Before the
National Institute of Standards and Technology
Gaithersburg, MD

In re Study to Advance a More Productive Tech Economy (COMPETE Act)	Docket No. 211116-0234 (NIST-2021-0007)

COMMENTS OF
COMPUTER & COMMUNICATIONS INDUSTRY ASSOCIATION

The Computer & Communications Industry (CCIA)[1] submits the following comments in response to the National Institute of Standards and Technology (NIST)'s November 22, 2021, Request for Information on its Study to Advance a More Productive Tech Economy.[2]

CCIA is an international, not-for-profit trade association representing a broad cross section of communications and technology firms. For fifty years, CCIA has promoted open markets, open systems, and open networks. CCIA members employ more than 1.6 million workers, invest more than $100 billion in research and development, and contribute trillions of dollars in productivity to the global economy.

CCIA members are at the forefront of research and development in emerging technology fields such as artificial intelligence and machine learning[3], quantum computing[4], the Internet of Things and its use in manufacturing, advanced materials and material processing technologies for semiconductors, and many other developing technologies. CCIA members are also active participants in the patent system, active participants in standards development processes, and partner with government organizations to develop new technologies in many areas.

CCIA appreciates NIST's attention to how best to ensure U.S. leadership in emerging areas of technology while simultaneously ensuring that a robust competitive environment exists in those areas in accordance with President Biden's recent executive order on "Promoting Competition in the American Economy."[5]

To ensure both growth and competition, CCIA believes two key concerns should be studied.

[1] A list of CCIA members is available online at https://www.ccianet.org/about/members.
[2] Study To Advance a More Productive Tech Economy, 86 Fed. Reg. 66287 (Nov. 22, 2021).
[3] USPTO, *Inventing AI*, Fig. 6 (Oct. 2020), https://www.uspto.gov/sites/default/files/documents/OCE-DH-AI.pdf.
[4] *See* Elliott Mason, *Trends in quantum computing patents* (May 24, 2021), https://quantumconsortium.org/blog/trends-in-quantum-computing-patents/.
[5] *Cf.* Exec. Order No. 14036, "Promoting Competition in the American Economy," 86 Fed. Reg. 36987 (July 9, 2021).

First, the potential negative impact of standard-essential patents on the emerging technology area must be minimized, including by adoption of the recent draft policy statement issued jointly by the Department of Justice, NIST, and the U.S. Patent and Trademark Office.

Second, the impact of intellectual property on the growth of areas of emerging technology should be examined. In just one example, the recent explosion of 3D printing technologies after the expiration of key patents is illustrative of how intellectual property can sometimes harm U.S. leadership in technology and limit robust competition. The use of government grants and prize programs to drive innovative activity should be considered as a viable complement and alternative to the intellectual property system.

I. The Impact of Standard-Essential Patents on Emerging Technologies

Standard-essential patents (SEPs)—those patents required in order to implement a standard—are a topic of much concern to standards development, as evidenced by numerous currently open dockets relating to the topic around the world[6] and ongoing global litigation. CCIA is heartened by the recent joint draft proposal to reform the federal government's position on SEPs and supports the general approach taken in that proposal.

In the area of emerging technologies, SEPs can have even more significant impacts. While even in developed technologies, SEPs can create serious barriers to entry and operation,[7] those barriers are far higher and more threatening in emerging areas of technology.

But in emerging technology standards, where the patent landscape is foggier than it is for established technology standards, those barriers are much higher. The abuse of SEPs in emerging technology standards can seriously hinder the adoption of those standards and the growth of those technologies.[8] New entrants are unlikely to have the resources and knowledge needed to negotiate the hurdles SEP abuse creates and may choose not to invest in developing emerging technologies as a result. SEP abuse may also lead to standards balkanization, as companies create new standards to avoid patent encumbrances on other standards, resulting in a fragmented market to the detriment of consumers.

A. SEPs and the Internet of Things

Taking the Internet of Things as a case study, the impact of SEPs on IoT is non-trivial. Even if standards balkanization is avoided, the multiplicity of areas where IoT may be utilized and the range of necessary standards, from physical layer to application layer to security standards, leads to a complex and fragmented standards system.

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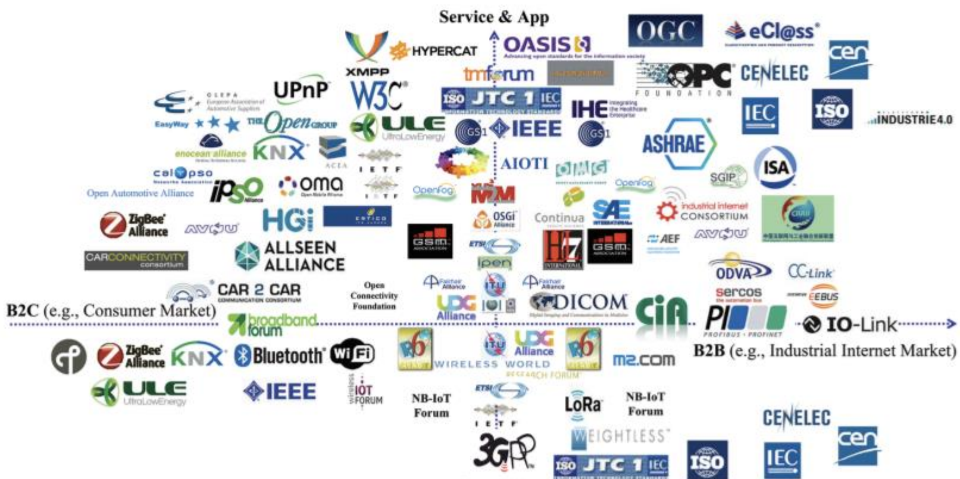
[6] *See, e.g.*, Draft Policy Statement on Licensing Negotiations and Remedies for Standards-Essential Patents Subject to Voluntary F/RAND Commitments, Dkt. No. ATR-2021-0001 (Dec. 6, 2021) (Dep't of Justice, NIST, & USPTO joint draft policy statement on SEPs); UKIPO, Standard Essential Patents and Innovation: Call for views (Dec. 7, 2021) (UKIPO seeking comments on SEP policy); Intellectual property – new framework for standard-essential patents (forthcoming 2022) (upcoming European Commission consultation on a framework for SEPs).

[7] *See, e.g.*, Findings of Fact and Conclusions of Law, *FTC v. Qualcomm*, 411 F. Supp. 3d 658 (N.D. Cal. 2019), *rev'd on other grounds by FTC v. Qualcomm*, 969 F.3d 974 (9th Cir. 2020) (summarizing how Qualcomm's SEP abuse has led to the exit of numerous baseband chip vendors).

[8] *See, e.g.*, Tineke Egyedi, *IPR Paralysis in Standardization: Is Regulatory Symmetry Desirable?*, 39:4 IEEE COMMS. MAG. 108 (Apr. 2001).

IoT SDOs and Alliances Landscape
(Technology and Marketing Dimensions)



Source: AIOTI WG03 (IoT Standardisation) – Release 2.6

As the preceding graphic illustrates, a given IoT product might implement dozens of standards, underscoring the complexity of licensing in this space.

Beyond the sheer number of standards to license, IoT manufacturers may choose to rely on existing physical layers such as 3G, LTE, and Wi-Fi, which in turn will bring in the problematic SEP licensing structures that currently exist in those arenas. While practices like end-user licensing may be possible when dealing with a few dozen handset companies, they are likely to create serious deadweight losses and even fail entirely when applied to the diverse business models and multiple verticals that the tens of thousands of SMEs likely to develop products relying on the IoT will operate in.

B. Choice of Licensing Level

SEP licensors currently deny licenses to non-favored licensees,[9] allowing them to select the licensing level that is most profitable to the SEP licensor, contributing to higher prices and reduced innovation for consumers. To avoid these types of problems, NIST should encourage IoT standards to require licensing of SEPs at the level of the value chain which is most efficient for the overall system. In the absence of an *ex ante* most efficient licensing level, an active obligation to license to anyone who requests a license combined with an active effort to encourage license cost transparency would likely result in the market settling on the most efficient licensing level. In situations where a large number of OEMs rely on a limited number of suppliers for a standardized functionality (e.g., the innumerable IoT products that rely on Wi-Fi vs. the limited number of suppliers who produce Wi-Fi transceiver chips) the efficient licensing level is likely the supplier level. Other market configurations may produce different efficient licensing levels.

C. SEP Transparency

Beyond choice of licensing level, enhanced transparency for SEP declarations and rates is likely to prove necessary to a practical SEP licensing program for IoT. Currently, SEP owners often either fail to provide publicly available rates or publicize rates that are significantly in

[9] *See* Findings of Fact, *supra* n. 7.

excess of the rates provided when their portfolios are evaluated by a court.[10] Lacking any disincentive to set a high public rate, licensors anchor their pricing with high "sticker prices," even if large licensees and courts are likely to negotiate or set significantly lower prices.[11] SMEs are more likely to pay this "sticker price" compared to sophisticated market participants, leading to reduced competition and reduction in the economic growth competition brings. While large entities may negotiate discounted rates based on considerations like cross-licenses, the disparity between published and actual rates significantly exceeds such countervailing considerations.

Setting a public rate that accurately reflects privately negotiated rates, making public anonymized actual negotiated rates, and permitting the use of patent pools for buyers as well as sellers of patent rights would all contribute to enhancing SEP rate transparency. Enhancing the declaration process and requiring essentiality declarations to include claim charts against the standard would both enhance transparency and reduce the cost of SEP compliance—a company should not be declaring a patent essential if they have not, at a minimum, charted it against the standard, and making those charts available to potential licensees will enable them to better understand what is patented.

D. Proposed Approaches to Minimize SEP Abuse in Emerging Technologies

While the above discussion utilizes IoT as an illustrative example, the general concerns with SEPs extend to other emerging technologies as they are standardized. Licensing at the efficient level in the value chain, enhanced transparency, and other reforms intended to mitigate SEP abuse will have equal value in those areas. CCIA also generally supports the joint DoJ/NIST/USPTO draft policy statement on licensing of SEPs and urges NIST to adopt a final rule generally consistent with the draft statement. Our detailed feedback on the draft policy statement will be provided in that docket.

II. The Impact of Intellectual Property on Emerging Technologies

CCIA also believes that NIST should consider studying how intellectual property can constrain the rapid development of emerging technologies. Particularly in early stages of technology, when rapid development is occurring, overly broad patents can create serious barriers to participation, delaying development of that technology. This difficulty is compounded by the difficulty in evaluating the importance of patents in an emerging technology. Valuation of patents, difficult at the best of times, is even more difficult at early stages of technology when it is unclear if the invention will succeed or fail miserably.[12]

Because of this, an approach to emerging technologies that focuses on patents to the exclusion of other incentives may well disrupt the development of the emerging technology, leading to a loss of U.S. technological leadership. In contrast, numerous examples over the past

[10] *See* Jorge Contreras, *Global Rate Setting: A Solution for Standards-Essential Patents?*, 94 WASH. L. REV. 701, 706-07 (2019) (noting the lack of transparency for SEP rates); Ann Armstrong, Joseph Mueller, & Tim Syrett, *The Smartphone Royalty Stack: Surveying Royalty Demands for the Components Within Modern Smartphones* (2014), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2443848 (comparing requested and court-awarded rates for SEPs).

[11] Armstrong *et al.*, *Smartphone Royalty Stack*; *see also* Bernard Chao, *Saliency, Anchors, and Frames: A Multicomponent Damages Experiment*, 26 MICH. TELECOMM. & TECH. L. REV. 1 (2019).

[12] *See* Robert Merges, *Intellectual Property Rights and Bargaining Breakdown: The Case of Blocking Patents*, 62 TENN. L. REV. 75, 85-86, nn. 41, 42 (1994).

100 years illustrate how a vibrant technology can emerge in a field that is either non-encumbered by intellectual property or where the encumbrance is for some reason ineffective. Examples include the computer, large portions of biotechnology, integrated circuits, the laser, polymer chemistry, television, and the Internet.[13]

A. Case Study: The Internet

The Internet grew out of federal and university funded projects in an era when software was generally not patentable and publicly funded research was not patented.[14] As a result, the foundational technology of the Internet emerged in an environment where anyone could develop software for the Internet without fear of patent infringement. Indeed, the creator of the World Wide Web credits this as one key element in its success; as he put it, "had the technology been proprietary, and in my total control, it would probably not have taken off. The decision to make the Web an open system was necessary for it to be universal."[15] While patents have played a role in the Internet as the field of technology matured, had they blocked development of networked software early on, the entire 20th century communications revolution might not have happened, or might have been severely delayed.

The history of patents and the Internet suggests that the lack of proprietary exclusive rights early in the development of an emerging technology, particularly where the barriers to entry to that technology are low, can actually increase the scope and pace of innovation in that technology.

B. Case Study: Artificial Intelligence

The recent explosion of artificial intelligence (AI) and machine learning is also instructive. While patent activity in AI is common, it is more generally aimed at applications of the technology. Many of the foundational techniques—techniques like deep learning—are either unpatented or made available without royalty obligations and often with a defensive suspension clause.[16] In particular, open-source machine learning tools[17] (and the availability of cloud computing to train those models) has allowed companies in a huge range of fields to begin applying these techniques.[18] The emergence of useful AI is thus not solely a reflection of intellectual property but rather has been driven by open access to foundational technology in the AI space.

By providing the baseline technology in a non-proprietary open-source form, innovators in artificial intelligence have enabled others to build on their foundation to create new applications of technology. By providing these tools widely, rather than controlling who can

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[13] *See* Mark Lemley, *Patenting Nanotechnology*, 58 STAN. L. REV. 601, 606-613 (2005) (describing how each field thrived in the absence of significant patent enforcement).
[14] *Id.* at 608.
[15] Tim Berners-Lee, *Frequently Asked Questions*, http://www.w3.org/People/Berners-Lee/FAQ.html (last visited Jan. 26, 2022).
[16] *See, e.g.*, Apache License Agreement V2 cl. 3 (Jan. 2004), https://www.apache.org/licenses/LICENSE-2.0. Notable AI software using the Apache V2 license includes TensorFlow and Hadoop.
[17] *See, e.g.*, TensorFlow; Caffe; PyTorch; MapReduce; Hadoop.
[18] While the technology is still in its early stages, there are strong signals that a similar approach will be taken in quantum computing, with open-source projects like TensorFlow Quantum and quantum cloud computing services in the works by Amazon, Google, and others. *See* CBInsights, *The Big Tech In Quantum Report: How Google, Microsoft, Amazon, IBM, & Intel Are Battling For The Future Of Computing* (Dec. 22, 2021), https://www.cbinsights.com/research/report/big-tech-quantum/.

access them, innovations in areas that might not have been predictable to the AI innovators have been created. Again, by limiting proprietary exclusive rights in basic aspects of an emerging technology, the scope and pace of innovation across that technology has been accelerated.

C. Case Study: 3D Printing

The final case study presents a different situation. Unlike the Internet and artificial intelligence, foundational 3D printing techniques were both heavily patented and not openly shared. The result was a long period in which 3D printing was relatively inaccessible to many and the development of the field was delayed. The post-expiration experience in 3D printing drives this point home—as foundational patents expired, each relevant subfield of 3D printing exploded. The patent on fused-deposition modeling (FDM), in which a thermoplastic substance is laid down in layers while liquid, fusing to the existing thermoplastic which has already cooled to a solid, expired in 2009.[19] After its expiration, prices for FDM printers dropped more than 10-fold and FDM printers moved from being present primarily in large industrial facilities to something accessible to small inventors, SMEs, and individuals.[20]

Similar stories have played out in the other major types of 3D printing. Key selective laser sintering (SLS) patents expired in 2014. Prior to this, SLS printers were "industrial, room-sized behemoths which started at $250,000."[21] After patent expiration, SLS machines in the $5,000 range began to be available, a 50-fold reduction in price.[22] A key stereolithography (SLA) patent also expired in 2014, which—combined with the wide availability of high-resolution screens from the mobile phone industry—led to an explosion in consumer SLA printers as well.[23]

In each case, during the period of patent protection the relevant 3D printing technique was restricted to large entities with the resources to acquire expensive machines. The expiration of the relevant patents reduced barriers to entry for creating 3D printers, but more importantly, the increased availability at a reduced cost led to 3D printing emerging as a technology that can be used in a wide variety of fields.

D. Recommendations on Intellectual Property in Emerging Technologies

In contrast to the Internet and artificial intelligence, both of which emerged due to a lack of patents, the emergence of 3D printing was delayed due to broad foundational patents blocking the technology from widespread use. Industrial policy designed to promote innovation should consider whether non-proprietary approaches such as prize competitions, direct grant funding, or open-source collaborative approaches might provide a better environment for emerging technologies to advance. Once the foundation of the technology has been set in place, exclusive rights over aspects of the technology may serve to drive innovation; prior to that time, broad foundational patents are more likely to delay development than advance it.

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[19] Filemon Schoffer, *How expiring patents are ushering in the next generation of 3D printing*, TechCrunch (May 15, 2016), https://techcrunch.com/2016/05/15/how-expiring-patents-are-ushering-in-the-next-generation-of-3d-printing/.
[20] *Id.*
[21] 3DSourced.com, *The Complete History of 3D Printing: From 1980 to 2022* (last visited Jan. 26, 2022), https://www.3dsourced.com/guides/history-of-3d-printing/.
[22] *Id.*
[23] *Id.*

III. Alternative Approaches to Incentivizing Growth in Emerging Technologies

Patents are sometimes described as necessary to stimulate investment in new innovations.[24] But there is a long history of alternative and complementary approaches to stimulating innovation. Even as far back as the pre-Revolution English practice, prize systems were in use, most famously in the form of a prize for creation of a method for precise determination of longitude at sea.[25] This history illustrates that intellectual property-based approaches are not the sole way to encourage growth in emerging technologies. Alternative approaches including prize/reward competitions, direct grant funding, and open-source approaches are all examples of approaches that can generate innovation without requiring exclusive intellectual property rights.[26] Emerging technologies such as the Internet and artificial intelligence benefited from these approaches, with significant direct grant funding originating the field of technology and open-source approaches driving many of core developments in that field. Another form of widely employed non-proprietary innovation incentive is the R&D tax credit, which incentivizes spending on innovative activity without a required proprietary right.[27]

As one example of non-IP approaches to incentivizing emerging technology, the Chinese government, which has identified artificial intelligence as of critical national interest, has simultaneously eliminated financial incentives to file patents and strengthened examination of patents, reducing its focus on patent activity.[28] At the same time, China has "backed up its strategic plans with significant state subsidies to technology firms and academic institutions that engage in cutting-edge AI research" and promoted 'national champion' firms to win global markets.[29] This suggests that at least one global peer competitor does not see patents as a sole solution to driving innovation in emerging technologies, but rather as one component of a larger industrial strategy.

CCIA suggests that, as NIST develops strategies for innovation in emerging technologies, NIST should consider these alternative incentive structures as a complement to or substitute for intellectual property, rather than relying solely on outdated producer-centered intellectual property models. Such alternative approaches may well obviate some of the concerns regarding standard-essential patents and negative impacts from over-patenting described above.

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[24] *See* Mark Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989 (1997).

[25] *See* Mark Abramowicz, *Prize and reward alternatives to intellectual property, in* RESEARCH HANDBOOK ON THE ECONOMICS OF INTELLECTUAL PROPERTY LAW 350, 355 (DePoorter, Menell, & Schwartz eds., 2019).

[26] *See, e.g.*, Abramowicz, *supra* n. 25; Daniel J. Hemel & Lisa Larrimore Ouellette, *Beyond the Patents-Prizes Debate*, 92 TEX. L. REV. 303 (2013); Toshiko Takenaka, *Inclusive Patents for Open Innovation*, 29 TEX. INTELL. PROP. L.J. 187 (2021); Eric von Hippel, FREE INNOVATION (2017); Nancy Gallini & Suzanne Scotchmer, *Intellectual Property: When Is It the Best Incentive System?*, *in* 2 INNOVATION POLICY AND THE ECONOMY 51, 51 (Adam B. Jaffe *et al.* eds., 2002) Carliss Baldwin & Eric von Hippel, *Modeling a Paradigm Shift: From Producer Innovation to User and Open Collaborative Innovation*, 22 ORG. SCI. 1399 (2011); Joseph E. Stiglitz, *Economic Foundations of Intellectual Property Rights*, 57 DUKE L.J. 1693, 1719-24 (2008).

[27] Hemel & Ouellette, *Beyond* at 321.

[28] Paolo Beconcini, *New Procedures Indicate China's Patent System is Now Focused on Quality, not Quantity, of Patents*, XI NAT'L L. REV. 46 (Feb. 15, 2021), https://www.natlawreview.com/article/new-procedures-indicate-china-s-patent-system-now-focused-quality-not-quantity.

[29] Final Report of the National Security Commission on Artificial Intelligence at 161 (2021).

CCIA thanks NIST for the opportunity to comment on the national strategy for innovation in emerging technologies, and welcomes any further opportunity to work with NIST to ensure U.S. leadership in these crucial areas.

Respectfully submitted,

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