Below, Mark Gorenberg, Member of the US President's Council of Advisors on Science and Technology, writes about the ever increasing demand for bandwidth, and he calls spectrum the "engine of the wireless economy".

The rapid creation and explosive use of new wireless applications has spurred economic growth and service improvements across a variety of sectors, such as transport, environment and health. In Europe, as in the United States, new devices, applications, and services, combined with unforgiving consumer expectations regarding seamless connectivity, continue to drive bandwidth demand across the continent.

All of these innovations, however, rely on a finite and valuable resource -- access to electromagnetic spectrum. While almost all the spectrum in the range suitable for today's wireless broadband services has been assigned, in many instances, the assigned spectrum is not fully utilized. While we can't create new spectrum, new technologies and new policies can maximize the usefulness of what's available. Responding to that challenge has been the subject of different policy initiatives in the United States and in Europe.

In July 2012, the U.S. President's Council of Advisors on Science and Technology (PCAST) released a report entitled "Realizing the Full Potential of Government-Held Spectrum to Spur Economic Growth." The premise of the report is simple: in order to meet today's growing demands for spectrum, foster economic growth, and develop technological leadership, the United States and other nations must find ways for different kinds of users to share spectrum effectively.

Thankfully, the technologies to enable sharing already exist. For instance, modern databases can enable commercial use of spectrum that historically has been dedicated exclusively to governmental purposes, when and where the government doesn't have immediate need for it. The PCAST report outlined a new three-tier "dynamic sharing" Spectrum Access System (SAS) that makes spectrum sharing by Federal users the norm, and also allows sharing with commercial users. Under the SAS, Federal primary systems would receive the highest priority and protection from harmful interference; secondary licensees would register deployments and use in a database and receive some quality of service protections, possibly in exchange for fees; and General Authorized Access users would be allowed opportunistic access to unoccupied spectrum when no Primary or Secondary Access users are using a given frequency band in a specific geographical area or time period. For example, a shipboard radar system may depend on spectrum, but that same spectrum can be made available by the SAS for commercial purposes at other times and places or when the ship is away from port.

In the United States, the regulatory process for accommodating such sharing is already underway. The White House, The National Telecommunications and Information Administration (NTIA) within the Department of Commerce, and the Federal Communications Commission (FCC) have all taken significant, concrete steps in furtherance of PCAST recommendations. For example, about five months after the PCAST report, the FCC initiated a rulemaking proceeding in which it proposed a new three-tiered form of spectrum management based on the PCAST model. If finalized later this year as planned, this initiative will create the initial rules to allow industry to start building and implementing Spectrum Access Systems for an initial 150 MHz of spectrum.

In June 2013, less than a year after the PCAST report, the White House issued a Presidential Memorandum adopting a number of the other PCAST recommendations or variations thereof, which are now being carried out by the new White House Spectrum Policy Team (the formation of which was itself prompted by PCAST), NTIA and other Federal agencies. For example, the NTIA has now identified a total of 960 MHz that could be candidates for spectrum sharing using SAS technology.

Sharing between government agencies and consumer devices is a win-win solution: Governmental entities can continue to use their spectrum and lower costs by taking

advantage of the commercial equipment. For network operators and end users, sharing makes additional spectrum available for wireless services more quickly than if existing users had to be relocated. Spectrum sharing minimizes delays by leaving incumbent operations in place.

While the PCAST report outlined sharing between government and commercial users, the same concepts can be expanded to sharing among commercial users. This was a very interesting aspect of the European Commission's policy communication on spectrum sharing from September 2012, soon after the PCAST report. It made a case for enabling more sharing possibilities based on sharing contracts between users operating in the market. This new model allows flexible commercial use of the spectrum, where the database can mediate between uses like mobile wireless that require certainty around their access, and other uses like Wi-Fi that can better tolerate disruption if not enough spectrum is available for all. This approach is a natural extension of the spectrum policies that have served both the United States and Europe very well: licensed access allows operators to offer a predicted quality of service, while license-exempt access fosters widespread contributions to innovation and fast-paced investment in emerging technologies. By enabling both types of access to the same spectrum, we can get the best of both worlds and thereby maximize opportunities for innovation.

Experimentation with sharing among commercial services has been flourishing around the world. For example, numerous countries have pursued regulations or trials that enable license-exempt, Wi-Fi-like devices to access vacant spectrum in the television broadcast bands. These patches of vacant spectrum between broadcast television channels are often called “white spaces.” The United States and Singapore have adopted rules enabling license-exempt use of white spaces, while Canada is in the process of doing so. The United Kingdom, Japan, Korea, the Philippines, Kenya, Tanzania, and Malawi are all piloting this technology. The technology has been used in a variety of ways, including improving Internet access in schools, facilitating the delivery of government services, and establishing communication channels in the wake of earthquakes and typhoons.

As dynamic sharing evolves, spectrum can be reused in smaller and smaller cells, improving capacity effectiveness thousands of times. Innovation in wide area mobile communications, sensor networks, and whole new industries and products that we cannot foresee will emerge.

In July 2014, the NTIA and the FCC issued a notice proposing the establishment of a Model Wireless City, based on another PCAST report recommendation. The public notice seeks comment on how the FCC’s rules could be applied or modified to promote the early-stage rollout of innovative technologies and business models in real-world urban environments, as a means of expediting eventual widespread commercial deployment.

To be sure, a more aggressive approach to spectrum sharing has its challenges, particularly from the perspective of incumbent commercial or Government users who are reluctant to give up their exclusive rights to individual spectrum bands. Yet technology is being developed and deployed to allow for such sharing by new entrants without risking interference to the incumbents’ systems. And the investment in that technology will open up spectrum to highly productive and innovative new services and applications supporting every sector of the economy and create great returns.

Spectrum is the engine of the wireless economy. By managing it efficiently and maximizing its use, we can transform the availability of this natural resource from scarcity to abundance and maintain the innovation in wireless that is boosting economies and improving daily life.

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