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CSCI 2690 Capstone Report

Azure Board:
https://seaforth.research.cs.dal.ca/CSCI%202690

GitHub Link:
https://github.com/nihalhk/finalAssignment

Meetings:
- Planning: https://dalu.sharepoint.com/teams/CSCI2690Fall2021-TeamC-2690Superstore/Shared%20Documents/Recordings/Planning%20Meeting%20-%20Final%20Assignment-20211213_205407-Meeting%20Recording.mp4?web=1
- Standup: https://dalu.sharepoint.com/teams/CSCI2690Fall2021-TeamC-2690Superstore/Shared%20Documents/Recordings/Standup%20Meeting%20-%20Final%20Assignment-20211213_213013-Meeting%20Recording.mp4?web=1
- Review: https://dalu.sharepoint.com/teams/CSCI2690Fall2021-TeamC-2690Superstore/Shared%20Documents/Recordings/Review%20Meeting%20-%20Final%20Assignment-20211215_170417-Meeting%20Recording.mp4?web=1
- Retrospective: https://dalu.sharepoint.com/teams/CSCI2690Fall2021-TeamC-2690Superstore/Shared%20Documents/Recordings/Retrospective%20Meeting%20-%20Final%20Assignment-20211215_171704-Meeting%20Recording.mp4?web=1

Process Description:
I created the repository on GitHub as well as branches for everyone to work on as requested. Seif recorded and saved all of our meetings and lead us to follow the rubric as requested by our TA. We met and discussed how we plan on distributing tasks and created time estimates for everything. I was assigned the second question which was "What are the list of services that we need to activate on GCP". I started by understanding what GCP is as well as how it works and what can be done using it. Afterwards, I found a few resources which talked about the main services that are used and what each one is used for.

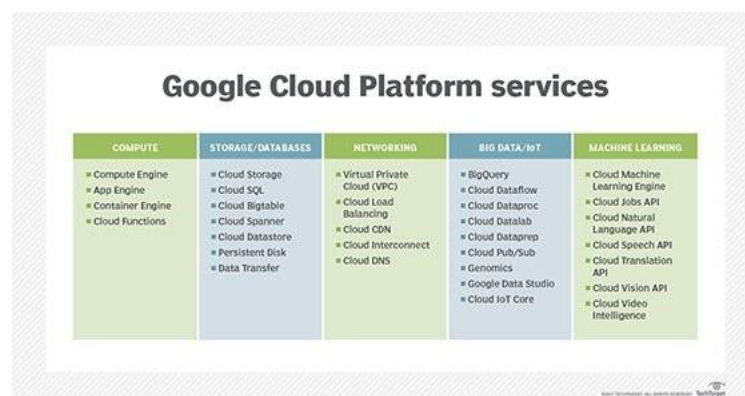**Azure vs GKE, which is better for our company? (Pierce Johnson)**
   When comparing AKS to GKE, there are a few clear examples of where GKE outshines AKS, for example, google presents a better offering when it comes to allowed quotas on its managed Kubernetes service GKE. Using GKE you are allowed to run up to 50 clusters/zones in addition to 50 regional clusters, this is the same as AKS's offering, however where they differ is that with GKE there can be up to 5000 nodes per cluster, and 1000 nodes per pool. AKS on the other hand, allows 1000 nodes per cluster, and 100 nodes per pool. Though AKS allows for more individual pools, 250 vs GKE's 110, GKE allows for 10x the number of nodes per pool when compared to AKS, which means that GKE supports a greater number of total nodes overall when compared to AKS. In terms of upgradability, GKE is far less of a hassle. GKE supports automatic upgrades to its control plane and worker nodes, whereas AKS does not, instead relying on manual user upgrades whenever needed, which results in slower, and less frequent upgrades. Furthermore, when it comes to operating system support, AKS does not support open-source Ubuntu as well as Windows Server. GKE allows for Container Optimized OS, as well as Ubuntu and Windows Server, thus its accessibility is higher.

Now that we've gone over some of the technical advantages, let's look at it through a business sense. Firstly, because of it supports more OS than AKS, by moving the GKE we would be allowing our developers the potential to work in whatever OS they are comfortable in with the use of containers. Furthermore, it allows us to consider standardizing a different OS than windows for our developers, should that be the approach we desire. Next, there's the advantage that as GKE is a Google product, it is created to work operating system and does not particularly favour one over any others. AKS is a Microsoft product; thus, it is designed with Windows in mind, so should our company wish to at any point in the future move away from using Windows products, it would be an easier task to do so with GKE than with AKS.

However, are these benefits enough to outweigh some of the risks and complications that are presented through the switch? At the end of the day, even if GKE is better on paper than AKS, if the switch is going to too complicated or too damaging to introduce. In that regard, though there are certainty risks, as can be seen in the risk register, I do not believe any of them to be great enough that they cannot be mitigated through careful planning and implementation. So? In my opinion then do the benefits outweigh the risks? Yes, I believe they do, and as such, I believe it would be beneficial for us as a company to move from AKS to GKE.

What are the list of services that we need to activate on GCP? (Nihal Kamal)
GCP (Google Cloud Platform) is a cloud-computing services platform which offers many services for computing, storage and applications for Google hardware. Accessing GCP is simple as long as there is a network connection that is dedicated to the cloud. The services that are offered by GCP are ones used for handling and dealing with mainly operating systems, security, big data, cloud management and development. Since GCP has many platform services, it also has some services which are widely used to acquire for all cloud-computing needs. The main ones we would need to activate on GCP are Google Compute Engine, Google App Engine, Google Cloud Storage, and Google Container Engine. These are the main four which we would need to activate on GCP to accomplish many things. Google Compute Engine helps with the operating systems in the sense that it gives a virtual machine to work on. Google App Engine is useful for software developing as it offers many kits and products to work on that can also access Google's virtual machine for hosting their software. Google Cloud Storage helps by providing access to many databases provided by Google as well as the ability to store on the large cloud provided. Google Container Engine essentially manages for Docker containers and provides the ability to run on the cloud. Below is a diagram which illustrates the platform services and what they can be used for, i.e. Computing, storage, networking, big data, and machine learning.

Google Cloud Platform services

COMPUTE	STORAGE/DATABASES	NETWORKING	BIG DATA/IoT	MACHINE LEARNING
▪ Compute Engine	▪ Cloud Storage	▪ Virtual Private Cloud (VPC)	▪ BigQuery	▪ Cloud Machine Learning Engine
▪ App Engine	▪ Cloud SQL	▪ Cloud Load Balancing	▪ Cloud Dataflow	▪ Cloud Jobs API
▪ Container Engine	▪ Cloud Bigtable	▪ Cloud CDN	▪ Cloud Dataproc	▪ Cloud Natural Language API
▪ Cloud Functions	▪ Cloud Spanner	▪ Cloud Interconnect	▪ Cloud Datalab	▪ Cloud Speech API
	▪ Cloud Datastore	▪ Cloud DNS	▪ Cloud Dataprep	▪ Cloud Translation API
	▪ Persistent Disk		▪ Cloud Pub/Sub	▪ Cloud Vision API
	▪ Data Transfer		▪ Genomics	▪ Cloud Video Intelligence
			▪ Google Data Studio	
			▪ Cloud IoT Core	

What resources do I need to do this migration? (Aiden Dunfield)

To do this migration we need to do the following:

Configure the source and destination for migration

Set up GCP as a migration destination. Before beginning a migration to Google Cloud, you must create Identity and Access Management permissions.

Set up a VPN for communication between the migration source and destination. Plan for and create a secure connection between Azure and Google Cloud. One way to do this is to follow this guide.

Configure network access. See Network Access Requirements for detailed information on firewall, routing, and network tag considerations for your Migrate for Compute Engine deployment.

Create Azure credentials in the Migrate for Compute Engine Manager that will enable Migrate for Compute Engine to connect to Azure.

Set up the Migrate for Compute Engine Manager. The Migrate for Compute Engine Manager provides a web UI and controls migration operations from Google Cloud.

Create Cloud Details on your Migrate for Compute Engine Manager using your Azure credentials.

Set up Cloud Extensions. After configuring the Migrate for Compute Engine Manager, create Cloud Extensions for your migration.

Prepare your Linux VMs. If you are migrating Linux VMs, install the Migrate for Compute Engine package to reconfigure them for Google Cloud.

Migrate VMs

Migrate a wave of VMs. Migrate for Compute Engine organizes groups of VMs into waves. When you understand the dependencies of your applications, create runbooks that contain groups of VMs, then begin your migration.

Migration process of VMs:

During migration of an instance from Azure to Google Cloud, Migrate for Compute Engine does the following:

Stops the source VM in Azure.

Creates the Migrate for Compute Engine VM Importer at Azure.

Takes a snapshot from the source VM disk.

Creates a data disk from source VM snapshots and attaches it to the Migrate for Compute Engine importer.

Creates an instance in Google Cloud.

Streams data from the importer to the Google Cloud Extension.

When migration is complete, Migrate for Compute Engine terminates the importer and resources are cleaned up.

At the end of the process, the original Azure instance remains intact and powered off.

Migrating with waves

You can migrate VMs from Azure to Google Cloud with Wave Migrations

What deployment pattern should I use to minimize the impact on my clients? (Seif ELBayomi)

We should use a sequential approach to migrate to GKE to have the least impact on the client. The process should be as follows:

1. Prepare teams for a Google Cloud migration

This can be achieved by proper training for all the teams to ensure those teams are taking full advantage of all the Google tools and services they might need to optimize app performance and take full advantage of the cloud.

2. Use monitoring and automation to safeguard performance

NAPM solutions such as Accedian's Skylight are ideal for offering a holistic view of the network and delivering proactive alerts for correcting issues before they impact app and SD-WAN performance.

Automation is another important tip for a successful, optimized app migration. Critical jobs like deployments, exchanges and configuration updates may all be easily automated. It reduces the chance of manual errors and prevents valuable human workers from wasting time and money on repetitive tasks.

3. Take advantage of Google's managed service

A few examples include App Engine, which offers serverless web hosting, and CloudSQL for MySQL, which replaces MySQL cluster management. GCP also provides AutoML for tagging and classifying images with the option to deploy workloads on GKE instead of managing Kubernetes clusters.

4. Scale resources to optimize app and network performance

As GCP enables horizontal scaling, which allows users to elastically add or remove VMs, cluster nodes, and database instances. Vertical scaling allows more resources to be added to existing instances without the need for any additional physical infrastructure.

Again, a strong NAPM offering is beneficial when making changes to the network, providing real-time monitoring and alerts about app and network performance. This enables administrators to make changes proactively before they have a negative impact on network operations.

5. Use GCP app migration to reduce costs

Google's migration tools help with in-cloud testing and validation during migration, which can help spot performance issues early. Workloads also can be migrated in phases (known as "migration waves") for a more orderly migration.

By using GCP's built-in migration tools, many of the typical "gotchas" of app migration can be avoided or resolved quickly. When used in tandem with a NAPM solution like Skylight, performance issues can even be eliminated during the move to GCP.

Migrating apps and workloads to the Google Compute Platform clearly offer major benefits to enterprises. By taking advantage of the above tips, businesses can optimize their app migration and glean the most value from GCP.

App optimization during a cloud migration is simply not possible without close monitoring and management of network and application performance. That's why Google actually recommends that its enterprise customers deploy a monitoring and alerting system to ensure applications and networks achieve and maintain optimal performance both during and after a cloud migration.

Risk Register

ID	Description	Likelihood of risk occurring	Impact of risk	Owner	Mitigation Notes	Date Raised
1	Loss of control over data and process	4	5	Project Manager	Restrict access manually. Encrypt data to help with security.	[enter date]
2	Inadequate Preventive Security Checks	3	4	Project Manager	Outsource someone with expertise in cloud migration	[enter date]
3	Additional latency	2	2	Project Manager	Improve network localization and optimization. Track traffic flow by segment Interconnect multiple clouds. Outsource the Internet at the edge. Engage business partners and ecosystems for data sharing and digital commerce	[enter date]
4	Infrastructure vulnerabilities	3	3	IT Team	Perform a cloud readiness assessment With IT team	[enter date]
5	Incompatibility with current configuration	5	2	Project Manager	Hire IT to fix tech debt, review the legacy architecture, make comprehensive documentation, and measure interdependent parts.	[enter date]

Screenshots:

Team C - 2600 Superstore Team Lead Time
Last 30 days

9 Days on average
(Created to Completed)

📊 16 Requirements