



DEPARTMENT OF COMMERCE

National Telecommunications and Information Administration

[Docket Number: 240430-0121]

RIN: 0660-XC062

Advancement of 6G Telecommunications Technology

AGENCY: National Telecommunications and Information Administration, U.S. Department of Commerce.

ACTION: Notice, request for public comment.

SUMMARY: The National Telecommunications and Information Administration (NTIA) is requesting comments on the current state of development of sixth generation (6G) wireless communications technology and to guide Executive Branch policies on necessary steps to facilitate the advancement of this technology. As potential requirements for 6G are being developed by industry, governmental, academic, and civil society stakeholders, NTIA hopes to hear from the public on the following questions to inform our own future engagement in support of 6G development and deployment.

DATES: Comments are due on or before **[INSERT DATE 90 DAYS AFTER DATE OF PUBLICATION IN THE *FEDERAL REGISTER*]**.

ADDRESSES: All electronic public comments on this action, identified by Regulations.gov docket number NTIA-2024-0001, may be submitted through the Federal e-Rulemaking Portal at <http://www.regulations.gov>. The docket established for this rulemaking can be found at www.Regulations.gov, NTIA-2024-0001. Click the “Comment Now!” icon, complete the required fields, and enter or attach your comments. Responders should include a page number on each page of their submissions. Please do not include in your comments information of a confidential nature, such as sensitive personal information or proprietary information. All comments received are a part of the public record and will generally be posted to

Regulations.gov without change. All personal identifying information (e.g., name, address) voluntarily submitted by the commenter may be publicly accessible. Information obtained as a result of this notice may be used by the federal government for program planning on a non-attribution basis. For more detailed instructions about submitting comments, see the “Instructions for Commenters” section at the end of this Notice.

FOR FURTHER INFORMATION CONTACT: Kate Dimsdale, National Telecommunications and Information Administration, U.S. Department of Commerce, 1401 Constitution Avenue, NW, Room 4701, Washington, DC 20230; telephone: (202) 482-3167; email: kdimsdale@ntia.gov. Please direct media inquiries to NTIA’s Office of Public Affairs: (202) 482-7002; email: press@ntia.gov.

SUPPLEMENTARY INFORMATION:

Background

Secure and reliable telecommunications services are vital to ensuring the United States’ economic competitiveness. As the telecommunications industry continues to deploy 5G wireless communications systems across the United States that both embody and enable standards-based, secure, reliable, and interoperable telecommunications ecosystems, the industry is beginning to plan for the development of the next generation of wireless communications: 6G. Advances in mobile networks have brought the Internet to billions of people around the world who have, in turn, been able to access new opportunities and make new connections. 6G is expected to be the next step in continuing this positive momentum. Indeed, the U.S. and its like-minded partners have already established a core set of principles to shape the future of this critical technology to advance economic and national security interests.¹

In a report submitted to NTIA in December 2023, the Commerce Spectrum Management Advisory Committee (CSMAC) describes the 6G Vision as "Dynamic connectivity across public

¹ “Joint Statement Endorsing Principles for 6G: Secure, Open & Resilient by Design,” February 2024. [Online]. Available: <https://ntia.gov/speechtestimony/2024/joint-statement-endorsing-principles-6g-secure-open-resilient-design>.

and private digital and physical domains that enables intelligent communications while creating conditions for economic growth, enhanced national security, and societal well-being."² In addition to International Telecommunication Union's (ITU) work on International Mobile Telecommunications-2030 (IMT-2030), there are a variety of organizations authoring 6G visions, including the U.S. NextG Alliance,³ the India's Bharat 6G Alliance,⁴ China's IMT-2030 Promotion Group,⁵ and more. 6G is expected to be a general-purpose technology that provides pervasive and seamless connectivity across public and private digital and physical domains. 6G usage scenarios will likely not only build on those that began in 5G—including enhanced mobile broadband, massive machine-type communications, and ultra-reliable, low-latency communications—but will also expand ubiquitous connectivity, integrated sensing and communication, and artificial intelligence. New and emerging 6G-enabled applications hold promise to help achieve both societal and economic domestic goals including public safety, security, resilience, interoperability, economic competitiveness, and digital equity; international goals such as the United Nations' Sustainable Development Goals and environmental goals; and enterprise goals like productivity, cost savings, quality, and time-to-market.

To ensure that 6G can meet these objectives, NTIA is requesting comments from interested parties to help inform the development of appropriate policy positions that will enable the U.S. to plan effectively for the 6G future and ensure that U.S. industry plays a leading role in the development of global standards and innovation ecosystems for 6G.

NTIA is most interested in comments on 6G topics related to proposed priorities, likely or potential use cases, and research and development from relevant stakeholders, including comments from stakeholders in the private sector (specifically, wireless broadband Internet

² "CSMAC Report of Subcommittee on 6G," December 2023. [Online]. Available: https://www.ntia.gov/sites/default/files/2023-12/6g_subcommittee_final_report.pdf.

³ "National 6G Roadmap," February 2022. [Online]. Available: <https://nextgalliance.org/wp-content/uploads/2022/02/NextGA-Roadmap.pdf>.

⁴ "Bharat 6G Vision," March 2023. [Online]. Available: https://xsinfoways.net/6G-Alliance/img/Bharat-6G-Vision-Statement-copy%202_1.pdf.

⁵ "White Paper on 6G Vision and Candidate Technologies," June 2021. [Online]. Available: <http://www.caict.ac.cn/english/news/202106/P020210608349616163475.pdf>.

service providers, original equipment manufacturers and network vendors, developers and end-users of spectrum-based technologies and services, and contractors for federal missions), academia, civil society, the public sector, and others.

This request for comment is not focused on spectrum issues surrounding 6G. NTIA, in coordination with executive branch agencies and the Federal Communications Commission (FCC), is currently implementing the 2023 National Spectrum Strategy (NSS), which received over 130 comments and established the foundation for the 2024 NSS Implementation Plan.⁶ NTIA encourages interested parties to engage with NTIA's Office of Spectrum Management on implementation of the NSS and other spectrum matters.

Request for Comments

NTIA welcomes input on any matter that commenters believe is important to the U.S. Government's role in 6G development and use. Commenters are invited to comment on the full range of issues presented by this Request for Comments and are encouraged to address any or all of the following questions, or to provide additional information relevant to 6G technology. When responding to one or more of the questions below, please note in the text of your response the number of the question to which you are responding. As part of their response, commenters are welcome to provide specific actionable proposals, rationales, and relevant factual information. NTIA seeks public comment on the following questions:

Enabling 6G Success

1. Which specific use cases will benefit from 6G technology initially, and how can the U.S. Government support these innovations?

⁶ "National Spectrum Strategy," November 13, 2023. [Online]. Available: <https://www.ntia.gov/report/2023/national-spectrum-strategy-pdf>, "National Spectrum Strategy Implementation Plan," March 12, 2024. [Online]. Available: <https://www.ntia.gov/sites/default/files/publications/national-spectrum-strategy-implementation-plan.pdf>, and "National Spectrum Strategy Request for Comment Responses," April 19, 2023. [Online]. Available: <https://www.ntia.gov/issues/national-spectrum-strategy/stakeholder-engagement/received-comments/request-for-comment-responses>.

2. What existing or future policies should the U.S. Government promote to support 6G development beyond spectrum use? What existing or future U.S. Government policies or initiatives could potentially stifle 6G development and deployment, or harm the ability of companies in the U.S. or its like-minded partners to compete in international markets?
3. What new challenges will arise from 6G regarding privacy, equity, and civil liberties? How can the U.S. Government ensure that the benefits of 6G technology extend to all segments of society?
4. How should the U.S. Government cooperate with like-minded countries on enabling 6G success globally? Are there existing international initiatives on 6G that the U.S. Government should consider? Are U.S. companies and those of likeminded countries positioned to be global leaders in 6G development, standardization, adoption, and deployment? What other countries or regions represent the strongest challenges to U.S. leadership in 6G? What can the U.S. Government do to enable success of U.S. companies in the global 6G market?
5. Previous commercial wireless generations have been deployed and operated predominantly by dedicated Mobile Network Operators (MNOs) whose primary business function is deployment and operation of such networks. More recent use cases for 5G-Advanced and 6G, however, envision other types of entities, such as industries and corporate or academic campuses, operating their own non-public networks (NPNs). What barriers need to be addressed to enable 6G adoption in these non-traditional verticals?
6. What is required to develop a domestic workforce capable of designing, manufacturing, deploying, and operating 6G networks and equipment? Will retraining or expansion of the currently wireless industry workforce be necessary for U.S. success in 6G?
7. What public-private partnerships would help enable U.S. leadership in global 6G development?

8. How are standards being set or developed to ensure that 6G supports interoperability between multiple telecommunications infrastructure suppliers?
9. With regard to the transition from 5G to 6G, what can be done now with 5G development to enable 6G success? How should these efforts be prioritized?
10. What supply chain issues currently present in 5G deployment and operation could potentially also impact 6G development and deployment? How will the 6G supply chain, for both hardware and software, differ from the 5G supply chain?
11. What infrastructure issues currently inhibit 5G deployment (e.g. lack of access to high-speed backhaul infrastructure, standalone and non-standalone networks, etc.)? How can infrastructure be improved to enable a smooth and speedy deployment of 6G? Will siting needs for densified network infrastructure and Fixed Wireless Access (FWA) backhaul require additional antenna placements on buildings, particularly those owned by public housing agencies or similar? Will these placements require additional site leases?

6G and Beyond Research and Development

12. What areas of foundational research will accelerate 6G and beyond technology development? What advances in related technologies, such as artificial intelligence, machine learning, satellite communication, energy storage and transmission, semiconductor fabrication, etc., will be essential for successful development and deployment of 6G technologies and those for subsequent generations? Do developments in these or other emerging technologies such as quantum computing have the potential to substantially change the basic functionality or evolution of 6G or subsequent generations?
13. What are the necessary or priority investment areas for 6G testbeds and platforms to help support and accelerate 6G and beyond innovations in the United States?
14. In what areas should the U.S. Government focus its 6G and beyond research?

15. What standards development organizations, industry consortia, and stakeholder groups have taken up important topics related to 6G? Conversely, are there industries, stakeholders, or other groups whose perspectives are necessary to help ensure 6G research is interdisciplinary and extends across all necessary industry sectors?
16. What does the intellectual property landscape for 6G technology look like and how does this affect the U.S. Government strategy for 6G development? Do certain companies or regions own a disproportionate share of the Intellectual Property anticipated to be necessary for building 6G systems?
17. What roadmaps for development, standardization, and rollout currently exist? To what extent, if any, do these roadmaps conflict with each other, and how will these conflicts be reconciled?
18. What can the U.S. Government do to more effectively to engage on 6G standards development through IMT-2030?
19. When is 6G technology expected to begin lab and field trials and then become commercially available? What developments in 6G technology could accelerate replacement of obsolete technologies?
20. What new developments should be explored for:
 - a. 6G Radio Interface;
 - b. Core and Transport Networks;
 - c. User Equipment;
 - d. Open Source Software and Open Architectures
 - e. Intelligent Architecture/Machines;
 - f. Artificial Intelligence/Machine Learning;
 - g. Security and Privacy;
 - h. Non-terrestrial Networks;
 - i. Power-efficient and Sustainable Networks;

- j. Wireless Sensing;
 - k. Internet of Things (IoT); and
 - l. Spectrum Sharing, including Dynamic Spectrum Access?
 - m. Security and Resiliency; and
 - n. Semiconductor Technologies.
21. What can be done to enable seamless and ubiquitous access to heterogeneous 6G services across multiple radio access types (e.g. terrestrial radio, non-terrestrial/satellite communication)?

6G Safety, Security, and Environmental Concerns

22. How could 6G improve network resiliency during disaster and recovery operations, such as in hurricane response and other natural and man-made disasters that impact network performance?
23. How could 6G improve public safety and first responder mission critical communications?
24. Are there challenges in upgrading legacy public safety services (such as Enhanced 9-1-1, E9-1-1) to 5G that could affect 6G deployment? Will 6G exacerbate existing incompatibilities between commercial wireless networks and E9-1-1 service?
25. What impact will 6G have on the migration to Next Generation 9-1-1 (NG9-1-1) by public safety entities? Are there hurdles which will impair the ability of public safety entities to communicate with the general public and first responders as these stakeholders upgrade to 6G?
26. What steps should be taken to ensure that 6G technology can support critical services, e.g., mission critical services used by first responders and other National Security/Emergency Preparedness (NS/EP) services, that require secure, highly available, and resilient networks?

27. Are there any concerns about the energy efficiency of 6G equipment and networks? If so, what steps could potentially be taken to reduce the energy consumption associated with this equipment?
28. Much of 6G's energy costs will come from operating the network. However, manufacturing, installing, and maintaining the physical infrastructure of 6G also has energy and environmental costs. Is the industry taking initiatives to reduce overall energy necessary to build and install 6G network infrastructure, and if so, what are they? Is it feasible to recycle or retrofit legacy network equipment or Open Radio Access Network (RAN) components to cut back on electronic waste? What cybersecurity challenges have been faced in the development and deployment of 5G technology? How can such challenges be prevented in the development and deployment of 6G technology?

Commerce Spectrum Management Advisory Committee 6G Report

29. CSMAC's 6G report, published in December 2023 and available at https://www.ntia.gov/sites/default/files/2023-12/6g_subcommittee_final_report.pdf, addressed a wide array of topics including overarching 6G vision, 6G use cases, 6G technical capabilities, and potential uses for 6G by the government. We seek comment on its findings and recommendations. Are there subjects addressed by the CSMAC report that should be further explored? Is the CSMAC report missing any additional topics of consideration regarding 6G? Have events occurred since publication of the report that affect industry's understanding of 6G? Do you have additional information or views that you believe would be helpful to NTIA?

Instructions for Commenters: NTIA invites comments on the full range of issues that may be presented in this Notice, including issues that are not specifically raised in the above questions. Commenters are encouraged to address any or all of the above questions. Comments that contain references to studies, research, and other empirical data that are not widely available should include copies of the referenced materials with the submitted

comments. Attachments to electronic comments should be machine-readable and should not be copy-protected. Responders should include the name of the person or organization filing the comment, which will facilitate agency follow-up for clarifications as necessary, as well as a page number on each page of their submissions. All comments received are a part of the public record and will generally be posted on the NTIA website, <http://www.ntia.gov/>, without change. All personal identifying information (for example, name, address) voluntarily submitted by the commenter may be publicly accessible. Do not submit confidential business information or otherwise sensitive or protected information.

Dated: May 17, 2024.

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National Telecommunications and Information Administration.

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