



Cloud Security: Part 1

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References

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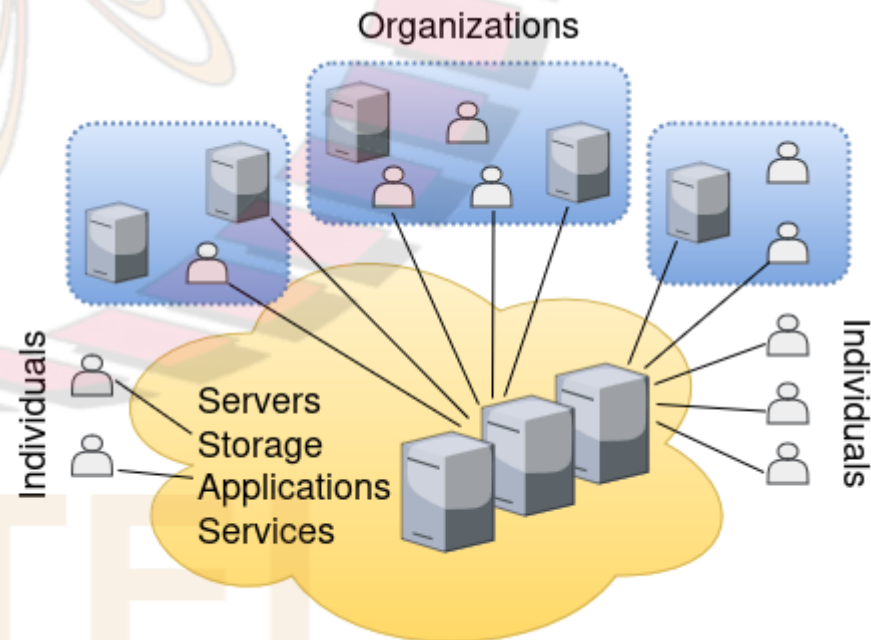


Cloud Computing

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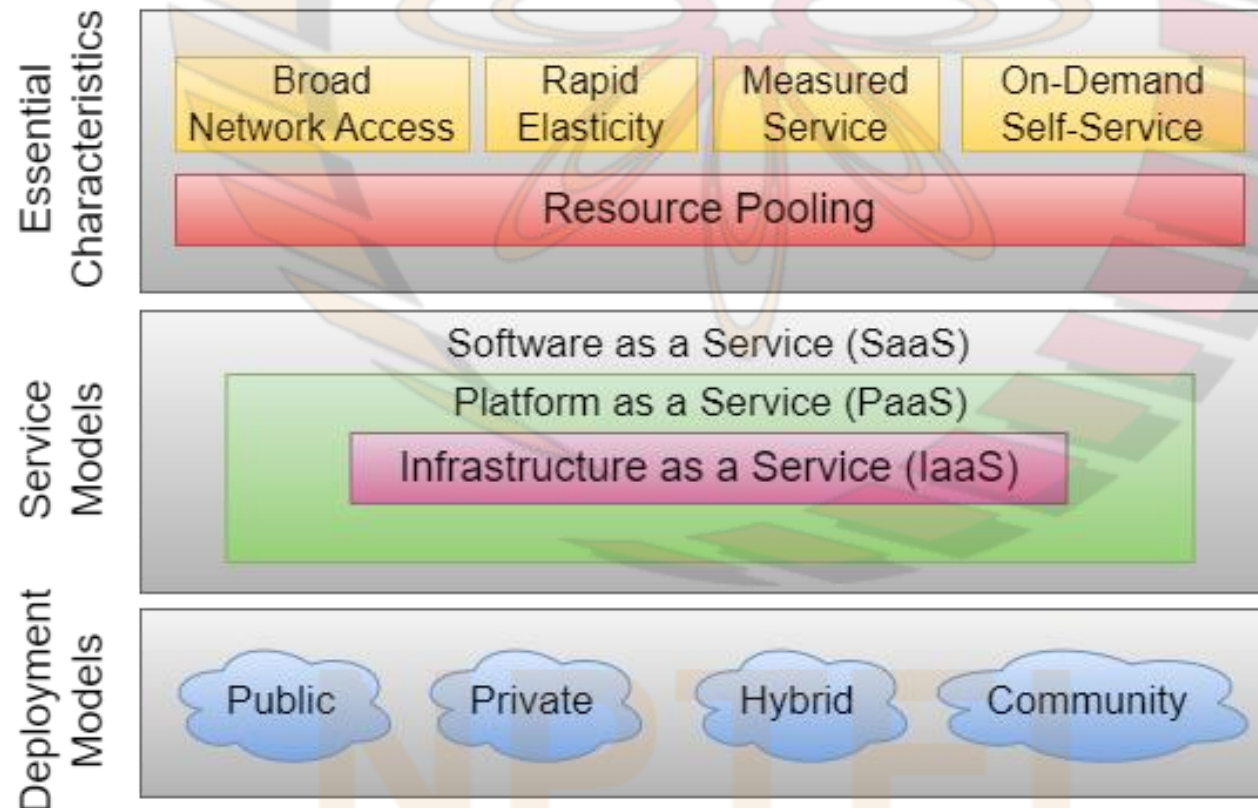
Introduction

- Increasing trend in many organizations to move a substantial part or all information technology (IT) operations to an Internet-connected infrastructure
 - ❑ called enterprise *cloud computing*
- Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources
 - ❑ e.g., networks, servers, storage, applications, and services
- These computing resources can be rapidly provisioned and released with minimal management effort or service provider interaction



Cloud Model

- This cloud model is composed of:
 - ❑ Five essential characteristics,
 - ❑ Three service models, and
 - ❑ Four deployment models

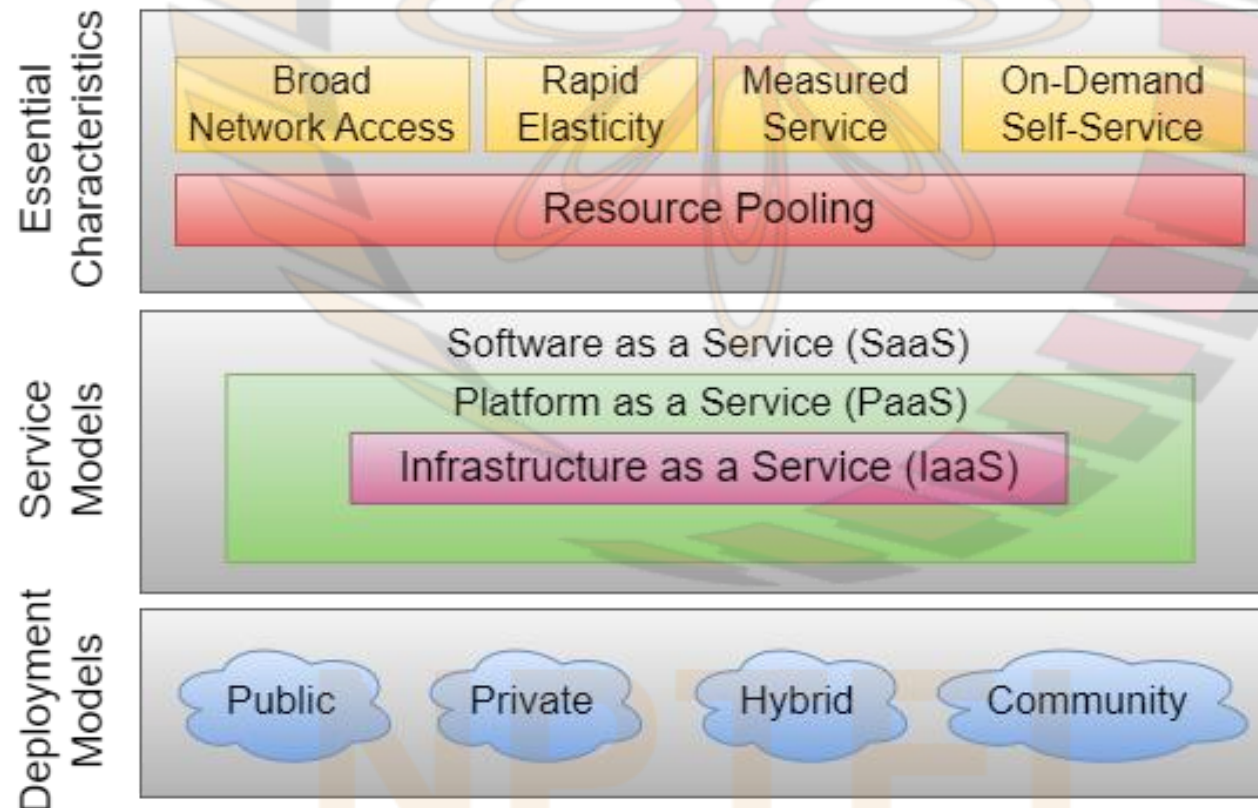


Essential Characteristics of Cloud Computing

- **Broad Network Access:**
 - ☐ Capabilities are available over the network
 - ☐ Accessed through standard mechanisms and used by heterogeneous thin or thick client platforms (e.g., mobile phones, laptops, PDAs, etc.)
- **Rapid Elasticity:**
 - ☐ Resources can be expanded and reduced according to the specific service requirements of the clients
 - ☐ E.g.:
 - a client may need a large number of server resources for the duration of a specific task
 - these resources released upon completion of the task
- **Measured Service:**
 - ☐ Cloud systems use a metering capability appropriate to the type of service (e.g., storage, processing, bandwidth, etc.)
 - ☐ This metering capability used to automatically control and optimize resource use
 - ☐ Such metering provides transparency for both the provider and consumer of the utilized service
- **On-Demand Self-Service:**
 - ☐ A cloud service consumer (CSC) can unilaterally provision computing capabilities, such as server time and network storage
 - ☐ This is done as needed automatically, without requiring human interaction with service provider
- **Resource Pooling:**
 - ☐ Provider's computing resources (e.g., storage, processing, memory, network bandwidth, virtual machines) are pooled to serve multiple CSCs
 - ☐ Different physical and virtual resources dynamically assigned and reassigned according to consumer demand
 - ☐ CSC generally has no control or knowledge of exact location of provided resources, but may be able to specify location at a higher level of abstraction (e.g., country, state, or data center)

Cloud Service Models

- There are the following three service models:
 - ❑ Software as a Service (SaaS)
 - ❑ Platform as a Service (PaaS)
 - ❑ Infrastructure as a Service (IaaS)



Software as a Service (SaaS)

- Provides service to customers in the form of application software, running on and accessible in the cloud
- Enables the customer to use cloud provider's applications running on the provider's cloud infrastructure
- Applications are accessible from various client devices through a simple interface such as a Web browser
- Instead of obtaining desktop and server licenses for software products it uses, an enterprise obtains the same functions from the cloud service
- Use of SaaS avoids the complexity of software installation, maintenance, upgrades, and patches
- E.g.:
 - ☐ Google Gmail
 - ☐ Microsoft 365
 - ☐ Salesforce
 - ☐ Citrix GoToMeeting
 - ☐ Cisco WebEx

Platform as a Service (PaaS)

- Provides service to customers in the form of a platform on which the customer's applications can run
- Enables customer to deploy onto the cloud infrastructure customer-created or acquired applications
- PaaS is an operating system in cloud
- E.g.:
 - ☐ Google AppEngine
 - ☐ Engine Yard
 - ☐ Heroku
 - ☐ Microsoft Azure Cloud Services
 - ☐ Apache Stratos

Infrastructure as a Service (IaaS)

- Customer has access to hardware resources of underlying cloud infrastructure
- Customer has control over operating systems and deployed applications
- IaaS provides virtual machines (VMs) and other virtualized hardware
- IaaS offers the customer processing, storage, networks, and other fundamental computing resources so that:
 - ☐ customer is able to deploy and run arbitrary software, which can include operating systems and applications
- E.g.:
 - ☐ Amazon Elastic Compute Cloud (Amazon EC2)
 - ☐ Microsoft Azure
 - ☐ Google Compute Engine (GCE)
 - ☐ Rackspace

Comparison of the Three Service Models

- Fig. compares the functions implemented by cloud service provider for the three service models

