# Research and Comparison of IaaS, PaaS, and SaaS services of IBM, Google, and Amazon Cloud

NYU Cloud and machine Learning
Spring 2023
I-HSIN CHUNG and HAO YU
Homework 1
Xiaohan Wu (xw2788)

**IaaS**

IBM Cloud: IBM Cloud Virtual Servers

1. IBM Cloud Virtual Servers provides virtualized computing resources on demand, including virtual machines, block storage, and network. Besides the resources, it also provides users with fine-grained control along with a secure, protected environment.

Google Cloud: Google Compute Engine (GCE)

2. GCE provides secure and customizable compute service with types of machines, persistent disks for storage and a range of network options to run virtual machines on Google's infrastructure. Users can customize and manage their virtual machine instances, as well as take advantage of GCE's pre-configured machine types and global load balancing.

Amazon Cloud: Amazon Elastic Compute Cloud (EC2)

3. Amazon EC2 offers secure and scalable computing resources in the cloud, providing users with on-demand access to the infrastructure they need for their applications. With flexible options for optimizing performance and costs, EC2 enables users to tailor their computing resources to their specific needs.

**PaaS**

IBM Cloud: IBM Cloud Code Engine

1. IBM cloud code engine is a serverless platform that is completely managed by IBM. Users can focus more on coding rather than managing infrastructure. IBM cloud code engine manages, deploys, and scales the underlying infrastructure and networking for the users.deployment and management easier.

Google Cloud: Google App Engine (GAE)

2. GAE supports building applications in popular development languages. It provides zero server management and zero configuration deployments with a range of developer tools. Without any concern about managing the infrastructure, users can focus on the code within the fully managed environment.

Amazon Cloud: AWS Elastic Beanstalk

3. AWS Elastic Beanstalk helps provisioning and managing infrastructure. It simplifies the deployment process so that users can focus on their own business. It also offers automated scaling and load balancing to handle peaks in traffic and minimizing costs.

**SaaS**

Note: IBM, Google, and Amazon all have platforms to generate a certain chatbot. For this section, we only focus on what the generated chatbots can do, but not the platform.

IBM Cloud: IBM Watson Assistant

1. IBM Watson Assistant is a chatbot assistant offering virtual agents built on natural language processing and machine learning to deliver friendly and fast interactions like understanding questions and searching for answers. It also uses intent classification to better understand the questions to help complete the user's intended need.

Google Cloud: Google Dialogflow (chatbot)

2. Google Dialogflow(chatbot) is a virtual assistant supporting rich, intuitive customer conversations powered by Google's leading AI. It features natural and accurate interactions and could handle spike requests through scaling.

Amazon cloud: Amazon Lex (chatbot)

3. Amazon Lex(chatbot) also uses NLP and ML to understand intent and context. It could help automate simple tasks across many languages. It also connects to the AWS services for better user experience.

**Comparison**

| | IBM Cloud | Google Cloud | Amazon Cloud |
|---|---|---|---|
| IaaS | IBM Cloud Virtual Servers | GCE | E2 |
| Price(x86, Linux, 1 instance, 2vCPUs,8 GiB RAM, 4 Gbps, 100 Boot volume) | $134.50/month | $ 107.92/month | $109.50/Month |
| usability | UI + web-based consoles + APIs | UI + web-based consoles + APIs | UI + web-based consoles + APIs |
| High memory | 2464 GB | 128 GB | 32 GB |
| GPU | NVIDIA Tesla V100 16 GB | NVIDIA Tesla K80/P100/P4/V100/T4 | Not available in E2 |
| High bandwidth | 80 Gbps | custom | 25 Gbps |
| PaaS | IBM Cloud Code Engine | GAE | AWS Elastic Beanstalk |
| Price | 100,000 vCPU seconds per month<br>200,000 GB seconds per month<br>100,000 HTTP requests per month | 730 Instance hours per month | Free of charge for itself, but needs to pay for resources. |

| | | | |
|---|---|---|---|
| Beyond Free | $ 0.000032 per vCPU second<br>$ 0.0000033 per GB second<br>$ 0.5 per 1 million HTTP request | $0.05 per hour per instance | N/A |
| functionality | Container-based<br>Automatic deployment and scaling | Automates deployment web applications and mobile backends<br>Many popular development languages | Automatic scaling, load balancing, and monitoring |
| SaaS | IBM Watson Assistant | Google Dialogflow (chatbot) | Amazon Lex (chatbot) |
| price | Free: Up to 1,000 unique monthly active users (MAUs), up to 10,000 messages per month.<br>Plus(140/month*): 1,000+ MAUs | Text: $0.007 per request<br>Audio: $0.06 per minute | $0.004 per speech request<br>$0.00075 per text request |

**Summary**

All of the three provisioners provide rich IaaS, PaaS, and SaaS cloud services for different customer use. Besides the productions, they also have comprehensive documentations and tutorials and use cases for all levels of users to get started on the services. They also have big communities to help answer any question. It is pretty user friendly.

Based on my experience of searching for the information and comparison, IBM cloud services usually have the best instructions among the three, clear and well-designed. However, it is often the most expensive one. Google cloud and Amazon cloud are quite similar, their prices are similar and the information is also similarly organized. While Amazon cloud depends more on underlying services, Google cloud services are independent which gives me a better user experience for when I want a service, I don't really need to care about the underlying components.

If I were from a startup company where the budget is tight, I would use google cloud services; if I were from a large company where focus more on the service, I would use IBM cloud services.

## References


1. “IBM Cloud Virtual Servers” [oneline]. Available: https://www.ibm.com/cloud/virtual-servers
2. “Google Computer Engine” [oneline]. Available: https://cloud.google.com/compute
3. “Amazon EC2” [oneline]. Available: https://aws.amazon.com/ec2/
4. “IBM Cloud Code Engine ” [oneline]. Available: https://www.ibm.com/cloud/code-engine
5. “Google App Engine” [oneline]. Available: https://cloud.google.com/appengine
6. “AWS Elastic Beanstalk ” [oneline]. Available: https://aws.amazon.com/elasticbeanstalk/
7. “IBM Watson Assistant” [oneline]. Available: https://www.ibm.com/products/watson-assistant
8. “Dialogflow | Google Cloud” [oneline]. Available: https://cloud.google.com/dialogflow
9. “Amazon Lex” [oneline]. Available: https://aws.amazon.com/lex/