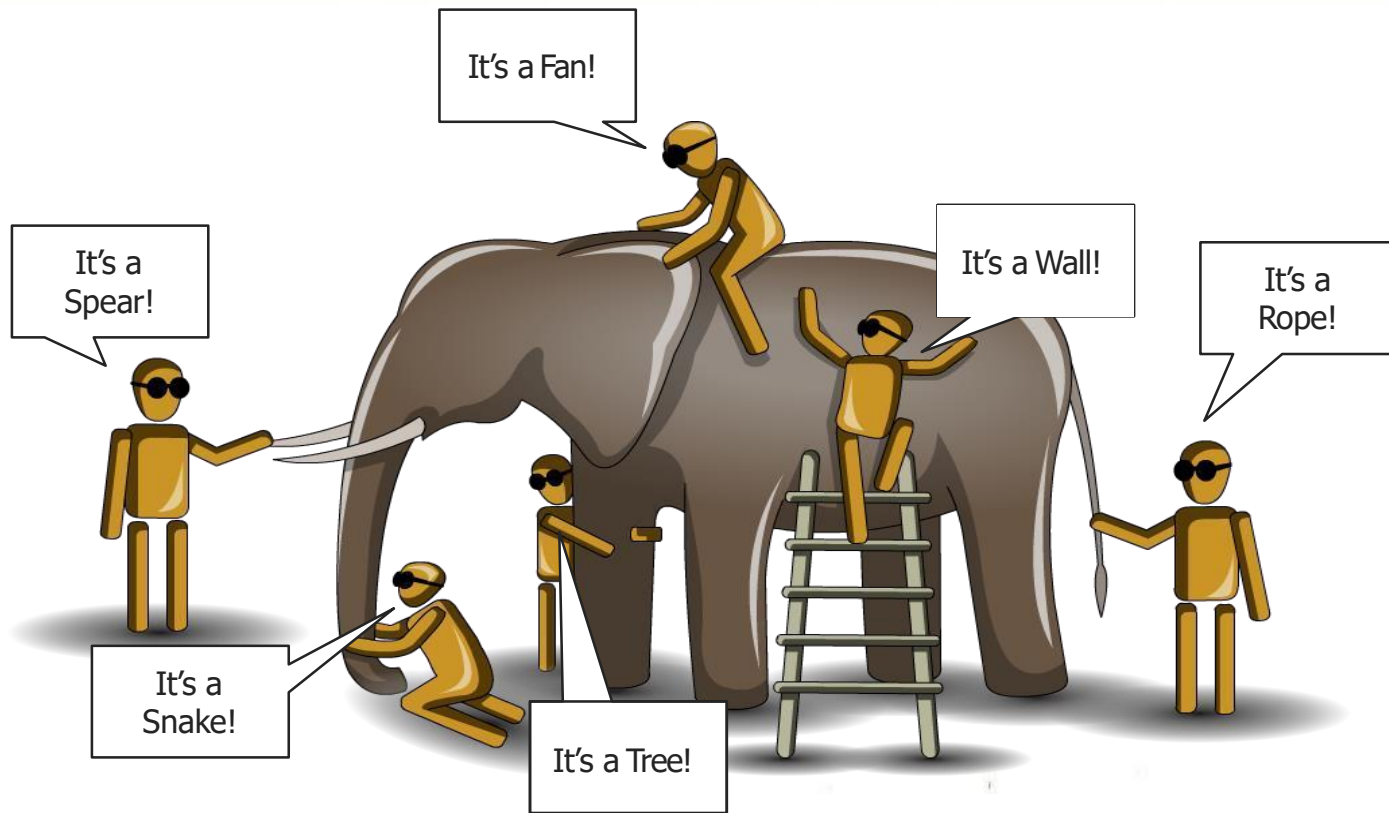




INTRODUCTION TO CLOUD COMPUTING

What is Cloud Computing? (Contd.)



Cloud Introduction

→ According to Forrester, Cloud Computing is:

“A form of **standardized** IT-based capability — such as Internet-based services, software, or IT infrastructure — offered by a service provider that is **accessible via Internet protocols** from any computer, is **always available and scales automatically** to adjust to demand, is either pay-per-use or advertising-based, has Web- or programmatic-based control interfaces, and enables full customer self-service.”

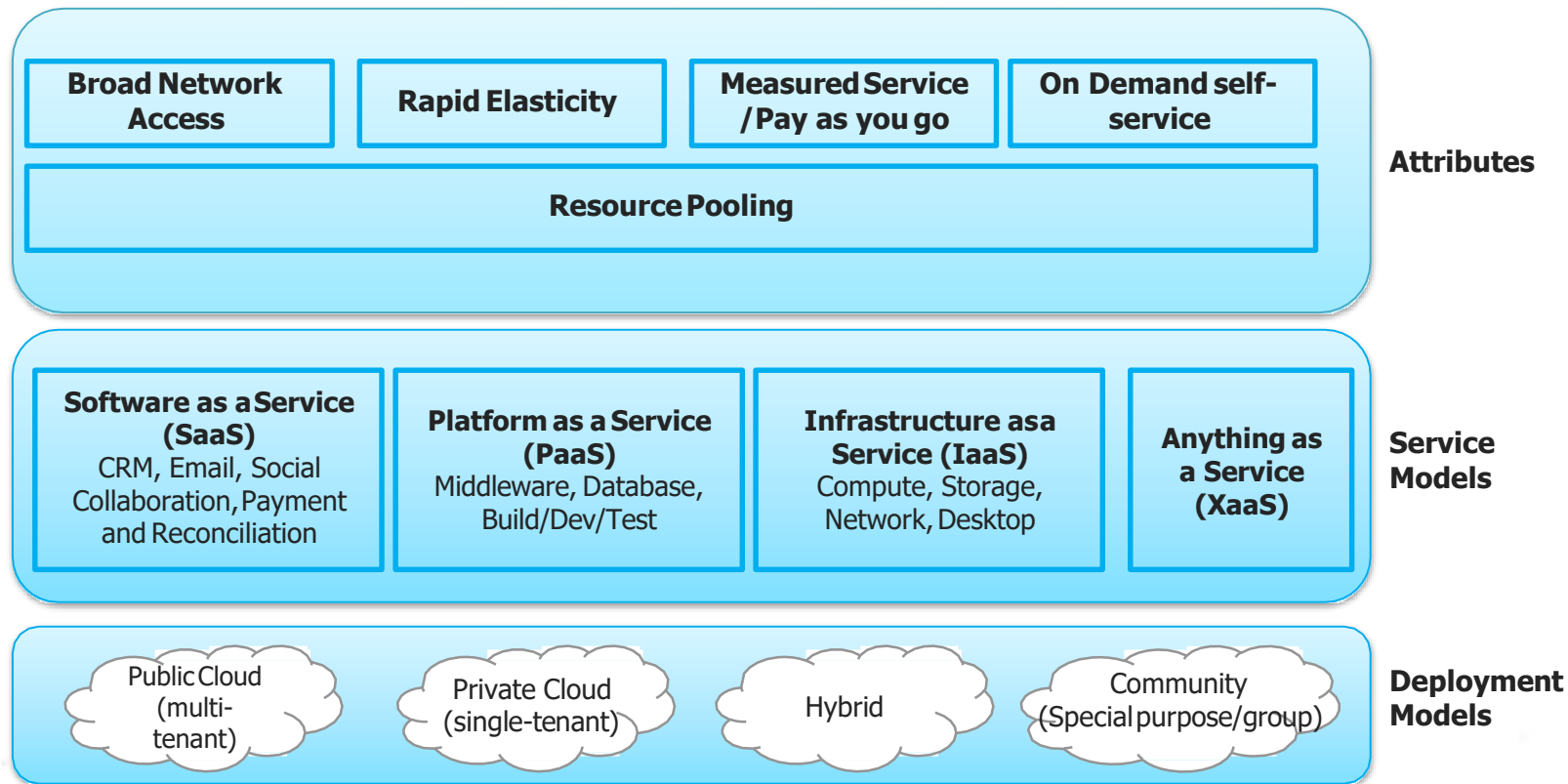


Cloud Introduction

→ According to NIST, Cloud Computing is:

“Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model promotes availability and is composed of five essential characteristics, three service models, and four deployment models.” - (NIST)

Cloud Introduction



Cloud Delivery Models

→ Software as a Service (SaaS):




- » The application is hosted centrally
- » Software testing takes place at a faster rate
- » Reduction in IT operational costs
- » No need to install new software to release updates

→ Platform as a Service (PaaS):

- » Facilitation of hosting capabilities
- » Designing and developing the application
- » Integrating web services and databases
- » Providing security, scalability and storage

→ Infrastructure as a Service (IaaS):

- » Virtualization of Desktop
- » Internet availability
- » Use of billing model
- » Computerized administrative tasks

	SaaS	PaaS	IaaS
	CONSUME 	BUILD 	HOST 
Consumer	End User	Application Owner	Application Owner
Type of Service Provided	Completed Application	<ul style="list-style-type: none">• RunTime Scenario• Cloud Storage• Integration, etc	<ul style="list-style-type: none">• Cloud Storage• Virtual Server
Coverage at service level	<ul style="list-style-type: none">• Application Uptime• Application Performance	<ul style="list-style-type: none">• Environment Availability• Environment Performance• No Application Coverage	<ul style="list-style-type: none">• Virtual Server Availability• Time to Provision• No platform or application coverage
Examples of Services Provided	<ul style="list-style-type: none">• CRM• e-mails• Collaborvatives• ERP	<ul style="list-style-type: none">• Application Development• Decision Support• Web• Streaming	<ul style="list-style-type: none">• Caching• Security• Legacy• System• Management

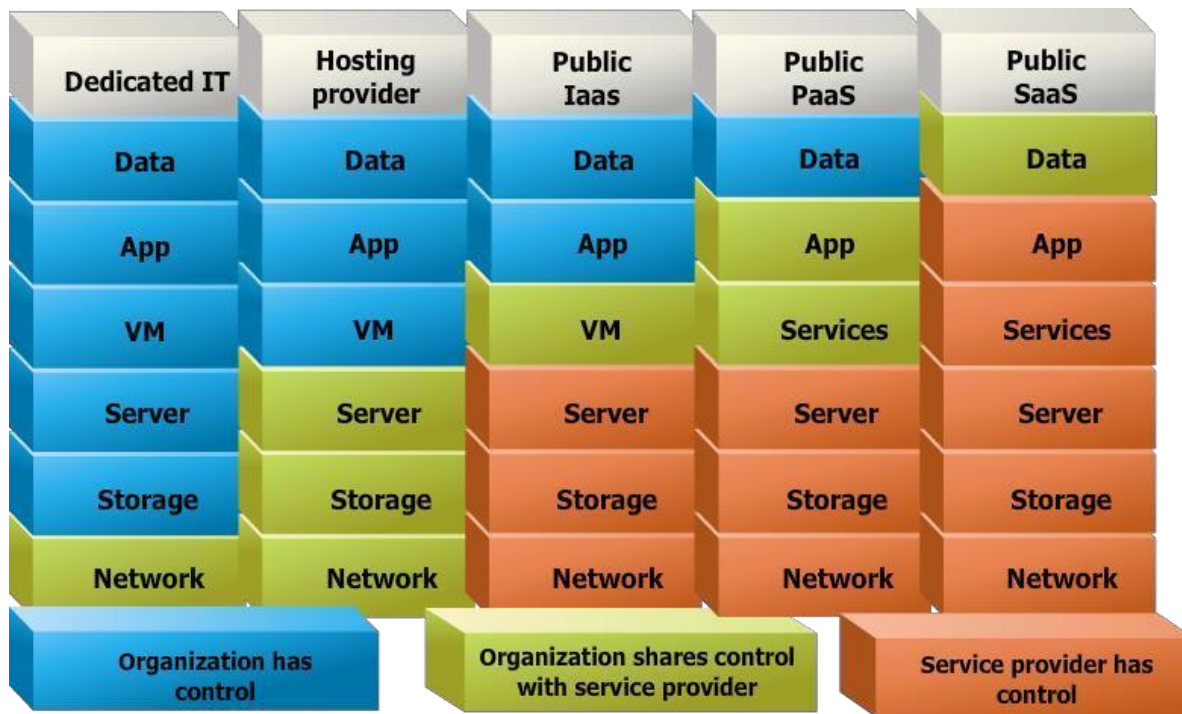
What does Pay-as-you-go Mean?

Service Model	Typical Unit of Measure	Typical values
SaaS	Per user per month, Per location per month, etc.	No norm. The vendor is free to set his pricing and the unit of measure!
PaaS	Per GB per month for DBs, Per connection per month for integration layer, Data Transfer In/Out	10 USD/GB-month
IaaS	Instance-hours per month, Data Transfer in/Out, GB per month for storage	10 cents/hour 10 cents/GB – in, 15 cents/GB-out 10 cents/GB-month

Sample Benefits and Risks for Cloud Types

Service Model	Benefits	Risks	Best Fit
IaaS	On-Demand Infrastructure	Security Data persistence Data aggregation Business Risk of Outages Service failures can affect multiple tenants and customers	Non-legacy apps Consolidation Efforts Hosting for Dev & Test
PaaS	Standardized development environment Rapid development & testing	Similar risks as above Vendor Lock-in	New application development Application development that uses provider building blocks to reduce time-to-market
SaaS	Re-usable services Only requires limited configuration & management	Similar risks as IaaS Lack of control Vendor Lock-in	Configuration over customization Commoditized applications

Distribution of Control between Service Models



Cloud Computing Deployment Models

Public Cloud

- Mega-scale Infrastructure and Services
- Sold publically
- Pay-Per-Use
- Multitenant applications and services
- Access virtually unlimited resources

Private Cloud

- Finite Infrastructure and Services
- Enterprise owned or leased
- Charge-back to LOBs or Users
- Cloud Computing model in a company's own datacenter or providers
- Access limited resources that must be managed by LOBs or Central IT

Hybrid Cloud

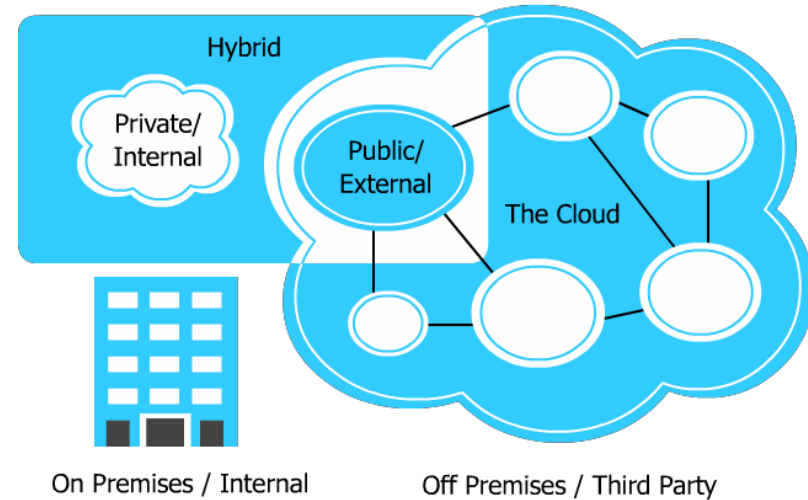
- Composition of two or more clouds
- Mixed usage of both public and private clouds
- Enables application components to be spread between multiple public and/or private clouds

Hybrid Cloud

→ Hybrid Cloud consisting of multiple internal and/or external providers will be typical for most of the enterprises

→ **Example** : GoGrid, Amazon VPC

Cloud Computing Types



Sample Benefits and Risks for Cloud Models

Delivery Model	Benefits	Risks	✓ Best Fit
Public	<ul style="list-style-type: none">→ Costs→ Time-to-Market→ Elasticity→ Self-Service→ Simplicity	<ul style="list-style-type: none">→ Lack of Control→ Security→ Regulatory & Compliance→ Data Migration→ Application Development→ Software Licensing→ Vendor Lock-In→ Limitations	<ul style="list-style-type: none">→ Applications and Data that can be publicly hosted→ Applications that can be easily moved or ported to commodity virtual platforms
Private	<ul style="list-style-type: none">→ Control→ Security→ Compliance	<ul style="list-style-type: none">→ Scale→ Management Tools→ Charge-back→ Adoption→ ROI	<ul style="list-style-type: none">→ Applications and data that can not be hosted publicly for security or compliance reasons→ Applications and data the require a high-level of control
Hybrid	<ul style="list-style-type: none">→ Flexibility→ Security→ Efficiencies	<ul style="list-style-type: none">→ Multiple Points of Failure→ Same risks as public and private clouds	<ul style="list-style-type: none">→ When it is required to separate applications and data between private and public clouds→ When public clouds can not accommodate requirements→ When public cloud resources are only required temporarily and workloads can be migrated between clouds

Key Characteristics

→ Agility :

- » Improves with users able to rapidly and inexpensively re-provision technological infrastructure resources

→ Cost (Pay as You Go) :

- » Cost is greatly reduced and capital expenditure is converted to operational expenditure . Also you can convert fixed cost to variable

→ Device and location independence :

- » Enable users to access systems using a web browser regardless of their location or what device they are using, e.g., PC, mobile

→ Multi-tenancy:

- » Enables sharing of resources and costs among a large pool of users, allowing for:
 - » **Centralization** of infrastructure in areas with lower costs (such as real estate, electricity, etc.)
 - » **Peak-load capacity** increases (users need not engineer for highest possible load-levels)
 - » **Utilization and efficiency** improvements for systems that are often only 10-20% utilized

Key Characteristics

- **Reliability** : improves through the use of multiple redundant sites, which makes it suitable for business continuity and disaster recovery
- **Scalability** : via dynamic ("on-demand") provisioning of resources on a fine-grained, self-service basis near real-time, without users having to engineer for peak loads
- **Sustainability** : comes about through improved resource utilization, more efficient systems, and carbon neutrality. Nonetheless, computers and associated infrastructure are major consumers of energy
- **Virtualized** : applications are decoupled from the underlying hardware. Multiple applications can run on one computer (virtualization a la VMWare) or multiple computers can be used to run one application

Typical Use Case for Cloud



Infrastructure
Transformation



SaaS (e-mail,
collaboration, etc.)



Dev and Test



Hosted Solutions



Content Delivery
Networks



High performance
Computing



POCs



Backup



DR



VPCs/ Private
Clouds

Verticals Cloud Catersto



Communication
& Media

Accounts for 20% of public storage



Education

Driven by mobile, storage, budget cuts and hybrid classes



Banking

Suffer legacy drag, but still a leader in Cloud



Healthcare

Initially just email and DR



Insurance

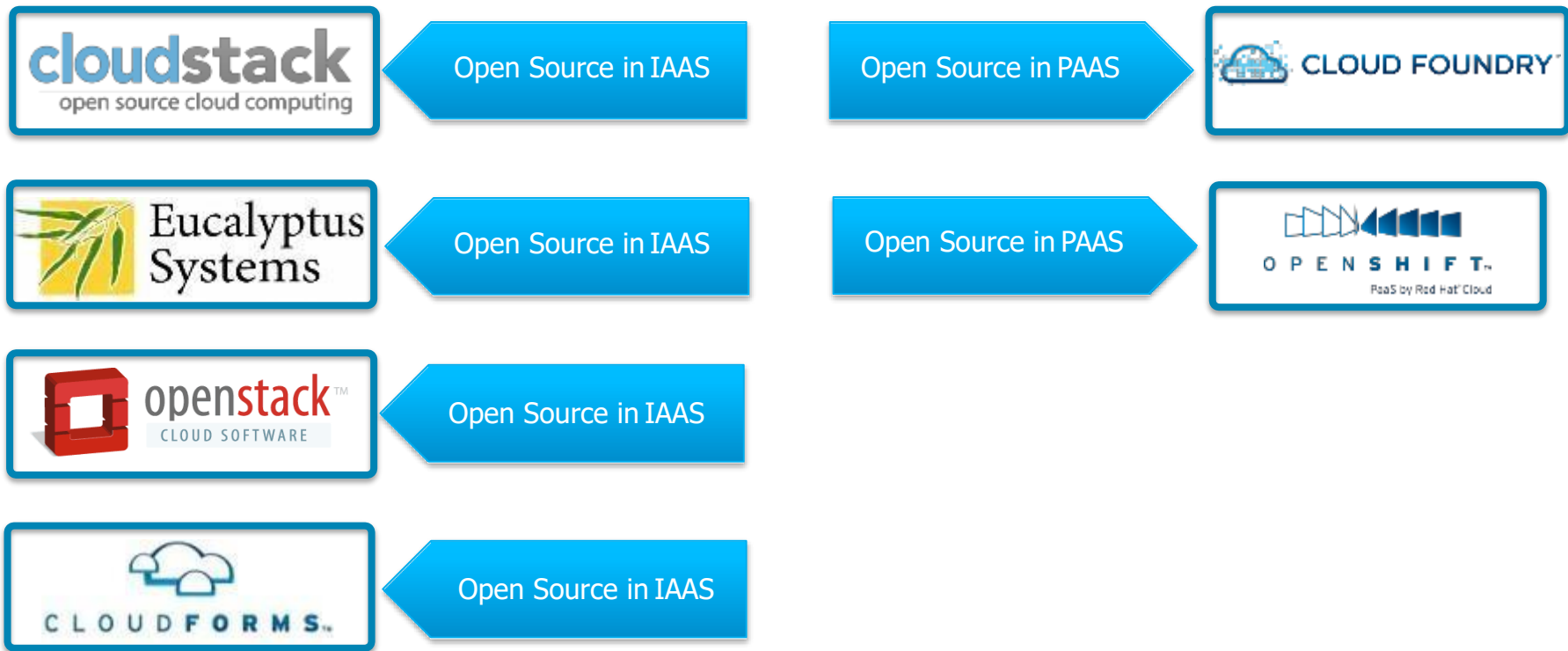
A place to test "beachheads" or industry-specific cloud platforms – less regularly/ compliance constrained



Manufacturing

CRM is most popular app

Cloud & Open Source



Cloud Computing Concerns

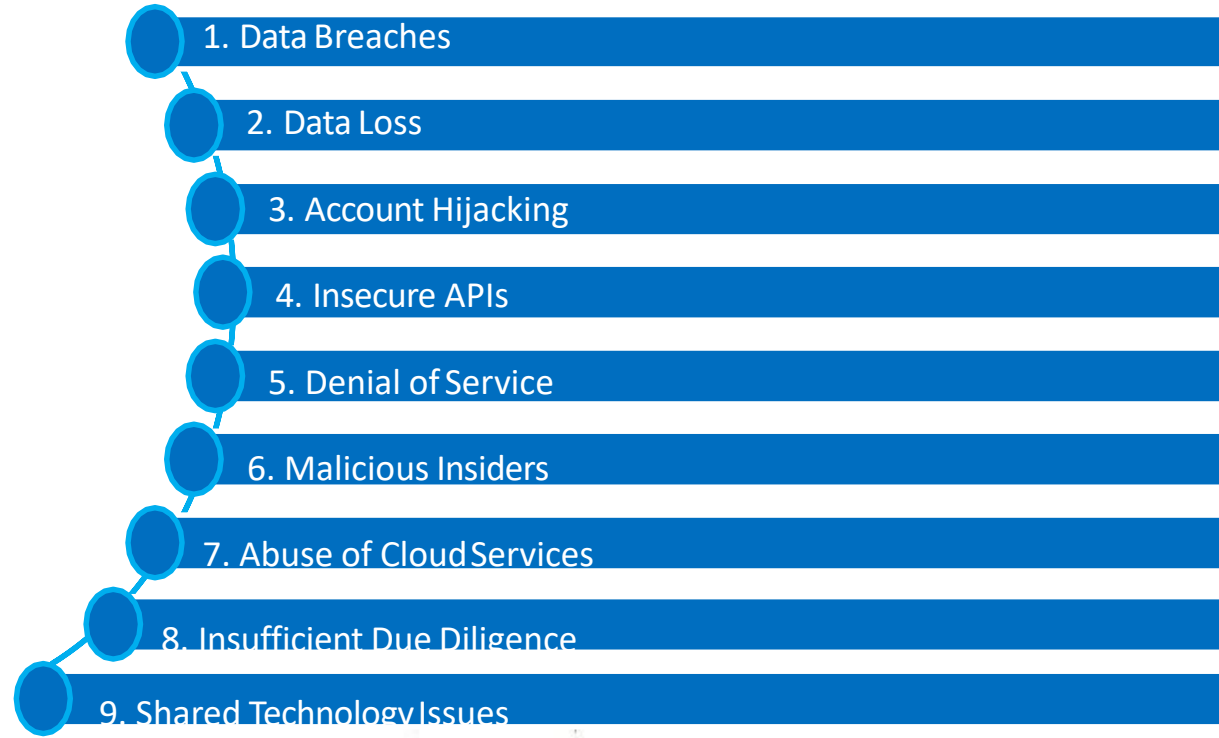
- Loss of control
- Integration: enterprise & federated authorization
- Interoperability: with key enterprise applications
- Accessibility and UI limitations of web apps
- Reliability, performance, security; offline access
- Features; changes; vendor lock-in

Cloud Computing Concerns

- Policy/compliance concerns (privacy)
- Breach forensics and mitigation
- Business “surprises”
- Support; More Logins
- Consequences of “Creative Destruction”

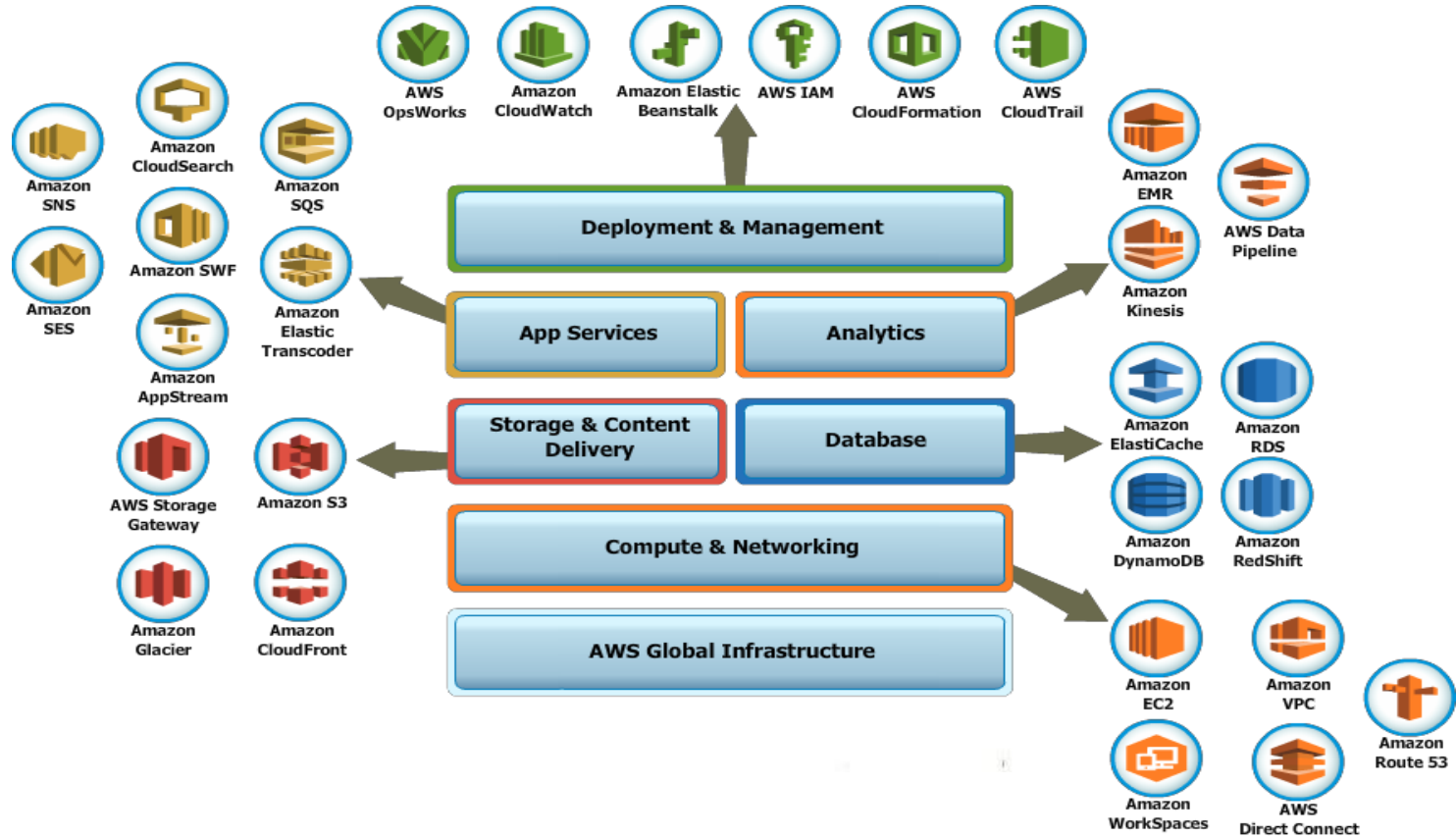
Security issues in Cloud Computing

Notorious Nine



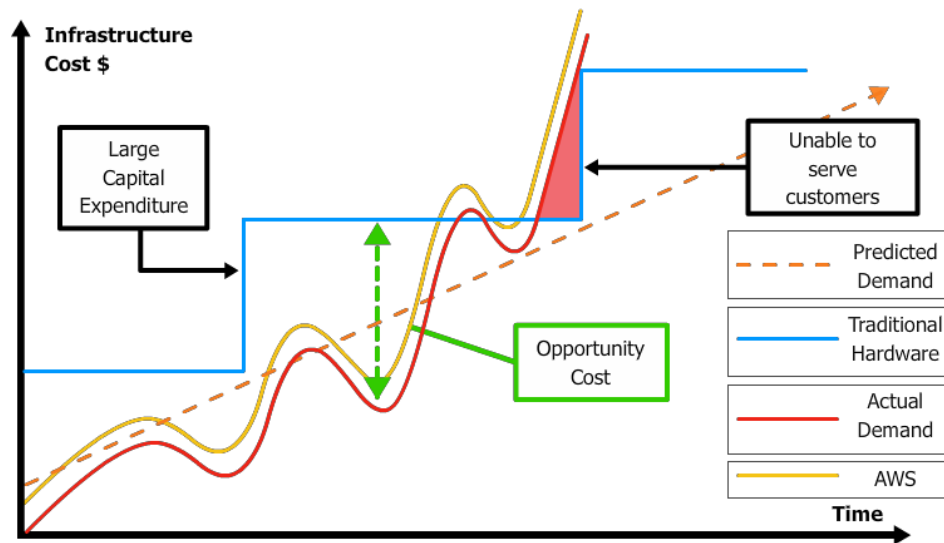
https://downloads.cloudsecurityalliance.org/initiatives/top_threats/The_Notorious_Nine_Cloud_Computing_Top_Threats_in_2013.pdf

Amazon Web Services



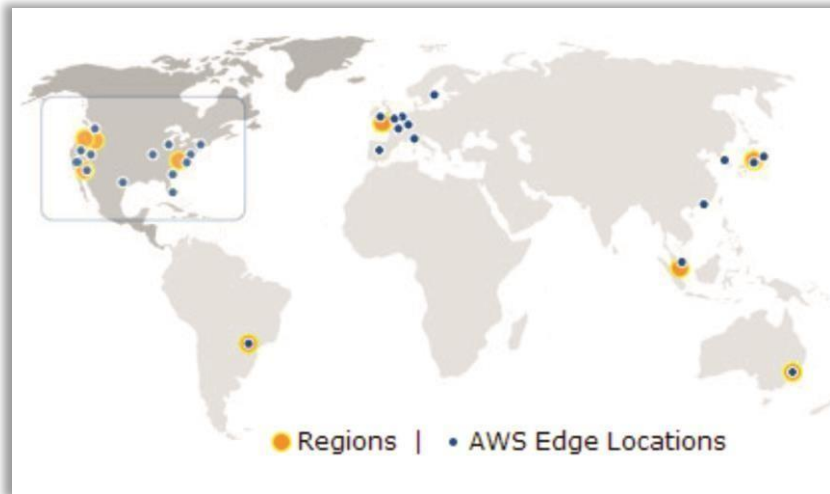
Why AWS?

Elastic and Pay-Per Use Infrastructure



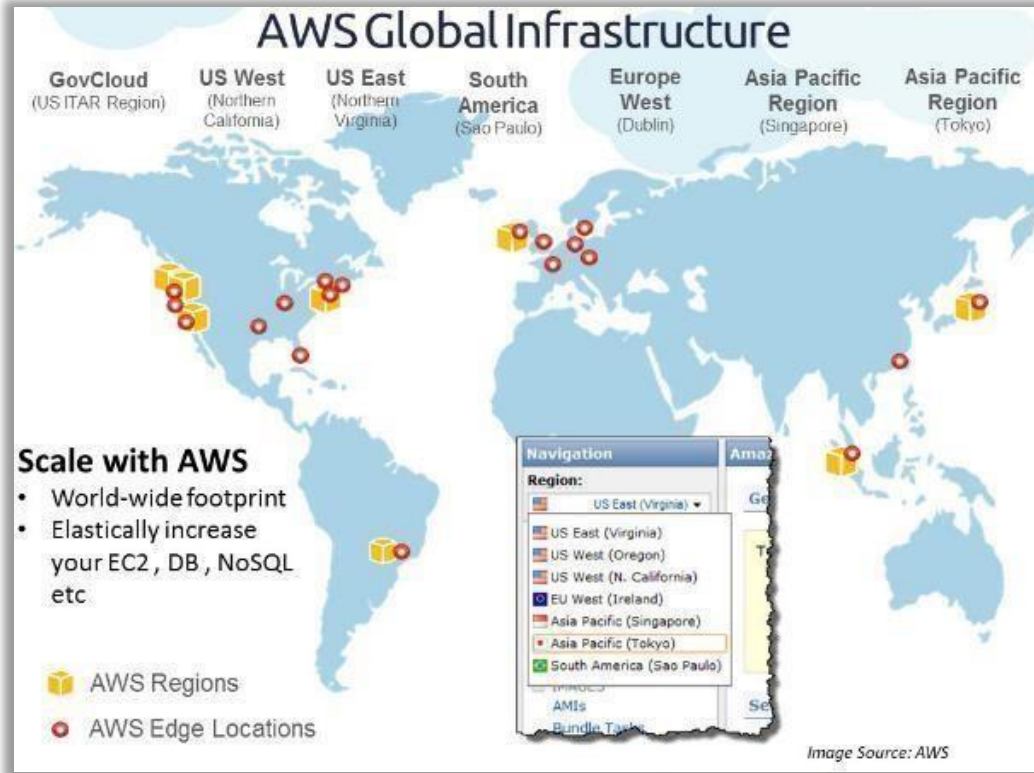
Regions & Zones

- Amazon EC2 provides the ability to place instances in multiple locations
 - » Amazon EC2 locations are composed of Availability Zones and Regions
- By launching instances in separate Regions, you can design your application to be closer to specific customers or to meet legal or other requirements
 - » By launching instances in separate Availability Zones, you can protect your applications from the failure of a single location



Ref: <http://aws.amazon.com/about-aws/globalinfrastructure/>

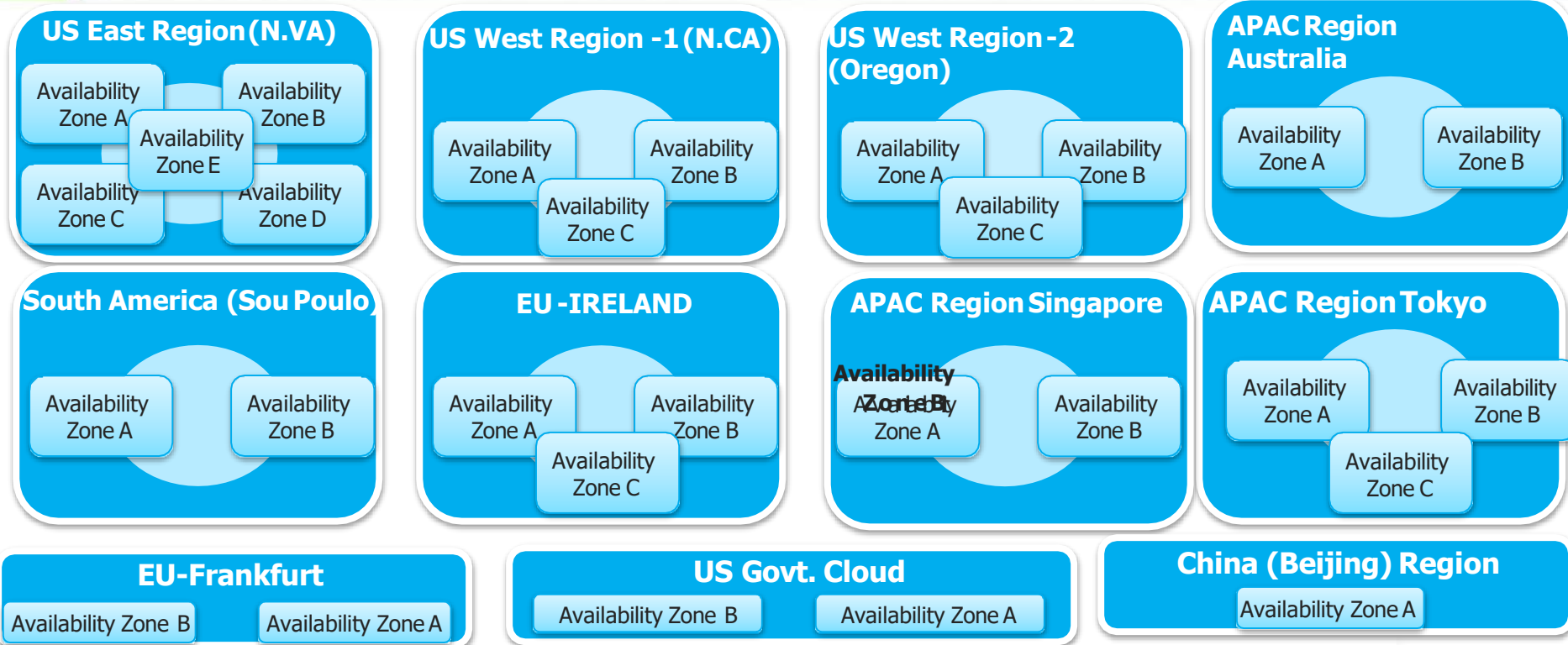
Regions & Zones



11 regions
30 availability zones
53 edge locations

<http://harish11g.blogspot.in/2012/07/amazon-availability-zones-aws-az.html>

Regions & Zones



*New customers can access three EC2 Availability Zones in US East (Northern Virginia) and two in US West (Northern California)

<http://aws.amazon.com/about-aws/globalinfrastructure/>

Amazon Cloud Characteristics

- Availability & Reliability
- Scalability & Elasticity
- Performance
- Flexible (Numerous options of Programming, APIs , Access)
- Secure

Access AWS



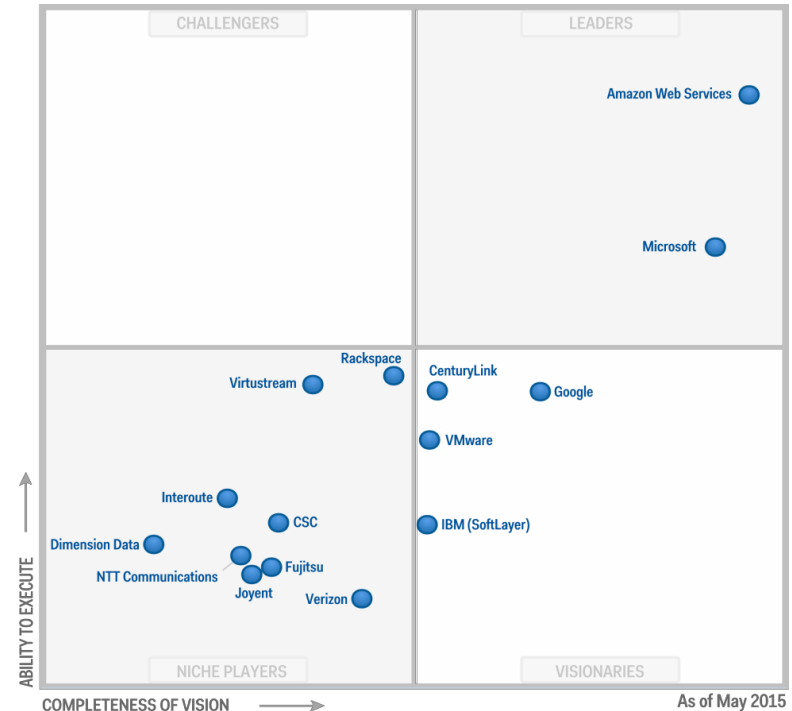
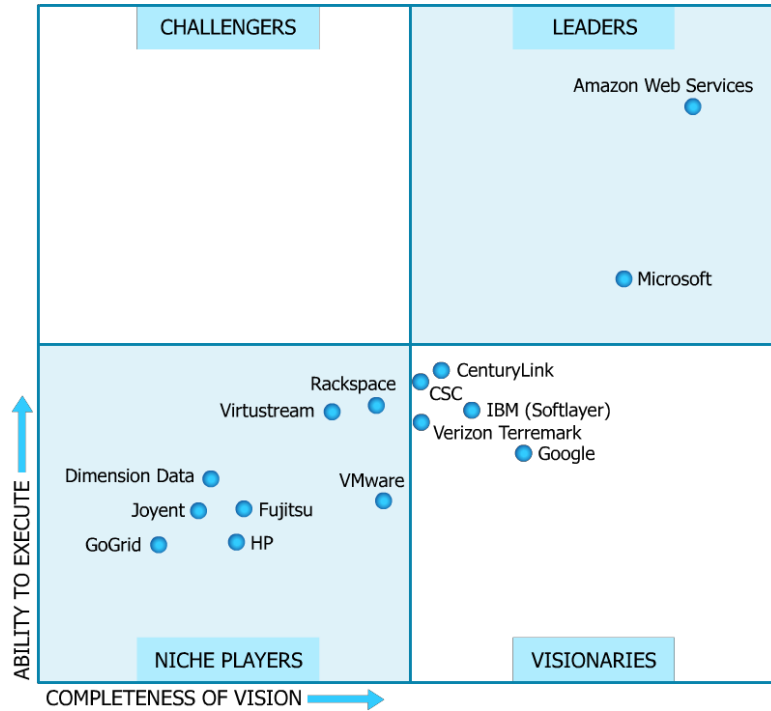
AWS
Management
Console

AWS
Web service
APIs

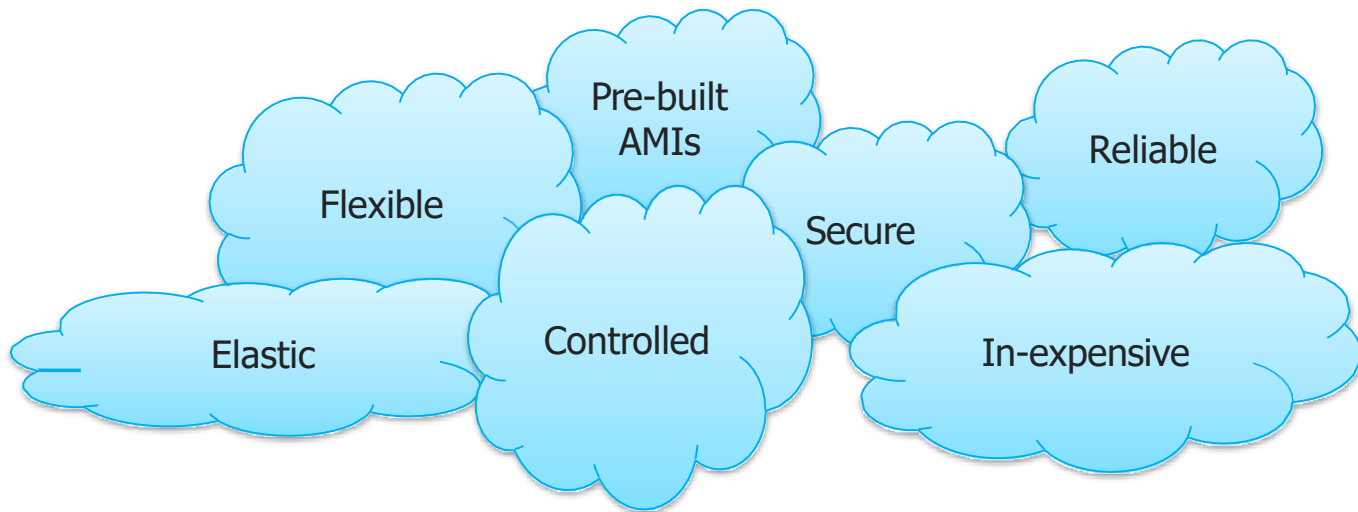
AWS CLI

AWS SDKs

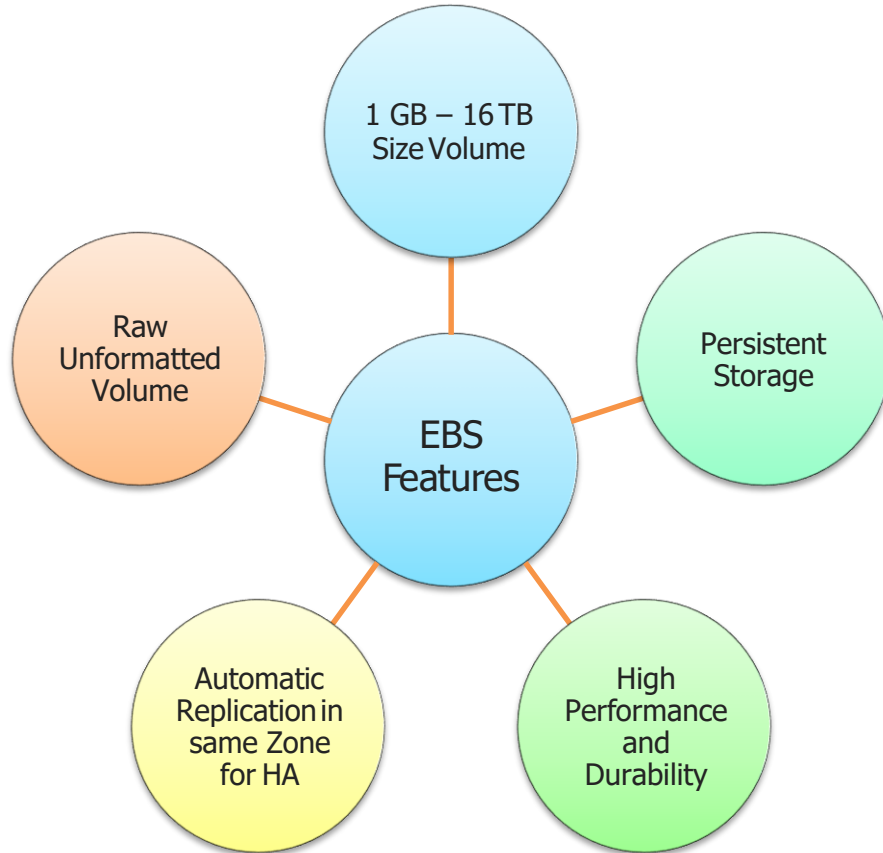
Why AWS



EC2 Highlights



EBS Features



EBS Definitions

→ EBS:

- » EBS is a distributed, replicated block data store that is optimized for consistency and low latency read and write access from EC2 instances

→ EBS Volume:

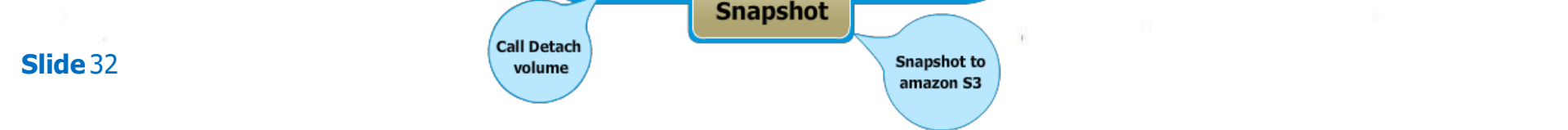
- » A volume can only be attached to one instance at a time, but many volumes can be attached to a single instance

→ EBS Snapshot:

- » Snapshots can also be used to instantiate multiple new volumes, expand the size of a volume or move volumes across Availability Zones. Snapshots can be shared using AWS Management Console or using API calls

→ Amazon EBS is particularly well-suited for use as the primary storage for a file system, database, or for any applications that require fine granular updates and access to raw, unformatted, block-level storage

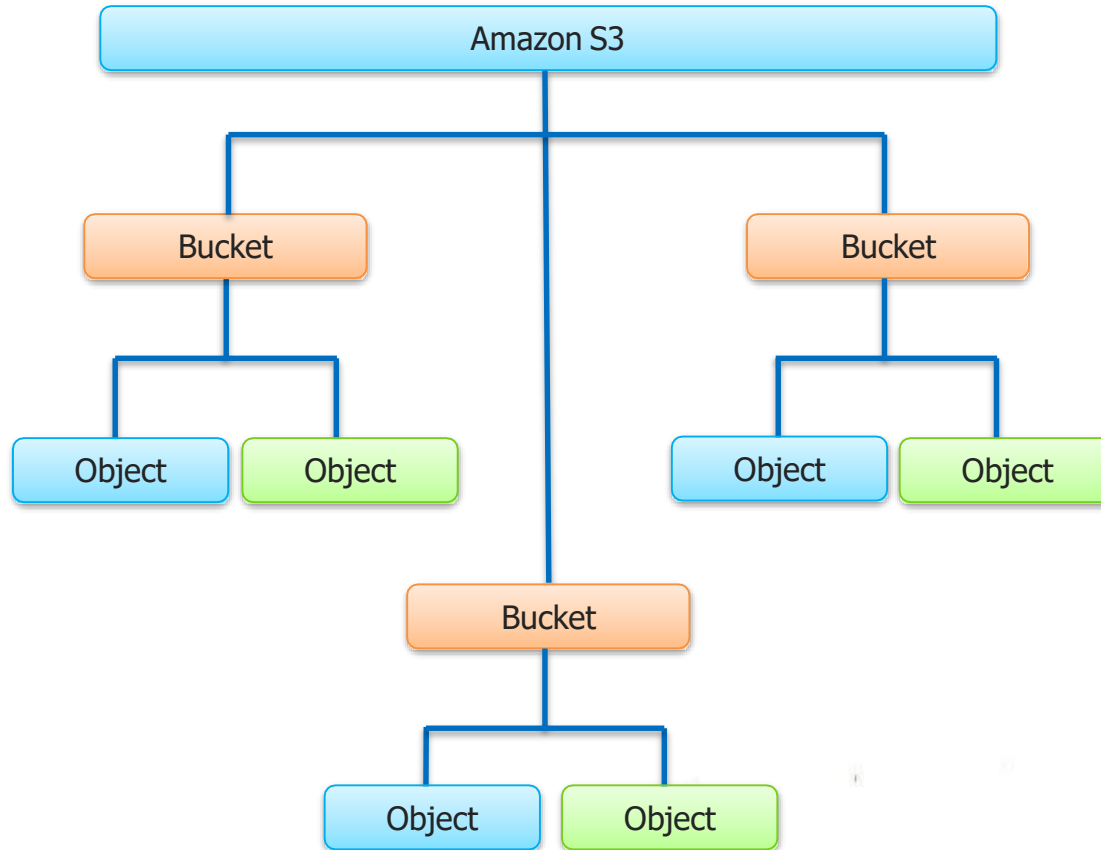
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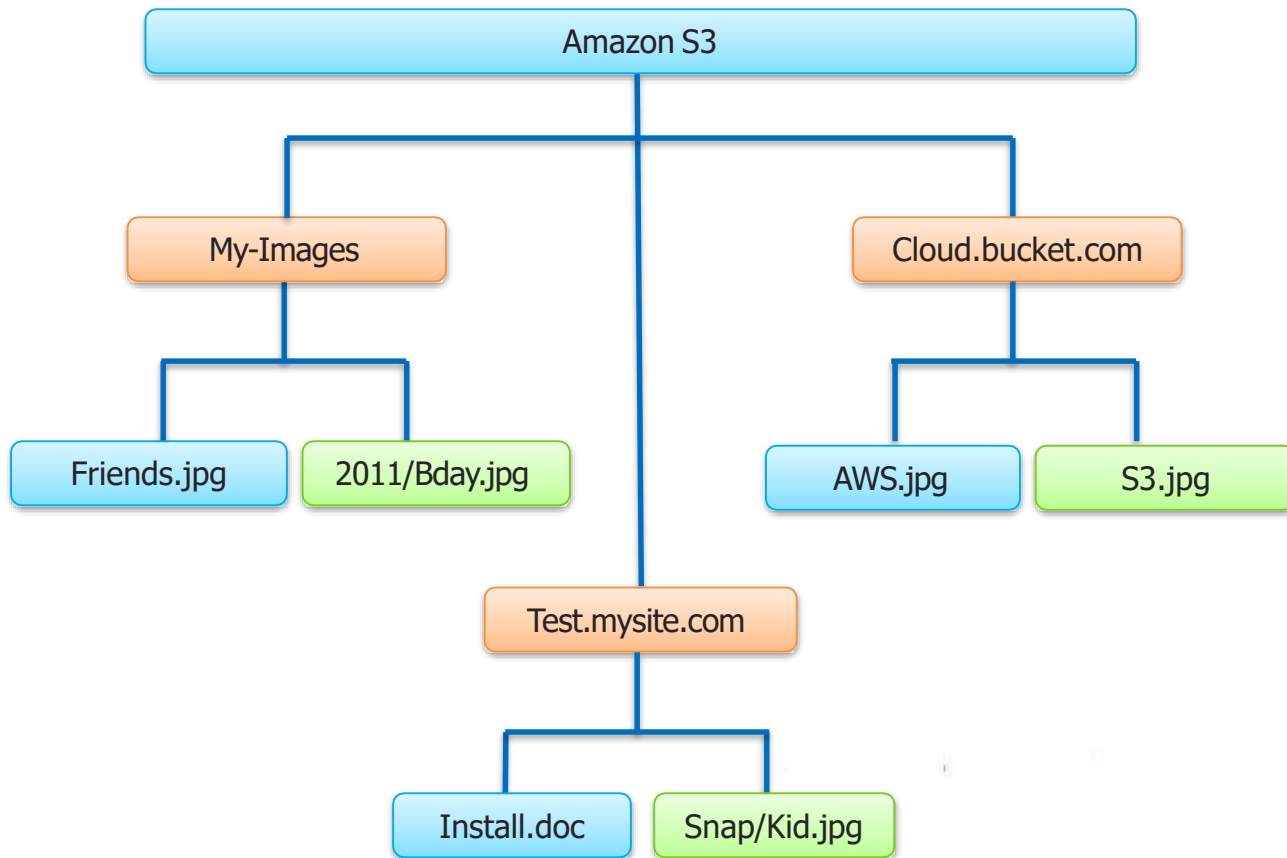
S3 Definitions

- **Bucket** – Collection (container) of objects. Up to 100 per account. Names up to 255 characters long
- **Object** – Objects are the fundamental entities stored in Amazon S3. Objects consist of object data and metadata. They are Individually addressable data item. Any number per bucket and per account. An object is uniquely identified within a bucket by a key (name) and a version ID
- **Key** – A key is the unique identifier for an object within a bucket. Every object in a bucket has exactly one key
- **ACL** – Access Control List

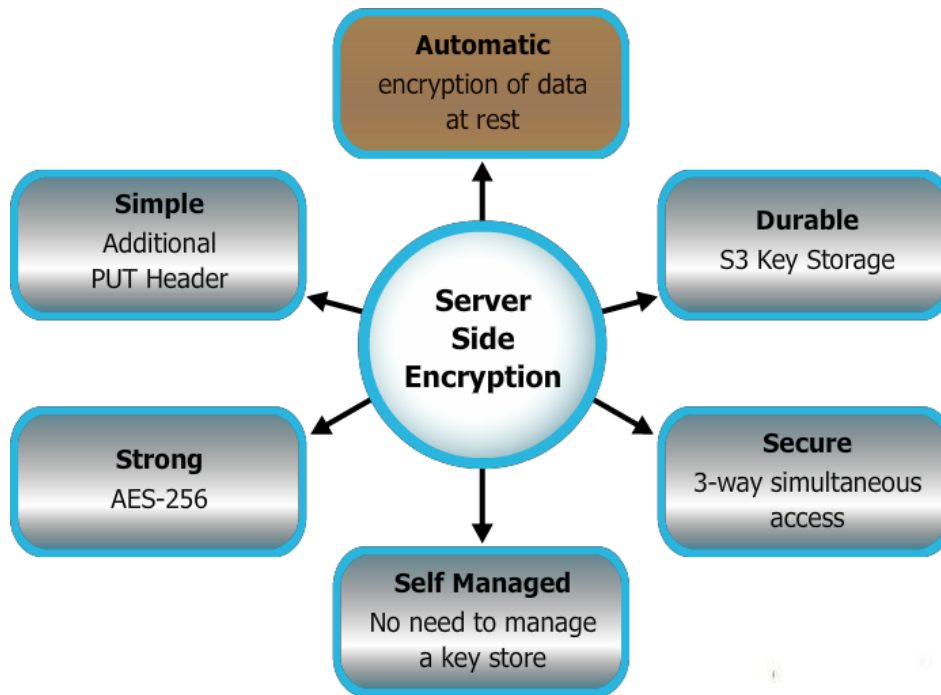
Amazon S3 Namespace



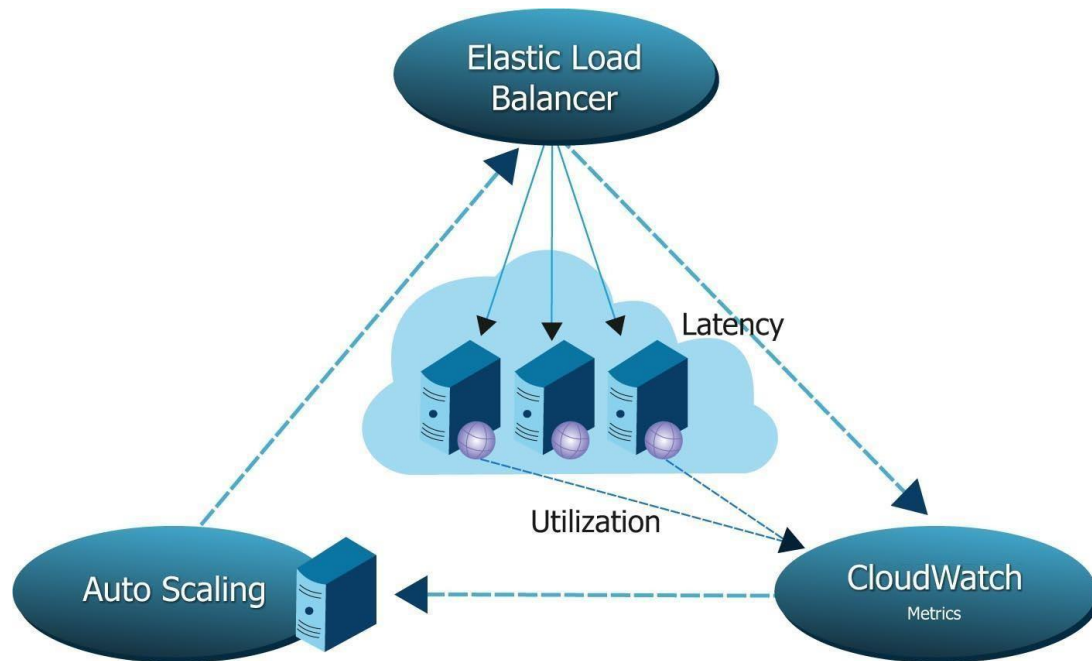
Amazon S3 Namespace (Contd.)



Server Side Encryption

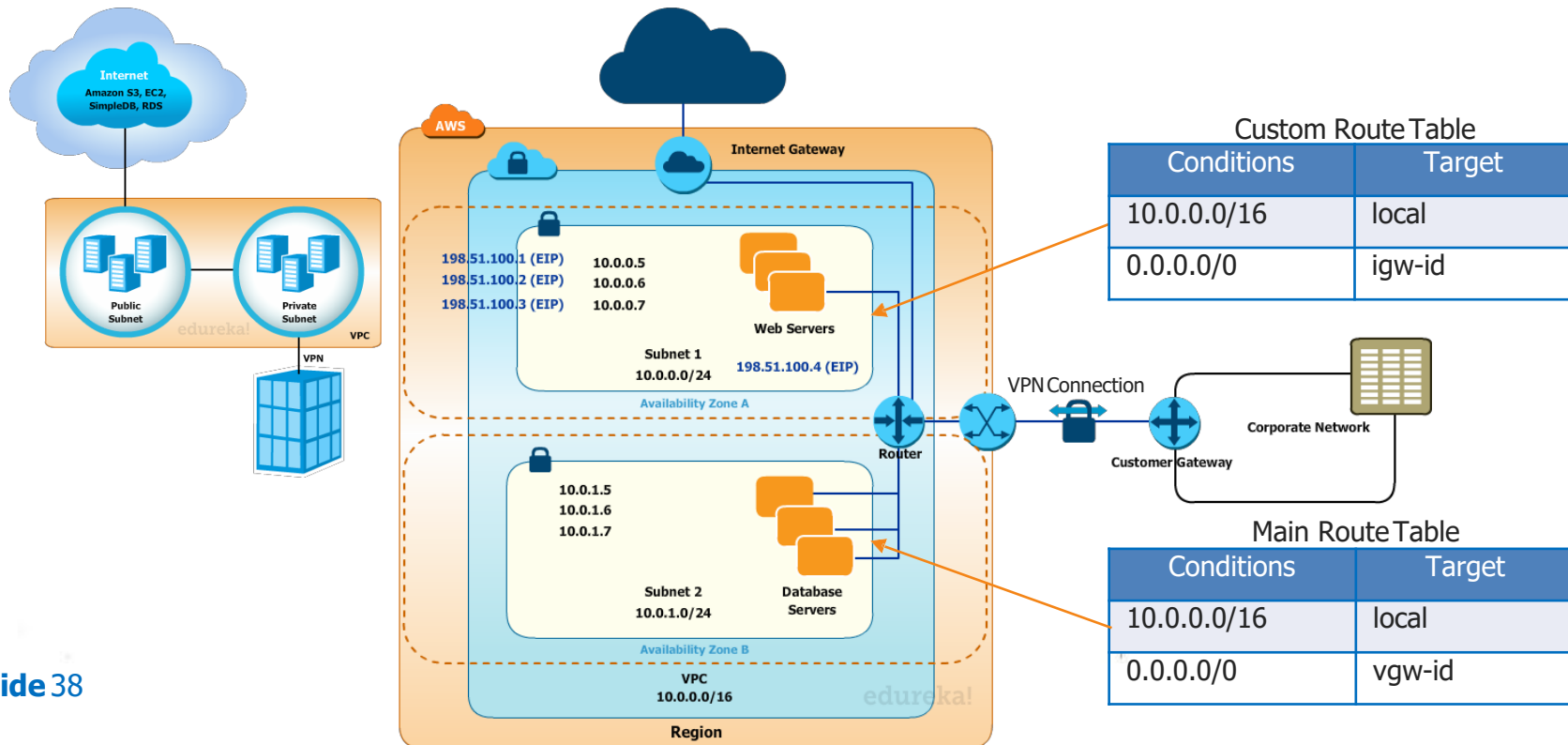


Three Services Better Together

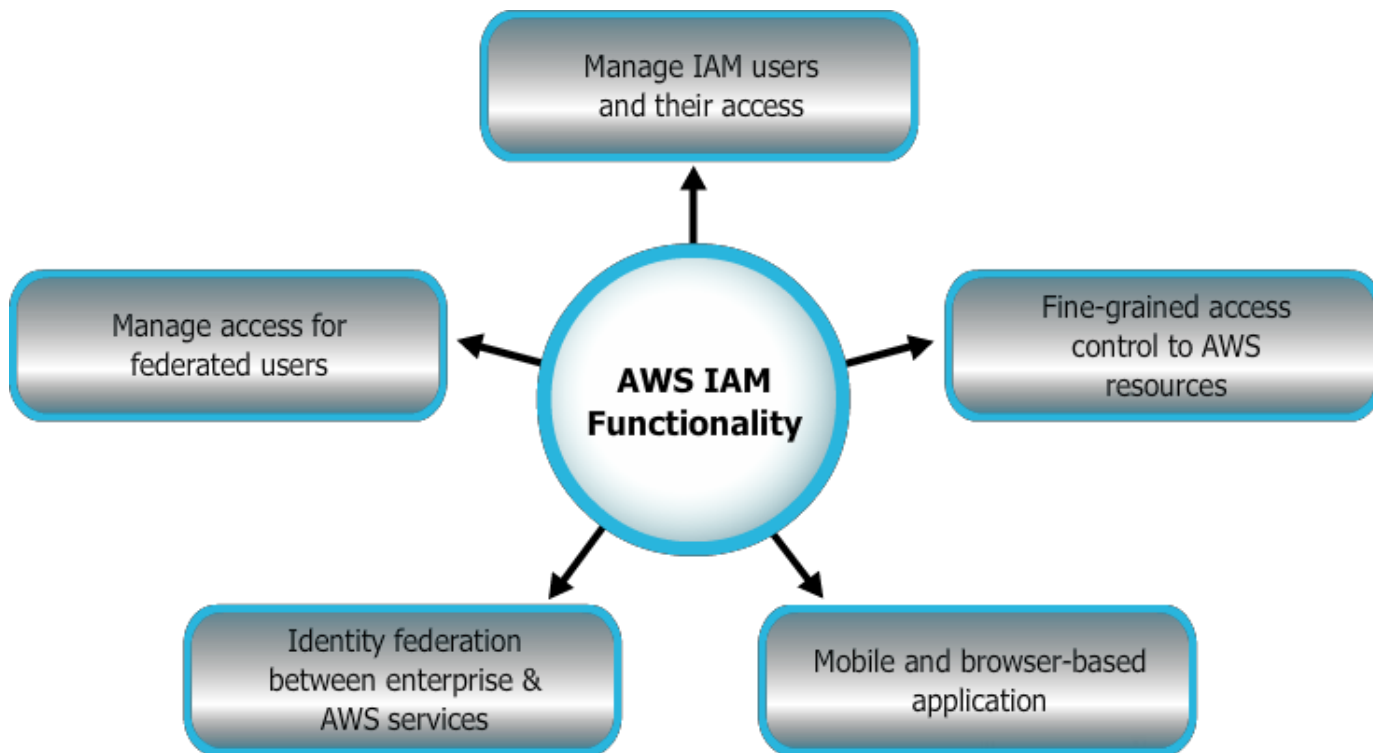


VPC Architecture Scenarios

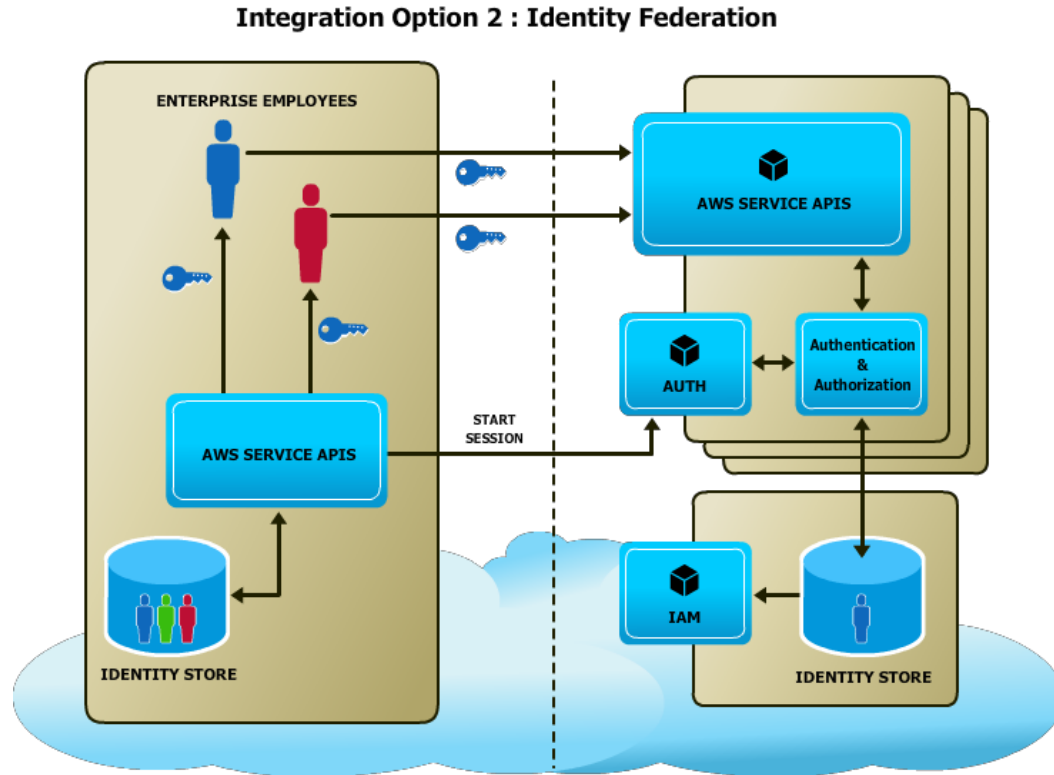
3. VPC with Public and Private Subnets and Hardware VPN Access



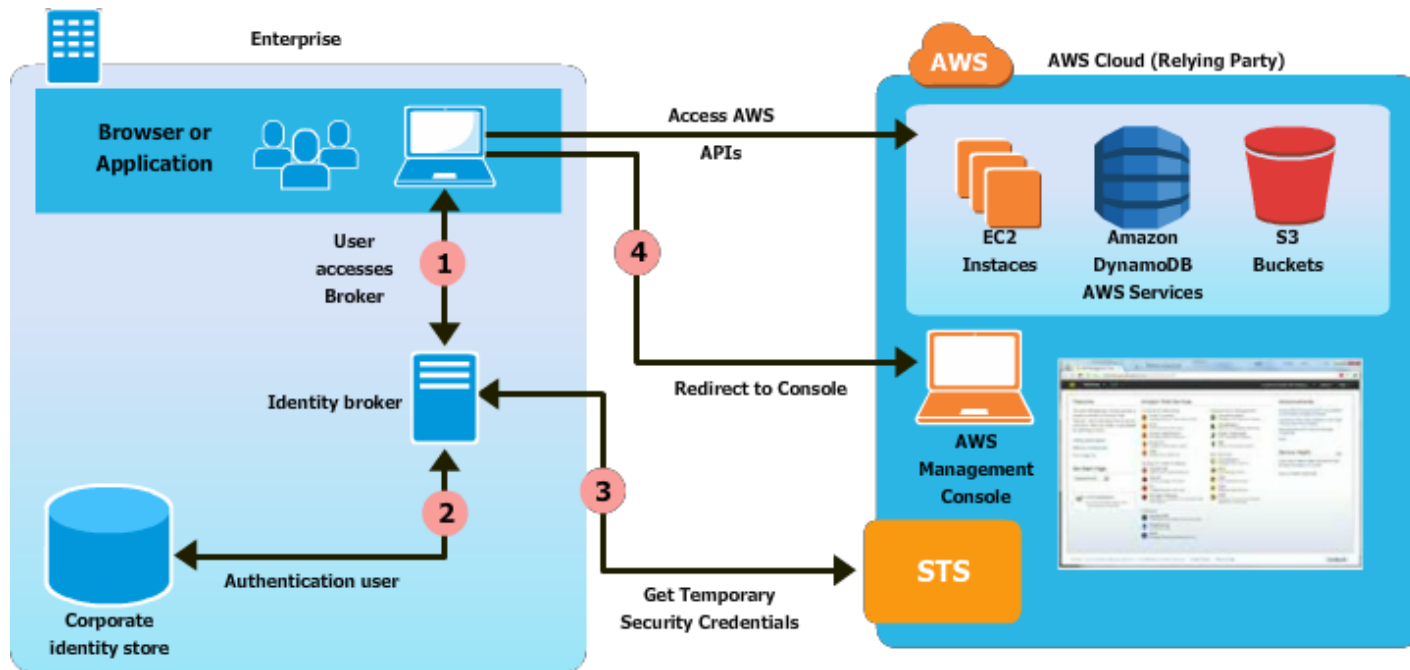
AWS IAM Functionality



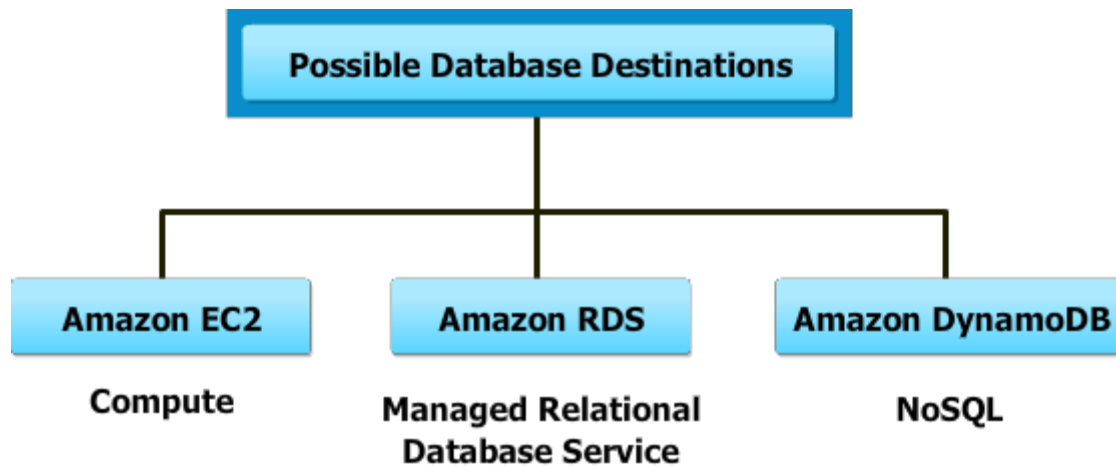
Integration Option 2 : Identity Federation



Integration Option 2 : Identity Federation (Contd.)



Database In AWS Cloud



RDS Highlights



Why RDS?

- Supports Popular DB like MySQL, Oracle, MS SQL & Now PostgreSQL [\[Now Aurora\]](#)
- Rapid DB Instance Creation
- backups, software patching, automatic failure detection, and recovery
- Scaling
- HA & Durability
- Automated DB Software Upgrade
- Monitoring & Metrics
- Security
- Cheap

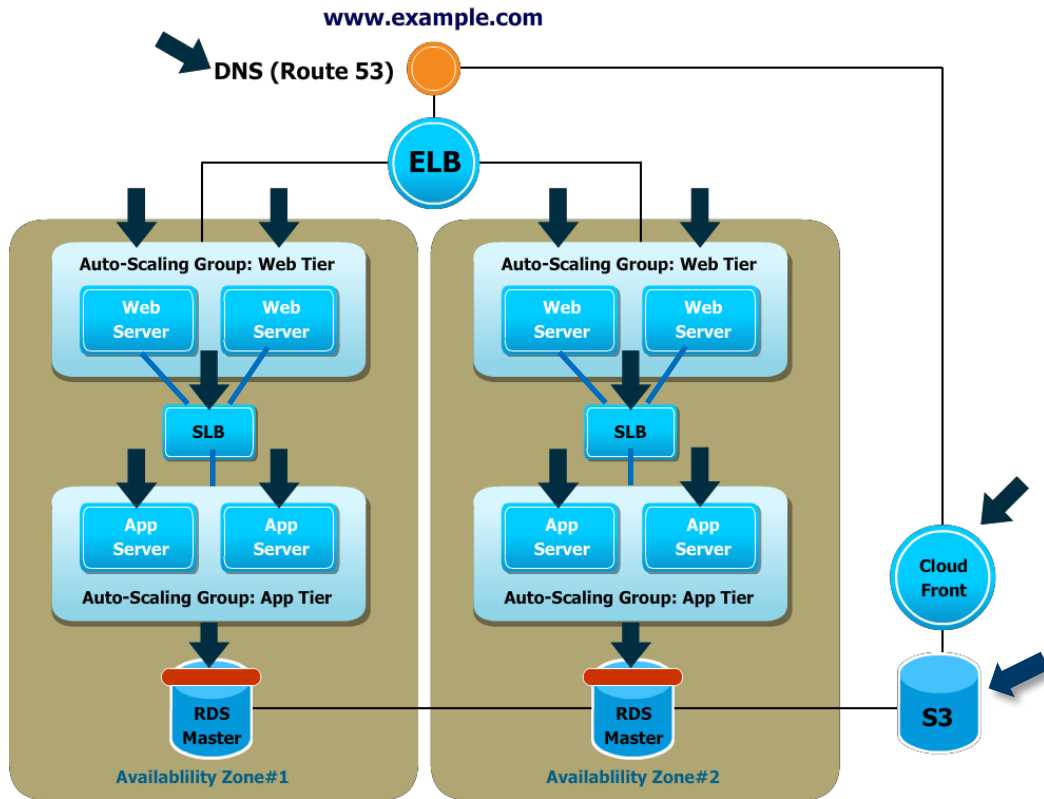
Security Best Practices (Contd.)

Example: Build security Into Every Layer

→ HA Architecture

→ Security Characteristics:

- Route 53 (highly scalable DNS)
- Autoscaling Groups
- Security Groups
- ELB Security Group
- OS Firewalls (on Instances)
- RDS
 - » DB Security Groups
 - » backup window
 - » snapshots
 - » multi-AZ
- CloudFront
 - » Private Distribution
 - » Pre-signed URLs
- S3 Bucket Policies
 - » Private bucket



Questions



How it Works?



Experienced Instructor



Live Online Class



In-class Questions



Survey Feedback



24x7 Support



Class Recording in LMS



Module Wise Assessment



Project Work



Verifiable Certificate



Android & iOS App

AWS Architecture and Design

→ Module 1

- » Introduction to Cloud Computing & AWS

→ Module 2

- » Amazon EC2 and Amazon EBS

→ Module 3

- » Amazon Storage & Monitoring Services : S3, RRS & CloudWatch

→ Module 4

- » 'Scaling' and 'Load Distribution' in AWS

→ Module 5

- » Amazon VPC & Route 53

→ Module 6

- » Identity and Access Management Techniques (IAM) & IAM Techniques and Amazon Managed Relational Database (RDS)

→ Module 7

- » Multiple AWS Services and Managing the Resources' Lifecycle

→ Module 8

- » AWS Architecture and Design

→ Module 9

- » Migrating to Cloud & AWS Case Study

→ Module 10

- » Project & AWS Certification Discussion

Survey

Your feedback is important to us, be it a compliment, a suggestion or a complaint. It helps us to make the course better!

Please spare few minutes to take the survey after the webinar.



Thank you!

