

**U.S. LEADERSHIP IN AI:  
A PLAN FOR FEDERAL ENGAGEMENT IN  
DEVELOPING TECHNICAL STANDARDS  
AND RELATED TOOLS**

**DRAFT FOR PUBLIC COMMENT**

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**EXECUTIVE SUMMARY**

23

[TO BE ADDED]

24 **1 STANDARDS AND ARTIFICIAL INTELLIGENCE**

25 **(A) WHY IS A PLAN FOR FEDERAL ENGAGEMENT IN AI TECHNICAL STANDARDS IS NEEDED?**

26 Emphasizing the importance of artificial intelligence (AI) to the future of the U.S. economy and  
27 national security, on February 11, 2019, the President issued an Executive Order (EO 13859)<sup>1</sup>  
28 directing Federal agencies to take a variety of steps designed to ensure that the nation maintains its  
29 leadership position in AI.

30 Among its objectives, the EO aims to “Ensure that technical standards...reflect Federal priorities  
31 for innovation, public trust, and public confidence in systems that use AI technologies...and  
32 develop international standards to promote and protect those priorities.” The EO also states that the  
33 United States must drive development of appropriate technical standards in order to enable the  
34 creation of new AI-related industries and the adoption of AI by today’s industries. Technical  
35 standards will provide agreed upon language and frameworks that underpin the development and  
36 deployment of technological innovations. With the goal of fulfilling their missions more effectively  
37 and efficiently, Federal agencies are major players in developing and using AI technologies<sup>2</sup>  
38 Likewise, these agencies should be directly engaged in prioritizing and developing AI technical  
39 standards.

40 The order directs the Secretary of Commerce, through the National Institute of Standards and  
41 Technology (NIST), to issue “a plan for Federal engagement in the development of technical  
42 standards and related tools in support of reliable, robust, and trustworthy systems that use AI  
43 technologies.”

44 This plan provides guidance for bolstering Federal agencies’ engagement in AI technical standards  
45 to promote continued U.S. leadership in AI. It focuses on the Federal government’s role in  
46 advancing AI standards and priorities for research that support development of technically sound  
47 and fit for purpose standards.

48 *Note: While definitions of AI vary<sup>3</sup>, for purposes of this plan AI technologies and systems are  
49 considered to comprise of software and/or hardware that can learn to solve complex problems,  
50 make predictions or undertake tasks that require human-like sensing (such as vision, speech, and  
51 touch), perception, cognition, planning, learning, communication, or physical action. Examples  
52 are wide-ranging and expanding rapidly. They include, but are not limited to, AI assistants,  
53 computer vision systems, biomedical research, unmanned vehicle systems, advanced game-playing  
54 software, facial recognition systems as well as application of AI in both Information Technology  
55 (IT) and Operational Technology (OT).*

56 **AI and Trustworthiness**

57 Increasing trust in AI technologies is a key element in accelerating their adoption for  
58 economic growth and future innovations that can benefit society. Today, the ability to

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<sup>1</sup> Maintaining American Leadership in Artificial Intelligence <https://www.govinfo.gov/content/pkg/FR-2019-02-14/pdf/2019-02544.pdf>

<sup>2</sup> <https://www.whitehouse.gov/ai/ai-american-values/>

<sup>3</sup> For selected definitions, see Appendix I, Definitions.

59 understand and analyze the decisions of AI systems and measure their trustworthiness is  
60 limited. AI standards and related tools, along with AI risk management strategies, can  
61 help to address this limitation and spur innovation.

62 Among the characteristics that relate to trustworthy AI technologies are accuracy,  
63 reliability, robustness, security, explainability, safety, and privacy – but there still is  
64 much discussion about the range of characteristics that determine AI systems’  
65 trustworthiness. Ideally, these aspects of AI should be considered early on in the design  
66 process and tested during the development and use of AI technologies.

## 67 (B) WHAT ARE TECHNICAL STANDARDS AND WHY ARE THEY IMPORTANT?

68 For the purpose of this Plan “technical standards” refer to “documentary” standards. ISO/IEC  
69 Guide 2:2004 Standardization and related activities – General vocabulary<sup>4</sup> defines such a standard  
70 as “a document, established by consensus and approved by a recognized body, that provides for  
71 common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at  
72 the achievement of the optimum degree of order in a given context.” This plan refers to these as  
73 “standards.”

74 Widespread use of standards facilitates technology advancement by defining and establishing  
75 common foundations for product differentiation, technological innovation, and other value-added  
76 services. Standards also promote an expanded, more interoperable and efficient marketplace. AI  
77 standards that articulate requirements, specifications, guidelines, or characteristics can help to  
78 ensure that AI technologies and systems meet critical objectives for functionality, interoperability,  
79 and trustworthiness, and perform accurately, reliably and safely.

80 In contrast, standards that are not fit-for-purpose, are not available when needed, or that are  
81 designed around less than ideal technological solutions may hamper innovation and constrain the  
82 effective or timely development and deployment of trustworthy AI technologies.

## 83 (C) HOW ARE TECHNICAL STANDARDS DEVELOPED?

84 The standards development approaches followed in the United States rely largely on the private  
85 sector to develop voluntary consensus standards, with Federal agencies contributing to and using  
86 these standards. Typically, the Federal role includes providing agency requirements for standards  
87 projects, contributing technical expertise to standards development, incorporating voluntary  
88 standards into policies and regulations, and citing standards in agency procurements. This use of  
89 voluntary consensus standards that are open to contributions from multiple parties, especially the  
90 private sector, is consistent with our market-driven economy and has been endorsed in Federal  
91 statute and policy. (See “Maximizing Use of the Voluntary Consensus Standards Process” on Page  
92 12).

93 Some governments play a more centrally managed role in standards development-related activities  
94 – and they use standards to support domestic industrial and innovation policy, sometimes at the

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<sup>4</sup> <https://www.iso.org/standard/39976.html>

95 expense of a competitive, open marketplace. This merits special attention to ensure that U.S.  
96 standards-related priorities and interests, including those related to advancing trustworthy AI  
97 systems, are not impeded.

98 The timing of standards development can greatly influence the state of technologies. Standards  
99 development has to occur at the right time; premature efforts can result in standards that do not  
100 reflect the state of technology or may not be supported by a critical mass of technological  
101 understanding. This can yield standards that are not fit-for-purpose and it can have an adverse  
102 impact on innovation. Alternatively, development efforts timed too late may deliver standards that  
103 cannot gain market acceptance due to the built-up infrastructure and market-power exerted by  
104 incumbent technologies, which will also hinder innovation. Regular review and update is also a key  
105 element of the process to ensure that standards reflect technological innovations and take into  
106 account changing economic and societal systems.

107 The development of standards for IT is integral to AI technologies and systems. IT encompasses all  
108 technologies for the capture, storage, retrieval, processing, display, representation, security, privacy  
109 and interchange of data and information. Worldwide, there are multiple Standards Development  
110 Organizations (SDOs) developing IT standards using different models to address different  
111 standardization needs. The rapid innovation in IT has been accompanied by competition among  
112 SDOs in areas of market relevance (e.g., cloud computing, cybersecurity, Internet of Things). This  
113 has encouraged SDOs to streamline their consensus-building processes to develop and approve  
114 timely, technically sound standards that meet current market needs.

115 Broadly, IT standards can address cross-sector or sector-specific needs. *Horizontal* IT standards  
116 can be used across many applications and industries. Standards developed for specific applications  
117 areas such as healthcare or transportation are *vertical* standards. Developers of horizontal standards  
118 often seek to establish collaborative working relationships (e.g., liaisons) with sector-specific  
119 (vertical) standards developers. These liaisons foster cooperation, establish or reinforce boundaries,  
120 and help to ensure that horizontal standards are relevant to other IT standardization efforts and vice  
121 versa.

#### 122 (D) WHAT AI TECHNICAL STANDARDS ARE NEEDED?

123 Systems using AI technologies are generally systems of systems, and AI standards should take this  
124 into account. AI standards encompass those specific to AI applications as well as standards for  
125 parts of an AI-driven system – and *both types of standards are needed*.

##### 126 **One Perspective on AI Technical Standards**

127 The Center for Data Innovation describes AI standards this way:

128 “Technical standards for AI can encompass a wide variety of issues, including safety,  
129 accuracy, usability, interoperability, security, reliability, data, and even  
130 ethics...Flexible, robust, common technical standards for AI will be critical to the  
131 successful development and deployment of the technology for two key reasons.

132 First, technical standards can provide developers clear guidelines for the design of AI  
133 systems to ensure that they can be easily integrated with other technologies, utilize best

134 practices for cybersecurity and safety, and adhere to a variety of different technical  
135 specifications that maximize their utility.

136 Second, common standards can serve as a mechanism to evaluate and compare AI  
137 systems. For example, in some contexts, there may be a legal requirement for  
138 transparency for a decision-making process, such as judicial decision-making. However,  
139 without clear standards defining what algorithmic transparency actually is and how to  
140 measure it, it can be prohibitively difficult to objectively evaluate whether a particular  
141 AI system meets these requirements or expectations, or does so better than another  
142 similar system, which discourages the adoption of these technologies. For this reason, in  
143 many cases technical standards will be a key component of determining whether an AI  
144 system is appropriate for use in a particular context.”<sup>5</sup>

145  
146 A growing number of cross-sector (horizontal) and sector-specific (vertical) AI standards exist  
147 and many others are being developed by numerous SDOs.<sup>6</sup> These SDOs have liaison  
148 relationships in place to facilitate information exchange and collaboration on standards  
149 development. Some areas, such as communications, have well established and regularly  
150 maintained standards in widespread use. Other aspects, such as trustworthiness, are only now  
151 being considered, if at all.

152 Table 1 and Table 2 capture the present state of AI-relevant standardization based on  
153 stakeholder input from the NIST Request for Information, the NIST AI Standards Workshop,  
154 and other stakeholder interactions. It is important to recognize that these tables reflect high-  
155 level point-in-time snapshots of the AI related standards development efforts. Additionally,  
156 areas of standards listed are not mutually exclusive. Often, guidance and requirements in one  
157 standard are referenced in others. And lastly, even where standards are noted as available, each  
158 area could need additional standards to keep pace with and advance AI technologies, and their  
159 widespread use in a trustworthy manner.

160 While each category in Table 1 is important and some standards efforts are being undertaken in  
161 all areas, some are more primed for standards development than others. These include  
162 standards for concepts and terminology, data, human interaction, metrics, networking,  
163 performance testing and reporting methodology, as well as standards targeted to specific  
164 vertical domains. Standardization of AI safety, risk management, and some aspects of  
165 trustworthiness such as explainability or security, are at formative stages and especially would  
166 benefit from research to provide a strong technical basis for development. By defining common  
167 vocabularies, establishing the essential characteristics of trustworthy AI technologies, and  
168 identifying the best practice within the life cycle of an AI system, these standards can  
169 accelerate the pace of innovation. Similarly, human interaction and performance testing  
170 standards spur innovation by establishing the ‘rules of the game’ and forming a baseline from  
171 which new technologies emerge.

172  
<sup>5</sup> <https://www.nist.gov/sites/default/files/documents/2019/05/10/nist-ai-rfi-ctr-for-data-innovation-001.pdf>

<sup>6</sup> See Appendix II for a list of SDOs that are developing AI standards.

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Table 1. Technical Standards Related to AI Based on Stakeholder Input

AI Standards	Available	Being Developed
Concepts and Terminology		★
Data <sup>7</sup> and Knowledge <sup>8</sup>	★	★
Human Interaction	★	★
Metrics	★	★
Networking	★	★
Performance Testing and Reporting Methodology <sup>9</sup>	★	★
Safety	★	★
Risk Management	★	★
Trustworthiness <sup>10</sup>		★

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Input to development of this Federal engagement plan suggests that it is important for those participating in AI standards development to be cognizant of, and to act consistently with, policies and principles set by public and private entities such as those mentioned in Section 1(F). Table 2 lists AI-related standards activities that may inform risk management and policy decisions.

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Table 2. Additional AI-related Standards to Inform Policy Decisions, Based on Stakeholder Input

AI Standards	Available	Being Developed
Societal and Ethical <sup>11</sup> considerations		★
Governance <sup>12</sup>		★
Privacy <sup>13</sup>	★	★

180

**(E) WHAT AI STANDARDS-RELATED TOOLS ARE NEEDED?**

<sup>7</sup> Data standards include guidance and requirements for: big data analytics; data exchange; data quality; and data privacy.

<sup>8</sup> Knowledge standards include standards for knowledge representation and querying, such as the W3C Web Ontology Language (OWL) and the ISO Common Logic language (ISO/IEC 24707:2007), as well as standard ontologies formulated in such languages.

<sup>9</sup> Performance Testing and Reporting Methodology standards include testing guidance and requirements at the technology, prototype, and AI operational system levels.

<sup>10</sup> Trustworthiness standards include guidance and requirements for: accuracy; explainability; resiliency; safety; security; and reliability. Aspects of trustworthiness also intersect with, and are addressed in, additional areas displayed in this table.

<sup>11</sup> Societal and ethical considerations in IT consists of the analysis of the nature and social impact of IT and the corresponding formulation and justification of policies for the appropriate use of such technology. Examples include IEEE P7000 - Model Process for Addressing Ethical Concerns During System Design.

<sup>12</sup> Governance of IT, for instance, can be defined as consisting of the principles to assist organizations to understand and effectively fulfill their legal, regulatory, and ethical obligations to their use of IT. Governance of IT is a component of organizational governance. An example of a standard is ISO/IEC 38500:2015 Information technology — Governance of IT for the organization.

<sup>13</sup> Privacy standards may or may not be specific to AI. They can encompass IT-related issues and operations and also may be much broader with a focus on an organization’s overall approach to consider potential problems individuals could experience arising from system, product, or service operations with data. For example, see the [IEEE P7000™](#) series of standards under development, including P7002 - Data Privacy Process.



Standards must be complemented by an array of related tools to advance the development and adoption of effective, trustworthy AI technologies. These tools – which often have overlapping applications – include, but are not limited to<sup>14</sup>:

- ***Data standards and data sets in standardized formats, including metadata*** for training, validation and testing of AI systems. Data standards are vital in measuring and sharing information about the quality, utility and access of data sets, preserving privacy, assisting potential users in making informed decisions about the data’s applicability to their purpose and helping prevent misuse.
- ***Tools for capturing and reasoning with knowledge in AI systems*** to promote consistent formulation of, reasoning with, and sharing of knowledge, thereby promoting interoperability of AI systems and minimizing their misunderstandings and inferential errors.
- ***Fully documented use cases*** that provide a range of data and information about specific applications of AI technologies and any standards or best practice guides utilized in making decisions about deployment of these applications. For these use cases to be of real value, they must be accompanied by explicit information about the parameters of use.
- ***Testing methodologies*** to validate and evaluate AI technologies’ performance, especially to prescribe protocols and procedures. These tools are needed for specifying, assessing, comparing, and managing the performance and trustworthiness of AI technologies. Among other things, applications include testing for conformance, interoperability, and comparing AI systems to human performance.
- ***Metrics*** to define quantifiable measures to characterize AI technologies, including but not limited to aspects of hardware and its performance (at device, circuit, and system levels) and trustworthiness (e.g., accuracy, reliability, robustness, security, explainability, safety, and privacy), complexity, risk, uncertainty, and economic impact.
- ***Benchmarks and evaluations*** such as challenge problems to drive innovation by promoting advancements aimed at addressing strategically selected scenarios; they also provide objective data to validate and track the evolution of AI technologies.
- ***AI testbeds*** “so that researchers can use actual operational data to model and run experiments on real-world system[s] ... and scenarios in good test environments.”<sup>15</sup>
- ***Tools for accountability and auditing*** to enable examination of an AI system’s output (e.g., decision-making or prediction), including traceability, to provide a record of events such as their implementation, testing, and completion.

### HELP WANTED: Data Standards and Data Sets

<sup>14</sup> Text for several of the needed tools described in this section stems from discussions among member agencies of the National Science and Technology Council (NSTC) Machine Learning/Artificial Intelligence (ML/AI) Subcommittee.

<sup>15</sup> SRI International and USC Information Sciences Institute, “Cybersecurity Experimentation of the Future (CEF): Catalyzing a New Generation of Experimental Cybersecurity Research”, Final Report, July 31, 2015

214 Data standards make the training data needed for machine learning applications more  
215 visible and more usable to all authorized users. Descriptions of data that define  
216 authorized use are important elements of data standards. These attributes include but are  
217 not limited to: Federal government security classification, the presence of law  
218 enforcement sensitive data, proprietary data, acquisition-sensitive data, personally  
219 identifiable information (to include biographic, biometric and contextual data for  
220 individuals), Freedom of Information Act (FOIA) exemptions, and even fees that might  
221 be required for data access. This information can help potential users to rapidly evaluate  
222 the value and utility of the data before investing time seeking access.

### 224 **Examples of AI Benchmark Programs**

225 One successful example of a high-impact, community-based, AI-relevant benchmark  
226 program is the Text Retrieval Conference (TREC),<sup>16</sup> started by NIST in 1992 to provide  
227 the infrastructure necessary for large-scale evaluation of information retrieval  
228 methodologies. More than 250 groups have participated in TREC, including academic  
229 and commercial organizations both large and small. The standardized, widely available,  
230 and carefully constructed set of data put forth by TREC has been credited with  
231 revitalizing research on information retrieval.<sup>17</sup>

232 NIST also developed a comprehensive set of standard test methods and associated  
233 performance metrics to assess key capabilities of emergency response robots, including  
234 ground and aerial vehicles. The objective is to facilitate quantitative comparisons of  
235 different robot models by capturing data on robot capabilities using standard test  
236 methods. These comparisons guide purchasing decisions and help developers to  
237 understand the robots' capabilities. Resulting test methods are being standardized  
238 through the ASTM International Standards Committee on Homeland Security  
239 Applications for robotic operational equipment. Versions of the test methods are used to  
240 challenge the research community through the RoboCup Rescue Robot League  
241 competitions,<sup>18</sup> which emphasize autonomous capabilities such as mapping and  
242 navigation in unknown environments with difficult terrains.

243 Another example is the Agile Robotics for Industrial Automation Competition  
244 (ARIAC),<sup>19</sup> which is a joint competition sponsored by NIST and the Open Source  
245 Robotics Foundation. This competition promotes robot agility using the latest advances  
246 in AI. A core focus is to test the agility of industrial robot systems, with the goal of  
247 enabling them to be more productive and autonomous.

248 While these efforts provide a strong foundation for driving AI evaluations forward, they  
249 are limited by being domain-specific. Additional metrics, testing requirements, testbeds,

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<sup>16</sup> <http://trec.nist.gov>.

<sup>17</sup> E. M. Voorhees and D. K. Harman, TREC Experiment and Evaluation in Information Retrieval (Cambridge: MIT Press, 2005), Economic Impact Assessment of NIST's Text REtrieval Conference (TREC) Program, July 2010, Brent R. Rowe, Dallas W. Wood, Albert N. Link, Diglio A. Simoni, RTI International, <https://trec.nist.gov/pubs/2010.economic.impact.pdf>

<sup>18</sup> <https://www.robocup.org>

<sup>19</sup> <http://www.nist.gov/ariac>.

250 and benchmarks are needed across a broader range of domains to ensure that AI  
251 solutions are broadly applicable and widely adopted.

## 252 (F) WHAT ARE OTHER IMPORTANT CONSIDERATIONS?

253 Like several other pioneering areas of science and technology, the development of AI raises a host  
254 of legal, ethical, and societal issues which create real and perceived challenges for developers,  
255 policy makers, and users, including the general public. These are matters appropriate for  
256 consideration in the policy realm, often captured as overarching or narrow principles to be applied  
257 in the development and deployment of AI technologies and systems. Standards are one tool for  
258 implementing or informing policies and principles related to such issues.

259 Public input on this Federal engagement plan has highlighted the importance of establishing  
260 aspirational principles and goals in developing AI standards – along with the associated need to be  
261 mindful of the current state of the practice and its limitations. Principles to guide AI are being  
262 forged by multiple organizations, including the Organisation for Economic Cooperation and  
263 Development (OECD), whose member countries recently adopted those principles.<sup>20</sup>

264 While stakeholders in the development of this plan expressed broad agreement that societal and  
265 ethical considerations must factor into AI standards, it is not clear how that should be done and  
266 whether there is yet sufficient scientific and technical basis to develop those standards. Two areas  
267 where there appears to be some consensus are:

- 268 • The degree to which ethical considerations might be incorporated into standards should be tied  
269 tightly to the degree of risk to humans, and
- 270 • Privacy considerations should be included in any standards governing the collection,  
271 processing, sharing, storage, and disposal of personal information.

272 Legal, ethical, and societal considerations also can come into play as developers and policy makers  
273 consider whether and how to factor in the management of risk. Some standards and standards-  
274 related tools aim to provide guidance for evaluating risk that can be used by developers and policy  
275 makers in considering how to manage risk. Ultimately, it is up to system owners to determine what  
276 risks they are willing to accept, mitigate, or avoid.

## 277 2 U.S. GOVERNMENT AI STANDARDS PRIORITIES

### 278 (A) PRIORITIES FOR FEDERAL GOVERNMENT INVOLVEMENT

#### 279 WHICH STANDARDS DEVELOPMENT EFFORTS MERIT FEDERAL ENGAGEMENT?

280 In deciding which standards efforts merit strong Federal government involvement, U.S.  
281 government agencies should prioritize AI standards efforts that are:

- 282 • ***Inclusive and accessible***, to encourage input reflecting diverse communities of users and  
283 developers, vendors, and experts representing technical disciplines as well as non-traditional

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<sup>20</sup> <https://www.oecd.org/going-digital/ai/principles/>

284 disciplines of special importance to AI such as ethicists, economists, legal professionals, and  
285 policy makers: essentially, accommodating all desiring a “seat at the table,” regardless of  
286 resources.

- 287 • **Open and transparent**, operating in a manner that: provides opportunity for participation by all  
288 directly and materially affected persons, has well-established and readily accessible operating  
289 rules, procedures and policies that provide certainty about decision making processes, allows  
290 timely feedback for further consideration of the standard, and ensures prompt availability of the  
291 standard upon adoption.
- 292 • **Multi-channel**, developed through traditional and novel standards-setting approaches and  
293 organizations that best meet the needs of developers and users in the marketplace as well as  
294 society at large. (See text box.)
- 295 • **Consensus-based**, where decision-making is based upon clearly established terms or  
296 agreements that are understood by all involved parties and are used consistently in the  
297 standards development process.
- 298 • **Globally relevant and non-discriminatory** to all stakeholders, regardless of their degree of  
299 involvement in the standards-development process (e.g., avoid standards becoming non-tariff  
300 trade barriers or locking in particular technologies or products).

#### 301 **Maximizing Use of the Voluntary Consensus Standards Process**

302 Current and potential future Federal agency engagement in the development and use of  
303 AI technical standards and related tools should meet agency requirements and support  
304 the Nation’s broader needs. OMB Circular A-119: Federal Participation in the  
305 Development and Use of Voluntary Consensus Standards and in Conformity  
306 Assessment Activities<sup>21</sup>, highlights several Federal government goals for participation  
307 and use of voluntary standards:

308 “Many voluntary consensus standards are appropriate or adaptable for the Federal  
309 government's purposes. The use of such standards, whenever practicable and  
310 appropriate, is intended to achieve the following goals:

- 311 (i) eliminating the cost to the Federal government of developing its own  
312 standards and decreasing the cost of goods procured and the burden of  
313 complying with agency regulation;
- 314 (ii) providing incentives and opportunities to establish standards that serve  
315 national needs, encouraging long-term growth for U.S. enterprises and  
316 promoting efficiency, economic competition, and trade; and
- 317 (iii) furthering the reliance upon private sector expertise to supply the Federal  
318 government with cost-efficient goods and services.”

319 Other relevant statutes and policies include The National Technology Transfer and  
320 Advancement Act of 1995 (Public Law 104-113, 1996) (NTTAA) and the World Trade  
321 Organization Technical Barriers to Trade Agreement (WTO TBT).

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<sup>21</sup> (A-119, *Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities*, is available at [https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A119/revised\\_circular\\_a-119\\_as\\_of\\_1\\_22.pdf](https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/circulars/A119/revised_circular_a-119_as_of_1_22.pdf))

**Wanted: Nimble, Multi-Channel Standards Development**

“There is a need for stability (provided by the arena of formal standards bodies), coping with rapid change (provided by consortia and alliances), specific intellectual property and marketing environments, and the need for robust community involvement (provided by Open Source). To tackle the vast emerging standardization needs for AI and AI systems, the groups within each arena need to more effectively work together to create standards of the highest quality, through open systems and open standardization processes that effectively contribute to the public good”(IEEE response to RFI: [www.nist.gov/sites/default/files/documents/2019/05/28/nist-ai-rfi-ieee\\_001.pdf](http://www.nist.gov/sites/default/files/documents/2019/05/28/nist-ai-rfi-ieee_001.pdf))

“Standardization processes must be sufficiently nimble to effectively address the development and commercial application of rapidly evolving technologies such as AI, and they must be open to addressing ethically aligned design concepts from the onset.” (IEEE RFI response [www.nist.gov/sites/default/files/documents/2019/05/28/nist-ai-rfi-ieee\\_001.pdf](http://www.nist.gov/sites/default/files/documents/2019/05/28/nist-ai-rfi-ieee_001.pdf))

**WHICH STANDARDS CHARACTERISTICS ARE IMPORTANT?**

There are a variety of characteristics related to AI standards that deserve priority Federal government consideration, including:

- ***Innovation-oriented*** to keep pace with rapid technology changes, including maximum flexibility, technology and platform neutral, and a preference for performance-based – versus prescriptive – requirements to accommodate varied approaches in meeting the standard’s provisions.
- ***Applicable across sectors (horizontal)*** to allow for wide-scale deployments in multiple areas of industry, government, and society.
- ***Focused on particular sectors and applications (vertical)***, especially where there are specific risks and impacts.
- ***Clearly stated provenance and intended use or design (“intent of design”)*** to allow users to decide whether an AI system appropriate for an intended application is appropriate for other applications due to the data or algorithms used, or the level of risk deemed acceptable.
- ***Address the need to monitor and manage AI systems*** throughout the entire product lifecycle.
- ***Reflective of the early state of development and understanding of AI technologies, risk, and societal implications*** so that standards initiatives appropriately represent the state of AI technological feasibility and understanding.
- ***Regularly updated*** to reflect the rapid pace of change in AI technology and to avoid locking out new developments and knowledge, both of technological and social impacts.
- ***Effective in measuring and evaluating AI system performance*** to assist in determining degree of risk, deciding on fit-for-purpose and readiness, considering conformance, and monitoring effectiveness.

- 361 • **Human-centered** to ensure that human interactions and values are considered during AI data  
362 collection, model development, testing, and deployment.
- 363 • **Harmonized and using clear language** to define AI-related terms and concepts and to promote  
364 interoperability.
- 365 • **Sensitive to ethical considerations**, identifying and minimizing bias, and incorporating  
366 provisions that protect privacy and reflect the broader community’s notions of acceptability.

367 (B) PRIORITIZING LEVELS OF U.S. GOVERNMENT ENGAGEMENT IN AI STANDARDS

368 AI standards needs are expansive and challenging, and it is widely acknowledged that serious work  
369 on AI-specific standards has only recently begun in earnest. U.S. engagement in establishing AI  
370 standards is critical; AI standards developed without the appropriate level and type of involvement  
371 of U.S. interests may exclude or disadvantage U.S.-based companies in the marketplace as well as  
372 government agencies. Moreover, due to the foundational nature of standards, the lack of U.S.  
373 stakeholder engagement in the development of AI standards can negatively impact the  
374 innovativeness and competitiveness of U.S. interests in the long term. Possible levels and types of  
375 Federal involvement in the standards development process can be grouped into four categories  
376 ranked from least-to-most engaged:

- 377 • **Monitoring:** Following either a specific standards effort or broader programs and evolving  
378 standards being produced by SDOs to address unique needs or interests.
- 379 • **Participating:** Commenting on and providing meaningful contributions to strategically  
380 important standards, including potentially serving as an observer on a committee.
- 381 • **Influencing:** Developing a deeper understanding of, and relationships with, the key players –  
382 working directly with industry and international players and exerting influence through formal  
383 and informal discussions and by providing expertise.
- 384 • **Leading:** Leading standards efforts by convening or administering consensus groups, serving  
385 as standards project editor or in similar technical leadership roles, or acting as the liaison  
386 representative between standards groups. This level of leadership also can be exercised by  
387 serving on the Board of Directors or in other executive positions of an SDO.<sup>22</sup>

388 Each of these categories of engagement requires having qualified U.S. government participants  
389 (Federal employees or contractors) function in these capacities based on their expertise,  
390 relationships, and knowledge of specific standards development processes and best practices.

391 (C) PRACTICAL STEPS FOR AGENCY ENGAGEMENT IN AI STANDARDS

- 392 1. Identify how AI technologies can be used to further the agency’s mission – for example,  
393 research, technology development, procurement, or regulation.

---

<sup>22</sup> See OMB Circular A-119: Federal Participation in the Development and Use of Voluntary Consensus Standards and in Conformity Assessment Activities, pp 27-28, for the policy regarding participation on boards of standards development organizations.

- 394 2. Know existing statutes, policies and resources relating to participation in the development  
395 of, and use of standards (e.g., OMB Circular A-119, Trade Agreements Act of 1979 as  
396 amended, Interagency Committee on Standards Policy).
- 397 3. Conduct a landscape scan and gap analysis to identify standards and related tools that exist  
398 or need to be developed.
- 399 4. If appropriate standards exist, use them.
- 400 5. If appropriate standards do not exist, engage in their development:
  - 401 i. Coordinate with other Federal agencies that may have similar needs.
  - 402 ii. Follow guidance on where and how to engage: see section 2(A).
  - 403 iii. Identify, train, and enable staff to participate in standards development.

### 404 **Agencies Determining Their AI Standards Needs**

405 Federal agencies contributing to the development of standards leading to trustworthy AI  
406 must first understand and articulate the anticipated role that AI has on agency  
407 operations and its regulations and regulated entities, and provide a vision of how AI will  
408 beneficially impact the stakeholders and communities nationwide served by the agency  
409 mission.

410  
411 A Federal agency cannot smartly resource standards activities if it has not yet  
412 determined its needs for standards and specific requirements, let alone participate in an  
413 effective leadership capacity to meet these needs. Several Federal departments and  
414 agencies are ahead of the curve in considering the use and impact of AI and strategies  
415 for considering the role of AI standards.

416 The Department of Transportation report, [Preparing for the Future of Transportation:  
417 Automated Vehicles 3.0](#) (AV 3.0) provides a vision for using AI and its potential  
418 impact. Voluntary consensus standards are mentioned throughout the report as a  
419 strategy for supporting Automated Driving Systems and Automated Vehicle  
420 development.

421 The Food and Drug Administration report [Proposed Regulatory Framework for  
422 Modification to Artificial Intelligence/Machine Learning \(AI/ML\)-based Software as a  
423 Medical Device \(SaMD\)](#) leans forward in “considering a...product lifecycle-based  
424 regulatory framework for technologies that would allow for modifications to be made  
425 from real-world learning and adaptation, while still ensuring that the safety and  
426 effectiveness...is maintained.”<sup>23</sup>

427 Both of these agencies articulate an understanding of the impact of AI and propose a  
428 path forward upon which focus and resource for standards activities can be made. The  
429 white paper study “[ai: using standards to mitigate risk](#),”<sup>24</sup> published jointly through the  
430 Department of Homeland Security and the Office of the Director of National  
431 Intelligence, serves to “start a dialogue on creating standards that will reduce the risk

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<sup>23</sup> Abstracted from webpage: <https://www.fda.gov/medical-devices/software-medical-device-samd/artificial-intelligence-and-machine-learning-software-medical-device>

<sup>24</sup> ai Usining utandards to mitigate risks, produced by the Public-Private Analytic Exchange Program, 2018. [https://www.dhs.gov/sites/default/files/publications/2018\\_AEP\\_Artificial\\_Intelligence.pdf](https://www.dhs.gov/sites/default/files/publications/2018_AEP_Artificial_Intelligence.pdf),

432 from use, misuse, and exploitation of AI”.[pg. 3] These examples highlight the urgent  
433 need of every agency to comprehend and appreciate the impact of AI on their missions.

### 434 **3 RECOMMENDED FEDERAL GOVERNMENT STANDARDS ACTIONS TO ADVANCE** 435 **U.S. AI LEADERSHIP**

436 America’s success and prospects as the global AI leader demands that the Federal government play an  
437 active role in developing AI standards. That includes AI standards-related efforts needed by agencies  
438 to fulfill their missions by:

- 439 • supporting and conducting AI research and development,
- 440 • engaging at the appropriate involvement level in AI standards development,
- 441 • procuring and deploying standard-based products and services, and
- 442 • developing and implementing policies, including regulatory policies where needed.

443 The government’s meaningful engagement in fulfilling that role is necessary – but not sufficient – for  
444 the nation to maintain its leadership in this competitive realm. Active involvement and leadership by  
445 the private sector, as well as academia, is required.

446 In addition to the guidance provided regarding priorities and levels of engagement called for in the  
447 previous section of this plan, *the Federal government should commit to deeper, consistent, long-term*  
448 *engagement in AI standards development activities to help the United States to speed the pace of*  
449 *trustworthy AI technologies*. Specifically, the Federal government<sup>25</sup> should:

#### 450 **1. Bolster AI standards-related knowledge, leadership, and coordination among Federal agencies** 451 **to maximize effectiveness and efficiency.**

- 452 • The National Science and Technology Council (NSTC) Machine Learning/Artificial  
453 Intelligence (ML/AI) Subcommittee should designate a Standards Coordinator with  
454 responsibility to gather and share AI standards-related needs, strategies, roadmaps,  
455 terminology, and best practices around the use of trustworthy AI in government operations,  
456 including:
  - 457 – planned and ongoing standards approaches and engagement activities,
  - 458 – requirements for input into proposed standards activities, and
  - 459 – analyses of whether ongoing standards activities meet Federal government needs.
- 460 • Make maximum use of existing standards that are broadly adopted by industry sectors that can  
461 be used or evolved within the new context of AI solutions.
- 462 • Reinforce the importance of agencies’ adherence to Federal policies for standards and related  
463 tools, for example data access and quality. *Suggested lead: OMB-OIRA.*
- 464 • Maintain a flexible posture in specifying AI standards that are referenced in regulatory or  
465 procurement actions. Flexibility is required to adapt to the rapid pace of AI technology

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<sup>25</sup> Except where specific agencies are noted, all agencies with AI-related needs and activities should consider their possible contribution to implementing each recommendation.



466 developments and standards and our understanding about trustworthiness and human-centered  
467 implications of AI. *Suggested lead: GSA, DoD, NIST*

- 468 • Grow a cadre of Federal staff with the relevant skills and training, available to effectively  
469 engage in AI standards development in support of U.S. government interests. *Suggested lead:*  
470 *NIST, OPM.*

471

472 **2. Promote focused research to advance and accelerate broader exploration and understanding**  
473 **of how aspects of trustworthiness can be practically incorporated within standards and**  
474 **standards-related tools.**

- 475 • Plan, support, and conduct research and evaluation that underlies technically sound, fit-for-  
476 purpose standards and related tools for trustworthy AI. *Suggested lead: NSF and research*  
477 *funding agencies.*
- 478 • Develop metrics to assess trustworthy attributes of AI systems, focusing on approaches that are  
479 readily understandable, available, and can be put on a path to standardization. *Suggested lead:*  
480 *NIST and research funding agencies..*
- 481 • Prioritize multidisciplinary research related to trustworthiness and associated aspects that may  
482 help to identify technical approaches to implement responsible behaviors. *Suggested lead:*  
483 *research funding agencies.*
- 484 • Conduct research to inform risk management strategies including monitoring and mitigating  
485 risks. *Suggested lead: research funding agencies.*
- 486 • Identify research needs, requirements and approaches that help advance scientific  
487 breakthroughs for trustworthy AI, give us confidence in AI technologies and cultivate trust in  
488 design, development, and use of AI. *Suggested lead: NIST and research funding agencies.*

489

490 **3. Support and expand public-private partnerships to develop and use AI standards and related**  
491 **tools to advance trustworthy AI.**

- 492 • Strategically increase participation in the development of technical AI standards in targeted  
493 venues and exercise a variety of engagement options ranging from monitoring to leading –  
494 especially at the early stage of standards development where major decisions can be made  
495 about the scoping and leadership. In making decisions about involvement in standards  
496 development, consider the priorities and guidelines cited in Section 2(A) and (B) and SDO  
497 activities cited in Appendix II.
- 498 • Lead non-traditional collaborative models for standards development, such as open source  
499 efforts and Federal open data initiatives.
- 500 • Increase data discoverability and access to Federal government data that enable more  
501 widespread training and use of AI technologies.
- 502 • Lead in benchmarking efforts to assess the trustworthiness of AI systems. Ensure that these  
503 benchmarks are widely available, result in best practices, improve AI evaluations and methods  
504 for verification and validation.

505       • Foster collaborative environments to promote creative problem solving through AI challenge  
506       problems and testbeds.

507 **4. Strategically engage with international parties to advance AI standards for U.S. economic**  
508 **and national security needs.**

509       • Champion U.S. AI standards priorities in international AI standards development activities.

510       • Partner and accelerate the exchange of information between Federal officials and counterparts  
511       in like-minded countries on AI standards and related tools. *Suggested lead: NIST, Department*  
512       *of State, International Trade Administration, National Institute of Justice.*

513       • Track and understand AI standards development strategies and initiatives of foreign  
514       governments and entities. *Suggested lead: NIST, Department of State, International Trade*  
515       *Administration, National Institute of Justice.*

516

## APPENDIX I DEFINITIONS

517 **ANSI INCITS 172-2002 (R2007) Information Technology - American National Standard**  
518 **Dictionary of Information Technology (ANSDIT) (Revision and Redesignation Of ANSI X3.172-**  
519 **1996)**

520

521 **artificial intelligence (AI):**

522 (1) A branch of [computer science](#) devoted to developing [data processing systems](#) that performs  
523 [functions](#) normally associated with human intelligence, such as [reasoning](#), [learning](#), and self-  
524 improvement. (2) The capability of a device to perform functions that are normally associated with  
525 human intelligence such as reasoning, learning, and self-improvement.

526

527 **ISO/IEC 3WD 22989 Information Technology — Artificial Intelligence — Artificial Intelligence**  
528 **Concepts and Terminology**

529

530 **artificial intelligence**

531 capability of a system to acquire, process and apply knowledge

532 Note 1 to entry: knowledge are facts, information, and skills acquired through experience or education

533

534 **AI system**

535 technical system that uses artificial intelligence to solve problems

536

537

## APPENDIX II AI STANDARDS

538 Noting that standards development is an ongoing effort with new projects and new technical focus  
539 areas being added regularly, any listing of standards bodies and associated AI standards development  
540 activities is only current as of the time the list was developed. The following are examples of activities  
541 provided by respondents to the NIST Request For Information and by Federal agencies.

542

### 543 **International Organization for Standardization (ISO) and the International Electrotechnical** 544 **Commission (IEC)**

545

546 *ISO/IEC JTC 1/SC 42 Artificial Intelligence* was established in October 2017 to develop AI standards  
547 that can be applied across applications and industries. SC 42 is chartered to work on Information  
548 Technology standards, with current work items focused on topics such as updated AI terminology,  
549 interoperable framework for AI systems, AI lifecycle, big data, AI trustworthiness (e.g., robustness,  
550 unbiased, and risk managed), use cases, and computational approaches.

### 551 **Published Standards under ISO/IEC JTC 1/SC 42 Artificial Intelligence**

552 ISO/IEC 20546:2019 Information technology — Big data — Overview and vocabulary

553 ISO/IEC TR 20547-2:2018 Information technology — Big data reference architecture – Part 2:  
554 Use cases and derived requirements

555 ISO/IEC TR 20547-5:2018 Information technology — Big data reference architecture – Part 5:  
556 Standards roadmap

557

### 558 **Standards under development by ISO/IEC JTC 1/SC 42 Artificial Intelligence**

559 ISO/IEC AWI TR 20547-1: Information technology — Big data reference architecture — Part  
560 1: Framework and application process

561 ISO/IEC DIS 20547-3: Information technology — Big data reference architecture — Part 3:  
562 Reference architecture

563 ISO/IEC WD 22989: Artificial Intelligence Concepts and Terminology

564 ISO/IEC WD 23053: Framework for Artificial Intelligence (AI) Systems Using Machine  
565 Learning (ML)

566 ISO/IEC NP TR 24027: Information technology — Artificial Intelligence (AI) — Bias in AI  
567 systems and AI aided decision making

568 ISO/IEC NP TR 24028: Information technology — Artificial Intelligence (AI) — Overview of  
569 trustworthiness in Artificial Intelligence

570 ISO/IEC NP TR 24029-1: Artificial Intelligence (AI) — Assessment of the robustness of neural  
571 networks — Part 1: Overview

572 ISO/IEC NP TR 24030: Information technology — Artificial Intelligence (AI) — Use cases

573 ISO/IEC NP 38507: Information technology — Governance of IT — Governance implications  
574 of the use of artificial intelligence by organizations

575 ISO/IEC NP 23894: Information technology — Artificial Intelligence — Risk Management

576

577 **Other ISO/IEC JTC 1 and ISO Standards Activities**

578 AI-related cross sector and sector specific standards have been and are being developed in several  
579 committees and subcommittees.

580 JTC 1 SC 7: Software and systems engineering

581 JTC 1 SC 17: Cards and security devices for personal identification

582 JTC 1 SC 22: Programming languages, their environments and system software interfaces

583 JTC 1 SC 24: Computer graphics, image processing and environmental data representation

584 JTC 1 SC 27: Information Security, cybersecurity and privacy protection

585 JTC 1 SC 28: Office equipment

586 JTC 1 SC 29: Coding of audio, picture, multimedia and hypermedia information

587 JTC1 SC 32: Data management and interchange

588 Examples:

589 ISO/IEC 24707:2018 Information technology -- Common Logic (CL) -- A framework  
590 for a family of logic-based languages

591 ISO/IEC DIS 21838-2 Information technology -- Top-level ontologies (TLO) -- Part 2:  
592 Basic Formal Ontology (BFO)

593 JTC 1 SC 36: Information technology for learning, education and training

594 JTC 1 SC 37: Biometrics

595 JTC 1 SC 40: IT Service Management and IT Governance

596 JTC 1 SC 41: Internet of Things and related technologies

597 ISO TC 184: Automation systems and integration

598 ISO TC 199: Safety of machinery

599 ISO TC 299: Robotics

600

601 **Institute of Electrical and Electronics Engineers (IEEE)**

602

603 **Standards under development by IEEE**

604 Starting in 2016, the *IEEE P7000™* series of standards projects addresses specific issues at the  
605 intersection of technological and ethical considerations for AI.

606 P7000 - Model Process for Addressing Ethical Concerns During System Design

607 P7001 - Transparency of Autonomous Systems

608 P7002 - Data Privacy Process

609 P7003 - Algorithmic Bias Considerations

610 P7004 - Standard for Child and Student Data Governance

611 P7005 - Standard for Transparent Employer Data Governance

612 P7006 - Standard for Personal Data Artificial Intelligence (AI) Agent

613 P7007 - Ontological Standard for Ethically Driven Robotics and Automation Systems

- 614 P7008 - Standard for Ethically Driven Nudging for Robotic, Intelligent and Autonomous  
615 Systems
- 616 P7009 - Standard for Fail-Safe Design of Autonomous and Semi-Autonomous Systems
- 617 P7010 - Wellbeing Metrics Standard for Ethical Artificial Intelligence and Autonomous  
618 Systems
- 619 P7011 - Standard for the Process of Identifying and Rating the Trustworthiness of News  
620 Sources
- 621 P7012 - Standard for Machine Readable Personal Privacy Terms
- 622 P7013 - Inclusion and Application Standards for Automated Facial Analysis Technology
- 623 P2801 Recommended Practice for the Quality Management of Datasets for Medical Artificial  
624 Intelligence
- 625 P2802 Standard for the Performance and Safety Evaluation of Artificial Intelligence Based  
626 Medical Device: Terminology
- 627 P3652.1 Guide for Architectural Framework and Application of Federated Machine Learning  
628

#### 629 **ASTM Technical Committees**

630 Several ASTM technical committees are developing standards to support the reliable, robust, and  
631 trustworthy systems that use AI.

632 **ASTM Committee F15 on Consumer Products** was formed in 1973 and maintains over 100  
633 standards. Subcommittee F15.75 on Connected Products is working on a standard to provide  
634 guidance for consumer Internet of Things (IoT) as it relates to connected product hazards. It  
635 will apply to consumer products connected to the internet that need testing and evaluation of  
636 software to prevent cybersecurity vulnerabilities and software weaknesses that could  
637 compromise safety related performance of the product and create a safety hazard. Consumer  
638 IoT product (CIP) means a physical object that transmits or receives data remotely through a  
639 network, other than a mobile phone or personal computer, primarily intended for consumer use  
640 remotely through a network. Examples of these types of products include baby monitors,  
641 wearable health trackers, and connected appliances. Consumer IoT standards will be intended  
642 to apply in conjunction with product specific standard requirements to address the overall  
643 system safety of a connected end product.

644 **ASTM Committee F45 on Driverless Automatic Guided Industrial Vehicles** was formed in  
645 2014. This Committee addresses issues related to performance standards and guidance  
646 materials for 'automatic'- (e.g., automatic guided vehicles) through 'autonomous'- (e.g., mobile  
647 robots) unmanned ground vehicles (A-UGVs) with industrial applications. A-UGV applications  
648 include, but are not limited to: indoor warehouse, manufacturing, and medical facilities and  
649 outdoor security and shipyards. It also works closely with industrial vehicle safety standards  
650 organizations.

651 **ASTM Committee F38 on Unmanned Aircraft Systems** was formed in 2003 and maintains  
652 over 15 standards. This Committee addresses issues related to design, performance, quality  
653 acceptance tests, and safety monitoring for unmanned air vehicle systems. F38 is working on  
654 standards to assist unmanned aircraft in detection and avoidance and containing complex  
655 functions sometimes referred to as “autonomous.”

656 **ASTM Committee F42 on Additive Manufacturing (AM) Technologies** was formed in 2009  
657 and maintains over 22 standards. This committee addresses standards related to the process of  
658 creating three-dimensional objects by the successive addition of material – whether plastic,  
659 metal, ceramic, or composite. Artificial intelligence, machine learning (ML), and deep learning  
660 (DL) are used in the selection of AM materials and the development of AM devices/systems to  
661 find the best combinations of processing routes to obtain required properties or functionalities.  
662 Such technologies help rapidly suggest candidate materials for AM or predict functionalities of  
663 devices/systems based on multiple AM design parameters. Such digital, smart AM frameworks  
664 operate by reducing the huge design space needed for materials, guiding processes, and  
665 facilitating integration of complex data from design, processing, characterization, and  
666 simulation. In addition, AI/ML/DL for AM are intimately connected with other data-intensive  
667 activities such as AM data management/databases with respect to the data FAIR (findable,  
668 accessible, interoperable, and reusable) principles, as well as data-driven areas such as  
669 integrated computational materials engineering (ICME) and the Materials Genome Initiative  
670 (MGI) to identify structure-property-processing-performance relationships.

671 The **Consumer Technology Association (CTA)** is currently developing three standards:  
672 Definitions and Characteristics of Artificial Intelligence (under development)  
673 Scope: This standard defines terms related to artificial intelligence and associated  
674 technologies.  
675 Definitions and Characteristics of Artificial Intelligence in Health Care  
676 Scope: This standard defines terms related to artificial intelligence and associated  
677 technologies in health care.  
678 The Use of Artificial Intelligence in Health Care: Trustworthiness  
679 Scope: Artificial Intelligence (AI) is quickly becoming a pervasive tool in the health  
680 care industry. This standard explores the impact of the trustworthiness of AI in health  
681 care through the lens of the end user (e.g., physician, consumer, professional and family  
682 caregiver). Additionally, the standard will identify the unique challenges and  
683 opportunities for AI in the health care sector.  
684

685 The **International Telecommunication Union Telecommunication Standardization Sector (ITU-**  
686 **T)** is investigating possible standardization work for AI in the following focus groups:  
687 Focus Group on Machine Learning for Future Networks including 5G  
688 Focus Group on Artificial Intelligence for Health  
689 Focus Group on Environmental Efficiency for Artificial Intelligence and other Emerging  
690 Technologies

691 The **Object Management Group (OMG)** cross-sector AI-related specifications under development  
692 include:

693 Application Programming Interfaces for Knowledge Platforms (API4KP)  
694 Robotics Service Ontology (RoSO)

695 OMG's sector-specific AI-related specifications under development include:

696 A retail specification for digital receipts that embodies an ontology defining not only the  
697 receipts themselves, but also content related to jurisdiction-specific taxation.

698 A joint effort between OMG's Retail and Robotics Task Forces to create a standard for point-  
699 of-sale/point-of-service (POS) robotic interfaces for the 2020 Olympics specifically, but which  
700 will be broadly applicable to POS robotic services.  
701

702 **Society of Automotive Engineering International (SAE International)**

703 SAE J 3016-2018, *Taxonomy and Definitions for Terms Related to Driving Automation*  
704 *Systems for On-Road Motor Vehicles*.

705  
706 **U.S. Department of Transportation**

707 Examples of both horizontal cross sector and vertical sector-specific standards for AI systems  
708 are found in the Department of Transportation report, [Preparing for the Future of](#)  
709 [Transportation: Automated Vehicles 3.0](#) (AV 3.0). Voluntary consensus standards are  
710 mentioned throughout this report as a strategy for supporting Automated Driving Systems and  
711 Automated Vehicle development. Appendix C, “Voluntary Technical Standards for  
712 Automation,” lists numerous AI-relevant horizontal and vertical standards in the functional  
713 areas of: Definitions and Architecture; Data; Design; Maintenance and Inspections;  
714 Functional/Performance; Protocols (Communications); Security; and Testing/Test Target.

715  
716 **World Wide Web (W3C)**

717 The W3C Web Ontology Language (OWL) is a Semantic Web language designed to represent rich and  
718 complex knowledge about things, groups of things, and relations between things. OWL is a  
719 computational logic-based language such that knowledge expressed in OWL can be exploited by  
720 computer programs, e.g., to verify the consistency of that knowledge or to make implicit knowledge  
721 explicit. OWL documents, known as ontologies, can be published in the World Wide Web and may  
722 refer to or be referred from other OWL ontologies. OWL is part of the W3C’s Semantic Web  
723 technology stack,

724  
725 **The W3C Semantic Web Standards**

726 The term “Semantic Web” refers to W3C’s vision of the Web of linked data. Semantic Web  
727 technologies enable people to create data stores on the Web, build vocabularies, and write rules for  
728 handling data.

729  
730 Standards include: [RDF](#), [OWL](#), [SPARQL](#), [RDFa](#), [JSONLD](#), [SKOS](#), [RDFS](#), [GRDDL](#), [POWDER](#),  
731 [PROV](#), [RIF](#), [SAWSDL](#), [RDB2RDF](#)



733 **APPENDIX III RELATED TOOLS FOR AI STANDARDIZATION**

734 The following are examples of related tools provided by respondents to the NIST Request For  
735 Information and by Federal agencies.

736

737 **Data Sets** (e.g., for algorithm training)

738 Data sets are critical where data are essential for training and applying AI models. Some examples of  
739 AI data sets include:

740 [CIFAR-10](#) dataset (Canadian Institute for Advanced Research) is a collection of images that are  
741 commonly used to train machine learning and computer vision algorithms.

742 [COCO](#) is a large-scale object detection, segmentation, and captioning dataset.

743 [Data.gov](#) is a U.S. government website launched in late May 2009. Its goal is to improve public  
744 access to high value, machine readable datasets generated by the Executive Branch of the  
745 Federal Government. The site is a repository for federal, state, local, and tribal government  
746 information made available to the public.

747 [ImageNet](#) project is a large visual database designed for use in visual object recognition  
748 software research. More than 14 million images have been hand-annotated by the project to  
749 indicate what objects are pictured and in at least one million of the images, bounding boxes are  
750 also provided.

751 [MNIST](#) dataset of handwritten digits has a training set of 60,000 examples, and a test set of  
752 10,000 examples. It is a subset of a larger set available from NIST.

753 [OpenML](#) is a data set repository that links data to algorithms to teach machines to learn better.

754 [Pascal VOC](#) data sets provides standardized image data sets for object class recognition, a  
755 common set of tools for accessing the data sets and annotations, and enables evaluation and  
756 comparison of different methods.

757 [UC Irvine Machine Learning Repository](#) currently maintain 474 data sets as a service to the  
758 machine learning community.

759

760 **Evaluations and Benchmarks**

761 NIST TREC efforts today extend to more sophisticated AI tasks including complex question  
762 answering, incident management, and news summarization, as well as to industry specific  
763 challenges. NIST TREC has also expanded into modalities beyond text, such as with the NIST  
764 TRECVID evaluations for tasks related to digital video, NIST Multimedia Event Detection  
765 (MED), and NIST Multimedia Event Recounting (MER). These evaluations are important for  
766 driving fundamental advancements in the accuracy of AI technologies on a growing field of  
767 tasks using data modalities such as images, video, speech, and text.

768 The IIC [Deep Learning Facilities Testbed](#) is intended to optimize diagnosis, maintenance, and  
769 repair of monitored assets; increase energy efficiency by adjusting power-consuming services,  
770 and improve visitor experience relative to wait times and ambient climate control.

771 The [MLPerf](#) effort aims to build a common set of benchmarks that enables the machine  
772 learning (ML) field to measure system performance for both training and inference from  
773 mobile devices to cloud services.

774 [AI-Matrix](#) is an AI benchmark suite aiming at measuring the performance of AI hardware  
775 platforms and software frameworks. This deep learning benchmark suite currently consists of  
776 three types of workloads: layer-based benchmark, macro benchmark, and micro benchmark.

777 [AIIA DNN](#) is a benchmark is to objectively reflect the current state of AI accelerator  
778 capabilities and all metrics are designed to provide an objective comparison dimension.

779 [AnTuTu](#) is a benchmarking tool for Android smartphones and tablets for checking device  
780 performance.

781 [DeepBench](#) is intended to benchmark operations that are important to deep learning on  
782 different hardware platforms.

783 [Fathom](#) provide reference workloads for modern deep learning.

#### 784 **Metrics**

785 In its [TREC](#) evaluations, NIST has helped to establish important metrics for the AI field -  
786 precision vs. recall, mean average precision, and false alarm vs. miss rate.

787 Industry has also played a prominent role in the development of metrics, such as in the case of  
788 the [BLEU](#) metric created by IBM Research, which has achieved wide use for evaluating natural  
789 language-related AI tasks.

790 Industry- and academia-driven evaluations are also using metrics such as top-1 and top-5  
791 accuracy for evaluating classification results and intersection-over-union to measure  
792 localization in object detection.

#### 793 **Open Source Software**

794 There are a number of open source AI frameworks available such as the following:

795 [Caffe](#) was developed by Berkeley AI Research (BAIR) and by community contributors.

796 [Keras](#) is a deep-learning library that sits atop TensorFlow and Theano.

797 [Machine Learning in R \(mlr\)](#) provides a generic, object- oriented, and extensible framework for  
798 classification, regression, survival analysis and clustering for the R language. It provides a  
799 unified interface to more than 160 basic learners and includes meta-algorithms and model  
800 selection techniques to improve and extend the functionality of basic learners with, e.g.,  
801 hyperparameter tuning, feature selection, and ensemble construction.

802 [MxNet](#) is an open-source deep learning software framework, used to train, and deploy deep  
803 neural networks.

804 [Scikit-learn](#) is a software machine learning library for the Python programming language.

805 [TensorFlow](#) is an end-to-end open source platform for machine learning. It has a  
806 comprehensive, flexible ecosystem of tools, libraries and community resources that lets  
807 researchers push the state-of-the-art in ML and developers easily build and deploy ML powered  
808 applications.

809 [Theano](#) is a Python library and optimizing compiler for manipulating and evaluating  
810 mathematical expressions, especially matrix-valued ones.

811 [Torch](#) is an open-source machine learning library, a scientific computing framework, and a  
812 script language based on the Lua programming language

813

814 Other AI open source software projects include:

815 [Acumos AI](#) is a platform and open source framework that makes it easy to build, share, and  
816 deploy AI apps. Acumos standardizes the infrastructure stack and components required to run  
817 an out-of-the-box general AI environment.

818 [Adversarial Robustness Toolbox \(ART\)](#) IBM has released this open source toolbox. ART  
819 implements state-of-the-art attacks and defenses, including adversarial training and data  
820 poisoning detection, as well as multiple metrics for robustness.

821 [AI Fairness 360 \(AIF360\)](#) IBM has released this open source. AIF360 implements more than  
822 ten bias mitigation algorithms and seventy state-of-the-art metrics related to fairness in a  
823 common software framework. The AIF360 toolbox is industry sector neutral, and thus, can be  
824 applied to a wide range of problem domains.

825 [Apache Jena](#) is an open source Semantic Web framework for Java.

826 [Deep Learning Benchmark Suite](#) has been developed by HPE, in conjunction with Hewlett  
827 Packard Labs. It is an open source performance benchmark suite for comparing Deep Learning  
828 frameworks, models, and compute platforms.

829 [Explainable Artificial Intelligence \(XAI\)](#) program by DARPA has the goal of developing a  
830 toolkit library consisting of machine learning and human-computer interface software modules  
831 that could be used to develop future explainable AI systems.

832 [Flora-2](#) is an advanced object-oriented knowledge representation and reasoning system.

833 [Hierarchical Data Format 5 \(HDF5\)](#) from the HDF Group, is a standard representation of  
834 scientific data sets, together with metadata, and is used in particular for the interchange of  
835 training data sets used in machine learning.

836 [Plugin Machine Intelligence \(PMI\)](#) project is a plugin for the Pentaho Kettle engine that  
837 provides access to supervised machine learning algorithms from various underlying "engines".

838 [Neural Network Exchange Format \(NNEF\)](#), developed by the Khronos Group, "reduces  
839 machine learning deployment fragmentation by enabling a rich mix of neural network training  
840 tools and inference engines to be used by applications across a diverse range of devices and  
841 platforms."

842 [Open Neural Network eXchange \(onnx\)](#) is an open-source, community-driven effort to allow  
843 developers to more easily move between machine learning frameworks. The initiative was  
844 launched by Facebook and Microsoft and was subsequently supported by IBM, Huawei, Intel,  
845 AMD, ARM and Qualcomm.

846 [OpenAI Gym](#) is a reinforcement learning toolkit a wide range of environments and an online  
847 scoreboard for developing and comparing reinforcement learning algorithms.

848 [Pellet](#) is an open-source Java based OWL 2 reasoner. It can be used in conjunction with both  
849 Jena and OWL API libraries; it can also be included in other applications.

850 [Protégé](#) is an open-source platform that provides a suite of tools to construct domain models  
851 and knowledge-based applications with ontologies.  
852

853 **APPENDIX IV THE ASSIGNMENT AND APPROACH**

854 **EXECUTIVE ORDER ON MAINTAINING AMERICAN LEADERSHIP IN ARTIFICIAL**  
855 **INTELLIGENCE**

856 Emphasizing the importance of artificial intelligence (AI) to the future of the U.S. economy and  
857 national security, on February 11, 2019, the President issued an Executive Order (EO 13859)<sup>26</sup>  
858 directing Federal agencies to take a variety of steps designed to ensure that the nation maintains its  
859 leadership position in AI.

860 Among its objectives, the EO aims to “Ensure that technical standards minimize vulnerability to  
861 attacks from malicious actors and reflect Federal priorities for innovation, public trust, and public  
862 confidence in systems that use AI technologies; and develop international standards to promote and  
863 protect those priorities.”

864 The order directs the Secretary of Commerce, through the National Institute of Standards and  
865 Technology (NIST), to issue “a plan for Federal engagement in the development of technical standards  
866 and related tools in support of reliable, robust, and trustworthy systems that use AI technologies.” That  
867 plan is to be completed within 180 days of the EO – by August 10, 2019.

868 The EO specifies:

- 869 (i) Consistent with OMB Circular A-119, this plan shall include:
- 870 (A) Federal priority needs for standardization of AI systems development and deployment;
- 871 (B) identification of standards development entities in which Federal agencies should seek  
872 membership with the goal of establishing or supporting United States technical  
873 leadership roles; and
- 874 (C) opportunities for and challenges to United States leadership in standardization related to  
875 AI technologies.
- 876 (ii) This plan shall be developed in consultation with the Select Committee, as needed, and in  
877 consultation with the private sector, academia, non-governmental entities, and other  
878 stakeholders, as appropriate.”

879 **THE PROCESS NIST USED TO DEVELOP THIS PLAN**

880 NIST reached out widely to solicit input for the AI standards engagement plan that is the basis of this  
881 document. That outreach and consultation included:

- 882 • Publication of a Request for Information in the Federal Register that attracted 97 comments,  
883 including recommendations regarding AI standards priorities and the appropriate Federal role  
884 for engaging in the standards development process. See Appendix V for the text of the Request  
885 for Information.
- 886 • Contacts and discussions with members of the White House Select Committee on Artificial  
887 Intelligence and other Federal agencies involved with artificial intelligence and related topics,  
888 especially through the National Science and Technology Council (NSTC) Machine

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<sup>26</sup> Maintaining American Leadership in Artificial Intelligence <https://www.govinfo.gov/content/pkg/FR-2019-02-14/pdf/2019-02544.pdf>

- 889 Learning/Artificial Intelligence (ML/AI) Subcommittee and the Networking and Information  
890 Technology Research and Development (NITRD) Program.
- 891 • Contacts and discussions with members of the Interagency Committee on Standards Policy<sup>27</sup>.
  - 892 • A workshop on a Federal AI standards engagement strategy that attracted more than 400  
893 representatives (about 215 in person and 210 webcast participants) from the private and public  
894 sectors, including standards developing organizations and other non-profit organizations,  
895 companies, academia, Federal agencies, and others. See Appendix VI for the workshop agenda.
  - 896 • Public and federal agencies' review and comment on a draft version of this AI standards  
897 Federal engagement plan.

898 This plan for Federal engagement in AI standards is *one component* of the overall Federal strategy for  
899 AI called for by the AI executive order.

900

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<sup>27</sup> <https://www.nist.gov/standardsgov/what-we-do/federal-policy-standards/interagency-committee-standards-policy-icsp>

**APPENDIX V REQUEST FOR INFORMATION**

**Billing Code: 3510-13**

**DEPARTMENT OF COMMERCE**

**National Institute of Standards and Technology**

**Docket Number: [190312229-9229-01]**

**Artificial Intelligence Standards**

**AGENCY:** National Institute of Standards and Technology, U.S. Department of Commerce.

**ACTION:** Notice; Request for Information (RFI)

**SUMMARY:** The February 11, 2019, Executive Order on Maintaining American Leadership in Artificial Intelligence (AI) directs the National Institute of Standards and Technology (NIST) to create a plan for Federal engagement in the development of technical standards and related tools in support of reliable, robust, and trustworthy systems that use AI technologies (Plan). This notice requests information to help NIST understand the current state, plans, challenges, and opportunities regarding the development and availability of AI technical standards and related tools, as well as priority areas for federal involvement in AI standards-related activities. To assist in developing the Plan, NIST will consult with Federal agencies, the private sector, academia, non-governmental entities, and other stakeholders with interest in and expertise relating to AI.

**DATES:** Comments in response to this notice must be received on or before May 31, 2019 at 5:00 pm Eastern Time.

**ADDRESSES:** Written comments in response to this RFI may be submitted by mail to AI-Standards, National Institute of Standards and Technology, 100 Bureau Drive, Stop 2000, Gaithersburg, MD 20899. Online submissions in electronic form may be sent to [ai\\_standards@nist.gov](mailto:ai_standards@nist.gov). Submissions may be in any of the following formats: HTML, ASCII, Word, RTF, or PDF. Please cite “RFI: Developing a Federal AI Standards Engagement Plan” in all correspondence. All relevant comments received by the deadline will be posted at <https://www.nist.gov/topics/artificial-intelligence/ai-standards> and [regulations.gov](https://www.regulations.gov) without change or redaction, so commenters should not include information they do not wish to be posted (e.g., personal or confidential business information). Comments that contain profanity, vulgarity, threats, or other inappropriate language or content will not be posted or considered.

**FOR FURTHER INFORMATION CONTACT:** For questions about this RFI contact: Elham Tabassi, NIST, MS 8900, 100 Bureau Drive, Gaithersburg, MD 20899, telephone (301) 975-5292, e-mail [elham.tabassi@nist.gov](mailto:elham.tabassi@nist.gov). Please direct media inquiries to NIST’s Public Affairs Office at (301) 975-NIST.

**SUPPLEMENTARY INFORMATION:**

Genesis of the Plan for Federal Engagement in Artificial Intelligence Standards

The Executive Order (EO) on AI<sup>28</sup> states that “[c]ontinued American leadership in AI is of paramount importance to maintaining the economic and national security of the United States and to shaping the global evolution of AI in a manner consistent with our Nation’s values, policies, and

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<sup>28</sup> <https://www.whitehouse.gov/presidential-actions/executive-order-maintaining-american-leadership-artificial-intelligence/>.

944 priorities.” Accordingly, Section 1 of the EO calls for a coordinated Federal Government strategy, the  
945 American AI Initiative, and notes that the U.S. must drive development of appropriate AI technical  
946 standards in order to enable the creation of new AI-related industries and the adoption of AI by today’s  
947 industries. This can be achieved through the work and partnership of industry, academia, and  
948 government.

949 Section 1(d) of the EO states that the U.S. must foster public trust and confidence in AI  
950 technologies and protect civil liberties, privacy, and American values in their application in order to  
951 fully realize the potential of AI technologies for the American people.

952 Section 2(d) of the EO directs Federal agencies to ensure that technical standards minimize  
953 vulnerability to attacks from malicious actors and reflect Federal priorities for innovation, public trust,  
954 and public confidence, and to develop international standards to promote and protect those priorities.

955 Section 6(d) of the EO directs the Secretary of Commerce, acting through the Director of NIST,  
956 to issue a Plan for Federal engagement in the development of technical standards and related tools in  
957 support of reliable, robust, and trustworthy systems that use AI technologies. It further directs NIST to  
958 lead the development of the Plan with participation from relevant agencies, as determined by the  
959 Secretary of Commerce.

960

#### 961 Approach for Developing this Plan

962 NIST will develop the Plan in a manner that fulfills the objectives of the EO and is consistent  
963 with relevant provisions of the Office of Management and Budget (OMB) Circular A-119, “Federal  
964 Participation in the Development and Use of Voluntary Consensus Standards and in Conformity  
965 Assessment Activities,” and NIST’s mission to promote U.S. innovation and industrial  
966 competitiveness. NIST has a special interest in advancing the development and use of standards relied  
967 upon by all sectors of the economy and society, recognizing that the vast majority of standards are  
968 developed through a voluntary process led by the private sector.

969 NIST will be informed through an open process that will include this RFI and other  
970 opportunities, such as a public workshop, to provide input. NIST expects to develop a draft Plan on  
971 which it will seek comment from the public and Federal agencies. Information about this effort,  
972 including ways to provide input, and future steps, will be available at  
973 <https://www.nist.gov/topics/artificial-intelligence/ai-standards>.

974

#### 975 Goals of this Request for Information

976 Timely and fit-for-purpose AI technical standards – whether developed by national or  
977 international organizations – will play a crucial role in the development and deployment of AI  
978 technologies, and will be essential in building trust and confidence about AI technologies and for  
979 achieving economies of scale.

980 NIST seeks to understand the:

- 981 • Current status and plans regarding the availability, use, and development of AI technical standards  
982 and tools in support of reliable, robust, and trustworthy systems that use AI technologies;
- 983 • Needs and challenges regarding the existence, availability, use, and development of AI standards  
984 and tools; and
- 985 • The current and potential future role of Federal agencies regarding the existence, availability, use,  
986 and development of AI technical standards and tools in order to meet the nation’s needs.

987 For purposes of this Plan<sup>29</sup>, AI technologies and systems are considered to be comprised of  
988 software and/or hardware that can learn to solve complex problems, make predictions or solve tasks  
989 that require human-like sensing (such as vision, speech, and touch), perception, cognition, planning,  
990 learning, communication, or physical action. Examples are wide-ranging and expanding rapidly. They  
991 include, but are not limited to, AI assistants, computer vision systems, automated vehicles, unmanned  
992 aerial systems, voicemail transcriptions, advanced game-playing software, facial recognition systems  
993 as well as application of AI in both Information Technology (IT) and Operational Technology (OT).  
994

995 Responding to This Request for Information

996 The scope of this RFI includes AI technical standards and related tools regardless of origin or  
997 use.<sup>30</sup> Respondents may define “standards” as they desire, indicating clearly what they mean when  
998 using the term. AI technical standards and related tools should include those necessary or helpful to  
999 reduce barriers to the safe testing and deployment of AI and to support reliable, robust, and trustworthy  
1000 systems that use AI technologies.

1001 Respondents may define tools as broadly or as narrowly as they wish. They should indicate  
1002 clearly what they mean when using specific terms (e.g., practices, datasets, guidelines). An illustrative,  
1003 non-exclusive list of standards-related tools includes:

- 1004 • Test tools (e.g., executable test code) for conformance testing, performance testing, stress  
1005 testing, interoperability testing, and other purposes;
- 1006 • Use cases;
- 1007 • Reference data and datasets;
- 1008 • Reference implementations; and
- 1009 • Training programs.

1010 Where this RFI uses the term “organizations,” it refers to private, public, and non-profit bodies,  
1011 and includes both national and international organizations. If desired, commenters may provide  
1012 information about: the type, size, and location of their organization(s); and whether their organization  
1013 develops AI technology and related tools; uses or potentially uses AI technology and related tools;  
1014 and/or participates in the development of AI standards or related tools. Provision of such information  
1015 is optional and will not affect NIST's full consideration of the comment.

1016 Comments containing references – including specific standards and related tools – studies,  
1017 research, and other empirical data that are not widely published (e.g., available on the Internet) should  
1018 include paper or electronic copies of those materials, unless they are restricted due to copyright or are

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<sup>29</sup> This RFI is intended to be broadly directed to any and all technologies that might be considered AI by the US Government and other interested parties. AI systems have been defined in different ways, and this RFI is directed to any information that might fall within any of these definitions. See, for example, section 238(g) of the John S. McCain National Defense Authorization Act, 2019 (P.L. 115-232), in which AI is defined to include the following:

- (1) Any artificial system that performs tasks under varying and unpredictable circumstances without significant human oversight, or that can learn from experience and improve performance when exposed to data sets;
- (2) An artificial system developed in computer software, physical hardware, or other context that solves tasks requiring human-like perception, cognition, planning, learning, communication, or physical action;
- (3) An artificial system designed to think or act like a human, including cognitive architectures and neural networks;
- (4) A set of techniques, including machine learning, that is designed to approximate a cognitive task; and
- (5) An artificial system designed to act rationally, including an intelligent software agent or embodied robot that achieves goals using perception, planning, reasoning, learning, communicating, decision making, and acting.

<sup>30</sup> OMB Circular A-119 defines standards broadly to include: (1) Common and repeated use of rules, conditions, guidelines or characteristics for products or related processes and production methods, and related management systems practices; and (2) The definition of terms; classification of components; delineation of procedures; specification of dimensions, materials, performance, designs, or operations; measurement of quality and quantity in describing materials, processes, products, systems, services, or practices; test methods and sampling procedures; or descriptions of fit and measurements of size or strength.



1019 otherwise proprietary. In those cases, NIST encourages respondents to provide clear descriptions and  
1020 designations of those references. Do not include in comments or otherwise submit any information  
1021 deemed to be proprietary, private, or in any way confidential, as all comments relevant to this RFI  
1022 topic area that are received by the deadline will be made available publicly at  
1023 <https://www.nist.gov/topics/artificial-intelligence/ai-standards> and [regulations.gov](https://www.nist.gov/topics/artificial-intelligence/regulations).

1024 The following list of topics covers the major areas about which NIST seeks information. This  
1025 list is not intended to limit the topics that may be addressed by respondents, who may provide  
1026 information about any topic which would inform the development of the Plan. Possible topics,  
1027 subdivided by area, are:

1028  
1029 AI Technical Standards and Related Tools Development: Status and Plans

- 1030 1. AI technical standards and tools that have been developed, and the developing organization,  
1031 including the aspects of AI these standards and tools address, and whether they address  
1032 sector-specific needs or are cross-sector in nature;
- 1033 2. Reliable sources of information about the availability and use of AI technical standards and  
1034 tools;
- 1035 3. The needs for AI technical standards and related tools. How those needs should be  
1036 determined, and challenges in identifying and developing those standards and tools;
- 1037 4. AI technical standards and related tools that are being developed, and the developing  
1038 organization, including the aspects of AI these standards and tools address, and whether  
1039 they address sector-specific needs or are cross sector in nature;
- 1040 5. Any supporting roadmaps or similar documents about plans for developing AI technical  
1041 standards and tools;
- 1042 6. Whether the need for AI technical standards and related tools is being met in a timely way  
1043 by organizations; and
- 1044 7. Whether sector-specific AI technical standards needs are being addressed by sector-specific  
1045 organizations, or whether those who need AI standards will rely on cross-sector standards  
1046 which are intended to be useful across multiple sectors.
- 1047 8. Technical standards and guidance that are needed to establish and advance trustworthy  
1048 aspects (e.g., accuracy, transparency, security, privacy, and robustness) of AI technologies.

1049  
1050 Defining and Achieving U.S. AI Technical Standards Leadership

- 1051 9. The urgency of the U.S. need for AI technical standards and related tools, and what U.S.  
1052 effectiveness and leadership in AI technical standards development should look like;
- 1053 10. Where the U.S. currently is effective and/or leads in AI technical standards development,  
1054 and where it is lagging;
- 1055 11. Specific opportunities for, and challenges to, U.S. effectiveness and leadership in  
1056 standardization related to AI technologies; and
- 1057 12. How the U.S. can achieve and maintain effectiveness and leadership in AI technical  
1058 standards development.

1059  
1060 Prioritizing Federal Government Engagement in AI Standardization

- 1061 13. The unique needs of the Federal government and individual agencies for AI technical  
1062 standards and related tools, and whether they are important for broader portions of the U.S.  
1063 economy and society, or strictly for Federal applications;
- 1064 14. The type and degree of Federal agencies' current and needed involvement in AI technical  
1065 standards to address the needs of the Federal government;

- 1066 15. How the Federal government should prioritize its engagement in the development of AI  
1067 technical standards and tools that have broad, cross-sectoral application versus sector- or  
1068 application-specific standards and tools;  
1069 16. The adequacy of the Federal government’s current approach for government engagement in  
1070 standards development,<sup>31</sup> which emphasizes private sector leadership, and, more  
1071 specifically, the appropriate role and activities for the Federal government to ensure the  
1072 desired and timely development of AI standards for Federal and non-governmental uses;  
1073 17. Examples of Federal involvement in the standards arena (e.g., via its role in  
1074 communications, participation, and use) that could serve as models for the Plan, and why  
1075 they are appropriate approaches; and  
1076 18. What actions, if any, the Federal government should take to help ensure that desired AI  
1077 technical standards are useful and incorporated into practice.

1078 Kevin A. Kimball,  
1079 Chief of Staff

1080  
1081  
1082 **Notice of RFI Extension**  
1083

1084 **Billing Code: 3510-13**

1085 **DEPARTMENT OF COMMERCE**  
1086 **National Institute of Standards and Technology**  
1087 **Docket Number: [190312229-9229-01]**  
1088 **Artificial Intelligence Standards**

1089 **AGENCY:** National Institute of Standards and Technology, U.S. Department of Commerce.  
1090 **ACTION:** Notice; extension of comment period.

1091  
1092 **SUMMARY:** The National Institute of Standards and Technology (NIST) extends the period for  
1093 submitting written comments on the request for information (RFI) entitled “Artificial Intelligence  
1094 Standards,” published on May 1, 2019. The public comment period was originally scheduled to close  
1095 on May 31, 2019; the public comment period is extended to now close on June 10, 2019. NIST is  
1096 taking this action to provide additional time to submit comments because multiple interested parties  
1097 have expressed difficulty in submitting comments by the original deadline and have asked for an  
1098 extension.

1099  
1100 **DATES:** Comments must be received on or before June 10, 2019 at 5:00 pm Eastern Time.

1101  
1102 **ADDRESSES:** Written comments in response to this RFI may be submitted by mail to AI-Standards,  
1103 National Institute of Standards and Technology, 100 Bureau Drive, Stop 2000, Gaithersburg, MD  
1104 20899. Online submissions in electronic form may be sent to  
1105 ai\_standards@nist.gov. Submissions may be in any of the following formats: HTML, ASCII, Word,  
1106 RTF, or PDF. Please cite “RFI: Developing a Federal AI Standards Engagement Plan” in all  
1107 correspondence. All relevant comments received by the deadline will be posted at

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<sup>31</sup> See the National Technology Transfer and Advancement Act, <https://www.nist.gov/standardsgov/national-technology-transfer-and-advancement-act-1995>, and OMB Circular A-119, <https://www.whitehouse.gov/wp-content/uploads/2017/11/Circular-119-1.pdf>.

1108 <https://www.nist.gov/topics/artificial-intelligence/ai-standards> and [regulations.gov](https://www.regulations.gov) without change or  
1109 redaction, so commenters should not include information they do not wish to be posted (e.g., personal  
1110 or confidential business information). Comments that contain profanity, vulgarity, threats, or other  
1111 inappropriate language or content will not be posted or considered.

1112

1113 **FOR FURTHER INFORMATION CONTACT:** For questions about this RFI contact: Elham  
1114 Tabassi, NIST, MS 8900, 100 Bureau Drive, Gaithersburg, MD 20899, telephone (301) 975-5292, e-  
1115 mail [elham.tabassi@nist.gov](mailto:elham.tabassi@nist.gov). Please direct media inquiries to NIST's Public Affairs Office at (301)  
1116 975-NIST.

1117

1118 **SUPPLEMENTARY INFORMATION:** On May 1, 2019, NIST published a notice and RFI in the  
1119 Federal Register (84 FR 18490), about Artificial Intelligence Standards. The notice requested public  
1120 comments on or before May 31, 2019. Multiple interested parties have expressed difficulty in  
1121 submitting comments by the original deadline, and have asked for an extension. In light of these  
1122 requests, NIST extends the period for submitting public comments to June 10, 2019. Previously  
1123 submitted comments do not need to be resubmitted.

1124 Kevin A. Kimball,  
1125 Chief of Staff.

1126

1127

**APPENDIX VI WORKSHOP AGENDA**

1128

**Federal Engagement in Artificial Intelligence Standards Workshop**

1129

National Institute of Standards and Technology | 100 Bureau Drive, Gaithersburg, MD 20899

<b>May 30, 2019 – Final Agenda</b>	
<b>9:00 AM</b>	<b>Welcome and Overview of Logistics</b> – Elham Tabassi, Acting Chief of Staff, NIST Information Technology Laboratory (Green Auditorium)
<b>9:20 AM</b>	<b>Opening Remarks</b> – Walter G. Copan, NIST Director and Under Secretary of Commerce for Standards and Technology
<b>9:30 AM</b>	<p><b>Panel Session – What's Next in Standards Setting for AI</b>                      Panel presented by the Center for Data Innovation, <a href="https://www.datainnovation.org/">https://www.datainnovation.org/</a>                      This panel will explore the many facets of AI standards and federal engagement in standards development, specifically. Introduction of panelists by Chuck Romine, Director, NIST Information Technology Laboratory.                      Panel Discussion:</p> <ul style="list-style-type: none"> <li>▪ Jason Matusow, General Manager, Corporate Standards Group, Microsoft</li> <li>▪ Joshua New, Senior Policy Analyst, Center for Data Innovation (Moderator)</li> <li>▪ Lynne Parker, Assistant Director for Artificial Intelligence, White House Office of Science and Technology Policy</li> <li>▪ Anthony Robbins, Vice President, North America Public Sector, Nvidia</li> </ul>
<b>10:45 AM</b>	<i>Transition to Working Session #1 (multiple breakouts, locations varied)</i>
<b>11:00 AM</b>	<p><b>Working Session #1 – What’s Out there Already? What’s in the Works?</b>                      This breakout session will review the current status and plans for, and identify needs and challenges regarding, the availability, use, and development of AI technical standards and tools to support reliable, robust, and trustworthy systems that use AI technologies. Among topics to be addressed: sector specific vs. cross-sector standards, available inventories of AI standards, and AI standards roadmaps.</p>
<b>11:55 AM</b>	<i>Return to Green Auditorium for Plenary</i>
<b>12:00 PM</b>	<p><b>Plenary Session—Insights from Working Session #1</b>                      All-attendee readout/discussion</p>
<b>12:45 PM</b>	<i>Lunch – NIST Cafeteria (on your own)</i>
<b>2:00 PM</b>	<p><b>Panel Session – What AI Standards are Needed by Federal Government Agencies?</b>                      This session will offer examples of the widely varying needs of federal agencies for AI standards to carry out their missions including, but not limited to, R&amp;D, national security, economic development, and oversight.                      Panel Discussion:</p> <ul style="list-style-type: none"> <li>▪ Dan Chenok, Executive Director, Center for The Business of Government, IBM Global Business Services (Moderator)</li> <li>▪ Rob High, IBM Fellow, Vice President and Chief Technology Officer, IBM Cloud and Cognitive Software</li> <li>▪ Timothy A. Klein, Director Technology Policy and Outreach, Office of the Assistant Secretary for Research and Technology, U.S. Department of Transportation</li> <li>▪ Bakul Patel, Director of Division of Digital Health, Food and Drug Administration, U.S. Department of Health and Human Services</li> <li>▪ Jon White, Deputy National Coordinator for Health Information Technology, U.S. Department of Health and Human Services</li> </ul>
<b>3:00 PM</b>	<i>Transition to Working Session #2 (multiple breakouts, locations varied)</i>
<b>3:05 PM</b>	<p><b>Working Session #2 – How Should the Federal Government Engage?</b>                      This breakout session will review the current and potential future engagement of Federal agencies in the development and use of AI technical standards and tools in order to meet the nation’s needs. Participants will discuss the unique needs of the federal government and individual agencies for AI technical standards and related tools, and how federal agencies’ priorities can be aligned with national needs and priorities.</p>
<b>4:00 PM</b>	<i>Break</i>
<b>4:15 PM</b>	<p><b>Plenary – Insights from Working Session #2</b>, Green Auditorium                      All-attendee readout/discussion</p>
<b>5:00 PM</b>	<i>Wrap up + Adjourn</i>

1130

<https://www.nist.gov/topics/artificial-intelligence/ai-standards>