement to Microsoft's operating system software, Windows) were thought by the government to constitute a strategy to protect the underlying operating system from competition.

[23] Horizontal competitors may, at least theoretically, collude to create and share monopoly power. This strategy must overcome prisoners' dilemmas, and is in any event illegal under the antitrust laws.

> and prices because any customer will have numerous service options from which to choose. Thus, regardless of whether PCS is determined to be a private or common carrier service, there will be no captive customers who must take the service from a monopoly (or near monopoly) service provider, and government rate and service regulation should not be necessary to protect customers from monopoly abuse. Accordingly, regardless of the regulatory classification, we tentatively conclude that PCS should be subject to minimal regulation.[24]

As anticipated, competition has successfully developed, as the FCC has consistently found on numerous occasions, in the context of its annual CMRS Reports, in analyzing industry concentration in the Spectrum Cap proceeding, and in evaluating mergers within the sector. For instance, in its most recent CMRS Report, the FCC determined that "competitive 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. Price rivalry is evidenced by the introduction of 'mobile to anyone' calling options, and by the proliferation of a variety of prepaid plans, or distinct prepaid brands (such as "Boost Mobile"), targeted at previously untapped segments of the market."[25] The rationale for deregulation has been fulfilled by the Commission's own findings.

B. Regulating the Scope of Firms

Legally imposing lines around the scope of the network replaces the function provided by market forces. The proposal therefore begs the question: what party is best equipped to make decisions to optimize network utilization? Given the history of wireless telecommunications, the answer is obvious: network owners have better information and superior incentives for protecting users' interests than business interests (including input suppliers or applications providers) which do not internalize all costs and benefits of network operations, or government regulators who must rely on information supplied by others and who have no personal stake in market outcomes.[26]

Skype's requested voice-over-Internet (VoIP) policy is illustrative. The firm seeks regulation to guarantee that its service will be available, at zero incremental cost, to all broadband subscribers. The suggestion is that, but for the anti-competitive profit motives of wireless carriers, such access would be available already. But that claim is contrary to available evidence, as many broadband networks entirely lacking profit motives have sought to block certain VoIP applications as *costly to the network.* For example, university LANs (local area networks) have often restricted peer-to-peer VoIP applications as offered by Skype because such applications add system cost, congestion,

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[24] *Notice of Proposed Rulemaking and Tentative Decision,* FCC Rcd. 5676 (1992), par. 94.

[25] FCC, *Annual Report and Analysis of Competitive Market Conditions With Respect to CommercialMobile Services, Eleventh Report* (Released on Sep. 29, 2006) par. 3.

[26] For a general analysis of the incentives of regulators, see the classic treatment by Charles Wolf, Jr., Markets or Governments: Choosing Between Imperfect Alternatives, Second Edition (MIT Press, 1993).

and security threats.[27] In the college network setting, profit motives are lacking and no competitive, or anti-competitive, benefits available to networks. Nonetheless Skype regards this behavior, when exhibited by carriers, as "using illegitimate network management practices as an excuse for otherwise anti-consumer behavior,"[28] and seeks regulation to prohibit it. This blanket restriction – regulation applied both to network owners and to consumers, who are deprived of a right to enter into contracts deemed inappropriate -- would thereby eliminate pro-consumer actions taken by IT managers to protect users. This pre-empts bargaining among parties in the market to negotiate mutually beneficial terms for network applications, sacrificing efficiencies from cooperation between networks and application providers.

C. Efficiencies of Competitive Network Owners

Given current demands, costs, and the requirements of untethered mobility, cellular networks crucially rely on management coordination. This is particularly true in the creation of advanced data networks – of which DoCoMo's iMode system in Japan is a stellar example (discussed below). Consumers rely on networks to invest substantial resources to create infrastructure, coordinate technology, price access, and otherwise police traffic flows such that they can reliably use wireless applications when and where they like. *Carterfone* plainly is not a useful approach for today's competitive, unregulated mobile networks, which demonstrably benefit from cellular operators' coordination of complex spectrum sharing.

Heavier regulation was tried in wireless, during the cellular duopoly, and then abandoned with the introduction of PCS competition. Its removal graphically demonstrated the superiority of competition to regulation in consumer protection. Under the cellular duopoly – where state Public Service Commissions were permitted to control cellular rates at the retail and/or wholesale level – prices for mobile phone service averaged over 50 cents per minute. When state regulation was pre-empted, and all price controls (including wholesale "open access" mandates) abolished in 1994, the result was

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[27] Many universities in England have blocked access to Skype from university-connected computers. The issue has been reported as follows:

> Lots of IT managers simply want to shut Skype down. "I wouldn't go so far as to say all companies should block Skype," says Brown, "but it's something they should be aware of."
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> Skype denies that it's unpopular with IT. "I speak frequently to enterprise IT departments and CIOs about trying to integrate Skype into their architectures," says Kurt Sauer, director of security operations at Skype.
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> But, even before the botnet threat emerged, the UK's university networks blocked Skype, says Crowcroft: "It's not to stop people getting free voice calls, but because the uncontrolled extra traffic gives us a large bill - and is against our acceptable use policy." When it lost the UK's university students, Skype lost two million paying customers, who would have bought credit for SkypeOut, says Crowcroft.
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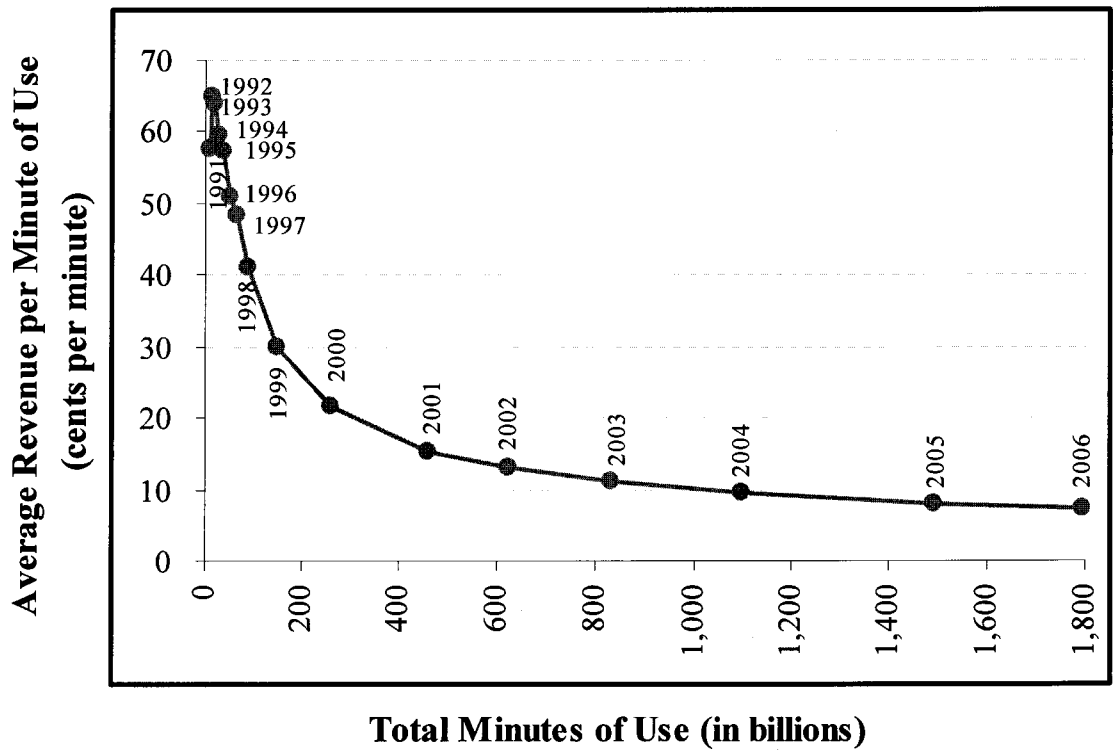
> Blocking Skype is not easy, though, because Skype wants its software to be used. "There's an arms race between firewall manufacturers and applications like Skype," says Brown. IT managers block Skype as much as they can, but it often finds a way through.

Peter Judge, *How Bad is the Skype Botnet Threat? Skype's Sneakiness Leads to a Security Risk*, TECHWORLD (Jan. 25, 2006); http://www.techworld.com/security/features/index.cfm?featureid=2199.

[28] Skype Petition, p. 2.

that prices did not increase, not even in the interim between deregulation and the entry of new PCS licensees.[29] And when the new networks began offering service, prices plummeted – to 11 cents a minute in 2003 and about 7 cents a minute in 2006. See Fig. 1. The "opening" of cellular networks under regulated terms and conditions failed to protect consumers; deregulated competition, however, did.

FIG. 1: REV/MOU VS. MOU, U.S. MOBILE PHONE SERVICE, 1991-2006




*Source: Semi-Annual Wireless Industry Survey,* CTIA except minutes of use in the second half of 2006, which is collected from *Wireless Quick Facts,* CTIA.
***Notes:*** REV/MOU = revenue per minute of use. Total revenues, containing local service revenues and roaming revenues, is divided by total minutes of use that includes total billable minutes from local calls as well as roaming to calculate average revenue per minute of use.

In 1992, the FCC established the policy currently followed by the Commission, arguing that bundling restrictions (of the sort imposed via *Carterfone*) were inappropriate given the end of rate-of-return regulation and the emergence of competition:

> [T]he lack of regulation based on rate-of-return principles, combined with the absence of monopoly status for cellular carriers, significantly reduces one important motive for carriers to bundle – to build unregulated CPE costs into the service rate base and cross-subsidize at the expense of the subscriber. As the DOJ notes, 'absent a guaranteed return on their cellular service investments, carriers cannot expect to recover CPE discounts by including it

[29] Thomas W. Hazlett, *Is Federal Preemption Efficient in Cellular Phone Regulation?* 56 FEDERAL COMMUNICATIONS LAW JOURNAL 155 (Dec. 2003).

(the amount of the CPE discounts) in their rate base. We agree with this conclusion.[30]

The choice was made to reject the "regulated monopoly" approach and to embrace competition, delegating the old regulatory choices to the market. As Reed Hundt, FCC Chair during the PCS licensing phase, declared: "We totally deregulated wireless."[31]

The *Carterfone* policy had been relegated to history in wireless as of 1992; its application is even more antiquated today. Cellular rivalry, invigorated with the award of PCS licenses and further encouraged by the recent (2006) auction of AWS licenses, demonstrates how effectively market competition substitutes for regulation. One interesting result is that, under wholesale rate regulation, such as was imposed by the Public Utilities Commission in California, no substantial competitive networks resulted. Yet, unregulated markets today host at least two dozen MVNOs[32] – mobile virtual network operators that use the physical networks of licensed carriers to provide a range of diverse devices, pricing menus, and data applications, targeting consumers demanding specialized use of wireless networks. These third party providers contract with existing cellular networks to provide vertical services – or suites of services – economic activity that is judged by carriers as compatible with other network applications. These burgeoning markets offer graphic evidence of the intense interest shown by carriers in promoting wholesale network access for the benefit of millions of customers.

Such developments illustrate how competitive forces organize markets in innovative ways, discovering and satisfying consumer demands. Tracfone, for instance, offers pre-paid services with meters that display minutes remaining, helping its more than 7 million customers "track" usage.[33] These subscribers gain wireless access via the physical facilities of dozens of cellular networks, each of which contracts with Tracfone.[34] The Tracfone target market consists of infrequent cell phone users, including low-income workers and retirees[35]; the average revenue per user is just $13,[36] compared to a U.S. mean (2006) of over $47.[37] Virgin Mobile, alternatively, focuses on the youth market, serving more than 4 million subscribers via the Sprint cellular network, which entered a

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[30] FCC, *Report and Order,* 7 FCC Rcd No. 13 (Released on June 10, 1992), par. 25.

[31] Reed Hundt, You Say You Want a Revolution (New Haven: Yale U. Press; 1999), p. 98.

[32] OECD, *Fixed-Mobile Convergence: Market Developments and Policy Issues,* REPORT PRESENTED TO THE WORKING PARTY ON COMMUNICATION INFRASTRUCTURES AND SERVICES POLICY (March 23, 2007), p. 26.

[33] Tracfone, http://www.tracfone.com/howitworks.jsp?nextPage=howitworks.jsp&task=howitworks.

[34] *TracFone Scores 215,000 Customers During Third Quarter,* 25 RCR WIRELESS NEWS 44 (Oct. 30, 2006), p. 25.

[35] Vince Vittore, *Prepay: Upfront and Center,* TELEPHONY ONLINE (Nov. 1, 2003); http://telephonyonline.com /wireless/mag/wireless_prepay_upfront_center/.

[36] America Movil S.A.B. De C.V., *Fourth Quarter of 2006 Financial and Operating Report* filed with SEC (Feb. 9, 2007); http://www.secinfo.com/d17EG1.u81.htm#1stPage.

[37] Computed by dividing the total wireless revenues per month (the number reported for the second half of 2006 is divided by 6) by the total number of wireless subscribers at year-end 2006. Source: CTIA-The Wireless Association, *Wireless Quick Facts* (Dec. 2006); http://www.ctia.org/media/industry_info/index.cfm/AID/10323.

partnership with Virgin's parent company to form the venture.[38] Newer MVNO entrants such as Helio and Amp'd are specializing in high-end, data-intensive users.[39]

It is revealing that, in these spontaneous market outcomes, incumbent cellular operators host direct retail competitors – selling billions of wholesale minutes to firms which are then enabled to reduce the carrier's market share of end users. Since the Skype allegation is that restrictions on phone networks are instituted to restrict 3rd party suppliers from competing, that carriers host this widespread rivalry is left unexplained.

The service packages offered MVNO customers are targeted, "forcing" customers to choose between the phones and services pre-selected by the retailer. Tracfone currently offers 16 handset models, for instance, Virgin Mobile 10 (also 8 older or discontinued models). Helio is promoting its only two models (Heat and Drift) as advanced, multi-functional radios that offer wide-area broadband data access along with local-area network wi-fi links. Jitterbug, an easy to read, easy to use phone marketed largely to senior citizens, offers two models, which connect to a live operator but do not enable access to data services.[40] Kajeet, a service aimed at the "tween" market, is developing 6 phones for its Spring 2007 roll-out.[41]

Each MVNO *could* offer far broader selections, allowing their customers greater freedom to use different devices (including multi-mode phones) given the range of options featured by MVNOs across the market. But each of the firms chooses to truncate such choices to capture other efficiencies, including gains from specialization. Economies of scale in purchasing bulk quantities, and savings realized when marketing and technical support focus on fewer models, produce trade-offs suggesting to each of these MVNOs that limited device choices are *pro*-competitive.

Similarly, rural WISPs – as in the VBB example noted above -- restrict the amount of data their customers are permitted to download, the types of files sent, and the use of devices accessing their network. Rules to block these market outcomes will disrupt efficiencies. The same types of management efficiencies are also available to larger networks. A blanket rule condemning all network control devices would deter the creation and expansion of wireless networks for voice and broadband.

D. *Carterfone* v. UNE-P

How is it, then, that *Hush-a-Phone* and *Carterfone* rules appear to have succeeded in promoting competition, given that they imposed arbitrary regulatory interfaces on the

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[38] *Virgin Mobile USA Ends Year With 4.6 Million Wireless Subscribers,* CELLULAR-NEWS (Jan. 5, 2007); http://www.cellular-news.com/story/21244.php.

[39] Sue Marek, *Pre or Post – The Battle Continues,* WIRELESSWEEK (July 1, 2006); http://www.wirelessweek.com/article.aspx?id=90572 .

[40] David Pogue, *Some Phones Are Just, Well, Phones,* THE NEW YORK TIMES (Sep. 28, 2006); http://www.nytimes.com/2006/09/28/technology/28pogue.html?ex=1317096000&en=318ccccf0ee04bca&ei=5088&partner=rssnyt&emc=rss . It does, however, produce a dialtone, and connect to a human operator when a user punches "0."

[41] Kelly Hill, *Interview: Daniel Neal,* RCR WIRELESS (April 2, 2007), p. 8.

existing fixed-line telephone network? This question has been partly answered by the monopoly and regulatory distinctions discussed above, pre-existing conditions that made such government intervention a potentially pro-consumer policy. A further answer is supplied by former FCC Chief Economist Gerry Faulhaber. In his 2003 paper,[42] he examines episodes in which "open access" requirements set by government appear to have succeeded in advancing consumer interests, and those in which they have failed. The Skype petition, while presenting an argument based on the purported success of the *Carterfone* policy, fails to incorporate – or even acknowledge – the many failures of "open access" regulation.

Faulhaber helps provide the necessary balance. He finds "a transaction cost theory of the firm" useful in order to see where mandates to unbundled packages are able to work in a pro-consumer fashion. He concludes that "open access" will not likely be successful where "transactions… are best done *within* the firm,"[43] writing that, "transaction costs thus help define the optimal boundary of the firm: all complex transactions take place *inside* the boundary and only simple transactions take place *across* that boundary."[44]

His policy conclusion is that the wall-plug modularity that helped introduce competitive customer premises equipment (CPE) into the AT&T monopoly following *Carterfone* (and other decisions) offered a relatively simple transaction that – by the nature of the network interface – did not implicate complexity involving other users of the network.

> [A] simple technical specification could enable an existing industry to sell CPE to customers and seamlessly plug into the existing telephone industry, all at very low transactions cost. In other words, the CPE/network interface is a "natural" market boundary, in which transactions cost are very low. The FCC deregulation of CPE thus transformed a somewhat unnatural integration of CPE and the network into the more natural market disintegration at very low cost.[45]

But these conditions, Faulhaber augurs, were unique. "The success of CPE deregulation via an FCC administrative fiat was not to be repeated." Conditions elsewhere generally did not admit to easy regulation-defined boundaries. In particular, Faulhaber notes the failure of unbundling rules to induce competitive local exchange service. Writing just as these network sharing, or "open access" rules, were being overturned by federal courts and abandoned by the FCC, the experiment has now been performed in reverse: facilities-based competition has *accelerated* in the absence of LEC sharing rules.[46] If the plea for a "wireless *Carterfone*" is to be entertained, it is

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[42] Gerry R. Faulhaber, *Policy-Induced Competition: The Telecommunications Experiments*, 15 INFORMATION ECONOMICS AND POLICY 1 (March 2003).
[43] Faulhaber, op. cit., p. 77 (emphasis in original).
[44] Faulhaber, ibid.
[45] Faulhaber, op. cit., p. 79.
[46] Thomas W. Hazlett, *Rivalrous Telecommunications Networks With and Without Mandatory Sharing*, 58 FEDERAL COMMUNICATIONS LAW JOURNAL 3 (June 2006).

appropriate that the policy be simultaneously evaluated as a "wireless UNE-P" petition, taking cognizance of the multiple outcomes observed for the proffered regulatory regime.

## IV. NETWORK RULES AS PRODUCTIVE INPUTS: THE CASE OF DOCOMO

Wireless markets discover consumer-pleasing innovation, relying heavily on coordination supplied by rival networks. These enterprises bring investors, technology suppliers, applications and content vendors together in a coherent manner, organizing activities to support the joint costs associated with network development. Without this coordinating function, consumers would be deprived of a rich mix of valuable services. This activity is highly productive but violates, at almost every step, *Carterfone* regulatory principles advanced by Skype.

There are myriad examples, but a convenient one to focus on is the wireless data system known as i-mode, developed by NTT's DoCoMo in Japan. This pioneering network brought web access to millions of customers beginning in 1999, *before* cellular systems were re-engineered for broadband (or 3G) applications. The network was a runaway success with Japanese consumers, attracting over 30 million subscribers in just three years (see Table 1), and has become a paradigm business model success story. "NTT DoCoMo," writes a British business publication, is "the most experienced company of all in building ecosystems."[47] .

And that is where the i-mode story begins: with the realization that wireless service depends critically on the creation of a family of products. The Skype argument is that government regulation to limit networks will best provide for these complementary inputs, but DoCoMo created an "ecosystem" advancing the wireless web by exerciseing control over a wide range of products complementing wireless connectivity, bundling them (and excluding others) for the benefit of its customers.

NTT DoCoMo[48] launched i-mode in February 1999 as "the first packet-based, always-on, mobile Internet service available anywhere in the world."[49] "Official" i-mode vendors are featured on the phone's menu, enabling customers to easily access their content. Billing is handled exclusively through DoCoMo, which lists transactions on subscribers' monthly statements, and charges content providers nine percent of revenues for the service. DoCoMo also allows "unofficial sites" to be accessed by i-mode users, and these vendors can charge customers however they wish. But such sites are at a disadvantage, particularly given the relatively limited use of credit cards in Japan.

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[47] *Microsoft Excluded from DoCoMo's Ecosystem*, THE REGISTER (Nov. 26, 2004); http://www.theregister.co.uk/2004/11/26/microsoft_excluded_from_docomo/.

[48] Originally NTT Mobile Communications Network. Renamed NTT DoCoMo in April 2000.

[49] John Ratliff, *DoCoMo as National Champion: I-Mode, W-CDMA and NTT's Role as Japan's Pilot Organization in Global Telecommunications* (Santa Clara, California: Santa Clara University, 2000), p. 12.

This directly implicates the regulatory issues raised by Skype. Indeed, critics complain that DoCoMo erected a "walled garden" limiting customer choice.[50]

The truth is just the reverse: i-mode has created an innovative hot-house for content, optimizing its delivery via network control. By enabling a platform that encompasses pricing and vertical restraints (including payments to the ISP and inclusion in the preferred providers list based on compliance with operator-set specifications), content providers have been given more productive opportunities to search for value-added niches. Writing in *Wired*, Frank Rose sees the "walled garden" view as simplistic.

> At the heart of all this is a paradox: i-mode depends on outside providers for everything from handsets to content, yet it's managed so carefully that nothing is left to chance. Critics see a walled garden, more mobile mall than wireless Web. But in fact, i-mode's success comes less from being walled than from being obsessively tended.[51]

The network both restricts and coordinates user access to applications and content, for the purpose and effect of producing value for consumers. "It's a complex ecosystem—a self-sustaining world in which hundreds of companies, from Bandai to Cybird to DoCoMo itself, feed off one another for their mutual benefit."[52]

Rather than provoke objections from content providers opposing DoCoMo's far-reaching control of the platform (or its nine-percent commission), the platform has proven exceptionally popular. Katzutomo Robert Hori, CEO of Cybird, with 23 sites connected to i-mode, says that, "For a company like us," Hori said, "the i-mode environment has proven very profitable."[53]

These gains from trade have been the result of active decision-making by the network to shape the platform on which content providers operate. In doing so, DoCoMo necessarily favors certain technologies, formats, or business models, disadvantaging others. One important instance occurred in DoCoMo's decision to support Linux and Symbian software for i-mode applications, but to exclude Microsoft.[54]

The argument Skype makes against such network control is that innovation will suffer. But Jack Qiu of the University of Southern California finds that i-mode customers are loyal to the service due, in large part, to a steady stream of content innovation.[55] In fact, the Internet access provided by DoCoMo proved so consumer-friendly that it became Japan's leading ISP.

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[50] Frank Rose, *Pocket Monster*, WIRED (Sept. 2001).
[51] *Ibid.*
[52] *Ibid.*
[53] *Ibid.*
[54] *Microsoft Excluded from DoCoMo's Ecosystem*, THE REGISTER (Nov. 26, 2004); http://www.theregister.co.uk/2004/11/26/microsoft_excluded_from_docomo/.
[55] Jack Qiu, *NTT DoCoMo: Review of a Case*, JAPAN MEDIA REVIEW (Oct. 2004); http://www.ojr.org/japan/research/1097446811.php.

| TABLE 1. DOCOMO I-MODE SUBSCRIBERS AND REVENUES, 2002-2006[56] | | | | | |
|---|---|---|---|---|---|
| | *3/2003* | *3/2004* | *3/2005* | *3/2006* | *3/2007* |
| *Cellular subs (millions)* | 44.1 | 46.3 | 48.8 | 51.1 | 52.6 |
| *I-mode subs (millions)* | 37.8 | 41.1 | 44.0 | 46.4 | 47.6 |
| *DoCoMo mobile market share (%)* | 58.1 | 56.6 | 56.1 | 55.7 | 54.4 |
| *i-mode subs/ DoCoMo subs (%)* | 86.1 | 88.7 | 90.2 | 90.6 | 90.4 |
| *Aggregate mo. ARPU (yen)* | 8,130 | 7,890 | 7,200 | 6,910 | 6,700 |
| *i-mode monthly ARPU (yen)* | 2,120 | 2,240 | 2,060 | 2,040 | 2,160 |

DoCoMo has provoked Japan's other wireless networks, KDDI and Softbank,[57] to each offer their own versions of i-mode (KDDI's is called "au,"[58] Softbank's "Live"). Entry into the wireless web "platform" space sparks competitive rivalry for the best network bundles. The original innovator, DoCoMo, responded not by abandoning coordination of its platform, but by extending it into e-commerce.[59]

The argument that unregulated cellular carriers will deny users valuable opportunities to access content and applications is, like the criticism of DoCoMo's "walled garden," overly simplistic. Skype's petition proposes to prohibit vertical restrictions that cellular operators might impose. The assumption is that such restraints are not a form of productive coordination, but categorically anti-competitive. The i-mode development underscores just how empirically lacking this view is. Network coordination facilitates a wide range of productive activity, furthering consumer interests.

[56] Data from NTTDoCoMo, http://www.nttdocomo.co.jp/english/corporate/ir/finance/annual/.

[57] Softbank acquired the assets of Vodafone Japan in 2006. Vodafone purchased J-Phone in 2001.

[58] For an analysis of KDDI strategy, see Atushi Matsumoto, *NTT DoCoMo 2003* (Charlottesville, VA: University of Virginia Darden School Foundation, 2003).

[59] See, e.g., Dan Einhorn, *DoCoMo's "New Business Model,"* BUSINESS WEEK ONLINE (April 19, 2004); John Boyd, *Here Comes the Wallet Phone*, IEEE SPECTRUM (Nov. 2005). DoCoMo also created the Mobile Society Research Institute to study how users interact with their mobile phones and to invent applications for making the phones more useful. Stephen McClelland, *Japan: A Future Mobile Society?*, TELECOMMUNICATIONS MAGAZINE (June 7, 2005).

## V. CONCLUSION

The argument for a "wireless *Carterfone*" not only disregards the economic rationale for the real *Carterfone*, but categorically dismisses precisely the market forces that policy makers embraced when deregulating wireless telephone services 15 years ago. The market that has developed is not only unregulated, it exhibits a high degree of competitiveness as determined, and often re-affirmed, by the Commission itself. Wireless carriers are driven by economic self-interest to craft valuable networks, creating platforms with massive investments and wide-ranging rules characterized by some as vertical restraints. These create "ecosystems" for the delivery of valuable services to subscribers, who choose among the feature-rich packages offered by rival carriers. Where customers believe networks impose too much control – or too little – they are free to switch carriers.

And they do. Capital investors judge the worth of wireless networks, in large measure, by how successful they are in enlisting current subscribers to re-subscribe. When a network fails in this task, churn rates rise, stock prices fall, and network owners lose wealth. The market punishes carriers for disappointing consumers. Crucially, such disappointments can come in unlimited dimensions, and be the product of *overly lax* or *overly strict* network management. Finding the proper mix of rules – those that extend individual options while protecting shared network resources -- is a subtle balancing act. Firms with profit incentives are far more likely to discover the relevant trade-offs and to effectively implement optimal solutions than are government agencies imposing blanket rules at the behest of interested parties.

The wireless market coordinates a massive degree of complexity. Mobile subscribers have access to a diverse panoply of complementary goods and services; carriers have strong incentives to enable these applications whenever the cost to the network is exceeded by the benefit to its subscribers. This imposes efficiency constraints all around, producing an environment conducive to the discovery of spectrum sharing solutions that maximize the value of wireless networks.

It is notable that virtually all such firms impose rules that limit how individual subscribers may utilize their facilities. Even in the case of tiny WISPs lacking any market power, usage restrictions are a standard part of "acceptable use" policies. Non-profit organizations similarly impose governance rules to manage their networks. Competitive entrants into wireless broadband services today carefully manage their "ecosystems," imposing vertical restraints. These observed forms of market organization reveal the importance of network management. It also illustrates the straightforward, cost-efficient mechanisms that develop for dealing with potentially disruptive activities that could undermine valuable opportunities for all. To bluntly quash such market outcomes would stifle efficiencies and reduce the supply of wireless broadband services.

"Wireless *Carterfone*" would, furthermore, re-impose controls shown inferior to competitive market forces in the deregulation of wireless markets. To revive regulatory mandates long ago abandoned would disrupt the ability of wireless networks to craft their

packages, organizing investments, technologies, infrastructure, equipment, applications, business models, and customer service. It would render impossible the high degree of economic development that is on display in the wireless marketplace. To do so based on an analogy to rules imposed in a distinct context some four decades ago is to misunderstand the economics of the fixed telecommunications market then, or the wireless telecommunications market today.

Prof. Thomas W. Hazlett (March 2007)

Thomas W. Hazlett is Professor of Law & Economics at George Mason University, where he also serves as Director of the Information Economy Project. Prof. Hazlett, who has previously held faculty appointments at the University of California at Davis, Columbia University, and the Wharton School, writes extensively on economic and public policy issues in both academic journals and the popular press (including the *Financial Times*, where he is a Columnist in the New Technology Policy Forum). Prof. Hazlett's special expertise is in the government regulation of telecommunications markets and the information sector. His book, *Public Policy Toward Cable Television*, was co-authored with Matthew L. Spitzer (MIT Press, 1997). In 1991-92, he served as Chief Economist of the Federal Communications Commission. For more information, see: http://mason.gmu.edu/~thazlett/.

# EXHIBIT B

# Implications of the Skype Petition for Wireless Carriers and Consumers

**Mark Lowenstein**

**April 30, 2007**

## Executive Summary

Skype's February 20, 2007 *Petition to Confirm A Consumer's Right to Use Internet Communications Software and Attach Devices to Wireless Networks* requests certain FCC actions based on numerous mischaracterizations and misunderstandings of the business and economics of the wireless phone industry.

Skype would relegate wireless carriers to the status of pure "pipe" providers, allowing any application to merely pass through the network, regardless of the economics of the industry, or the negative impact on the end-user experience. Skype fails to acknowledge that the wireless carrier is not purely in the business of providing network connectivity to its subscribers. The costs involved in securing spectrum licenses and building wireless networks are predicated on wireless carriers providing a host of applications and content to their subscribers *in addition* to voice services. Skype also dismisses wireless devices as simply micro versions of PCs – again with little or no recognition of the technical limitations of the handset and network, the complexity involved in delivering a decent experience to the user, and the relative immaturity of most online brands and content providers with regard to designing mobile applications.

The wireless industry has indeed changed in the twenty-three years since CMRS were introduced in the United States. The industry remains vibrant and competitive. It is growing at a faster rate than nearly any other sector of the communications industry. Customers have a choice of four or more service providers in every major market, plus a growing number of resellers and "virtual network operators." The United States is one of the most competitive wireless markets in the world today, and consumers enjoy among the lowest prices for voice and data services among OECD countries. Within the U.S. industry, the operator-OEM relationship is a healthy one, and the current structure of the market allows consumers a robust choice of devices at very competitive prices. Wireless carriers provide a robust suite of messaging services, broadband access to the Internet, and offer thousands of titles of content to their subscribers, from games to ring tones, video clips, and live television, all with an eye to a superior user experience.

Skype's request for a completely open device and software model for wireless is impractical. It ignores the technical need for coordination between the handset and the network and the complexity involved in delivering an excellent experience to the end-user, considering a wireless device's limitations with respect to screen size, input capabilities, and memory. It also ignores factors such as the role of wireless carriers' customer service functions which service hardware, software, and service, unlike the modus operandi of the PC world today.

Finally, Skype's suggestion that wireless operators are preventing the offering of VoIP services ignores the factors involved in hosting VoIP or any software application. VoIP is certainly worth evaluating as a commercial opportunity. But, wireless operators must also consider this opportunity in light of their need to deliver an excellent quality of service experience to users and network economics and capacity limitations.

## I. Competition in the Wireless Handset Market

In its Petition, Skype takes issue with many aspects of the nature of the relationship between wireless operators and handset suppliers and its effect on consumers. Skype complains that consumers cannot use handsets from one carrier to another and cannot freely select the features and applications that run on their mobile phones. But, Skype ignores that the mobile handset market in the U.S. is highly competitive, and there are valid technical and competitive reasons for the alleged restrictions on wireless handsets.

*Competition in the U.S. Wireless Handset Market*

The wireless handset market is highly competitive. Users have significant choice of models and suppliers. The average wireless carrier today supports dozens of SKUs of handsets. A typical wireless carrier retail store carries more than 25 models. A non-carrier branded store carries selections from at least two of the "national" carriers, select "regional" carriers, pre-paid providers such as TracFone, and MVNOs such as Virgin Mobile, Disney Mobile, and AMP'd.

It should also be noted that, more than any other sector of the communications industry, wireless carriers are significant retailers. All major wireless operators in the U.S. run hundreds of their own branded stores, in addition to having significant presence in other retail distribution channels such as Best Buy, Circuit City, Wal-Mart, and Radio Shack. The device lineup in a carrier-branded store is the most compelling aspect of the retail experience and is what draws customers into stores. Watering down a carrier's ability to sell unique devices as part of the overall proposition to the end-user is like requiring Macy's and Nordstrom to carry the same line-up of a particular designer's clothing line.

But, if consumers prefer not to buy handsets from a service provider, they can buy handsets on carrier approved lists from third-party outlets, and have them activated on their chosen wireless network. As noted above, Radio Shack, Wal-Mart, Circuit City and Best Buy all compete in sales of mobile phones. Consumers can also purchase phones at full retail price directly from handset manufacturers, such as Motorola or Samsung.

*Differences in the European, Asian and U.S. Markets*

As Skype notes, there are some differences between the United States and certain markets in Europe and Asia, but these differences have produced benefits for U.S. consumers. In the U.S., the wireless industry supports three air interface platforms – CDMA, GSM, and iDEN – whereas in Europe GSM is the only standard supported. This diversity of air interfaces in the U.S. has allowed for the provision of unique and differentiated services, such as Nextel's Direct Connect service using the iDEN platform. The support of multiple interface standards is a result of the FCC allowing market forces to determine the course of development here. In Europe, by contrast, the European Telecommunications Standards Institute (ETSI) mandated that GSM would be the sole air interface standard for cellular services. Regulators have gone even further, in

mandating that spectrum gained in auctions be used for a particular type of service (*i.e.*, 3G) and technology (*i.e.*, W-CDMA).

*Competition to Offer Unique and Exclusive Devices*

The competitive market for wireless handsets reflects consumer demand and the carriers' product and service differentiations. In the early days of the wireless market, the principal objective was to deliver cellular voice services to consumers, who used either "car phones" or transportable "bag phones." But since the advent of the portable phone in the early 1990s, the wireless device has become as much a personal accessory — and even fashion — device, capable of performing a host of additional non-voice functions, accessing myriad applications and a wealth of content. When consumers make a choice of wireless carrier and service plan, they look at many factors, including network quality, service pricing, and application capabilities. Device brand, capabilities, and form factor also play a huge role in the purchase decision, and are often lead considerations in a user's decision to switch wireless service providers. Therefore, the breadth and depth of wireless devices offered by a wireless carrier are key parts of its overall service proposition to the consumer and of its competitive positioning in the marketplace.

All carriers have access to the same network and device *technology*. But the phone is a highly person-specific device, even more than the PC, which might be shared by multiple individuals (*i.e.,* in a household). To extend the logic used in the Petition, if all handsets are made available to all carriers, does that mean all the same colors, applications, content titles, and content relationships too? How would a wireless operator differentiate its service proposition, from Skype's point of view in the Petition?

Sometimes, the device is geared toward a particular type of application, as in the case of the Blackberry. Even though Blackberry is now available from all of the "Big Four" wireless operators in the United States, this was not always so. For many years, only some operators carried the Blackberry. This was simply a business decision between Research in Motion, the supplier of Blackberry devices, and the wireless operator. As in any business, the operator must determine the demand for the service, and then must be able to negotiate terms with a supplier that makes sense for both parties.

The same logic applies to the nature of handset OEM-operator relationships today. Select devices are available from some operators and not others. This is caused by any one of the following reasons:

- **Business Decision**. The wireless operator might choose not to carry that device, for whatever combination of business reasons (lack of demand, price, etc).
- **Technology Constraints.** Some handsets might not be available for a certain air interface (CDMA, GSM, etc.) or spectrum band

- **Competitive Reasons.** In certain cases, there is an agreement that the device be exclusive to a particular operator, in some cases for a certain period of time.

Competition drives the market for exclusive handset models. There are occasionally agreements between handset suppliers and operators to offer a device on an exclusive basis to the operator for a period of time. This might apply to the entire handset model, a particular color, unique feature(s), or even select applications embedded on the device.

The RAZR V3 phone, designed and manufactured by Motorola, exemplifies how the current wireless market works to develop innovative products, fulfill user demand, and reduce prices to consumers, even for increased technology, and at a rapid pace. Made available in the U.S. in November 2004 as a GSM phone exclusively through Cingular, the ultra thin RAZR quickly became popular as a high-end phone, selling for around $500 with a two-year service agreement.[1] In just three years, as demand for the RAZR swelled, the phone has become available through many other U.S. and foreign carriers, with a steady decrease in price.

The RAZR V3 was innovative in form, featuring a unique ultra thin design and a hardened-glass keypad. The RAZR V3 included 5.5 MB of usable memory capacity, and a camera with resolution of 0.3 megapixels. Motorola released a CDMA version of the device, the RAZR V3c, distributed by Verizon Wireless, ALLTEL and other CDMA carriers at the end of 2005. The CDMA version was slightly thicker than the GSM version, but had more memory (30 MB) and a 1.3 megapixel camera.

The initial Cingular RAZR was black, but, Motorola continued to introduce the RAZR in different colors, at first, with a pink RAZR in various shades available from Cingular, Verizon, and T-Mobile. Motorola teamed up with Dolce & Gabbana to release a gold RAZR phone. As new models appeared, the RAZR featured more memory, a better resolution camera, a microSD card slot for additional memory, Bluetooth features, and music players (e.g., iTunes, Motorola's Digital Audio Player), and supported carrier-specific applications, such as T-Mobile's MyFaves and Verizon Wireless's V-CAST multimedia services.

Despite the increase in form and function, prices for the RAZR have fallen dramatically. When Verizon Wireless introduced the V3c in December 2005, the phone was offered at a retail price of $199 after a $100 rebate with a two-year customer agreement.[2] The Verizon Wireless website now offers silver and pink RAZR V3m featuring Bluetooth functions, removable memory, enabled for V-CAST music, for $49.99, after an on-line discount, with a two-year contract.

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[1] *See* "The Wait Is Over! New Motorola RAZR V3 Now Available Exclusively at Cingular Wireless," Motorola Press Release (Nov. 16, 2004).

[2] *See* "This Year's Wireless Must-Have Debuts at Verizon Wireless: The V Cast Enabled Motorola RAZR," Motorola Press Release (Dec. 6, 2005).

And, the diversity in RAZRs is reflected in choices for consumers among RAZR models and carriers. On its web-site, T-Mobile offers the RAZR V3 in a variety of colors for $49.99 after discount and rebate with qualifying plan (or a buy-one-get-one-free offer); plus, the V3t with an MP3 player and memory card slot, for $99.99 after discount and rebate with qualifying plan; plus the V3i Dolce-Gabbana gold RAZR, with MP3 player and memory slot, for $149.99, after discount and rebates with qualifying plan.

By July 2006, Motorola announced that it had shipped 50 million RAZRs, making it one of the most popular phones ever distributed. The RAZR is an example of just one product that has been introduced successfully into the wireless market, at first with limited distribution, which then became available through more carriers, and gradually developed better technology and more functions, at lower prices, as carriers responded to consumer demand. The RAZR demonstrates that in a competitive market such as wireless, there is no need to impose regulations to achieve consumer choices when consumer demand achieves that goal faster.

This example has played out in numerous additional cases. Verizon Wireless offered the Motorola "Q" device for a certain period before it became available from other operators. Cingular is the only operator in the United States offering the Samsung Blackjack device. T-Mobile is the only U.S. operator offering the Sidekick device. Carrier competition and differentiation will drive availability of devices – precisely the way that a pro-consumer market should work.

*The Effect of Technology Differences*

CDMA and GSM-based handsets do not *naturally* work on each other's networks, because they represent different air interface technologies and require a unique radio. A limited number of devices that have two radios in them to meet the needs of global travelers. Since CDMA networks are not as pervasive worldwide as GSM networks, there are fewer models of CDMA handsets available and their wholesale price is somewhat higher. Certain leading handset suppliers, such as Nokia, do not actually manufacture CDMA handsets – again, a decision driven by market forces.

In considering the realities of what it would be like to use the same device on another carrier's network, maintaining a good user experience is harder than might be readily apparent. Outside of core functionality (voice calling, text messaging), wireless operators have their own user interface software design that might not easily port to another carrier's network. Or there might be unique applications loaded onto the device that the other carrier either does not support or that might work differently. Skype assumes that users would prefer its proposals, but these practicalities would make it difficult for users to enjoy the same reliable experience from wireless networks in the regime envisioned by Skype.

## II. The Operator-OEM Relationship

In its Petition, Skype made several references to the unfairness of the "contract" relationship between the wireless operator and the wireless subscriber. But, this model has substantially benefited consumers. Since the early days of the cellular industry, the prevailing model has been that the wireless operator "subsidizes" the cost of the handset and other costs in return for a service contract of some length of time. In most other cases, the subscriber is paying less for that handset than the operator paid to the handset manufacturer. This business model allows the end-user a greater selection of handset form factors and capabilities when subscribing to their wireless service, at a lower entry cost, than would be the case if the device were not subsidized. The "latest and greatest," whose wholesale cost might be over $500, is available for a more affordable price to the subscriber, if they are prepared to sign a contract.

That said, wireless subscribers are not obligated to sign a contract in order to obtain wireless services. There are numerous alternative service plans available, notably pre-paid services where users buy a certain bank of minutes for a certain price with the option of "replenishing" the minutes when they are used up. Wireless subscribers also have the option to pay closer to the full retail price for the device if they do not want to sign a contract. For example, a Verizon Wireless subscriber today who is "off contract" (*i.e.*, the contract has expired) can purchase a new handset at full retail price and does not have to sign a new contract.

The subsidization model is used in other industries, without nearly the same "scrutiny" that seems to exist in wireless. In the satellite TV business, for example, the initial equipment cost is often offered at a substantial discount in order to encourage users to sign up for the service. In satellite radio, there are numerous plan options, including an annual plan that has an early termination fee. Vonage offers equipment discounts, which the consumer must repay if they cancel their service within six months of signing up.

Skype ignores the fact that the current business model in wireless has facilitated innovation in the marketplace. Some of the most innovative handset models are available in the United States. Handset replacement rates in the United States are higher than they are in Europe, averaging less than two years. This demonstrates that U.S. consumers are just as able to get the "latest and greatest" handsets as in any other region. Certainly, there are differences from one country to another in terms of handset type and capability. Handsets capable of m-commerce are available in Japan today, or with certain video capabilities in South Korea. Yet there are "firsts" here as well, such as the first MediaFLO-enabled phones for live TV, devices such the Palm Treo and the Motorola Q.

## III. Software and Innovation

Skype requests that users have unfettered access to applications from any device attached to a wireless network. A complete decoupling of the application and device from the access medium could significantly tarnish the end-user experience. In fact, many of the "best" user experiences today are delivered in an ecosystem where hardware, software and the network experience are tightly integrated.

*Examples of In-Demand Tightly-Integrated Handsets*

Two examples that come immediately to mind are the Blackberry and the iPod. In the case of Blackberry, the marriage of device, software, optimization of the carrier network, and tight security all combine to deliver the most successful wireless e-mail service in the market today. In order to use Blackberry's proprietary push e-mail capability, enterprises must install Blackberry Enterprise Servers and the subscriber must buy a Blackberry device and a service plan from a wireless carrier. The Blackberry software, except in very rare cases, cannot be used on non-Blackberry devices. In addition to Blackberry, Verizon Wireless offers the Good and Intellysinc platforms for enterprise customers. For consumers, there are at least five BREW applications that can be downloaded onto a phone that provide access to nearly any POP3 e-mail account.

A similar example is Apple's highly successful iPod. If a user buys a song on iTunes, it can only be played on an iPod device. Similarly, songs purchased in other media formats, such as WMA, cannot be played on iPods. The tight integration of hardware, software, and on-line service has helped to create a vibrant and legal downloadable music market, but one where Apple also dominates, with 75%+ share of all portable music players sold. Attempts to compete with the iPod require similarly tight integration. Sandisk's Sansa e200R music player is designed to work closely with RealNetworks Inc.'s Rhapsody subscription music service, for example.[3]

The upcoming iPhone product again illustrates the benefits of tightly-integrated wireless products. Apple's exclusive relationship with Cingular is not necessarily about Apple having an exclusive carrier for the device – there is an economic model that Apple has proposed, and a business relationship that has been agreed to between the two parties. It remains to be seen whether it is Apple's strategy to have an exclusive carrier for each area. Skype, however, would prohibit such a device.

Contrast the iPhone with the options available from Verizon Wireless. On the Verizon Wireless music service, any song purchased on the V-CAST Music web site, or over the phone, can be played on an V-CAST enabled phone and can also be transferred to a PC and then over to other MP3 players, supporting a variety of formats, including AAC

[3] A New Wireless Player Hopes to Challenge iPod, Wall Street Journal, April 9, 2007.

(Apple's proprietary format). It is not at all clear, therefore, what Skype means when it implies that the device is "closed."

*Other Industry Segments with Tightly-Integrated Products*

Additional examples abound across the communications and digital media industries where there are applications tied to particular devices or networks.

- **Console Video Games**. In today's highly competitive console-based video game market, there are numerous "platforms," each supported by a different manufacturer. Examples include Microsoft's Xbox, Sony Playstation, and the Nintendo Wii. Game titles bought for one of these platforms cannot be played interchangeably on another platform. And there are game titles, or content, that are unique to each platform.
- **Satellite Television and Satellite Radio**. Again, consumers must make "platform" decisions in order to access certain capabilities and content. Today, if consumers want the NFL Package on television, the only way to get it is through DirectTV (which requires their equipment and a subscription to their service). In satellite radio, subscribers who want Howard Stern must subscribe to Sirius, but if they want the Major League Baseball package they must subscribe to XM. This is an "either/or" purchase decision, in terms of both equipment and service.

The recently introduced MediaFLO service, which offers live television to cellular devices using the 700 MHz spectrum, is another example. In this case, Qualcomm is playing a role not unlike a wireless operator. It spent the money (more than $700 million) and took on the risk of building a network (the FLO network) and established a business model for "service providers" (*e.g.,* Verizon Wireless) and content providers (*e.g.,* NBC). Additionally, the terms of each service provider relationship are different – in terms of exclusivity, content relationships, and economic model. But the logic used in Skype's Petition would require any MediaFLO-capable handset to be able to access the network and all the content running over that network, regardless of service provider and content provider relationships and differentiated business models. That destroys the business model, and provides no incentive for communications companies to develop other innovative technologies and services.

*Consumer Benefits of Tightly-Integrated Products*

In the case of the iPod, the integration of the device, online store, and synchronization with the PC resulted in two primary benefits from an end-user perspective: first, a legitimate, legal model to buy digital music, rather than the "open" but "illegal" structure in the era of Napster and Kazaa; and second, an experience transformed from the province of hard-core techies to one that could be enjoyed by the typical consumer.

As for the Blackberry, there are benefits over the numerous other wireless e-mail services available on the market, such as:

- **Superior user experience**. No other wireless e-mail service has been able to quite replicate the "push" email capability of the Blackberry service.
- **Security**. The Blackberry service has a higher level of security than other corporate e-mail offerings. Research in Motion (RIM) has spent huge sums of money to create a network operations center that provides the triple DES encryption and other security features that enterprises demand and for which are prepared to pay a premium.
- **Customer support.** Again, RIM has a sales, account management, and customer support infrastructure in addition to what the wireless carrier offers.

Other examples of the superiority of select "tightly integrated" offerings abound in the consumer communications and consumer electronics areas. Palm for example, has been well recognized for its superior user interface and PC synchronization capabilities. This involves the elegant marriage of device, PC, and service. For example, Verizon Wireless offers two versions of the Treo smartphone: the "P", which uses Palm operating system on a Palm device and the "W", which uses the Windows for Mobile operating system on a Palm device. Analysts and others who have reviewed the two devices consistently cite the superiority of user experience of the "P" compared to the "W".

*Skype Fails to Recognize the Benefits of Tightly-Integrated Products*

In its Petition, Skype fails to make the distinction between "closed" and "tightly integrated" service/device experiences. On Palm and Blackberry devices, for example, developers must write applications that work on those operating systems, just as they do for Windows, Apple, and Linux. The challenge, as compared to writing applications for a PC, is the technical limitation of the mobile device: limited input capability, memory, processing power, and smaller screen size. Skype also infers that the BREW "operating system" is closed and tightly managed by the carrier. This is simply not the case. BREW is a turnkey infrastructure that provides:

- Templates for developers to write mobile-centric applications,
- A qualification/certification program to ensure that applications and content are both appropriate and of reasonable quality,
- A service delivery platform, so applications can render properly on mobile devices, and
- A third-party billing and payments system, providing the appropriate revenue allocation between operator, developer, and licensee.

The BREW platform is integrated at 69 wireless carriers in 31 countries, has 48 handset OEMs as partners, and has facilitated more than $1 billion in earnings for publishers and developers as of March 2007.[4]

[4] BREW Web site. http://brew.qualcomm.com/brew/en/about/brew_today.html#brewmilestones

## IV. Openness of Networks

Skype asks the Commission to "liberate software innovation and free manufacturers from unreasonable control by carriers." Yet, Skype has identified no example in the Petition where there is either a lack of software innovation in wireless or where unreasonable control exists.

*Innovation in Software on Wireless Networks*

There are vast numbers of innovative applications on wireless devices today. These include a host of "non-voice" services that comprise more than 15% of industry revenues today, led by text messaging, wireless e-mail, picture messaging, and the ability for users to access thousands of SKUs of content, from ringtones to video clips and all sorts of information services. These applications are available from both the wireless carriers, via the phone "deck" or on-line (referred as "on-portal") as well as hundreds of third party applications developers and content providers (referred to as "off-deck"). For example, a user can go to the Major League Baseball web site and choose all sorts of content that can be sent to their wireless phone, including team-specific ring tones, live updates, player statistics, and video highlights. Wireless carriers, similar to other service providers, from AOL to Comcast, also have unique content available only to their own subscribers. Verizon Wireless has YouTube video clips, Cingular has HBO, and so on. If content is part of the competitive playing field in wireless, then a wireless carrier should have the right to offer unique and exclusive content to its subscribers. The ability to be major players in the content game is one of the key reasons why carriers acquired the spectrum for and have now built 3G wireless networks.

Given the need to be protective of the user experience, and to ensure that content is safe, secure, and appropriate, carriers do have rigorous partner qualification/certification programs. Again, a mobile phone operates in quite different environments compared to a PC. It is a highly personal, portable device. Parents, who might be able to keep track of how their children are using the PC in the household, need to be comfortable that their children are not accessing illicit or inappropriate content from their mobile phone when outside the normal realm of supervision. This is also why carriers have been more conservative than other "service providers" with regards to adult content or other potentially inappropriate content.

Consumers also have a high degree of opportunity to access applications of their choice on wireless devices. Verizon Wireless, for example, offers its Mobile Web service for $5 per month, through which wireless users can access any Web site from their mobile phone. How a particular Web site looks, loads, and displays on a mobile device will vary depending on whether the brand has "optimized" for use on mobile devices. In the airline industry, for example, Delta Airlines has taken more steps to optimize its Web site for mobile than many other airlines. Regardless of the industry, this decision is entirely

within the purview of the brand, and not the wireless carrier or handset manufacturer. Unless the wireless carrier has a specific arrangement with the brand, it has no control over what happens if a subscriber simply surfs to the site.

There are additional aspects of "openness" which the Petition does not acknowledge. All major wireless carriers in the U.S. offer a service that allows the wireless subscriber to access the Internet wirelessly from their laptop computer (Verizon Wireless' service is called Broadband Access) for a daily or monthly subscription fee. In Verizon Wireless' case, there are also options for connecting a phone to a laptop or desktop computer and using it as a "modem" to access the Internet or perform other applications such as e-mail.

Finally, consumers can also choose to purchase an OS-based device, such as the Palm Treo or Motorola Q. These PDA-type devices have larger screens, greater memory, and pocket versions of typical browsers such as Explorer, allowing subscribers a more "PC-like" experience. There are multiple OSs in the handset market today: BREW, JAVA, and handsets based on the Microsoft OS, the Palm OS, Linux, and so on.

*The Critical Role of the User's Experience*

Even though there are more and more ways to broadly access the Internet or use third-party content, the Commission must be cognizant of the unique aspects – and limitations – of the wireless experience. The average cellular phone is not a "mini PC", as Skype's Petition would have the Commission believe. A cellular phone has a small screen, internal memory of only 50-60 MB on average (compared to 40 GB on a PC), and limited input capabilities. Given these limitations, much work is involved in order to deliver the user the best experience possible when accessing applications. A particular application, or piece of content, must be easy to find, and require as few clicks as possible to "get to". It must display properly on a device, not be too "thick" (which would result in a long download time), and not consume too high a percentage of the limited memory available on a device.

Given these requirements, it is not surprising that wireless carriers are skittish about allowing the complete "Wild West" aspect of the Internet experience apply to mobile, which is the logical outgrowth of Skype's proposals. After all, in addition to wanting to provide the best user experience, the wireless carrier is also responsible for most aspects of the "back end" of wireless data content and applications. The carrier is responsible for billing for most third party applications, for example. Customer care is another concern. If there is a question or concern about a particular application or piece of content, the wireless carrier is generally the only point of contact for customer calls. Unlike the broader Internet space, where customers can call their broadband provider, PC manufacturer, or software provider, in the wireless case the carrier is the "catch all". Given the significant costs of customer care, it is logical that the carrier will keep a close eye on the user experience.

Security is another concern. Wireless carriers have taken significant measures to ensure that spam and viruses, which have been so damaging to the PC experience, do not hit mobile devices as well. Viruses and spam would be especially grievous to the wireless industry, given the highly personal and portable nature of the mobile device. Memory limitations also mean that a virus could more easily "crash" a mobile device. And wireless communications capabilities such as Bluetooth provide for the possibility that viruses could "spread" in a rapid-fire manner unbeknown to the user. With these concerns in mind, wireless carriers must take the right steps and provide the proper safeguards regarding the data access capabilities of their devices.

*Applications Such as VoIP*

It is not the purpose of this paper to examine what any wireless carrier's strategy is with respect to VoIP. However, it is important to note the key considerations from a wireless carrier's perspective, especially those factors that go unrecognized in the Petition:

- **Economic**. Wireless carriers spend billions annually on their network, more as a percentage of revenue than in any other segment of communications or digital media. Wireless is ultimately a spectrum/capacity constrained network. Carriers have to be attentive to the implications of any one application or use case affecting other users in the sector. Slingbox is one example of both economics (cost to the carrier of carrying that MB of traffic) as well as quality (if there are two users in the same sector using Slingbox at any one time, other users' ability to make voice calls or access the data network could be compromised). VoIP on the landline side uses broadband access networks, usually cable or DSL, whose economics (cost to carry a MB of traffic) are vastly different than that of the cellular network.

  Even the so-called "open" network has limitations. Two points should be noted about 3 UK, one of the wireless carriers currently supporting Skype, Slingbox, and in general the type of "open" framework requested in the Petition. First, the monthly access fee required of the user in order to access these applications is close to $100. Second, the 3G network being used to offer these applications is new and thus has far fewer users and applications contending for network capacity. Even so, 3's contract has a "fair use" guideline, which places a cap on data consumption (depending on the application).[5]

- **Quality of Service**. The carrier is responsible for providing a reasonable quality of service. There are still concerns about the overall quality of VoIP delivered on landline networks today. According to research done by InterNAP, VoIP

[5] http://www.three.co.uk/xseries/features/skype/index.omp

succeeds in delivering cellular-level voice quality only 60% of the time.[6] This study was conducted using landline network VoIP. Supporting VoIP over 3G wireless networks (at least in the radio access portion, until they get to the PSTN) would offer additional challenges.

If the subscriber uses a home broadband network to subscribe to Vonage, for example, the ISP (*e.g.,* Comcast) bears no responsibility for the quality of the experience. The subscriber also has to buy unique equipment to enable Vonage, or separate equipment to use Comcast's own VoIP offering. Buying Comcast's VoIP service, however, costs more than Vonage (or Skype for that matter) but in that case Comcast bears the responsibility to deliver a certain quality of service (as well as other services expected by the consumer, such as 911, Directory Assistance, and so on).

- **User Experience**. Wireless operators have a responsibility to consumers to protect the integrity of the experience. This means ensuring network coverage, voice quality, security, a good user interface, a customer service infrastructure, and so on. In the more "open" model espoused in the Petition, where does the responsibility lie? The cable and DSL companies provide a broadband network, but their responsibility begins and ends with providing basic connectivity. Any consumer who has had problems with a PC knows that it can be very difficult to isolate the point of failure. Any PC user has undoubtedly experienced, at some point, a problem that has resulted in hours of phone calls to myriad parties in order to find a resolution. But in the wireless industry, the carrier's customer support responsibilities cover a broader range of issues than in most other sectors of the communications industry or the PC space.

Wireless carriers have collectively invested more than $100 billion, in just this decade in the United States, in improving network coverage and building out 3G networks to add voice capacity and improve data throughput speeds. Even so, wireless carriers get their fair share of heat — from consumers and regulators alike — for issues related to network coverage and voice quality. VoIP service, while it has improved over the past couple of years, is still inferior to landline telephony quality of service (a combination of voice quality, network reliability, network availability, and so on). It is more susceptible to being adversely affected by bad weather, power failures, and other circumstances. Voice quality, on a landline-based VoIP service, can also degrade markedly in times of high bandwidth consumption – listen to what happens to voice quality when trying to download a large file or view streaming video, for example. There is a risk that such scenarios could be exacerbated when using VoIP over a wireless network, where bandwidth and capacity are even more constrained. And wireless carriers have had to

[6] VoIP Quality Questions Stir Echoes, Telephony, June 6, 2005.

*pay* for this spectrum, unlike telco and cable companies who are today's primary access providers for VoIP services.

*Summary*

Hence, contrary to the main positions in Skype's petition:

- The wireless phone can not be treated as a "mini-PC" with respect to attachments and software applications;
- The wireless carrier is not a mere "pipe provider" but must manage the wireless network, including the handsets;
- The OEM-carrier relationship is healthy from the perspective of the industry, the financial markets, and the consumer; and
- There are key technical, economic and quality of service considerations in determining whether VoIP can ride free and unfettered on mobile devices and over cellular networks.

**Mark Lowenstein Biography**

Mark Lowenstein is a leading wireless industry analyst, commentator, and consultant. Most recently, Lowenstein was an executive at Verizon Wireless, where as Vice President of Strategy he led the company's efforts in pricing, market segmentation, and business planning.

Prior to his role at Verizon Wireless, Lowenstein was Managing Director of the consulting firm, Mobile Ecosystem, where he advised companies and C-level executives across the landscape of wireless communications on market, product, and industry strategy. Prior to founding Mobile Ecosystem, Lowenstein spent ten years at the Yankee Group, where he founded and led the company's wireless practices on a global basis.

Lowenstein has appeared as an expert witness on the wireless industry in several proceedings. He provided a statement as an expert on behalf of the major wireless carriers before the California Public Utilities Commission in its "Consumer Bill of Rights" proceeding. He has provided similar statements as an expert on the wireless industry before the Hawaii Public Utilities Commission and the Federal Communications Commission.

During the course of his fifteen year career as an industry consultant, Lowenstein has advised nearly every major player in the wireless communications industry. He has also had retainer relationships with top venture capital and private equity firms. Lowenstein was selected by Boston Mayor Thomas Menino to be part of an executive group to determine wireless strategy for the City of Boston. As one of the wireless industry's leading analysts, Lowenstein is a sought-after speaker, delivering keynote addresses at major industry and private corporate events.

Over the past 15 years, Lowenstein has published periodic newsletters and columns on the wireless industry, including the monthly "Lowenstein's Lens on Wireless," while running Mobile Ecosystem, and a monthly column for Wireless Week. Lowenstein has been an invited speaker numerous times across the United States at meetings and events hosted by industry trade associations, major wireless carriers, telecommunications infrastructure providers, accounting firms, wireless application developers, wireless CPE manufacturers, Wall Street equity research firms, and major U.S. banks. Lowenstein founded the Boston Wireless Braintrust, a group of twenty CEOs and wireless industry thought leaders who meet quarterly, on a proprietary basis, to discuss key industry issues, opportunities and challenges.

Lowenstein currently resides in Maplewood, New Jersey with his wife and two children.

# EXHIBIT C

# Verizon Wireless
## Technical Statement in Response to Skype Petition

## 1. Introduction

In its recent Petition to the Federal Communications Commission (FCC),[1] Skype attacks the fundamental controls all wireless carriers place within their networks to ensure reliable and equitable distribution of shared, reasonably priced services they make available to their millions of subscribers. This Technical Statement addresses Skype's misconceptions as to the technical and consumer-driven decisions behind Verizon Wireless's network management policies. Far from reducing competition and consumer choices, these practices in fact have led to many of the benefits that consumers enjoy from wireless devices and services.

## 2. Handset and Application Management

Throughout its Petition, Skype claims that carriers' device, software, and network integration testing and management efforts are designed solely to serve the interests of a carrier's bottom-line financials and not the interests of consumers. These claims are incorrect. Skype has profoundly underestimated the tasks and requirements related to consistently offering robust and reliable wireless network and services to subscribers.

For example, Skype claims that "carriers are using their considerable influence over handset design and usage to maintain an inextricable tying of applications to their

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

transmission networks and are limiting subscribers' rights to run applications of their choosing." *Skype Petition*, at 2. While it is certainly true that all wireless carriers exert some influence over the user devices and applications that run on their networks, within Verizon Wireless, these practices are undertaken in partnership with all of our approved vendors to ensure consistent and reliable performance of the features and services sold on the Verizon Wireless network.

A more accurate description of the handset and application development environment is that carriers, hardware manufacturers, application developers, value-added resellers, and infrastructure providers all work together to develop, deploy, and promote a wide array of increasingly enhanced versions of services to the enterprise (i.e., business customers) and individual subscriber base. Examples of recent advancements include mobile web browsing, Short Message Service (SMS), Multimedia Message Service (MMS), wireless e-mail, mobile Instant Messaging (IM), MP3 integration, and wireless navigation and location features. Given their pervasive integration into the wireless "value chain," these services could only have been developed through a cooperative effort between carriers, handset manufacturers, infrastructure providers, application developers, and standards setting bodies.

Each of the cooperative product development efforts employed by Verizon Wireless is specifically designed to bring new features and services to the consumer base to ensure that all newly developed services perform as they are advertised. These services can range from gaming applications to life-saving deployments of location-based services designed to locate customers in need of 911 assistance. Each service, whether it be entertainment or safety based, receives the same type of scrutiny regarding its relative

impact on the performance and reliability of the network -- the most critical factors in the pricing assumptions related to a given product offering.

Verizon Wireless, in particular, spends a significant amount of time and resources to ensure that all of its devices meet strict interference and general compliance guidelines. As noted above, much of this effort is coordinated through active partnerships with device manufacturers, application providers, and infrastructure vendors. But beyond this general coordination, Verizon Wireless has also built a diverse set of internal teams for the express purpose of ensuring that all devices perform as designed prior to their release into the retail marketplace.

## 3. Device Development

Approximately a year before the introduction of a new device onto the Verizon Wireless network, a device vendor will formally approach our internal device teams with the release specifications they intend to bring to their new product line at launch. These specifications are primarily developed to meet a formal device requirements document that Verizon Wireless puts out on a quarterly basis. This requirements document provides device vendors with guidelines on the minimum performance specifications required to introduce a handset onto the network. In addition to the exchange of technical documentation, typically, there are also a number of detailed technical meetings to review all the specifications related to the new products.

At approximately nine months before launch, Verizon Wireless typically has a face-to-face meeting with the device vendor to review its products' overall compliance with the device specifications matrix, which is based upon the device requirements document. The matrix includes approximately fourteen hundred specific device

requirements that each device must meet prior to its introduction into the marketplace. In addition to this effort, a separate compliance review takes place to ensure the device, as designed, will meet the Verizon Wireless user interface requirements (e.g., form, function, usability, etc.).

Assuming the matrix review meets the internal device teams' requirements, at approximately the six month mark, the device vendor submits prototype devices to be used in our "Safe for Network" (SFN) testing.[2] SFN is a specific series of tests designed to ensure that neither the device, nor the applications included in the device, will cause any harm to the shared network at large (e.g., consuming large amounts of RF bandwidth, initiating a high volume of call attempts). These tests include, but are not limited to, RF parametric testing of CDMA2000, 1xEVDO, and Global Positioning Satellite receiver, CDMA 2000 signaling conformance, AMPS RF performance (if applicable), Verizon Wireless Mobile IP (MIP) and Dynamic Mobile IP key Update (DMU), and MediaFLO (if applicable) testing. Additionally at this time, the device vendor conducts a Binary Runtime Environment for Wireless (BREW) readiness review with Qualcomm Information Services. If the Qualcomm testing passes, Verizon Wireless branded applications for VCAST video, music, instant messaging, etc. can be ported onto the new device.

When the device has successfully passed SFN testing, the device vendor is then permitted to have a small number of the new devices operating on a live Verizon Wireless network. This next stage allows the device vendor to perform the additional testing required for the vendor to submit devices to Verizon Wireless for what is referred

[2] Separately, the device manufacturer must ensure that the device passes the FCC's equipment certification procedures for mobile wireless devices.

to as "Phase 1" and "Phase 2" device approval. The remaining months, prior to launch, are dedicated to the completion of these approval phases and any additional training or documentation required to support the successful retail launch of the device.

Prior to Phase 1 device approval, the device vendor must submit its product to the Alcatel-Lucent, Motorola, and Nortel CDMA Development Group (CDG) interoperability labs. These labs use industry-approved tests to validate the operation of the device with the various infrastructure providers (e.g., Lucent, Motorola). In this phase, the devices are then put through a series of tests designed to certify the successful support of the following types of functionalities: Firmware Over the Air (FOTA), Product Support Tool, complete RF parametrics, signaling conformance, system acquisition, enhanced roaming indicator, E911, audio, accessories, MIP/DMU, Push-to-Talk (PTT) logging performance, Global Certification Forum compliance (GCF - global products only), 1xEVDO access authentication, Location-Based Services (LBS) performance, MediaFLO, and roaming. Phase I testing takes approximately one month to complete, but can take longer depending upon the performance of the handset during testing.

Phase 2 testing brings the devices back into Verizon Wireless' labs, so that we can conduct our own testing on the following services: Bluetooth, BREW, SMS, Enhanced Message Service (EMS), MMS, Wireless Application Protocol (WAP), data throughput (uplink and downlink), data connectivity, battery utilization, standby time, Over the Air Service Provisioning (OTASP), and OTAPA, FOTA, PTT (if applicable), BREW pre-load application, user interface, LBS, MediaFLO, call processing origination/terminations, and long call test. In addition, an internal user trial is also conducted during Phase 2 compliance testing. The internal trial is designed to collect

more subjective feedback on the overall performance of the handset and its associated applications.

After Phase 2 device approval is complete, Verizon Wireless device teams review all the test results to make a determination whether fixes to the device are so critical that a launch delay is required, or if minor adjustments to the device can be made after launch. If there are no "show stoppers" for a device, it receives technical approval and is permitted to be placed into queue for future retail distribution. At no time in the history of validating device specifications and performance of a handset and its associated applications, have the Verizon Wireless device teams ever encountered a new device that required no modification from the original specifications submitted by a device vendor prior to the launch of the device. While this simple fact validates the value that each of Verizon Wireless' internal device teams bring to the table, it also, more importantly, emphasizes why a healthy level of oversight by the carriers is not only prudent, but is fundamentally necessary to the success of all commercial wireless service offerings in providing the reliability and the capabilities that customers want.

Prior to the final release of the device into our sales channels, further due diligence may be performed (e.g., provisioning, billing), if it is determined that a device is being launched specifically to support a new service offering. An example of such a scenario would be the launch of any devices needed to support Verizon Wireless' real-time mobile video offering. This type of combined offering (i.e., handset and service) requires approximately two months of additional testing to ensure that all aspects of the combined device/service offering perform as expected.

Once all of the above testing and validation have been completed, a Verizon Wireless and device vendor launch team work together to prepare all of the necessary documentation needed to train internal and external sales people, and correctly develop all of the associated collateral for consumer education and information needed to assist in the launch of the device.

The wireless services regime advocated by Skype would make much of the above testing and compliance procedures impossible. If consumers can choose unilaterally what devices and applications to operate on wireless networks, then the controls over how those devices and applications affect the reliability and performance of the network will inevitably not be applied to some devices and applications. As illustrated below, it only takes one or two poorly performing devices or applications to disrupt the accessibility of the network for thousands of users, all of whom will look for responsibility to the network operator. Verizon Wireless and other wireless carriers have invested millions in developing network performance and reliability standards based on consumer preferences.

## 4. Feature Enablement

In addition to the coordination described above for standard device certification, more advanced devices sometimes require restrictions on the types of devices and services running on said devices. As an example, someone unfamiliar with complexities associated with developing and supporting even the most basic of service offerings (e.g., voice) may incorrectly assume that a CDMA handset can operate on any CDMA network and run any and all applications provided by a given wireless operator. Although some wireless carriers do share similar wireless interface standards (e.g., CDMA, GSM), this

choice of protocol is only the start of long list of device and application interdependencies that are uniquely built to meet the quality and performance specifications of a given wireless carrier. Skype's Petition does not reflect the resources needed to launch and maintain a commercial service offering in today's highly competitive environment.

Unlike other communication media, wireless carriers expend a tremendous amount of time, money, and energy ensuring that applications and handsets perform exactly as required, to ensure that our aggregate expectations on how the shared network facilities will operate is, in fact, accurate. CDMA handsets, although similar in many ways, also operate to meet all of the specific design criteria of a given wireless operator. It is for this reason that carriers restrict the kinds of devices and certain types of applications that operate on the network. Small deviations from our design criteria, while immaterial on an individual basis, can have a dramatic impact when their numbers multiply into the tens or hundreds of thousands of devices.

The complexities of this kind of effort can best be described through one of Verizon Wireless' recent handset and application offerings developed to deliver push-to-talk using our CDMA data network.

This service was based on the development of a custom application server and associated client software running on a specific handset. This product offering included what was thought to be an innocuous "presence" service that would update the on-net status for a pre-selected group of numbers commonly referred to as a "buddy list." As a user using the service turned his device on or off, all other users included in his buddy list would have their devices updated to show his new presence state on the network. In most

instances, the devices being notified were operating in what is referred to as a dormant state (i.e., non-established radio link). When each of these notifications was sent out by the presence application, it would cause all of the buddy list devices to experience a dormant/active transition on the network. In particular, this application drove, on average, 30 to 60 dormant/active transitions per hour for each push-to-talk subscriber. This adjustment in handset behavior resulted in a 1,500% - 3,000% increase in the typical dormant/active transitions we would see from our subscribers. This change severely impacted not only our cellular data network, but created a harmful situation by upsetting the normal operating model used for our voice network – a change that would potentially severely limit wireless users' ability to access the network's shared resources (i.e., blocked calls).

After carefully analyzing our options associated with this issue, we quickly realized there were two available solutions that we could employ to resolve the situation. One, we could more than double the number of switches used to operate our network to handle the increased rate of dormant/active transitions -- requiring an additional investment of many billions of dollars in our network. Two, we could withdraw support for the presence service for our push-to-talk product. We decided the best recourse was to eliminate the presence service from the application, and return the push-to-talk service offering back within the realms of the normal use patterns seen by other wireless users on our network.

This simple example showcases the features that can go wrong within a wireless network, even when a carrier has full control over a solution's associated device, application, and network infrastructure. Obviously, were resource-intensive applications

permitted to proliferate without our knowledge, even a small number of deployed devices could easily cripple the day-to-day operation of the network and the accessibility of the spectrum resource to consumers.

## 5. Security

Beyond the fundamental need to provide a robust and reliable network to our consumer base, a number of security-related issues underlie Verizon Wireless's development and distribution of devices and applications. Verizon Wireless maintains certain controls on devices that operate on its network in order to protect our customer's security interests, with the following customer goals in mind:

1. Preventing unauthorized disclosure of customers' private information.
2. Preventing third parties from hijacking or otherwise using Verizon Wireless services in an unauthorized manner.
3. Preserving the integrity of the operation of subscribers' devices.
4. Ensuring fair allocation of network resources.

As will be illustrated below, to protect our customers' security needs properly, Verizon Wireless requires a combination of complementary capabilities both on the device and within the network. As with all other service offerings, the pairing of devices with associated applications and network infrastructure must work in absolute harmony to allow the level of data and user integrity that is required to serve our customers. Should any aspect of this relationship fall outside of a carrier's control, the impact, from a security – either customer or network – standpoint, could be severe.

It is also important to note that, from a consumer standpoint, the topic of securing a wireless service offering is never easily compartmentalized into a device or an application or the network infrastructure. Most, if not all consumers, would likely believe that the responsibility for securing a wireless service offering rests solely with the carrier, irrespective of the segments of the service offering that may be responsible for a specific breach. For example, in the much-publicized "T-Mobile Paris Hilton" incident in 2005, it was reported that personal contact information and personal photos were extracted from Paris Hilton's wireless handset and/or wireless account either through a potential compromise of an available Bluetooth connection, or an attack on T-Mobile's internal databases, or some combination of the two. Neither the press nor general public was inclined to distinguish the source of the compromise from the network itself. The pertinent points were that the subscriber's private information was exposed and that T-Mobile was held accountable in the press.

Highly publicized events such as disclosure of a celebrity's personal information underscore the many difficult decisions that carriers need to make with respect to freedom of loading applications on a device versus device and network integrity. While, in a perfect world, every new interface and application technology would be made readily available to consumers as soon as they are developed, there are certain practical limitations (e.g., security vulnerabilities) that must be taken into consideration before these new types of technologies can be widely distributed.

With the protection goals and potential problems highlighted above, Verizon Wireless must plan to counter at least two threats, or vectors of attack.

1. The threat from within the device, which would typically be accomplished through malware on the device, and,
2. The threat from external attack to the device, which could be accomplished through the cellular network or through localized wireless capabilities such as Infrared, Bluetooth, or WiFi.

Of course, a blended attack involving both of these threats is possible.

Malware can be best described as an application that is designed to damage or compromise the integrity of a device or network without the informed consent of a user or network operator. Within the wireless environment, these threats can manifest themselves as pieces of software that reside on users' handsets, which could then migrate onto the shared network infrastructure, potentially impacting many thousands of users.

There are two key strategies in dealing with malware on devices – (a) to minimize its presence through prevention or through effective detection-and-removal and (b) to minimize its impact should these efforts fail. Because malware can undermine all of the protection goals we have noted above, Verizon Wireless believes that both strategies are essential.

Information can be found on the user's device that is deemed sensitive or private in nature. This information, while most commonly stored on a device, might also be stored in a network-based application service (e.g., an address book), or may represent Customer Proprietary Network Information (CPNI) obtained through network interaction (e.g., a location-based service, or LBS). Unless the device includes controls for access to particular application programmable interfaces (APIs) for this sensitive information, any device-based application, rogue or otherwise, could access it, broadcast it, and distribute

it to unauthorized third parties. Examples of countermeasures that Verizon Wireless promotes are application code signing (i.e., private-public key certification used to certify software authenticity) and access controls to these APIs with complementary testing to ensure that this sensitive information is properly handled. Again, as with all other aspects of network management, these access controls are carefully designed into every device and application and tested as they pass through our compliance labs, with the goal of ensuring that every priority related to security and resource management meets designed specifications.

Beyond the issue of personal information, malware such as worms can also be disruptive to the management of the carrier's network. Similar device-based controls, such as code signing, can help to minimize the presence of this type of malware and, hence, its impact.

Another security consideration is authentication of the user and/or device. Wireless carriers generally rely on device-based authentication for most services, meaning, the network recognizes the device rather than requiring the user to provide identification, e.g., through a password, although passwords may be required to enter certain network applications. Device-based authentication can increase the potential for malware to be used to access network application services. It is not practical for a user to put in, say, a login and password for each network-based service. In essence, the device is authenticated and "vouches" for the user. Malware disrupts that trust model, and the solution is for carriers to implement tighter controls on the device.

Device-based countermeasures could be employed to combat the issues raised above, but a device-based anti-virus is not a panacea or "magic pill" for addressing such

concerns. Even if carriers successfully tackled the business, operational, product immaturity, and customer choice challenges associated with a comprehensive anti-virus solution for devices – and these can hardly be discounted – other complementary controls such as the code signing are needed.

Verizon Wireless recognizes that network-based anti-virus solutions, designed to prevent the introduction of viruses from external sources, are possible controls. But, again, a similar set of attendant challenges would need to be resolved, and there would still be a need for broader set of harmonized controls between user devices, the applications that ride on these devices, and the network elements that control their interaction with other users. Even if these prospective network-based controls were 100% effective, malware could be introduced to the device in numerous ways through any of the varied access choices that consumers have available today.

One of the access choice-driven threats to a device can manifest itself through access to a local connection using a Wi-Fi, Infrared, or Bluetooth. While such a connection is in use, third parties could potentially:

- Unknown to the customer, steal service cycles and access the network, potentially adding charges to the customer's account (e.g., by bridging a local connection to the cellular network);
- Access network-based applications and services that rely on device-based authentication, potentially yielding private information; and,
- Obtain private information stored or cached directly on the device, information again that might have been obtained or derived from a network service.

Verizon Wireless believes that protecting customers from these threats, by designing some access limitations into its products, will not unduly restrict its subscribers from taking full advantage of their device capabilities. But, a completely open device model will neglect these protections, thereby compromising the trust consumers and enterprises place in a carrier's service offerings. Taking countermeasures does not demonstrate the desire to restrict users and promote a carriers' revenues, but rather, a carefully attentive and selective application of controls needed to ensure that our consumers' best interests are kept in the forefront of the decision-making process as it relates to service offerings.

By selective application of such controls, Verizon Wireless can first consider ways to empower users to protect themselves through education and awareness, default configuration, user prompting, etc. Verizon Wireless also carefully considers the ease with which a potential vulnerability might be exploited, and works to close any potential gaps that may prove harmful to an end user's wireless experience.

Whatever the service provided to the customer, there is an inherent level of trust that must be enabled between the wireless carrier and the customer. Much, if not all, of this trust is derived from Verizon Wireless' due diligence with device manufacturers and application providers that authentication credentials and device access are properly protected. Again, without our regimented approach to device and application certification, it would be impossible for a carrier to assure its customers, with any confidence, that the necessary security measures are in place to protect personal information and/or the overall performance of the shared network. If Verizon Wireless cannot establish a sufficient level of assurance that stored credentials are protected from

improper disclosure – attacked from within or without – then it cannot serve its customers' security interests and expectations.

Other threats to the network can also arise from seemingly innocent, but ultimately dangerous, sources. Disproportionate allocation of network resources can arise from devices or users that utilize exorbitant bandwidth, or through applications that "check in" or receive inbound push traffic with excessive frequency. While such applications may not use many packets or bytes, they still expend the limited network resources on the radio access network, either causing repeated call setup activity or preventing resources from being released for other subscribers. Such an application raises security concerns because it essentially hijacks network resources and prevents fair allocation of resources to other users, in a way that is similar to the failed "presence" application on the push-to-talk product offering discussed above.

Landline carriers do not face the same degree of capacity challenges. In the context of the Skype Petition, this is noteworthy for two reasons. First, the majority of consumers are not aware of how a device-based application behaves on the network, and billing them according to this behavior is not practical or in line with their expectations. Second, although network-based controls can help ensure some level of fairness, these controls are upstream from the radio access network – a carrier's most precious resource. Thus, in ensuring fair access to network resources, device-based controls are needed as complementary measures to network-based controls and deterrents to abusive subscriber behavior. A wireless regime in which users can use any device or run any application of their choosing would undermine those controls and the benefits they provide to subscribers.

## 6. Network and Device Complexity

Skype's Petition incorrectly assumes that the complexities and connectivity options available at the time of the many decades old *Carterphone* decision are similar to those available within with wireless marketplace of today. Skype claims that "consumers have the freedom to attach whatever devices they choose to their phone line, as long as the device does no harm to the network. This is made possible by the technical standards such as those of the RJ-11 telephone jack." *Skype Petition,* at 9.

The physical interface to the PSTN referenced by Skype oversimplifies the complex and varied world of wireless communications today. Among domestic Wide Area Network (WAN) providers alone, there are a wide variety of wireless access standards, all of which are incompatible with each other.

Although all cellular providers initially began offering service through a single standard developed by Bell Labs known as Advanced Mobile Phone System (AMPS), the onslaught of digital technologies brought with it a host of new, competing standards to be used for both voice and data communication. Examples of these differing technologies include, Time Division Multiple Access (TDMA), Integrated Digital Enhanced Network (iDEN), Code Division Multiple Access (CDMA), Global System for Mobile communication (GSM), Evolution Data Optimized (EVDO), High Speed Downlink Packet Access (HSDPA). In the future, newer revisions of both existing standards and newly created standards (e.g., WiMAX) will continue to proliferate throughout the commercial wireless space.

As is obvious from the varied air interfaces alone, the wireless world of today is far more complex than the wireline network at issue in the *Carterfone* decision. Each of

these standards requires specialized handsets with specialized interfaces, all of which need to be thoroughly tested and evaluated well before any integration into the network can begin.

While someone operating outside the industry might think that the easiest way around all these varied standards is to create a uniform handset that conforms to all of the available interfaces, such technical integration is from both an engineering and financial standpoint unmanageable.

Handset features, including the network interface standards employed (e.g., CDMA, GSM, WiFi) all come at a cost (price, performance, handset size, etc.). Verizon Wireless has, on a selected basis, chosen to integrate new network interface standards into some handsets, but not all. These decisions have been driven by both the perceived needs of the consumers and the complexity that comes with a more technically complex device.

For example, adding WiFi functionality to a handset can add roughly 24% to the cost of the device. In addition to the cost, WiFi functionality typically adds to the size and weight of a handset, and it also requires additional testing and validation to ensure operation of all the features expected to perform on the WiFi interface (in addition to all of the other standard CDMA interfaces). And, it presents new security risks, as discussed above. The additional interface also results in a greater drain on battery life, which results in a poorer performing handset from a consumer standpoint.

Installing additional interfaces multiplies the issues. If one were to take on the monumental task of adding all current and future network interface capabilities into that same handset, the cost and complexity associated with this massive integration (if it were

even possible), would result in a product -- given the additional cost, size, and degraded performance -- that no carrier would likely be capable of selling on the open market.

In addition to the device interface complexity, wireless network operators would have to contend with increased complexity in the day-to-day management throughout their operations. Mobile voice and broadband networks are engineered to provide a certain accessible capacity in specific geographic areas based on availability of spectrum, traffic patterns of actual use and anticipated user demand, among other factors. The mobile services offered today have been built on the success of carefully engineered deployment of high quality networks that maximize access and reliability within clearly defined performance thresholds. Mobile broadband networks require, in particular, a high degree of dynamic management to optimize the user experience, because bandwidth consumption of the variety of applications available to Internet access users is less predictable than traditional voice service.

Network management is thus key to maximizing accessibility and addressing variations in present and future demand on capacity and varying types of network utilization. Even though the security issues outlined previously are crucial to the trust that is required for a user to have confidence in our network's capabilities, network management is much more complicated than simply ensuring that the network is operating and protected from security risks. Dynamic usage management and performance enhancing applications are required to allocate resources and protect against isolated disruptions, unrelated to either malware or outside attacks, to ensure the best user experience attainable for the maximum number of users allowable on a given network. By contrast, if all users were allowed unrestrained, and thus unpredictable, access, few

users would find the resulting experience worth the price of subscription. Not only would the accessibility of the network to multiple users and many applications degrade precipitously, but also, the costs of managing the wireless network to provide the expected level of quality and reliability would skyrocket.

To understand some of the issues that may result from unfettered access to shared network resources, it is important to recognize that every device and every cell site operating on the network has a specific and calculable impact on the aggregate resources available to all consumer attempting to access a given carrier's resources. Should any one of these components behave in an unanticipated manner, the impact is never relegated simply to the offending device or piece of network infrastructure. Rather, these kinds of impacts affect both the immediate and surrounding resources that all consumers may be attempting to access at any time on a given day.

An example of the disruption a carrier can encounter when some aspect of the network operates in an unanticipated manner occurred in 2006, when Verizon Wireless discovered a situation where an FCC certified repeater was improperly installed within a Manhattan office building. This particular installation was performed without Verizon Wireless' knowledge by a well-intentioned customer looking to enhance the coverage within the building. Although the customer was informed by the manufacturer that the FCC certified device was thoroughly tested to operate effectively on a CDMA network, the solution immediately proved there is more to the integration of a device into a wireless network than simple certification.

Once this device was installed in the building, local RF engineers immediately began to see a degradation on both the local and surrounding network. When the final

impact of this rogue installation was calculated completely, this single device negatively impacted ~200 surrounding cells sites within the New York metropolitan area, which resulted in tens of thousands of blocked voice and data sessions on our network. While this particular instance resulted in lost revenue for Verizon Wireless and inconveniences to our customer base (i.e., frustration over poor service), this problem, if it would have gone unchecked, could have very well prevented the successful completion of a call into 911 or similar type of critical communication service – a scenario any wireless provider always strives to avoid.

This particular situation, although different than the one identified with our push-to-talk service offering, illustrates the same point. All of the service offerings within a wireless network require a service operator to have intimate knowledge of all the elements that could potentially impact the use of the network's resources (e.g., devices, applications, infrastructure, etc.). Without this specific knowledge and control, there can be no guarantee that the services Verizon Wireless and other carriers offer will perform to meet the type of quality and performance metrics consumers have come to expect.

## 7. Limitations of Shared Resources

Skype complains that the "largest wireless operators include in their terms of service explicit limitations that make it impossible for consumers to use the full features of 3G devices to access and utilize applications and services of their choosing." *Skype Petition*, at 18. While Verizon Wireless puts limits on the volume and types of uses available to individuals on the network, these limitations are designed to ensure that Verizon Wireless can offer all of its customers a specific level of service at a reasonable price point.

Unlike wireline networks, which essentially provide each user with a dedicated connection to the network, the "last mile" connection between a mobile user and wireless network operates on spectrum shared by all users on-line within the same geographic area. Each mobile user thus has some impact on the availability of a network signal connection to other users in the same geographic area, which varies depending the number of users, the applications they are running, and the various factors (time of day, weather, terrain, etc.) affecting signal strength in the area. The bottom line is that wireline networks generally can provide substantially more capacity on a continuous basis to an individual user or residence than a wireless network. Expectations based on the wireline experience must be adjusted to fit the realities of today's wireless networks.

With a shared "last mile" resource on the wireless broadband network, large capacity users can consume a disproportionate share of the available spectrum, which results in degrading or blocking access for other users in the same area. For most web browsing, email and intranet access applications, so-called "bursty applications," there will be little difference to the mobile user. A difference will be more noticeable for high-

capacity activities, such as downloading movies or games and peer-to-peer file sharing, a difference arising from the way capacity is consumed for various Internet activities.

"Bursty" activities, such as Internet browsing and email access increase and decrease capacity requirements in bursts while the user accesses and reviews data. Even if there are many users in one area, they do not all require the same amount of capacity at the same time. Moreover, users are not generally active in such sessions for long periods of time, and these applications are usually not time sensitive.

High capacity activities are the opposite of bursty activities in several respects, and so, affect the wireless network in significant ways. First, they require much more capacity, eating up the available spectrum allotment in the area where the user is located. Second, they require continuous streams of data usage, which cuts down on the advantages of intermittent use offered by bursty activities. Streaming video content can easily use in one hour the amount of data capacity required by Internet browsing for an entire month. Third, watching a movie keeps a user on-line for hours at a time, rather than in periodic intervals during a day, thus, impairing access by other mobile users for long stretches of time. Moreover, with the advent of data applications, networks have to cope with how software developers have designed their products, sometimes efficiently, sometimes not. The longer an inefficient application is running on a wireless network, the longer it can degrade performance for users in the same area.

Mobile service providers must monitor usage on a real-time dynamic basis to ensure that there is an appropriate allocation of the available resources, so the most users have access to the most resources at any given time. Skype's requests would impede that critical network management function.

## 8. Competitive Landscape

Beyond the fundamental misconceptions Skype demonstrates in its Petition with respect to handset and network integration, security, network complexity, and ongoing resource management, Skype incorrectly asserts that there is no self-correcting "maverick" behavior to force any of the four national carriers to introduce new services or lower existing price structures. *Skype Petition*, at 25.

Quite to the contrary, competitive pressure and "maverick behavior" is alive and well within the wireless space. The most recent example can be seen with Sprint Nextel's announcement offering unlimited voice and broadband data services to its customers. A recent BusinessWeek article reported that Sprint Nextel's "all-you-can-eat wireless calling plans...if adopted on a wider scale, could take a bite out of rivals' sales."[3] In addition, this same article advised that "competition is likely to accelerate amid communication-service providers."[4] This recent offering from one of the four major wireless service providers directly refutes the claims made by Skype. While it should still be assumed that, as with all other services offered by the national carriers, there are some service restrictions on the allowable utilization of Sprint Nextel's offering, this one example showcases the downward pricing pressure all of the carriers continue to face with their integrated service offerings.

In addition to Sprint Nextel's recent offering, other new entrants (e.g., ClearWire) and local wireless providers (e.g., MetroPCS) are making inroads within the wireless voice and data markets, by offering their own versions of these same all-you-can-eat packages. Each of these new and existing entrants offers a continual barrage of pricing,

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[3] Olga Karif, "Sprint's All-You-Can-Talk Offer," BusinessWeek, (March 2007)
[4] *Id.*

technology, and innovation pressure that compels each of the four national carriers to expand beyond their comfort zones and develop new, compelling applications and services at the fastest pace sustainable. Doing anything to the contrary would limit each carrier's ability to either acquire new customers, or retain the existing base of customers.

**DECLARATION**

I, Brian Higgins, am a Director of Technology in the Network Services department of Verizon Wireless. As part of my responsibilities, I have personal knowledge of the Verizon Wireless' network management, product development and design procedures, security practices, and general policies on delivery of wireless products and services to subscribers. I have prepared, or directed preparation, of the discussion in the foregoing Technical Statement in response to the "Petition to Confirm a Consumer's Right to Use Internet Communications Software and Attach Devices to Wireless Networks" submitted to the Federal Communications Commission by Skype Communications, S.A.R.L., on February 20, 2007.

I declare under penalty of perjury that the foregoing is true and correct to the best of my personal knowledge.

Executed on April 22, 2007.

Brian Higgins
Verizon Wireless