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Emerging Technologies Challenging Current Legal Paradigms

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U.S. patent law has made assumptions about where new inventions will be created, who will create them, and how they will be infringed. Throughout history, emerging technologies have challenged these paradigms. This decade's emerging technologies will allow humans to create in virtual worlds, connect billions of every day devices via the Internet, and use artificial intelligence to invent across technology fields. If countries like the U.S. wish to encourage inventors to seek patent protection in these emerging areas, then a paradigm shift in the law must occur. Specifically, the law must clarify patent eligibility, recognize the increasing role of artificial intelligence in inventing, and continue to develop the doctrinal framework for enforcing interactive patents.

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I. INTRODUCTION

The way in which U.S. law addresses patent eligibility and enforcement must adapt to continue encouraging invention in the emerging areas of virtual reality (VR), the Internet of Things (IoT), and artificial intelligence (AI). The law has always struggled to keep pace with technological developments.[1] Recently, the U.S Court of Appeals for the Federal Circuit (Federal Circuit) has expanded enforcement opportunities for interactive inventions. However, our current understanding of requirements such as patent eligibility, inventorship, and utility, raise questions about whether inventions in these emerging areas can obtain meaningful patent protection.[2]

The emerging technologies of VR, AI, and IoT have garnered an incredible amount of attention.[3] With the development of the Internet and advancements in programming and computer hardware, many science fiction ideas have become a reality. Humans now can experience and interact with virtual worlds. Complex network systems connected via the Internet have allowed once inanimate objects to come to life and aid in everyday activities.[4] Finally, computers have reached the point

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1. *See* Wolfgang Drechsler & Vasilis Kostakis, *Should Law Keep Pace with Technology? Law as Katechon*, 34 BULL. SCI. TECH. & SOC'Y 128, 128 (2014); Manav Tanneeru, *Can the Law Keep Up with Technology?*, CNN (Nov. 17, 2009), http://www.cnn.com/2009/TECH/11/17/law.technology/index.html.

2. *See* Kenie Ho, *Internet of Things Patents: Tough to Enforce?*, FINNEGAN (Nov. 7, 2016), https://www.finnegan.com/en/insights/internet-of-things-patents-tough-to-enforce.html; Mark Lyon et al., *When AI Creates IP: Inventorship Issues to Consider*, LAW360 (Aug. 10, 2017), https://www.law360.com/articles/950313/when-ai-creates-ip-inventorship-issues-to-consider; Casey C. Sullivan, *Who Gets to Patent Inventions Made by AI?*, FINDLAW (Jan. 23, 2017), http://blogs.findlaw.com/technologist/2017/01/who-gets-to-patent-inventions-made-by-ai.html.

3. *See, e.g.*, Steven Max Patterson, *Google I/O 2017: AI, IoT and VR/AR Predictions*, NETWORK WORLD (May 10, 2017), https://www.networkworld.com/article/3196068/internet-of-things/google-io-2017-ai-iot-and-vrar-predictions.html.

4. *See* Richard Baguley & Colin McDonald, *Appliance Science: The Internet of Toasters (and Other Things)*, CNET (Mar. 2, 2015), https://www.cnet.com/g00/news/appliance-science-the-internet-of-toasters-and-other-things/.

of sentience, with the ability to think, act, and feel like their human creators.[5]

Given the importance of these technologies to the future, the law must protect virtual inventions, clarify patent eligibility for software, and recognize AI's increasing role in inventing. This essay explores questions about how patent law should change in the face of emerging technologies. While this implies the law must adapt, this essay stops short of making any suggestion as to whether legislative or judicial action is needed. It may be the case that simply thinking differently about how the law applies to these emerging areas may be enough of a paradigm shift. The Federal Circuit's recent decisions on divided infringement, an important enforcement issue for interactive inventions in the IoT space, is an example of the court changing its perspective on a controversial patent enforcement issue.

Divided infringement occurs when more than one party performs every step of a method claim such that their collective performance infringes the claim. In the last ten years, the Federal Circuit has changed the law to make it easier for patent owners to assert method claims infringed by divided performance. One possible explanation for this shift is that the Federal Circuit has come to understand the importance of interactive inventions.

This essay is organized as follows. Part I briefly defines the emerging technologies of AI, VR, and IoT. Part II discusses the challenges the current patent law paradigm imposes on these technologies. For each technology, the essay concludes that the law must adapt to the new technological environment and suggests avenues for implementing that change. This essay uses the recent doctrinal changes in divided infringement to identify reasons for changes in the law responsive to emerging technologies and explore the implications of such changes.

II. BACKGROUND

The following part provides a brief background on the emerging technologies of AI, VR, and IoT. In addition to technical information, this section provides context for the

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5. *See, e.g.*, Ian Sample, *Google's DeepMind Makes AI Program that Can Learn Like a Human*, GUARDIAN (Mar. 14, 2017), https://www.theguardian.com/global/2017/mar/14/googles-deepmind-makes-ai-program-that-can-learn-like-a-human.

potential influence of these technologies on current U.S. patent law.

A. ARTIFICIAL INTELLIGENCE

In recent decades, AI has emerged from the pages of science fiction novels and Hollywood films into everyday life.[6] Each year, advances in computer power and portability propel AI technology forward. From cars to phones, everyday objects are becoming smarter.[7] Further, by reverse engineering the human brain, "next generation AI" is becoming more humanlike.[8]

AI is "the study of mental faculties through the use of computational models."[9] AI is used in almost every industry and includes a variety of technologies and tools, all enabled by big data, the cloud, and modern processing.[10] Current computer processing takes a "logical" approach: the computer can scan millions of web pages to match a google search or analyze thousands of chess games to anticipate or suggest a chess move.[11] However, to mimic the human mind, these processes will need to be grounded in understanding and experience by interacting with the outside world.[12]

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6. *See* Yvette Joy Liebesman, *The Wisdom of Legislating for Anticipated Technological Advancements*, 10 J. MARSHALL REV. INTELL. PROP. L. 154, 172 (2010) (citing BLADE RUNNER (Warner Brothers 1982); I, ROBOT (Twentieth Century Fox 2004)).

7. *See id.*; Ryan Abbott, *I Think, Therefore I Invent: Creative Computers and the Future of Patent Law*, 57 B.C. L. REV. 1079, 1088–89 (2016) (discussing the combination of rapid increases in computing power and software sophistication via the example of IBM's "Watson," of *Jeopardy!* fame).

8. *See* Steven B. Roosa, *The Next Generation of Artificial Intelligence in Light of* In Re Bilski, 21 No. 3 INTELL. PROP. & TECH. L.J. 6, 6–7 (2009).

9. EUGENE CHARNIAK & DREW MCDERMOTT, INTRODUCTION TO ARTIFICIAL INTELLIGENCE 6 (Mark S. Dalton et al. eds., 1985); *see also* PATRICK HENRY WINSTON, ARTIFICIAL INTELLIGENCE 1 (2d ed. 1984) (defining artificial intelligence as "the study of ideas that enable computers to be intelligent").

10. Prakash Mallya, *Slowly, But Surely, AI Use Is Rising Across Industries*, HINDU (Feb. 18, 2018), http://www.thehindu.com/business/Industry/slowly-but-surely-ai-use-is-rising-across-industries/article22790867.ece; Paige Tanner, *The Role of Cloud and Data Center in the Artificial Intelligence World*, MKT. REALIST (Jan. 23, 2018), https://marketrealist.com/2018/01/role-cloud-data-center-artificial-intelligence-world?source=google.

11. Jeremy Hsu, *Robotic Madness: Creating True Artificial Intelligence*, LIVE SCI. (Mar. 18, 2009, 6:13 AM EST), https://www.livescience.com/3407-robot-madness-creating-true-artificial-intelligence.html.

12. *Id.*

Since the introduction of AI at a conference in 1956, the field has steadily received attention, funding, and achieved increasing success.[13] Many early AI implementations attempted to create "human-like" conversation, often measured by the Turing Test.[14] The Turing Test purports to measure a computer's ability to exhibit behavior indistinguishable from human behavior. Many commentators have criticized this test in recent years because AI research has developed beyond the goal of mimicking human-like intelligence.[15] Scientists are now developing AI that can create and make discoveries. For example, IBM Watson is being used to discover new drugs, and may one day develop a cure for cancer.[16]

Despite AI's potential to do good, many people are also concerned about what a world with advanced AI will look like for humanity. The film *The Terminator* popularized the vision of violent robots determined to enslave humans. Elon Musk has claimed that AI is more dangerous than nuclear weapons.[17] Musk fears that AI will replace human labor at all levels including the nuanced work done by doctors and lawyers.[18] In contrast, technology moguls such as Bill Gates and Mark

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13. Tanya Lewis, *A Brief History of Artificial Intelligence*, LIVE SCI. (Dec. 4, 2014, 2:07 PM EST), https://www.livescience.com/49007-history-of-artificial-intelligence.html.

14. A.M. Turing, *Computing Machinery and Intelligence*, 59 No. 236 MIND 433–60 (1950).

15. Lewis, *supra* note 13 (quoting Professor Don Perlis: "The vast majority of people in AI who've thought about the matter, for the most part, think it's a very poor test, because it only looks at external behavior[.]").

16. *See* Abbott, *supra* note 7, at 1119.

17. Ruth Umoh, *Why Elon Musk Might Be Right About His Artificial Intelligence Warnings*, CNBC (Aug. 25, 2017, 10:53 AM EST), https://www.cnbc.com/2017/08/25/why-elon-musk-might-be-right-about-his-artificial-intelligence-warnings.html (quoting Elon Musk: "AI is a fundamental risk to the existence of human civilization in a way that car accidents, airplane crashes, faulty drugs or bad food were not — they were harmful to a set of individuals within society, of course, but they were not harmful to society as a whole[,]" and citing a tweet from Musk stating that AI is more risky than North Korea).

18. Camila Domonoske, *Elon Musk Warns Governors: Artificial Intelligence Poses 'Existential Risk'*, NPR (July 17, 2017, 10:39 AM EST), https://www.npr.org/sections/thetwo-way/2017/07/17/537686649/elon-musk-warns-governors-artificial-intelligence-poses-existential-risk.

Zuckerberg are optimistic about AI, and continue to praise its development as beneficial to the human race.[19]

For now, optimism seems to be winning. The AI market is expected to grow from $8 billion in 2016 to more than $47 billion in 2020. Recent reports put current AI penetration in businesses at 38 percent, and its adoption is predicted to grow to 62 percent by the end of 2018.[20] The U.S. Patent and Trademark Office ("USPTO") has seen a 500 percent increase in patent applications assigned to the AI data processing systems classification.[21] AI might have had its origins in science fiction, but we are now on the path toward discovering what our future with AI will be.[22]

B. VIRTUAL REALITY

Virtual reality ("VR") is a technology for simulating real or imaginary systems. While American novelist Philip Roth believed that there is no remaking reality, the past 50 years of technological advancement suggest otherwise. Recent progress in virtual reality indicates a strong possibility that we may soon be able to remake, and perhaps even design, alternate realities through software. The most popular implementation of VR immerses people in a virtual, three-dimensional, computer-generated environment where users can move and interact with their surroundings as if they were in the real world.[23] Coined

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19. Catherine Clifford, *Bill Gates: I Do Not Agree with Elon Musk About A.I. 'We Shouldn't Panic About It'*, CNBC (Sept. 25, 2017, 4:06 PM EST), https://www.cnbc.com/2017/09/25/bill-gates-disagrees-with-elon-musk-we-shouldnt-panic-about-a-i.html.

20. Gil Press, *Top 10 Hot Artificial Intelligence (AI) Technologies*, FORBES (Jan. 23, 2017, 9:09 AM), www.forbes.com/sites/gilpress/2017/01/23/top-10-hot-artificial-intelligence-ai-technologies/#63abf3c91928.

21. Frank A. DeCosta III, *Intellectual Property Protection for Artificial Intelligence*, 24 WESTLAW J. INTELL. PROP. 1 (2017). *See generally Class 706: Data Processing - Artificial Intelligence*, USPTO (Oct. 6, 2000), https://www.uspto.gov/web/offices/ac/ido/oeip/taf/def/706.htm; USPTO, PATENT COUNTS BY CLASS BY YEAR (JANUARY 1977—DECEMBER 2015), (Mar. 28, 2016), https://www.uspto.gov/web/offices/ac/ido/oeip/taf/cbcby.pdf.

22. *See* Jack B. Balkin, *The Path of Robotics Law*, 6 CAL. L. REV. 45, 60 (2015).

23. Mark A. Lemley & Eugene Volokh, *Law, Virtual Reality, and Augmented Reality*, 166 U. PA. L. REV. (forthcoming 2018), at 2, https://ssrn.com/abstract=2933867; *see also* Crystal Nwaneri, *Ready Lawyer One: Legal Issues in the Innovation of Virtual Reality*, 30 HARV. J.L. & TECH. 601, 604 (2017).

"virtual reality" by Jaron Lanier in the early 1990s, VR detects your body's position through sensors known as "peripherals" (commonly seen as a glove) to allow the user to interact with the digital world.[24] These peripherals allow users to move and change position within the virtual world just as they would in the real world.

In 2014, Facebook made a big splash in the VR space by purchasing Oculus VR for two billion dollars.[25] Oculus VR designs and manufactures VR headsets such as the Oculus Rift. Considered the "future of computing" by Mark Zuckerberg, Oculus VR began shipping a commercial version of the Oculus Rift to consumers in March of 2016.[26] As the availability of VR headsets like the Oculus Rift grows, VR applications are also expected to grow dramatically over the next few years.[27]

Today, VR technology consists primarily of a variety of commercialized headsets used for real-time rendering of the surrounding world and the interactions with that world.[28] While VR has almost exclusively been developed for the gaming industry, the technology will eventually impact other industries, such as healthcare and education.[29] In addition to the above commercial applications, advancements in VR hold potential for use in military training and medicine: VR is already used therapeutically to treat psychological and psychiatric ailments.[30] Most impressively, Google's Project Tango has begun mapping indoor, public buildings to create virtual shopping centers of the future.[31]

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24. Nwaneri, *supra* note 23, at 605.

25. *Id.* at 605–06 ("Unlike many other headsets on the market for much higher prices, the Oculus Rift provided a wide 100-degree field of view, a high resolution display, and low latency in its tracking system . . . . [C]omposed of a magnetometer, gyroscope, and accelerometer, [the Oculus Rift] is able to capture and track movements one thousand times per second.").

26. *Id.*

27. *See* Jonathan M. Purow, *Virtual Reality May Create Novel IP Issues in the Real World*, LAW360 (Mar. 28, 2016, 10:10 AM), http://www.law360.com/articles/769479/virtual-reality-may-create-novel-ip-issues-in-the-real-world ("The virtual world Second Life is populated by 1 million people on a daily basis, and there are expected to be as many as 171 million active VR users by 2018.").

28. Lemley & Volokh, *supra* note 23, at 2–3.

29. *Id.*

30. *See Government Immune from Scientist's Patent Infringement Claims* Lamson v. United States, 21 No. 9 WESTLAW J. INTELL. PROP. 6 (2014).

31. *See Tango*, https://www.tango.me (last visited Feb. 21, 2018).

C. INTERNET OF THINGS[32]

Bruce Sterling, a science fiction writer, popularized the idea of an IoT.[33] His vision predicted that physical objects connected to the Internet would be traceable in space and time.[34] Today, technologies such as Wi-Fi connect various devices and allow them to share information.[35] In 2010, for the first time in history, the number of connected devices outnumbered the number of humans.[36] At the end of 2015, it was estimated that there were 25 billion connected devices on the planet compared to only 7.2 billion people.[37] Accordingly, Sterling's vision is becoming a reality.

The IoT is defined as an "infrastructure of networked physical objects."[38] IoT is an advancement from Internet Age technology.[39] The Internet allowed people and things to be interconnected.[40] The true power of the IoT is allowing smart objects to interact and collaborate with each other.[41] In other words, "devices are the users of the IoT network."[42]

Particularly, instead of simply facilitating human interaction, the IoT allows devices to interact with the physical environment, gather information from that environment, and share that information with other devices, people, or

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32. Portions of this section are excerpted from W. Keith Robinson, *Patent Law Challenges for the Internet of Things*, 15 WAKE FOREST J. BUS. & INTELL. PROP. L. 655 (2015).

33. *See* Cory Doctorow, *Bruce Sterling's "The Epic Struggle of the Internet of Things"*, BOINGBOING (Sept. 13, 2014, 6:00 PM), https://boingboing.net/2014/09/13/bruce-sterlings-the-epic-s.html.

34. *See* Gerd Kortuem et al., *Smart Objects as Building Blocks for the Internet of Things*, IEEE 30, 30 (Frédéric Thiesse & Florian Michahelles eds., Jan./Feb. 2010), http://www.fahim-kawsar.net/papers/Kortuem.IEEEInternet2010.Camera.pdf.

35. *See id.*

36. *See* Oladayo Bello & Sherali Zeadally, *Intelligent Device-to-Device Communication in the Internet of Things*, 10 No. 3 IEEE SYS. J. 1172, 1172 (2016), https://ieeexplore-ieee-org.ezp3.lib.umn.edu/stamp/stamp.jsp?arnumber=6725683 (stating that "[b]y 2010, the number of devices connected to the Internet rose to 12.5 billion while the world's population increased to 6.8 billion . . . ").

37. *Id.*

38. Kortuem et al., *supra* note 34, at 30.

39. Bello & Zeadally, *supra* note 36, at 2 ("Akin to how humans are the users of the Internet, devices [things] are the users of the IoT.").

40. *Id.* at 1.

41. *Id.* at 50.

42. Bello & Zeadally, *supra* note 36, at 1173.

environments.[43] Technologies and equipment, in addition to the Internet, that provide the platform for the IoT include smart devices, information processing equipment, and device sensing equipment.[44]

Smart objects—devices with sensing, processing, and communication abilities—are the backbone of the IoT.[45] Smart objects can be used in nanotechnology, electromechanical systems, or digital electronics.[46] These smart objects are connected via network systems that have both short- and long-range capabilities.[47] Data captured by smart objects can be transmitted via the network and may also be stored using cloud computing applications.[48]

A typical application of IoT technology will require smart objects to collect data and transmit that data to other devices or to a central analysis object.[49] The smart objects can be governed by policies concerning their performance or the environmental data they collect.[50] Based on these policies, smart objects can collaborate with other smart objects or humans.[51]

The fields in which IoT technology can be deployed are almost limitless—transportation, finance, and health care are just a few examples.[52] Because of its possible application to many daily activities, the IoT is a tremendous growth area for innovation. Further, there is an opportunity to create business models and business methods that will make use of the IoT platform in new and innovative ways.[53] In sum, with the

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43. *Id.* at 1172.

44. *See* Peng-fei Fan & Guang-zhao Zhou, *Analysis of the Business Model Innovation of the Technology of Internet of Things in Postal Logistics*, IEEE 532, 532 (2011) ("The Internet of Things, which bases on the Internet, uses a variety of information sensing identification device and information processing equipment, such as RFID, GPS, GIS, JIT, EDI, and other devices to combine with the Internet to form an extensive network in order to achieve information and intelligence for Entity.").

45. Kortuem et al., *supra* note 34, at 44.

46. Bello & Zeadally, *supra* note 30, at 2.

47. *Id.*

48. *Id.*

49. *Id.* at 6.

50. Kortuem et al., *supra* note 34, at 48.

51. *Id.*

52. *Id.* at 533.

53. *Id.* at 536–37 (explaining models are needed to maximize the potential of the IoT in China).

proliferation of connected devices, IoT will affect every person in all walks of life.[54]

III. OBTAINING AND ENFORCING EMERGING TECHNOLOGY PATENTS

Current legal disputes regarding AI, IoT, and VR technologies already include privacy and contract issues.[55] Future legal disputes will almost certainly involve intellectual property rights. This section will explore questions related to challenges the current patent law paradigm presents for AI, VR, and the IoT.

A. ARTIFICIAL INTELLIGENCE

Current patent and copyright laws suggest that human creation is required to obtain IP protection. Specifically, a patent may be obtained by "[w]hoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof."[56] The use of the word "whoever" implies that only a person can be considered an "inventor."[57]

Generally, a patent application must indicate the name of an inventor.[58] The inventor is the one "who conceived the invention" and "maintains intellectual domination of the work."[59] The conception of an invention is the "complete performance of the mental part of the inventive act" and it is "the formation in the mind of the inventor of a definite and

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54. *Id.* at 532.

55. *See* ZeniMax Media, Inc. v. Oculus VR, LLC, 166 F. Supp. 3d 697 (N.D. Tex. 2015) (holding the Texas Uniform Trade Secrets Act did not preempt common-law misappropriation of trade secret claims, and ordering Oculus Rift to pay $500 million in damages). *But see* Total Recall Techs. v. Luckey, C 15-02281 WHA, 2016 WL 199796, at *1 (N.D. Cal. Jan. 16, 2016) (dismissing breach of contract and non-disclosure agreement claims by Total Recall Techs).

56. 35 U.S.C. § 101.

57. *See* Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980).

58. U.S. CONST. art. I, § 8, cl. 8 ("[The Congress shall have power] To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and *Inventors* the exclusive Right to their respective Writings and Discoveries[.]") (emphasis added).

59. *See* Morse v. Porter, 155 U.S.P.Q. 280, 283 (B.P.A.I. 1965) (stating that such domination must be maintained through the "making [of] the invention down to the successful testing, selecting or rejecting as he goes . . . even if such suggestion [or material] proves to be the key that unlocks his problem.").

permanent idea of the complete and operative invention as it is thereafter to be applied in practice . . . ."[60] Similar to "whoever," the use of the word "mind" seems to imply that the law assumes the inventor is a living individual.

Despite this assumption, patent stakeholders in the U.S. recognize that AI can be more than just an assistant to humans in the inventing process.[61] There is evidence that inventions created by non-humans have been patented.[62]

Thus, patent law needs to adapt to AI's emerging capabilities. Absent recognition that, at a minimum, an invention can be jointly invented by AI, the U.S. may be disadvantaged globally. For example, some foreign patent systems do not require the applicant to identify the inventor. [63] If U.S. law cannot protect AI inventions in the U.S., the result could hamper future U.S. innovation and investment.

B. VIRTUAL REALITY

Similar to the AI field, practitioners have led the way in influencing how the law should treat VR inventions. One scholar has already predicted that intellectual property law "will make a smooth expansion into a virtual reality environment because of legislative foresight, the current trend to expand the scope of protected interests, and the probability of using a virtual reality environment for commerce."[64] For example, some patent attorneys include language in patent applications to protect

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60. U.S. PATENT & TRADEMARK OFFICE, U.S. DEP'T OF COMMERCE, MANUAL OF PATENT EXAMINING PROCEDURE § 2138.04 (9th ed. Nov. 2015) (quoting Townsend v. Smith, 36 F.2d 292, 295 (CCPA 1930)).

61. See Ryan Abbott, *I Think Therefore I Invent: Creative Computers and the Future of Patent Law*, 57 B.C. L. REV. 1079 (2016).

62. *Id.* at 1088.

63. *See e.g.*, *FAQ – Applying for a Patent*, EUR. PAT. OFF., http://www.epo.org/service-support/faq/own-file.html (last visited Feb. 21, 2018) (The EPO requires only an "applicant." "European patent applications must contain: [1] a request for the grant of a European patent . . . [2] a description of the invention [3] one or more claims [4] any drawings referred to in the description or the claims [and] [5] an abstract." "This should be accompanied (where applicable - i.e. where the applicant is not the inventor or is not the sole inventor) by a 'Designation of the inventor' form . . . .").

64. Timir Chheda, *Intellectual Property Implications in a Virtual Reality Environment*, 4 J. MARSHALL REV. INTELL. PROP. L. 483, 484 (2005) (citations omitted).

inventions created in simulated environments.[65] However, the current IP paradigm does not provide much guidance for how to treat inventions wholly created within the virtual world. Courts have addressed the validity of trademarks and copyright in virtual worlds.[66] However, potential VR inventions present a unique set of challenges.

First, an invention within a VR world must be patent eligible subject matter as described in § 101.[67] Second, the invention must be "useful." An invention is useful if it is operable and provides a "real world" benefit.[68] The "useful" requirement concerns both the operability (whether the invention works as claimed and described in the patent), and the substantiality (a subject analysis focusing on the *degree* of usefulness or whether the claimed invention has *enough* utility, or benefit to the public given the policies of patent law) of the invention.[69] Courts have used "practical utility" and "real world utility" interchangeably in determining whether an invention offers a "substantial" utility.[70]

It is an open question as to how the "real world" utility requirement[71] applies to virtual world inventions. Programming

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65. Thai Phi Le, *More than Just a Game*, D.C. BAR: WASH. LAW. (May 2013), https://www.dcbar.org/bar-resources/publications/washington-lawyer/articles/may-2013-virtual-game.cfm ("With these issues in mind, when [attorney Ross A.] Dannenberg works on a patent application, he includes language regarding a computer embodiment of the product, if applicable.").

66. *See, e.g.*, Taser Int'l, Inc. v. Linden Research, Inc., 2:2009cv00811 (D. Ariz. Apr. 17, 2009) (alleging rampant sales of unauthorized TASER branded virtual stun guns within the virtual world; Taser withdrew their claim as a result of settlement); Marvel Enters., Inc. v. NCSoft Corp., CV 04-9253RGKPLAX, 2005 WL 878090, at *1 (C.D. Cal. Mar. 9, 2005) (alleging indirect infringement on NCSoft for their game "City of Heroes" that allowed users to make superheroes similar to those of Marvel).

67. 35 U.S.C. § 101 (2012) (Patentable subject matter is "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof . . . .").

68. 35 U.S.C. § 101; In re Fisher, 421 F.3d 1365 (Fed. Cir. 2005).

69. *In re Fisher*, 421 F.3d 1365, 1371.

70. *See id.* at 1371 ("[T]o satisfy the 'substantial' utility requirement, an asserted use must show that that claimed invention has a significant and presently available benefit to the public.")

71. *See, e.g.*, U.S. Patent No. 4,772,020 (issued Sept. 20, 1988) (A "NERF" football stabilizes the normally erratic flight pattern resultant when a small hand throws a regular football). In a virtual reality environment, all spirals could be perfect regardless of this invention.

within virtual worlds can circumvent real world physical laws.[72] Further, within the virtual world, an invention may produce outcomes that has no impact on the real world.[73]

Despite the concerns raised above, the utility requirement has historically been a low bar to meet. Thus, an economic connection between a virtual world and the real world may be enough for a virtual-world invention to qualify as a "real world" use. For example, the video game Second Life has an economy, which is linked to the real-world economy, that allows "virtual goods" to be traded and sold.[74] These "virtual goods" are often paid for with real money. In some cases, countries have treated theft of a virtual item as real theft.[75] Moreover, a virtual invention which brings about a real-world effect, such as emotion or entertainment could justify protecting a virtual invention under current law.[76]

Finally, issues may also arise concerning ownership of virtual inventions. Many of the online video games in the U.S. operate under end-user license agreements (EULA) that state that the "relevant game operators have exclusive control and ownership of the games, and virtual items therein have no legal significance or status."[77] Thus, the inventor of a VR invention may lack ownership of any virtual items embodying their

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72. *See, e.g.*, Diamond v. Chakrabarty, 447 U.S. 303, 305 (1980). Chakrabarty's process for producing oil-eating microorganisms, could result in anything a virtual reality programmer wishes, destroying the applicability of protection.

73. Chheda, *supra* note 64, at 506.

74. *See* Oliver Chiang, *Meet the Man Who Just Made a Half Million from the Sale of Virtual Property*, FORBES (Nov. 13, 2010, 7:20 PM), https://www.forbes.com/sites/oliverchiang/2010/11/13/meet-the-man-who-just-made-a-cool-half-million-from-the-sale-of-virtual-property/#20e78b3421cd ("Jon Jacobs . . . sold a virtual space station he's spent the past five years managing for . . . $635,000 in total . . . .").

75. *'Virtual Theft' Leads to Arrest*, BBC NEWS (Nov. 14, 2007, 2:37 PM GMT), http://news.bbc.co.uk/2/hi/technology/7094764.stm.

76. Note, however, that this may bring about issues of "general utility" shared across this general class of patents. In this case, there may be no "specific utility," and therefore, this class could fail the utility requirement.

77. Oliver Herzfeld, *What Is the Legal Status of Virtual Goods?*, FORBES (Dec. 4, 2012, 1:09 PM), https://www.forbes.com/sites/oliverherzfeld/2012/12/04/what-is-the-legal-status-of-virtual-goods/#beab906108a2 (explaining that, however, this is divorced from the expectations of consumers and players, where "in 2010 a virtual resort was sold for $635,000 and a virtual space station for $330,000.").

invention or lack the ability to enforce their patent against the owner of a VR platform and its users.

C. INTERNET OF THINGS[78]

1. Patent Eligibility

IoT inventions will likely face challenges on patent eligibility grounds. These challenges will be complicated because of the current issues surrounding software patents.[79] Software is patent-eligible, but simply using software to implement abstract ideas is not patentable.[80] Examples of abstract ideas include basic algorithms, principal concepts, and fundamental practices.[81]

The Supreme Court has held that a process claim embodying an algorithm for converting binary-coded decimal numbers into pure binary numbers was patent-ineligible.[82] Further, the Supreme Court held that a process claim on the basic concept of hedging against risk in a financial transaction was patent-ineligible because the claim was attempting to cover a fundamental economic practice.[83] On similar grounds, the Supreme Court held a process claim directed toward the concept of intermediated settlement was also ineligible for patenting.[84]

The current test for determining patent eligibility for an invention is articulated in *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*[85] There, the Supreme Court set forth a two-step analysis for determining whether a patent claim was directed to a patentable invention.[86] First, the court must determine whether the claim is directed to a patent ineligible

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78. Portions of this section are excerpted from W. Keith Robinson, *Patent Law Challenges for the Internet of Things*, 15 WAKE FOREST J. BUS. & INTELL. PROP. L. 655 (2015).

79. *See, e.g.*, Daniel E. Harmon, *Patents in the Balance?: IP Analysts Continue to Ponder* Alice *Ramifications*, 32 LAW. PC 1 (2015).

80. *See* Alice Corp. Pty. v. CLS Bank Int'l, 134 S. Ct. 2347, 2357 (2014) (concluding that generic computer implementation of an abstract idea is not patentable).

81. *See id.* at 2355.

82. *See* Gottschalk v. Benson, 409 U.S. 63, 71–72 (1972).

83. *See* Bilski v. Kappos, 561 U.S. 593, 611 (2010).

84. *See Alice*, 134 S. Ct. at 2360.

85. *Id.* at 2355 (citing to Mayo Collaborative Servs. v. Prometheus Labs., 566 U.S. 66 (2012)).

86. *Id.*

concept, such as an abstract idea.[87] If the claim is directed to an abstract idea, then it is patentable only if the court can identify an inventive concept.[88]

The Supreme Court applied this test in its *Alice* decision to conclude that the software related claims at issue were not patentable.[89] Specifically, the Court found that using a third party for intermediated settlement is a fundamental economic practice and, therefore, an abstract idea.[90] Moreover, the Court concluded that simply requiring generic computer implementation of that abstract idea did not make the idea patent-eligible.

The holding in *Alice* could limit what IoT related software is patent-eligible. Based on the *Mayo* framework, novel innovation in software will obtain patent protection only if it solves a technological problem or improves a technological process.[91] Accordingly, prospective patentees of IoT software inventions will need to craft their patent applications to emphasize "elements" that contribute to their inventions being "significantly more" than an abstract idea.[92]

One consequence of this stricter patentability requirement will be that other non-patentable software and methods will become "open source" where the commercial benefit for developers is derived from ancillary services such as the Software as a Service ("SaaS") business model.[93] Further, because of the *Alice* decision, strong apparatus claims directed to the devices themselves will be increasingly important.

2. Divided Infringement

The nature of IoT technology is interactive. Accordingly, a scenario may arise where the activities of more than one party are involved in possibly infringing a patent. Third party liability

87. *See id.*

88. *Id.*

89. *Id.*

90. *Id.*

91. *See e.g.*, Diamond v. Diehr, 450 U.S. 175, 185–93 (1981) (holding that a process for molding rubber that used a mathematical algorithm was patent-eligible).

92. *See Alice*, 134 S. Ct. at 2355.

93. Simon Phipps, *Federal Hearing Today Marks Turning Point in War on Software Patents*, INFOWORLD (Feb. 8, 2013), https://www.infoworld.com/article/2613542/open-source-software/federal-hearing-today-marks-turning-point-in-war-on-software-patents.html.

for patent infringement is addressed under the patent statute's inducement and contributory infringement provisions.[94] However, another highly controversial doctrine referred to as divided infringement may also apply.[95]

Divided infringement deals with the question of whether there can be infringement liability when the performance of a method claim is split among multiple parties, actors or devices.[96] The current rule, recently articulated by the Federal Circuit, is that there may be infringement liability when the steps of a method are performed by multiple parties if a single defendant "[e]xercises 'control or direction' over the entire process such that every step is attributable to the controlling party."[97] There may also be liability when an alleged infringer "conditions participation in an activity or receipt of a benefit upon performance of a step or steps of a patented method and establishes the manner or timing of that performance."[98] Finally, an entity may be liable where actors form a joint enterprise.[99]

The current test for divided infringement represents a significant shift in the law from just ten years ago. In 2007, liability for divided infringement required a showing that one party directed or controlled another to perform the infringed method. The direction and control test was an incredibly high bar to meet. Commentators viewed the test as a "loophole" for infringement; Judge Newman famously lamented that interactive patents were not patents at all because they could not be enforced under the direction or control test.[100]

Two factors likely contributed to the court's evolution. First, interactive technology has become increasingly prevalent.

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94. *See* 35 U.S.C. § 271(b)–(c) (2012).

95. *See* Akamai Techs., Inc. v. Limelight Networks, Inc., 692 F.3d 1301, 1325 (Fed. Cir. 2012), *rev'd*, 134 S. Ct. 2111 (2014) (acknowledging the doctrinal difficulties that arise when the acts of more than one party allegedly combine to infringe a method claim).

96. *See id.*

97. Muniauction, Inc. v. Thomson Corp., 532 F.3d 1318, 1329 (Fed. Cir. 2008) (citing BMC Res., Inc. v. Paymentech, L.P., 498 F.3d 1373, 1380–81 (Fed. Cir. 2007)).

98. Akamai Technologies, Inc. v. Limelight Networks, Inc., 797 F.3d 1020, 1023 (2015).

99. *Id.*

100. *See McKesson Technologies Inc. v. Epic Systems Corp.*, OBLON (Apr. 14, 2011), http://www.oblon.com/news/mckesson-technologies-inc-v-epic-systems-corp/.

Growth in demand for financial services and internet retail has been driven in part by innovation and explosive growth in the wireless industry.[101] The United States has more mobile internet users than any other country in the world.[102] "Apps," or applications that run on smart mobile devices, have also contributed to the growth of the wireless industry.[103] The revenue generated from mobile app sales was projected to increase 190% and surpass 15.1 billion dollars in 2011.[104] Accordingly, the global economy has become dependent upon this interconnected system of wireless devices, internet storefronts, and financial services.[105]

Second, the USPTO's patent quality initiatives have influenced the Federal Circuit to expand the enforcement capability of valid interactive patents. Currently, the USPTO's Patent Trials and Appeals Board conducts hearings for reviewing and challenging granted patents on a number of grounds. For example, inter partes review ("IPR") is a proceeding for reviewing the patentability of one or more claims on novelty or non-obviousness grounds. The post grant review ("PGR") proceeding reviews the patentability of one or more claims of a granted patent on any ground of patentability, including eligibility under § 101 and whether the claims comply with the written description and enablement requirement. Finally, the transitional program for covered business method patents ("CBM") is a proceeding for reviewing the patentability of one or more claims in a business method patent.

In combination with the *Alice* decision, the threat of PTAB proceedings may have caused the quality of asserted interactive patents to rise. Recent statistics suggest that CBM petitions challenging patent claims on patent eligibility grounds have a

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101. *See* Brief of CTIA—the Wireless Association® and Metropcs Wireless, Inc. at 3, *Akamai/McKesson I*, 692 F.3d 1301 (Nos. 06-CV-11109, 06-CV-11585), 2011 WL 4071472, at *3–4 ("Advances in wireless technology have enabled explosive innovation in the last decade. Ten years ago, consumers used cell phones almost exclusively to make voice calls. Five years later, they were texting, sharing pictures, and surfing the Internet.").

102. *Id.* at 8 (stating that 234 million or more Americans use mobile devices).

103. *Id.* at 4.

104. *Id.*

105. Brief of Amicus Curiae the Financial Services Roundtable in Support of Limelight Networks, Inc. and Affirmance at 16, *Akamai/McKesson I*, 692 F.3d 1301 (Nos. 2009-1372, 2009-1380, 2009-1416, 2009-1417), 2011 WL 7730148.

high likelihood of being instituted.[106] Further, to date, few, if any, claims challenged on patent eligibility grounds have survived CBM review.[107]

In sum, the law concerning enforcement of interactive claims has changed rapidly over the last decade. Patentees of IoT inventions face a higher bar of patentability. However, valid interactive patents are now more likely to be found infringed because of the Federal Circuit's expansion of the divided infringement doctrine.

IV. CONCLUSION

The emerging technologies of AI, VR, and the IoT will be incorporated into everyday life within the next half-century. These technologies demonstrate that traditional assumptions in patent law about who may invent, where an invention may be created, and how an invention may be infringed are outdated. Thus, the law must clarify patent eligibility for virtual inventions, recognize the increasing role of artificial intelligence in inventing, and continue to develop the doctrinal framework for enforcing interactive patents.

106. See AIA Blog, Claim and Case Disposition, https://www.finnegan.com/en/america-invents-act/claim-and-case-disposition.html (last visited May 9, 2018).

107. *Id.*