



**Globus, Azure, IBM Cloud,  
Amazon Cloud, Samsung Cloud,  
iCloud**

## **TECHNICAL REPORT**

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## High Performance Computing

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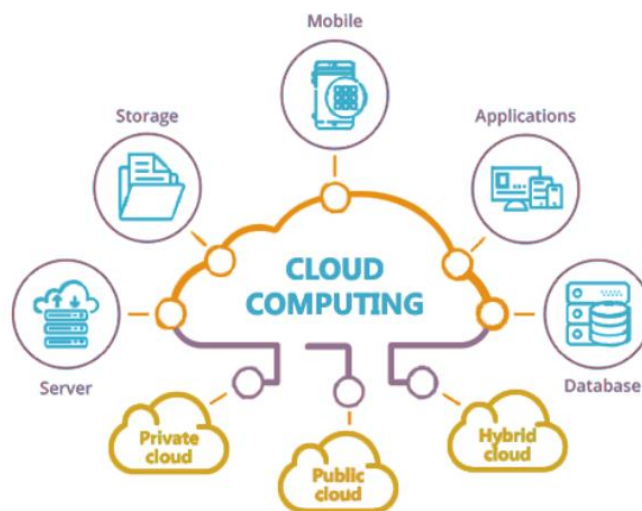
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### INSTRUCTIONS

This report is made to outline the information regarding 'Globus, Azure, IBM Cloud, Amazon Cloud, Samsung Cloud, iCloud.'

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## Cloud & Cloud Computing

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## Cloud

"The cloud" refers to servers that are accessed over the Internet, and the software and databases that run on those servers. Cloud servers are located in data centers all over the world. By using cloud computing, users and companies do not have to manage physical servers themselves or run software applications on their own machines. The cloud enables users to access the same files and applications from almost any device, because the computing and storage takes place on servers in a data center, instead of locally on the user device. Therefore, a user can log in to their Instagram account on a new phone after their old phone breaks and still find their old account in place, with all their photos, videos, and conversation history. It works the same way with cloud email providers like Gmail or Microsoft Office 365, and with cloud storage providers like Dropbox or Google Drive.

For businesses, switching to cloud computing removes some IT costs and overhead: for instance, they no longer need to update and maintain their own servers, as the cloud vendor they are using will do that. This especially makes an impact for small businesses that may not have been able to afford their own internal infrastructure but can outsource their infrastructure needs affordably via the cloud. The cloud can also make it easier for companies to operate internationally, because employees and customers can access the same files and applications from any location.



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# Cloud Computing

## **What is cloud computing, in simple terms?**

Cloud computing is the delivery of on-demand computing services -- from applications to storage and processing power -- typically over the internet and on a pay-as-you-go basis.

## **How does cloud computing work?**

Rather than owning their own computing infrastructure or data centers, companies can rent access to anything from applications to storage from a cloud service provider.

One benefit of using cloud computing services is that firms can avoid the upfront cost and complexity of owning and maintaining their own IT infrastructure, and instead simply pay for what they use, when they use it.

In turn, providers of cloud computing services can benefit from significant economies of scale by delivering the same services to a wide range of customers.

## **What cloud computing services are available?**

Cloud computing services cover a vast range of options now, from the basics of storage, networking, and processing power through to natural language processing and artificial intelligence as well as standard office applications. Pretty much any service that doesn't require you to be physically close to the computer hardware that you are using can now be delivered via the cloud.

## **What are examples of cloud computing?**

Cloud computing underpins a vast number of services. That includes consumer services like Gmail or the cloud back-up of the photos on your smartphone, though to the services which allow large enterprises to host all their data and run all of their applications in the cloud. Netflix relies on cloud computing services to run its video streaming service and its other business systems too, and have a number of other organizations.

Cloud computing is becoming the default option for many apps: software vendors are increasingly offering their applications as services

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over the internet rather than standalone products as they try to switch to a subscription model. However, there is a potential downside to cloud computing, in that it can also introduce new costs and new risks for companies using it.

### **Why is it called cloud computing?**

A fundamental concept behind cloud computing is that the location of the service, and many of the details such as the hardware or operating system on which it is running, are largely irrelevant to the user. It's with this in mind that the metaphor of the cloud was borrowed from old telecoms network schematics, in which the public telephone network (and later the internet) was often represented as a cloud to denote that the just didn't matter -- it was just a cloud of stuff. This is an over-simplification of course; for many customers location of their services and data remains a key issue.

### **What is the history of cloud computing?**

Cloud computing as a term has been around since the early 2000s, but the concept of computing-as-a-service has been around for much, much longer -- as far back as the 1960s, when computer bureaus would allow companies to rent time on a mainframe, rather than have to buy one themselves.

These 'time-sharing' services were largely overtaken by the rise of the PC which made owning a computer much more affordable, and then in turn by the rise of corporate data centers where companies would store vast amounts of data.

But the concept of renting access to computing power has resurfaced again and again -- in the application service providers, utility computing, and grid computing of the late 1990s and early 2000s. This was followed by cloud computing, which really took hold with the emergence of software as a service and hyperscale cloud computing providers such as Amazon Web Services.

### **What are the main service models of cloud computing?**

**Software-as-a-Service (SaaS):** Instead of users installing an application on their device, SaaS applications are hosted on cloud servers, and users access them over the Internet. SaaS is like renting a house: the landlord maintains the house, but the tenant mostly gets to use it as if they owned

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it. Examples of SaaS applications include Salesforce, MailChimp, and Slack.

**Platform-as-a-Service (PaaS):** In this model, companies don't pay for hosted applications; instead, they pay for the things they need to build their own applications. PaaS vendors offer everything necessary for building an application, including development tools, infrastructure, and operating systems, over the Internet. PaaS can be compared to renting all the tools and equipment necessary for building a house, instead of renting the house itself. PaaS examples include Heroku and Microsoft Azure.

**Infrastructure-as-a-Service (IaaS):** In this model, a company rents the servers and storage they need from a cloud provider. They then use that cloud infrastructure to build their applications. IaaS is like a company leasing a plot of land on which they can build whatever they want — but they need to provide their own building equipment and materials. IaaS providers include Digital Ocean, Google Compute Engine, and OpenStack.

Formerly, SaaS, PaaS, and IaaS were the three main models of cloud computing, and essentially all cloud services fit into one of these categories. However, in recent years a fourth model has emerged:

**Function-as-a-Service (FaaS):** FaaS, also known as serverless computing, breaks cloud applications down into even smaller components that only run when they are needed. Imagine if it were possible to rent a house one little bit at a time: for instance, the tenant only pays for the dining room at dinner time, the bedroom while they are sleeping, the living room while they are watching TV, and when they are not using those rooms, they don't have to pay rent on them.

FaaS or serverless applications still run on servers, as do all these models of cloud computing. But they are called "serverless" because they do not run on dedicated machines, and because the companies building the applications do not have to manage any servers.

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## Cloud computing advantages and disadvantages

Cloud computing is not necessarily cheaper than other forms of computing, just as renting is not always cheaper than buying in the long term. If an application has a regular and predictable requirement for computing services, it may be more economical to provide that service in-house.

Some companies may be reluctant to host sensitive data in a service that is also used by rivals. Moving to a SaaS application may also mean you are using the same applications as a rival, which may make it hard to create any competitive advantage if that application is core to your business.

While it may be easy to start using a new cloud application, migrating existing data or apps to the cloud may be much more complicated and expensive. And it seems there is now something of a shortage in cloud skills with staff with DevOps and multi-cloud monitoring and management knowledge in particularly short supply.

In one recent report a significant proportion of experienced cloud users said that they thought upfront migration costs ultimately outweigh the long-term savings created by IaaS.

And of course, you can only access your applications if you have an internet connection.

## Cloud Platforms

There are the following 4 types of cloud that you can deploy according to the organization's needs.

Public Cloud-Public cloud platforms are third-party providers that deliver computing resources over the Internet. Examples include AWS, Google Cloud Platform, Alibaba, Microsoft Azure etc.



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Private Cloud- A private cloud platform is exclusive to a single organization. It's in an on-site data center or hosted by a third-party service provider.

Hybrid Cloud-It is a combination of public and private cloud platforms. Data and applications move seamlessly between these two.

Community Cloud-Community cloud allows systems and services to be accessible by a group of several organizations to share the information between the organization and a specific community. It is owned, managed, and operated by one or more organizations in the community, a third party, or a combination of them.

## Globus

Globus is a cloud-based service designed to let users move, share, and discover research data via a single interface, regardless of its location or number of files or size.

Globus was developed and is maintained at the University of Chicago and is used extensively at supercomputer centers and major research facilities.

With Globus, subscribers can **move, share, & discover data** via a single interface – whether your files live on a supercomputer, lab cluster, tape archive, public cloud, or your laptop, you can manage this data from anywhere, using your existing identities, via just a web browser.

Developers can also use Globus to **build applications and gateways** leveraging our advanced identity management, single sign-on, search, authorization, and automation capabilities.

### What can we do with Globus?

- **Transfer files:** From kilobytes to petabytes, with Globus you can efficiently, reliably, and securely move data between systems within your site or across an ocean
- **Share files with others:** All you need is an email address to share data with colleagues – Globus manages authentication and access

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- **Develop applications and gateways:** Globus's open REST APIs and Python SDK empower you to create an integrated ecosystem of research data services, applications, and workflows

### Who uses Globus?

- **Researchers** at hundreds of universities, national labs, government facilities, and other research institutions – plus a growing number of commercial companies – use Globus routinely as they work with data
- **Research computing managers and IT groups** depend on Globus to make storage more accessible for their researchers, and to monitor and report on storage system usage
- **Developers** use Globus to automate data workflows and build custom web applications—such as science gateways and searchable data portals—as well as mobile, desktop, and command line applications and services.

### Why should we care?

Globus removes data management roadblocks and headaches by providing unified access to all storage locations – in short, Globus makes it much easier to work with data, while ensuring security and reliability. When researchers (and the IT teams who support them) can worry less about moving and sharing their data, authenticating new users or connecting new storage systems, they can focus more time and energy on research.

Globus is supported by an expert team with decades of research data management experience, so users have first-rate support plus access to professional services for custom projects.

### Why Use Globus?

- Globus transfer and sharing are easy, fast, secure, and reliable. Sites around the world rely on Globus for research data management, freeing users to spend more time on research.
- Globus presents a secure, unified interface to identities and storage across Globus-connected sites, within the visibility and access control limits set by each site. Globus makes life easier for researchers with data on multiple systems and for system administrators who must support collaboration while maintaining secure systems.

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- Globus is software as a service (SaaS), enabled by the cloud and built with widely adopted industry standards. Globus works with your existing systems and storage.
  - Globus was developed by researchers, for researchers. Computer scientists at the University of Chicago and Argonne National Laboratory purpose-built the Globus services to meet the needs and requirements of the research community. Dedicated professionals provide commercial-quality software and user support. The Globus team is committed to sustainably supporting science, not to making a profit.

## Azure

### What is Microsoft Azure?

Microsoft has leveraged its constantly expanding worldwide network of data centers to create Azure, a cloud platform for building, deploying, and managing services and applications, anywhere. Azure lets you add cloud capabilities to your existing network through its platform as a service (PaaS) model or entrust Microsoft with all your computing and network needs with Infrastructure as a Service (IaaS). Either option provides secure, reliable access to your cloud hosted data—one built on Microsoft's proven architecture. Azure provides an ever-expanding array of products and services designed to meet all your needs through one convenient, easy to manage platform. Below are just some of the capabilities Microsoft offers through Azure and tips for determining if the Microsoft cloud is the right choice for your organization.

### What can Microsoft Azure Do?

Microsoft maintains a growing directory of Azure services, with more being added all the time. All the elements necessary to build a virtual network and deliver services or applications to a global audience are available, including:

- Virtual machines

Create Microsoft or Linux virtual machines (VMs) in just minutes from a wide selection of marketplace templates or from your own

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custom machine images. This cloud based VMs will host your apps and services as if they resided in your own data center.

- SQL databases

Azure offers managed SQL relational databases, from one to an unlimited number, as a service. This saves you overhead and expenses on hardware, software, and the need for in-house expertise.

- Azure Active Directory Domain services

Built on the same proven technology as Windows Active Directory, this service for Azure lets you remotely manage group policy, authentication, and everything else. This makes moving and existing security structure partially or totally to the cloud as easy as a few clicks.

- Application services

With Azure it's easier than ever to create and globally deploy applications that are compatible on all popular web and portable platforms. Reliable, scalable cloud access lets you respond quickly to your business's ebb and flow, saving time and money. With the introduction of Azure Web Apps to the Azure Marketplace, it's easier than ever to manage production, testing and deployment of web applications that scale as quickly as your business. Prebuilt APIs for popular cloud services like Office 365, Salesforce and more greatly accelerate development.

- Visual Studio team services

An add-on service available under Azure, Visual Studio team services offer a complete application lifecycle management (ALM) solution in the Microsoft cloud. Developers can share and track code changes, perform load testing, and deliver applications to production while collaborating in Azure from all over the world. Visual Studio team services simplify development and delivery for large companies or new ones building a service portfolio.

- Storage

Count on Microsoft's global infrastructure to provide safe, highly accessible data storage. With massive scalability and an intelligent pricing structure that lets you store infrequently accessed data at a

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huge savings, building a safe and cost-effective storage plan is simple in Microsoft Azure.

### **Why are people trusting their workloads to Microsoft Azure?**

It's been said that the on-premises data center has no future. Like mainframes and dial-up modems before them, self-hosted data centers are becoming obsolete, being replaced by increasingly available and affordable cloud solutions. Several important players have emerged in the cloud service sphere, including Amazon Web Services (AWS), perennial computing giant IBM, and Apple's ubiquitous iCloud, which holds the picture memories and song preferences of hundreds of millions of smartphone users, among other data. With so many options, why are companies like 3M, BMW, and GE moving workloads to Microsoft Azure? Just some of the reasons:

- **Flexibility**

With Microsoft Azure you can spin up new services and geometrically scale your data storage capabilities on the fly. Compare this to a static data center, which would require new hardware and OS purchasing, provisioning, and deployment before additional power could be brought to bear against your IT challenges. This modern flexibility makes Azure a tempting solution for organizations of any size.

- **Cost**

Azure solutions don't just make it faster and easier to add and scale infrastructure, they make it cheaper. Physical services and infrastructure devices like routers, load balancers and more quickly add up to thousands or even hundreds of thousands of dollars. Then there's the IT expertise required to run this equipment, which amounts to major payroll overhead. By leveraging Microsoft's massive infrastructure and expertise, Azure can trim our annual IT budget by head-turning percentages.

- **Applications**

With a la carte service offerings like Visual Studio Team Services, Visual Studio Application Insights, and Azure's scalable, on-demand storage for both frequently accessed and 'cold' data, Microsoft makes developing and testing mission-critical apps a snap. Move an application from test to production mode on the fly across a globally distributed network. Microsoft also offers



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substantial licensing discounts for migrating their existing apps to Azure, which represents even more opportunity for savings.

- Disaster recovery

Sometimes the unthinkable becomes the very immediate reality. Another advantage of Microsoft Azure lay in its high-speed and geographically decentralized infrastructure, which creates limitless options for disaster recovery plans. Ensure that your critical application and data can run from redundant sites during recovery periods that last minutes or hours instead of days. Lost time is lost business, and with Azure you can guarantee continuous service delivery even when disaster strikes.

The combination of Microsoft's vast infrastructure, constant application and services development, and powerful presence in the global IT marketplace has made Microsoft Azure solutions the choice of two-thirds of the world's Fortune 500 companies. But the infinite scalability of Azure can make it just as right for your small personal business.

## IBM Cloud

**IBM Cloud**, (formerly known as **Bluemix**) is a set of cloud computing services for business offered by the information technology company IBM.

The service supports several programming languages and services as well as integrated DevOps to build, run, deploy and manage applications on the cloud. Natively supported languages including Java, Node.js, Go, PHP, Swift, Python, Ruby Sinatra, and Ruby on Rails, and functionality can be extended to support other languages such as Scala through the use of build packs.

When it comes to public cloud computing vendors, IBM doesn't always enjoy the same mindshare as Amazon Web Services (AWS), Microsoft Azure and Google Cloud Platform. However, some analyst reports have claimed that IBM has a larger share of the infrastructure as a service (IaaS) and platform as a service (PaaS) market than Google. Other analyses place it solidly in fourth place behind the "big three." Either way, IBM is one of the largest cloud computing providers on the planet.

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Telling the story of IBM's public cloud computing capabilities is complicated by the fact that IBM uses a lot of different brand names for its cloud services. The "IBM Cloud" label is an umbrella category that encompasses its hardware, software, and services for helping enterprises build private clouds, as well as its Bluemix public cloud services. The "Bluemix" name used to be reserved for IBM's PaaS services for developers, but now Bluemix also offers some IaaS services.

In addition, IBM has another IaaS service called SoftLayer. Organizations can still purchase cloud computing services under the SoftLayer brand name, but IBM seems to be migrating toward the Bluemix brand. These days the company describes SoftLayer as the infrastructure that forms "the core of IBM Bluemix," and the "about us" link on the SoftLayer website takes you to the Bluemix site.

If all that weren't confusing enough, over the years IBM has used a number of other brand names for its cloud services, including Cloudburst, Smart Business and SmartCloud.

## **IBM Cloud Services**

Because IBM seems to be focusing more attention on Bluemix than SoftLayer, this list will cover its Bluemix offerings rather than those available through SoftLayer. The company divides its Bluemix Services into twelve categories:

1. Compute Infrastructure — includes its bare metal servers (single-tenant servers that are highly customizable), virtual servers, GPU computing, POWER servers (based on IBM's POWER architecture) and server software
2. Compute Services — includes Open Whisk serverless computing, containers and Cloud Foundry runtimes
3. Storage — includes object, block and file storage, as well as server-backup capabilities

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4.Network — includes load balancing, Direct Link private secure connections, network appliances, content delivery network and domain services

5.Mobile — includes IBM's Swift tools for creating iOS apps, its MobileFirst Starter package for getting a mobile app up and running, and its Mobile Foundation app back-end services

6.Watson — includes IBM's artificial intelligence and machine learning services, which it calls "cognitive computing," such as Discovery search and content analytics, Conversation natural language services and speech-to-text

7.Data and analytics — includes data services, analytics services, big data hosting, Cloudera hosting, MongoDB hosting and Risk hosting

8.Internet of Things — includes IBM's IoT platform and its IoT starter packages

9.Security — includes tools for securing cloud environments, such as a firewall, hardware security modules (physical devices with key management capabilities), Intel Trusted Execution Technology, security software and SSL certificates

10.DevOps — includes the Eclipse IDE, continuous delivery tools and availability monitoring

11.Application services — includes Blockchain, Message hub and business rules, among others

12.Integration — includes tools for building virtual bridges for hybrid cloud and multi-cloud environments, such as API Connect and Secure Gateway

## **WHY YOU SHOULD CHOOSE IBM CLOUD?**

The IBM Cloud has a few unique offerings that its competitors can't match. For example, it is the only major cloud vendor that emphasizes its bare metal servers, which can be very attractive for organizations that have performance or security requirements. IBM also gives organizations a lot of flexibility and customization options that the other vendors don't have. On the downside, it can take up to several hours to configure and

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deploy a custom server, so these options don't offer the same speed as AWS, Azure or Google.

IBM also stands out in some other areas, like its cutting-edge blockchain offering, and its Watson cognitive computing capabilities. Ever since its Watson technology appeared on the television game show Jeopardy, IBM has been garnering attention for its artificial intelligence capabilities — although it does face stiff competition from Google and others.

Organizations that already use IBM technology, such as Power8 servers or IBM software, in their data centers will likely be drawn to the IBM Cloud in the same way that Microsoft users are drawn to Azure. The company has made significant investment in enabling hybrid cloud computing, and many of its cloud management and security tools work across hybrid and multi-cloud environments.

Gartner has noted, "Customers report positive experiences of IBM's Bluemix support and their business relationship. Strategic support of the hybrid deployment model and the broad spectrum of platform choices, from hosted to cloud-native, are well-suited to the variety of cloud migration strategies used by IBM customers." Similarly, in a survey conducted by Cowen & Co., IBM scored high for the quality of its IT support, but those surveyed cited its cost as a weakness.

## **Advantages and disadvantages of IBM Cloud**

### **Advantages**

For example, it is the only major cloud vendor that emphasizes its bare metal servers, which can be very attractive for organizations that have performance or security requirements. IBM also gives organizations a lot of flexibility and customization options that the other vendors don't have. On the downside, it can take up to several hours to configure and deploy a custom server, so these options don't offer the same speed as AWS, Azure or Google.

### **Disadvantages**

If you need to set up a short-term cloud computing instance in a hurry, IBM probably isn't the vendor for you. Where the other cloud vendors can spin up instances in seconds or minutes, it can take up to four hours to configure a Bluemix bare metal server. While the flexibility and customization possibilities make that time lag acceptable in some situations, it probably wouldn't be the best choice for a team setting up

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a quick dev or test environment that they only plan to use for a few hours or days.

## Amazon Cloud

Amazon Web Services (AWS) is a secure cloud services platform, offering compute power, database storage, content delivery and other functionality to help businesses scale and grow.

In simple words AWS allows you to do the following things-

- 1)Running web and application servers in the cloud to host dynamic websites.
- 2)Securely store all your files on the cloud so you can access them from anywhere.
- 3)Using managed databases like MySQL, PostgreSQL, Oracle or SQL Server to store information.
- 4)Deliver static and dynamic files quickly around the world using a Content Delivery Network (CDN).
- 5)Send bulk email to your customers.
- 6)Compute: EC2 (Elastic Compute Cloud) , LightSail, ECS (Elastic Container Service) , EKS (Elastic Container Service for Kubernetes), Lambda, Batch, Elastic Beanstalk
- 7)Storage: S3 (Simple Storage Service), EFS (Elastic File System) , Glacier, Storage Gateway
- 8)Databases: RDS (Relational Database Service), DynamoDB, ElastiCache, Neptune, Redshift
- 9)Migration: DMS (Database Migration Service), SMS (Server Migration Service), Snowball
- 10)Networking & Content Delivery: VPC (Virtual Private Cloud), CloudFront, Route53, Direct Connect, API Gateway
- 11)Developer Tools: CodeStar, CodeCommit, CodeBuild, CodeDeploy, CodePipeline, Cloud9, X-Ray



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12) Security, Identity, and Compliance: IAM (Identity and Access Management), Inspector, Certificate Manager, Directory Service, WAF (Web Application Firewall) and etc.

13) Analytics: Athena, EMR (Elastic Map Reduce), CloudSearch, ElasticSearch, Kinesis and etc.

### **Advantages and disadvantages of Amazon Cloud**

Advantages:

- User-friendly - AWS is easy to use as the platform is specially designed for quick and secure access. Users can modify their data whenever they want, wherever they want.
- Flexible - It always lets you use those operating systems, programming languages, and web application platforms that you are comfortable with.
- Secure - Data protection, Identity and access management, Infrastructure protection, Threat detection and continuous monitoring, Compliance and data privacy.
- Cost-effective - AWS offers a pay-as-you-go pricing method.
- Scalable and Elastic - the AWS Auto Scaling service automatically increases the capacity of constrained resources as per requirements so that the application is always available.
- Highly Performant - AWS always lets you know how many resources you are using at the moment.

Disadvantages:

- Limitations - The problem comes when default resource limits vary from region to region.
- Lack of Experts - Only a few professionals are skilled in AWS or any cloud provider.
- Price Variations
- General Issues

## **Samsung Cloud**

It is possible to create backups of your data or free up local storage space on your Samsung smartphone using Samsung Cloud, which is a cloud storage service that allows you to save apps, music, and other

things online. Mobile cloud storage is a form of cloud storage that is accessible on mobile devices such as laptops, tablets, and smartphones. Mobile cloud storage providers offer services that allow the user to create and organize files, folders, music, and photos, like other cloud computing models. Services are used by both individuals and companies. Most cloud file storage providers offer limited free use but charge for additional storage once the free limit is exceeded. These costs are usually charged as a monthly subscription rate and have different rates depending on the amount of storage desired. Samsung Cloud is a cloud storage service that allows owners of Samsung devices to create copies of their data or free up local storage space for apps, music and other files.

### **How Samsung Cloud works?**

Making backups of your data and freeing up local storage space on your Samsung smartphone is feasible with Samsung Cloud, which is a cloud storage service that allows you to keep apps, music, and other items online and access them from any device.

As a result of this reduction in availability, Samsung plans to remove the option to save photographs and files off-device, which will be the first step in the process of phasing out the service.

Eventually, users will only be able to save lightweight information on the Samsung Cloud platform such as contact information, calendar appointments, and notes.

Backup is for automatically backing up your documents, pictures, and files to your Samsung Cloud account.

Sync-Data synchronization is the ongoing process of synchronizing data between two or more Samsung devices.

Restore-Data restore is the process of copying backup data from secondary storage and restoring it to its original location or a new location.

## **iCloud**

## **Find My iPhone**

Find My iPhone, formerly part of MobileMe, allows users to track the location of their iOS device or Mac. A user can see the device's approximate location on a map (along with a circle showing the radius depicting the margin of error), display a message and/or play a sound on the device (even if it is set to silent), change the password on the device, and remotely erase its contents. The feature was first announced on June 10, 2009, and was included in the iOS 3.0 software update as a feature for paying MobileMe users. Find My iPhone was made free of charge with the iOS 4.2.1 software update on November 22, 2010, but only for devices introduced in 2010. An iOS app was also released by Apple on June 18, 2010, which allows users to locate their device from other iOS devices running iOS 4 or later software. In iOS 5, Find My iPhone was continued as a feature for iCloud. iOS 6 introduced Lost Mode, a new feature that allows the user to mark a device as "lost", making it easier to protect and find. The feature also allows someone that finds the user's lost iPhone to call the user directly without unlocking it. Similar phone finder services under various names are available for other families of smartphones.

Activation Lock was introduced in 2013 with iOS 7. It is integrated with iCloud and Find My iPhone feature. This new feature locks the activation of any iPhone, iPad, iPod touch or Apple watch which has been restored in either DFU or Recovery mode without first disabling the Find My iPhone feature. Once restore is completed, the device will ask for the Apple ID and password that has been previously associated with it, to proceed with activation, ultimately preventing any stolen device from being usable.

As of iOS 9, Find my iPhone is a built-in app, and thus cannot be removed.

In iOS and iPadOS 13, Both Find my iPhone and Find My Friends have been removed in favour of Find My.

## **iCloud Keychain**

iCloud Keychain is a password manager developed by Apple that syncs passwords across devices and suggests secure ones when creating new accounts.

iCloud Keychain backups provide different security guarantees than traditional iCloud backups. This is because iCloud Keychain uses "end-to-end encryption", meaning that iCloud Keychain backups are designed so that the provider does not have access to unencrypted data. This is accomplished through the use of a novel "key vault" design based on a Hardware Security Module located in Apple's data centers.

## **iTunes Match**

iTunes Match debuted on November 14, 2011. It was initially available to US users only. For an annual fee, customers can scan and match tracks in their iTunes music library, including tracks copied from CDs or other sources, with tracks in the iTunes Store, so customers do not have to repurchase said tracks. Customers may download up to 100,000 tracks in 256 kbit/s DRM-free AAC file format that matches tracks in any supported audio file formats in customers' iTunes libraries, including ALAC and MP3. Customers also have the choice to keep their original copies stored on their computers or have them replaced by copies from the iTunes Store. Any music not available in the iTunes Store is uploaded for download onto customers' other supported devices and computers; doing this will not take storage from the customers' iCloud's storage allowance. Any such tracks stored in the higher quality lossless audio ALAC, or original uncompressed PCM formats, WAV and AIFF, are transcoded to 256 kbit/s DRM-free AAC format before uploading to the customers' iCloud storage account, leaving the original higher quality local files in their original format.

If a user stop paying for the iTunes Match service, all copies of the DRM-free AAC iTunes Store versions of tracks that have already been downloaded onto any device can be kept, whether on iOS devices or computers.

From iOS 7 and OS X Mavericks, the iTunes Radio function will be available across devices, including integration with the Music app, both on portable iOS devices and Apple TV (2nd generation onwards), as well as inside the iTunes app on Macintosh and Windows computers. It will be included in an ad-free version for subscribers to the iTunes Match service and is currently available only in the US and Australia.

The streaming Genius shuffle is not available in current <sup>11</sup> versions of iOS but is available in iTunes on the Mac.

On January 28, 2016, ad-free iTunes Radio was discontinued and is therefore no longer part of iTunes Match.

As of March 26, 2014, iTunes Match is available in 116 countries, while iTunes in the Cloud is available in 155 countries.

## **iWork for iCloud**

During the 2013 Apple Worldwide Developers Conference (WWDC) keynote speech, iWork for iCloud was announced for release at the same time as the next version of the app versions of iWork later in the year. The three apps for both iOS and macOS that form Apple's iWork suite (Pages, Numbers, and Keynote), will be made

available on a web interface (named as Pages for iCloud, Numbers for iCloud, and Keynote for iCloud respectively), and accessed via the iCloud website under each user's iCloud Apple ID login. They will also sync with the user's iOS and macOS versions of the app, should they have them, again via their iCloud Apple ID.

This allows the user to edit and create documents on the web, using one of the supported browsers: Safari, Chrome, and Microsoft Edge. It also means that Microsoft Windows users now have access to these native – previously only Apple device– document editing tools, via the web interface.

## **Photo Stream**

Photo Stream is a service supplied with the basic iCloud service which allows users to store the most recent 1,000 photos on the iCloud servers for up to 30 days free of charge. When a photo is taken on a device with Photo Stream enabled, it is automatically uploaded to the iCloud servers. From there, it becomes available for viewing and saving on the rest of the user's Photo Stream-enabled devices. The photo is automatically removed from the server after 30 days or when it becomes photo number 1,001 in the user's stream. Photo Stream installed on a Mac or Windows desktop computer includes an option to have all photos permanently saved on that device. The service is also integrated with Apple TV, allowing users to view their recent photos wirelessly on their HDTV.

## **iCloud Photos**

iCloud Photos is a feature on iOS 8.1 or later and OS X Yosemite (version 10.10) or later, plus web app access. The service stores all of the user's photos, maintaining their original resolution and metadata. Users can access their iCloud Photos on supported devices via the new Photos app when available or via the iCloud Photos web app at iCloud.com, which helps limit the amount of local storage each device needs to use to store photos (particularly those with smaller storage capacities) by storing lower-resolution versions on the device, with the user having the option to keep some/all stored locally at a higher resolution.

## **Storage**

Since its introduction in 2011, each account has 5 GB of free storage for owners of either an iOS device using iOS 5.x or later, or a Mac using OS X Lion 10.7 or later. Users can purchase additional storage for a total of 50 GB, 200 GB or 2 TB. The amount of storage is shared across all devices per iCloud Apple ID.



Several native features of iCloud use each user's iCloud storage allowance, specifically, Backup and restore, and email, Contacts, and Calendars. On Macs, users can also store most filetypes into iCloud folders of their choosing, rather than only storing them locally on the machine. While Photo Stream uses the iCloud servers, usage does not come out of the user's iCloud storage allowance. This is also true for iTunes Match music content, even for music that is not sold in the iTunes Store, and which gets uploaded into iCloud storage, it does not count against the user's allowance. Other apps can optionally integrate app storage out of the user's iCloud storage allowance.

Not all a user's content counts as part of their iCloud storage allowance. Apple can keep a permanent track of every purchase a user makes under their Apple ID account, and by associating each piece of content with the user, it means only one copy of every Store item is needed to be kept on Apple's servers. For items bought from the iTunes Store (music, music videos, movies, TV shows), Apple Books Store (books), or App Store (iOS apps), this uses a service Apple call iTunes in the Cloud, allowing the user to automatically, or manually if preferred, re-download any of their previous purchases on to a Mac, PC, or iOS device. Downloaded (or streamed, provided the user is connected to the Internet) iTunes Store content can be used across all these devices, however, while Apple Books Store and App Store content can be downloaded to Macs and PCs for syncing to iOS devices, only iOS and Mac devices (and their respective apps) can be used to read the books. Similarly, macOS apps purchased from the Mac App Store are also linked to the Apple ID they were purchased through and can be downloaded to any Mac using the same Apple ID. Also, when a user registers any new device, all previously bought Store content can be downloaded from the Store servers or non-Store content from the iCloud servers.

Audiobooks and their metadata fields from non-Apple purchased sources are not synced across devices (macOS or iOS) inside the Apple Books apps, and nor does the metadata from non-Apple purchased books (in Ebook or PDF format). There remains a syncing mismatch on some types of media, between Apple-purchased content and non-Apple purchased content that remains in effect for iCloud users.

## **iCloud Drive**

iCloud Drive is iCloud's file hosting service, that syncs files across devices running iOS 8, OS X Yosemite (version 10.10), or Windows 7 or later, plus online web app access via iCloud.com. Users can store any kind of file (including photos, videos, documents, music, and other apps' data) in iCloud Drive and access it on any Mac, iPad, iPhone, iPod Touch,

or Windows PC, with any single file being a maximum of 50 GB in file size (earlier it was 15 GB). This allows users to start their work on one device and continue on another device. By default, users still get 5 GB of storage for free as previously, but the expandable storage plans available have increased in size (current tiers: 50 GB, 200 GB, and 2 TB), and altered to monthly subscription payment options from the yearly ones offered under the previous MobileMe service.

In iOS 11, iCloud Drive has been integrated into the new Files app that gives users access to all their cloud and local on-device storage, which replaced the standalone iCloud Drive app.

### **Messages on iCloud**

Messages on iCloud is a feature on iOS 11.4 and macOS High Sierra 10.13.5 which keeps all a user's iMessages and SMS texts stored in the cloud.<sup>[64]</sup>

### **Private Relay**

Private Relay, an iCloud+ feature currently on beta, allows users to browse Safari privately, like a virtual private network. The Private Relay feature is not available in China, Belarus, Colombia, Egypt, Kazakhstan, Saudi Arabia, South Africa, Turkmenistan, Uganda, and the Philippines, but this may vary over time.

### **Hide My Email**

Hide My Email is available to iCloud+ users and allows users in Mail and Safari to generate temporary Apple email addresses which forward messages to their main email address.

### **Custom email domain**

Custom email domains, an iCloud+ feature, allows users to personalize their email address with a custom domain name and invite family members to use the same domain with their iCloud Mail accounts.

### **Criticism**

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iCloud has been criticized by third-party developers for bugs that make some features nearly unusable under earlier versions of iOS and macOS, specifically the use of Core Data in iCloud, for storing and syncing larger amounts of data between third-party apps on users' devices. Third-party developers have reported that the changes implemented in the release of iOS 7 and OS X Mavericks (version 10.9) address these iCloud criticisms.

### **Name dispute**

iCloud Communications, a telecommunications company in Arizona, sued Apple in June 2011 for trademark infringement shortly after Apple announced iCloud. The lawsuit was filed in the US District Court of Arizona and demanded that Apple stop using the iCloud name and pay unspecified monetary damages. iCloud Communications changed its name to Clear Digital Communications in August 2011 and dropped its lawsuit against Apple shortly thereafter.

## **Privacy**

Apple's iCloud service, including iCloud Drive and iOS device backups, does not provide end-to-end encryption, also known as client-side encryption, and without end-to-end encryption, users' information is left unsecured because it remains easily accessible to unauthorized persons. Furthermore, Apple reserves the right to and admits to scanning user data for illegal content.

In August 2014, it was rumored that hackers had discovered an exploit involving the Find My iPhone service, which potentially allowed an attacker to brute-force a user's Apple ID and access their iCloud data. The exploit was later incorrectly rumored to have been used as part of an August 2014 leak of many private, nude photos of celebrities that had been synced to their iCloud storage from their iPhone. Apple confirmed that it was working with law enforcement agencies to investigate the leak. Apple subsequently denied that the iCloud service itself or the alleged exploit was responsible for the leak, asserting that the leaks were the result of a very targeted phishing attack against the celebrities. On September 13, 2014 Tim Cook, while being interviewed by Charlie Rose, stated on camera that the celebrity leaks were not an iCloud exploit at all, but rather the celebrities had been phished by very targeted phishing to trick them out of their login credentials.

Apple has been scanning iCloud Mail for CSAM information starting 2019. On August 5, 2021, Apple confirmed it has planned to be started scanning iCloud Photos for the same reason. After receiving a public backlash against Apple scanning private photos, Apple announced it will collect further input before releasing new functionality.