Bucknell University Cloud Strategy

Cloud Definitions

While ubiquitous in tech circles, the term “cloud” is often not defined, poorly understood, and open to various interpretations. While simple in concept, in practice cloud computing revolutionizes the technology landscape and offers a multitude of possibilities.

Put simply, **cloud computing is utilizing technology infrastructure and services owned by someone else via the internet instead of, or in addition to, owning and managing your own on-premise versions.** Available cloud services include servers, storage, databases, software, networking, and much more.

Cloud service offerings take several basic forms, including:

> **Public Cloud** - Likely the most popular and most understood form of cloud services today are Public Clouds. These are pools of technology resources and services “rented” to multiple users by a third party who owns and manages them. Users (“tenants”) can use and pay for services as they need them as the third party has excess capacity available for rent. Common examples of Public Cloud providers include Amazon Web Services (AWS), Microsoft Azure, and Google Cloud.
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> **Private Cloud** - Private Cloud differs from Public in that the pool of technology resources and services is used exclusively by one tenant. While allowing more customization to meet that one tenant’s needs and several of Public Cloud’s other advantages, Private Clouds have some additional constraints on scaling and costs.
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> **Hybrid Cloud** - As the name implies, Hybrid Cloud combines elements of both Public and Private as well as traditional on-premise technology into a single environment that can be tailored to meet specific needs of the tenant. Workloads can be shifted between platforms as needed by performance demands and/or security and privacy considerations.

Additionally, cloud services - primarily Public Cloud services include:

> **Infrastructure-as-a-Service (IaaS)** - Arguably the most basic version of cloud services, IaaS is simply some of the basic technology building blocks, including servers and storage, that are located off-premise in a third party’s data center. The third party assumes responsibility for the basic functioning and maintenance of those elements, including hardware, electricity, air conditioning, and physical security. Tenants gain

advantages related to availability and scalability that can be difficult and/or expensive to achieve on-premise.

Platform-as-a-Service (PaaS) - PaaS expands upon IaaS, as the third party also assumes responsibility for higher order elements of the technology stack, such as the operating system or database running on the servers. PaaS tenants gain more value, but lose some amount of control, by renting a complete technology platform that is fully managed by the third party.

Software-as-a-Service (SaaS) - SaaS further expands upon IaaS and PaaS, as the third party assumes responsibility for the entire technology stack allowing the tenant to rent a fully functional and managed application or system. Examples of SaaS include GMail and Workday.

Cloud Advantages

Cloud services offer numerous advantages to traditional, on-premise technology, including:

'Limitless' resources - The major cloud services providers have essentially limitless capacity (at least at Bucknell's scale) available to us at the click of a button. We will never again run out of storage space or servers.

Economies of scale - The major cloud services providers have developed efficient methods of provisioning and managing those services which is reflected in lower cost as we consume resources.

Innovation - The major cloud services providers continue to innovate and make available to us services that we haven't even needed yet. We can experiment with those services at very low cost and without expensive on-premise infrastructure.

Cost transparency - Instead of a new service's cost being buried in periodic capital budgets, each cloud service we use results in an identifiable and manageable line item in the monthly bill.

Scalability - Cloud tools allow for auto-scaling of applications and systems as demand increases and decreases. This solves the perpetual problem of sizing on-premise technology systems to accommodate maximum possible demand scenarios. As an example, the class registration system had to be sized for the peak demand during the student registration period, while most of that capacity went unused the rest of the year.

Speed to solutions - By allowing service provision at the click of a mouse, cloud services can be up and running far sooner than a traditional solution that included the purchase, installation, and provisioning of on-premise hardware.

Availability / High Availability (HA) - The major cloud services providers all offer multiple world-class data centers across various geographic regions to host tenant's workloads. These facilities are more secure and better managed than what any tenant can likely achieve or afford on their own. Additionally, tenants can protect against local and regional incidents by running workloads in geographically distant data centers, something not possible in on-premise solutions.

Skill set transition - By outsourcing the commodity efforts necessary to support and manage the underlying technology platform to the service provider, tenants are able to focus their limited IT resources on end-user needs.

Space and Sustainability - Cloud services free up on-campus space currently used to house technology for other purposes. Additionally, energy use is transferred to the relatively more green facilities of the cloud service provider.

Security and privacy remain topics of debate within the industry. Unique security and privacy challenges exist in cloud solutions that need to be managed as carefully as with on-premise technology. While major cloud providers implement security measures and controls that no single tenant can likely afford, bad security and privacy practices in the Cloud can potentially expose the institution to additional risk. Further, placing Bucknell assets in the possession of a Cloud provider means that we're trusting the provider's security measures to protect our data, versus likely less diligent but fully understood on-premise security protocols.

One of the advantages promised most prominently early in the evolution of Cloud is one of the most elusive and difficult to achieve. Pure cost savings in a dollar-for-dollar comparison with on premise technology, while possible, is challenging. It is only through aggressive optimization of provisioned resources with mature auto-scaling to handle excess demand that Cloud services can achieve an appreciable reduction in ongoing technology costs.

Bucknell's Strategy

Throughout 2018 and 2019, Bucknell shifted from a "always consider Cloud" to a "Cloud first" strategy due to continuing success with the platforms as well as continuing pressure to 'do more with less'. We will consider Cloud as the favored alternative for all new technology solutions until ruled out. Further, when existing technology is approaching refresh dates, Cloud will be the favored upgrade path.

When Bucknell is able to choose the cloud provider to use, we will use AWS. This is true of all IaaS use cases and some PaaS and SaaS use cases. We will continue to monitor and evaluate AWS competitors for signs that this posture should change.

In other PaaS and SaaS use cases where the service provider chooses the Cloud provider, we will support other services, including Microsoft Azure and Google Cloud, but AWS is preferred.

Note that “Could first” does not mean “Cloud always”. Cloud may not make sense on any given initiative due to a variety of possible reasons.

Current State

The following major Bucknell systems are already offsite and utilizing cloud technologies:

- GMail / GSuite
- Slate Admissions
- Workday
- Blackbaud CRM
- Banner Student / Financial Aid / A/R
- Ascend SmartTouch People Document Management
- Bucknell Data Warehouse (BDW)

In addition, L&IT has much of our critical infrastructure running in AWS, including:

- Oracle relational database
- Microsoft SQL Server relational database
- MongoDB no-SQL database
- Disaster Recovery for our authentication and file storage solutions

Next Steps

Additional major Bucknell systems planned to migrate to the cloud include:

- Moodle
- StarRez
- User / departmental file storage

We will also continue to migrate key infrastructure to AWS.