Amazon Web Services Introduction

AWS Initiate
Fabrizio Pappalardo, Europe Public Sector Partners

Agenda

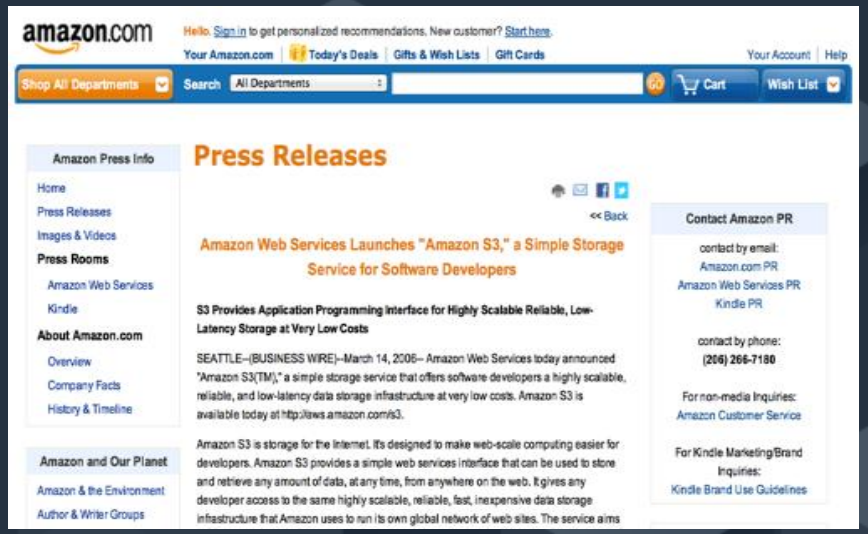
- Global Infrastructure
- Key Services

Security
Computer
Storage
Databases
Networking
Big Data
IOT
Machine Learning / Artificial Intelligence
Next Steps

Background

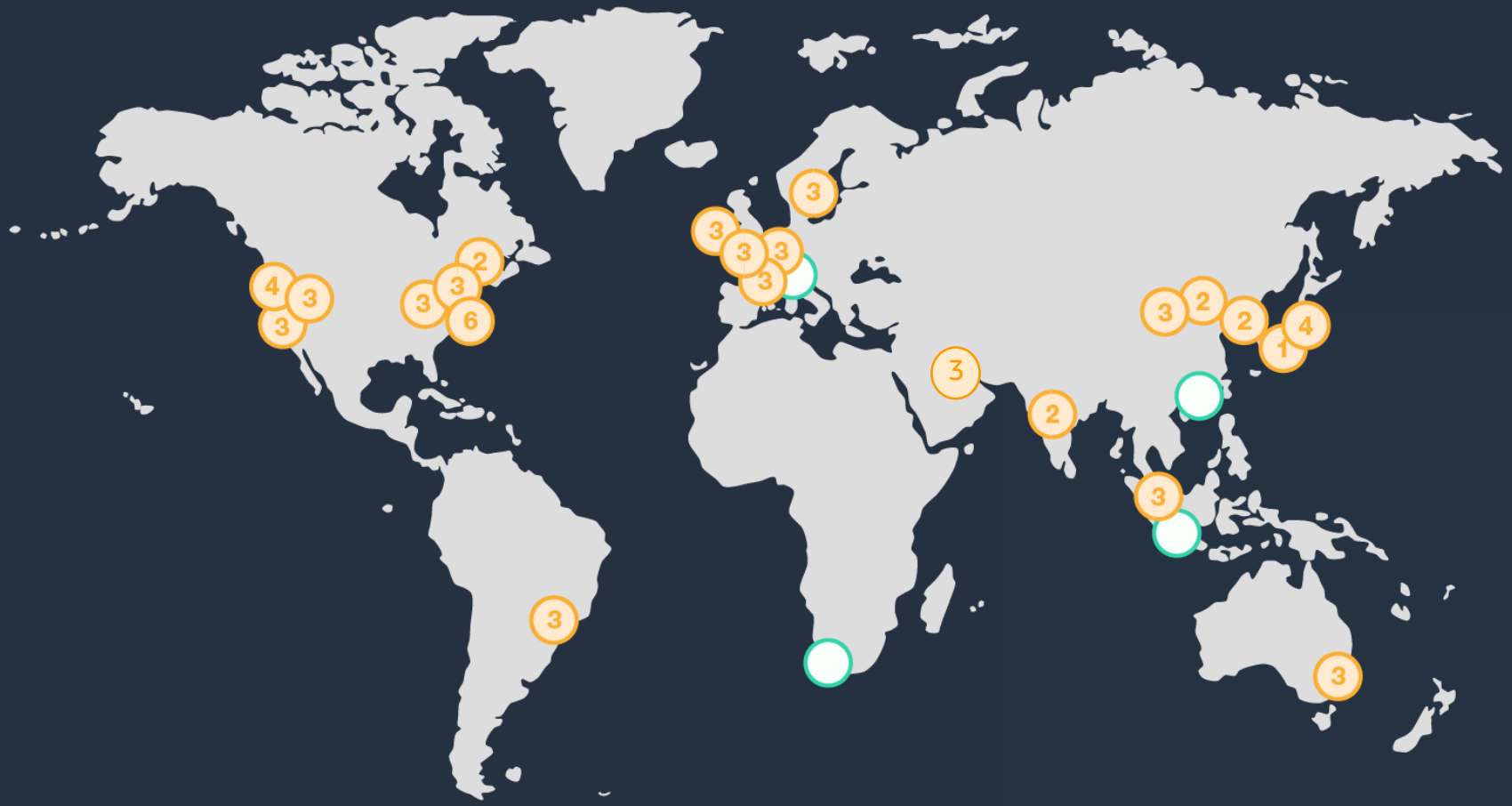
13+ years of commercial service experience
The originator of cloud computing

- Launched the first service Amazon S3 on Mar. 14, 2006
- 13 years of commercial experience
- 165 cloud services
- 4800 third-party products
- Millions of active customers
- Tens of thousands of partners



Global infrastructure

AWS Global Infrastructure



69 AZs in 22 regions around the world

- Low latency
- Wide coverage
- Multi-operator access

Plan to add new areas:

- Milan
- Cape Town
- Hong Kong Special Administrative Region of China
- Jakarta

Milan

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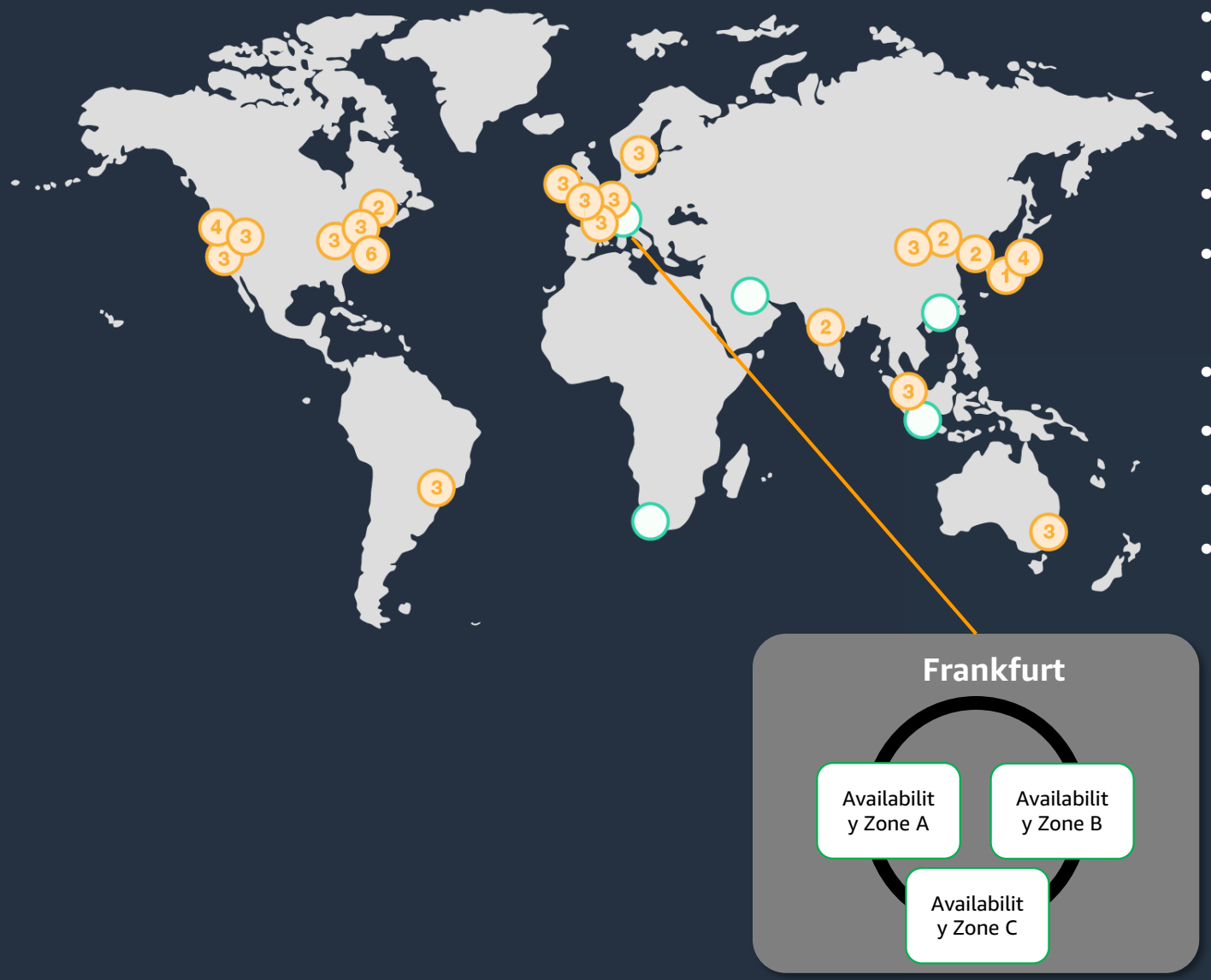
Availability Zone



- Multiple data centers
- 22 regions and 69 AZs
- At least 2 AZs per region
- Each AZ consists of multiple data centers
- AZs are independently designed and operated in terms of geography and network
- Delay between AZs < 3ms
- Delay in an AZ < 0.3ms
- HA across AZs
- Real-time city level DR at very low cost

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Product & Service

aws The broadest and deepest cloud platform for today's builders

Technical & Business Support

- STORAGE
- TRAINING & CERTIFICATION
- PARTNER ECOSYSTEMS
- SECURITY & BILLING REPORTS
- PROFESSIONAL SERVICES
- SOLUTIONS MANAGEMENT
- OPTIMIZATION GUIDANCE
- ACCOUNT MANAGEMENT
- PERSONALIZED DASHBOARD

Marketplace

- BUSINESS APPS
- SECURITY
- STORAGE
- BUSINESS INTELLIGENCE
- NETWORKING
- DATABASES
- DEVOPS TOOLS

Analytics

- DATA WAREHOUSE
- ELASTICSEARCH
- STREAMING DATA COLLECTION
- BUSINESS INTELLIGENCE
- DATA PIPELINES
- STREAMING DATA ANALYSIS
- HADOOP/SPARK
- INTERACTIVE SQL QUERIES
- ETL

DevOps

- ONE-CLICK APP DEVELOPMENT
- APPLICATION LIFECYCLE MANAGEMENT
- PATCHING
- RESOURCE TEMPLATES
- DEVOPS RESOURCE MANAGEMENT
- AUTHORING
- BUILD & TEST
- TRIGGERS
- PIPELINE ORCHESTRATION
- CONTAINERS
- ANALYZE & DEBUG

IoT

- RULES ENGINE
- DEVICE GATEWAY
- DEVICE SHADOWS
- REGISTRY
- DEVICE SDKS
- LOCAL COMPUTE

Machine Learning

- FACE ANALYTICS
- VIDEO AND IMAGE ANALYTICS
- IMAGE LABELLING
- SPEECH TRANSCRIPTION
- TEXT TO SPEECH
- ML AT THE EDGE
- FACE RECOGNITION
- HOSTED NOTEBOOKS
- SENTIMENT ANALYSIS
- HARDWARE ACCELERATION
- ENTITY EXTRACTION
- CHATBOTS
- TOPICS MODELING
- MULTIPLE FRAMEWORKS
- NATURAL LANGUAGE PROCESSING
- TRANSLATION
- PRE-TRAINED MODELS
- MODEL HOSTING
- MODEL TRAINING
- MODEL OPTIMIZATION

Mobile Services

- API GATEWAY
- SYNC
- TARGETED PUSH NOTIFICATIONS
- SINGLE INTEGRATED CONSOLE
- MOBILE ANALYTICS
- DEVELOPMENT FRAMEWORK
- IDENTITY
- MOBILE APP TESTING

App Services

- QUEUING & NOTIFICATIONS
- EMAIL
- SEARCH
- WORKFLOW
- TRANSCODING

Blockchain

- BLOCKCHAIN TEMPLATES

Enterprise Apps

- VIRTUAL DESKTOPS
- CONTACT CENTER
- APP STREAMING
- SHARING & COLLABORATION
- ONLINE MEETINGS
- COMMUNICATIONS
- CORPORATE EMAIL
- VOICE ENABLED WORKPLACE
- MOBILE ACCESS

Infrastructure

- REGIONS
- GLOBAL NETWORK BACKBONE
- CUSTOM HARDWARE
- AVAILABILITY ZONES
- POWER INFRASTRUCTURE
- DATA CENTER INFRASTRUCTURE
- POINTS OF PRESENCE

Migration

- SCHEMA CONVERSION
- DATABASE MIGRATION
- EXABYTE-SCALE DATA MIGRATION
- SERVER MIGRATION
- APPLICATION MIGRATION

Security & Compliance

- IDENTITY MANAGEMENT
- KEY MANAGEMENT & STORAGE
- ASSESSMENT & REPORTING
- DDOS PROTECTION
- CONFIGURATION COMPLIANCE
- MONITORING & LOGS
- RESOURCE & USAGE AUDITING
- WEB APPLICATION FIREWALL
- ACCESS vvhCONTROL
- ACCOUNT GROUPING

Core Services

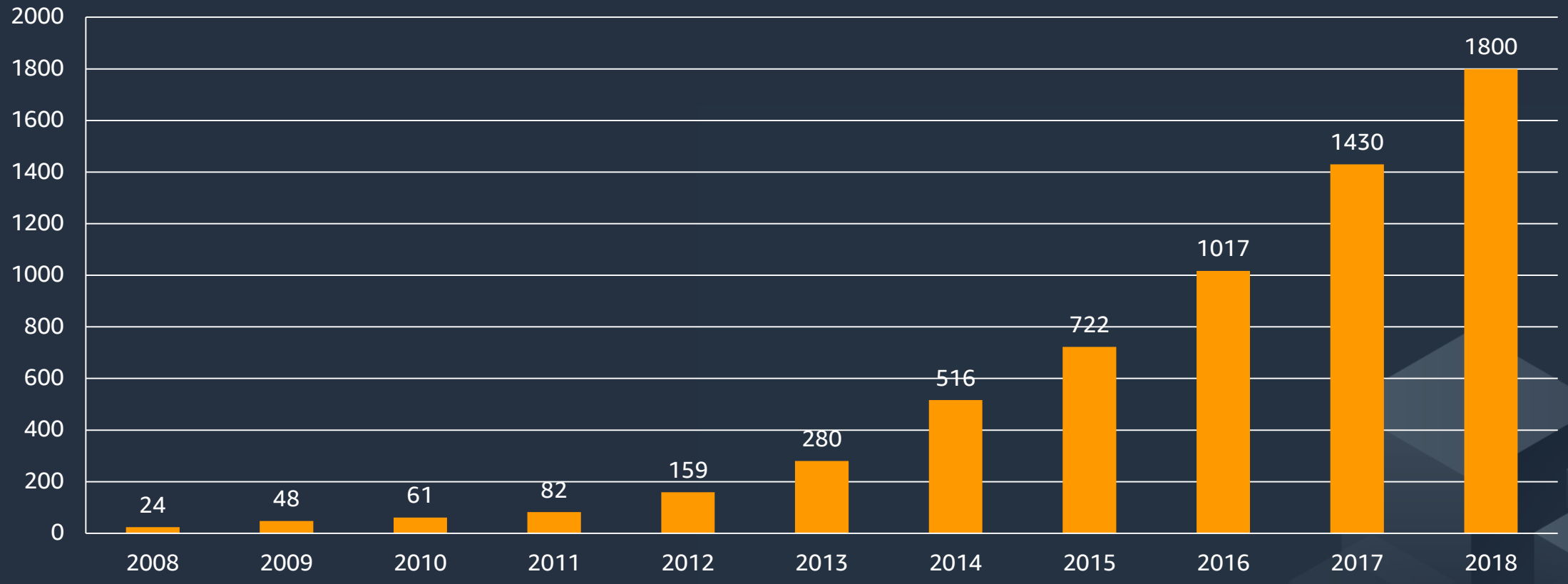
- COMPUTE
- DATABASES
- CDN
- STORAGE
- NETWORKING

Management Tools

- MANAGE RESOURCES
- MONITORING
- SERVICE CATALOGUE
- PROVISIONING
- SERVER MANAGEMENT
- CONFIGURATION TRACKING
- RESOURCE TEMPLATES
- GOVERNANCE

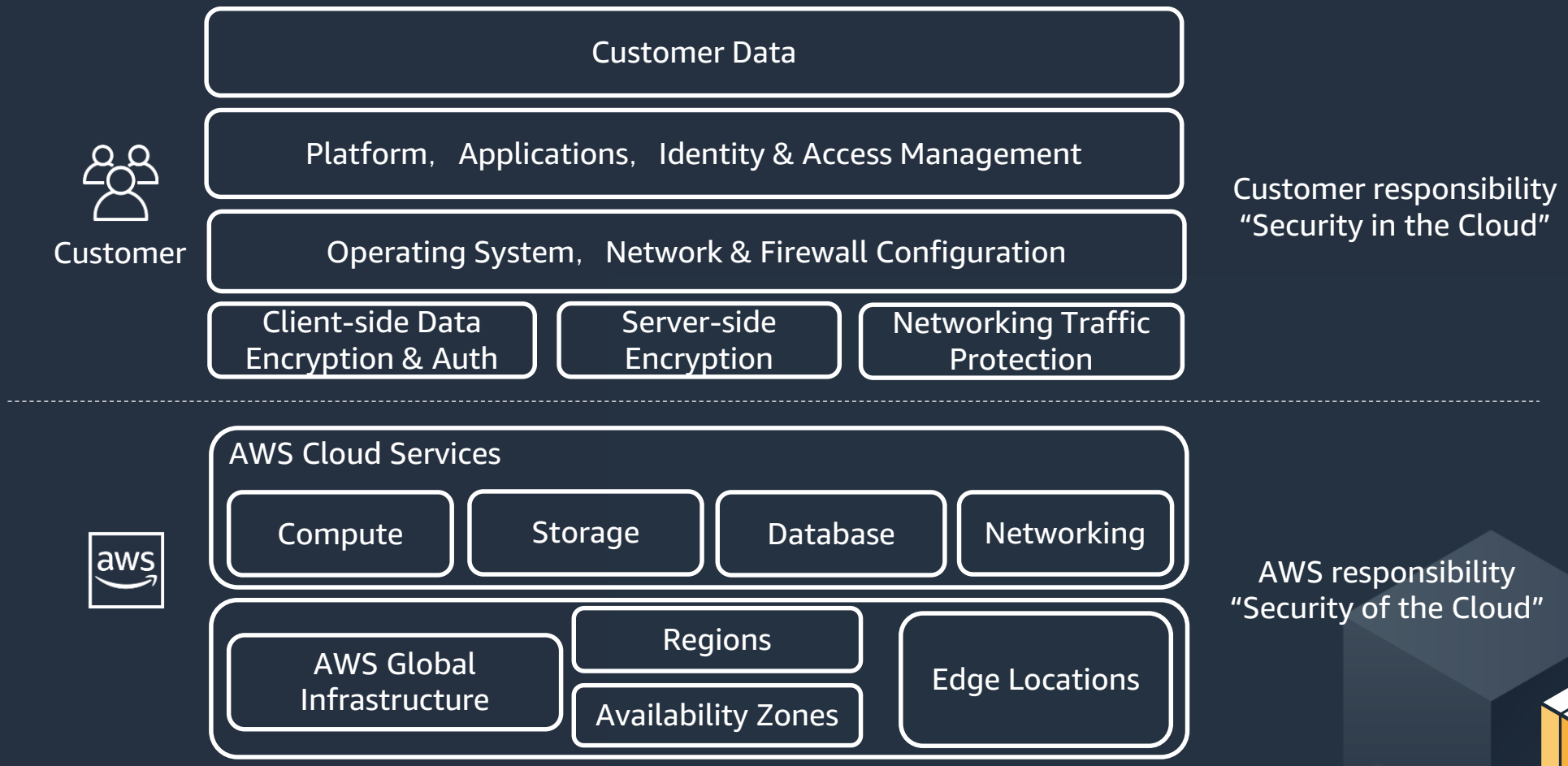
AWS：High-speed innovation based on customer needs

AWS has committed to provide more services and capabilities to meet with cloud services requirements in different industries and verticals. It has provided more than 150 services across computing, storage, networking, databases, data analytics, enterprise application services, automated operations and management, mobile applications etc. Since its inception in 2006, AWS has cumulatively released more than 6,000 new services and features.



Security is the highest priority

Shared Responsibility Model



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Family of AWS Security Services

Authentication & Authorization

- AWS Identity & Access Management (IAM)
- AWS Organizations
- Amazon Cognito
- AWS Directory Service
- AWS Single Sign-On

Monitor & Control

- AWS CloudTrail
- AWS Config
- Amazon CloudWatch
- Amazon GuardDuty
- VPC Flow Logs

Infrastructure Security

- Amazon EC2 Systems Manager
- AWS Shield
- AWS Web Application Firewall (WAF)
- Amazon Inspector
- Amazon Virtual Private Cloud (VPC)

Data Protection

- AWS Key Management Service (KMS)
- AWS CloudHSM
- Amazon Macie
- AWS Certificate Manager
- Server Side Encryption
- Secrets Manager

Emergency Reaction

- AWS Config Rules
- AWS Lambda

AWS Compliance

SOC 1 / ISAE 3402	ISO 27001	FedRAMP
SOC 2	ISO 9001	ISO 27017
SOC 3	ISO 27018	PCI DSS Level 1
HIPAA	GxP	FIPS 140-2
CJIS	ITAR	G-Cloud 
DoD SRG Levels 2 & 4	FERPA	IT-Grundschutz 
MLPS Level 3 	Section 508 / VPAT	MPAA
MTCS Tier 3 	NIST	Cloud Security Alliance
IRAP 	FISMA, RMF, and DIACAP	Cyber Essentials Plus 

The most powerful,
secure and innovative compute cloud

AWS Compute Services

Amazon EC2

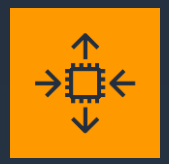
Virtual servers in the cloud

Amazon ECS

Run and manage docker containers

Auto Scaling

Scale compute capacity to meet demand



Elastic Load Balancing

Distribute incoming traffic across multiple targets

Amazon EKS

Run managed Kubernetes on AWS

Amazon Fargate

Run containers without managing servers or clusters

Amazon LightSail

Launch and manage virtual private servers

AWS Batch

Run batch jobs at any scale

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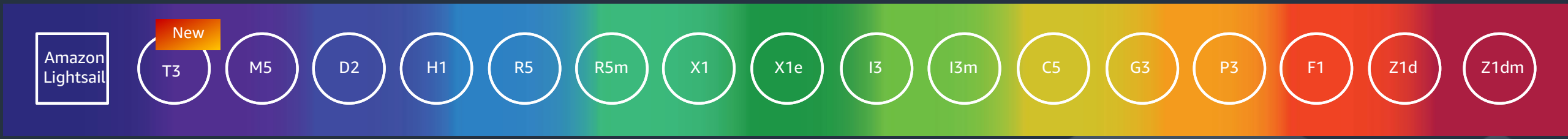
EC2 Instance: A Wide Selection of Instance Types



Virtual Private Servers	Burstable	General Purpose	Dense Storage	Big Data Optimized	Memory Optimized	In-memory	Memory Intensive	High I/O	Bare Metal High I/O	Compute Intensive	Graphics Intensive	General Purpose GPU	FPGA	Compute and Memory Intensive

EC2 Elastic Graphics

- attaching graphics acceleration to the EC2

EC2 Fleet

- Simplify the Capacity Evaluation
- Manage Thousands of Instances with One Request
- automate scaling upon the load

Supported Operating System by EC2

- Windows 2003R2/2008/2008R2/2012/2012R2/2016
- Amazon Linux
- Debian
- Suse
- CentOS
- Red Hat Enterprise Linux
- Ubuntu

Operating Systems on AWS Marketplace
https://aws.amazon.com/marketplace/b/2649367011

EC2 Pricing

Free tier

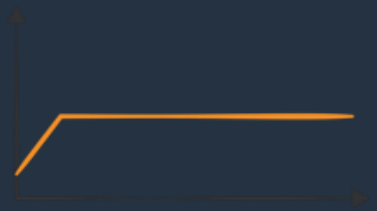
Gain free, hands-on experience with the AWS platform, products, and services

On-Demand

pay for compute capacity by per hour. No longer-term commitments. For short-term, spiky, or unpredictable workloads.

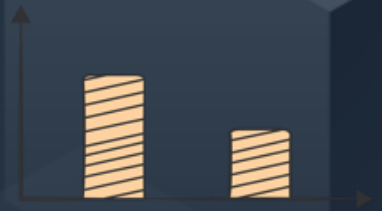
Reserved Instances

a significant discount. For steady state or predictable usage.



Spot instances

Request spare EC2 computing capacity for up to 90% off. For the applications with flexible start and end times.



Dedicated Hosts

A physical EC2 server dedicated for your use. Help you meet compliance requirements.

Seamless Integration with Container

ECS
Run containerized applications in production

- Containers without servers
- Containerize Everything
- Secure
- Performance at Scale
- AWS Integration

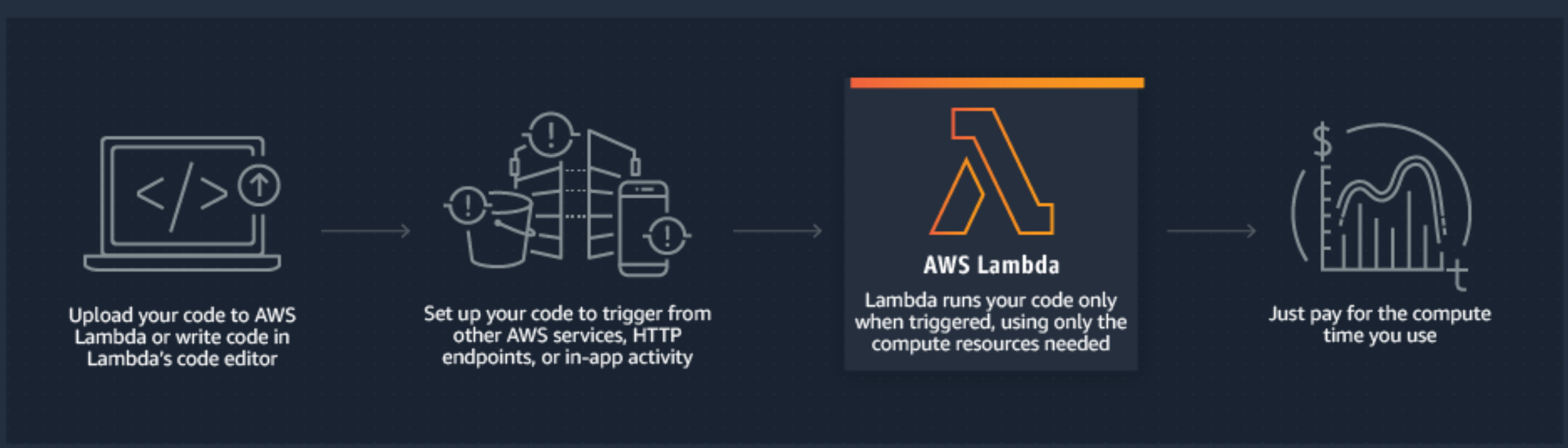
EKS
Highly available, scalable, and secure Kubernetes service

- No Control Plane to manage
- Secure by default
- Built with the Community
- Conformant and Compatible

Amazon ECS: https://aws.amazon.com/ecs/
Amazon EKS: https://aws.amazon.com/eks/

Lambda: Serverless, Event-Driven Compute

Serverless Compute: Completely automated administration



No Servers to Manage

Extend other AWS services with custom logic

Run code in response and auto scaling

Pay per use

Amazon Lambda：
https://aws.amazon.com/lambda/

Diversified storage

Amazon S3 Storage Classes

S3 Standard

- Active, frequently accessed data
- Milliseconds access
- > 3 AZ
- From: $0.0210/GB

S3 Intelligent-Tiering

- Variable access frequency
- Milliseconds access
- ≥ 3 AZ
- From: $0.0210 至 $0.0125/GB
- Object-by-object monitoring billing
- Min storage duration

S3 Standard-IA

- Infrequently accessed data
- Milliseconds access
- > 3 AZ
- From: $0.0125/GB
- Retrieval fee per GB
- Min storage duration
- Min object size

S3 One Zone-IA

- Re-creatable less accessed data
- Milliseconds access
- 1 AZ
- From: $0.0100/GB
- Retrieval fee per GB
- Min storage duration
- Min object size

S3 Glacier

- Archive data
- Minutes to hours access
- > 3 AZ
- From: $0.0040/GB
- Retrieval fee per GB
- Min storage duration
- Min object size

S3 Glacier Deep Archive

- Archive data
- 10+ hours access
- ≥ 3 AZ
- From: $0.00099/GB
- Retrieval fee per GB
- Min storage duration
- Min object size

Access Frequency

Frequent ← → Infrequent

Powerful Database Service

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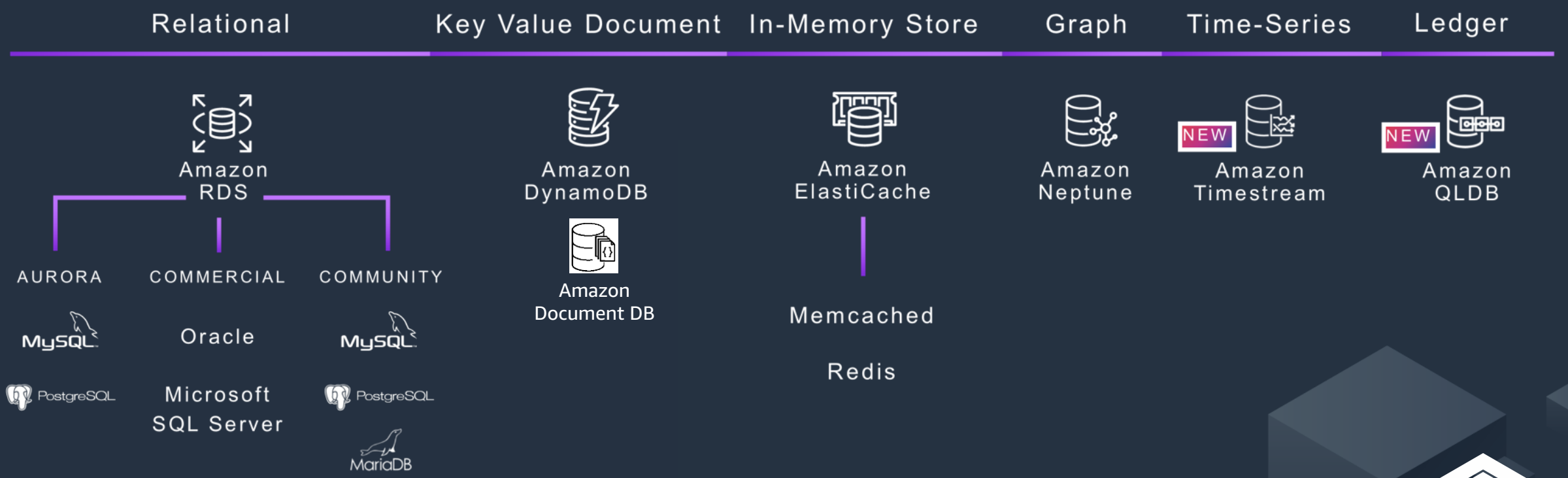
Use the Database by Business Scenario



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RDS：Managed Relational Database Service

Amazon Aurora
PostgreSQL
MySQL
MariaDB
Microsoft SQL Server
Oracle

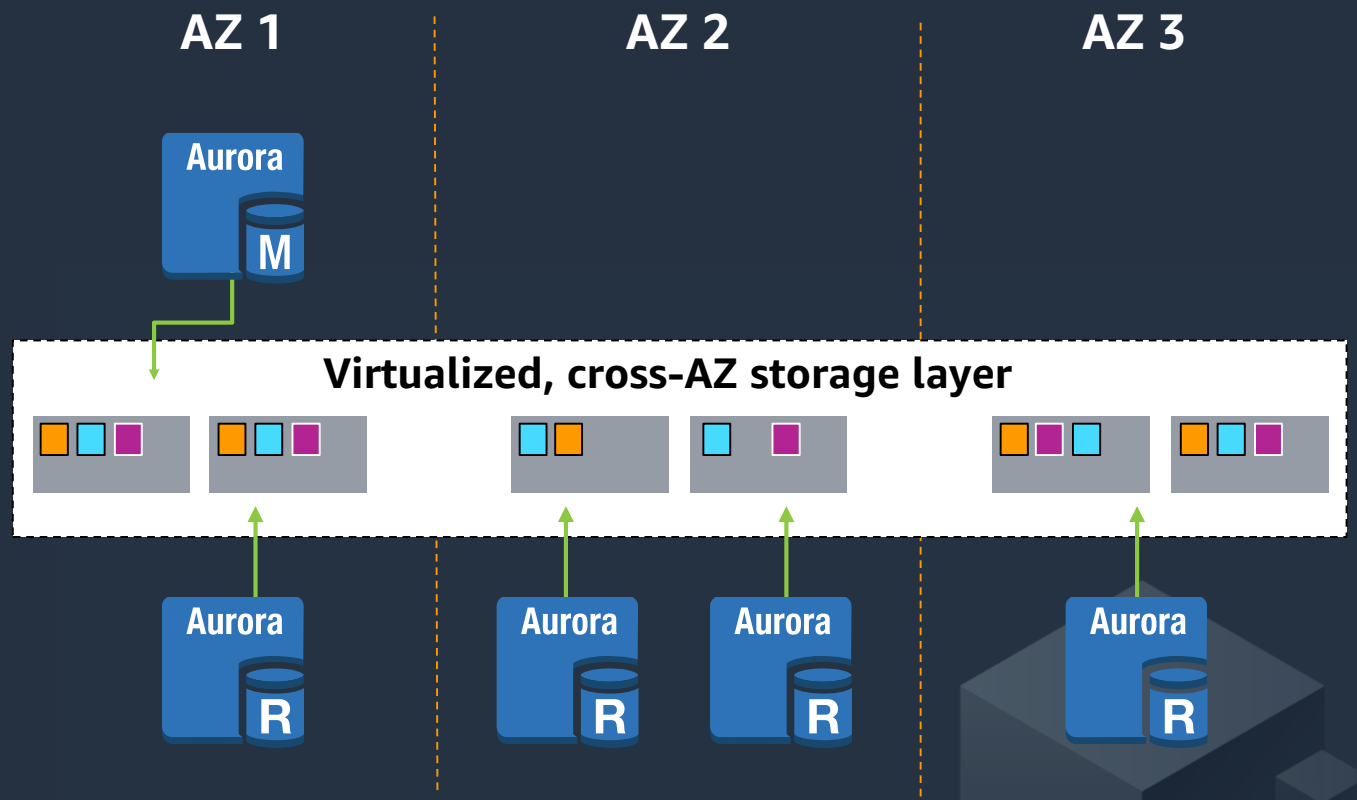
Easy management, free from infrastructure management
Automate database lifecycle management through API calls
Focus on database access settings and application security
Manage master and slave replicas easily
Simplified HA setting
Automate backup DBA tasks such as backup and minor version upgrade



Amazon RDS：https://aws.amazon.com/rds/

Amazon Aurora: Cloud Native High Performance Relational Database

Fully compatible with PostgreSQL and MySQL
Up to 5x better performance than MySQL
At a price point 1/10 of a commercial database
One-Click online migration from MySQL to Aurora
Scale Up to 32vCPUs, 244 GiB
Storage scale out automatically: 10GB to 64TB
Storage volume striped across hundreds of storage nodes distributed over 3 different AZ for 6 copies
Automatic detection and failover
Add up to 15 Replicas
Encryption at rest and in transit



Amazon Aurora：https://aws.amazon.com/rds/aurora/

Global Networks

Networking and Content Distribution

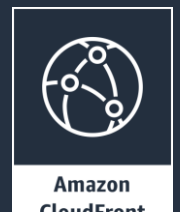
Amazon VPC

- Customer gateway
- Elastic network adapter
- Elastic network interface
- Endpoints
- Flow logs
- Internet gateway
- NAT gateway
- Network access control list
- Peering
- Router
- VPN Connection
- VPN Gateway

Elastic Load Balancing

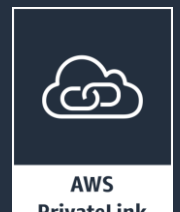
- Application load balancer
- Classic load balancer
- Network load balancer

Amazon API Gateway

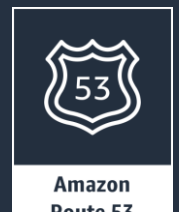


Amazon CloudFront

- Download distribution
- Edge location
- Streaming distribution



AWS PrivateLink



Amazon Route 53

- Hosted zone
- Route table

AWS Direct Connect

- Direct Connect gateway

BigData

Rich Product Portfolio of Big Data Solutions

Object storage
S3
Unlimited expansion
99.999999999% durability

Archive, cold storage
Glacier
Flexible conversion with S3
$0.01/GB/month

NoSQL database
DynamoDB
Fully managed,
Single-digit millisecond response

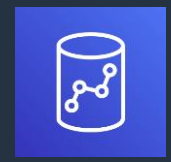
Managed Hadoop cluster
EMR
Support Spark, Hive, Hbase
Support for Spot instance

Search engine
ElastiSearch
Less operation
Support Geolocation search

Interactive query
Athena
S3-based serverless service
Support standard SQL

Real-time data stream ingesting and processing
Kinesis
High throughput
Flexible expansion

Analysis
machine learning Machine Learning
Easy modeling
Easy to use

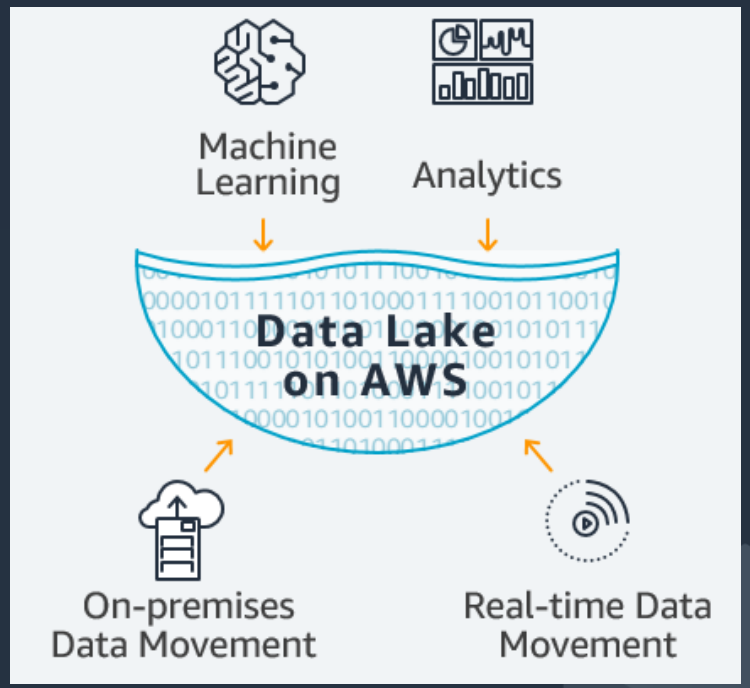


Data Warehouse
Redshift
MPP parallel computing
$1000/TB/year
one-tenth the cost of other solutions

Intelligent BI display
Quicksight
Spice-based memory-based query engine
one-tenth the cost of other solutions

Typical Big Data Using Scenarios and Industry for AWS Users

- User Behavior Analysis – Citizen Services, eCommerce, Social, Gaming
- Business Data Analysis – Retail
- Clickstream analysis – webpage
- Ad serving / real-time bidding - real-time advertising
- Smart recommendation – E-Commerce
- Genetic data analysis



Amazon Kinesis: Streaming Data Delivery and Real-Time Analytics

Kinesis Streams

- Users build their own programs to handle streaming data
- AWS provides development kits for data production and consumption
- The data production end can also be connected to Flume, Fluentd, Log4j, etc.
- The data consumer can connect to Spark, Storm, etc.

Kinesis Firehose

- Output data to S3 / Redshift / ElasticSearch
- Users no longer need to run consumer programs to extract data.

Kinesis Analytics

- The kinesis streams and firehose streams were analyzed using standard SQL queries.
- Analysis results can be restored in kinesis streams and firehose.

EMR

Clickstream analysis

EMR can be used to analyze clickstream data in order to segment users, understand user preferences, and deliver more effective ads.

Real-time analytics

Consume and process real-time data from Amazon Kinesis, Apache Kafka, or other data streams with Spark Streaming on EMR. Perform streaming analytics in a fault-tolerant way and write results to S3 or HDFS.

Log analysis

EMR can be used to process logs generated by web and mobile applications. EMR helps customers turn petabytes of un-structured or semi-structured data into useful insights about their applications or users.

Extract transform load (ETL)

EMR can be used to quickly and cost-effectively perform data transformation workloads (ETL) such as - sort, aggregate, and join - on large datasets.

Predictive analytics

Apache Spark on EMR includes MLlib for scalable machine learning algorithms or you can use your own libraries. By storing datasets in-memory, Spark can provide great performance for common machine learning workloads.

Genomics

EMR can be used to process vast amounts of genomic data and other large scientific data sets quickly and efficiently. Researchers can access genomic data hosted for free on AWS.

IoT

Why AWS IoT

Broad and Deep

AWS has broad and deep IoT services, from the edge to the cloud. Device software, Amazon FreeRTOS and AWS IoT Greengrass, provides local data collection and analysis. In the cloud, AWS IoT is the only vendor to bring together data management and rich analytics in easy to use services designed specifically for noisy IoT data.

Multi-Layered Security

AWS IoT offers services for all layers of security. AWS IoT includes preventative security mechanisms, such as encryption and access control to device data. AWS IoT also offers a service to continuously monitor and audit security configurations. You receive alerts so you can mitigate potential issues, such as pushing a security fix to a device.

Superior AI Integration

AWS is bringing AI and IoT together to make devices more intelligent. You can create models in the cloud, and then deploy them to devices where they run 2x faster compared to other offerings. AWS IoT sends data back to the cloud for continuous improvement of models. AWS IoT also supports more machine learning frameworks compared to other offerings.

Proven at Scale

AWS IoT is built on a scalable, secure, and proven cloud infrastructure, and scales to billions of different devices and trillions of messages. AWS IoT integrates with services such as AWS Lambda, Amazon S3, and Amazon SageMaker, so you can build complete solutions, such as an application that uses AWS IoT to manage cameras and Amazon Kinesis for machine learning.

AWS IoT

Amazon FreeRTOS

An operating system for microcontrollers that makes small, low-power edge devices easy to program, deploy, secure, connect, and manage.

AWS IoT Greengrass

A software that lets you run local compute, messaging, data caching, sync, and machine learning inference capabilities on connected devices in a secure way.

AWS IoT Core

Lets connected devices easily and securely interact with cloud applications and other devices.

AWS IoT Device Management

Makes it easy to securely onboard, organize, monitor, and remotely manage IoT devices at scale.

AWS IoT Device Defender

Continuously monitors and audits your IoT configurations to make sure that they aren't deviating from security best practices.

AWS IoT Things Graph

Makes it easy to connect different devices and cloud services to build IoT applications.

AWS IoT Analytics

Makes it easy to run sophisticated analytics on massive volumes of IoT data.

AWS IoT SiteWise

Makes it easy to collect, structure, and search IoT data from industrial facility databases and use it to analyze equipment and process performance.

AWS IoT Events

Makes it easy to detect and respond to events from large numbers of IoT sensors and applications.

AI & ML

AWS AI Architecture

AI

(Developer who has limited knowledge on ML)

Video and Image Analytics

Rekognition Image

Rekognition Video

Textract

Voice

Polly

Transcribe

Language

Translate

Comprehend

Chatbots

Lex

Forecast

Forecast

Recommendation

Personalize

ML

(ML Developer and Data Scientist)

Amazon SageMaker

AWS DeepLens

AWS Deep Racer

Build

Pre-defined algorithm and notebook

Data Labeling (Ground Truth)

Algorithm and Model(ML in AWS Marketplace)

Training

"One-Click" Model Training and Improvement

Reinforcement Learning

Improvement(NEO)

Deploy

"One-Click" deployment

ML Framework and Infrastructure

(ML Researcher and Academic)

Framework

Optimized TensorFlow

mxnet

PYTORCH

Chainer

HOROVOD

Interface

GLUON

Keras

Infrastructure

EC2 P3 & P3dn

EC2 C5

FPGAs

Greengrass

Elastic Inference

Amazon Inferentia

Broadest AI Platform and Services

AI Services

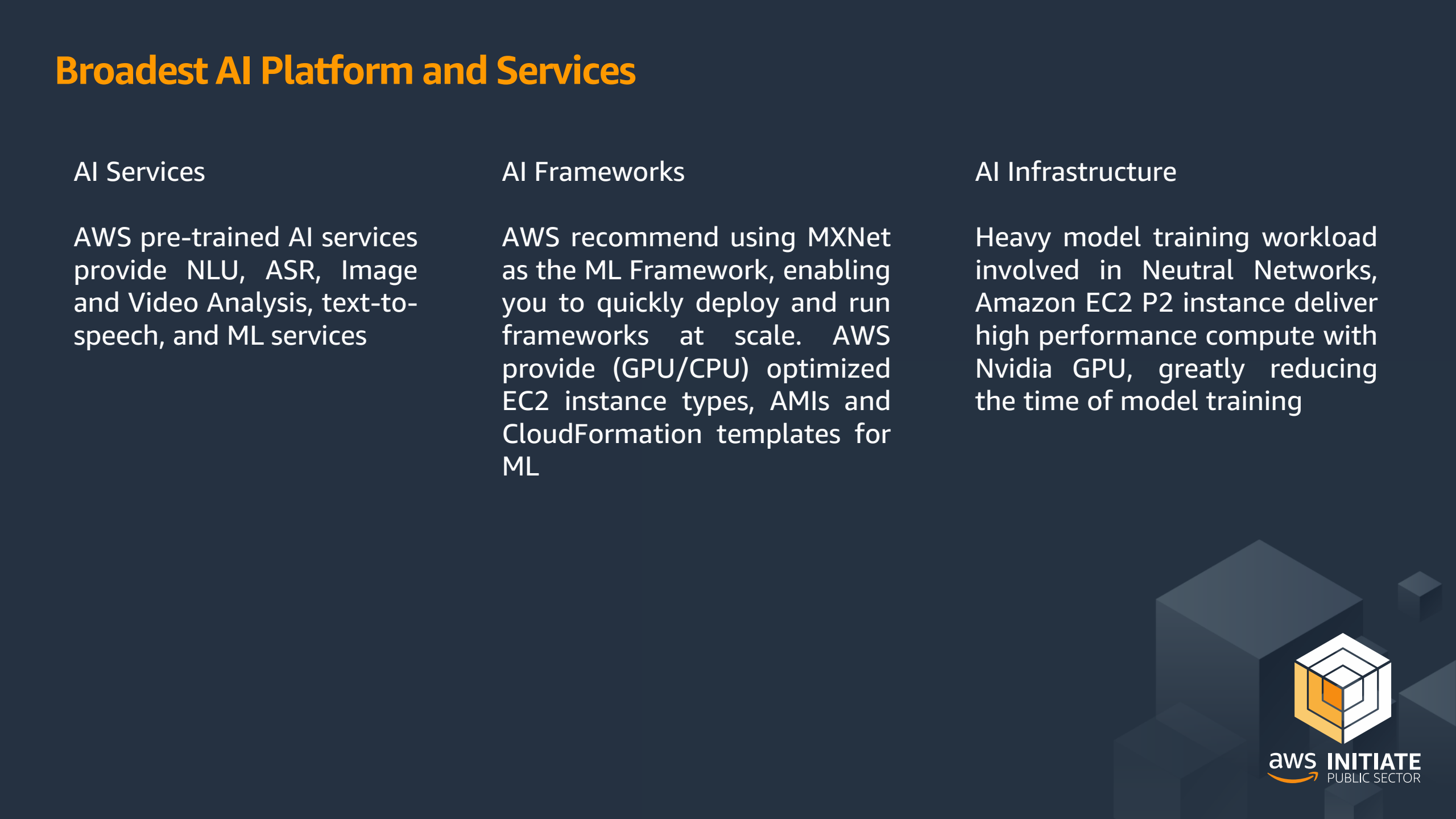
AWS pre-trained AI services provide NLU, ASR, Image and Video Analysis, text-to-speech, and ML services

AI Frameworks

AWS recommend using MXNet as the ML Framework, enabling you to quickly deploy and run frameworks at scale. AWS provide (GPU/CPU) optimized EC2 instance types, AMIs and CloudFormation templates for ML

AI Infrastructure

Heavy model training workload involved in Neutral Networks, Amazon EC2 P2 instance deliver high performance compute with Nvidia GPU, greatly reducing the time of model training



AWS Pre-trained AI Services Provide Ready-made Intelligence for Common Use Cases

If you need to:	Consider using:
Easily build conversational agents to improve customer service and increase contact center efficiency	Amazon Lex
Add image and video analysis to applications to catalog assets, automate media workflow and extract meaning	Amazon Rekognition
Turn text into lifelike speech to give voice to your applications	Amazon Polly
Build, train, and deploy Machine Learning applications fast	Amazon Machine Learning
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Table 5 Comparison of clustering accuracy between TM-score and the various 3D descriptors (optimal number of clusters) for

	Num. clusters	Rand index
ore	8	89.7%
	9	89.3%
	9	89.5%
	7	92.0%
	8	85.3%
ned silhouette weights	7	**92.2%**
ned equal weights	7	90.2%

hest accuracy is highlighted

method. Then, the proteins were clustered using the *k*-medoids method with the optimal number of clusters.

ated using two types of measures. The first is the ave silhouette width itself, which is a measure of the c ter compactness and separation. In general, clusterir based on the assumption that the underlying data f compact clusters of similar characteristics. Larger a age silhouette width means that the result of a cluste algorithm consists of compact clusters which are well arated from each other, i.e. probably close to the ac data distribution. A small average silhouette width m e.g. that one of the clusters discovered by the cluste

most of the proteins have been correctly clustered, with few exceptions. Moreover, the clustering method discovered 7 clusters, instead of 6, splitting stereotyped subset #2 (green-blue color) into two clusters (indexes 4 and 7). The reason behind this separation is probably the pattern of somatic mutations in the immunoglobulin heavy-chain variable region gene (IGHV).

Clustering of all BcR IGs

The procedure followed for clustering the annotated dataset was repeated, this time using the whole BcR IG protein dataset, including both stereotyped (annotated) and non-stereotyped (non annotated) cases. For each type of descriptor, the optimal number of clusters was first determined, using the maximum average silhouette width

average silhouette width is an internal evaluation measure, in the sense that it uses only information contained in the dataset, without assuming any knowledge of ground truth class labels or clusterings.

The second type of evaluation measure is the Rand index, which is an external measure, in the sense that it makes use of ground truth knowledge. The evaluation using the Rand index is similar to the evaluation of the annotated dataset in the previous section, by comparing the produced clusterings to the ground truth clustering. However, only the annotated BcR IG were used for the computation of the Rand index. In other words, after computing a clustering of all proteins, both annotated and unannotated, we wanted to evaluate how well they have been clustered by examining the clustering distribution

Fig. 3 Clustering of the annotated protein dataset, using the combined descriptors method

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Roundabout count

Total sum of turning movements from origin to destination.

Road volume data

Count of vehicle and bicycle volumes on a road segment.

Vehicle gap data

Measure of headway time between vehicles in seconds.

Pedestrian & bicycle pathway count

Count of pedestrians and bicycle volumes on sidewalks, paths, or intersecting paths.

Thank you!