

Most Popular Cloud Computing Platforms

There are many cloud computing platforms with plenty of advantages. This study considers four popularly adopted platforms namely Amazon web services, Microsoft windows azure, Google app engine and IBM cloud.

Amazon Web services

This is provided by Amazon which was **launched in 2006**, known today as the pioneer in cloud computing. Amazon web services offers on request cloud services to different kind of users such as firms, organizations, business enterprises. Customers mostly use the pay as you go option for available services which allows them to completely manage the virtual servers with assistance via the web (Swedha and Dubey, 2018).

AWS offers a vast array of cloud services that helps in the improvement of complex apps. It also allows the deployment of applications on a global scale at a minimal cost. The user just pays for the services used on a fixed rate (Ferriman et al., 2015).

Examples of some popular clients of AWS are US Navy, Unilever, Kellogg's, and Siemens (Purohit, 2017).

Figure 3.4 shows the components of AWS which are Monitoring, Management, Tools, Networks, Processing, Content Delivery, Messaging, Payments, On-Demand workforce and the main features which are compute, storage and database available

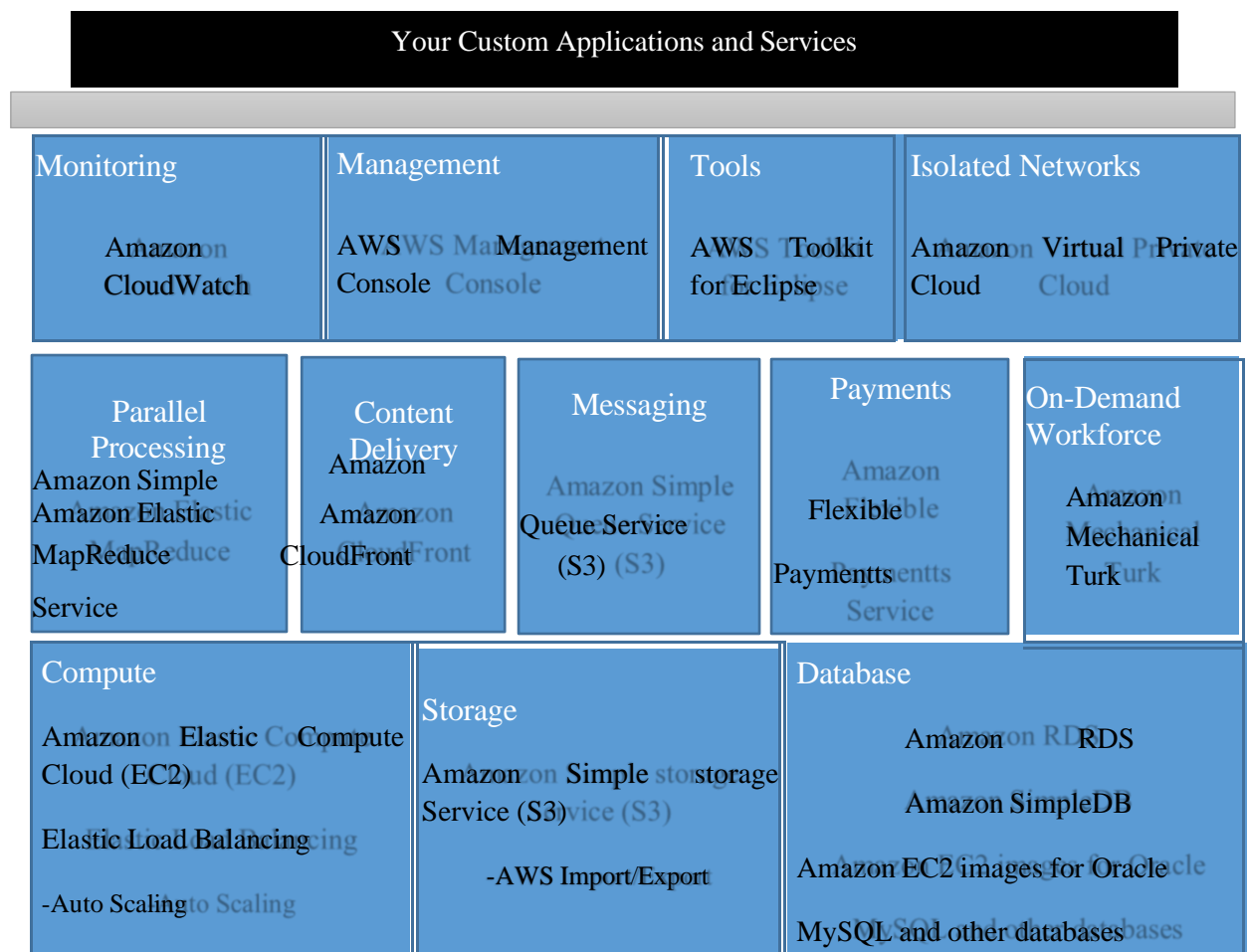


Figure 3.3: Main components of AWS (Understanding Amazon Web Services (AWS) | OracleApps Epicenter, 2019)

The architecture of Amazon web services is primarily made up of four parts: Elastic Compute Cloud (EC2), Simple Storage Service (S3), SimpleDB, and Simple Queue Service Amazon (SQS) (Padhy et al., 2011; Laxamaiah and Sharma, 2019).

- **Elastic Compute Cloud Amazon (EC2):** This allows a user to run numerous virtual servers on demand. It is scalable, efficient, protected and significantly affordable, as a user only pays for tools used (Laxamaiah and Sharma, 2019).
- **Simple Storage Service Amazon (S3):** This provides a flexible asset space for storing any data easily accessible over the internet. It is also used to back up and archive files (Sweda and Dubey, 2018).
- **Amazon SimpleDB:** This is a form of non-relational database that enables a user to store data. It uses a simple read/write command from the Application program interface (Ampaporn and Gertphol, 2015).
- **Simple Queue Service Amazon (SQS):** This is a service which passes a message among any cloud components (Laxamaiah and Sharma, 2019).

Microsoft Windows Azure

This is the major part of Microsoft cloud computing platform which was launched in 2010, it offers users with tools and platforms to create, operate and execute web applications on a huge, worldwide network.

Microsoft Windows Azure provides high performance, flexibility, and low service cost for IAAS, SAAS, and PAAS. It is accessible in over one hundred and forty countries and twenty eight regions (Al-Sayyed et al., 2019).

Migration of virtual machines on public cloud is simple because Microsoft windows azure is developed in windows server and shares almost the same softwares and application. Examples of some popular clients of Microsoft azure are Mazda, NBC sports, Xerox and FreshDirect (Purohit, 2017).

Figure 3.6 below shows the components of Microsoft azure which are compute, Data management, networking, Developer and IT services, identity and access, mobile, backup,

messaging and integration, compute assistance, performance, big compute and big data, media and commerce. These components help a user to explore available applications and services.



Figure 3.4: Components of Microsoft azure

The five essential features of Microsoft windows azure are: Compute, Storage, Content Delivery Network (CDN), SQL Azure and Fabric controller. (Padhy et al, 2011, Tajadod et al., 2012; Laxmaiah & Sharma 2019)

- **Compute:** This feature enables applications and services to be implemented on window azure platform. Compute in azure consists of web role for implementing web based apps, worker role for implementing of codes and Virtual machine for the migration of applications on window servers to azure (Tajane et al., 2018).
- **Storage:** It enables the storing of any size of data for a duration, there are three types of storage which are, blobs, table and queues. Blobs stores extensive tons of unorganized data, it's applicable to binary objects. Tables allows applications to function in an organized manner. Queues allow web based applications to connect with code implemented by a user (Tajane et al., 2018).
- **Content Delivery Network (CDN):** It improves overall quality by indexing content at places nearest to users. It creates accessibility since users have easy access to obtained data everywhere from the internet (Tajadod et al, 2012).
- **SQL Azure:** It offers data storage capacities comparable to Amazon simple storage service. It enables relational query to be rendered towards data in storage that can be organized, semi-organized or unorganized, users get connected in a number of different form like ADO.NET, PHP and Open Database Connectivity (Laxamaiah and Sharma, 2019).
- **Fabric controller:** This controls, oversee servers and organizes Microsoft windows azure applications and database development (Verma et al., 2018).

Google App Engine

This cloud platform is provided by Google was launched in 2011. Google App Engine is mainly a platform as service that allows a user to develop and execute applications through Google framework, thus removes the need for expensive acquisition and maintaining of database, as it is managed by Google (Tabot and Hamada, 2014; Narula et al, 2015).

The objective of GAE development is to boost the online presence by allowing several users create apps for the web. It does not charge anything to get started, charges are made based on the use of storage and bandwidth by a user at an affordable price range (Laxamaiah and Sharma, 2019).

It provides resources for data storage management, page monitoring, and asset utilization, testing and logging. It offers both PaaS and SaaS services. PaaS service such as GAE while SaaS services such as Gmail, Google doc, calendar and Google drive (Padhy et al, 2011).

Examples of some popular clients of Google cloud are Snapchat, Coca-Cola, Motorola and Airbus (Purohit, 2017).

Figure 3.7 below, shows the structure of Google app engine which include client capabilities containing the tools available for a user, cloud computing services and the support services in place.

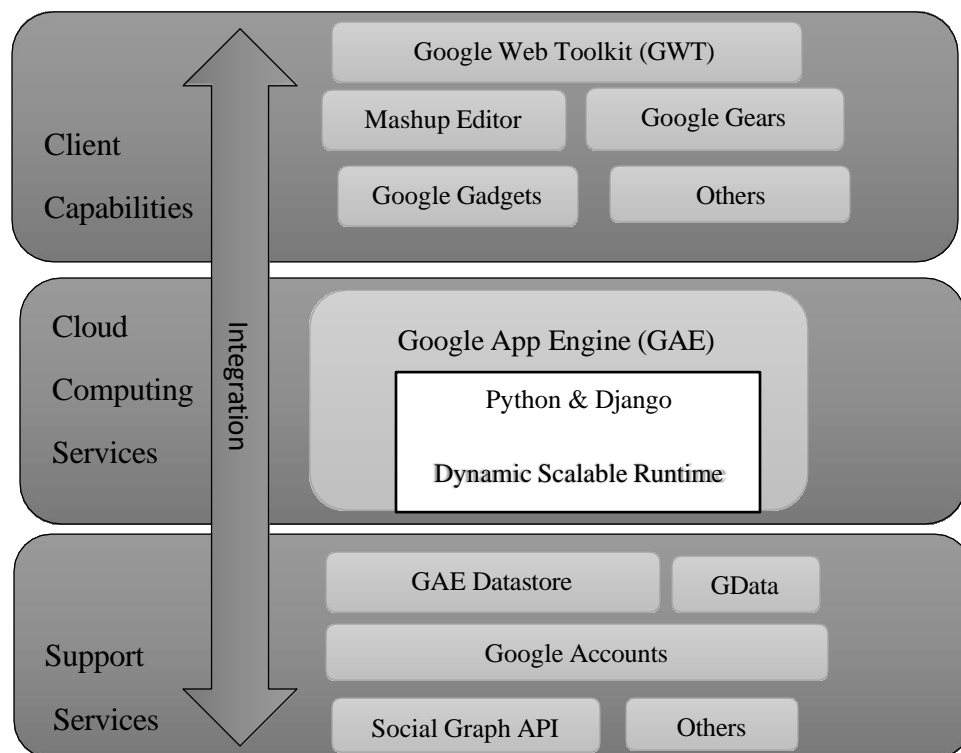


Figure 3.5: Structural design of Google App Engine (Laxmaiah and Sharma, 2019)

TABLE: 3 SUMMARY OF TECHNICAL PARAMETERS OF AWS, AZURE AND GCP[6,812,14]

Parameter	Amazon Web Service	Microsoft Azure	Google Cloud Platform
Infrastructure (IaaS) collection of hardware/ software elements/ interface to enable/access cloud computing services/ virtualized resources.	Amazon- EC2(Xen virtualization Engine	Microsoft common language run time(CLR) (Hypervisor-V)	Google Cloud Platform (GCP)
Computing Services (PaaS) : Provide the IT as service over the internet or	AWS Beanstalk, Amazon Lightsail, AWS Batch, AWS	Platform-as-a- service(PaaS) Function-as-a- service(FaaS) Service Fabric Azure Batch	Google App Engine; Graphic processing unit; Docker Container;
network with delivery on demand and price as –use.	Fargate,		Compute Engine; &
Network Technologies: It allow to access the network infra- structure directly and securely.	Amazon allows VPC services; Amazon Route 53 services, The Cloud Front service, & AWS- Direct Connection.	It provides branch cache, direct access for services, It helps in core Network Guide framing, DNS Service, and load balancing	Cloud Interconnect, Cloud VPN, Carrier Peering, and Direct Peering
Storage technologies : maintain and manage the data and makes the accessible on network on demand)	Following services of Amazon can be availed such as simple storage service, Amazon Glacier, Amazon Elastic Block Store, & Amazon Elastic file System.	Azure It allows scalable object store It can store text and binary data. Azure Files: It manages file's for cloud for on- premises deployments. Azure Queues: A messaging	Data Store, Blob store Google cloud, SQL
Relational Data Base Support: allow to users to access the database without installing software/setting- up environment	Amazon- RDS, SQL, MySQL and Oracle	Azure SQL, Azure-SQL- DW	Cloud-SQL, Cloud- Spanner
Back-Up Services: restore/backup of data or application remotely or online.	Glacier	Archival storage, Recovery backups, Site recovery	Near-line, Cold-line are frequently used to access data
Key Tools: for AI/IOT/ serverless	AI/ML:, Machine Learning, Translate, Deep Lens, Deep Learning, Apache IoT: Core, Free RTOS, Device Defender, IoT Device Management. Serverless: AWS- Examples are	AI/ML: Machine Learning, Azure Bot Service & many more can be availed IoT: IoT Hub ,IoT Edge, Stream Analytics, Time Series Insights Serverless: This Functions can also be	AI/ML: The Cloud service helps in Machine Learning, Cloud Natural Language, Cloud Speech NLP, The Cloud Translation API, For Cloud Video, Intelligence, & Cloud Job Discovery IoT: Cloud
	Lambda, Serverless Application Repository.	availed here,	IoT Core can be managed Serverless: Cloud Functions are available

Summary of General Parameters of AWS, Azure and GCP.

Parameter	Amazon Web Service (AWS)	Microsoft Azure	Google Cloud Platform (GCP)
Type of Service Model	All computing models- IaaS, PaaS,SaaS but major in IaaS a,PaaS	All three computing models- IaaS,PaaS,SaaS but major in SaaS	All three computing models- IaaS,PaaS, SaaS but major in PaaS
Focus	Enterprise Friendly offerings and Public Cloud (off Premise)	Microsoft tools Integration, Open Source and Hybrid Cloud(on/off premise)	Open Source & Portability and Hybrid Cloud (off premise)
Availability Regions & Range of services	66 It is extremely wide	54 It is wide	20 It is just Limited but is expandable
Unique Selling Point of cloud computing: Ability to quickly respond	This provides Tight security system	This Integrated with Microsoft tools	It helps in Top-notch data & analytics tools
Security	Moderate	Moderate	Moderate
Nature of services	It provides Enterprise- centric services	It is Not totally 'enterprise- ready'	It is Designed for cloud- based businesses
Reach	It is an Established global presence	It is Expanding gradually	It is New to the market
Major drawback	It is Difficult to use, options may seem confusing	The Management tooling is inefficient	It has Limited data centers across the world
Price and Payment	Free, Commercial (Pay-as-you-go) (\$0.11/Hour- (roundup) Subscription: Hourly/ Monthly	Commercial (Pay-as-you-go),(\$0.02/Min utes) (roundup- commitment Subscription: Monthly	Free, Commercial (Pay-as- you-go) (\$0.02/Min utes) (Minimum 10 minutes) Subscription: Hourly/Mo nthly.

Managed Service Provider (MSP)

- A Managed Service Provider (MSP) is a third-party company **that remotely manages and assumes responsibility for a defined set of day-to-day management** services for its clients.
- A service provider that manages one or more of your business areas to maintain business continuity on a day-to-day basis is a managed service provider.

Many industries have tight labor pools and a competitive market for finding and retaining good talent, which has motivated organizations to contract with managed service providers to supplement their in-house staff. (Will Venters, London School of Economics)

These services can include:

1. **Network Management:** Monitoring and managing network infrastructure to ensure optimal performance and uptime.
2. **Cybersecurity:** Implementing security measures to protect against cyber threats, such as malware, phishing attacks, and data breaches. This often includes firewall management, antivirus solutions, and intrusion detection systems.
3. **Data Backup and Recovery:** Regularly backing up data to prevent loss in the event of a disaster or system failure and implementing recovery plans to restore data and system functionality.
4. **IT Support:** Providing technical support and troubleshooting for hardware and software issues. This can include help desk services for end-users.
5. **Cloud Services:** Managing cloud-based services and infrastructure, including migration to cloud platforms, cloud storage, and cloud computing resources.
6. **Compliance and Risk Management:** Ensuring that the client's IT infrastructure complies with industry regulations and standards, such as GDPR, HIPAA, or PCI DSS.
7. **Software Management:** Handling software updates, patches, and licensing to ensure that all systems are up-to-date and legally compliant.
8. **Consulting and Strategy:** Offering strategic advice on technology planning and IT investment to align with business goals.

Challenges with Managed IT Service Providers

There is no reason why you can't outsource strategic functions to third-party providers, but you have to have tight legal contracts, skilled internal talent to monitor these engagements, and provisions to ensure that data doesn't fall into the wrong hands.

(Rudy Hirschheim, PhD, distinguished professor of information systems, Louisiana State University)

1. **Cybersecurity Threats:** MSPs are prime targets for cyberattacks due to the sensitive data they handle and the access they have to clients' systems. Ensuring robust cybersecurity measures are in place is a constant challenge.

2. **Keeping Up with Technology:** The rapid pace of technological advancement means MSPs must continually update their skills, tools, and services. This requires ongoing investment in training and infrastructure.
3. **Compliance and Regulations:** Adhering to various industry regulations and standards (such as GDPR, HIPAA, etc.) can be complex and resource-intensive. MSPs need to stay informed about regulatory changes and ensure compliance.
4. **Customer Retention and Satisfaction:** Maintaining high levels of customer service and satisfaction is crucial. This involves regular communication, efficient problem resolution, and the ability to anticipate and meet clients' evolving needs.
5. **Scalability:** As MSPs grow, they need to scale their operations effectively. This includes managing increased workloads, hiring and training new staff, and maintaining service quality.
6. **Cost Management:** Balancing the costs of providing high-quality services with the need to remain profitable can be difficult. MSPs must manage expenses while offering competitive pricing.
7. **Vendor Management:** MSPs often rely on third-party vendors for software, hardware, and other services. Managing these relationships and ensuring vendor reliability is critical.
8. **Market Competition:** The MSP market is competitive, with many providers offering similar services. Differentiating themselves and maintaining a unique value proposition is a constant challenge for MSPs.
9. **Talent Acquisition and Retention:** Finding and retaining skilled IT professionals is a common challenge. The demand for tech talent is high, and MSPs need to offer attractive compensation packages and career development opportunities.
10. **Remote Work Management:** With the increase in remote work, MSPs need to support clients' remote workforce, which includes managing remote access, ensuring cybersecurity, and providing remote IT support.