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

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CLOUD COMPARISON

WHAT IS CLOUD COMPUTING

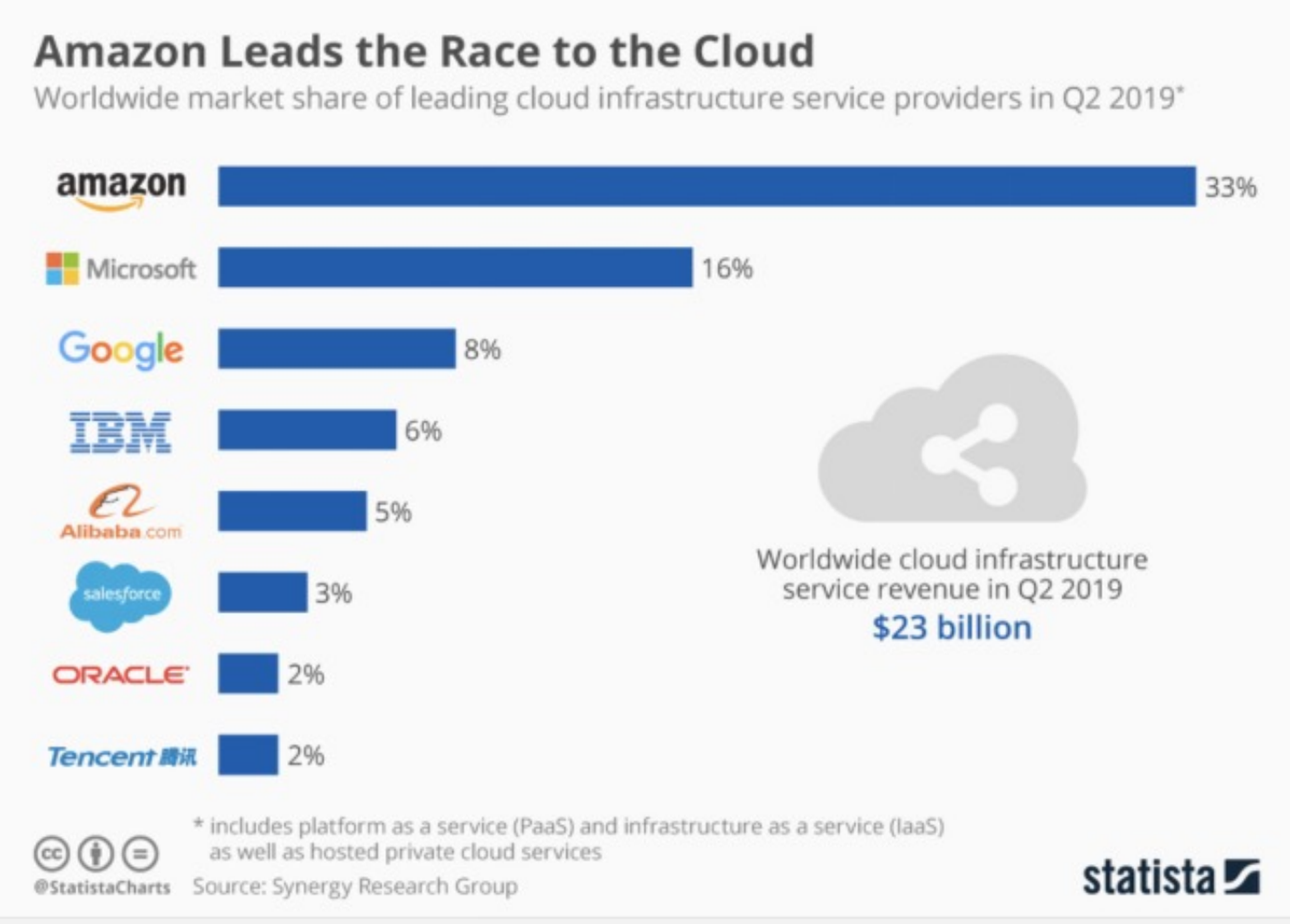
Shared resources

On-demand

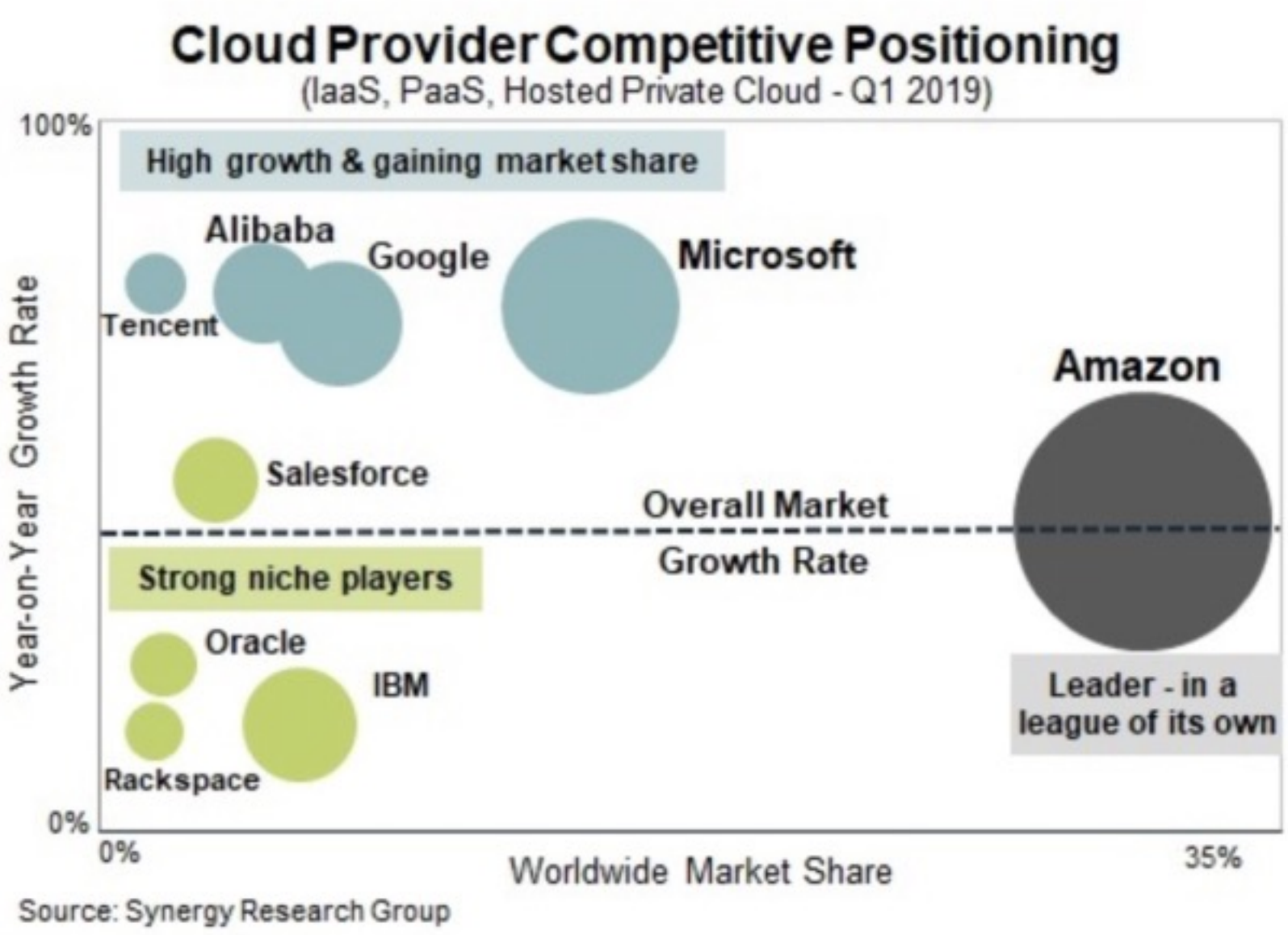
Easily scalable

Accessed via internet

CLOUD COMPUTING GLOBAL MARKET



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

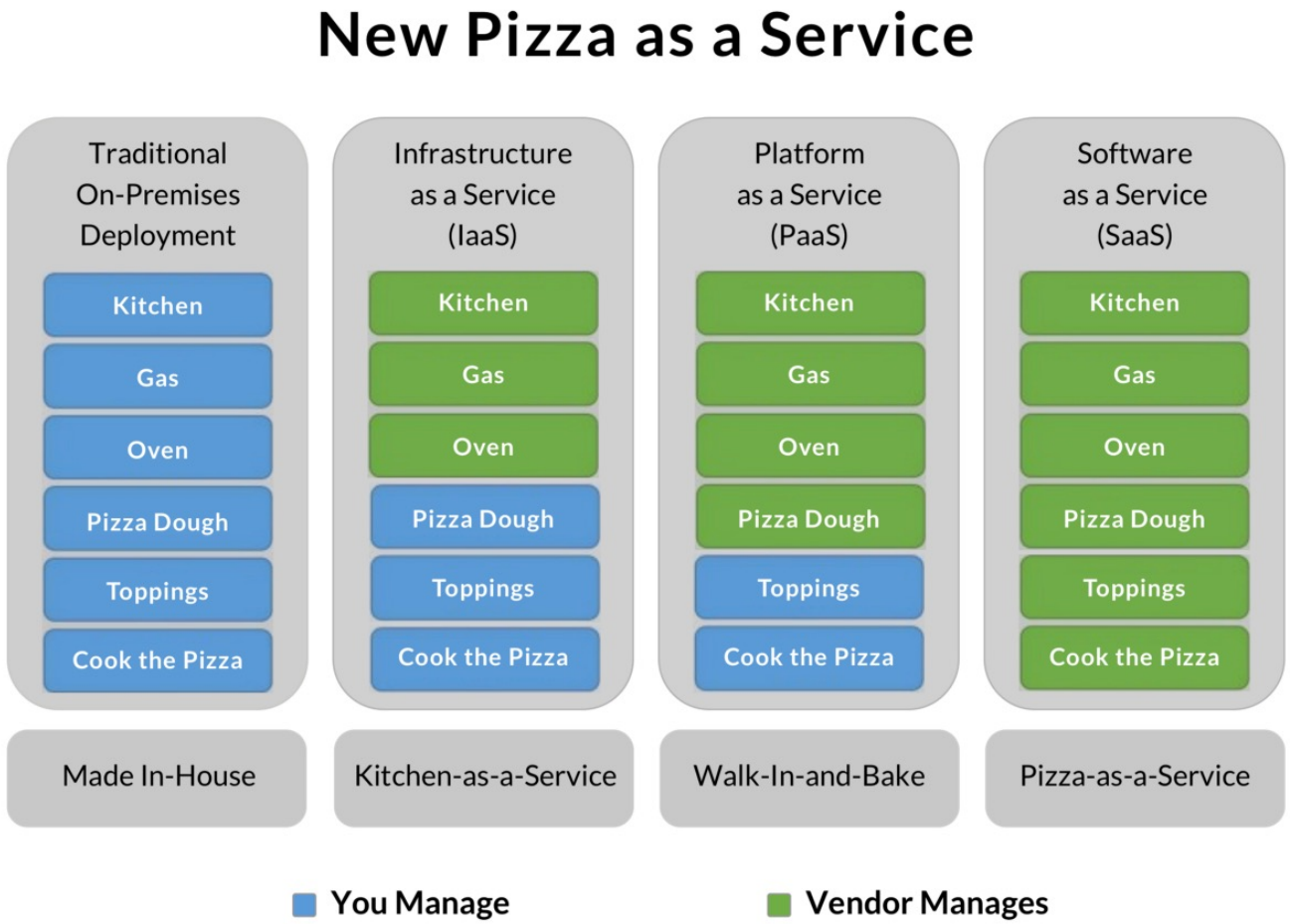
If you distribute your instances across multiple Availability Zones and one instance fails, you can design your application so that an instance in another Availability Zone can handle requests

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

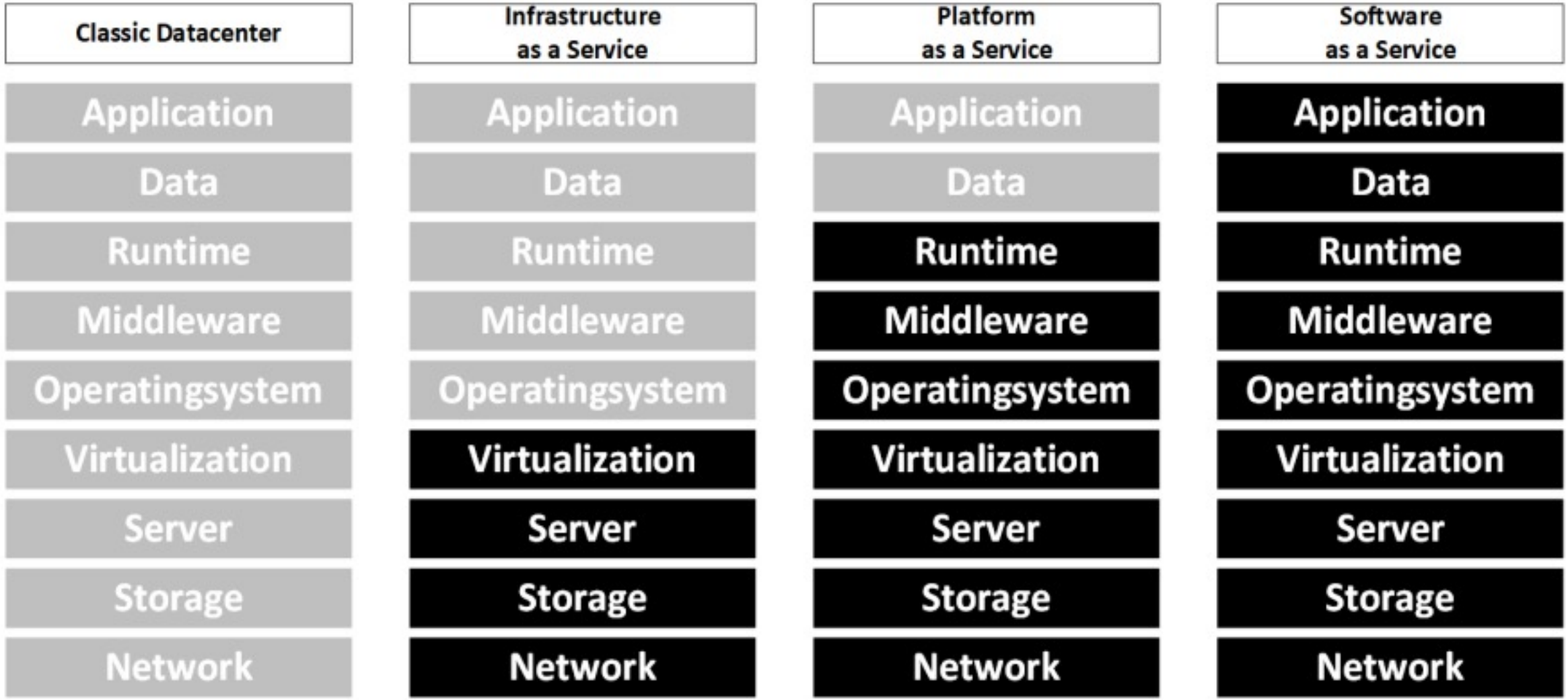
Clouds usually offer Content Delivery Network (CDN)

- 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



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.”

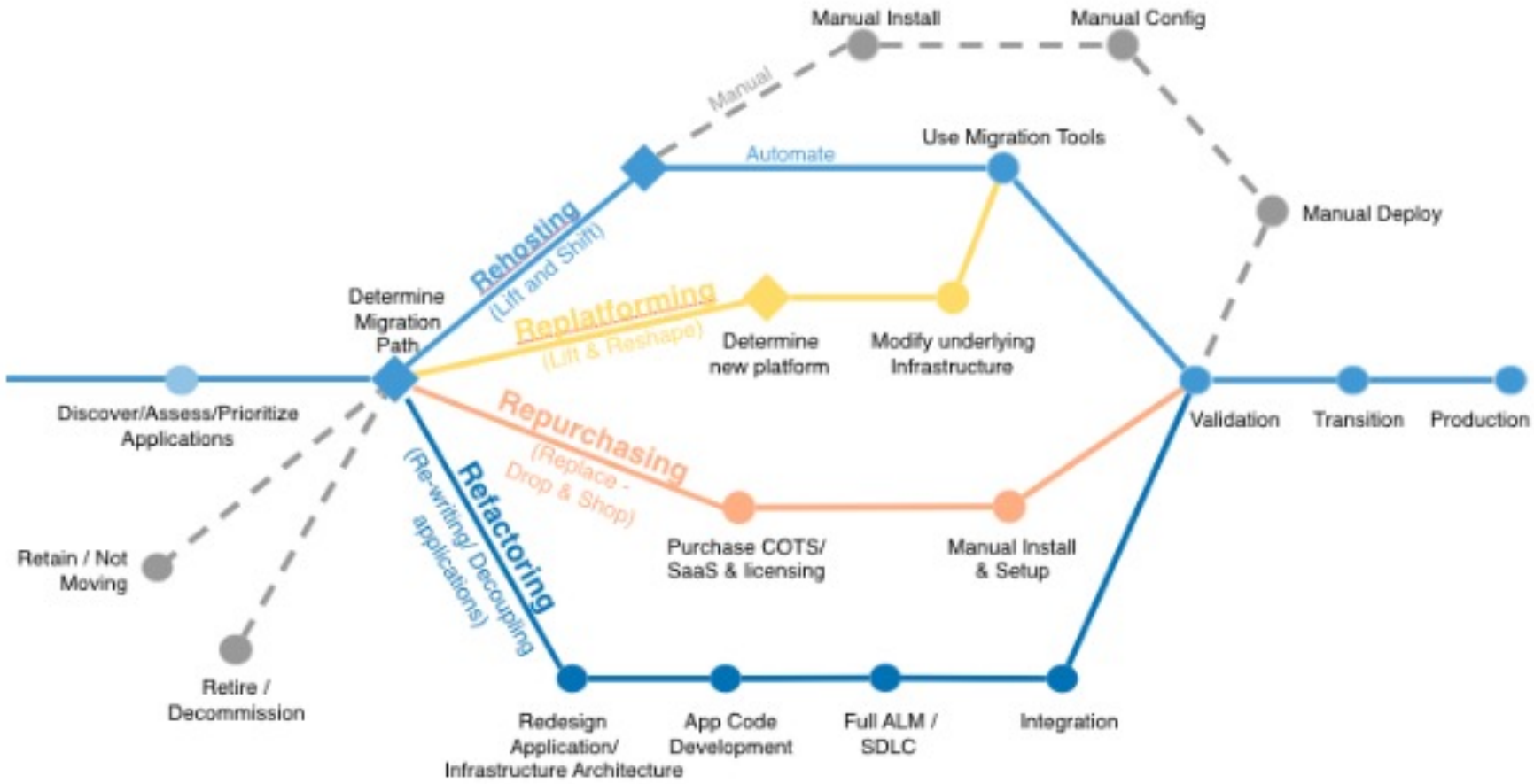
Repurchasing—Moving to a different product.

Refactoring / Re-architecting

Retire—Get rid of.

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

CLOUD MIGRATION STRATEGIES



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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

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CLOUD COMPARISON

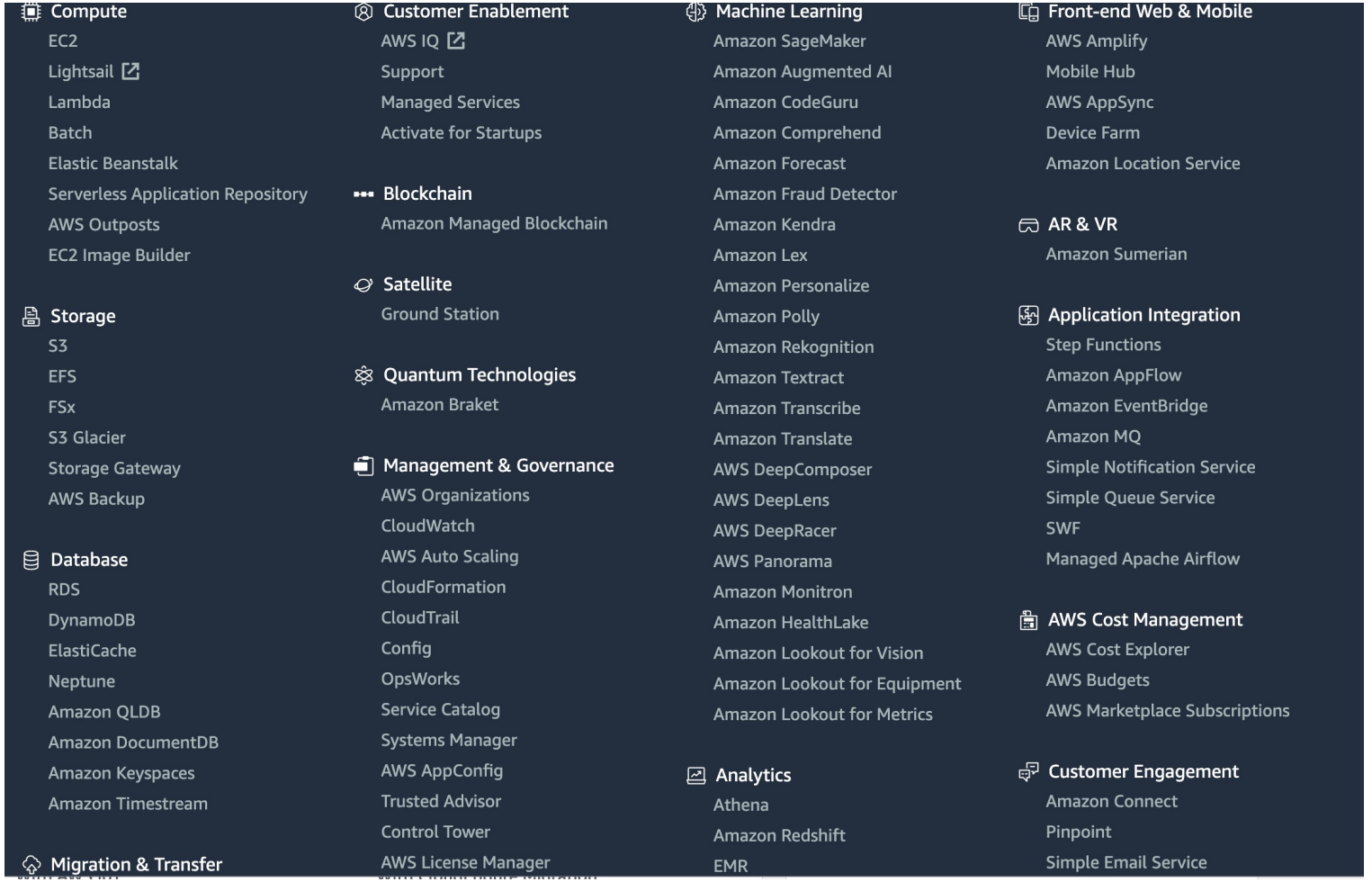
AWS SERVICES

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)



AWS CLOUD9

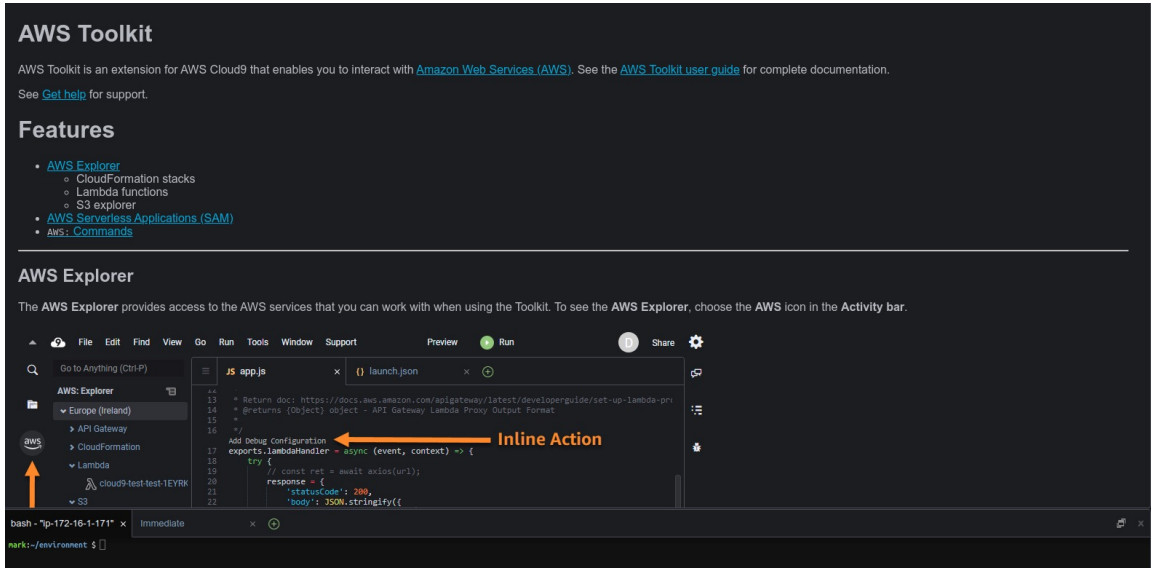
Cloud-based IDE that helps users to write, debug, and run their code

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



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

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CLOUD COMPARISON

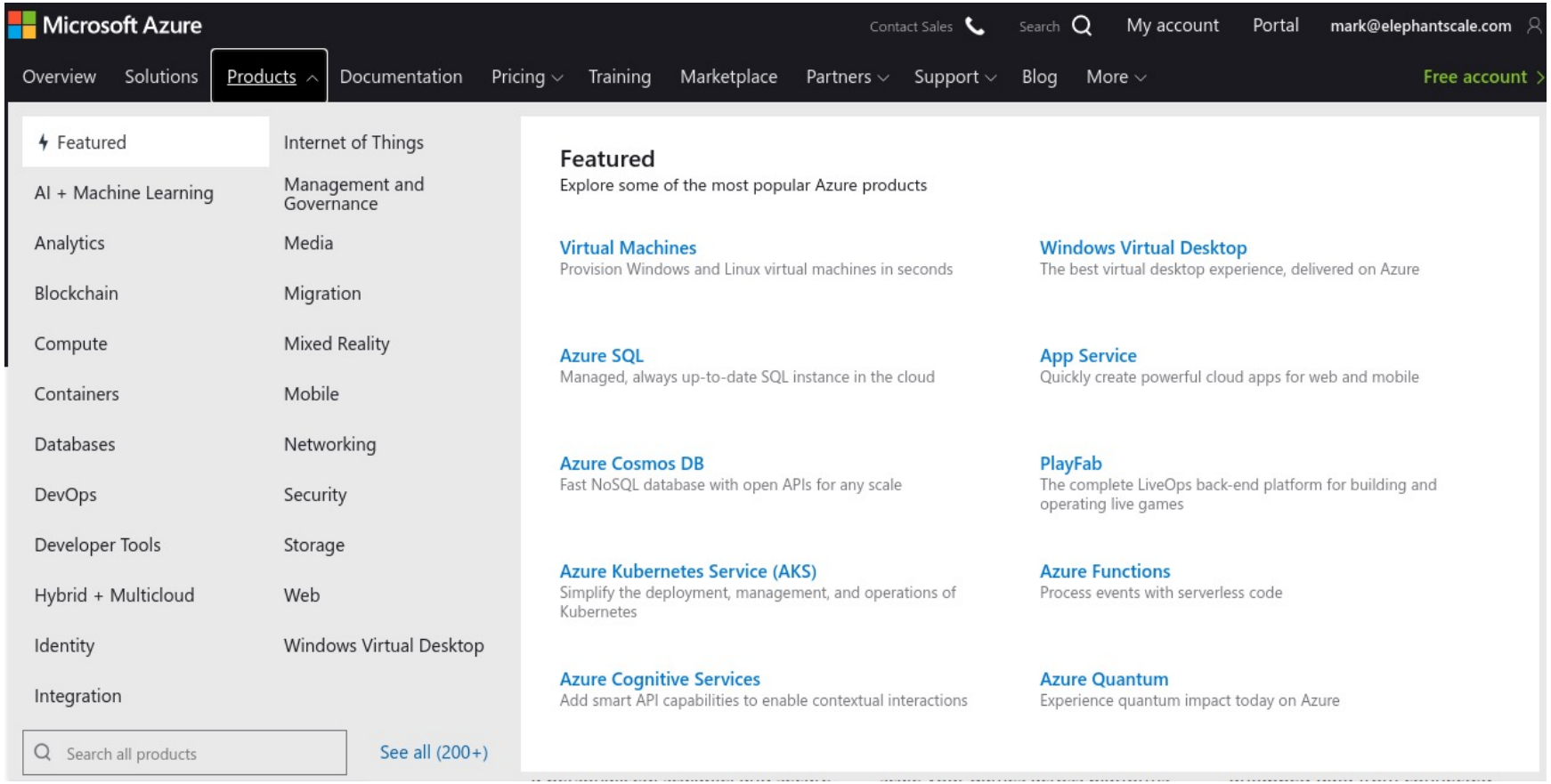
MICROSOFT AZURE

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



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

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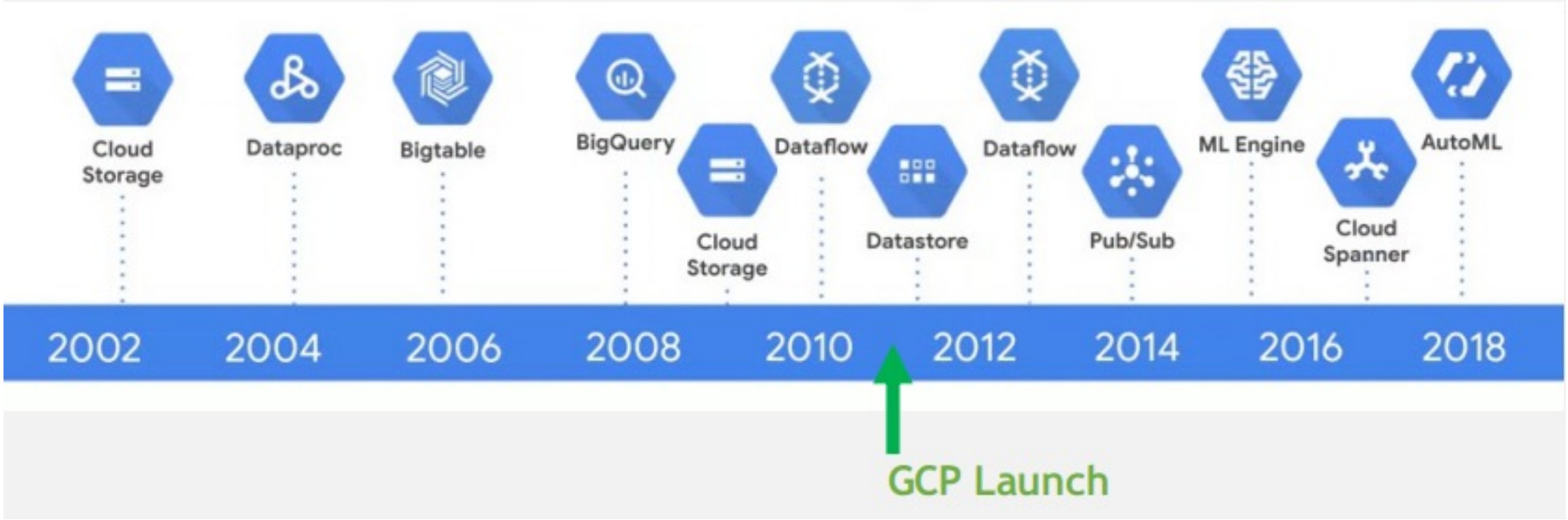
GOOGLE TECHNOLOGY TIMELINE

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



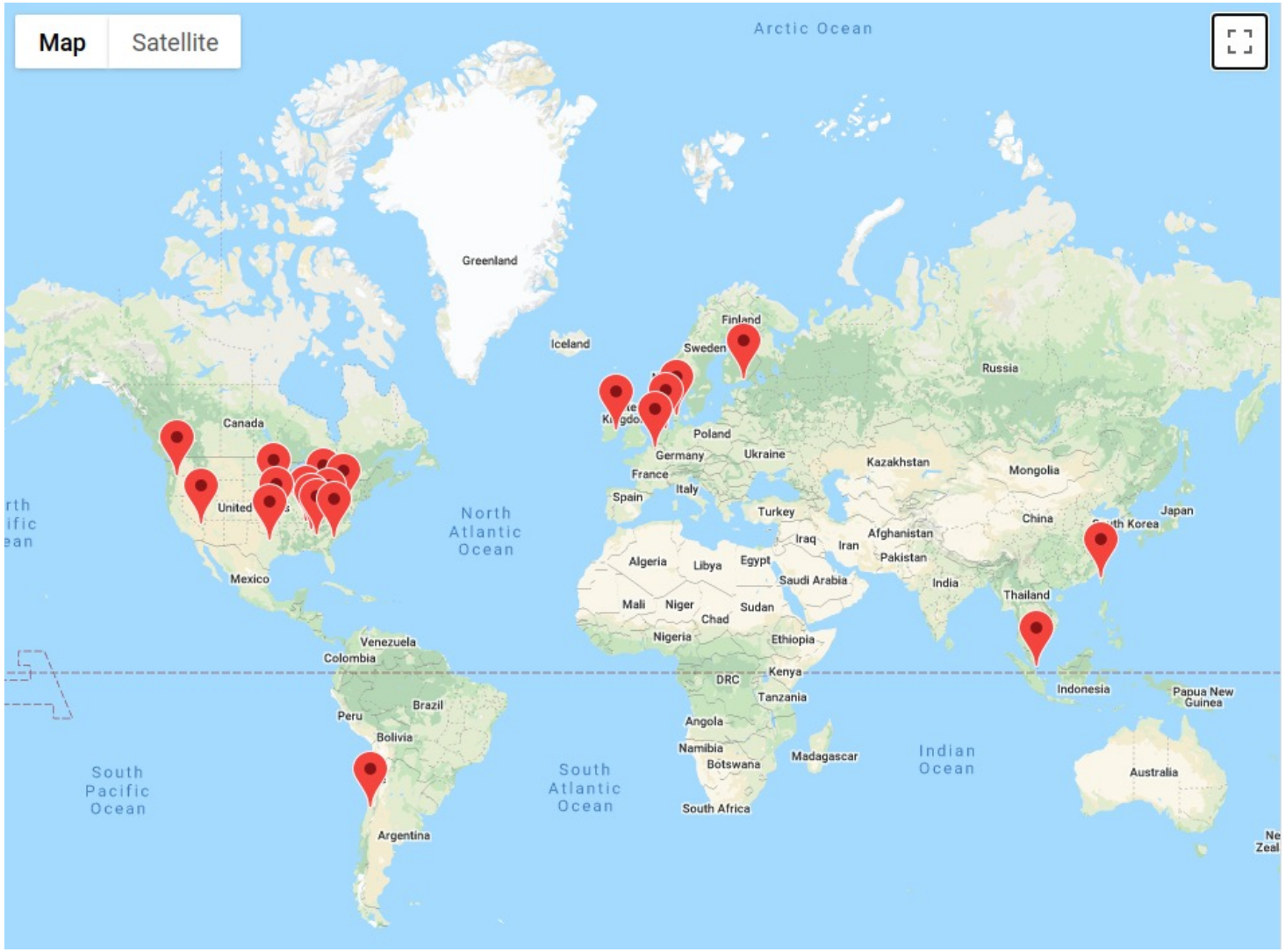
GEOGRAPHY AND REGIONS

Well present in North America

Growing presence in Europe

Less available in Asia and South America

GCP REGIONS



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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

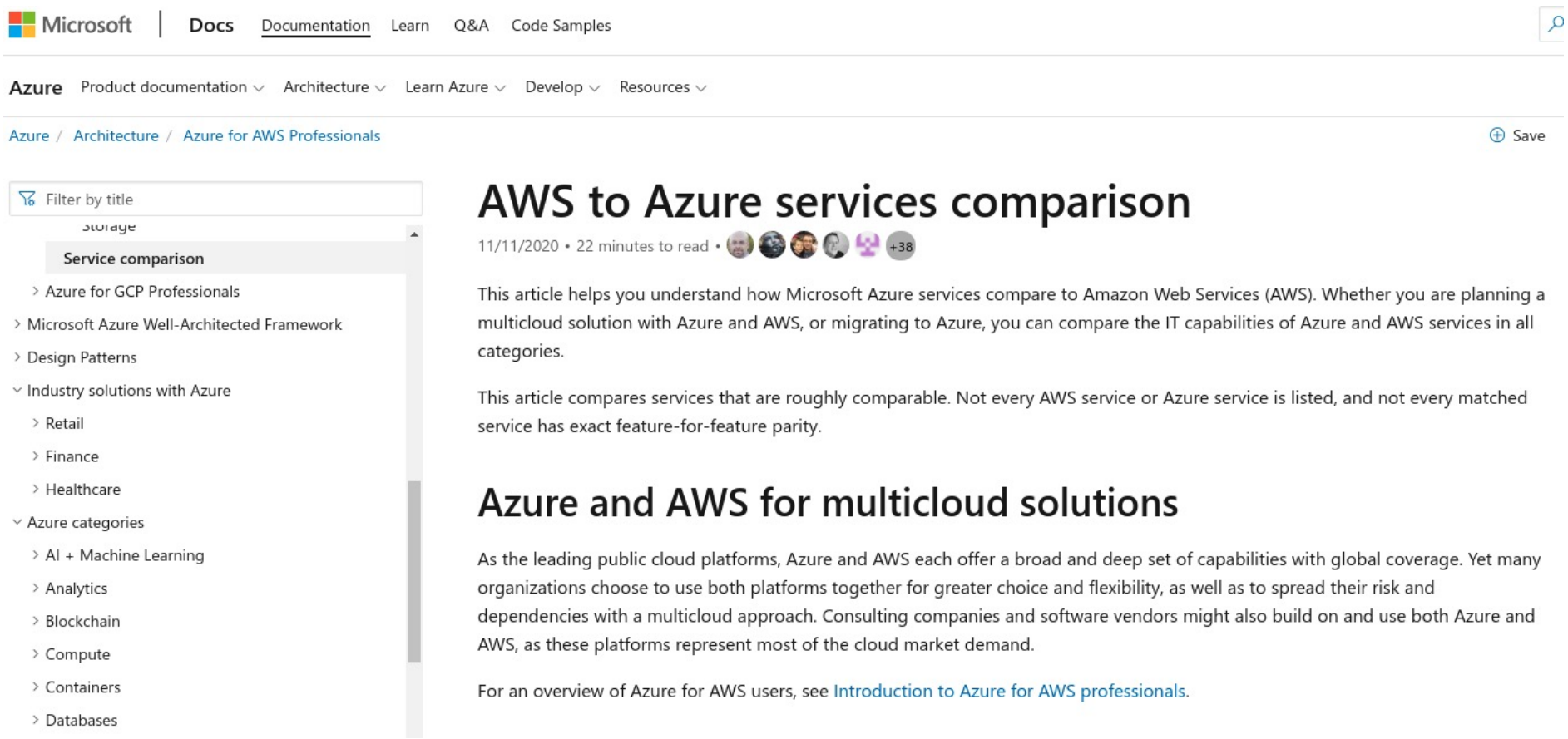
KEY ADVANTAGES

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



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