Cloud Computing Architectural Model

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Types of clouds

- Clouds constitute the primary outcome of cloud computing
- They are a type of parallel and distributed system harnessing physical and virtual computers presented as a unified computing resource
- Clouds build the infrastructure on top of which services are implemented and delivered to customers. Such infrastructures can be of different types and provide useful information about the nature and the services offered by the cloud
- A more useful classification is given according to the administrative domain of a cloud: It identifies the boundaries within which cloud computing services are implemented, provides hints on the underlying infrastructure adopted to support such services, and qualifies them

Types of clouds

- **Public clouds:**The cloud is open to the wider public
- **Private clouds:** The cloud is implemented within the private premises of an institution and generally made accessible to the members of the institution or a subset of them
- **Hybrid or heterogeneous clouds:** The cloud is a combination of the two previous solutions and most likely identifies a private cloud that has been augmented with resources or services hosted in a public cloud
- **Community clouds:** The cloud is characterized by a multi-administrative domain involving different deployment models (public, private, and hybrid), and it is specifically designed to address the needs of a specific industry

Public clouds

- Public clouds constitute the first expression of cloud computing
- They are a realization of the canonical view of cloud computing in which the services offered are made available to anyone, from anywhere, and at any time through the Internet
- From a structural point of view they are a distributed system, most likely composed of one or more datacenters connected together, on top of which the specific services offered by the cloud are implemented
- Any customer can easily sign in with the cloud provider, enter her credential and billing details, and use the services offered

Public clouds

- Historically, public clouds were the first class of cloud that were implemented and offered. They offer solutions for minimizing IT infrastructure costs and serve as a viable option for handling peak loads on the local infrastructure
- They have become an interesting option for small enterprises, which are able to start their businesses without large up-front investments by completely relying on public infrastructure for their IT needs
- What made attractive public clouds compared to the reshaping of the private premises and the purchase of hardware and software was the ability to grow or shrink according to the needs of the related business
- By renting the infrastructure or subscribing to application services, customers were able to dynamically upsize or downsize their IT according to the demands of their business
- Currently, public clouds are used both to completely replace the IT infrastructure of enterprises and to extend it when it is required

Public clouds

- A fundamental characteristic of public clouds is multitenancy
- A public cloud is meant to serve a multitude of users, not a single customer
- Any customer requires a virtual computing environment that is separated, and most likely isolated, from other users
- This is a fundamental requirement to provide effective monitoring of user activities and guarantee the desired performance and the other QoS attributes negotiated with users
- QoS management is a very important aspect of public clouds. Hence, a significant portion of the software infrastructure is devoted to monitoring the cloud resources, to bill them according to the contract made with the user, and to keep a complete history of cloud usage for each customer
- These features are fundamental to public clouds because they help providers offer services to users with full accountability

Public clouds

- A public cloud can offer any kind of service: infrastructure, platform, or applications
- For example, Amazon EC2 is a public cloud that provides infrastructure as a service; Google AppEngine is a public cloud that provides an application development platform as a service; and SalesForce.com is a public cloud that provides software as a service
- What makes public clouds peculiar is the way they are consumed: They are available to everyone and are generally architected to support a large quantity of users. What characterizes them is their natural ability to scale on demand and sustain peak loads

Public clouds

- From an architectural point of view there is no restriction concerning the type of distributed system implemented to support public clouds
- Most likely, one or more datacenters constitute the physical infrastructure on top of which the services are implemented and delivered
- Public clouds can be composed of geographically dispersed datacenters to share the load of users and better serve them according to their locations

Public clouds

- For example, Amazon Web Services has datacenters installed in the United States, Europe, Singapore, and Australia; they allow their customers to choose between three different regions: us-west-1, us-east-1, or eu-west-1
- Such regions are priced differently and are further divided into availability zones, which map to specific datacenters
- According to the specific class of services delivered by the cloud, a different software stack is installed to manage the infrastructure: virtual machine managers, distributed middleware, or distributed applications