

# Module 4

# Database & Machine Learning Intro

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# SQL and NoSQL Databases

	SQL	NoSQL
Data Storage	Rows and Columns	Key-Value
Schemas	Fixed	Dynamic
Querying	Using SQL	Focused on collection of documents
Scalability	Vertical	Horizontal

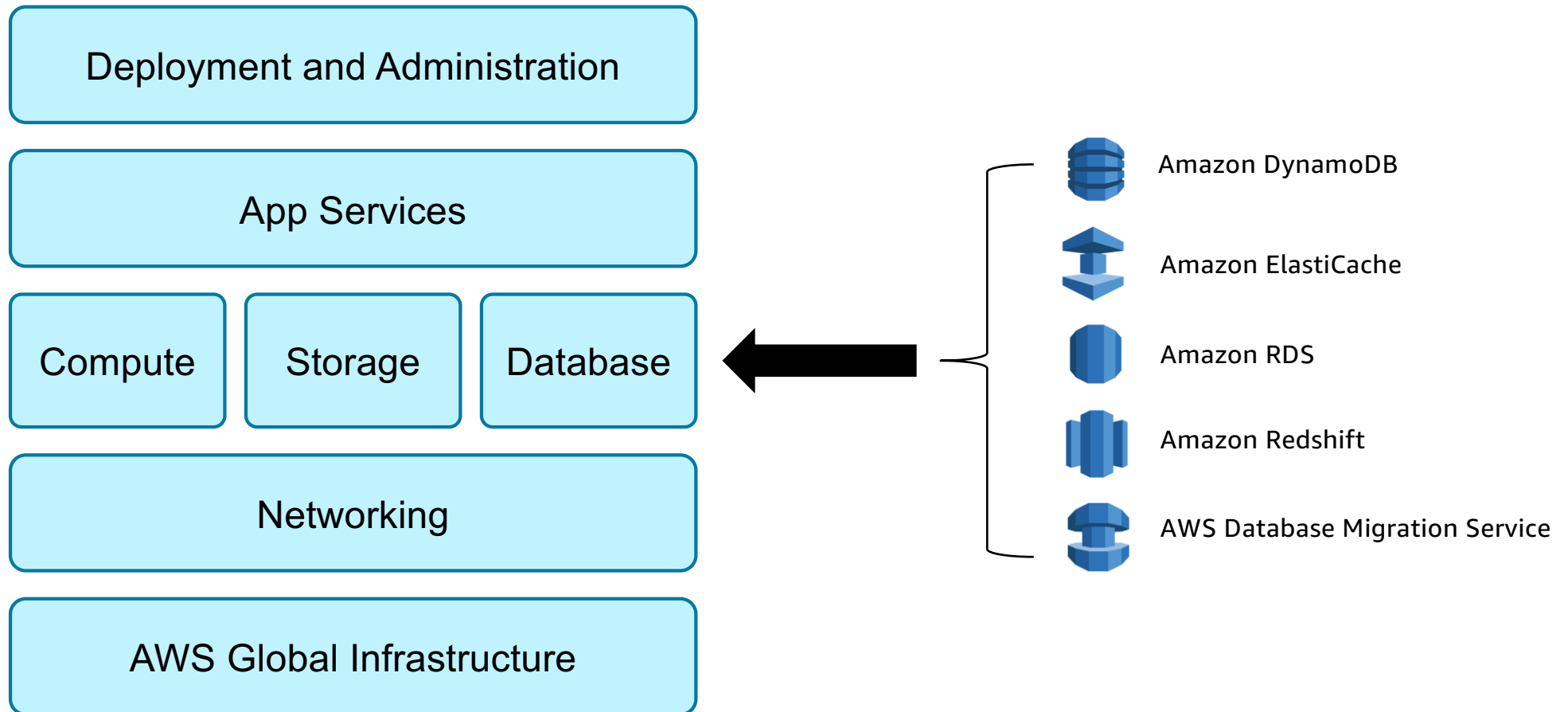
## SQL

ISBN	Title	Author	Format
9182932465265	Cloud Computing Concepts	Wilson, Joe	Paperback
3142536475869	The Database Guru	Gomez, Maria	eBook

## NoSQL

{ ISBN: 9182932465265, Title: "Cloud Computing Concepts", Author: "Wilson, Joe", Format: "Paperback" }
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# AWS Managed Database Services



# Amazon Relational Database Service (RDS)



Amazon  
RDS

- Cost-efficient and **resizable capacity**
- Manages time-consuming **database administration** tasks
- Access to the full capabilities of **Amazon Aurora, MySQL, MariaDB, Microsoft SQL Server, Oracle, and PostgreSQL** databases

# Amazon RDS



- Simple and **fast to deploy**
- **Manages** common database administrative tasks
- **Compatible** with your applications
- Fast, predictable performance
- Simple and **fast to scale**
- Secure
- Cost-effective



# How Amazon RDS Backups Work



## Automatic Backups:

- Restore your database to a point in time.
- Are enabled by default.
- Let you choose a retention period up to 35 days.
- Are stored in Amazon S3

## Manual Snapshots:

- Let you build a new database instance from a snapshot.
- Are initiated by the user.
- Persist until the user deletes them.

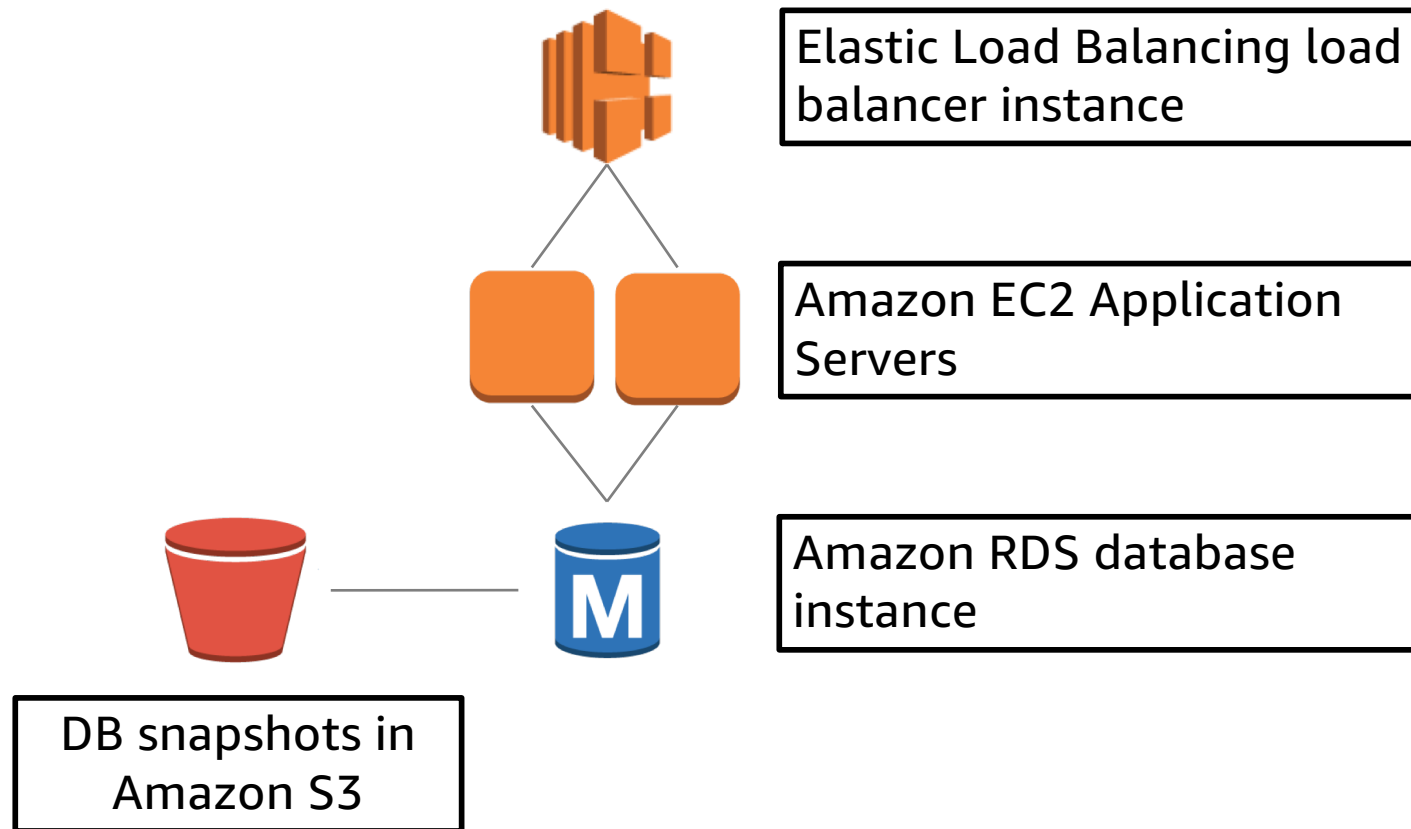


# Cross-Region Snapshots

- Are a **copy** of a **database** snapshot stored in a **different AWS Region**.
- Provide a backup for disaster **recovery**.
- Can be used as a **base** for **migration** to a different region.



# A Simple Application Architecture



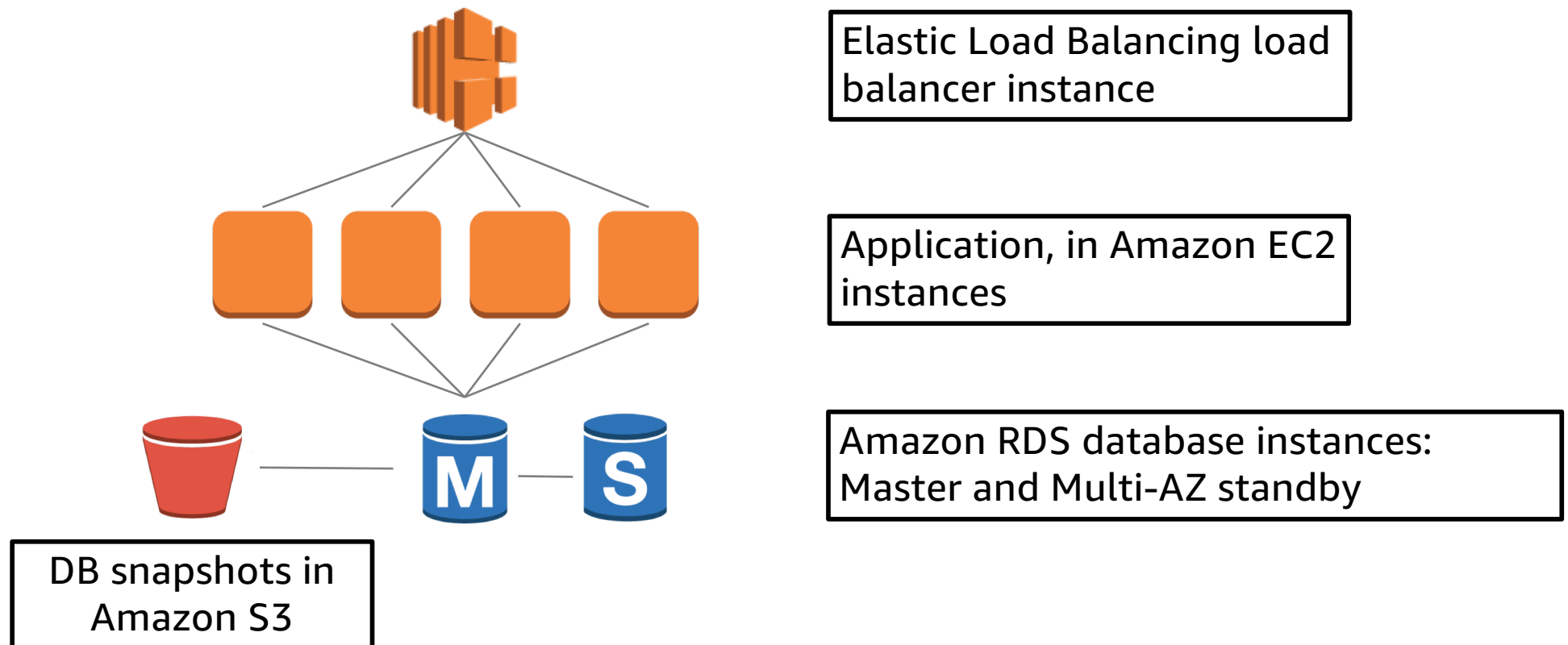


# Multi-AZ RDS Deployment



- With **Multi-AZ** operation, your database is **synchronously replicated to another Availability Zone** in the same AWS Region.
- **Failover** to the standby **automatically** occurs in case of master database failure.
- Planned maintenance is applied first to standby databases.

# A Resilient, Durable Application Architecture



# Instructor Demo

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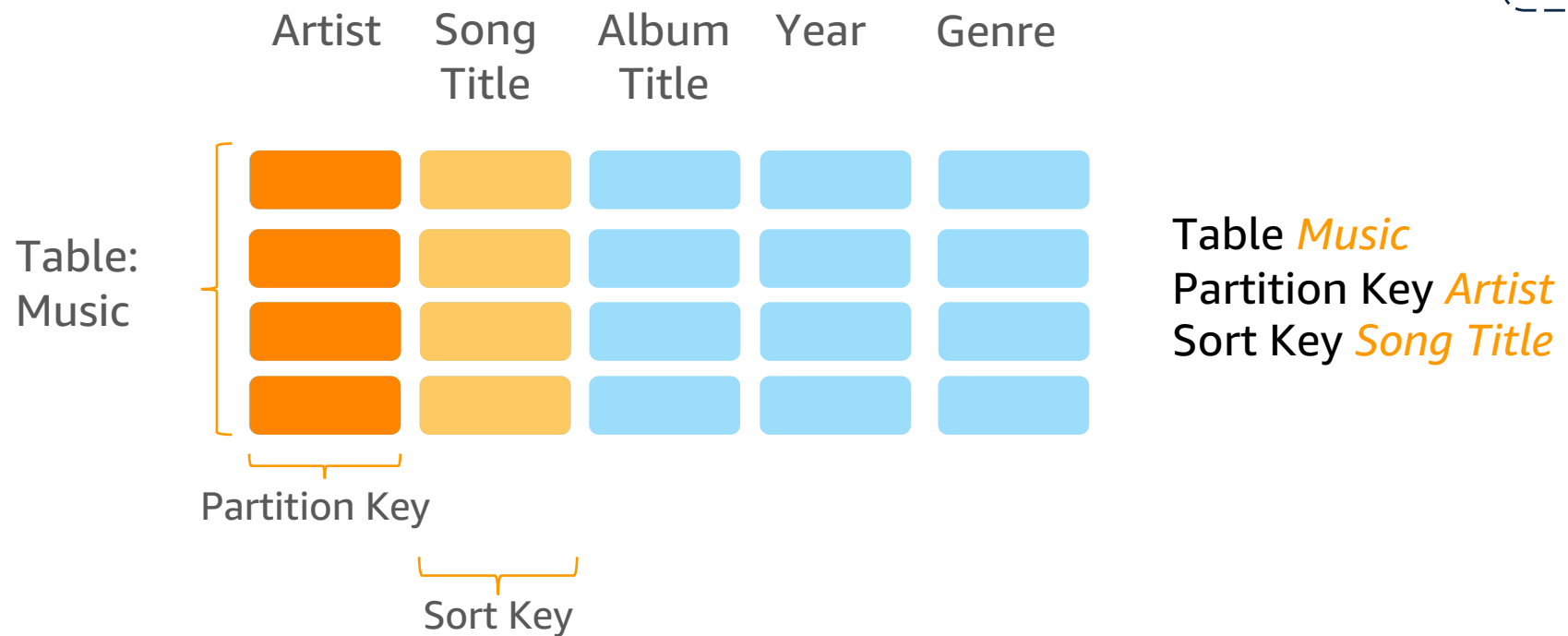
# Amazon DynamoDB



Amazon  
DynamoDB

- Allows you to store any amount of data with **no limits**.
- Provides fast, predictable performance using **SSDs**.
- Allows you to easily provision and change the request capacity needed for each table.
- Is a **fully managed, NoSQL** database service.

# Primary Keys






(DynamoDB maintains a sorted index for both keys)

# Supported Operations



- **Query:**
  - Query a table using the partition key and an optional sort key filter.
  - If the table has a secondary index, query using its key.
  - It is the **most efficient way to retrieve items** from a table or secondary index.
- **Scan:**
  - You can scan a table or secondary index.
  - Scan reads every item – **slower than querying**.
- You can use conditional expressions in both Query and Scan operations.

# Database Considerations

If You Need	Consider Using
A relational database service with minimal administration	<b>Amazon RDS</b> <ul style="list-style-type: none"><li>• Choice of Amazon Aurora, MySQL, MariaDB, Microsoft SQL Server, Oracle, or PostgreSQL database engines</li><li>• Scale compute and storage</li><li>• Multi-AZ availability</li></ul> 
A fast, highly scalable NoSQL database service	<b>Amazon DynamoDB</b> <ul style="list-style-type: none"><li>• Extremely fast performance</li><li>• Seamless scalability and reliability</li><li>• Low cost</li></ul> 
A database you can manage on your own	Your choice of <b>AMIs</b> on Amazon EC2 and Amazon EBS that provide scale compute and storage, complete control over instances, and more. 



# Amazon Aurora

Fastest-growing AWS service, ever

MySQL and PostgreSQL compatible

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5X faster than standard MySQL and 3X PostgreSQL

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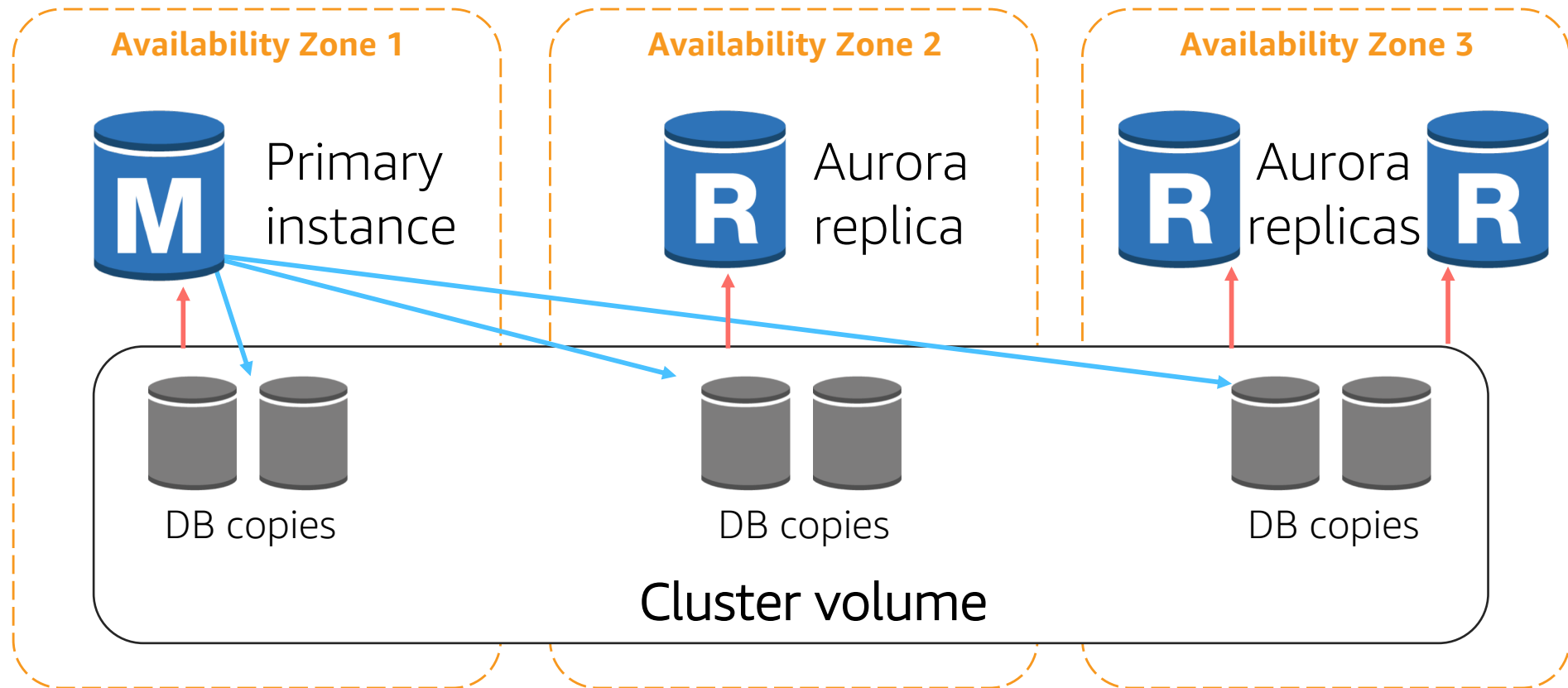
Highly available and durable

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1/10<sup>th</sup> the cost of commercial grade databases



## Each Aurora DB cluster can have up to 15 Aurora replicas



# Aurora Serverless

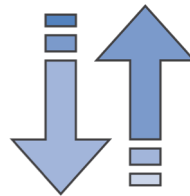


Responds to your application automatically

- Scales capacity
- Shut down
- Start up



Pay for number of ACUs used



Good for spiky, unpredictable workloads

# Machine Learning

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# AWS deep experience differentiates services



1995

Amazon has invested in AI/ML since our inception, and we share our knowledge and capabilities with our customers



2017



**Product recommendation engine**



**Robot-enabled fulfillment centers**



**New product categories**



**ML-driven supply chain and capacity planning**



**Natural language processing-supported contact centers**



**Checkout-free shopping using deep learning**

# The AWS ML Stack

Broadest and most complete set of Machine Learning capabilities

## AI SERVICES

### VISION



Amazon  
Rekognition

### SPEECH



Amazon  
Polly



Amazon  
Transcribe  
*+Medical*

### TEXT



Amazon  
Comprehend  
*+Medical*



Amazon  
Translate



Amazon  
Textract

### SEARCH



Amazon  
Kendra

### CHATBOTS



Amazon  
Lex

### PERSONALIZATION



Amazon  
Personalize

### FORECASTING



Amazon  
Forecast

### FRAUD



Amazon  
Fraud Detector

### DEVELOPMENT



Amazon  
CodeGuru

### CONTACT CENTERS



Contact Lens  
*For Amazon Connect*

## ML SERVICES



Amazon SageMaker

Ground  
Truth

ML  
Marketplace

Built-in  
algorithms

Notebooks

Experiments

Model  
training &  
tuning

Debugger

Autopilot

Model  
hosting

Model Monitor

SageMaker Studio IDE

Neo

Augmented  
AI

## ML FRAMEWORKS & INFRASTRUCTURE



PYTORCH



DeepGraphLibrary

Deep Learning  
AMIs & Containers

GPUs &  
CPUs

Elastic  
Inference

Inferentia

FPGA

# Key Stakeholders – ML use case



## Data scientists

Try out ideas quickly

Need high productivity

“Let me focus on models,  
not infrastructure”



## Ops engineers

Secure access to data

Max out utilization of expensive compute

Facilitate build, train, deploy

“Give me a secure, scalable, flexible platform”



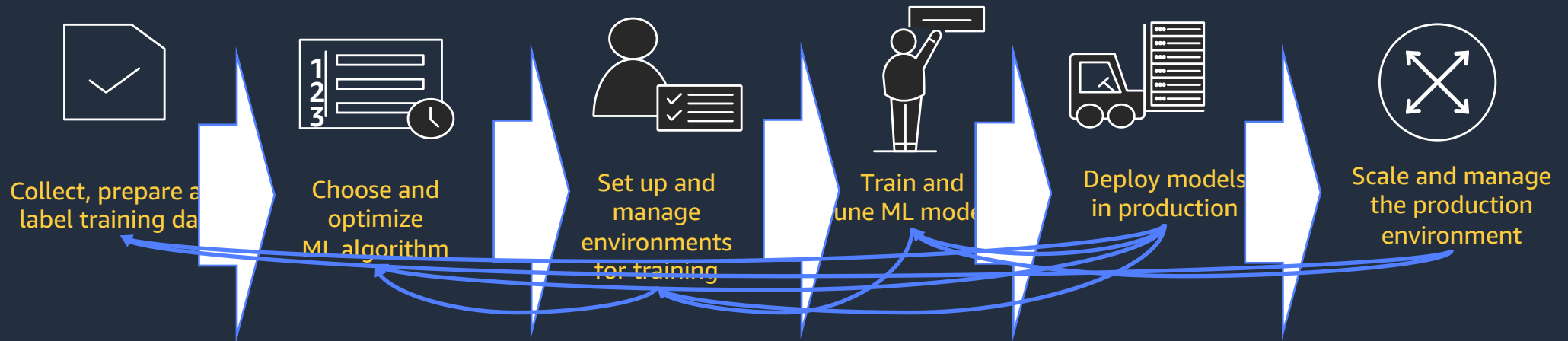
## Business leaders

Deliver tangible business outcomes

Scale ML across all business units

“Keep the costs down”

# Traditional Machine learning process is hard



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# What is the right ML platform?

## Build-your-own ML platform

Custom tooling, security

Operations



Amazon  
EC2

**Data scientists ~ \$300/hr.**

**Infrastructure ~ \$3/hr.**

## Use a managed ML Service



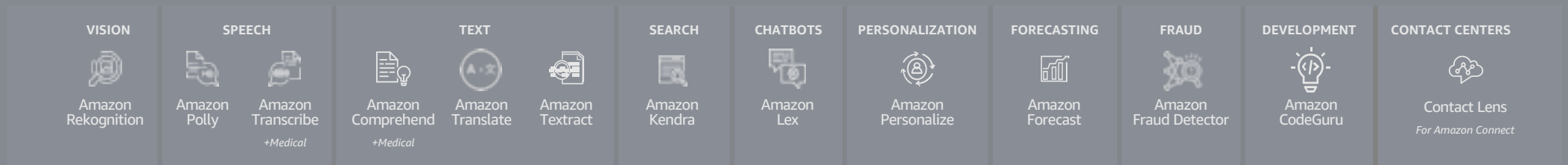
Amazon SageMaker



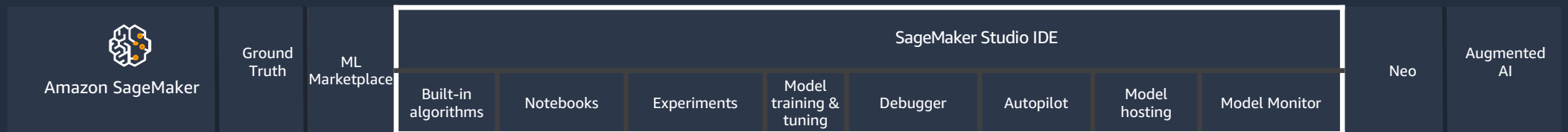
# The AWS ML Stack

Broadest and most complete set of Machine Learning capabilities

## AI SERVICES



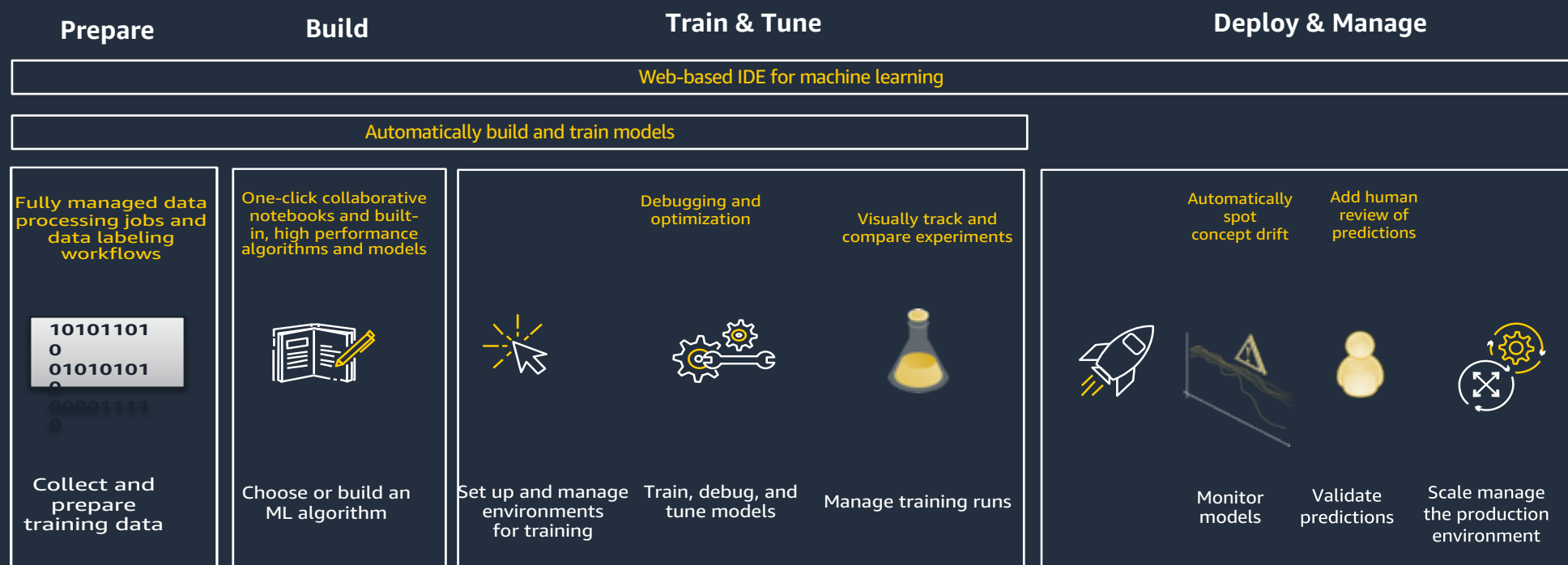
## ML SERVICES



## ML FRAMEWORKS & INFRASTRUCTURE



# Amazon SageMaker helps you build, train, and deploy models



# Amazon SageMaker

Build, train, deploy machine learning models quickly at scale

## Prepare

## Build

## Train & Tune

## Deploy & Manage

### Amazon SageMaker Studio

*Integrated Development environment(IDE) for Machine Learning*

### Amazon SageMaker Autopilot

*Automatically build and train models*

### One Click Deployment

*Supports real-time, batch & multi-model*

### Amazon SageMaker GroundTruth

*Build and manage training dataset*

### Amazon SageMaker Notebooks

*One-click notebooks with elastic compute*

### One Click Training

*Supports supervised, unsupervised & RL*

### Amazon SageMaker Model Monitor

*Automatically detect concept drift*

### Processing Job

*Supports Python or Spark*

### AWS Marketplace

*Pre-built algorithms, models, and data*

### Automatic Model Tuning

*One-click hyperparameter optimization*

### Amazon SageMaker Neo

*Train once, deploy anywhere*

### Amazon SageMaker Experiments

*Capture, organize, and compare every step*

### Amazon Elastic Inference

*Auto scaling for 75% less*

### Amazon SageMaker Debugger

*Debug and profile training runs*

### Amazon Augmented AI

*Add human review of model predictions*