FEDERAL IT MODERNIZATION SUMMIT

DECEMBER 13, 2018 | MARRIOTT METRO CENTER | WASHINGTON, D.C.

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 13, 2018 in Washington, D.C. in conjunction with the ATARC Federal IT Modernization Summit.

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

MITRE Chair: Mano Malayanur

Challenge Area 1: Cloud Adoption
Industry Vice Chairs
Shad Imam, Principal Cloud Engineer, Mulesoft
Gaurav Pal, CEO and Founder, StackArmor

MITRE Chair
Howard Small, Principal Software Systems Engineer, MITRE

Challenge Area 2: Contact Center of the Future
Industry Chair
Brian Boardman, Salesforce Practice Lead, IBM

MITRE Chair
Bruce Patterson, Principal Network Systems & Distributed Systems Engineer, MITRE

Challenge Area 3: Customer Experience
Industry Vice Chairs
Jamie Bowerman, Senior Lead Technologist, Booz Allen Hamilton
Lisa Waple, Director of Customer Experience, CGI

MITRE Chair
Tamara Ambrosio-Hemphill, Co-Department Head, MITRE

Challenge Area 4: Data & Analytics
Government Chair
Pam Hird, Project Manager, USDA

Industry Vice Chairs
Chris Roberts, Solution Architect, Quest Software
Pete Tseronis, Former CTO of DOE

MITRE Chair
Vidyababu Kuppusamy, Lead Software Systems Engineer, MITRE

Challenge Area 5: IT Infrastructure Optimization
Government Chair
Mike Cassidy, CTO, DOJ

Industry Vice Chairs
Stephen Kovac, VP of Global Government and Compliance, ZScaler
Tony Vicinelly**,** Federal Technology Director, NLyte

MITRE Chair
Hugh Goodwin**,** Principal Systems Engineer, MITRE

Below is a list of government, academic and industry members who participated in these dialogue sessions:

Challenge Area 1: Cloud Adoption: Shad Imam, Mulesoft; Bharti Desai, IRS; Valenka Jimenez, Treasury; Xin Wang, DOT; Berel Dorfman, OPIC; Eric Nerenberg, Mulesoft; Bill Brooks, Peace Corps

Challenge Area 2: Contact Center of the Future: Annette Mitchell, IRS; Prakash Yarlagadda, Node Digital; Matthew Brown, DHS; Christopher Proffitt, FTC

Challenge Area 3: Customer Experience: David Charbonneau, EPA; Lauren Dower, Carahsoft; Brian Boardman, IBM; Ashley Ferguson, IBM; Stephen Roddewig, Carahsoft

Challenge Area 4: Data & Analytics: Kelly Bose, DOE; Philip Guinter, Apptio; Leslie Barry, SNAP; Julie Potter, GSA; LeAnn Oliver, DOE; Kelby Funn, SEC; Pam Hird, NASS; Chris Roberts, Quest; Vidyababu Kuppusamy, MITRE

Challenge Area 5: IT Infrastructure Optimization: Keith Trout, SSA; Jake Bishop-Green, DOJ; Bruce Patterson, MITRE; Michael Sanchez, RRB; Tony Vicinelly, Nlyte; Hugh Goodwin, MITRE; Jason Ng, DOS

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,

Tom Suder
President,
Advanced Technology Academic Research Center (ATARC)

FEDERAL IT SUMMIT SERIES

DECEMBER 2018 FEDERAL IT MODERNIZATION SUMMIT REPORT*

March 29, 2019

Mano Malayanur, Sharon Mayer, Tamara Ambrosio-Hemphill,
Hugh Goodwin, Vidyababu Kuppusamy, Bruce Patterson, Howard Small,
Justin F. Brunelle
The MITRE Corporation

Tom Suder
The Advanced Technology Academic Research Center

Contents

1 ABSTRACT

The ATARC (Advanced Technology Academic Research Center) Federal IT Modernization Summit was held on December 13, 2018 in Washington, D.C. This was the first ATARC summit on the topic. During this summit, five 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 infrastructures. The goal of the summit was to create an interactive forum for participants to exchange ideas on best practices, recommendations, success stories, barriers, and requirements to advance IT Modernization in government.

Participants in the collaboration sessions were from government, industry, academia, and MITRE. Each collaboration session was led by representatives from government, MITRE, and industry. The sessions facilitated discussions on the IT modernization challenges faced by government agencies, followed by discussions and recommendations on how they may be addressed.

This white paper summarizes the collaboration session discussions and identified recommendations. The collaboration sessions were aligned with the General Services Administration (GSA) IT Modernization Centers of Excellence (CoEs)[1], and were focused on the following topics:

1. Cloud Adoption
2. Contact Center
3. Customer Experience
4. Data Analytics and
5. Infrastructure Optimization

Key challenges identified in the collaboration sessions included the following:

1. Agencies, and often their components, are not learning from each other's cloud adoption experiences, practices, and lessons learned; as a result, they are therefore repeating some of the same – potentially major – missteps.
2. Agencies are faced with significant and often confusing options in migrating systems to the cloud which impacts portability, cloud usage, acquisition, and governance.

[1] `https://coe.gsa.gov/`

3. Agencies have significant difficulties in hiring, training, and retaining qualified staff to work on cloud adoption projects.
4. Agencies need to reduce the cost per contact and to align with changes in technology that impact drivers for agency contact centers.
5. Government agency customer services are hindered by onerous and legacy policies, lack of communication, and aversion to risk.
6. There is exponential growth in data but a lack of enterprise wide data strategy for analytics, quality, integrity, and security.
7. Data analytics is missing from organizational culture and workforce skills which impacts an overall willingness for adoption.
8. Optimization of the government's infrastructure is built around the concept of incorporating modern commercial technologies while complying with the unique rules and regulations applicable to the Federal Government.

Key recommendations that resulted from the sessions included the following:

1. Agencies should leverage existing collaboration forums (such as the DevOps Federal Interagency Council (IRS) and the Cloud and Infrastructure CoP (GSA)) for sharing ideas, experiences, practices, and lessons among agencies for cloud adoption.
2. Agencies need to establish more standardized methodology for assessing, planning, and implementing cloud adoption.
3. Hire, train, and retain qualified staff to work on cloud adoption projects, especially in the area of cybersecurity.
4. Consider centralizing IT responsibilities under agency CIOs, to improve standardization, information sharing and cloud adoption success.
5. Consider the set of contact channels to support that make the best use of knowledge and resources. Leverage existing data and verify results to improve support outcomes and efficiency.
6. Effective government customer service requires senior leader support to advocate and influence change; change champions that are delegated to communicate and run operations to implement change; and an agile approach to deploy changes to improve the customer experience.

7. Establish teams that comprise of dedicated resources from both the IT and the business aspects of the organization to understand both sides of challenges and respective needs to drive data analytic policies and changes within organizations.

8. Leverage a "Centers of Excellence" (CoE) model to help define a common set of data analytic best practices, work standards, and provide guidance and support to assist in implementing these changes.

9. Leverage emerging technologies such as artificial intelligence (AI) and machine learning to make it possible to link data to gain insights on existing business in addition to growing the business.

10. Prioritize existing data center consolidation using the guidance in the draft Data Center Optimization Initiative Policy Update[2].

11. Modernize Federal IT Delivery to an use an agile model to focus on meeting the end-user's requirements to include the implementation of security into the development process.

12. Update outdated policies and procedures which inhibit innovation and create duplicative activities. Promote access to shared services to increase the economy of scale across the organization.

13. Work on improving the IT workforce's understanding of cloud services and cybersecurity awareness.

[2] `https://datacenters.cio.gov/`

2 INTRODUCTION

The ATARC (Advanced Technology Academic Research Center) Federal IT Modernization Summit was held on December 13, 2018 in Washington, D.C. This was the first ATARC summit on the topic. During this summit, five 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 infrastructures. The goal of the summit was to create an interactive forum for participants to exchange ideas on best practices, recommendations, success stories, barriers, and requirements to advance IT Modernization in government.

Participants in the collaboration sessions were from government, industry, academia, and MITRE. Each collaboration session was led by representatives from government, MITRE, and industry. The sessions facilitated discussions on the IT modernization challenges faced by government agencies, followed by discussions and recommendations on how they may be addressed.

The MITRE Corporation is a not-for-profit company that operates multiple Federally Funded Research and Development Centers (FFRDCs)[6]. ATARC is a non-profit organization that leverages academia to bridge between government and corporate participation in technology[3]. MITRE works in partnership with ATARC to host these collaborative sessions as part of the Federal IT Modernization Summit.

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

3 COLLABORATION SESSION OVERVIEW

Each of the five MITRE-ATARC collaboration sessions consisted of a focused and moderated discussion of current problems, gaps in work programs, potential solutions, and ways forward regarding a specific challenge area. The collaboration sessions were aligned with the General Services Administration (GSA) IT Modernization CoEs[4], and were focused on the following topics:

- Cloud Adoption – What are best practices for migrating to cloud environments?

[3] http://www.atarc.org/about/

[4] https://www.gsa.gov/about-us/organization/federal-acquisition-service/technology-transformation-services/office-of-the-centers-of-excellence

- Contact Center - Which technologies and tools should an organization consider to better integrate customers and services efficiently and effectively via their contact center?
- Customer Experience – How to improve the experience of using government online services, as well as the adoptability of those services?
- Data Analytics – What are enterprise-wide approaches for driving change through incorporating emerging technologies in data analytics and overcoming organization transformation challenges?
- Infrastructure Optimization – How to continue to comply with the unique rules and regulations applicable to the Federal Government while optimizing infrastructure via modern commercial technologies?

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

3.1 Cloud Adoption

Cloud adoption is a strategic focus of IT modernization. It involves migration of systems (applications and data) and infrastructures (data centers and networks) by leveraging cloud technologies. The migration must incorporate cybersecurity technologies and practices to ensure appropriate levels of system and infrastructure protection.

This collaboration session focused on the process of system migration as well as infrastructure migration.

3.1.1 Session Goals

Cloud adoption is a strategic focus of IT modernization. It involves migration of systems (applications and data) and infrastructures (data centers and networks), by leveraging cloud technologies. The migration must incorporate cybersecurity technologies and practices to ensure appropriate levels of system and infrastructure protection.

System migration includes the rationalization of applications to establish cloud readiness and feasibility, selection of service and deployment models as target environments, and determination of migration methods (lift & shift, rack & stack, etc.). This also includes the transfer of data to the cloud (depending on the sensitivity or classification) via direct connection or appliance.

Infrastructure migration includes the evaluation of multi-cloud and hybrid cloud environments, consolidation of existing data centers, and the integration of systems between clouds. This also includes establishing network connectivity to the cloud via perimeter security devices and cloud exchanges.

3.1.2 Challenges

The session identified the following agency collaboration challenges:

- Inter-Agency
  - Agencies have limited insight into each other's cloud adoption efforts
  - Collaboration forums exist but are not widely known
  - Agency best practices and lessons learned are not formally documented
- Intra-Agency
  - Agency components tend to operate autonomously, with potentially unsynchronized approaches to cloud funding, acquisition, implementation and operation
  - Components may make independent purchase decisions, which could lead to IT incompatibilities and missed opportunities for volume discounts

These agency collaboration challenges imply that agencies – and often their components – are not learning from each other's experiences, practices, and lessons learned and are therefore repeating some of the same – potentially major – missteps. Note that similar collaboration challenges were discussed in the June 2018 ATARC session on cloud migration [1].

The session also identified the following adoption methodology challenges:

- What standard approach to cloud adoption phases, analyses, decisions, and practices
- How to get started, in terms of strategies, roadmaps, and plans to be prepared
- What cloud providers, models, and resources to select
- How to architect systems for scalability, redundancy, and performance
- How to implement a hybrid cloud environment, and ensure integration among systems
- How to optimize network connectivity (e.g., high-speed links, cloud exchanges, VPNs, TICs)

- How to address security holistically (e.g., access control, data protection, network perimeter security)

These adoption methodology challenges imply that agencies are faced with significant and often confusing options in migrating systems to the cloud and could benefit from more prescriptive guidance.

The session also identified the following workforce consideration challenges:

- There is an insufficient number of qualified government staff to engineer, migrate, and operate systems in the cloud.
- Agencies don't have standardized roles and responsibilities for cloud adoption projects.
- Many agencies suffer from high attrition due to more attractive opportunities at Cloud Service Providers (CSPs) and related product and services vendors .
- Hiring and training the workforce is expensive.
- The current hiring freeze further exacerbates the ability to hire qualified staff.
- Contractors don't always have the required skills initially, and often take the knowledge and experience gained with them to other opportunities .

These workforce consideration challenges imply that agencies have significant difficulties in hiring, training and retaining qualified staff to work on cloud adoption projects. Note that similar workforce challenges were discussed in a previous ATARC session on cloud migration [2].

In addition, the session discussed the following topics:

- Portability: Agencies are concerned about vendor lock-in and the ability to port systems between cloud environments, especially given the complex range of resources offered by CSPs.
- Cloud Usage: Although the cloud offers scalable, on-demand resources, there is still a lot of "cloud waste" from over-provisioned and unmonitored resources.
- Acquisition: Agencies are challenged with identifying or establishing the appropriate vehicles for acquiring cloud resources and are considering whether to adopt ultra-large-scale acquisitions, similar to DoD's JEDI[5] (for cloud hosting) and DEOS[6] (for business productivity).

[5] https://defensesystems.com/articles/2018/07/26/jedi-hits-the-street.aspx
[6] https://www.fedscoop.com/deos-dod-acquisition-moved-to-gsa-scheduled-70/

- Governance: Some agencies have limiting policies that are hard to change, though federal policies, such as Cloud First and the upcoming Cloud Smart [4] policies, offer improved guidance.

3.1.3 Discussion Summary

The discussion during this session focused on the following points for each of the three major themes:

- Collaboration
  - Need to share ideas, recommendations, practices, and lessons across the federal community
  - Need to setup agency communication channels
  - Need to collaborate on cloud adoption, DevOps, security, and related topics
  - Consider establishing appropriate cloud-focused Communities of Practice (CoPs)
  - Agencies need to work with components to get "buy in" on cloud-related decisions
- Methodology
  - Need to better understand how and where to start, and how to establish a phased approach to adoption
  - Need to understand how to extract the best value from the cloud (e.g., what to deliver, how to improve agility, and how to establish enhanced security)
  - Need an approach to selecting CSPs, service models (SaaS, PaaS, IaaS), and deployment models (public, private, community, hybrid, along with multi-cloud)
  - Need to know how to architect systems for the cloud
  - How to improve practices for backup/DR/redundancy, and how to provision and test cloud environments (e.g., dev, test, staging, production)
  - Need to consider standardized approaches to achieving Authority to Operate (ATO)
  - Need to understand what third-party SaaS products are available, and which CSPs offer the products in their respective marketplaces
  - What types of analyzes should be standardized (e.g., Business / Mission analysis, system analysis, Cost/Benefit Analysis)

  - Need to know how to establish connectivity and integration between on-premises and off-premises cloud environments

- Workforce
  - Need to establish and maintain expertise within the IT workforce
  - Need staff training and re-training, especially in cyber
  - Hiring is expensive
  - Hard to build teams for custom system development
  - Need more qualified and cleared personnel
  - Need to determine the required support for development, deployment and operations
  - Consider establishing cloud-related CoPs, especially for CIOs, PMs, technical, and mission staff
  - Need to document agency knowledge, especially from contractors, as they are hard to replace and often take their knowledge and experience with them
  - Also need to document end-to-end adoption approaches, possibly in standard operating procedures, Wikis, and stakeholder interviews
  - Consider moving all IT responsibility under agency CIOs
  - Consider establishing a Cloud PMO or Cloud Broker's Office to guide adoptions

3.1.4 Recommendations

The cloud adoption session identified recommendations organized by the three major themes: collaboration, methodology, and workforce.

1. Collaboration
   (a) Leverage existing collaboration forums, such as the DevOps Federal Interagency Council (IRS) and the Cloud and Infrastructure CoP (GSA)[7] for sharing ideas, experiences, practices, and lessons among agencies.
   (b) Consider additional forums as appropriate.
   (c) Work with agency components to establish more standardized approaches to cloud adoption.

[7] https://www.cio.gov/about/cloud-infrastructure-cop/

2. Methodology

   (a) Develop structured approaches with stages to analyze, select and adopt cloud resources.

   (b) Develop approaches to architecting systems and provisioning cloud resources, and potentially using automated tools (e.g., DevOps, migration).

   (c) Develop approaches to connect and integrate on-premises and off-premises clouds.

   (d) Conduct pilots at agencies to develop knowledge and create champions.

3. Workforce

   (a) Hire, train, and retain qualified staff to work on cloud adoption projects.

   (b) Retain institutional knowledge in a dynamic IT environment.

   (c) Focus on specific training, especially cybersecurity.

   (d) Consider centralizing IT responsibilities under agency CIOs to improve standardization, information sharing, and adoption success.

3.2 Contact Center

The application of advanced technologies to the contact center can transform the customer experience from beginning to end. Big data, cloud technologies, unified omni-channel communications, collaboration tools, and AI are changing the way contact centers operate. Which technologies and tools should an organization consider to better integrate customers and services efficiently and effectively via their contact center.

This session held some preliminary discussions and then merged with the Customer Experience session.

3.2.1 Session Goals

This session had the following goals:

- Discuss the technologies used in modern contact centers
- Explore the set of principles that drive contact center modernization
- Discuss and explore best practices for contact center modernization

- Develop recommendations to the government and industry for adoption of next-generation contact centers

3.2.2 Challenges

Commercial companies have implemented contact center solutions for several government agencies. As a complementary effort, there are ongoing efforts with government organizations to develop strategic plans and requirements for contact center development. Challenges identified in this session include the following:

- Need to reduce the cost per contact
- Strategic direction to move services to the cloud
- Understanding the depth of knowledge required for individual contact centers
- Understanding how changes in technology impact needs for contact centers

3.2.3 Discussion Summary

Over the past 6 to 10 years, government agencies have consolidated the number of data centers in efforts to reduce costs for IT services. Government agencies are now being asked to reduce costs for the IT services run from those data centers such as contact/call center activities.

In September 2018, the Office of Management and Budget (OMB) announce the Cloud Smart strategy updating the Cloud First strategy [4]. The Cloud Smart enhances Cloud First [5] by focusing on the security, procurement, and workforce needs as part of IT modernization. For services such as contact centers, agencies must now consider impacts to security, procurement methods, and workforce training required as the application/service is modernized. If modernization moves the application/service to the cloud, either as an agency run host application or contracted as a Contact Center as a Service (CCaaS), the agency must understand changes to security posture, changes to procurement funding and acquisition, and workforce training needed to meet mission and operational functions.

Modern contact centers handle support calls using a variety of media contact channels (e.g., voice, email, chat, social media) with new types of channels being added every few years. The types of channels that are effective for a contact center depends on the users age, where they are located, technology they use, business support functions provided, in addition to other external factors. Forcing users to use a specific channel can frustrate some users and

some channels are not compatible with certain business functions. Person to person phone calls are often the most expensive contact calls and reduce the number can reduce costs. Automated systems and knowledge bases at Tier-1 can often handle simple and repetitive support calls without human interaction, reducing service time and cost. Complex calls, typically associated with complex services, may require multiple tier support interactions, human involvement, and are higher in cost.

Contact centers have long used software tools such as automated call distribution (ACD) and interactive voice response (IVR) to filter and direct calls to the appropriate support agents or knowledge databases. Modern contact center now employ machine learning and AI to analyze customer data, contact trends, responses, and other information to gain actionable insights, predict customer behavior, and recommend actions. These technologies need data on which to perform analysis. Best practice suggests developing use cases to determine the data that is needed, an expectation of results, and the target audience or users. Starting small with a limited pilot can help determine if results can meet expectations.

Modernization of a contact center requires upfront effort to determine requirements such as the following:

- What types of services the contact center(s) handles?
- Who are the users of the services the contact center(s) supports?
- How complex are the services the contact center(s) deals with?
- Has the ACD, IVR, or other contact center software been customized to meet special needs?

Metrics collected by ACD, IVR, and other software can help answer many of these questions.

3.2.4 Recommendations

The Contact Center of the Future session participants identified several important findings and recommendations.

- Define what the organization wants to achieve from modernizing the contact center.
- Understand the current and future contact center services, users, and complexities the center needs to support.

- Consider the set of contact channels to support in the modernized center that makes the best use of knowledge and resources. Consider how to leverage existing data to improve support outcomes and efficiency.
- Start small and use an iterative (i.e., agile) approach to development to ensure solutions better meet expectations.

3.3 Customer Experience

The Customer Experience session focused on ways to improve the user experience for citizens using government online services. Creating an easy to use and robust online service offering is difficult – even for the private sector. For the government it is even more challenging. For example, the government must design its online tools to be usable by different types of computers, smart phones, and tablets that operate on different platforms and may have out of date software. The government must also make all information accessible with vision and hearing challenges. The participants in this collaboration session were interested in learning more about improving the experience of using government online services, as well as improving the adoptability of those services.

3.3.1 Session Goals

This session had the following goals:

- Discuss characteristics of a good customer experience for online services
- Review the challenges that the Federal Government has in providing those online services
- Develop recommendations for the government to provide better online services

The session began with an exercise in which participants described the best customer experience they had at a restaurant, in retail, etc. Participants excitedly discussed excellent service from a server at a restaurant, tailored selections from an online tie retailer, and several other memorable experiences. The group listed the following items as characteristics of excellent private sector customer experiences:

- Responsive service that exceeded expectations
- Simplified processes

- Consistency in the product – high quality
- Easy access to needed information
- Informed, personalized service providers
- Ability to "try before you buy"
- Unique products tailored to specific sizes and/or needs (e.g., tall people, travelers)

At the end of this exercise the group discussed ways that the government could provide these types of experiences to the people that use Federal online services. A number of challenges were identified and enumerated in the next section.

3.3.2 Challenges

Primarily, the group discussed the following challenges:

1. **Personalization**: The government doesn't have a "target market". It must design its online services for everyone to use. This limits the ability to personalize services.
2. **Volume of services**: The government doesn't provide just one services (e.g., clothes, food). It is expected to provide a large volume and variety of services to an even larger number of people. In addition, often it is difficult to find the needed service on the website because there are so many webpages to sort through. This increases the difficulty of providing good customer experiences.
3. **Lack of communication**: Websites are typically developed as part of a program. Often, budgets are tight and don't provide funding for reaching out to users to do extensive requirements gathering or user testing before the site is launched. Nor do the budgets typically provide funding to cover campaigns to raise awareness of the online services and how to use them.
4. **Website design**: Government websites are designed to run on any device and any platform. They also must be accessible to people with vision and hearing impairments. This limits options for functionality that improve the customer experience. For example, features that are offered by private online vendors can't be offered by the government because they require too much memory or bandwidth.
5. **Cyber security**: Government sites are often targets for cyber threats. Therefore, they must be cyber hardened in ways that may limit usability and customizations.

6. **Aversion to risk**: The government must be a good steward of taxpayer dollars. Agencies must also be responsive to Congress and their constituents needs. Therefore, agencies are reluctant to take on any unnecessary risk – even if there are great gains that can be achieved. Also, the government is slow to take a risk and adopt a new change because it wants to move forward carefully to ensure there are not any unintended consequences.

7. **Policies are burdensome**: Existing policies dictate how services (including online services) must be followed. When the policies are designed for manual services it can be cumbersome to apply those policies to online services. Also, there are often several policies guiding one service. These policies may conflict causing confusion and delays. Most policies are difficult to update and improve.

8. **Acquisition constraints**: The acquisition process is long and arduous.

3.3.3 Discussion Summary

The participants had a robust discussion about the ideal customer service characteristics and the challenges that the Federal Government faces in incorporating these characteristics into the services that it provides. The group then discussed the largest challenges and how agencies could overcome them. They agreed that the three most significant and common challenges were:

- Policies are burdensome
- Lack of communication
- Aversion to risk

These challenges surfaced during almost every project discussed. These are complex and complicated challenges that must be addressed through a number of different means to holistically address the challenge.

3.3.4 Recommendations

The participants decided that with limited time and budgets available, the most effective recommendations to address these three challenges were:

1. Senior leader support:

(a) Executives can influence, and often remediate many of the challenges discussed in the previous sections. They need to communicate the "why" behind the change and how it is important to the agencies and the country. When employees understand why a change is occurring, they are more likely to work towards it.

(b) Senior leaders can directly advocate for policy changes and to increase user involvement. With senior leader support and involvement, changes can occur more quickly and be operationalized more effectively.

(c) Strong, influential leaders can also change the culture of an organization to be more innovative and less risk adverse. These leaders can motivate and empower employees to think more creatively, streamline processes, and provide more personalized service to users.

2. Change champions: Senior leaders should delegate responsibilities and authority to a group of change champions. These champions should be responsible for day-to-day operations of implementing the changes. They will help maintain the two-way information flow amongst government employees and with various user groups.

3. Start small and scale well: The government should continue looking for ways to repurpose existing successful applications and online services. While planning and implementing pilots they should look for opportunities to use the tool to solve similar problems in another area. In addition, the government should take a more agile development approach to online service production. They can focus on "mini releases" (as is customary in various agile practices) of online services to ensure that needed features are added to websites as quickly as possible and can be shared as broadly as possible across the agency and the government.

Additional recommendations that were considered include:

1. Prioritization and planning: Agencies have many services that they need to offer; therefore, there are often many "top priorities". However, agencies fall into a trap because if everything is a priority – then nothing is a priority. Agencies should conduct portfolio planning to ensure the agency's true top priorities are well resourced. In addition, the portfolios and the programs should work together to develop transition plans to implement the new agreed upon changes.

2. Build partnerships and collaboration: To provide more robust customer experiences, the government should partner with other teams within their organization, other

agencies, and with the academic and private sectors. Through these partnerships funding, knowledge, tools, and other resources can easily be shared.

3. Adaptable acquisition: Government agencies should get a better understanding of the acquisition options open to them. Perhaps another agency's contract can be used or a bulk purchase agreement can be leveraged. Other transaction authorities should be leveraged, as well.

4. Reskill workforce: As more government services are automated and move online, the government workforce will need to learn more service and technical related skills. The government so look for ways to retrain existing staff through on-the-job training, educational programs (e.g., certificates, advanced degrees), and fellowships with industry.

5. Leverage hiring authorities: Programs should meet with their human resources departments to understand which hiring authorities they can leverage to get the "right" people into positions.

3.4 Data and Analytics

The data and analytics collaboration session focused on organization to enable evidence-based decision making, re-engineer and refactor business processes, and overcome complexity and ambiguity to drive business value. Discuss ways where leading technologies such as AI, machine learning, and Robotic Process Automation can revolutionize advanced data analytics and can shape data strategy, accountability, governance, security, and privacy. The session discussed the ways in which data can support these tasks, and how these considerations shape the development of a data strategy.

3.4.1 Session Goals

This session had three goals:

- Discuss the use of data analytics and challenges in driving business value and achieving mission goals
- Identify ways organization can make use of emerging technologies (AI, machine learning, and deep learning) to reduce risk and can shape data strategy, accountability, governance, security, and privacy
- Identify any best practices for establishing a data strategy

3.4.2 Challenges

The collaboration session discussions identified the following challenges for data analytics evolution:

- Enterprise-wide solution and approaches
- Organizational transformation (people, process, and technology to support innovation)
- Driving change through incorporating emerging technologies in data analytics

3.4.3 Discussion Summary

The session began with capturing participants' expectations and the challenges that they encountered in adopting data analytics using emerging technologies. Discussion ranged from understanding the value of data analytics to drive organization mission goals, to overcoming agencies' cultural barriers in implementing solutions that leverages emerging technologies. Each identified challenge was discussed at length in the collaboration session. Collation of those discussions revealed common themes that warranted further discussion and collaboration. The following topics were among the most actively discussed in this context:

- Enterprise wide data strategy for analytics
- Data Quality, Integrity, and Security
- Culture, Workforce, and Adoption

Government organizations continue to struggle to solve problems around data analytics. In the recent past, there has been an exponential growth in data (such as imaging and farming data). Organizations are struggling to understand which data is relevant to their business. Islands of good information is scattered throughout the enterprise and there is a growing need to bring these disparate data together to drive organization decisions.

The participants expressed that there is lack of agreement within their stakeholder organization to identify the authoritative data sources. This in part due to the quality of the data and the timeliness of the data. Lots of their existing process are convoluted, manual, and dependent on their IT organizations. There is a culture of hiring IT personnel to handle business decisions. However, there is a growing disconnect between what IT can provide and what business need in terms of advanced analytics. IT should be the enabler of business. Lack of adequately skilled subject matter experts, stove-pipe systems, and broken processes

impedes the implementation of an organizational data strategy. Additionally, lack of guidance and oversight over the data strategy, the management of data to facilitate successful evolution, and the implementation of advanced analytics can hinder an organization's effective use of data. Data standardization and governance models are needed (and must remain vendor neutral/vendor agnostics) prior to the adoption of advanced analytics. There is a need for public and private partnership model to solve these problems.

There is a need for cultural mechanisms that can communicate, share and reinforce organizational vision. Equally, there is a need for mechanisms to reengineer and refactor business processes accordingly. Technical components are needed that show how the operational and analytical data needs of the enterprise will be met with technology. Also, there is a need to demonstrate how the enterprise builds and operates systems and solutions to deliver data to meet enterprise, operational, and analytical data needs. These improvements should be appropriately incentivized.

The session discussion moved to focus on security policies, procedures, and solutions to provide proper authentication, authorization, access, and auditing of data assets that aligns to the data architecture and solutions and reduce enterprise risk. There is a need for policy, guidance, business use, and processes for data exchange with partners and data providers.

A strategic roadmap, action plan, and management approach is required to implement the data strategy along with people, process, and technology aspects that will transform organization business and technology.

3.4.4 Recommendations

The participants in the data and analytics collaboration session identified several important findings and recommendations.

Build a Shared Partnership Model

The shared partnership model provides a structured and repeatable process to effectively and efficiently build and maintain business relationships that may become an asset for building effective data analytics and competitive advantage.

Partners have different capabilities and roles, and over time, all partners will have contributed in one form or the other to the creation of data strategy and analytics in varying degrees. All other things being equal, the longer one has spent in this partnership model, the more it is likely to have contributed to the creation enhance analytics the businesses.

Establish teams that comprise dedicated resources from IT and the Business to understand each other challenges and needs. Focus on delivery, quality of working solution to users in increments. Some of the key areas includes:

- Strengthen the partnership between IT and business
- Jointly built and gain consensus on the organizational framework and operating model for the development of the enterprise data strategy
- Develop a common understanding of data challenges with a focus on understanding the business challenges
- Collaborate and socialize across business and IT leadership to gain an agreement on the enterprise data strategy framework and related components [7]
- Prioritize and explore key challenges using the data strategy framework

Establish Center for Excellence

A CoE model is needed to support continuous improvements in the area of data analytics. A COE will help defining a common set of best practices and work standards, assessing (or helping others to assess) the maturity profile of the data against these best practices and work standards. Providing direct and/or indirect guidance and support to assist in implementing these best practices and work standards.

Having a COE can also demonstrate an organization is committed to excellence. They can eliminate risks, have flexibility to innovate fast and fail fast, and help develop Key Performance Indicators (KPIs) to measure organization success. Leverage the Federal Data Strategy as catalyst and Federal Information Technology Acquisition Reform Act (FITARA) [3] requirements while building the COE. Build community of practices and thought leadership within/across organization to share, nurture organic growth of ideas and act an innovation hub. Inter-agency groups such as National Institute of Standards and Technology (NIST) can bring technical depth to the data analytics.

Leverage Emerging Technologies

Emerging technologies such as AI and machine learning can reshape the expectations of data analytics. Data analytics using AI can make it possible to link data to gain insights on their business and grow the business. AI and machine learning can expand the frontiers in data analytics. Human factors should be taken into consideration when building the models using AI.

Machine learning and AI models rely on high-quality datasets and extensive training to be adequately utilized. Data preparation, selection, cleaning, and verification is an essential aspect of leveraging AI or machine learning to help automate a task. Care should be taken to ensure the algorithms are being utilized effectively, trained on the right data, and being applied to the appropriate use cases.

3.5 Infrastructure Optimization

The IT Infrastructure Optimization session considered the challenges as IT is rapidly changing from providing services from a dedicated on-premise solution to solutions which incorporate hybrid clouds, shared services, and other off-premise options.

3.5.1 Session Goals

The discussions covered a wide range of topics ranging from network, printer, and mobile device management to data center consolidation. An integral part of all the discussions was an awareness of the changes that future activities will have on policy and business process reengineering. Additionally, group members shared some of their successes in modernizing their infrastructure and incorporating new concepts (e.g., infrastructure as code).

3.5.2 Challenges

The collaboration session discussions identified the following challenges facing the government in IT Infrastructure Optimization:

- Data center consolidation
- Cybersecurity optimization
- Cloud optimization
- Policies, processes, and procedures

3.5.3 Discussion Summary

Optimization of the Government's infrastructure is built around the concept of incorporating modern commercial technologies while complying with the unique rules and regulations applicable to the Federal Government. The pillars of optimization are:

- People and process
- Strengthened cybersecurity
- Data center alignment
- Cloud computing

The discussions focused on data center consolidation discussed the need to develop a method to select which centers to retain and which to close. Some of the criteria that could be utilized were based on the physical attributes of the data center such as facility age, size, server density, geographical location, and network connectivity. Other criteria were related to what was the ability of applications to migrate, criticality of the data and its sensitivity, as well as the capability to remotely operate and monitor the facility. Financial considerations such as operating costs were the final criteria discussed.

In general, the group agreed that older, smaller, and facilities with high operational costs were better candidates for closure then newer facilities supporting high value or sensitive information. However, analysis should be completed to account for the impact of the facilities closure on core business functions and the costs to maintain and modernize versus consolidation or replacement with cloud or shared services.

The discussions on cyber security were focused on the protection of high value assets through the automation of compliance and the implementation of Continuous Diagnostics and Mitigation (CDM). A key element of this effort would be the training of the existing security and IT workforce that do not have a cloud background with some of the unique cybersecurity requirements associated with obtaining services from CSPs. Areas of focus of this training should include topics such as: how to embed security into the agile development process, methods for leveraging the FedRAMP authorizations when conducting the agency accreditation reviews, understand of cloud architectures and how interfaces to the CSPs are secured and monitored. Agencies should consider implementing zero trust networks and the next generation of the Trusted Internet Connect (TIC) policy currently in draft.

The group then opened discussion on cloud optimization covered the entire life cycle from negotiating with the CSPs through the development of an exit strategy. The group agreed that the migration to the cloud could not be done in isolation from the other aspects of IT optimization. The following items were thought to be essential when migrating to a cloud environment:

- A cloud architecture that defines an end-to-end view of the system
- A robust and secure network with the capacity to expand to meet future requirements
- Clear understanding of CSP licensing, service offerings, and cloud management policies that clearly define roles and responsibilities in a hybrid cloud environment
- An exit strategy to enable the movement to another CSP without disrupting the end user

The group recognized that cloud services are constantly evolving and that agency demand for services is moving beyond IaaS and into are that was described as “infrastructure as code” where the entire application build process could be completed in a serverless environment using containers and then deployed independently.

IT optimization requires the balancing of policies and human resources. Agencies need to review policies that may be outdated or have been designed to address the traditional IT service model and not the implementation of commercial services. A key element in accelerating IT optimization is to provide value to both the IT workforce and the end user by following an agile approach. This approach would address the following aspects of the optimization:

- Modernize the IT Service Model
- Focus on specific problems and barriers to performance
- Develop applications to overcome the barrier identified
- Incorporate existing processes that are working well into solutions
- Proceed in an incremental fashion
- Continually collaborate with users

3.5.4 Recommendations

The participants decided that several actions need to be undertaken.

1. Prioritize existing data center consolidation using the guidance in the draft Data Center Optimization Initiative Policy Update.
2. Modernize Federal IT Delivery to an agile model to focus on meeting the end-user’s requirements to include the implementation of security into the development process.
3. Update outdated policies and procedures which inhibit innovation and create duplicative activities. Promote access to shared services to increase the economy of scale across the organization.
4. Work on improving the IT workforces understanding of cloud services and cybersecurity awareness.

4 SUMMIT RECOMMENDATIONS & CONCLUSIONS

The December 2018 Federal IT Modernization Summit highlighted several challenges facing the Federal Government's adoption of IT modernization and presented recommendations to address them. The discussions in the sessions 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. Note that these are simplified versions of thematic and common threads elaborated on in earlier sections of the document.

4.1 Challenges

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

1. Government agencies need to – but often are unable to – share information and lessons learned with each other.
2. Agencies need to focus on modernizing the workforce.
3. Lack of sufficient communication among stakeholders (across the board).

4.2 Recommendations

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

1. Agencies engaged in IT modernization should start small and build on successes.
2. Agencies should develop their workforce as they embark on IT modernization initiatives.
3. Agencies should find and use opportunities to partner and collaborate both among each other and externally.

ACKNOWLEDGMENTS

The authors of this paper would like to thank The Advanced Technology Academic Research Center and The MITRE Corporation for their support and organization of the summit.

The authors would also like to thank the session leads and participants that helped make the collaborations and discussions possible. A full participant list is maintained and published by ATARC on its web site[8].

REFERENCES

[1] J. F. Brunelle, S. Anand, G. Barmine, M. Spina, K. Warren, A. Winston, M. Javid, A. Kemmer, C. Kim, S. Masoud, T. Harvey, and T. Suder. August 2017 ATARC Federal Cloud & Data Center Summit Report. Technical report, The MITRE Corporation; The Advanced Technology Academic Research Center, 2017.

[2] J. F. Brunelle, S. Anand, R. Cagle, C. Kim, M. Kristan, M. Spina, K. Warren, T. Harvey, and T. Suder. February 2017 ATARC Federal Cloud & Data Center Summit Report. Technical report, The MITRE Corporation; The Advanced Technology Academic Research Center, 2017.

[3] Department of Homeland Security. Federal information security modernization act (fisma). https://www.dhs.gov/fisma, 2016.

[4] S. Friedman. OMB drafts new 'Cloud Smart' strategy. https://fcw.com/articles/2018/06/13/cloud-smart-omb-friedman.aspx, 2018.

[5] V. Kundra. Federal Cloud Computing Strategy. https://www.whitehouse.gov/sites/default/files/omb/assets/egov_docs/federal-cloud-computing-strategy.pdf, 2011.

[6] The MITRE Corporation. FFRDCs – A Primer. http://www.mitre.org/sites/default/files/publications/ffrdc-primer-april-2015.pdf, 2015.

[7] M. Wahnish, R. Campbell, R. Daniels, L. Glikbarg, G. Hayes, S. Renner, C. Rieser, J. F. Brunelle, and T. Suder. October 2018 Federal Big Data and Analytics Summit Report. Technical report, The MITRE Corporation; The Advanced Technology Academic Research Center.

[8] https://www.atarc.org/