



# A Comprehensive Overview of Cloud Technologies:

Players, Markets, Apps, and All the Essentials

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## Objective

Nowadays many businesses keep their IT infrastructure in the cloud or are thinking about transitioning. Why? Because by doing so, they can make their development teams more agile, benefit from huge scalability, cut out the guesswork regarding infrastructure capacity requirements, and save money on managing infrastructure assets. These benefits are undoubtedly contributing to the robust cloud market growth: according to the [Rightscale 2019 State of the Cloud Report](#), 94% of enterprise respondents now use the cloud, with 84% of them even using a multi-cloud strategy.



## Main Problems to Be Solved/ Needs to Be Addressed

Cloud technologies have quickly become one of the most rapidly growing major investments for organizations of any size. And it's clear why this is the case; the benefits of operating in the cloud are numerous:

- **Rapid implementation:** Cloud environments can be implemented much faster than on-premise counterparts. Onsite implementation can take 3+ months, whereas cloud implementation of the same scope and complexity can be completed in a couple of weeks.
- **Abundant resources and testing environments:** Cloud technology has virtually infinite resources – and, what's more, it lets testing and development teams quickly provision storage and server resources with just a few clicks.
- **Heightened business agility:** For an organization to keep up with its competitors, having on-demand access, flexible IT resources are non-negotiable. With cloud solutions, nearly 100% of IT resources are available on demand. Organizations no longer need to wait for weeks for the installation of hardware components.

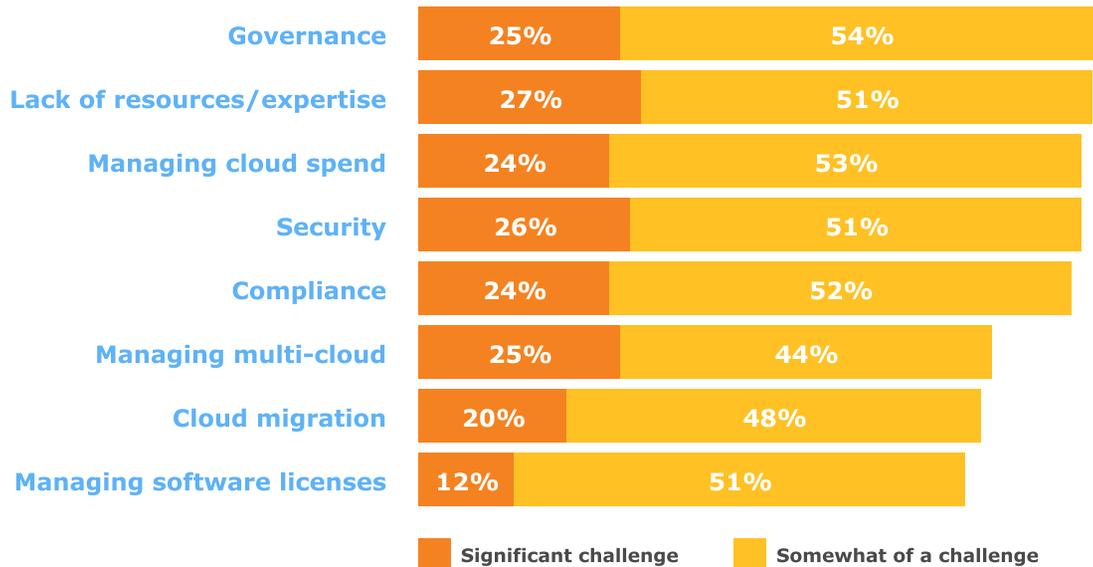
- **Minimization of resource costs:** IT leaders can easily determine the right size of computing resources that their business requires, thus cutting excess spending. Instead of having to estimate capacity needs ahead of time, organizations that operate in the cloud can adjust as they go.
- **Elimination of end-of-life timelines:** With on-premise solutions, IT departments have to deal with long-term contracts and rigid licensing agreements.
- **Consolidation of data centers:** Cloud computing is powerful – IT leaders can now outsource back-end duties to cloud providers and redistribute resources to higher-value activities. What’s more, organizations can increase enterprise efficiency by consolidating operations and distributing access to cloud services when necessary.
- **Digital transformation:** Thanks to innovative developments in cloud computing, organizations can now digitize many more core functionalities, including SAP, data analytics, and CRM.
- **Enhancement of security without add-ons:** When an organization uses cloud technologies, encrypting dynamic and static data becomes much easier. That’s because the cloud has native encryption, whereas many on-premise solutions require third-party add-on applications for encryption.
- **New technologies:** Organizations that migrate to the cloud can use certain technologies that weren't practical with on-premise solutions – like neural networks for machine learning and AI development.

Keep in mind, though, that even with all the benefits that come with cloud solutions, there are still several challenges – which occur in cloud computing itself and the migration process.

In January 2019, RightScale surveyed 786 IT professionals on their adoption of cloud infrastructure. One of the areas of the survey addressed cloud computing challenges. Some of the most common challenges identified in the [2019 State of the Cloud report](#) included governance, expertise, and expenditure, among others.

## CLOUD CHALLENGES

% of All Respondents



Source: RightScale 2019 State of the Cloud Report from Flexera

### Governance Challenges

When your computing is cloud-based, your IT department doesn't always have total control over the delivery, provisioning, and operation of infrastructure. Thus, it is much more difficult for IT to provide the necessary management of compliance, risks, and data quality.

### Lack of Expertise/ Resources

Not every organization has enough expert personnel and the tools necessary to properly implement cloud technology. Teaching employees about the tools and the process of cloud services can be a huge challenge – but this can be addressed by hiring workers who have cloud computing certifications.

### Managing Cloud Expenditure

Many enterprises are failing at managing cloud costs; this is largely due to billing complexity, poor budget forecasting, a lack of cloud activity visibility, poor application architecture design, and a misaligned approach towards methodologies.

### Security

A 2018 study from [Cybersecurity Insiders](#) found that 90% of security professionals have qualms about cloud security, 67%

were concerned about data leakage and loss, 61% felt that data privacy was not satisfactory, and 53% had fears about breaches of confidentiality. High-quality cloud management and security system are essential.

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### Compliance

Each time an organization transfers data from internal storage to a cloud solution, it must comply with laws and industry regulations. However, this can be addressed by hiring a data protection officer who helps companies meet legal data privacy obligations.

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### Managing Multi-Cloud

[RightScale's 2019 report](#) also found that 84% of enterprises use a multi-cloud strategy (a 3% YoY increase), and 58% are planning to use a hybrid cloud strategy (an 8% YoY increase). Some difficult areas of multi-cloud management include a shortage of staff with multi-cloud skills, spiraling costs, difficult app management across multiple environments, and siloed vendor tools.

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### Managing Software Licenses

Because cloud-based services are hosted on the vendor's servers, providers can easily check your consumption and configurations; without careful oversight of IT services via cloud license management, you risk unexpected cost increases.

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## Cloud Migration Challenges

As mentioned in the list of cloud computing challenges, there are difficulties inherent to the migration itself. These include:

- **Managing Costs:** While the cloud can deliver cost-savings, predicting the cost of the cloud service itself can be difficult.
- **Complexity:** Public clouds are relatively simple to manage, but the complexity grows when you begin to introduce hybrid elements.
- **Legacy applications:** Some applications are very challenging to move to the cloud; you'll need to determine what can be kept as-is, what should be rebuilt, and what could be repurchased to save efforts.

- **Data storage:** Transferring huge amounts of data to the cloud can be time-consuming. However, some cloud providers offer options whereby you can ship them hardware/solid state media which contains your data.
- **Stakeholder Support:** Leadership needs to be committed to cloud solutions for the long-term, so it is necessary to build credibility, enthusiasm, and motivation.
- **Building Cloud Fluency:** You can't rely only on your central cloud team. Thus, you must build cloud fluency across your entire organization, so your cloud experts don't become overburdened.

## Overview

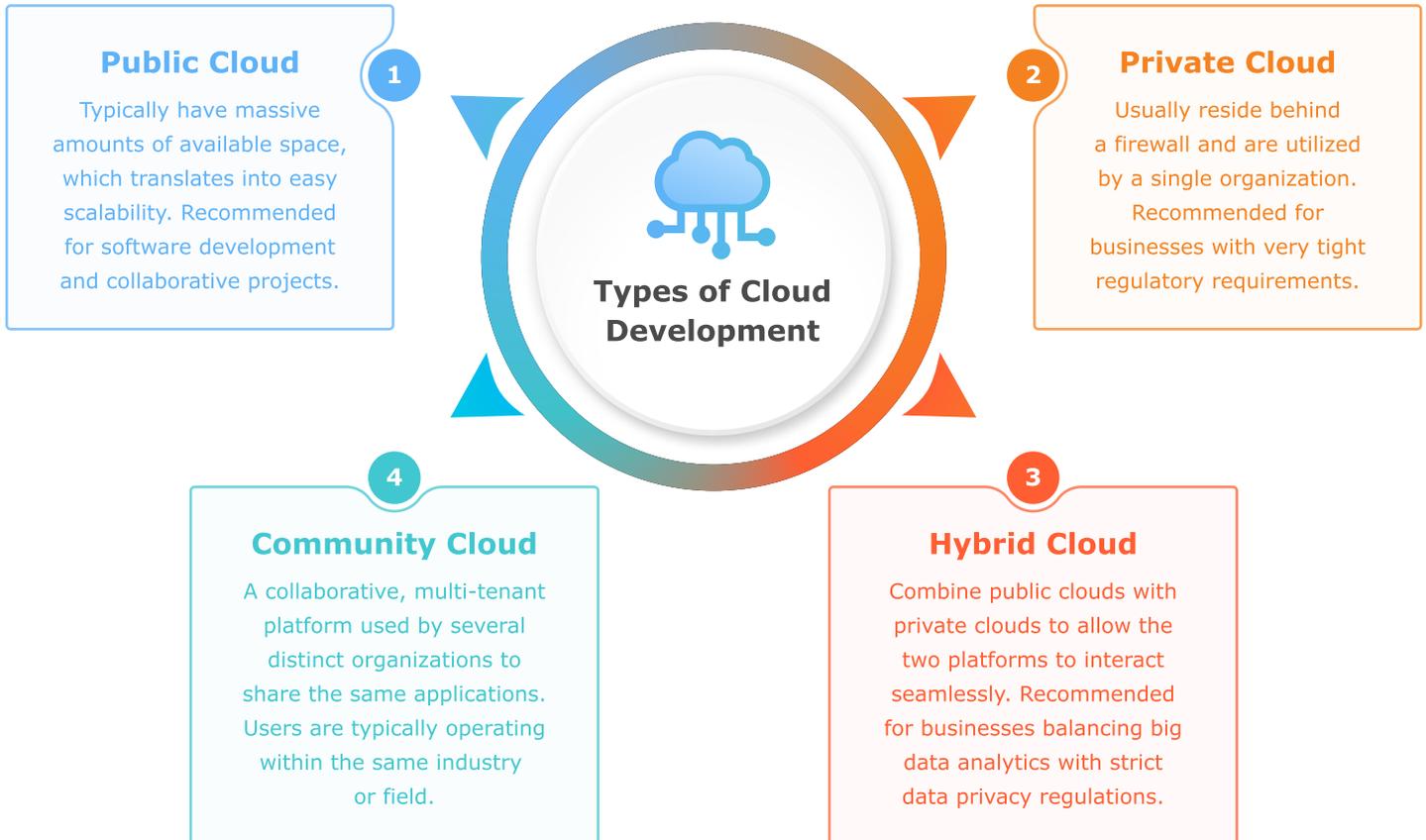
We have compiled some of the core information on cloud computing, as well as a list of key players. While the terminology is enough to assist in the comprehension of this whitepaper, it is by no means comprehensive. For a deeper understanding of cloud computing's key terminology, check the "Further Reading" section.



### What Is Cloud Computing?

As mentioned in the list of cloud computing challenges, there are difficulties inherent to the migration itself. These include:

## There are 4 types of cloud deployment: Public, Private, Hybrid, and Community



### 1 Public

Some examples of public cloud providers include Google, Microsoft, and Amazon. These companies provide infrastructure and services that all customers share. Such clouds usually have a huge amount of available space, which makes scalability easy. Public clouds are highly suitable for collaborative projects and software development. Companies can test a project in the public cloud and, afterward, move it to the private cloud for production processes.

The greatest advantage of using a public cloud is its “pay as you go” structure – this enables customers to use more capacity as required. It makes your system scalable without requiring huge capital expenditure. What’s more, by using hosted cloud services, you are covered by your provider’s disaster recovery and security plan – and you are compliant with industry security standards.

However, the main disadvantage of the public cloud is that the cloud provider retains full control over the essential infrastructure. This may cause difficulties when changing providers or if the cloud provider goes out of business.

## 2 Private

Typically, private clouds are used by a single organization and reside behind a single firewall – it is a great choice for businesses that have very strict regulatory requirements. Some organizations use totally on-premise cloud solutions, while others use private clouds that are implemented through a colocation provider.

A private cloud enables authorized users to access, store, and use data. It makes it simple to restrict access to valuable assets. What's more, because an outside vendor doesn't control the private cloud, you don't have to worry about sudden changes disrupting the entire infrastructure. Yet, you also get the benefits of technical support and disaster recovery that public cloud users get.

Private cloud usage, though, is more expensive than the public cloud – this is because private clouds are not as versatile or as easily scalable; they can only be expanded by purchasing more storage capacity and hardware.

## 3 Hybrid

Hybrid clouds are designed to allow public and private cloud platforms to interact seamlessly. One commonly used type of hybrid cloud architecture is cloud bursting – this model primarily stores data and houses propriety applications in the private cloud. However, when service demands are heightened, the public cloud's computing resources are used supplementarily. This way, organizations can handle increased traffic without the need to buy more servers.

The second model outsources non-critical applications to a public cloud; this model is often used by companies that need to access CRM platforms, basic productivity software, or specialized development tools.

A hybrid cloud's main draw is that it provides a public cloud's scalable computing power alongside the private cloud's controlled security measures. It is cost-effective in the long run, but it does have a higher initial expenditure.

## 4 Community

This is the least commonly used type of cloud platform; such clouds are multi-tenant, collaborative platforms on which multiple distinct organizations share applications. Usually, the organizations are part of the same industry and have shared security, compliance, and performance concerns.

Essentially, a community is a private cloud that has public cloud functions. It is commonly used by healthcare organizations, government agencies, and financial firms.

A community cloud allows for heightened flexibility and full compliance with industry regulations; however, because bandwidth and storage are shared, it can cause problems with performance and prioritization.

## Types of Cloud Computing Services

According to the [National Institute of Standards and Technology](#) (NIST), in order for a service to be considered “cloud,” it must have these characteristics:

- Self-service on demand: End-users can sign up for and obtain services without a lengthy delay.
- Resource pooling: Resources can be distributed across many customers.
- Broad network access: Users can use standard platforms (e.g., laptop, desktop, mobile device) to access the services.
- Measured service: Usage is metered, and billing is delivered as a utility.
- Rapid elasticity: The capability of the services can scale to cope with heightened demand.

We'll look at four kinds of cloud computing services:





## Software as a Service (SaaS)

SaaS is software that provides all its functionality over the Internet. SaaS providers license an app to customers as a service on demand – either via subscription or with a pay-as-you-go model. Furthermore, SaaS can be free of charge if there is another way to generate revenue (such as through advertisement). The SaaS provider takes care of the operating systems, middleware, infrastructure, and data that are necessary to deliver the program – they make sure that the software is accessible wherever and whenever you need it. In many cases, there is no need for hardware or software installation, as SaaS applications can be run directly through a web browser. Thus, internal IT teams can reduce software management issues.

When a company uses SaaS applications, the start-up process is expedited, and operations can be rapidly scaled. Even complex enterprise-level apps, like ERP and CRM programs, can be easily used by smaller organizations.

Some of SaaS' defining characteristics include:

- Internet-based access to commercial software
- Software that is managed from a central location
- Software that follows a one-to-many delivery model
- Users do not have to handle patches or software upgrades
- APIs allow the integration of different pieces of software

So which applications should be moved to SaaS? One prime candidate is a largely undifferentiated solution – such as email. Competitors will often use the exact same email software – the SaaS doesn't give them a competitive advantage, but it is fundamental technology necessary for doing business. Other uses include mobile sales management software, collaboration software, and solutions that have demand spikes, such as tax software. SaaS might not be appropriate for applications that need to process real-time data quickly.

Examples of SaaS include:





## Platform as a Service (PaaS)

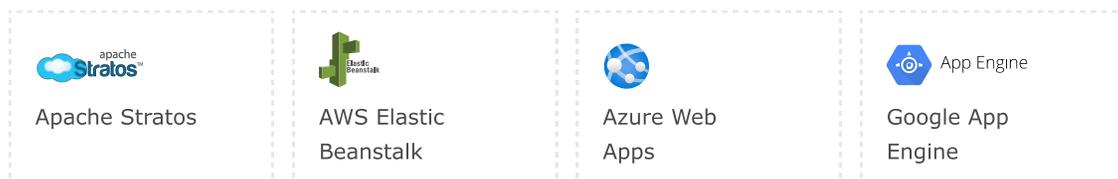
PaaS is a computing platform that enables you to create web applications quickly and easily without needing to buy and maintain the underlying infrastructure and software. PaaS provides the framework necessary for building, testing, deploying, updating, and managing software products. It includes the development tools, database management systems, operating systems, and middleware necessary for creating these software applications. This means that customers can access the tools they need for developing their app without having to make outright purchases. Since numerous PaaS tools have pre-coded applications built into the platform, companies can get their products on the market faster.

Some of its characteristics include:

- Built-in scalability, including failover and load balancing
- Integration with databases and web services through common standards
- Tools that handle subscription/billing management
- Multi-tenant architecture
- Services to develop, test, host, deploy, and support apps all from one environment
- Web-based UI creation tools

PaaS is useful for a project that has multiple developers and interaction from external parties. It is also very handy for organizations that have a data source and want to leverage the data with an application. Agile software development's popularity has sped up the adoption of PaaS, as this service enables the rapid development of software. PaaS is not ideal in situations where an app needs to be highly portable (in terms of hosting) or in which proprietary technologies hinder the development process.

Examples of PaaS include:





## Infrastructure as a Service (IaaS)

IaaS offers cloud computing infrastructure as an on-demand service; it includes storage, servers, operating systems, and networks. IaaS can be obtained as a private, public, or combination infrastructure. It is considered to be the foundation of the cloud computing pyramid, and it is the most flexible and comprehensive cloud service. The IaaS provider manages the physical infrastructure, including data storage space and servers, in a data center, but customers can customize the virtualized resources as they see fit. A customer can buy, install, customize, and manage any software they need, including operating systems, applications, middleware, development tools, and business analytics.

Some of IaaS' characteristics include:

- Dynamic scaling is allowed
- Resources are distributed as a service
- Utility pricing model
- Multiple users are allowed on one piece of hardware

IaaS is suitable for organizations that don't have the resources to invest in buying their own hardware. Furthermore, it is an ideal solution when a company is growing rapidly, thus causing problems with scaling. However, IaaS could be problematic if compliance regulations make offshore or outsourced data processing and storage challenging.

Examples of IaaS include:





## Function as a Service (FaaS)

FaaS, also known as serverless computing, enables customers to execute code without needing to allocate processing resources beforehand. The cloud provider manages the infrastructure, so the client can exclusively focus on deploying the application code. Since the functions scale automatically, this type of service is a great fit for dynamic workloads that have fluctuating resource consumption. The majority of FaaS applications are simple and can be deployed quickly. All the customer has to do is upload the compiled function code and instruct the platform on how to provision resources upon execution. When the function is at rest, it does not consume resources.

FaaS's main disadvantage is its execution time; since functions must provision resources upon each run, there is the possibility of slight performance lags during peak usage times.

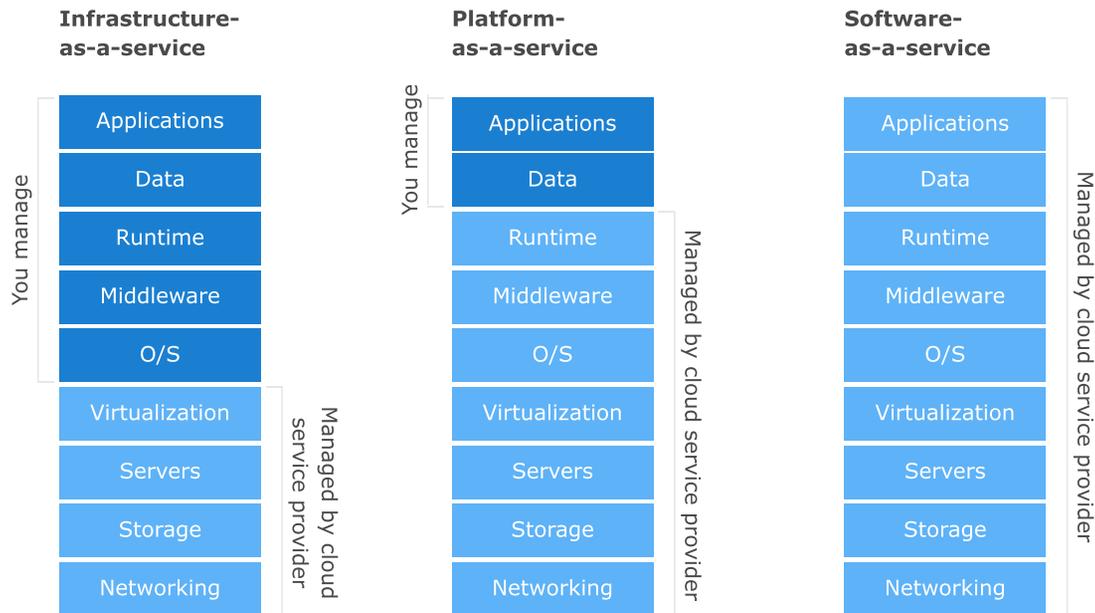
Examples of FaaS include:



So, out of the various cloud service models, which do we recommend using? It truly depends on the goal of your organization.

With SaaS, your organization can cut down on its CAPEX expenditure – and your IT department no longer has to take care of updates and patches manually. With PaaS, you can get access to tools that would typically be expensive to buy and use, and services are easily scalable. And with IaaS, you'll get amazing security, availability, and reliability for specific projects and dynamic workloads. What's more, even small businesses can enjoy enterprise-level technology. And nothing can beat FaaS' true pay-as-you-go pricing. All four models will bring significant advantages to your organization, but it is hard to beat IaaS in terms of cost savings, scalability, and task virtualization.

## The Cloud Computing Stack



Source: CloudOnMove



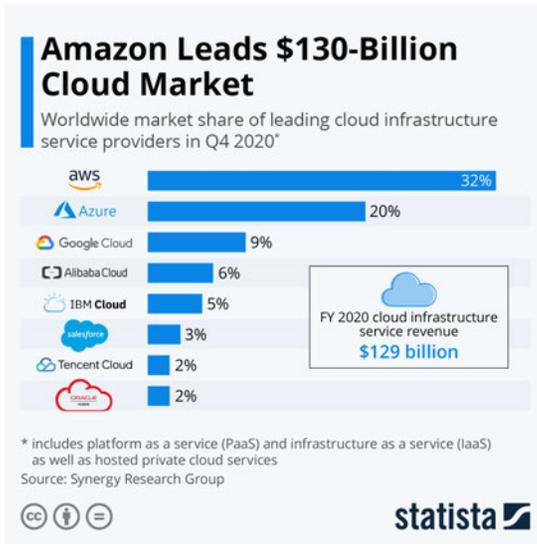
## Main Players

There are numerous cloud service providers, including:



However, we have chosen to focus on the top 3 services, AWS, Microsoft Azure, and Google Cloud.

aws **Amazon Web Services**



Amazon’s capabilities are unmatched: its ever-growing toolset currently boasts over [5,000 services](#). However, its cost structure is not completely clear – and, what’s more, because it solely focuses on public cloud (rather than hybrid or private cloud), interoperating with your [data center](#) isn’t a key priority of AWS.

Speaking of AWS – many organizations assume that this provider is a huge data aggregator that has access to corporate information. Thus, they wonder whether there is data on how many files are stored and whether this is sorted by region.

In actuality, storing data is just a tiny part of what AWS does. As mentioned above, there are approximately 5,000 features in AWS – 200 of which are fully-fledged services that can be used to build any system and absolutely solve any problem. AWS has over 1 million customers across all industries using their solutions.

**Total New Services and Features**



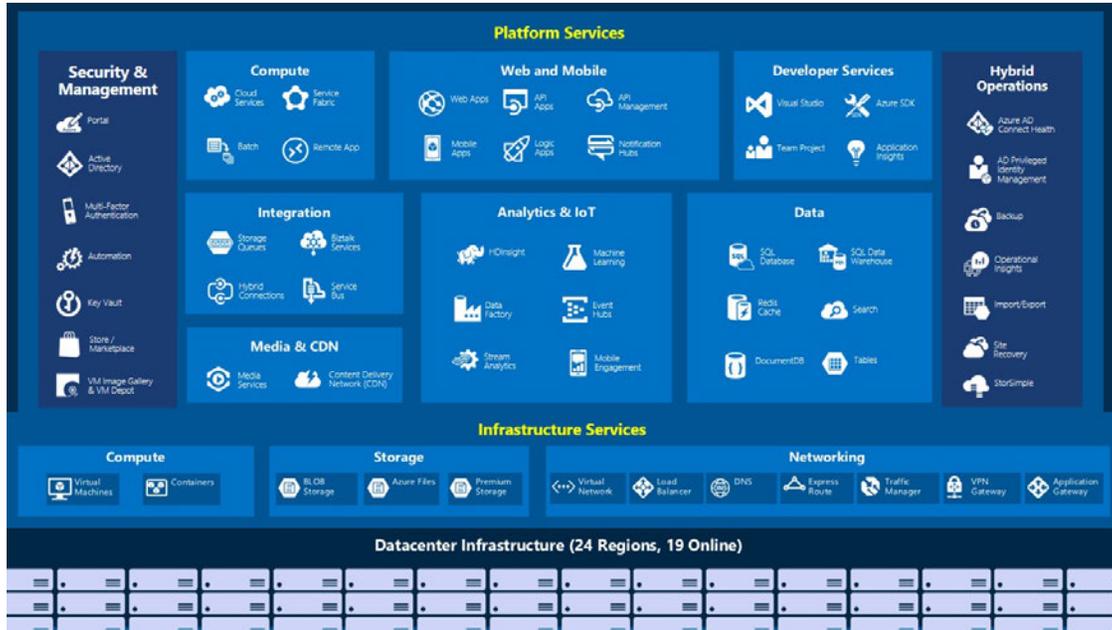
There are many different layers and levels in AWS, but only people who enter data into the cloud have access to corporate data. If you are interested in learning more, there are several AWS zero-level courses available [here](#).

More and more people are getting involved in AWS, and we would recommend taking these courses to get acquainted with their services.



**Microsoft Azure**

Microsoft Azure is AWS's closest competitor and has an exceptionally capable cloud infrastructure. Azure is one of the best options for enterprise customers, as interoperability is one of the service's main priorities. Its hybrid cloud is one of its biggest strengths over AWS.



**Google Cloud**

While Google Cloud may be an underdog in the list of cloud service providers, it is certainly well funded. The main reason for its lag is that it entered the cloud market relatively late. Furthermore, its lack of enterprise focus means that it doesn't draw in as many corporate customers. However, Google Cloud has profound technical expertise, and its main advantages include cutting-edge data analytics, machine learning, and AI tools.



## Comparing Top Providers: What's Best for You?



**AWS:** Because of AWS's massive scale and comprehensive tool collection, this provider is a good choice. However, if you desire a more personalized service, Amazon is simply too large of a company to provide a close relationship with its customers.



**Azure:** The greatest appeal of this choice is the connection to Microsoft shops. Your existing .net code will work with Azure, and your server environment will connect, making it easy to migrate on-premise apps to the cloud. What's more, because Azure has a strong focus on hybrid cloud services, you can bridge the legacy data center environment with Microsoft's feature-rich, rapidly scalable cloud.



**Google:** While Google is growing quickly, it is still a work in progress. This industry giant doesn't have a legacy background when it comes to businesses. However, it has invested billions of dollars into cloud development – and, what's more, it is partnered with Cisco, which is fully familiar with enterprise. If you were unimpressed with Google a year ago, you should take another look now. Google's cloud plays to its strengths, which are machine learning and scale.

When deciding which provider to go with, consider the following criteria:

|                      |   |
|----------------------|---|
| <b>Availability</b>  | Is one virtual machine available?   |
| <b>Cost</b>          | What is the monthly cost for the VM configuration you require?              |
| <b>Location</b>      | How many data centers are there, and which services do they have available? |
| <b>Functionality</b> | Which additional services, like load-balancer and databases, are available? |
| <b>Sizing</b>        | Which types of instances are available?                                     |

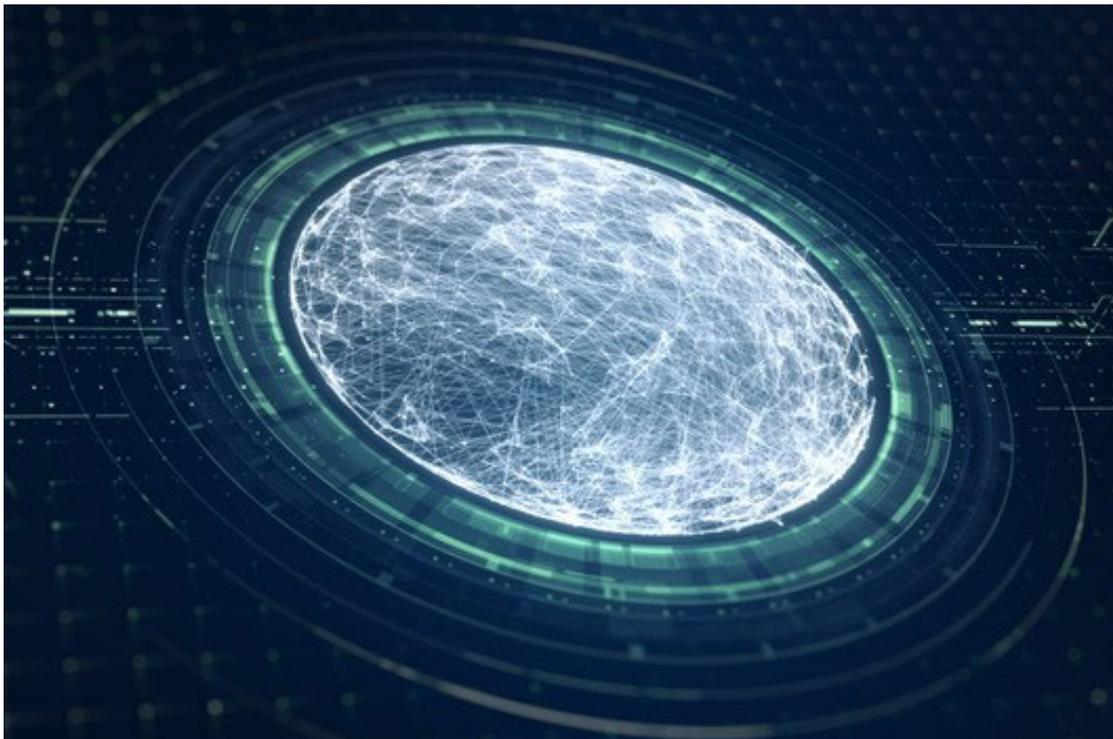


Decide which criteria you need to prioritize. As far as availability is concerned, all three providers are equal.

## Alternatives

You are not limited to “The Big 3.” A few alternatives include:

- **DigitalOcean**  
This was designed for developers and is the only cloud service that runs 100% on solid-state drives. It offers a collaborative workspace with easy-to-set-up permissions. There are hourly and monthly pricing plans available.
- **OpenShift**  
This is Red Hat’s PaaS, which enables developers to quickly develop, host, and scale applications in the cloud.
- **Heroku**  
This PaaS is often compared to EC2. There is no need for developers to set up and maintain instances with Heroku.



## Total Market Volume

In Q3 2020, worldwide cloud infrastructure services were collectively worth \$36.5 billion – which was \$1.9 bn more than the previous quarter and \$9 bn more than Q3 2019. Overall, the market has had a 33% YoY increase. According to a [study by Canalys](#), the top three cloud infrastructure services in Q3 2020 were:



## Forecasted Growth

According to [Gartner Inc](#), global spending on public cloud services should increase by 18.4% during 2021 – from \$257.5 bn to \$304.9 bn. This doesn't just include infrastructure services; it also covers cloud management and security services, cloud application services, Desktop-as-a-Service, and more.

|  | 2019           | 2020           | 2021           | 2022           |
|--|----------------|----------------|----------------|----------------|
| Cloud Business Process Services (BPaaS)          | 45,212         | 44,741         | 47,521         | 50,336         |
| Cloud Application Infrastructure Services (PaaS) | 37,512         | 43,823         | 55,486         | 68,964         |
| Cloud Application Services (SaaS)                | 102,064        | 101,480        | 117,773        | 138,261        |
| Cloud Management and Security Services           | 12,836         | 14,880         | 17,001         | 19,934         |
| Cloud System Infrastructure Services (IaaS)      | 44,457         | 51,421         | 65,264         | 82,225         |
| Desktop as a Service (DaaS)                      | 616            | 1,204          | 1,945          | 2,542          |
| <b>Total Market</b>                              | <b>242,696</b> | <b>257,549</b> | <b>304,990</b> | <b>362,263</b> |

## Cloud Computing Market Landscape

An overwhelming majority of companies are operating some processes in the cloud, with the goal of reducing IT expenditure and increasing the speed of their service delivery. However, cloud computing has so much more potential and can enable enterprise digital transformation. How can companies get more value from the cloud? First, we'll highlight some key statistics on cloud usage:

- By 2022, other countries will be far behind the US in the adoption of cloud technologies. (Gartner)
- 50% of people surveyed said that cloud usage increased due to COVID-19. (Flexera)
- The average employee uses 36 cloud applications or services in their daily workday. (Skyhigh)
- 80% of companies see operation improvements within a few months of adopting cloud technology. (Multisoft)
- 40% of small and medium-sized businesses find third-party cloud services to be 40% more cost-effective than an in-house system. (Multisoft)

### Vector 1: Adopting AI

More than ever, enterprises are quickly increasing their investments in AI; according to the [IDC's Worldwide Artificial Spending Guide](#), AI expenditure will increase at an annual rate of 38% and could exceed \$79 billion in 2022. AI impacts every facet of business, including the adoption of cloud services.

Cloud vendors are adding fuel to the fire by offering an ever-growing number of services and tools for developing, testing, enhancing, and operating AI systems. With such services, IT companies don't need to fund large, upfront investments.

Examples of these services and tools include AI development workflow platforms, hardware optimized for machine learning, and machine learning modeling tools. This makes it easier for enterprises to adopt cloud-based AI services. [Walgreens](#) is a great example of that; they are using Azure's cloud AI platform to create innovative health care delivery models. Another example is how the [American Cancer Society](#) analyzes breast tissue images with Google's machine learning cloud services.

The relationship between AI and the cloud accelerates the adoption of both services. According to market research from [Tractica](#) (one of Omdia's research brands), AI could make up 50% of cloud service revenue by 2025.

## **Vector 2: Using Industry Clouds**

Some companies do not want to go through the hassle of migrating core legacy applications over to the cloud. Other companies may wish to upgrade their systems to be compatible with modern operating systems – without the need to build it all from scratch. Industry clouds can address both concerns.

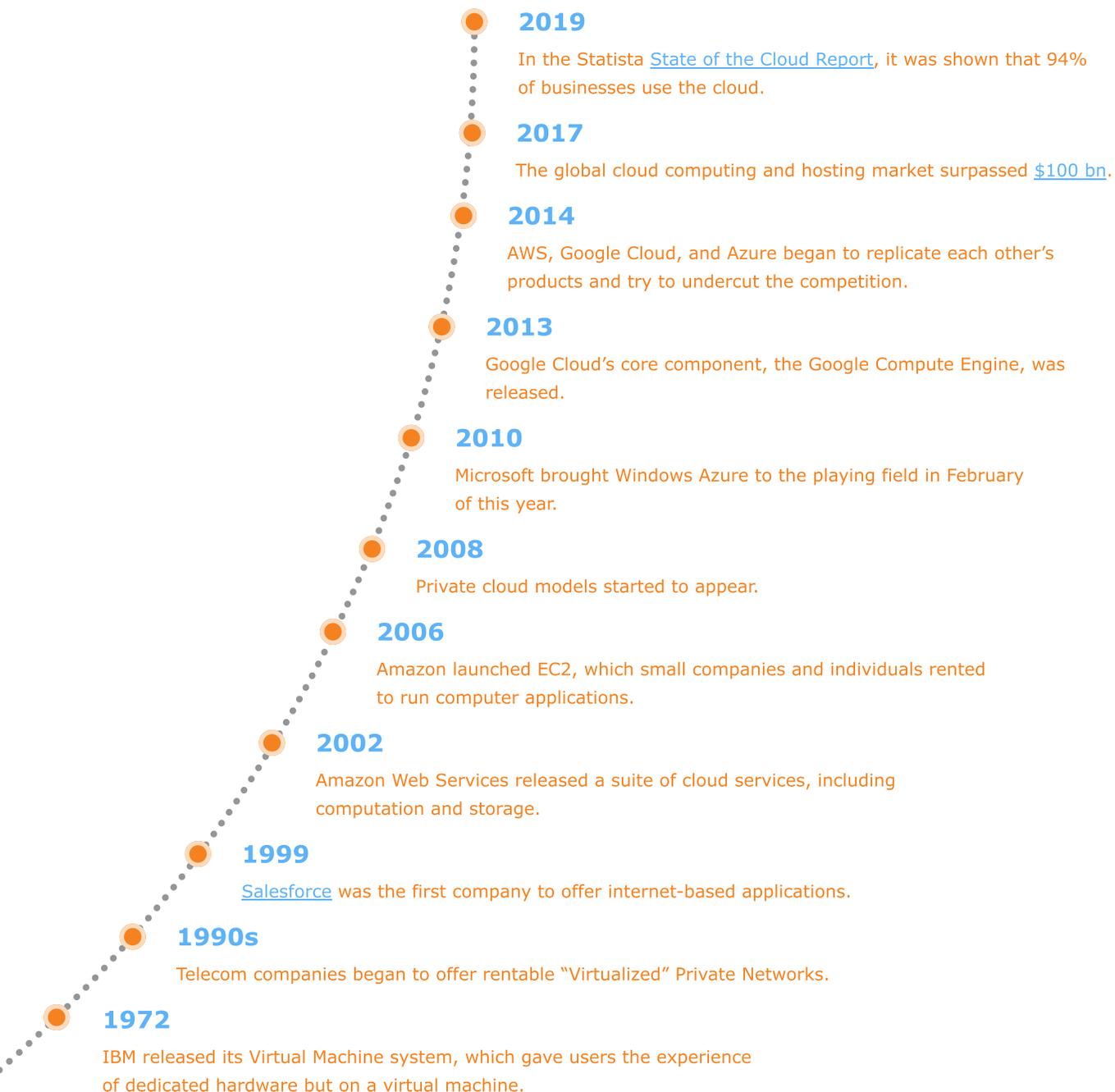
An industry cloud is a cloud-based application that's tailor-made for a certain industry; they are becoming increasingly popular. Industry clouds are able to handle workflows, standards compliance, and data sources that are industry-specific. This kind of cloud provides a ready-to-use environment, full of services and tools that are customized for a specific industry. This helps lower the barriers to cloud adoption for companies with limited resources. What's more, by combining data from multiple clients, a cloud vendor could provide industry insights and benchmarks.

[The IDC found](#) that companies are already requesting industry-specific expertise and solutions from their cloud vendors. To address this, key cloud suppliers such as Google, Microsoft, AWS, and Salesforce, are expanding their industry-specific services.

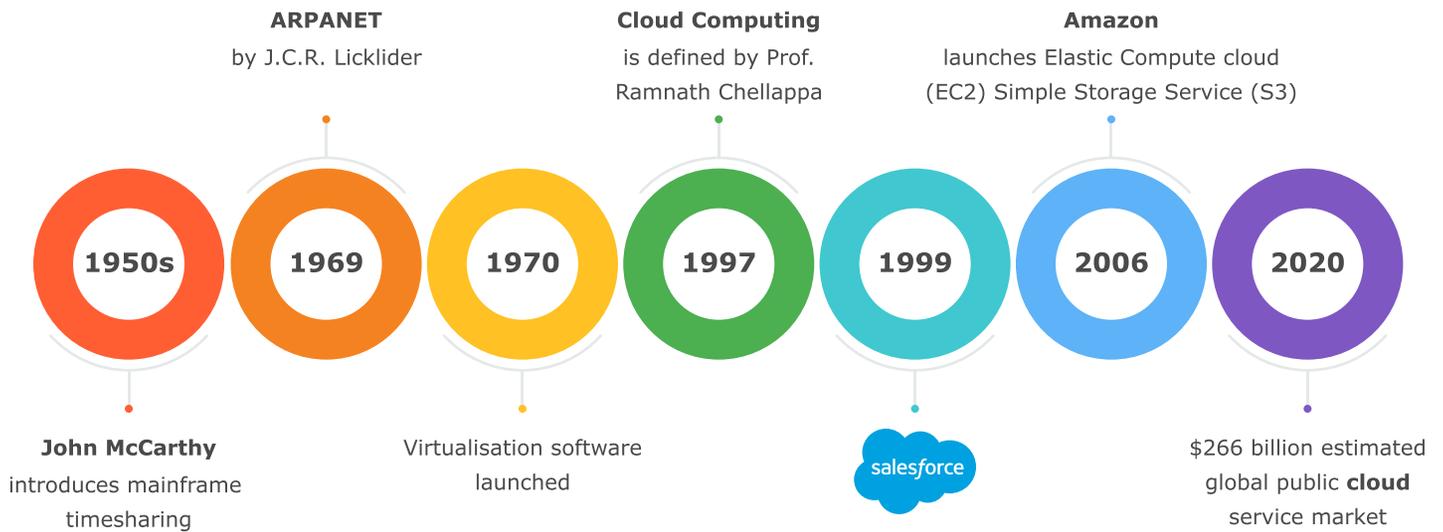
The industry cloud market also has niche players, such as Accela (for government), Viewpoint (for construction), and Veeva (for life sciences).

## A Brief History of Development

The phrase “cloud computing” was [first coined in 1996](#), inside a Compaq document in which tech executives were discussing the future of the internet. They predicted that all business software would eventually move to the web and that cloud computing applications would be commonplace. And they were very correct. This timeline of cloud computing shows how quickly the industry has developed and become a standard.



## CLoud COMPUTING HISTORY

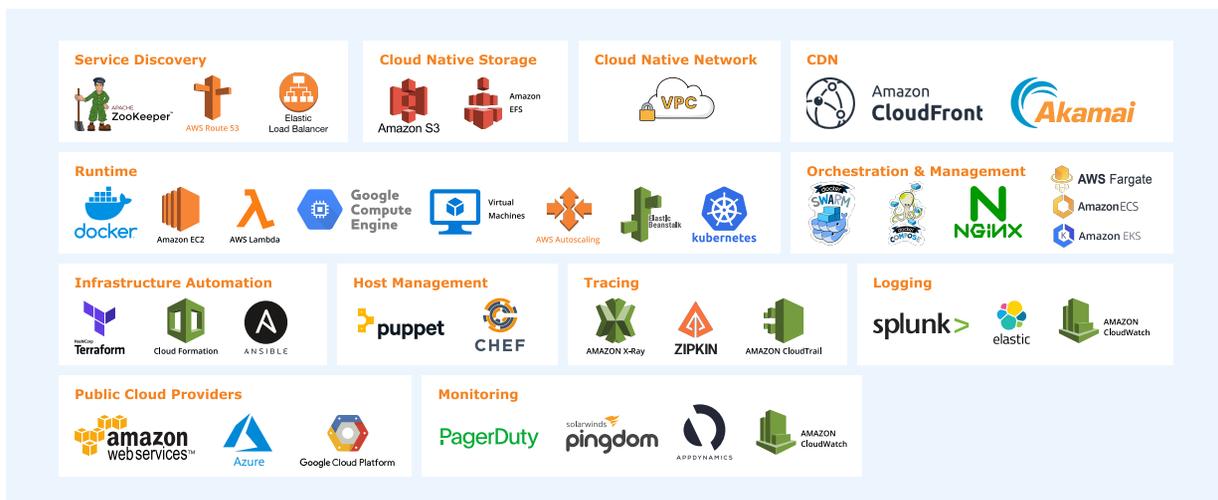


Source: [net solutions](#)

## Main Tech Components

A successful software project starts with a great stack. But what is a stack? This term refers to a set of programming languages, tools, and technologies that work together to build solutions and digital products. Below, we've included some of the most common cloud tech stacks.

### Infrastructure Tech Stack



- **Public cloud providers**

The public cloud is defined as 'computing services offered by third-party providers over the public Internet, making them available to anyone who wants to use or purchase them'.

- **Monitoring**

Cloud monitoring is the process of reviewing, monitoring, and managing the operational workflow and processes within a cloud-based IT asset or infrastructure. It is the use of manual or automated IT monitoring and management techniques to ensure that a cloud infrastructure or platform performs optimally.

- **Logging**

This is a service that captures, indexes, and correlates real-time data in a searchable repository from which it can generate graphs, reports, alerts, dashboards, and visualizations.

- **Provisioning**

Provisioning is the process of setting up IT infrastructure. It can also refer to the steps required to manage the access to data and resources and make them available to users and systems. When the term "provisioning" is used, it can mean many different types of provisioning, such as server provisioning, network provisioning, user provisioning, service provisioning, and more.

**Infrastructure Automation**

Infrastructure as code (IaC) is the process of managing and provisioning computer data centers through machine-readable definition files, rather than physical hardware configuration or interactive configuration tools. Using this approach, you can describe all your cloud resources as a code and resources will be created based on this description.

**Host management**

This includes configuration management and application-deployment tools.

- **Tracing**

Tracing tools help developers analyze and debug production and distributed applications, such as those built using microservices architecture. With Tracing tools, you can understand how your application and its underlying services are performing to identify and troubleshoot the root cause of performance issues and errors.

- **Runtime**

These are services and tools that you can use to run your applications.

- Orchestration & Management**  
 Orchestration is the automated configuration, coordination, and management of computer systems and software.
- Service Discovery**  
 Service discovery is the automatic detection of devices and services offered by these devices on a computer network.
- Cloud Native Storage**  
 Cloud storage is a way for businesses and consumers to save data securely online so that it can be accessed anytime from any location and easily shared with those who are granted permission. Cloud storage also offers a way to back up data to facilitate recovery off-site.
- Cloud Native Network**  
 A virtual private cloud (VPC) is an on-demand configurable pool of shared resources allocated within a public cloud environment, providing a certain level of isolation between the different organizations (denoted as users hereafter) using the resources.
- CDN**  
 A CDN (Content Delivery Network) is a highly-distributed platform of servers that helps minimize delays in loading web page content by reducing the physical distance between the server and the user. This helps users around the world view the same high-quality content without experiencing slower loading times.

## App Definition & Development Tech Stack

The image displays a comprehensive tech stack organized into nine categories:

- Analytics:** AMAZON Athena, AMAZON Redshift, AMAZON EMR, AMAZON ES, AMAZON Kinesis, AMAZON Glue, AMAZON QuickSight
- App Integration:** AMAZON Step Functions, AMAZON SNS, AMAZON SQS, ATTUNITY
- ML:** AMAZON CodeGuru
- Source Code Management:** GitHub, Bitbucket, AWS CodeCommit
- Registry Services:** sonatype, Amazon ECR
- CI/CD:** AWS CodeBuild, AWS CodeDeploy, AWS CodePipeline, Jenkins, Google Cloud Build
- Customer Engagement:** AMAZON SES, twilio, ORACLE responsys
- Data:** PostgreSQL, MySQL, Microsoft SQL Server, mongoDB, redis, Solr, AMAZON DynamoDB, AMAZON RDS, elastic, AMAZON ElastiCache, AMAZON Neptune, Google BigQuery
- Languages & Frameworks:** Java, .NET, python, JS, GOLANG, php, JS, spring, ANGULAR, Flask, WORDPRESS, React

- **Languages & Frameworks**

Different languages and frameworks can be used to develop applications.

- **Data**

There are various technologies available to store data, including Relational, NoSql, Graph and in-memory, key-value databases, full-text search engines, and data warehouses.

- **Code**

**Source code management**

Source code management (SCM) is used to track modifications to a source code repository. SCM tracks a running history of changes to a code base and helps resolve conflicts when merging updates from multiple contributors. SCM is also synonymous with Version control.

**Registry Services**

These manage binaries and build artifacts across your software supply chain.

**CI / CD**

In software engineering, CI/CD generally refers to the combined practices of continuous integration and either continuous delivery or continuous deployment. CI/CD bridges the gaps between development and operation activities and teams by enforcing automation in building, testing, and deployment of applications.

**ML**

This is a code analysis developer tool that provides intelligent recommendations to improve your code quality and identify an application's most expensive lines of code. Such tools can automate code reviews during application development, continuously monitor application performance in production, provide recommendations and visual clues for improving code quality and application performance, and reduce overall cost.

- **Analytics**

Analytic technologies help get more relevant insights from data more quickly in order to stay ahead of the competition. Using data effectively requires a data architecture, where raw data can effectively be collected, categorized, and transformed into valuable insights.

- **Application integration**

Integrate distributed systems and serverless applications with less code. Application integration is a suite of services that enable communication between decoupled components within microservices, distributed systems, and serverless applications. You don't need to refactor your entire architecture to benefit – decoupling applications at any scale can reduce the impact of changes, making it easier to update and faster to release new features.

- **Customer Engagement**

Such technologies engage customers in a personal, dynamic, and natural way across contact centers and through mobile and email messaging.

## Management and Governance Tech Stack



- **Security**

Technologies to securely run your business with the most flexible and secure cloud computing environment available today. You will benefit from a network architected to protect your information, identities, applications, and devices. You can improve your ability to meet core security and compliance requirements, such as data locality, protection, and confidentiality, with comprehensive cloud services and features.

Such services allow you to automate manual security tasks so you can shift your focus to scaling and innovating your business. Plus, you pay only for the services that you use.

- **Billing**

Services that you use to pay your bill, monitor your usage, and analyze and control your costs.

AWS Billing and Cost Management provides useful tools to help you gather information related to your cost and usage, analyze your cost drivers and usage trends, and take action to budget your spending.

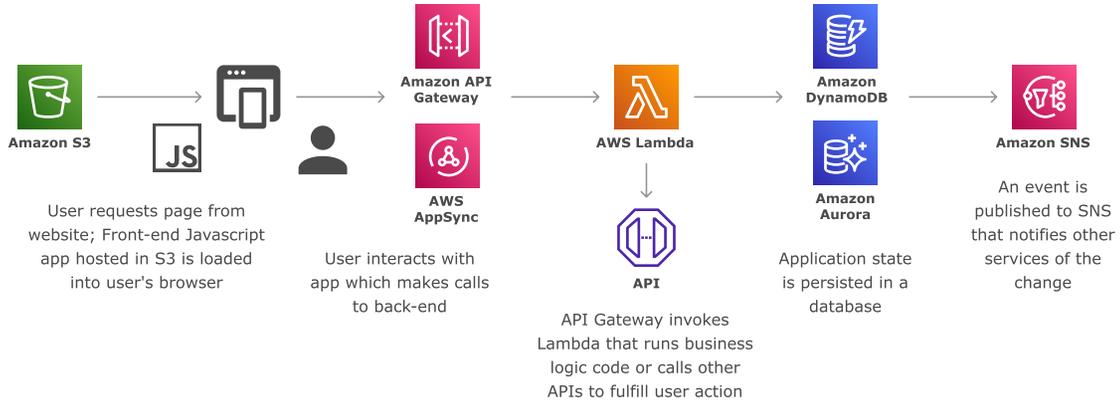
- **Management and Governance**

In the past, organizations have had to choose between innovating faster and maintaining control over cost, compliance, and security. With Management and Governance services, customers don't have to choose between innovation and control – they can have both. Customers can enable, provision, and operate their environment for both business agility and governance control.

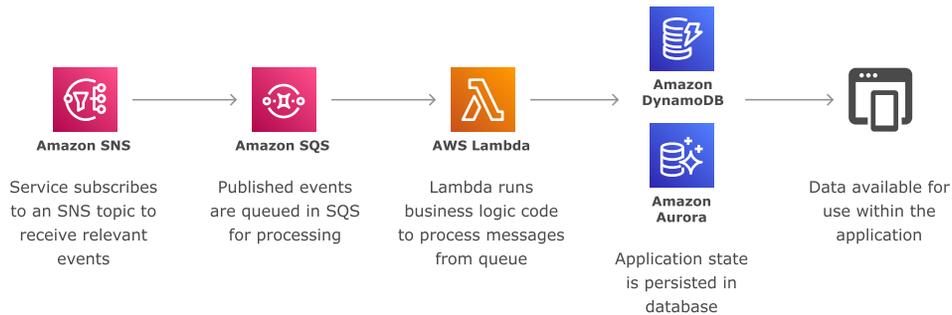
Customers can use Management and Governance services to assess their resource utilization and identify ways to reduce costs.

## Examples of Reference Architectures in AWS

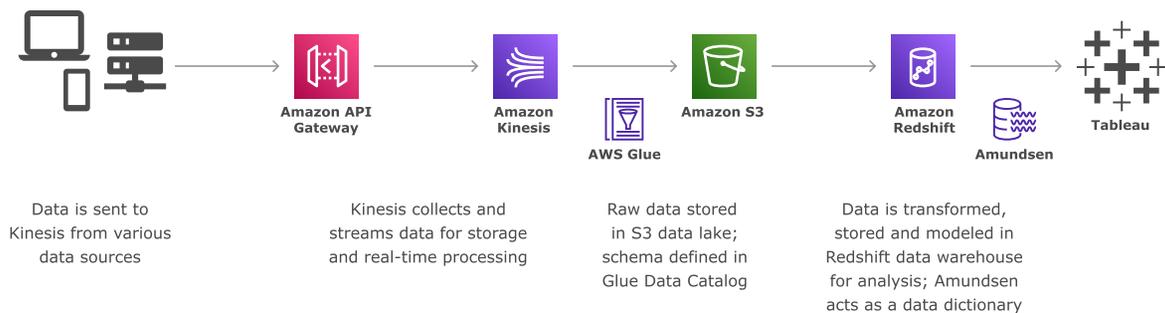
### Web Application Serverless Architecture



### Messaging Serverless Architecture



### Business Intelligence Serverless Architecture



Visit [here](#) for more information.

## Main Applications and Impact Delivered

Almost any imaginable industry and technology can be run through public cloud providers. In the table below, you can see some of the technological categories that cloud computing can be applied to, including analytics, machine learning and AI, networking, security, and more.

These technologies are used in a wide range of industries, including but not limited to aerospace, defense, hospitality, retail, and transportation. Check the table for a more comprehensive list of applicable technologies and industries.

|                            |  |   |
|----------------------------|--|---|
| <b>Technology Category</b> | Analytics<br>Application integration<br>Compute<br>Database<br>Developer tools<br>IoT                          | Machine learning & AI<br>Front-end web & mobile<br>Networking & content delivery<br>Security, identity, compliance<br>Storage                       |
| <b>Industry</b>            | Aerospace<br>Agriculture<br>Automotive<br>Defense<br>Financial services<br>Gaming<br>Healthcare<br>Hospitality | Life sciences<br>Manufacturing<br>Manufacturing (semiconductors)<br>Power & utilities<br>Retail & wholesale<br>Transportation & logistics<br>Travel |

Some specific examples of applications include:

- **Scalable Usage**

Cloud computing offers clients scalable resources, meaning that you only pay for the computing resources you actually use. **Netflix** uses scalability to its advantage. It faces server load surges during peak streaming time, but since it migrated to the cloud, it can expand its customer base without needing to set up and maintain expensive infrastructure.

- **Virtual Assistants**

The cloud's expanded capacity and computing power allow devices to store user preferences, which can then be used to provide personalized messages, products, and solutions. [Alexa](#), [Siri](#), and [Google Assistant](#) are all cloud-based chatbots that use this capability to provide customized, context-relevant experiences for customers.

- **Communication**

With the cloud, users can get network-based access to calendars, emails, and other network-based communication tools. Most messaging and calling apps (e.g., [WhatsApp](#) and [Skype](#)) also use cloud infrastructure. This means that your messages aren't stored on your personal device – rather, they are kept on the service provider's hardware. Thus, you can access your information from any device with an internet connection.

- **Productivity**

[Google Docs](#), [Microsoft Office 365](#), and other office tools use cloud computing; users can access highly productive tools over the internet. Documents, spreadsheets, and presentations can be edited from any place and at any time. What's more, because data are stored in the cloud, such office tools enable the sharing and collaboration of documents in real-time.

- **Business Process**

Enterprise resource planning (ERP), customer relationship management (CRM), and other business management applications are based in the cloud. [Marketo](#), [Salesforce](#), and [Hubspot](#) all use SaaS to deploy their enterprise-level software. This is highly efficient: it ensures the maintenance, security, and smooth management of an enterprise's critical resources – which can be accessed via a web browser.

- **Data Backup and Recovery**

When an organization chooses to use cloud-based data storage, the service provider is responsible for meeting compliance and legal requirements. The cloud also provides heightened flexibility through increased storage and backups on demand. Recovery is also a quicker process because the stored data is on a network of physical servers instead of at one on-premise data center. [Google Drive](#), [Dropbox](#) and [Amazon S3](#) are excellent examples of data backup solutions that operate in the cloud.

- **Testing and Development**

Organizations can leverage the cloud to cut expenses and get their apps on the market quicker. Instead of needing to set up physical environments, developers can instead set up and take down test/development environments in the cloud. The technical team no longer has to secure budgets and spend critical resources and project time on creating a physical environment. Cloud-based dev-test environments can also be scaled up or down depending on the requirements. Two popular cloud-based testing tools are [Loadstorm](#) and [BlazeMeter](#).

- **Social Networking**

Many social networking sites, including [Twitter](#), [Facebook](#), and [LinkedIn](#) use cloud computing. Such sites are designed to help users find people they know or would like to know. Users also share lots of personal information about themselves – that information isn't just shared with friends or followers but also with the platform itself – thus, the platform needs a powerful hosting solution so it can store and manage data in real-time. Cloud usage is critical for this purpose.

## CoE – Center of Excellence

For organizations that are considering the transition to the cloud, setting up an IT Cloud Center of Excellence (CCoE) is sometimes one of the best options. CoE is a team that provides leadership, best practices, research, support, and training for a certain focus area. Sometimes it's also called a competency center, a capability center, or a tech community.

The Cloud Center of Excellence itself should ideally contain 3-5 people who have varied IT backgrounds along with cloud skills. This will foster balanced knowledge and broad perspectives. Some roles to include in your CCoE are:

- » Infrastructure/Solution Architect
- » IT/Operations Financial Manager
- » Network Engineer
- » Systems Administrator
- » Application Developer
- » Database Administrator

A CCoE is the best approach to facilitate cloud-enabled transformation; by using one, the organization can set up repeatable, federated procedures, policies, frameworks, and reference architectures. The company's infrastructure and development/IT teams can follow those as they migrate infrastructure and applications to the cloud, thus saving effort and time while simultaneously ensuring compliance and security measures.

If you are interested in gaining a deeper understanding of the topic, you will benefit from reading this article:

[Centers Of Excellence As A Business Enabler In The Era Of Millennials.](#)



**Boris Kontsevoi**

CEO and  
President/COP



***The CoE is a specialized team that develops and provides leadership, best practices, research, support, and training for a focus area. This enables organizations to address their innovation and transformation agenda, gain a competitive advantage, and secure continuous success. CoEs benefit everyone from stakeholders to employees to customers.***

## Case study: Desk-Net Solution for Newsroom Management

**DESK-NET** >

This case study was made possible via an Offshore Cloud CoE and Custom Software Development Team, Intetics.

### The challenge

The client is a Hamburg-headquartered company that renders website management and development services for publishing houses. The client specializes in the design and conceptualization of news websites and has rich experience in providing solutions for the German publishing industry. The client's "Desk-Net" project was created to help publishing houses plan editorial processes – such as managing stories, arranging appointments, and coordinating staff. The client wanted to sell the application under the SaaS model, meaning that all customers would use a single-entry point.

The client was in need of a custom software development provider to implement the idea with care and expertise.

### The solution

The client and the development provider began to collaborate to develop the main application. Major processes that were automated included storyboard management, appointment planning with reporters and photographers, and staff coordination. Some scheduling functionalities included:

- Import of internal and external appointment data
- Quick and simple entry of appointments via "Express Entry"
- Detailed Entry (a panel that is used to enter related information about an appointment)
- Assignment of staff to appointments
- Reminders for repeating appointments
- Overviews of appointments in daily, weekly, and long-term timeframes
- Special print-out template
- Alert page

Furthermore, each user had their own site for tracking assignments. Managers can use the "Notes" function for target communication with staff. There is also a Cross-Media Story Management feature, which has functionalities which include:

- Idea list
- Story search
- Personal story repository
- Series planning

Such a large-scale system requires rich and well-planned administration. This makes it possible to create an organizational structure, including hierarchical departmental, page and page elements, and publishing objects. The user management was based on access rights given to the different editorial departments.

More information on the case study can be found [here](#).

## Solutions That Are Hard to Build On-Site but Easy to Build in the Cloud

The flexibility of the cloud makes it simple to develop solutions that would otherwise be difficult to build on-site.

### Serverless Computing

Serverless computing is a cloud computing execution model where backend services are provided to clients on an as-used basis. Companies that are contracted with serverless vendors are charged based on their usage rather than on a number of servers or a fixed amount of bandwidth. According to the [Flexera 2020 State of the Cloud Report](#), serverless computing was one of the 5 most rapidly growing PaaS cloud services in 2020.



### What Are the Advantages of Serverless Computing?

- **No server management is necessary**  
Developers never have to deal with the servers. They are managed by the vendor. This can reduce the investment necessary in DevOps, which lowers expenses, and it also frees up developers to create and expand their applications without being constrained by server capacity.

- **Developers are only charged for the server space they use, reducing cost**

As with a 'pay-as-you-go' phone plan, developers are only charged for what they use. Code only runs when backend functions are needed by the serverless application, and the code automatically scales up as needed. Provisioning is dynamic, precise, and real-time. Some services are so exact that they break their charges down into 1-millisecond increments. In contrast, in a traditional 'server-full' architecture, developers have to project in advance how much server capacity they will need and then purchase that capacity, whether they end up using it or not.

- **Serverless architectures are inherently scalable**

Applications built with a serverless infrastructure will scale automatically as the user base grows or usage increases. If a function needs to be run in multiple instances, the vendor's servers will start up, run, and end them as they are needed, often using containers. As a result, a serverless application can handle an unusually high number of requests just as well as it can process a single request from a single user. A traditionally structured application with a fixed amount of server space can be overwhelmed by a sudden increase in usage.

- **Rapid deployments and updates are possible**

When using a serverless infrastructure, there is no need to upload code to servers or do any backend configuration in order to release a working version of an application. Developers can very quickly upload bits of code and release a new product. They can upload code all at once or one function at a time, as the application is not a single monolithic stack but rather a collection of functions provisioned by the vendor.

This also makes it possible to quickly update, patch, fix, or add new features to an application. It is not necessary to make changes to the whole application; instead, developers can update the application one function at a time.

- **Code can run closer to the end-user, decreasing latency**

Because the application is not hosted on an origin server, its code can be run from anywhere. It is, therefore, possible, depending on the vendor used, to run application functions on servers that are close to the end-user. This reduces latency because requests from the user no longer have to travel all the way to an origin server.

## What Are the Disadvantages of Serverless Computing?



- **Serverless computing introduces new security concerns**

When vendors run the entire backend, it may not be possible to fully vet their security, which can be a problem, especially for applications which handle personal or sensitive data.

Because companies are not assigned their own discrete physical servers, serverless providers will often be running code from several of their customers on a single server at any given time. This issue of sharing machinery with other parties is known as 'multitenancy' – think of several companies trying to lease and work in a single office at the same time. Multitenancy can affect application performance and, if the multi-tenant servers are not configured properly, it could result in data exposure. Multitenancy has little to no impact for networks that sandbox functions correctly and have powerful enough infrastructure.

- **Serverless architectures are not built for long-running processes**

This limits the kinds of applications that can cost-effectively run in a serverless architecture. Because serverless providers charge for the amount of time code is running, it may cost more to run an application with long-running processes in a serverless infrastructure compared to a traditional one.

- **Performance may be affected**  
Because it's not constantly running, serverless code may need to 'boot up' when it is used. This startup time may degrade performance. However, if a piece of code is used regularly, the serverless provider will keep it ready to be activated – a request for this ready-to-go code is called a 'warm start.'  
A request for code that hasn't been used in a while is called a 'cold start.'
- **Vendor lock-in is a risk**  
Allowing a vendor to provide all backend services for an application inevitably increases reliance on that vendor. Setting up a serverless architecture with one vendor can make it difficult to switch vendors if necessary, especially since each vendor offers slightly different features and workflows.

## Who Should Use Serverless Architecture?

Developers who want to decrease their go-to-market time and build lightweight, flexible applications that can be expanded or updated quickly may benefit greatly from serverless computing.

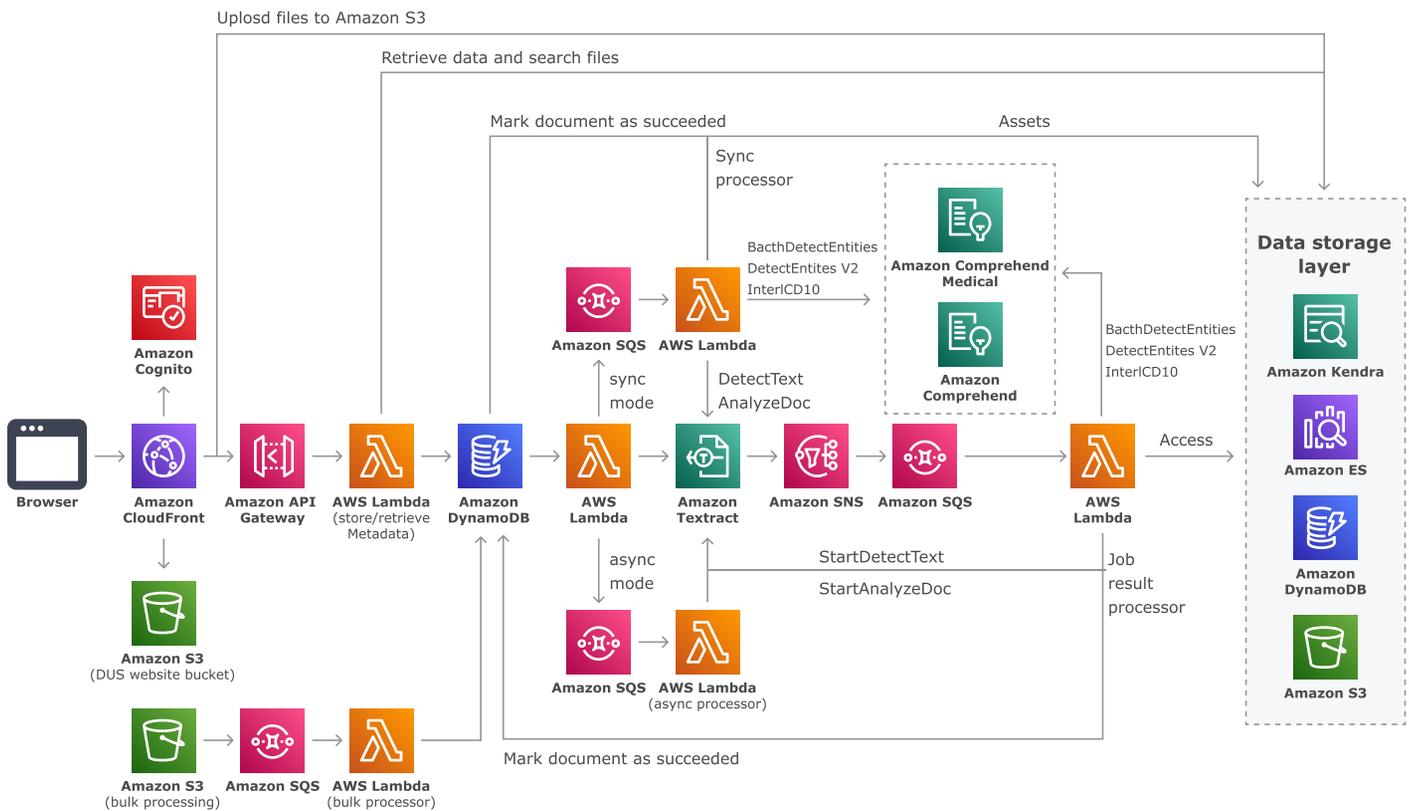
Serverless architectures will reduce costs for applications that see inconsistent usage, with peak periods alternating with times of little to no traffic. For such applications, purchasing a server or a block of servers that are constantly running and always available, even when unused, might be a waste of resources. A serverless setup will instantly respond when needed and will not incur costs when at rest.

Also, developers who want to push some or all of their application functions close to end-users for reduced latency will require at least a partially serverless architecture, as doing so necessitates moving some processes out of the origin server.

## When Should Developers Avoid Using Serverless Architecture?

There are cases when it makes more sense, both from a cost perspective and from a system architecture perspective, to use dedicated servers that are either self-managed or offered as a service. For instance, large applications with a fairly constant, predictable workload may require a traditional setup, and in such cases, the traditional setup is probably less expensive.

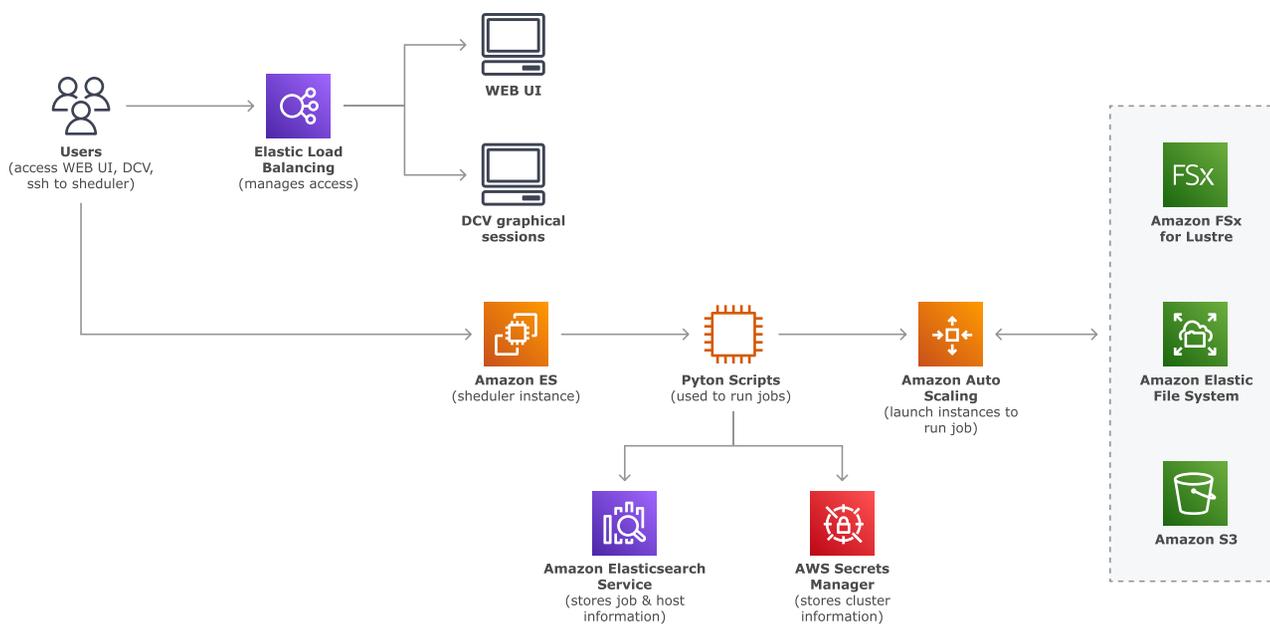
Additionally, it may be prohibitively difficult to migrate legacy applications to a new infrastructure with an entirely different architecture.



[Document Understanding Solution on AWS](#)

## Scale-Out Computing on AWS

When customers use AWS’s Scale-Out Computing solution, it is easier for them to deploy and operate multiuser environments with intense computational workflows, such as deep learning training and computer-aided engineering. This solution from AWS has a fast network backbone, a large selection of computing resources, unlimited storage, and cost management integration. There is also a UI that has file management, cloud workstations, and automation tools that can be used to make your own scheduler resources, queues, and Amazon Machine Images.



[Find more](#)

## Distributed Computing

Distributed Computing refers to a number of servers or a fixed amount of bandwidth. According to the [Flexera 2020 State of the Cloud Report](#), serverless computing was one of the 5 most rapidly growing PaaS cloud services in 2020.

Distributed computing links multiple computer servers over a network into one cluster; they coordinate processing power and share data. This cluster is called a “distributed system,” and it offers heightened scalability, high levels of performance, stronger resilience, and cost-effectiveness.

## Specific Computing Requirements

Sometimes there is a need to have special hardware to run the production workload. Public cloud providers can help with this. For example, Amazon EC2 offers several [instance types](#) that allow you to scale resources to match your target workload's requirements. Some instance types include:

- **General purpose**  
It provides a balance of memory, computing, and networking resources. These instances are a good fit for applications that use those resources in relatively equal proportions – like code repositories and web servers, for instance.
- **Memory-optimized**  
These instances deliver speedy performance for memory-intensive applications, such as in-memory caches, open-source databases, and real-time, big data analytics.
- **CPU optimized**  
Such instances are ideal for compute-bound applications that work best with high-performance processors. Instances in this family can easily tackle batch processing workloads, high-performance computing, media transcoding, scientific modeling, and other compute-intensive applications.
- **Accelerated computing**  
These instances use hardware acceleration to perform graphics processing, floating-point number calculations, data pattern matching, and other functions as efficiently as possible.
- **Storage optimized**  
This kind of instance is designed for workloads that need high and sequential read/write access to large, locally stored data sets. Data warehousing, analytics workloads, scale-out transactional databases, and NoSQL databases are all use cases of this kind of instance.
- **Computer-optimized**  
Such instances are ideal for compute-bound applications that work best with high-performance processors. Instances in this family can easily tackle batch processing workloads, high-performance computing, media transcoding, scientific modeling, and other compute-intensive applications.

## Big Data

There are three big “V’s” of big data (volume, variety, and velocity) that cause challenges that a traditional database can’t solve. The cloud, however, is well-equipped to handle the challenges of big data.

|  |   |   |
|--|---|---|
| <p><b>Volume</b></p> <p>The size of stored data arrays can go up to many petabytes.</p> <p>V</p> | <p><b>Variety</b></p> <p>Data can be pulled from many sources and formats, including ecommerce transactions, weblogs, and social media interactions.</p> <p>V</p> | <p><b>Velocity</b></p> <p>Data must be collected and processed in a short window of time, which depends on the business’ requirements. It could range from real-time to a daily basis.</p> <p>V</p> |
|--|---|---|

## Data Lake and Analytics

A data lake aggregates all data, regardless of its format or source. You can store your data in the data lake as-is; there is no need to structure it first. Then, you can run analytics on the aggregated data, including visualizations, machine learning, big data processing, and real-time analytics. When you use a cloud provider’s data transformation and processing program, you can process the data when needed and only pay per job.

## High Load in the Cloud

Public cloud providers offer services that let applications scale up and manage an almost unlimited load. Use cases include:

- » Auto-scaling
- » Content Delivery Network (CDN)
- » Automation
- » Caching
- » NoSQL databases
- » Messaging queues
- » SOA/microservices

- **Auto-Scaling**  
It is a waste of money to always provision enough capacity to match your peak traffic load. It's a more cost-effective idea to match your compute power to demand. Auto-scaling automatically resizes computing clusters to match what you need. Just define the minimum and maximum pool size.
- **CDN**  
By moving your web app's static content to Amazon CloudFront and S3, you can lighten your web tier servers' load and improve efficiency and performance. CloudFront is Amazon's CDN and stores your data across 53 global edge locations. It provides your users with the lowest latency, possibly by caching content at edge locations.
- **Automation**  
Let's say your infrastructure is growing and can scale to thousands of instances. Perhaps you have read replicas and horizontal scaling, but you need to have automation to help manage all of this. There are Do it Yourself automation tools, such as AWS CloudFormation. You can also use higher-level services, such as AWS Elastic Beanstalk or AWS OpsWorks.
- **Caching**  
Shift the session state off of your web tier and lighten the load. You can do so by storing the session state in DynamoDB or ElastiCache – this approach will enable your system to support future auto-scaling. Another option is to cache your database's data into ElastiCache.
- **Managed Services**  
Managed services are the practice of outsourcing the responsibility for maintaining, and anticipating the need for a range of processes and functions in order to improve operations and cut expenses.

**Elastic Load Balancer (ELB)**

This is a single DNS endpoint for your application; it loads balances across your web host instances, and it uses health checks so your traffic doesn't go to failed hosts. You don't have to do anything for it to scale; if ELB sees additional traffic, it will vertically and horizontally scale behind-the-scenes.

**Amazon ElastiCache**

This service automatically scales and manages Memcached clusters. It is self-healing, so if nodes fail, new ones are automatically started.

**AWS Lambda**

You can run code without needing to provision or manage servers.

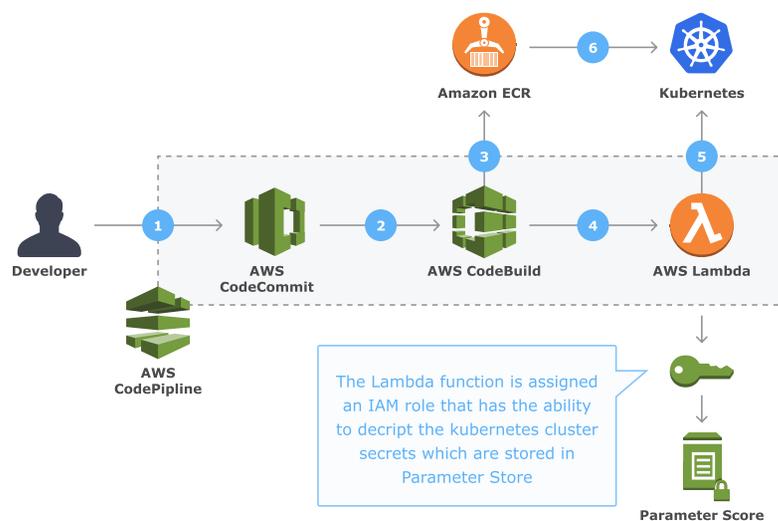
- Messaging Queues**

Amazon SQS is a queuing service that is secure, scalable, and simple. Queuing helps you send messages between your infrastructure’s different components. For example, a photo CMS should have two independent systems – one to collect photos and one to process them. The two systems should be loosely coupled and able to scale independently. You take a photo, put it in the queue, and then workers can pull the photos off the queue and work with them.
- Memory-optimized SOA/Microservices**

These instances deliver speedy performance for memory-intensive applications, such as in-memory caches, open-source databases, and real-time, big data analytics. You can use SOA/microservices to decouple your infrastructure. The individual services are then able to be independently scaled, thus giving you much more flexibility. Loose coupling enables you to scale and fail independent components, design everything as a black box, and favor services with built-in scalability and redundancy instead of building your own.

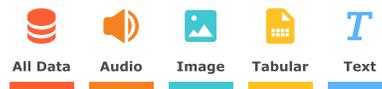
## Continuous Deployment

Nowadays, enterprises are up against rapid changes across competitive fields, ever-evolving security requirements, and the need for performance scalability. Enterprises need to bridge the gap between the rapid development of features and the stability of operations. CI/CD, or continuous integration and continuous delivery, enables speedy software changes without lowering the system’s security or stability.



## Artificial Intelligence Engineering

AI is a key driver in cloud technology that adapts to our needs. Cloud-as-a-service platforms let users access machine learning functions with nearly any budget or skill level – such functions include language processing, image recognition tools, and recommendation engines. The cloud will make these toolsets more accessible, and we anticipate them becoming widely deployed by enterprises across all fields and of all sizes.



### AWS Forecast

- Retail Forecasting
- Demand Forecasting

### AWS Personalize

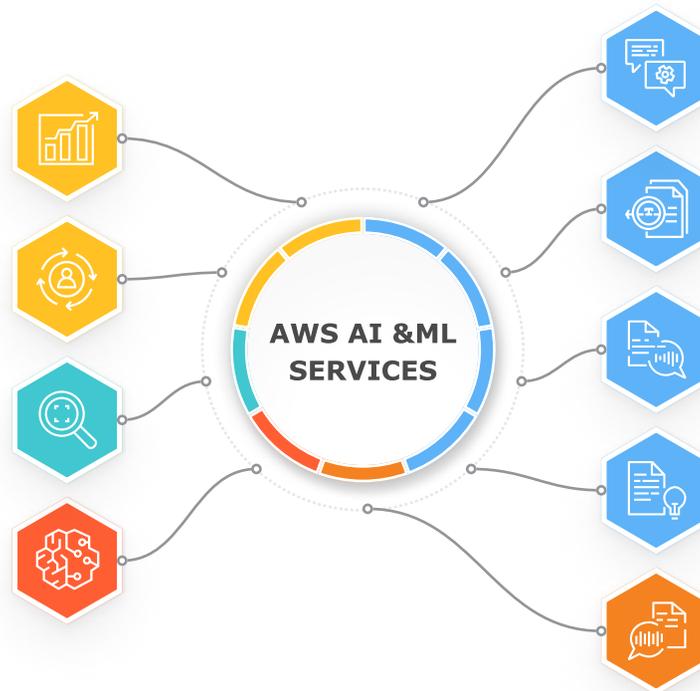
- Recommendation
- Personalization

### Amazon Rekognition

- Object Detection
- Text Detection
- Image Moderation
- Activity Detection (Video)

### AWS SageMaker

- Tabular – Regression, Classification, Clustering
- Text – Text Classification, Machine Classification, Topic Modelling
- Image – Image classification, Object detection, Semantic/Instance Segmentation



### AWS Lex

- Conversational Chat-bots
- AI Chat-bots

### AWS Textract

- Document Extraction
- Document Redaction
- Table Extraction

### AWS Polly

- Conversational Chat-bots
- AI Chat-bots

### AWS Comprehend

- Sentiment Analysis
- Topic Modeling
- Key-phrase Extraction
- Entity Detection
- Classification

### AWS Transcribe

- Create Transcripts
- Content Redaction
- Vocabulary Filtering

## IoT

With the proliferation of devices worldwide, you need broad and deep IoT solutions to connect these devices and to collect, store, and analyze their data. AWS IoT is the only cloud vendor that has brought together rich analytics and data management in intuitive services designed for IoT data.

Its services have multi-layered security and superior AI integration, and they are proven at scale.

**Multi-layered security**

This includes encryption, access control, and an auditing service.



**Superior AI integration**

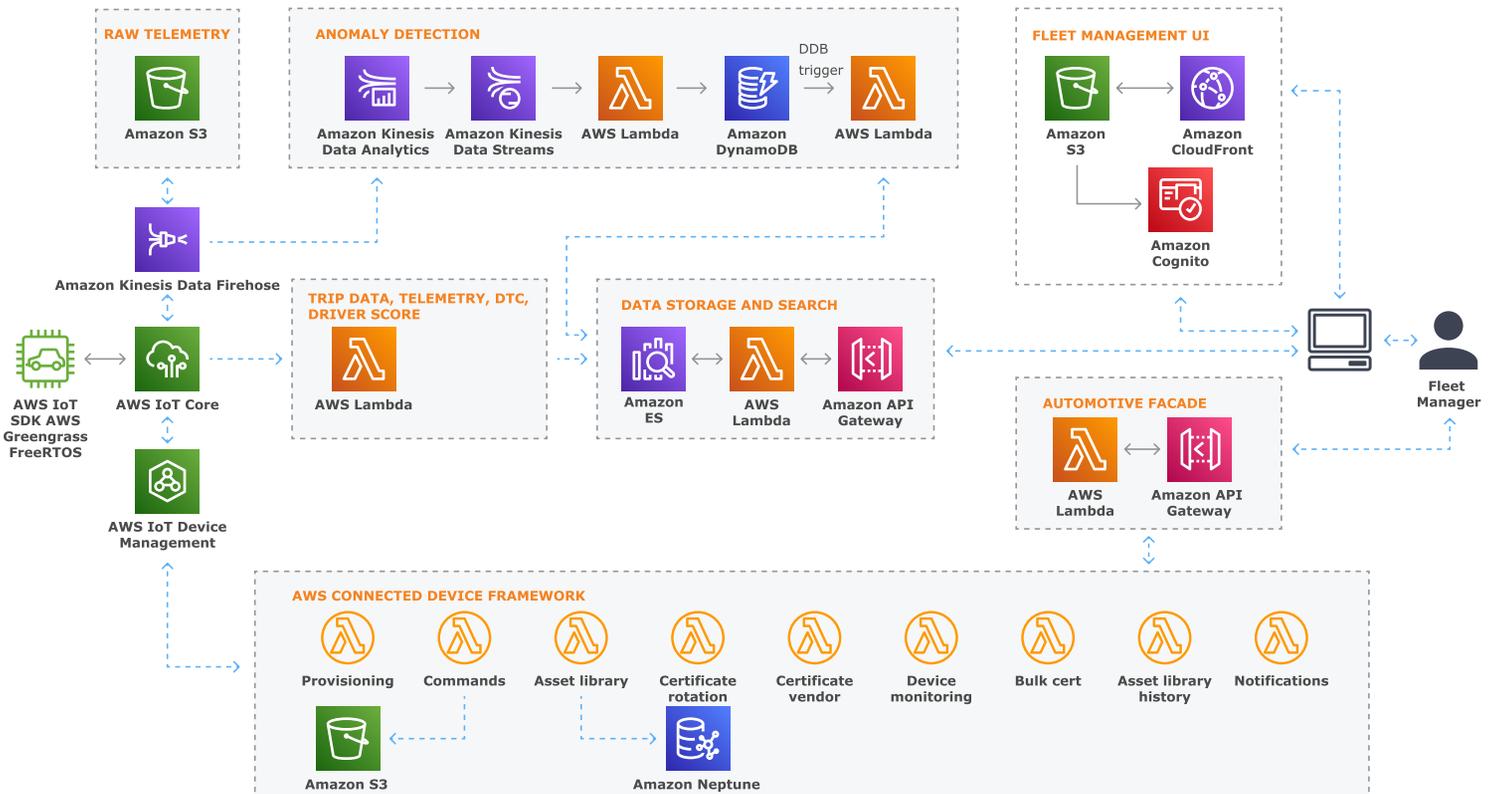
IoT and AI are brought together to help make devices more intelligent. When you use AWS IoT to create models in the cloud and then deploy them to devices, they will run twice as fast, on average, as other vendors.



**Proven at scale**

AWS IoT scales to trillions of messages across billions of devices.

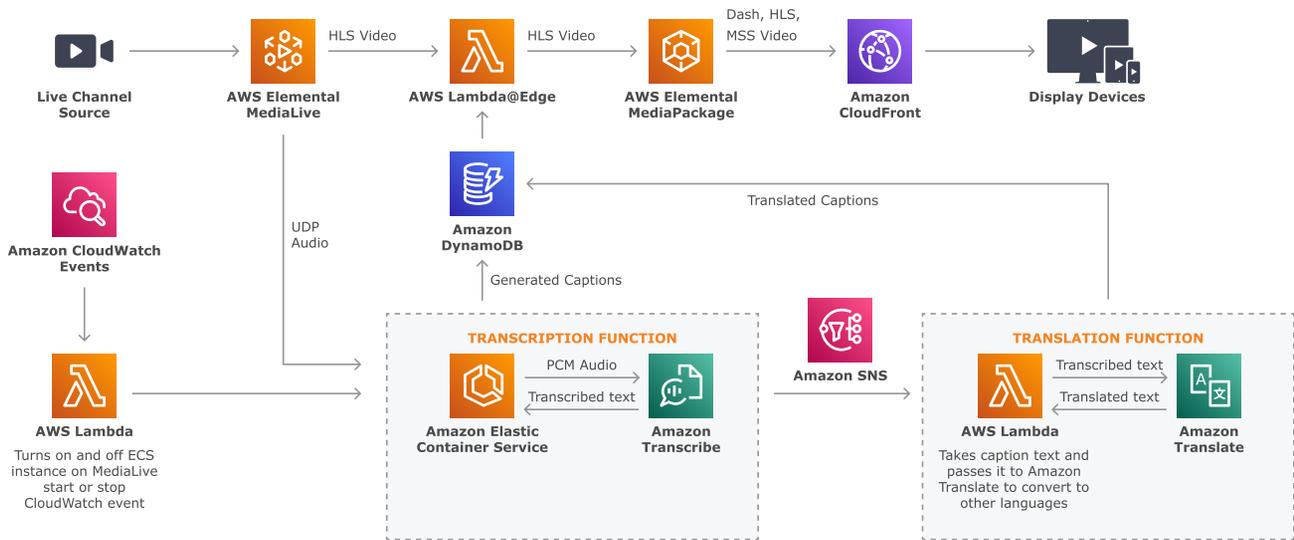




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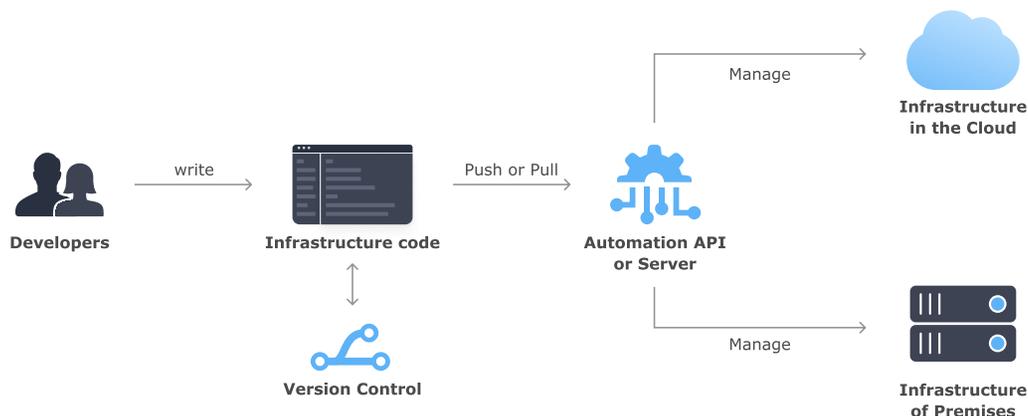
## Content Distribution and VOD

Content distribution is when an organization promotes online content to its audience through various channels and in multiple media formats. One specific kind of content distribution is Video on Demand (VoD), which lets viewers access videos without being constrained by a static broadcasting schedule. Amazon offers a Content Delivery Network that implements two kinds of video streaming: on-demand and live-streaming. Head here for a closer look at how AWS facilitates live streaming with automated multi-language subtitles you can read [here](#).



## Automated Cloud Orchestration and Optimization

Having to manage the quality and quantity of interconnected services across applications would overwhelm even the best IT organizations. Cloud platforms, though, help by developing services for automated cloud optimization and orchestration.



## Virtual Cloud Desktops

This cloud solution is essentially where the entire workstation environment is delivered to our desktop or laptop screen. Organizations can lower their costs by only paying for the time that employees are working on their machines, via per-hour subscriptions. Plus, the cost of hardware updates is eliminated.



## Multi-Cloud

A multi-cloud models' main purpose is to deliver specialization and versatility. In an enterprise-level organization, there are unequal cloud needs across departments. For instance, an enterprise's marketing department will have different cloud computing needs than the HR department. Instead of getting boxed into a one-size-fits-all solution, a multi-cloud model lets companies pick and choose what they need.

## Cloud Agnostics

“Cloud agnostic” applies to tools, services, and applications that can move between on-premises infrastructure and a cloud platform. The term is also used to describe applications that operate on 2+ cloud platforms. A cloud-agnostic tool gives organizations standard and consistent performance, no matter which platform it is deployed on.

84% of enterprises use a multi-cloud strategy, which isn’t surprising. It lets businesses leverage the price and feature differences between providers. Furthermore, they can avoid vendor lock-in.

Two key strategies for becoming cloud-agnostic include:

- **Utilizing container technologies**  
A container packages source code with its dependencies and libraries, thus allowing the application to port from one environment to another with no conflict.
- **Using managed databases**  
In such services, the provider will install, maintain, manage, and give access to a database. Microsoft Azure, Google, and AWS offer possibilities for migrating these databases between providers.

## Cloud-Agnostic Infrastructure Provisioning

As enterprises use the public cloud to meet their infrastructure needs, there are three questions that they should address.

1. How can you evolve your infrastructure in a cost-effective, safe, and agile manner?
2. If you are going to implement a multi-cloud strategy, how will you account for the need to learn and maintain cloud-specific tools across multiple vendors?
3. How can you avoid vendor lock-in?

As enterprises use the public cloud to meet their infrastructure needs, there are three questions that they should address.

Terraform addresses all of these changes; read more [here](#).

## Solution-Focused Partners

As companies continue to use SaaS, IaaS, and PaaS solutions, there will always be a need for third-party vendors that specialize in addressing specific use cases and addressing arising cloud challenges. Your cloud provider will handle infrastructure needs, but outsourced companies can help with more specific needs like visibility, data, AI and ML technology, and IoT.

[Intetics participated in a partner program with AWS.](#)

## SOLUTIONS

### Distributed System

A distributed system, also known as distributed computing, is a system with multiple components located on different machines that communicate and coordinate actions in order to appear as a single coherent system to the end-user.

Distributed systems offer better availability, durability, scalability, and efficiency.

### Serverless

Serverless computing is a method of providing backend services on an as-used basis. A serverless provider allows users to write and deploy code without the hassle of worrying about the underlying infrastructure. A company that gets backend services from a serverless vendor is charged based on their computation and does not have to reserve and pay for a fixed amount of bandwidth or number of servers, as the service is auto-scaling. Note that despite the name serverless, physical servers are still used, but developers do not need to be aware of them.

### Reduce DevOps Effort/Less Maintenance and Simplification of IT

The infrastructure-as-a-code approach allows developers to describe and create all necessary resources in AWS.

Maintaining computer hardware and software is a full-time job. Literally. With a public cloud, you don't have to have employees spending time dedicated to the tedious maintenance of equipment that doesn't directly contribute to business objectives. Your cloud service provider ensures the infrastructure is in place, so your tech wizards can focus on driving business outcomes.

### **Continuous Deployment**

Continuous Deployment (CD) is a software release process that uses automated testing to validate if changes to a codebase are correct and stable for immediate autonomous deployment to a production environment. Get daily releases, zero deployment downtime, and no more manual regression testing.

## **BENEFITS FROM SOLUTIONS**

### **Rapid Implementation and Time-to-Value**

Cloud implementations can be rapid relative to on-premise variants. For instance, an on-premises implementation could take three months, while a SaaS application of the same relative complexity and scope would only take two weeks.

### **Cost Savings and Effectiveness**

Cloud gives you the ability to only pay for the resources you use. This gives you access to resources that would cost way too much time and money to maintain yourself, which ties back into scalability.

A traditional IT approach to scaling up is costly. It takes planning; it can take months, requires hardware at a large upfront cost, electricity to keep it all operating and cool, and skilled IT staff capable of getting it all up and running. With the cloud, that's all done nearly instantly by your cloud provider.

In the cloud, IT leaders can easily allocate computing resources according to unique business requirements and cut wasteful spending. Rather than estimate capacity needs in advance, organizations can adjust on the fly, as well as eliminate unnecessary hardware or rigid on-premises assets.

### **Security and Compliance**

Most cloud providers are large companies, with other large companies relying on them. That's why they go out of their way to consider security and compliance, which includes staying on top of updates and trends that will ensure your sensitive data are safe in the cloud.

Public cloud providers typically bring to the table policies, tech, and controls that are a huge step up from the average organization's security practices. This is paired with considerations for almost any industry-specific compliance need.

Encrypting data at rest and in motion is much easier when using cloud technologies. Encryption is native to the cloud and doesn't require third-party add-on applications like many on-premises solutions do.

## Monitoring

Cloud infrastructure monitoring software allows companies to visualize and track the performance of their cloud applications or services. Monitoring tools aggregate data in real time to display information related to a company's cloud-based resources. These tools can track application performance, network availability, and resource allocation, among other cloud-related factors. They are typically used by IT departments to ensure services are functioning optimally and securely while also ensuring no money is being spent unnecessarily.

## Elasticity and Scalability

Many organizations are undergoing digital transformations to create incremental value out of existing assets. Thanks to recent advances in cloud computing, leaders can digitize more core functionality, including CRM, SAP, data analytics, and more.

Migrating to the cloud opens up numerous doors of opportunity when it comes to leveraging modern technologies. For example, organizations that migrate can take advantage of machine learning and AI, which aren't feasible on-premises. They can also spin up highly complex cloud-native technologies, such as Kubernetes containers and data lakes, in minutes.

## Move From CapEx to OpEx

Cloud shifts tech systems from capital expenditure (CapEx) to operating expenditure (OpEx) – or from an investment in something you hold onto for a few years that will depreciate in value (like a room full of expensive hardware gathering cobwebs) to a regular, ongoing cost of running a business (like paying for internet).

## Agility and Flexibility

"Cloud agility" is often used to describe the ability to quickly develop, test, and launch business applications. But the cloud also gives you the agility to respond quickly as needs change.

Even small businesses get access to the same powerful tools the biggest enterprises use. New services can be accessed with a few mouse clicks, so when a new need, challenge, or opportunity arises, it's possible to respond immediately.

Business agility is key in the modern global economy. Having access to flexible, on-demand IT resources is crucial for keeping pace with competitors and rapidly changing industry dynamics. In the cloud, over 99% of what you need is available on-demand. Organizations don't have to wait weeks or months for hardware components and installations. Instead, they can lease valuable capabilities directly from cloud providers and get to market much more quickly.

## Cloud Migration checklist – What’s the Cloud Migration Process?



### Evaluate the “why”

Why are you moving to the cloud?



### Plan for what’s moving and how

Take stock of what’s in your environment, noting any interdependencies, then figure out what you’ll migrate first and how you’ll migrate it. Look at which applications can be moved as they are, which ones will need some (or A LOT of) reworking, and which tools are out there to simplify migration of those trickier workloads.



### Migrate applications and data

Applications should be designed, migrated, and validated using one of the migration strategies.



### Modernize and move ahead

## What Are the Types of Cloud Migration Strategies?

### Lift-and-Shift (Rehosting)

It’s quick and requires minimal refactoring. But the downsides of lift-and-shift include the fact that you may miss out on benefits you’d see if going cloud-native because you’re performing the bare minimum changes needed. This means you could end up paying for the speed and the ease of your migration in the long run – at least when compared to a more thorough approach.

1

### Move-and-Improve (Replatforming)

This approach to migration includes making some modern updates to your application – like, say, introducing scaling or automation – without throwing the whole thing out. This happy-medium approach can seem like the superior option at a glance, but it can result in migrations where you keep all your technical debt and get none of the cloud-native benefits.

2

### Rip-and-Replace (Refactoring)

This approach (also called refactoring or re-architecting) means rebuilding your workload from scratch to be “cloud-native”. It takes an investment in time and skills development (particularly reskilling and upskilling your existing talent), but it pays out with the maximum benefits available in the cloud.

3

## Migration Tools – AWS

- [AWS Migration Hub](#)  
This hub lets you track the progress of migrations across AWS solutions, helping you pick the right tools, track metrics, and more.
- [AWS Application Discovery Service](#)  
Plan for your migration by letting AWS review your on-prem data setup. Collected data is encrypted and accessible from the Migration Hub.
- [AWS Server Migration Service](#)  
This service makes it easy and quick to move workloads to AWS, particularly when dealing with large-scale server migrations.
- [AWS Database Migration Service](#)  
Easily and securely move your databases to AWS. Bonus: The source database remains functional throughout the migration, minimizing downtime.
- [CloudEndure Migration](#)  
This automated lift-and-shift solution is free for 90 days.

## Migration Tools – Azure

- [Azure Migrate](#)  
Microsoft's built-in migration service serves as a central hub for tools, progress tracking, insights, and guidance to plan and successfully migrate to the cloud. Most other tools covered below are integrated into this central dashboard.
- [Azure Migrate: Server Assessment and Server Migration](#)  
These tools let you assess and migrate servers to Azure, including physical servers and VMware, Hyper-V, public cloud, and other VMs.
- [Data Migration Assistant](#)  
DMA helps locate compatibility issues that could derail your migration. It points out unsupported features, new features and helps you plot a proper path for database migration.
- [Azure Database Migration Service](#)  
Migrate on-prem databases to Azure VMs.

- [Azure Data Box](#)  
Move large amounts of offline data to the Azure cloud.
- [Movere](#)  
This SaaS platform was acquired by Microsoft in 2019. It's a discovery solution that increases business intelligence to see and control environments across.



## Migration Tools – GCP

- [Transfer Service](#)  
Execute large-scale data transfers from online and on-premises sources to Google Cloud Storage.
- [Transfer Appliance](#)  
For offline bulk data migration, Transfer Appliance lets you securely capture, ship, and upload data using 100TB or 480TB models.
- [Migrate for Anthos](#)  
Migrate and modernize existing workloads to containers.
- [Migrate for Compute Engine](#)  
Get enterprise applications running in Google Cloud while data migrates in the background. Validate, run, and migrate applications without reworking them.
- [BigQuery Data Transfer Service](#)  
Let your analytics team set the foundation for a BigQuery data warehouse and schedule and automate data transfers from your SaaS applications.

## Standards in Use and Planned/ In Development Ones

The Cloud Standards Customer Council is an advocacy group for cloud end-users; it is dedicated to accelerating the successful adoption of the cloud as well as creating industry standards for the security and interoperability of the migration process. Here are some of the whitepapers and articles they have published:

- » [Impact of Cloud Computing on Healthcare](#)
- » [Cloud Customer Architecture for eCommerce](#)
- » [Convergence of Social, Mobile, and Cloud: 7 Steps to Ensure Success](#)
- » [Cloud Customer Architecture for Mobile](#)
- » [Cloud Customer Architecture for IoT](#)
- » [Security for Cloud Computing: 10 Steps to Ensure Success V3.0](#)

Amazon has also released a set of standards of its own: the [AWS Well-Architected Framework](#), which outlines the design principles, key concepts, and architectural best practices that should be used when designing and running cloud-based workloads. There are five pillars within the framework, which you can read about in detail on the framework's web page.

- » **Pillar 1:** Operational Excellence
- » **Pillar 2:** Security
- » **Pillar 3:** Reliability
- » **Pillar 4:** Performance Efficiency
- » **Pillar 5:** Cost Optimization

## Industry Associations, Magazines, Social Media Groups

For organizations who are interested in enhancing their knowledge of cloud computing, the following resources provide expert information.

### 1 [AWS News Blog](#)

Amazon Web Services is one of the top cloud providers, which makes its news and updates well worth following.

### 2 [AWS on Youtube](#)

AWS also has a YouTube channel, in which they share everything from short insights from guest experts to hour-long roundtables.

### 3 [Google Cloud Platform on Youtube](#)

While the AWS YouTube channel had plenty of longer videos, Google Cloud's channel mostly focuses on bite-sized tutorials. If you have a few minutes to spare, you can learn about topics like "Making data public in cloud storage" and "Using object versioning."

### 4 [Microsoft Azure Blog](#)

This highly-informative blog contains over 2,500 posts that cover product features, news, and industry events. You can hear the latest perspectives from Azure's developers and experts.

### 5 [Cloud Foundry](#)

This site provides a self-paced eLearning course to give developers a hands-on, comprehensive introduction to the Cloud Foundry platform. It can be used to prepare for the Cloud Foundry Certified Developer exam. Furthermore, the site has a set of free tutorials built by the site's community.

### 6 [AWS Certified Global Community](#)

By taking and passing the AWS certification, you gain access to the private LinkedIn community for certified AWS specialists. Make new connections, engage with peers, and learn from others who have also validated their technical expertise via AWS certification.

### 7 [Cloud Computing Association](#)

This independent membership organization is devoted to building a community of cloud service providers and end-users. The Association creates face-to-face and online events in which providers and end-users can meet, network, and discuss the benefits and challenges of cloud-based technologies.

## Main “Heroes,” Authorities, and Contributors of This Tech

Want to follow experts in the field? You can use the AWS Heroes and the Microsoft MVP search tools to find and follow updates on the cloud computing industry’s most knowledgeable professionals.



### AWS Heroes

The [AWS Heroes](#) program highlights several categories of experts, including machine learning, IoT, DevTools, Data, Community, Container, and Serverless Heroes. You can also filter Heroes by location, superpowers (blogger, educator, author, speaker, etc.), and their length of time in the program. You can use the search tool to connect with the hero on LinkedIn and follow them on various web channels.

### Microsoft Most Valuable Professional

The [Microsoft MVP](#) search tool works similarly to the AWS Heroes one, except there are fewer filtering options. However, you can search by keyword to find certain experts. When you find an expert, you get a very comprehensive biography and an overview of their recent activities and recognitions.

## Available Certifications for Practitioners

There are plenty of cloud computing certificates available; we've gathered some of the most popular and respected ones that help practitioners get an edge in the IT job marketplace.

- **Google Certified Professional Cloud Architect**  
This certification covers the knowledge and skills that IT professionals must have to work with enterprise-level Google Cloud technologies. The certification exam tests your ability to design, develop, and manage secure and scalable cloud-based business solutions.
- **Google Certified Professional Data Engineer**  
It is designed for data engineers who are working with Google Cloud. The exam tests whether you can design, build, operationalize, secure, and monitor machine learning models and data processing systems.
- **AWS Certified Solutions Architect – Associate**  
This certification was designed for solutions architects who have 1+ years of experience designing AWS-based systems. The exam will test your knowledge of application architecture and of how to deploy secure apps on the Amazon cloud. Furthermore, you will be tested on whether you can pinpoint solutions that meet customer requirements and provide implementation guidance throughout a project's lifecycle.
- **AWS Certified SysOps Administrator**  
The certification exam for this covers the deployment, management, and operation of scalable AWS systems, in addition to the implementation and control of data flow, identification of AWS operation best practices, and migration of workloads to AWS.
- **AWS Certified Developer – Associate**  
This certification is aimed at cloud professionals who have 1+ years of experience in developing and maintaining AWS-based apps. The exam tests a developer's knowledge of AWS core services, architecture best practices, life cycle management of an application, and programming languages.

- **Microsoft Certified: Microsoft Azure Fundamentals**  
This certification shows that you understand the fundamentals of cloud concepts, Azure’s core services, and the basics of privacy, security, and compliance.
- **Certified Cloud Security Professional (CCSP)**  
It is designed for data engineers who are working with Google Cloud. The exam tests whether you can design, build, operationalize, secure, and monitor machine learning models and data processing systems.
- **CompTIA Cloud+**  
This certification validates that a cloud practitioner can optimize and maintain cloud infrastructure services. It is vendor-neutral.

## “Healthcheck”

Even with all its positive sides, a cloud transition may seem like an excessive option for your business in this current period of time. To make sure that you are not making a rushed decision, we suggest analyzing the current situation according to the following checklist:

- **Do you need company data to be accessible outside the office?**  
If every interaction with data happens through a local network and is never intended to be accessed outside the office building, then transitioning to the cloud will only bring unnecessary dependency on the internet connection and add additional security risks. Your local network is always onsite, while the connection to the cloud services can be lost in the case of IRS or cloud provider failure. However, the situation is reversed if you are focused mostly on external users – in this case, cloud hosting beats any on-premise solution.
- **How stagnant is your IT infrastructure?**  
If you feel that your business will not require expansion of its IT infrastructure over the next 5 to 10 years, then maybe cloud migration is not for you. However, for most companies, stagnation in the field of new technologies is never a good sign. Plus, any estimate of the remaining life of your current hardware is always a theoretical number – no one can guarantee that your server won’t die while you are reading this White Paper.

- **Are there cloud services available for your business needs?**  
With a 99% probability, there are. The 5,000 different services provided AWS alone is a significant number. And even if not all of your needs are entirely satisfied by cloud services – the majority of the other aspects will improve greatly.
- **Will your data be safe in the cloud?**  
On the one hand, cloud data centers are compliant with the highest security standards in the industry. So even when your data is stored somewhere far from your office building, it is well protected. On the other hand, some security risks arise during the process of cloud migration and adaptation to the new working processes. Transitioning from known and tested security protocols to anything else is always risky and should be undertaken with a high level of precaution.
- **Will you be able to pay for the cloud services?**  
The correct application of cloud architecture usually comes with the benefit of cost-saving and a high level of predictability of future expenses. At the same time, major mistakes in the design of the architectural change may result in excessive costs.
- **Will you be able to manage the cloud services?**  
If your IT department is stagnant and not willing to adopt new technologies, you might face some hiring decisions alongside other cloud migration challenges. And even in a perfect scenario, some changes and employee training will be required.

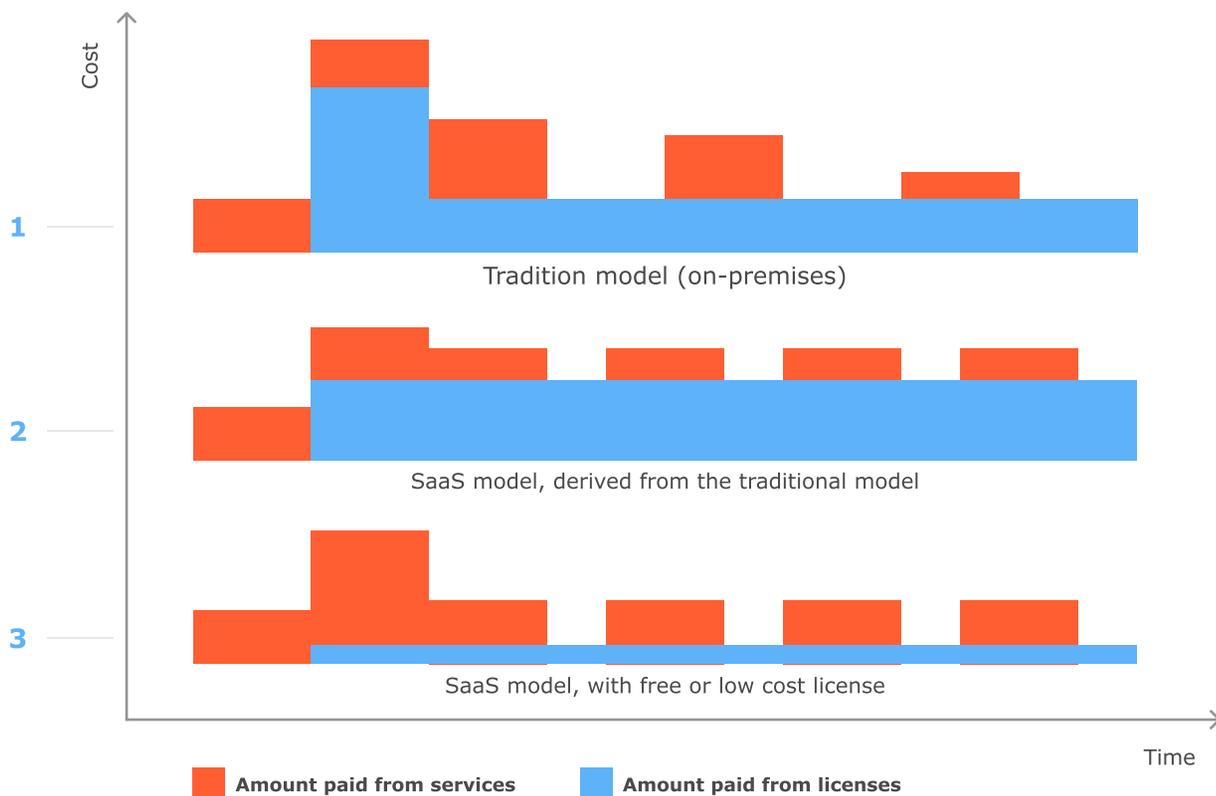
As you may have noticed, most of the points above don't necessarily tell you that you must rush to the cloud or should avoid it for the rest of your company life. These are merely common challenges and not complete roadblocks. Ignoring new technology is always the easiest decision to make and seems the safest option in many situations. But in most situations, the benefits of cloud migration beat any of these temporary challenges – and statistics of enterprises migrating to the cloud proves it.

## A Closer Look: Cost Savings in the Cloud

One common belief about the cloud industry is that the cloud has reduced operating costs for software distribution. Is this so?

The ever-growing adoption of SaaS cloud computing has had a profound effect on the cost structure of software distribution – namely, that costs are much lower than the traditional, on-premises model.

### REVENUE MODELS LINKED TO SOFTWARE DISTRIBUTION



In the image above, the first model is the traditional one, in which a user purchases the rights to use a product and then pays regularly for updates. The service aspect, in this case, is mostly related to initial interfacing and software integration, later followed by successive upgrades.

The second model, which is traditional SaaS, has a more budget-friendly approach that is made possible by the cloud. How? The software is not installed on the client's machine – instead, it is a shared resource that is rented to the client, thus eliminating upstart purchase costs and allowing invoicing per usage. While this model doesn't have a huge impact on costs over time, it enables improved adaptation of resources.

You can see from the chart that the third model is very different from the first two. As part of its offering, it reduces the cost of the software; its aim is to have a huge installed base to foster product usage and related services. In such cases, the value for the software publisher comes from their installed base (a huge number of users) in addition to any premium services that they can monetize.

The third model also brings significant benefits to IT usage:

- The affordable (or even non-existent) cost of solutions cuts down the product decision and adoption cycles. An installed base can be created rapidly, and a large base can be grounds for requests for usage extensions and interconnection of systems and platforms (like mobile platforms, in particular).
- Because license fees are either absent or low-cost, they free up an existing budget, thus freeing up resources for users' specific needs.
- Such applications can provide a high rate of adoption and rapid ROI; thus, they are "quick wins."

Now, let's take a look at another common belief: that cloud computing reduces the amount spent on servers. In fact, technically, the cost of the service is more expensive than keeping your own servers, even though the number of admins remains the same, no servers are needed, and everything is stored in Amazon or Microsoft's data servers in other countries.

It would seem like organizations that pay for cloud servers are getting the short end of the deal, but this isn't necessarily the case. Upfront costs might be higher, but these benefits come with plentiful cost-savings over time:

- Clients pay only for what they use; there is no need to pay for servers in advance.

- Because organizations have gone “serverless” - meaning that there are no “servers” as such, and everything is managed by AWS - clients can configure what they need in a matter of minutes. It is no longer necessary to have a whole DevOps team.
- New resources are obtained in seconds.
- Operating in the cloud facilitates a tech system shift from CapEx to OpEx. Essentially, with CapEx, an organization is investing in tech that they will hold onto for several years but will depreciate in value. OpEx, on the other hand, is an ongoing cost for running the business. It is much easier to calculate OpEx's value to the company.



## Further Reading

For readers who are interested in exploring the topic of cloud computing further, we recommend the following resources:

### Books

- » "Accelerating Cloud Adoption" by Michael Kavis
- » "AWS Certified Developer Official Study Guide" by Nick Alteen
- » "AWS Certified Cloud Practitioner Study Guide" by Ben Piper
- » "AWS Well-Architected Framework" by AWS
- » "Cloud Data Centers and Cost Modeling" by Caesar Wu and Rajkumar Buyya
- » "Official Google Cloud Certified Associate Cloud Engineer Study Guide" by Dan Sullivan
- » "AWS Certified Solutions Architect Study Guide" by Ben Piper
- » "Official Google Cloud Certified Professional Cloud Architect Study Guide" by Dan Sullivan
- » "Microsoft Azure: Essential User Guide to Learn Microsoft Azure" by William Hazelberg

### Courses

- [A Cloud Guru](#)  
Take courses and complete hands-on labs in Azure, Google Cloud, AWS, and more.
- [Cloud Computing Coursera Specialization](#)  
This series of 6 courses is offered by the University of Illinois at Urbana-Champaign. The specialization takes users on a basic tour through cloud computing systems. It can also be used as an entry point to the University's Master of Computer Science Degree in Data Science.

## Miscellaneous

Want a laugh? Check out these comics that are sure to get a chuckle out of cloud practitioners. Here's our favorite one!



## Summary and Conclusions



Cloud computing is the future – if you delay migration, you'll be left behind. If your organization still uses traditional IT infrastructure, it's high time that you develop and implement a cloud migration strategy – the increased data security, increased productivity, and promotion of business growth will be well worth it.

## Main Terminology

### A — ●

#### Auto Scaling

This cloud computing feature automatically scales up or down the number of computing resources being allocated to your application based on its computing requirements at any given moment. Autoscaling ensures that new instances are continuously increased during demand spikes and reduced during demand drops, guaranteeing lowered costs and consistent performance. Services like the AWS Auto Scaling service allow end-users to configure one unified scaling policy per application source, like a set of resource tags or an AWS CloudFormation stack.

- **Amazon Web Services (AWS)**

It is the suite of cloud computing services from Amazon, which spans SaaS, IaaS, and PaaS models. Popular services include Amazon EC2, Amazon S3, and Amazon Elastic Beanstalk.

### B — ●

#### Big data

This phrase is used to refer to the large volume of structured, semi-structured, and unstructured data that is difficult to mine using traditional software and database techniques. Big data is typically characterized by 3V's- Volume of data, Variety of data types, and the Velocity at which the data has to be processed.

### C — ●

#### Cloud Application

An external program or service that resides on the cloud or is hosted by 3rd party computers. Cloud applications are accessed through a web browser and don't use up storage space on the user's computer. Dropbox and Google Drive are two examples; they allow users to store, edit, and share files over the web.

- **Cloud Computing**

Cloud computing is the delivery of information technology services over a network, usually the internet. In the cloud computing model, infrastructure, data, and software are hosted by the vendor and delivered to the user as a service, much like a utility company would deliver water or electricity.

- **Cloud Engineer**

This IT professional is responsible for any duties related to cloud computing, including planning, design, management, and maintenance. They may also be tasked with assessing an organization's infrastructure and migrating different functions to a stable and reliable cloud-based system. The demand for cloud engineers is on the rise as more companies move crucial business applications and processes to private, public, and hybrid cloud infrastructures.
- **Cloud Foundry**

This is an open-source Platform as a Service (PaaS) that was initially developed in-house at VMware and is now owned by Pivotal Software, which is a joint venture between General Electric, EMC, and VMware. Cloud Foundry is highly customizable, enabling developers to code in multiple frameworks and languages; this greatly minimizes the potential for vendor lock-in, which is a common concern with PaaS.
- **Cloud Economics**

This branch of knowledge covers the costs, principles, and benefits of cloud computing. This allows organizations to save money and re-invest it in innovation or expansion. IT decision-makers within an enterprise have to closely examine the economics of migrating to the cloud before deciding whether or not to invest in the time and expertise needed to maximize cloud investments.
- **Cloud migration**

This is the process of transferring applications, data, or other business elements from a company's on-site premises behind a firewall to the cloud - or moving them from one cloud environment to another (cloud-to-cloud migration). Richard Watson, a lead analyst at Gartner, pointed out that once a CIO makes the decision for cloud migration they, "must consider an organization's requirements, evaluation criteria, and architecture principles."
- **Cloud Native**

It is an application that has been specifically developed for cloud platforms. They are designed to reap the maximum services and functionality of cloud computing and virtualization infrastructure, which are composed of loosely-coupled cloud services.

- **Cloud Platform**

This refers to a service hosted and distributed by a third-party service provider to facilitate the processing and deployment of apps without the complexity and cost of acquiring, installing, and maintaining underlying software and hardware layers.

- **Cloud Provider (CSP)**

This is a company that delivers cloud computing services to individuals or businesses via on-demand, pay-as-you-go systems as a service, typically as Platform as a Service (PaaS), Software as a Service (SaaS), or Infrastructure as a Service (IaaS).

**D** — **Data Migration**

This process moves data between storage systems, data centers, servers, or formats. Data migration is typically done to replace or upgrade servers or storage equipment, relocate a data center, or conduct server maintenance. Scripts or software apps are used to map system data for automated migration.

- **DevOps (Development and Operations)**

The term is used in several different ways; in its most broad definition, DevOps is simply a philosophy that emphasizes communication, collaboration, and integration between software development and IT operations with the goal of streamlining software development and quality assurance.

- **Distributed Computing**

A computing concept where a software system's components (like data and applications) are distributed across multiple computers, thus improving efficiency and performance.

**E** — **Elasticity**

This refers to the ability of a program, service, or resource to be conveniently expanded or resized to support the short-term, tactical needs of an organization.

**H** — **Hybrid Cloud**

A cloud computing environment composed of interlinked private and public clouds that perform separate operations within one organization. This kind of architecture is able to provide greater flexibility and more deployment options due to the facilitation of workload movement.

**I** — **Infrastructure as a Service: (IaaS)**

This fundamental cloud service runs alongside Software as a Service and Platform as a Service, which encompasses the provision of virtualized computing resources that are remotely accessed through the internet. The resources are deployed and managed by cloud service providers.

- **Internal Cloud**

A cloud environment that is hosted entirely through an organization's infrastructure and dedicated resources.

**M** — **Microsoft Azure**

Is Microsoft's cloud computing platform, which offers PaaS and IaaS services.

**O** — **On-Demand Computing**

In this computing model, software, storage, and other computing resources are used in real-time as required.

**P** — **Platform as a Service (PaaS)**

The cloud service is managed by third-party service providers. It is distributed to provide platforms where users can host, run, develop or test their own programs without worrying about the complexities and costs of acquiring support infrastructure. Examples include Apache Stratos, Google App Engine, Force.com, Heroku, Windows Azure, and AWS Elastic Beanstalk.

- **Public Cloud**

A cloud service that is managed by 3-rd party providers; users can run, host, test, and develop programs without needing to acquire their own costly infrastructure. Examples include Windows Azure, AWS Elastic Beanstalk, and Google App Engine.

**S** — **Scalability**

A system's ability to keep full functionality regardless of changes to size or volume. Scalability supports an organization's strategic, long-term needs.

- **Software as a Service (SaaS)**

It is a centrally hosted application distributed by service providers over the internet for users to utilize on a subscription basis. Examples include Concur, Workday, Salesforce, and Google Apps.

## Used materials

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