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Exclusion and sources of technological competition in mobile networks

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Exclusion and Sources of Technological Competition in Mobile Networks

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Abstract

The degree of competition in a market is one of the key determinants of its health and the related need for regulatory remedies. Modern industrial economics and their legal counterpart, antitrust law, have distilled a set of factors to consider when assessing the competitive pressures firms face in the market. However, the economic aspects of competition are not enough to give the full picture of the sources of competitive pressures in technology-intensive industries such as mobile telecommunications. We present here an account of how the technological nature of mobile telecommunications alters our perception of the true competitive conditions actors face in the mobile telecommunications industry. This technological side of competition has remained so far either marginal or presented in an unsystematic way. It is only by considering all aspects of competition—economic and technological—that one can assess the need for regulatory intervention to make up for any perceived lack of competition.

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1 . Technological Competition and the Ability to Exclude

Few topics in telecommunications policy have proven as enduring as exclusion. Exclusion, or in antitrust jargon foreclosure, is the practice of refusing proper access to a complement in the upstream or downstream market along the value chain, or to a competitor horizontally.¹ Because exclusion essentially blocks some inputs or distribution channels from the value chain it has generally been treated with hostility and has been associated with anti-competitive and anti-innovation effects.²

However, the mere ability to exclude does not necessarily result in harm for the competitive conditions in the market. One of the basic tenets of market organization is that if the process of competition remains vibrant, occasional threats should not be considered a source of concern without proof of the potential to incur actual harm.³ Along the lines of law and economics, and antitrust analysis we adopt here the view that for exclusion to be harmful it needs to diminish the sources of competition. Based on that we suggest that the technical nature of mobile telecommunications networks increases the sources of competition, thereby making the industry more competitive and conversely reducing the harmful effects of exclusionary practices.

Simply asking where does one look for competition begets the tautological answer “competitors.” The obvious weakness here is that this answer fails to help identify who

1 Patrick Rey & Jean Tirole, A Primer on Foreclosure, in Handbook of Industrial Organization (Vol 3) 2145, 2148 (#### eds. 2007).

2 See among others Mark A. Lemley & Lawrence Lessig, End of End-to-End: Preserving the Architecture of the Internet in the Broadband Era, 48 UCLA Law Review 925 (2000); Timothy Bresnahan & Manuel Trajtenberg, General Purpose Technologies 'Engines of Growth', 65 Journal of Econometrics 83 (1995); Brett Frischmann, Infrastructure: The Social Value of Shared Resources (2012); Susanne Schotchmer, Standing on the Shoulders of Giants: Cumulative Research and Patent Law, 1991 Journal of Economic Perspectives 29 (1991); Philip J. Weiser, Law and Information Platforms, 1 Journal on Telecommunications and High Technology Law 1 (2002).

3 See infra at

competitors are and where they come from. One may be inclined to think that existing direct (horizontal) competitors are the only players in the position to exert pressure. Or that once competitors emerge consumers will actually be able to switch to them. However, as decades of scholarly and judicial developments in antitrust law and industrial economics demonstrate, the competitive forces that constrain a firm in the market are more complex.⁴ To this complexity, technology adds an extra layer because it creates new opportunities for firms to compete and for consumers to access their preferred services and products.

We adopt here a simple but effective framework for competitive analysis inspired by antitrust law, which in turn relies on industrial economics to identify the relative and important factors in considering the competitive pressure firms face in the industry. The goal is to use that framework in examining the role of technology by superimposing arguments that relate to the technology-intensive nature of mobile telecommunications. The inclusion of technological competition in the analysis will hopefully provide a more comprehensive understanding of the competitive interrelations of firms in the mobile telecommunications market.

In considering sources of competition, the mainstream analysis of industrial economics and antitrust today look mainly at three things:⁵ (a) who are the potential competitors competitors. Business strategies are delineated by the responses of other firms in the market, which are in the

4 The emergence of modern industrial economics and the transition from the Harvard School of antitrust to the Chicago school helped structure the market analysis on a sounder methodology. From the vast literature, good evolutionary accounts can be found in Herbert Hovenkamp, *Post-Chicago Antitrust: A Review and Critique*, 2001 *Columbia Business Review* 257 (2001); F. M. Scherer, *The Posnerian Harvest: Separating Wheat from Chaff* (Reviewing *Antitrust Law: An Economic Perspective* by Richard Posner), 86 *Yale Law Journal* 974 (1977); Herber Hovenkamp, *Antitrust Policy After Chicago*, 84 *Michigan Law Review* 213 (1985); Nelson, *Comments on a Paper by Posner*, 127 *University of Pennsylvania Law Review* 949 (1979).

5 See generally the seminal article by William Landes & Richard Posner, *Market Power in Antitrust Cases*, 94 *Harvard Law Review* 937 (1981).

position to provide close substitutes.⁶ This is known as supply-side substitution.⁷ It relates both to the competitive response of existing players in the market, and to potential entry that business strategies will attract; (b) the demand side of the market, which considers how consumers react to business strategies, and specifically whether they can and they will switch to a competitor in response to a firm's certain behavior in the market.⁸ Alternatives in the supply side may be there, but if consumers cannot get to them, the market is still locked in a bottleneck; (c) lastly, a recent consideration that is beginning to emerge in analyses of competitive conditions considers the durability of market power. The idea is that market power is a source for concern only if it can persist through time;⁹ otherwise it will dissipate quickly under the competitive pressure of other market players.¹⁰

Together, these three factors answer not only the question of where to look for competition, but also whether these sources are actually available to consumers, and whether they can be a persistent cause of concern for regulators or if they are simply transient. We find that technological considerations can be overlaid to this framework, and that in fact the technological component is necessary if one is to fully appreciate the extent of competitive pressures firms face in the market.¹¹ The idea that historical factors or economics alone can fully explain today the

6 Frank H. Easterbrook, *The Limits of Antitrust*, 63 *Texas Law Review* 1, 20 (1984).

7 Hovenkamp, *Federal Antitrust Policy: The Law of Competition and its Practice* 88 (4th ed 2011). For an application of this factor in antitrust see *Telex Corp. v. IBM Corp.*, 510 F.2d 894 (10th Cir. 1973), cert. denied at 423 U.S. 802 (1975).

8 Hovenkamp, *supra* note 7 at 101. For an application of this factor in antitrust see *United States v. E.I. du Pont de Nemours & Co.*, 51 U.S. 377 (1956).

9 Robert Jacobsen, *The Persistence of Abnormal Returns*, 9 *Strategic Management Journal* 415, 415-417 (1988); Frank H. Easterbrook, *The Limits of Antitrust*, 63 *Texas Law Review* 1, 3 (1984).

10 Thomas G. Krattenmaker, *Monopoly Power and Market Power in Antitrust Law*, 76 *Georgetown Law Journal* 241, 248-250 (1987).

11 This type of technological competition was popularized by Joseph Schumpeter in the 1940s, it was forgotten later for decades, only to re-emerge recently. See, e.g., Michael Tushman & Philip Anderson, *Technological*

strategic interactions that define the degree of competition in an industry driven and dominated by rapid technological progress is arguably an incomplete account of reality.¹²

Technology is an important factor to study not simply because the details of the technical design of networks offer complementary support to economics or policy,¹³ but rather because technology directly biases the debate, as it creates the playing field on which economic and policy actors will tussle to defend their interests.¹⁴

Every design consists of rules that forge the relationships among the partaking actors, and even seemingly neutral decisions change the constellation of interactions and redefine the distribution of power among actors.¹⁵ In every technical design various considerations are embedded and serve as influential determinants of whether a design will be accepted or rejected.¹⁶ To fully appreciate, then, the competitive interrelations among actors in an industry,

Discontinuities and Organizational Environments, 31 *Administrative Science Quarterly* 439 (1986); Sidney Winter, Schumpeterian Competition in Alternative Technological Regimes, 5 *Journal of Economic Behavior & Organization* 287 (1984); Timothy F. Bresnahan & Shane Greenstein, Technological Competition and the Structure of the Computer Industry, 47 *The Journal of Industrial Economics* 1 (1999); Robin Mansell, *The New Telecommunications* (1994).

12 See Marcelo Cataldo et al., Socio-Technical Congruence: A Framework for Assessing the Impact of Technical and Work Dependencies on Software Development, *Proceedings of the 2008 ACM-IEEE International Symposium on Empirical Software Engineering and Measurement*, Kaiserslautern, Germany.

13 See Christopher S. Yoo, Law and Technology: Toward a Closer Integration of Law and Computer Science, 57 *Communications of the ACM* 33 (2014).

14 See David D. Clark et al., Tussle in Cyberspace: Defining Tomorrow's Internet, 32 *ACM SIGCOMM Computer Communication Review* 347, 349-51 (2002). See also Robin Mansell, *The New Telecommunications* 35 (1994) ("The production of products and services within the communication environment is the concrete manifestation of the dynamic processes at work in the generation and implementation of the public telecommunication infrastructure. In this sense, the telecommunication system is much more than a technical system composed of hardware and software, transmission links and switching apparatus. It is a technological system which embraces the technical artefacts and the institutions which shape its development, diffusion and use.").

15 Robin Mansell, *The New Telecommunications* 4 (1994).

16 *Id.* at 35 ("The production of products and services within the communication environment is the concrete manifestation of the dynamic processes at work in the generation and implementation of the public telecommunication infrastructure. In this sense, the telecommunication system is much more than a technical system composed of hardware and software, transmission links and switching apparatus. It is a technological system which embraces the technical artefacts and the institutions which shape its development, diffusion and use.").

one has to consider not only what markets traditionally identify as sources of competitive pressure, but also how the technological nature of mobile telecommunications introduces new forms of competition that are not prevalent in non-technical industries. In essence, our inquiry here is to analyze whether and how competition is any different in technology-dominated industries such as mobile telecommunications.

We begin by documenting the various ways by which the technical structure of mobile telecommunications networks strengthens competition in the market, either by facilitating entry or by fostering conditions for competitive pressure by existing players. Then, on the demand side, we show how consumers are able to utilize interconnection and multihoming to facilitate access to competing products and services making competition more meaningful. Lastly, we examine the issue of the duration of market power rivals can maintain in the market, and suggest that in technology-intensive markets such as mobile telecommunications sources of competition may find it harder to maintain their competitive advantage.

2 . Structural Prerequisites for Anticompetitive Exclusion

While theoretically any firm in the market can choose to exclude or discriminate against inputs or distribution channels, not every firm's exclusionary practices can have a distorting effect on the market. To do so would require that the excluding firm has some degree of market power.¹⁷ This is not to say that exclusion by a minor actor could not occasionally disadvantage a few direct competitors, complements or consumers, but that minor actors would not be in the

¹⁷ See Daniel Spulber & Christopher S. Yoo, *Networks in Telecommunications: Economics and Law* 144 (2009); EU Guidelines, *supra* note ###, at §22.

position to harm competition or innovation as institutional processes.¹⁸ The consequences of a limited scale exclusion would not be grave because existing firms or potential entrants stand ready to offer what the excluding actor has denied the market, and sooner or later the pressure from the general competitive conditions will discipline the pathogenic actor.¹⁹ To illustrate, Microsoft cannot credibly be said to have the ability to harm competition or innovation in the mobile applications market if it decides to block an application on its Windows Phone, because it only has a 3% market share. The claim is different in desktop computing, where Microsoft has a market share between 60% and 70%.²⁰

Although market power is usually defined as the ability of an actor to raise prices by a substantial degree and in a non-transitory manner, market power can also manifest itself in non-price ways: strategic behavior, such as exclusion, also presupposes and is the result of market power.²¹ And because market power itself is not frowned upon (for example, intellectual property rights are a form of tolerated monopoly), the practices it enables must it associated with anti-competitive harm. In the case of a price increase, the harm is that consumers have to pay more for the same product. In the case of exclusion the potential harm is the raising of competitors' costs,²² or the inability of competitors or complements to reach necessary inputs or distribution channels, which in turn impairs the dynamic element of competition and suppresses sources of

18 Sullivan & Grimes, *supra* note ###, at 21. Easterbrook, *supra* note ###, at 20.

19 Easterbrook, *supra* note ###, at 20.

20 For a list of different usage shares measurements see Usage Share of Operating Systems, Wikipedia, available at http://en.wikipedia.org/wiki/Usage_share_of_operating_systems (###date), and

21 Herbert Hovenkamp, *Federal Antitrust Policy: The Law of Competition and its Practice* 88 (4th ed 2011); Sullivan & Grimes, at 29-30.

22 See, e.g., Thomas G. Krattenmaker & Steven C. Salop, *Anti-competitive Exclusion: Raising Rivals' Costs to Achieve Power over Price*, 96 *Yale Law Journal* 209, 234-238 (1986).

innovation.²³

The market power requirement and its relation to exclusion were summarized well in the Lorain Journal case.²⁴ The *Journal*, a newspaper published in Lorain, Ohio, where it enjoyed a 99% market share, refused to accept any local advertisements coming from agents who also advertised in WEOL, a local radio station, which was perceived by the Journal to compete in the news dissemination market. The Court analyzed the market conditions and concluded that the Journal's prominent position in the market made it “an indispensable medium of advertizing.”²⁵ Therefore, the Journal's decision to block advertizers who cooperated with WEOL as well had a detrimental effect both to them and to the prospects of competition in the Lorain market, because other entrants (such as WEOL) were denied access to advertizing revenues. Had the Journal not enjoyed such a dominant position, it wouldn't have been able to extort advertizers; they would simply turn to the Journal's competitors.

In the Lorain case the ability to exclude was attributed to the newspaper's near-monopoly market share. The Journal had a 99% penetration rate and the fact that it sustained such high market share from 1933 until 1948 convinced the Court that it lacked serious competition which made exclusion effective and persistent. But market share, albeit a helpful first indicator, is not any more relied on exclusively to determine the competitive advantage of a firm in the market. Other indexes come into play in establishing that an actor has accumulated the kind of feared influence over the market that would allow him to block out potential rivals.²⁶

23

24 Lorain Journal Co. v. United States, 342 U.S. 143 (1951).

25 Lorain Journal, at 152

26 See generally the seminal article by William Landes & Richard Posner, Market Power in Antitrust Cases, 94 Harvard Law Review 937 (1981).

Today the most standard market analysis will insist on certain structural characteristics before it can conclude that a firm's ability to exclude can result in competitive harm in the market. In particular a firm must possess *substantial* and *non-transitory* power in a *given market*, which it would then leverage to exclude complements or rivals.²⁷ The “substantial” element tells us the degree of power, which is determined by proxies such as market share, the degree of the ability to raise price or to (afford to) exclude.²⁸ The measurement itself (whether it reaches up to the *substantial* level) is an empirical question and is outside the scope of the analysis here. The “non-transitory” element dictates that the identified market power must be durable, whereas the “given market” element means that power is assessed within certain market boundaries. Market boundaries are delineated by demand and supply substitution (elasticities of demand and supply).

These factors, while they may seem sufficiently separate, are intertwined. The degree of market power (“substantial”) cannot be measured unless the market has been defined (“given market”), which in turn presupposes knowing the demand and supply substitution conditions. Consequently, to say that an actor's *ability* to exclude can inflict competitive harm one must prove (a) that supply side substitution is low, (b) that demand side substitution is difficult, and (c) that these conditions can hold for an appreciable duration of time.

2.1 SUPPLY SIDE CONSIDERATIONS

Supply side substitution (also known as supply elasticity) is the measure that determines the

27 Sullivan & Grimes, at 23-24. Hovenkamp, *supra* note ###, at 88-89. Cf. Merger Guidelines, *supra* note ###, at 7.

28 See Sullivan & Grimes, *supra* note ###, at 59-70 (where the authors discuss the different proxies and parameters that are taken into account when measuring market power).

response of competitors to a certain action.²⁹ It can mean that an action attracts new entry by competitors, or that it causes countermeasures by existing competitors.³⁰ So, supply side substitution can be measured either as a parameter of market definition (i.e. anticipated responses by competitors) or as a parameter of entry barriers (i.e. potential entry).

Assume a downstream firm that excludes an upstream input with the goal to deny it of a distribution channel making it more costly for it to reach consumers. This strategy cannot be successful if the downstream firm's rivals are ready to offer a distribution channel to the input or if the input expands into the downstream market itself.³¹ Consider also the opposite situation where a downstream firm excludes its competitors from accessing a cost-saving input with the goal to make them less competitive by raising their costs (“cost” here is used generically to denote any competitive advantage).³² For this strategy to work one must assume that the input market is protected by entry barriers so that no other cost-saving input is available to competitors can join.³³ In effect, if whenever an actor attempted to dominate the market or exercise his power, new actors entered the market or existing actors reacted with a competitive strategy, the effectiveness of anti-competitive strategies would be limited, even to the point that anticipation of countermeasures would eclipse the incentive behind them.³⁴

29 Hovenkamp, *supra* note ###, at 118-119, 123.

30 Cf. Merger Guidelines, *supra* note ###, at 15-16 and 27-29 (where it is proposed that the response by competitors should be assessed *inter alia* based on timeliness, likelihood and sufficiency).

31 Krattenmaker & Salop, *supra* note ### (yale law journal), at 254.

32 This in turn presupposes that the input supplier has an interest in partnering only with the exclusionary downstream firm, and for this to be profitable for the input supplier that downstream firm must possess a rather large market share. See Malcolm B. Coate & Andrew N. Kleit, Exclusion, Collusion, and Confusion: The Limits of Raising Rivals' Costs, Federal Trade Commission Working Paper No. 179, October 1990, at 8-14. See also Thomas G. Krattenmaker & Steven C. Salop, Analyzing Anticompetitive Exclusion, 56 Antitrust Law Journal 71-89 (1987). This problem disappears if the upstream and downstream firms integrate.

33 Coate & Kleit *supra* note ###, at 7.

34 “Ease of Entry” is now considered a standard defense in mergers. See Sullivan & Grimes, *supra* note ###, at

Supply side substitution is a relatively recent consideration in analyzing market structure. One of the first cases to explicitly take it into account was *Telex Corp. v. IBM Corp.*, where the issue was whether IBM monopolized the market for “plug-compatible” peripherals.³⁵ To assess this the court had to define the market, and, by extension, IBM's competitors. The district court defined the relevant market as *IBM plug-compatible* peripherals under the rationale that non-compatible peripherals could not be used by users of IBM machines.³⁶ The circuit court reversed the decision opining that producers of non-compatible peripherals could switch to producing compatible peripherals, and that they could use cheap adaptors to make non-compatible peripherals compatible.³⁷ In effect the circuit court expanded the competitors list to include not only direct and existing competitors, but also potential competitors that could switch from neighboring markets. Under this analysis, the effect of IBM's exclusionary strategy was limited also by firms that initially were not direct competitors (due to incompatibility) but could become such in response to IBM's actions.

By factoring in all the potential competitive sources one is in a better position to assess the true power of an actor. The question is who counts as a potential competitor that can counterbalance exclusionary practices.³⁸ A credible intention to compete as well as the technical expertise to do so are essential. We revisit below the issue of how the technology-intensive nature of mobile telecommunications helps with the emergence of more sources of competitive

603-608.

35 510 F.2d 894 (10th Cir. 1973), cert. denied at 423 U.S. 802 (1975). See similarly in Europe *Europemballage Corporation and Continental Can Inc. v. Commission*, ECR 215 (1973).

36 367 F. Supp. 258, 276 et seq. (1973)

37 510 F.2d 894, at 919.

38 See Hovenkamp, *supra* note ###, at 22.

pressure that can serve as a backstop to the intention or effect of exclusion.

2.2 DEMAND SIDE CONSIDERATIONS

Demand side substitution refers to the degree of substitutability of a product or service in consumers' eyes.³⁹ In economics this factor is called cross-price elasticity and it reflects the rate at which *consumers switch* to a competing product in response to a price increase.⁴⁰

In the case of exclusion in telecommunications where many products and services act as multi-sided platforms, substitutability means the ability of end users *or* developers to turn to a product or service similar to that which is excluded. Because in telecommunications the end user experience is the combination of consecutive platforms and inputs, substitutability can be the result of either switching to a competitor of the exclusionary actor or to a competitor of the excluded input. For instance, if Apple blocks an application on the iPhone, demand side substitutability is the extent to which end users can switch to a similar application or to a competing mobile operating system/phone. The effectiveness of exclusion in this case is analogous to the extent of market power the excluding actor holds, and if there are sufficient players remaining, then exclusion can hardly be the source of competitive harm.⁴¹

From the perspective of the demand side, effective exclusion would mean either that there are no competitors to whom end users or developers can switch, or that there are, but something prevents end users or developers from switching. The former describes a monopoly situation

39 Hovenkamp, *supra* note ###, at 101.

40 For a famous application of this factor in antitrust see *United States v. E.I. du Pont de Nemours & Co*, 51 U.S. 377 (1956).

41 Sullivan & Grimes, *supra* note ###, at 631

(either complete lack of competitors or lack of close substitutes). The latter can be attributable to various reasons including high switching costs, the technical inability to use the substitute (e.g. because of incompatibility), behavioral considerations (e.g. brand loyalty especially in the case of a primary product and a complement both of which can be supplied by the same firm), and the inability to reach competitors or substitutes because they are in different geographical markets (this is true even on telecommunications networks, where some services are available only to users from a specific country or region).⁴²

2.3 DURABILITY OF THE COMPETITIVE ADVANTAGE

The observation that the structural conditions for effective exclusion are present is still not conclusive evidence of competitive harm in the market. The observed conditions that give rise to market power can simply be the fortunate confluence of factors such as shocks in supply and demand, changes in consumer taste, or the introduction of a new technology in the market.⁴³ Such factors are ephemeral and can lead only to spikes of market power, which is naturally bound to attenuate when the factors that gave rise to it disappear.⁴⁴ On the other hand, market power can be attributable to more resilient factors, such as industry concentration (and the concomitant collusion and suppression of competition) and entry barriers, which are stronger indications that market power may persist.⁴⁵

42

43 Robert Jacobsen, *The Persistence of Abnormal Returns*, 9 *Strategic Management Journal* 415, 415 (1988).

44 Cf. Merger Guidelines, *supra* note ###, at 16 (where it is acknowledged that market shares can understate or overstate a firm's actual power, and that historical data must be taken into account to determine whether the observed market share is transient or persistent).

45 Jacobsen, *supra* note ###, at 417.

To be a source of concern the structural conditions underlying exclusion must be non-transitory.⁴⁶ A firm that builds up dominance at some point in a market's lifetime cannot be assumed to have the ability to harm the competitive process through exclusion, because normally in competitive markets the buildup of chronic market power is considered a disequilibrium phenomenon.⁴⁷ The amassed market power is expected to dissipate thanks to the pressure coming from existing competitors or new entrants. Therefore, sustaining market power is an extraordinary condition, which requires the continuous conflux of the causal factors. These factors must be proven, rather than assumed, and any conditions that might accelerate the attenuation of market power should also be considered. We propose below that the technology-intensive nature of the mobile telecommunications market presents such a case.

To be sure, even transient market power can inconvenience competitors or have some degree of negative impact on the market, and in that sense be of (limited) competitive significance. But the reason why transient market power, despite its real -however limited- consequences, is not enough to evoke regulatory or judicial response is that such response comes with a cost. One of the great downsides of regulation and adjudication is that both are very resource-intensive, time-consuming, and maybe most importantly irreversible.⁴⁸ With efficient markets, an anomaly that results in some market power will be short-lived. As Judge Easterbrook put it “judicial errors that tolerate baleful practices are self-correcting, while erroneous condemnations are not.”⁴⁹ A premature or erroneous intervention to rectify perceived anticompetitive conduct will cause the

46 A common proxy for market power is *persistent* high profits, whereas anecdotal evidence of supra-competitive profits does not suffice. See Sullivan & Grimes, *supra* note ###, at ###

47 See, e.g., Thomas G. Krattenmaker, Monopoly Power and Market Power in Antitrust Law, 76 Georgetown Law Journal 241, 248-250 (1987).

48

49 Easterbrook, *supra* note ###, at 3.

benefits of a potentially beneficial strategy to be lost for good, whereas allowing potentially harmful conduct should pass the test of time before regulatory authorities or courts are convinced that it will not go away without intervention.

3 . The Technology Component in the Structural Prerequisites of Anticompetitive Exclusion

The conditions presented above are not immutable from industry to industry. The special characteristics of a given industry may cause them to apply with lesser or greater vigor. We propose here that the technology-intensive nature of mobile telecommunications exerts significant influence on the demand and supply sides' reactions to exclusion as well as on the time horizon of exclusion. In detail we trace how technology (a) multiplies the sources of competition and facilitates competitive interactions on the demand side, (b) simplifies and nurtures the ability of consumers to reach substitutes and gain access to alternative routes to the desired products and services, (c) changes how we think of the durability of market power at the root of exclusionary practices. Because technology is such an important parameter, not taking into account technological competition would result in a distorted picture of the state of the market and potentially result in underestimation of the competitive pressures firms face in the market.

3.1 SUPPLY SIDE CONSIDERATIONS

The common perception of the organization of markets is that actors who have similar functions in the value chain, i.e. they provide similar products or services, are competitors, and are placed in a horizontal relationship, whereas, actors that provide services and products that are meant to work together in the course of generating value are thought to be complements to each other, and are placed in a vertical relationship.⁵⁰ Indeed, competition law by and large studies the effect of practices of *competitors*, that is actors *within* the same market. Albeit intuitive, this approach overlooks the important competitive pressures that can emerge in parts of the value chain that do not belong in the same level (and therefore are not in a horizontal relationship), as well as the dynamic interfacing of the different parts of the value chain.⁵¹ We identify two groups of ways by which the technical nature of mobile networks facilitates supply side competition in that direction.

3.1.1 Multiplication of Potential Entrants and Competitive Pressure

This section traces the ways by which the technical nature of mobile telecommunications facilitates entry thereby making the supply side more responsive to exclusionary practices. The possibility of entry either weakens the effects of exclusion or acts in a dissuasive manner to

50 See Robert L. Steiner, Vertical Competition, Horizontal Competition, and Market Power, 53 The Antitrust Bulletin, 251, 251-253; NonHorizontal Merger Guidelines (Originally issued as part of "U.S. Department of Justice Merger Guidelines," June 14, 1984, §4.0 ("By definition, nonhorizontal mergers involve firms that do not operate in the same market.")).

51 See Steiner, supra note ###, at 256-259; Ioannis Lianos, The Vertical/Horizontal Dichotomy in Competition Law: Some Reflections with Regard to Dual Distribution and Private Labels, in Private Labels, Brands and Competition Policy 161 (Ariel Ezrachi & Ulf Bernitz eds. 2009).

prevent exclusion from taking place in the first place.

3.1.1.1 Technological Proximity and Vertical Entry

In the classic static view of a value chain the various layers that make it up are thought to have been assigned *distinct* roles, and the final product or service is the result of the cumulative contributions of all layers.⁵² This understanding implies that, although the layers are working together, they are separate and each is confined to its own respective area of activity. A software developer will contribute the applications, a hardware manufacture will contribute the device, a network provider will contribute connectivity and so on.

However, there is nothing that axiomatically locks firms in a single layer. In fact it is rather intuitive that, given the opportunity and provided that it makes business sense, a firm in one layer can enter adjacent layers. In this context, firms that used to serve as complements to other levels of the value chain can transcend their boundaries and enter a competing relationship with their once complementors.⁵³ Vertical mobility of this kind adds to the supply side pressure the same way direct horizontal entry would occur to fill in whatever the excluding firm deprived the market of.

Technology-driven industries are particularly prone to vertical mobility. As Bresnahan and Greenstein have persuasively argued, the technological interdependence of firms along the value chain and the ability of firms to accumulate technical knowledge around their surroundings

⁵² See, e.g.,

⁵³ Timothy F. Bresnahan & Shane Greenstein, Technological Competition and the Structure of the Computer Industry, 47 *The Journal of Industrial Economics* 1, 37-38 (1999).

enables them to cross over to neighboring layers upstream or downstream:

“Technically, there are no given and exogenous boundaries between the layers. The functions now performed by one platform component might instead be performed by another. Both software and hardware have shown this malleability. The firms supplying key components of the same platform often have broadly similar technical capabilities. Each would be capable of taking over the other’s position.”⁵⁴

This process can take time. Established platforms and technologies can be hard to dislodge because they are linked to significant investments, a well-developed customer base, and often lock-in effects.⁵⁵ But prospective entrants can eventually amass the necessary knowledge and capital over time, “attain sufficient capabilities to attract a larger network of suppliers and support ... [and] grow strong enough to move into an old platform's market.”⁵⁶ Cohen and Levinthal describe a similar process, which they call *absorptive capacity*.⁵⁷ The absorptive capacity of firms increases with their familiarity with the new knowledge they acquire from another firm, and so the closer the firms are in terms of prior knowledge and activities proximity the easier it is for them to cooperate or compete.⁵⁸

54 Timothy Bresnahan, New Modes of Competition, in Competition, Innovation and the Microsoft Monopoly: Antitrust in the Digital Marketplace, 155 (Jeffrey Eisenach and Thomas M. Lenard eds, 1999).

55 See John Sutton, Sunk Costs and Market Structure ### (2007) (who concludes that a platform or technology incurs significant endogenous sunk costs on the basis of irreversibility, specificity, unlimited efficacy, and (near-) unanimity about efficacy). See also Stanley M. Besen & Garth Saloner, Compatibility Standards and the Market for Telecommunications Services, in Changing the Rules: Technological Change, International Competition, and Regulation in Communications 177, 194-199 (Robert W. Crandall & Kenneth Flamm, eds 1989).

56 Bresnahan & Greenstein, supra note ###, at 20-21.

57 Wesley M. Cohen and Daniel A. Levinthal, Absorptive Capacity: A New Perspective on Learning and Innovation, 35 Administrative Science Quarterly 128, 128 (1990). See also Joris Knobens & Leo A.G. Oerlemans, Proximity and Inter-Organizational Collaboration: A Literature Review, 8 International Journal of Management Reviews 71, 77-78 (2006).

58 Cohen & Levinthal, supra note ###, at 135-136.

In effect, firms “that had previously supplied different segments, now compete for the same customers.”⁵⁹ Potential entrants are no longer only firms that do business in the same market (horizontal competition), but also firms that supplied a necessary component within the same value chain, have a good understanding of the end service or product, and can therefore tweak their technology to move upstream or downstream and expand to another level too. If a firm, then, decides to exclude inputs or foreclose distribution channels, thereby creating unmet demand in the market, these “technologically adept” firms are waiting in the wings to fill in.

The greater the technological proximity between two layers, the easier it is for firms in separate layers to “invade” each others' turf and directly introduce competing products and services. Neighboring layers are particularly good candidates for that.

Consider, for example, the gradual expansion of Google into the mobile industry value chain. Google was initially solely an applications and services provider. The company soon realized that if it wanted to go beyond the limited distribution that it could achieve through such partnerships, it would have to bypass the mobile operating system bottleneck entirely.⁶⁰

Capitalizing on its experience with mobile services and applications Google forayed into the adjoining mobile operating system market by assuming stewardship of the Android project. Soon after, and with a solid position in the mobile operating systems market,⁶¹ Google crossed another layer and entered the devices market as well.⁶² The operating system (a layer which Google had

59 Id. at 2.

60 Fred Vogelstein, *Dogfight: How Apple and Google Went to War and Started a Revolution* 51 (2013) (explaining how Google feared that if Microsoft—their number one rival at the time—managed to dominate the mobile market, it would interfere with users' access to Google services).

61 When Google launched Nexus the Android market share had already surpassed iOS with a spectacular 615% growth from 2009 to 2010. See Jacqui Cheng, *Android Tops Everyone in 2010 Market Share; 2011 May Be Different*, *Ars Technica*, January 31, 2011.

62 Amol Sharma, *Google Pushes Tailored Phones to Win Lucrative Ad Market*, *The Wall Street Journal*, August 2,

already dominated) is one of the most critical components of a mobile device, and Google's expertise in the operating system layer could be leveraged to successfully enter the adjacent devices market too. Considering Google's path, it should come as no surprise that the company has expressed interest in cracking into the physical network market too.⁶³ The fact that it has yet to successfully enter the infrastructure market can be seen as a validation of the technological proximity theory, which predicts that a firm will cross over an adjacent layer only after having accumulated the necessary know-how. Arguably, managing the transmission part of a wireless network presents different challenges than developing applications and services or managing an IP server farm network that never directly reaches users.

The effect of Google's vertical expansion in the market is quite noticeable. At the time of Android's introduction all major mobile operating systems were tied to devices manufactured by the developers of the installed operating system (iPhone to iOS, Nokia phones to Symbian, Blackberry phones to Blackberry OS). With the mobile market split in three large market shares vertical exclusion was a concern. Google's Android would be the first major operating system to come with the promise of openness and customizability, a model that departed from that of the existing major operating systems.⁶⁴ The competitive pressure created by Android was so great that two of the three main competitors -Blackberry and Nokia- were eclipsed from the mobile market in a matter of five years post Google entry, and Apple was forced to become more open.⁶⁵

2007.

63 David Goldman, Google: Your New Phone Carrier?, CNN, January 1, 2011; Michael Santo, Google and Dish Network Teaming on New Data-only Wireless Carrier Service, Examiner, November 17, 2012.

64

65 VisionMobile, A Clash of Ecosystems, November 2011, available at <http://www.visionmobile.com/product/clash-of-ecosystems/>; Justin Fox, Why Apple Has to Become More Open, Harvard Business Review, March 11, 2013.

In a speech that went viral in mid 2013 Tim Cook, Apple's CEO, famously stated “I think you will see us open up more in the future,”⁶⁶ and some commentators have even suggested that Apple is more open than Google.⁶⁷

To be sure, the ability of firms to move upstream or downstream as they develop comparable technical expertise can harm competition for the same reasons it can enhance it. The vertical expansion of a dominant firm in one layer to adjacent levels of production is at the core of the fears surrounding exclusion. This, for example, was a common concern in the early life of Java. Java was originally developed as a middle layer between the operating system and the software that ran on top of it. It was seen as a platform layer distinct from that of the applications that were designed for Java and from the underlying operating system. In this configuration Sun -the company behind Java- was not in a competing relationship with developers of Java applications. However, the growing popularity of Java raised fears that Sun would enter the applications layer too. As Garud et al. explain:

“Such concerns were heightened by Sun's introduction of Java products that competed with those offered by other members of the Java collective. Even ardent supporters were afraid that Sun's control would give it undue advantage when competition intensified in the Java product-market. Pat Suelz, then general manager of Java software at IBM, suggested: 'Sun ... should establish the standard and compete above it. To the extent that Sun has any advantage, it limits the creativity of their partners.’”⁶⁸

But the fact that vertical mobility can cut both ways does not detract from the theory. As a

66 Ina Fried, Could Apple Be Getting Just a Bit More Open?, AllThingsD, May 28, 2013.

67 Christopher Mims, It's Official: Apple Is Now More Open than Google, MIT Technology Review, August 4, 2011; VisionMobile, Open Governance Index, July 2011, available at <http://www.visionmobile.com/product/open-governance-index/>.

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matter of principle any factor that facilitates entry in the market should be welcome. The fact that technological proximity makes entry easier and can form a stepping stone for abuse of market power is no reason for concern unless the rest of the conditions that antitrust proscribes are met.

3.1.1.2 Expansion of Natural Technical Boundaries

Entry as the result of technological proximity is a *strategic* choice by a firm to expand into a market after having familiarized itself with the technical know-how of the new market. In a sense, vertical entry of this kind presents itself as an opportunity rather than a pressing need. Slightly different is the situation where technical considerations do not simply suggest expansion into a new layer, but almost mandate it for the efficient operation of the product or service. In this case too, the technological imperatives facilitate vertical mobility which in turn increase supply side pressure.

The boundaries of the firm can change to incorporate or lose functions for a variety of reasons. Initially, scholarship focused on economics and management/organization. A long line of relevant literature has suggested that firms' boundaries expand or contract on the basis of transaction costs or managerial control. The transaction costs theory places the natural boundaries of the firm around those activities that are cheaper to produce or perform internally than procure from the open market.⁶⁹ Managerial/organizational control theories revolve around the idea that the insular nature of the firm enhances internal cohesion, coordination and control,

69 Ronald Coase, The Nature of the Firm, 4 *Economica* 386, 397 (1937); Steven N.S. Cheung, The Contractual Nature of the Firm, 26 *Journal of Law and Economics*, 1 (1983); Oliver E. Williamson, The Vertical Integration of Production: Market Failure Considerations, 61 *American Economic Review* 112, 112-114 (1971)

and so activities that are closely linked together should be brought under the same roof.⁷⁰

The economics and management literature examined the economic and organizational aspects of the firm. Recent technology studies have attempted to explain how technology becomes a relevant parameter of boundary delineation in technology-intensive industries. The proposition is that every system can be broken down into smaller modules, and that the technical functions and components that are closely intertwined should be grouped together and put in the same module.⁷¹ The goal is to limit interactions and spillovers *between* modules because external-to-the-module interactions impose an overhead cost to the completion of an operation. When all functions that exhibit high interdependencies are grouped in appropriately defined modules the system performs optimally.

Importantly for our purposes here, modules do not have to remain static. As technical realities change the functions performed by modules can be rearranged, or removed completely,

70 David Teece et al., Understanding Corporate Coherence, *Journal of Economic Behavior and Organization* 1, 18-19 (1994); Pavel Pelikan, Can the Innovation System of Capitalism Be Outperformed, in *Technical Change and Economic Theory* (Giovanni Dosi et al., eds. 1988); Armen A. Alchian & Harold Demsetz, Production, Information Costs, and Economic Organization, 62 *American Economic Review* 777, 778 (1972). Alchian and Demsetz describe the essence of the firm as a contractual structure with: 1) joint input production, 2) several input owners, 3) one party who is common to all the contracts of the joint inputs, 4) who has rights to renegotiate any input's contract independently of contracts with other input owners, 5) who holds the residual claim, 6) who has the right to sell his central contractual residual status. Id. At 794; Benjamin Klein et al., Vertical Integration, Appropriable Rents and the Competitive Contracting Process, 21 *Journal of Law and Economics* 297 (1978); Bruce Kogut & Udo Zander, Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology, 3 *Organization Science* 383 (1992). ("Firms exist because they provide a social community of voluntaristic action structured by organizing principles that are not reducible to individuals," at 384); Morris Silver, Enterprise and the Scope of the Firm: The Role of Vertical Integration 17 (1984) ("[The entrepreneur's] problem is that he cannot, at reasonable cost, convey his implausible 'secret' to those with the technical capabilities needed to produce the required operations at the lowest cost"); Edith Penrose, *The Theory of the Growth of the Firm* (4th ed. 2009).

71 Carliss Y. Baldwin & Kim B. Clark, Design Rules: The Power of Modularity 64, 70 (2000); Carliss Y. Baldwin & Kim B. Clark, Modularity in the Design of Complex Engineering Systems, in *Complex Engineered Systems: Science Meets Technology* 175 (Dan Braha et al. Eds., 2006); Herbert A. Simon, The Architecture of Complexity, 16 *Proceedings of the American Philosophical Society* 467, 474-477 (1962); Ron Sanchez & Joseph T. Mahoney, Modularity, Flexibility, and Knowledge Management in Product and Organization Design, 17 *Strategic Management Journal* 63, 65 (1996).

or new functions can be introduced in the system to accommodate new functionality that is dictated by the principles of efficiency and progress.⁷² In the process, modules that were thought to fall exclusively under one level of the value chain can expand (or shrink) to include operations that belonged in another part.

These changes are accordingly reflected in firms' boundaries. Firms constantly re-evaluate their position in the mobile industry value chain and might decide to change their boundaries to engulf (or discard) some functionality and roles because this is the most efficient scope of operation on technical grounds.⁷³ At any given moment, technology designers seek and delineate their products' and services' "natural boundaries"⁷⁴ and enter new markets by internalizing the production of resources that they used to procure from complementors. This brings used-to-be complementors in a competing relationship with the newly enlarged firms. Under these circumstances, should a firm exclude a complement or distribution channel from the market, the competitive response may not only come from its direct horizontal competitors, but also from firms that will expand upstream or downstream to fill in for the excluded complement, or create an alternative distribution channel, if doing so can be technically efficient.

This type of boundary rearrangement and the ensuing competitive pressure was obvious in the early phases of the mobile devices industry. In the 90s the market for mobile computing and communication devices was still nascent and the character and identity of such devices was still

72 Baldwin & Clark, *supra* note ###, at 156, 180. #####

73 Kevin Boudreau, *The Boundaries of the Platform: Vertical Integration and Economics Incentives in Mobile Computing* MIT Sloan Working Paper, 2006), at 2-3; Annabelle Gawer & Rebecca Henderson, *Platform Owner Entry and Innovation in Complementary Markets: Evidence from Intel*, 16 *Journal of Economics and Management Strategy* 1, 3-6 (2007).

74 See Baldwin & Clark, *supra* note ###, at 64 (speaking of a "natural division" between parts in modular systems).

very fluid. This resulted in intense experimentation with the scope of firms.

Consider Palm, the company behind the very popular Palm Pilot. Palm was born with the vision to lead the handheld computing and communications devices market. Despite that grand aspiration Palm started with only two software engineers and originally planned to write just the applications for the device; the operating system and the hardware would come from third parties.⁷⁵ Palm partnered with GEOS for the operating system and Tandy (now Radioshack) for the hardware (the device was called Zoomer), but the result was not a success. GEOS was incomplete for the required device specifications (e.g. it wasn't designed to accommodate touch pen functionality on which Palm relied heavily) and Palm's relationship with Tandy proved rocky.⁷⁶

Palm soon realized that while the value of a handheld device to users would come from the applications (and so in a sense it was in the right market), the available technology at the time would never allow Palm to offer a well-rounded solution unless it expanded to and controlled the more critical components of the “Palm platform” experience, namely the operating system and the device.⁷⁷ In the years following Zoomer Palm set out to design its own device and operating system. The new product, Palm Pilot, running Palm OS, was a big success when it hit the market in 1996.

Palm's expansion into the operating system and device market was not solely initiated on economic or managerial grounds. At the time there was no mature stand-alone operating system

75 Andrea Butter & David Pogue, *Piloting Palm: The Inside Story of Palm, Handspring, and the Birth of the Billion Dollar Handheld Industry* 5-18 (2002).

76 *Id.*

77 Ramon Casadesus-Masanell, *Palm (A): The Debate on Licensing Palm's OS*, Harvard Business School Case N9-708-514 (May 20, 2008), at 5.

that companies could credibly rely on to develop mobile applications, and because mobility had only recently begun to be an issue, hardware manufacturers also didn't have good ready propositions. The coupling between applications and operating system was so tight that Palm had to enter the operating system market too.⁷⁸

The same was true for other competitors. Microsoft joined the race around the same time after a few failed internal projects.⁷⁹ It left the hardware to outside manufacturers, but it, too, set as a priority to come up with an operating system (Windows CE) (as well as a set of applications) from the beginning.⁸⁰ The third major competitor, Psion took a fully integrated approach from the very beginning, including applications, operating system and hardware.⁸¹ However, the tying of software to hardware in Psion products was explained more by historical rather than technical reasons (Psion had been in the integrated portable devices market for more than a decade already and its handheld computer was essentially an outgrowth of that line of products).⁸²

When the technical interdependencies between applications and the operating system thinned out, decoupling and different combinations were became more viable options.⁸³ With

78 Butter & Pogue, *supra* note ###, at 131 (“Palm had *had* to produce a new OS. No existing OS would permit the design of a fast, easy- to-use, and inexpensive handheld computer. The Palm OS was small, fast, powerful, flexible, and designed for connectivity to the PC—all the things the other OS options were not.”).

79 Chris Tilley, *The History of Windows CE, HPC Factor*, available at <http://www.hpcfactor.com/support/windowsce/default.asp>

80 *Id.*

81 Andrew Orlowski, *Psion: The Last Computer*, *The Register*, June 26, 2007 (where the author describes Psion 5 as “a remarkable achievement: entirely new silicon, a new operating system, middleware stack and applications [all] developed from scratch in just over two years.”). See also Steve Litchfield, *The History of Psion*, *Palmtop Magazine*, ###month###, 1998, available at <http://stevelitchfield.com/historyofpsion.htm>.

82 Litchfield, *id.*

83 See, e.g., Rahul C. Basole & Karla Jurgen, *On the Evolution of Mobile Platform Ecosystem Structure and Strategy*, 3 *Business & Information Systems Engineering* 313, 318-319 (2011) (where the authors chronicle the expansion of the mobile ecosystem and the different combinations among the participating players).

greater standardization and better interfaces, the natural boundaries of applications, operating system and devices were more clearly delineated and separated, and firms could open up parts of their value chain to third parties. Nearing the end of the 90s Psion started licensing its OS to other device manufacturers, until it was absorbed by Nokia's Symbian, which also absorbed Palm OS, and both Symbian and Windows CE opened up to third party application developers.⁸⁴

The preceding narrative shows that firms move in and out of markets not only because they see a business opportunity, but rather a necessity. From a competition point of view this is welcome because it creates imperative incentives for firms to cross their boundaries and enter new markets. By doing so they weaken bottlenecks and fill in for what their rivals may have deprived them market of.

During Psion's dominance from 1991 (introduction of its Series 3) to 1996, competition in the applications market industry-wide was feeble, since Psion was a fully integrated firm and unless it approved an application, third party applications could not gain access to a major distribution channel. In 1996, when Palm realized that it needs to expand from the applications domain down to the operating system and device layers too in order to compete effectively, it became the first real competitor to Psion.⁸⁵ With the expansion of Palm and Microsoft, the mobile chain became less dependent on Psion and more channels were created thus limiting the bottleneck effect.

84 See Benjamin Edelman et al., Symbian, Google & Apple in the Mobile Space (A), HBS Case 909-055 (April 2009), at 2 (with internal links).

85 Sunil Chhabra et al., US Robotics: Owning the Pocket, University of Michigan Business School Case, available at <http://www-personal.umich.edu/~afuah/cases/case18.html>.

3.1.1.3 Flexible Locus of Functionality

Up to this point entry in the various levels of the value chain occurred through the expansion of existing players upstream or downstream. The expansion was motivated either by a strategic choice to leverage existing technical expertise to enter an adjacent market, or by the necessity to do so on the grounds of technical efficiency. Both conditions suggest that when an actor deprives the market of an input or distribution channel at a certain level of the value chain, the surrounding actors have the ability (or even need) to enter the bottleneck market. The prospect of entry is expected to dissuade firms from resorting to exclusionary practices, or, in case exclusion occurs, actual entry will restore the market to (more) competitive levels and will mitigate the effect of exclusion.

Taking it a step further now, we posit that competitive pressure does not necessarily have to come from existing firms, or from firms that adjoin the bottleneck market, or as the result of entry in the bottleneck market. It is enough that the utility or functionality of the product or service offered by the bottleneck market be replicated by another actor regardless of the positioning of that actor in the value chain. As long as the market can supply consumers with what they want the internal reshuffling of actors and roles in the market does not matter. Indeed, the technical nature of mobile telecommunications networks allows the flexible relocation or replication of functionality along the value chain thereby creating competition in new parts of the value chain and adding to the list of competitive sources that constrain firms' bottleneck behavior.

Probably the most well-known illustration of this type of competitive entry is Java's business

model as highlighted by its battle with Microsoft.⁸⁶ Java is technically a programming language, and its innovation lies in the “write once, run everywhere” ability, which means that once an application is developed for Java on a given platform (e.g. the Microsoft Windows operating system) it can run on any platform without the need to be recompiled (e.g. a Java-enabled mobile phone).⁸⁷ This revolutionary feature formed an operating environment that allowed Java software to run regardless of the underlying operating system. In effect Java created a new middle layer between the operating system and the applications that ran on top of it, which broke the link and interdependence between an operating system's APIs and the applications.

As anyone familiar with the Microsoft case knows, Microsoft vehemently fought Sun -the company behind Java- and attempted to exclude it from Microsoft Windows by introducing incompatibilities between Microsoft's and Sun's Java Virtual Machine.⁸⁸ Microsoft was concerned that the independent evolution of Java might mean that a new platform for applications development would emerge, one that did not depend on Windows to run.⁸⁹ Although

86 See U.S. v. Microsoft, 253 F.3d 34, 74 et seq. (2001).

87 See Sun Microsystems, JavaSoft Ships Java 1.0, January 23, 1996, available at <http://tech-insider.org/java/research/1996/0123.html> (“Java's write-once-run-everywhere capability along with its easy accessibility have propelled the software and Internet communities to embrace it as the de facto standard for writing applications for complex networks.”).

88 Raghu Garud et al., Institutional Entrepreneurship in the Sponsorship of Common Technological Standards: The Case of Sun Microsystems and Java, 45 Academy of Management Journal 196, ### (2002). See also U.S. v. Microsoft, supra note ###, at (“The District Court held that Microsoft engaged in exclusionary conduct by developing and promoting its own JVM. Sun had already developed a JVM for the Windows operating system when Microsoft began work on its version. The JVM developed by Microsoft allows Java applications to run faster on Windows than does Sun's JVM, but a Java application designed to work with Microsoft's JVM does not work with Sun's JVM and vice versa.” (internal citations omitted)). The claim here is not that Microsoft violated antitrust laws on the basis of its exclusionary conduct. As the court noted “[i]n order to violate the antitrust laws, the incompatible product must have an anticompetitive effect that outweighs any procompetitive justification for the design. Microsoft's JVM ... allows Java applications to run faster on Windows ... and does not itself have any anticompetitive effect. Therefore, we reverse the District Court's imposition of liability for Microsoft's development and promotion of its JVM.”). *Id.* at 75.

89 In a 1995 memo addressed to Microsoft's executives Bill Gates wrote: “A new competitor 'born' on the Internet is Netscape. Their browser is dominant, with 70% usage share, allowing them to determine which network extensions will catch on. They are pursuing a multi-platform strategy where they move the key API into the

Java was not an operating system and hence did not compete in the same (horizontal) market as Windows, the fear was that it could replace Windows “as the ubiquitous platform for software development” and usurp a lot of its functionality directly competing with it as a platform for software development.⁹⁰

In this scenario, even if Windows wanted to exclude an application, it could only do so when the application ran directly on Windows, not if it could run on Java's intermediate layer. Potential exclusionary practices on the Windows' side could therefore be curtailed not because of a new operating system, but because part of the functionality of the operating system would have migrated to another part of the value chain, namely the new layer introduced by Java.

While Java's intermediation function is becoming less relevant in the mobile development ecosystem, because application execution goes through the gateway of the applications store,⁹¹ the same principle of functionality relocation still applies. Consider, for example, how modern operating systems for mobile applications shed functions and features to become more lightweight to match the limited capabilities of mobile devices⁹² and the increasing tendency to rely on remote storage and processing capacity.⁹³ In effect, modern mobile operating systems become “thin clients” for services to be executed remotely. Many of the applications and services

client to commoditize the underlying operating system.' See Bill Gates, *The Internet Tidal Wave*, Microsoft Case Exhibit 20 (1995), available at <http://www.justice.gov/atr/cases/exhibits/20.pdf>.

90 U.S. v. Microsoft, 253 F.3d 34, 74 (2001).

91 That said, Java remains very relevant as a programming language (especially given that Android's ecosystem development greatly relies on Java). See Andrew Binstock, *If Java is Dying, It Sure Looks Awefully Healthy*, Dr.Bobb's, October 8, 2013; Zach Walton, *Java, Objective-C Still Popular Thanks To Mobile Development*, WebProNews, January 9, 2014.

92 On the limited capacities of mobile devices and what they mean for the services they can support see Tim Bjarin, *Processing Power Versus Bandwidth*, PCMag, October 19, 2007; Henry Samueli, *Mobile Chips Can't Get Faster Forever*, Broadcom Warns, PCWorld, December 7, 2013.

93 See Michael Armbrust, *Above the Clouds: A Berkeley View of Cloud Computing*, Technical Report No UCB/EECS-2009-28, at 4-5, available at <http://www.cs.columbia.edu/~roxana/teaching/COMS-E6998-7-Fall-2011/papers/armbrust-tr09.pdf>.

traditionally offered by desktop operating systems, such as file storage and management, file search, media reproduction, basic office tools and others, move away from the operating system and into the (often third-party) applications domain.

While to the end user this transition is transparent, the impact of such relocation of functionality on the competitive inter-relations of the players along the value chain is considerable. For instance, Google (which serves as Android's main supporter and developer) uses its power over the Android ecosystem to force manufacturers to ship their devices with Google's applications pre-installed, set as default in their category and unable to be removed (a setup very reminiscent of what Microsoft did with Internet Explorer and Netscape).⁹⁴ Google does so because it wants to ensure that its operating system gives preferential treatment to its own applications.⁹⁵ This kind of protectionism is triggered because on mobile devices, much like on desktop computers a decade earlier, the mobile operating system is becoming thinner, more transparent and less of a bottleneck. Under those circumstances, exclusion may come as an attempt of an actor to remain relevant in an industry that changes its center of gravity. While such exclusionary conduct is not necessarily innocuous, the threat posed by it must be assessed also in relation to the new center of gravity and not only the exclusionary actor's traditional direct competitors.

As a general matter anyone who is concerned about exclusionary practices in a certain part of the value chain, should take into account the evolutionary pressure created by the fluidity

94 Ron Amadeo, Google's Iron Grip on Android: Controlling Open Source by Any Means Necessary, *Ars Technica*, October 21, 2013.

95 *Id.* ("If a company other than Google can come up with a way to make Android better than it is now, it would be able to build a serious competitor and possibly threaten Google's smartphone dominance. This is the biggest danger to Google's current position: a successful, alternative Android distribution.")

between the scope of that part and its complements. With the advent of the new generation of cellular mobile telecommunications networks, the type of rearrangements described above can only get more intense. Though for most people next generation mobile networks are reduced to just LTE and higher speeds in the access network, the biggest changes are taking place in the core of the network, and affect where functionality lies when it comes to providing mobile communications services to end users.

LTE is part of a wider overhaul of mobile telecommunications networks, called SAE (System Architecture Evolution). LTE is the new access network,⁹⁶ whose core counterpart is EPC (Evolved Packet Core), the new upgraded version of the core network.⁹⁷ SAE is the first cellular mobile telecommunications structure to rely on the IP protocol for the transmission of data, and, although it hasn't been fully deployed (transition will take several years and carriers still largely rely on the legacy 2G/3G networks with the incremental 4G upgrade), all carriers will eventually transition to it.⁹⁸ Service provision in this new IP structural framework relies on a system called IP Multimedia Subsystem (IMS) which is a standardized architecture carriers have agreed on for the transmission multimedia, including voice, text messages, video and other traffic.⁹⁹

The adoption of the IP structure for the entire network has certain implications: the IP layer

96 Kalyani Bogineni et al. LTE Part II: Radio Access, 47 IEEE Communications Magazine 40 (2009).

97 Kalyani Bogineni et al., LTE Part I: Core Network, 47 IEEE Communications Magazine 40 (2009).

98 See Darren McQueen, The Momentum Behind LTE Adoption, ### IEEE Communications Magazine 44 (2009); Alexander Harrowell, IMS: Two Visions of the Telecoms Future, 130 Mobile Telecommunications International 1 (2006). For the transition to full IP see also Voice over LTE, Ericsson White Paper 284 23-3145 Uen, December 2010, available at ###

99 Antonio Cuevas et al., The IMS Service Platform: A Solution for Next-Generation Network Operators to Be More than Bit Pipes, 44 IEEE Communications Magazine 75 (2006); Gilles Bertrand, The IP Multimedia Subsystem in Next Generation Networks (unpublished manuscript), available at http://www.rennes.enst-bretagne.fr/~gbertran/files/IMS_an_overview.pdf.

serves as the spanning layer, which is the layer that achieves interoperability between technologies up and down that layer.¹⁰⁰ This, enables for the first time cellular networks to natively (i.e. without the need for gateways) connect to other networks running IP, such as the Internet, Wi-Fi and WiMAX networks, and IP services and applications to be deployed across networks.¹⁰¹ The—even partial—adoption of the IP protocol stack also means clearer layer separation as opposed to legacy telephony protocol stacks (###),¹⁰² and greater programmability because of the general-purpose nature of the IP protocol stack.¹⁰³

All these innovations are not just technical upgrades. SAE is the cellular mobile networks' first-time departure from a system designed and optimized for one service (voice) to a general platform that can accommodate a variety of services and applications (much like the Internet).¹⁰⁴ For the first time since the commercialization of the Internet an alternative general purpose platform, encompassing all players along the value chain, and potentially equivalent in reach and scope, is beginning to emerge. As Siemens' Director for Fixed-Mobile Convergence Solution put it: “IMS is designed to provide operators with the means to satisfy the growing demand for rich, diverse communications services ... For vendors and new application providers, the IMS

100 David D. Clark, Interoperation, Open Interfaces and Protocol Architecture, in *The Unpredictable Certainty: White Papers Information Infrastructure Through 2000* 133, 133-134 (NII 2000 Steering Committee, Computer Science and Telecommunications Board, Commission on Physical Sciences, Mathematics, and Applications, National Research Council, 1998).

101 Gonzalo Camarillo & Miguel A. Garcia-Martin, *The 3G IP Multimedia Subsystem: Merging the Internet and the Cellular Worlds* 5 (2005); Jyh-Cheng Chen & Tao Zhang, *IP-Based Next-Generation Wireless Networks: Systems, Architectures and Protocols* 20 (2004).

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104 Antonio Cuevas et al., *The IMS Service Platform: A Solution for Next-Generation Network Operators to Be More than Bit Pipes*, 2006 IEEE Communications Magazine 75 (2006). Compare Barry M. Leiner et al., *The Past and Future History of the Internet*, 40 Communications of the ACM 102, 104 (1997) (“[t]he Internet was not designed for just one application but as a general infrastructure on which new applications could be conceived”).

architecture supports rapid and efficient service creation. For users, IMS makes it possible to access multiple services in the course of the same call or session.”¹⁰⁵ SAE does not seek to overtake the Internet, but it does aim to imitate its general purpose nature, and where possible, extend it with the enhanced mobility, reliability and location awareness that cellular mobile networks are usually associated with.

Most interestingly, the vision behind SAE is not limited to SAE's implementation. The specific implementation SAE is putting forth is but one possibility of alternative platforms that are emerging alongside existing networks.¹⁰⁶ The key point here is that many actors in the mobile telecommunications market are beginning to realize that a single homogeneous uniform network cannot cover the ever increasing diversity of users' and developers' needs.¹⁰⁷ Alternative Internet architectures as well as more specialized alternative networks proposals abound and much like SAE some have already begun to materialize. As these new networks proliferate or strengthen their position in the market the functionality and capabilities offered by today's networks will be replicated and extended, which in turn will make them a more formidable market player that will add to the competitive pressure on the supply side.

105 Felipe Alvarez del Pino, IMS: Application Enabler and UMTS/HSPA Growth Catalyst, in Business Models and Drivers for Next-generation IMS Services 4 (International Engineering Consortium, 2007).

106 For alternatives see Joseph Ghetie, Fixed-Mobile Wireless Networks Convergence: Technologies, Solutions, Services 343-5 (describing the overlapping functionality of Software Delivery Platforms with IMS); see also Kyriacos Sabatakakis, New Service Creation in an IP Environment: The Advantages of Integrated IMS and Service Delivery Platform Capabilities, 1(6) IEC Magazine 0 (2006).

107 See David Clark's discussion on alternative IP platforms and how regulation should be based not on legacy factors but on the criterion of whether platforms are addressed to the same audience (developers and users) and serve the same purpose and functions. David Clark, Platform models for sustainable internet regulation, Paper presented at the 41st TPRC.

3.1.2 *Competitive Pressure and Dissuasive Effects from Existing Players*

The kind of competitive pressure presented so far stems from *entry* in the bottleneck market where exclusionary practices are feared. On top of the limiting effect competitive entry has on exclusionary practices, a parallel dissuasive effect can arise from the actions of *existing* players in the value chain *without entry actually occurring* in the bottleneck market. It is enough that the technological proximity and interdependency between firms in the value chain can serve as a backstop to anticompetitive behavior without firms becoming direct competitors in the same market.

3.1.2.1 Shifts of Power due to Technological Proximity

We saw previously how technological proximity between firms along the value chain enables them to jump from one layer to another and how this undermines the power of bottlenecks. We use the same theoretical insights here to make a slightly different argument: technological proximity facilitates the exchange of power between players in a way that can weaken bottlenecks by moving the center of value elsewhere in the value chain. A dominant actor around whom a platform or a technology revolves can lose some of his relevancy when control over the platform or technology shifts to other actors. While new entry does not actually take place, the fact that control and value have shifted means that the once dominant player will likely not be able to enforce an exclusionary policy that harms the platform or technology.

Systems that consist of multiple components (much like the mobile telecommunications value chain) are not necessarily locked in a fixed allocation of value and importance among their

parts and components.¹⁰⁸ While the overall value may remain the same, the internal allocation and the actors representing each part can change, and the change is motivated by the “vertical competition for control of a platform among the sellers of its various components.”¹⁰⁹ At any given time only one or a few parts of the value chain can be those that define its general architectural shape.¹¹⁰ These are the ones around which the rest of the parts will develop. As the system evolves in time it is possible that another component will take the lead as the epicenter of the system's design. The system will then coagulate around that new keystone component.

In such contexts it is often unclear which standard, platform, function or component will become the strategically most important one, around which value and market activity will coalesce, and it is also entirely possible that none is actually sufficiently defined, in which case competition between and within them for one to emerge (temporarily) victorious is inevitable.¹¹¹ As this process unfolds the various components in a system are not only constrained by their counterparts in other systems, but also within the system itself by their own complements.¹¹²

The most representative example in the literature is how IBM lost leadership of the personal computer (PC) platform to Microsoft and Intel.¹¹³ In the early 1980s IBM introduced its personal

108 See, e.g., Hemant Kumar Sabat, *The Evolving Mobile Wireless Value Chain and Market Structure*, 26 *Telecommunications Policy* 505 (2002); Joe Peppard et al., *From Value Chain to Value Network: Insights for Mobile Operators*, 24 *European Management Journal* 128 (2006).

109 See Bresnahan, *supra* note ### (Technological Competition and the Structure of the Computer Industry), at 23.

110 Carliss Y. Baldwin & Jason C. Woodard, *The Architecture of Platforms: A Unified View*, 2009 *Platforms, Markets and Innovation* 19, ### (2009).

111 Pieter Ballon, *Platform Types and Gatekeeper Roles: The Case of the Mobile Communications Industry*, Paper presented at the Druid Summer Conference 2009, at 4, available at <http://www2.druid.dk/conferences/viewpaper.php?id=5952&cf=32>; Boudreau, *supra* note ###.

112 See Joseph Farrell et al., *The Vertical Organization Of Industry: Systems Competition versus Component Competition*, 7 *Journal of Economics and Management Strategy* 143 (1998) (where the authors compare competition between systems as a whole and between components of systems)

113 For a relevant account see Bresnahan, *supra* note ### (Technological Competition and the Structure of the Computer Industry), *passim*.

computer, which it decided to build on a modular architecture and rely on Microsoft's Windows for the operating system and on Intel for the processor.¹¹⁴ Despite its initial success, the fact that other vendors could use Microsoft Windows and Intel to build their own “IBM-compatible” personal computers weakened IBM's position in the market.¹¹⁵ IBM responded (belatedly) by introducing proprietary interfaces and its own operating system (OS/2), but control had already shifted from IBM to the “Wintel” duo. IBM was relegated to just another personal computer manufacturer. This example highlights how two firms that were not directly competing with IBM, but to the contrary were a big part of the “personal computer platform,” managed to take away control from IBM and in doing so exposed IBM to much fiercer competition from other manufacturers, who absent the enabling factor of the Wintel duo would not have been able to compete effectively with IBM.

These dynamics are also noticeable in the mobile communications value chain. The increasing influence of the operating system as a component is a good example. It used to be the case that the operating system of a mobile device was not the most pronounced element in the users' experience; with the emergence of smart touch phones and the application distribution platforms model, the operating system became a defining part of how users interface with their devices as well as what capabilities, applications and services they can access.¹¹⁶ As such it now

114 Charles H. Ferguson & Charles R. Morris, *Computer Wars: The Post-IBM World* 7-10 (1993).

115 Burton Grad, *A Personal Recollection: IBM's Unbundling of Software and Services*, 24 *IEEE Annals of the History of Computing* 64 (2002); Thomas Hamilton, *IBM's Unbundling Decision: Consequences for Users and the Industry* ### (1969)

116 Adrian Holzer & Jan Ondrus, *Mobile Application Market: A Developer's Perspective*, 28 *Telematics and Informatics* 22, 22 (“For many years, the development of mobile services was mostly controlled and managed by the mobile network operators (MNO), phone manufacturers, and some mobile application and content providers ... Recently, this has changed with the arrival of software companies with new mobile phones and platforms such as the iPhone and Android.”).

defines to a large extent the shape of the value chain and serves as a limiting factor to the power of other actors.¹¹⁷

The interplay between Google and Samsung is an interesting case study: Google provides the operating system (Android) that runs on top of Samsung's devices and both companies provide applications for Android, but the Android operating system has become such an important part of Samsung's devices that Google is now in the position to explicitly prioritize its own services over those of Samsung even on Samsung's phones to its detriment.¹¹⁸ In a pre-smartphone era, when Samsung manufactured its own operating system for its devices, this was not a problem. The increasing pressure Samsung faces from Google explains why Samsung decided to experiment with switching back to an operating system of its own.¹¹⁹ If Samsung's operating system proves a success the tables can once again be turned and Samsung will be able to be the one that discriminates against Google's services and applications—if so it will. The relationship between these two companies shows that the keystone element in a system can change, and once this happens the old reigning firm loses its ability to unilaterally impose its will and discriminate or exclude rivals' products.

117 Jeremy Wagstaff, In a Samsung Galaxy Far, Far Away ... Will Android Still Rule?, Reuters, May 3, 2012 (where the author quotes analysts speculating that Samsung may just be “enabling someone else's ecosystem” and that “Microsoft had shown that whoever owned the operating system could relegate every hardware manufacturer to be a commodity player.”).

118 See Ron Amadeo, Google's Iron Grip on Android: Controlling Open Source by Any Means Necessary, Ars Technica, October 20, 2013. See also Haydn Shaughnessy, Google, Pitting Itself Against Samsung, Prepares For Device War, Forbes, August 31, 2013 (where the author describes how Google gained power through the proliferation of Android-powered devices).

119 Devindra Hardawar, Samsung's Love/Hate Android Relationship Continues: Plans Tizen Phone, Android Wear Watch for This Year, Venture Beat, April 16, 2014; Tim Bajarin, Could Samsung Ditch Android for Tizen?, PC Mag, March 17, 2014. We don't mean to imply that the competitive pressure flows unidirectionally from Google to Samsung; both companies compete against each other over who will grab the biggest share of the value in the value chain. See Amir Efrati, Samsung Sparks Anxiety at Google, Wall Street Journal, February 25, 2013 (“Google executives worry that Samsung has become so big—the South Korean company sells about 40% of the gadgets that use Google's Android software—that it could flex its muscle to renegotiate their arrangement.”).

Similar dynamics characterize the relationship between Apple and AT&T. While carriers were traditionally thought to be the dominant figure in the value chain,¹²⁰ the advent of the iPhone in 2007 which had the potential to drive up usage rates (as it did) and become a driving force for AT&T's data packages adoption, brought Apple up to a much stronger negotiating position.¹²¹ This caused some power to shift to Apple, but—again—not permanently. A few years later, in 2013, AT&T flexed its muscles, and blocked Facetime, one of iPhone 4's flagship features, on its network, the reason being that Facetime was too bandwidth-demanding.¹²² A possible parameter in AT&T's decision allowing it to oppose Apple was that AT&T was less dependent on Apple in 2013 than it was in 2007, because by 2013 AT&T had partnered with several other highly successful smartphones and Apple could no longer stop AT&T from blocking part of its system.

In all these examples, because the technical details and specifications of the end product and service that will be delivered to consumers are contributed by different and often competing firms, power is divided among them.¹²³ In this co-dependent relationship it is unknown *ex ante* around which part of the value chain value will concentrate,¹²⁴ and in fact there is no reason why

120 See, e.g., Jason Dedrick et al., *The Distribution of Value in the Mobile Phone Supply Chain*, 35 *Telecommunications Policy* 505 (2011).

121 Peter Cohan, *Project Vogue: Inside Apple's iPhone Deal With ATT*, *Forbes*, September 10, 2013; Amol Sharma et al., *How Steve Jobs Played Hardball in iPhone Birth*, *Wall Street Journal*, February 17, 2007; Edelman et al, *supra* note ###, at 5.

122 FCC, *Mobile Broadband Working Group - Open Internet Advisory Committee, AT&T/Facetime Case Study* (2013), available at transition.fcc.gov/cgb/events/ATT-FaceTimeReport.pdf.

123 See Martin Fransman, *The New ICT Ecosystem* 9-10 (“the four layers [networked elements, network operators, content and applications, consumers] of the system, although hierarchically structured, are interdependent. Each layer depends on the layer (or layers) adjacent to it. For the system as a whole to operate, each layer needs to do its own functional job.”) (2010); Joe Peppard & Anna Rylander, *From Value Chain to Value Network: Insights for Mobile Operators*, 24 *European Management Journal* 128 (2006) (examining the evolution of actors in the mobile industry).

124 Annabelle Gawer & Rebecca Henderson, *Platform Owner Entry and Innovation in Complementary Markets: Evidence from Intel*, 16 *Journal of Economics & Management Strategy* 1, 1-3 (2007).

the distribution of power must remain fixed. Under these circumstances, one should be concerned with exclusion as market strategy only when a firm has indeed the relative power to impose its exclusionary plan unto the rest of its complementors and partners, something that should not be taken for granted. It took, for example, many years for the almighty Comcast to get the once parochial Netflix streaming service to capitulate and strike a more profitable agreement for Comcast, under the threat of degraded quality.¹²⁵ For an external observer, Comcast might always have seemed the big powerful player in the value chain and yet an effective plan to corner Netflix proved elusive for years. A proper analysis would probably show—among other factors—that Netflix was as a complement too valuable to squeeze out and exclusion or discrimination were not as likely threats as many feared.

3.1.2.2 Networks Are the Result of a Continuous Tussle

The argument advanced here is more general in nature than those presented so far. It relates to the overall mode of existence of network industries, and describes how networks are the result of incessant battles of interests among all involved actors. The supply side of the mobile telecommunications industry comprises a plethora of participants at different levels of the value chain, each coming from a different place and each representing different interests. As a result, the services that reach end users are the denouement of either compromise or consensus,¹²⁶ but

¹²⁵ See Karl Bode, No, Netflix's New Deal With Comcast Probably Won't Destroy The Internet. Yet., *Techdirt*, February 24, 2014; Dan Rayburn, Inside The Netflix/Comcast Deal and What The Media Is Getting Very Wrong, *StreamingMediaBlog*, February 23, 2014. See also Sue Zeidler, Netflix Scrambles Future of TV and Films, *Reuters*, December 1, 2010.

¹²⁶ Cf. also Laura DeNardis (ed.), *Opening Standards: The Global Politics of Interoperability* viii-ix (where the

most likely not the unilateral will of one actor, unless that actor is so dominant as to be able to impose a de facto standard or technology.¹²⁷ In fact, negotiations and the attempts to strike the perfect balance can become so heated as to bring the evolution process to a stalemate.¹²⁸ But, whereas the possibility of a stalemate is real, the continuous tussle also means that various and competing interests are incorporated along the way. In the context of exclusion, this means that the relevant decision to exclude is *not taken in vacuum*, but in the pressure of peers and complementors.

While this sounds much like plain competition, the point here is broader. The actors that participate in the tussle and serve as a backstop to other players' agenda don't need to be direct competitors, nor somehow push against the boundaries of others in one of the ways described above. It is enough that they are in the position to influence others' business behavior or the rules of the game that in turn constrain harmful behavior. This interplay is noticeable during standards development, auctions, rulemaking proceedings, lobbying, and other activities that shape the industry.

An example that beautifully illustrates this point is the “openness” condition in the C Block of the 700 MHz spectrum that was auctioned in 2008. In that auction, on the insistence of major companies like Google and the Public Interest Spectrum Coalition, the FCC included a term

author explains how complex the standard-setting process is because of the different and competing priorities players bring to the table: “technical standards not only provide technological interoperability but also produce significant political and economic externalities. Battles over standards are sometimes market conflicts between technology companies ... [S]tandards are also political, making decisions about individual civil liberties online.”).

127 See Besen & Saloner, *supra* note ###, at 181-182.

128 This risk is evidenced well by the very slow transition from IPv4 to IPv6 as well as by the slow-paced approval of other critical features in the Internet's infrastructure. See, e.g., Mark Handley, *Why the Internet Only Just Works*, 24 *BT Technology Journal* 119 (2006); Geoff Huston, *The Internet – 10 Years Later*, ### *The IP Journal* ###

requiring the licensee to provide open platforms for devices and applications, if the winning offer exceeded \$4.6 billion.¹²⁹ If the offer did not exceed that price, the block would be re-auctioned without the openness requirement. Google was one of the most ardent supporters of this condition, because as a service (and later device) provider, it would benefit from end users being able to use its products and services freely without any limitations from the carriers. Google openly declared to the FCC that if and only if an openness requirement is included will it bid at the auction.¹³⁰ At the time, Google was not seriously considering becoming an infrastructure provider, and in any case it knew that other companies needed and were willing to pay more for that part of the spectrum.¹³¹ Indeed, Google bid just over the threshold price to make sure that the openness condition would be triggered, but not high enough to actually win the auction (Verizon, which won the C block paid a total of \$9.6 for licenses including in the C block).¹³²

The outcome of this power play was that Verizon committed to a non-exclusion policy at least for a part of its network, even though it initially opposed this term.¹³³ The conditions of

129 FCC, In the Matter of Service Rules for the 698-746, 747-762 and 777-792 MHz Bands (Second Report and Order), 22 FCC Rcd 15258 et seq. (2007). (“[W]e will require only C Block licensees to allow customers, device manufacturers, third-party application developers, and others to use or develop the devices and applications of their choosing in C Block networks, so long as they meet all applicable regulatory requirements and comply with reasonable conditions related to management of the wireless network (i.e., do not cause harm to the network) . Specifically, a C Block licensee may not block, degrade, or interfere with the ability of end users to download and utilize applications of their choosing on the licensee’s C Block network, subject to reasonable network management,” at 15365).

130 Eric Bangeman, Google Announces Intent to Bid on 700MHz Spectrum Auction, If..., *Ars Technica*, July 20, 2007.

131 Verizon, AT&T Win FCC Auction, Google Wins Open Spectrum, *AFP*, March 20, 2008.

132 Sandro Brusco et al., The “Google Effect” in the FCC’s 700 MHz Auction, 21 *Information Economics and Policy* 101 (2009); Saul Hansell, Verizon and AT&T Win Big in Auction of Spectrum, *New York Times*, March 21, 2008.

133 FCC, In the Matter of Service Rules, *supra* note ###, at 15360 et seq. (Verizon Wireless argues that imposing an open access business model undermines the auction process and competitive bidding Verizon Wireless asserts that imposing open access regulations runs contrary to the Commission’s “light regulatory touch” for wireless services generally According to Verizon Wireless, requiring winners of licenses in the 22 MHz block to provide open access would impose an asymmetrical regulatory regime on only one segment of the industry, thus drawing arbitrary distinctions Also, according to Verizon Wireless, the Commission cannot

openness that accompanied the 700 MHz C block were not activated because Verizon caved to competitive pressure by one of its direct competitors or some other player in the value chain. They were triggered by a combination of lobbying to convince the FCC to include the relevant terms in the auction rules,¹³⁴ and of a company's flexing its financial muscle to achieve favorable rules.¹³⁵

What makes this kind of tussle rather effective is that it does not simply occur once the market is set up and ready, but rather throughout the development of the mobile telecommunications ecosystem, thereby continuously readjusting the balance of power between players. In telecommunications networks there is no final result or outcome (as opposed -say- to an architectural project), which once reached, the balance of power solidifies. The power games are ongoing and the supply side map is subject to constant revision. David Clark, who played a major role in the design of Internet protocols, has eloquently described how engineers design network elements and software not to accommodate all needs and goals but rather to accommodate indeterminacy. In his own words “[a]ny practicing engineer knows that the process of design is ... one of *balancing considerations* and resolving tensions to get an acceptable

impose access requirements without violating various sections of the Communications Act and affecting the First Amendment rights of existing providers” (internal citations omitted)); Om Malik, Verizon Sues, Google Expresses Dismay Over 700 MHz Auction, Gigaom, September 13, 2007.

134 The FCC started considering the FCC after the Public Interest Spectrum Coalition submitted a relevant proposal in its comments. See Ex Parte Comments of the Ad Hoc Public Interest Spectrum Coalition, PS Docket No. 06-229 and WT Docket Nos. 06-150, 05-211, 96-86, at 9, 18-19 (filed Apr. 3, 2007); FCC, In the Matter of Service Rules for the 698-746, 747-762 and 777-792 MHz Bands (Report for Order and Further Notice of Proposed Rulemaking), 22 FCC Rcd 8064 (2007).

135 At least one analysis of the auction concludes that if it were not for Google's bidding, the openness condition would not have been triggered, because Verizon wasn't planning to meet the lowest threshold price. See Brusco et al., *supra* note ### at 112, where: “We can speculate that Verizon’s bidding strategy was not to bid on the C-block licenses if no other bidder bid up to the reserve price. Verizon’s bidding in the early rounds of the auction is consistent with this. Thus, we speculate that, without Google’s participation in the auction, the C-block reserve price would not have been met, triggering a re-auction of that block without the restrictions. In that case, we would expect prices for the C-block licenses that were more in line with the other blocks and other recent spectrum sales.”).

specification” (emphasis added).¹³⁶ Designing for tussle is to design for variation in outcome “so that the outcome can be different in different places, and [so that] the tussle takes place *within the design*” (emphasis added).¹³⁷

Naturally, for the tussle to be effective the synthesis of the game should be such that competing interests are in fact adequately represented. This can either mean that there is a potent number of players, or that power along the value chain is not disproportionately concentrated in the hands of a single player or a class of players, who would therefore be in the position to dominate the tussle.

We think this is the case. The mobile telecommunications industry has grown vastly in complexity and scope,¹³⁸ so much indeed that a single actor rarely has the power and expertise to fully enforce his will.¹³⁹ In highly technical and sophisticated markets the degree of specialization and secularization is such as to lead to “an increase in the number of firms that possess the necessary technical knowledge and commercial capabilities to bring to market some component or service to ... users.”¹⁴⁰ Greenstein calls this “absence of unilateral bargaining” and brings it as a reason why the Internet, despite it accommodates dominant actors in every part of its value chain, is characterized by “innovative health:”

136 David D. Clark, Tussle in Cyberspace: Defining Tomorrow's Internet, 13 IEEE/ACM Transactions on Networking 462, 463 (2005).

137 Id. at 466.

138 Cf. Christopher S. Yoo, The Dynamic Internet ### (2012) (chronicling how the broadband market became from relatively homogeneous in technologies and business relationships to deeply heterogeneous).

139 See George J. Stigler, The Division of Labor Is Limited by the Extent of the Market, 59 Journal of Political Economy, 185 (1951) (where the author states that the higher the division of labor in an industry the more actors will be involved in the production and commercialization process).

140 Shane Greenstein, Innovative Conduct in Computing and Internet Markets 477, 492, in Handbook of the Economics of Innovation (Volume 1) (Bronwyn H. Hall & Nathan Rosenberg, eds. 2010).

“In a network with a high degree of technical interrelatedness, there are general gains to all parties from bringing routines into business processes and activities, much like there are gains to adopting standards and platforms to coordinate activities. While there may be no better way to reduce complexity, adopting such routines may require negotiation between multiple parties.”¹⁴¹

Sections ### to ### highlighted that in the decision-making process throughout the value chain many more actors than the direct competitors are implicated. And still more, the scope of the tussle as understood here goes even further to include the broader community of participating actors in the market. In the Google-Verizon example above the two companies were unrelated in terms of their competitive overlap. Similarly in some standard-setting proceedings, even consumers have a say. When Microsoft attempted to get the Office Open XML standard approved as an open standard, it faced the opposition of a variety of activists that feared that Microsoft would refuse to make its standard fully open and interoperable—as it pledged—and instead discriminate against or exclude competing software from reading OOXML files and competing open standards, such as the ODF.¹⁴² In such situations, the ability or inability to exclude or discriminate is embedded in the design of the technology itself and the forces that affect the design can go well beyond the immediate competitors.

141 Shane Greenstein, Glimmers and Signs of Innovative Health in the Commercial Internet, 8 *Journal on Telecommunications and High Technology Law* 25, 63 (2010).

142 See Ryan Paul, OOXML Critics: Iso Approval Demonstrates The Need For Reform, *Ars Technica*, April 3, 2008; DeNardis, *supra* note ###, at vii-ix; Dylan Bushell-Embling, Bias Claim on Big Office Vote, *Sunday Morning Herald*, February 26, 2008;

3.2 DEMAND SIDE CONSIDERATIONS

The previous part described how the technical realities of mobile networks enable and facilitate competitive responses that limit the impact of exclusion in the market or have a dissuasive effect. Here, the focus is on how technology facilitates demand-side actors in finding alternatives and switching to competitors thusly bypassing exclusionary bottlenecks along the value chain. The analysis of the demand side is necessary because it is not enough for an option or alternative to be available, consumers must also be in the position to get to it.

An array of diverse options is indeed available throughout the value chain. Putting aside the applications and services layer which is where most of the heterogeneity occurs, there is also considerable variety in the application distribution layer (iPhone AppStore, Google Play, Amazon Apps, Windows Marketplace), operating systems (iOS, Andoid, Windows Phone), content delivery mechanisms (cloud architectures, CDNs, other intermediaries), transmission networks (cellular network, Internet, IMS, corporate intranets, other IP networks), mobile devices (phones, tablets, phablets, laptops), and physical transmission technologies (cellular, femtocells, Wi-Fi, other radio bands).

Even though not every combination is possible among actors and resources in each of the above levels, multiple links and paths still remain open. The ability to multihome and the intricate and extensive system of interconnections open up to actors various paths through which they can access products and services, and this weakens the position of exclusionary bottlenecks in the market.

3.2.1 Multihoming

Multihoming is the ability of subscribers to join multiple systems (networks and platforms) at the same time. This allows them to access multiple environments and to draw complementary utility from all of them.¹⁴³ Under multihoming subscribers reap the benefits of multiple systems and do not depend exclusively on one of them. In essence, multihoming opens up multiple paths between a source (service or application developer) and a destination (end users) through all the intermediaries along the value chain (operating systems, software delivery platforms, network operators, device manufacturers etc). An example of multihoming on the developers' side is the design of an application for more than one mobile operating systems (e.g. iOS and Android); an example of multihoming on the users' side is the ability to use both the cellular network and Wi-Fi on a mobile phone; an example of multihoming of players in the middle of the value chain is a device manufacturer partnering with more than one mobile operating system developers (e.g. HTC's mobile phones run Android or Windows Mobile).

Under multihoming exclusionary behavior by one system does not completely negate access to an input or distribution channel as long as one of the sides multihomes to another system. In that case, actors on the demand side can turn to a competing input or distribution channel thereby bypassing the exclusionary actor. In essence, multihoming weakens the power position of bottlenecks and limits the effect of exclusionary practices, because it opens up alternative paths to connect actors in the industry.¹⁴⁴ The more extensive multihoming is in every level of the value

143 Jay Pil Choi, Tying in Two-Sided Markets with Multi-Homing, 58 *Journal of Industrial Economics* 607, 607 (2010).

144 See Nicholas Economides, The Economics of the Internet Backbone, in *Handbook of Telecommunications Economics* 373, 383-385 (Sumit K. Majumdar et al., eds 2006).

chain the less power is concentrated in each link and the easier it becomes for actors to connect to each other.

The overlapping options thanks to multihoming create a form of redundancy in the market, such that market actors are not dependent on a specific device, mobile operating system, network or other element to access services, content and applications. The availability of multiple systems at the fingertips of subscribers means that multiple paths open up through which they can “meet,” which reduces the possibility that they won't be able to access a service or application because of exclusionary practices.¹⁴⁵

There is no doubt that multihoming is neither a perfect alternative to competition nor that it guarantees that every combination of inputs and platforms will be possible, a result that could be obtained by the complete banning of exclusion. Multihoming potentially imposes a cost to subscribers (that of joining more than one systems),¹⁴⁶ and it can reduce welfare as well as competition under certain conditions.¹⁴⁷

145 Competition is analogous to the degree of overlap between the networks subscribers multihome to. See Alexander Rasch, Platform Competition with Partial Multihoming under Differentiation, 12 Economics Bulletin 1, 1-2 (2007).

146 Toker Doganoglu & Julian Wright, Multihoming and Compatibility, 24 International Journal of Industrial Organization 45, ###; Jean J. Gabszewicz & Xavier Y. Wauthy, Two-Sided Markets and Price Competition with Multi-homing, at 2, available at <http://ssrn.com/abstract=975897>; Sujit Chakravorti and Roberto Roson, Platform Competition in Two-Sided Markets: The Case of Payment Networks, Federal Bank of Chicago Working Paper 2004-09, 2004), at 24 et seq.. The cost does not have to be monetary. For example, when the FCC was scrutinizing the AOL – Time Warner merger, they were considering mandating that AOL Messenger be interoperable with other messengers, because AOL's argument that users can simply install and use more than one messengers (i.e. the cost of multihoming to multiple messengers) was deemed to be too burdensome for users. See In the Matter of Applications for Consent to the Transfer of Control of Licenses and Section 214 Authorizations by Time Warner Inc. and America Online, Inc., Transferors, to AOL Time Warner Inc., Transferee, Memorandum Opinion and Order (FCC 01-12), §153-174.

147 It can reduce competition because subscribers buy more than once and so systems don't compete for exclusivity. For the same reason it can also reduce compatibility incentives. Lack of competition can sustain prices at higher levels, and lack of compatibility can be welfare reducing when compatibility is desirable, i.e. when network effects are strong and the cost of achieving compatibility is low. See Doganoglu & Wright, supra note ###, passim.

But its growing popularity is also a testament to the outweighing benefits both to subscribers and to platforms. Multihoming expands the potential adoption pool for developers and providers, it creates more options for end users to better serve their preferences, and it results in output increase in the market.¹⁴⁸ Additionally, multihoming creates strategic pressure on systems not to exclude for the following reason: in a two-sided system with developers on one side and users on the other side multihoming on one side reduces the incentives of multihoming on the other side, because access to the subscribers on the other side is guaranteed anyway.¹⁴⁹ That is, if users multihome, developers can switch from an exclusionary system to a non-exclusionary one, and they will still be able to reach all users. This creates incentives for the exclusionary system to refrain from this practice for fear of driving away developers.

For these reasons, multihoming has become prevalent throughout the mobile telecommunications value chain. ComScore reports that as of December 2013 56% of U.S. digital media consumers multihome (i.e. use more than one device to access services, content and applications), up from 48% earlier the same year.¹⁵⁰ Deloitte predicts that more than 50 million subscribers globally will receive premium programming from more than one source (e.g. pay TV and broadband).¹⁵¹

Android and Windows Mobile, which partner with multiple device manufacturers, unlike

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149 This holds under the assumption that exclusive subscribers (end users or developers) to a network are more valuable than subscribers who multihome. See Attila Ambrus et al., *Either or Both Competition: A “Two-sided” Theory of Advertising with Overlapping Viewerships*, Working Paper, available at ###. Roson also concludes that multihoming on one side reduces the incentives to multihome on the other side. See Roberto Roson, *Platform Competition with Endogenous Multihoming*, Working Paper Nota di Lavoro 20.2005, 2005, available at ###

150 ComScore, *U.S. Digital Future in Focus 2014* (April 2014), at 7. See also ComScore, *Marketing to the Multi-Platform Majority* (October 2013).

151 Deloitte, *Technology, Media and Telecommunications Predictions 2014* (January 2014), at 26.

Apple or Blackberry, capture over 50% of the market.¹⁵² Android supports alternative application platforms on top of the official Google Play (e.g. Amazon's AppStore) and installations from “unsupported” sources (e.g. a direct link from a website) which give yet another option to service and application developers to reach end users.

At the same time, most of the modern mobile communication devices support both licensed and unlicensed spectrum connectivity, doubling the channels through which consumers can access services and applications.¹⁵³ There is considerable evidence that the wireless future will be dominated by smart or cognitive radios, which allow devices to switch seamlessly between different bands of the spectrum—e.g. cellular, WiFi, WiMAX—and can represent different systems to which users can subscribe.¹⁵⁴

As long as actors' needs and preferences in the telecommunications value chain remain heterogeneous and no single option can satisfy all of them, there will be room for multihoming, and as technology makes it easier, such as the case for smart radios, its relevance in the market will remain and affect the competitive abilities of players.

152 For a list of measurements see Wikipedia, Mobile Operating System, available at http://en.wikipedia.org/wiki/Mobile_operating_system#Market_share

153 Travis E. Litman, Cognitive Radio: Moving Toward a Workable Framework for Commercial Leasing of Public Safety Spectrum, *Journal on Telecommunications and High Technology Law* 249, 256-258 (2005).

154 See, e.g., NTIA's advisory panel opinion stating that “the communications industry is beginning the implementation of a new generation of cellular technology that incorporates smart antennas, Internet protocol, and other new techniques for content compression. Over the next 10 to 20 years, these new technologies will effectively multiply existing cellular-communications spectrum allocations by at least an additional 10 times.” Michael Calabrese et al., Report from the Spectrum Inventory Working Group of the Commerce Spectrum Management Advisory Committee 4 (2010). See also J. Brad Bernthal et al., Trends and Precedents Favoring a Regulatory Embrace of Smart Radio Technologies, 2nd IEEE International Symposium on New Frontiers in Dynamic Spectrum Access Networks, 2007.

3.2.2 Interconnection and Compatibility

Multihoming as discussed previously represents a vertical relationship between actors in different levels of the value chain, and it demonstrates how the ability of a subscriber in one level to connect to multiple systems (e.g. network, platform) at another level limits the power of each individual system and makes exclusion less effective in the presence of other alternatives.

Instead of subscribers connecting to multiple systems a similar effect can be achieved horizontally by having systems in the same level connect to each other. Several words are used to describe this arrangement but it is more commonly known as interconnection: the physical and logical connection between two actors/elements in a network for the purpose of exchanging traffic.¹⁵⁵ Interconnection technically presupposes that network elements “speak” the same language, otherwise they won't be able to communicate. The use of mutually agreed protocols that enable two different systems to communicate with each other makes them *compatible*,¹⁵⁶ and lack of incompatibility is tantamount to exclusion.¹⁵⁷ In recent years a special kind of interconnection, known as peering, i.e. the exchange of IP traffic between providers without mutual remuneration, has surfaced as a common business settlement.¹⁵⁸

What all these arrangements have in common is that they multiply the links between

155 See 47 C.F.R. 51.5; Directive 2002/19/EC on Access to, and Interconnection of, Electronic Communications Networks and Associated Facilities, Art. 2(b); ITU, NGN Interconnection and Access (GSR 2007 Discussion Paper), at 5; Daniel F. Spulber & Christopher S. Yoo, Network Regulation: The Many Faces of Access, 1 Journal of Competition Law and Economics 635, 641 (2005); Gerald Faulhaber, Access (does not equal) Access(1) + Access(2), 2002 Michigan State DCL Law Review 677, 686 (2002).

156 Joseph Farrell & Timothy Simcoe, Four Paths to Compatibility, in The Oxford Handbook of the Digital Economy 34, 34-38 (Martin Peitz & Joel Waldfoegel eds., 2012).

157 Nicholas Economides & Lawrence J. White, Networks and Compatibility: Implications for Antitrust, 38 European Economic Review 651, 655 (1994) (“the decision to produce and sell a component that is incompatible with potentially complementary components is tantamount to exclusion.”).

158 Geoff Huston, Interconnection, Peering and Settlements, 9 proc. INET 1 (1999).

systems (and actors within systems) and, thereby, open up more paths through which end users can access services and applications.¹⁵⁹ As actors across systems become more interconnected with each other, the ability of each individual actor to affect how traffic flows decreases, because the availability of alternative paths through which data can be detoured undermines, much like multihoming, the power and effectiveness of bottlenecks and exclusionary behavior.¹⁶⁰ In fact, adequate interconnection has been recommended as the only necessary requirement for a network free of bottlenecks well-positioned to exclude or discriminate.¹⁶¹

Common knowledge, for example, suggests that one of the main reasons why the Internet is considered to be so resilient and also hard to regulate end to end is that it consists of several interconnected autonomous systems that are intricately linked to each other, so that if one of them fails or refuses to accept traffic, traffic can be routed around it to and from its destination.¹⁶² As a general matter then, extensive interconnection and compatibility transform a purely vertical value chain into a “diagonal” ecosystem. If, for instance, network A blocks traffic that comes directly from source B, but is in a peering agreement with network C, and the service level agreement between A and C stipulates that A must accept all traffic from C, then traffic from B can be rerouted through C to reach A's subscribers.¹⁶³

The question now is whether interconnection and compatibility are dependable options in terms of their natural occurrence, that is whether industry dynamics will transition from a mere

159 See, e.g., David Gilo, A Market-Based Approach to Telecom Interconnection, 77 Southern California Law Review 1, 6-7 (2003).

160 Kevin Werbach, Only Connect, 22 Berkeley Technology Law Journal 1233, 1294-1297 (2007).

161 Id. at 1297 (“Interconnection, as a safety valve for routing around platform bottlenecks, is the best mechanism to tame anti-competitive behavior in such an environment.”).

162 See also Yoo supra note ### (Dynamic Internet), at ### (where the author makes a similar point for secondary peering).

163 Cf. Werbach, supra note ###, at 1294-1295.

theoretical technical availability of interconnection and compatibility to actual implementation without the need for regulatory interference.

The prevailing line of thought suggests that as long as there are a few players of comparable size in the market, it is in their interest to interconnect and to achieve compatibility between their services.¹⁶⁴ The rationale is that with networks of roughly similar size none of them can unilaterally dominate the market through incompatibility or lack of interconnection, but to the contrary they can exploit stronger network effects if they combine their networks.¹⁶⁵ It would take indeed a rather dominant player in the market—and there is some disagreement as to the exact market share required—to make exclusion of other networks a profitable strategy.¹⁶⁶

Additionally, the observation that a dominant player blocks interconnection and compatibility with smaller rivals is not in itself enough to prove ability to harm smaller rivals without knowing their competitive strategy. For example, Malueg and Schwarz develop a model where competition between the excluded smaller rivals serves as a promise for higher quality to consumers and makes them more appealing than the larger network.¹⁶⁷ It is also known that the

164 Jacques Cremer et al., *Connectivity in the Commercial Internet*, 48 *Journal of Industrial Economics*, 433, ### (2000); Michael Katz & Carl Shapiro, *Network Externalities, Competition and Compatibility*, 75 *American Economic Review* 424, ### (1985).

165 See FCC, *Interconnection and Resale Obligations Pertaining to Commercial Mobile Radio Services*, Third Report and Order, 155 FCC Rcd 15975, para. 24 (2000). See also *Automatic and Manual Roaming Obligations Pertaining to Commercial Mobile Radio Services*, Notice of Proposed Rulemaking, 15 FCC Rcd 21628, para. 32 (2000).

166 See David Malueg & Marius Schwartz, *Interconnection Incentives of a Large Network*, Georgetown University Department of Economics Working Paper 1.05 (2001), at 38 (“Overall our analysis indicates that, for [given] parameter values ... global degradation is unlikely to be profitable unless the largest network controls substantially more than half the installed-base customers. Regarding targeted degradation, we found that it is profitable in CRT’s [Cremer, Ray, Tirole] example only for a small set of parameter values.”).

167 *Id.* (“The logic is that a larger number of (Cournot) rivals implies stronger competition among them, which—for suitable consumer expectations—leads to more new subscribers being added and a concomitant increase in the relative quality of the rivals’ network. Indeed, for some parameter values, if the largest network pursued global degradation then the only possible equilibrium would be tipping to the rivals. Competition among the rivals serves as a commitment to consumers that the rivals’ network will expand more aggressively than would a single firm (for the same initial base), and this competition-based advantage of the rivals’ network can

size of the network is not the only factor that weighs in in consumer choices; their expectations from the network as well as how well the network complements their existing choices and investments are also important.¹⁶⁸

Further, even in the presence of a dominant player, refusal to interconnect or achieve compatibility does not inexorably result in anticompetitive effects. Ostensibly, a dominant player would want to block interconnection and compatibility to exclude the subscribers of the smaller networks and deprive them of positive network externalities with the ultimate goal to lure them into his own network. However, several factors need to be in place for subscribers to switch to another (even bigger) network: network effects must be strong, switching costs must be low, coordination between the smaller players must also be low¹⁶⁹, and players must be unable or unwilling to internalize the positive externality that they will create for the network they join (excess momentum),¹⁷⁰ or the negative externality for the network they leave (excess inertia).¹⁷¹ Given these factors it is entirely possible that subscribers of smaller networks do not want or do not need to switch to the larger network, and therefore the larger network's exclusionary policies are essentially innocuous.

Moreover, a feature of interconnection and compatibility is that to achieve redundancy in the

overcome the disadvantage of its smaller installed base.“).

168 Michael L. Katz & Carl Shapiro, Systems Competition and Network Effects, 8 *Journal of Economic Perspectives* 93, passim (1994).

169 Faulhaber, *supra* note ###, at 689-699 (where the author discusses the conditions that need to be present for anticompetitive behavior to arise. A dominant firm will opt to not interconnect if (a) it is substantially larger than its competitors, (b) there are strong network effects, (c) switching costs are low, (d) smaller players don't interconnect among themselves).

170 Michael L. Katz, Product Introduction with Network Externalities, 40 *Journal of Industrial Economics* 55, 55-56 (1992).

171 Joseph Farrell & Garth Saloner, Installed Base and Compatibility: Innovation, Product Preannouncements, and Predation, 76 *American Economic Review* 940, 940-941 (1986).

market not all actors have to be connected to all other actors. If network A interconnects with network B but not C, and C interconnects with B, subscribers of network C can still reach subscribers of network A (*mutatis mutandis* for compatibility). In that scenario C's bargaining position may not be in the position to strike a direct interconnection agreement with A, but the desired affect can be achieved with B's intermediation. Such indirect interconnection or compatibility may come with an additional cost, economic or technical, but this is not an issue that lends itself to *ex ante* regulation. Indeed, the Commission has so far refrained from specifying a particular type of interconnection (direct or indirect, IP or TDM) as evidenced by the still open debate on the transition from TDM to IP telephony in fixed and mobile networks.¹⁷²

3.3 DURABILITY OF POWER

We mentioned previously that one of the factors influencing the degree of threat exclusionary power poses touches on its ability to persist in time. If it is simply transitory, regulatory or judicial measures might prove premature and unnecessarily burdensome.

The question before us now is whether we have good reasons to believe that market power in technology-intensive markets such as mobile telecommunications fades away faster than regulatory or judicial measures can respond. This is not to say that market power is impossible to accrue in the mobile telecommunications industry,¹⁷³ but that the nature of the industry is such

172 See, e.g., Reply Comments of Verizon, Connect America Fund, et al., Report and Order and Further Notice of Proposed Rulemaking, WC Docket Nos. 10-90 et al., FCC 11-161, at 31-43 (2012) (stating that the Commission does not specify the details of interconnection) and Reply Comments of Sprint Nextel Corporation, Connect America Fund, et al., Report and Order and Further Notice of Proposed Rulemaking, WC Docket Nos. 10-90 et al., FCC 11-161, at 19-22 (2011) (asking the Commission to adopt detailed interconnection rules).

173 Even the most progressive of antitrust scholars consent that dominance and market distortions are a possibility that cannot be ignored and for that reason antitrust and market supervision still has a place and time. See, e.g.,

that some evidence of market power treated in isolation of the dynamic evolution of the industry should not be enough to substantiate concerns of dominance.¹⁷⁴ In this context the emergence of exclusionary practices can very well be transient and they will be eclipsed along with the market power on which they rely. As a result, the determination of harmful exclusionary conduct must rest on an elevated measure of scrutiny that can prove not only its existence, but also its ability to persist *despite* the high dynamism of the market in which it occurs.

We base this cautionary treatment of the power to exclude on the fact that technology-intensive industries, such as mobile telecommunications, exhibit strong network effects which accelerate market evolution, and on theoretical and empirical evidence that rapid technological progress undermines the competitive advantage of firms at least during the early stages of a market's development.

3.3.1 Network Effects in Technology-Intensive Industries

Network effects are a familiar concept in telecommunications and many of their implications are directly and widely applicable. It is well known that in network industries extreme market shares are normal, and so are unequal profits,¹⁷⁵ and also that network markets tend to tip and so

Robert Pitofsky, Antitrust Analysis in High-Tech Industries: A 19th Century Discipline Addresses 21st Century Problems, 4 Texas Review of Law & Policy 129, 133 (1999) (“I believe antitrust should-indeed must-continue to apply. None of the ‘high-tech differences’ justifies a complete or even substantial exemption.”).

174 David S. Evans & Richard Schmalensee, Some Economic Aspects of Antitrust Analysis in Dynamically Competitive Industries, in Innovation Policy and the Economy (Volume 2) 1, 18-20 (Adam B. Jaffe et al. Eds, 2002) (concluding that “a proper market-power inquiry in new-economy industries must include a serious analysis of the vigor of dynamic competition. This requires looking beyond current sales figures.” *Id* at 20).

175 See Nicholas Economides & Frederick Flyer, Economides, Nicholas, Compatibility and Market Structure for Network Goods (Discussion Paper EC-98-02, Stern School of Business, N.Y.U., 1998) available at <http://www.stern.nyu.edu/networks/98-02.pdf>.

competition *for* the market is often fierce (and very productive).¹⁷⁶ These effects expose the reinforcing nature of network effects within the industry. But taking it a step further, we will focus here on one of the lesser known aspects of network effects, which relates to their catalyzing impact on the speed of market power accumulation and loss. The argument is that network effects help firms gain market power faster than if network effects were not present, but the same reason can eventually result in the firms' own demise making market power volatile.¹⁷⁷ Therefore, any exclusionary practices that are enabled by such market power may be temporary and lacking the ability to inflict long-term harm on the industry.

A market is characterized by network effects when the participating players derive more value from joining or participating as their number grows. This externality occurs either because the value of the market is directly tied to the number of players in it (e.g. a telephone network becomes more valuable as the number of subscribers that can be reached through it increases), or indirectly because the number of players in the market drives up the number of complements that will be created for the market making it more valuable (e.g. the value of an operating system increases with the applications that are written for it).¹⁷⁸

The link between value and size means that size leads to value and value, in turn, causes size to grow in an ever-increasing feedback loop. This is also known as “the rich get richer effect” and demonstrates how network effects magnify the impact of the already installed base to attract

176 Jeffrey H. Rohlfs & Hal R. Varian, Bandwagon Effects in High Technology Industries 13-18 (2005); Michael L. Katz & Carl Shapiro, Technology Adoption in the Presence of Network Externalities, 94 Journal of Political Economy 822 (1986).

177 See Nicholas Economides & Charles Himmelberg, Critical Mass and Network Evolution in Telecommunications, in *Toward a Competitive Telecommunications Industry: Selected Papers from the 1994 Telecommunications Policy Research Conference* 47 (Gerard Brock ed., 1995).

178 See Nicholas Economides, The Economics of Networks, 14 International Journal of Industrial Organization 673, 675-699 (1996).

even more players, and the larger the base becomes the greater the pull towards the network.¹⁷⁹ Consequentially, when network effects are involved the customers base grows faster than when network effects are absent. Therefore, large market shares build up and market evolution occurs at higher rates in network industries.¹⁸⁰

However, the same goes for competitors. When an incumbent actor is challenged by a new entrant, any network effects that accrue to the entrant work to the disadvantage of the incumbent,¹⁸¹ because they help the entrant grow faster. As this process repeats itself, players in network industries enjoy fast growth, but upon emergence of a competing wave of network effects, they also face *rapid displacement*.¹⁸² To the extent that entry is possible and competitors are drawn into the market, even extreme market shares can dissipate quickly. Hence, the mere observation of market power in isolation of factors that can cause it to disappear rapidly, is not good evidence to fear persistent and harmful exclusionary behavior.¹⁸³

Technology-intensive industries are good candidates for the kind of rapid succession of waves described here. Technological networks (that give rise to network effects) are prevalent in

179 David Easley & Jon Kleinberg, *Networks, Crows & Markets: Reasoning About a Highly Connected World* 479 et seq. (2010); Joseph Farrell & Paul Klemperer, *Coordination and Lock-In: Competition with Switching Costs and Network Effects*, in *Handbook of Industrial Organization* (Volume 3) 1967, 1974 (Mark Armstrong & R. Porter eds, 2007)

180 See Economides & Himmelberg, *supra* note ###, at 58 (where the authors examine the growth of the fax market from introduction to maturity and conclude that the “tremendous surge in demand was not driven as much by outside shifts in consumer demand and price reductions as much as it was driven by the 'feedback' effect induced by both past increases and anticipated future increases in the size of the installed base.”).

181 The network effects that accrue to the entrant do not have to rely on the same factors as those that accrued to the incumbent.

182 See Sangin Park, *Quantitative Analysis of Network Externalities in Competing Technologies: The VCR Case*, 86 *Review of Economics and Statistics* 937 (2004) (where the author examines how network effects helped the VCR standard overtake the Betamax standard).

183 ### See also Evans & Schmalensee, *supra* note ###, at 14 (“the rational expectation of significant market power for some period of time is a necessary condition for dynamic competition to exist in high-technology industries. Thus if dynamic competition is healthy, the presence of short-run market power is not a symptom of a market failure that will harm consumers.”).

every stage of the mobile telecommunications value chain. For example, Nokia's Symbian application ecosystem grew rapidly until 2008, when Apple's App Store was introduced and soon took the lead, until itself was undercut a few years later by competition from Android, today's largest application platform.¹⁸⁴ In a matter of less than a decade three major platforms succeeded each other as the leader in their relevant market.¹⁸⁵

Anyone concerned about market power in technological industries should be mindful of the inherent volatility of this kind of schumpeterian competition. When the competitive advantage stems from a structural characteristic of the industry, as are network effects, any entrant is a potential candidate to exploit the same characteristic that boosted the incumbent leader in that position and replace him.

3.3.2 Rapid Progress in Technology-Intensive Industries

Exclusion is further hard to achieve when the advantage on which an actor relies to serve as a bottleneck is based on a technical design that can soon become obsolete. Acute technological dynamism in an industry can quickly render a player and his practices irrelevant. This is true for every industry that exhibits some measure of progress, but high technology industries are thought to progress even faster, with frequent new developments sending recurrent waves of pressure to existing players.¹⁸⁶

184 For the relevant market shares see Wikipedia, List of mobile software distribution platforms

185 See similarly Evans & Schmalensee, *supra* note ###, at 12, 17.

186 See, e.g., Pitofsky, *supra* note ###, at 131 ("New generations of products, undermining existing market power, appear more frequently in high-tech than in mature industries. In the first half of the 20th century, firms in steel, oil and aluminum remained dominant for generations, but that is often not the case in many high-tech industries. An oft-cited example involves IBM, which probably was a dominant firm, if not a monopolist, in certain markets when the government initiated its case in 1969, but which had lost monopoly power in many of these

A variety of explanations has been offered in support of this view. Network effects, for the reasons explained previously, is one of them. Further, sectoral surveys over the past twenty years have suggested that traditional sources of advantage such as economies of scale, advertising, distribution systems, and R&D, albeit still important, can sometimes be trumped by such features of technology-intensive industries as lower barriers to entry, more frequent technological change, ease of switching on the side of consumers, the dominant role of intellectual property and high rates of patenting and cross-licensing.¹⁸⁷ These developments increase mobility in the market and allow only temporary advantage until competitors catch up with or outmaneuver aggressors.¹⁸⁸ In no small part because of the technological interdependence vehement standard competition and continuous experimentation are considered staple characteristics of high technology industries.¹⁸⁹ Some scholars have gone as far as to suggest that “hypercompetition”—the idea that the competitive advantage is getting harder to maintain in today's environment—characterizes not only technical industries, but industries across the board.¹⁹⁰ This should elevate the threshold of proof for when market power is resilient enough to be of concern.

It has also been noted that technology-intensive industries present greater product differentiation and are in a better position to address niche audiences and more specialized

markets when the case was abandoned thirteen years later.”).

187 See, e.g., Richard D'Aveni, *Hypercompetition: Managing the Dynamics of Strategic Maneuvering* 4-10 (1994); Richard Schmalensee, *Antitrust Issues in Schumpeterian Industries*, 99 *American Economic Review* 192 (2000); Lacy Glenn Thomas, *The Two Faces of Competition: Dynamic Resourcefulness and The Hypercompetitive Shift*, 7 *Organization Science* 221 (1996); Guy Gellatly & Valerie Peters, *Understanding the Innovation Process: Innovation in Dynamic Service Industries* 20 (Statistics Canada, Research Paper No. 127, 1990).

188 Bala Chakravarthy, *A New Strategy Framework for Coping with Turbulence*, 38 *Sloan Management Review* 69 (1997).

189 Greenstein, *supra* note ###, at 46-63.

190 Robert R. Wiggins & Timothy W. Ruefli, *Schumpeter's Ghost: Is Hypercompetition Making the Best of Times Shorter?*, 26 *Strategic Management Journal* 887 (2005); Lacy Glenn Thomas & Richard D'Aveni, *The Rise of Hypercompetition from 1950 to 2002: Evidence of Increasing Industry Destabilization and Temporary Competitive Advantage*, Tuck School of Business Working Paper (2004), available at ###

consumer needs.¹⁹¹ The larger scope of available solutions leads to higher “internal” competition, faster obsolescence and ultimately to new waves of innovation.¹⁹² Lucrative niche markets can then serve as the source of funding for the new waves of innovation.¹⁹³

Moreover, because in highly technical industries human capital and know-how form a large part of the innovation cost, disruptive innovations that affect business models and organizational paradigms are easier to bring to the market compared to innovations that require primarily capital-intensive investments.¹⁹⁴ In such an environment market leaders may have a hard time maintaining their dominance against rivals.¹⁹⁵

Despite what one would expect the empirical literature is largely missing. From the relevant studies Thomas, and Wiggins and Ruefli corroborate the theoretical underpinnings of hypercompetition.¹⁹⁶ Thomas examined 200 manufacturing industries over the 1958–1991 interval and Wiggins and Ruefli examined over 40 industries from 1978 to 1997, and both found that sustained superior economic performance attenuates faster over time.¹⁹⁷ Castrogiovanni, on the other hand, sampled 88 industries during the 1967–1992 time interval and found no support for the hypothesis that dynamism (which he defines as instability of sales, employment, value

191 Eric H. Kessler & Alok K. Chakrabarti, Innovation Speed: A Conceptual Model of Context, Antecedents, and Outcomes, 21 *Academy of Management Review* 1143, 1156–57 (1996).

192 Morton I. Kamien & Nancy L. Schwarz, Market Structure and Innovation 9-11 (1982); Ross Brennan, Evolutionary Economics and the Markets-as-Networks Approach, 35 *Industrial Marketing Management* 829, 831–32 (2006).

193 Kessler & Chakrabarti, *supra* note ###.

194 Thomas F. Cooley & Mehmet Yorukoglu, Innovation and Imitation in an Information Age, 1 *Journal of European Economic Association* 406, 407 (2003).

195 See Walter J. Ferrier et al., The Role of Competitive Action in Market Share Erosion and Industry Dethronement: A Study of Industry Leaders and Challengers, 42 *Academy of Management Journal* 372 (1999).

196 Thomas, *supra* note ###; Wiggins & Ruefli, *supra* note ###.

197 *Id.*

added and price-cost margin) in “new” industries increases.¹⁹⁸ Vaaler and McNamara, fall somewhat in the middle, finding statistically significant correlation between very high performing technical industries (as opposed to simply highly technical industries) and a decrease in abnormal returns, which they used as proxy for dominance.¹⁹⁹

From the combination of the theoretical and empirical literature it is safe to say that technology-intensive industries are *at least very likely* to progress rapidly and faster than other industries. Therefore, one should remain wary toward the observation of significant market power or even abusive (read:exclusionary) practices based thereupon, because it may well mean either that this is the natural modus operandi of the industry or that the firm under scrutiny is simply trying to compete in the cutthroat environment of technology-intensive industries. Schmalensee in his defense of Microsoft's exclusionary practices against Netscape notes that

“in a 'winner take most' business, any profit-seeking firm must have such an objective [i.e. to crush its competitors]. Microsoft' s intention to compete hard enough to maintain its market position necessarily entailed excluding Netscape from a major role in the platform business. Similarly, in 1995 Marc Andreessen, a founder of Netscape, expressed his intention to compete in the platform business by asserting that Netscape intended to reduce Windows to an unimportant collection of 'slightly buggy device drivers.’”²⁰⁰

We do not mean to say that the accumulation of market power is never a problem in high technology industries, but rather that an elevated measure of scrutiny and extreme caution are warranted in forming hypotheses and reaching conclusions as to when seemingly anticompetitive

198 Gary J. Castrogiovanni, Organization Task Environments: Have They Changed Fundamentally Over Time?, 28 Journal of Management 129 (2002).

199 Paul M. Vaaler, Gerry McNamara, Are Technology-Intensive Industries More Dynamically Competitive? No and Yes, 21 Organization Science 271 (2010).

200 Schmalensee, supra note ###, at 195.

practices have the potential to inflict long-term harm and are worthy of regulatory or judicial response.

This is particularly true during the early stages of an industry's or product's development. While the literature discussed previously does not differentiate between the various phases in an industry's or product's evolution, there is additional evidence that young (as opposed to mature) industries are even more unstable and fast-changing, and the argument that caution should be exercised applies with greater vigor during that early phase.

As early as the 1950s the *product life cycle theory* introduced the familiar S-curve to describe how products and markets mature.²⁰¹ It distinguishes between four stages—introduction, growth, maturity and decline—²⁰²of which introduction is when the product develops its main qualities and characteristics, and innovation rates are high, as is risk.²⁰³ Abernathy, Utterback and Dosi, also divide evolution in two phases, the *pre-paradigmatic* and the *paradigmatic*.²⁰⁴ The pre-paradigmatic phase roughly corresponds to the introduction stage of the product life cycle theory, and is characterized by fluidity in design, high uncertainty, innovation and

201 Joel Dean, Pricing Policies for New Products, Harvard Business Review, November 1950, at 45. For a graphical summary of different curves of product life cycles see David R. Rink, & John E. Swan, Product Life Cycle Research: A Literature Review, 7 Journal of Business Research 219, 221-223 (1979). See generally David R. Rink & John E. Swan, Product Life Cycle Research: A Literature Review, ### Journal of Business Research 219, (1979). See also William E. Cox, Jr., Product Life Cycles as Marketing Models, 40 Journal of Business 375 (1967). The PLC theory is applicable to both individual products and markets; see Yoram Wind, A Note on the Operationalization of the Product Life Cycle Concept, Wharton Working Paper 3-4 (1975), available at <https://marketing.wharton.upenn.edu/files/?whdmsaction=public:main.file&fileID=1884>.

202 See Porter, supra note ###, at 158. See also Philip Kotler & Kevin Lane Keller, Marketing Management ### (10th ed. 2012).

203 See Porter, supra note ###, at 159-161.

204 James M. Utterback & William J. Abernathy, A Dynamic Model of Process and Product Innovation, 3 Omega: The International Journal of Marketing Management 639 (1975) ; Dosi, supra note ###, at 151-157. See also Tushman & Anderson, supra note ###, at 441; Scott Gallagher & Seung Ho Park, Innovation and Competition in Standard-based Industries: A Historical Analysis of the US Home Video Game Market, 49 IEEE Transactions on Engineering Management 67 (2002). See generally Devendra Sahal, Patterns of Technological Innovation (1981).

experimentation, small market size and low demand.²⁰⁵ Once a *dominant design* emerges, the market moves to the paradigmatic phase, which sees increasing standardization around the dominant design and market expansion, much like the growth and maturity stages of the product life cycle theory predicts.²⁰⁶

Other theories prolong the phase during which products and markets are volatile and under constant reshaping. In the *complex products and systems* (CoPS) literature, in which telecommunications is the paradigmatic example, the unit of analysis is a system made up of components that adhere to an overall architecture,²⁰⁷ and it never really takes a final form due to the continuous recombining of its components, and because not all of its parts develop at the same pace.²⁰⁸ Similarly platform studies attempt to explain evolution of platform industries and products through a separation between the platform itself and its inputs/components, and note that initially the overall architecture of the platform is set up, then the ecosystem around the platform is mobilized to attract more complements and finally the platform matures and complements proliferate.²⁰⁹

Although the number of stages in these theories fluctuates,²¹⁰ there is a clear evolutionary

205 Utterback & Abernathy, *supra* note ###, at 643. Utterback & Abernathy, *supra* note ###, at 44-45.

206 *Id.* at 644-646. Utterback & Abernathy, *supra* note ###, at 44.

207 Mike Hobday, Product Complexity, Innovation and Industrial Organization, 26 *Research Policy* 689, 691-692 (1998); Davies, *supra* note ### 230-232. Ying-Tao Ren & Khim-Teck Yeo, Research Challenges on Complex Product Systems (CoPS) Innovation, 23 *Journal of the Chinese Institute of Industrial Engineers* 519, 521-523 (2006).

208 Davies, *id.* at 233-238; Hobday, *supra* note ### 700-701.

209 Thomas R. Eisenmann, Managing Proprietary and Shared Platforms: A Life-Cycle View, HBS Working Paper 07-105, at 2 (2007).

210 There are many other variations on top of those presented here. See, e.g. Pink & Swan, *supra* note ###, at 222; Chester Wasson, *Dynamic Competitive Strategy and Product Life Cycles* 3-10 (1978). Utterback & Abernathy, *supra* note ###, at 641-45.

path common to all of them:²¹¹ initially, new products, services and markets go through a flux stage during which they acquire the main characteristics that will define their form throughout their life cycle; then, they enter the phase where details in the design are filled in, the product or service takes its most representative form and the market expands around it.

For the introductory phase they emphasize that it is highly experimental and fluid,²¹² and that there is constant redesign and adaptation to match market feedback, which itself is rudimentary, and to correct perceived errors in the initial design.²¹³ The inherent potentials of an innovation are unclear and so is consumer demand and needs.²¹⁴

Accordingly, any market power that builds up during this phase is contingent upon the success of the proposed design, something that neither the firm nor regulators or courts are in the position to know. During this phase the innovator should be let alone “[to] be intimately coupled to the market,” which involves picking the right partners and, as a logical inference, excluding those that are deemed inappropriate or threatening.²¹⁵ The ability to move swiftly in the market without externally imposed obligations and restrictions enhances coordination, accelerates the emergence of standards and processes for resources to be able to work together, and attracts investment in necessary resources (if nothing else at least by diminishing free riding).²¹⁶

211 See Dosi, *supra* note ###, at 157-158; Fernando F. Suarez, Battles for Technological Dominance: An Integrative Framework, 33 *Research Policy* 271, 271 (2004); James M. Utterback & Fernando F. Suarez, Innovation, Competition, and Industry Structure, 22 *Research Policy* 1, 5-7 (1993).

212 Donald K. Clifford, Jr., Leverage in the Product Life Cycle, *Dun's Review* (May 1965), at ###

213 Porter, *supra* note ###, at 159-161.

214 Trevor J. Pinch & Wiebe E. Bijker, The Social Construction of Facts and Artifacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other. 14 *Social Studies of Science* 399, ### (1984)

215 Teece, *supra* note ###, at 290-291. (profiting from)

216 See Eisenmann, *supra* note ###, at 3-6 (Managing propr platforms); See also Eisenmann et al., *supra* note ###, *passim* (Opening Platforms).