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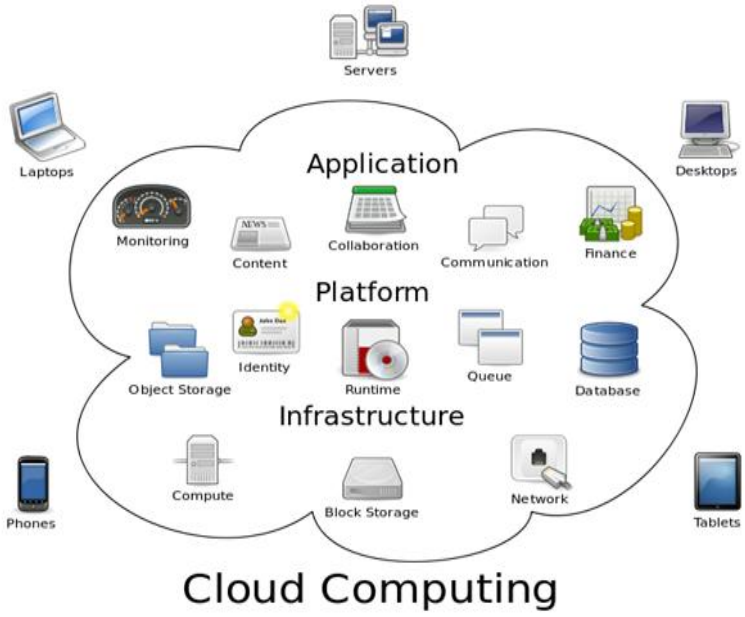
Cloud computing

Cloud computing is a type of **internet-based computing** that provides shared computer processing resources and data to computers and other devices on demand.

Cloud services and storage are accessible from anywhere in the world over an Internet connection.

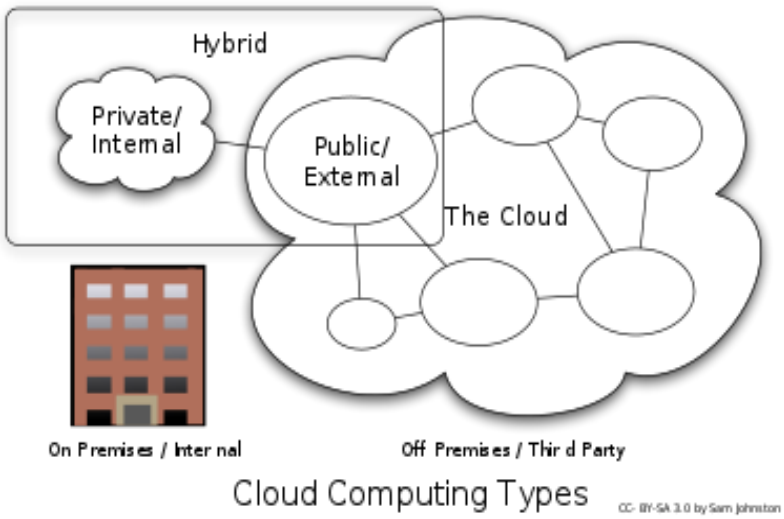
In cloud computing applications and files are hosted on a “cloud” consisting of thousands of computers and servers, all linked together and accessible via the internet.



Cloud computing is a computing paradigm, where a large pool of systems are connected in private or public networks, to provide dynamically scalable infrastructure for application, data and file storage.

Due to cloud computing, the cost of computation, application hosting, content storage and delivery is reduced.

It provide “reusability of IT capabilities”.



In other words, cloud computing is "a pool of abstracted, highly scalable, and managed compute infrastructure capable of hosting end customer applications and billed by consumption".

There are six key properties of cloud computing:

Cloud computing is user-centric : whatever is stored on cloud—documents, messages, images, applications, whatever—becomes yours. Any device that accesses your data in the cloud also becomes yours.

Task-centric : Instead of focusing on the application and what it can do, the focus is on what you need done and how the application can do it for you.

Powerful: cloud creates a wealth of computing power impossible with a single desktop PC.

Accessible : users can instantly retrieve more information from multiple repositories.

Intelligent :data mining and analysis are necessary to access that information in an intelligent manner.

Programmable : Many of the tasks necessary with cloud computing must be automated.

A Short History of Cloud Computing

Client/Server Computing: Centralized Applications and Storage

In the 1980s everything operated on the *client/server model.*

All the software applications, all the data, and all the control resided on huge mainframe computers, otherwise known as ***servers***.

Users connected to the server via a computer terminal, sometimes called a workstation or ***client***. when multiple people are sharing a single computer, even if that computer is a huge mainframe, you have to wait your turn.

Peer-to-Peer Computing: Sharing Resources

P2P computing defines a network architecture in which **each computer has equivalent capabilities and responsibilities.**

In the P2P environment, every computer is a client *and a server;* ***there are no masters and slaves.***

By recognizing all computers on the network as peers, P2P **enables direct exchange of resources and services.**

P2P was also a **decentralizing concept**.

Distributed Computing: Providing More Computing Power

One of the most important **subsets of the P2P model** is *distributed computing,* where **idle PCs across a network or across the Internet are tapped to provide computing power** for large, processor-intensive projects.

It's a simple concept, all about ***cycle sharing between multiple computers.***

Collaborative Computing: Working as a Group

In this, multiple users to work simultaneously on the same computer-based project.

The goal was (and is) to enable multiple users to collaborate on group projects online, in real time.

Most collaboration systems offer the complete range of audio/video options, for full-featured multiple-user video conferencing.

Cloud Computing: The Next Step in Collaboration

With the growth of the Internet, there was no need to limit group collaboration to a single enterprise's network environment.

Users from multiple locations within a corporation, and from multiple organizations, desired to collaborate on projects that crossed company and geographic boundaries.

To do this, projects had to be housed in the "cloud" of the Internet, and accessed from any Internet-enabled location.

people are using cloud services and storage to create, share, find, and organize information of all different types.

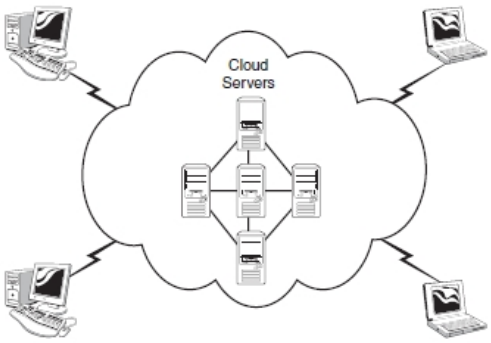
Cloud Architecture

The key to cloud computing is the "cloud"—a massive network of servers or even individual PCs interconnected in a grid.

The cloud is a collection of computers and servers that are publicly accessible via the Internet.

This hardware is typically owned and operated by a third party on a consolidated basis in one or more data center locations.

How users connect to the cloud.

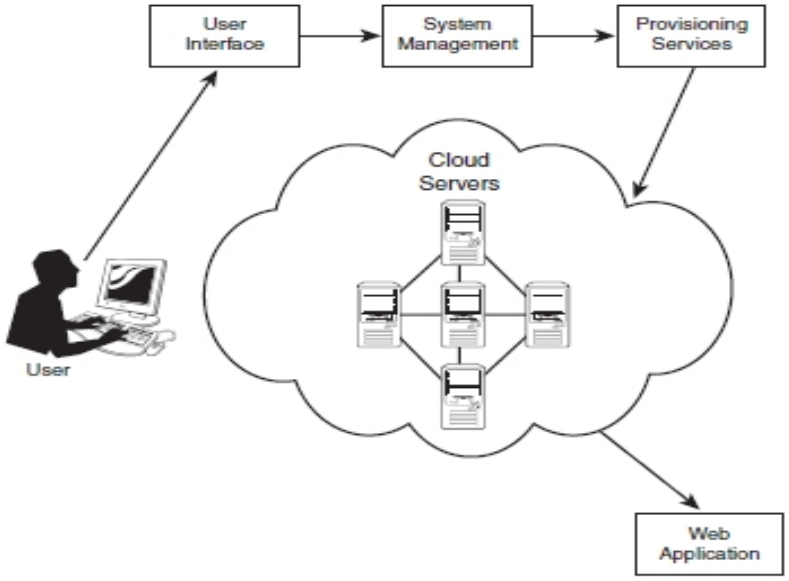


As shown in Figure , individual users connect to the cloud from their own personal computers or portable devices over the Internet.

To these individual users, the cloud is seen as a single application, device, or document.

The hardware in the cloud (and the operating system that manages the hardware connections) is invisible.

The architecture behind a cloud computing system.



All starts with the front-end interface seen by individual users.

This is how users select a task or service (either starting an application or opening a document).

The user's request then gets passed to the system management, which finds the correct resources and then calls the system's appropriate provisioning services.

These services carve out the necessary resources from the cloud, launch the appropriate web application, and either creates or opens the requested document.

After the web application is launched, the system's monitoring and metering functions track the usage of the cloud so that resources are apportioned and attributed to the proper user(s).

Cloud Storage

One of the **primary uses of cloud computing is for data storage**.

With *cloud storage, data is stored on multiple third-party servers, rather than on the dedicated* servers used in traditional networked data storage.

When storing data, the user sees **a *virtual server*—*that is,* *the* place doesn't exist in reality**.

In reality, the user's data could be stored on any one or more of the computers used to create the cloud.

The actual storage location may even differ from day to day or even minute to minute, as the cloud dynamically manages available storage space.

But even though **the location is virtual, the user sees a "static" location for his data**—and can actually manage his storage space as if it were connected to his own PC.

Cloud storage has both **financial** and **security**-associated advantages.

Financially, virtual resources in the cloud are typically cheaper than dedicated physical resources connected to a personal computer or network.

As for security, data stored in the cloud is secure from accidental erasure or hardware crashes, because it is duplicated across multiple physical machines;

since multiple copies of the data are kept continually, the cloud continues to function as normal even if one or more machines go offline.

If one machine crashes, the data is duplicated on other machines in the cloud.

Need of cloud computing

There are many implications of cloud technology, **for both developers** and **end users.**

For developers, cloud computing provides increased amounts of storage and processing power to run the applications they develop.

Cloud computing also enables new ways to access information, process and analyze data, and connect people and resources from any location anywhere in the world.

For end users, who using a web-based application isn't physically bound to a single PC, location or network. His applications and documents can be accessed wherever he is, whenever he wants.

Documents hosted in the cloud always exist, no matter what happens to the user's machine.

There's the benefit of group collaboration.

Cloud computing does all at lower costs.

Hardware doesn't have to be physically adjacent to a firm's office or data center.

Cloud infrastructure can be located anywhere.

Provide more processing power.

Advantages of Cloud Computing

1. **Lower-Cost Computers for Users :** Because the application runs in the cloud, not on thedesktopPC, that desktop PC doesn't need the processing power or hard disk spacedemanded by traditional desktop software. Hence the client computers incloud computing can be lower priced, with smaller hard disks, less memory,more efficient processors, and the like.
2. **Lower IT Infrastructure Costs :** Instead of investing in larger numbers of more powerful servers, the IT staff can use the computing power of the cloud to supplement or replace internal computing resources.
3. **Lower Software Costs :** Instead of purchasing separate software packages for each computer in the organization, only those employees actually using an application need access to that application in the cloud.
4. **Fewer Maintenance Issues :** With less hardware (fewer servers) necessary in the organization, maintenance costs are immediately lowered.
5. **Improved Performance :** computers in a cloud computing system will boot up faster and run faster, because they'll have fewer programs and processes loaded into memory.
6. **Improved Compatibility Between Operating Systems :** You can connect your Windows computer to the cloud and share documents with computers running Apple's Mac OS, Linux, or UNIX. In the cloud, the data matters, not the operating system.

7. **Improved Document Format Compatibility :** all documents created by web-based applications can beread by any other user accessing that application. There are no format incompatibilities when everyone is sharing docs and apps in the cloud.
8. **Increased Computing Power :** you can attempt greater tasks in the cloud than you can on your desktop.
9. **Increased Data Safety :** a computer crashing in the cloud doesn't affect the storage of your data. That's because data in the cloud is automatically duplicated, so nothing is ever lost.
10. **Instant Software Updates :** When the app is web-based, updates happen automatically and are available the next time the user logs in to the cloud. Whenever you access a web-based application, you're getting the latest version—without needing to pay for or download an upgrade.
11. **Easier Group Collaboration :** Sharing documents leads directly to collaborating on documents. The edits one user makes are automatically reflected in what the other users see onscreen. It's all possible, of course, because the documents are hosted in the cloud, not on any of your individual computers. All you need is a computer with an Internet connection, and you're collaborating.
12. **Universal Access to Documents :** With cloud computing, you don't take your documents with you. Instead, they stay in the cloud, where you can access them from anywhere you have a computer and an Internet connection.
13. **Unlimited Storage Capacity :** the cloud offers virtually limitless storage capacity.
14. **Latest Version Availability :** When you edit a document at home, that edited version is what you see when you access the document at work. The cloud always hosts the latest version of your documents; you're never in danger of having an outdated version on the computer you're working on.
15. **Removes the Tether to Specific Devices :** There's no need to buy a special version of a program for a particular device, or save your document in a device-specific format. Your documents and the programs that created them are the same no matter what computer you're using.

Disadvantages of Cloud Computing

1. **Requires a Constant Internet Connection :** Cloud computing is impossible if you can't connect to the Internet. Because you use the Internet to connect to both your applications and documents, if you don't have an Internet connection, you can't access anything, even your own documents.
2. **Doesn't Work Well with Low-Speed Connections :** Similarly, a low-speed Internet connection, such as that found with dial-up services, makes cloud computing painful at best and often impossible.
3. **Can Be Slow :** Even on a fast connection, web-based applications can sometimes be slower than accessing a similar software program on your desktop PC. That's because everything about the program, from the interface to the document you're working on, has to be sent back and forth from your computer to the computers in the cloud. If the cloud servers happen to be backed up at that moment, or if the Internet is having a slow day, you won't get the instantaneous accessyou're used to with desktop apps.
4. **Features Might Be Limited :** the feature set of Google Presentations with that of Microsoft PowerPoint; there's just a lot more you can do with PowerPoint than you can with Google's web-based offering. The basics are similar, but the cloud application lacks many of PowerPoint's advanced features.
5. **Stored Data Might Not Be Secure :** With cloud computing, all your data is stored on the cloud. That's all well andgood, but it is not secure in the cloud; beacuse, unauthorized users gain access to your confidential data.
6. **If the Cloud Loses Your Data, You're Screwed**: Theoretically, data stored in the cloud is unusually safe, replicated across multiple machines. But on the off chance that your data does go missing, you have no physical or local backup.

Cloud Services

Any web-based application or service offered via cloud computing is called a ***cloud service***. Cloud services can include anything from calendar and contact applications to word processing and presentations.

Cloud providers offer services that can be grouped into three categories:

i. **Software as a Service (SaaS)**
ii. **Platform as a Service (PaaS)**
iii. **Infrastructure as a Service (IaaS)**

Web based application

Cloud services, in the form of centralized web-based applications, also appeal to the IT professional. Because,

- Cheaper
- Easier to manage
- Upgrading a cloud app only has to be done one time
- The small business avoids the cost of purchasing expensive hardware to host similar software

Most small companies could outsource their software development and hosting, moving those applications to the cloud, companies don't have to invest in locally hosted systems, freeing up their staff and resources to focus on the day-to-day running of their own businesses.

Pros and Cons of Cloud Service Development

Advantages of Cloud Development

Economy of scale :

- a developer can offer better, cheaper, and more reliable applications. The application can utilize the full resources of the cloud, if needed—without requiring a company to invest in similar physical resources.
- cloud applications are typically "rented," priced on a per-user basis.

All management activities are managed from a central location, this enables IT staff to access applications remotely via the web.

When a company need more storage space or bandwidth, companies can just add another virtual server from the cloud. It's a lot easier than purchasing, installing, and configuring a new server in their data center.

Easier to upgrade : Application features can be quickly and easily updated by upgrading the centralized application, instead of manually upgrading individual applications located on each and every desktop PC in the organization.

With a cloud service, a single change affects every user running the application, which greatly reduces the developer's workload.

Disadvantages of Cloud Development

Security risks : many businesses prefer to keep their applications, data, and IT operations under their own control.

Cloud computing host goes offline : if a company relies on a third-party cloud platform to host all of its data with no other physical backup, that data can be at risk.

Types of Cloud Service Development

1. **Software as a Service (SaaS)**
2. **Platform as a Service (PaaS)**
3. **Infrastructure as a Service (IaaS)**
4. **Web Services**
5. **On-Demand Computing**

1. **Software as a Service (SaaS)**

- In this model a complete **applications offered to the customer, as a service on demand**.
- With SaaS, **a single application is delivered to thousands of users** from the vendor's servers.
- **Customers don't pay for owning the software**; rather, **they pay for using it**.
- Users **access an application via an API** accessible over the web.

- **For customers**, SaaS requires **no upfront investment in servers or software licensing**.
- **For the application developer**, there is **only one application to maintain for multiple clients**.
- SaaS is offered by companies such as Google, Salesforce, Microsoft, Zoho etc

2. **Platform as a Service (PaaS)**
   - In this a layer of software or **development environment** is encapsulated and **offered as a service.**
   - To meet manageability and scalability requirements of the applications PaaS provider offer a predefined combination of OS and application server such as **LAMP** platform(Linux, Apache, MySql and PHP), restricted J2EE, Ruby etc.

3. **Infrastructure as a Service (IaaS)**
   - IaaS provides **basic storage and computing capabilities**as standardized services over the network.
   - Examples are Amazon, GoGrid , Cisco Metapod, Microsoft Azure, Google Compute Engine (GCE) etc.

4. **Web Services**
   - **A web service is an application that operates over a network—typically, over the Internet.**
- A good example of web services are the "mashups" created by users of the Google Maps API.
- The advantages of web services include faster (and lower-cost) application development, leaner applications, and reduced storage and bandwidth demands.

5. **On-Demand Computing**

   As the name implies, on-demand computing packages computer resources (processing, storage, and so forth) as a metered service similar to that of a public utility.

   On-demand computing is also known as **utility computing.**

   In this model, customers pay for as much or as little processing and storage as they need.

In previous years, on-demand computing was provided from a single server via some sort of **time-sharing arrangement**. Today, the service is based on large grids of computers operating as a single cloud.

Discovering Cloud Services Development Services and Tools

- The large number of small and start-up companies offering cloud development tools.
- The more fully featured offerings include development tools and pre-built applications that developers can use as the building blocks for their own unique web-based applications.

Amazon

Amazon, one of the largest retailers on the Internet, is also one of the primary providers of cloud development services.

Amazon has spent a lot of time and money setting up a multitude of servers to service its popular website, and is making those vast hardware resources available for all developers to use.

The service in question is called the **Elastic Compute Cloud**, also known as **EC2**.

This is a commercial web service that allows developers and companies to rent capacity on Amazon's proprietary cloud of servers.

EC2 enables scalable deployment of applications by letting customers request a set number of virtual machines, onto which they can load any application of their choice.

EC2 is just part of Amazon's Web Services (AWS) set of offerings, which provides developers with direct access to Amazon's software and machines.

Amazon's service classified into 3 category

Small: 1.7 GB memory, 160 GB storage, one 32 bit core processor.

Large : 7.5 GB memory, 850 GB storage, two 64 bit core processor.

Extra Large : 15 GB memory, 1.7 TB storage, four 64 bit core processor.

Google App Engine

- Google is a leader in web-based applications.

- The company also offers cloud development services.
- These services come in the form of the Google App Engine, which enables developers to build their own web applications utilizing the same infrastructure that powers Google's powerful applications.
- The Google App Engine provides a fully integrated application environment.
- Using Google's development tools and computing cloud, App Engine applications are easy to build, easy to maintain, and easy to scale.

- Google offers following features:
    - Dynamic web serving
    - Full support for all common web technologies
    - Persistent storage with queries, sorting, and transactions
    - Automatic scaling and load balancing
    - APIs for authenticating users and sending email using Google Accounts
- Google provides a fully featured local development environment that simulates the Google App Engine on any desktop computer.
- Google App Engine is completely free to use—at a basic level

IBM

- The company is targeting small- and medium-sized businesses with a suite of cloud-based on demand services via its Blue Cloud initiative.
- Blue Cloud is a series of cloud computing offerings that enables enterprises to distribute their computing needs across a globally accessible resource grid.
- One such offering is the Express Advantage suite, which includes data backup and recovery, email continuity and data security functionality.
- To manage its cloud hardware, IBM provides open source workload-scheduling software called Hadoop, which is based on the MapReduce software used byGoogle in its offerings.

- Also included are PowerVM and Xen virtualization tools, along with IBM's Tivoli data center management software.