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Testimony of

Doug Brake

Director of Telecommunications Policy

Information Technology and Innovation Foundation

Before the

U.S.-China Economic and Security Review Commission

Hearing on

"China, the United States, and Next Generation Connectivity"

March 8, 2018

2255 Rayburn House Office Building

Washington, DC

Co-chairs Wessel and Wortzel and members of the Commission, thank you for this opportunity to discuss the views of the Information Technology and Innovation Foundation on China, the United States, and next generation connectivity.[1]

INTRODUCTION AND SUMMARY

Next generation connectivity, 5th Generation (5G) in particular, represent a tremendous economic opportunity. Deploying 5G at scale, and seeing it leveraged for productivity gains throughout the economy, should be a national imperative. There are several technological components to 5G, but the key architectural shift requires far more cell sites, meaning an expensive infrastructure deployment justifying a rethinking of local permitting policies and federal regulations.

The Chinese are extending their influence in standards organizations and international bodies like the International Telecommunications Union (ITU). They are also engaged in intensive research and development, and already making key contributions to essential 5G patents. While they may not be the first to use 5G, many expect they will aggressively deploy a final 5G specification at tremendous scale. The U.S. government should focus on improving the investment conditions for deploying 5G through reforms to siting and permitting policies and make more spectrum available on a flexible licensed, unlicensed, and shared basis.

The United States should continue to rely on its competitive private sector to deploy 5G networks and not consider a government-built network. Furthermore, any policy focused on specific Chinese firms must be considered as a component of a broader, nuanced strategy to return to a rule-of-law, market-driven expectation on trade and protection of intellectual property. Presumptive blocking of specific firms is likely not the best route.

5G REPRESENTS A TREMENDOUS ECONOMIC OPPORTUNITY

Discussions of the evolution of mobile classify the various technologies into different "generations." The first generation of mobile was focused purely on basic voice service, and was an analog (as opposed to digital) service; 2G was still focused on voice, but made the switch to digital standards; 3G introduced data services, expanding the functionality beyond voice and including multimedia, texting and some limited internet access. It was not until 4G that we got a full Internet Protocol (IP)-based specification. The waves of new generations of technology have come in roughly decade-long cycles, 1G mobile voice in the 1980s, 2G in the 1990s, 3G basic data in the 2000s, and 4G LTE data in the 2010s.[2] 5G is expected to not just bring faster downloads, but bring a much more flexible network that can adapt to the needs of different verticals throughout the economy. It will bring a new architecture, with significant changes to the core network and potentially seeing deployments of hundreds of thousands of small cells.

Within the United States, the four main wireless carriers are racing to deploy 5G, but generally different varieties. For example, Verizon, partnering with Ericsson and Samsung, has been focused on a fixed-wireless flavor of 5G that will beam connectivity to a piece of equipment fixed on the side of a building.[3] AT&T is focused on first deploying wireless hotspots, rather than phones. Cable companies are also exploring their role in 5G networks, and may be well positioned considering their extensive existing wireline facilities.

A report by Accenture commissioned by the wireless trade association CTIA estimates 5G will require infrastructure investments by U.S. telecom operators of about $275 billion, and ultimately contribute 3 million jobs and $500 billion in GDP growth to the U.S. economy.[4] Some of the expected benefits are expected to flow from "smart city" applications. For example, 5G connectivity, combined with data analytics, could be applied to the "management of vehicle traffic and electrical grids could produce $160 billion in benefits and savings through reductions in energy usage, traffic congestion and fuel costs."[5]

5G is being designed to meet three general types of use cases: enhanced mobile broadband, massive Internet of Things (IoT) connections, and critical high-reliability and low-latency services. The goal is to have a flexible network that can adapt to a wide variety of use cases throughout a number of different vertical industries. Enhanced mobile broadband should see faster throughput (with multi-gigabit per second speeds possible), latencies as low as 1milisecond, and a consistent user experience. Massive IoT services within 5G are being designed for power efficiency and simplification to keep device cost low, as well as long range and support for far denser IoT connections.

There are certainly technologies other than 5G to perform IoT services. Some are wireless-carrier centric such as LTE-M or Narrow Band IoT (NB-IoT). Others leverage unlicensed spectrum. The Internet of Things is expected to contribute up to $11 trillion in value per year globally by 2025.[6] Forecasters expect global cellular IoT connections will increase from 520 million in 2016, to 2.5 billion in 2025.[7] Companies can use the Internet of Things to become more efficient, for example by reducing downtime in factories as they constantly monitor machine performance to address issues before they become problematic, or as they use real-time data about customer demand to better manage supply chains.

Successfully deploying and utilizing next generation networks is a crucial goal to spur economic growth.

NEXT-GENERATION CONNECTIVITY INCLUDES A VARIETY OF TECHNOLOGICAL COMPONENTS

Understanding how the United States and China are positioning economic and policy forces around next generation connectivity requires an understanding of what we mean by next generation connectivity. This section offers a brief, non-technical background on the technological components of 5G networks and the Internet of Things (IoT) for the purposes of discussing the strategy of different countries and companies.

The New Radio (NR) Standard

The Third Generation Partnership Project (3GPP), a cluster of seven different telecommunications standard development organizations, has been hard at work developing the 5G radio and related standards. The aptly named "New Radio" (NR) standard allows base stations to communicate with mobile devices. There are other important standardization processes for other parts of the network, but the radio interface is a defining characteristic of the transition to the next generation.

The NR standard has been broken into two phases: standalone and non-standalone. Both are components of 3GPP Release 15, but the key difference is the non-standalone version utilizes an

LTE control channel or anchor, and was put on an accelerated timeline and completed last December.[8] The non-standalone version allows carriers to continue to leverage their investments in 4G LTE networks while 5G chipsets are designed and integrated into handsets and equipment specific to 5G is deployed. The standalone version is targeted to be released later this year.

mmWave

The use of extremely high-frequency spectrum is one of the most prominently discussed components of a future 5G system. For discussion purposes, mobile spectrum can be broken down into three different ranges: low-, mid-, and high-band spectrum. Low-band spectrum is below 1 GHz. Mid-band spans from 1 GHz to 6 GHz. The high-band spectrum envisioned for use as part of 5G systems is above 24 GHz.

These are often called the millimeter wave bands (or mmWave), as their wavelengths can be measured in millimeters. These bands were long thought useless for mobile applications, as their propagation is severely limited. Signals in this frequency range are easily blocked by clutter on the ground—like buildings or trees. Rain can significantly impede these transmissions, and electromagnetic energy is even absorbed by oxygen at some portions of high-band spectrum.

The hope is that recent advancements in advanced antenna technologies can overcome these challenges and make these bands more practical for mobile operations than previously thought. NYU Wireless at New York University has been a research leader in exploring the feasibility of using this spectrum for mobile broadband.

Advanced Antenna Technology

High-band spectrum really shines when combined with advanced antenna technologies. Antenna size is inversely proportional to the spectrum frequency the antenna is built for. By turning to the millimeter wave bands, engineers can shrink antennas tremendously compared to what are used for wide-area networks today. In turn, far more of these small antennas can be fit into devices and equipment.

Using multiple antennas to transmit a single stream of information is a technique known as Multiple Input Multiple Output (MIMO). A particular flow of traffic can be broken down into pieces and intelligently transmitted through multiple antennas, with the effect of dramatically increasing throughput and reliability. MIMO can be used with other spectrum bands, but the small antenna size enabled by high-frequencies allows for large arrays of antennas to be used—known as massive MIMO.

Small Cell Architecture

Historically, spectrum reuse has been far and away the source of most gains in increasing the overall use of wireless systems. Techniques like making smaller cell sizes or splitting cells into different sectors allow for greatly increased capacity, but this solution is limited as well. As cells get smaller, costs skyrocket. The expenses of additional equipment, backhaul connections, rights-of-way negotiations, and the engineering to avoid self-interference quickly swamp the benefits and cannot easily be borne by additions to consumers' monthly bills alone. This will

continue to be an important consideration as we move closer to 5G—what the technology can achieve and what is economically feasible to actually deploy may not necessarily coincide.

Network Slicing, Automation, and Programmability

Access network operators are quickly adopting technologies to shift aspects of networking traditionally done by hardware to software environments. Specifically, the last few years have seen a dramatic rise in the use of software-defined networking (SDN) techniques. This is a technology well-proven in data centers; it essentially creates another layer of abstraction that separates the control over where network traffic is sent from underlying systems. This new software-centric control over networks enables network slicing, which will give control over logically separate data flows and allow the network to tailor specific technical requirements for different use cases. Network slicing will give better performance, supplying resources on demand and enable new business models beyond the classic mobile carrier.

These changes to how networking is done may seem obscure and technical, but they are incredibly important to how networks will transition to 5G. These technologies allow for a far more dynamic network that can adapt to the needs of specific applications on a granular basis.

The long-term goal is a combination of 5G connectivity and artificial intelligence, not just within the orchestration and operation of networks, but to enable the coordination of decision-making at the application layer. As researchers with Huawei have put it, "One of the most fundamental features among the revolutionary techniques in the 5G era, i.e., there emerges initial intelligence in nearly every important aspect of cellular networks, including radio resource management, mobility management, service provisioning management, and so on."[9] The integration of advanced machine learning into next generation networks is an area of intense research; for example, Huawei has supported research in artificial intelligence, internally as well as in the United States, including a strategic partnership into basic AI with UC Berkeley.[10]

Summary: Phase 1 vs. Phase 2 in 5G

There will be two phases of deployment of 5G networks. This divergence between the two phases is the clearest in the standardization process, where 3GPP is developing a "standalone" and "non-standalone" version of 5G New Radio. The body accelerated the non-standalone version last December, allowing for chipset development and earlier commercial launch plans.[11]

Rollout of 5G is likely to be an evolutionary process in the United States, with carriers first looking at incorporating aspects of 5G through the non-standalone version of NR standard, relying on existing LTE networks, and gradually deploying 5G hotspots, wireless point-to-point connections to the home, with true mobile coverage with pure 5G technology coming later.

U.S. operators have set an aggressive timetable to deploy early versions of the Phase 1 standard, looking at commercial launches this year. Chinese operators, on the other hand, appear content to wait for a uniform global standalone version of 5G, with commercial launches targeting 2020.[12] In other words, U.S. operators will explore a more experimental, evolutionary path, leveraging our existing LTE networks and transitioning to 5G systems where it makes the most economical sense. They will use the non-standalone standard for years until making a gradual shift to pure 5G technology.

China Mobile is eyeing an aggressive push of the standalone specification.[13] This will prove more expensive for the state-run carrier at first, but will gain early economies of scale in the particular technology and vendors they rely on. Guang Yang, a senior analyst at Strategy Analytics, believes China Mobile is likely trying to leverage its deep financial strength for competitive advantage.[14] Standalone 5G will demand higher up-front capital expenditure, making it difficult for competitors to follow in the early rollout of the standalone version. Yang also notes that China Mobile is risking that interoperability and interworking for the new standard may not be complete by its planned commercial launch in 2020 and "may delay the deployment."[15]

DYNAMICS OF INTERNATIONAL COMPETITION IN NEXT GENERATION NETWORKS

5G is an incredibly complex technology, with a wide variety of arenas for companies and countries to exert influence over the shape of the next generation networks. A recent report from investment analysts at Jeffries examined the geopolitics of 5G and IoT across intellectual property rights ownership, influence within standard-setting bodies like 3GPP, and spectrum coordination efforts both within countries and at the international level at the ITU.[16] The analysts explained their view that "China will roll out 5G fast and big" once international standards (phase 2) are finalized.[17]

It can be difficult to ascertain the level of influence intellectual property rights of any one company has over these technology platforms, but one 2017 estimate by LexInnova put total China ownership at about 10 percent of "5G-essential" intellectual property rights, most of which are owned by Huawei.[18] The leader in overall 5G patents is Qualcomm, with about 15 percent of the total.[19] One important breakthrough for Huawei was the acceptance by 3GPP of its proposed coding methodology for the control channel in the non-standalone "phase 1" 5G version.[20]

As a part of this growing contribution of R&D, China, mostly through Huawei and state-owned China Mobile, but also ZTE and others, is dramatically increasing its participation in standards-setting bodies like 3GPP and the ITU. According to Jeffries, The number of Chinese representatives in 3GPP technical working groups has risen from 8 in 2013 to 10 in the most recent election (out of a total of 57 positions). FCC Commissioner Michael O'Rielly has criticized ITU processes, claiming it "needs an overhaul… [to prevent] authoritarian governments [from] push[ing] their myopic agendas."[21]

Ultimately what makes the biggest difference is how well these technologies are integrated with the broader IT ecosystem and enable innovation and productivity gains throughout a nation's economy.

CHINA IS NOT YET LEADING IN 5G DEPLOYMENT, BUT HAS LONG-TERM ADVANTAGES AND IS EXECUTING A COHERENT STRATEGY

It is likely the U.S. will win the race to be first to deploy 5G. However, China has a long-term strategy to deploy phase 2 standalone 5G at scale.

The Context of China's Innovation Mercantilism

We at ITIF have argued that effectively managing the U.S.-China trade and economic relationship is one of the most significant international challenges facing the United States.[22] The ITIF report, "Stopping China's Mercantilism: A Doctrine of Constructive, Alliance-Backed Confrontation," explored the challenge:

> "There is a growing understanding that China is an outlier when it comes to global norms and rules governing trade, investment, and economic policy, and that the unremitting and even accelerating 'innovation mercantilist' behavior on the part of the Chinese government represents a threat not only to the U.S. economy, particularly its advanced industries, but indeed to the entire global economic and trade system."[23]

However, we also argued that a "new approach to U.S.-China economic and trade policy from the U.S. government will need to be pursued with great care and sophistication," that the goal must be a careful return to rules-based international trade order, and not about punishing China or holding back its economy or its contributions.[24]

China is Working to Gain Influence Over Next Generation Connectivity

The Chinese government is actively supporting both the development of 5G standards as well as the deployment of 5G networks. Beyond government support for research and development, policies find explicit articulation in the "Made in China 2025" plan and the 13th Five Year Plan, which aims for a commercial launch of 5G services by 2020.[25]

China is working collaboratively with a number of industry associations, governments, and research universities to develop a global standard and set of technologies that can be quickly scaled.[26] Chinese companies, such as Huawei, invest heavily in R&D and have continually increased their patent portfolio.

As discussed above, China has increased its presence in both the 3GPP and ITU, and Huawei has already made key contributions to the 5G NR specification. All of these mechanisms lead to greater influence over the direction of ICT development, lowering costs for their technology and increasing their bargaining power in the ICT space. 5G is also anticipated to be a key platform for economic growth—successful deployment of next generation wireless is a matter of national competitiveness.

China has Advantages in Allocating Spectrum and Overcoming Deployment Challenges

The general consensus is that the United States and China are leading in 5G, closely followed by Japan and South Korea. According to Nokia CEO Rajeev Suri, "It's a neck-and-neck race between the U.S. and China to see who will be first to deploy."[27] Europe is generally seen as lagging in 5G deployment, as the market is highly fragmented and the average revenue per user is lower than other countries, making the investment needed to deploy more difficult to justify.

China has the advantage of a large population and relatively concentrated market at the operator level (China Mobile has roughly 70 percent market share). The government is also able to exert much stronger control over existing spectrum users, allowing for more efficient use, potentially driving global economies of scale. Furthermore, China does not share our system of

federalized government, which is important for the physical deployment of wireless infrastructure. Here, local governments often have control over the terms on which wireless companies gain access to poles or rights-of-way, and can hold out for fees in a way that may contravene national interests.[28]

THE UNITED STATES SHOULD NOT DEPLOY ITS OWN NATIONALIZED 5G NETWORK

Earlier this year, *Axios* reported that the Trump administration was considering "nationalizing" a 5G network.[29] The reporting included a memo and a slide deck presentation arguing that a centralized and rapidly deployed 5G network, with a focus on incorporating robust security features and sourced through a trusted supply chain is necessary because "China has achieved a dominant position in the manufacture and operation of network infrastructure," and "China is the dominant malicious actor in the Information Domain."[30]

The memo considered 5G only in narrow terms of national security, and did not appreciate the complexity of dynamic global supply chains adapting to new market challenges and cutting-edge research. It appears the memo and presentation were preliminary efforts of a single employee within the National Security Council, and thankfully do not represent the official views of the administration. The memo's author, an Air Force Brigadier General, left his detail to the White House's National Security Council shortly after its publication.[31]

This proposal would represent an especially bad direction to follow, as it would undermine one of the key advantages of the U.S. model: private sector led innovation and experimentation. As economists and telecommunications experts Thomas Hazlett and Scott Wallsten recently explained, "The idea floated was considerably worse than commonly understood."[32] They explained:

> The means [the memo proposed] were dubious and dangerous. A contemplated pivot away from market competition — the product of a longstanding consensus that dispatched the old, staid Ma Bell monopoly with an array of robust networks, devices and mobile app ecosystems — reached back into the dustbin of history, reprising methods that long stymied progress.[33]

Leading in next generation networks is not a question of shock and awe, 3-year timeframe buildout. It will be an iterative process, especially in the transition from Phase 1 to Phase 2. The U.S. government—at the federal, state, and local level—can do a lot to make spectrum available and streamline the process for accessing rights-of-way, poles, and streetlights. It can do more to support U.S. industry through trade and protection of intellectual property rights. But to actually take over the build-out and development of the network itself is a radical and unhelpful suggestion.

THE UNITED STATES SHOULD NOT PRESUMPTIVELY BLOCK PARTICULAR EQUIPMENT MANUFACTURERS

The most acute area of contention between the United States and China when it comes to next generation connectivity is Huawei and ZTE's access to the U.S. market. This dispute can be resolved through the combination of an open and ongoing review of these companies' equipment and practices and targeted economic incentives without devolving into a trade war or

encouraging further protectionism. Any action should be a part of a broader policy of insisting on reciprocity from China so that the market access conditions facing U.S. firms in China are the same as the ones facing Chinese firms in the United States.

The United States, however, should not be Pollyannaish. Over the years, Verizon's Data Breach Investigations Reports have continually highlighted data breach and cybersecurity violations originating from China. Its government strongly supports an increased international role for its information technology sector, sometimes through means that do not comport with its commitments to enterprise-led, market-driven, and rules-based trade.

Yet virtually every telecommunications network worldwide incorporates foreign technology. These are complicated supply chains with each component often sourcing technology from a variety of different firms—simple answers won't suffice. A nuanced approach should be integrated with a broader strategy on international trade and intellectual property.

Background of Huawei and ZTE Attempts to Enter the U.S. Market

Huawei and ZTE, two telecommunications equipment manufacturers, have long attempted to enter the U.S. market, primarily for network equipment, but also in handsets. These efforts have been rebuffed by the U.S. government through a variety of mechanisms.

In 2012 the House Intelligence Committee released a 60-page report titled "Investigative Report on the U.S. National Security Issues Posed by Chinese Telecommunications Companies Huawei and ZTE."[34] The report highlighted ways in which the companies did not fully cooperate with the body's investigation, and recommended U.S. network providers seek other vendors for equipment and services. The Intelligence Committee noted that "Based on available classified and unclassified information, Huawei and ZTE cannot be trusted to be free of foreign state influence and thus pose a security threat to the United States."[35] The U.S. national-security clearance of SoftBank's acquisition of Sprint in 2013 included restrictions on use of Chinese equipment.[36]

In recent testimony to the Senate Intelligence Committee, FBI Director Chris Wray said the intelligence body is "concerned about the risks of allowing any company or entity that is beholden to foreign governments that don't share our values to gain positions of power inside our telecommunications networks."

Bicameral legislation recently introduced by Senators Marco Rubio (R-FL) and Tom Cotton (R-AR) in the Senate and Representative Michael Conaway (R-TX) in the House that would explicitly prohibit the U.S. government from purchasing or using telecommunications equipment or services from Huawei and ZTE.[37]

Huawei's response has been pointed, with its current CEO Richard Yu calling recent developments "ridiculous" at trade show Mobile World Congress earlier this month.[38] He went on to point to Huawei's competitors, saying "Our competitors are using some political way … to try to kick us out from the U.S. market but we have no issue at all. We are transparent …. But they cannot compete with us on product, on technology, on innovation, so they compete with us [using] politics."[39]

As further discussed in our policy recommendations below, we do not think a heavy-handed approach strikes the right balance for navigating the difficult path of achieving an effective return to rules-based trade and ongoing development of a mutually beneficial innovation ecosystem going forward. We should take care that any actions are aimed to dissuade China from doubling down on the "secure and controllable" route, and avoid their tightening and centralizing state control over information flows and technology equipment.

Here the institutional arrangements in the United Kingdom point to one possible way forward. In 2004, Huawei made a successful bid for a major network upgrade for the incumbent wireline operator British Telecom. In 2010 Huawei opened the "Huawei Cyber Security Evaluation Center" (HCSEC). An oversight board was established in 2014 to audit the group's practices.[40] The evaluation center and the oversight board have found "no high or medium priority findings."[41]

The United States should create a strengthened version of this body to oversee equipment entering the U.S. market. The HCSEC is staffed by Huawei employees (although the oversight board is a third-party)—a similar body made up of technical experts from different organizations could perform a similar function in the United States.

POLICY RECOMMENDATIONS

Below we outline a number of policy recommendations to ensure continued U.S. leadership in the deployment and use of next generation communications networks, and an option to navigate potential security threats in the global equipment supply chain. We must continue to rely on our private-sector driven, light-touch regulation model, while supporting basic R&D and clearing the path to 5G investment.

on Importing Chinese Telecommunications Equipment

It is important to look at the net risk of a system and weigh the costs of any approach. By excluding some equipment from the U.S. market you eliminate one attack vector, but it comes at a cost while not eliminating all risks. U.S. policy should recognize there is a wide array of potential security threats throughout the telecommunications supply chain and up the stack. The vast majority of malware actions are through email attachments, and are not sophisticated hardware attacks.

It is difficult but possible to evaluate individual technologies on an ongoing basis to ensure security. Any project or body to examine equipment destined for U.S. markets should not be comprised wholly of employees of the company in question, such as is the case in the U.K. HCSEC.

There should be a robust incentive structure in place to ensure strong repercussions if, for example, an insecure backdoor was discovered in a company's equipment. One potential mechanism is through an international agreement—several large markets should agree not to do business with a company if a deliberate insecurity is discovered.

There can also be a distinction for equipment that is destined for national security or public safety networks, rather than everyday consumers. Also, there should be a requirement that all components of equipment and handsets that are evaluated by this body be explainable.

to Ensure Continued Development of Next-Generation Connectivity

The U.S. government should support basic R&D to support the continued evolution of next generation networks. Basic R&D in particular, can be difficult for companies to monetize, and the government can play an important role here.

Consider, Huawei, for example, is intensely focused on R&D, having consistently invested over 10 percent of its revenue in R&D every year.[42] In 2016, the company had about 80,000 employees—about 45 percent of its workforce—engaged in R&D.[43] From 2015 to 2016, Huawei increased its patent holding by about 50 percent, rising to number 28th in the world.[44]

to Supply Additional Spectrum for 5G

5G will make use of a wide variety of spectrum. While there is currently a great deal of excitement around the ultra-high millimeter wave bands, next generation wireless networks will leverage lower frequencies as well. The 5G NR specification as well as advances in network core are "spectrum agnostic" technologies. The FCC, in coordination with Congress and the National Telecommunications and Information Administration, should work to ensure spectrum continues to be evaluated and potentially put to higher and better use.

More specifically, the FCC should be encouraged to move with haste to auction the 3.7 to 4.2 GHz band, as well as mmWave spectrum above 24 GHz. Thankfully the secondary market has already seen some spectrum in the 28 and 39 GHz bands being repurposed for what will likely be 5G, but additional auctions are needed. Thankfully the FCC is making strong progress on all of these fronts.[45] Before those auctions can take place, Congressional action is needed to resolve a conflict between the FCC's requirement that auction revenues be placed in an interest bearing account and recent changes to banking laws.[46]

It is also important that the State Department have a strong presence at the International Telecommunications Union (ITU) to advocate on behalf of U.S. interests at the World Radio Conference in 2019. The international spectrum coordination at the ITU is key for gaining economies of scale in some types of equipment, and is also necessary for satellite uses that can supplement 5G.

to Protect Intellectual Property

China is the world's leading source of intellectual property theft.[47] The "2016 China Business Climate Survey Report" the American Chamber of Commerce in the People's Republic of China lists IP infringement as a concern regarding doing business in China, with 23% of respondents listing it as a top challenge.[48]

The U.S. should also work to ensure reciprocity in technology and intellectual property licensing. The United States needs a new regime to contest China's strict technology-licensing laws.

The United States should also bring more trade cases against China at the WTO, in collaboration with international partners, where possible. One potential WTO case could concern China's continuing coerced technology and intellectual property transfer requirements. The prospects

for such a case would be greatly improved if U.S. law required notification to the U.S. government on a confidential basis of technology licenses to China and of transactions in China in which the Chinese government or Chinese government-affiliated entities are involved. When China joined the WTO in 2001, it agreed that foreign firms would not be pressured by government entities to transfer technology to a Chinese partner as part of the cost of doing business in China. But as ITIF documents in reports such as "Stopping China's Mercantilism: A Doctrine of Constructive, Alliance-Backed Confrontation" China continues to compel the disclosure of technology and IP as a condition of market access (or eligibility for benefits such as subsidies for the purchase of electric vehicles). The United States and like-minded trade partners need to more aggressively contest these policies.

to Spur 5G and IoT Deployment in the United States

Many of the policy challenges facing 5G and IoT deployment are at the local level. Experts Blair Levin and Larry Downes explored these dynamics in a recent essay, advocating for the "preempt[ion of] unnecessary intergovernmental conflict" in addition to four other policy recommendations for local communities: streamlining process and permitting to access poles and rights-of-way, partnering with operators to test early deployments, targeting applications for smart cities, and establishing pro-investment pricing policies.[49] These are exactly the types of polices that will assist in early deployment of 5G networks and support innovation of new types of applications they enable.

Thankfully, the FCC is taking steps to help streamline the deployment of wireless networks. It appears the commission is rolling out several changes to federal policy, and even considering further preemption of state and local siting rules to help streamline the process and remove regulations designed for a different technology. For example, the commission recently announced changes to how the small cells anticipated for 5G will be considered under the National Historic Preservation Act and the National Environmental Policy Act—changes ITIF supports.[50] The shift from large 200 foot-tall macro cells to much smaller, lower-power, but more numerous small cells requires a retooling of regulations and permitting processes at the local level as well. As the Center for Data Innovation has argued, United States should also have a comprehensive strategy for the Internet of Things.[51]

to Ensure Robust Platforms and Use of Next Generation Networks

The goal should be effective use of these 5G platforms. Commonsense policies to encourage further use of 5G, such as allowing continued innovation at the application layer and avoiding taxes on Internet uses.

Effective responses to constantly evolving cybersecurity risk require collaborative efforts between all of industry and the public sector. One opportunity may lie in the recently announced "Council to Secure the Digital Economy." Organized by leading companies in the tech and telecom industries, and coordinated through associations USTelecom and the Information Technology Industry Council, the group hopes to more effectively coordinate players up and down the Internet stack with government agencies.[52]

Thank you again for this opportunity to appear before you today.

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[1] Founded in 2006, ITIF is an independent 501(c)(3) nonprofit, nonpartisan research and educational institute—a think tank—whose mission is to formulate, evaluate, and promote policy solutions that accelerate innovation and boost productivity to spur growth, opportunity, and progress. Ranked by the University of Pennsylvania as the world's leading science and technology think tank, ITIF's goal is to provide policymakers around the world with high-quality information, analysis, and recommendations they can trust. To that end, ITIF adheres to a high standard of research integrity with an internal code of ethics grounded in the core values of analytical rigor, policy pragmatism, and independence from external direction or bias.

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