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Claimable Aspects of Software-Implemented Business Methods

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ABSTRACT

Business method patent claims may be directed to at least two distinct aspects of software: formal (mathematical/logical) system behavior as seen from the programmer's perspective, and informal (interactive) system behavior as seen from the user's perspective. This article identifies some strategic implications of this dichotomy for the drafting, interpretation, valuation, and management of business method patent claims. I describe certain prior art principles of theoretical computer science that may raise the threshold to patentability for claims directed solely to formal aspects of system behavior. I also show how the application of antitrust principles to certain basic concepts in intellectual property licensing and software engineering can assist in the drafting of claims directed solely to informal system behavior. Finally, I illustrate the application of these principles and techniques to a well-known business method patent of interest to the financial services industry: the Amazon.com "one-click" patent.

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I. ASPECTS OF SYSTEM BEHAVIOR

The claims of a United States patent define the substantive legal scope of the patentee's invention and exclusionary rights. The characterization of a patent as a "business method patent" for purposes of public policy or private strategic analysis should therefore be derived directly from the scope of the patent's claims, rather than its Patent Office classification, the industry in which its assignee participates, or its

treatment in the trade and popular press. Consider, for example, the following method claims from three different patents:

> (a) A computerized data mining method for automatically determining a prediction model for a dependent data mining variable based on at least one independent data mining variable, said method comprising the following steps: a variable replacement step replacing said independent data mining variable with potential values from a global range by a multitude of independent local data mining variables, each independent local data mining variable with potential values from a subrange of said global range; an initialization step initializing a current prediction model; a looping sequence including a first step having substeps of determining for every independent local data mining variable not yet reflected in said current prediction model a multitude of partial regression functions, each partial regression function depending only on one of said independent local data mining variables; determining for each of said partial regression functions a significance value; selecting the most significant partial regression function and the corresponding not yet reflected local data mining variable; and a second step of adding said most significant partial regression function to said current prediction model and of associating said corresponding local data mining variable with said significance value.
>
> (b) A banking fraud prevention process using a digital computer and utilized to prevent the submission for payment of checks having information printed on the face of the check altered, comprising the steps of: converting the printed check information to a first digital value via a predetermined but not

publicly known algorithm; receiving a presented check having said printed check information printed thereon; converting the presented check information to a second digital value via said predetermined algorithm; comparing said first digital value and said second digital value to determine whether a match exists; and when a match does not exist, reconverting said presented check information to a third digital value by iteratively evaluating one or more field positions for which more than one value may exist and using an alternate value to determine said digital third value and comparing said third digital value to said first digital value to determine whether a match exists.

(c) A method of placing an order for an item comprising: under control of a client system, displaying information identifying the item; and in response to only a single action being performed, sending a request to order the item along with an identifier of a purchaser of the item to a server system; under control of a single-action ordering component of the server system, receiving the request; retrieving additional information previously stored for the purchaser identified by the identifier in the received request; and generating an order to purchase the requested item for the purchaser identified by the identifier in the received request using the retrieved additional information; and fulfilling the generated order to complete purchase of the item, whereby the item is ordered without using a shopping cart ordering model.

Claim (a) comes from a pending patent application filed on behalf of International Business Machines Corp. ("IBM").[1] Claim (b) is from a patent, jointly owned by Merrill

[1] U.S. Patent Application No. 20020120591, cl. 1 (published Aug. 29, 2002).

Lynch and Mellon Bank, directed to a system and method for detecting check alterations.[2] Claim (c) is the principal claim from Amazon.com's famous "1-click" patent.[3]

The Patent Office has routed all three of these patents into Class 705, as methods of "data processing, financial, business practice, management, or cost/price determination."[4] This classification is based on the Patent Office's determination that the claimed methods are "uniquely designed for or utilized in the practice, administration, or management of an enterprise, or in the processing of financial data."[5] Under the most prominent public policy initiative in this area, the Business Method Patent Improvement Act of 2001,[6] that determination would have become legally cognizable as a basis for selecting patent applications for heightened scrutiny and special administrative proceedings.[7] As I shall argue, however, the classification of a patent as a business method patent can obscure an important distinction that can be drawn directly from the language of its claims.

All three of our example claims serve to specify characteristics of the behavior of a computer system running software; in the parlance of software engineering, they are all *specifications*.[8] Specifications may have very different implications for software design, however, depending on whether they are *formal* or *informal*. A specification is formal if

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[2] U.S. Patent No. 5890141, cl. 10 (issued March 30, 1999).
[3] U.S. Patent No. 5960411, cl. 1 (issued Sept. 28, 1999).
[4] *See* U.S. Patent Classification System, Class 705 <http://www.uspto.gov/web/offices/ac/ido/oeip/taf/def/705.htm> (visited March 5, 2003).
[5] *See id.*
[6] H.R. 1332, 107th Cong., 1st Sess. (2001).
[7] *See id.* at § 2 (defining "business method" as "a method of administering, managing, or otherwise operating an enterprise or organization, including a technique used in doing or conducting business," as determined by the USPTO director).
[8] *See generally* ALI BEHFOROOZ & FREDERICK J. HUDSON, SOFTWARE ENGINEERING FUNDAMENTALS ch. 4 (1996) (describing development and analysis of software specifications).

it is written entirely in terms of mathematically provable statements, with precisely defined semantics and syntax;[9] otherwise, it is informal.

Of the three claims, only claim (a) is amenable to interpretation as a formal specification. In other words, for claim (a) there is a corresponding formal specification such that every limitation in claim (a) can be met, if at all, by a system that satisfies the formal specification. This is because every term in every step in the method of claim (a) — "prediction model," "independent data mining variable," "potential values," "global range," and so on — when read in light of the patent specification and other relevant evidence and principles of claim construction, has a meaning in the claim that can be fully captured in a procedural programming language with precisely defined semantics and syntax. Claim (a) is best understood as a set of constraints on software design and implementation, to be viewed from the programmer's perspective.[10] Claims of this type will be described as "formal."

In contrast, every step in the method of claim (c) refers to at least one of the terms "order" and "purchaser," neither of which can be fully captured as a concept by computer programming instructions. Instead of defining limitations on computer programs formally, from a programmer's perspective, claim (c) is better understood as describing the steps of an interaction between a user and a system informally, from the user's perspective. Claims of this type will be referred to as "informal."

Claim (b) contains limitations of both kinds: most of the steps in the method refer to the term "check," which does not correspond to any formal programming construct,

[9] *See id.* at 176.
[10] *See generally* PETER PADAWITZ, DEDUCTION AND DECLARATIVE PROGRAMMING (1992) (demonstrating general techniques for capturing and verifying declarative programs in terms of formal software specifications).

but the remainder refer only to terms whose meanings can be realized through programming instructions. Claims of this type will be called "hybrid."

The distinction between formal and informal claims has significance for both the validity and valuation of software patents. Of course, since formal claims contain no field-of-use or other limitations that would categorically distinguish them over prior art references in theoretical computer science, they may be more susceptible to invalidation than are hybrid or informal claims directed to the same software invention, which may be construed as more narrowly drawn to the field of application in which any informal terms are defined.[11] This article serves to make two further observations in this regard. First, in addition to overcoming a relatively broad range of relevant prior art references, a formal claim may need to meet the elevated standard of patentability over a prior art genus. Second, since the scope of an informal claim is defined by reference to the purposes and intentions of the software user rather than the design choices of the software developer, it may be possible to draft informal claims with a view to encompassing an entire software product market and thereby acquiring market power.

[11] *See* E. Robert Yoches & Terry S. Callaghan, *The Next Battle: New Forms of Software Prior Art*, 2 U. BALT. INTELL. PROP. L.J. 115, 123 (1994) (noting that many software patents employ use limitations, environmental limitations, and capability limitations to distinguish over the prior art).

II. A PRIOR ART GENUS FOR FORMAL CLAIMS

A. Turing Machines

A *Turing machine* is an abstract model of a programmable computer.[12] In its most basic form, a Turing machine consists of an infinite strip of *tape* partitioned into an infinite number of spaces, and a *head* that can move in either direction along the tape and can print a symbol taken from a finite alphabet into the space where it resides, replacing whatever was in the space before. At any given time, the machine is in one of a finite number of *states*. The head performs work on the tape through a sequence of *moves*. During each move, the head may (a) perform a read, write or erase operation, (b) change to any state (or remain in the current state), and (c) move one space either to the left or to the right. The specific move to be taken by the head at any given time is determined by a *next move function* that depends on two variables: the current state of the machine and the current contents of the space where the head is located.

[12] For a more detailed introduction to Turing machines, *see, e.g.*, A.K. DEWDNEY, THE NEW TURING OMNIBUS 207-15 (1993); JOHN E. HOPCROFT & JEFFREY D. ULLMAN, INTRODUCTION TO AUTOMATA THEORY, LANGUAGES, AND COMPUTATION 146-50 (1979).

Machine State	If scanner reads a blank	If scanner reads a +
State 1	STOP	Write <blank>; change to state 2; move left
State 2	Write +; change to state 3; move left	Remain in state 2; move left
State 3	Write +; change to state 4; move right	Remain in state 3; move left
State 4	Change to state 5; move right	Remain in state 4; move right
State 5	STOP	Write <blank>; change to state 2; move left

Figure 1. Next move function for a Turing machine that doubles whole numbers.

The table in Figure 1 describes the next move function for a particular Turing machine that has five states and uses the alphabet { +, <blank> }.

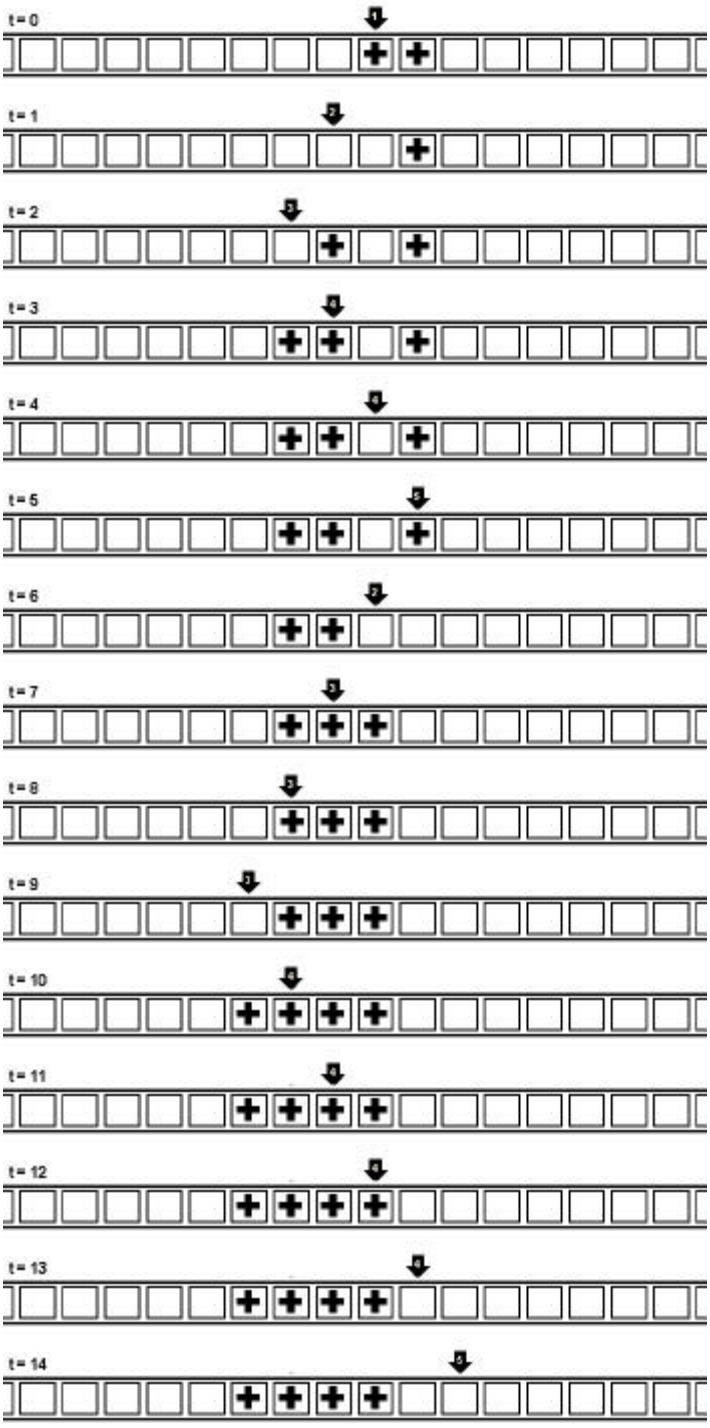

Figure 2. First 14 steps of a computation on a Turing machine with the next move function defined in Figure 1.

As shown in Figure 2, the initial content of the tape, or *input*, consists of a single contiguous string of + symbols on an otherwise blank tape. Initially (at time t=0), the head is initially in state 1 and is located at the leftmost + symbol. Given this initial condition and the next move function defined in Figure 1, it is possible to determine the sequence of all subsequent moves. As shown in Figure 2, the Turing machine continues for 14 steps and then stops in state 5. This particular Turing machine is designed to double the number of + symbols on the tape.

The Turing machine has endured as a model of computation because of its relative simplicity and unsurpassed generality. It is possible, through known procedures, to construct a Turing machine equivalent to any calculation that can be performed by any existing digital computer or by any theoretical model of computation yet developed.[13] Furthermore, the computer science community's long experience with such computers and models to date has not contradicted the more general hypothesis, credited to Alonzo Church and Alan Turing, that the Turing machine is capable of emulating every conceivable machine computation on integers, even though such a claim is too ambiguous to be amenable to mathematical proof.[14]

B. The Universal Turing Machine

The Turing machine model is defined as describing one specific computational procedure, but the model is actually general enough that it is possible, through known methods, to design a single Turing machine (a "universal Turing machine") that is

[13] *See* HOPCROFT & ULLMAN, *supra* note 12, at 153-74 (explaining general principles of Turing machine construction and assigning exercises suitable for an undergraduate theoretical computer science course).
[14] *See id.* at 166. For a survey of the literature on the Church-Turing thesis,

capable of performing any computation that can be performed by any Turing machine.[15] The key to making this work is a systematic method for numbering Turing machines, so that a universal Turing machine is capable of determining the complete specification of a Turing machine (its alphabet, states, and next move function) from its number. The input to a universal Turing machine is a data string consisting of two parts: a number that identifies the particular Turing machine whose computation is to be performed, and the input to this computation. The universal Turing machine is able to interpret this string and perform the same computation that would have been performed by the specified Turing machine on the specified input.

C. Implications for Validity

The generality of Turing machines and the existence of universal Turing machines may have subtle but profound implications for the validity of formal software claims. Since such claims are limited only by programming constraints and not by any application-specific elements, each claimed computational procedure has equivalent representations as a Turing machine, and as a number that identifies this Turing machine to a universal Turing machine. Moreover, methods for translating among these equivalent representations are known to those of ordinary skill in the art (i.e., undergraduate computer science students). The scope of a formal claim is therefore equivalent to a selection of some of the possible inputs to a universal Turing machine. In terms of patent doctrine, the universal Turing machine is a genus that may be cited as a prior art reference against a formal software claim. Although this does not serve by itself

[15] For a more detailed introduction to universal Turing machines, *see, e.g.*, DEWDNEY, *supra* note 12, at 339-44; HOPCROFT & ULLMAN, *supra* note 12, at 181-85.

to invalidate formal software claims, it does serve to raise the threshold for patentability over other software prior art, as I will now explain.

A prior art reference may anticipate a claim under § 102(a) of the Patent Act[16] if it describes each element of the claim either expressly or inherently.[17] A claim is obvious under § 103 if its differences from the prior art "are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the claimed subject matter pertains."[18]

While a prior art genus ordinarily does not serve to anticipate every claim that encompasses one or more of its species,[19] under certain circumstances it can render such a claim invalid for obviousness.[20] To avoid a rejection for obviousness, the applicant must demonstrate that the species claimed within the prior art genus provides a unique and unexpected advantage or property that distinguishes it over the unclaimed species.[21]

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[16] 35 U.S.C. § 102(a) (2003).
[17] *See* Verdegaal Bros. v. Union Oil Co., 814 F.2d 628, 631 (Fed. Cir. 1987).
[18] 35 U.S.C. § 103(a) (2003).
[19] *See, e.g.*, In re Meyer, 599 F.2d 1026, 1031 (C.C.P.A. 1979); 2 DONALD S. CHISUM, PATENTS § 3.02[2], at 3-20 to 3-25 (1991) ("a prior art genus which does not explicitly disclose a species does not anticipate a later claim to that species"); *but see* In re Petering, 301 F.2d 676 (C.C.P.A. 1962) (holding that a generic chemical formula encompassing 20 compounds provided a sufficient description of a limited class to anticipate a claimed species).
[20] *See* CHISUM, *supra* note 19 ("the prior genus will often render a later species obvious under Sectiobn 103").
[21] *See* CHISUM, *supra* note 19, at § 3.02[2], at 3-23 to 3-25 & nn. 8-9 ("To avoid [an obviousness] rejection, the applicant would have to demonstrate that the particular species had unique and unexpected advantages or properties that distinguish it from other species within the prior genus."); *see, e.g.*, California Research Corp. v. Ladd, 356 F.2d 813, 820 (D.C. Cir. 1966) (citations omitted) ("Where the claimed advance over the prior art lies in focusing on the special attributes of a sub-genus that is part of a genus already broadly disclosed, there is particular need to show that the limitation is critical. The criticality issue turns on whether the claim is an advance over products and processes previously known and sufficiently distinctive to warrant a patent monopoly."); Ex parte Winters, 11 U.S.P.Q.2d 1387, 1388 (Bd. Pat. App. & Int'f 1989) ("Generally speaking, there is nothing unobvious in choosing 'some' among 'many' indiscriminately. Some compounds, falling within the scope of a prior art genus, are unpatentable in the absence of a showing of unexpectedly superior results.").

Although the consideration of prior art genii in the nonobviousness analysis most commonly arises in connection with claims to chemical compounds,[22] the Patent Office has issued guidelines that are generally applicable to the examination of prior art genii in all fields of invention.[23] Under these guidelines, a patent examiner's nonobviousness inquiry will be based on findings as to (a) the structure of the prior art genus and that of any expressly described species or subgenus within the genus; (b) any physical or chemical properties and utilities disclosed for the genus, as well as any suggested limitations on the usefulness of the genus, and any problems alleged to be addressed by the genus; (c) the predictability of the technology; and (d) the number of species encompassed by the genus.[24]

The Patent Office guidelines purport to follow leading Federal Circuit precedents holding that a large prior genus does not render a claimed species obvious, in the absence of any teaching that suggests the selection.[25] Although the genus consisting of computations that can be performed on a universal Turing machine has a mathematically predictable structure and function, the description of the genus encompasses an astronomical number of species and does not teach a significant utility for any species. Accordingly, a universal Turing machine by itself would probably not be found to render obvious a claim to software that fulfilled a particular use.

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[22] *See* Jeffery Fredman, *Are Oligonucleotide Primers and Probes Prima Facie Obvious Over Larger Prior Art Nucleic Acids?* 19 SANTA CLARA COMPUTER & HIGH TECH. L.J. 285, 299-302 (2002).
[23] U.S. PATENT AND TRADEMARK OFFICE, MANUAL OF PATENT EXAMINING PROCEDURE § 2144.08 (2003).
[24] Id.
[25] *See, e.g.*, In re Baird, 16 F.3d 380 (Fed. Cir. 1994) ("A disclosure of millions of compounds does not render obvious a claim to three compounds, particularly when that disclosure indicates a preference leading away from the claimed compounds."); In re Bell, 991 F.2d 781 (Fed. Cir. 1993) ("Absent anything in the cited prior art suggesting which of the 1036 possible sequences suggested by Rinderknecht corresponds to the IGF gene, the PTO has not met its burden of establishing that the prior art would have suggested the claimed sequences.").

The existence of a universal Turing machine does, however, imply that analogous prior art software references serve in part to disclose an equivalent of a subgenus of the universal Turing machine, together with its known properties and utilities. The requirement of a unique and unexpected advantage or property beyond those that are cumulatively disclosed in such prior art contrasts sharply with the generally applicable utility requirement, which requires no net advantage over the prior art.[26] In this respect, the universal Turing machine serves to raise the threshold for patentability over other software prior art.

To the extent that this higher threshold poses a barrier to patentability, it can be overcome. In a previous article,[27] I suggested that a software patent claim could be drafted to include limitations directed to algorithmic efficiency, thereby distinguishing it over the highly inefficient universal Turing machine (and by implication, its subgenii).[28] Hybrid software claims take the different approach of including limitations directed to a specific field of use. In either case, the subject matter of the claim is no longer equivalent to a selection from the inputs to a universal Turing machine, and the genus/species analysis described above no longer applies.

[26] *See* Lowell v. Lewis, 15 F. Cas. 1018, 1019 (C.C.D. Mass. 1817) (rejecting the argument that to qualify for a patent, a pump "must be, for the public, a better pump than the common pump").
[27] Andrew Chin, *Computational Complexity and the Scope of Software Patents*, 39 JURIMETRICS J. 17 (1998).
[28] *See id.* at 22.

III. A MONOPOLY-SEEKING METHOD FOR DRAFTING INFORMAL CLAIMS

Although it is common to speak of a "patent monopoly,"[29] it should be remembered that a patent confers monopoly power only when it is so broad in scope that the owner can profitably restrict output of the patented product without fear that consumers will turn to substitutes and competitors.[30] Such a situation is widely thought to be rare,[31] even though the hope of achieving monopoly power is the only incentive that informs the drafting of every patent claim.[32]

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[29] *See, e.g.*, Morton Salt Co. v. G.S. Suppiger, Co., 314 U.S. 488, 492 (1942) ("The grant to the inventor of the special privilege of a patent monopoly carries out a public policy adopted by the Constitution and laws of the United States, 'to promote the Progress of Science and useful Arts.'"); Kendall v. Winsor, 62 U.S. 322, 329 (1859) (referring to patent grant as a "limited and temporary monopoly"); Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1024-46 *passim* (1989); Bruce Ramsey, *Living Assets: Patenting of Human Cell Lines, Genes by Biotech Companies Creates an Ethical Firestorm*, SEATTLE POST-INTELLIGENCER, June 19, 1995, at B4 (reporting Council for Responsible Genetics's objection to the "conversion" of DNA molecules into "corporate property through patent monopolies").

[30] *See* Nuno Pires de Carvalho, *The Primary Function of Patents*, 2001 J. L. TECH. & POL'Y 25, 61-66.

[31] *See, e.g.*, Northern Pacific R.R. Co. v. United States, 356 U.S. 1, 10 n.8 (1958) ("Of course it is common knowledge that a patent does not confer a monopoly over a particular commodity."); ROBERT M. SHERWOOD, INTELLECTUAL PROPERTY AND ECONOMIC DEVELOPMENT 51-52 (1990); Carvalho, *supra* note 30, at 62 ("Only a few patents do afford monopoly power"); Lori M. Berg, Comment, *The North American Free Trade Agreement and Protection of Intellectual Property: A Converging View*, 5 TRANSNAT'L L. & POL'Y 99 (1995) ("Rarely is a patent on a single product the equivalent of a marketplace monopoly"); Kenneth W. Dam, *The Economic Underpinnings of Patent Law*, 23 J. LEGAL STUD. 247, 249-50 (1994) ("Indeed, without the benefit of empirical research, it is entirely plausible to conclude that in the great bulk of instances no significant market power is granted."); J. Paul McGrath, *Patent Licensing: A Fresh Look at Antitrust Principles in a Changing Economic Environment*, 27 PAT., TRADEMARK & COPYRIGHT J. (BNA) 624, 626 (1984) ("[T]he exclusive rights to patents rarely give their owners anything approaching a monopoly"); *see also* Nickola v. Peterson, 580 F.2d 898, 914 n.25 (6th Cir. 1978) (Markey, J.) ("Of course it is common knowledge that a patent does not always confer a monopoly over a particular commodity."); *but cf.* In re ISOs Antitrust Litigation, 964 F. Supp. 1479, 1488 (D. Kan. 1997) (holding that antitrust law does not forbid "a single 'patent monopoly' [to] be used to secure multiple 'economic monopolies,' i.e., monopolies in more than one relevant antitrust market"); Ramon A. Klitzke, *Patents and Monopolization: The Role of Patents Under Section Two of the Sherman Act*, 68 MARQ. L. REV. 557, 595 (1985) ("Section Two of the Sherman Act, the antimonopolization statute, stands in polar opposition to the monopoly granted by the Patent Act.")

[32] *See, e.g.*, Giles S. Rich, *Infringement Under Section 271 of the Patent Act of 1952*, 35 J. PAT. OFF. SOC'Y 476, 479 (1953) ("It is essential to keep in the forefront of our thinking the fact that a patent is a monopoly

This section describes a method of drafting an informal software patent claim that is certified to encompass an entire relevant product market and may therefore be expected to confer monopoly power in that market. In the software field, which is generally characterized by uncertain patent valuations, a patent claim that is annotated with a rigorous market definition analysis is likely to be seen as valuable. I will also illustrate these ideas with a toy example inspired by Amazon.com's "1-click" patent.

A. Market Definition

Antitrust cases frequently involve a determination as to whether the defendant has, or is likely to obtain, monopoly power or market power in some relevant market.[33] It is therefore often necessary for parties and courts to begin their legal analyses by defining the relevant market in question. This line of inquiry is expressly indicated by the federal antitrust statutes, which condemn monopolization of "any part of . . . trade or commerce"[34] and mergers that tend to lessen competition "in any line of commerce in any section of the country,"[35] and has been adopted by the courts in their interpretations of these statutes. A properly-defined relevant market is necessary to calculate a firm's market share for the purpose of inferring individual market power.[36] Also, the analysis of

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because its only value as an incentive depends upon securing to its owner monopoly power over the invention. That is the only thing that gives the possibility of profit.").

[33] Monopoly power is "the power to control prices or exclude competition." United States v. E.I. duPont de Nemours & Co., 351 U.S. 377, 391 (1956). Market power is "the ability to raise price and restrict output." Eastman Kodak Co. v. Image Technical Services, Inc., 504 U.S. 451, 464 (1992) (citations omitted). Although the Supreme Court has indicated that monopoly power "requires, of course, something greater than market power," id. at 481, courts and commentators are increasingly reluctant to acknowledge a distinction between the two for purposes of economic analysis. See Andrew I. Gavil, *Copperweld 2000: The Vanishing Gap Between Sections 1 and 2 of the Sherman Act*, 68 ANTITRUST L.J. 87, 102 (2000). For a comprehensive discussion of the relationship between the market definition and market power inquiries, see IIA PHILLIP A. AREEDA ET AL., ANTITRUST LAW ch. 5 (2002).

[34] 15 U.S.C. § 2.

[35] 15 U.S.C. § 18.

[36] AREEDA, *supra* note 33, at ¶¶ 531c-d, at 188-89 (2002).

both horizontal and vertical conduct under the judicially-created rule of reason ordinarily calls for the definition of a market in which the conduct may or may not be found to have unreasonable anticompetitive effects.[37] Accordingly, market definition has become deeply embedded in common-law doctrines relating to such diverse conduct as monopolization,[38] mergers,[39] tying,[40] exclusive dealing,[41] territorial and customer restrictions,[42] and non-price horizontal restraints.[43] In sum, "the most important single issue in most enforcement actions — because so much depends on it — is market definition."[44]

In general, two products belong in the same relevant market when the ability of consumers and producers to substitute between them imposes an effective competitive

[37] *See* ABA SECTION OF ANTITRUST LAW, ANTITRUST LAW DEVELOPMENTS 495 (4th ed. 1997) (citation omitted) ("Ascertaining the restraint's competitive effects [under the rule of reason] ordinarily requires a definition of the relevant market and an analysis of the restraint's effect on competition within that market"); Phillip Areeda, *The Rule of Reason: A Catechism on Competition*, 55 ANTITRUST L.J. 571, 576-77 (1986) (noting that market definition is the usual approach to assessing the potential for anticompetitive effects, but that such an approach is "superfluous if we have already observed adverse effects"); *see also* Thomas E. Kauper, *The Problem of Market Definition Under EC Competition Law*, 20 FORDHAM INT'L L.J. 1682, 1685 (1997) ("Market definition is now an essential element in a broad range of U.S. cases. Indeed, one can plausibly argue that it is necessary in all but cartel and resale price maintenance cases.").

[38] *See, e.g.*, United States v. Grinnell Corp., 384 U.S. 563 (1966) ("The offense of monopoly under s 2 of the Sherman Act has two elements: (1) the possession of monopoly power in the relevant market and (2) the willful acquisition or maintenance of that power as distinguished from growth or development as a consequence of a superior product, business acumen, or historic accident.").

[39] *See, e.g.*, FTC v. H.J. Heinz Co., 246 F.3d 708, 715 (D.C. Cir. 2001) (explaining that the government establishes a presumption of anticompetitive effect by showing that a merger "would produce 'a firm controlling an undue percentage share of the relevant market, and [would] result[] in a significant increase in the concentration of firms in that market").

[40] *See, e.g.*, Jefferson Parish Hospital District No. 2 v. Hyde, 466 U.S. 2, 20-21 (1984) ("[A] tying arrangement cannot exist unless two separate product markets have been linked.").

[41] *See, e.g.*, Tampa Elec. Co. v. Nashville Coal Co., 365 U.S. 320, 327 (1961) (stating that "the line of commerce" (i.e., the product market) and "the area of effective competition" (i.e., the geographic market) must be delineated in order to determine whether an exclusive dealing arrangement will "foreclose competition in a substantial share of the line of commerce affected").

[42] *See* ABA SECTION ON ANTITRUST LAW, *supra* note 37, at 154-55 n. 852 (4th ed. 1997) ("Courts [reviewing territorial and customer restrictions under the rule of reason] typically require plaintiffs to show that a supplier has sufficient market power to affect competition in the relevant market.").

[43] *See, e.g.*, Rothery Storage & Van Co. v. Atlas Van Lines, Inc., 792 F.2d 210, 217 (D.C. Cir. 1986) (defining a nationwide market for the interstate carriage of used household goods in order to "analyze the economic nature and effects of the system [of non-price horizontal restraints] Atlas has created").

[44] Robert Pitofsky, *New Definitions of Relevant Market and the Assault on Antitrust*, 90 COLUM. L. REV. 1805, 1807 (1990).

constraint against the exercise of monopoly power.[45] The definition of a relevant market serves to describe a boundary between products[46] that compete with each other in this way and those that do not. This boundary has two dimensions, a geographic market and a product market, which are determined through separate lines of analysis. A geographic market defines "the 'area of effective competition . . . in which the seller operates, and to which the purchaser can practicably turn for supplies.'"[47] A product market identifies "producers which, because of the similarity of their products, have the ability — actual or potential — to take significant amounts of business away from each other."[48]

It should be noted at the outset that market definition, like the rest of antitrust jurisprudence, is not an exact science,[49] and the method described herein constitutes only one of many potentially valid approaches to defining product markets in the software industry.[50] The Supreme Court has characterized the product market inquiry in rather imprecise terms as identifying those "products that have reasonable interchangeability for the purposes for which they are produced — price, use, and qualities considered."[51]

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[45] *See, e.g.*, U.S. DEP'T OF JUSTICE & FEDERAL TRADE COMM'N, HORIZONTAL MERGER GUIDELINES §§ 1.11 & 1.21 (1992), *reprinted at* 4 Trade Reg. Rep. (CCH) ¶ 13,104 (hereinafter "Horizontal Merger Guidelines") (describing product and geographic markets as product groupings and regions in which a "hypothetical monopolist" could profitably impose a "small but significant and nontransitory" price increase); George J. Stigler, *Introduction*, *in* NATIONAL BUREAU OF ECONOMIC RESEARCH, BUSINESS CONCENTRATION AND PRICE POLICY 4 (1955) ("An indsutry should embrace the maximum geographical area and the maximum variety of productive activities in which there is a strong long-run substitution.").

[46] Throughout this article, the term "products" refers to both products and services.

[47] United States v. Philadelphia Nat'l Bank, 374 U.S. 321, 359 (1963) (quoting Tampa Elec. Co. v. Nashville Coal Co., 365 U.S. 320, 327 (1961)) (emphasis omitted).

[48] SmithKline Corp. v. Eli Lilly & Co., 575 F.2d 1056, 1063 (3d Cir.), *cert. denied*, 439 U.S. 838, 99 S.Ct. 123, 58 L.Ed.2d 134 (1978).

[49] *See, e.g.*, United States v. Philadelphia Nat'l Bank, 374 U.S. 321, 360 n. 37 (1963) (noting that "fuzziness" is inherent in the determination of a relevant geographic market); Pitofsky, *supra* note 44, at 1812 (arguing that market definition should be seen "as an array of estimates with no market description being exactly right").

[50] *See* James A. Keyte, *Market Definition and Differentiated Products: The Need for a Workable Standard*, 63 ANTITRUST L.J. 697 (1995) (noting "the lack of any clear standard for defining the relevant product market"); Pitofsky, *supra* note 44, at 1807 (noting the "persistent and unreconciled conflicts of approach [to market definition] in important judicial decisions").

[51] du Pont, 351 U.S. at 399.

Phillip Areeda's treatise describes market definition as contingent on a "critical policy choice": namely, the extent and duration of market power that will be considered legally problematic in the context of any particular antitrust case.[52] This article does not purport to provide a definitive standard for "reasonable interchangeability" or to resolve the "critical policy choice" for the courts. Rather, by identifying the attributes of and relationships among software products that are relevant to the product market inquiry, this article will provide an analytical framework wherein such standards and choices can be determined in the context of any particular case.

Moreover, this article will only address the problem of defining product markets in the software industry. This focus is not intended to trivialize the need for rigor in defining geographic markets in the software industry. Even with the emergence of electronic commerce on the Internet, there is no legal presumption that trade in the software industry is characterized by global geographic markets.[53] For example, many software products continue to be sold exclusively through local or national distribution channels or in connection with local installation, maintenance and support services.[54] Also, some software products, particularly those involving encryption technology, are subject to export controls.[55] These and other variations in the marketing and use of particular software products will continue to call for a fact-specific geographic market determination.

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[52] AREEDA, supra note 33, at ¶¶ 530b-c, at 182-85.
[53] *See, e.g.*, Lantec, Inc. v. Novell, Inc., 306 F.3d 1003 (10th Cir. 2002) (finding insufficient factual support for a worldwide geographic market for the competing software products).
[54] *See, e.g.*, United States v. Computer Associates Int'l, 2001-1 Trade Cas. (CCH) ¶ 72,805 (D.D.C. 1999), 1999 WL 1808406, at *14 (finding national geographic market where vendors were found to sell software products "to customers located throughout the United States").
[55] For example, the United States imposes export controls on certain encryption software. See Ira S. Rubinstein & Michael Hintze, *Export Controls on Encryption Software*, in COPING WITH U.S. EXPORT CONTROLS 2000, at 505 (PLI Commercial Law & Practice Course Handbook Series No. 812, 2000).

The definition of software product markets warrants particular attention as a discipline in antitrust practice, however, because it is the part of the market definition analysis that requires technology-specific methods. Product market analysis in the software industry needs to consider the specific intellectual property rights and technological features that comprise a particular software product, so that "similar[]" products capable of "tak[ing] significant amounts of business away"[56] from it can be identified. In contrast, geographic market analysis in the software industry is based on the physical locations where producers and consumers can find each other to deal in a software product or its substitutes. In this respect, geographic markets in the software industry are identified using the same methods as in any other industry. Even though software and other information products are distinctive in that they may be distributed over the Internet, geographic market analysis does not examine any technological aspect of the software product itself. Mischaracterizations of software technology and intellectual property concepts are therefore more likely to lead to errors in product market definition than in geographic market definition.

B. Product Markets Generally

The determination of a product market begins by identifying the defendant's product as the initial product in a "provisional market."[57] The relevant product market is

[56] SmithKline Corp., 575 F.2d at 1063.

[57] *See* AREEDA, *supra* note 33, at ¶ 560, at 295.

Antitrust liability may be based on harms to competition not only in product markets consisting of the economic substitutes for one product, but also in "cluster markets" that aggregate markets for numerous products sold by the defendant even though they may not be economic substitutes for each other. This approach is for administrative convenience and may not be undertaken where separate treatment of the products would result in a different conclusion regarding the existence or cause of monopoly power. *See generally* United States v. AT&T, 524 F. Supp. 1336, 1375-77 (D.D.C. 1981) (citations omitted) (aggregating markets for 200,000 products sold by defendant into a single cluster market); AREEDA, *supra*

then defined as the market in which this initial product competes. The analysis proceeds by iteratively extending the boundaries of the provisional market to include additional products that may be significant substitutes for the products already found to be in the market.[58] Such substitution may occur on both the demand side (when consumers are able to switch from using one product to using another)[59] and the supply side (when producers are able to switch from making one product to making another).[60] If product *A* is in the relevant market, and a significant price increase beyond the competitive level in the price of *A* would induce customers of *A* to buy product *B* instead, or induce producers of *B* to make and sell *A* instead, then *B* should also be included in the relevant market.[61] In either case, products *A* and *B* "have the ability — actual or potential — to take significant amounts of business away from each other,"[62] and are deemed to be in effective competition with each other.[63]

The definition of a product market thus calls for a careful analysis of demand and supply substitutability. As the Supreme Court explained in *Brown Shoe Co. v. United States*,[64] courts are to perform this analysis by examining the available evidence relating to "reasonable interchangeability of use or the cross-elasticity of demand between the product itself and substitutes for it," and seven "practical indicia," namely "industry or public recognition of the [product market] as a separate economic entity, the product's

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note 33, at ¶565, at 335 ("Whenever the Supreme Court did approve the clustering of noninterchangeable goods into a single market for administrative purposes, it was because there was no good reason for doubting that the defendant had the same degree of dominance with respect to all the goods in the cluster.").

[58] *See id.*

[59] *See id.* at ¶ 562, at 303-10.

[60] *See id.* at ¶ 561, at 296-303.

[61] *See id.* at ¶ 561, at 296.

[62] SmithKline Corp. v. Eli Lilly & Co., 575 F.2d 1056, 1063 (3d Cir.), cert. denied, 439 U.S. 838, 99 S.Ct. 123, 58 L.Ed.2d 134 (1978).

[63] *See supra* text accompanying notes 45-48.

[64] 370 U.S. 294 (1962).

peculiar characteristics and uses, unique production facilities, distinct customers, distinct prices, sensitivity to price changes, and specialized vendors."[65]

1. Demand Substitutability

The analysis of demand substitutability looks to "the reasonable interchangeability of use or the cross-elasticity of demand between the [initial] product itself and substitutes for it."[66] Although the cross-elasticity of demand between two products is a precise quantity,[67] in practice courts rarely consider precise cross-elasticity data.[68] Instead, most courts use the term more generally as a synonym for "reasonable interchangeability of use," as discerned from the qualitative tendency of an increase in the price of one product to result in an increase in the demand for a second product within a reasonably short time.[69]

Two products are said to exhibit "reasonable interchangeability of use" if (1) they are functionally interchangeable and (2) purchasers have a significant propensity to

[65] Id. at 325. While *Brown Shoe* identifies these indicia as relevant specifically in connection with the determination of "submarkets," courts and commentators have widely recognized their applicability to the delineation of product markets in general, and it is doubtful whether there remains any meaningful distinction between the identification of submarkets and product markets. *See generally* Rothery Storage & Van Co., Atlas Van Lines, 792 F.2d 210, 219 (D.C. Cir. 1986), *cert. denied*, 479 U.S. 1033 (1987) (concluding that "submarket indicia" are best viewed as "proxies for cross-elasticities" of supply and demand); AREEDA, *supra* note 33, at ¶ 533c, at 201-04 ("Only 'markets' are relevant"); 3 J. VON KALINOWSKI, ANTITRUST LAWS AND TRADE REGULATION § 8.02[2], at 8-27 (1986) (describing *Brown Shoe* indicia as "several new factors" for evaluating "interchangeability between different products").
[66] Brown Shoe Co. v. United States, 370 U.S. 294, 325 (1962).
[67] The cross elasticity of demand is the percentage change in demand for one good attributable to a percentage change in the price of another good. *See* E. THOMAS SULLIVAN & JEFFREY L. HARRISON, UNDERSTANDING ANTITRUST AND ITS ECONOMIC IMPLICATIONS 31 (1998).
[68] *See* ABA SECTION OF ANTITRUST LAW, *supra* note 37, at 503-05; *see also* AREEDA, *supra* note 33, at ¶ 531, at 187 (noting that if the defendant's own elasticities of supply and demand were known, it would be possible to infer market power directly, and therefore unnecessary to infer it from market share and market definition).
[69] *See id.*

switch from one to the other in response to a change in price.[70] Strictly speaking, reasonable interchangeability requires only that the second of these criteria be met: "[t]he ultimate determinant of whether products belong in the same market is whether customers are willing to substitute one product for the other."[71] Functional interchangeability between two products is, however, a necessary (but not sufficient[72]) condition for consumers to be able to switch between them, and serves as a useful heuristic filter to identify possibly competing products. Thus, in the standard formulation of the reasonable interchangeability inquiry, functional interchangeability is considered first:

> To determine whether [products] are in competition in a particular industry it is first necessary to decide whether they can be used for the same purpose — whether they are functionally interchangeable; and functional interchangeability does not require complete identity of use. Having found one or more products functionally interchangeable with [the product] in a particular use, the next

[70] *See* FTC v. Staples, Inc., 970 F. Supp. 1066, 1074 (D.D.C. 1997) (citing Hayden Pub. Co. v. Cox Broadcasting Corp., 730 F.2d 64, 70 n.8 (2d Cir.1984)) ("the general question is 'whether two products can be used for the same purpose, and if so, whether and to what extent purchasers are willing to substitute one for the other'"); United States v. Sungard Data Systems, Inc., 172 F. Supp. 2d 172, 182 (D.D.C. 2001) (same); FTC v. Swedish Match, 131 F. Supp. 2d 151, 157 (D.D.C. 2000) (same); Bon-Ton Stores v. May Dep't Stores Co., 881 F. Supp. 860, 868 (W.D.N.Y. 1994) (same); ABA SECTION OF ANTITRUST LAW, *supra* note 37, at 503 & n. 44 (citing *Bon-Ton*); Joshua A. Newberg, *Antitrust for the Economy of Ideas: The Logic of Technology Markets*, 14 HARV. J.L. & TECH. 83, (2000) ("The [*du Pont*] Court's product market inquiry into 'reasonable interchangeability of use or the cross-elasticity of demand between the product itself and substitutes for it' subsumes both the functional interchangeability of products and the actual propensity of buyers to switch from product A to product B in response to changes in price.").

[71] ABA SECTION ON ANTITRUST LAW, *supra* note 37, at 505.

[72] *See, e.g.*, U.S. Anchor Manufacturing, Inc. v. Rule Industries, Inc., 7 F.3d 986 (11th Cir. 1993), *cert. denied*, 512 U.S. 1221 (1994) (finding brand-name anchors functionally interchangeable with generic anchors, but that there was insufficient evidence of demand substitutability between them); United States v. Archer-Daniels-Midland Co., 866 F.2d 242, 246 (8th Cir. 1988) (accepting finding that sugar and high fructose corn syrup are functionally interchangeable, but concluding that "they are not reasonably interchangeable because of the price differential between the two products"); United States v. Charles Pfizer & Co., 246 F. Supp. 464, 468 n.3 (E.D.N.Y. 1965) ("While a finding of functional interchangeability must precede that of reasonable (reactive) interchangeability, it is not determinative. For products to be classified in the same market they must be both functionally and reasonably interchangeable.")

> question to be resolved is one of purchaser reaction — the willingness or readiness to substitute one for the other.[73]

Functional interchangeability. When a product can be used for only one purpose, the functional interchangeability inquiry is relatively straightforward: another product either serves the same purpose or it does not. For products that can be used for multiple purposes, however, there does not appear to be a bright-line test for functional interchangeability. On the one hand, "functional interchangeability does not require complete identity of use." For example, in *United States v. E.I. du Pont de Nemours & Co.*,[74] a finding that cellophane "has to meet competition from other materials in every one of its uses" was sufficient for the Supreme Court to conclude that "a very considerable degree of functional interchangeability exists between these products,"[75] even though no single material was a significant competitor to cellophane in all of cellophane's uses.[76] On the other hand, it may sometimes be proper to draw a product market boundary that distinguishes a group of buyers who are interested in a product only for certain purposes.[77] For example, the Seventh Circuit upheld a product market definition that included sales of new components for automotive electrical units to rebuilders who used them in production-line work, but excluded such sales to rebuilders who used them in custom or retail work.[78]

Given the indeterminacy that arises when there is competition with respect to some but not all of the purposes served by the defendant's product, it is well to remember

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[73] Pfizer, 246 F. Supp. at 468 (citation omitted).
[74] 351 U.S. 377 (1956).
[75] Id. at 399.
[76] *See id.* at 407 (showing market shares of different wrapping materials for various end uses of cellophane).
[77] *See infra* text accompanying notes 91-128 (describing price discrimination markets).
[78] *See* Avnet, Inc. v. FTC, 511 F.2d 70, 77-79 (7th Cir.), *cert. denied*, 423 U.S. 833 (1975) (Stevens, J.).

that the functional interchangeability inquiry is neither intended nor suited to resolve these complexities. It seems prudent in such cases, therefore, to stop at identifying the group of products that are functionally interchangeable with the defendant's product in each of its relevant uses separately,[79] and to defer the overall question of which products are functionally interchangeable for purposes of defining the relevant product market until the propensity of purchasers to switch can be examined.[80]

Propensity to switch. The inquiry into the propensity of purchasers to switch between products is directed to "whether buyers would respond to a significant increase in the price of *A* [from the competitive level to a supracompetitive level] by so shifting to product *B* as to make that price increase unprofitable to the *A* producers."[81] A willingness to shift between products may be inferred from observed shifts between products,[82] from correlation in the prices or price movements of products,[83] or from "the factors that normally determine the choice or preference of the user."[84]

Product and price differentiation. Courts often define product markets broadly enough to encompass differences that are material in the minds of buyers.[85] Even substantial differences in product features may "wash out," either when a particular

[79] *See supra* text accompanying note 73 (describing functional interchangeability inquiry as directed to finding "one or more products functionally interchangeable with [the product] in a particular use").
[80] *See infra* text accompanying notes 109-114.
[81] AREEDA, *supra* note 33, at ¶ 562, at 304.
[82] *See id.*
[83] *See id.*
[84] United States v. Charles Pfizer & Co., 246 F. Supp. 464, 468 (E.D.N.Y. 1971).
[85] *See, e.g.*, United States v. E.I. du Pont de Nemours & Co., 351 U.S. 377 (1956) (various flexible packaging materials); United States v. Continental Can Co., 378 U.S. 441, 456-57 (1964) (glass jars and metal cans); Cable Holdings v. Home Video, Inc., 825 F.2d 1559, 1563 (11th Cir. 1987) (cable television, satellite television, videocassettes, and free broadcast television); FTC v. PPG Indus., 798 F.2d 1500, 1504-06 (D.C. Cir. 1986) (glass and plastic aircraft transparencies).

product has both wanted and unwanted features, or when different buyers have opposite preferences for a particular feature.[86]

Notwithstanding any differences in price and features between two products, if preferences with respect to such factors show that consumers are willing to switch between them, then a court will find that the products are reasonably interchangeable.[87] In particular, it is generally the case that "a price differential, even a substantial one, is irrelevant for purposes of determining reasonable interchangeability."[88] This is because (absent a structural barrier to entry into the product market) price differentials between functionally interchangeable products are usually offset by differences in quality or other preferred attributes, thereby allowing the prices of more and less expensive products to constrain one another.[89] Courts have been particularly reluctant to define product markets based on differences in price or quality where a group of functionally interchangeable products forms a continuous "spectrum" of choices for consumers.[90]

Price discrimination markets. When user preferences regarding product characteristics are sufficiently differentiated to raise the possibility of price discrimination, this may justify the delineation of additional, narrower markets around groups of "captive" or "inframarginal" buyers to whom a significant price increase could

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[86] *See id.*
[87] *See generally* ABA SECTION OF ANTITRUST LAW, *supra* note 37, at 508-16 (reviewing cases involving differences in product type, differences in grade or quality, price differences and trends, and differences in product condition or availability).
[88] United States v. Archer-Daniels-Midland Co., 866 F.2d 242, 246 (8th Cir. 1988), *cert. denied*, 493 U.S. 809 (1989).
[89] *See* AREEDA, *supra* note 33, at ¶ 563, at 310.
[90] *See, e.g.*, In re Super Premium Ice Cream Distribution Antitrust Litigation, 691 F. Supp. 1262, 1268 (N.D. Cal. 1988) (emphasis in original) (citations omitted) ("Courts have repeatedly rejected efforts to define markets by price variances or product quality variances. Such distinctions are economically meaningless where the differences are actually a *spectrum* of price and quality differences."); *but see* United States v. Gillette Co., 828 F. Supp. 78 (D.D.C. 1993) (defining a market for premium writing instruments in a retail price range between $50 and $400); Keyte, *supra* note 50, at 722 (describing Gillette as "arguably breath[ing] some life back into carving out submarkets along a continuous price continuum").

be profitably targeted.[91] While such a "price discrimination market" is predicated on the theory that price discrimination against the captive buyers is possible, its valid use is not limited to cases involving an alleged or actual practice of price discrimination.[92] For purposes of market share/market power analysis, a price discrimination market stands on equal footing with any other relevant product market.[93]

To succeed with a price discrimination strategy, a seller must be able to identify and discriminate in price against a group of buyers who would not switch to other products, or find other sources, in sufficient numbers to make a "small but significant and nontransitory" price increase unprofitable.[94] In particular, other customers who can buy at a lower price must not be able to engage widely in arbitrage; i.e., purchasing the product for resale to disfavored buyers.[95]

The courts have recognized the ability to price-discriminate as relevant evidence of market power,[96] and have acknowledged support in the agency guidelines and in

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[91] Commentators have likened groups of captive buyers to the "distinct customers" referred to as one of the *Brown Shoe* indicia. *See, e.g.*, Jonathan B. Baker, *Stepping Out in an Old Brown Shoe: In Qualified Praise of Submarkets*, 68 ANTITRUST L.J. 203, 207-08 & n.20 (2000).

[92] As amended by the Robinson-Patman Act, section 2(a) of the Clayton Act, 15 U.S.C. § 13(a), prohibits a seller from "discriminat[ing] in price between different purchasers of commodities of like grade and quality" when such discrimination adversely affects competition.

[93] *See, e.g.*, United States v. Eastman Kodak Co., 63 F.3d 95, 106-07 (2nd Cir. 1995) (considering a price discrimination market proposed in connection with the disposition of a consent decree resolving a monopolization claim); Horizontal Merger Guidelines, *supra* note 45, at § 1.12 (defining price discrimination markets for use in merger review).

More generally, commentators have described the entire approach to market definition in the Horizontal Merger Guidelines as a determination of the feasibility of price discrimination. *See* Jerry A. Hausman & J. Gregory Sidak, *A Consumer-Welfare Approach to the Mandatory Unbundling of Telecommunications Networks*, 109 YALE L.J. 417, 477 (1999).

[94] *See* Horizontal Merger Guidelines, *supra* note 45, at § 1.12.

[95] *See* Horizontal Merger Guidelines, *supra* note 45, at § 1.12; Pitofsky, *supra* note 44, at 1814.

[96] *See, e.g.*, Eastman Kodak Co. v. Image Technical Servs., Inc., 504 U.S. 451, 475-78 (1992) (citing Kodak's ability to price-discriminate against unsophisticated, small-volume, and locked-in customers as supporting Image Technical Services's allegations of market power).

academic commentary for price discrimination markets,[97] but thus far have provided only scattered precedent for a price discrimination approach to market definition.[98]

For example, in *U.S. Anchor Mfg., Inc. v. Rule Industries, Inc.*,[99] an Eleventh Circuit case, U.S. Anchor alleged that Rule had attempted to monopolize a market for fluke anchors that encompassed generic and economy anchors as well as "Danforth" brand anchors sold only by Rule.[100] Rule argued that the relevant product market consisted of generic and economy anchors only.[101] At trial, the district court denied Rule's motion for directed verdict, and the jury found Rule liable, on the attempted monopolization claim.[102] On appeal, the Eleventh Circuit considered whether U.S. Anchor had introduced sufficient evidence to raise a jury question on the inclusion of Danforth anchors in the relevant product market.[103] After examining the *Brown Shoe* indicia,[104] the court concluded that there was insufficient evidence for a reasonable juror to find significant cross-elasticities of demand and supply between Danforth and the less expensive anchors.[105] The court went on to observe that "[t]he fluke anchor industry presented the unusual circumstance of severe price discrimination" against consumers loyal to Danforth, and that this brand loyalty may have been sufficient to justify finding a

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[97] *See* United States v. Eastman Kodak Co., 63 F.3d 95, 107 (2nd Cir. 1995) (citing AREEDA, *supra* note 33, at § 534d, at 183-85; Pitofsky, *supra* note 44).
[98] *See* LAWRENCE A. SULLIVAN, HANDBOOK OF THE LAW OF ANTITRUST § 17, at 62 (1977) (noting that the Supreme Court has never explicitly articulated a price discrimination approach to market definition).
[99] *See also* U.S. Anchor Mfg., Inc. v. Rule Indus., Inc., 7 F.3d 986, 998 (11th Cir. 1993) (citations omitted) (noting that the ability to price-discriminate against a distinct group of customers "demonstrates the existence of market power with respect to that group" and "may, as a practical matter, remove the higher priced product from the broader market composed of its functional substitutes").
[100] *See id.* at 989-991.
[101] *See id.* at 991.
[102] *See id.* at 992.
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[104] *See supra* note 65 and accompanying text.
[105] 7 F.3d at 996-97.

separate market for the Danforth anchors.[106] The court noted that such a finding, without more, would not necessarily imply that Danforth anchors were to be excluded from the relevant product market.[107] In the absence of "demonstrable empirical evidence" of supply and demand substitution between Danforth and the other anchors, however, the court concluded as a matter of law that the Danforth anchors should have been excluded from the relevant product market.[108]

A clearer case for price discrimination markets is presented when consumer groupings are based not on brand loyalty or personal tastes, but on the buyers' utilities for the various purposes that a product may serve.[109] Accordingly, the agencies have adopted the practice of defining a product market "consisting of a particular use or uses by groups of buyers of the product" that could be profitably discriminated against by a hypothetical monopolist,[110] and courts have most commonly defined price discrimination markets by identifying one or more "segments" of consumers, each associated with the

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[106] 7 F.3d at 997.
[107] Id. at 998.
[108] Id. at 998-99.
[109] *See* Keyte, *supra* note 50, at 741 ("Identifying inframarginal consumers becomes much more complex when . . . a consumer's reluctance to switch products reflects brand preferences or purely personal tastes rather than the utility of the product itself. In these circumstances some courts have found that it is unrealistic to attempt to define an inframarginal group of consumers around any particular product characteristic. . . .").

Such groupings are characteristic of markets for software products and other information goods in particular. As at least one court and numerous commentators have observed, intellectual property rights serve in part as legal guarantees of an owner's ability to price-discriminate based on end-use segments. *See, e.g.*, ProCD, Inc. v. Zeidenberg, 86 F.3d 1447, 1449-50 (7th Cir. 1996); Yochai Benkler, *An Unhurried View of Private Ordering in Information Transactions*, 53 VAND. L. REV. 2063, 2067-72 (2000); James Boyle, *Cruel, Mean, or Lavish? Economic Analysis, Price Discrimination and Digital Intellectual Property*, 53 VAND. L. REV. 2007, 2027-35 (2000); Julie E. Cohen, *Copyright and the Perfect Curve*, 53 VAND. L. REV. 1799, 1801-08 (2000); William W. Fisher III, *Property and Contract on the Internet*, 73 CHI.-KENT L. REV. 1203,1234-40 (1998); Wendy J. Gordon, *Intellectual Property as Price Discrimination: Implications for Contract*, 73 CHI.-KENT L. REV. 1367, 1369 (1998); Louis Kaplow, *The Patent-Antitrust Intersection: A Reappraisal*, 97 HARV. L. REV. 1813, 1878-81 (1984); Michael J. Meurer, *Price Discrimination, Personal.Use and Piracy: Copyright Protection of Digital Works*, 45 BUFF. L. REV. 845, 877-80 (1997); Michael J. Meurer, *Copyright Law and Price Discrimination*, 23 CARDOZO L. REV. 55, 80-90 (2001).
[110] Horizontal Merger Guidelines, *supra* note 45, at § 1.12.

one or more of the product's distinct "end uses."[111] For example, in *Illinois ex rel. Hartigan v. Panhandle E. Pipe Line Co.*,[112] a district court analyzing a monopolization claim against Panhandle reasoned that the natural gas market needed to be "narrowed by reference to the capabilities of different types of end-users to take advantage of either alternative fuel or energy conservation methods or both."[113] After a bench trial, the court found that residential and commercial end-users' abilities to conserve their consumption of natural gas or switch to other fuels were "much more restricted" than those of industrial end-users, and concluded that sales of natural gas to residential and commercial end-users constituted the relevant product market.[114] Although Panhandle was shown to have market power in this market,[115] the court ultimately concluded that Panhandle's conduct in most instances did not constitute willful acquisition or maintenance of monopoly power.[116]

For an end use to serve as the basis for a price discrimination market, it must *specifically* account for some significant part of the consumer demand for the product. Such an end use must therefore be complete, meaningful and well-defined in the eyes of consumers, and must not be functionally interchangeable with any other end use or combination of end uses. For example, in *Nobel Scientific Industries v. Beckman Instruments, Inc.*,[117] the defendant Beckman was one of several companies that made

[111] *See* Keyte, *supra* note 50, at 740-41.
[112] Illinois ex rel. Hartigan v. Panhandle E. Pipe Line Co., 730 F. Supp. 826 (C.D. Ill. 1990), *aff'd sub nom.* Illinois ex rel. Burris v. Panhandle E. Pipe Line Co., 935 F.2d 1469 (7th Cir. 1991), *cert. denied*, 502 U.S. 1094 (1992).
[113] Id. at 900.
[114] Id.
[115] Id. at 902-06.
[116] Id. at 910.
[117] 670 F. Supp. 1313 (D. Md. 1986), *aff'd without opinion*, 831 F.2d 537 (4th Cir. 1987), *cert. denied*, 487 U.S. 1226 (1988).

blood analyzing machines and reagents.[118] Nobel alleged that Beckman had monopolized or attempted to monopolize the market for machines capable of performing seven particular tests simultaneously on a "stat" (high priority) basis, and the market for reagents to be used in such machines.[119] On Beckman's motion for summary judgment, the court rejected Nobel's market definition, citing uncontradicted evidence to the effect that the need to perform the seven specified stat tests simultaneously on one machine was not a complete, meaningful and well-defined consideration in the eyes of hospitals and laboratories.[120] Expert witnesses testified that hospitals base decisions to purchase analyzing machines on the cost and availability of the reagents and of other services needed to run an analyzer[121] and the need to perform routine (normal priority) tests and tests for other chemicals.[122] The evidence also showed that Beckman's machine was functionally interchangeable with other individual analyzers and combinations of analyzers for the purpose of performing the seven specified tests,[123] and that Beckman's reagents were functionally interchangeable with reagents sold by others for conducting the tests on Beckman's and other machines.[124] The court concluded that it would be "overly restrictive" to define product markets that attributed consumer demand specifically to the seven specified tests where "few, if any, of the analyzers available

[118] *See id*. at 1315-16.
[119] *See id*. at 1317-19.
[120] *See id*. at 1319.
[121] *See id.*
[122] *See id.* at 1321.
[123] *See id.* at 1320.
[124] *See id.* at 1320-22.

[were] specifically limited to doing the seven named tests"[125] and where consumers valued the analyzers and reagents for many other features and purposes.[126]

To summarize, a product that has multiple uses may be found to face competition in two or more relevant product markets, each of which involves a significant group of consumers who are specifically interested in some subset of its uses. A precise definition of these markets, however, requires an equally precise characterization of a "use"; one will be supplied for software products in Section C *infra*.

Illustration: Product differentiation and price discrimination in the Cellophane case. In *United States v. E.I. du Pont de Nemours & Co.*,[127] the government charged du Pont with monopolizing the manufacture and sale of cellophane in violation of § 2 of the Sherman Act. The Supreme Court, on direct appeal, reviewed the district court's determination that the "relevant market for determining the extent of du Pont's market control" was not cellophane, but all flexible packaging materials.[128] Noting that physical characteristics do not necessarily serve to distinguish one material from another for purposes of the market definition inquiry,[129] a 4-3 majority of the Court held that "[i]n determining the market under the Sherman Act, it is the use or uses to which the commodity is put that control."[130] Turning to the trial record, the Court noted differences among the physical characteristics and prices of cellophane and other flexible packaging materials, but found that cellophane "has to meet competition from other materials in

[125] See id. at 1320.
[126] *See id.* ("Some analyzers are valued for the number of tests they can do, some for their speed, some for their cost, and some for other features. All of the machines, however, compete for the same contracts and business. Therefore one cannot separate out the competition to sell reagents for only these seven tests. Reagent competition is for selling reagents for any of the tests that the machines can run.").
[127] 351 U.S. 377 (1956).
[128] 351 U.S. at 380.
[129] Id. at 394.
[130] Id. at 395-96.

every one of its uses" and that "a very considerable degree of functional interchangeability exists between these products."[131] In the case of Pliofilm, a more expensive alternative to cellophane, the Court found that its superior physical characteristics, which made it preferable for use in wrapping meat, "apparently offset cellophane's price advantage," thereby making the price of Pliofilm a constraint on the price of cellophane in the eyes of consumers.[132] The Court concluded that the relevant market "is composed of products that have reasonable interchangeability for the purposes for which they are produced — price, use and qualities considered," and therefore included at least the packaging materials that were shown at trial to be functionally interchangeable with cellophane.[133] Given cellophane's "competition and interchangeability with other wrappings," du Pont could not be found liable for monopolization.[134]

The dissenters objected that du Pont, by monopolizing cellophane, could price-discriminate against certain end-use segments, such as buyers engaged in wrapping cigarettes, who required cellophane in part for properties that other flexible packaging materials did not have.[135] Commenting on the case, Robert Pitofsky answers that any such discrimination would have been defeated by arbitrage,[136] but observes that arbitrage opportunities in general do not follow immediately from a price differential:

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[131] Id. at 399.
[132] Id. at 399-400.
[133] Id. at 404.
[134] Id. at 404.
[135] *See id.* at 424-25 (Warren, C.J., dissenting).
[136] *See* Pitofsky, *supra* note 44, at 1813-14; *accord* SBC Communications Inc. v. F.C.C., 56 F.3d 1484, 1493-94 (D.C. Cir. 1995) (affirming FCC's determination that relevant market was for all interexchange service rather than interexchange service to cellular customers, inter alia, because of the California attorney general's finding that "arbitrage activities would defeat any attempt by AT & T/McCaw to raise cellular interexchange rates above existing levels").

> To be effective in the arbitrage business, the customers must know the identity of the other customers who are being discriminated against, undertake the expenses of buying, storing, reselling, and reshipping the product, and do so at a scale that would make an impact on the discriminating sellers. Finally, the arbitrageurs must be willing to go into this new business at whatever investment level is required, knowing that they could be frustrated completely in their initiative if the seller abandons its discriminatory scheme.[137]

Quality restraints. Non-price competition among functionally interchangeable products, particularly those "in which differences in features are important (and in which improvement is possible),"[138] is especially vital to consumers in the software industry.[139] To the extent that such non-price competition, particularly in the software industry, is recognized as a concern of antitrust law,[140] the practice of defining markets based on

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[137] Pitofsky, *supra* note 44, at 1848-49.

[138] Glen Holly Entertainment, Inc. v. Tektronix, Inc., 100 F. Supp. 2d 1073, 1081 (C.D. Cal. 1999).

[139] *See id.* at 1081 ("The importance of [non-price competition among] competing product lines may be particularly important in high technology fields."); Lande, *supra* note 140, at 517 (noting that nonprice competition is most likely to be necessary to protect consumer choice "with respect to certain kinds of intellectual property, some of which can play a competitive role only in an environment of organizational independence).

Microsoft chairman Bill Gates has acknowledged that non-price competition can predominate over price competition in a software market:

> With intellectual property, the upfront costs are what it's all about. . . . Say a piece of software costs $10 million to create and the marginal costs, because it's going to be distributed electronically, are basically zero. Once the costs of development have been recouped, every single additional unit is pure profit. But if someone comes along with a significantly superior product, your demand can literally almost drop to zero.

Alan Murray, *Intellectual Property: Old Rules Don't Apply*, WALL ST. J., Aug. 23, 2001, at A1 (quoting Gates).

[140] *See, e.g.*, Weit v. Continental Illinois Nat'l Bank & Trust Co., 641 F.2d 457, 477 (7th Cir. 1981) (citing C-O-Two Fire Equipment Co. v. United States, 197 F.2d 489, 493 (9th Cir. 1952) ("[I]n an oligopoly, . . . non-price competition is valuable, and anything tending to standardize non-price terms harms competition."); Glen Holly, 100 F. Supp. 2d at 1081 (concluding in dicta that antitrust laws favor non-price competition among product lines, particularly in high technology fields); Douglas H. Ginsburg, *Nonprice Competition*, 38 ANTITRUST BULL. 83, 83 n.1 (1993) (citing Catalano, Inc. v. Target Sales, Inc., 446 U.S. 463 (1980)) (noting Court's "appreciat[ion] that an agreement to fix a nonprice term of trade is analytically indistinguishable from an agreement to fix price"); Robert H. Lande, *Consumer Choice as the Ultimate Goal of Antitrust*, 62 U. PITT. L. REV. 503, 514-17 (2001) (noting that the agencies have recognized non-

price discrimination should account for the ability of a seller with market power to discriminate against a particular end-use segment by reducing the quality of the product significantly below a competitive level with respect to that end use only.[141] Since a reduction in the quality of a product constitutes an increase in the product's quality-adjusted price,[142] such a practice is equivalent to quality-adjusted price discrimination against the end-use segment in question, and a price discrimination market should be defined accordingly. Even though this form of discrimination against a group of buyers may not be cognizable as price discrimination under the Robinson-Patman Act,[143] it provides an appropriate criterion for identifying a market in which non-price competition may be harmed by the exercise of market power.[144]

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price competition as an antitrust concern "in sufficiently clear circumstances" and arguing that it "should become a higher priority for antitrust enforcement"); E. Thomas Sullivan, *On Nonprice Competition: An Economic and Marketing Analysis*, 45 U. PITT. L. REV. 771 (1984) (same).

[141] A seller with market power may find it profitable to reduce product quality in the eyes of a captive group of consumers if the seller can thereby reduce production costs or, more generally, if the seller's interests are adverse in some way to the consumers' preferences.

[142] *Cf.* Timpinaro v. S.E.C., 2 F.3d 453, 457 (D.C. Cir. 1993) (Ginsburg, J.) (citing Douglas H. Ginsburg, *Non-Price Competition*, 38 ANTITRUST BULL. 83 (1993)) (noting that "[n]on-price discounts have the same pro-competitive effect as a price discount"); Competitive Telecommunications Ass'n v. F.C.C., 998 F.2d 1058, 1062 (D.C. Cir. 1993) (Ginsburg, J.) (same).

Quality and price may not be fully commensurable in quantitative terms. *See id.* at 516 (noting that "[s]ome elements of non-price competition might be captured through use of the concept of 'quality-adjusted price,'" but that "'quality-adjusted price' may be a difficult concept to apply in concrete situations where the non-price components of competition are particularly important, or where they take subtle or complex forms"). The point here is a qualitative one; i.e., that a reduction in the quality of a product raises the same antitrust concerns as a corresponding increase in the product's price. *See id.* at 514-17; Peter J. Hammer, *Questioning Traditional Antitrust Presumptions: Price and Non-Price Competition in Hospital Markets*, 32 U. MICH. J. L. REFORM 727, 759 n. 85 (1999) ("It is simply wrong, however, to conclude that there are no antitrust issues when one observes constant prices in the face of falling quality."); cf. Thomas A. Piraino, Jr., *The Case for Presuming the Legality of Quality Motivated Restrictions on Distribution*, 63 NOTRE DAME L. REV. 1, 1-2 (1988) (characterizing the argument that price-related and non-price resale restrictions should be reviewed under the same rule-of-reason standard as based on the assumption that manufacturers will rationally seek to provide consumers with the lowest possible quality-adjusted price).

[143] *See* 15 U.S.C. § 13(a) (prohibiting price discrimination between purchasers of commodities of "like grade and quality").

[144] *See supra* notes 92-93 and accompanying text; *see also* Miller v. Indiana Hosp., 814 F. Supp. 1254 (W.D. Pa. 1992) (citation omitted) ("A defendant possesses monopoly power if it has the ability to change the competitive variables of a product to the disadvantage of consumers without causing effective competitors to enter the relevant market.").

Quality-adjusted price discrimination markets of this kind are more likely to involve information goods than the physical goods that have typically been the subjects of price discrimination theories of market definition. To the extent that physical goods are fully characterized by their physical properties, this fact may usually be expected to constrain a seller's ability to reduce quality with respect to only one end use. For example, Robert Pitofsky's observation that arbitrage would defeat price discrimination in *du* Pont[145] implicitly relies on the reasonable assumption that any attempt to modify the physical properties of cellophane (e.g., heat-sealability, printability, clarity, tear and burst strength and resistance to oils[146]) to make it less useful for wrapping cigarettes would also reduce its quality with respect to wrapping various foods.[147]

In contrast, digital information goods are highly susceptible to a vendor's legal and technological controls over individual end uses, as demonstrated by the burgeoning field of digital rights management.[148] An arbitrageur might be able to defeat these controls technologically by altering the product so that it supports new uses or better supports existing uses,[149] but license terms usually prohibit such activities.[150] More

[145] *See supra* text accompanying note 136.
[146] Id. at 411.
[147] To the extent that du Pont's cellophane monopoly was derived in part from patent exclusivity, *see id.* at 382-84, du Pont was also constrained from modifying the physical properties of cellophane by the scope of the relevant patent claims.
[148] For a survey of digital rights management technologies, *see, e.g.*, Stephen M. Kramarsky, *Copyright Enforcement in the Internet Age: The Law and Technology of Digital Rights Management*, 11 DEPAUL-LCA J. ART & ENT. L. 1 (2001).
[149] *See, e.g.*, Universal City Studios, Inc. v. Reimerdes, 111 F. Supp. 2d 294, 308 (S.D.N.Y. 2000), *aff'd sub nom.* Universal City Studios, Inc. v. Corley, 273 F.3d 429 (2nd Cir. 2001) (describing the DVD-descrambling software utility known as "DeCSS"); *cf.* Michael J. Meurer, *Copyright Law and Price Discrimination*, 23 CARDOZO L. REV. 55, 86 (2001) (describing arbitrage against software quality discrimination by modifying software to supply missing functionalities). *See infra* text accompanying notes 152-155 for an explanation of quality discrimination.
[150] *See id.* (noting that software modifications for the purpose of arbitrage "violate the derivative rights of the copyright owner); Darren C. Baker, Note, *ProCD v. Zeidenberg: Commercial Reality, Flexibility in Contract Formation, and Notions of Manifested Assent in the Arena of Shrinkwrap Licenses*, 92 NW. U. L.

generally, intellectual property rights powerfully reinforce a vendor's ability to price-discriminate against particular end uses.[151]

Before leaving the topic of quality restraints, I should mention that an emerging body of literature has recognized the ability of intellectual property licensors to restrict the market output of quality through a related but different practice known as "quality discrimination."[152] Quality discrimination occurs whenever a seller "discriminate[s] among consumers with different tastes for quality . . . by offering an array of qualities."[153] Except where a reduction in quality targeted at a specific end-use segment is involved, quality discrimination appears to be similar to product differentiation in its implications for product market definition.[154] I therefore wish to emphasize the distinction between quality-adjusted price discrimination and quality discrimination, and to clarify that I am not proposing here to define product markets based on a quality discrimination theory.[155] The literature on quality discrimination in intellectual property licensing is worth noting in the present context, however, because it highlights another common situation in the software industry wherein licensors have wide discretion over product quality.

REV. 379, 391 (1997) (describing prohibitions on reverse engineering and modification as "standard or typical terms" in shrinkwrap licenses).

[151] *See supra* note 109.

[152] *See, e.g.*, Meurer, *supra* note 149, at 73-74; Hal R. Varian, *Versioning Information Goods*, *in*: INTERNET PUBLISHING AND BEYOND: ECONOMICS OF DIGITAL INFORMATION AND INTELLECTUAL PROPERTY (1997), available at <http://www.sims.berkeley.edu/~hal/Papers/version.pdf>.

[153] JEAN TIROLE, THE THEORY OF INDUSTRIAL ORGANIZATION 149-50 (1988).

[154] *See generally* Shubha Ghosh, *Gray Markets in Cyberspace*, 7 J. INTELL. PROP. L. 1 (1999) (characterizing practices of quality discrimination in cyberspace as forms of product differentiation).

[155] *See supra* text accompanying notes 85-90 for a discussion of the analysis of product differentiation as it relates to product market definition.

2. Supply Substitutability

Although courts have tended to focus more on demand substitutability than on supply substitutability in determining the relevant product market,[156] supply substitutability considerations have been found to be materially relevant in enough cases that it would be erroneous to define a market on the basis of demand substitutability alone.[157]

Recall that a product market is to identify "*producers* which, because of the similarity of their products, have the ability — actual or potential — to take significant amounts of business away from each other."[158] The demand substitutability inquiry, on the other hand, identifies *products* that have reasonable interchangeability of use.[159] The supply substitutability inquiry serves to complete the analysis by identifying firms that are actual or potential producers of these products.

The supply substitutability inquiry focuses on "[c]ross-elasticity of supply, or production flexibility among sellers"[160] or, equivalently, "the ability of firms in a given line of commerce to turn their productive facilities toward the production of commodities

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[156] *See* ABA SECTION ON ANTITRUST LAW, *supra* note 37, at 516.
[157] *See, e.g.*, Rebel Oil Co. v. Atlantic Richfield Co., 51 F.3d 1421, 1436 (9th Cir.) ("[D]efining a market on the basis of demand considerations alone is erroneous. . . . A reasonable market definition must also be based on 'supply elasticity.'"), *cert. denied*, 516 U.S. 987 (1995); Virtual Maintenance, Inc. v. Prime Computer Inc., 11 F.3d 660, 664 (6th Cir. 1993), *cert. dismissed*, 512 U.S. 1216 (1994) ("Defining a market, or "submarket," on the basis of demand considerations alone is erroneous because such an approach fails to consider the supply side of the market."); In re Municipal Bond Reporting Antitrust Litig., 672 F.2d 436, 441 (5th Cir. 1982) (finding that plaintiff's proposed market definition "fails to give due accord to the significance of elasticity of supply"); United States v. Empire Gas Corp., 537 F.2d 296, 303 (8th Cir. 1976) ("The cross-elasticity of supply would seem to be as important as the demand factor in determining the relevant product market."). *See* AREEDA, *supra* note 33, at ¶ 533f, at 207.
[158] SmithKline Corp. v. Eli Lilly & Co., 575 F.2d 1056, 1063 (3d Cir.), cert. denied, 439 U.S. 838, 99 S.Ct. 123, 58 L.Ed.2d 134 (1978) (emphasis added).
[159] *See supra* text accompanying notes 66-73.
[160] Kaiser Aluminum & Chem. Corp. v. FTC, 652 F.2d 1324, 1330 (7th Cir. 1981).

in another line because of similarities in technology between them."[161] As with cross-elasticity of demand, the cross-elasticity of supply between two products is a precise quantity,[162] but the issue has usually been formulated less precisely in antitrust decisions.[163] Courts have placed products in the same product market if they could be produced interchangeably from the same production facilities,[164] but have declined to do so where there were sufficient barriers, such as large research and development costs,[165] to make a shift in production unprofitable.[166]

The 1992 Horizontal Merger Guidelines provide a theoretically accurate, if difficult to administer, approach to the analysis of supply substitution.[167] Specifically, the Guidelines include within the relevant market all firms that currently produce or sell the identified products and any other firms whose "inclusion would more accurately reflect probable supply responses."[168] Supply response is deemed probable if it is "likely to occur within one year and without the expenditure of significant sunk costs of entry

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[161] Twin City Sportservice, Inc. v. Charles O. Finley & Co., 512 F.2d 1264 (9th Cir. 1975), *after remand*, 676 F.2d 1291 (9th Cir. 1982), *cert. denied*, 459 U.S. 1009 (1982).

[162] The cross elasticity of supply is the percentage change in supply for one good attributable to a percentage change in the price of another good. *See* AREEDA, *supra* note 33, at ¶ 507, at 108.

[163] *See generally* ABA SECTION ON ANTITRUST LAW, *supra* note 37, at 517-19 & nn. 102-08 (reviewing cases).

[164] *See, e.g.*, Yoder Bros. v. California-Florida Plant Corp., 537 F.2d 1347, 1367-68 (5th Cir. 1976), *cert. denied*, 429 U.S. 1094 (1977) (finding that growers could easily switch production from other flowers to chrysanthemums); Telex Corp. v. IBM, 510 F.2d 894, 916 (10th Cir. 1975) (finding that manufacturers could switch production from non-IBM-compatible peripherals to IBM-compatible peripherals).

[165] *See, e.g.*, United States v. Ivaco, Inc., 704 F. Supp. 1409, 1417 (W.D. Mich. 1989); B.A.T. Indus., 104 F.T.C. 852, 932 (1984).

[166] *See, e.g.*, U.S. Anchor Mfg. v. Rule Indus., 7 F.3d 986, 997 (11th Cir. 1993), *cert. denied*, 512 U.S. 1221 (1994); Ansell, Inc. v. Schmid Lab., 757 F. Supp. 467, 475-76 (D.N.J.), *aff'd mem.*, 941 F.2d 1200 (3rd Cir. 1991).

[167] *See* AREEDA, *supra* note 33, at ¶ 561d, at 302-03 (generally praising the Guidelines as taking the approach that is "best when the data are clear," but noting difficulty of inferring market shares); Pitofsky, *supra* note 44, at 1860-61 (opining that the Guidelines "handle these supply substitution questions well," but noting that they fail to explain "what sort of evidence properly can be relied upon to establish supply substitution").

[168] Horizontal Merger Guidelines, *supra* note 45, at § 1.32.

and exit, in response to a 'small but significant and nontransitory' price increase."[169] In determining the likelihood of supply response, the agencies will consider "technological capability," as well as any "difficulties in achieving product acceptance, distribution, or production."[170]

C. Software Product Markets

1. Software, Software Products, and Consumer Demand

The following discussion serves to define the italicized terms as they will be used in this article.

Software is code. Software is *used* by installing and running it on a system, thereby producing *system behavior*. Consumers desire to use software for producing system behavior that supports various *tasks*. System behavior of the kind that supports a task occurs in the form of an *interaction* between the user and the system.

In response to these consumer desires for user-system interactions, producers market *software products*. A software product is defined by reference to accompanying software and documentation, and consists essentially of a limited license, and technological access, to install and run the software on a system according to the documentation; it does not include the software itself. The documentation describes legal and technological *preconditions* for using the software product, and tasks that may be supported by using the software product subject to such preconditions.

The use of a software product may require a system to run not only the software that accompanies the software product, but also other software that has previously been

[169] Id.
[170] Id.

installed on the system. For example, the use of *application software*[171] requires the use of preinstalled *operating system software*.[172] It may therefore be a precondition for using one software product that another software product has previously been acquired and its accompanying software preinstalled on the system. In such a case, the two products are recognized as complements, not substitutes;[173] and any required preinstalled software is referred to as *platform software*.

A software product specifies which software is to run on the system when the software product is used, even though not all such software necessarily accompanies the software product.[174] For example, a program may instruct the system to run specific routines in preinstalled platform software by using the conventions defined in the platform software's *application programming interface* (which is part of the documentation accompanying the platform software).[175] A software product is said to *support a task* if it specifies which software is to run on the system in order to produce behavior that supports the task, and (subject to its documented preconditions) confers sufficient legal rights and technological access to do so.

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[171] An application is a "software program[] . . . that perform[s] specific user-oriented tasks." United States v. Microsoft Corp., 84 F. Supp. 2d 9, 12, at ¶ 2 (D.D.C. 1999).

[172] An operating system is a "software program that controls the allocation and use of computer resources (such as central processing unit time, main memory space, disk space, and input/output channels)." Id.

[173] This distinction is especially significant in the context of product market definition. A properly defined relevant market includes goods that are reasonably close substitutes for one another, but not complementary goods. See AREEDA, *supra* note 33, at ¶ 565a-b, at 329-32.

[174] Specifically, the software that accompanies a software product may make procedure calls to previously installed software, as when an application makes calls to the application programming interfaces of an operating system. *See id.* For a technical description of this process, see JOHN R. LEVINE, LINKERS & LOADERS 187-227 (2000) (describing linking of code using shared libraries, including Windows dynamically linked libraries). *Cf.* United States v. Microsoft Corp., 84 F. Supp. 2d 9, 50, at ¶ 162 (describing "knitting" together of different software layers).

[175] *See Free On-Line Dictionary of Computing* <http://www.foldoc.org> (visited March 1, 2003) (defining "application program interface" as "[t]he interface (calling conventions) by which an application program accesses operating system and other services").

In summary, a consumer may wish to acquire a software product because of some of the tasks it supports, or because of its complementarity to some other desired software products that require its acquisition as a precondition. I will use the terms *consumer purpose* and *end use* interchangeably and generically to refer to any such supported task or complementarity relationship.

For illustration, some examples of preconditions for using and consumer purposes served by the software products Microsoft Windows, Netscape Navigator for Windows, and Microsoft Word for Windows are:[176]

Microsoft Windows — Precondition: The system is an Intel-based PC. Consumer purposes: Platform software for Netscape Navigator for Windows; platform software for Microsoft Word for Windows; play solitaire.

Netscape Navigator for Windows — Precondition: Microsoft Windows software is preinstalled. Consumer purposes: Platform software for Java applets; perform Web transactions.

Microsoft Word for Windows — Preconditions: Microsoft Windows software is preinstalled; document is a file in Word .DOC format. Consumer purposes: Edit document.

2. Tasks and Essential Use Cases

The procedure for defining product markets we have described above, particularly price discrimination markets, calls for the consideration of end uses that may be degraded or withheld at a vendor's discretion. In determining a relevant product market in which a

[176] Microsoft, Windows and Word are registered trademarks of Microsoft Corporation. Netscape and Navigator are registered trademarks of Netscape Communications Corporation.

particular software product competes, it is therefore necessary to identify any consumer purposes that may be cognizable as captive end use segments under a price discrimination theory. Any such consumer purpose must be characterized in terms that are complete, meaningful, and well-defined from the user's perspective, so that the resulting end use segment represents a well-defined group of users who are interested in the software product for that consumer purpose.[177] The characterization of a consumer purpose should also be in terms that are simple, general, abstract, technology-free and implementation-independent, so that the corresponding end use segment avoids drawing false distinctions between different technological approaches to supporting what from a user's perspective is essentially the same task.[178]

Computer scientists and software engineers have considerable experience with the specification of software use, and have developed many models and methodologies to describe software behavior at various levels of abstraction.[179] Of particular relevance for present purposes is a highly abstract software modeling construct known as an *essential use case*, which was introduced in Larry Constantine and Lucy Lockwood's groundbreaking software engineering textbook, *Software for Use*:[180]

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[177] *See supra* text accompanying note 117.

[178] Such variations in technological implementation are more appropriately analyzed as a kind of product differentiation rather than a division of a product market into end use segments. *See* AREEDA, *supra* note 33, at ¶ 563a, at 310 ("Products are differentiated when many buyers regard them as different even though the products still perform the same essential function.").

[179] For highly formal models of software behavior, *see, e.g.*, JOHN COOKE, CONSTRUCTING CORRECT SOFTWARE (1998); D.C. INCE, AN INTRODUCTION TO DISCRETE MATHEMATICS, FORMAL SYSTEM SPECIFICATION, AND Z (1992). For highly abstract models, *see, e.g.*, STEPHEN M. MCMENAMIN & JOHN F. PALMER, ESSENTIAL SYSTEMS ANALYSIS (1984). For intermediate approaches, *see, e.g.*, ALI BEHFOROOZ & FREDERICK J. HUDSON, SOFTWARE ENGINEERING FUNDAMENTALS (1996); GRADY BOOCH, OBJECT-ORIENTED DESIGN WITH APPLICATIONS (1991).

[180] LARRY L. CONSTANTINE & LUCY A.D. LOCKWOOD, SOFTWARE FOR USE: A PRACTICAL GUIDE TO THE MODELS AND METHODS OF USAGE-CENTERED DESIGN (1999).

> An *essential use case* is a structured narrative, expressed in the language of the application domain and of users, comprising a simplified, generalized, abstract, technology-free and implementation-independent description of one task or interaction that is complete, meaningful, and well-defined from the point of view of users in some role or role in relation to a system and that embodies the purpose or intentions underlying the interaction.[181]

Given this definition and the foregoing discussion, no background in software engineering is needed to appreciate that the concept of an essential use case is very likely to be applicable to product market definition as a way of characterizing the tasks supported by a software product.

A full overview of the techniques necessary to construct essential use cases is presented in Chapter 5 of *Software for Use*[182] and is beyond the scope of this article. A concrete example taken from that chapter, however, will serve to illustrate the suitability of essential use cases for identifying cognizable end use segments.

[181] Id. at 103 (emphasis in original).
[182] Id. at 97-123 (Chapter 5: "Working Structures: Task Modeling with Essential Use Cases").

gettingCash

USER ACTION	SYSTEM RESPONSE
insert card	
	read magnetic stripe
	request PIN
enter PIN	
	verify PIN
	display transaction option menu
press key	
	display account menu
press key	
	prompt for account
enter amount	
	display amount
press key	
	return card
take card	
	dispense cash
take cash	

Figure 3. A use case for the task of getting cash from an ATM.[183]

To understand what is meant by an essential use case, it is first necessary to be familiar with the more general concept of a *use case*. Invented in the late 1960s by software engineer Ivar Jacobson,[184] use cases are a methodology for narrating user-system interactions commonly used by software developers (and increasingly, customers) to describe required system behavior.[185] In particular, use cases play a central role in

[183] Id. at 102.
[184] *See* ALISTAIR COCKBURN, WRITING EFFECTIVE USE CASES, at xx (2001).
[185] See id. at 1-3 (describing a use case as "a contract between the stakeholders of a system about its behavior"); DARYL KULAK & EAMONN GUINEY, USE CASES: REQUIREMENTS IN CONTEXT 50 (2000) (suggesting that use cases be used in requests for proposals to specify desired software behavior).

object-oriented software design techniques using the Unified Modeling Language.[186] Figure 1 is a use case depicting the process of getting cash from an automatic teller machine ("ATM").

Recently, proponents of use case-based design methods have emphasized the importance of describing the user-system interaction at a high level of abstraction, avoiding any implementation-specific language that assumes particular choices on the part of the system designer.[187] For example, the use case in Figure 3 presupposes that the user identification mechanism is a card with a magnetic stripe, that the system provides information to the user via a visual display, and that the user provides information to the system via a keypad.[188] The use case limits the choices available to the designer as to how the system will support the task of getting cash from an ATM.[189] Unless tasks are specified in an implementation-independent form, software designers may be constrained from choosing the design that best serves the purposes of the user.[190]

[186] *See, e.g.*, JIM ARLOW & ILA NEUSTADT, UML AND THE UNIFIED PROCESS: PRACTICAL OBJECT-ORIENTED ANALYSIS AND DESIGN (2001); GRADY BOOCH ET AL., THE UNIFIED MODELING LANGUAGE USER GUIDE (1998).
[187] *See, e.g.*, CONSTANTINE & LOCKWOOD, *supra* note 180, at 102-03; KULAK & GUINEY, *supra* note 185, at 36-37.
[188] *See* CONSTANTINE & LOCKWOOD, *supra* note 180, at 103.
[189] *See id.*
[190] *See id.*

gettingCash

USER INTENTION	SYSTEM RESPONSIBILITY
identify self	
	verify identity
	offer choices
choose	
	dispense cash
take cash	

Figure 4. An essential use case for the task of getting cash from an ATM.[191]

Figure 4 presents an essential use case for the same task. Note that all implementation-specific language has been abstracted away, and the narrative of the user-system interaction is expressed solely from the perspective of a user who has a particular purpose in mind. This essential use case fully captures "the purpose or intentions underlying the interaction": i.e., for any system to support the task of getting cash from an ATM, it is necessary and sufficient for the system to support each of the interaction steps shown in Figure 4. Beyond the requirement that the system serve this specified user purpose, the essential use case does not constrain the design and implementation of the system in any way.[192] For example, user identification may be implemented with voice recognition, thumbprint analysis, or a retinal scan; and choices might be offered through voice synthesis, or conveniently arranged so that the customer's usual withdrawal amount is listed most prominently.[193]

[191] Id. at 105.
[192] *See id.*
[193] *See id.*

Because an essential use case captures a user purpose without restricting design, it provides antitrust analysis with a precise criterion for deciding whether two software products "can be used for the same purpose"[194] and which software products, in supporting a task that is also supported by the defendant's product, may thereby compete with the defendant's product within the corresponding end use segment.

Of course, these inquiries into functional interchangeability and end use segments represent only some of the relevant considerations for the delineation of a product market. Product and price differentiation among functionally interchangeable products, and supply substitution by current producers and probable market entrants should also be examined. As it happens, software engineering can provide frameworks for these analyses as well.

3. Competitive Variables, Metrics and Preconditions

Within the parameters of an essential use case, a task can be implemented by a virtually unlimited variety of design approaches, thereby giving rise to significant differentiation among functionally interchangeable software products. Even with respect to differentiated products, however, if shifts in demand or correlations between prices or price movements are observed,[195] then such products should be seen as reasonably interchangeable. Otherwise, the product market definition analysis should examine the

[194] United States v. Charles Pfizer & Co., 246 F. Supp. 464, 468 (E.D.N.Y. 1965).
[195] *See supra* text accompanying notes 82-83.

products' *competitive variables*;[196] i.e., "the factors that normally determine the choice or preference of the user."[197]

Software engineers have considerable experience with the measurement of software performance and quality, and have identified those *metrics* that play significant roles in a user's evaluation of software products.[198] Constantine and Lockwood have identified two categories of software metrics that are relevant to the differentiation of software products: *preference metrics* (based on subjective user evaluations of user-system interactions) and *performance metrics* (based on controlled, systematic testing of user-system interactions).[199]

Preference metrics[200]	Performance metrics[201]
Affect	Completeness
Efficiency (subjective)	Correctness
Helpfulness	Effectiveness
Control	Efficiency (objective)
Learnability	Proficiency
	Productiveness

Figure 5. Aspects of software use that may be measured by preference and performance metrics.

A full survey of software metrics is presented in Chapters 17 and 18 of *Software for Use*[202] and is beyond the scope of this article. Figure 5 lists some of the many aspects

[196] *See* Horizontal Merger Guidelines, at § 1.11 (stating that the agency will consider buyer and seller "response to relative changes in price or other competitive variables" in defining the relevant product market).
[197] United States v. Charles Pfizer & Co., 246 F. Supp. 464, 468 (E.D.N.Y. 1971).
[198] *See, e.g.*, TOM GILB, SOFTWARE METRICS (1977); STEPHEN H. KAN, METRICS AND MODELS IN SOFTWARE QUALITY ENGINEERING (2002).
[199] *See* CONSTANTINE & LOCKWOOD, *supra* note 180, at 419. A third category of metrics, referred to as either "predictive metrics" or "design metrics," are used by software developers to evaluate prototypes of software products early in the development process, rather than working software products in consumer markets. *See id.* at 423-42.
[200] *See id.* at 421.
[201] *See id.* at 454.

of software use for which metrics have been developed. Of couse, not all of these aspects and metrics will factor into every market definition analysis. Courts and parties should examine the relevant evidence to identify those particular aspects of software use that are material to "the choice or preference of the user" for a software product to serve a particular purpose, and then to identify those software products that effectively compete with the defendant's product with respect to these aspects of software use.[203]

Software products that support the same task (as defined by an essential use case) may also vary with respect to their preconditions.[204] In deciding whether two software products are reasonably interchangeable, courts and parties should determine whether any overlap between their preconditions is broad enough to permit effective competition between them.[205] Where two software products have mutually exclusive preconditions (e.g., incompatible system hardware requirements), they should be deemed both reasonably and functionally non-interchangeable, even though both may support the same task.

Relevant evidence for the analysis of metrics and preconditions may be found in such documents as software product marketing studies, published reviews of the software products, other descriptions of user experiences with software products, bug reports, patches to and new versions and releases of the software product and accompanying documentation, and the general computer science, software engineering, and software consumer literature. Testimonial evidence from computer science and software

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[202] Id. at 417-62 (Chapter 17: "By the Numbers: Measuring Usability in Practice"; Chapter 18: "Test Scores: Laboratory and Field Testing of Usability").
[203] *See supra* text accompanying note 63.
[204] *See supra* section III.C.1.
[205] *See supra* text accompanying note 63.

engineering experts and software vendors, developers and users, and demonstrative evidence (e.g., verifying system behavior in the presence of the court) may also be relevant.

4. Price Discrimination Markets

As we have seen, essential use cases can be used to identify end use segments that are possible targets for (quality-adjusted) price discrimination.[206] If a particular end use specifically accounts for some significant part of the consumer demand for the defendant's software product,[207] and a hypothetical monopolist of software products supporting the end use would have the legal and technological ability to reduce the quality of its products significantly below a competitive level with respect to that end use only,[208] then the respective end use segment should be deemed a relevant product market. Discrimination against that end use segment would be expected to succeed, as a would-be arbitrageur would be unable to alter the monopolist's software product so as to restore the product's quality to a competitive level with respect to the end use.[209]

To prove the technological feasibility of such a strategy, a party could develop and demonstrate a prototype software product that removes or significantly degrades the defendant product's ability to support the relevant end use without affecting its performance with respect to all other end uses. Other relevant evidence could include testimony or documentation regarding the presence or absence of functional or logical relationships among the software product's various end uses that would impede discrimination against only one of them. For example, essential use cases may be

[206] See supra section III.C.2.
[207] *See supra* text accompanying note 117.
[208] *See supra* text accompanying note 141.
[209] *See supra* text accompanying notes 148-151.

interrelated in various ways, including by classification, by extension, by composition, or by affinity.[210]

5. Supply Substitutability

Once a group of products having reasonable interchangeability of use has been determined, current producers of these products can be identified for inclusion in the relevant product market. Under the Merger Guidelines' approach to supply substitution, the product market should also include firms that would probably begin producing these products in response to a price increase, taking into account "significant sunk costs of entry and exit," "technological capability," and "difficulties in achieving product acceptance, distribution or production."

In the software industry, which is generally characterized by high fixed costs (mostly in research and development to design the product) and near-zero marginal costs of production and distribution,[211] the principal structural barriers to entry into a product market will typically arise from the technological difficulty of designing a product that is functionally and reasonably interchangeable with the products already in the market ("incumbent products"). Some examples of structural impediments are:

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[210] CONSTANTINE & LOCKWOOD, *supra* note 180, at 109. For a formal description of these relationships, *see id.* at 109-15.

[211] *See, e.g.*, Ronald A. Cass & Keith N. Hilton, *Antitrust Intent*, 74 S. CAL. L. REV. 657, 725 (2001) ("Virtually all the costs of production are in the design of the software and therefore independent of the amount sold, so that marginal costs are virtually zero."); Einer Elhauge, *Why Above-Cost Price Cuts to Drive Out Entrants Are Not Predatory —And the Implications for Defining Costs and Market Power*, 112 YALE L.J. 681, 710 (2003) (describing software's marginal cost of production as "near zero"); Thomas A. Piraino, *A Proposed Antitrust Approach to High Technology Competition*, 44 WM. & MARY L. REV. 65, 86 (2002) (noting that marginal costs for electronically distributed software are "basically zero"); Richard A. Posner, *Antitrust in the New Economy*, 68 ANTITRUST L.J. 925, 926-27 (2001) ("[I]n the case of software, . . . it is only a slight overstatement to speak of marginal cost as zero."); Murray, *supra* note 140 (quoting Bill Gates's statement that the marginal costs of software production "are basically zero").

Exclusionary preconditions: An incumbent product may have preconditions that require the system to work with proprietary technology, and may therefore be incompatible with preconditions of other software products that support the same task. Depending on the existence and extent of any remaining overlap among the products' preconditions, proprietary technological requirements can warrant a determination of functional or reasonable non-interchangeability. For example, a word processing software product may require as a precondition for use that any input file be in a certain proprietary document format. A would-be competitor may be legally and technologically precluded from developing another word processing software product that works with the same document format.

Proprietary platform software: Where incumbent products serve the purpose of preinstalling platform software for one or more complementary products, an entrant will typically be able to design a product that serves the same purpose only if it is legally permitted and technologically possible to reverse-engineer the platform software. Even when this is possible, it can be a risky, costly and difficult undertaking.[212]

Interference from preinstalled software: An incumbent product that supports a particular task may be designed to interfere with the ability of other software products to support the same task. This may be a rational strategy if the incumbent product has a sufficiently large installed base that its software has often been preinstalled on a system even when the user has chosen a different software product to support the task.

[212] *See* United States v. Microsoft Corp., 84 F. Supp. 2d 9, 22, at ¶ 46 (D.D.C. 1999) (describing IBM's unsuccessful effort to clone the Windows platform in 1994 at a cost of "tens of millions of dollars").

D. Summary of the Market Definition Procedure

This section serves to summarize the procedure I have described for defining a software product market.

1. Define the defendant's product.

A software product is defined by reference to accompanying software and documentation, and consists essentially of a limited license, and technological access, to install and run the software on a system according to the documentation.[213]

2. List relevant consumer purposes for the defendant's product.

The list should consist of consumer purposes for the defendant's product that are relevant to the challenged practice and complete, meaningful, and well-defined from the user's perspective.[214] Consumer purposes may include (a) tasks supported by the defendant's product and (b) the satisfaction of preconditions for running other software products by the acquisition of the defendant's product and the preinstallation of its accompanying platform software.[215]

The list need not include all consumer purposes served by the defendant's product. It may, for example, consist of a single end use that could be targeted for price discrimination where the challenged practice has been alleged to affect competition in the market for products serving that end use.[216]

3. Represent any relevant tasks as essential use cases.

[213] *See supra* section III.C.1.
[214] *See supra* text accompanying notes 117 and 177.
[215] *See supra* text accompanying note 176.
[216] *See supra* text accompanying notes 109-111.

Each relevant task should be characterized in the form of an essential use case; i.e., a structured narrative, expressed in the language of the application domain and of users, comprising a simplified, generalized, abstract, technology-free and implementation-independent description of the user-system interaction that supports the task.[217]

4. Identify products that are functionally interchangeable with the defendant's product for the relevant consumer purposes.

A product should be deemed functionally interchangeable with the defendant's product if it serves any of the consumer purposes identified in step 2, as characterized in step 3.[218]

5. List relevant competitive variables.

Competitive variables include material preference and performance metrics with respect to each relevant task, and material preconditions for using the defendant's product.[219] A factor is material if it would normally determine the user's choice or preference of a software product for the relevant end use.[220]

6. Identify products that are reasonably interchangeable with the defendant's product for the relevant consumer purposes.

The reasonable interchangeability analysis begins with a provisional market consisting of the defendant's product and proceeds by iteratively extending the boundaries of the provisional market to include additional products that are reasonably

[217] *See supra* section III.C.2.
[218] *See supra* text accompanying note 194.
[219] *See supra* section III.C.3.
[220] *See supra* text accompanying note 197

interchangeable with the products already found to be in the provisional market.[221] A product identified in step 4 as functionally interchangeable with the defendant's product is reasonably interchangeable if, given consumer preferences with respect to the competitive variables identified in step 5, consumers would respond to a quality-adjusted price increase above a competitive level by a hypothetical monopolist of the provisional market by switching to the functionally interchangeable product in sufficient volume so as to make such a price increase unprofitable.[222] This iterative process should continue until no more reasonably interchangeable products can be added to the provisional market.[223]

7. Identify structural barriers to entry.

The software product market definition procedure concludes by identifying producers that could respond to a price increase above a competitive level by a hypothetical monopolist of the provisional market by making and selling any of the incumbent products identified in step 6, or a reasonably interchangeable new product, in sufficient volume so as to make such a price increase unprofitable.[224] This analysis should account for structural barriers to entry into the product market that may arise from the technological difficulty of designing a functionally and reasonably interchangeable new product, such as exclusionary preconditions, proprietary platform software, and interference from preinstalled software.[225]

[221] *See supra* text accompanying notes 57-58.
[222] *See supra* text accompanying note 70.
[223] *See supra* text accompanying note 58.
[224] *See supra* section III.C.5.
[225] *See id.*

E. Drafting Claims to Encompass the Product Market

A software product market defined by the above approach may be delineated by the interaction steps of an essential use case, by legal and technological preconditions, and by ranges of preference and performance metrics. Each of these characteristics is amenable to rewriting as a claim limitation. Note that any combination of claim limitations will serve to define a claim that encompasses the entire product market, as omitting one or more claim limitations has the effect of broadening the claim. Thus, a method claim encompassing the product market may be written in the following general form:

A method of doing [user purpose], comprising:

{in a system where [precondition]};

[interaction step 1], {wherein [performance metric 1a corresponding to interaction step 1] is in the range [range 1a] …};

{[interaction step 2] …}; …

purchasing an item

precondition: Purchaser is a previous customer about whom information has been stored

USER INTENTION	SYSTEM RESPONSIBILITY
	display item
identify self	
order item	
	receive request
	retrieve previously stored purchaser information
	generate purchase order
	fulfill purchase order

Figure 6. An essential use case for the task of purchasing an item.

For example, suppose that a product market has been defined by the essential use case shown in Figure 6 and by the performance metric that consists of the number of purchaser actions required to cause the "receive request" step to occur. By following the general form shown above and applying basic general principles of claim drafting (e.g., antecedent bases), the following claim can readily be drafted:

A method of allowing a user to purchase an item, comprising:

displaying the item to a purchaser;

allowing the purchaser to identify himself or herself;

allowing the purchaser to order the item;

receiving a request from the purchaser to identify himself or herself and to order the item, wherein only one purchaser action is required to cause the request to be received;

retrieving previously stored information regarding the purchaser;

generating a purchase order; and

fulfilling the purchase order.[226]

IV. CONCLUSIONS

Many of the procedures described in this article can be readily extended to cases and inventions not discussed here. The product market definition approach described in Section III.C is generally applicable to antitrust analysis in the software industry, and is employed in my forthcoming article focusing on the definition of the browser software product market in *United States v. Microsoft Corporation*.[227] The claim drafting approach described in Section III.E can be adapted to system and article-of-manufacture claims, using well-known techniques in the field of software patents.

Our results suggest that the dichotomy between formal and informal software claims presents the patent applicant with a fundamental choice that may have profound implications for patent validity and valuation. Although I believe the techniques and methods described in this article to be legally and technologically accurate and useful in their present form, it remains to be seen whether parties and patent attorneys (with the assistance of computer science experts) will find them to be practical and cost-efficient tools for use in patent prosecution and litigation.

[226] *Cf. supra* note 3 and accompanying text (claim 1 of the Amazon.com "1-click" patent).
[227] Andrew Chin, *Defining Product Markets in the Software Industry: A First Principles Approach* (manuscript, in preparation).