

# Cloud Concepts - Introduction

**Julien MANTEAU**



## Contenu

**What is “Cloud”**

**Who's who: Cloud Edition**

**Cloud building blocks**

Where is the Cloud ?

In France,  
Creuse !



# 1

## Cloud Definition

What is “the cloud” ?



## Cloud Computing

Cloud computing is the on-demand availability of computer system resources (data storage, computing power, services) without direct active management by the user



## Cloud Computing

Cloud is not a new technology by itself but a new way of consuming IT services.

“



**There is no cloud**  
it's just someone else's computer

It's true (partially)



## Cloud Definition - UC Berkeley (2009)

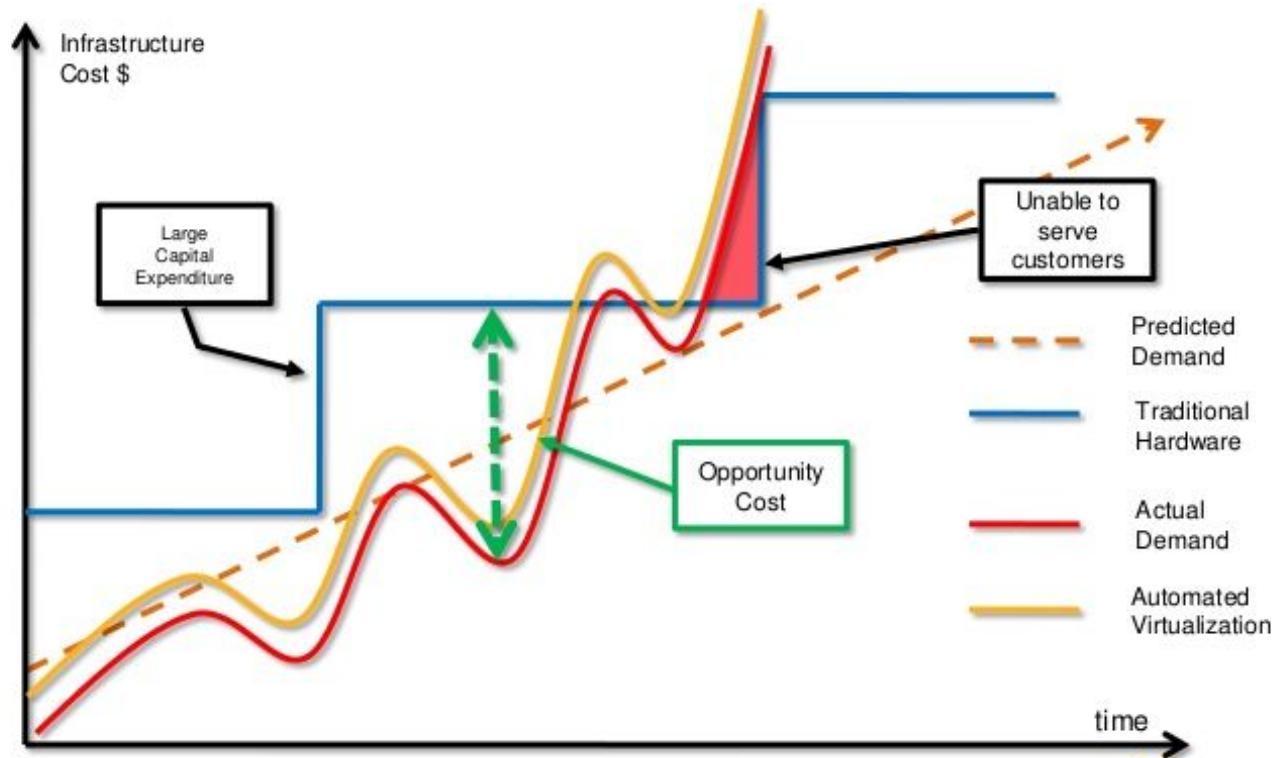
- **Elasticity:** The illusion of infinite computing resources available on demand, thereby eliminating the need for Cloud Computing users to plan far ahead for provisioning.
- **Self Service Provisioning :** The elimination of an up-front commitment by Cloud users, thereby allowing companies to start small and increase hardware resources only when there is an increase in their needs.
- **Pay per use:** The ability to pay for use of computing resources on a short-term basis as needed (e.g., processors by the hour and storage by the day) and release them as needed, thereby rewarding conservation by letting machines and storage go when they are no longer useful.



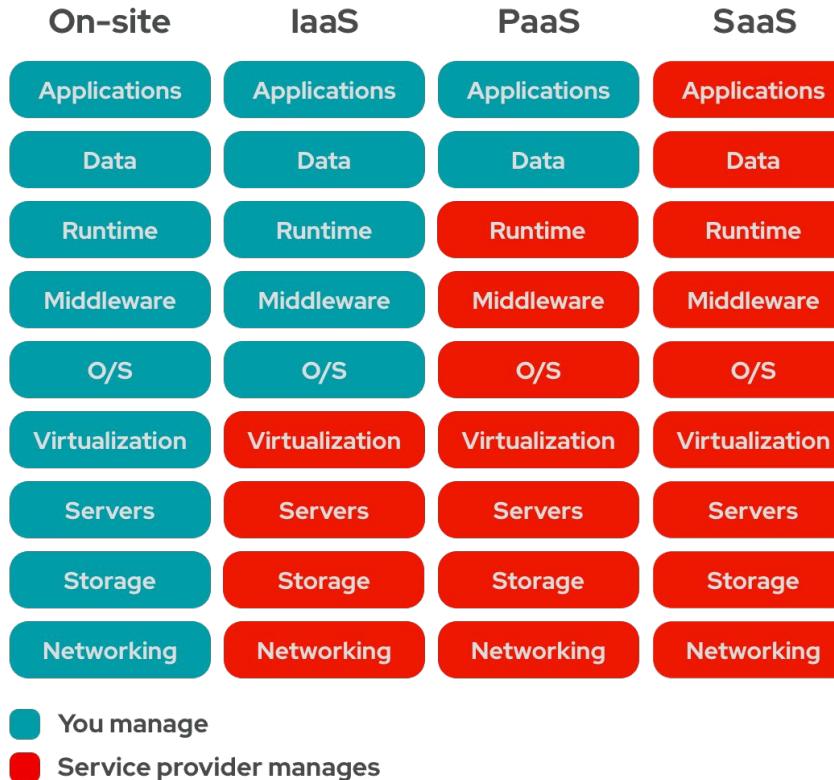
## Cloud Definition - NIST (2011)

- Service must be **on-demand and self-service** (with pay per use)
- **Broad network access** geographically diverse and can be accessed by heterogeneous clients
- **Resource pooling** (computing resources are pooled together to serve multiple customers)
- **Rapid elasticity** (capabilities available for provisioning often appear to be unlimited and can be appropriated in any quantity at any time.)
- **Measured service** (usage can be monitored, controlled, and reported)

## Zoom on elasticity concept



# Cloud Service Models



IaaS: Infrastructure as a Service

PaaS: Platform as a Service

SaaS: Software as a Service

# Summary





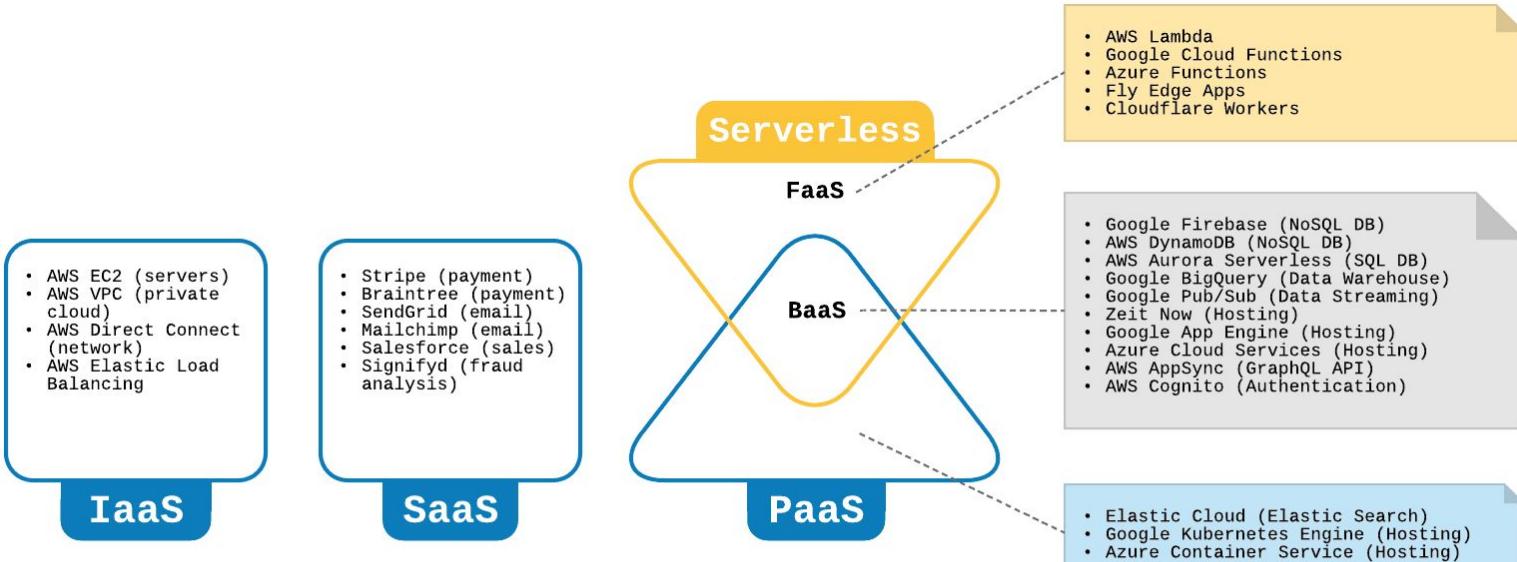
## Serverless Definition - UC Berkeley (2019)

- **Decoupled computation and storage:** Storage and computation scale separately and are provisioned and priced independently. In general, the storage is provided by a separate cloud service and the computation is stateless.
- **Executing code without managing resource allocation:** Instead of requesting resources, the user provides a piece of code and the cloud automatically provisions resources to execute that code.
- **Paying in proportion to resources used instead of for resources allocated:** Billing is by some dimension associated with the execution, such as execution time, rather than by a dimension of the base cloud platform, such as size and number of VMs allocated.

## Serverless: two mains layers

- Function as a Service (FaaS) runs user code in a isolated instance (usually a managed container) and adjust automatically underlying resources to cope with demand
- Backend as a Service (BaaS) store data without user management and scale based on the needs (write IOPS, data size). Can be a file service, a relational database, an nosql database etc.

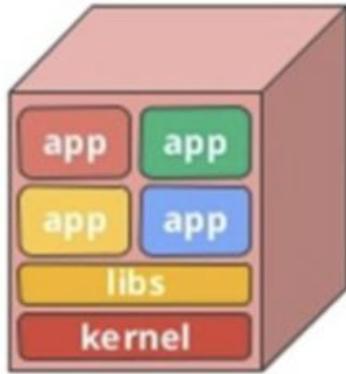
# Summary



**ASSEMBLE  
BEFORE  
DEPLOYING**

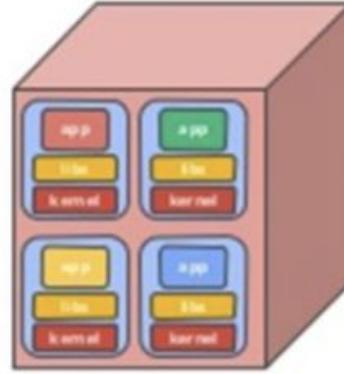
**BUY  
DON'T  
DEPLOY**

**DEPLOY**



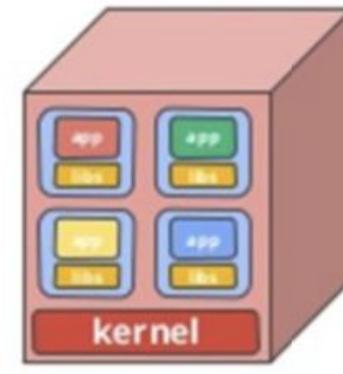
## Shared Machines

- ✗ No isolation
- ✗ Shared Libraries



## Virtual Machines

- ✓ Isolation
- ✓ No Shared Libraries
- ✗ Hard to manage
- ✗ Expensive and Inefficient



## Containers

- ✓ Isolation
- ✓ No Shared Libraries
- ✓ Less overhead
- ✗ Less Dependency on Host OS

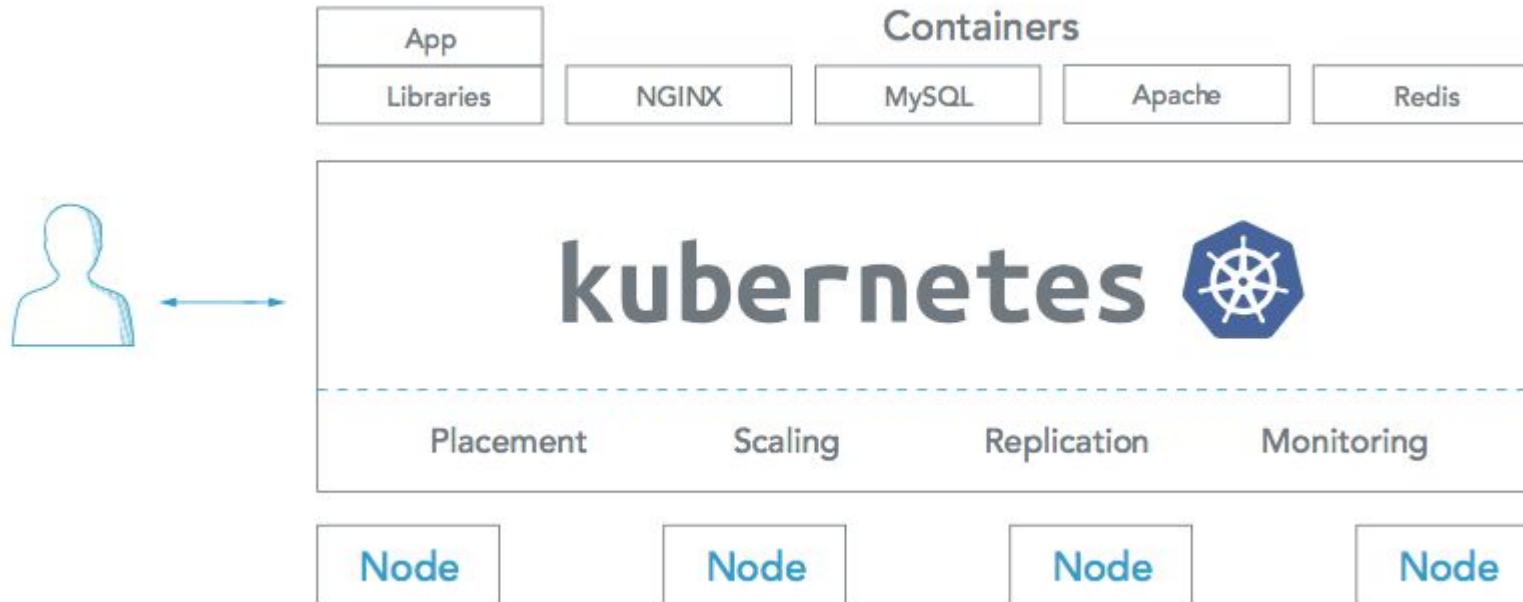
## Kubernetes

Kubernetes is a system for:

- Automating deployment
- Scaling
- Management of containerized applications.

Kubernetes has a number of features. It can be thought of as the **kernel of the cloud native Operating System**. Its distributions are GKE, Kops, EKS, K3S, etc

# Kubernetes



# Analogy



# Pizza as a Service 2.0

<http://www.paulkerrison.co.uk>



Homemade

Communal Kitchen

Bring Your Own

Takeaway

Restaurant

Party



You Manage



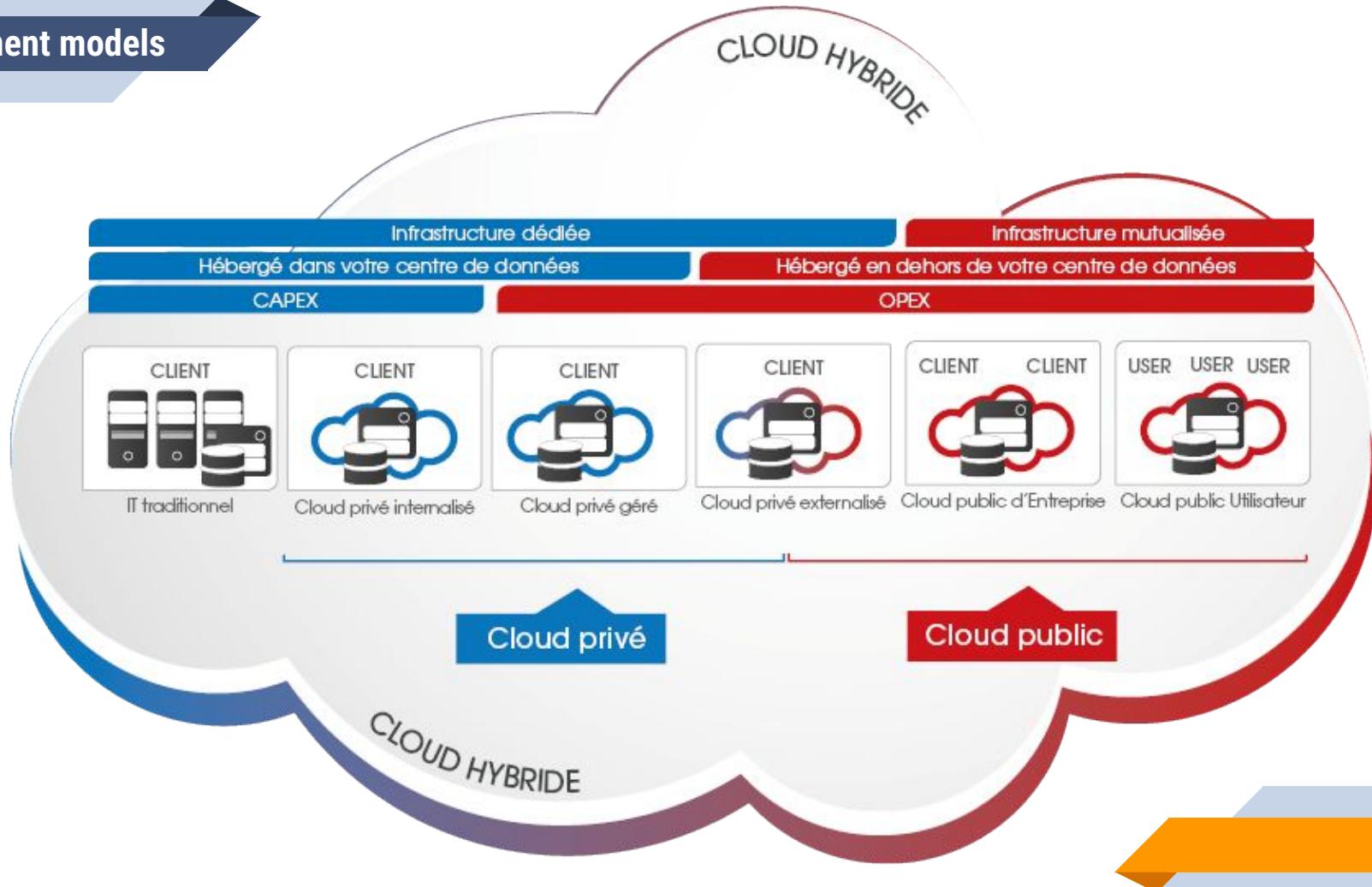
Vendor Manages

# Définitions des modèles de déploiement de Cloud

- **Internal Cloud** is located in the enterprise data center and it owns the assets
- **External Cloud** is located at a service provider and charges are expensed
- **Private Cloud** is dedicated to an organization (even if it may be used by many internal tenants within the organization)
- **Public Cloud** : is shared across many organizations that don't know about each other and is managed by a service provider on a mutualized infrastructure.
- **Community Clouds:** Community cloud infrastructures can be shared by enterprises with common concerns, requirements, needs and/or structures
- **Hybrid Cloud** : Combine any of the above clouds and bind them together to expand deployment options.

Several combinations of the above make sense: internal private cloud, external private cloud, external public cloud, etc

## Deployment models



**Automation – ‘Infra As Code’ :** IaC is a method to provision and manage IT infrastructure through the use of source code, rather than through standard operating procedures and manual processes.. Automate the infrastructure deployment process in a repeatable, consistent manner by using API, SDK or cloud tooling and leverage software ecosystem (versioning, pipeline, code analysis, etc)

**Auto-scaling :** You can scale your applications up and down to match your unexpected demand without any human intervention. Auto-scaling encourages automation and drives more efficiency.

**More Efficient Development lifecycle :** Production systems may be easily cloned for use as development and test environments. Staging environments may be easily promoted to production.

**Improved Testability** : You can automate your test with spinning a new environment only for the test campaign based on the production one and remove it afterward. And this at all stages of development.

**Easier Disaster Recovery Plan** : Cloud allows to replicate your infrastructure in a geographically diverse manner in an easy way. Backup can be stored and recovered whenever you need them and a full environment can be reproduced in several minutes.

**Cloud as overflow** : Cloud can be used to improve on prem application in peak load by spinning up instances and modifying load balancing policies. Batch computing can be done at night for transient workloads.

- Design for failure and nothing will fail

Be a pessimist when designing architectures in the cloud; assume things will fail over time and incorporate that thinking into your architecture. In other words, always design, implement and deploy for automated recovery from failure. You will end up creating a fault-tolerant architecture that is optimized for the cloud.

- Decouple your components

The cloud reinforces the Service-oriented architecture design principle that the more loosely coupled the components of the system, the bigger and better it scales. Decoupling your components, building asynchronous systems and scaling horizontally become very important in the context of the cloud.

- Implement elasticity

To implement “Elasticity”, one has to first automate the deployment process (by using Cloud’s API) and streamline the configuration and build process. This will ensure that the system can scale without any human intervention.

- Think parallel

The cloud makes parallelization effortless. Whether it is requesting data from the cloud, storing data to the cloud, processing data (or executing jobs) in the cloud. The beauty of the cloud shines when you combine elasticity and parallelization.

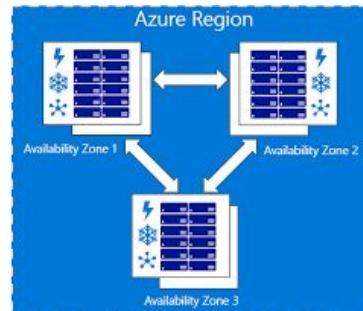
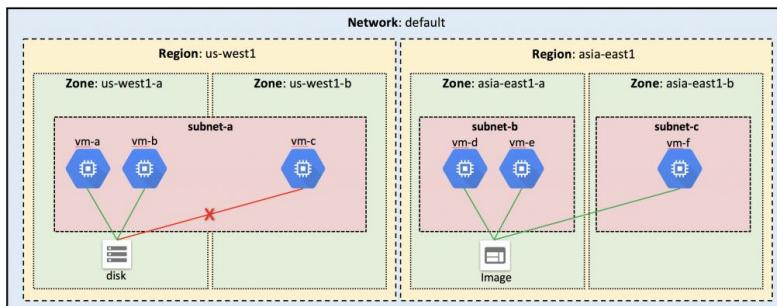
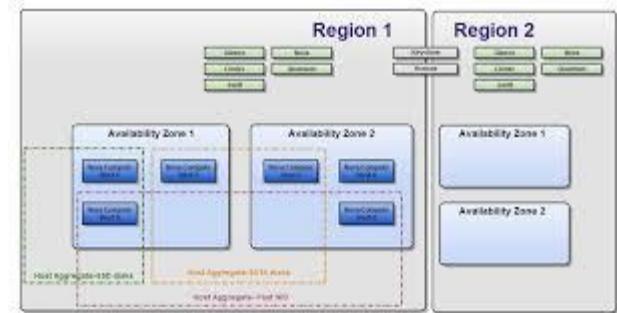
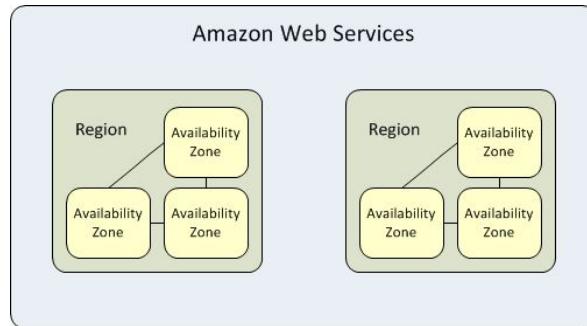
- Keep dynamic data closer to the compute and static data closer to the end-user

In general it's a good practice to keep your data as close as possible to your compute or processing elements to reduce latency. In the cloud, this best practice is even more relevant and important because you often have to deal with Internet latencies.

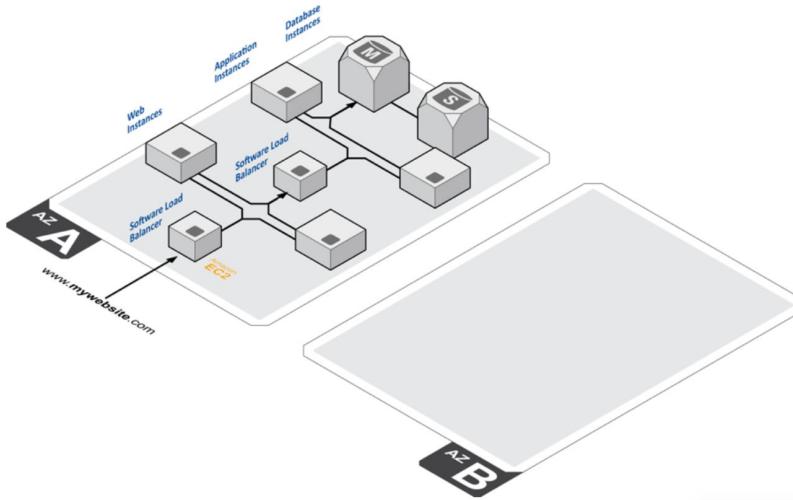
-> Read AWS Well architected framework

# Regions / AZs

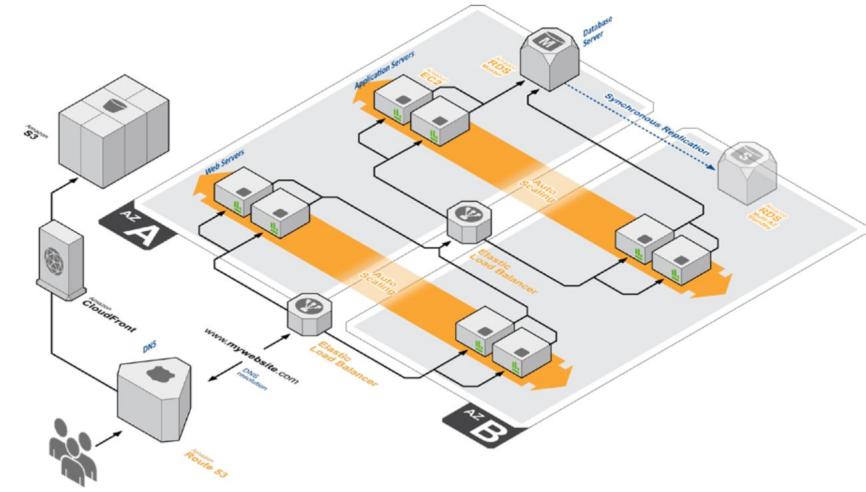
Region are geographically close datacenters and linked with a Metropolitan Network with low latency and high speed. Regions are geographic locations in which public cloud service providers' data centers reside. Availability Zone (AZ) are isolated locations within a region. Each availability zone can holds one or more data centers. Failure of one AZ will not impact another one in the same region.



# Regions / AZs

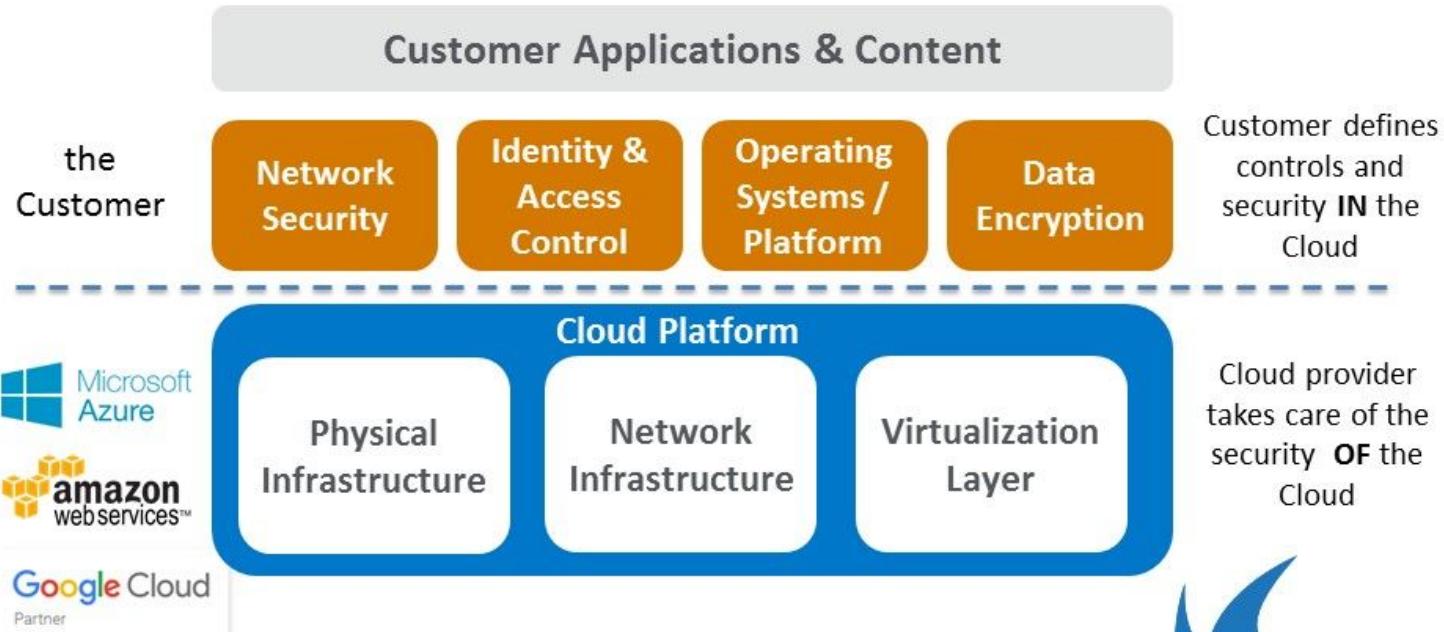


Bad



Good

# The Shared Responsibility Model

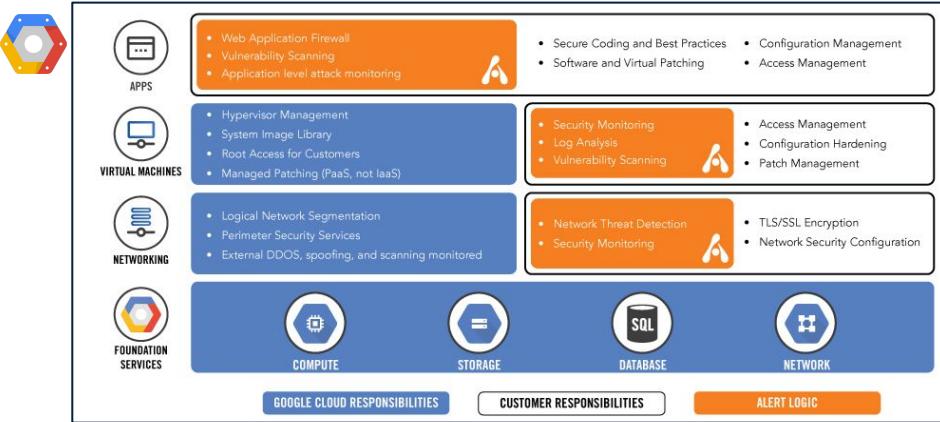
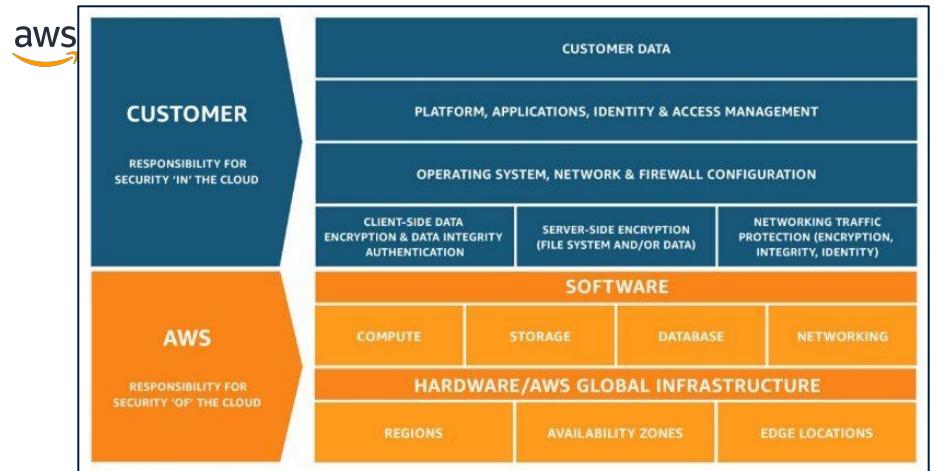


# Déclinaisons




| Responsibility                       | On-Prem | IaaS | PaaS | SaaS |
|--------------------------------------|---------|------|------|------|
| Data classification & accountability | ■       | ■    | ■    | ■    |
| Client & end-point protection        | ■       | ■    | ■    | ■    |
| Identity & access management         | ■       | ■    | ■    | ■    |
| Application level controls           | ■       | ■    | ■    | ■    |
| Network controls                     | ■       | ■    | ■    | ■    |
| Host infrastructure                  | ■       | ■    | ■    | ■    |
| Physical security                    | ■       | ■    | ■    | ■    |

■ Cloud Customer ■ Cloud Provider



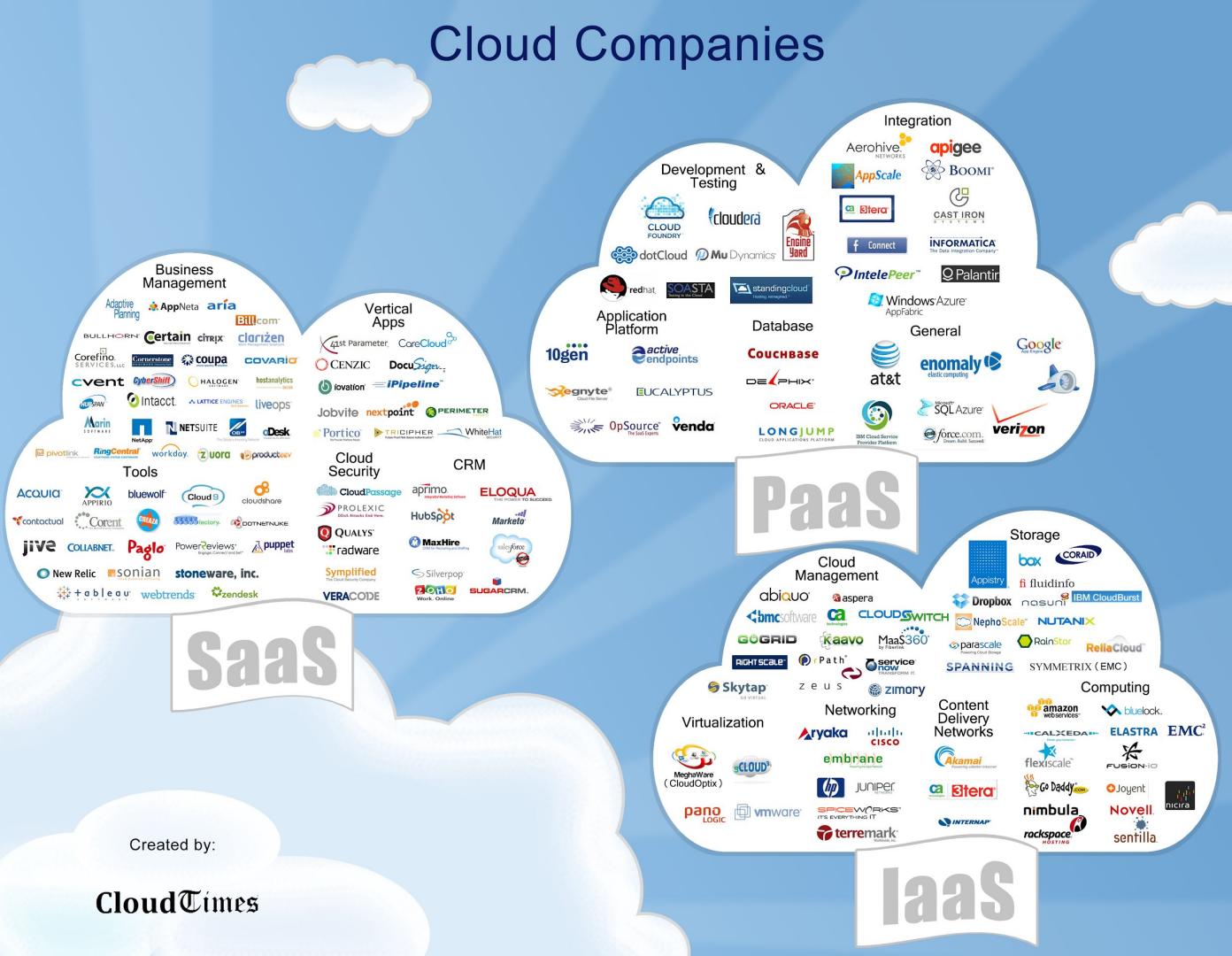
- **3 level of service (SaaS, PaaS, IaaS).**
- **Serverless**
- **Cloud deployment models ( private/public, internal/external, community, hybride)**
- **5 main characteristics (on-demand and self-service, broad network access, resource pooling, elasticity, measured service)**
- **Principle of regions and AZs**
- **Technical value (Infra as code, scaling, reproducibility/testability, DRP) and design best practices (failure tolerance, decoupling, elasticity, parallelization, data location)**
- **Shared security model**

# 2

## Who's who

Cloud Edition

# Cloud Companies



Created by:

CloudTimes



Figure 1. Magic Quadrant for Cloud Infrastructure and Platform Services







# Amazon Web Services



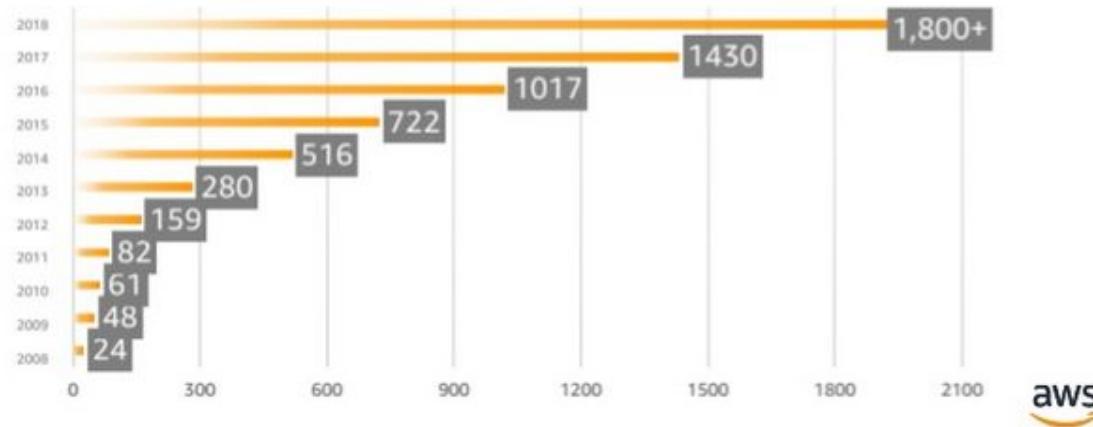
Amazon.com subsidiary launched in 2006 providing on-demand cloud computing platforms to individuals, companies, and governments

Gartner

AWS is the most mature, enterprise-ready provider, with the deepest capabilities for governing a large number of users and resources. Thus, it is the provider not only chosen by customers that value innovation and are implementing digital business projects, but also preferred by customers that are migrating traditional data centers to cloud IaaS.

## AWS' Pace of Innovation

90%+ of those new features were a direct result of feedback from our customers and invent on behalf of customers



While AWS has maintained profitability and a leading global infrastructure as a service (IaaS) and platform as a service (PaaS) market share of over 42%, its growth rate relative to its key competitors slowed in 2023.

AWS Cloud spans 111 Availability Zones within 35 geographic regions around the world





5,000,000 km  
Terrestrial fiber optic cable

400 Gbps  
Network backbone



# Microsoft Azure

**Microsoft subsidiary launched in 2010 (beta in 2008) providing on-demand cloud computing platforms targeted to companies**

## Gartner

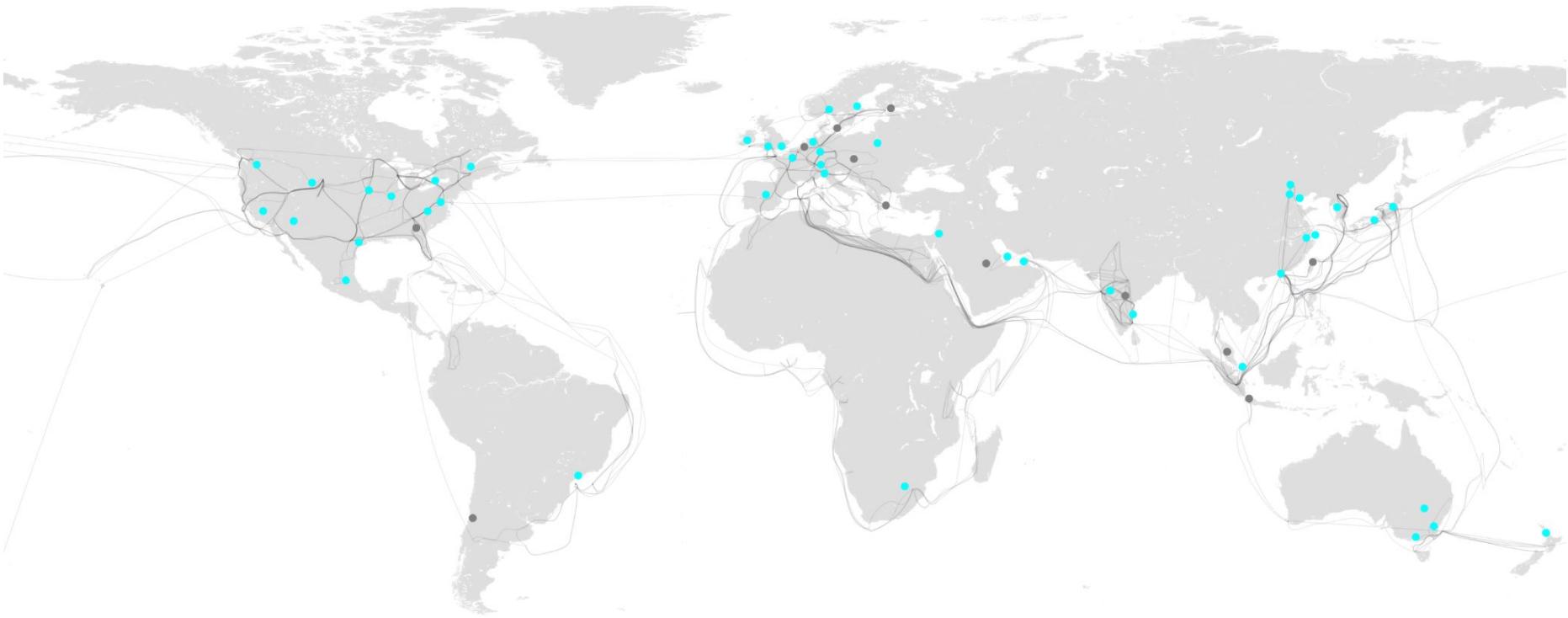
Microsoft Azure maintains a comprehensive array of IaaS and PaaS services that meet all enterprise IT use cases. Azure provides robust hybrid cloud capabilities, allowing enterprises to integrate their on-premises, Windows-based environments with the cloud.

Microsoft's vast network of partners worldwide make Azure a logical choice for many customers in regional markets.

Microsoft competes aggressively in every area of cloud computing and integrates Azure with its other leading cloud platforms to promote a "better together" story in the market.

**The task of administering certain technologies such as Windows Server, Active Directory, and SharePoint can be greatly eased with the combination of Azure and Office 365.**

As of 2023, Microsoft Azure consists of 60+ regions, 300+ datacenters (AZs) worldwide, 190+ points of presence, and over 280,000+ kilometers of terrestrial and subsea fiber worldwide





# Google Cloud Platform



**Alphabet subsidiary (Google parent company ) launched 2008 (Google App Engine) is a suite of cloud computing services that runs on the same infrastructure that Google uses internally for its end-user products**

Gartner

GCP) appeals to enterprises with a goal of transforming their IT to a fully cloud-native approach, with an emphasis on AI-enabled services. It offers a strong portfolio of IaaS and PaaS capabilities and a wide global network of cloud regions.

Over the past few years, Google's ability to address traditional enterprise needs has steadily improved, including more robust enterprise account management, a larger partner network and more integrated support for VMware and Oracle workloads.

GCP has core strengths in container-based architecture, advanced data center design and industry-leading GenAI models. This, coupled with a vibrant cloud-native developer community, has helped fuel Google's rapid rise in the SCPS market. In 2023, GCP revenue grew by 28%, more than 50% faster than the public cloud industry as a whole. Its overall market share now stands at 11.5%.

AVAILABLE IN

41

REGIONS

124

ZONES

187

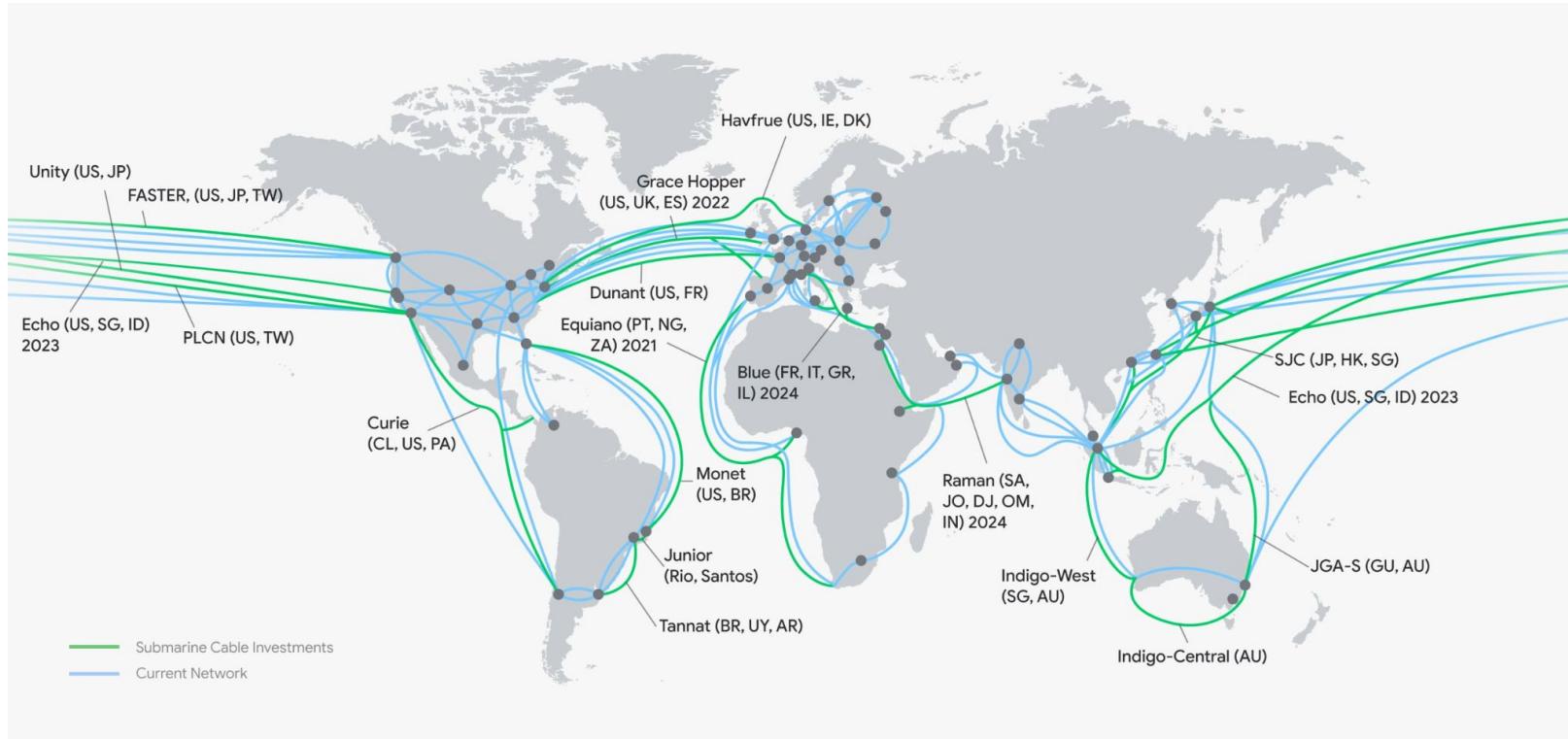
NETWORK EDGE LOCATIONS

200+

COUNTRIES AND TERRITORIES



more than 3.2 million kilometers of terrestrial and subsea fiber

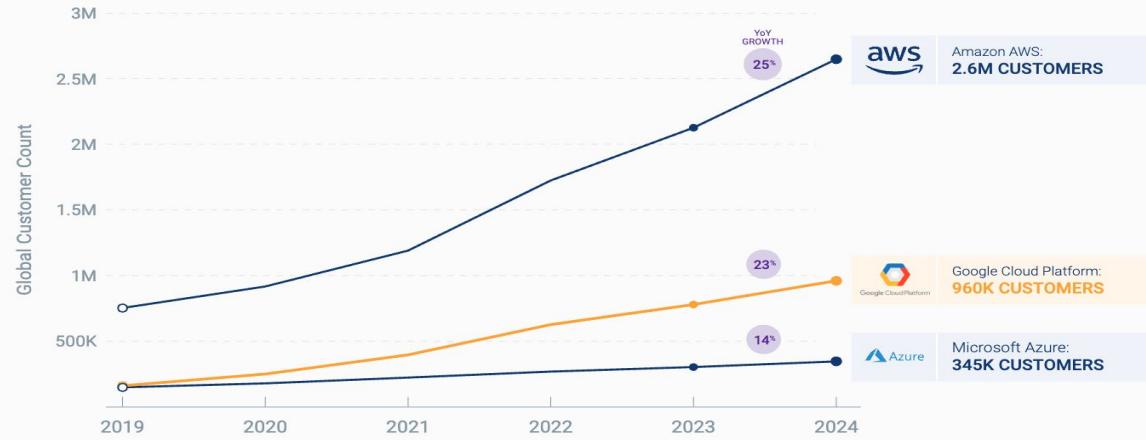




# Comparing the Big 3

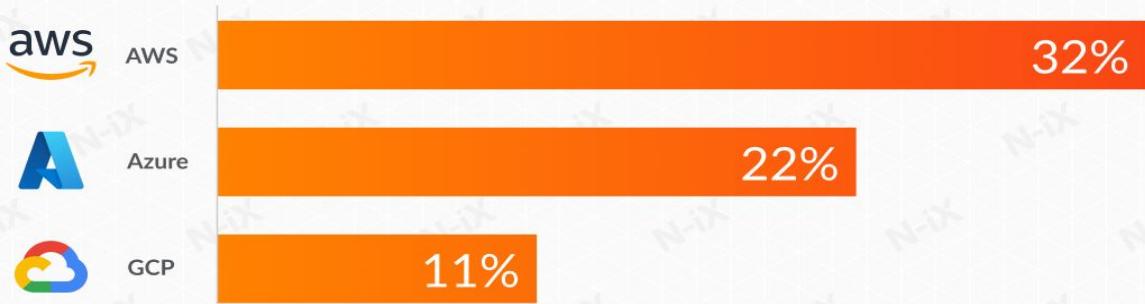
## Growth of Leading Providers' Customer Count Since 2019

AWS is exhaustive and target both large enterprises and smaller ones. Azure is really focused on the enterprise segment and GCP provides a strong developer experience and is recognized for its machine learning and data processing capabilities.



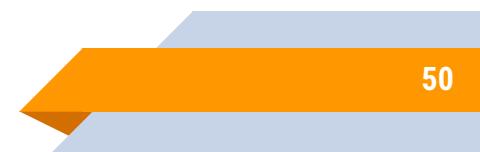
## AWS, Azure, and GCP market share comparison

Sources: Statista



Azure has less customers but they are enterprise and pay more than AWS and GCP.

|              | <b>Strengths</b>   | <b>Cautions</b>   |
|--------------|--|---|
| <b>AWS</b>   | Robust service delivery and distributed architecture.                              | Complex, inconsistent service interfaces.                                 |
|              | Solutions support via co-design sessions with specialized architects.              | Limited traction for proprietary AI models (Titan).                       |
|              | Extensive and updated SDKs for diverse programming languages.                      | Fewer sovereign cloud options compared to competitors.                    |
| <b>GCP</b>   | AI/ML modernization via Vertex AI and Gemini models.                               | Limited understanding of traditional enterprise needs.                    |
|              | Industry-leading sustainability with renewable energy and circularity.             | Uneven resilience across regions with incomplete disaster recovery tools. |
|              | Strong digital sovereignty solutions like Assured Workloads and Distributed Cloud. | Distributed cloud inconsistencies requiring workload adjustments.         |
| <b>Azure</b> | Integration with Microsoft ecosystems (e.g., 365, Power BI).                       | Security concerns noted by U.S. Cyber SRB                                 |
|              | Strong industry cloud strategy with connectors and AI services.                    | Capacity shortages in key regions (e.g., Europe, U.S.).                   |
|              | Strategic partnership with OpenAI for leading GenAI solutions.                     | Below-average ratings for service, support, and partner network quality   |



# And the others ?



China is the third largest cloud computing market after the US and Europe with company such as Alibaba cloud, Huawei & Tencent.

The US dominance stems from a high concentration of large enterprises, a mature technology ecosystem, and the presence of leading cloud providers like AWS, Microsoft Azure, and Google Cloud Platform (GCP).

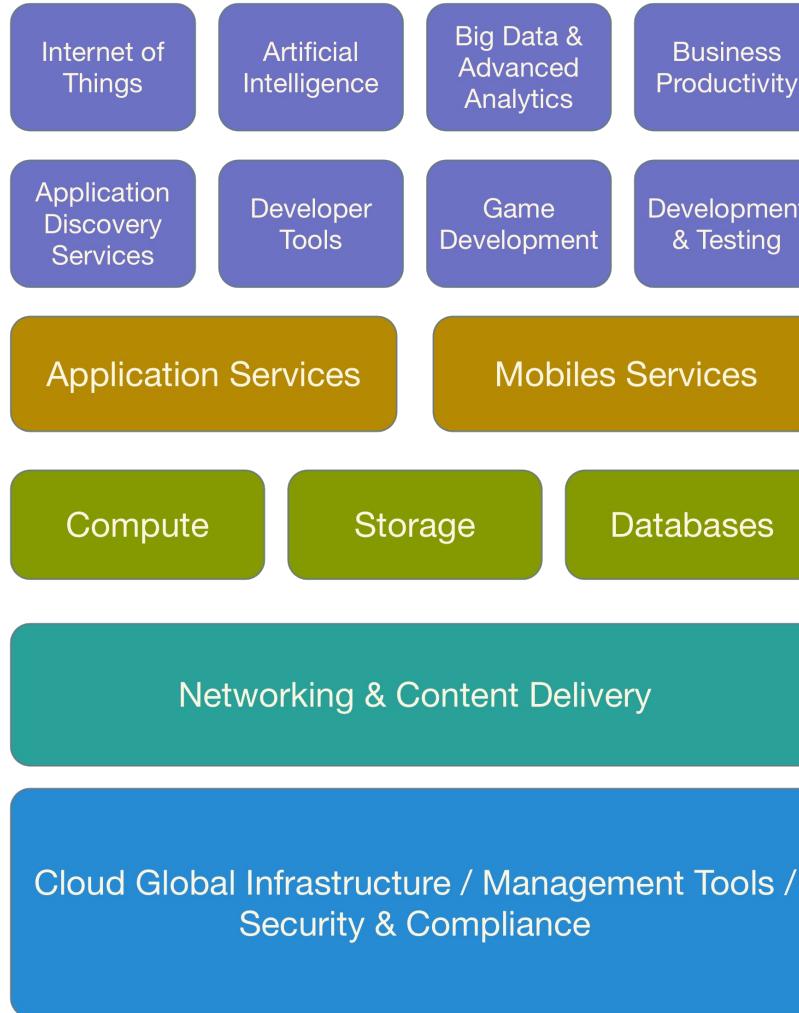
European market is rapidly expanding and has strong regional players such as OvhCloud, Hetzner or Scaleway but most companies still use americans Hyperscalers.

Open Source solutions like OpenStack or Apache CloudStack provides alternatives to the proprietary solutions of the Hyperscalers.

# 2

## Cloud building blocks

# Cloud Services



# Compute

| Category | Service   | Amazon Web Services™  | Azure  | Google Cloud Platform  |
|----------|---|---|--|--|
| Compute  | Virtual Server                                    |  Amazon EC2  |  Azure Virtual Machine   |  Compute Engine         |
| Compute  | Container Management Service                      |  Amazon EC2 Container Service<br> Amazon Elastic Container Service for Kubernetes (EKS) | Azure Kubernetes Service (AKS)<br> Azure Container Instances   |  Kubernetes Engine      |
| Compute  | Micro Services App Development Platform           |  AWS Lambda  |  Azure Service Fabric<br> Azure Functions<br> Event Grid |  Google Cloud Functions |
| Compute  | Auto Scaling                                      |  Auto Scaling  |  Azure Autoscale<br> Virtual Machine Scale Sets  |  Auto Scaler            |
| Compute  | App Development/Deployment (Java/.Net/PHP/Python) |  AWS Elastic Beanstalk   |  Azure Web Apps<br> Azure Cloud Services   |  Google App engine      |

# Compute : type

## On-Demand

Pay for compute capacity by the hour. No long-term commitments



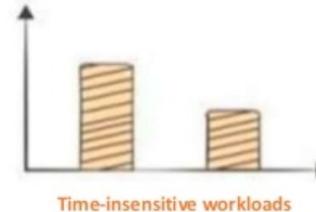
## Reserved

Pay upfront in exchange for hourly prices that are 50-75% lower than On-Demand



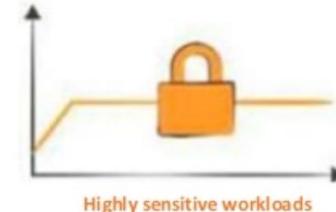
## Spot

Bid for unused Amazon EC2 capacity



## Dedicated

Launch instances in VPC on dedicated customer hardware





# EC2 instance types

|             | General Purpose                        |   | Compute Optimized               | Memory Optimized             |                                      | Accelerated Computing                           | Storage Optimized                         |   |                    |
|-------------|--|---|---------------------------------|------------------------------|--------------------------------------|---|---|---|--------------------|
| Type        | t2                                     | m5                                      | c5                              | r4                           | x1e                                  | p3  | h1  | i3  | d2                 |
| Description | Burstable, good for changing workloads | Balanced, good for consistent workloads | High ratio of compute to memory | Good for in-memory databases | Good for full in-memory applications | Good for graphics processing and other GPU uses | HDD backed, balance of compute and memory | SSD backed, balance of compute and memory | Highest disk ratio |
| Mnemonic    | t is for tiny or turbo                 | m is for main or happy medium           | c is for compute                | r is for RAM                 | x is for xtreme                      | p is for pictures                               | h is for HDD                              | i is for IOPS                             | d is for dense     |

<https://www.ec2instances.info/>

<https://calculator.s3.amazonaws.com/index.html>

# Type de storage



## BLOCK STORAGE

Data stored and managed as blocks within sectors and tracks



Client Via OS

Fixed Sys Attributes

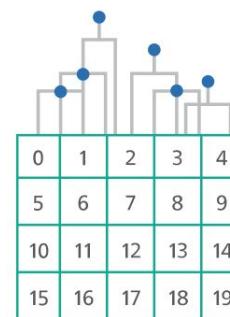
Transactional Data

Performance



## FILE STORAGE

Data stored as files  
manages files organized into hierarchical file systems



Client Via OS

Fixed Sys Attributes

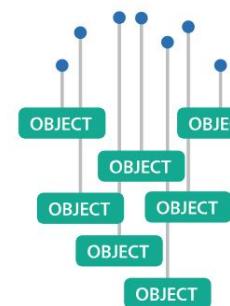
Shared Changing File

Access, Single Site



## OBJECT STORAGE

Data stored as objects in massively scalable containers with a globally unique identifier, instead of a file name and a file path



Client is App

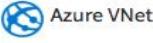
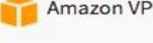
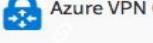
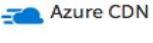
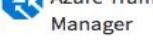
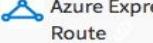
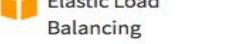
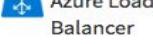
Custom Metadata

Shared Semi-Static File

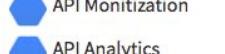
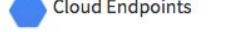
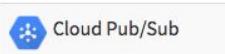
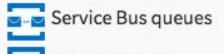
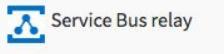
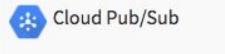
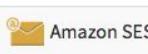
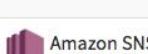
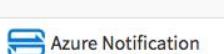
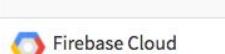
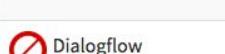
Scalable, Multi-Site

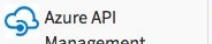
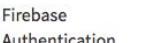
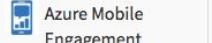
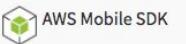
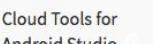
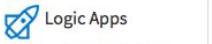
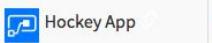
# Storage

| Category           | Service   | Amazon web services™   | Azure   | Google Cloud Platform   |
|--------------------|---|--|---|---|
| Storage            | Object Storage                                      |  Amazon Simple Storage Service (S3) |  Azure Blob Storage   |  Cloud Storage   |
| Storage            | Virtual Machine Disk Storage                        |  Amazon Elastic Block Storage (EBS) |  Azure Page Blobs / Premium Storage<br><br> Managed Disks |  Persistent Disk   |
| Storage            | File Storage (SMB Compatible)                       |  Amazon Elastic File System (EFS)   |  Azure File Storage   |  File Store  |
| Storage            | Long Term Cold Storage                              |  Amazon Glacier                     |  Azure Archive Storage<br><br> Azure Cool Storage         |  Cloud Storage<br><br> Archival Storage (NEARLINE & COLDLINE) |
| Migration Services | Large Scale Data Transfer Solution (Terabyte Scale) |  AWS Snowball Edge                  |  Azure Data Box (Preview)   |  Transfer Appliance (Beta)   |

| Category                                 | Service                                  |  Amazon Web Services™   |  Azure                 |  Google Cloud Platform |
|--|--|--|--|---|
| <b>Networking &amp; Content Delivery</b> | <b>Virtual Networking</b>                |  Amazon VPC   |  Azure VNet            |  Cloud Virtual Network |
| <b>Networking &amp; Content Delivery</b> | <b>Network Gateway</b>                   |  Amazon VPN   |  Azure VPN Gateway     |  Cloud VPN             |
| <b>Networking &amp; Content Delivery</b> | <b>Content Delivery Network</b>          |  Amazon CloudFront  |  Azure CDN             |  Cloud CDN             |
| <b>Networking</b>                        | <b>Networking &amp; Content Delivery</b> |  Amazon Route 53  |  Azure DNS             |  Cloud DNS             |
| <b>Networking</b>                        | <b>Global Traffic Management</b>         |  Amazon Route 53 Traffic Flow   |  Azure Traffic Manager |   |
| <b>Networking &amp; Content Delivery</b> | <b>Private Connectivity</b>              |  AWS Direct Connect<br> AWS Private Link |  Azure Express Route   |  Cloud InterConnect    |
| <b>Networking &amp; Content Delivery</b> | <b>Load Balancers</b>                    |  Elastic Load Balancing   |  Azure Load Balancer   |  Cloud Load Balancing  |

| Category        | Service   |  Amazon Web Services™   |  Azure   |  Google Cloud Platform   |
|-----------------|---|--|--|---|
| <b>Database</b> | <b>Relational Database Management Service</b>     |  Amazon Aurora<br> Amazon RDS  |  Azure SQL Database<br> SQL Server Stretch Database<br> Azure Database for MySQL<br> Azure Database for PostgreSQL |  Cloud SQL<br> Cloud Spanner        |
| <b>Database</b> | <b>Non Relational Database Management Service</b> |  Amazon DynamoDB<br> Amazon DynamoDB Accelerator (DAX)<br> Amazon Neptune (Preview) |  Azure CosmosDB<br> Table Storage<br> Azure Time Series Insights  |  Cloud Datastore<br> Cloud BigTable |
| <b>Database</b> | <b>Timeseries Database</b>                        |  Amazon DynamoDB  |  Azure Time Series Insights   |  Cloud BigTable  |
| <b>Database</b> | <b>In-Memory Data Store</b>                       |  Amazon ElastiCache   |  Azure RedisCache   |  Cloud MemoryStore (Beta)  |
| <b>Database</b> | <b>Data Warehousing</b>                           |  Amazon Redshift  |  Azure SQL Data Warehouse   |  BigQuery  |

| Category             | Service                |  Amazon web services™   |  Azure  |  Google Cloud Platform  |
|----------------------|------------------------|---|--|---|
| Application Services | API Management Service |  Amazon API Gateway  |  Azure API Management  |  Apigee API Platform<br> API Monitization<br> API Analytics<br> Apigee Sense<br> Cloud Endpoints |
| Application Services | Queuing Services       |  Amazon SQS<br> Amazon MQ |  Service Bus queues<br> Queue Storage<br> Service Bus topics<br> Service Bus relay |  Cloud Pub/Sub   |
| Application Services | Mobile Analytics       |  Amazon Pinpoint   |  Mobile Engagement   |   |
| Application Services | Email Services         |  Amazon SES  |  |   |
| Application Services | Notification Services  |  Amazon SNS  |  Azure Notification Services   |  Firebase Cloud Messaging  |
| Application Services | Blockchain Services    | Amazon Managed Blockchain (Preview)   |  Blockchain<br> Blockchain Workbench   |   |
| Application Services | Chatbot                |  Lex Chatbots   |  Azure Bot Service  |  Dialogflow   |

| Category        | Service                                      |  Amazon Web Services™       |  Azure  |  Google Cloud Platform           |
|-----------------|--|---|--|--|
| Mobile Services | Mobile App Development Services              |  AWS Mobile Hub            |  Azure Mobile Apps   |  Cloud Mobile App               |
| Mobile Services | Web API Management Service                   |  Amazon API Gateway        |  Azure API Management  |  Cloud Endpoints                |
| Mobile Services | Web/Mobile Authentication Services           |  Amazon Cognito            |  Azure Mobile SDK,Offline/Sync   |  Firebase Authentication        |
| Mobile Services | Consolidated Mgmt of Multiple Cloud Accounts |  Amazon Pinpoint           |  Azure Mobile Engagement   |  |
| Mobile Services | Mobile App Testing Service                   |  AWS Device Farm           |  Xamarin Test Cloud (Front End)<br> Azure DevTest Labs (Back End)  |  Cloud Test Lab                 |
| Mobile Services | Mobile App Software Development Toolkit      |  AWS Mobile SDK            |  Azure Mobile SDK  |  Cloud Tools for Android Studio |
| Mobile Services | Application Services                         |  AWS Step Functions        |  Microsoft Flow<br> Logic Apps<br> Azure Functions<br> Event Grid<br> Azure App Service WebJobs |  App Engine                     |
| Mobile Services | Mobile App Analytics                         |  Amazon Mobile Analytics |  Hockey App  |  Firebase Analytics           |

| Category        | Service                        |  Amazon web services™  |  Azure   |  Google Cloud Platform   |
|-----------------|--------------------------------|---|--|---|
| Developer Tools | Cloud Software Development Kit |  AWS Cloud9<br> AWS Code Star<br> AWS CodeCommit<br> AWS CodeBuild<br> AWS CodeDeploy<br> AWS CodePipeline<br> AWS X-Ray |  Azure Boards<br> Azure Pipelines<br> Azure Repos<br> Azure Test Plans<br> Azure Artifacts |  Cloud Source Repositories   |
| Developer Tools | Cloud Software Development Kit |  AWS SDK   |  Azure SDK Visual Studio   |  Cloud SDK Cloud Tools for IntelliJ<br> Cloud Tools for Android Studio<br> Cloud Tools for Powershell<br> Google Plugin for Eclipse |

| Category                | Service  | AWS  | Azure   | Google Cloud Platform   |
|-------------------------|--|--|---|---|
| <b>Management Tools</b> | <b>Cloud Deployment Templates/ Infra as Code</b>   |  AWS CloudFormation   |  Azure Resource Manager<br> Azure Building Blocks   |  Cloud Resource Manager<br> Cloud Deployment Manager  |
| <b>Management Tools</b> | <b>Logging &amp; Monitoring</b>                    |  Amazon CloudWatch<br> |  Log Analytics<br> Azure portal<br>   |  Google StackDriver<br><br><br><br><br> |
| <b>Management Tools</b> | <b>Resource / Configuration Inventory</b>          |   |   |  Cloud Security Scanner<br> Cloud Data Loss Prevention API<br> Access Transparency (Beta)  |
| <b>Management Tools</b> | <b>Cloud Cost / Performance / Security Advisor</b> |   | <br>  |    |
| <b>Management Tools</b> | <b>Cloud Management Tools</b>                      | <br>                   | <br><br><br><br> | <br><br><br>   |

| Category                        | Service                        |  Amazon Web Services™   |  Azure  |  Google Cloud Platform  |
|---------------------------------|--------------------------------|---|--|---|
| Security & Identity, Compliance | Hardware Based Security Module |  AWS CloudHSM<br> AWS Secrets Manager |  Azure Key Vault   |  Cloud Key Management Service  |
| Security & Identity, Compliance | Directory Services             |  AWS Directory Service   |  Azure Active Directory<br> Azure Active Directory B2C<br> Azure Active Directory Domain Services<br> Azure Active Directory Multi Factor Authentication |  Cloud IAM<br> Cloud Identity-Aware Proxy<br> Security Key Enforcement |
| Security & Identity, Compliance | Key Management Services        |  AWS Key Management Service  |  Azure Key Vault   |  Cloud Key Management Service  |
| Security & Identity, Compliance | DDoS Protection Service        |  AWS Shield  |  Azure DDoS Protection   |  Cloud Armor (Beta)  |
| Security & Identity, Compliance | Web Application Firewall       |  AWS WAF   |  Azure WAF   |   |

| Category                                 | Service   |  Amazon web services™  |  Azure  |  Google Cloud Platform   |
|--|---|--|--|--|
| <b>Big Data &amp; Advanced Analytics</b> | <b>Big Data Query as a Service</b>                    |  Amazon Athena  |  Azure Data Lake Analytics   |  BigQuery   |
| <b>Big Data &amp; Advanced Analytics</b> | <b>Big Data Managed Cluster as a Service</b>          |  Amazon EMR   |  Azure HDInsight   |  Cloud DataProc   |
| <b>Big Data &amp; Advanced Analytics</b> | <b>Cloud Search</b>                                   |  Amazon CloudSearch<br> Amazon Elastic Search Service  |  Azure Search  |  |
| <b>Big Data &amp; Advanced Analytics</b> | <b>Streaming Service</b>                              |  Amazon Kinesis<br> Amazon Kinesis Video Streams   |  Azure Stream Analytics<br> Azure Event Hub  |  Cloud Dataflow   |
| <b>Big Data &amp; Advanced Analytics</b> | <b>Data Warehouse</b>                                 |  Amazon Redshift  |  Azure SQL Data Warehouse  |  BigQuery   |
| <b>Big Data &amp; Advanced Analytics</b> | <b>Business Intelligence &amp; Data Visualization</b> |  Amazon QuickSight  |  PowerBI   |  Google Data Studio (Beta)  |
| <b>Big Data &amp; Advanced Analytics</b> | <b>Cloud ETL</b>                                      |  AWS Data Pipeline<br> AWS Glue<br> Amazon Simple Workflow Service (SWF) |  Azure Data Factory<br> Azure Data Catalog<br> Logic Apps |  Cloud DataPrep (Private Beta)<br> Cloud Composer (Beta) |

| Category                | Service                | Amazon Web Services™  | Azure   | Google Cloud Platform   |
|-------------------------|------------------------|---|---|---|
| Artificial Intelligence | Language Processing AI |  Amazon Lex<br> Amazon Comprehend   |  LUIS (Language Understanding Intelligent Service)<br> Azure Bot Service<br> Azure Speech Recognition API |  Natural Language API<br> Cloud Text-to-Speech (Beta)<br> DialogFlow Enterprise Edition (Beta) |
| Artificial Intelligence | Speech Recognition AI  |  Amazon Polly<br> Amazon Transcribe<br> Amazon Translate |   |  Translation API<br> Speech API   |
| Artificial Intelligence | Image Recognition AI   |    |  Emotion API<br> Face API<br> Computer Vision API   |  Vision API<br> Cloud Video Intelligence  |
| Artificial Intelligence | Machine Learning       | <br>  |  Azure Machine Learning<br> Azure Machine Learning Workbench<br> Azure Machine Learning Model Management  |  Cloud DataLab<br> Cloud AutoML (Alpha)<br> Cloud Machine Learning Services                    |

| Category              | Service                   |  Amazon Web Services™ |  Azure  |  Google Cloud Platform   |
|-----------------------|---------------------------|--|---|---|
| Software MarketPlace  | Cloud Marketplace         |  AWS Marketplace      |  Azure MarketPlace  |  Cloud Launcher  |
| Internet of Things    | IoT Platform              |  AWS IoT Platform     |  Azure IoT Platform<br> Azure IoT Hub |  Cloud IoT Core (Beta)<br> Google Cloud IoT |
| Internet of Things    | IoT Development Solutions |  AWS Greengrass       |  Azure IoT SDK<br> Azure IoT Edge     |   |
| Internet of Things    | IoT Hardware              |  AWS IoT Button       |  Azure Sphere   |   |
| Game Development      | Game Development          |  Amazon Lumberyard    |  Visual Studio  |   |
| Development & Testing | Development & Testing     |  AWS Dev/Test         |  Azure Dev/Test   |   |

## Labs

You should have received on your academic email the means of connection to AWS Academy

Go to <https://github.com/jmanteau/cloud-concepts-introduction-labs> for the lab part

## Cloud is tool but not the only one.

**C** The tech press is full of people who want to tell you how completely awesome life is going to be when everything moves to "the cloud" – that is, when all your important storage, processing and other needs are handled by vast, professionally managed data-centres. Here's something you won't see mentioned, though: the main attraction of the cloud to investors and entrepreneurs is the idea of making money from you, on a recurring, perpetual basis, for something you currently get for a flat rate or for free without having to give up the money or privacy that cloud companies hope to leverage into fortunes.



[Cry Doctorow](#), from a [Guardian](#) article