Cloud n Loud

(C)LOUD YOUR DREAMS

Introduction to Cloud Computing

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ENTERPRISE ARCHITECT

EUROPEAN COMMISSION

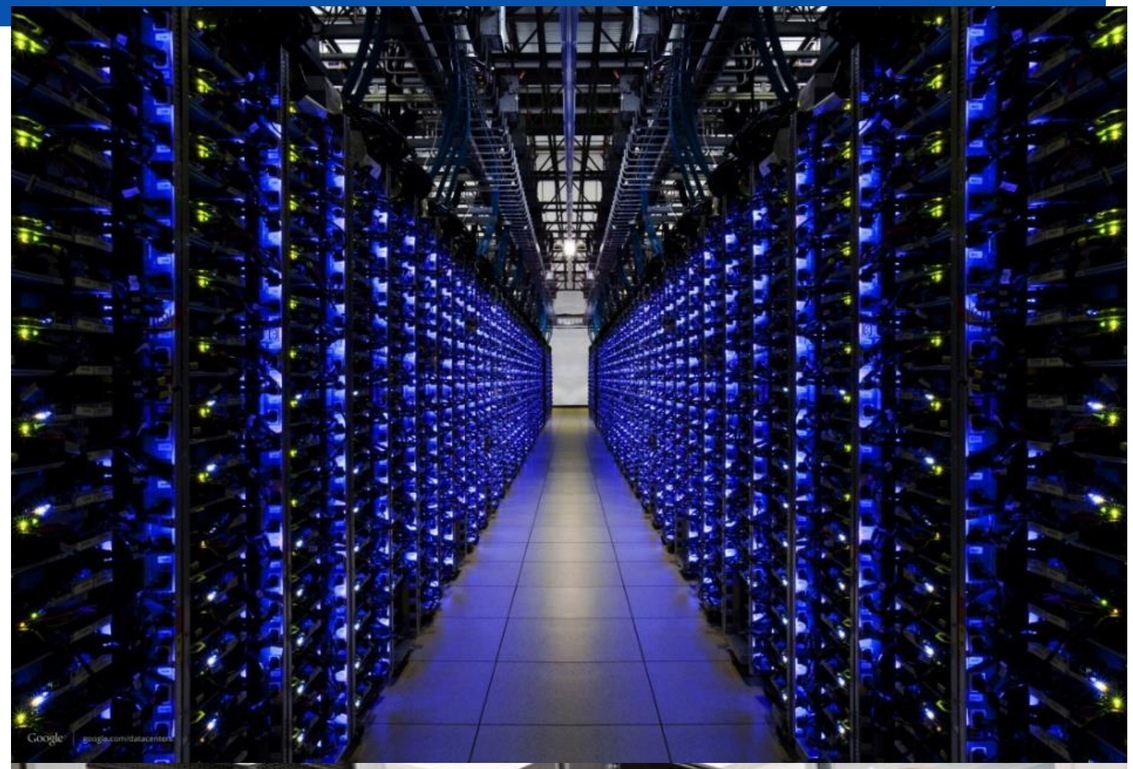
CloudnLoud

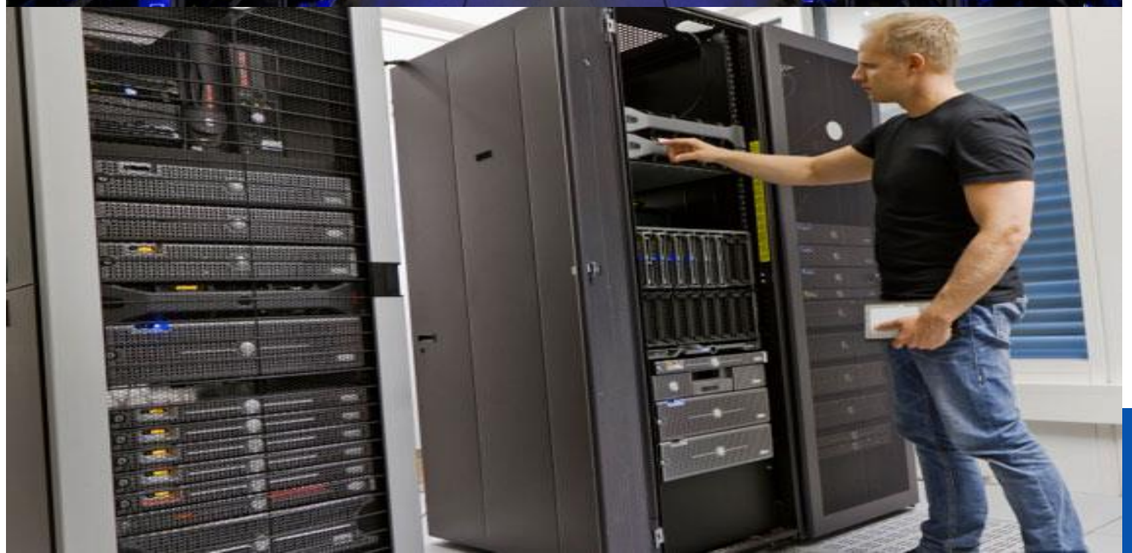
Datacenter

- What is Datacenter
- Traditional Datacenter
- Virtualized Datacenter
- Cloud Datacenter

Datacenter

A data centre is a dedicated space where companies can keep and operate most of the ICT infrastructure that supports their business. This would be the servers and storage equipment that run application software and process and store data and content. For some companies this might be a simple cage or rack of equipment, for others it could be a room housing a few or many cabinets, depending on the scale of their operation.



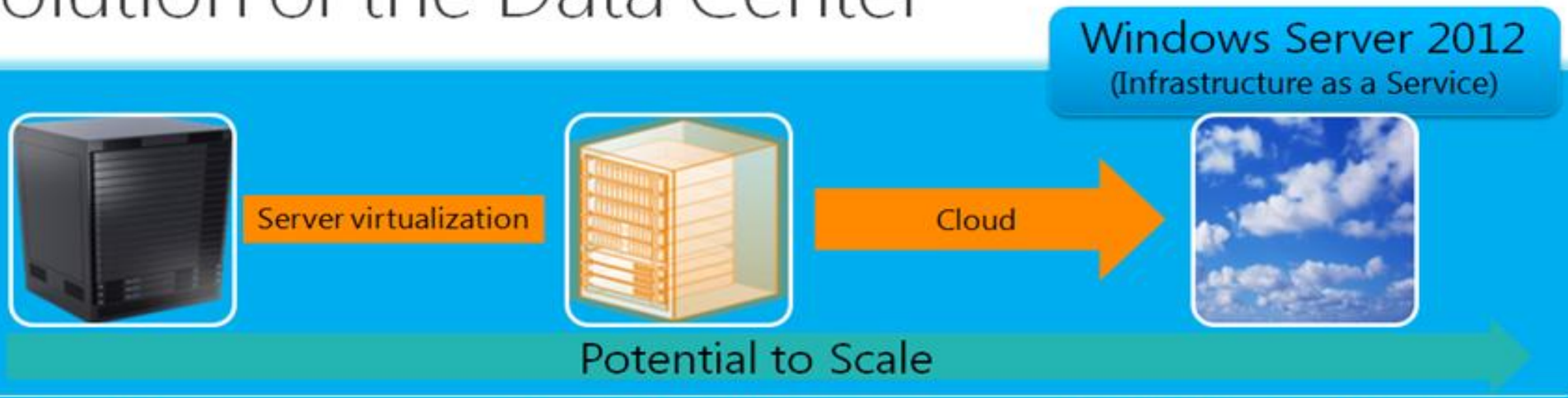


Capex / Opex

Traditional **CAPEX** model - buy the dedicated hardware and depreciate it over a period of time.

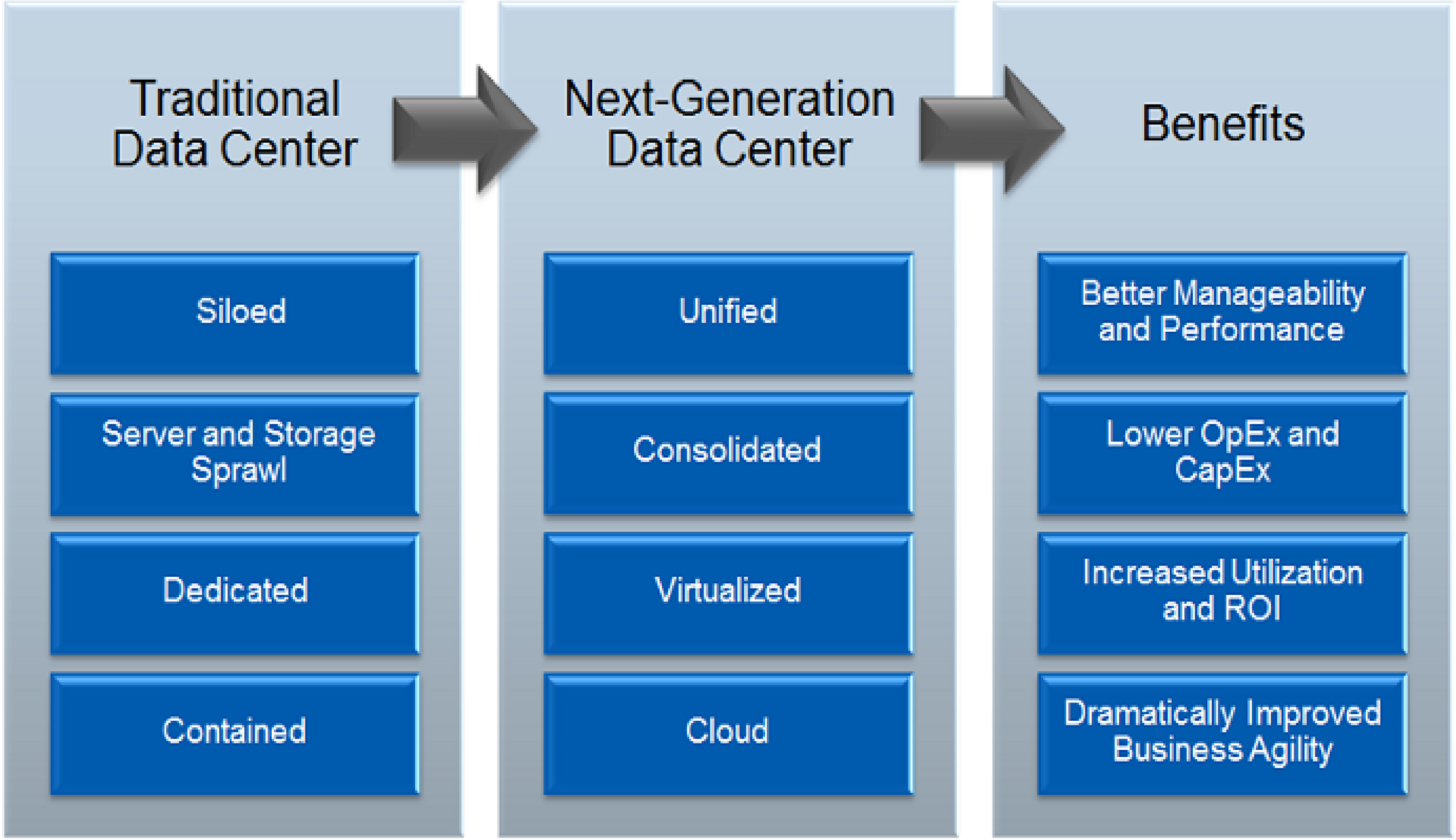
OPEX model - use a shared cloud infrastructure and pay as one uses it.

The Evolution of the Data Center

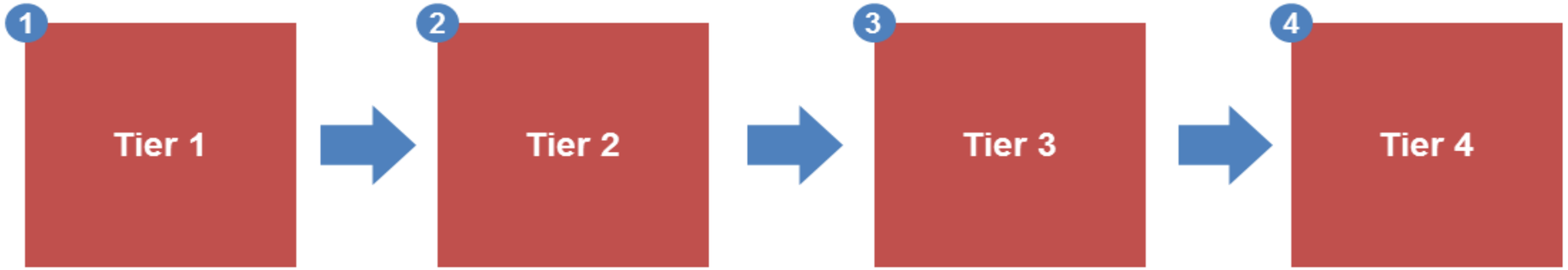


Characteristics	• Dedicated servers • No virtualization	• Server virtualization	• Shared Compute, Storage, Network • Multi-tenancy & isolation • Converged network fabric • Hybrid clouds
Benefits	• Hardware isolation	• Server consolidation • Some scale-out • Heterogeneous server hardware	• Efficient infrastructure utilization • Automatic deployment / migration of Apps, VM's and Services • Scaling of network/storage

Datacenter Journey



Datacenter - Types



Description	Basic Data Center	Redundant Components	Concurrent Maintenance	Fault Tolerant
Characteristics	▪ Single non-redundant distribution path serving the IT equipment ▪ Non-redundant capacity components ▪ Basic site infrastructure guaranteeing 99.671% availability	▪ Fulfills all Tier 1 requirements ▪ Redundant site infrastructure capacity components guaranteeing 99.741% availability	▪ Fulfills all Tier 1 & Tier 2 requirements ▪ Multiple independent distribution paths serving the IT equipment ▪ All IT equipment must be dual-powered and fully compatible with the topology of a site's architecture ▪ Concurrently maintainable site infrastructure guaranteeing 99.982% availability	▪ Fulfills all Tier 1, Tier 2 and Tier 3 requirements ▪ All cooling equipment is independently dual-powered, including chillers and Heating, Ventilating and Air Conditioning (HVAC) systems ▪ Fault tolerant site infrastructure with electrical power storage and distribution facilities guaranteeing 99.995% availability

Datacenter – Types (Contd..)

Tier 1 - Basic	• Single path for power and cooling without redundancy • Many single points of failure
Tier 2 - Redundant Component	• Single path for power and cooling with component redundancy
Tier 3 - Concurrently Mantainable	• Multiple path for power and cooling of which one is active allowing maintenance or testing on one path without causing interruption to the critical load
Tier 4 - Fault Tolerant	• Multiple active paths for power and cooling with redundancy in each path

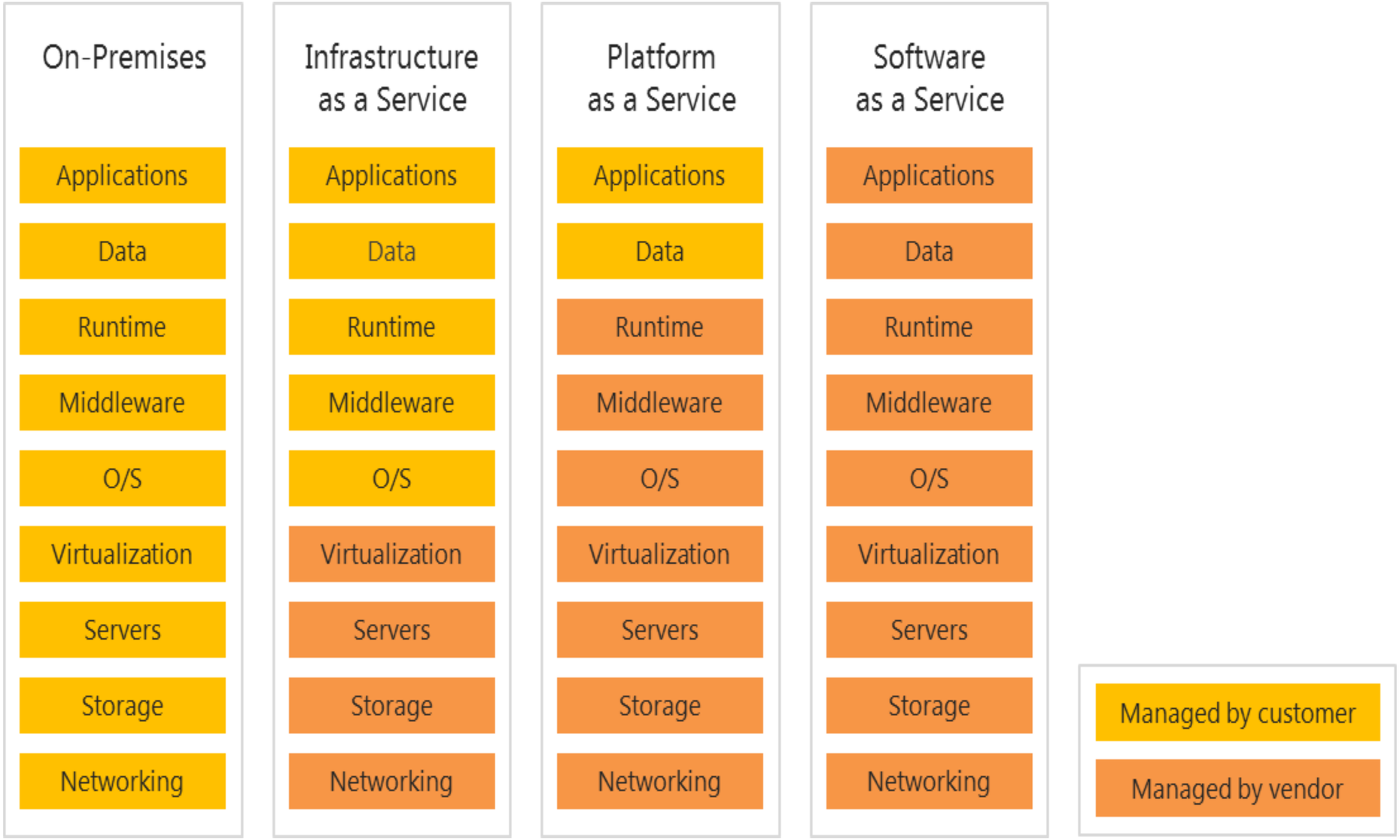
Datacenter – Types - Availablity

	Tier I: Basic Components	Tier II: Redundant Maintainable	Tier III: Concurrently Tolerant	Tier IV: Fault Tolerant
Number of Delivery paths	Only 1	Only 1	1 Active, 1 Passive	2 Active
Redundant Components	N	N + 1	N + 1	2 (N + 1) S + S
Support Space to Raised Floor Ratio	20%	30%	80-90%	100%
Initial Watts/m²	60-90	120-150	120-180	150-240
Ultimate Watts/m²	60-90	120-150	300-450	450 +
Raised Floor Height	30cm	45cm	80-90cm	80-90cm
Floor Loading Kilograms/m²	415	488	732	732 +
Utility Voltage	208, 480	208, 480	12-15kV	12-15kV
Months to Implement	3	3 to 6	15 to 20	15 to 20
Year First Deployed	1965	1970	1985	1995
Annual IT Downtime Due to Site	28.8 hrs	22.0 hrs	1.6 hrs	0.4 hrs
Site Availability	99.671%	99.749%	99.982%	99.995%

Traditional v/s Cloud

Cloud Benefits

Cloud TYPES

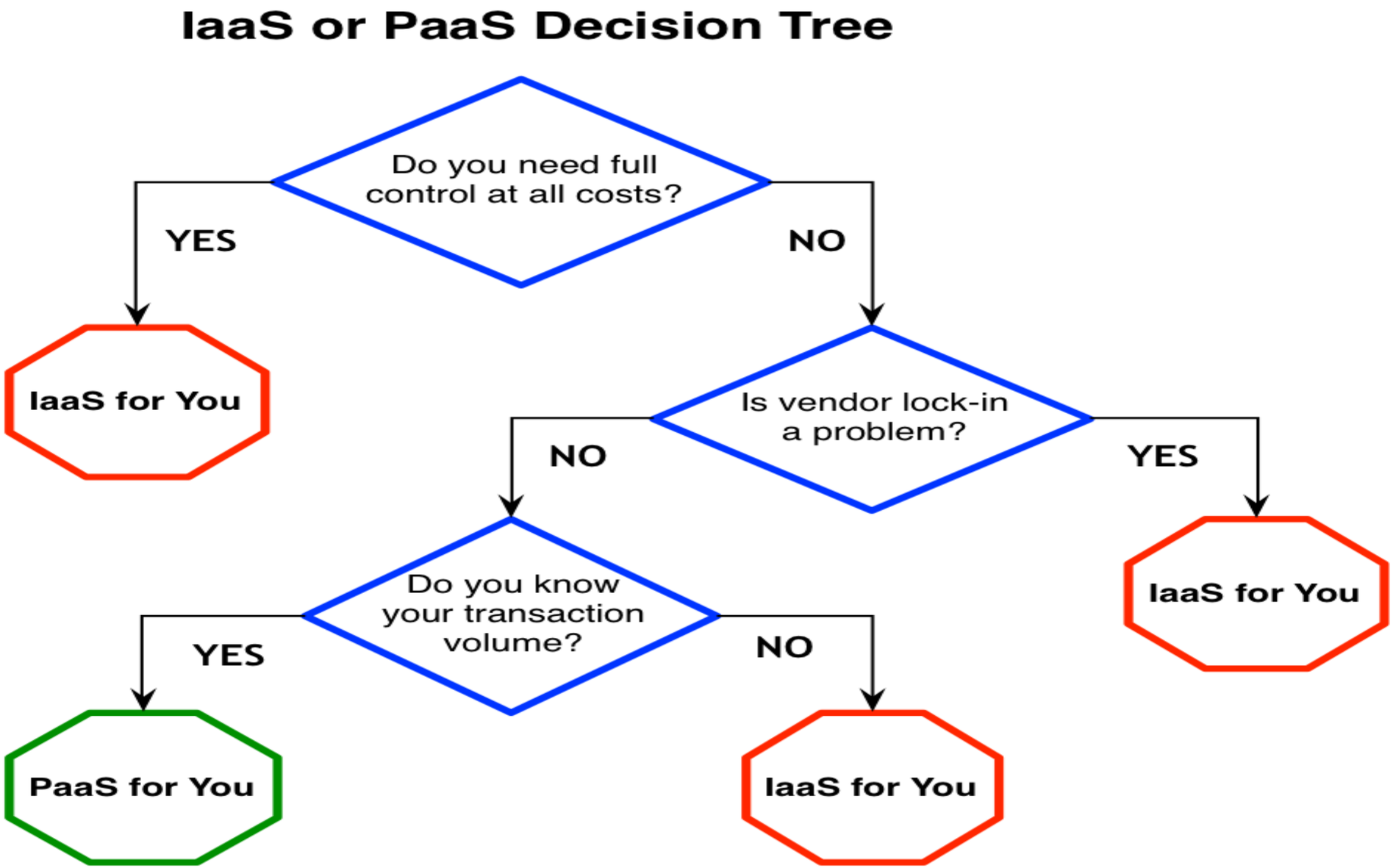

On-Premises
Applications
Data
Runtime
Middleware
O/S
Virtualization
Servers
Storage
Networking
Infrastructure as a Service
Applications
Data
Runtime
Middleware
O/S
Virtualization
Servers
Storage
Networking
Platform as a Service
Applications
Data
Runtime
Middleware
O/S
Virtualization
Servers
Storage
Networking
Software as a Service
Applications
Data
Runtime
Middleware
O/S
Virtualization
Servers
Storage
Networking
Managed by customer
Managed by vendor

Cloud vs. data center costs

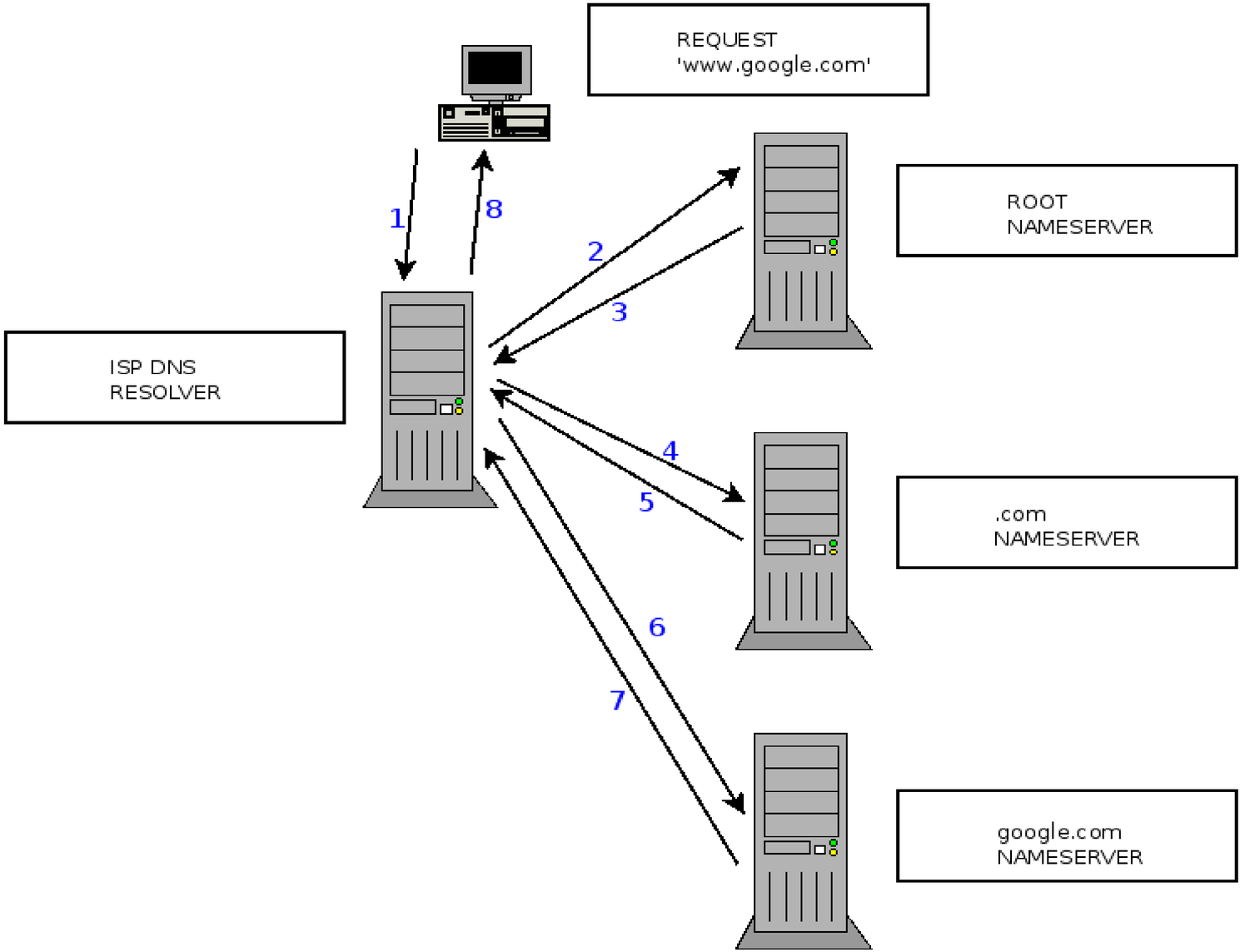
For most small businesses, the cloud is a more cost-effective option than a data center. Because you will be building an infrastructure from the ground up and will be responsible for your own maintenance and administration, a data center takes much longer to get started and can cost businesses $10 million to $25 million per year to operate.

Unlike a data center, cloud computing does not require time or capital to get up and running. Instead, most cloud providers offer a range of affordable subscription plans to meet your budget and scale the service to your performance needs. Whereas data centers take time to build, depending on your provider, cloud services are available for use almost immediately after registration.

IaaS or PaaS Decision Tree

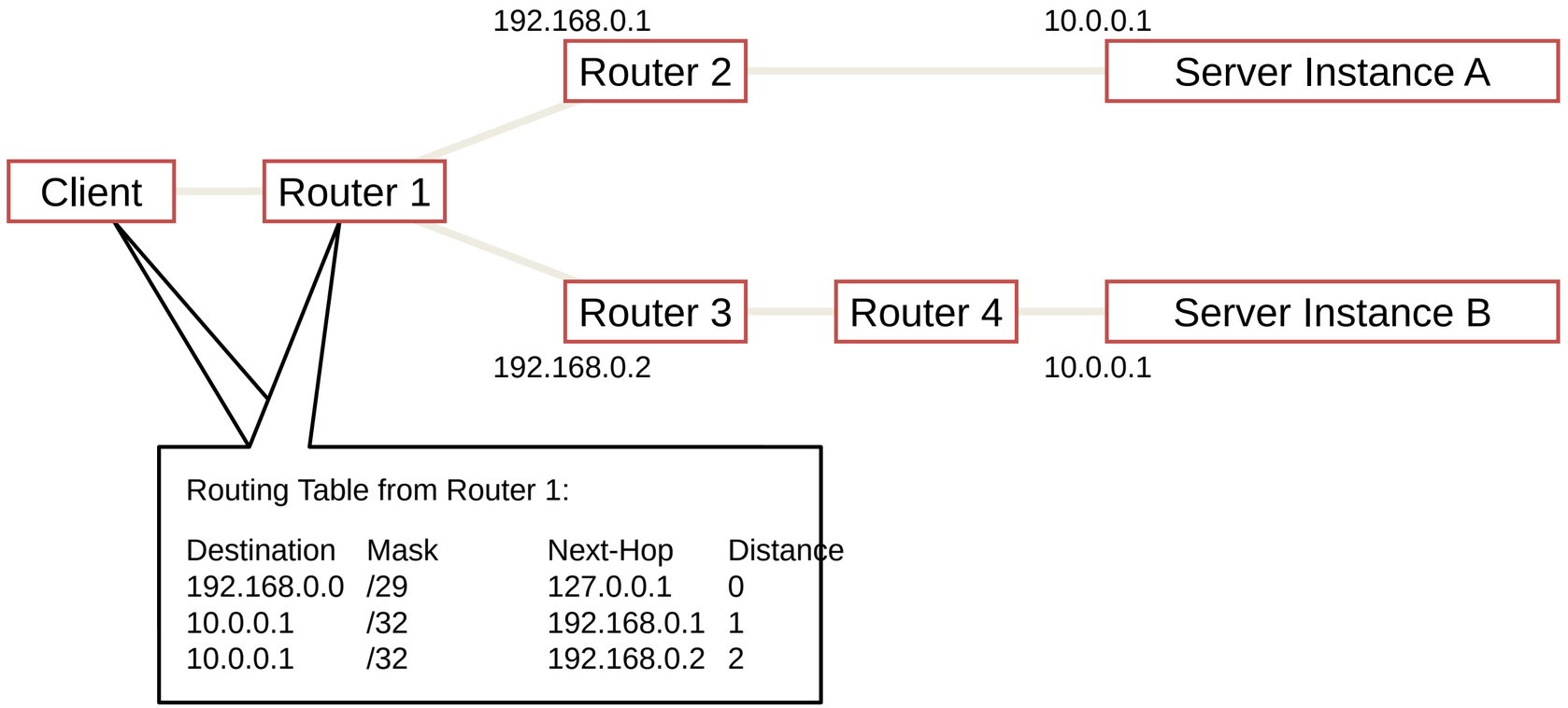


Anycast V/s GeoDNS



ANYCAST

Any Cast Configuration



ANYCAST

How Does Anycast Work?

- The basic idea is extremely simple:
- Multiple instances of a service share the same IP address.
- The routing infrastructure directs any packet to the topologically nearest instance of the service.
- What little complexity exists is in the optional details.

Anycast V/s GeoDNS

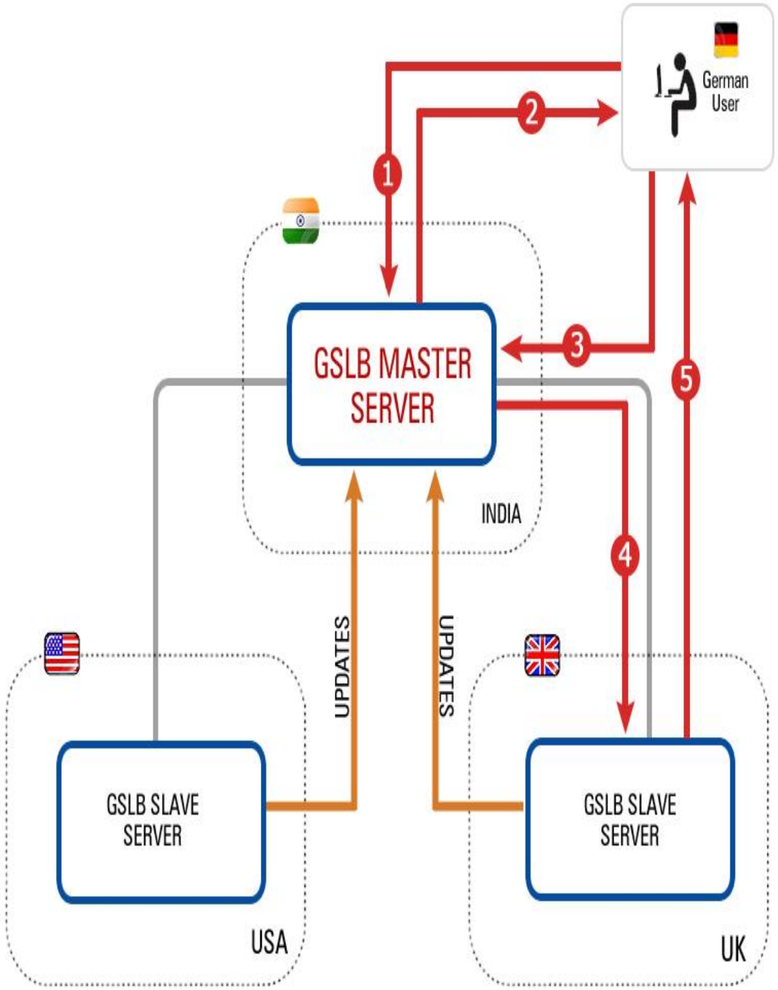
The key benefit of GeoDNS is that it resolves the same name to different IP addresses based on the requester's IP address.

An Anycasted DNS server will return the same IP address regardless of who is doing the asking.

The two work at different network layers. Anycast is below GeoDNS since it has no sense of the requester IP address's location, just its place in the network diagram. What may be close to the DNS server may not be close to the resource being requested, and the Anycasted DNS server has no way to tell this.

GeoDNS uses a map of resource locations and performs logic to determine which of those resources is closest to a given requesting IP address, and then returns that IP address.

GEO DNS - Global Server Load Balancing



Step 1: User (In this case user is from Germany) enters website or requests for the domain CentOS.org. Because of GSLB the request will go to the Primary server (India Based).

Step 2: Primary Server will send a query to the requester for querying IP address; once the user IP gets confirmed it sets a cookie containing all the information on users system.

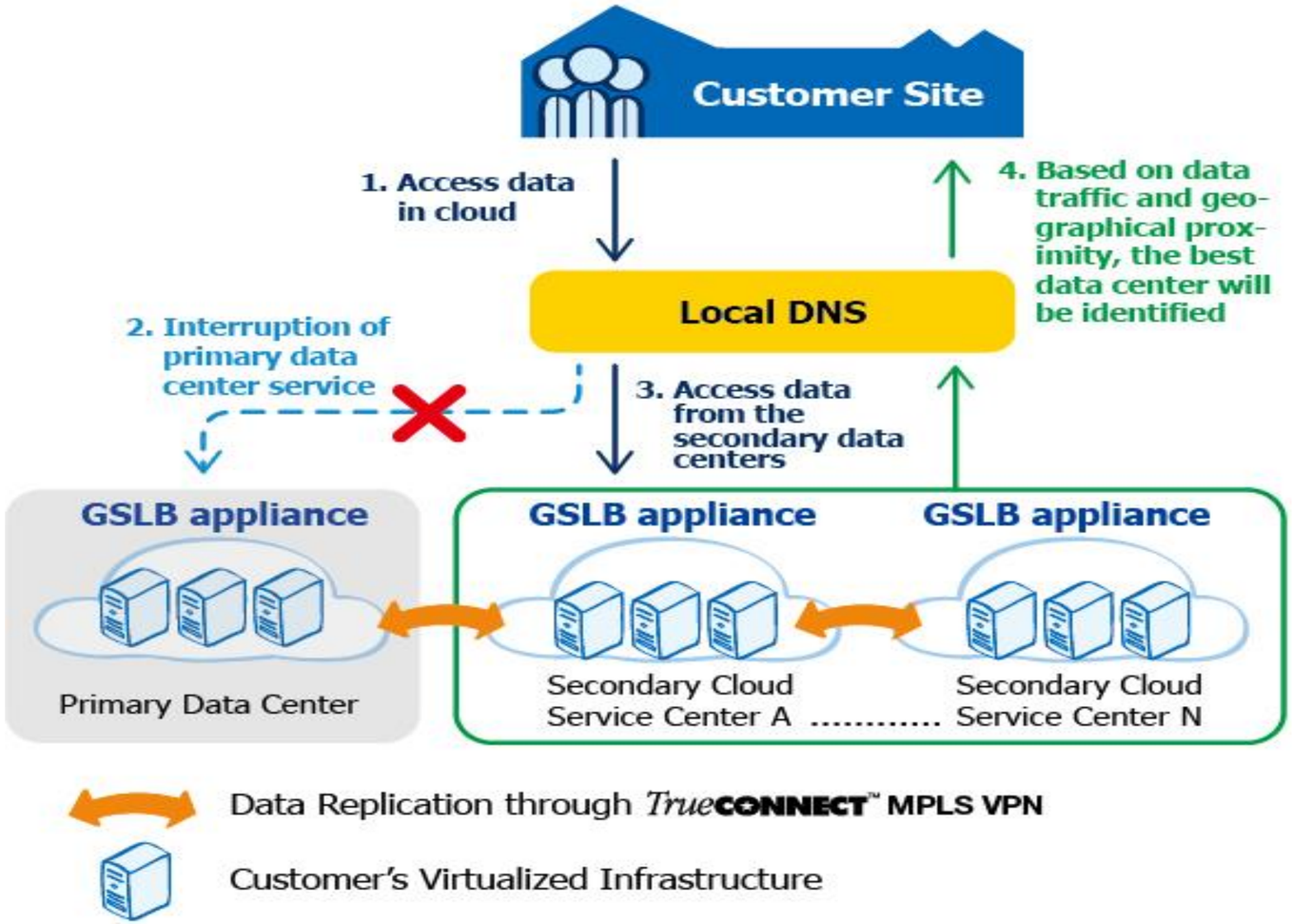
Step 3: Information about the user is passed to the Master Server which checks the health and responsiveness of the slaves.

Step 4: GSLB Primary Server then redirects the request to closest Slave Server (in UK).

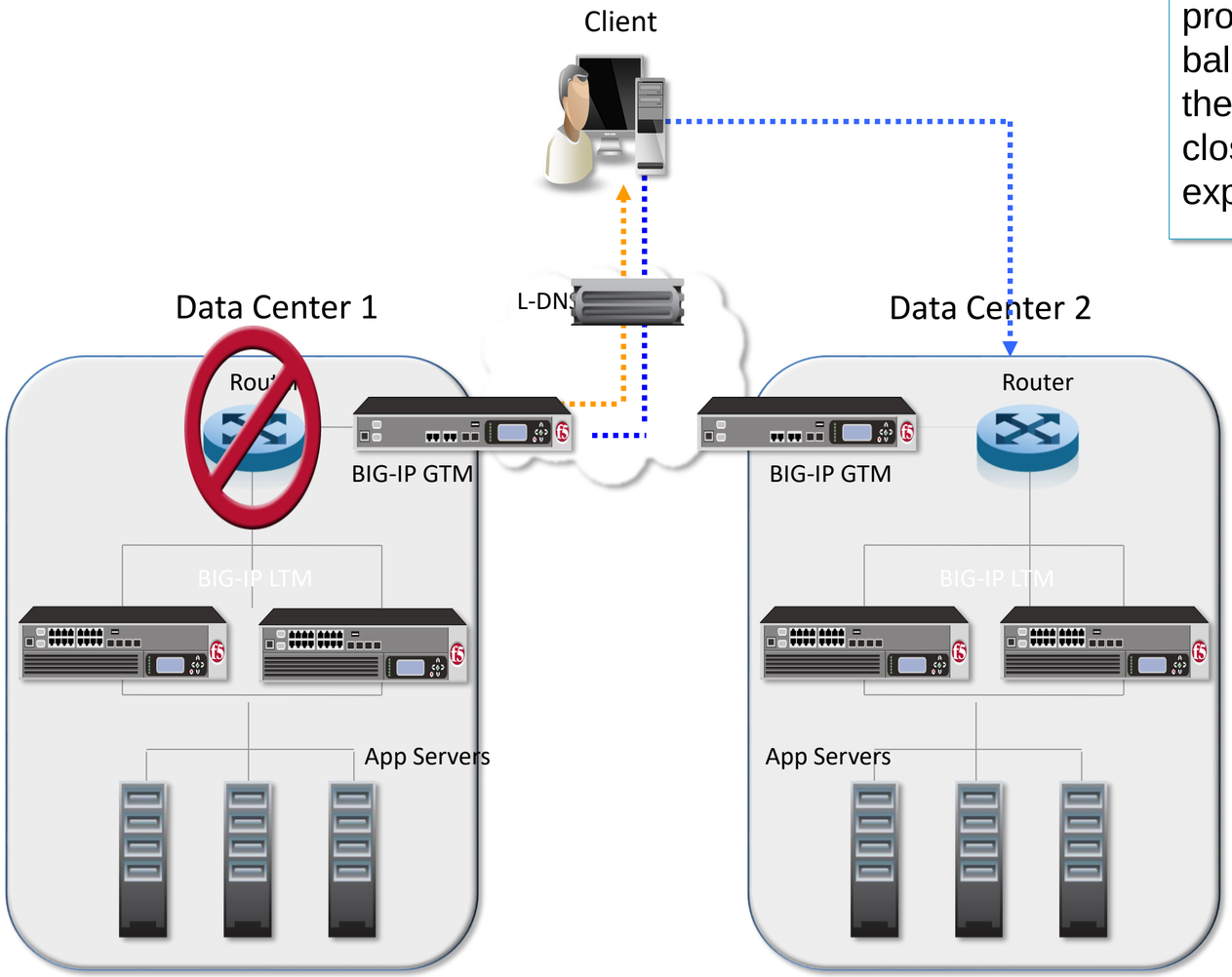
Step 5: User gets the respond / web pages from Nearest Server with high speed.

Primary server gets the updated files from slave servers.

GEO DNS - Global Server Load Balancing in CLOUD



BIG-IP Global Traffic Manager
Direct traffic to the best available data center



BIG-IP Global Traffic Manager provides dynamic data center load balancing, ensuring users are sent to the best available location, and the closest location to provide the fastest experience.

BIG-IP Global Traffic Manager is an integral part of any DNS core infrastructure by providing scale, security, and simplification.

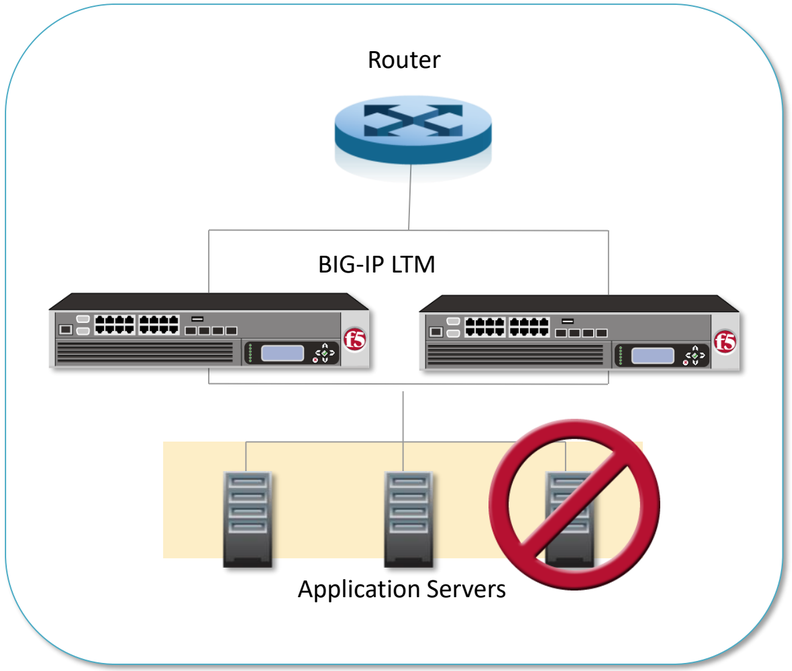
BIG-IP Local Traffic Manager

Direct traffic to the best available server
Guarantee application availability

Available
- Load balancing
- Health Monitor
- Server Persistence

Fast
- Compression
- RAM Caching
- TCP Multiplexing

Secure
- DDoS protection
- TCP proxy
- Application proxy
- SSL offload



RPO vs RTO

RPO - Recovery Point Objective is specifically about data backup in order to maintain continuity. It is essential to determining how often a business should schedule data backup on their network.

RTO- Recovery Time Objective is how long it will take an organization to get back up and running to the Recovery Point Objective.

NFR

Customer used to give these RTO/RPO expectations in NFR (Non Functional requirements) document.As an infrastructure person we should review and understand the business needs.Normally NFR document contains the business expectations.In order to achieve those business expectations what necessary infrastructure required is our call to plan end to end across the platform.

RPO vs RTO

Example - RPO

In environment 1 ,the daily backup will be occurred at 5 pm (daily).
one fine day morning (Tuesday) at 9 am the servers are crashed and business were down.All the users are affected and not able to do any online transactions.
In this scenario we have the data till Monday 5 pm.so between Monday 5 pm to till 9 am, we lost the data.

So in this scenario we lost 16 hours business and data.As per the NFR document if the business cant tolerate data loss beyond 4 hours then we must plan carefully in order to meet that expectation by the way of implementing necessary back infrastructure across platform.

RPO vs RTO

Example - RTO

In environment 2 ,the daily backup will be occurred at 5 pm (daily).
one fine day morning (Tuesday) at 9 am the servers are crashed and business were down.All the users are affected and not able to do any online transactions.

As per the recovery process the ops team has started recovery and the business website has been restored at Tuesday 6 pm (same day).End users are started their transactions from 6 pm onwards.
In this scenario between 9 am (start recovery) and 6 pm (full service restored for end user) is calculated as RTO objective.
So in this scenario the recovery interval is 9 hours.As per the NFR document if the business have the expectations on recovery within 4 hours,then we must plan carefully in order to meet that expectation by the way of implementing necessary recovery infrastructure across platform.

Let us Demystify Cloud Computing …!

Virtualization ✖ Cloud Computing

- It is a common myth that Virtualization is Cloud Computing. .Where as Virtualization is the first step for your journey to Cloud Computing

Cloud Computing – Infrastructure Framework

PaaS

SaaS

IaaS

Cloud Management Stack

(Self service Portal, Service catalogue ,Metering , Automation)

Virtual Infrastructure

(Hypervisor, VM's, vLAN, vSAN , vSwitch)

Physical Infrastructure

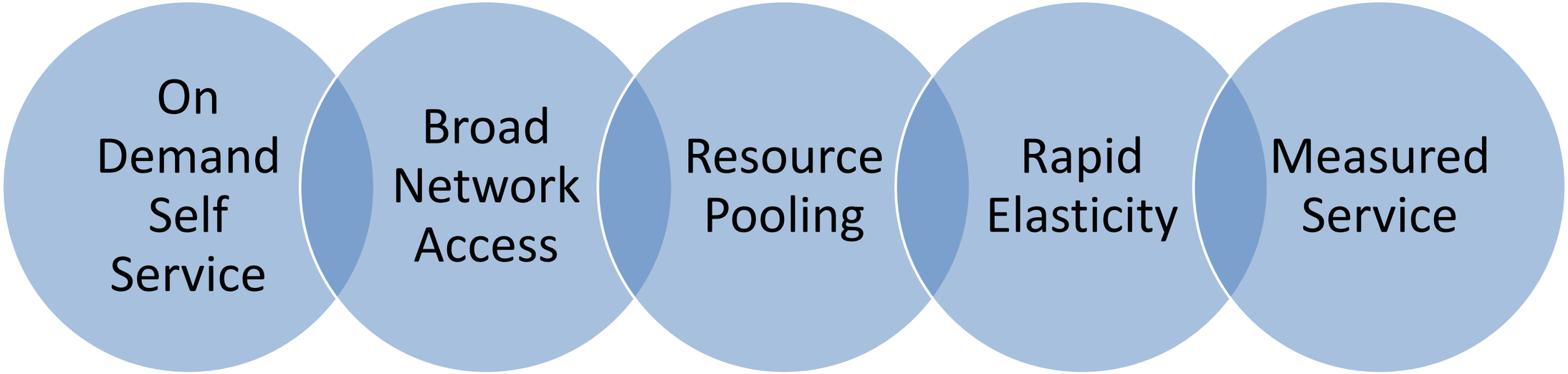
(Physical Server, Network Switches, Storage, SAN Fabric)

Theory in Practice : Cloud Infrastructure Management Products

vCloud Director

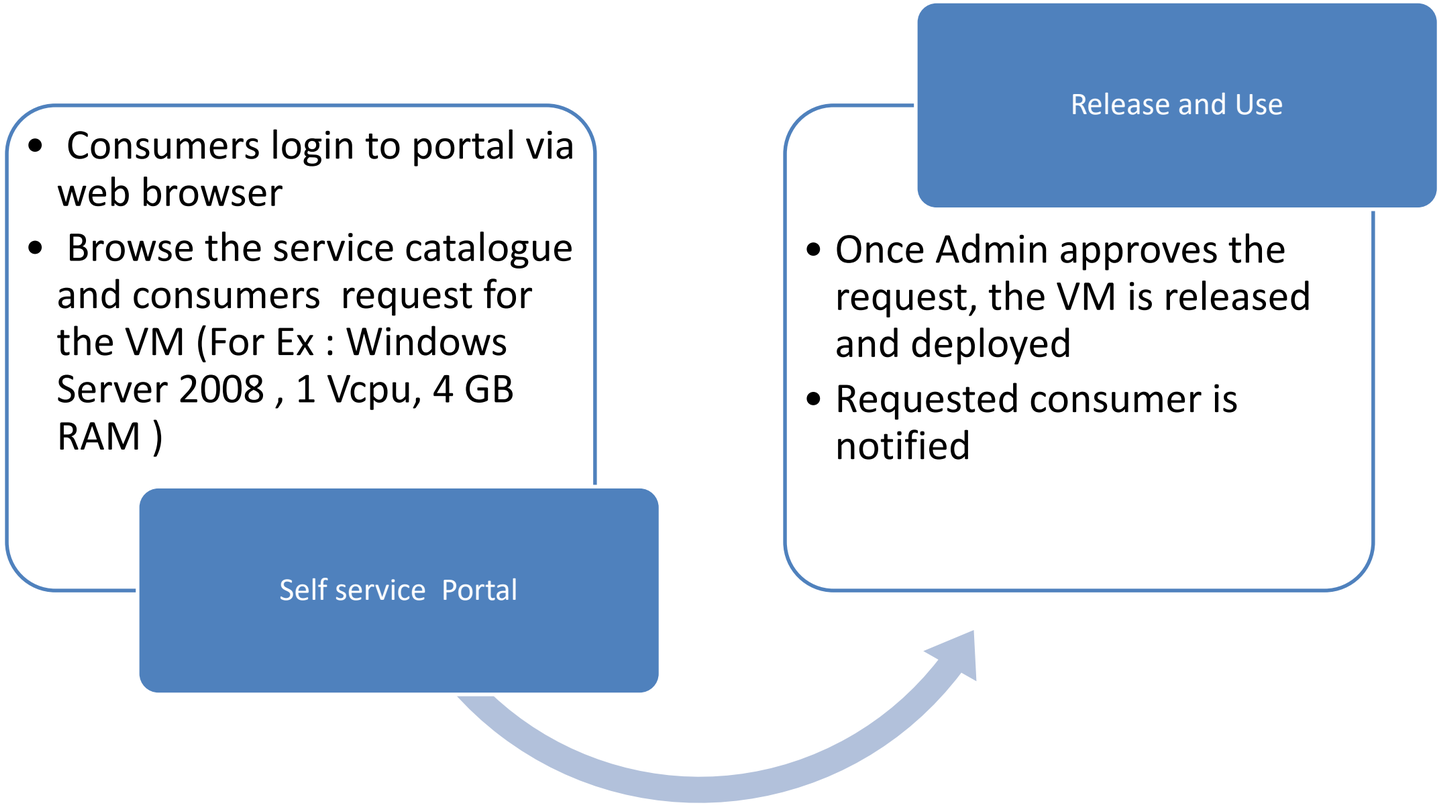
Characteristics of Cloud Computing?

The NIST definition lists five essential characteristics of cloud computing ,as outlined below



On-Demand Self Service – Cloud Characteristic

On-demand self-service: A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider. Below is an example of VM Self provisioning

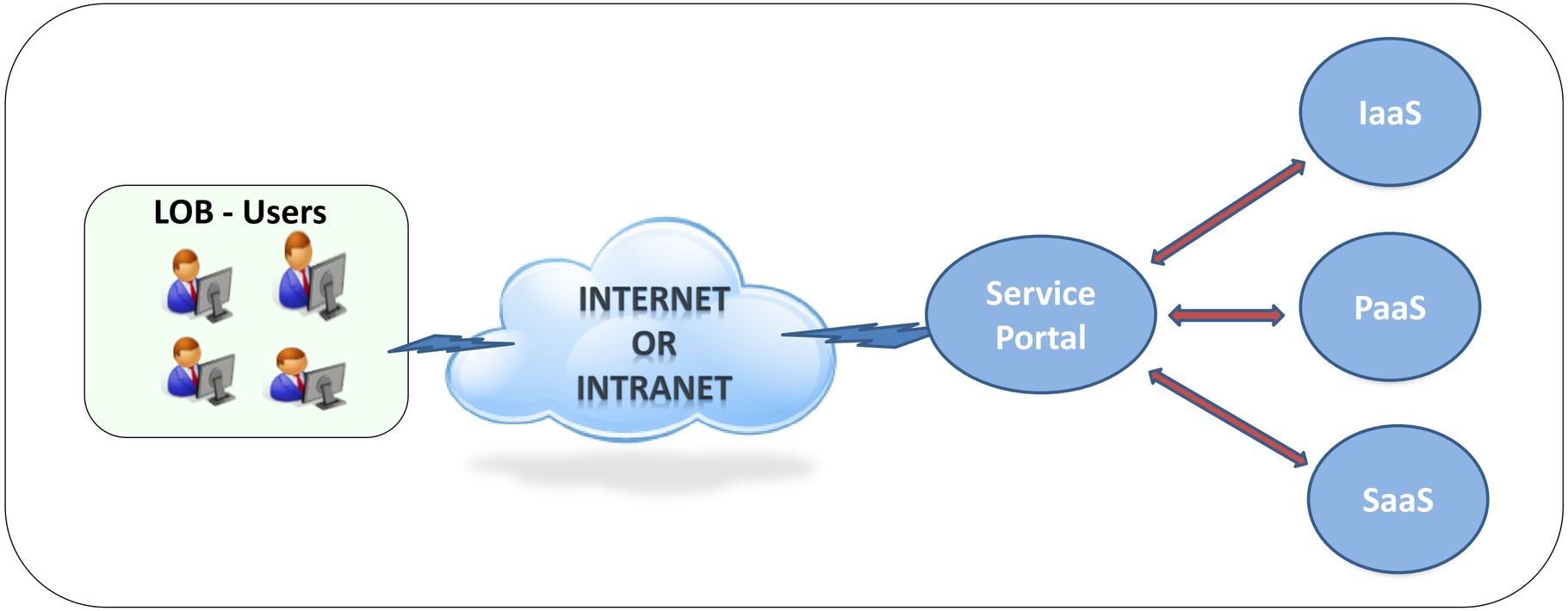


Agenda

1. Private Cloud
2. Public Cloud
3. Hybrid Cloud
4. Cloud Deployment Models
5. Cloud Service Models

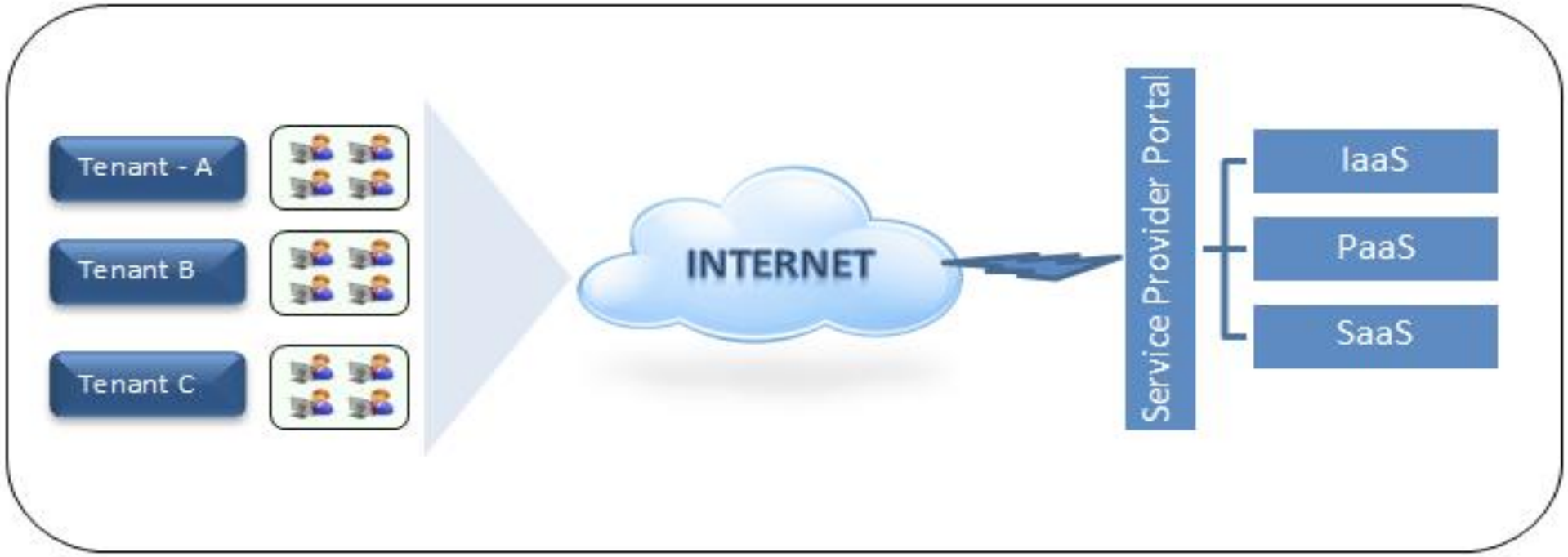
Private Cloud- An Overview

Definition: *"A Private Cloud is a highly virtualized Data centre (VDC) with Cloud Service Management tools deployed on top of the VDC, which allows an Enterprise to deliver one or more cloud services like IaaS, PaaS, and SaaS to internal consumers i.e. Line of Business and employees with Service catalogue, Self-Service portal and chargeback ability "*



Public Cloud –An Overview

Definition: *"A Public Cloud is a highly available physical and Virtualized Data centre (VDC) with Cloud Service Management tools deployed on top of the VDC, which allows a Service Provider to deliver one or more cloud services like IaaS (Physical or Virtual Servers), PaaS, SaaS, STaaS, BaaS to external consumers with Service catalogue, Self-Service portal and chargeback ability – Anil Bidari"*



Hybrid Cloud

- A combination /Federation of Private cloud and one or more Public Cloud service providers
- Consumers access services through organization's self provisioning portal and some of the services via internet from public cloud
- Consumers are organizational LOB's and Individuals
- Private Cloud Infrastructure is owned ,deployed and managed by the Organization's internal IT Team
- Public Services infrastructure is owned ,deployed and managed by service provider

Deployment Models - Summary

Private Cloud

- Single Tenancy
- CAPEX model
- Owned and managed by customer
- Customer has Complete control over resources
- Cloud infrastructure is hosted on premises or hosted at service provider data centers

Public Cloud

- Multi-Tenancy
- OPEX Model
- Owned and Managed by Cloud Service Provider(CSP)
- CSP has complete control on resources
- Customer has limited control over his applications based on subscription

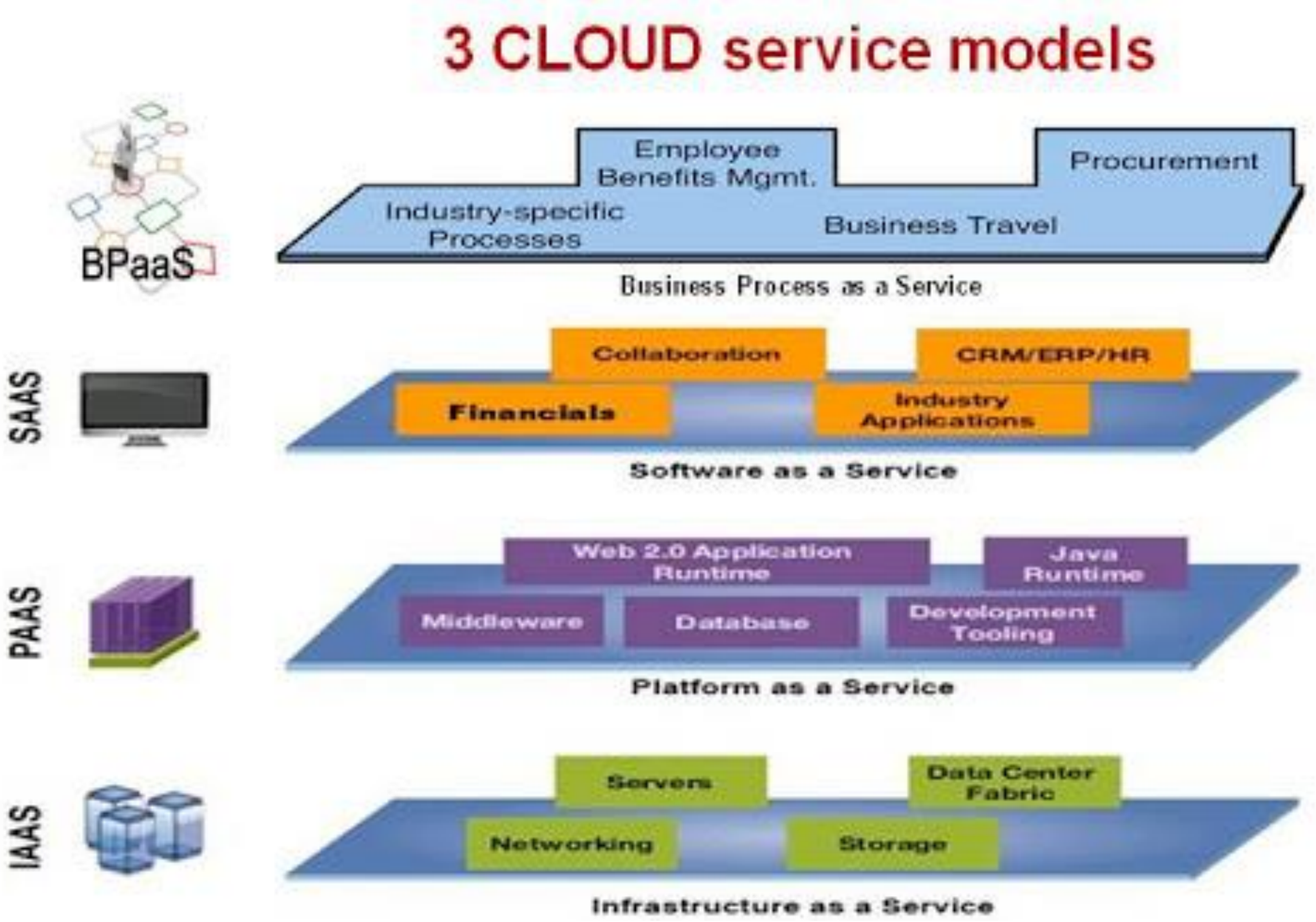
Hybrid Cloud

- Federation of Private and Public Cloud
- Ideal for critical workloads on Private cloud and non critical workloads on Public cloud
- Results in 40 -60 % cost savings compared managing Infrastructure in house and Physical data center

Community Cloud

- The Cloud infrastructure is provisioned for exclusive use by a specific community of consumers
- Consumers have shared concerns (e.g. mission, security requirements, policy and compliance needs
- owned , managed, and operated by one or more organization in the community

Cloud Services Delivery Model



¿ITaaS?

Infrastructure-As-A-Service (IaaS)

What Consumer Gets ?

- *Consumers get dedicated Physical Infrastructure and Virtual Infrastructure-As-A-Service*
  - *Dedicated Physical Servers (Single, Dual and Quad Socket servers) - Charged Per System Per Month*
  - *Virtual Servers (VM's running windows or Linux OS) - Charged Per VM Per Hour*
  - *Dedicated Storage (SAN or NAS storage) - Charged Per System Per Month*
  - *Virtual Storage (Block or File Storage) - Charged Per GB Per Month*

Who Manages Cloud Infrastructure In IaaS Cloud Services ?

- In Private Cloud internal IT team manages the Cloud Infrastructure
- In Public Cloud, The Service provider manages the entire Cloud Infrastructure

Consumer Role in IaaS ?

- Consumer can deploy operating systems and run applications of his choice
- The consumer does not manage or control the underlying cloud infrastructure

Platform-As-A-Service (PaaS)

What you Get ?

- Consumer will get ability to use Development environments like .Net, Java, Ruby,Python, Perl etc…

How they Charge You ?

- Consumer is charged Per hourly basis

Who manages Cloud Infrastructure in PaaS ?

- In Private Cloud internal IT team manages the Cloud Infrastructure
- In Public Cloud, The Service provider manages the entire Cloud Infrastructure

Consumer Role ?

- The consumer does not manage or control the underlying cloud infrastructure including network, servers, operating systems, or storage

Software-As-A-Service (SaaS)

What Consumer Gets ?

- *Consumer can use the software which is developed and deployed and maintained by the SaaS Cloud Provider*
- Consumer can use the software application through internet from Any Device like (ipad, Android Mobile, Desktop or Laptop)

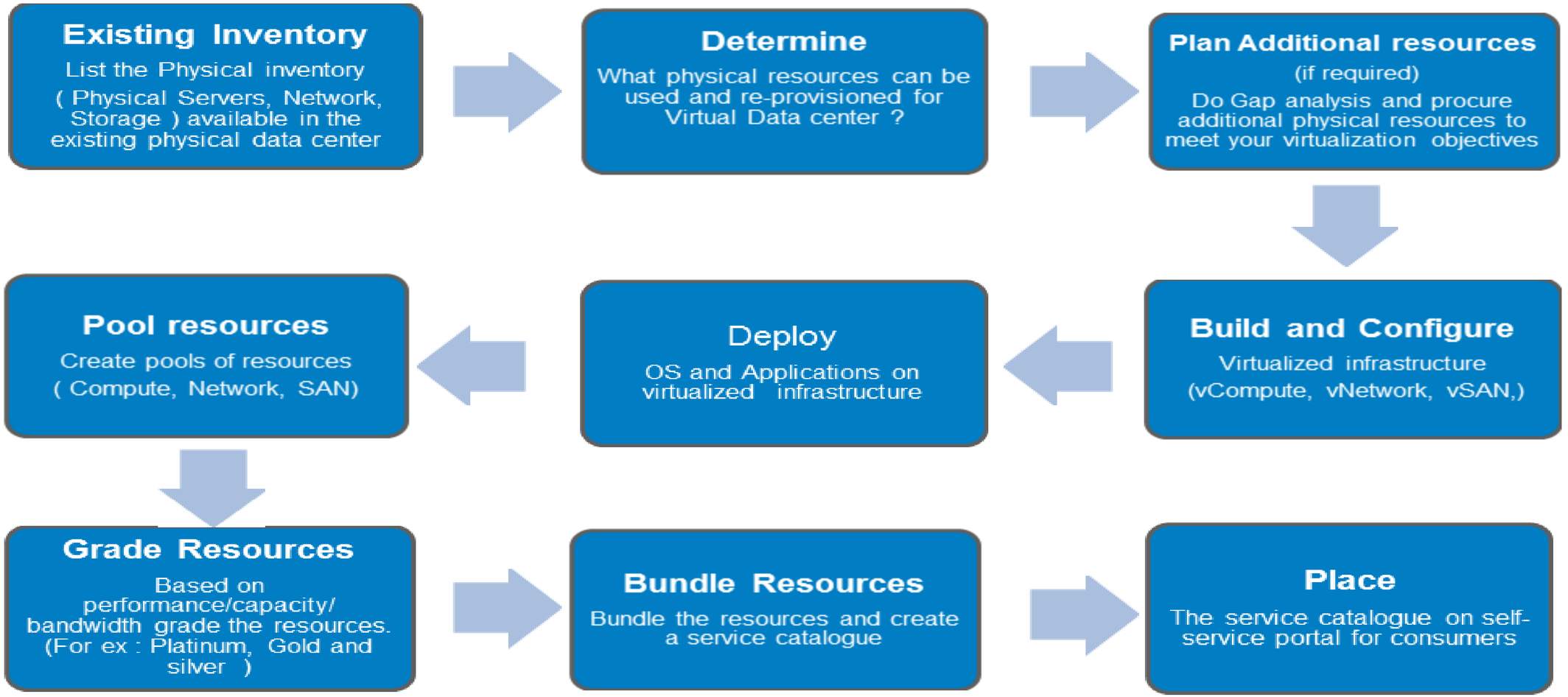
How is consumer is Charged ?

- Consumer is Charged per User Per month
  - *Example A : Salesforce is CRM software which developed, deployed and managed by Salesforce company*
    - *If 10 employees want to use Salesforce app ,they pay 5 USD per employee per month*

Consumer Role ?

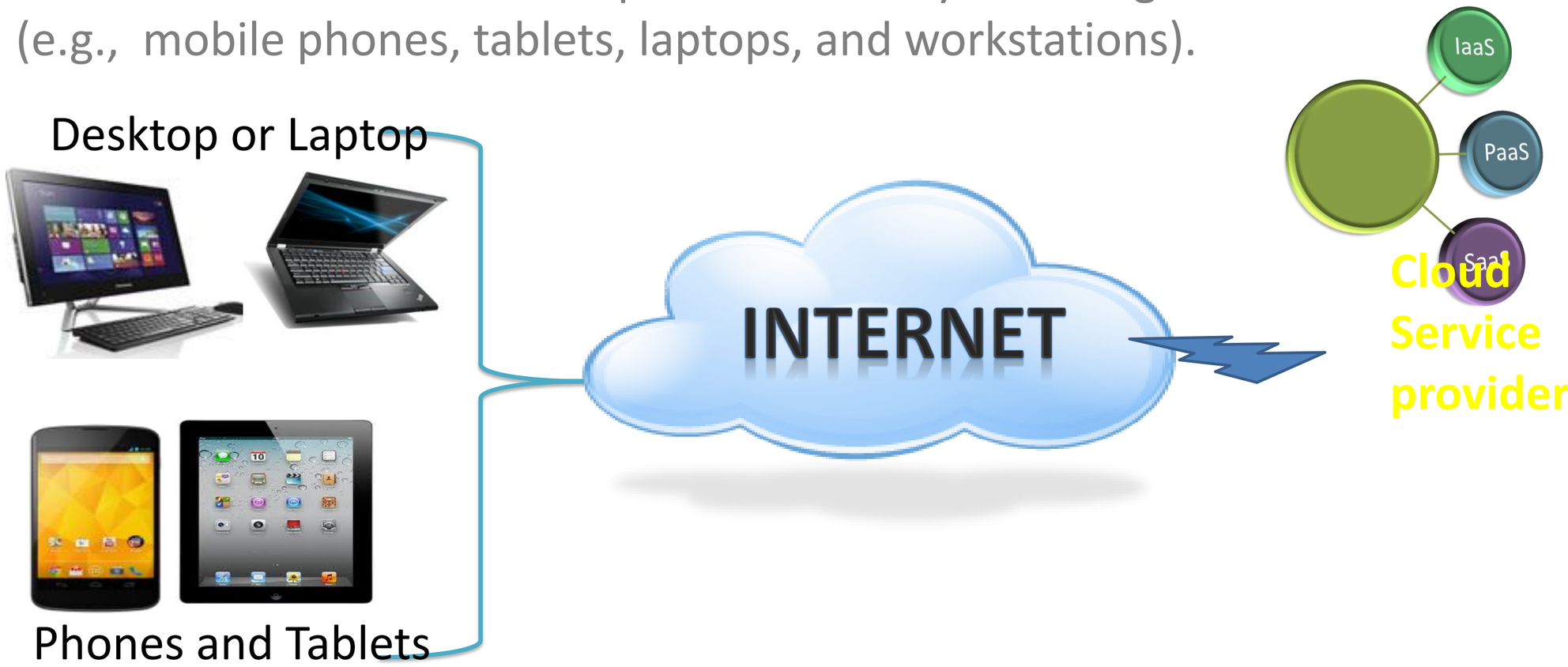
- Consumer is merely a user ,and uses application AS-IS basis ,without ablity to change or modify application

Transitioning from Physical to Virtual to Cloud



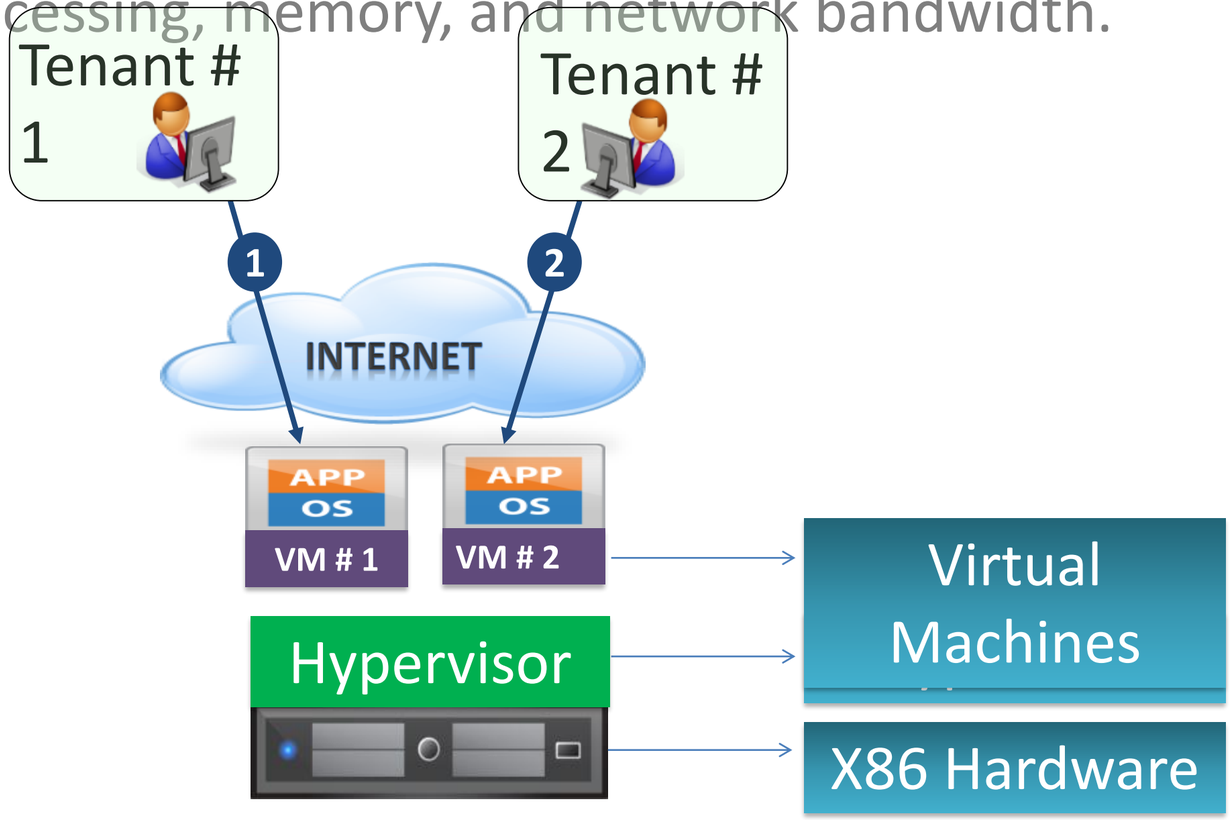
Broad Network Access - Cloud Characteristic

Broad network access : Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, tablets, laptops, and workstations).



Resource Pooling – Cloud Characteristic

Resource pooling : The provider's computing resources are pooled to serve multiple consumers using a multi-tenant model, with different physical and virtual resources dynamically assigned and reassigned according to consumer demand. Examples of resources include storage, processing, memory, and network bandwidth.



Rapid Elasticity – Cloud Characteristic

Rapid elasticity : Capabilities can be elastically provisioned and released, in some cases automatically, to scale rapidly outward and inward commensurate with demand. To the consumer, the capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time.

Measured Service – Cloud Characteristic

Measured service: Cloud systems automatically control and optimize resource use by leveraging a metering capability at some level of abstraction appropriate to the type of service (e.g., storage, processing, bandwidth,... Resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service.

HOW MUCH CONSUMED

HOW MUCH IT COSTS

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