# Introduction to Cloud Computing

**Power-All Networks**

**(1st Draft)**

**Abstract:**

This introduction gives the basic concept, defines the terms used in the industry, and outlines the general architecture and applications of Cloud computing. It gives a summary on what Power-All Networks stands in Cloud Computing and provides a good foundation for understanding an excellent collection of white papers and Power-Points on the topics from the company.

## Introduction

Today, **"Cloud Computing"** is a general and a loose term used to describe a new class of network based computing over public networks such as Internet and/or over private WAN networks.

In other words, this is a collection or groups of integrated and networked hardware, software and internetworking infrastructure (called as a **platform)** using Internet as their communications and transport links to provide hardware, software and networking services to end clients (could be end users or software applications as usual. However, such platforms hide the complexities and details of the underlying infrastructure from end users and end applications by providing very simple graphical interface or API (Applications Programming Interface). In addition, the said platforms provide an on demand, always on, anywhere, anytime and any place, pay as used and as needed, highly elastic (scale up and down in capacity and functionalities) hardware and software services to the general public, general and vertical corporate and businesses markets etc.

## Characteristics

In brief, "Cloud" here implies four main characteristics:

1. The "no-need-to-know" in terms of the underling details of infrastructure, applications interface with the infrastructure through API (Applications Programming Interface);
2. The "flexibility and elasticity" to scale up and down at will in utilizing computing resources of all kinds (storage, server capacity, load balancing, data bases etc.);
3. 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.
4. As the Cloud is transparent to users and applications, it could be built in multiple ways. It could be on branded products, costumed hardware or software or off-the-shelf PCs. In general, it is built on clusters of PC

servers and off-the-shelf components plus Open Source software combined with in-house applications and/or system software.

**The terms used in the industry**

The business of Cloud computing is an on-demand service business model. The general term used in the industry to reflect service business based on the said cloud platform is **PaaS** (Platform as a Service).

The Cloud computing platform above offers two types of services: the **SaaS** ( Software as a Service) and **HaaS** (Hardware as a Service).

Free Web based services such as the Google Map and Facebook, and Web based services based on per usage or pay as used and on demand basis, are classified as SaaS. Many SaaS are offered by third parties using the HaaS hardware services offered by the the Cloud infrastructure.

Hardware services such as S3 (on demand storage), EC2 (processors) from Amazon.Com are examples of HaaS. Users can use the HaaS as needed to minimize their investments and operational cost.

**What is the purpose and benefits?**

"Cloud computing" enables companies and applications, which are system infrastructure dependent, to be infrastructure-less (this is less computer and software infrastructure in house than before). By using the Cloud infrastructure on "pay as used and on demand", all of us save in capital and operational investments.

Clients can put their data on the said 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. The term "cloud" is used to describe and to reflect this class of Internet or Wan centric computing infrastructure being transparent (users do not need to know what is behind), highly scalable (scale up and down as needed), on-demand, pay as needed and as used.

After so many years, Cloud Computing today is the beginning of "network based computing" over Internet in force. It is the technology of the decade and is the beginning of two totally new computing models as described later.

**What does Cloud computing enable?**

The industry has been practicing Client-Server computing. This computing model is well understood and is continuously evolving from the pure text based HTML at the beginning to the graphic and video heavy browsers of today. This computing model would stay and continue to evolve to meet the challenge of new applications.

Instead of just having a server or a collection of servers behind the clients, Cloud Computing enables two new computing models:

1. Client-Cloud computing
2. Terminal-Cloud computing

As in the Client-Server computing, the client could be a PC or another server or some other devices such as mobile devices. The cloud infrastructure replaces the server infrastructure to provide the on-demand, pay as used and other features and inherent benefits in Cloud computing.

Client side devices are evolving into bipolar extremities. One is to jam more and more features, functions and computing power into the devices, this is one extreme, the heavy client approach. The other extreme is to make the devices as simple as possible and push as mush as possible to the server or the cloud side. The devices in the later case become functionally a little bit more powerful than or similar to the simple terminals (a keyboard plus a monitor with minimum intelligence for transferring ASCII texts) before. The cloud becomes the resource of all computing. This is what we called the terminal-cloud computing.

From this point on the industry would evolve with major and fundamental pivotal changes:

- Network centric, cloud computing and storage over Internet vs desktop centric computing and storage.
- Web based centric applications vs desktop centric applications.
- Cloud OS vs the traditional OS such as Window and Linux

**Why now and not before?**

The advent in Internet in terms of bandwidth and coverage, the popularities of PCs, the continuous cost reduction in PCs and servers, the 'Open Source" software movement and the pioneer in the commercial market such as Google make cloud computing viable.

Past history of Cloud computing on the hardware side could be traced to the Thin Client computing and Grid network computing before. On the "on demand" software side, it could be traced to the ASP (Application Service Provider) first and then the utility computing proposed by HP, IBM and the like. Particularly in the commercial markets, these past attempts are more thunders and less rain due to many reasons. It is our opinion that the value proposition in the past is not pervasive enough for users to change their habit and the supporting infrastructure behind is not there as described early.

**What is the future?**

After so many years, Cloud Computing today is the beginning of "network based computing" over Internet in force. It is the technology of the decade and is the enabling element of two totally new computing models, the Client-Cloud computing and the Terminal-Cloud computing. These new models would create whole generations of applications and business.

Our prediction is that it is the beginning to the end of the dominance of desktop computing such as that with the Windows. It is also the beginning of **a new Internet based service economy**: the Internet centric, Web based, on demand, Cloud applications and computing economy.