

Cloud Computing: An Introduction

What is Cloud Computing?

Cloud Computing is a general term used to describe a new class of network based computing that takes place over the Internet,

- basically a step on from Utility Computing
- a collection/group of integrated and networked hardware, software and Internet infrastructure (called a platform).
- Using the Internet for communication and transport provides hardware, software and networking services to clients

These platforms hide the complexity and details of the underlying infrastructure from users and applications by providing very simple graphical interface or API (Applications Programming Interface).

What is Cloud Computing?

In addition, the platform provides on demand services, that are always on, anywhere, anytime and any place.

Pay for use and as needed, elastic

scale up and down in capacity and functionalities

The hardware and software services are available to general public, enterprises, corporations and businesses markets

Cloud Summary

Cloud computing is an umbrella term used to refer to Internet based development and services

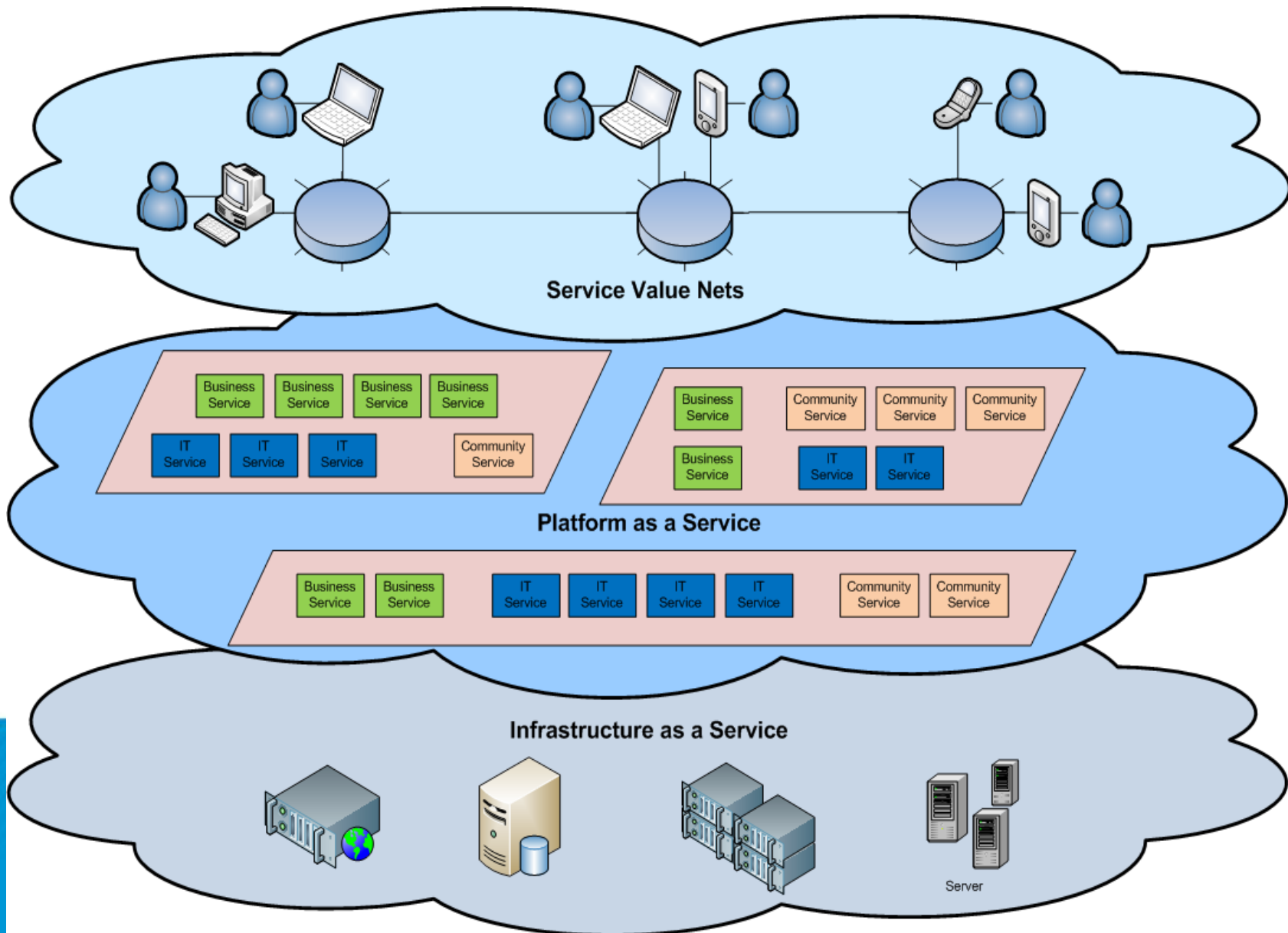
A number of characteristics define cloud data, applications services and infrastructure:

Remotely hosted: Services or data are hosted on remote infrastructure.

Ubiquitous: Services or data are available from anywhere.

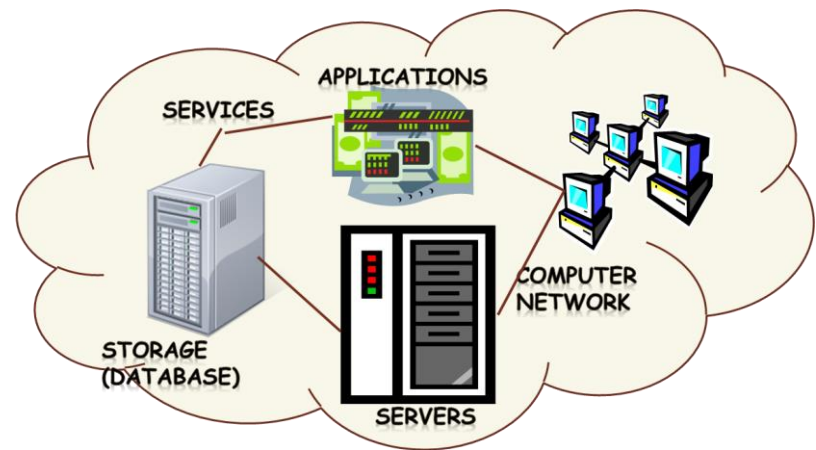
Commodified: The result is a utility computing model similar to traditional that of traditional utilities, like gas and electricity - you pay for what you would want!

Cloud Architecture



What is Cloud Computing

- Shared pool of configurable computing resources
- On-demand network access
- Provisioned by the Service Provider



Cloud Computing Characteristics

Common Characteristics:

Massive Scale

Resilient Computing

Homogeneity

Geographic Distribution

Virtualization

Service Orientation

Low Cost Software

Advanced Security

Essential Characteristics:

On Demand Self-Service

Broad Network Access

Rapid Elasticity

Resource Pooling

Measured Service

Cloud Service Models

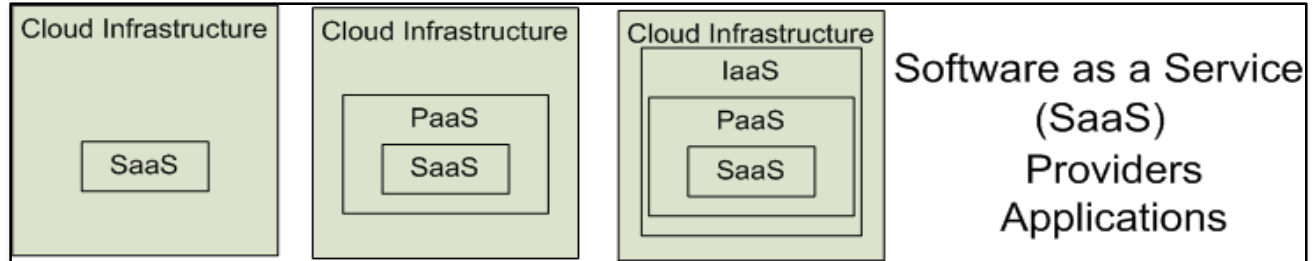
Software as a Service (SaaS)

Platform as a Service (PaaS)

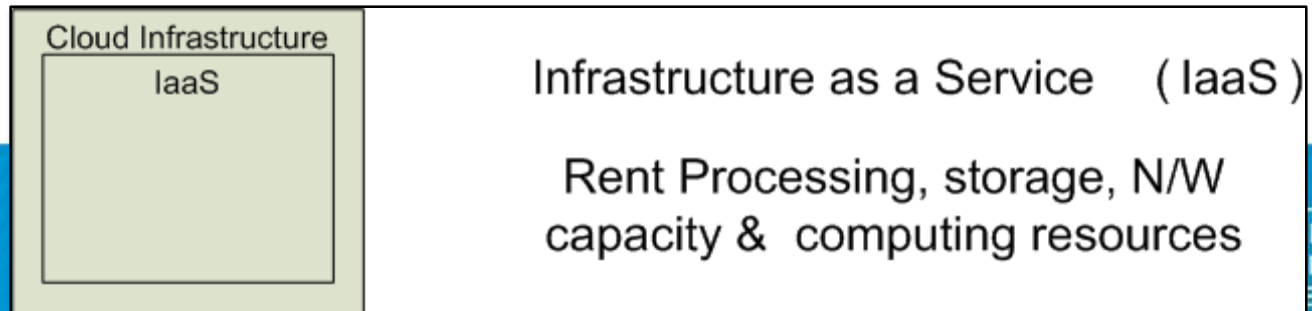
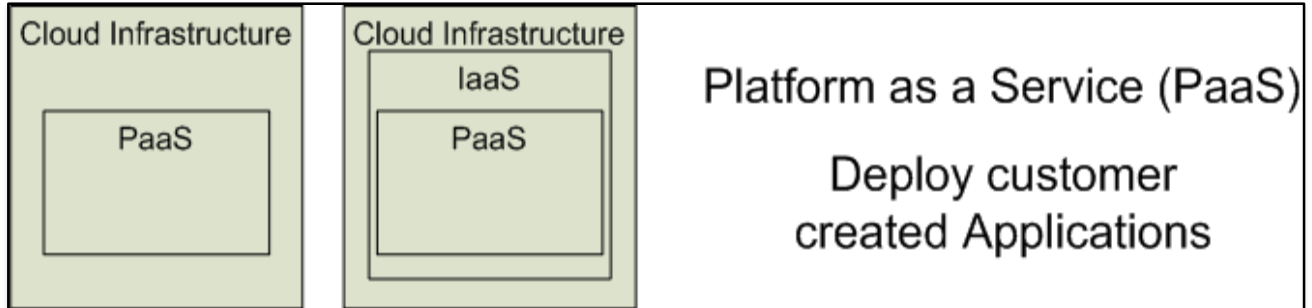
Infrastructure as a Service (IaaS)

SalesForce CRM

LotusLive



Google App



Basic Cloud Characteristics

The “**no-need-to-know**” in terms of the underlying details of infrastructure, applications interface with the infrastructure via the APIs.

The “**flexibility and elasticity**” allows these systems to scale up and down at will

utilising the resources of all kinds

CPU, storage, server capacity, load balancing, and databases

The “**pay as much as used and needed**” type of utility computing and the “**always on!, anywhere and any place**” type of network-based computing.

Basic Cloud Characteristics

Cloud are transparent to users and applications, they can be built in multiple ways

branded products, proprietary open source, hardware or software, or just off-the-shelf PCs.

In general, they are built on clusters of PC servers and off-the-shelf components plus Open Source software combined with in-house applications and/or system software.

Software as a Service (SaaS)

SaaS is a model of software deployment where an application is hosted as a service provided to customers across the Internet.

SaaS alleviates the burden of software maintenance/support

but users relinquish control over software versions and requirements.

Terms that are used in this sphere include

Platform as a Service (PaaS) and

Infrastructure as a Service (IaaS)

Virtualization

Virtual workspaces:

An abstraction of an execution environment that can be made dynamically available to authorized clients by using well-defined protocols,

Resource quota (e.g. CPU, memory share),

Software configuration (e.g. O/S, provided services).

Implement on Virtual Machines (VMs):

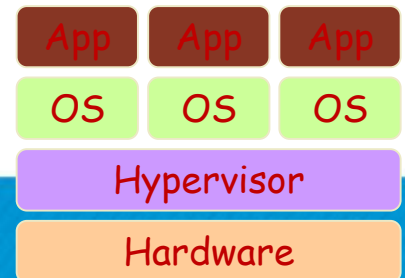
Abstraction of a physical host machine,

Hypervisor intercepts and emulates instructions from VMs, and allows management of VMs,

VMWare, Xen, etc.

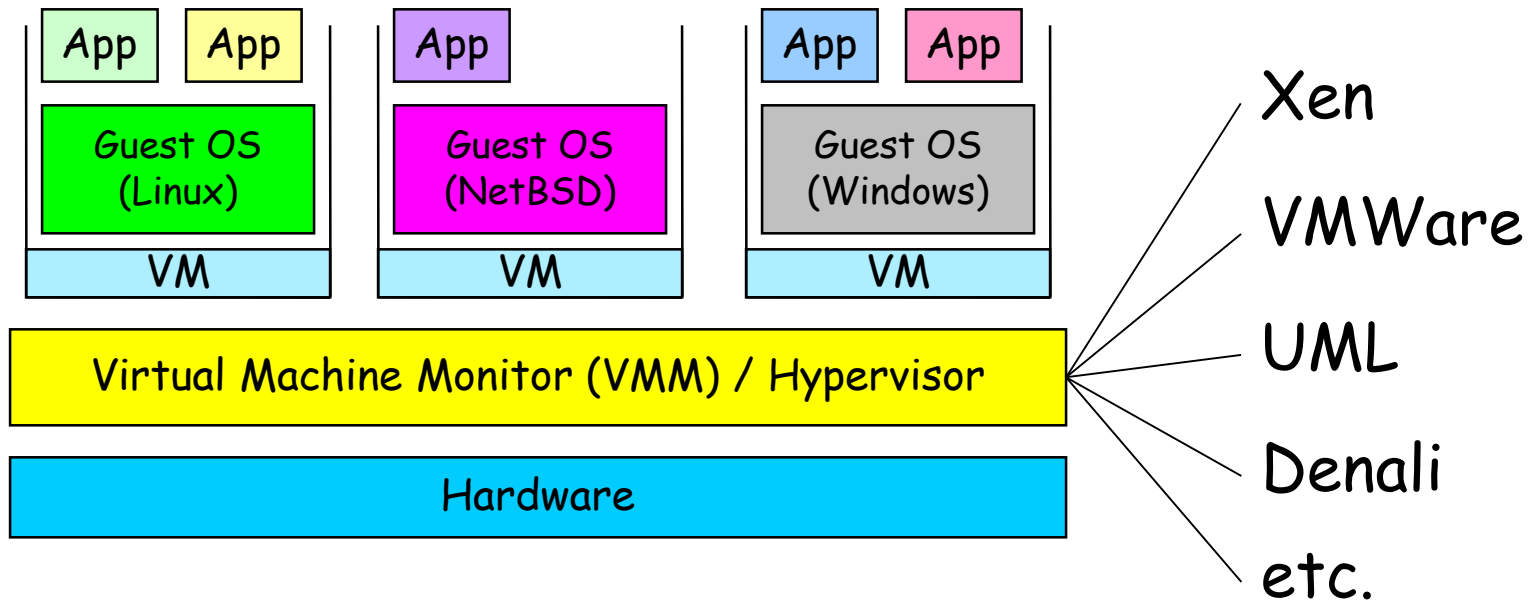
Provide infrastructure API:

Plug-ins to hardware/support structures



Virtual Machines

VM technology allows multiple virtual machines to run on a single physical machine.



Performance: Para-virtualization (e.g. Xen) is very close to raw physical performance!

What is the purpose and benefits?

Cloud computing enables companies and applications, which are system infrastructure dependent, to be infrastructure-less.

By using the Cloud infrastructure on “pay as used and on demand”, all of us can save in capital and operational investment!

Clients can:

- Put their data on the platform instead of on their own desktop PCs and/or on their own servers.

- They can put their applications on the cloud and use the servers within the cloud to do processing and data manipulations etc.

Some Commercial Cloud Offerings



Amazon Elastic Compute Cloud (Amazon EC2) - Beta



Cloud Taxonomy

Infrastructure Services

Storage

- Amazon S3
- Amazon EBS
- CTERA Portal
- Mosso Cloud Files
- Nirvanix

Compute

- Amazon EC2
- Serve Path GoGrid
- Elastra
- Mosso Cloud Servers
- Joyent Accelerators
- AppNexus
- Flexiscale
- ElasticHosts
- Hosting.com CloudNine
- Terramark
- GridLayer
- ITRICITY
- LayeredTech

Services Management

- RightScale
- enStratus
- Scalr
- CohesiveFT
- Kaavo
- CloudStatus
- Ylastic
- Dynect
- CloudFoundry
- NewRelic
- Cloud42

Cloud Software

Data

- 10Gen MongoDB
- Oracle Coherence
- Gemstone Gemfire
- Apache CouchDB
- Apache HBase
- Hypertable
- TerraCotta
- Tokyo Cabinet
- Cassandra
- memcached

Compute

- Globus Toolkit
- Xeround
- Beowulf
- Sun Grid Engine
- Hadoop
- OpenCloud
- Gigaspace
- DataSynapse
- Xeround

Cloud Management

- 3Tera App Logic
- OpenNebula
- Open.ControlTier
- Enomaly Enomalism
- Altor Networks
- VMware vSphere
- OnPathTech
- CohesiveFT VPN Cubed
- Hyperic
- Eucalyptus
- Reductive Lbs Puppet
- OpenQRM
- Appistry

File Storage

- EMC Atmos
- ParaScale
- Zmanda
- CTERA

Appliances

- PingIdentity
- Symplified
- rPath
- Vordel

CLOUD TAXONOMY

Platform Services

General Purpose

- Force.com
- Etelos
- LongJump
- AppJet
- Rollbase
- Bungee Labs Connect
- Google App Engine
- Engine Yard
- Caspio
- Qrimp
- MS Azure Services Platform
- Mosso Cloud Sites

Business Intelligence

- Aster DB
- Quantivo
- Cloud9 Analytics
- Blink Logic
- K2 Analytics
- LogiXML
- Oco
- Panorama
- PivotLink
- Sterna
- ColdLight Neuron
- Infobright
- Vertica

Integration

- Amazon SQS
- MuleSource Mule OnDemand
- Boomi
- SnapLogic
- OpSource Connect
- Cast Iron
- Microsoft BizTalk Services
- gnip
- SnapLogic SeaS Solution Packs
- Applan Anywhere
- HubSpan
- Informatica On-Demand

Development & Testing

- Keynote Systems
- Mercury
- SOASTA
- SkyTap
- Aptana
- LoadStorm
- Collabnet
- Dynamsoft

Database

- Google BigTable
- Amazon SimpleDB
- FathomDB
- Microsoft SDS

Software Services

Desktop Productivity

- Zoho
- IBM Lotus Live
- Google Apps
- Desktoptwo
- Parallels
- ClusterSeven

Sales

- Xactly
- LucidEra
- StreetSmarts
- Success Metrics

Legal

- DirectLaw
- Advologix
- Fios
- Sertifi

Financials

- Concur
- Xero
- Workday
- Beam4d

Billing

- Aria Systems
- eVapt
- OpSource
- RediZ
- Zuora

Document Management

- NetDocuments
- Questys
- DocLanding
- Aconex
- Xythes
- Knowledge TreeLive
- SpringCM

CRM

- NetSuite
- Parature
- Responsys
- Rightnow
- Salesforce.com
- LiveOps
- MSDynamics
- Oracle On Demand

Backup & Recovery

- JungleDisk
- Mozy
- Zmanda Cloud Backup
- OpenRSM
- Synclplicity

Content Management

- Clickability
- SpringCM
- CrownPoint

Human Resources

- Taleo
- Workday
- iCIMS

Social Networks

- Ning
- Zemby
- Amitive

Collaboration

- Box.net
- DropBox

Cloud Storage

Several large Web companies are now exploiting the fact that they have data storage capacity that can be hired out to others.

allows data stored remotely to be temporarily cached on desktop computers, mobile phones or other Internet-linked devices.

Amazon's Elastic Compute Cloud (EC2) and Simple Storage Solution (S3) are well known examples

Mechanical Turk

Amazon Simple Storage Service (S3)

Unlimited Storage.

Pay for what you use:

\$0.20 per GByte of data transferred,

\$0.15 per GByte-Month for storage used,

Second Life Update:

1TBytes, 40,000 downloads in 24 hours - \$200,



Utility Computing – EC2

Amazon Elastic Compute Cloud (EC2):

- Elastic, marshal 1 to 100+ PCs via WS,

- Machine Specs....,

- Fairly cheap!

Powered by Xen – a Virtual Machine:

- Different from Vmware and VPC as uses “para-virtualization” where the guest OS is modified to use special hyper-calls:

- Hardware contributions by Intel (VT-x/Vanderpool) and AMD (AMD-V).

- Supports “Live Migration” of a virtual machine between hosts.

Linux, Windows, OpenSolaris

Management Console/AP

Opportunities and Challenges

In parallel there has been backlash against cloud computing:

Use of cloud computing means dependence on others and that could possibly limit flexibility and innovation:

The others are likely become the bigger Internet companies like Google and IBM, who may monopolise the market.

Some argue that this use of supercomputers is a return to the time of mainframe computing that the PC was a reaction against.

Security could prove to be a big issue:

It is still unclear how safe out-sourced data is and when using these services ownership of data is not always clear.

There are also issues relating to policy and access:

If your data is stored abroad whose policy do you adhere to?

What happens if the remote server goes down?

How will you then access files?

There have been cases of users being locked out of accounts and losing access to data.

Advantages of Cloud Computing

Lower computer costs:

You do not need a high-powered and high-priced computer to run cloud computing's web-based applications.

Since applications run in the cloud, not on the desktop PC, your desktop PC does not need the processing power or hard disk space demanded by traditional desktop software.

When you are using web-based applications, your PC can be less expensive, with a smaller hard disk, less memory, more efficient processor...

In fact, your PC in this scenario does not even need a CD or DVD drive, as no software programs have to be loaded and no document files need to be saved.

Advantages of Cloud Computing

Improved performance:

With few large programs hogging your computer's memory, you will see better performance from your PC.

Computers in a cloud computing system boot and run faster because they have fewer programs and processes loaded into memory...

Reduced software costs:

Instead of purchasing expensive software applications, you can get most of what you need for free-ish!

most cloud computing applications today, such as the Google Docs suite.

better than paying for similar commercial software

which alone may be justification for switching to cloud applications.

Advantages of Cloud Computing

Instant software updates:

Another advantage to cloud computing is that you are no longer faced with choosing between obsolete software and high upgrade costs.

When the application is web-based, updates happen automatically available the next time you log into the cloud.

When you access a web-based application, you get the latest version without needing to pay for or download an upgrade.

Improved document format compatibility.

You do not have to worry about the documents you create on your machine being compatible with other users' applications or OSes

There are potentially no format incompatibilities when everyone is sharing documents and applications in the cloud.

Advantages of Cloud Computing

Unlimited storage capacity:

Cloud computing offers virtually limitless storage.

Your computer's current 1 Tbyte hard drive is small compared to the hundreds of Pbytes available in the cloud.

Increased data reliability:

Unlike desktop computing, in which if a hard disk crashes and destroy all your valuable data, a computer crashing in the cloud should not affect the storage of your data.

if your personal computer crashes, all your data is still out there in the cloud, still accessible

In a world where few individual desktop PC users back up their data on a regular basis, cloud computing is a data-safe computing platform!

Advantages of Cloud Computing

Universal document access:

That is not a problem with cloud computing, because you do not take your documents with you.

Instead, they stay in the cloud, and you can access them whenever you have a computer and an Internet connection

Documents are instantly available from wherever you are

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

as long as you are connected, you are not in danger of having an outdated version

Advantages of Cloud Computing

Easier group collaboration:

Sharing documents leads directly to better collaboration.

Many users do this as it is an important advantages of cloud computing

multiple users can collaborate easily on documents and projects

Device independence.

You are no longer tethered to a single computer or network.

Changes to computers, applications and documents follow you through the cloud.

Move to a portable device, and your applications and documents are still available.

Disadvantages of Cloud Computing

Requires a constant Internet connection:

Cloud computing is impossible if you cannot connect to the Internet.

Since you use the Internet to connect to both your applications and documents, if you do not have an Internet connection you cannot access anything, even your own documents.

A dead Internet connection means no work and in areas where Internet connections are few or inherently unreliable, this could be a deal-breaker.

Disadvantages of Cloud Computing

Does not 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.

Web-based applications require a lot of bandwidth to download, as do large documents.

Features might be limited:

This situation is bound to change, but today many web-based applications simply are not as full-featured as their desktop-based applications.

For example, you can do a lot more with Microsoft PowerPoint than with Google Presentation's web-based offering

Disadvantages of Cloud Computing

Can be slow:

Even with a fast connection, web-based applications can sometimes be slower than accessing a similar software program on your desktop PC.

Everything about the program, from the interface to the current document, 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 would not get the instantaneous access you might expect from desktop applications.

Disadvantages of Cloud Computing

Stored data might not be secure:

With cloud computing, all your data is stored on the cloud.

The questions is How secure is the cloud?

Can unauthorised users gain access to your confidential data?

Stored data can be lost:

Theoretically, data stored in the cloud is safe, replicated across multiple machines.

But on the off chance that your data goes missing, you have no physical or local backup.

Put simply, relying on the cloud puts you at risk if the cloud lets you down.

Disadvantages of Cloud Computing

HPC Systems:

Not clear that you can run compute-intensive HPC applications that use MPI/OpenMP!

Scheduling is important with this type of application

as you want all the VM to be co-located to minimize communication latency!

General Concerns:

Each cloud systems uses different protocols and different APIs

may not be possible to run applications between cloud based systems

Amazon has created its own DB system (not SQL 92), and workflow system (many popular workflow systems out there)

so your normal applications will have to be adapted to execute on these platforms.

The Future

Many of the activities loosely grouped together under cloud computing have already been happening and centralised computing activity is not a new phenomena

Grid Computing was the last research-led centralised approach

However there are concerns that the mainstream adoption of cloud computing could cause many problems for users

Many new open source systems appearing that you can install and run on your local cluster

should be able to run a variety of applications on these systems

Homework

<https://cloudacademy.com/cloud-computing/what-is-cloud-computing-introductory-course/>