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The White House

For Immediate Release

July 15, 2016

Fact Sheet: Administration Announces an Advanced Wireless Research Initiative, Building on President's Legacy of Forward-Leaning Broadband Policy

Twenty-first century businesses need 21st century infrastructure—modern ports, and stronger bridges, faster trains and the fastest Internet...I intend to protect a free and open Internet, extend its reach to every classroom, and every community, and help folks build the fastest networks so that the next generation of digital innovators and entrepreneurs have the platform to keep reshaping our world.

- President Obama, 2015 State of the Union

Under President Obama, we have seen technological breakthroughs and strategic investments that have propelled the United States to the forefront of wireless broadband—with world-leading 4G/LTE coverage for more than 98 percent of U.S. citizens. Today, the Obama Administration is announcing new steps to maintain U.S. leadership and win the next generation of mobile technology with the launch of a \$400 million Advanced Wireless Research Initiative led by the National Science Foundation (NSF). This new program will enable the deployment and use of four city-scale testing platforms for advanced wireless research over the next decade and builds upon the Federal Communications Commission's (FCC) *Spectrum Frontiers* vote yesterday.

That vote made the United States the first country in the world to make vast quantities of high-frequency millimeter wave spectrum available for both licensed and unlicensed use. This spectrum, in combination with other spectrum already available, promises to enable faster speeds, quicker response times (“lower latency”), and increased capacity in future wireless networks. The United States leads the world in 4G deployment in significant part because of its spectrum-first, flexible-use strategy, and the Administration expects the United States to continue to spearhead future wireless innovations because of the FCC’s actions yesterday.

The Advanced Wireless Research Initiative announced today will also build on President Obama’s seven-and-a-half-year track record of accomplishment in wireless and wireline broadband policy, and on the nearly \$150 billion in 4G LTE investment by wireless operators since 2010. It includes an \$85 million investment in advanced wireless testing platforms by a public-private effort, including NSF and more than 20 technology companies and associations; plans by NSF to invest an additional \$350 million over the next 7 years in academic research that can utilize these testing platforms; and complementary efforts by other Federal agencies. These platforms, and the fundamental research supported on them, will allow academics, entrepreneurs, and the wireless industry to test and develop advanced wireless technology ideas, some of which may translate into key future innovations for 5G and beyond.

Collectively, these spectrum policy and research efforts will accelerate the deployment of a new generation of wireless networks that are up to 100 times faster than today. These super-fast, ultra-low latency, high-capacity networks will enable breakthrough applications for consumers, smart cities, and the Internet of Things that cannot even be imagined today. Possible advances in the next decade could bring:

- Mobile phones and tablets that can download full length HD movies in less than 5 seconds, 100 times faster than 4G (6 minutes) and 25,000 times faster than 3G (26 hours).
- First responders and emergency room doctors who get live, real-time video and sensor data from police vehicles, ambulances, and drones, along with patient vitals and medical records—all before the patient arrives at the hospital door.
- Semi- or fully-autonomous vehicles that can communicate with the outside world and with each other to improve travel efficiency and safety.
- Factories equipped with always-connected smart manufacturing equipment that self-diagnose and repair themselves before they break.
- Gigabit-speed wireless broadband available in businesses, public transportation stations, stadiums, campuses, schools, malls, parks, and other public spaces.
- Virtual reality training environments and simulators that allow entry-level workers to develop and demonstrate skills in high-demand fields like solar energy installation—anytime, from anywhere.

MORE THAN SEVEN YEARS OF INNOVATIVE WIRELESS POLICY

President Obama has prioritized wireless and wireline broadband since his first day in office. Through forward-thinking spectrum policy initiatives, targeted Federal spending, and aggressive private investment, the United States has become a world leader in wireless, with more than 98 percent of Americans having access to fast 4G/LTE mobile broadband at speeds up to ten times faster than 8 years ago. This progress is about more than just faster download speeds: Internet access provides substantial economic benefits across the U.S. economy, including for job-seekers and workers, as highlighted by [a recent report](#) from the President’s Council of Economic Advisers.

One of President Obama’s first actions was to sign the Recovery Act to help the nation recover from the worst economic crisis since the Great Depression. The Act funded nearly \$5 billion in broadband investments, including support for more than 114,000 miles of broadband infrastructure, especially in under-served areas, to connect anchor institutions and wireless towers. The Administration also supported targeted tax incentives to provide wireless companies with the incentives and certainty they needed to invest tens of billions in infrastructure and services. And President Obama challenged Federal agencies to streamline permitting for broadband and wireless infrastructure deployment, and supported “Dig Once” policies for fiber-optic backhaul along America’s roads and highways.

President Obama also committed the Administration to making available 500 MHz of Federal and nonfederal spectrum by 2020 for mobile and fixed wireless broadband use. Through concerted effort from nearly two dozen Federal agencies, the Federal Government has made available half of that amount already, including raising more than \$40 billion for American taxpayers through the FCC’s Advanced Wireless Services 3 (AWS-3) auction last year. The FCC’s ongoing incentive auction promises to make available up to 126 MHz of additional prime spectrum.

Recognizing the increasing complexity of the wireless world, the Administration has also made sharing a central part of its

wireless policies, reflecting the **recommendations** of the President's Council of Advisors on Science and Technology. Commercial companies and Federal agencies are collaborating to explore innovative new ways to free up valuable airwaves. Sharing was a key to the unprecedented success of the AWS-3 auction, and underpins the first-of-its-kind three-tier access system established for the 3.5 GHz band. The Federal Government has also taken bold steps to increase the availability of unlicensed spectrum by opening up white spaces between television channels and is exploring the possibility of expanding access to the 5 GHz band that currently supports advanced Wi-Fi services.

APPLYING THE SUCCESSFUL LESSONS OF 4G TO THE WIRELESS CHALLENGES OF TODAY AND TOMORROW

During the last seven and a half years, wireless use has exploded, underpinning significant U.S. economic growth and productivity. More than 350 million smartphones, connected tablets, and wearable devices are in use across the United States, more than double the number from a decade ago. Wireless networks carry more than 100,000 times the traffic they were supporting in 2008. Millions of Americans rely daily on products and services provided by new wireless companies and applications that could only be dreamed of a decade ago. The President remarked 6 years ago that "[t]he world has gone wireless and we cannot be left behind." And indeed, the United States has surged ahead, with U.S. competitive advantage in connectivity forming a foundation for rapid growth in the global information and innovation economy.

Much of the credit for this growth is due to America's innovators, entrepreneurs, path-breaking wireless network companies, private-sector investors, and the unparalleled productivity of America's workers. In addition, America's success in 4G is also a story of a clear policy strategy that favored making spectrum available early and establishing flexible-use rules to enable innovators and entrepreneurs to define the future of wireless technologies and applications. By avoiding a rigid, top-down, standards-setting process and technology roadmap, the American spectrum strategy enabled a flourishing of technologies and ideas, and an open competition that allowed successful technologies to win in the marketplace of ideas.

Also contributing to the American success story in wireless is another clear policy strategy—sustained Federal investments in fundamental academic research that leads to technology breakthroughs that drive growth in the American economy. Time and time again, Federally-funded researchers have contributed to breakthroughs that have helped to harness airwaves once considered low value—including the high-frequency bands that the FCC just opened up. In addition, NSF, the Defense Advanced Research Projects Agency (DARPA), and other Federally-funded academic research into new channel access, antenna, modulation, and other technologies has made important contributions to the 3G and 4G revolutions, the broad deployment of Wi-Fi, millimeter wave (mmWave) technologies, and new dynamic spectrum-sharing arrangements.

Today, the importance of ultra-high-speed, high-bandwidth, low-latency wireless connectivity is only increasing. The burgeoning Internet of Things will add significantly to wireless needs, with 50 billion connected devices anticipated globally by 2020. Devices are also expected to continue to consume ever-greater amounts of data—traffic in North America is expected to grow at a 42 percent compounded annual growth rate between 2015 and 2020.

To meet these demands, the United States must build on the successful strategies it used to become a leader in 4G, starting with spectrum. The FCC took a critical step yesterday in this regard with its *Spectrum Frontiers* ruling. The rules adopted yesterday open up vast amounts of spectrum for new uses and offer additional spectrum flexibility, while preserving a path forward for continued and expanding Federal and satellite deployments. The FCC also proposed opening up even more spectrum in the future, to ensure that the United States remains a leader in wireless technology.

Today's announcements to invest in cutting-edge fundamental wireless research will leverage the Commission's efforts to make spectrum available for flexible use.

INVESTING MORE THAN \$400 MILLION IN ADVANCED WIRELESS RESEARCH

NSF today is committing \$50 million over the next 5 years, as part of a total \$85 million investment by NSF and private-sector entities, to design and build four city-scale advanced wireless testing platforms, beginning in FY 2017. As a part of this investment, NSF also announces a \$5 million solicitation for a project office to manage the design, development, deployment, and operations of the testing platforms, in collaboration with NSF and industry entities.

Each platform will deploy a network of software-defined radio antennas city-wide, essentially mimicking the existing cellular network, allowing academic researchers, entrepreneurs, and wireless companies to test, prove, and refine their technologies and software algorithms in a real-world setting. These platforms will allow researchers to conduct at-scale experiments of laboratory-or-campus-based proofs-of-concept, and will also allow four American cities, chosen based on open competition, to establish themselves as global destinations for wireless research and development.

NSF is also announcing plans to invest \$350 million over the next 7 years in fundamental research on advanced wireless

technology projects that can utilize NSF's share of time on these platforms. This will allow a broad base of NSF-funded experiments on potential breakthrough technologies to be taken from proof-of-concept to real-world testing at scale, here in the United States.

COMPLEMENTARY FEDERAL ANNOUNCEMENTS TODAY

In addition to these testing platforms and research investments, the Administration is also announcing additional coordinated efforts and investments across Federal agencies to help accelerate the growth and development of advanced wireless technology.

- In addition to its support for the testing platforms and fundamental research, the NSF is also announcing:
 - Two prize challenges to enhance wireless broadband connectivity. The first challenge will focus on providing rapid, large-scale wireless connectivity to restore critical communication services in the aftermath of a disaster. The second will seek innovative solutions to provide low-cost, seamless connectivity in urban areas, leveraging fiber optics in overhead light poles.
 - A \$6 million jointly-funded solicitation with Intel Labs on information-centric wireless edge networks, with the goal of developing the ability to process very large quantities of information with response times of less than one millisecond.
 - A \$4.7 million joint NSF- and Academy of Finland-funded solicitation to support joint U.S.-Finland research projects on novel frameworks, architectures, protocols, methodologies, and tools for the design and analysis of robust and highly dependable wireless communication systems and networks, especially as they support and enable the Internet of Things.
 - Federal funding of a Millimeter Wave Research Coordination Network to foster biannual meetings of international researchers to identify emerging challenges, share cutting-edge research, and form collaborations around millimeter-wave broadband wireless networks.
 - A large-scale networking platforms "Communities of Practice" workshop designed to gather international expertise on best practices that can successfully guide the advanced wireless research testing platforms being announced today.
 - Follow-on NSF workshop on ultra-low latency networks, with the goal to identify research challenges and pathways that need to be solved in order to support ultra-low response times across networks.

Find more information [here](#) to learn more about these NSF announcements.

- DARPA is announcing its plans to demonstrate the viability of the technologies being developed for its latest Grand Challenge, the Spectrum Collaboration Challenge (SC2), within the testing platforms being announced today. The SC2 competitors are reimagining spectrum access strategies and developing a new wireless paradigm of collaborative, local, real-time decision-making where radio networks will autonomously collaborate and reason about how to share the RF spectrum. Advanced wireless test platforms like those being announced today are key to ensuring that advanced technologies, like those that will be created under SC2, are able to move rapidly from concept to adoption. [Learn More.](#)
- Today, the National Institute of Standards and Technology (NIST) is announcing:
 - The creation of a multi-disciplinary working group—the Future Generation Communications Roadmap—focused on identifying key gaps and R&D opportunities related to future-generation communications systems and standards.
 - A coordinated channel measurement, verification, and comparison campaign within indoor environments by the NIST-supported 5G mmWave Channel Model Alliance. The Alliance will discuss the preliminary results of this study at the First International Workshop on 5G Millimeter Wave Channel Models scheduled for December 4, 2016 at IEEE's GLOBECOM conference. [Learn More.](#)
- Finally, the National Telecommunications and Information Administration (NTIA) announces the following actions by its Institute for Telecommunications Sciences (ITS) that build on its spectrum test bed and other measurement programs:
 - This fall, ITS will be sponsoring undergraduate and graduate student wireless spectrum research that will utilize the spectrum test bed that ITS is developing in collaboration with the University of Colorado-Boulder (CU-Boulder) to span the Federal and university campuses. The spectrum test bed will facilitate research to explore campus-scale wireless networking, spectrum sharing, and mobile applications, and enable collaborations between ITS, CU-Boulder, and the City of Boulder.
 - Along with the Center for Advanced Communications, ITS will be demonstrating its Measured Spectrum Occupancy Database (MSOD) project at the August 1-3 International Symposium on Advanced Radio Technologies in Colorado. MSOD has been successfully tested and used to record spectrum utilization 24 hours a day, seven days a week, over a period of several years, using data from multiple sensor installations. Additional networked sensor sites are

being installed this fall, and spectrum analysis capabilities are being added.

- ITS will be expanding its **Urban and Indoor Radio Frequency (RF) Propagation Measurement** campaign that advances urban and indoor propagation research by making advances in measuring and characterizing radio frequency propagation characteristics in both urban and indoor environments to include four more cities to provide additional data to improve the accuracy of RF propagation models in urban terrain.
- ITS will begin utilizing its expertise in electromagnetic compatibility research this fall to perform **electromagnetic compatibility (EMC) analyses** and conduct empirical tests of potential device-to-device interference in a mobile network operating within an independent fixed network infrastructure. Lab tests and simulations will be performed initially, followed by experimental validation of results in the field.

PRIVATE-SECTOR ANNOUNCEMENTS

Reflecting the importance of these research testing platforms to the development of wireless technology, more than twenty private-sector companies and associations in the U.S. wireless industry have cumulatively pledged more than \$35 million in cash and in-kind support to the design, development, deployment, and ongoing operations of these testing platforms. In addition to financial support, these entities will be providing design support; technical networking expertise; networking hardware, including next-generation radio antennas, software-defined networking switches and routers, cloud computing, servers, and experimental handsets and devices; software; and wireless network testing and measurement equipment.

These companies are announcing today the following contributions to the testing platforms:

- **AT&T** will provide on-site mobile connectivity in the cities selected as testing grounds for advanced wireless platform research.
- **Carlson Wireless Technologies** will contribute equipment, technology, and expertise in TV white spaces and dynamic spectrum sharing, allowing researchers to examine a variety of use cases including residential broadband and the Internet of Things.
- **CommScope**, in support of the testing platforms, will contribute connectivity solutions such as antennas, RF cabling, cabinets, small cells, and fiber optics.
- **HTC** will support the testing platforms by providing technical expertise, mobile devices, IoT sensors and virtual reality systems.
- **Intel** will contribute its portable 5G mobile trial platform and server equipment to the testing platforms, to assist in research on mmWave, multi-antenna array, steerable beamforming, novel radio interface techniques, and anchor-booster architecture.
- **InterDigital** will contribute financial support to the testing platforms and access to tools focused on areas like spectrum and bandwidth management, heterogeneous networks and backhaul.
- **Juniper Networks** will contribute software, systems, and expertise to help with the design and architecture of multiple research platforms to advance orchestration and authentication of massively-scalable, massively-distributed IoT networks, as well as new approaches to secure these networks.
- **Keysight Technologies** will support the testing platforms with a range of current and next-generation cellular and WLAN hardware and software products and with wireless experts to deliver consulting and testing assistance.
- **National Instruments** will provide equipment from its software defined radio platform to support next-generation wireless communications research in areas like mmWave and Massive MIMO.
- **Nokia**, together with **Nokia Bell Labs**, will provide financial contributions, research collaborations, governance, and product platform support, and will focus on software-defined radios, the Internet of Things, remote sensing, mmWave, security, new use cases and applications, and dynamic spectrum sharing.
- **Oracle** will provide core network controls, analytics, and network orchestration to researchers and help them understand the impact of subscriber behaviors, enhance orchestration, and bolster security.
- **Qualcomm** will contribute financial support as well as engineering equipment and guidance to help enable the testing platforms to explore new and innovative communication systems.
- **Samsung** will contribute research design and engineering expertise to the testing platforms, with a particular emphasis on technologies for future wireless networks in the 28GHz and other millimeter wave bands, as well as continued enablement for the Internet of Things.
- **Shared Spectrum** is contributing to the testing platforms technical expertise in dynamic spectrum sharing to support the design and architecture of research platforms.
- **Sprint** will support research and development to further the progress of advanced technologies slated for 5G and beyond. Sprint will provide technical expertise on network design, use cases, and architecture requirements for core and radio access networks and the devices that will access them.

- **T-Mobile USA, Inc.** will provide technical expertise to the testing platforms, including staff engineering assistance or advice in the design and deployment of the testing platforms.
- **Verizon** will contribute technical expertise to the testing platforms, such as staff engineering assistance in the design and deployment of the testing platforms, and in fixed and mobile systems, indoor and outdoor environments, and residential and commercial buildings.
- **Viavi Solutions** will provide test, measurement, assurance, and optimization solutions for lab and field trials for network and services to enable next-generation technologies for the always-connected society and Internet of Things.

These associations are announcing today the following contributions to the testing platforms:

- **The Alliance for Telecommunications Industry Solutions (ATIS)** will provide technical assistance and staff time on the design and deployment of the testing platforms. ATIS will also support the testing platforms by identifying potential opportunities for research to be conducted on the platforms.
- **CTIA** will contribute engineering and technical assistance to help align industry R&D and university research to be conducted on the testing platforms with next-generation wireless networks, devices, and applications.
- **The Telecommunications Industry Association (TIA)**, will provide technical and engineering expertise in wireless network deployment, Internet of Things, interoperability, and software-defined networking. TIA will also assist with expanding industry awareness of the testing platforms.

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