

UMKC Information Services

Cloud Strategy Recommendations



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Table of Contents

- Executive Summary..... 3
- Recommendation Summary 4
- Recommendation 1:** UMKC should pursue a multi-modal cloud environment..... 5
- Recommendation 2:** UMKC should consider the cloud first 7
- Recommendation 3:** UMKC should evaluate existing solutions and services..... 8
- Recommendation 4:** UMKC should facilitate the ability to use the cloud by eliminating barriers 9
- Recommendation 5:** UMKC should develop a next generation IT workforce..... 10
- Recommendation 6:** UMKC should serve as a center of excellence for cloud computing 11
- Acknowledgements**..... 12

Executive Summary

While UMKC Information Services (IS) has embraced cloud offerings like Box and Microsoft Office 365, we have not developed a comprehensive cloud computing strategy. On-premise hosting has begun to create inadequacies toward addressing the range of needs increasingly called for by our customers. Before deciding how to integrate cloud technologies in our environment, we must first understand the different concepts and approaches that cloud computing presents as options. Choosing the right combination of cloud, on-premise, and hybrid, along with various flavors of SaaS (Software as a Service), IaaS (Infrastructure as a Service), and PaaS (Platform as a Service), is key to organizational success. Ultimately, the goal of a cloud shift should be to grow our capabilities and service offerings in ways that are significant and appropriate.

Moving our resources to the cloud requires alignment and buy-in across the organization, and establishing new policies and procedures that fit with cloud technology will be a challenging, yet necessary, task. Focusing on preparation and developing nimble processes will lay solid groundwork for moving forward. Adoption of a cloud-first approach, coupled with regular evaluation of existing services to determine their cloud-worthiness will allow UMKC to innovate while remaining flexible.

By strategically embracing cloud computing partnerships and developing a structured adoption approach, we will not only keep up with the reality of modern computing, but position ourselves to be better prepared to move into the future of computing – not only for traditional needs, but to contribute to research which will build that future.

With these ideas in mind, we believe the following recommendations are necessary to move UMKC forward in the rapidly changing cloud landscape.

Recommendation Summary

Recommendation 1: UMKC should pursue a multi-modal cloud environment that comprises IaaS, PaaS, and SaaS solutions.

Recommendation 2: UMKC should consider the cloud first when new solutions are needed, identifying reasons why the cloud would not be optimal for a given solution.

Recommendation 3: UMKC should evaluate existing solutions and services on an ongoing basis to determine if they should be re-architected/moved to the cloud to deliver a better product or service.

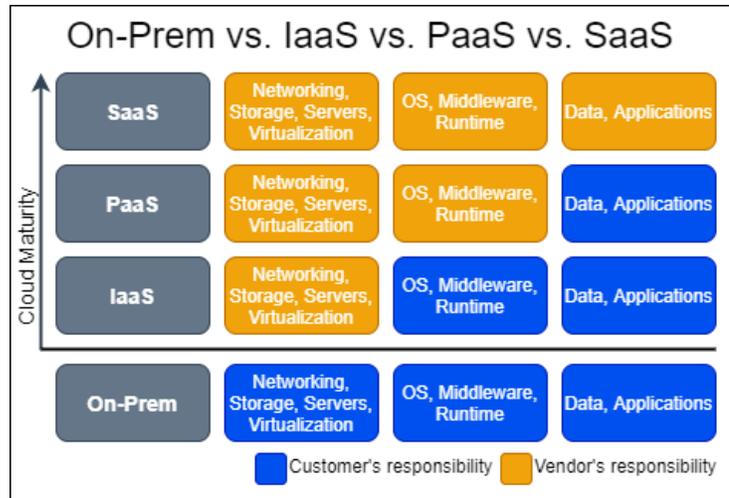
Recommendation 4: Governance practices should facilitate the ability to use the cloud by eliminating barriers and offering a base infrastructure that complies with University security and confidentiality needs.

Recommendation 5: UMKC should develop a next generation IT workforce with expertise in cloud technologies.

Recommendation 6: UMKC should serve as a center of excellence for cloud deployments for the University of Missouri System.

Recommendation 1: UMKC should pursue a multi-modal cloud environment that comprises IaaS, PaaS, and SaaS solutions.

In the technology realm, there is no “one size fits all” solution where hosted services are concerned. “Cloud computing” as a concept entails a dizzying variety of methods and platforms, from the fundamental components to highly specific services. Thus, we must be prepared with a cloud computing strategy that is agile enough to extend or integrate at every level of need.



There are three types of cloud offerings, each suited to particular applications:

- IaaS (Infrastructure as a Service)** provides for the underlying backbone of an off-premise hosted environment such as hardware, storage, servers, and network components. Examples of this include Amazon Web Service’s (AWS) Elastic Compute Cloud (EC2) and Google Cloud Platform’s (GCP) Compute Engine virtual machine services. IaaS is the “lift and shift” approach to cloud migration where OS, application, and data are all migrated to the cloud without redesigning the service/application.
- PaaS (Platform as a Service)** is the next level of cloud computing that typically lives on top of a pre-existing IaaS environment. At the PaaS layer, customers are provided a suite of services allowing them to develop, run, and manage applications without the complexity of building and maintaining an underlying infrastructure. An example of this would be AWS’s Lambda and relation database (RDS) services, which provide a platform to run code and relational databases without provisioning or managing servers. PaaS sits neatly between IaaS and SaaS by taking advantage of native cloud services, but stopping short of a complete re-architecture. Updating an existing application to use AWS RDS instead of a self-managed

database instance is a typical example. Time is saved maintaining a database server, but OS and application security patches are still necessary on the application end.

- **SaaS (Software as a Service)** is the highest level of cloud computing. SaaS technology offers fully realized applications hosted in a pre-existing IaaS or PaaS environment, which can be directly utilized by end users to accomplish their needs. Examples of this would be Box file storage and Microsoft's Office365 cloud productivity suite.

To reduce the complexity of deploying, maintaining, and supporting service offerings, we should pursue SaaS solutions whenever possible. Only when a fully realized application does not meet the identified needs should we first consider PaaS, next IaaS, and finally on-premise hosting. Careful consideration should be taken at each level as IS involvement and responsibility grow as we move down the stack.

A multi-modal strategy encompasses not only many layers but also many providers, AWS and GCP being the industry leaders and UMKC's preferred providers. This greatly expands the opportunities to leverage cloud computing to address nearly any need, and does so with the capacity to "right-size" the methods used to address those needs, in terms of capability as well as cost. Additionally, partnering with multiple cloud vendors strengthens our cloud presence resiliency, so that we are not at the mercy of any one vendor's level of service and reliability for every cloud computing solution we rely on. This will also foster competition among vendors and ensure competitive pricing.

Recommendation 2: UMKC should consider the cloud first when new solutions are needed, identifying reasons why the cloud would not be optimal for a given solution.

As existing on-premise infrastructure reaches its maximum capacity, there is a strong impetus to determine how best to address the cost and effort of growing our ability to provide computing resources to our campus's administrative, teaching, and research needs. The best path forward is to leverage existing cloud infrastructures and platforms as a method of growth with lower or equivalent cost (over time) to up-front capital expenditure, and generally with instant access to the investment made. Whereas the traditional approach of expanding an existing data center to host additional racks of servers would entail months of planning, purchasing, and configuration before those servers can become operational, in a cloud computing scenario those servers could be instantiated and configured for use within days, and would not consume additional space, cooling, or power.

The focus, then, is to adopt a "cloud first" policy when determining how and where new services should be implemented, explicitly identifying reasons *not* to use the cloud for these services. It is understood that not all solutions will be met by cloud computing, but as many as possible should be, so that we can conserve our valuable on-premise space, capacity, and resources for those systems which truly must be physically hosted on campus. In this way, we can greatly extend the lifespan of our existing physical hosting resources and minimize the costs associated with maintaining or growing them over time.

Recommendation 3: UMKC should evaluate existing solutions and services on an ongoing basis to determine if they should be re-architected/moved to the cloud to deliver a better product or service.

As the lifecycle of technology progresses, and older systems and software are required to evolve to keep pace with modern computing ecology, much work is put into either updating or maintaining the infrastructure, platform, or software that provides for a solution. Since these efforts are already continually underway, with varying degrees of time and cost associated, it only makes sense to insert a determination as to whether an existing solution requires on-premise hosting, or would be an opportunity for cloud computing migration, as an integral part of technology lifecycle management.

Some factors that may initiate a reassessment include aging hardware, unsupported applications, major upgrades, maintenance renewals, security isolation, and increasing costs. This does not imply that on-premise infrastructure will be eliminated entirely, as certain business needs are likely to be best served by on-premise technology. A greater portion of needs, however, do lend themselves to fulfillment through cloud computing services that are readily available. This can include resilient web hosting, web application development, research computing (Big Data and Artificial Intelligence in particular), office productivity, group file sharing/collaboration, and mass storage for production or backup.

The level of service that can be provided through a cloud computing resource may often exceed that which relies upon localized infrastructure and support, given access to a larger pool of training and support resources provided by the cloud vendors, and further allow organizational IT staff to focus on the continual work of developing, expanding, and maintaining both on-site and in-cloud technology services for the organization's benefit.

Recommendation 4: UMKC should facilitate the ability to use the cloud by eliminating barriers and offering a base infrastructure that complies with University security and confidentiality needs.

Security requirements and knowledge gaps, with their associated up-front costs, are barriers to entry that must be considered and mitigated. As an organization that values information security and data privacy, our policies around the same have been tailored to our existing, on-premise architectures. Traditional approaches to information security are not well-suited for use with the cloud: we often find policies and architectures that are not nimble enough to allow for the rapid pace of change required to develop and implement a cloud strategy that suits our needs.

At present, implementing a cloud service separate from traditional on-premise architectures carries with it a high cost of entry including firewall licensing and ongoing support costs. These costs act as deterrents to migration and ultimately innovation, as no one group or individual wishes to bear the costs alone. To mitigate this barrier, we must identify specific pre-approved architectures and build security structures and policies tailored toward these areas. In doing so, we can make cloud technologies more accessible to end users, control entry costs, and focus IT efforts on highlighted technologies while allowing IT to grow experts in those identified areas. With this in mind, we should work towards the following goals:

1. Reexamine existing security policies at the campus and system level with the cloud in mind in order to fully realize the benefits of the cloud.
2. Provide a base cloud networking and security infrastructure to allow users to take full advantage of the cloud without being burdened with the cost of the foundational layer.
3. Improve the end-user experience and manage risks, by providing pre-approved architectures for common needs, including:
 - a. HPC, Big Data, and Deep Learning
 - b. Online Collaboration
 - c. Storage and Backup

Recommendation 5: UMKC should develop a next generation IT workforce with expertise in cloud technologies.

The breadth and complexity of the cloud demands a workforce that is well-versed in different IT disciplines including physical and virtual compute, network, and database management. To ensure we can provide the best cloud-based solutions that meet diverse needs, IT staff will need focused training in various cloud technologies. This training will ensure our IT workforce will be able to meet the unique consultation needs of campus constituents and will develop a team of knowledgeable experts positioned to act as facilitators for various cloud solutions. To that end, the following goals are important:

1. Invest in training and certifications in cloud technologies for IT staff and provide regular instructor-led training to end-users.
2. Expand hiring of new or positional replacement IT staff with the aim to on-board existing experience and knowledge of cloud computing technologies and principles.
3. Ensure that awareness of the existence and advantages of cloud computing resources permeates the organization's gestalt mentality from top to bottom, through development of advocacy and education resources made easily accessible to the entire workforce.

Recommendation 6: UMKC should serve as a center of excellence for cloud deployments for the University of Missouri System.

As we grow to embrace cloud computing through a cloud-first and multi-modal strategy, we also position ourselves to become a wellspring of experience and expertise in cloud computing technologies. This can benefit the University of Missouri System as a whole by allowing our campus to become a proving ground for how to leverage cloud technology for best effect, and provide other campuses with consultation and training to make their own cloud computing transitions simpler. In addition to cultivating in-house expertise and fostering ubiquitous cloud computing awareness and capability, UMKC will become well suited to act as an auditor and advocate toward vetting the best cloud vendor partnerships that serve to address a myriad of needs. The landscape of such vendors grows daily, and determining which are worthwhile for long-term reliance from those that are transient or unreliable, is an ever-present challenge in maintaining excellence in organizational technology services. By becoming a center of excellence in cloud computing, we will be able to identify the best practices and standards for addressing university-wide needs through cloud solutions, and aid each campus in identifying which cloud computing solutions best fit their specific goals and requirements.

Acknowledgments

Baylor University – [Cloud Technology Services](#)

Gartner – [6 Steps for Planning a Cloud Strategy](#)

IBIS Technology – [7 Reasons Why You Should Move from On-Premise to Cloud Computing](#)

Lera Blog – [Breaking Down the Differences Between IaaS, PaaS, and SaaS](#)

Rutgers University – [Recommendations of the ITLC Enterprise Cloud Strategy Committee](#)

University of Central Florida – [UCF Cloud Strategy](#)