# Introduction to Cloud Computing

# Assignment 1

## Question no. 1:

1. **Write a short note on Google Cloud Platform. Discuss at least 10 of its featured products.**

### Google Cloud Platform:

Google Cloud Platform is a suite of Cloud computing that has combination of tens of services and products offered by Google. Google Cloud Platform provides services in computing, networking, big data, analytics, storage, etc. It lets the users exploit the resources for applications and software development and deployment. It follows pays-as-you-go model in which there is no upfront payment.

Alongside modular cloud services, GCP also provides a number of tools and platform for management purposes. It provides infrastructure as a service, platform as a service, and server-less computing environments. One can build cloud-based infrastructure with possible utmost control and flexibility.

### Featured Products:

* **Compute Engine:** Users are facilitated to acquire computing infrastructure including pre-defined or customized virtual machine sizes. GCE can be accessed by developers’ console, RESTful API or Command Line Interface.
* **Cloud Storage:** It is a RESTful online file storage web services for storing and accessing data on Google Cloud Platform Infrastructure, seen as more suitable for enterprises.
* **Dataflow:** It is a fully managed streaming analytics service that minimizes latency, processing time, and cost through auto scaling and batch processing. It enables developers to set up processing pipelines integrating, preparing and analyzing large datasets.
* **Cloud SDK:** It is a set of tools that are used to manage applications and resources that are hosted on Google Cloud Platform.
* **Cloud CDN:** Cloud Content Delivery Network enables customers to deliver content hosted on and off premises. It is a low latency solution for small to enterprise businesses.
* **Cloud SQL:** it’s a database service that makes it easy to set-up, maintain, manage and administer MySQL and Postgre SQL databases on cloud.
* **Cloud Run:** Google Cloud Run is a fully managed platform that a Docker image and runs it as a stateless HTTP service.
* **Operations:** It’s a monitoring service that provides IT teams with performance data about applications and virtual machines running on Google Cloud Platform.
* **Cloud Functions:** It is a server-less execution environment for building and connecting cloud services.
* **BigQuery:** Google BigQuery is a cloud based big data analytics web service for processing very large read-only data sets.

1. **What is serverless computing? Does Google Cloud Platform support serverless computing?**

### Serverless Computing:

It’s a method of providing back-end services on as-used basis. Serverless architecture allows one to deploy code and use resources without any hassle of worrying about underlying considerations. Cloud Service providers run servers and dynamically manage allocation of resources.

Although called serverless, there are still servers but consumers don’t have knowledge about those servers as the resources are provisioned and released dynamically without any manual interaction..

Google Cloud Platform, with Google Cloud Functions, App Engine, Cloud Run and many services, provides server-less execution environment for deploying cloud services.

1. Discuss case study of 3 industry giants who are using Google Cloud Platform

### Verizon:

It’s an American telecommunication company which offers wireless products and services. Verizon uses Google Cloud Center AI solution that helps them in providing better services. Currently, Verizon spends $79 million for GCP services [[1]](https://www.contino.io/insights/whos-using-google-cloud-platform).

### SAP:

SAP has joined hands with Google cloud to help customers for better service quality. Recently, SAP has announced first ever SAP data center powered Google Cloud infrastructure [[2]](https://cloud.google.com/blog/products/sap-google-cloud/update-on-google-clouds-partnership-with-sap-in-2020). According to a report, SAP has spent $40.1 million on their collaboration with Google.

### Intel:

Google was first cloud service provider that partnered with Intel. Currently both provide joint solutions for High Performance Computing, Big Compute, Analytics and AI.[[3]](https://www.intel.com/content/www/us/en/artificial-intelligence/google-cloud-platform.html#:~:text=Intel%20and%20Google%20Cloud,that%20benefit%20from%20our%20technology.) Currently Intel’s expenditure on GCP services is $39.2 million.

1. **The video link below is a brief introduction of GCP. Summarize the key points discussed in the video**

* Need of Clouds:

On Premise: Companies have to do scaling to fulfil the needs of their consumers and employees

Time Sharing: Over-budgeted resources can be rent out if they aren’t in use.

* Cloud as Set of three tools i.e. Infrastructure as a Service, Platform as a Service and Software as a service.
* Google Cloud is combination of Google Cloud Platform and G-suite where in IaaS and PaaS are part of GCP while SaaS is part of G-suite.
* Compute, Storage, Data Migration, Networking, IoT core, tools for building API and tools for maintaining security and administration in platform.
* Companies like Coca Cola, Spotify use Google Cloud by acquiring data centers managed by Google, for giving their users better experience.
* Two examples of cloud smart usage by researchers were given. In first one, students used Google processing tools to parse gigantic data of flights schedule, timings and prices to know the best flight. And in the second one, google compute engine and speech to text API, developers were able to make conversation possible for a person speaking on call and the other one doing it on text.
* A live demo was given about creating an instance of VM on GCP.

## Question no. 2:

Containers offer a logical packaging mechanism in which applications can be abstracted from the environment in which they actually run. This decoupling allows container-based applications to be deployed easily and consistently, regardless of whether the target environment is a private data center, the public cloud, or even a developer’s personal laptop.

1. **The video explains the concepts of container. You are required to summarize the contents of this video.**

### Summary:

Containers are the units that allow developers to isolate a process (sandboxing) from rest of the environment. The container processes are tightly coupled with the lifecycle of container.

Unlike other applications, Containers have image that have all necessary executables, binary codes, libraries and configuration files. These images can have multiple altered instances. That’s why, any number of different versions of applications that require different versions of libraries, can be run on a single operating system, making them light-weight and portable.

Docker Host was explained. Docker is tied with a registry that contains containers. One can push and pull from the registry and while doing so, one only push and pull the bits that are needed as the image cache already has bunch of other images that might have sufficient bits and if not so then those bits can be loaded. Clients interact with the daemon that is positioned inside Docker host and can push, pull, create and manage container. Alongside container lifecycle management, client can also do network and storage configuration

1. **What are the key similarities and differences between containers and virtual machines (VMs).**

### Similarities:

* Both Containers and Virtual Machines provide isolation from the environment. In VMs, complete isolation is provided while in containers; partial or light-weight isolation is provided.
* VMs run complete OS while containers run user-mode portion of OS.
* Both can deploy multiple instances.
* Both need to upgrade OS files individually.

### Differences:

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| --- | --- |
| Virtual Machines | Containers |
| There is strong security boundary in VM as VMs don’t share same OS. | Comparatively less secure because of OS sharing. |
| It can run any guest operating system. | Rather than creating guest OS, container can be launched accessing Kernel of the host OS. |
| Individual VMs can be deployed using Windows Admin Center or Hyper- V Manager and multiple VMs can be deployed using Power Shell or System Center VM Manager. | Individual containers can be deployed using Docker and multiple containers can be deployed using an orchestrator. |

## Question No. 3:

Kubernetes (K8s) is an open-source system for automating deployment, scaling, and management of containerized applications. The video links below presents a brief introduction to Docker and Kubernetes. Summarize the key points discussed in these videos.

### Summary:

With Docker, single instance of application can be run on one Docker host. For running multiple applications, one has to give command for adding up instances when requirement outnumbers the resources. Kubernetes is a tool that can perform container orchestration consisting of multiple Docker hosts with precise commands. This way, it provides better failure handling and scaling in terms of instances and hosts. It also lends hand for networking between containers as well as in load balancing, security and configuration management.

Docker Swarm and Mesos are the competitors of Kubernetes in container orchestration but Kubernetes is great option if advanced features and better container orchestration is requirement.

With simple commands like run replicas, scale replicas, rolling update, rollback, etc. Kubernetes makes containers orchestration easy.

With Open Architecture, Kubernetes supports vide range of network and storage vendors along with security with the help of authorization and authentication.

Kubernetes Cluster consists of nodes that are monitored and managed by a master that actually does container orchestration. Kubernetes includes API Server (acts as Front-End), etcd server (implements logs to ensure that there is no conflict between the masters), scheduler (distributes work across multiple nodes), controller (brain of orchestration, makes decisions), container runtime (run containers), Kubelet (agent that runs on each cluster). Another tool called Cube Control tool is Kubernetes CLI which is used to deploy and manage application on governance cluster.

## Question Number 4:

The COVID-19 pandemic has enforced the work from home environment. Organizations are increasingly shifting to cloud to improve business continuity. However, selecting a cloud service provider is not that straight forward. Suppose you are the IT manager at an enterprise that was running a private data center before the pandemic. As you decide to shift your services to cloud, what will be your primary evaluation criteria to determine the most suitable cloud provider? Also, give a detailed comparison of top cloud providers: AWS, Microsoft Azure, and Google Cloud

### Criteria for Selecting Cloud Service Providers:

* **Technical Advancement**

The one that is advanced in technical competencies offers trending technical support and handles the requirements of high speed networking, high-bandwidth and workloads.

* **Cost Effectiveness:**

Since the decision of shifting to cloud is costly, there is need to seek the factor of cost effectiveness while opting for cloud service provider.

* **Data Security and Governance:**

Main concern that can arise in shifting from private data center to cloud is data security. The vendor that gives utmost security along with control over the data and storage will be the best choice in such case.

* **Reliability and Performance:**

Cloud service provider’ capability to handle the planned and unplanned downtime is a must consider factor. One must ensure that there are sufficient tools and options for monitoring and reporting.

* **Migration support and Vendor Lock In:**

Cloud services that rely heavily on bespoke or unique proprietary components may impact portability to other providers or in-house operations resulting in vendor lock-in. Therefore the chosen provider must have minimal restrictions for migration.

* **Manageability:**

There must be ease in implementing the solution of cloud service provider to that there would be least difficulty in management.

* **Certifications and Standards:**

Cloud Service provider must have compliance with the industry standards and frameworks.

### Comparison between Top Service Providers:

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| --- | --- | --- | --- |
| **Criteria** | **Amazon Web Services** | **Microsoft Azure** | **Google Cloud** |
| **Features** | * Mobile-friendly access * Serverless Cloud functions * Sufficient storage * AWS managed database * Good compliance and security * AWS Marketplace. | * Data resiliency * Good Data security with Storage Side Encryption * BCDR(Business Continuity/ Disaster Recovery) integration with back-up agents and site recovery. * Excellent Capacity management * Automation and security solutions with hybrid infrastructure | * Offers persistent object storage with BigQuery, Hadoop, BigTable, etc. * Allows building event based micro services. * Google Container Engine and Compute for excellent services. |
| **Key Strengths** | * Market Leader * Secure network * All-in-global coverage | * Significant discounts * Hybrid cloud setup * Easy integration of existing infrastructure | * Intuitive simplicity and easy to use interface * Big data analytics and Machine Learning applications. |
| **Weaknesses** | * Requires a lot of set up work * Absence of hybrid cloud solution like Microsoft | Support for other operating systems is limited | It’s a B2C business and large enterprises find it challenging to work with their cloud services. |