NIST Interagency Report
NIST IR 8433

Advanced Communications Technologies Standards

Report of the

Advanced Communications Technologies

Working Group

Christopher Greer
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This publication is available free of charge from:
https://doi.org/10.6028/NIST.IR.8433

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
U.S. DEPARTMENT OF COMMERCE

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August 2022

U.S. Department of Commerce
Gina M. Raimondo, Secretary

National Institute of Standards and Technology
Laurie E. Locascio, NIST Director and Under Secretary of Commerce for Standards and Technology

NIST IR 8433
August 2022

Publication History
Approved by the NIST Editorial Review Board on 2022-08-26

How to Cite this NIST Technical Series Publication
Greer C, Bohn R, Zhang T (2022) Advanced Communications Technologies Standards, Report of the Advanced Communications Technologies Interagency Working Group. (National Institute of Standards and Technology, Gaithersburg, MD), NIST Interagency Report (IR) NIST IR 8433. https://doi.org/10.6028/NIST.IR.8433

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Abstract

This report of the Advanced Communications Technologies Working Group of the Interagency Committee on Standards Policy (ICSP) provides an overview of Federal agency advanced communications technologies (ACT) standards activities and recommends standards priority areas for ICSP consideration. The ACT standards priorities recommendations section of the report sets out nine areas for consideration by the ICSP. The landscape review section provides an overview of each contributing agency's relevant ACT standards activities, including its mission, ACT goals, role in ACT standards, participation in standards development organizations, ACT focus areas, and examples of standards activities for each contributing Federal agency or office.

Keywords

Advanced communications technologies; interagency; international technical standards; Federal agency standards activities; standards; standards development organizations, standards priority areas.

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Acknowledgments

Acknowledged for their significant contributions to this report are Phillip Ashlock (GSA), Abdella Battou (NIST), Jason Coder (NIST), Christopher Cook (NRC), Bernard Edwards (NASA), Jaydee Griffith (NTIA), Adam Lusin (Dept. of State), Douglas Montgomery (NIST), Ashley Moore (USAGM, retired), Paul Najarian (Dept. of State), Christopher Pollock (GSA), Timothy Puvogel (DoD CIO C3), Jianchao Zhang (FDA), and the participating members of the Advanced Communications Technologies Interagency Working Group.

Executive Summary

This report of the Advanced Communications Technologies Working Group (ACTWG or Working Group) of the Interagency Committee on Standards Policy (ICSP) provides an overview of Federal agency advanced communications technologies (ACT) standards activities and recommends standards priority areas for ICSP consideration.

The primary strategy for Federal agency engagement in ACT standards development, as set out in Circular A-119 from the Office of Management and Budget (OMB) and the National Technology Transfer and Advancement Act (NTTAA), focuses on reliance on private sector leadership supplemented by Federal government contributions to discrete standardization processes.

Participation by agencies in standards activities focuses on open, consensus-based, voluntary, private sector-led, and science- and engineering-informed standards that enable:

- Innovation in products and services;
- Interoperability across systems and devices;
- Open and competitive national and global markets; and
- Efficient and effective acquisition processes.

The Advanced Communications Technologies Working Group (ACTWG) was chartered by the Interagency Committee on Standards Policy (ICSP) to enable interagency coordination on communications technologies standards efforts. Eighteen Federal agencies, departments, and offices are participating in this interagency group.

This annual report of the Working Group to the ICSP provides:

- Recommendations for ACT standards priorities areas; and an
- Overview of ACT standards activities for each of the contributing agencies or units.

The ACT standards priorities recommendations section of the report sets out nine areas for consideration by the ICSP.

- **Emerging Network Technologies** – Standards for AI-enabled network systems; networks supporting AI-enabled applications and distributed systems; and automated, virtual networks and services.
- **Security and Privacy** – Standards for communications technology (CT) security and resilience, including compromise detection and sustained safe operation; CT systems supply chain security and reliability; and distributed ledger methods for cooperative trust and privacy protection among network entities.
- **IoT** – Standards for massively-scaled connectivity and interoperability in internet of things (IoT) environments including connected vehicles, uncrewed aerial systems (UAS), intelligent infrastructure and smart cities, eHealth, advanced manufacturing, emergency response, smart grid, and other application areas.
- **End-to-End Services and Quality Assurance (Q/A)** – CT standards for architectures, protocols, and measurement methods that support differentiated and optimized services tailored to and responsive to application requirements, including those for critical infrastructure systems.

- **Emerging & Future IP Networks** – Standards that promote innovation, enable broad participation, and preserve access and privacy for next-generation IP network technologies.
- **Spectrum Measurement & Management** – CT standards for maximizing spectrum resources for 5G and 6G technologies, including channel propagation models and measurement methods, wireless coexistence, antenna evaluation methods, and integrated satellite communications.
- **Communications for Data Access and Sharing** – CT standards meeting the rate, volume, quality of service, security, and privacy needs of the expanding data universe and a global information society.
- **Quantum Communications** – CT standards for quantum technologies, including memory, interfaces, and key distribution systems, that enable advanced quantum networks and their interactions with conventional network systems.
- **Open Source/*de facto* Standards** – Strategic Federal role in accelerated standards processes, including interactions with industry consortia and alliances developing *de facto* standards.

To provide an overview of contributing relevant ACT standards activities, the landscape review section provides, for each contributing Federal agency or unit, a description of the following.

- Agency Mission
- Advanced Communications Technology (ACT) Goals
- Agency Role in ACT Standards
- Agency Participation in Standards Development Organizations (SDOs)
- ACT focus areas
- Examples of Standards Activities

1. Introduction and Overview

1.1. Strategy and Policy for Government Engagement in Standards Development

It is the policy of the Federal government to rely on private sector led voluntary consensus standards whenever possible. Voluntary consensus standards development processes are those that are open, balanced, and consensus-based, with provisions for due process and appeals. Voluntary consensus standards that are informed by good science and engineering can be a powerful force for:

- Innovation in products and services development;
- Interoperability across systems and devices;
- Open and competitive national and global markets; and
- Efficient and effective acquisition processes.

Reliance on private sector leadership, supplemented by Federal government participation and contributions during the development of standards, remains the primary U.S. strategy for government engagement in standards development.

This strategy is implemented in both legislation and policy. With respect to legislation, the National Technology Transfer and Advancement Act (P.L. 104-113 or NTTAA) directs Federal agencies to use technical standards "that are developed or adopted by voluntary consensus standards bodies, using such technical standards as a means to carry out policy objectives or activities determined by the agencies and departments." The Act further provides that "Federal agencies and departments shall consult with voluntary, private sector, consensus standards bodies and shall, when such participation is in the public interest and is compatible with agency and departmental missions, authorities, priorities, and budget resources, participate with such bodies in the development of technical standards." The National Institute of Standards and Technology (NIST) is charged with coordinating Federal agency implementation of NTTAA provisions.

The Trade Agreements Act of 1979 (as amended) prohibits U.S. agencies from engaging in standards-related activities that create unnecessary obstacles to trade and gives the U.S. Trade Representative (USTR) the responsibility to coordinate the consideration of international trade policy issues related to standards and conformity-assessment procedures.

With respect to policy, a central element in implementing the National strategy is Office of Management and Budget (OMB) Circular A-119 on Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity-Assessment Activities. The Circular directs agencies to use voluntary consensus standards in lieu of government-unique standards except where inconsistent with law or otherwise impractical. It also provides guidance to agencies on participation in the development of voluntary consensus standards and articulates policies relating to the use of standards by Federal agencies.

The October 2011 memorandum[1] from the Subcommittee on Standards of the National Science and Technology Council provides a high-level overview of the legal and policy framework for

[1] https://www.nist.gov/system/files/documents/standardsgov/Federal_Engagement_in_Standards_Activities_October12_final.pdf

government engagement in private-sector standards and sets out the following fundamental objectives for Federal government engagement in standards activities.

- Ensure timely availability of effective standards and efficient conformity assessment schemes critical to addressing national priorities
- Achieve cost-efficient, timely, and effective solutions to regulatory, procurement, and policy objectives
- Promote standards and standardization systems that enable innovation and foster competition
- Enhance U.S. competitiveness while ensuring national treatment[2]
- Facilitate international trade and avoid the creation of unnecessary obstacles to trade

1.2. Interagency Committee on Standards Policy

The Interagency Committee on Standards Policy (herein after referred to as the "ICSP" or "Committee") is established to provide a forum for coordination on policies related to Federal participation and use of standards and conformity assessment consistent with OMB Circular A-119. The purpose of the Committee is to promote effective participation by the Federal Government in domestic and international standards and conformity assessment activities and the adherence to uniform policies by Federal agencies in the development and use of standards and in conformity assessment activities. Well-considered Federal policies reflecting the public interest can expedite the development and adoption of standards that stimulate competition, promote innovation, and protect the public safety and welfare. The objective of the Committee is to promote effective and consistent standards and conformity assessment policies in furtherance of U.S. goals and to foster cooperative participation by the Federal Government, U.S. industry, and other private organizations in standards and conformity assessment activities.

1.3. Advanced Communications Technologies Working Group

The Advanced Communications Technologies Working Group (herein after referred to as the "ACTWG" or "Working Group") is established under the provisions of the charter of the Interagency Committee on Standards Policy (ICSP). The objective of the ACTWG is to facilitate coordination of Federal agency advanced communications technologies (ACT) standards activities, respond to requests for information, and develop recommendations relating to ACT standards policy matters to the ICSP. The ACTWG is responsible for the following.

1. Assisting the ICSP in promoting effective and consistent Federal policies in advanced communications technologies standards.
2. Providing an annual report to the ICSP on the current ACT standards activities of participating Federal agencies and recommendations for strategic directions in Federal ACT standards efforts.
3. Responding to requests for information and advising the ICSP on effective means of coordinating advanced communications technologies standards activities with those of the private sector.

[2] World Trade Organization, Technical Barriers to Trade Committee

4. Sharing best practices in advanced communications technologies standards among Federal agencies.
5. Coordinating Federal advanced communications technologies standards interests across application areas such as transportation, energy, public safety, and others.

This report was developed under the provisions of item (2) above.

2. Recommendations to the ICSP for Strategic Standards Priority Areas

The ACTWG charter (see Appendix A) directs the Working Group to provide an annual report to the ICSP, including "recommendations for strategic directions in Federal ACT standards efforts." Through its monthly meeting process, the Working Group identified the following nine areas for strategic standards coordination across Federal agencies and offices.

1. **Emerging Network Technologies:** Future networks will become not just highly automated but also increasingly autonomous. Future network capabilities extend beyond automating network operations and are moving towards a dynamic self-learning process which will result in systems that are more intelligent, capable, and adaptive. These future networks will rely heavily on Artificial Intelligence (AI), Machine Learning (ML), and other new technologies such as edge intelligence. Standards are needed that support broad implementation of new ways to explore, validate, and trouble-shoot AI/ML-powered distributed network functions and how these functions can work together to accomplish intended networking goals.

2. **Security and Privacy:** Future communication networks will be more immersed in every aspect of our society and hence must be more secure and resilient. At the same time, these networks will be more distributed, dynamic, complex, and hence more difficult to protect. Consequently, they will require more scalable and distributed trust management, more timely detection of compromises, reliable and resilient operation even when compromised, and risk-appropriate remote responses to incidents. Furthermore, industries are becoming increasingly connected ecosystems (e.g., interconnected producers, suppliers, brokers, delivery companies, and customers in a supply chain) that are susceptible to many security vulnerabilities, counterfeit components, and poorly designed processes. Standards and guidelines are needed for advanced cybersecurity and privacy approaches that go beyond current methods to meet the needs of future communication networks.

3. **Internet of Things (IoT):** Advanced communications technologies are the essence of the Internet of Things, especially for IoT applications with stringent latency and reliability requirements (e.g., automated driving, vehicle teleoperation, and factory automation). Challenges include connecting billions of devices, meeting stringent performance and reliability requirements, enabling interoperability, ensuring security and privacy for networked devices across different domains, and providing wireless networking capabilities in complex environments. Important application areas include connected vehicles, advanced manufacturing, and medical devices and systems. Developing a coherent strategic approach to IoT standards efforts can accelerate the adoption of effective IoT applications across all sectors of our society and economy.

4. **End-to-End Services and Assurance:** Advanced communication networks, including 5G and beyond, are advancing beyond one-size-fits-all connectivity to supporting differentiated and even optimized services. However, assuring end-to-end (E2E) differentiated quality of service (QOS) remains a significant challenge. New approaches will be required to enable not only QOS provisions, but also quality-of-experience capabilities that measure end user's experience (e.g., voice quality, speech intelligibility, message delivery success, E2E delay to access/use resources, and total system latency). Providing E2E service assurance will require new architectures, protocols, and measurement methods standards for applications such as telehealth, automated transportation, and advanced energy infrastructures.

5. **Emerging and Future IP Networks:** While the basic architecture of the public Internet has remained unchanged for several decades, a new generation of more advanced private IP networks is now providing more sophisticated services beyond best-effort packet forwarding. To address this growing divergence, several significant efforts are underway in various international standards bodies. Ensuring that these efforts provide for openness, interoperability, reliability, and security in future IP networks that promote freedom of expression, open communication and trade, and rights for peaceful assembly and association is paramount. Developing and standardizing such future IP networks will be essential to both next-generation networks, such as 6G, and the Internet more generally.

6. **Spectrum Measurement and Management**: Spectrum sharing is critical to increasing the utility of scarce spectrum resources and hence an important part of advanced communication technologies. Designing effective spectrum-sharing systems requires advanced methods to, for example, measure spectrum usage and avoid potential interference among different devices. Advanced spectrum measurement and management also includes standards based on better channel propagation models for design and testing, wireless coexistence, best practice measurement guidelines for instrumentation at gigahertz to terahertz frequencies, and effective antenna evaluation methods.

7. **Communications for Data Access and Sharing**: A major goal of communication is to enable users – human and machine – to access and share data. Profound changes are underway in the lifecycle of data, from data generation to consumption. For example, data are becoming more diverse, dynamic, and distributed as increasing amounts are created at the network edge while users demand easier, faster, more secure, and privacy-preserving ways to access and share data. Standards-based interoperable data access and sharing (e.g., standardized web protocols) provide essential foundations for the core infrastructure underlying the information economy. Data interoperability is also essential for enabling the aggregation and analysis of data across different organizations and for enabling more seamless, accessible, and unified user experiences. Supporting such advanced data needs calls for new measurement capabilities and standards.

8. **Quantum Communications**: Quantum communication takes advantage of the laws of quantum physics to transport and protect data. Relevant technologies include quantum

repeaters, quantum memory, quantum interfaces (transferring qubit states from photons at one wavelength to another, which is necessary for connecting or scaling quantum computers), and quantum key distribution (exchanging cryptographic keys in a quantum state using qubits). Quantum networking has seen significant progress over the past decade with more fundamental breakthroughs expected in the near future. Standards and best practices for reliable and reproducible performance measurement are needed to accelerate progress and enable broad adoption.

9. **Open Source and de facto Standards:** The software industry has long been using open source to develop software systems that then may become de facto standards. More recently, the communications industry is increasingly leveraging open source to develop and implement new technologies, evidenced by the many open source implementations of 5G systems. Open source efforts form new ecosystems, not limited to traditional standards organizations, in which the communications industry develops next-generation communication technologies that inform future standards. Expanding beyond traditional approaches is needed if Federal agencies are to continue to support the private sector as it leads in this evolving communications standards landscape.

With ICSP guidance and input on which of the priority areas are appropriate for further consideration, the ACTWG will seek community input on standards gaps and opportunities in the selected priority areas and consider recommendations for next steps for interagency coordination.

3. Contributing Agency/Office ACT Standards Landscape Overview

The ACTWG charter also directs the Working Group to provide "an annual report to the ICSP on the current ACT standards activities of participating Federal agencies." This section provides an overview of the following for each contributing agency or office.

- Agency Mission
- Advanced Communications Technology (ACT) Goals
- Agency Role in ACT Standards
- Agency Participation in Standards Development Organizations (SDOs)
- ACT focus areas
- Examples of Standards Activities

3.1. Department of Defense, Office of the Chief Information Officer (DoD CIO)

3.1.1. DoD Mission

The mission of the Department of Defense (DoD) is to provide the military forces needed to deter war and ensure our nation's security.

The DoD Chief Information Officer (DoD CIO) is the principal staff assistant and senior advisor to the Secretary of Defense and Deputy Secretary of Defense for information technology (IT) (including national security systems and defense business systems), information resources management (IRM), and efficiencies. This means that DoD CIO is responsible for all matters

relating to the DoD information enterprise, such as cybersecurity, communications, information systems, and more.

3.1.2. DoD CIO Advanced Communications Technology (ACT) Goals

The Director, Command and Control, Communications Infrastructure (C3I) is responsible for the governance, oversight and policy development of DoD tactical communications, tactical data links, combat identification systems, public safety communications, satellite communications, positioning, navigation and timing, and mobility/5G systems.

3.1.3. DoD CIO Role in ACT Standards

The DoD CIO seeks to harness the functional capability of 5G telecommunications technology, including encouraging relevant commercial standards that contribute to:

- Reducing time and cost of adoption;
- Increasing scalability;
- Optimizing interoperability; and
- Ensuring security.

3.1.4. DoD CIO Participation in Standards Development Organizations (SDOs)

3GPP, O-RAN Alliance, IEEE, OneM2M, ATIS

3.1.5. DoD CIO ACT focus areas

- Secure communications
- Spectrum sharing and security
- Connected vehicle (V2X) security (with Department of Transportation)
- IoT Security
- Supply chain assurance
- Network security
- 5G New Radio (NR) and Uncrewed Aerial Systems (UAS)
- Communications attestation/privacy
- Augmented reality/virtual reality
- Edge computing

3.1.6. Examples of Standards Related Activities

- 3GPP – Cellular vehicle to everything (V2X)
- 3GPP- Secure sidelink for UAS
- 3GPP – Vehicle mounted relays
- 3GPP – Spectrum tracking
- OneM2M – IoT Security
- IEEE – Augmented reality

3.2. General Services Administration (GSA)

3.2.1. GSA Mission

Deliver value and savings in real estate, acquisition, technology, and other mission-support services across government.

3.2.2. GSA Advanced Communications Technology (ACT) Goals

GSA is responsible for establishing contracts for the procurement of products and services for customers throughout the US Government including DoD, Executive Agencies and in some cases State and Local Governments. In addition, GSA has responsibility for policy based programs such as Meta Data Standards.

3.2.3. GSA Procurement Activities in Communications Technologies

Telecommunications and Network Services (R10) provides Federal Acquisition Service customers with end-to-end telecommunications services which include voice, data, video conferencing, local and long distance and wireless telecommunications needs throughout 11 regional offices across the U.S.

Enterprise Infrastructure Solutions (EIS) is the go-to contract for enterprise telecommunications and networking solutions.

Networx allows Federal agencies to build seamless and secure operating environments through customized telecommunications services.

Satellite Communications (SATCOM) Products and Services offers commercial satellite communications services to help Federal, state, local, and tribal governments maintain essential and secure communications where no wire line or wireless infrastructure exists.

Connections II offers secure telecommunications equipment, labor, services, and solutions for your Federal infrastructure, building, or campus.

Wireless Mobility Solutions (WMS) offers a centralized source for wireless service plans, devices, and infrastructure support.

Local Telecommunications Services provides Federal agencies a full range of first mile/last mile telecommunications products, services, and solutions.

Federal Relay (FedRelay) provides telecommunications services to Federal agencies and tribal governments to conduct official business with individuals who are deaf, hard of hearing, or have speech disabilities.

3.2.4. GSA Role in ACT Standards

Most of the interaction with standards bodies during the procurement process involves referencing standards and determining compliance.

3.2.5. GSA Participation in Standards Development Organizations (SDOs)

ANSI, UL, ASTM, World Wide Web Consortium (W3C), Schema.org

3.2.6. GSA ACT focus areas

- Communications for Data Access and Sharing
- Security and Privacy
- Emerging Network Technologies
- Internet of Things

3.2.7. Examples of Standards Related Activities

- Ongoing & Planned Advanced Communications Programs
- Metadata standards for open data policies (e.g. DCAT-US)
- The Data.gov program in GSA TTS has supported technical implementation guidance for open data policies (See OMB Memorandum M-13-13 & Evidence Act, OMB Circular A-16 and Geospatial Data Act) including alignment of the metadata standard for agency-wide data inventories with the W3C DCAT specification and the Schema.org dataset schema. The current schema was finalized in 2014.
- Priorities: Update metadata schema requirements
- Updates to the DCAT-US metadata schema will be needed based on upcoming Evidence Act guidance. This is expected to be led by the CDO Council with input from OMB and GSA
- Collaborators: Data.gov (GSA TTS), OMB OFCIO, CDO Council
- Contribution (or relevance) to standards: Collaboration and alignment with W3C DCAT, European DCAT standards, Schema.org standards.
- Accomplishments: The Federal government was the largest publisher of the DCAT/Schema.org structured metadata on Google Dataset Search.
- Inventory and resources for data standards
- The Data.gov program in GSA TTS has supported initial efforts to inventory interoperable data standards and support related tools and best practices. This has been done through Evidence Act requirements and the Federal Data Strategy 2020 Action Plan (Action 11) with support from GSA 10x, OMB, and NARA
- Priorities: Long term operations, maintenance, and governance for inventory
- Ongoing management of the repository is awaiting new GSA staff hires and will involve collaboration with additional parties beyond GSA (below)
- Collaborators: Data.gov (GSA TTS), OMB OFCIO, NARA, CDO Council
- Contribution (or relevance) to standards: Inventory of data standards and related efforts
- Accomplishments: Initial launch of data standards inventory website, prototyping reusable data validation tool.

3.2.8. Additional Web Links:

- Telecommunications and Network Services

- DCAT-US Schema v1.1 (Project Open Data Metadata Schema)
- Resources.data.gov – standards
- United States Data Federation

3.3. National Aeronautics and Space Administration (NASA)

3.3.1. NASA Mission

NASA drives advances in science, technology, aeronautics, and space exploration to enhance knowledge, education, innovation, economic vitality and stewardship of Earth.

3.3.2. NASA Advanced Communications Technology (ACT) Goals

NASA's Space Communications and Navigation (SCaN) program office builds, operates, and maintains NASA's two primary communications networks – the Near Space Network and the Deep Space Network; investigates new communications and navigation technologies so that these networks can support advanced missions; and develops interoperability standards with other civil space agencies around the world via the Inter Agency Operations Advisory Group (IOAG) and the Consultative Committee for Space Data Systems (CCSDS).

3.3.3. NASA Role in ACT Standards

International Consultative Committee for Space Data Systems (CCSDS): 11 member agencies, 31 observer agencies representing 29 nations and 3 European organizations, 101 commercial associates. Interagency Operations Advisory Group (IOAG) with 8 international member agencies and 7 observer agencies. ISO TC20/SC13 (space data and information transfer systems) with representatives from 20 nations and comprising 6 technical areas with 23 teams.

3.3.4. NASA Participation in Standards Development Organizations (SDOs)

3GPP, CCSDS, IOAG, ISO

3.3.5. NASA ACT focus areas

- Commercial communications services
- 3GPP Non-terrestrial applications
- 4G/5G in the lunar environment
- Optical communications

3.3.6. Examples of Standards Activities

- Commercial communications services – Commercial SATCOM for space mission users; commercial providers in direct-to-Earth communications; enabling technology and standards including non-terrestrial networking (NTN), 5G for NTN
- CCSDS 883.0 1 (2022) to recommend interoperable LTE configurations for high data rate proximity wireless networks
- 3GPP mobile telecommunications standards for near-Earth and lunar surface communications
- Evolved Node B (eNB) – connecting terrestrial and satellite-based user equipment
- LunarLiTES: emulate and characterize LTE networks within NASA's lunar communications architecture
- 5G lunar surface to lunar relay satellite
- Lunar surface communications via 3GPP/5G, base stations and relay satellites for Non-Terrestrial Networking (NTN)
- Optical communications for near-Earth/Moon and deep space communications
    - LCRD – Laser Communications Relay Demonstration
    - TBIRD – Terabyte Infrared Delivery
    - O2O- Orion Artemis II Optical Communications system
    - DSOC – Deep Space Optical Communications, Gen-1 user terminal, optical hybrid antenna
    - CCSDS developing optical communication standards for optical on-off keying, high data throughput, high photon efficiency
- IOAG Working Groups
    - Spacecraft (S/C) Emergency Cross Support
    - Lunar Communications Architecture
    - Mars Communications Architecture
    - Sustainability of Operations in Space
    - Mission Operations Systems Strategy
    - Service Catalogue

3.4. National Institute of Standards and Technology (NIST)

3.4.1. NIST Mission

To promote U.S. innovation and industrial competitiveness by advancing measurement science, standards, and technology in ways that enhance economic security and improve our quality of life.

3.4.2. NIST Advanced Communications Technology (ACT) Goals

Measure, innovate, and lead to enable reliable, resilient, and secure communication networks of today and tomorrow, including advances in connectivity and interoperability for powerful solutions in manufacturing, public safety, and infrastructure.

3.4.3. NIST Role in ACT Standards

270+ technical research publications in advanced communications technologies since 2019

350+ NIST staff and associates in the Communications Technology Laboratory

50+ NIST experts serving in leadership roles in global ACT standards development activities of the following SDOs: 3GPP, IEEE, IETF, ITU, ORAN, ATIS, ISO-IEC/JTC1, FIDO Alliance, and WInnForum

180+ participants from 80+ industry, academia and government organizations led by NIST in the 5G mmWave Channel Model Alliance to enhance 5G performance and spectrum sharing and to provide coordinated input to inform U.S. positions on international standards

3.4.4. NIST Participation in Standards Development Organizations (SDOs)

3GPP, ANSI, ATIS, CTIA, IEC, IEEE, IETF/IRTF, INCITS, INCOSE, ISO, ITU, OEOSC, OMG, TIA, WInnForum, and others

3.4.5. NIST ACT focus areas

- Core network technologies, including next generation internet protocols and future internet architectures based on Information Centric Networking (ICN)
- Next generation wireless systems
- Public safety communications
- Communication and sensing networks for smart infrastructure and manufacturing
- Spectrum sharing and sensing
- Fundamental electromagnetic technologies and standards
- Networking and communications for cloud computing
- Cybersecurity and privacy for advanced communications technologies

3.4.6. Examples of Standards Activities

- **Core network technologies, including next generation internet protocols**
    - IETF: IPv6, Internet, IoT, Routing, Domain Name System, Operations/Management
    - IRTF Internet Research Task Force Information Centric Networking Research Group (ICNRG)
- **Next generation wireless systems**
    - 3GPP: Services, Security and Privacy, Physical Layer, Interface, Performance, Conformance

  - IEEE: 802.11, Propagation Modeling, Specialty Networks, mmWave, Channel Sounders
  - ITU: Propagation
  - CTIA: Reverb Chambers

- **Public safety communications**
  - 3GPP: Mission Critical Apps, Cryptography, Security, Privacy, Supply Chain, Cybersecurity Profiles, Testing, Specifications,
  - TIA: Broadband
  - ANSI: Coordination on Indoor Localization and Tracking (e.g. ISO/IEC 18305)

- **Communication and sensing networks for smart infrastructure and manufacturing**
  - OMG: Systems Engineering, Manufacturing, Quality, SysML, Analysis and Design
  - IEC: Medical Equipment (IEC 62)
  - ISO: Automation, Smart Manufacturing, Data, UUID, Visualization, Conformance, STEP Modelling, Digital Manufacturing,
  - ISO/IEC JTC1: IoT
  - INCOSE: Modelling & Simulation
  - INCITS: Sensor Networks
  - IEEE: Automated Driving, Smart Grid, Interoperability, Sensors
  - ANSI: US TAG to ISO/IEC JTC1/SC31: Identification & Data Capture
  - ITU-T: IoT
  - CTIA: IoT
  - RTCA: Avionics

- **Spectrum sharing and sensing**
  - IEEE: Machine Learning, Coexistence, Calibration & Measurements, EM Compatibility, Interference, Spectrum Etiquette, Terminology, Testing, Autonomous Systems, Frequency Allocation, Massive MIMO
  - ANSI: Coordination on Test Sites, Validation, Instrumentation (e.g. ISO 61000)
  - WInnForum: Spectrum Sharing, Sensors, 6 GHz
  - 3GPP: RAN, Systems and Architecture

- **Fundamental electromagnetic technologies and standards**
  - IEEE: Calibration, Signal Processing, Antennas, Waveform/Wave Propagation, Waveguides, Optics, Shielding, Industrial Wireless, EM Noise
  - IEC: Interference, Reverb Chambers, High Frequency, EM Disturbances

- **Networking and communications for cloud computing**
  - ISO/IEC JTC1: SC38 Cloud, Service Level Agreements Multi-cloud, Data Flows, Vocabulary & Concepts
  - IEEE: Interoperability, Portability, Intercloud, Profiles
  - INCITS: Distributed Platforms

- **Cybersecurity and privacy for advanced communications technologies**
  - IETF: Network Security
  - 3GPP: Cryptography, Security, Privacy, Supply Chain, Profiles

3.5. National Telecommunications and Information Administration (NTIA)

3.5.1. NTIA Mission

NTIA is the Executive Branch agency that is principally responsible for advising the President on telecommunications and information policy issues. NTIA's programs and policymaking focus largely on expanding broadband Internet access and adoption in America, expanding the use of spectrum by all users, and ensuring that the Internet remains an engine for continued innovation and economic growth.

3.5.2. NTIA Advanced Communications Technology (ACT) Goals

- Manage Federal use of spectrum and identifying additional spectrum for commercial use
- Administer grant programs that further the deployment and use of broadband and other technologies in America
- Develop policy on issues related to the Internet economy, including online privacy, copyright protection, cybersecurity, and the global free flow of information online
- Promote the stability and security of the Internet's domain name system through its participation on behalf of the U.S. government in ICANN (Internet Corporation for Assigned Names and Numbers) activities
- Perform cutting-edge telecommunications research and engineering with both Federal government and private sector partners

3.5.3. NTIA Role in ACT Standards

- Inform U.S. government telecom policies and agency operations
- Support the U.S. telecom industry and users
- Monitor and evaluate standards efforts for U.S. policy implications or relevance to current NTIA and U.S. government technical standards initiatives

3.5.4. NTIA Participation in Standards Development Organizations (SDOs)

3GPP, ATIS, ITU, WInnForum, IETF, IEEE, and others

3.5.5. NTIA Focus Areas

- Monitoring ACT standards development
- Promoting U.S. interests
- Promoting spectral efficiency
- Coordinating U.S. government involvement in 3GPP
- Supporting DoD 5G standards
- Development of public safety standards for LTE/5G
- Development of international propagation modeling standards through ITU-R

3.5.6. Examples of Standards Activities

- **Monitoring ACT Standards Development**
    - NTIA monitors and contributes to the development of standards in multiple SDOs, including 3GPP, ATIS, ITU, WInnForum, IETF, IEEE, RTCA, and others.
- **Promoting U.S. Interests**
    - NTIA leverages its standards participation to promote technical standards that are advantageous to U.S. industry, U.S. consumers, and/or U.S. government stakeholders.
    - NTIA actively supports SDOs in taking a private sector-led, government-supported approach to standards development.
- **Promoting Spectral Efficiency**
    - NTIA's Institute for Telecommunication Sciences (NTIA/ITS) led the development of the IEEE 802.15.22.3 standard for Spectrum Characterization and Occupancy Sensing (SCOS)
    - NTIA/ITS Propagation Modeling Program provides authoritative, validated propagation models and open-source implementations for SDOs (such as ITU-R). Examples include:
        - Reference implementation of ITU-R Rec P.528
        - Extended Hata (eHata) Urban Propagation Model used by WInnForum in CBRS (citizens broadband radio service) standards
    - NTIA's Office of Spectrum Management (NTIA/OSM) participates as a voting member of relevant Radio Technical Commission for Aeronautics (RTCA) Special Committees
    - NTIA coordinates, on behalf of the NSC, 3GPP standards activities amongst Federal agencies. This has led to better awareness across agencies in understanding individual priorities and areas for collaboration.
    - FirstNet and the NTIA/ITS provided critical work in enabling the adoption of public safety services standards.
- **Supporting DoD 5G Standards**
    - In collaboration with the DoD 5G Initiative, NTIA/ITS is:
        - Conducting the 5G Challenge to accelerate the adoption of 3GPP compliant open interfaces, interoperable subsystems, and modular, multi-vendor solutions
        - Providing subject matter expertise to support creation of a standards development strategy to ensure DOD equities are identified and represented in 3GPP.
- **Development of Public Safety Standards in LTE/5G**
    - The First Responder Network Authority (FirstNet), an independent authority under NTIA, takes an active role in promoting public safety communications standards in 3GPP. This includes private-sector collaboration with AT&T and

within government (with NIST Public Safety Communications Research Division and within NTIA)
- Proximity Services (ProSe) functionalities, including Mission-Critical Push-To-Talk (MCPTT), have been used as baselines for industry-led specifications to tackle other ACT issues (e.g., ProSe served as the baseline for developing Cellular V2X (C-V2X)).

- **Development of International Standards**
  - NTIA/OSM coordinates the Federal Government's participation in World Radiocommunications Conferences (WRC).
  - NTIA/ITS leads the U.S. Delegation to ITU-R Study Group 3 (Radio wave Propagation); SG3 is organized and run by NTIA/ITS, which holds 3 of the 4 U.S. Working Group Chairs.
  - NTIA's Office of International Affairs (NTIA/OIA) participates and holds leadership roles in ITU-T Study Groups 2, 3, 11, 13, and 17; and the Telecommunication Standardization Advisory Group (TSAG).

3.6. United States Agency for Global Media (USAGM)

3.6.1. USAGM Mission

To inform, engage & connect people around the world in support of freedom and democracy.

3.6.2. USAGM Advanced Communications Technology (ACT) Goals

TV and radio distribution transitioning from transport stream to IP stream delivery.

Transitioned first-hop distribution from satellite to internet.

The same technologies allow USAGM to improve its 24/7 global content monitoring capabilities.

Realigning transmission network to keep shortwave and mediumwave where valuable and allow for scaling back elsewhere

3.6.3. USAGM Role in Standards Activities

Monitors relevant standards development activities, including AI-enabled communications systems, to facilitate strategic planning and implementation in support of the agency's mission.

3.6.4. USAGM Participation in Standards Development Organizations (SDOs)

IEC, IEEE, IETF, ISO, ITU

3.6.5. USAGM Focus Areas

- Maximize program delivery agility
- Enhance strategic cooperation between networks
- Focus on key issues and audiences
- Improved accountability and impact measurement
- Target public/private partnerships on innovation and media reach

3.6.6. USAGM Radio Platforms

- USAGM broadcasts via Shortwave, Medium wave (AM), FM, TV (satellite + terrestrial)
- 67 automated receiver sites recording approximately 19,000 signal samples every day, allowing TSI to continuously refine and improve our cross-border radio signals.
- USAGM has over 100 FM sites globally, virtually all of them in Africa and the Middle East. In Iraq, USAGM covers all major population centers.
- FM radio remains a popular platform in many countries, particularly where streaming audio remains unavailable or prohibitively expensive. USAGM FMs allow audiences unfettered access to news and other programming affiliates may be unwilling to carry.
- Business Development - TSI's Office of Business Development manages the business relationships with media outlets worldwide that broadcast and share USAGM content.

3.7. United States Department of State

3.7.1. Department of State Mission

The U.S. Department of State leads America's foreign policy through diplomacy, advocacy, and assistance by advancing the interests of the American people, their safety and economic prosperity.

3.7.2. Department of State Advanced Communications Technology (ACT) Goals

The Division for International Communications and Information Policy (CIP) in the Bureau of Economic and Business Affairs (EB) enables a connected, innovative, and secure digital economy; promotes competitive and secure networks, including 5G; supports a multi-stakeholder approach to internet governance; contributes to international technical standards activities that promote an innovative digital economy and the trustworthy use of related emerging technologies; and encourages cross-border data flows in ways that protect privacy and personal data.

The Office of Multilateral Affairs (MA) in CIP works closely with industry and civil society to determine U.S. interests and lead U.S. delegations to multilateral meetings to advocate for fair and market friendly digital economy, telecommunications, and internet policies.

3.7.3. Department of State Role in ACT Standards

The Department of State has statutory authority as lead of U.S. engagement at the ITU. CIP leads senior level delegations to major ITU meetings and conferences. The Department of State convenes the International Digital Economy and Telecommunication Advisory Committee (IDET), which advises the Department of State with respect to digital economy, digital connectivity, economic aspects of emerging digital technologies, telecommunications, and communication and information policy matters, including those related to U.S. participation in the work of standards setting bodies.

3.7.4. Department of State Participation in Standards Development Organizations (SDOs)

ITU, WRC, CITEL, OECD, G7, G20, IGF, APEC-TEL

3.7.5. Department of State ACT focus areas

- Shape an enabling environment for innovation and ICT development in areas such as:
    - Wireless spectrum;
    - Treaties related to international telecommunications and activities related to cybersecurity, internet governance and emerging technology;
    - ICT Standards; and
    - Relationship building and engagement, including with developing countries.

3.7.6. Examples of Standards Activities

- March 2022: World Telecommunication Standardization Assembly (WTSA-20; Geneva; delayed from November 2022)
    - WTSA-20 goals:
        - An ITU-T that reflects U.S. goals and values for international standards (voluntary, consensus- based, market-relevant, private sector led and driven, timely, technology-neutral, robust and fit-for-purpose)
        - Focus on core ITU-T strengths
        - Enhance collaboration with ITU-D on standards capacity building
- June 2022: ITU World Telecommunication Development Conference 2021 (WTDC-21; delayed from Nov. 2021
    - WTDC-21 Goals:
        - Strengthened U.S. collaboration and relationships with developed and developing countries.
        - Increased global telecommunications/ICT connectivity, affordability, and digital skills; reduced digital divides.
        - Demonstrate U.S. leadership in connecting the unconnected.
        - Increased ITU-D focus on capacity building, creating enabling policy environments, developing spectrum management capacity, and efforts to encourage adoption of new technologies, business models and forms of

partnerships needed to connect the unconnected with affordable broadband services.
    - WTDC-21 as a vehicle or catalyst for delivering connectivity/ICT development partnerships that produce sustainable and effective solutions.
    - Increased value proposition for stakeholders to engage in a full range of Telecommunications Development Bureau (BDT) activities, especially from the Americas region.

- September 2022: The ITU Plenipotentiary Conference 2022 (PP-22; Bucharest, Romania)
- November 2023: The World Radiocommunication Conference 2023 (WRC-23; UAE)

3.8. United States Food and Drug Administration (FDA)

3.8.1. FDA Mission

The Food and Drug Administration is responsible for protecting the public health by ensuring the safety, efficacy, and security of human and veterinary drugs, biological products, and medical devices; and by ensuring the safety of our nation's food supply, cosmetics, and products that emit radiation. FDA is also responsible for regulating the manufacturing, marketing, and distribution of tobacco products; and advancing public health by helping to speed innovations that make medical products more effective, safer, and more affordable and by helping the public get accurate, science-based information. FDA has an important counterterrorism role in ensuring the security of the food supply and by fostering development of medical products to respond to deliberate and naturally emerging public health threats.

3.8.2. FDA Advanced Communications Technology (ACT) Goals

The Standards and Conformity Assessment Program (S-CAP) at the Center for Devices and Radiological Health (CDRH) supports the FDA's mission by driving the development, recognition, and appropriate use of voluntary consensus standards for medical devices, radiation-emitting products and emerging technologies. Conformity to relevant standards promotes efficiencies and quality in regulatory review. The S-CAP:

- Produces and implements clear policies to promote the appropriate use of standards in regulatory processes.
- Anticipates the need for and leads the development of national and international consensus standards.
- Advances initiatives to enhance confidence in conformity assessment activities.
- Fosters innovation and standardization in technologies that facilitate patient access to novel devices.
- Provides leadership in standards quality and utilization through outreach and global harmonization.

3.8.3. FDA's Role in Consensus Standards

- 816 FDA standards liaisons active in 1,006 SDO committees across FDA
- 436 CDRH standards liaisons across 550 SDO committees

3.8.4. FDA Participation in Standards Development Organizations (SDOs)

ISO, IEC, AAMI, ANSI, ASTM, IEEE, ASME, CLSI, NEMA, MITA, RESNA, ADA, CTA, INCITS HL7, etc.

3.8.5. FDA Focus Areas in ACT Standards

- Cybersecurity
- Medical Device Interoperability
- Wireless and Electromagnetic Compatibility (EMC)
- Artificial Intelligence

3.8.6. Examples of ACT Standards Activities

The listing below incudes examples of both standards activities and recognized standards. Recognition is the process whereby the FDA identifies standards to which manufacturers of medical devices may submit a declaration of conformity to demonstrate they have met relevant requirements in the Federal Food, Drug, and Cosmetic Act (FD&C Act). The FDA may recognize all, part, or none of a standard established by a national or international SDO.

- **Cybersecurity**
  - AAMI SM/WG05: Medical Device Security
  - UL STP 2900: Software Cybersecurity for Connectable Healthcare and Wellness Systems
  - IEEE: Healthcare Device Security Working Group
  - Recognized Standards
    - ISO/IEC 80001 series: Risk Management of Medical Devices on a Network
    - AAMI TIR57: Principles for Medical Device Security
    - IEC 62443 series: Security for Automation and Control Systems
    - UL 2900: Software Cybersecurity for Network-Connectable Products
- **Medical Device Interoperability**
  - IEEE 11073 WGs: Personal Health Device Communication, Point-of-care Medical Device Communication
  - AAMI Interoperability Working Group:
  - ISO TC215 WG2 Systems and Device Interoperability
  - Health Level 7
  - Recognized Standards
    - IEEE 11073 series: Personal Health Device Communication, Point-of-care Medical Device Communication

    - ANSI/AAMI/UL 28001-1: Safety for Medical Device Interoperability

- **Wireless and EMC**
    - ANSI C63 SC01 (EMC), 05 (Immunity), 07 (Coexistence), 08 (Medical Device EMC)
    - AAMI SM/WG06: Wireless Working Group
    - AAMI EMC Committee
    - IEC TC62/SC62A/MT23 Electromagnetic Compatibility
    - Recognized Standards
        - IEC 60601-1-2: Electromagnetic Disturbances – Requirements and Tests
        - ANSI/IEEE C63 series: Wireless Devices
        - AAMI TIR69: Risk Management of Radio-Frequency Wireless Coexistence for Medical Devices and Systems

- **Artificial Intelligence**
    - ISO/IEC JTC1/SC42: Artificial Intelligence
    - CTA R13 Committee: Artificial Intelligence
    - IMDRF AI for MD WG: International Medical Device Regulators Forum AI Working Group
    - IEEE AIMD WG: P2801, P2802 AI for Medical Devices
    - AAMI Committee on AI: Guidance and Standards for AI/ML in Medical Technology
    - Recognized Standards
        - AI standards under review for potential recognition

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3.9. United States Nuclear Regulatory Commission (NRC)

3.9.1. NRC Mission

NRC licenses and regulate the Nation's civilian use of radioactive materials to provide reasonable assurance of adequate protection of public health and safety, and to promote the common defense and security and to protect the environment.

3.9.2. NRC Advanced Communications Technology (ACT) Goals

NRC staff use-consensus standards developed by voluntary consensus standards bodies consistent with the provisions of Federal law: 1) National Technology Transfer and Advancement Act (1995) (Public Law 104-113) and 2) Nuclear Energy Innovation and Modernization Act (Public Law 115–439).

3.9.3. NRC's Role in ACT Standards

NRC works with domestic and international Standard Development Organizations (SDOs) to develop consensus standards associated with systems, equipment, or materials used by the nuclear industry.

NRC endorses standards and guidance through a process consisting of the following components:

Rulemaking
Regulatory Guides
Standard Review Plans
Other Documents
Conduct research related to ACT and standards

3.9.4. NRC Participation in Standards Development Organizations (SDOs)

Approximately 200 staff members participate in over 150 standards development committees serving on multiple SDOs, including IEEE. ANS, IEC, and ASME amongst others. NRC staff use voluntary consensus standards from these and other SDOs as an integral part of our regulatory framework. Additional information is available at: https://www.nrc.gov/about-nrc/regulatory/standards-dev.html

3.9.5. NRC ACT focus areas

- Cyber Security
- IoT
- Drones/UAS/Automated Vehicles
- Interoperability Between Different CT and Levels of Importance
- Continuity of Operations Due to External Events
  - Space Weather Impacts
  - EMP
  - Hurricanes/Tornadoes

Appendix A. Advanced Communications Technologies Working Group Charter

Establishment

The Advanced Communications Technologies Working Group (herein after referred to as the "ACTWG" or "Working Group") is established under the provisions of the charter of the Interagency Committee on Standards Policy (ICSP). The ICSP advises the Secretary of Commerce and the heads of other Federal agencies in matters relating to the implementation of OMB Circular A-119 and reports to the Secretary of Commerce through the Director of the National Institute of Standards and Technology (NIST).

Purpose

The objective of the ACTWG is to facilitate coordination of Federal agency advanced communications technologies (ACT) standards activities, respond to requests for information, and develop recommendations relating to ACT standards policy matters to the ICSP. The ACTWG reports to the Chair of the ICSP and advises the members of the ICSP on relevant issues.

Functions

The ACTWG is responsible for:

- Assisting the ICSP in promoting effective and consistent Federal policies in advanced communications technologies standards.
- Providing an annual report to the ICSP on the current ACT standards activities of participating Federal agencies and recommendations for strategic directions in Federal ACT standards efforts.
- Responding to requests for information and advising the ICSP on effective means of coordinating advanced communications technologies standards activities with those of the private sector.
- Sharing best practices in advanced communications technologies standards among Federal agencies.
- Coordinating Federal advanced communications technologies standards interests across application areas such as transportation, energy, public safety, and others.

Organization

Participants include Federal agency representatives with expertise relevant to standards in advanced communications technologies. Each participating Federal entity will identify one voting member to represent the entity. The ACTWG co-chairs comprise one NIST staff member designated by the ICSP Chair and serving as secretariat, along with other co-chairs as elected by majority vote of the ACTWG members present. The Working Group will follow a similar meeting schedule as the ICSP and will meet at least three times each year. Other meetings may be called at the discretion of the co-chairs.

Approval and Renewal

Approved by the ICSP 25 May 2021. This charter expires three years after the date of approval unless renewed by the ICSP.

Appendix B. Glossary

3GPP	3rd Generation Partnership Project
5G	5th generation mobile network
AAMI	Association for Advancement of Medical Instrumentation
ACT	Advanced communications technologies
ACTWG	Advanced Communications Technologies Working Group
ADA	American Dental Association
ANS	American Nuclear Society
ANSI	American National Standards Institute
APEC-TEL	Asia-Pacific Economic Cooperation Telecommunications Working Group
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	ASTM International, formerly American Society for Testing and Materials
ATIS	Alliance for Telecommunications Industry Solutions
AWS	American Welding Society
CCSDS	Consultative Committee for Space Data Systems
CDC	Centers for Disease Control and Prevention
CITEL	Inter-American Telecommunication Commission (OAS)
CLSI	Clinical and Laboratory Standards Institute
CT	Communications Technology
CTA	Consumer Technology Association
CTIA	U.S. Wireless Industry Assoc., formerly Cellular Telecommunications Industry Assoc.
DHS	Department of Homeland Security
DoD	Department of Defense
DODCIOC3	Department of Defense Chief Information Officer Command, Control, Communications
DOE	Department of Energy
DOT	Department of Transportation
EM	Electromagnetic
EMC	Electromagnetic compatibility
EMP	Electromagnetic pulse
EPA	Environmental Protection Agency

FDA	Food and Drug Administration
GSA	General Services Administration
G7	Group of Seven Inter-governmental Forum
G20	Group of Twenty Intergovernmental Forum
GSA	General Services Administration
HL7	Health Level Seven International
IAEA	International Atomic Energy Agency
ICANN	Internet Corporation for Assigned Names and Numbers
ICRP	International Commission on Radiological Protection
ICSP	Interagency Committee on Standards Policy
ICT	Information and Communications Technology
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IEEE-SA	IEEE Standards Association
IETF	Internet Engineering Task Force
IGF	Internet Governance Forum
IHE	Integrating the Healthcare Enterprise
IMDRF	International Medical Device Regulators Forum
INCITS	International Committee for Information Technology Standards
INCOSE	International Council on Systems Engineering
IOAG	Interagency Operations Advisory Group
IoT	Internet of Things
IRTF	Internet Research Task Force
ISA	International Society of Automation
ISO	International Organization for Standardization
ISO/IEC JTC1	Joint technical committee on information technology for ISO and IEC
ITU	International Telecommunication Union
ITU-R ITU	Radiocommunications Sector, formerly CCIR
ITU-T ITU	Telecommunications Sector, formerly CCITT
ITU-D ITU	Telecom Development, formerly known as BDT
LTE	Long Term Evolution, wireless communications standard
MITA	Medical Imaging and Technology Alliance
NASA	National Aeronautics and Space Administration

NCRP	National Council on Radiation Protection and Measurements
NEI	Nuclear Energy Institute
NEMA	National Electrical Manufacturers Association
NIH	National Institutes of Health
NIST	National Institute of Standards and Technology
NRC	Nuclear Regulatory Commission
NTIA	National Telecommunications and Information Administration
OECD	Organization for Economic Cooperation and Development
OneM2M	Machine (M2M) and IoT Communications Partnership Initiative
O-RAN Alliance	Open Radio Access Network Alliance
RESNA	Rehabilitation Engineering and Assistive Technology Society of North America
Schema.org	Community-based Schema/Data Vocabularies Project
USAGM	U.S. Agency for Global Media
W3C	World Wide Web Consortium
WRC	World Radio Communications Conferences (ITU)

Appendix C. Participating Agencies and Offices

Agencies/Offices Contributing to this Report

- Department of Defense, Office of the Chief Information Officer (DoD CIO)
- General Services Administration (GSA)
- National Aeronautics and Space Administration (NASA)
- National Institute of Standards and Technology (NIST)
- National Telecommunications and Information Administration (NTIA)
- United States Agency for Global Media (USAGM)
- United States Department of State
- United States Food and Drug Administration (FDA)
- United States Nuclear Regulatory Commission (NRC)

Agencies/Offices Participating in the Advanced Communications Technologies Working Group

- Defense Information Systems Agency (DISA)
- Department of Defense, Office of the Chief Information Officer (DoD CIO)
- Department of Defense, Office of the Undersecretary of Defense R&E (OUSD/R&E)
- General Services Administration (GSA)
- National Aeronautics and Space Administration (NASA)
- National Institute of Occupational Safety and Health (NIOSH)
- National Institute of Standards and Technology (NIST)
- National Telecommunications and Information Administration (NTIA)
- United States Agency for Global Media (USAGM)
- United States Air Force (AFLCMC/HNAG/EZAC, AFMC)
- United States Army (STRI, DEVCOM, C5ISR, AMC, LDAC
- United States Department of State
- United States Department of Transportation (USDOT)
- United States Environmental Protection Agency (EPA)
- United States Food and Drug Administration (FDA)
- United States Navy (Navy)
- United States Nuclear Regulatory Commission (NRC)
- United States Trade Representative (USTR)