



**ITU-TRCSL Symposium on Cloud Computing**  
Session 2: Cloud Computing Foundation and Requirements



# What Cloud computing means in real-life

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# AGENDA

1. Quick Introduction
2. Why Standardization
3. Functional Requirements
4. Q&A



# CLOUD Quick Introduction

# Interesting Facts

- Cloud computing is **not a one technology** nor a **one single architecture**.
- **Technology** behind Cloud Computing is said to be the **easy part** and **People factor** is the **Hardest**.
- **Virtualization** is the biggest **technology driver** behind Cloud Computing. It is not a new technology and it has been in existence for over 4 decades in the IT industry.
- **Virtualization** is simply put as a **logical abstraction** of **Hardware** through a layer of **Software**.
- This technology (Virtualization) is used in **Computing power, storage** and **networks** in the form of VLAN for many years.
- Cloud Computing is essentially the next phase of innovations and adoption of platform for Computing, Storage and Networking technologies designed to provide rapid time to market and significant cost reductions.

# Cloud Computing Definition

*“Cloud Computing is a pay-per-use **Model** for enabling ubiquitous, convenient, on-demand network access to a **shared pool of configurable computing resources** (e.g., Network, Servers, Storage, Applications and Services) that can be **rapidly provisioned** and released with **minimal management effort** or service provider interaction”*

- National Institute of Standards and Technology (NIST)

# Characteristics of Clouds

## Broad Access Network

Accessible via multiple devices – computers, Mobile etc.

Universal high bandwidth

Low latency network

Highly scalable and stable network access

## On-demand self-service

Ability to provision computing capabilities by CS user with minimal or no intervention of Service Provider

Ability to do what user needs when he needs with relative reduction in costs, time, and effort needed in doing so

## Resource pooling

Physical resource virtualization

Multi Tenancy while using abstraction to mask the complexity of the process from the customer

Data and computations are isolated from and inaccessible to one another

## Measured service

Usage of pooled resources has to be monitored, measured and reported to the consumers of the cloud

Making available and providing visibility in to the usage, consumers can plan for usage and associated costs

## Rapid Elasticity

Ability to quickly provision and de-provision of resources based on the customer demands which is critical for cost savings

Ability to flatten the IT supply chain to provision applications in a matter of minutes instead of days or weeks

# Cloud Service Models

There are lot of emerging models and the following three are the most popular models

## 1. Software as a Services (SaaS)

- ability to use Application Software packages on someone else's infrastructure. E.g. Google's Gmail, CRM from Salesforce.com.

## 2. Platform as a Service (PaaS)

- Platform hosted in 3rd party infrastructure which provide all resources and facilities.
- Generally used for application development environments to quickly built, test and release software products.
- This is the fastest growing cloud model as of today due to increasing demand for mass scale smart phone application developments.

## 3. Infrastructure as a service (IaaS)

- The provision of hardware (Computing, Storage and Networking) required to run customer's application.

# Deployment Models

## Private Cloud

Designed and built for a single customer to support a specific function critical for business success

Might or might not be hosted at customer premises.

considered a cloud as long as the five essential characteristics are satisfied

## Community Cloud

More than one group with common and specific needs share infrastructure. It could be on-site or off-site

Generally with stringent security and regulatory controls shared by government institutes

## Public Cloud

This model of Cloud is most often thought of as real cloud environment

Multi-tenant capable environment shared by number of consumers who likely have nothing in common

## Hybrid Cloud

Combination of two or more of the previously described cloud models

Management framework to make environments appear as single cloud

Demand exist where strong requirement for security or regulatory compliance with price and performance



# Optimizing traditional IT Supply Chain

## Traditional IT supply chain



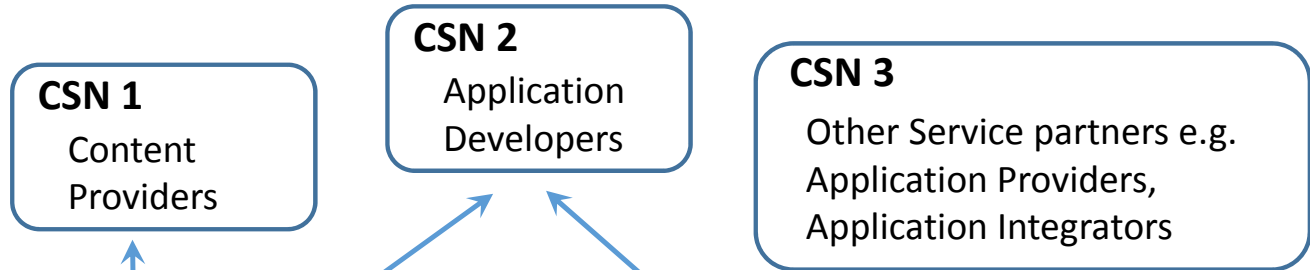
## Optimized by Cloud



# Cloud Computing Ecosystem

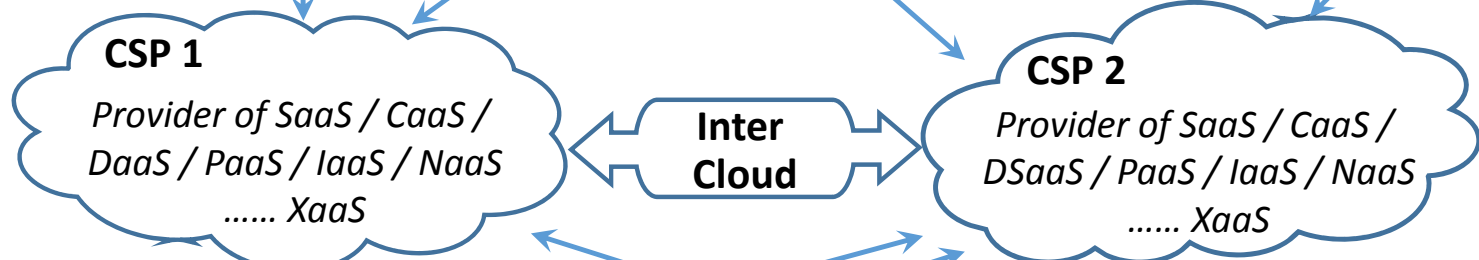
**Cloud Service Partner**

**CSN**



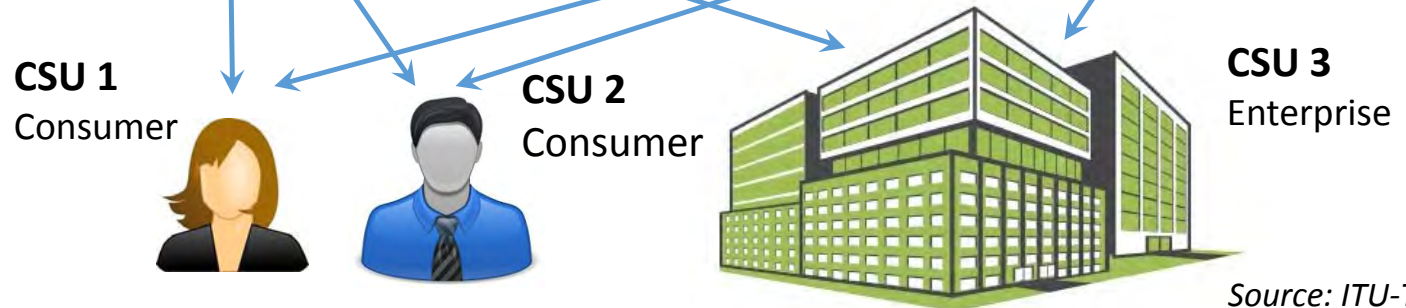
**Cloud Service Provider**

**CSP**



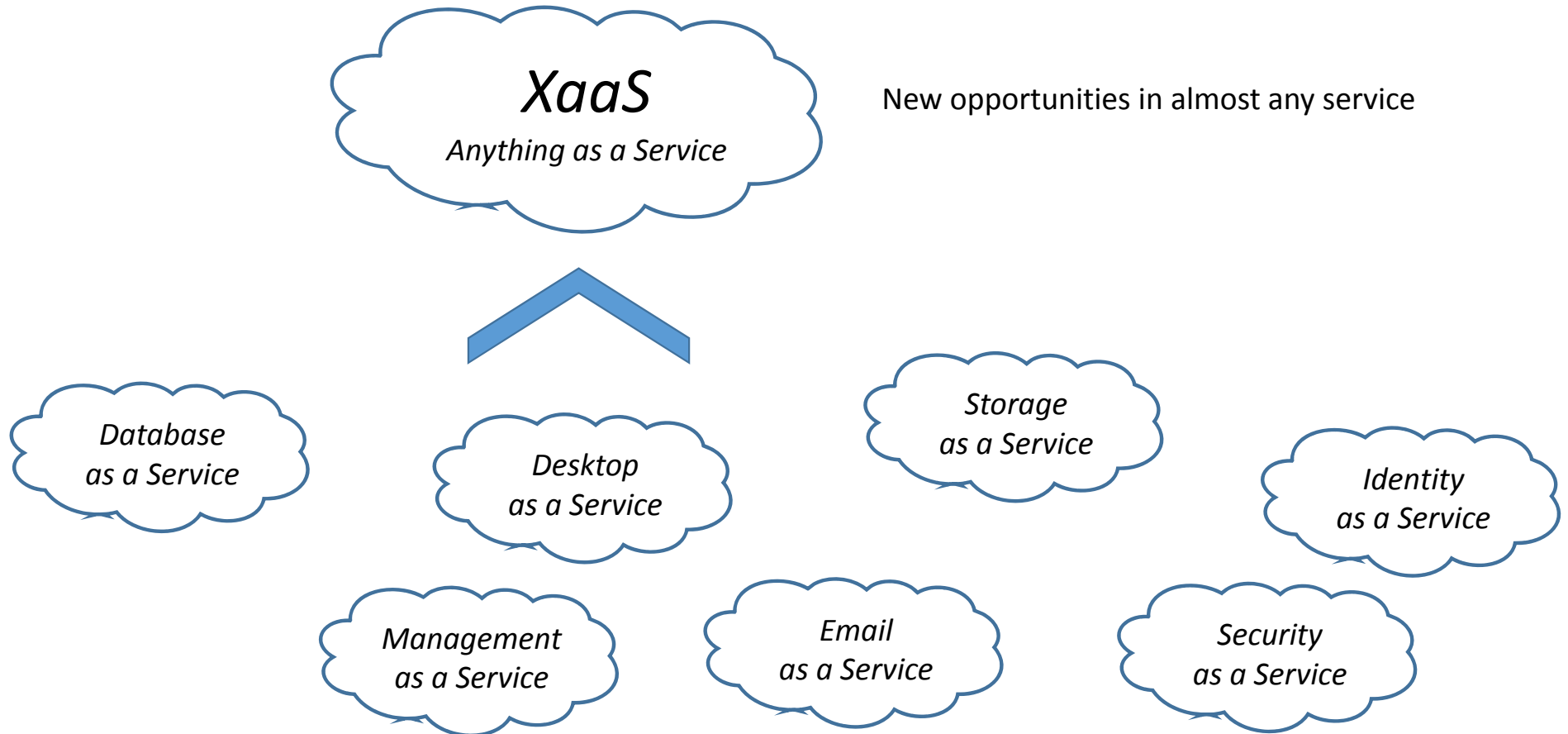
**Cloud Service User**

**CSU**



Source: ITU-T FG Cloud

# Emerging Models for Cloud Service



# Why Cloud

- Pay-per-use
- On demand use
- Ubiquitous Access  
(Anytime, Anywhere)
- Elasticity (Scale up/down)
- Low TCO (due to  
economies of scale / reuse)
- Optimized resource/  
Energy utilization (Green)
- Turn Key Operation  
(Time to Market Advantage)



# Decision making on Cloud adoption

- Good understanding of your compute, storage and network requirements is essential
- Should know the Budgets and TCO expectations
- Have a very strong understanding of Business processes and goals
- Clear and in-depth understanding of underlying application architecture
- Strong knowledge of critical data – where it resides, how it is used for business critical decisions – will enable making well-informed choice about Cloud platform and solutions.



# WHY Standardization

# Threats to CSUs (Users)

- Responsibility ambiguity
- Loss of governance
- Privacy Issues (Loss of trust)
- Portability Issues (CSP lock-in)
- Security Issues  
(Authentication/ Authorization)
- Lack of information  
(Asset management /Physical location  
of sensitive data)
- Reliability Issues  
(Performance / Service Availability)
- Data loss and leakage



*Source: ITU-T FG Cloud Part 5: Cloud security*



# Threats to CSPs (Service Providers)

- Responsibility ambiguity
- Protection inconsistency  
(Identity inconsistencies among different CSPs)
- Evolutional risks (design-time vs runtime vulnerability)
- Business discontinuity
- Portability Issues (Supplier lock-in)
- License risks
- Legal Issues in different Jurisdictions  
(Bylaw conflict)
- Bad integration
- Security Issues (Insecure administration API)
- Shared environment
- Hypervisor isolation failure
- Service unavailability
- Data unreliability
- Abuse right of CSP (Malicious configuration / Insider Attack)

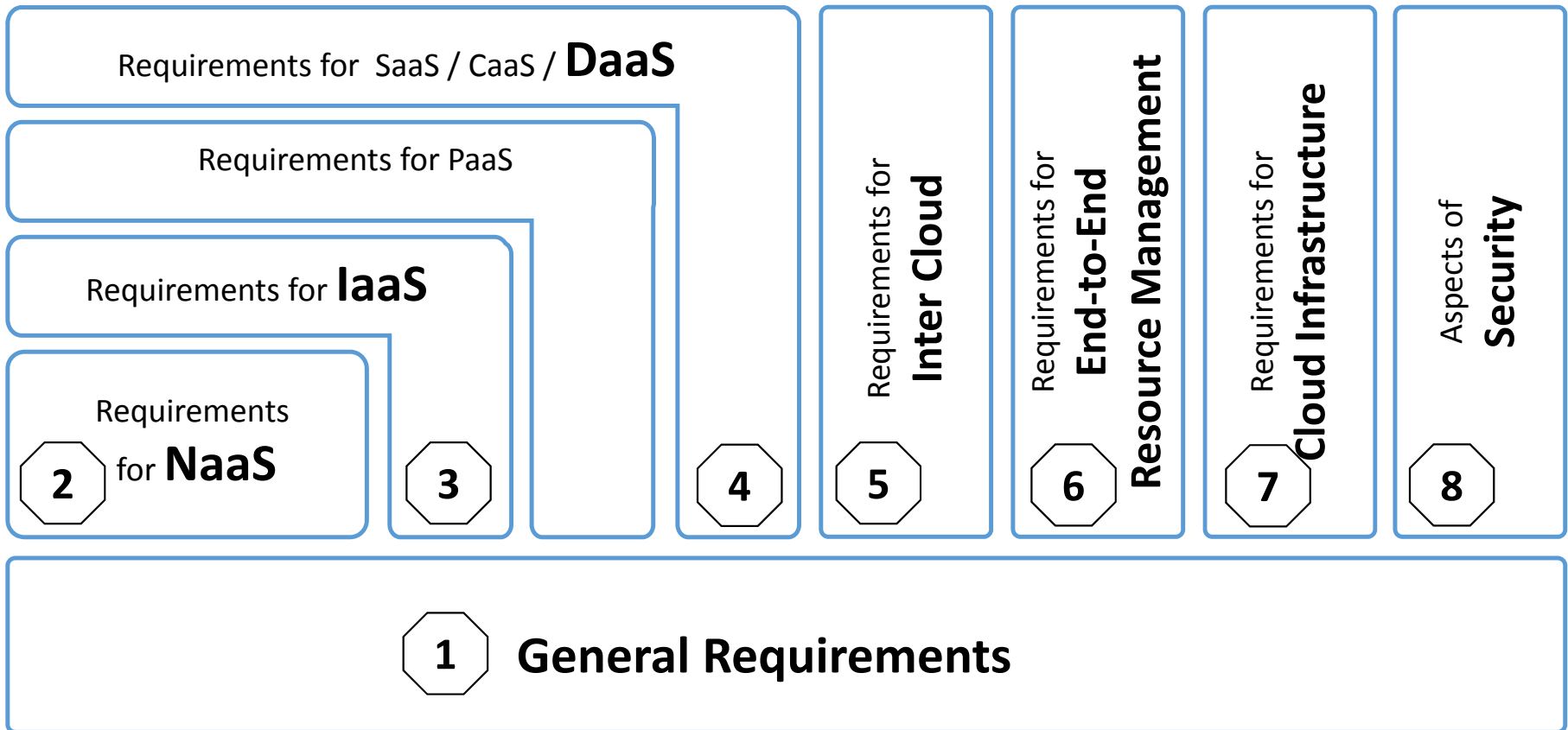
*Source: ITU-T FG Cloud Part 5: Cloud security*





# Functional Requirements

# Requirements for Cloud Computing

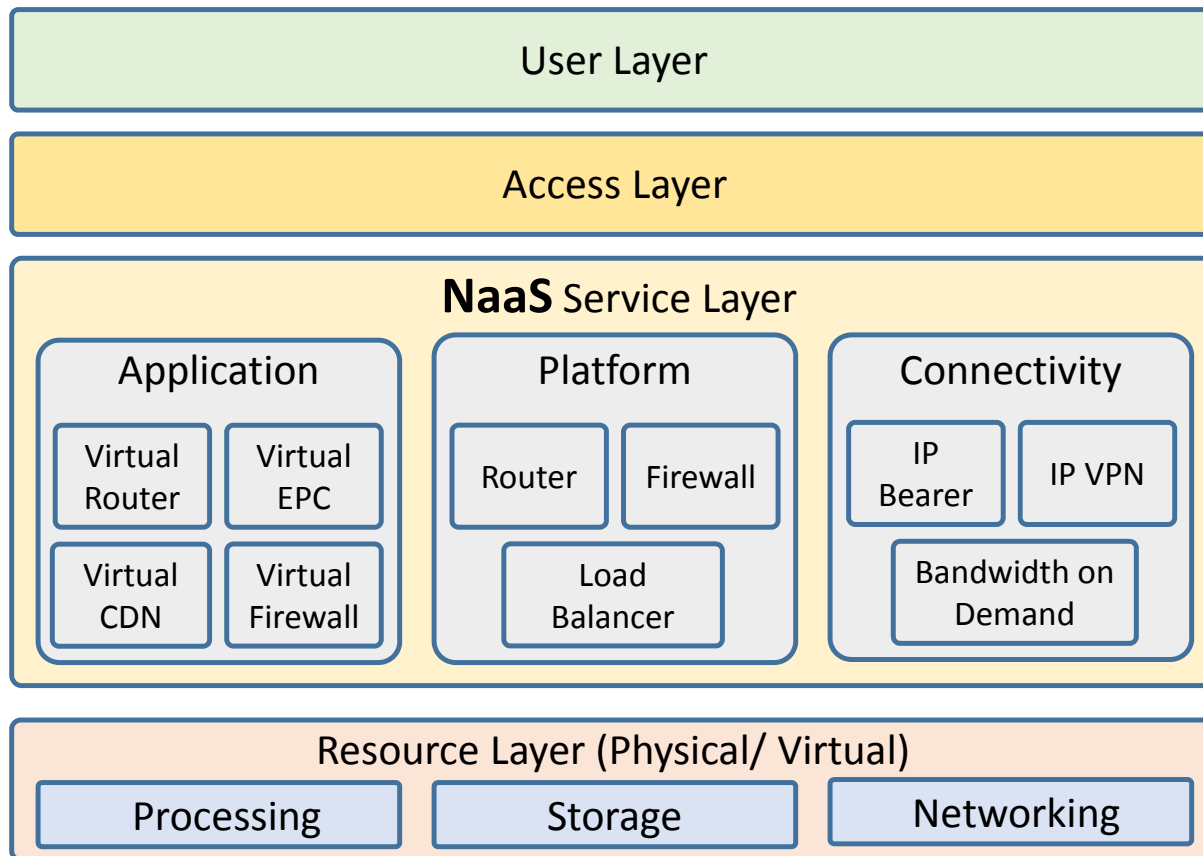


# 1. General Functional Requirements

- **Service life-cycle management:** automated service provisioning, modification and termination during the service life-cycle.
- **Regulatory aspects:** Conformity / privacy protection.
- **Security:** protect the interests of all stakeholders and organizations involved in the cloud computing ecosystem.
- **Accounting and charging:**
- **Efficient service deployment:** efficient use of resources for service deployment.
- **Interoperability:** Compliance with appropriate specifications and/or standards for interworking with other CSPs
- **Portability:** portability of software assets and data of cloud service customers (CSCs) with minimum disruption
- **Service access:** consistent experience when accessing from different devices
- **Service availability, service reliability and quality assurance:** end-to-end QoS assurance, service level agreement (SLA) with the CSC

*Source: ITU-T Y.3501 Recommendation : Cloud computing framework and high-level requirements*

## 2. Functional Requirements for NaaS

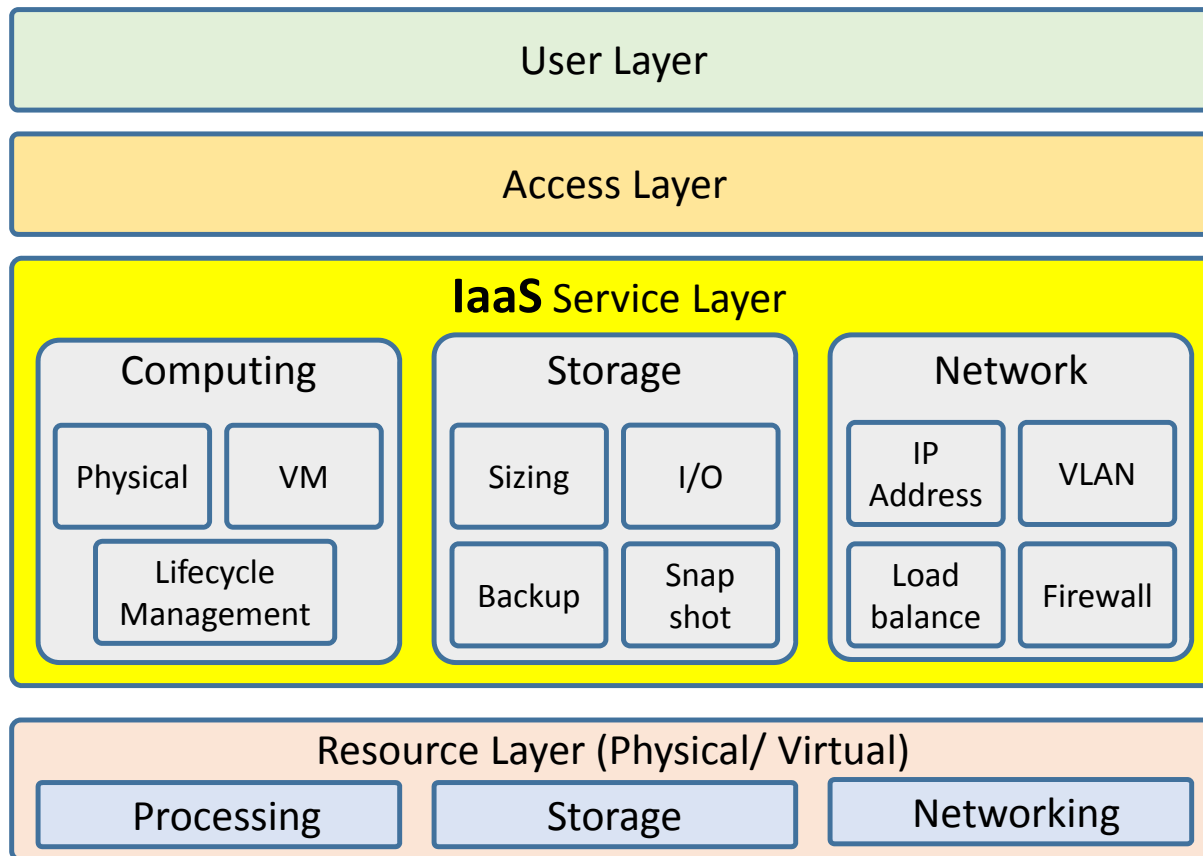


### NaaS

- On-demand network configuration
- Secure connectivity
- QoS-guaranteed connectivity
- Heterogeneous networks compatibility
- Service chain isolation for tenants
- Elastically configurable
- Bandwidth Management
- Granular level traffic engineering, routing and firewalling
- Abstraction View and Control View of Network Resources
- Overlapping of private IPs
- Interworking with different VPNs

Source: Adapted from ITU-T Y.3512 Functional Requirements of NaaS

# 3. Functional Requirements for IaaS



## IaaS

- Dynamic and Elastic Configuration, deployment and maintenance of resources
- Use and monitoring of resources
- SLA on Physical Hardware specifications such as CPU, no of cores memory etc.
- VM related services including specifications, migration, scaling, snapshot, clone, backup, image etc.
- Functions of storage: Reservation Size, I/O performance, migration, snapshot, backup, etc.
- Network: IP address, VLAN, policy migration, Firewall, Loadbalance, Gateway, QoS etc.

Source: Adapted from ITU-T Y.3513 Functional Requirements of IaaS

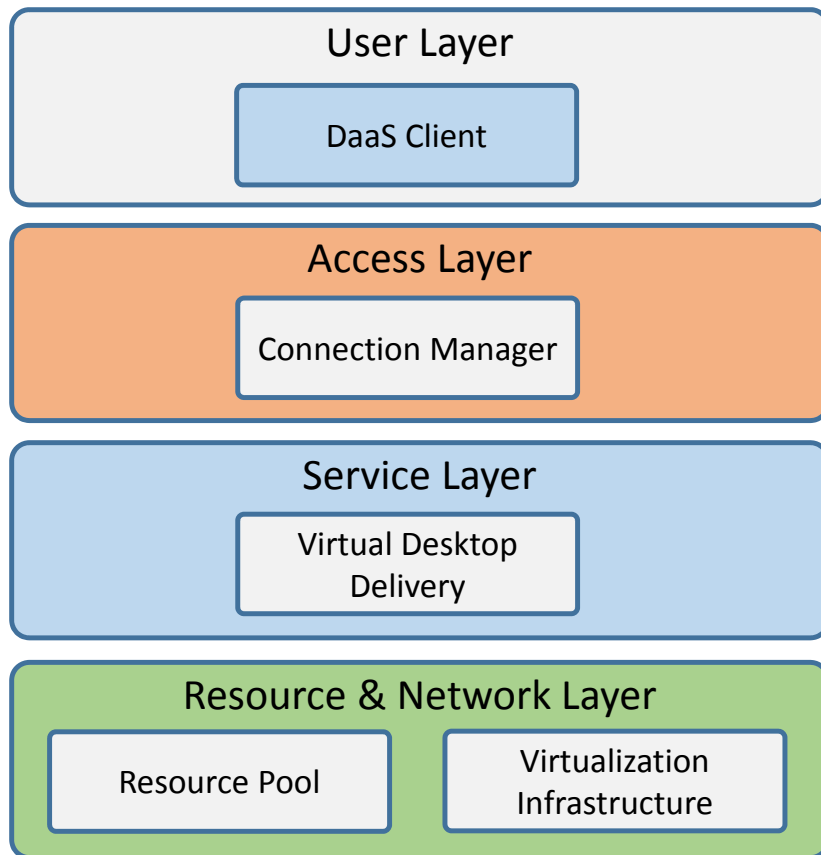
# 4. DaaS in real life

**BYOD**

**VDI**



# 4. Functional Requirements for DaaS



## DaaS

- Configurability of the virtual environment
- DaaS Client - Fast boot-up time
- Support for BYOD (Bring Your Own Device)
- Connection Management
- User profile / Session Management
- Authentication, Authorization, Accounting (AAA)
- Virtual Desktop Lifecycle Management
- Virtual Desktop Delivery
- QoE In terms of running speed of applications, capability to select and run various applications
- Single sign-on access control for all of DaaS functionality with security compliance
- Service availability and Continuity
- Audio and Video Support – 3D GPU Acceleration etc.

Source: ITU-T Y.3514 Functional Requirements of DaaS



# 5. Requirements for Inter-Cloud

- **On-demand assignment of cloud computing resources among CSPs:**
  - a trusted relationship between cooperating CSPs;
  - agreement and means of exchanging data on cost, performance and other information for each resource
  - agreed methodology for requesting, using and returning the resources of other CSPs.
- **Resource and load distribution:** wide-area load distribution according to the required promptness, flexibility and cost.
- **User environment adaptation:**
  - detect user environment changes,
  - discover alternative resources,
  - migrate smoothly with minimum impact based on the CSC's approval
- **Inter-cloud service intermediation:** select the most suitable services, create new services by integrating services offered by other CSPs.
- **Large-scale migration:** guarantee continuity of all the services by large-scale service migration to other federated CSPs with minimum impact using a priority scheme

*Source: ITU-T Y.3501 Recommendation : Cloud computing framework and high-level requirements*



# 6. & 7. Requirements for Resource management & Cloud Infrastructure

## End-to-End Resource Management

- **Manageability for a single cloud service:** ability to collect management, telemetry, diagnostics and/or status information from system components in various layers of cloud service implementation and report the information to the CSC
- **Manageability for multiple cloud services:** multiple CSPs work together to offer comprehensive status awareness and management information to expand across multiple cloud data centers

## Cloud Infrastructure

- **Resource abstraction and control:** resource abstraction and control capability to cloud services.
- **Resource provisioning:** Ability to provide collaboratively compute, storage, and network resources to cloud services and supporting functions.

*Source: ITU-T Y.3501 Recommendation : Cloud computing framework and high-level requirements*

# 8. Security Aspects

- Security architecture/model and framework
- Security management and audit technology
- Business continuity planning (BCP) and disaster recovery (DR)
- Storage security
- Data and privacy protection
- Account/identity management
- Network monitoring and incident response
- Network security management
- Interoperability and portability security
- Virtualization security



*Source: ITU-T FG Cloud Part 5: Cloud security*



Q & A



# Thank You

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