September 14, 2018

Executive Office of the President (EOP)
725 17th Street, NW
Room 5002
Washington, DC 20503

Attn: Gelila A. Teshome

Re: EOP Government Effectiveness Advanced Research (GEAR) Center – Request for Information (RFI): SPE-RFI-18-0001

Dear Ms. Teshome,

Amazon Web Services, Inc. (AWS) is pleased to submit our response to the GEAR Center RFI.

We look forward to further dialogue and an exchange of more detailed information as we progress further with this initiative. Please do not hesitate to contact me at erfrankl@amazon.com or (703) 328-4442.

Respectfully,

Erik Jude Franklin
Federal Civilian Business Development and Capture
Amazon Web Services, Inc.

Amazon Web Services Response to the Executive Office of the President (EOP) Government Effectiveness Advanced Research (GEAR) Request for Information (RFI)

September 14, 2018

Submitted By:

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Submitted To:

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1.0 Executive Summary

Amazon Web Services, Inc. (AWS) is pleased to respond to the Executive Office of the President (EOP) Request for Information (RFI) in support of the Government Effectiveness Advanced Research (GEAR) Center to improve mission delivery, citizen services, and stewardship of public resources via a public-private partnership. We believe that a hybrid physical/virtual construct, with multiple cross-sector participants, is the best approach to operationalizing the GEAR Center. AWS is eager to share our experience and ideas that we believe will help GEAR succeed.

One of Amazon's defining core principles is the "flywheel," which starts with a relentless focus on customers to drive repeatable, self-sustaining growth and innovation. AWS's customers (across public and private sectors) often engage us to learn more about the Amazon innovation process and culture that has been core to Amazon's success to date. To support this need, AWS initiated the "Innovation Center" program that helps our customers learn how Amazon's speed and scale can support their transformation goals. The AWS Innovation Center collaborates closely with higher-education sponsors and applies 10-week development cycles (sprints) to customer transformation challenges and solutions, which are vetted, tested, and ultimately released (typically via open-source models).

We envision a similar GEAR "flywheel" model that involves customer need, applied research, and commercially viable solutions. Subsequent to this RFI response, we welcome in-person discussions of the AWS Innovation Center program with EOP to enable deeper sharing of information. AWS envisions an organizational model for GEAR that will be led by a multi-disciplinary consortium consisting of educational and research institutions and supported by private sector support from companies like AWS, who can accelerate GEAR's impact through technology-led innovation.

A key benefit of a public-private partnership is the ability to share resources, risks, and responsibilities, while accessing new ideas from a diverse community of researchers, subject-matter experts, non-profits, and private industry across an array of disciplines, such as data science, organizational behavior, and user-centered design. However, some key challenges will need to be addressed before it is established. A clear, impartial process for the generation, prioritization, and selection of projects for advancement will be important to the success of the GEAR Center. This is especially important in ensuring that corporate interests do not overshadow mission focus and that political debates or opposition do not factor into selection of innovative projects. Another challenge is ensuring that the operation of the GEAR Center is in alignment with the President's Management Agenda and other appropriate regulatory frameworks. AWS recommends an Innovation Board (detailed in Question 1) to ensure that a diverse body of individuals is involved in identification, selection, and commitment of projects, which will in turn lead to success of the GEAR Center.

One of the stated goals of the GEAR Center is commercialization of federally owned datasets (detailed in Question 8). A key success factor for this effort will be availability of a global infrastructure to house the data; ubiquitous, low-cost access; open-source

applications and development platforms; and trained government personnel who can analyze, process, and share the data. Cloud computing is designed to provide ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources. Using a cloud infrastructure, the GEAR Center can enable pay-per-use computing resources, rather than building an infrastructure for each project, thus reducing costs. AWS can play a key role in providing a global, cloud infrastructure as well as the ability to use data analytics, artificial intelligence (AI), and machine learning (ML) capabilities to turn data into critical mission advantage for the government.

Finally, we agree that workforce reskilling and upskilling is critical to the success of an agency-wide initiative to increase federal government effectiveness. One consideration might be to establish a government-wide training institution, similar to the National Defense University, with a scope that encompasses all Federal Government agencies. We also recommend the development of custom "federal learning paths" that align to specific training needs. Our experience with training and education is detailed in Question 7.

2.0   Company Information

EOP Question	AWS Answer
The name of the individual(s) and/or organization responding.	Amazon Web Services, Inc. (AWS)
A brief description of the responding individual(s) or organization's mission and/or areas of expertise, including any public-private partnership work within the past three years with Federal, State, or local governments that is relevant to applied research on workforce reskilling and data commercialization.	Amazon launched AWS in 2006 so that other organizations could benefit from Amazon's experience and investment in running a large-scale, distributed, transactional IT infrastructure. AWS currently supports an almost limitless variety of workloads for millions of customers worldwide. The AWS Cloud is uniquely positioned to provide scalable, cost-efficient solutions to the U.S. Federal Government, helping find ways cloud services can be employed to meet mandates, reduce costs, drive efficiencies, and increase innovation. Thousands of government agencies are already using AWS to address a diverse set of use cases, from complex government systems to mission-critical intelligence projects dealing with large volumes of sensitive data. Case studies about government agencies and educational institutions already using the AWS Cloud can be found at https://aws.amazon.com/solutions/case-studies/government-education/. For information on the Amazon-Busan Cloud Innovation and Technology Centre, see this post from the AWS Government, Education, & Nonprofits Blog.
A contact for questions or other follow-up on your response.	Erik Franklin, Federal Civilian Business Development & Capture Phone: (703) 328-4442 Email: erfrankl@amazon.com

3.0   Informing the GEAR Center

1. Given the mission of the GEAR Center, what should be:
- Its strategic approach and operating objectives?
- Specific areas of innovation and practice to prioritize? For example, we anticipate an early focus on reskilling the Federal workforce and growing the economy through appropriate commercialization of Federal data.
- The process to identify and prioritize additional new areas on an ongoing basis?

The GEAR Center represents an ambitious opportunity for the Federal Government to engage more deeply with industry and academia to realize new possibilities regarding citizen interaction with government. Developing a lasting strategic approach with supporting operating objectives is critical to the GEAR Center's long-term success and self-sustainment. We support the government's "early focus areas" that will be prioritized as early-stage projects for GEAR, including federal workforce reskilling and upskilling and economic development through the commercialization of public datasets.

We believe that innovation within the Federal Government differs from innovation in academia and the private sector, in that it has a unique focus on mission delivery, citizen services, and stewardship of public resources. The GEAR Center will be in a unique position to harness the cutting-edge innovation that is being fueled within private industry, while at the same time linking it with mission-critical government initiatives that deliver on the promise of serving Americans citizens in the digital age.

AWS recommends establishing an Innovation Board for prioritizing projects for further development. This could also include a steering committee whose role is to vet innovation ideas against key parameters such as:

- **Mission Focus**: Does the innovation deliver tangible benefits that align to a Federal Government mission?
- **Stakeholder Alignment**: Is there an established level of support for stakeholders that will be required to implement the idea? Stakeholder support can serve as a "litmus test" for ensuring that innovation gains traction within the GEAR Center constituency.
- **Sustainability**: Is there measurable ROI for the project? How much seed funding will be required, and what is the timeframe before market-driven forces allow the project to become self-funding?
- **Training**: How much federal workforce reskilling and upskilling will be required and in what period of time?
- **Endurance**: Will the project be truly strategic, and will it survive changes in administration and other priorities?

Based on the outcomes of a thorough review, new areas of innovation can proceed, be modified, rejected, or put on hold, in anticipation of changes in policy, market forces, or industry trends.

2. How should a GEAR Center be operationalized, including its structure, such as a physical center, a network, a consortium of institutions, or other approaches?

To operationalize the GEAR Center, AWS recommends a hybrid physical/virtual construct that delivers the benefits of a physically collocated team but extends the reach and collaboration to a virtual network of functional and technical domain experts—both domestically and internationally. AWS believes strongly that the GEAR Center's objectives are best met by convening multiple cross-sector participants (i.e., educational institutions, think tanks, and private sector companies). This network/consortium will provide the government with broad access to the skills and technology required to solve problems and experiment in the relevant fields. The benefits to this approach include a diverse, cross-functional view of innovation; an objective, neutral idea generation engine; and a broad set of stakeholders to drive innovation through implementation and sustainment.

One model to consider in operationalizing the GEAR Center is the AWS Innovation Center. The core mission of the program is to improve the digital experience of citizens by enabling customer-driven innovation challenges to identify and gain the benefits inherent in cloud adoption. An innovation challenge is any problem or opportunity that end customers deem significant in their community. Challenges are generally tangible, such as optimizing the use of police body camera data, tracking water quality, or publishing city transportation data. The challenge can be thought of as a rapid product development lifecycle that identifies technology alternatives and may result in a prototype. Each challenge is in itself a time-bound project that must be planned, marketed, and managed to completion.

3. What models of public-private partnership should inform the GEAR Center:
- What sectors, stakeholders, types of expertise, and networks or programs should be involved?
- What should a governance structure look like or include?
- How should the GEAR Center maintain mission focus without the Federal Government being responsible for ongoing administration, staffing, and operational management?

To support the planning phase for the GEAR Center, AWS recommends establishing a diverse board comprised of senior-level public sector and commercial leaders. Board members will catalyze and steer innovation, provide independent advice, and address future challenges through the prism of reskilling the workforce, commercializing data to drive economic growth, and driving change in federal policy and practice.

The government's role would be to communicate the administration/President's Management Council's priorities, provide technical direction and steer the board, and partner with industry to adjudicate input on emerging trends, government successes, and technological expertise as it fits best with government's interest. Specifically, AWS can engage with the board and provide innovative solutions as the government reduces its data center footprint and migrates mission systems to the cloud—particularly, we can enable cutting-edge solutions using AI and ML.

One set of stakeholders AWS is connected with is The University Innovation Alliance, which is the leading national coalition of public research universities committed to increasing the number and diversity of college graduates in the United States. This group of public universities is committed to innovating together to raise graduation rates, increasing U.S. global competitiveness. One example of an innovative capability we can

leverage through this alliance is the Cal Poly Digital Transformation Hub, which works with government, education, and non-profit organizations to help solve the most pressing issues and challenges in the public sector. Prototypes are developed, and the solutions are published in the public domain for agencies to apply to their challenges.

Another AWS program that could be leveraged for the GEAR Center is our Pop-Up Accelerator, which is a program aimed at engaging end customers, partners, and emerging technology firms to implement strategy, fulfill missions, create new markets, and solve challenging problems. This collaborative method of engagement is flexible and can be utilized to focus on any business vertical (for example, healthcare, aerospace, and transportation), specific technology category, or public sector regulatory and/or economic development initiative.

Some of the benefits the GEAR Center could derive from this program include:

- Capital to fund both early-stage product development and later-stage scaling to meet capacity needs.
- Business model design and evaluation.
- Domain expertise in both commercial and public sector markets.
- Strategic direction based on the technology interests and needs of key market players (both commercial and government).

A successful private-public partnership model to consider would be the Department of Veterans Affairs (VA) Open Source Electronic Health Record Agent (OSEHRA). Its mission, to engage public and private sectors using an open-source model to ensure that veterans receive the best care and that VA clinicians have the best tools available, was met with great success.

OSEHRA is a 501(c)(6) non-profit organization dedicated to advancing open-source electronic health record software and related health IT. OSEHRA supports an open-source community of users, developers, and researchers with over 850 registered members, including 160+ industry, academic, and government organizations. OSEHRA works with VA in two ways.

First, OSEHRA performs work under contract with VA that includes the facilitation of VA-designated Technical Working Groups that identify, analyze, prioritize, and certify open-source software candidates for VA intake. Second, OSEHRA fosters an open ecosystem in which many organizations, including the VA, can equally participate. These organizations include, but are not limited to companies, non-profits, academic institutions, and state and Federal Government agencies. The principal objective of the contract is to enhance VA's ability to exploit the benefits of open-source innovation. The scope of work provides critical analysis, identification, prioritization, and code certification services to "tee up" desirable open-source code for intake by VA.

Following open-source best practice, operation under this contract is as transparent as possible. Community members are encouraged to submit suggestions for consideration and to participate in the OSEHRA certification process. All of the analyses, selection

criteria, prioritization documents, etc. that constitute each quarterly Capabilities-Based Assessment package are posted on the web for review and comment. The goal is to solicit maximum community participation in every aspect of the contract.

We have included additional examples in response to Question 4 below.

4. What examples already exist that serve a purpose similar to the GEAR Center, whether for governments or other institutions:
- How might such examples be replicated, scaled, connected, or more systematically leveraged?
- Opportunities for the Government to learn more about these examples, such as through a demonstration, virtual interaction, or other method?

Organizations with a similar purpose can help inform creation of the GEAR Center. They combine a physical institution and a virtual network for applied research to improve mission delivery, citizen services, and stewardship of public resources. The government's role is key in communicating the administration's priorities, technology needs, and board governance. Some examples of these organizations are detailed below.

Traditional teams and systems architectures do not provide the flexibility and agility to adapt to rapidly changing IT infrastructure. Successful modern digital service delivery teams tend to be cross-functional and fully vertically integrated, from user research and design to development and operations. They take a product management approach to delivery, taking ownership and responsibility for the entire user experience. Collaboration should include Subject-Matter Experts (SMEs), policy experts, and other stakeholders to facilitate research, delivery sprints, iterations, and new feature development. This allows adaption to include tradeoffs, alternate implementation paths, and new ideas based on evolving technology.

From a contractual perspective, creating 6-12 month base periods with multiple 6-month option periods enables agencies to prototype in the base period and make a more informed decision to either execute an option to continue with delivery, or pivot based on your discovery and prototyping work. This approach also allows reopening the contract to competition to maintain competitive pressure with vendors, ensuring continued high quality and delivery speed.

Rapid Prototyping Engagements – AWS works with our customers to develop solutions to their specific challenges. We leverage innovation labs, automated reference deployment executables, and documentation based on our best practices to enable customers to move from concept, to planning, to execution. This process enables customers to envision the "art of the possible" when leveraging AWS Cloud services to solve business challenges by rapidly creating working Proof of Concepts (PoCs) to validate approaches and build out a customer reference implementation. This process leverages collaboration with key business/technical stakeholders to define key challenges and identify PoC target outcomes that address them. The process includes workshops to address business challenges, collaborative shaping of possible customer outcomes, architecture options, sample code, planning, and training. AWS offers both short- and longer-term versions of this type of consultation, ranging from a single week

to multiple years based on customer needs and timing. These innovation engagements are designed to help our customers minimize IT costs, increase technology choices, spur economic development, and accelerate repeatable cloud successes.

Centers of Excellence (COEs) – GEAR will further the work that the Office of American Innovation (OAI) is doing to innovate within government, including modernizing infrastructure, workforce development, and government services. Specifically, this is aligned with the goals of the IT Modernization COE's stated purpose to accelerate the modernization of IT infrastructure across government, leverage private sector innovation, centralize best practices and expertise, collaborate across agencies, and focus on policy requirements and changes, while also providing implementation assistance. The COE model revolves around a central hub that develops research and best practices for innovation to develop solutions and jumpstart initiatives across a large sector of the government.

National Technical Information Service (NTIS) Joint Venture Partnership (JVP) – This program provides innovative data services to federal agencies through JVPs with the private sector to advance federal data priorities, promote economic growth, and enable operational excellence. Joint ventures are focused on improving access, analysis, and use of federal data and data services, either alone or in combination with non-federal data. The JVP program gives NTIS the ability to leverage leading, innovative companies to solve complex data challenges. It has the benefit of helping drive POCs quickly by avoiding the requirement to start by executing a significant contract to begin work.

America COMPETES Act – The America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science Act of 2007, or America COMPETES Act, is chartered to invest in innovation through research and development and to improve the competitiveness of the United States. Similar to the America COMPETES Act, GEAR can generate reports on the state of innovation and competitiveness in the government and assessments of agency science, technology, and engineering, and workforce capabilities.

We envision that the GEAR Center can leverage the components of the above programs to create repeatable processes and enable agencies to follow blueprints, leverage guiding principles, and tailor these for customer use cases. This process uses specific concepts, including user centrism, agile technology and acquisitions, and rapidly developed prototypes as key elements.

Best practices gleaned from many agencies help create repeatable processes based on proven approaches. These modular, repeatable components, such as microservices-based approaches and using containerization, can be shared, avoiding overly complex, inaccurate architectures that cannot scale or evolve with agency requirements.

The government should research, engage, and interview organizations to identify those components that can be reused to support the GEAR mission. The provided recommendations include demonstrations, proofs, in-person and virtual collaboration,

rapid prototyping, experimentation, and sharing of best practices—all of which can be leveraged by GEAR.

4.0   Establishing the GEAR Center

5. What model should be used to establish a GEAR Center, including:
- The most effective and low-burden mechanism to establish a GEAR Center, such as the Government issuing a challenge, pursuing a traditional procurement, or an alternate approach?
- If the Government were to pursue a challenge or other open competition, the key considerations in establishing a panel of judges?

In the early stages, to establish the GEAR Center, AWS recommends federal "seed" funding for challenges to develop prototypes (for example, Smart Cities for Department of Homeland Security), augmented by additional development funding for successful prototypes and/or traditional procurements for mission-critical initiatives.

GEAR can leverage funding best practices, including small, multi-phase procurements and POCs, joint venture public-private approaches, and prizes for competitions like America COMPETES.

In terms of key considerations for a competitive challenge, our recommendation would be to factor in the following categories:

- **Mission Focus**: Does the idea fit with the government's mission, and does it have broad applicability across federal agencies, or is it a single-agency project?
- **Financing**: Is it financially viable and a good use of taxpayer money (i.e., will it require seed funding but evolve successfully into a self-sustaining, market-driven model)? Will it obtain broad stakeholder financial support, or will it need to rely on heavy, traditional procurement models?
- **Customer and Stakeholder Mindshare**: Does the project have the potential to obtain broad mindshare from the government, private, and academic sectors? Does it have strong entrepreneurial leads within these communities? Does the customer regard this as a valuable project? Does it leverage GEAR's unique strengths?
- **Market Forces**: Is there a large, fast-growing private sector market for the innovation (particularly for commercialization of public datasets? Is it easy to tap into, or is it still nascent and therefore will take several years to become self-funding?
- **Technical**: Is it feasible and scalable? Does it open the door to Federal Government–wide adoption? Will the upfront investment required be satisfied by seed funding?

6. How should a GEAR Center be funded? The Federal Government expects to provide seed funding to support near-term establishment of the GEAR Center agenda, but a market-driven model will be needed to sustain the Center facilities, operations, and agenda over the long term.
- What could be sustainable funding approaches, including sources of funding?
- What market incentives are necessary to make the Center sustainable?

From a funding standpoint, we concur and support the government's approach to provide seed funding that successfully evolves into a market-driven, fee-for-service, and/or traditional procurement model to enable self-funding to sustain facilities, operations, and agenda over the long term. We believe that a mix of existing institutional incentives, in both the public and private sector, combined with 'pay for a Challenge' option can sustain the GEAR post-startup. One example of a market incentive currently in place through the AWS Public Data Set program, which seeks to democratize data by making it available for analysis. The incentive is that we cover the cost of storage for publicly available, high-value, cloud-optimized data sets. Data set owners are motivated to bring their information to the AWS Cloud, and other entities are then motivated to work with that data and potentially explore further opportunities with the data set owners. Similar incentives by the GEAR Center could encourage wider participation by private and public entities.

Subsequent to this RFI response, we welcome in-person discussions of the AWS Innovation Center program with EOP to enable deeper sharing of information.

5.0   Anticipated Early Focus

7. What models, approaches, and opportunities should inform an anticipated early focus on reskilling and upskilling Federal employees? For each questions, please cite any available data or research to support your answer.
- What are leading practices for effective reskilling, upskilling, and training adult workers, including opportunities for new applications of existing models?
- What approaches could be piloted for possible application and scalability across the Federal sector in various learning domains (e.g., cognitive, affective, behavioral) - such as gamification, use of massively open on-line courses (MOOCs), apprenticeship models, and other new approaches?
- What are examples of metrics currently used to assess the effectiveness of reskilling and upskilling efforts?
- Do any of the suggested approaches have a particular nexus to the Federal workforce and/or to the automation of existing workflows, and transformation of existing skills to in-demand skills expected to comprise the "future of work"? If there are occupations or skill sets that would provide an opportunity-rich environment, please include specifics.

AWS agrees that reskilling and upskilling federal employees is a key success factor for long-term sustainability of the GEAR Center. One consideration might be to establish a government-wide training institution, similar to the National Defense University, with a scope that encompasses all Federal Government agencies. We also recommend the development of custom "federal learning paths" that align to specific training needs.

Amazon has significant experience providing educational and training programs, catering to a wide audience, from schoolchildren to working professionals. Some of these programs and initiatives are detailed at a high level below.

AWS Educate
With the increasing demand for cloud computing experience in the workforce, AWS Educate provides an academic gateway for the next generation of IT and cloud professionals. AWS Educate is Amazon's global initiative to provide students and educators with the resources needed to greatly accelerate cloud-related learning and help power the entrepreneurs, workforce, and researchers of tomorrow. AWS Educate

also provides students with access to a job board populated by companies interested in hiring candidates with cloud skills. Launched in May 2015, by November 2017 AWS Educate had hundreds of thousands of student members and over 1,500 institution members globally, including the top 10 Global Computer Science & Information Systems institutions in the 2017 QS World University Rankings.

AWS Institute

AWS Institute engages global leaders who share an interest in solving some of the world's most pressing challenges using technology. By convening leaders, industry experts, and entrepreneurs for strategic dialogue in small, private roundtables, the institute helps turn ideas into action, accelerate innovation, and solve problems at scale.

Roundtable dialogues focus on identifying sector priorities for policy reform, gaps in infrastructure, and sector challenges to develop actionable, scalable, and cost-effective solutions. These in-depth conversations enable participants to learn from public sector and industry experts who use technology to innovate. AWS Institute focus areas include:

- **Digital Transformation and IT Modernization**: Organizations can leverage technology to more effectively provide services to citizens, make better decisions, facilitate resource deployment, and help shape conditions essential for attracting new economic activity.
- **Cybersecurity, Privacy, and Safety**: Cyber-attacks can hit critical infrastructure. Technology allows for the real-time collection of data, advanced analytics, and expert analysis to predict, identify, and react to potential threats. Through automatic risk monitoring, analysis, and security prioritization, organizations can earn constituents' trust, helping to set the stage for economic growth.
- **Education and Workforce Development**: Technology helps accelerate talent development. It opens new pathways for students and helps build the intellectual capital needed to excel in the digital economy. Academic organizations engage the institute to better understand teaching and learning solutions, analyze student data, and meet the ever-changing needs of the modern student.
- **Economic Development and Job Creation**: Technology has the potential to accelerate human progress, bridge the digital divide, and provide access to economic opportunity. Cities, nations, and regions are using technology to empower citizens and open markets. Making government data open and available for public consumption can help fuel entrepreneurship, accelerate scientific discovery, and create efficiencies across industries.

Cloud Associate Degree

The Cloud Associate Degree (CAD) initiative is a collaborative effort between AWS Educate and leading community colleges to develop academic programs (degrees and certificates) in cloud computing. CAD is designed to prepare graduates from community colleges, vocational schools, and technical academies for entry-level technical jobs in the cloud industry, such as with AWS and our customers and partners. AWS Educate will work with college faculty—and their high school and four-year university partners—

to integrate AWS content into their degree curriculum so that students have the opportunity to learn cloud computing with state-of-the-art AWS tools.

We are working with a group of community colleges across the U.S. to help them build their cloud computing academic programs. Northern Virginia Community College recently announced the launch of a new Cloud Associate Degree, and the California Cloud Workforce Project ("CA Cloud"), a consortium of 19 LA County community colleges and their sister high schools, will offer a Cloud Computing Certificate starting in 2018-19. The CA Cloud curriculum will also be shared globally through AWS Educate, along with materials contributed by Miami Dade College and British Columbia Institute of Technology.

AWS Academy
AWS Academy provides participating higher-education institutions worldwide with authorized AWS curriculum and learning resources, so institutions and educators can more easily offer cloud computing courses and students can become proficient and certified in AWS technology.

AWS Training and Certification
AWS Training is designed to help individuals delivering cloud-based solutions gain proficiency with AWS Cloud services and solutions. We offer free instructional videos, self-paced labs, and instructor-led classes. Our role-based technical training courses are designed around the three primary roles that comprise engineering teams delivering cloud-based solutions: Solutions Architect, SysOps Administrator, and Developer. Whether you are just getting started or looking to deepen your skills, we offer training to help you learn to design, develop, and operate available, efficient, and secure applications in the AWS Cloud.

AWS Training could also create new government-focused learning paths that would dive into the specific needs of government agencies and their employees and align training with these needs.

Another offering from AWS Training is skills assessments that can be used to understand existing skillsets and where the needs are for further training. Federal employees can then be aligned with the necessary training to ramp up their AWS Cloud–specific skills to support AWS migrations and operations once migrated. AWS Training offers these skills assessments free of charge.

Third-Party Training
Training on cloud technologies is also available through a wide range of third-party training providers.

8. For an anticipated early focus on how Federally owned data could help transform society and grow the economy:
- Are there opportunities for the Federal government to partner with the private sector to improve data architecture/taxonomy, and data quality/hygiene?
- Are there innovative economic models that highlight the value of the data, and would encourage private investment to capture that value both within the Government and across the broader economy? What are the barriers to implementing these models?

- Are there specific data sets that could be further leveraged by the Federal government, start-ups, and the public – that, once scaled, have a significant potential to contribute to the greater good (bolster the economy, improve population health, provide services to the general public, etc.)?

AWS believes that there are opportunities for the GEAR Center to partner with the private sector to improve data architecture and hygiene, with the goal of increasing usage of federally owned data, leading to commercialization of datasets. Current challenges to broad usage and commercialization of federally owned data include lack of awareness in industry, difficulty in accessing data, lack of usability due to its raw nature, insufficient documentation, and a lack of customer support. Not all federally owned data undergoes a curation phase, where raw data is cleansed, normalized, and made available within a "data lake" structure for Business Intelligence (BI) and data analytics.

An example use case is patent and trademark datasets, which are an aggregation of patent entries. Law firms and other end users need to invest heavily in clean-up before they can "productize" the data for broader use or conduct any meaningful analysis. One idea for private sector engagement is to identify key stakeholders that are willing to invest in data curation activities to enable broader commercialization (e.g., the IG/FBI would be interested stakeholders in IRS Form 990 data, but may not currently be a part of this initiative). Another example of where curation activities would be critical is the NOAA Big Data Project public dataset, which comprises a broad set of XML files with very few "wrapper" services such as customer support, documentation, or user community building.

In addition to curation of data, a second challenge is that network costs become cumbersome when sharing terabytes (TBs) and petabytes (PBs) of data. The establishment of cloud-enabled datasets that lend themselves to high-volume data access by broad-based user communities will be an instrumental step in commercialization of data. The [AWS Public Dataset Program](#) covers the cost of storage for publicly available, high-value, cloud-optimized datasets, and we work with data providers who seek to democratize access to data by making it available for analysis on AWS and encourage the development of communities that benefit from access to shared datasets.

AWS believes that sharing data effectively involves similar steps to launching a software product: understanding customer requirements, creating a positive UI and thoughtful design, developing valuable data lakes that can be accessed using a variety of BI and data analytics tools, and providing ongoing access to support services. The GEAR Center could serve as a venue for managing and funding data sharing and commercialization of that data.

In addition to facilitating access to data, AWS provides a comprehensive toolkit for gathering, storing, analyzing, and working with data at any scale. Breaking traditional silos of data by sharing in the cloud creates ecosystems that help build communities and tools around datasets that drive new businesses, accelerate research, and improve lives. For example, large datasets, such as Landsat satellite data, historically required hours or days to locate, download, customize, and analyze. Now, anyone can

programmatically access the data and, within minutes, spin up the resources they need to use the data. Cloud-based analytics enable innovation by collocating large data stores, like data lakes, in close proximity to powerful and ever-expanding web services, that consume and process this content. AWS provides the most comprehensive, secure, scalable, cost-effective portfolio of services that can be used to build data lakes and analytics solutions. Cloud-based data and analytics can be accessed by communities of interest to iterate, innovate, and solve new problems and challenges.

While we believe that many types of government data are indispensable for commercial activity and that federally produced data could generate revenue to fund data-producing government programs, we recommend caution with regard to monetizing access to data. We recommend continuing to provide most data at no cost, unless there is an established, strong demand from industry. "Cost recovery" or "requestor pay" economic models have been discussed in the past within the broader community; however, there has not been sufficient demand to sustain this model. One option that AWS would recommend exploring is a consortium approach, which is a hybrid funding model that sits between per user/usage fee and government bearing all cost, where an industry consortium consisting of a small group of stakeholders bears the financial burden for commercialization.

One example of a challenge that can arise from trying to monetize data is summarized by Tom Loveland from United States Geological Survey's (USGS) Landsat program, who recently said, "It costs a lot of money to charge money" in a Nature article about the possibility of charging for access to USGS's Landsat data. The Landsat program's practice of charging for data showed how charging for data can choke off access to data and diminish the value of a program. Charging for access to Landsat data limited data access to a small set of commercial users, hindered academic research, and created operational expenses required to charge for data access. Usage of Landsat data increased dramatically once USGS stopped charging for data access in 2008, and USGS economists determined that free access to Landsat data created $1.8 billion in value to the U.S. economy in 2011.

That said, providing large volumes of data requires investment. If agencies use best practices for distributing data in a public cloud environment, the cost of bandwidth to transfer data can be reduced dramatically because data can be processed in the same cloud where it's stored. We also believe that there are opportunities to make it cheaper to charge for data. The GEAR Center could provide us with a laboratory to experiment with solutions that allow agencies to experiment with ways to charge for data. If they can efficiently recover the costs of sharing data, some government agencies will be able to share data that was previously not shared due to operational cost concerns. A GEAR Center could be useful in developing business models that support government agencies' data gathering and distribution operations and allow them to expand their operations to provide even more data to the public.