

INTRODUCING THE CLOUD (RECORDED)

CLOUD COMPUTING

AWS

MICROSOFT AZURE

GCP

CLOUD COMPARISON

INTRODUCING THE CLOUD

Introducing the cloud and the cloud providers

OUR PLAN

Common cloud concepts

AWS, Azure, GCP observations

Cloud comparisons

CLOUD COMPUTING

CLOUD COMPUTING

AWS

MICROSOFT AZURE

GCP

CLOUD COMPARISON

WHAT IS CLOUD COMPUTING

Shared resources

On-demand

Easily scalable

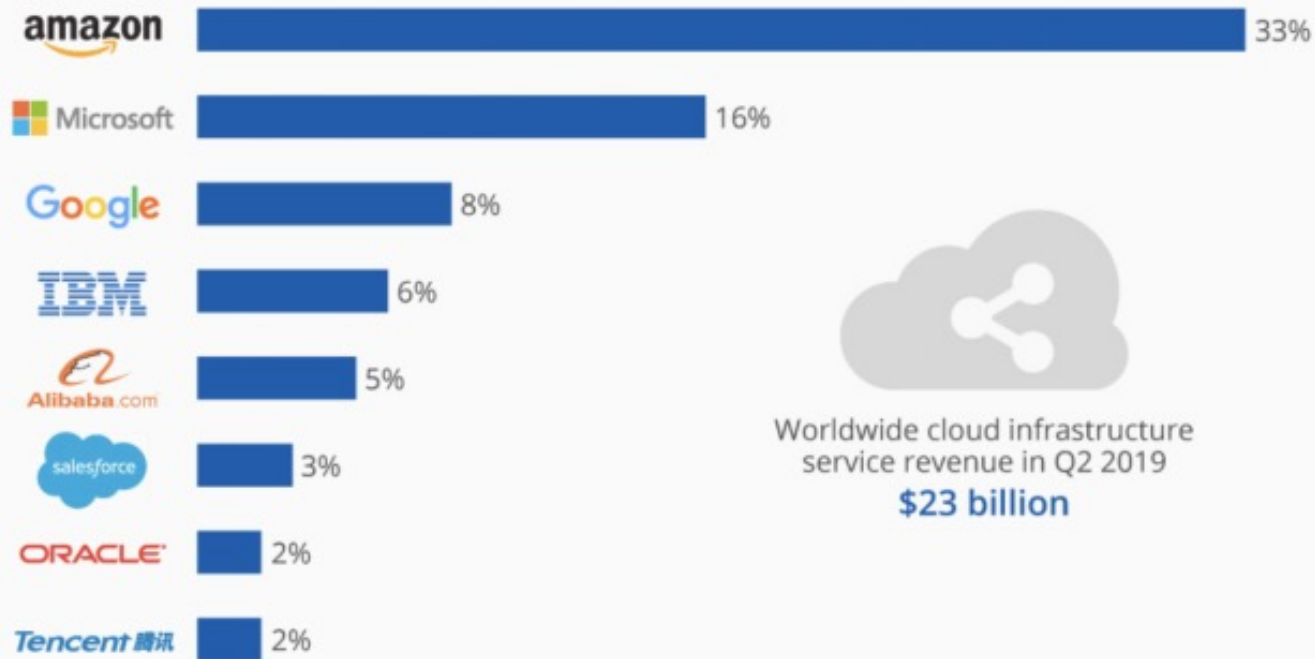
Accessed via internet



CLOUD COMPUTING GLOBAL MARKET

Amazon Leads the Race to the Cloud

Worldwide market share of leading cloud infrastructure service providers in Q2 2019*



Worldwide cloud infrastructure
service revenue in Q2 2019
\$23 billion

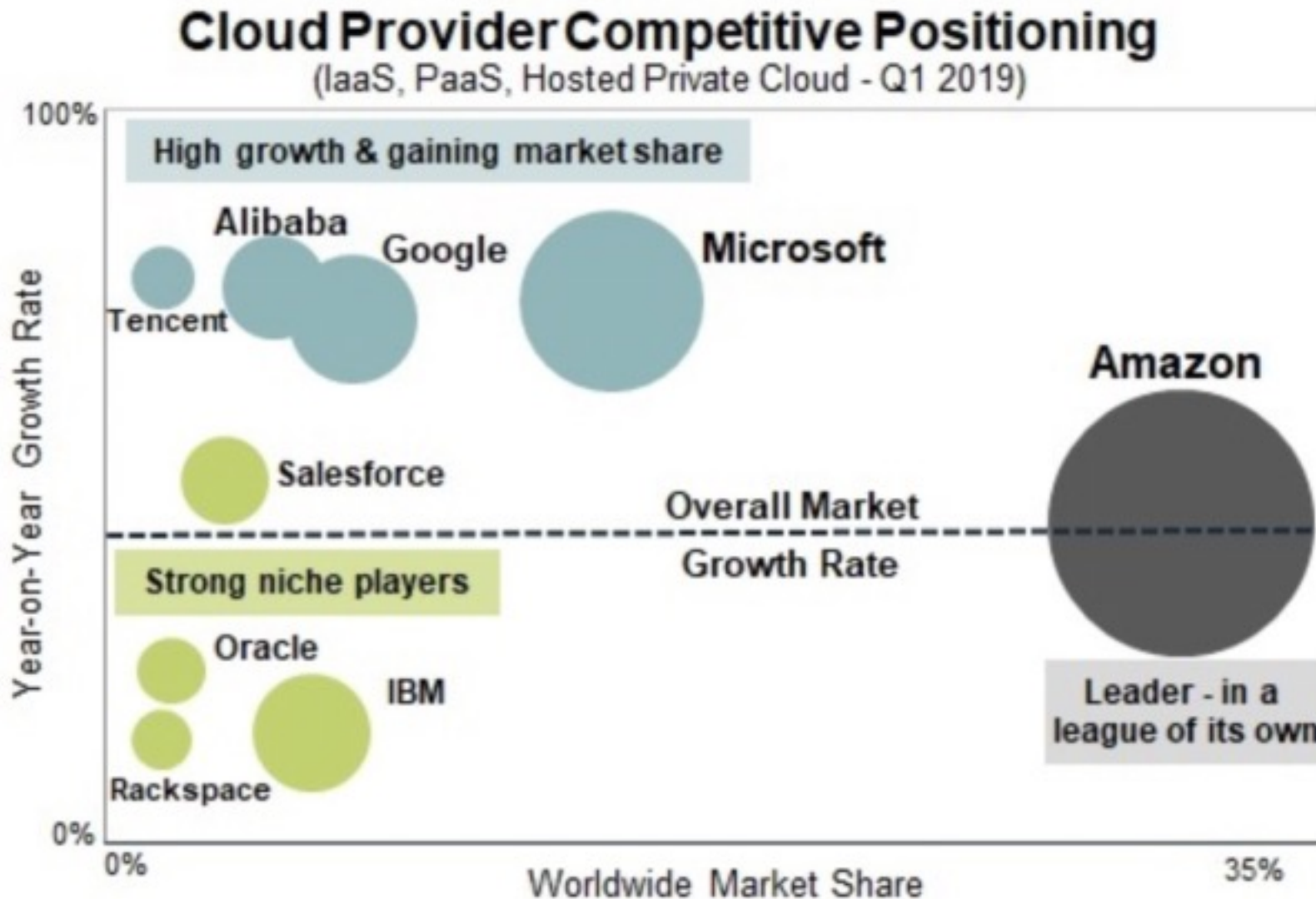


* includes platform as a service (PaaS) and infrastructure as a service (IaaS)
as well as hosted private cloud services

Source: Synergy Research Group

statista

MARKET PLAYERS POSITIONING



AWS VS AZURE VS GCP

Geographical Coverage

AWS:

- 80 Availability Zones within 25 geographic regions around the world, with announced plans for 15 more Availability Zones and 5 more AWS Regions in Australia, India, Indonesia, Spain, and Switzerland.

Azure:

- 54 regions worldwide, available in 140 countries

GCP:

- 25 regions, 76 zones, 200 + countries

Numerous edge points

REGIONS AND AVAILABILITY ZONES



REGIONS AND AVAILABILITY ZONES

Each region consists of multiple availability zones.

Each availability zone is physically separated and isolated from the others.

All availability zones within a region are connected to one another via highly redundant, low-latency, high-speed networks.

- For GCP, regions are also connected with cable network
- For Azure, regions may be couple into primary and secondary

REGIONS AND AZ BEST PRACTICES

Nearest to your physical location and/or your users' location to minimize network latency

Not all regions are equal

- Service offerings (newly deployed services are first offered in selected regions only)
- Pricing is not equal across multiple regions, use cost calculators
- Service Level Agreement (SLA) will vary by region
- Compliance such as GDPR is specific to a country therefore it varies region-to-region
 - Example: IRB-approved data with an audience that spans continents

FAULT TOLERANCE WITH MULTIPLE AZ

If you distribute your instances across multiple Availability Zones and one instance fails, you can design your application so that an instance in another Availability Zone can handle requests

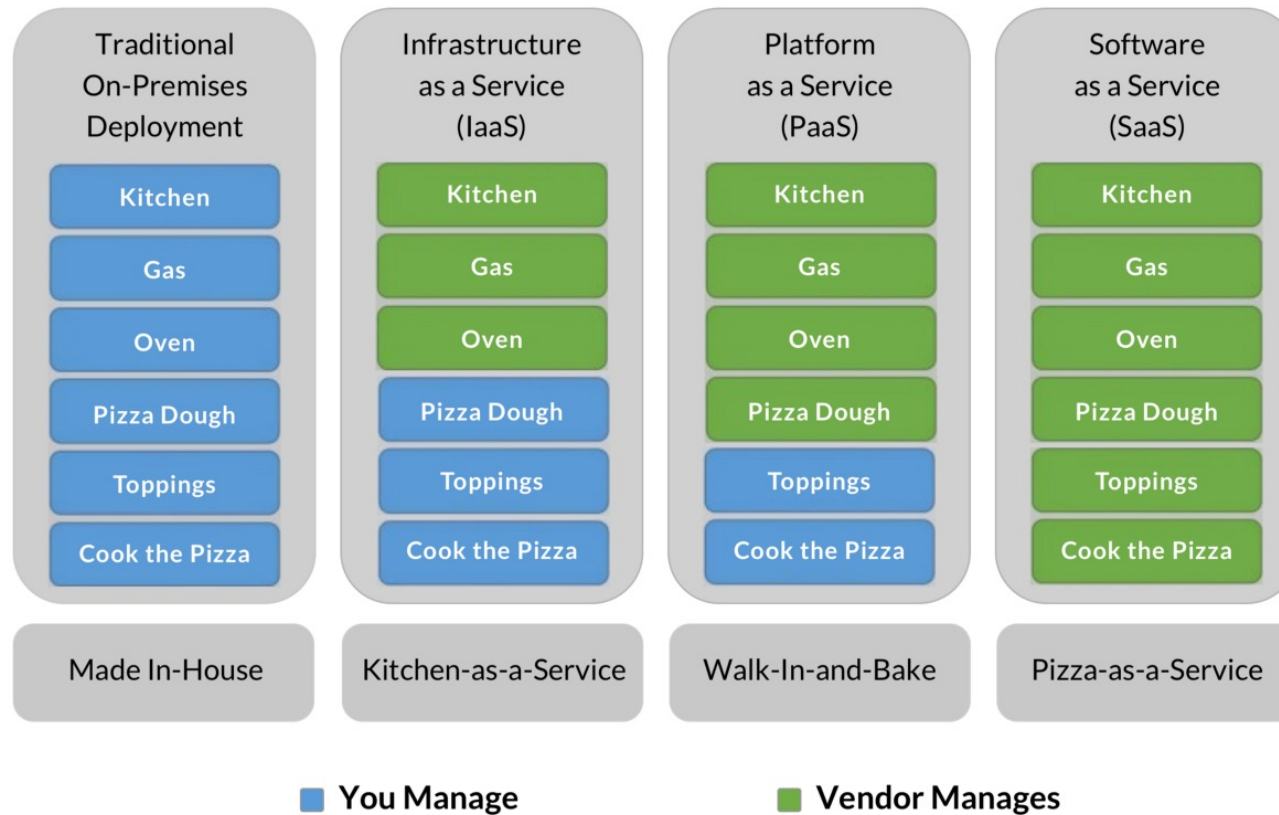
Availability Zones give you the flexibility to launch production apps and resources that are highly available, resilient/fault-tolerant, and scalable as compared to using a single data center

Clouds usually offer Content Delivery Network (CDN)

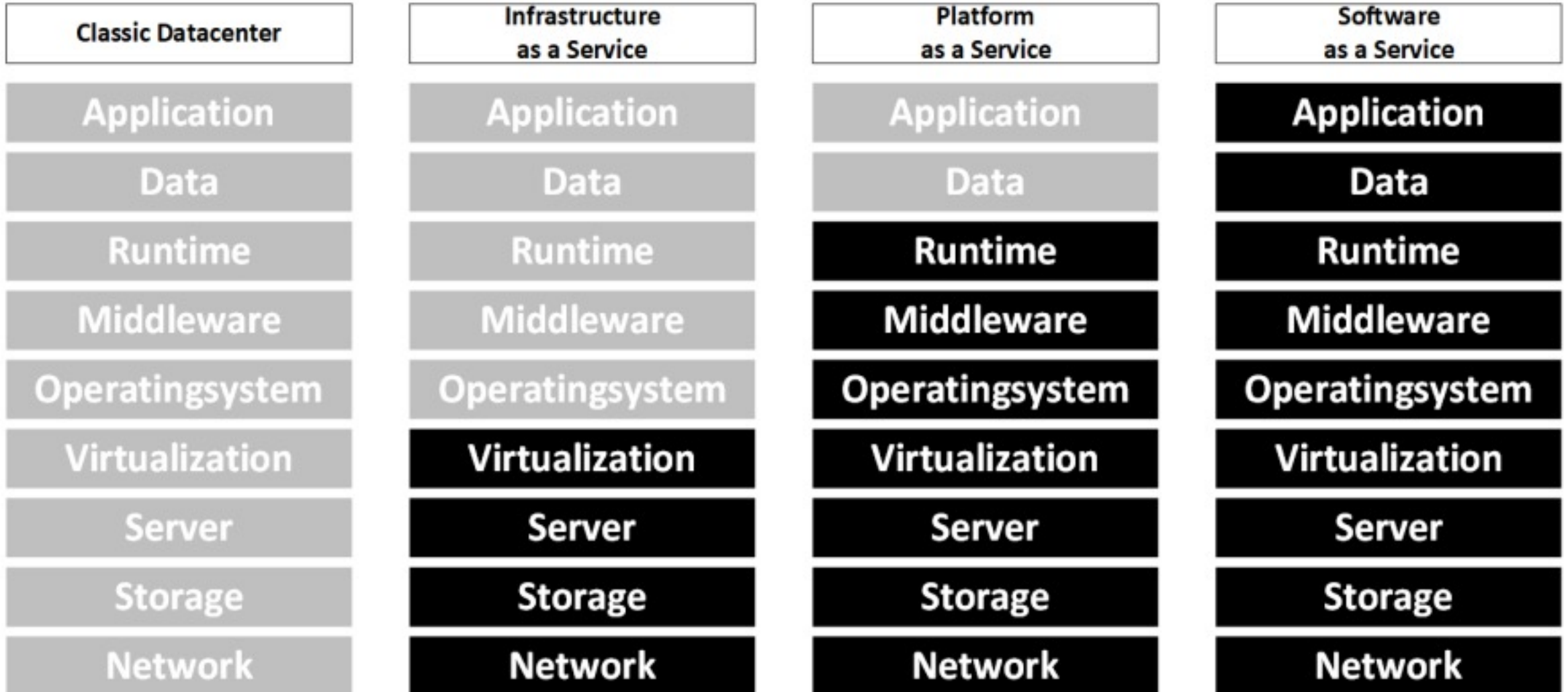
- Large images may be better delivered through CDN
 - "Better" means faster delivery to the requester
 - But this gets expensive as the demand scales
 - In the research world, there are few use cases that justify this expense

CLOUD SERVICE MODELS FOR PIZZA

New Pizza as a Service



CLOUD SERVICE MODELS



CLOUD MIGRATION STRATEGIES

6 Strategies for Migrating Applications to the Cloud, or 6 R's

Rehosting—Otherwise known as “lift-and-shift.”

Replatforming—sometimes called this “lift-tinker-and-shift.”

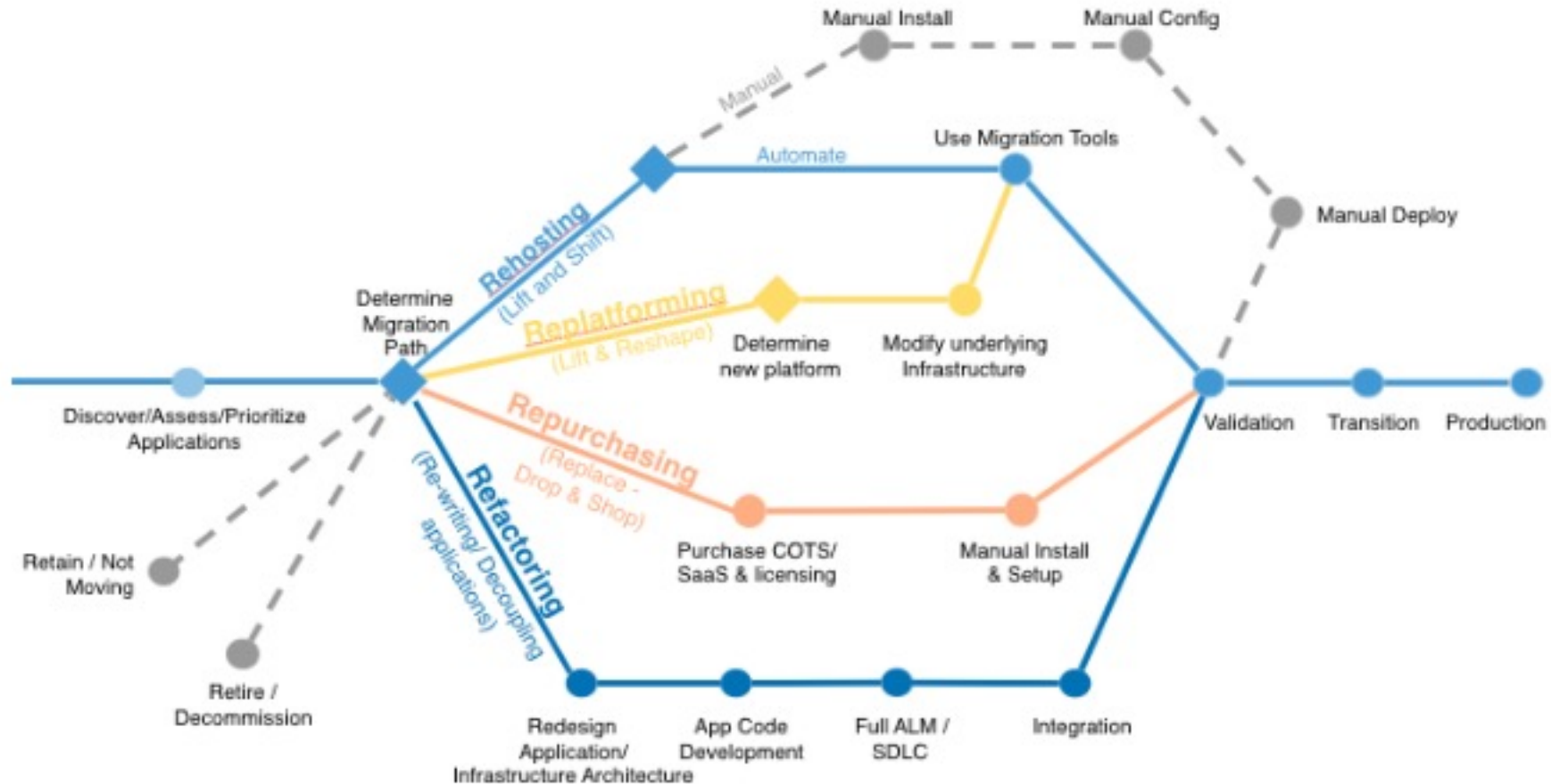
Repurchasing—Moving to a different product.

Refactoring / Re-architecting

Retire—Get rid of.

Retain—Usually this means “revisit” or do nothing (for now).

CLOUD MIGRATION STRATEGIES



ating-

QUICK KNOWLEDGE CHECK

Which is the order of cloud leaders, by market size?

- A) Azure, GCP, AWS
- B) GCP, Azure, AWS
- C) AWS, GCP, Azure
- D) AWS, Azure, GCP

QUICK KNOWLEDGE CHECK

Which represents the correct order, from the most to the least amount of work done by you?

- A) On Prem, IaaS, PaaS, SaaS
- B) SaaS, PaaS, IaaS, On Prem
- C) IaaS, PaaS, SaaS, On Prem
- D) SaaS, IaaS, PaaS, On Prem

QUICK KNOWLEDGE CHECK

A company wants to move to the cloud as their existing data center lease is expiring. What migration strategy should a company adopt for quickly migrating their existing applications to cloud?

- A) Replatform
- B) Retain
- C) Repurchase
- D) Rehost

QUICK KNOWLEDGE CHECK

Which of these strategies takes more time to execute?

- A) Retain
- B) Replatform
- C) Rehost
- D) Rearchitect

AWS

CLOUD COMPUTING

AWS

MICROSOFT AZURE

GCP

CLOUD COMPARISON

AWS SERVICES

AWS offers more than 1,000 services, and it keeps adding services at regular intervals.

Its stated goal is to offer every imaginable use case

AWS has been expanding in areas where it is the leader, and it has also expanded into newer territories.

AWS SERVICES (SOME)

Compute <ul style="list-style-type: none">EC2LightsailLambdaBatchElastic BeanstalkServerless Application RepositoryAWS OutpostsEC2 Image Builder	Customer Enablement <ul style="list-style-type: none">AWS IQSupportManaged ServicesActivate for Startups Blockchain <ul style="list-style-type: none">Amazon Managed Blockchain Satellite <ul style="list-style-type: none">Ground Station Quantum Technologies <ul style="list-style-type: none">Amazon Braket Management & Governance <ul style="list-style-type: none">AWS OrganizationsCloudWatchAWS Auto ScalingCloudFormationCloudTrailConfigOpsWorksService CatalogSystems ManagerAWS AppConfigTrusted AdvisorControl TowerAWS License Manager	Machine Learning <ul style="list-style-type: none">Amazon SageMakerAmazon Augmented AIAmazon CodeGuruAmazon ComprehendAmazon ForecastAmazon Fraud DetectorAmazon KendraAmazon LexAmazon PersonalizeAmazon PollyAmazon RekognitionAmazon TextractAmazon TranscribeAmazon TranslateAWS DeepComposerAWS DeepLensAWS DeepRacerAWS PanoramaAmazon MonitronAmazon HealthLakeAmazon Lookout for VisionAmazon Lookout for EquipmentAmazon Lookout for Metrics Analytics <ul style="list-style-type: none">AthenaAmazon RedshiftEMR	Front-end Web & Mobile <ul style="list-style-type: none">AWS AmplifyMobile HubAWS AppSyncDevice FarmAmazon Location Service AR & VR <ul style="list-style-type: none">Amazon Sumerian Application Integration <ul style="list-style-type: none">Step FunctionsAmazon AppFlowAmazon EventBridgeAmazon MQSimple Notification ServiceSimple Queue ServiceSWFManaged Apache Airflow AWS Cost Management <ul style="list-style-type: none">AWS Cost ExplorerAWS BudgetsAWS Marketplace Subscriptions Customer Engagement <ul style="list-style-type: none">Amazon ConnectPinpointSimple Email Service
Storage <ul style="list-style-type: none">S3EFSFSxS3 GlacierStorage GatewayAWS Backup			
Database <ul style="list-style-type: none">RDSDynamoDBElastiCacheNeptuneAmazon QLDBAmazon DocumentDBAmazon KeyspacesAmazon Timestream			
Migration & Transfer			

AWS CLOUD9

Cloud-based IDE that helps users to write, debug, and run their code

Users do not need to install any local IDE, as you get a code editor, a debugger, and a terminal with AWS Cloud9 in your web browser

More than 40 programming languages, including popular ones such as Python, PHP, and JavaScript are supported by AWS Cloud9

AWS Cloud9 connects to AWS EC2 instances to run code

AWS CLOUD9

AWS Toolkit

AWS Toolkit is an extension for AWS Cloud9 that enables you to interact with [Amazon Web Services \(AWS\)](#). See the [AWS Toolkit user guide](#) for complete documentation.

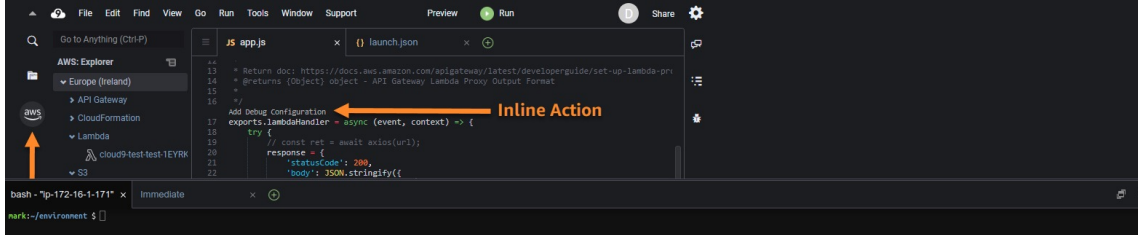
See [Get help](#) for support.

Features

- [AWS Explorer](#)
 - CloudFormation stacks
 - Lambda functions
 - S3 explorer
- [AWS Serverless Applications \(SAM\)](#)
- [AWS: Commands](#)

AWS Explorer

The AWS Explorer provides access to the AWS services that you can work with when using the Toolkit. To see the AWS Explorer, choose the **AWS** icon in the Activity bar.



The screenshot displays the AWS Toolkit interface within the AWS Cloud9 environment. The left sidebar shows the AWS Explorer with a tree view of services including Europe (Ireland), API Gateway, CloudFormation, Lambda, and S3. The central editor shows a JavaScript file named 'app.js' with a lambda handler function. An orange arrow points to the 'Add debug configuration' button in the code editor, labeled 'Inline Action'. The bottom terminal shows the command 'bash - "p-172-16-1-171" x Immediate' and the prompt 'marki:/environment \$'.

CLOUD SHELL

Every cloud offers cloud shell

Example of AWS Shell

- Login to AWS
- Start the shell
- Install terraform (<https://intelligentsysadmin.wordpress.com/2021/01/08/aws-cloudshell-and-terraform/>)
- **Let's do a demo!**

MICROSOFT AZURE

CLOUD COMPUTING

AWS

MICROSOFT AZURE

GCP

CLOUD COMPARISON

MICROSOFT AZURE

Azure is Microsoft's portfolio of integrated cloud services, built for developers and IT professionals.

Azure depends on high-bandwidth and low latency global networks, connecting Microsoft data centers around the globe.

Every service that Microsoft offers to its customers is delivered out of these Azure data centers and built from Azure services.

MICROSOFT AZURE

The screenshot displays the Microsoft Azure website's navigation and product showcase. The top navigation bar includes links for Overview, Solutions, Products (highlighted), Documentation, Pricing, Training, Marketplace, Partners, Support, Blog, and More. A search bar and user account information (mark@elephantscale.com) are also present. The main content area features a sidebar with a 'Featured' section and a list of product categories. The main body displays a grid of featured products, each with a title and a brief description.

Microsoft Azure Contact Sales Search My account Portal mark@elephantscale.com

Overview Solutions **Products** Documentation Pricing Training Marketplace Partners Support Blog More [Free account](#)

Featured

- Internet of Things
- Management and Governance
- Media
- Migration
- Mixed Reality
- Mobile
- Networking
- Security
- Storage
- Web
- Windows Virtual Desktop

Search all products [See all \(200+\)](#)

Featured
Explore some of the most popular Azure products

- Virtual Machines**
Provision Windows and Linux virtual machines in seconds
- Windows Virtual Desktop**
The best virtual desktop experience, delivered on Azure
- Azure SQL**
Managed, always up-to-date SQL instance in the cloud
- App Service**
Quickly create powerful cloud apps for web and mobile
- Azure Cosmos DB**
Fast NoSQL database with open APIs for any scale
- PlayFab**
The complete LiveOps back-end platform for building and operating live games
- Azure Kubernetes Service (AKS)**
Simplify the deployment, management, and operations of Kubernetes
- Azure Functions**
Process events with serverless code
- Azure Cognitive Services**
Add smart API capabilities to enable contextual interactions
- Azure Quantum**
Experience quantum impact today on Azure

MICROSOFT'S CLOUD-FIRST STRATEGY

Everything that Microsoft builds and develops is first made for Azure and Microsoft's other cloud offerings

Nearly every feature or product that Microsoft develops originates in Azure or M365

Microsoft 365 includes various SaaS offerings: Office 365, Windows, and Enterprise Mobility and Security.

REGIONS, DATA CENTERS AND NETWORK

Microsoft currently has 54 regions available

Goal: reaching every Microsoft cloud customer globally within a 22-millisecond network round-trip

Microsoft Azure US Department of Defense (DoD)

Microsoft Azure US Government (Gov)

Microsoft Azure China

Microsoft Cloud Germany

AZURE NETWORK



GCP

CLOUD COMPUTING

AWS

MICROSOFT AZURE

GCP

CLOUD COMPARISON

GOOGLE TECHNOLOGY TIMELINE

Google had had a long history of building cloud-enabling technology (with a heavy focus on big data) before its cloud services were launched



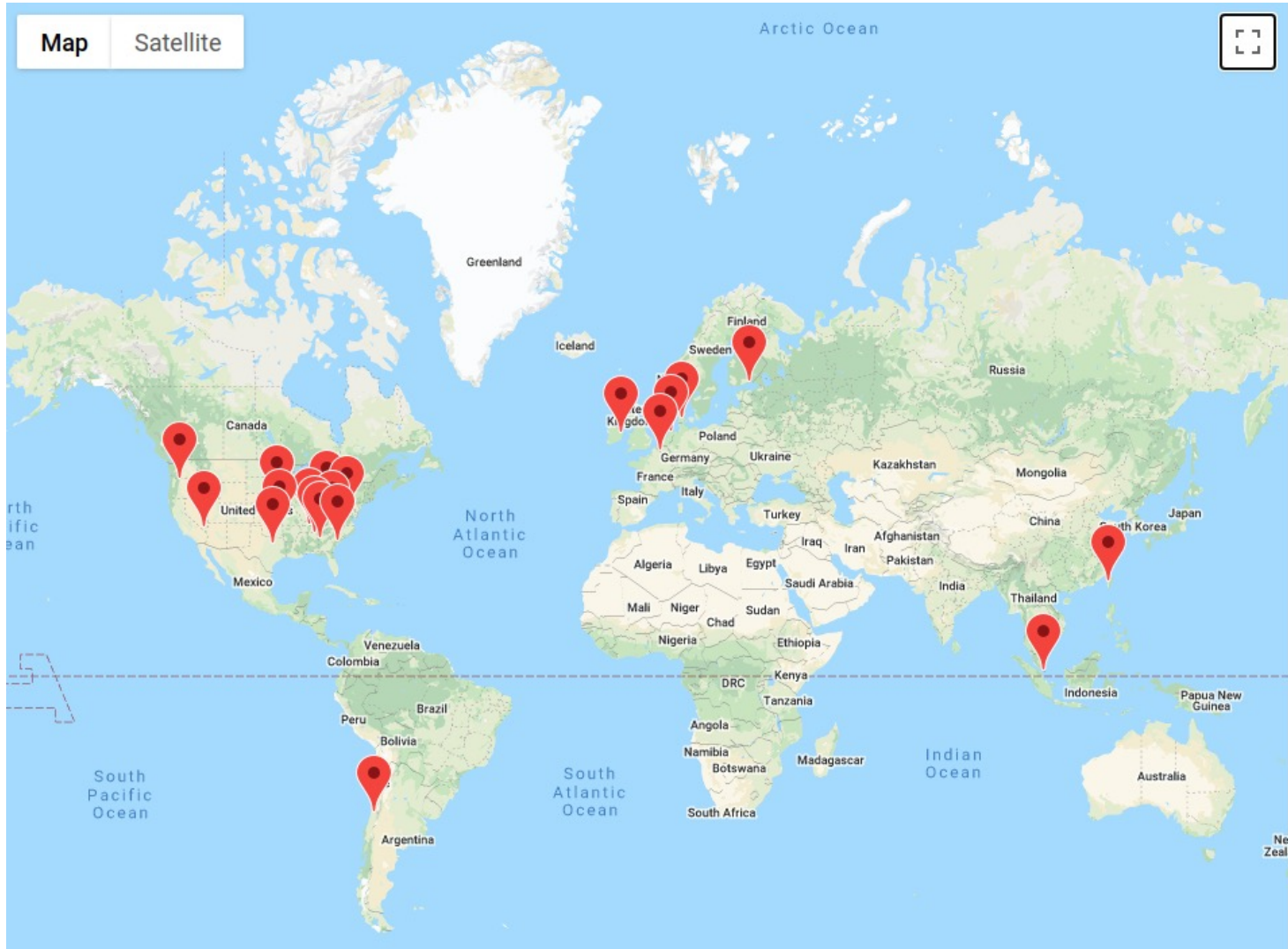
GEOGRAPHY AND REGIONS

Well present in North America

Growing presence in Europe

Less available in Asia and South America

GCP REGIONS



CLOUD COMPARISON

CLOUD COMPUTING

AWS

MICROSOFT AZURE

GCP

CLOUD COMPARISON

COMPUTE SERVICES

Services	AWS	Azure	GCP
IaaS	Amazon Elastic Compute Cloud	Virtual Machines	Google Compute Engine
PaaS	AWS Elastic Beanstalk	App Service and Cloud Services	Google App Engine
Containers	Amazon Elastic Compute Cloud Container Service	Azure Kubernetes Service (AKS)	Google Kubernetes Engine
Serverless Functions	AWS Lambda	Azure Functions	Google Cloud Functions

STORAGE

Services	AWS	Azure	GCP
Object Storage	Amazon Simple Storage Service	Azure Blob Storage	Google Cloud Storage
Block Storage	Amazon Elastic Block Store	Azure Block Storage	Google Compute Engine Persistent Disks
Cold Storage	Amazon Glacier	Azure Archive Blob Storage	Google Cloud Storage Nearline
File Storage	Amazon Elastic File System	Azure File Storage	Google Filestore

NETWORKING

Services	AWS	Azure	GCP
Virtual Network	Amazon Virtual Private Cloud (VPC)	Virtual Networks (VNETs)	Virtual Private Cloud
Load Balancer	Elastic Load Balancer	Load Balancer	Google Cloud Load Balancing
Peering	Direct Connect	ExpressRoute	Google Cloud Interconnect
DNS	Amazon Route 53	Azure DNS	Google Cloud DNS

DATASTORES

Services	AWS	Azure	GCP
RDBMS	Amazon Relational Database Service	SQL Database	Google Cloud SQL
NoSQL: Key–Value	Amazon DynamoDB	Table Storage	Google Cloud Firestore/Google Cloud Bigtable
NoSQL: Indexed	Amazon SimpleDB	Azure Cosmos DB	Google Cloud Datastore

KEY ADVANTAGES

AWS	Azure	GCP
Maturity	Great for developers	Aggressive growth
Service portfolio	Integration with open source	Attractive pricing models
Presence (market and geography)	Private datacenter integration	Best for AI and machine learning applications

OPINIONS

All opinions on cloud comparison are my personal

ARCHITECTURE COMPARISON




Filter by title

storage

Service comparison

- Azure for GCP Professionals
- Microsoft Azure Well-Architected Framework
- Design Patterns
- ▾ Industry solutions with Azure
 - Retail
 - Finance
 - Healthcare
- ▾ Azure categories
 - AI + Machine Learning
 - Analytics
 - Blockchain
 - Compute
 - Containers
 - Databases

AWS to Azure services comparison

11/11/2020 • 22 minutes to read •  +38

This article helps you understand how Microsoft Azure services compare to Amazon Web Services (AWS). Whether you are planning a multicloud solution with Azure and AWS, or migrating to Azure, you can compare the IT capabilities of Azure and AWS services in all categories.

This article compares services that are roughly comparable. Not every AWS service or Azure service is listed, and not every matched service has exact feature-for-feature parity.

Azure and AWS for multicloud solutions

As the leading public cloud platforms, Azure and AWS each offer a broad and deep set of capabilities with global coverage. Yet many organizations choose to use both platforms together for greater choice and flexibility, as well as to spread their risk and dependencies with a multicloud approach. Consulting companies and software vendors might also build on and use both Azure and AWS, as these platforms represent most of the cloud market demand.

For an overview of Azure for AWS users, see [Introduction to Azure for AWS professionals](#).

<https://docs.microsoft.com/en-us/azure/architecture/aws-professional/services>

REFERENCES

CloudBank: Managed Services to Simplify Cloud Access for Computer Science Research and Education

[NFS initiative](#)

[Cloudbank](#)

MORE REFERENCES

This differentiates core service offerings:

- <https://www.veritis.com/blog/aws-vs-azure-vs-gcp-the-cloud-platform-of-your-choice>

This is community sourced and has a feature matrix

- <https://spaces.at.internet2.edu/display/CA/Cloud+Provider+Feature+Matrix>

ASSIGNED READING

AWS: <https://aws.amazon.com/getting-started/fundamentals-core-concepts/> (read the entire document)

AWS: <https://docs.aws.amazon.com/wellarchitected/latest/framework/the-five-pillars-of-the-framework.html> (reference only)

Azure Well-Architected Framework: <https://docs.microsoft.com/en-us/learn/paths/azure-well-architected-framework/> (complete all 8 units in the module)

Google Cloud Architecture Framework: <https://cloud.google.com/architecture/framework> (only the overview page)

Google Cloud <https://cloud.google.com/architecture/framework/design-considerations> (only the systems design considerations page)

CONGRATS ON COMPLETION

