



ATARC IT MODERNIZATION SUMMIT

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On behalf of the Advanced Technology Academic Research Center, I am proud to announce the release of a White Paper documenting the MITRE-ATARC IT Modernization Collaboration Symposium held on December 11, 2019 in Washington, DC in conjunction with the ATARC IT Modernization Summit.

I would like to take this opportunity to recognize the following session leads for their contributions:

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Thank you to everyone who contributed to the MITRE-ATARC IT Modernization Collaboration Symposium. Without your knowledge and insight, this White Paper would not be possible.

Sincerely,

A handwritten signature in cursive script that reads "George Thomas Suder". The signature is written in dark ink and is positioned above the printed name and title.

Tom Suder

Founder, Advanced Technology Academic Research Center (ATARC)

FEDERAL IT SUMMIT SERIES

DECEMBER 2019 FEDERAL IT MODERNIZATION SUMMIT REPORT*

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Abstract

The Advanced Technology Academic Research Center (ATARC) Federal Information Technology (IT) Modernization Summit was held on December 11, 2019, in Washington, D.C. It was the second ATARC summit on the topic. During this summit, four MITRE-ATARC collaboration sessions provided representatives of industry, academia, government, and MITRE the opportunity to discuss challenges government agencies face while modernizing their information technology. The sessions were an interactive forum for participants to exchange ideas on best practices, recommendations, success stories, barriers, and requirements to advance IT modernization in government. Each collaboration session was led by representatives from government, MITRE, and industry. This white paper summarizes the collaboration session discussions. The sessions were aligned with the General Services Administration (GSA) IT Modernization Centers of Excellence (CoE)¹ and focused on the following topics:

- Cloud adoption
- Customer experience and contact center of the future
- Artificial intelligence and data analytics
- IT infrastructure optimization

The summit highlighted several challenges facing the Federal Government's modernization efforts and presented recommendations to address them. The session discussions were energetic and wide-ranging and the approaches taken by the various sessions for developing challenges and recommendation varied. Yet, a few themes ran across the sessions in terms of challenges and recommendations and are presented below. These are simplified versions of thematic and common threads detailed later in the document.

While the wide range of challenges identified in the collaboration sessions are difficult to classify, the following themes are discernible.

1. Agencies are having to meet customer expectations for mobility, responsiveness, and data access on platforms built for legacy technologies.
2. Agencies lack a comprehensive strategy that includes security, network, and cultural considerations when adopting IT modernization initiatives.
3. A complicated service offerings market makes it difficult for agencies to make informed decisions when procuring IT modernization services and technologies.

Likewise, several themes are discernible in the recommendations made in the sessions.

¹<https://coe.gsa.gov/>

1. Agencies need to focus on serving customer needs and meeting expectations when making strategic IT modernization decisions.
2. Agencies should develop flexible IT modernization strategies that take into account technology evolution and impacts.
3. Agencies need to educate and support employees to help them manage the complexities and organizational change introduced by IT modernization initiatives.

1 INTRODUCTION

The Advanced Technology Academic Research Center (ATARC) Federal IT Modernization Summit was held on December 11, 2019, in Washington, D.C. It was the second ATARC summit on the topic. During the summit, four MITRE-ATARC collaboration sessions provided representatives of industry, academia, government, and MITRE the opportunity to discuss challenges the government faces while modernizing their information technology (IT) infrastructures. During the interactive forums participants exchanged ideas on best practices, recommendations, success stories, barriers, and requirements to advance IT modernization in government.

Each collaboration session was led by representatives from the government, MITRE, and industry and covered four topics: cloud adoption; customer experience and contact center of the future; artificial intelligence and data analytics; and IT infrastructure optimization.

The MITRE Corporation is a not-for-profit company that operates multiple federally funded research and development centers (FFRDCs) [23]. ATARC is a non-profit organization that leverages academia to build a bridge between government and corporate participation in technology initiatives² and holds summits on key topics of current relevance to the government. MITRE works in partnership with ATARC to host the collaborative sessions as part of the ATARC summits.

This white paper summarizes the collaboration session discussions and identified recommendations for the summit.

2 COLLABORATION SESSION OVERVIEW

Each of the four MITRE-ATARC collaboration sessions consisted of a focused and moderated discussion of current problems, gaps in work programs, potential solutions, best practices, and ways forward regarding a specific challenge area. The collaboration sessions were aligned with the General Services Administration (GSA) IT Modernization Centers of Excellence (CoE)³, and were focused on the following topics:

- Cloud adoption – How can agencies successfully integrate cloud services? How can agencies effectively select and fashion the right migration path to implement by an industry partner?

²<http://www.atarc.org/about/>

³<https://www.gsa.gov/about-us/organization/federal-acquisition-service/technology-transformation-services/office-of-the-centers-of-excellence>

- Customer experience and contact center of the future – What is necessary in order to establish a repeatable methodology to help agencies improve service delivery and citizen interaction?
- Artificial intelligence and data analytics – How can data analytics increase the quality of data-driven, evidence-based decisions at both the executive and program delivery level?
- IT infrastructure optimization – What are the lessons learned regarding federated data center consolidation, application landscape modernization, security improvements, and IT infrastructure cost inefficiency elimination?

This section outlines the goals, themes, and findings of each of the collaboration sessions.

2.1 Cloud Adoption

Cloud environments have been used in the federal space for almost 10 years yet adopting a “cloud smart” [12] approach continues to be challenging. GSA has found that agencies need help in cloud domain areas such as: “Portfolio/architecture analysis, Application/system analysis, Cloud migration planning, Solution architecture support, Cloud governance implementation, Cloud security assessment, and Federal Risk Assessment Management Program (FedRAMP) advancement”⁴ [10].

2.1.1 Session Goals

The cloud adoption session focused on barriers preventing federal agencies from migrating their services to the cloud and the following potential strategies to overcome them to include the following goals:

- Addressing knowledge barriers to cloud adoption in federal agencies
- Developing strategies that are mission and goal-driven for cloud adoption
- Identifying risks introduced by adoption of cloud services and how to address them

⁴<https://coe.gsa.gov/coe/cloud-adoption.html>

2.1.2 Challenges

Various federal agencies have similar challenges with adopting cloud capabilities. This session identified several barriers blocking federal agencies from migrating to the cloud.

- **Lack of knowledge:** Government employees tasked with critical decision making on cloud adoption often lack general training, experience, and specific areas of cloud knowledge leading to difficulties in effectively utilizing cloud services.
- **Lack of a strategy:** Absence of a mission and goal-driven strategic approach to cloud adoption can lead to poor implementation of cloud technology and inability to adapt to technology-driven changes in process, culture, and IT management.
- **Risk of innovation:** Changes brought about by IT modernization and cloud adoption also introduce risks that must be managed.
- **Source selection:** The market of available cloud services is currently large and continuing to grow rapidly. Government decision makers lack guidance on widely accepted criteria designed to effectively evaluate cloud services.
- **Vendor control, transparency, and management:** Cloud Service Providers (CSPs) often do not provide the same level of detailed information transparency as government-owned, on-premise IT. Some agencies perceive this as a lack of direct and detailed system control, especially in the area of cyber security. Some questions arose during the session.
 - Is the security good enough?
 - Who is accessing the system?
 - What are the performance parameters?
 - How are CSPs implementing compliance requirements?
- **Cultural change:** Shifting away from traditional IT solutions and adopting cloud computing requires potentially significant cultural changes and creation of much more agile and adaptive federal agencies.

2.1.3 Discussion Summary

The session started by identifying multiple major barriers to cloud adoption experienced by the participants. They then briefly discussed the criticality of each topic and prioritized the

items they wished to discuss in more detail. The participants determined to take deep dives into three specific challenges: training and education, creating strategies, and managing the risks of cloud adoption.

Training opportunities are becoming much more widely available. Commercial cloud vendors often provide specific training on their services at little-to-no cost or package training with service fees. Online training through such services as Udemy and Coursera is becoming more broadly accepted and academia is also offering more cloud-based education. Conferences and events such as the ATARC Federal IT Summit Series are also becoming increasingly popular as a means to share information, lessons learned and collaboration on cloud adoption best practices. In addition, ATARC is standing up a cloud working group to address topics in more detail.

Next, the participants discussed the need for enterprise-level cloud adoption strategies that effectively integrate specific “bottom up” cloud implementations and migrations. One challenge is to avoid “silos of migration,” where a single application or project is migrated to a cloud environment without consideration of and coordination with the larger enterprise. In such circumstances, it is possible to disrupt data sharing needs, larger business process, and mission effectiveness by not addressing integration or coordination aspects. This situation can also create higher costs through lack of coordination, service re-use, one-off security implementations, and other issues. In order to address this, participants suggested high-level executives, such as chief information officers (CIO) and chief technology officers (CTOs), be fully committed to enterprise strategies that look to the future and enable immediate cloud migrations, as well as adoption of future technology advances. Executives should focus specifically on how IT enables and improves the mission by leveraging the cloud and emerging IT.

The group then discussed the following requirements for creating a strategy for cloud adoption:

- Aligning cloud leadership to strategies and goals
- Understanding how cloud computing adds value to agency missions
- Creating a roadmap that lays out an approach for cloud adoption over time
- Understanding dependencies between systems and processes and establishing a strategy that ensures that activities are properly ordered
- Realistically evaluating the sensitivity and classification of data to drive the implementation of security at the appropriate level

- Planning for the business process changes in acquisition, contract management, CSP partnership, security, and mission impacts
- Establishing continuous improvement program(s) to be implemented post migration (e.g., cost, performance, security)

This strategy discussion ended with a few final comments on budgetary challenges for training, strategy and planning, and cloud migration implementation efforts and that without these, the potential benefits of cloud adoption may not be fully achieved.

The group conversation then moved to risks of cloud adoption. In this discussion, session members outlined four risks related to integrating cloud services.

Continued operations versus innovation: Session members discussed the challenges of ensuring mission operations continue unaffected while innovations are under development. Risk strategies must be established to ensure that critical mission capabilities are at least as good as legacy processes, and preferably, improve with the implementation of cloud services.

Cultural risks of cloud adoption: Generally, people do not like change, especially change to things they do not understand. This has led to employees not being ready to migrate to the cloud. Employees will also have to shift to having a lack of control of the physical hardware their applications are running on and being unable to see what is going on behind the cloud.

Innovation at its own pace: As previously discussed, session members recognized that mission-focused agencies are not in charge of innovation (the discussion did not address research and development organizations such as DARPA⁵ or HSARPA⁶). Often, vendors are innovating technology; mission-focused agencies invest in and leverage proven technologies to improve their capabilities.

FedRAMP challenges: The acceleration of cloud service authorization requests to FedRAMP has created challenges. FedRAMP is very successful in their “do once, use many times” approach to processing provisional authorities to operate to cloud vendors. Federal agencies are relying more and more on leveraging Provisional Authorities to Operate (PATOs). As demand grows, FedRAMP needs to be better able to meet the growing demands, through automation, streamlining, and funding. Additionally, agencies need to fully understand how to leverage FedRAMP and when agency authorizations might be appropriate.

2.1.4 Recommendations

The collaboration session identified several major recommendations.

⁵<https://www.darpa.mil/>

⁶<https://www.dhs.gov/science-and-technology/hsarpa>

- **Provide cloud education:** Ensure all stakeholders have a foundational understanding of cloud computing and specific stakeholders have required specific knowledge pertinent to their specific roles (e.g., cloud security, Development, Security, and Operations (DevSecOps), acquisition changes).
- **Integrate top-down and bottom-up adoption:** Ensure a cloud adoption strategy is developed and executed that aligns mission strategic goals with individual migration projects.
- **Create a risk strategy for cloud adoption:** Ensure the strategy addressed risk management during the migration and operations, ensuring minimal negative impact to operations during the transition.

2.2 Customer Experience and Contact Center of the Future

The Customer Experience (CX) and Contact Center of the Future session examined what is necessary to establish a repeatable methodology to help agencies improve service delivery and citizen interaction. According to GSA [15], CX represents the sum of a person's involvement with a brand or an agency. It encompasses all their interactions over time in different places, via different channels that include contact centers. CX is about how people perceive their relationship with the service provider. It is about how they feel and what they do as a result. Throughout the interactive discussion, a major theme that emerged was how to enhance an agency's understanding of the voice of their customers to support effective CX and high-performing agency operations.

This topic is of interest to agencies as government lags private sector in CX design and delivery. With federal CX scores consistently ranking at bottom of the American Customer Satisfaction Index Scores, agency leadership must understand and manage the complex system-of-systems challenges and transformation involved with improving their CX environments [5]. Government agencies are taking customer experience seriously, as evidenced by Cap Goal 4 (improving customer experience with federal services) in the President's Management Agenda[20] and laws and pending legislation that include: the 21st Century Integrated Digital Experience Act [2], Evidence-Based Policymaking Act of 2018 [1], Federal Agency Customer Experience Act of 2019 [3] (pending), Taxpayer First Act of 2019 [4], and VA Mission Act [24]. Not only is CX noted in legislation, customer experience is critical in systems engineering to designing an agency's effective contact center and IT modernization strategy.

2.2.1 Session Goals

This session had several goals.

- Bring together business leaders to examine CX and IT modernization technology, tools, and techniques used by agencies to improve contact center efficiency and cost savings.
- Discuss agency challenges, approaches, and recommendations to improve the future vision of external-facing contact centers.
- Create a consensus-driven understanding of the key steps needed to achieve a future state CX vision for agency contact centers.

2.2.2 Challenges

Primarily, the group discussed several challenges.

Customer understanding: One of the most significant and lengthy discussions centered around agencies' lack of clarity about the needs and expectations of their customers. Participants agreed there is a significant challenge in collecting data on customers, using that data strategically and effectively to make decisions, and integrating the data collected across the organization and not just siloed in the area of the agency that collects the data.

IT modernization/digital services experience: As agencies implement leading practices and technologies to design, develop, and deliver innovative solutions faster there is a need for agencies to identify and link digital services to core systems and processes. Participants indicated that it was challenging to sustain operational excellence when balancing the maintenance of traditional channels with IT modernization efforts to transition to lower cost, personalized self-service channels. Participants also noted that the role of the contact center has evolved as agencies adopt innovative technologies and capabilities.

Workforce experience and organization culture: Another challenge discussed was the evolution of human/machine teaming to augment human skills traditionally used in contact centers. The speed of technology used by the public has created higher expectations of responsiveness and timeliness [22]. As agencies look at cost-effective solutions, there will be a need to adopt new approaches to not only serve the customer but also increase employee engagement during this transition. Helping employees build their resilience to change is critical during these transitions.

CX innovation, strategy, and planning: There is a significant challenge for agencies in aligning their strategy and decision-making processes to establish an enterprise-level, consistent CX. Where the CX capability resides within an organization (e.g., decentralized

versus centralized and within CIO vs. executive board) will influence how leaders drive the changes they are trying to implement.

2.2.3 Discussion Summary

The session opened with participant introductions and the session leads providing an overview of the topics to discuss. This included defining customer experience, providing context on what a contact center is and what contact center components might include, and describing the relationship between customer experience CX and contact centers. The discussion focused on several themes.

Voice of the customer: Most agencies face a challenge in understanding who their customers are and what their needs are. Moreover, agencies desire to look beyond the transactional relationship with their customers (e.g., why do customers interact with the agency) and segment customers based on attitudes and behaviors. This may also include evaluation of the different kinds of interactions customers have with the agency (e.g., request, submission, schedule, and guidance) and how those interactions occur today and can evolve in the future.

Employee experience: Participants shared the challenge of how agencies are struggling to not only define their CX but how to best support a positive internal employee experience during times of intense transformation. With many employees serving as the brand of an agency, certain critical interaction points for a customer will differ based on what they perceive as most critical. Panelists shared case studies illustrating the importance of accuracy and timeliness to a customer varies by citizen needs (e.g., accuracy in taxpayer correspondence or timeliness in benefits for a veteran). Each agency needs to evaluate those critical points, how they might vary across their customer segments, and proactively engage and support their employees to meet (and exceed) customer expectations at those critical points. Agencies need to decide on which interaction points are priorities given potentially competing demands and limited resources.

Employee skills and capabilities: As agencies implement bot, chat, and other self-service capabilities via their web platforms, help desk costs have actually increased because staff are involved in solving the “harder” problems (e.g., the inquiries and requests that cannot be handled via self-service capabilities). Help desk staff require training and skill development to support their shifting roles in handling more complex customer questions/problems. Balancing between automation, outsourcing, and reskilling is continuing to grow as a challenge for agencies.

Customer experience journey: Every agency is in a different spot in the design and delivery of their customer experience strategy. With high variance in agencies, there is a need

to define guiding principles that agencies can apply regardless of where it is on its path to providing a positive, cost-effective CX.

Integration and IT modernization: Participants consistently reported that there is still a challenge in identifying integration and collaboration points across internal departments and divisions within their agencies. Specifically, the conversation focused on the challenge of agreeing on the identification and prioritization of IT modernization initiatives.

2.2.4 Recommendations

The session participants made several recommendations will help agencies improve CX/contact center service delivery and citizen interaction.

Develop a CX strategy that reflects a deep understanding of their needs, preferences, expectations, and motivations: Agencies should adopt a data-driven approach for understanding the voice of the customer and improving their experience by relentlessly gathering feedback from and about their customers. This includes feedback that customers provide on request (e.g., through a survey), feedback that customers provide through their interactions (e.g., call center transcripts, chat transcripts, correspondence), transactional data (e.g., web analytics and volume of types of transactions), and operational data (e.g., number of notices sent, call wait times, average call length).

Align the organization's strategy across the customer journey: Measurement, governance and strategy, organization and culture, customer understanding, and service design are key in managing customer experience improvements [6]. Each of these categories overlap to help an agency solve the right problem, identify and measure the customer journey, and identify customer experience practices that are specific for that agency to improve customer satisfaction and operational efficiency. Each agency requires a specific, tailored plan.

Adopt a collaborative, integrated approach to ensure customers have a consistent experience: Collaboration is enabled by giving CX management tasks to specific roles within the organization and facilitating coordination across groups that share responsibility for a given experience. In some agencies, this sort of collaborative approach might require creating matrixed teams and/or realigning roles and teams to deliver on CX goals and objectives.

Think strategically about future workforce needs: As agencies modernize their technical and operational capabilities, the workforce needed to lead and support CX service delivery and the contact center of the future will inevitably evolve. Identifying and addressing the gaps between the workforce of today and the needs of tomorrow requires a strategic approach to workforce planning. The Office of Personnel Management's workforce planning model [21] provides agency leaders with a framework for planning current and future staffing

decisions based on organizational mission, strategic plans, and objectives (to include CX considerations), budgetary resources, and a set of desired workforce skills and competencies. It enables agencies to make decisions about how best to structure the CX organization and deploy the workforce by developing a comprehensive picture of where gaps exist between current workforce competencies and future competency requirements and identifying and implementing gap reduction strategies.

Adopt a disciplined approach for CX strategy execution and engage stakeholders throughout the strategy execution journey: Effective execution of CX strategies requires agencies to adopt an intentional focus on how they plan and prioritize the myriad technical and operational changes they seek to implement over time. This involves translating strategy into actionable component initiatives, understanding the dependencies and interrelationships that exist among the initiatives, and prioritizing and sequencing them into a roadmap (considering and balancing each's strategic impact and resource requirements). Agencies can mitigate the risk of employees and customers resisting change by proactively engaging them throughout the CX strategy execution journey. This includes creating opportunities for stakeholders to provide input and help to shape the future, seeking to understand needs and concerns, and supporting stakeholders with tools, training, and information to facilitate their adoption of new practices and behaviors.

2.3 Artificial Intelligence and Data Analytics

On February 11, 2019, the White House issued an executive order announcing, “the American Artificial Intelligence (AI) Initiative – the United States’ national strategy on AI”⁷. Other activities by Department of Defense⁸ and research communities⁹ highlight the importance of the technology to the economic and security interests of the country. NexGov, a production of the Government Executive Media Group, suggests that the public sector has embraced AI as a “critical priority”; at the same time, the federal government is hesitant to adopt this technology widely [19].

Similarly, data analytics (DA) is an area with great potential within the Federal Government. The Digital Analytics Program, for example, “provides a window into how people are interacting with the government online”¹⁰. However, according to NexGov, “the traditionally slow-moving and sometimes cash-strapped government is challenged to adopt those tech-

⁷<https://www.whitehouse.gov/ai/>

⁸<https://dodcio.defense.gov/About-DoD-CIO/Organization/JAIC/>

⁹<https://www.darpa.mil/program/explainable-artificial-intelligence>

¹⁰<https://analytics.usa.gov/data/#explanation>

nologies, to create intelligent, efficient teams around them to better capitalize on data and generally make the most of emerging capabilities” [11].

GSA recognizes the importance of these fields. It established CoEs to help government to both “provides strategic tools and infrastructure support to rapidly discover use cases, identify applicable artificial intelligence methods, and deploy scalable solutions across the enterprise” [16] and to “drive innovation at partner agencies in data management, organizational capacity, analysis and enterprise analytics infrastructure” [17].

The AI and DA collaboration session focused on three themes: emerging technologies and data strategy, data management and data access, and extract transform load (ETL). Participants discussed experiences leveraging emerging technologies such as AI to enable automation (e.g., bots) to increase and exploit the value of their data assets. Participants discussed how data management challenges persist across federal agencies; data ownership, stewardship, and provenance continue to be difficult problems along with improving data access without sacrificing data security. Finally, participants described how their organizations continue to be challenged with ETL processes related to legacy systems and data migration. They discussed how their organizations can improve decision making with these existing investments.

2.3.1 Session Goals

This session discussed challenges and solutions related to AI and machine learning.

- **Data strategy:** Are there insights around leveraging emerging technologies to better utilize data as a strategic asset? How should the government decide what technologies are most appropriate (e.g., AI, machine learning [ML], robotics)? How should it leverage these technologies to get the most value out of data and improve the overall experience of citizens/customers? How should the government use automation technology, specifically robotics and AI/ML, to increase innovation and improve efficiency? How should it respond to growing “reskilling” or job security fears in the public sector that are tied to the introduction of these emerging technologies?
- **Data management:** Enterprise data management can be overwhelming. Since federal agencies are at varying stages of data governance [8] and there is no “one size fits all” approach to data management, what are some recommendations when implementing data management and data governance best practices?
- **Data access:** Improved data access continues to be a top priority for several organizations. How can an appropriate balance be found between data access optimization

without sacrificing data security?

2.3.2 Challenges

Participants identified several challenges in each topic area.

- **Emerging technologies and data strategy:** Participants noted issues about data ownership and the content of data enabling AI. There are issues related to bias in the data, quality of training data sets, and the training of users. Initial data quality and its effects on ML is also a concern.
- **Data management and data access:** The participants identified several challenges with data ownership, particularly concerning cloud computing; data residency, which considers whether data are resident in a cloud or on-premise; and data provenance and the concern with who is “borrowing” data, why, and for how long, and when access to data can be terminated.
- **Extract transform and load:** The ETL conversation yielded similar concerns as above, recognizing data migration, data sharing, data ownership, and change management as challenges to be overcome when leveraging legacy systems. There is a need to improve data migrations from legacy systems and to improve service quality while reducing interruptions and downtime. These systems could benefit from consolidation and modernization as well as tools, tips, and AI tricks.

2.3.3 Discussion Summary

Participants discussed each of the three identified challenge areas. For emerging technologies and data strategy, the initial focus area was on the use of AI as an emerging technology, specifically the future of the industry, factors driving its adoption, and agency experiences. Several participants provided their perspectives and the group – in general – agreed that AI is no longer considered a standalone technology to be used in standalone applications and relegated to the back-office. Rather, it has moved more into the mission space and is augmenting mission applications. To introduce emerging technologies, the group generally agreed on the following best practices:

- Use an iterative approach and start small
- Employ a user-centric approach

- Be goal-oriented and define a roadmap to an end-state

The data management and data access conversations were oriented around identifying issues with data access, finding a balance between competing objectives of safeguarding and accessing data versus managing data assets when there are changing requirements and competing priorities. Participants discussed types of access (e.g., need to know, role-based access, on-demand access) and the use of data catalogs to record and track data assets but agreed that data challenges are unique for every organization. Advocacy from leadership is needed for data governance and to support technologies and activities such as data catalogs, metadata management, data stewardship, and data provenance.

The final discussion topic centered around ETL, relating to legacy systems and data migration. Participants agreed that there are still challenges with legacy systems, including bad data, but these can be overcome by employing the following best practices:

- Working with different organizations to share best practices
- Leveraging previous ETL efforts and shared services

2.3.4 Recommendations

Participants identified several important findings and recommendations.

Start small and build a prototype, and scale appropriately: It is essential to identify quick wins and starting small by building a prototype. This is an ideal approach to determine the value of the emerging technology. Following a successful prototype, scale and determine if the small approach is appropriate to large-scale problems.

Look for opportunities to standardize: Support the small prototyping effort to keep data where it currently resides and try not to move, assemble, aggregate, or integrate in any way. However, when developing for a large-scale AI solution identify the top data sources and pull them into a data lake. Identify requirements such as surveys and case studies that should lead to a framework that will help inform future needs, models, and predictive capabilities.

Identify the main pain-points: Look for the toughest problems and establish formal milestones and deliverables when developing AI solutions. Use a data-driven approach and identify metrics to monitor. Iterate and learn while having an eye on the future state of the AI solution, understanding that this can change due to shifting priorities.

Take a user-centered approach: As AI begins to move into the mission space, the government needs to shift its AI awareness to recognize the improved decision making made possible when considering man *and* machine as opposed to man *versus* machine (or the

notion that AI solutions are just tools). This will ultimately lead to a focus of AI and ethics related to AI (e.g., who or what is making the decisions) and government must respond by codifying rules and best practices to address these concerns.

Reskill workforce and change management: The government needs to account for formal, on-the-job training but also allow for self-learning on the job with a trained team. There needs to be a significant change management effort to support this shift, allowing the government workforce to develop the technical skills needed to support AI and other emerging technologies.

The data access and data management conversation yielded several take-aways.

Manage data access: The government needs to understand how to manage data assets given changing requirements and competing priorities. The use of data catalogs, metadata management, and other data governance tools are beneficial but should be informed by an enterprise data strategy. Leadership should be aware of and advocate for the strategy. Apply pressure to leadership to see the strategy through to success.

Identify data owners and data stewards [9]: As a part of a larger data governance approach, data owners and data stewards must be identified to manage data access, to determine need-to-know, and to manage role-based access. This is also a strategic IT consideration and can be informed by understanding people, processes, and technology.

Automated data provenance: Government must invest in capabilities that will automate data management capabilities to provide awareness of data assets. One approach is the use of blockchain to support data provenance. However, the session participants' advice was to choose a capability that is simple to implement and support and to iteratively build on this capability until the full data lifecycle can be documented.

Lastly, the ETL conversation yielded a single recommendation.

Take advantage of work that has already been done and closely align with existing IT modernization efforts. Because a lot of legacy systems still exist across government, it is difficult to make decisions that leverage these systems (e.g., when to decommission) or decisions about modernizing these systems without data. Government organizations should look across the enterprise to share best practices and learn how legacy systems are being utilized. While continuing to leverage these legacies for capability development, keep an eye out for IT modernization activities and align when appropriate.

2.4 IT Infrastructure Optimization

Infrastructure optimization encompasses a large spectrum of initiatives. GSA describes infrastructure optimization as consolidating federated data centers into a single enterprise facility, modernizing the application landscape, driving out IT infrastructure cost inefficiencies, improving security, and positioning the agency for future infrastructure improvements [18]. A major focus for a government information technologist in 2020 will be to improve the CX and align with how customers are accessing federal agencies. In the scope of the IT infrastructure, this translates to better integration with mobile technology to safely and efficiently provide citizens with the data they need to make decisions.

2.4.1 Session Goals

The session focused on several broad IT optimization topics.

- Digital Transformation – how technology is being used to fundamentally change the way the organizations collect, process, and act upon the data gathered [7].
- Multi-cloud management – how government agencies should manage a cloud environment with more than one service provider.
- Cultural and organizational change – how to address the people aspects of an infrastructure technology change.
- Transition from legacy systems – how to transition from a legacy technology to a modern one, such as from Networx [14] to the GSA Enterprise Infrastructure Solutions (EIS) [13].
- Security – how to maintain and enhance security through infrastructure changes.

2.4.2 Challenges

This session discussed two primary challenges.

- **Right data to the right user:** How do organizations deliver the right data to the right user? Challenges include the need to process large quantities of data, often from various sources, and securely deliver it to a diverse set of end user devices (e.g., mobile devices) without the user having to go through multiple logins.

- **EIS migration:** Addressing challenges associated with migrating from the legacy Networx contracts to the GSA EIS contract vehicle. Networx contracts traditionally provide agencies with the bulk of underlying network infrastructures whereas the EIS contract vehicle has much more diversity in its service offerings including cloud services.

2.4.3 Discussion Summary

Participants focused on how smart phones are rapidly becoming the primary device used by citizens when interacting with federal agencies. This shift brings up privacy, technological, and security considerations that federal agencies must address.

A use case discussed was healthcare data sharing. Large datasets of public healthcare information have been made available and are essential for enabling artificial intelligence, machine learning, or even basic research. In this case, original sources of the data (which often contain sensitive personal identification information) must be protected while still making enough data available to achieve the research objectives. This digital transition requires foundational changes into how data is connected, utilized, and displayed.

One approach is placing a data virtualization layer between the data source and the consumer that centralizes data, security, and governance to allow real-time access to data regardless of its location or structure. The value of this approach is that only the applications need to be developed or modernized in the beginning and the data sources can be updated later. It is important not to commit to a specific technology or application that has limited interoperability since technology is rapidly changing and consumers are using a numerous diverse device to access federal data.

Participants agreed that while developing solutions to shift to newer technological interfaces, security must be built into the architecture from the beginning and constantly evolve as the threats become more sophisticated. Protection of sensitive personal and agency data is crucially important as a greater numbers of citizens access data using interfaces such as mobile devices.

Agencies should have an action plan for if and when breaches occur to manage the incident, repair any damage, and rapidly restore the service. Additionally, changes in how security is incorporated and monitored are necessary. Applications will have to be able to access and manage data from multiple databases and locations in order to allow the end users to either analyze the data or use it for AI/ML.

The group discussed how the GSA EIS contract vehicle can provide tools that agencies need to modernize and optimize their infrastructure. Using this contract vehicle, agencies can order services and tools needed to meet modernization requirements while obtaining

assistance in planning the move to new services in a manner that will be transparent to the end user. EIS can provide cloud services (Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), and Software as a Service (SaaS)) in addition to network and communications services.

Finally, implementation and modernization require that agency staff receive the necessary training to upgrade their skills to meet the emerging changes in technology and to manage those services that are being acquired from the various types of suppliers, system integrators, managed service providers, value-added resellers, and cloud service providers. It is critical that people and policy be agile and adapt new ideas and technologies while assuring the integrity of the agencies systems.

2.4.4 Recommendations

From the IT optimization discussion there were several take-aways.

- **Mobile considerations:** Make sure to address customer interfacing technologies (e.g., mobile devices) as part of system interfaces and websites design.
- **Representing data:** When fulfilling a request, create a virtual layer of separation between the data source and the consumer that centralizes data, security, and governance to allow real-time access.
- **Security approach:** Adopt a common approach to security and ensure security is built into the product from the beginning (and not as an add-on).

3 SUMMIT RECOMMENDATIONS & CONCLUSIONS

A summary of challenges and recommendations for each of the sessions is presented in Figure 1.

In conclusion, the collaboration sessions enabled participants to exchange ideas on key challenges and recommendations in order to advance IT modernization in government.

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		 Cloud Adoption	 Customer Experience and Contact Center for the Future	 Artificial Intelligence and Data Analytics	 IT Infrastructure Optimization
Key Results from Collaboration Sessions	Challenges	<ul style="list-style-type: none"> Lack of knowledge Lack of a strategy Risk of innovation Source selection Vendor control, transparency, and management Cultural change 	<ul style="list-style-type: none"> Customer Understanding IT Modernization/Digital Services Experience Workforce Experience and Organization Culture, CX Innovation, Strategy, and Planning 	<ul style="list-style-type: none"> Introducing Emerging Technologies Data Management and Data Access Legacy Migrations 	<ul style="list-style-type: none"> Ability of agencies to provide requested information to citizens Migration from existing legacy systems to modernized, more diverse, and cloud-based systems Transition from legacy telecommunications systems to the Enterprise Infrastructure Solution (EIS)
	Recommendations	<ul style="list-style-type: none"> Provide general cloud education Integrate top-down and bottom-up adoption Create a strategy for cloud adoption 	<ul style="list-style-type: none"> Focus on vendor SLAs Align strategy across customer journey Adopt a collaborative, integrated approach for consistent experience Develop a CX strategy that reflects knowledge of customer Incorporate workforce planning in CX strategy Adopt a disciplined approach for CX strategy execution 	<ul style="list-style-type: none"> Start small and build a prototype Look for opportunities to standardize Identify the main pain-points Take a user-centered approach Reskill workforce and manage change Manage data access Identify data owners and data stewards Automate data provenance Take advantage of work that has already been done 	<ul style="list-style-type: none"> Consider mobility in development efforts Develop approaches to provide requested data to users across all platforms especially mobile Integrate security into the development effort at the outset

Figure 1: The results from the collaboration sessions are represented according to the session from which they were provided.

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