Federal Cloud Computing Summit: Summary and Way Forward

Abstract

The Federal Cloud Computing Summit took place on December 17th, 2013. The Summit included MITRE-led Collaboration Sessions that allowed industry, Government, and MITRE representatives the opportunity to collaborate and discuss main challenge areas in cloud computing. The discussions were government focused at a high-level, not addressing any specific solution and only identifying features of potential solutions or frameworks.

As part of the Collaboration Sessions, MITRE invited academics to participate in a collaboration session addressing each of the challenge areas addressed by the government, as well as identifying courses of action to be taken to enable government and industry collaboration with academic institutions. The academic participants focused on the challenge areas, as well as changes in curricula, research potential, and outreach opportunities. These outcomes will help academicians produce higher quality, better prepared and industry-ready graduates for hire.

This white paper summarizes the results of the government and academic collaboration sessions, as well as identifies recommendations for government and academia while identifying orthogonalities between challenge areas. It also proposes a community built around government and industry collaboration with academia to leverage potential untapped academic resources. The proposed community will be brokered by MITRE and the Advanced Mobility Academic Research Center (AMARC) to enable communications between the different participating communities.

Collaboration Session Outcomes

Each MITRE Collaboration Session was a focused and moderated discussion between government and industry representatives about a cloud computing challenge area.

The challenge areas for each session were as follows:

- Interoperability and Portability
- End-to-End Service Delivery
- Federal Standards and Service Level Agreements (SLAs)
- Cyber Security

Participants discussed current problems, gaps in work programs, potential solutions, and way forward for each of the challenge areas. This section outlines the goals, outcomes and summary of each of the four collaboration sessions.

Interoperability and Portability Collaboration Session

The Interoperability and portability session aimed to outline recommendations for migrating to cloud environments, migrating between cloud environments, ensuring data and service portability, and cross-cloud communication. These goals all center around ensuring users are not constrained to a single environment and can leverage multiple providers, services, and tools to achieve the best possible capabilities.

The goals of this session included:

- Recommendations for migrating to- and between-clouds
- Approaches for ensuring data and service portability
    - Scalability
    - Rapid Development
    - Disaster Recovery, Continuity of Operations Plan(DR COOP)
- Recommendations/Approaches/Standards for allowing cross-cloud communication and data sharing (both between and within silos in the government).

This session identified the following needs:

- Need policy and governance addressing portability
- Need to standardize security making it more granular
- Need a universal service catalog (at the federal government level) built to support portability
- Need updated procurement processes and policies to enable migration to and between clouds. Specific need to address growth potential and arbitrage of cloud computing and its user base.
- Need to move to "vertical solutioning" (solutions that address specific problems)
    - Compliance documentation as a product
    - Remove false gates by instituting critical path gates for each vertical solution
- Need Agile life-cycles
    - Mature operations through automation
    - Standardize reporting (measure and manage)

The summary of the collaboration session is below:

The Interoperability and portability session focused on including cloud providers in technical models, and how to improve service consumers' ability to migrate between platforms. Consumers' need to move between providers is apparent; this reduces vendor lock-in and allows for cloud platforms to be utilized to their greatest extent. Another clear outcome is the value of mobile in cloud computing. Thin devices, like mobile devices, are extremely portable and can reach back to cloud solutions. With the increasing number of cloud solutions and providers, it is difficult for human users to understand the full extent and canonical set of offerings available. For this reason, a universal service catalog should be developed. That is, a machine- and human-readable set of services and their locations that can be leveraged to ensure migration between services is as easy as possible. This can include vetting information, usage instructions, costing data, etc. to ensure the best and most suitable solutions are

being utilized. Major challenges are the current models, procurement processes, security policies, and governance. To improve interoperability, improved models should be created to allow for interchangeable cloud components, outline how cloud services fit into larger architectural models, and a CONOPS and best practices for governing the cloud-inclusive models and processes.

End-to-End Service Delivery Collaboration Session

The End-to-End Service Delivery session focused on recommendations for cloud service delivery (such as access to cloud-provided services such as Infrastructure as a Service (IaaS) or Software as a Service (SaaS)), service availability in disconnected, intermittent, and lossy (DIL) environments, and improving user value reaped from the cloud. In short, this session aimed to increase value provided to the users regardless of environment, access mechanism, or service provider.

The goals of this session included:

- Recommendations or areas for investigation for cloud service delivery
- Discussion and recommendations on DIL communications and service utilization
- Recommendations for improving user value of the cloud

This session identified the following needs:

- Need *a la carte* service selection and pricing
- Need improved models for evaluating services for migration to the cloud
- Service level agreement templates for assured elasticity with fixed maximum costs
- Need centralized service management and security
- Need updated acquisition processes and policies to enable pay per use model

The summary of the collaboration session is below:

The End-to-end service delivery session discussed methods of delivering maximum quality to end users and making services widely accessible despite network or accessibility challenges. Additionally, methods for improving value returned to government users were discussed. Due to the increasing variety of cloud computing needs and the offerings from cloud providers, a model for *a la carte* pricing is needed. That is, government users would benefit from a method and model for selecting, purchasing, vetting, and utilizing atomic components to construct a larger capability. Additionally, not all legacy systems and processes are suitable for cloud computing and improved models should be provided to ensure only suitable services are migrated to a cloud environment. This will save money and ensure that essential and suitable processes are migrated. Finally, the collaboration session suggested that template service agreements and models be developed that assure elasticity and cloud services with a maximum cap of cost. This will prevent vendor lock-in and surprise costs in the cloud by assuring a level of service and preventing budget overruns.

Federal Standards and Service Level Agreements (SLAs) Collaboration Session

The Federal Standards and SLAs session focused on suggested practices for creating and entering SLAs and items of consideration for cloud contracts including the limitation of vendor lock-in. This session revolved around ensuring contracts would benefit the government users and ensure that anticipated services could be leveraged without incurring unexpected cost or limitations.

The goals of this session included:

- Requirements and suggested practices for creating cloud SLAs
- Suggested items for consideration in cloud contracts – include vendor lock-in

This session identified the following needs:

- Need to understand how to include multiple providers in a SLA – templates would be useful
- Need improved governance and models for SLAs
- Government should make use of Agile methods to produce quality, low risk SLAs
- Increase collaboration between government organizations is key

The summary of the collaboration session is below:

With the expansion of cloud providers and increasing need of government consumers, SLAs and standards become increasingly important to ensure proper governance and agreements. This working group suggests models or templates for SLAs that manage consumption of a service from multiple providers by a single user base. That is, how can two different cloud providers be included in a SLA and ensure a proper level of service? The overall standards and service governance models should also be improved to ensure the acquisition process is completed smoothly and with government needs properly addressed. One particular tool in this process can be agile methodologies. The government should utilize small pilots, frequent user feedback, and other agile principles to fail-early and adapt to the changing landscapes as cheaply and easily as possible. This will lead to improved models and acquisitions. Finally, these sessions suggested improved collaboration between government organizations to leverage best practices and lessons learned across the government and prevent redundant processes.

Cyber Security Collaboration Session

The Cyber Security session focused on Identity Access Management (IdAM), security standards, and cloud service management recommendations. The goal of this session was to identify best practices for ensuring that data was secure in motion, at rest, and at consumption and that data is only accessible by vetted consumers.

The goals of this session included:

- Recommendations for IdAM in consolidated and distributed environments.
- Suggested areas of investigation for security standards.

- Data management, access management, and service management recommendations.

This session identified the following needs:

- Need Security as a Service – meaning allow cloud providers to offer security services as part of a contract or as a purchasable product
- Recommend *a la carte* security procurement to allow consumers to choose which security features they require or want
- Government should include security as part of contractual obligations (place some responsibility on cloud provider)
- Recommend using automatic detection for security leaks or violations

The summary of the collaboration session is below:

The collaboration session on cyber security discussed security in the cloud. The notion of Security as a Service came out of this session. That is, how can cloud consumers use *a la carte* pricing, procurement, and use to select the security solutions and technologies tailored to the current processes and needs. Additionally, these services should be included in contracts to ensure the cloud provider has a responsibility to provide high-quality security services, effectively including insurance into the contract. Finally, automatic detection should be utilized to detect security violations to eliminate as much human error from the process as possible.

Academic Collaboration Session

The Academic Collaboration Session's goal was to approach each of the previous four session areas from an academic point of view and to identify ways that academic institutions can research and evolve to help solve these challenges. This included curricula changes, research opportunities, partnership and funding sources, and ways to produce potential employees that can make an immediate impact upon hire into the government or industry.

The goals of this session included:

- Discuss academic solutions to previous four challenge areas
- Identify methods of collaboration with government and industry
- Discuss curriculum changes to produce hire-ready cloud subject matter experts

This session identified the following needs:

- Interoperability and portability: Mobile is an enabler
- End-to-end Service Delivery: Need real-time delivery to disconnected users
- Federal Standards and SLAs: Need improved governance and modeling
- Cyber Security: need automatic failure detection

The collaboration needs of academics included:

- Industry days
- Attention and connection to government trends
- Government and industry signal to academia for research needs

The summary of the collaboration session is below:

The academic participants from Old Dominion University, Hampton University, and Christopher Newport University met at the MITRE Hampton Roads site to discuss the four challenge areas (just as the government and industry representatives) as well as collaboration and research opportunities that the universities and government can pursue to increase the effectiveness of cloud computing research. An interesting outcome of the academic sessions is the striking parallel between the session outcomes of the government and the session recommendations from the academics. The academics that participated are not trained cloud subject matter experts, but came up with similar deliverables. This suggests that cloud computing research would benefit from academic perspectives on cloud computing futures.

Additionally, the academics suggest that the government increase the use of "industry days" to communicate the current challenges and state-of-the-art to the academic community, as well as communicate the current needs and trends. The academics can use this information to influence their course offerings, modify current courses to address or focus on current domain challenges, or propose new projects for students that focus on prototyping solutions. Finally, the government and industry should increase outreach to academic communities to collaborate on the current challenges and discuss joint research opportunities. In the event that government and industry do not have the knowledge to effectively carry out such collaboration, a talent broker (AMARC, MITRE) should be utilized to create the connections between government and academia and define the process for collaboration.

Summary

Across the four collaboration areas, there are several recurring themes. The government cloud computing domain requires improved governance, implementation, and acquisition models (across the community and for each challenge area), improved collaboration within government and between government, academia, and industry, improved agility and interchangeable components, and improved contract and SLA templates. Academic participation and research can help provide the frameworks necessary to expedite the acquisition processes, improve the current models, and provide fresh perspectives and algorithms that can be utilized by industry and academia. Across all aspects and challenge areas of the cloud computing domain, improved collaboration will improve the current state-of-the-art.

Session Recommendations

The recommendations made in the collaboration session can be summarized as increased investment in cloud computing frameworks, templates, collaboration, and models. More specifically, the sessions produced the recommendation for increased government investment in:

- interchangeable elements of cloud computing,
- increased collaboration within government and with academia,
- incorporating agile methods in the acquisition process,
- frameworks for *a la carte* capability procurement,
- service agreement templates,
- and agreements for assured service delivery with maximum elasticity for the government.

The investment in these frameworks and interchangeable concepts will benefit all sectors of government cloud research. These efforts should focus on cross-domain and cross-agency collaboration, communication, and benefit to achieve the maximum impact.

The academic session recommended that academic institutions invest in:

- invited industry days for government and industry representatives (for increased visibility, domain knowledge, and curriculum enrichment),
- curricula revision (to increase cloud computing focus on the target investment areas identified at the Summit),
- joint mobile and cloud course development and research efforts (to produce hire-ready graduates),
- and increase focus on cloud computing research funding opportunities in the areas outlined in this paper (to improve government collaboration opportunities and create *talent pipelines* to government and industry).

To enable the collaboration and communication brought to light by the MITRE Collaboration Sessions at the Federal Cloud Summit, a community of collaboration is recommended to improve the exchange of ideas, de-duplicate efforts, and improve cross-entity solution leveraging. Increased outreach efforts to academic institutions are recommended to help shape curricula to produce higher quality researchers and contributing members of the community. Finally, the creation of a model for joint research efforts between academics and the government community is recommended.

Proposed Community of Collaboration

With the recommendation for this outlined Community of Collaboration, MITRE and AMARC, have offered to broker discussions between academia, industry, and Government through unclassified Technical Exchange Meetings, increased government-only working groups, and continued participation in Federal Summits. To increase ownership and effectiveness of communication, assigning track leads and representatives from branches of government, industry, and academia (i.e., a representative from DoD, IC, industry, and academia) is recommended. These representatives will act as subject matter experts, as well as communication terminals into each organization or entity.

It is expected that the community of collaboration will deliver increased partnerships and projects with cross-cutting goals and deliverables between academia, government, and industry. The community will also identify challenge areas, gaps in current research, and areas for investigation within each of the three enclaves of the cloud community. Finally, the community will identify a portfolio of research areas and research directions brokered by an independent third party (such as MITRE or AMARC).

The below bullet list summarizes the above proposal:

- Increased Technical Exchange Meetings, Working groups, and Summits
- Increase cross-community participation (assign representatives or leads)
- Use AMARC as broker of academic participation
- Create partnerships between academicians and government/industry
- Propose a community with a set of subject matter experts and governance experts to direct the creation of models
- Identify specific challenge topics within the outlined areas, gaps in research, and define processes for pursuing research projects within industry, MITRE, and academia joint with government leads

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