

Cloud Computing

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Cloud computing is a paradigm that incorporates the concept of software as a service. This means the software and data are stored on servers that can be accessed over the Internet. The cloud means the Internet. The term is derived from the way in which the Internet is represented into the network diagrams.

The current cloud computing architecture involves the existence of data centers that are able to provide services to the clients located all over the world. The major players in field of the cloud computing are Google, Microsoft, Amazon, Yahoo, and some traditional hardware producers like HP, IBM, Intel.

Keywords: cloud computing, Internet, software services, applications.

Cloud Computing Fundamentals

Cloud computing allows to move the processing effort from the local devices to the data center facilities. In such a way, any phone, for example, could be able to solve complex differential equation systems by simply passing the specific arguments to a data center service that will be capable to give back the results in a very short time. In these conditions, the security of data and applications becomes a major issue.

Simply speaking, the cloud means the Internet. This term is derived from the way in which the Internet is often represented into the network diagrams.

Cloud computing represents a new paradigm of the Internet computing in which the software is seen as a service and the applications and data are stored on multiple servers that can be accessed from the Internet.

Cloud computing is totally different than grid computing that tries to create a virtual computer by joining together a cluster of computers. The aim of a grid computing architecture is to solve large tasks by using the advantage of concurrency and parallelism.

The current cloud computing architecture (figure 1) involves the existence of data centers that are able to provide services to the clients located all over the world. In this context, the cloud can be seen as a unique access point for all the requests coming from the customers/clients.

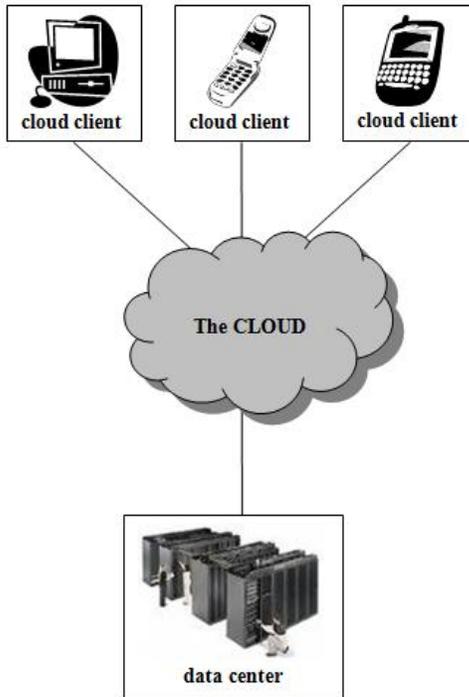


Figure 1 – Cloud Computing Architecture

It is important to notice a client could be a hardware device and/or a software application, like a browser, for example.

A mobile phone or PDA can successfully play the role of the cloud client. For this reason, the mobile device should run on the Android or iPhone platforms. Also, a web browser, like Google Chrome, can be a cloud client without any problem. Basically, the client is renting or simply accessing the processing capacity needed from the data center. The quality of the service becomes a crucial factor of the cloud computing success.

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The main advantages of the cloud computing are the following:

- there is no need to download or install a specific software;
- the cost is low or even free, in some cases;
- if the client computer crashes, there is almost nothing lost because everything is stored into the cloud;
- there is no need to update the local system when some new fix packs are released;
- cloud computing can be used on clients having minimal hardware requirements, like mobile phones or PDAs;
- the problem of licensing different software packages is moved to the data center level;
- no costs (or very small ones) for hardware upgrades;
- the users are not dependent by their personal computer because they can use any other device having an Internet connection and minimum software requirements.

Of course there are some disadvantages as well, like:

- an Internet connection is required in order to be able to access and use the cloud and this Internet dependence the offline mode impossible. On the other hand, some applications require a high speed Internet connection so the traffic speed may affect the overall performances;
- on a long term basis, the subscription fee may be more expensive than buying the hardware, for example;
- a very big concern is the data security because the data and the software are located on remote servers that can crash or disappear without any additional warnings. In this context, the service quality becomes crucial and the need of the backups is vital.

Applications of Cloud Computing

Due to the fact cloud computing becomes a very interesting subject, Microsoft announced it is developing a new Windows platform, called Windows Azure, which will be able to run cloud based applications.

One of the first application suite belongs to the Amazon and it is called AWS (Amazon Web Services), launched in 2002. AWS is a collection of remote services intended for client applications or web sites. According to the Amazon news, there are almost 500.000 developers that subscribed to the AWS.

The Amazon Web Services suite includes a component called Amazon Elastic Compute Cloud (or EC2), that allows to the users to rent from Amazon processing power to be used to run their own applications. Basically, the users are paying some fees and they receive virtual machines. The cloud is an elastic one just

because the user can start, stop and create the virtual machines through the web service. There are three predefined sizes for the virtual machines that can be rented: small, medium and large, depending on the physical hardware performances.

The main advantage of the AWC EC2 web service suite is the user doesn't need to install or run applications on the local computer, so there is no need of hardware support and maintenance.

Today, EC2 is able to host Windows Server and SQL Server database. From October 2008, also Oracle is running on the EC2 platform.

One of the biggest promoters of the cloud computing is Google. They already have a massive computer infrastructure (the cloud) where millions of people are connecting to. Moreover, Google joined with IBM trying to lead the cloud computing to a new stage.

The Google cloud can be accessed by using the Google Apps, intended to be a software as a service suite dedicated to information sharing and security.



Figure 2 – Google Apps

There are three main categories of services, as the following:

1. Messaging – includes Gmail, Calendar and Google Talk;
2. Collaboration – Google Docs, Video and Sites;
3. Security – email security, encryption and archiving.

No costs are involved by the Google Apps, no hardware or software licenses are needed and the data can be accessed in a secured manner from anywhere in the world by simply using a device connected to the Internet.

Table 1 presents the major incidents that impacted the cloud computing providers during the last years.

Table 1 – The most significant cloud computing incidents
(taken from *Cloud Computing Incidents Database*)

<i>Date</i>	<i>Product</i>	<i>Incident Type</i>	<i>Comments</i>
2009-01-31	Google	Outage	Lasted up to 1 hour
2009-01-30	Ma.gnolia	Data Loss	Both online and backup databases affected.
2008-10-18	AWS Services	Security	Issue present since service launch
2008-10-15	Gmail	Outage	Lasted more than 24 hours
2008-09-18	Google Docs	Security	Limited to ISP(s) in Thailand
2008-09-15	App Engine	Outage	Datastore writes experienced elevated latencies and error-rates.
2008-09-02	Google Apps	Security	Malicious service provider could impersonate a user at other service providers.
2008-08-26	FlexiScale	Outage	Full extended outage
2008-08-12	Gmail	Outage	Users unable to use webmail due to issues with loading contacts between 14:00 and 16:00
2008-08-08	The Linkup	Data Loss	Data claimed to be safe but inaccessible
2008-07-20	Amazon S3	Outage	Full outage for 8 (weekend) hours
2008-07-10	MobileMe	Outage	Scheduled outage window exceeded during upgrade to MobileMe
2008-07-09	.Mac	Outage	Full outage (except mail) during upgrade to MobileMe 18:00-00:00
2008-04-28	EC2	Outage	Result of a customer creating a large number of firewall rules and instances.
2008-02-15	Amazon S3	Outage	Early morning outage (04:31-06:48) caused by authentication service overload
2008-01-07	Salesforce.com	Outage	Affected all instances and supporting infrastructure
2007-09-29	EC2	Outage	Result of a customer creating a large number of firewall rules and instances.

Security Benefits

As stated before, a very big concern regarding the cloud computing is the data security because the data and the software are located on remote servers that can crash or disappear without any additional warnings.

Even if it seems improbable, the cloud computing provides some major security benefits for individuals or companies, like the following:

- centralized data storage – this goes to reduced effects of losing some hardware items, like a laptop, for example. While the main part of the applications and data is stored into the cloud, losing a client is not a big issue anymore – there are no sensitive data lost and a new client can be connected to the cloud very fast;
- monitoring of data access becomes easier because it is enough to monitor only one place, not thousands of computers belonging to a major company, for example;
- increased uncertainty – it is almost impossible for a thief to determine which physical component to steal in order to get a digital asset;
- virtualization allows a rapid replacement of a compromised server located into the cloud without major costs or damages. Also, the downtime for computers in the cloud could be substantially reduced because it is very easy to create a clone by using an image;
- logging – extended logs can be activated because the cloud is big enough to store large collections of data;
- the security changes can be easily tested and implemented

Conclusions

Cloud computing represents a very interesting concept of our days. There are a lot of applications able to exploit the cloud and the list is expanding very fast. Many devices are already cloud compatible – the traditional computers, PDAs, mobile phones and even browsers, like the Google Chrome.

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