UNIT-IV

[Cloud computing](https://www.geeksforgeeks.org/cloud-computing/) applications develops by leveraging platforms and frameworks. Various types of services are provided from the bare metal infrastructure to customize-able applications serving specific purposes.

**Amazon Web Services (AWS)**

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**What is AWS?**

AWS (Amazon Web Services) is a comprehensive, evolving cloud computing platform provided by Amazon. It includes a mixture of infrastructure-as-a-service ([IaaS](https://www.techtarget.com/searchcloudcomputing/definition/Infrastructure-as-a-Service-IaaS)), platform-as-a-service ([PaaS](https://www.techtarget.com/searchcloudcomputing/definition/Platform-as-a-Service-PaaS)) and packaged software-as-a-service ([SaaS](https://www.techtarget.com/searchcloudcomputing/definition/Software-as-a-Service)) offerings. AWS offers tools such as compute power, database storage and content delivery services.

Amazon.com Web Services launched its first web services in 2002 from the internal infrastructure that the company built to handle its online retail operations. In 2006, it began offering its defining IaaS services. AWS was one of the first companies to introduce a [pay-as-you-go cloud computing](https://www.techtarget.com/searchstorage/definition/pay-as-you-go-cloud-computing-PAYG-cloud-computing) model that scales to provide users with compute, storage and throughput as needed.

AWS offers many different tools and products for enterprises and software developers in 245 countries and territories. Government agencies, education institutions, nonprofits and private organizations use AWS services.

**Why is AWS important?**

With more than 200 services, AWS provides a range of offerings for individuals, as well as public and private sector organizations to create applications and information services of all kinds. The services are cloud-based and tend to be cost-effective. They interact with many programming languages, communicate over many different networks and interface with competing cloud service providers (CSPs).

## What is Google App Engine?

Google App Engine (GAE) is a service, a scalable environment, and a cloud computing technology that Google provides for building and hosting applications. It provides both a secure execution environment and a collection of services that simplify the development of scalable and high-performance Web applications.

GAE takes advantage of Google’s vast & efficient computing infrastructure to scale dynamically with changing demands over time. “Effortless” comes to mind when we talk of GAE as it frees developers from managing infrastructure and provides effortless development of applications.

Google Cloud Market Share via [Kinsta](https://kinsta.com/google-cloud-market-share/" \t "_blank):-

* As of Q4 2021, the Google Cloud market share is 9% worldwide
* The global cloud market was valued at $70.19 billion in 2021.
* That number is expected to grow to $83.41 billion in 2022.
* By 2029, the cloud market industry could be worth $376.37 billion.

Google App Engine’s market share is 10.71%, with more than 16506 companies using it.(Datanyze.com)

As a Google Cloud Platform service, it helps:

Build highly scalable applications on a fully managed serverless platform.– Google Cloud

## The App Engine architectu App Engine architecture in cloud computing looks like this:

Services provided by App Engine include:

* [Platform as a Service](https://www.netsolutions.com/insights/iaas-vs-paas-vs-saas/) (PaaS) to build and deploy scalable applications
* Hosting facility in fully-managed data centers
* A fully-managed, flexible environment platform for managing application server and infrastructure
* Support in the form of popular development languages and developer tools

## Is Google App Engine PaaS or SaaS?

Google App Engine in [cloud computing](https://www.netsolutions.com/hub/cloud-computing) is a PaaS, Platform as a Service model, i.e., it provides a platform for developers to build and deploy scalable applications on the [Google cloud platform](https://www.netsolutions.com/insights/what-is-google-cloud-its-advantages-and-why-you-should-adopt-it/). GAE excels in managing the built applications in Google’s data centers.

Organizations are then left free to focus on building applications on the cloud, and they do not have to worry about hosting and managing the application infrastructure. GAE is, therefore, a preferable choice for organizations as it streamlines workflows and lays the foundation for efficient processes. It helps ensure faster time to market, lets you focus on core business capabilities, and efficiently manages the consecutive release cycle.

## Major Features of Google App Engine in Cloud Computing

These prominent features enable GAE to be a hassle-free service platform.

### **1. Collection of Development Languages and Tools**

The App Engine supports numerous programming languages for developers and offers the flexibility to import libraries and frameworks through docker containers. You can develop and test an app locally using the SDK tools for deploying apps. Every language has its SDK and runtime.

Some of the languages offered include — Python, PHP, .NET, Java, Ruby, C#, Go, and NodeJs.

### **2. Fully Managed**

Google allows you to add your web application code to the platform while managing the infrastructure for you. The engine ensures that your web apps are secure and running and saves them from malware and threats by enabling the firewall.

### **3. Pay-as-you-Go**

The app engine works on a pay-as-you-go model, i.e., you only pay for what you use. The app engine automatically scales up resources when the application traffic picks up and vice-versa.

### **4. Effective Diagnostic & Security Services**

Cloud Monitoring and Cloud Logging help run app scans to identify bugs. Further, app reporting documents help developers fix bugs on an immediate basis. GAE also sets up rules for access, SSL certificates on custom domains, and TSL certificates without any extra charge to create user firewall systems.

### **5. Traffic Splitting**

The app engine automatically routes the incoming traffic to different versions of the apps as a part of A/B testing. You can plan the consecutive increments based on the app’s best version.

## What are the Benefits of Google App Engine?

Adopting the App Engine is a smart decision for your organization — It extends the benefits of cloud computing to application development & hosting. GAE allows businesses to innovate and stay focused on their core functions. Here’s why it is preferred as an app-building platform:

### **1. All-Time Availability**

When you develop and deploy your web applications on the cloud, you enable remote access for your applications. Considering the [impact of COVID-19 on businesses](https://www.netsolutions.com/insights/covid-19-impact-on-ecommerce-business/), Google App Engine is the right choice that lets the developers develop applications remotely while the cloud service manages the infrastructure needs.

### **2. Ensure Faster Time to Market**

For your web applications to succeed, ensuring faster time to market is imperative as the requirements will likely change if the launch time is extended. Using Google App Engine is as easy as it can get for developers. The diverse tool repository and other functionalities reduce the [Google Cloud application development](https://www.netsolutions.com/google-cloud-development) and testing time, ensuring a faster launch time for [Minimum Viable Product](https://www.netsolutions.com/hub/mvp-development) (MVP) and consecutive launches.

### **3. Easy to Use Platform**

The developers are only required to write code. You eliminate all the burdens of managing and deploying the code with zero configuration and server management. Google App Engine makes it easy to use the platform, which offers the flexibility to focus on other concurrent web applications and processes. The best part is that GAE automatically handles the traffic increase through patching, provisioning, and monitoring.

### **4. Diverse Set of APIs**

Google App Engine has several built-in APIs and services that allow developers to build robust and feature-rich apps. These features include-

* Access to the application log
* Blobstore, serve large data objects
* Google App Engine Cloud Storage
* SSL Support
* Page Speed Services
* Google Cloud Endpoint, for mobile application
* URL, Fetch API, User API, Memcache API, Channel API, XXMP API, File API

### **5. Increased Scalability**

Scalability is synonymous with growth — an essential factor that assures success and competitive advantage. The good news is that the Google App Engine cloud development platform is automatically scalable. Whenever the traffic to the web application increases, GAE automatically scales up the resources and vice-versa.

### **6. Improved Savings**

With Google App Engine, you do not have to spend extra on server management of the app. The [Google Cloud service](https://www.netsolutions.com/google-cloud-development) is good at handling the backend process. Also, Google App Engine pricing is flexible as the resources can scale up/down based on the app’s usage. The resources automatically scale up/down based on how the app performs in the market, thus ensuring honest pricing.

### **7. Smart Pricing**

The major concern of organizations revolves around how much does Google App Engine cost? For your convenience, Google App Engine has a daily and a monthly billing cycle, i.e.,

* Daily: You will be charged daily for the resources you use
* Monthly: All the daily charges are calculated and added to the taxes (if applicable) and debited from your payment method

Also, the App Engine has a dedicated billing dashboard, “App Engine Dashboard” to view and manage your account and subsequent billings.

To sum it all here’s an introductory video on App Engine by Google Cloud Platform:

## How does Google App Engine benefit your Business?

Google App Engine boosts businesses with the following advantages:

* Security norms for protecting sensitive data
* Expansive & Quicker Market reach with increased efficiency in app development & maintenance
* Easy Management backed by the consolidation of tools by GAE
* Market responsiveness with the ease of scalability that Google App Engine provides
* Efficient iterations by developers as per demand & requirements of users
* Smooth transitions to other environments since there aren’t too many dependencies

## What are the challenges that GAE presents?

Even with all the cloud computing benefits that Google App Engine ushers in, there are a few implementation challenges.

### **1. Control**

What does a user do if there is a problem related to the infrastructure? Wait for Google to solve it? Unfortunately, Back-end infrastructural setup, along with its advantages, also brings in a limitation of problem-solving.

### **2. Customer Support**

This is one aspect that has been under scrutiny. Users are known to have been dissatisfied with the customer support facilities.

### **3. Porting**

The porting of applications faces limitations because of potential vendor lock-in issues. Users often face issues with data migration to other NoSQL databases.

### **4. Limitations of access & performance**

Several times, developers have access to the Google App Engine file system only in a limited read-only manner, creating issues. Writing to local files is a hurdle many times. Moreover, performance is affected because one physical server could be playing host to many separate and unrelated app engine users.

### **5. Expense**

Some users have an issue that GAE can be costlier than self-hosted environments.

## Top 10 Google App Engine Alternatives & Comparisons

Most people seek time-saving, efficient software solutions with hassle-free app development & deployment. They want easy-to-use and reliable platforms. The following have come across as alternatives to GAE within the gamut of cloud platforms as services.

**Microsoft Azure**, often referred to as **Azure** ([/ˈæʒər, ˈeɪʒər/](https://en.m.wikipedia.org/wiki/Help:IPA/English) [*AZH-ər, AY-zhər*](https://en.m.wikipedia.org/wiki/Help:Pronunciation_respelling_key), [UK](https://en.m.wikipedia.org/wiki/British_English) also [/ˈæzjʊər, ˈeɪzjʊər/](https://en.m.wikipedia.org/wiki/Help:IPA/English) [*AZ-ure, AY-zure*](https://en.m.wikipedia.org/wiki/Help:Pronunciation_respelling_key)),[[2]](https://en.m.wikipedia.org/wiki/Microsoft_Azure#cite_note-2)[[3]](https://en.m.wikipedia.org/wiki/Microsoft_Azure#cite_note-3)[[4]](https://en.m.wikipedia.org/wiki/Microsoft_Azure#cite_note-4) is a [cloud computing](https://en.m.wikipedia.org/wiki/Cloud_computing) platform run by [Microsoft](https://en.m.wikipedia.org/wiki/Microsoft). It offers access, management, and the development of applications and services through global [data centers](https://en.m.wikipedia.org/wiki/Data_center). It also provides a range of capabilities, including [software as a service (SaaS)](https://en.m.wikipedia.org/wiki/Software_as_a_service), [platform as a service (PaaS)](https://en.m.wikipedia.org/wiki/Platform_as_a_service), and [infrastructure as a service (IaaS)](https://en.m.wikipedia.org/wiki/Infrastructure_as_a_service). Microsoft Azure supports many [programming languages](https://en.m.wikipedia.org/wiki/Programming_language), tools, and frameworks, including Microsoft-specific and third-party software and systems.

|  |
| --- |
| **Microsoft Azure** |

## Services[edit](https://en.m.wikipedia.org/w/index.php?title=Microsoft_Azure&action=edit&section=1)

Microsoft Azure uses large-scale [virtualization](https://en.m.wikipedia.org/wiki/Virtualization) at Microsoft data centers worldwide and offers more than 600 services.[[8]](https://en.m.wikipedia.org/wiki/Microsoft_Azure#cite_note-8)

### Computer services[edit](https://en.m.wikipedia.org/w/index.php?title=Microsoft_Azure&action=edit&section=2)

* [Virtual machines](https://en.m.wikipedia.org/wiki/Virtual_machine), [infrastructure as a service](https://en.m.wikipedia.org/wiki/Infrastructure_as_a_service) (IaaS) allowing users to launch general-purpose [Microsoft Windows](https://en.m.wikipedia.org/wiki/Microsoft_Windows) and [Linux](https://en.m.wikipedia.org/wiki/Linux) virtual machines, [software as a service](https://en.m.wikipedia.org/wiki/Software_as_a_service) (SaaS) as well as preconfigured machine images for popular software packages.[[9]](https://en.m.wikipedia.org/wiki/Microsoft_Azure#cite_note-9)
  + Starting in 2022, VMs are powered by [Ampere](https://en.m.wikipedia.org/wiki/Ampere_Computing) Cloud-native processors.[[10]](https://en.m.wikipedia.org/wiki/Microsoft_Azure#cite_note-10)
  + Most users run Linux on Azure, some of the many [Linux distributions](https://en.m.wikipedia.org/wiki/Linux_distribution) offered, including Microsoft's own [Linux](https://en.m.wikipedia.org/wiki/Linux_kernel)-based [Azure Sphere](https://en.m.wikipedia.org/wiki/Azure_Sphere).[[11]](https://en.m.wikipedia.org/wiki/Microsoft_Azure#cite_note-11)
* App services, [platform as a service](https://en.m.wikipedia.org/wiki/Platform_as_a_service) (PaaS) environment letting developers easily publish and manage websites.
* [Websites](https://en.m.wikipedia.org/wiki/Microsoft_Azure_Web_Sites), Azure Web Sites allows developers to build sites using [ASP.NET](https://en.m.wikipedia.org/wiki/ASP.NET), [PHP](https://en.m.wikipedia.org/wiki/PHP), [Node.js](https://en.m.wikipedia.org/wiki/Node.js), [Java](https://en.m.wikipedia.org/wiki/Java_(programming_language)), or [Python](https://en.m.wikipedia.org/wiki/Python_(programming_language)) and can be deployed using [FTP](https://en.m.wikipedia.org/wiki/File_Transfer_Protocol), [Git](https://en.m.wikipedia.org/wiki/Git_(software)), [Mercurial](https://en.m.wikipedia.org/wiki/Mercurial), [Team Foundation Server](https://en.m.wikipedia.org/wiki/Team_Foundation_Server) or uploaded through the user portal. This feature was announced in preview form in June 2012 at the Meet Microsoft Azure event.[[12]](https://en.m.wikipedia.org/wiki/Microsoft_Azure#cite_note-meetnew-12) Customers can create websites in PHP, ASP.NET, Node.js, or Python, or select from several open-source applications from a gallery to deploy. This comprises one aspect of the [platform as a service](https://en.m.wikipedia.org/wiki/Platform_as_a_service) (PaaS) offerings for the Microsoft Azure Platform. It was renamed Web Apps in April 2015.[[7]](https://en.m.wikipedia.org/wiki/Microsoft_Azure#cite_note-renaming-7)[[13]](https://en.m.wikipedia.org/wiki/Microsoft_Azure#cite_note-13)
* WebJobs are applications that can be deployed to an App Service environment to implement background processing that can be invoked on a schedule, on-demand, or run continuously. The Blob, Table and Queue services can be used to communicate between WebApps, [XYZ](https://en.m.wikipedia.org/wiki/XYZ_Affair), [iOS](https://en.m.wikipedia.org/wiki/IOS) Software and WebJobs and to provide state.[[5]](https://en.m.wikipedia.org/wiki/Microsoft_Azure#cite_note-:1-5)

Each of the scientific applications you mentioned involves complex computations and large datasets, making them suitable candidates for cloud computing due to the scalability and computational power it offers. Here's how each application can benefit from cloud-based solutions:

1. \*\*Healthcare: ECG Analysis in the Cloud\*\*:

- Cloud computing can provide scalable resources for processing and analyzing electrocardiogram (ECG) data from large populations.

- By leveraging cloud-based resources, healthcare providers can perform real-time analysis of ECG signals for early detection of cardiac abnormalities and monitoring of patients remotely.

- Cloud-based ECG analysis can also facilitate collaboration among healthcare professionals by enabling secure access to patient data from different locations.

2. \*\*Biology: Protein Structure Prediction\*\*:

- Protein structure prediction involves computationally intensive tasks such as molecular modeling and simulation.

- Cloud computing offers the computational resources required for protein folding simulations and structure prediction algorithms.

- Researchers can use cloud-based platforms to access specialized tools and databases for analyzing protein sequences and predicting their three-dimensional structures more efficiently.

- Cloud-based solutions enable collaborative research efforts by providing shared access to computational resources and data repositories.

3. \*\*Biology: Gene Expression Data Analysis for Cancer Diagnosis\*\*:

- Analyzing gene expression data for cancer diagnosis involves processing large datasets and running complex statistical algorithms.

- Cloud computing can accelerate the analysis of gene expression data by parallelizing computations across multiple virtual machines or containers.

- Cloud-based bioinformatics platforms offer pre-configured tools and pipelines for processing and analyzing gene expression data, reducing the time and expertise required for setting up computational infrastructure.

- Cloud-based solutions enable researchers to integrate diverse datasets and apply machine learning techniques for identifying biomarkers and developing diagnostic models for cancer.

4. \*\*Geoscience: Satellite Image Processing\*\*:

- Satellite image processing requires extensive computational resources for tasks such as image classification, feature extraction, and change detection.

- Cloud computing provides scalable infrastructure for processing large volumes of satellite imagery data in parallel.

- Cloud-based platforms offer specialized tools and libraries for geospatial analysis, allowing researchers to perform tasks such as land cover mapping, environmental monitoring, and disaster response.

- By leveraging cloud-based solutions, geoscientists can access up-to-date satellite imagery and perform near real-time analysis for various applications, including climate monitoring, urban planning, and natural resource management.

Certainly! Here's how cloud computing can benefit various business and consumer applications:

1. \*\*CRM (Customer Relationship Management) and ERP (Enterprise Resource Planning)\*\*:

- Cloud-based CRM and ERP solutions offer scalability, flexibility, and accessibility to businesses of all sizes.

- Companies can access customer data, manage sales pipelines, and streamline business processes from anywhere with an internet connection.

- Cloud-based CRM and ERP systems often provide subscription-based pricing models, reducing upfront costs and allowing businesses to scale resources according to their needs.

2. \*\*Productivity Applications\*\*:

- Cloud-based productivity suites, such as Google Workspace (formerly G Suite) and Microsoft Office 365, enable collaboration and document sharing among teams.

- Users can create, edit, and share documents, spreadsheets, and presentations in real-time, enhancing productivity and teamwork.

- Cloud-based productivity applications also provide seamless integration with other cloud services and third-party tools, enhancing workflow efficiency.

3. \*\*Social Networking\*\*:

- Social networking platforms leverage cloud computing to handle massive amounts of user-generated content, such as text, images, and videos.

- Cloud-based infrastructure enables scalability and responsiveness, ensuring a seamless user experience even during peak usage periods.

- Social networking companies can utilize cloud-based analytics tools to gain insights into user behavior, personalize content, and target advertisements more effectively.

4. \*\*Media Applications\*\*:

- Cloud computing powers streaming services like Netflix, Spotify, and YouTube, allowing users to access a vast library of content on-demand.

- Content delivery networks (CDNs) distribute media files efficiently across the globe, reducing latency and improving streaming quality.

- Cloud-based media applications leverage machine learning algorithms for content recommendation, personalized playlists, and user engagement optimization.

5. \*\*Multiplayer Online Gaming\*\*:

- Cloud gaming platforms like Google Stadia, NVIDIA GeForce Now, and Microsoft xCloud stream video games directly to users' devices from remote servers.

- Cloud gaming offloads the computational burden of rendering graphics and processing game logic to server farms, enabling high-quality gaming experiences on low-end devices.

- Cloud gaming services leverage global data centers to reduce latency and ensure smooth gameplay for multiplayer online games.