

## No Permission Needed

### Unlicensed spectrum, Wi-Fi, and America's competitive advantage

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Robust, resilient, and high-capacity internet service is critical to America's economic prosperity and success. A key part of internet service is Wi-Fi, which provides Americans broadband access in countless locations, including homes, schools, hotels, coffee shops, offices, airports, and airplanes. With over 18 billion devices in operation, Wi-Fi is always there and everywhere.<sup>1</sup>

Wi-Fi is a success story because it uses unlicensed spectrum, for which the Wi-Fi provider pays no price and there is no centralized control, allowing for anyone to provide Wi-Fi and for innovation in how that is achieved. It is this foundation in permissionless innovation that has led to Wi-Fi's success and the creation of immense value to the economy.

In this, we have seen a partial fulfillment of the prediction by genius inventor Nikola Tesla, who said that "when wireless is fully applied, the Earth will be converted into a huge brain, capable of response in every one of its parts."<sup>2</sup>

Though not the whole Earth just yet. The American approach stands in contrast to the approach taken by rival China, where permissionless innovation in internet services is seen as a threat. Wi-Fi shows that when America embraces permissionless innovation it creates competitive advantages. It is a true from trash to treasure story with important lessons about how value is created.

#### The full spectrum

To understand Wi-Fi and its evolution, it may be helpful to briefly review a few basics about spectrum and how it is allocated in the United States.<sup>3</sup>

There is licensed spectrum, which forms the core of mobile networks, and unlicensed spectrum, which is used

by services such as Wi-Fi.<sup>4</sup> Spectrum is a finite resource and federal agencies control most of the available spectrum, with the Department of Defense controlling most of that.<sup>5</sup>

The process for allocating spectrum from the federal government to non-governmental use can include congressional authorization, spectrum identification by an agency such as the National Telecommunications and Information Administration, and a Federal Communications Commission (FCC) auction of the allocated spectrum. Transmission equipment used for wireless services, including Wi-Fi, is approved by the FCC.<sup>6</sup>



<sup>1</sup> Greg Ennis, *Beyond Everywhere: How Wi-Fi became the world's most beloved technology*, Post Hill Press, 2023, p. 11.

<sup>2</sup> Celena Chong, "The inventor that inspired Elon Musk and Larry Page predicted smartphones nearly 100 years ago," *Business Insider*, July 6, 2015, <https://www.businessinsider.com/tesla-predicted-smartphones-in-1926-2015-7>.

<sup>3</sup> "Wi-Fi" is a made up term for the technology that is based on "wireless fidelity" and is intended to recall the "Hi-Fi" term for stereos. Other names considered but rejected were "TourchLight," "SkyRay," "Elevate" and "DragonFly." Ennis, *Beyond Everywhere*, pp. 210 – 214.

<sup>4</sup> There are three spectrum frequency bands (low, middle and high). Low-band has a wide coverage area but less capacity. High-band has a smaller coverage area but high capacity. Mid-band can cover more distance than high-band with more speed and capacity than low-band. See also, Westbase.io, *What is Low, Mid and High-Band? The 5G Spectrum Layers Explained*, May 27, 2022, <https://eu.westbase.io/what-is-low-mid-and-high-band-the-5g-spectrum-layers-explained/>.

<sup>5</sup> Jeffrey Westling, *2024 State of Spectrum*, American Action Forum, March 19, 2024, <https://www.americanactionforum.org/insight/2024-state-of-spectrum/>.

<sup>6</sup> 15 C.F.R. §§ 15.1 *et seq.* Part 15 of the FCC's rules permit the operation of authorized low power radio frequency devices without an FCC license. See also, "Equipment Authorization Approval Guide," Federal Communications Commission, accessed October 30, 2024, <https://www.fcc.gov/engineering-technology/laboratory-division/general/equipment-authorization>.

Licensed spectrum operates at full power in higher frequency ranges for exclusive use. This protects from interference. It is auctioned to bidders by the FCC. Licensed spectrum is important for communications technologies and is used by cellular network mobile service operators. Its exclusivity and auction process make it qualitatively different from unlicensed spectrum.

Unlicensed spectrum can be used by anyone on a non-exclusive basis. Wi-Fi operates at low power lower frequency ranges utilizing portions of the unlicensed spectrum. This part of the spectrum is decentralized. There are no license payments, auctions or centralized control for users. Anyone can provide Wi-Fi and it is widely available in coffee shops, stores, schools, hotels, and countless other locations.

Because Wi-Fi providers share the unlicensed spectrum through an optimizing technique that enables multiple users to safely use the same frequency bands, Wi-Fi providers must take care not to interfere with other users of the spectrum.<sup>7</sup> Wi-Fi is therefore considered a “polite” technology, one that has to “listen before talking” to prevent interference.<sup>8</sup>

Polite technology enhances the value of the unlicensed spectrum because all users can use it without interference. Spectrum sharing therefore provides high utility for this finite asset and forces Wi-Fi providers to innovate to maximize their use of a spectrum asset over which they lack exclusivity and control.

Wi-Fi and the unlicensed spectrum it utilizes have together become an essential part of the great wireless brain driving our economy and daily life activities.

## From trash to treasure

Wi-Fi’s beginnings are humble, in spectrum bands thought to have little value. In 1985, the FCC opened a limited number of spectrum bands for unlicensed use, allowing anyone who followed the FCC’s rules, which were not prescriptive and focused on non-interference, to use them.<sup>9</sup>

So little was expected from these spectrum bands that they were deemed “junk bands.” Spread spectrum techniques, which were initially developed in the 1940s for military applications and are characterized by high immunity to interference and low probability of intercept, helped make these junk bands attractive for consumer use.<sup>10</sup>

Initially, these spectrum bands supported baby monitors, cordless phones, and garage door openers, and the first wireless routers appeared in 1988.<sup>11</sup> Technology continued to develop. Wi-Fi is a wireless local area network (WLAN) technology that enables digital devices within a certain area to communicate via radio waves. It first came onto the market when the Institute of Electrical and Electronics Engineers (IEEE) published the 802.11 technical standard, the first WLAN standard.<sup>12</sup> This common standard allowed for interoperability and scale.

The initial major commercial breakthrough occurred when Apple introduced the first mass-marketed consumer products with Wi-Fi, the iBook, and the AirPort wireless base station.<sup>13</sup> This commercialized the Wi-Fi experience in a way that consumers had not before experienced.

As Wi-Fi grew in usage, *Wired* magazine took note of its innovative qualities:

*Over the past three years, a wireless technology has arrived with the power to totally change the game. It’s a way to give the Internet wing without licenses, permission, or even fees. In a world where we’ve been conditioned to wait for cell phone carriers to bring us the future, this anarchy of the airwaves is as liberating as the first PC’s - a street-level uprising with the power to change everything.*

*The technology is Wi-Fi... Like the web, it’s open, unregulated and free it doesn’t require a loyalty oath to some corporate behemoth. Anyone can deploy it and millions have. For many it’s an epiphany - the unforgettable impact of being in the presence of something important and new.<sup>14</sup>*

<sup>7</sup> “Spectrum Sharing,” National Institute of Standards and Technology, accessed October 30, 2024, <https://www.nist.gov/advanced-communications/spectrum-sharing>.

<sup>8</sup> “Listen Before Talk,” MultiTech Developer Resources, accessed September 12, 2024, <https://www.multitech.net/developer/software/lora/listen-before-talk/>.

<sup>9</sup> Federal Communications Commission, *First Report and Order* in GEN Docket No. 81-413, 101 FCC 2d 419 (1985) and 47 CFR Part 15, <https://www.ecfr.gov/current/title-47/chapter-1/subchapter-A/part-15>. See also, “Happy Birthday, Unlicensed Spectrum!,” WifiFORWARD, May 13, 2022, <https://wififorward.org/news/happy-birthday-unlicensed-spectrum/>. The FCC first allowed unlicensed devices to be sold and operate in 1938. See also, Federal Communications Commission, “Unlicensed and Unshackled: A Joint OSP-OET White Paper on Unlicensed Devices and Their Regulatory Issues,” May 2003, <https://docs.fcc.gov/public/attachments/DOC-234741A1.pdf>, (hereinafter Joint OSP-OET White Paper), p. 6.

<sup>10</sup> Joint OSP-OET White Paper, p. 7. A precursor technology was invented by Hollywood actress Hedy Lamarr and George Antheil during the 1940s to aid the war effort. They developed a new communication system used with the intention of guiding torpedoes to their targets involving the use of “frequency hopping” among radio waves, with both transmitter and receiver hopping to new frequencies together. This prevented the interception of the radio waves and allowed the torpedo to find its intended target. However, the Navy rejected the system and the patent expired before any money was earned. Notwithstanding, Lamarr was inducted into the National Inventors Hall of Fame in 2014, leading her to be called “the mother of Wi-Fi” and other wireless communications like GPS and Bluetooth. <https://www.womenshistory.org/education-resources/biographies/hedy-lamarr>.

<sup>11</sup> *Id.*

<sup>12</sup> IEEE Standards Association, “The Evolution of Wi-Fi Technology and Standards,” May 16, 2023, <https://standards.ieee.org/beyond-standards/the-evolution-of-wi-fi-technology-and-standards/>.

<sup>13</sup> IEEE Standards Association, “The Evolution of Wi-Fi.”

<sup>14</sup> Chris Anderson, “The Wi-Fi Revolution,” *Wired*, May 1, 2003, <https://www.wired.com/2003/05/wifirevolution/>. See also, Ennis, *Beyond Everywhere* p. 273.

iPhones, iPads, Amazon Fires, hotspots, home routers and many other devices would follow and change not only the economy but how Americans live their daily lives. The continued development of the 802.11 suite of protocols has enabled Wi-Fi's development and expansion, freeing consumers from desk bound computers.

Expected or not, the freedom that unlicensed spectrum and Wi-Fi created generated an explosion of economic creativity. And the highly successful 802.11 protocols have been globally embraced, with one notable and important exception.

## The heart of Wi-Fi's success

Wi-Fi's success is rooted in its use of unlicensed spectrum and that in the United States it is used as a broadband connection to access an internet fundamentally uncensored by the government. This enables the freedom to innovate. Unlicensed spectrum has no price associated with the use of the spectrum itself and no centralized control, so the barriers to entry are low. Anyone can therefore be a Wi-Fi provider and is free to innovate and experiment to find what works best. No permission is required.

Greg Ennis, a co-author of the technical proposal that was to become the Wi-Fi standard and Vice President of Technology for the Wi-Fi Alliance, described the development of Wi-Fi:

*The Wi-Fi market environment from the outset was seen to be very different from that of cellular. There were no independent islands of service managed by individual operators. Instead, it was more like the Wild West, an uncontrolled free-for-all in which thousands of overlapping installations are set up by ordinary consumers, with equipment from hundreds of manufacturers constantly moving in and out of multiple networks without any prior vendor authorization required.<sup>15</sup>*

Wi-Fi therefore is an example of the possibilities of "permissionless innovation," a concept that embraces the "Wild West" of innovation and entrepreneurialism. It embodies risk-taking and confidence in progress and overriding benefits. According to Adam Thierer of the Mercatus Center:

*It refers to the notion that experimentation with new technologies and business models should generally be permitted by default. Unless a compelling case can be made that a new invention will bring serious harm to society, innovation should be allowed to continue unabated and problems, if they develop at all, can be addressed later.<sup>16</sup>*

In stark contrast to permissionless innovation is the precautionary principle which generally refers to the belief that new innovations "should be curtailed or disallowed until their developers can prove that they will not cause any harms to individuals, groups, specific entities, cultural norms, or various existing laws, norms, or traditions."<sup>17</sup> It holds that regulation is required whenever an activity creates a substantial possible risk to health, safety, or the environment, even if the supporting evidence is speculative.<sup>18</sup>

Permissionless innovation is optimistic. It embraces human innovation and ingenuity as overall good things. It allows that harms from innovation can be addressed as they occur. Government need not attempt to anticipate or attempt to prevent potential harms, in large part because it is rarely possible to accurately predict what will go wrong and head that off at the pass.

The precautionary principle is at its heart pessimistic and technocratic. It embraces the notion that government can anticipate and prevent harm. This chills innovation and development – the express intention of the principle – until would-be innovators can disprove harm. People with this mindset are willing to accept the opportunity cost associated with losing innovation in favor of declarations of safety.<sup>19</sup> They would prefer that we live without innovation to reduce or eliminate harm. Their worldview is rooted in diffidence rather than confidence.

According to the precautionary principle, a regulator such as the FCC has the ability to discern actual risks and potential harms. It can then devise regulations limiting innovation that will either ameliorate the risks or block the innovation altogether.

This principle is often applied in environmental, health, and safety matters. For example, a key message of the International Institute for Sustainable Development is that the "precautionary principle guides decision-makers to take action to protect the environment, safety, and public health when there is *scientific uncertainty*."<sup>20</sup> (Emphasis

<sup>15</sup> Ennis, *Beyond Everywhere* p. 216.

<sup>16</sup> Adam Thierer, *Permissionless Innovation: The Continuing Case for Comprehensive Technological Freedom*, (Mercatus Center at George Mason University, 2014), p. vii, [C:\Users\brian\Downloads\Permissionless.Innovation.web\\_.pdf](C:\Users\brian\Downloads\Permissionless.Innovation.web_.pdf).

<sup>17</sup> Thierer, *Permissionless Innovation*, p. vii.

<sup>18</sup> "AI's Future: Liberty or License?," John O. McGinnis, Law and Liberty, June 1, 2023, <https://lawliberty.org/ais-future-liberty-or-license/>.

<sup>19</sup> For a brief discussion on the precautionary principle and opportunity cost as it applies to innovation, see "The Four Fault Lines in AI Policy," Will Rinehart, American Enterprise Institute, August 5, 2024, <https://www.aei.org/articles/the-four-fault-lines-in-ai-policy/>.

<sup>20</sup> Jose Felix Pinto-Bazurco, "Brief #4, The Precautionary Principle, International Institute for Sustainable Development," (International Institute for Sustainable Development, October 2020), p. 1, <https://www.iisd.org/system/files/2020-10/still-one-earth-precautionary-principle.pdf>.

added.) Scientific certainty (vs. plausibility) is a very high bar to clear, however. Many American states are passing and considering legislation on artificial intelligence to address perceived risks and uncertainties.<sup>21</sup>

We do not have to live like that. Wi-Fi shows the benefits of permissionless innovation's optimistic approach. When the FCC opened spectrum bands to unlicensed use, it didn't know and certainly could not have predicted where that decision would lead because Wi-Fi, tablets, and hotspots in coffee shops were years away. But that is the point. Even though the spectrum bands were considered junk at the time, letting them go was still an act of confidence, allowing developers to use spectrum without licenses and centralized control and take it where technology and consumer demand would lead them. The FCC didn't require proof of no harm. It allowed Wi-Fi to develop and issues to be resolved as they occurred.

Wi-Fi goes hand in hand with another example of permissionless innovation, the internet itself. With a few notable exceptions, Congress and the FCC have largely allowed the internet to develop in a manner consistent with the policy prescribed during the public internet's infancy in the Telecommunications Act of 1996, which seeks to preserve a free market for the internet "unfettered by Federal or State regulation."<sup>22</sup>

Permissionless innovation has been so successful that Americans' Wi-Fi usage now surpasses the use of exclusive use licensed spectrum.<sup>23</sup> An Ericsson study showed that we spend 90 percent of our time indoors and we consume up to 80 percent of our data indoors, and of course, it is Wi-Fi that is by and large used for indoor broadband.<sup>24</sup> According to The Internet and Television Association – NCTA, 53 percent of *all* US internet traffic is delivered over Wi-Fi and Wi-Fi carries more traffic than all exclusive use licensed spectrum bands combined.<sup>25</sup>

The Wi-Fi advocacy group WifiFORWARD sponsored studies showing that Wi-Fi "boosted the U.S. economy by \$995 billion in 2021 and predicting that the economic value of Wi-Fi will reach \$2.4 trillion dollars in 2027, which

includes a consumer benefit forecasted to be \$514 billion dollars."<sup>26</sup> Wi-Fi has been the perfect service to enable the application and data driven economic explosion.

Wi-Fi has also increased wireless competition. Cable companies are now important competitors for mobile service and have more than 15 million subscribers.<sup>27</sup> Wi-Fi has allowed them to adopt a model where they are mobile virtual network operators (MVNOs) who use the underlying mobile network of another provider for mobile service while at the same time using Wi-Fi to "offload" wireless broadband traffic onto their own networks.

The NCTA states that more than 80 percent of cable operators' mobile data traffic is offloaded to Wi-Fi networks.<sup>28</sup> But if Wi-Fi is carrying 80 percent of the traffic, that means that Wi-Fi is the primary choice for wireless traffic and that the cellular network is secondary. In reality, traffic is being offloaded onto the cellular network when Wi-Fi isn't available.<sup>29</sup> Wi-Fi has made the MVNO model more economical and allowed cable companies to effectively compete with other mobile providers, increasing consumer choice and providing an enhanced broadband experience.

Wi-Fi continues to produce innovation. Its quality and capacity has made Netflix and streaming possible. Consumer electronic devices, such as Smart TVs and tablets, connect to broadband via Wi-Fi and now come with Wi-Fi pre-installed.<sup>30</sup> Wi-Fi is also replacing cellular and wireline phone networks for voice calling as FaceTime, Zoom and other applications have become the "go to" services for personal and business calling.

The FCC found itself embracing permissionless innovation in approving unlicensed spectrum. That decision has led to the creation of massive consumer benefits, billions upon billions of dollars in economic development and technological innovation. It is a prime example of the benefits of government refraining from asserting a heavy regulatory hand. This cultivates a regulatory environment that allows technologists and entrepreneurs to create and innovate.

<sup>21</sup> "The Lurking Dangers in State-Level AI Regulation," Will Rinehart, American Enterprise Institute, June 24, 2024, <https://www.aei.org/articles/the-lurking-dangers-in-state-level-ai-regulation/>.

<sup>22</sup> 47 U.S.C. § 230(b).

<sup>23</sup> NCTA- The Internet and Television Association, Letter to Mr. Scott Blake Harris, Senior Spectrum Advisor, National Telecommunications and Information Administration, March 7, 2024, (hereinafter NCTA-Harris Letter), p. 3, [https://www.ncta.com/sites/default/files/2024-03/NCTA NSS Letter %28March 7 2024%29.pdf](https://www.ncta.com/sites/default/files/2024-03/NCTA%20NSS%20Letter%20March%207%202024%29.pdf).

<sup>24</sup> Diana Adams, "5 ways indoor 5G will change your life (and mine)," Ericsson Blog, July 26, 2023, <https://www.ericsson.com/en/blog/2023/7/5-ways-indoor-5g-will-change-life>.

<sup>25</sup> "An Internet Built for All, Broadband Facts & Stats," NCTA- The Internet and Television Association, accessed September 10, 2024, <https://www.ncta.com/broadband-facts>.

<sup>26</sup> "Wi-Fi: Billions for the Economy," WifiFORWARD, October 7, 2022, <https://wififorward.org/news/wi-fi-billions-for-the-economy/> and "Assessing the Economic Value of Wi-Fi in the United States," Telecom Advisory Services, LLC, September 2024, p. 7, <https://wififorward.org/wp-content/uploads/2024/09/Assessing-the-Economic-Value-of-Wi-Fi.pdf>.

<sup>27</sup> Linda Hardesty, "Cable must fight inertia to gain wireless subs," *Fierce Network*, April 26, 2024, <https://www.fierce-network.com/wireless/cable-must-fight-inertia-when-it-comes-gaining-wireless-subs>.

<sup>28</sup> NCTA-Harris Letter at 3.

<sup>29</sup> Ennis, *Beyond Everywhere* p. 381.

<sup>30</sup> In some cases, Smart TVs also have Ethernet connections. See, "What is a smart TV and how does it work?," Jennifer Fossenbell, CenturyLink, September 20, 2020, <https://discover.centurylink.com/what-is-a-smart-tv.html>.

Permissionless innovation gives America a competitive advantage, particularly regarding the internet and internet-related services such as Wi-Fi. This is especially so in comparison to America's prime global economic and security competitor: China.

## China: No flies allowed

China is America's most significant economic and strategic rival. The internet, including Wi-Fi, plays a critical role in that competition.

Former Chairman Deng Xiaoping famously said, "If you open the window for fresh air, you have to expect some flies to blow in."<sup>31</sup> This was a way of announcing the country's "Open Door Policy" designed to bring Western technology and know-how to China. There had been much concern expressed by the Chinese government (and Chinese Communist Party) about losing control as the population became exposed to outside influences. Deng accepted that risk and understood that the fresh air of openness would lead to some "flies" blowing in. His successors have not proved nearly so open to decentralized technologies.

When it comes to the internet, present day China has no toleration for flies. Despite former US President Bill Clinton's prediction that China's efforts to censor the internet would be like attempting to "nail Jello to the wall," China's internet is characterized by top down, centralized strict government control that includes:<sup>32</sup>

- Large scale content blocking under its "Golden Shield Project" which now uses technology and methods such as artificial intelligence and data analytics to improve the government's ability to monitor and censor the Internet.<sup>33</sup> Commonly referred to as the "Great Firewall," it combines technological and regulatory tools to monitor, filter, and restrict internet traffic within China.<sup>34</sup>
- Global internet traffic into and out of China travels through a limited number of terrestrial links and incoming content is filtered and inspected by government authorities who have the ability to block entire domain names and IP address ranges.<sup>35</sup> The Great Firewall therefore acts as a digital barrier between China and the rest of the world. China's internet is so separated from the global internet that the Internet Society says it is "more accurately described as a national intranet."<sup>36</sup>
- Within China, the internet experience is dictated by the government. Non-China based social media sites such as Google, Facebook, X and YouTube are blocked.<sup>37</sup>
- Company self-censorship is mandated to help prevent government prohibited topics and narratives from being provided.<sup>38</sup> China's Public Pledge of Self-Regulation requires that if an "Internet service provider discovers information which is inconsistent with the law on its website, it will remove it."<sup>39</sup>
- China also deploys tools such as the "Great Cannon," an internet attack tool used to launch denial of service attacks on websites that the government wants blocked and to enforce state censorship.<sup>40</sup> The Great Cannon is not simply an extension of the Great Firewall but a tool that can suppress, alter and replace content as it traverses the internet.<sup>41</sup>

<sup>31</sup> Anne Stevenson-Yang, "Keeping the Flies Out, China File, February 3, 2022, <https://www.chinafile.com/reporting-opinion/viewpoint/keeping-flies-out>.

<sup>32</sup> Steven Melendez, "Nailing Jello to the Wall: How China Shut Down the Open Internet," *Fast Company*, March 9, 2016, <https://www.fastcompany.com/3057604/nailing-jello-to-the-wall-how-china-shut-down-the-open-internet>.

<sup>33</sup> Xuan Loc Doan, "'Nailing Jello to the wall' is possible in Xi's China," *Asia Times*, November 14, 2018, ['Nailing Jello to the wall' is possible in Xi's China - Asia Times](https://www.asiatimes.com/2018/11/14/nailing-jello-to-the-wall-is-possible-in-xi-s-china/). See also, pinggp, "The Great Firewall of China," Torfox, A Stanford Project, June 1, 2011, <https://cs.stanford.edu/people/eroberts/cs181/projects/2010-11/FreedomOfInformationChina/author/pinggp/index.html>. The Golden Shield Project began development in the 1990s, was initiated in 2000 and was later updated with the Golden Shield Phase II.

<sup>34</sup> GreatFire.org is an organization dedicated to resisting China's internet censorship. See, "We monitor and challenge internet censorship in China," accessed August 28, 2024, <https://en.greatfire.org/>.

<sup>35</sup> The Internet Society, "When is the Internet not the Internet?," December 1, 2023, <https://www.internetsociety.org/resources/internet-fragmentation/the-chinese-firewall/>.

<sup>36</sup> The Internet Society, "When is the Internet."

<sup>37</sup> Doan, "Nailing Jello."

<sup>38</sup> Article 9, 5 of the Public Pledge of Self-Regulation and Professional Ethics for China Internet Industry, China Services Info, accessed August 28, 2024, <https://govt.chinadaily.com.cn/s/201812/26/WS5c23261f498eb4f01ff253d2/public-pledge-of-self-regulation-and-professional-ethics-for-china-internet-industry.html>.

<sup>39</sup> Article 9, 5 of the Public Pledge of Self-Regulation . Not content with the Great Firewall, Great Cannon and self-censorship, large amounts of Internet content have disappeared from China's Internet. See, Li Yuan, "As China's Internet Disappears, 'We Lose Parts of Our Collective Memory,'" *The New York Times*, June 4, 2024, <https://www.nytimes.com/2024/06/04/business/china-internet-censorship.html>.

<sup>40</sup> Bill Marczk et al, "An Analysis of China's 'Great Cannon,'" UC Berkeley Citizen Lab, 2015, <https://www.usenix.org/system/files/conference/foci15/foci15-paper-marczak.pdf>.

<sup>41</sup> Marczk et al, "Analysis of China's 'Great Cannon.'" pp. 1-2. See also, "Internet Censorship in China: The Struggle to Swat 'Flies,'" Amit Kumar, Away, *ICS Research Blog*, October 10, 2023, <https://icsin.org/blogs/2023/10/10/internet-censorship-in-china-the-struggle-to-swat-flies-away-2/>.

Wi-Fi in China is available in public places such as train stations, coffee shops and convenience stores. Due to the Chinese’s government control of the internet, a Wi-Fi user’s experience there is very different from that in the United States.<sup>42</sup> The state monopoly on internet access services is held by state owned entities such as China Mobile, China Telecom and China Unicom in their respective markets, so the underlying internet access service is purchased from one of these entities.<sup>43</sup>

China exercises control over Wi-Fi by having a unique Wi-Fi technical standard that is different from the 802.11 standard used in the United States and the rest of the world. China developed its own wireless LAN standard – WLAN Authentication and Privacy Infrastructure or “WAPI” – to serve as a competitor that would not be interoperable with Wi-Fi.<sup>44</sup>

The Chinese government only permits WAPI devices, forcing vendors to comply with two sets of Wi-Fi standards, WAPI for China and 802.11 for the rest of the world.<sup>45</sup> For example, to sell the iPhone in China Apple was required to add a WAPI option, which it did in 2010.<sup>46</sup> WAPI allows more government control than the 802.11 standard that was developed and is updated by a neutral technical society, the IEEE.

The Chinese government not only wants no flies getting in, it also wants to control its domestic flies. This control-focused approach dampens domestic innovation and gives the US a competitive advantage.

## America’s competitive advantage

Prosperity creation requires a constant struggle. Wi-Fi’s success exemplifies some of the United States’ competitive advantages: permissionless innovation, entrepreneurialism and freedom. Wi-Fi’s innovation and the economic evidence show how these advantages have combined to create great value.

The Chinese Communist Party has called regulation “a kind of love and care.”<sup>47</sup> In China, government control and limiting the population’s access to information are paramount concerns. Permissionless innovation is an anathema under these circumstances. It is the precautionary principle in the extreme for purposes of control and reinforcing the ideology of the Chinese Communist Party.

Losing control is the harm the government seeks to avoid and it will sacrifice innovation and prosperity to avoid it. This is the tradeoff the Chinese government makes. It would rather have a less innovative and less prosperous economy than live with the risks of letting in the “flies” of openness and freedom.<sup>48</sup> The internet and Wi-Fi in China are caught in this trap.

The United States therefore has competitive advantages it must not squander. The FCC must avoid the temptation to apply its own version of “love and care” as it did when it imposed heavy regulation on broadband internet access services in its 2015 and 2024 net neutrality orders (the 2024 order is currently stayed under appeal).<sup>49</sup>

Those orders classified broadband internet access service as a telecommunication service subject to utility-style telephone regulations, which include rate regulation, terms of service and determining returns on capital investment. The FCC should abandon prescriptive approaches and focus on regulatory policies that foster innovation and economic freedom, placing proven successful approaches above ideology.

Wi-Fi and unlicensed spectrum show the benefits of permissionless innovation and the advantages of the freedom to innovate. The unlicensed structure, low cost, and high level rules provide space to create and experiment – there’s no heavy-handed, prescriptive regulation or other barriers to entry to get in the way. This stands in contrast to the heavy regulation approach in the net neutrality orders.

<sup>42</sup> “Guide to choose the internet service,” International Services Shanghai, accessed August 28, 2024, Guide to choose the internet service Internet ([shanghai.gov.cn](http://shanghai.gov.cn)).

<sup>43</sup> “Most used internet providers/brands in China 2024,” Statista, accessed August 29, 2024, <https://www.statista.com/forecasts/1348259/most-used-internet-providers-brands-in-china>. China’s focus is on exclusive use spectrum and has promoted a plan that advantages Chinese government sponsored companies by allowing only exclusive, licensed mobile networks in the 6Ghz band. In so doing, it works to disrupt the United States efforts on unlicensed spectrum. See, “Digesting the 2023 World Radiocommunication Conference’s outcomes and implications for US-China 5G competition,” Ngor Luong, Strategic Insights Memo, Atlantic Council, April 12, 2024, <https://www.atlanticcouncil.org/content-series/strategic-insights-memos/digesting-the-2023-world-radiocommunication-conferences-outcomes-and-implications-for-us-china-5g-competition/>.

<sup>44</sup> Ennis, *Beyond Everywhere* pp. 309–310.

<sup>45</sup> Rahul Awati, “WLAN Authentication and Privacy Infrastructure (WAPI),” TechTarget, accessed August 29, 2024, <https://www.techtarget.com/searchsecurity/definition/WAPI-WLAN-Authentication-and-Privacy-Infrastructure>.

<sup>46</sup> Awati, WLAN Authentication.” See also, Ennis, *Beyond Everywhere* p. 334.

<sup>47</sup> Raymond Zhong, “China Fines Alibaba \$2.8 Billion in Landmark Antitrust Case,” *The New York Times*, April 9, 2021, <https://www.nytimes.com/2021/04/09/technology/china-alibaba-monopoly-fine.html>.

<sup>48</sup> This is not to say that there is no innovation, permissionless or otherwise, in China or that the Chinese government stifles all innovation. For one example, see Chen Liming, “China makes innovation new engine of growth,” *China Daily*, June 25, 2024, <https://www.weforum.org/agenda/2024/06/why-china-is-making-innovation-the-new-engine-of-growth/>.

<sup>49</sup> Federal Communications Commission, “Declaratory Report and Order on Remand, Declaratory Ruling, and Order, In the Matter of Protecting and Promoting the Open Internet,” FCC 1524, March 12, 2015, <https://docs.fcc.gov/public/attachments/FCC1524A1.pdf>, and Federal Communications Commission, “Declaratory Ruling, Order, Report and Order, and Order on Reconsideration, In the Matter of Safeguarding and Securing the Open Internet,” 89 Fed. Reg. 45404 (May 22, 2024), <https://docs.fcc.gov/public/attachments/FCC-24-52A1.pdf>. This order is currently stayed pending review by the 6th Circuit Federal Court of Appeals. *Ohio Telecom Association, et al., v. Federal Communications Commission; United States of America*, Nos. 24-7000 (lead), 24-3449, 24-3450, 24-3497, 24-3508, 24-3510, 24-3511, 24-3519, 24-3538, United States Court of Appeals for the 6th Circuit, (August 1, 2024), Order Granting Stay. <https://www.bloomberglaw.com/public/desktop/document/InreMCPNo185OpenInternetRuleFCC2452DocketNo24070006thCirJun122024>.

Additionally, spectrum sharing promotes the efficient use of spectrum among users, providing high utility for a finite asset. Wi-Fi is now the primary network choice for wireless consumers, so prioritizing unlicensed spectrum and spectrum sharing is smart policy because it reflects commitment to how consumers actually use wireless services.

The potential for future innovation must also be an ongoing consideration so that spectrum assets are maximized and opportunities that may be currently thought of as today's junk bands have a chance at innovation. Prescriptive regulation should give way to freedom and entrepreneurialism à la 1985, when the FCC first approved the unlicensed spectrum that led to Wi-Fi and so many other innovations.

Heavily censoring and controlling its internet and having its own Wi-Fi technical standard may be advantages for the Chinese government when it comes to control, but it stifles innovation. The permissionless innovation and low barriers of entry that unlicensed spectrum and Wi-Fi provide in the United States create competitive advantages for our economy. It leads to innovations and technological advancements that China's internet model restricts or prevents.

## Conclusion

The FCC's opening of spectrum bands for unlicensed use in 1985 led to Wi-Fi's blossoming and much technological innovation. It occurred because there was no heavy handed regulatory regime but rather an innovative environment with low costs and no barriers to entry. Permissionless innovation, trusting technologists and the marketplace to innovate, created great value that continues to multiply.

In modern China's internet, permissionless innovation is anathema. In the United States it's a success story that much of the rest of the economy ought to follow.

## About the author

**Brian A. Rankin** is an Adjunct Fellow at the Competitive Enterprise Institute who focuses on communications and technology issues. He is an attorney with over 30 years of experience practicing law for cable, telecommunications, and technology companies. His practice has included regulatory and policy matters, including advocacy before federal, state and local agencies, as well as counsel for business operations, mergers and acquisitions and other transactions.

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