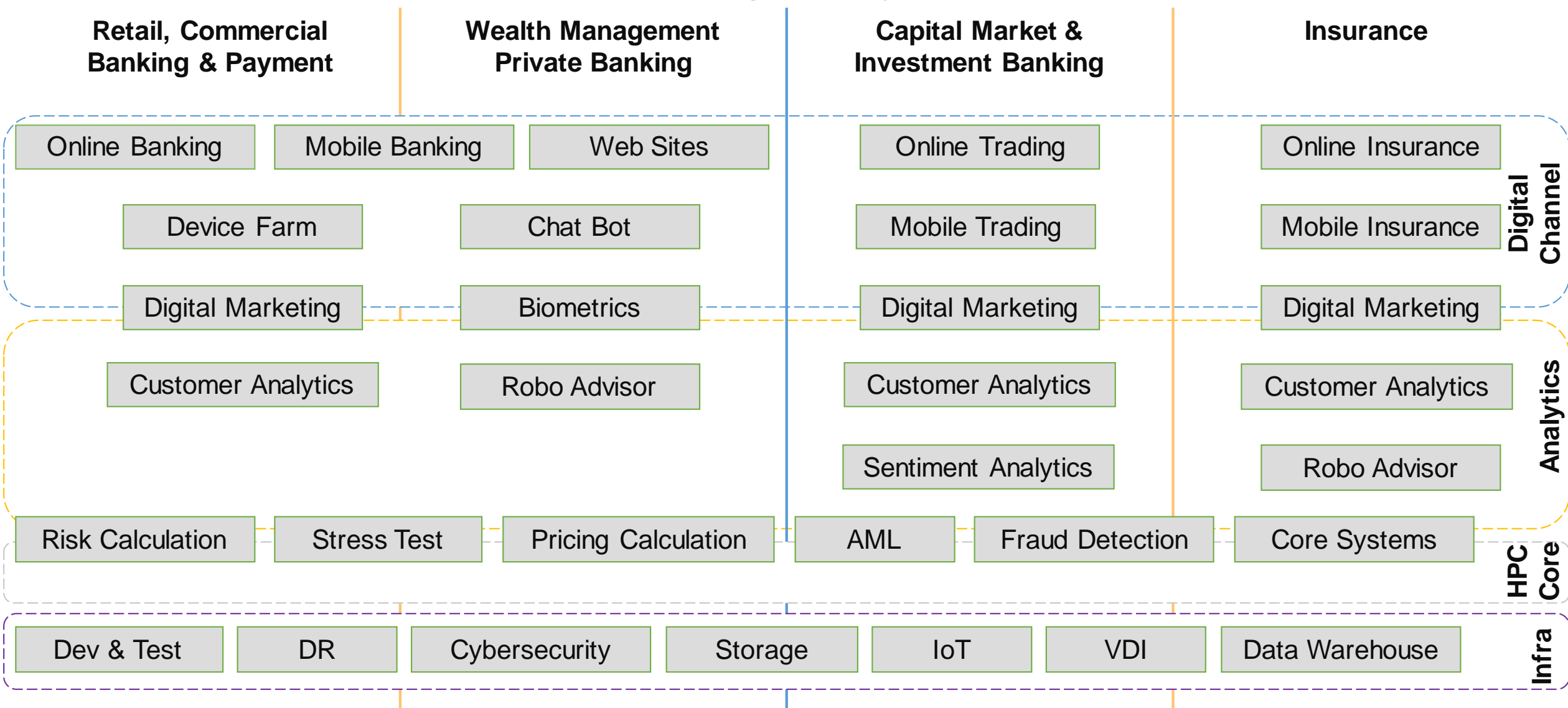


.NET on AWS

Amit Jha

Solutions Architect

Adoption is accelerating...Typical Use Cases



Representative sample of uses cases

AWS Services

More services and more functionality within those services

TECHNICAL & BUSINESS SUPPORT

Support Professional Services Optimization Guidance Partner Ecosystem Training & Certification Solutions Management Account Management Security & Billing Reports Personalized Dashboard

MARKETPLACE

Business Apps Business Intelligence DevOps Tools Security Networking Databases Storage

ANALYTICS

Data Warehousing
Business Intelligence
Hadoop/Spark
Streaming Data Analysis
Streaming Data Collection

Elasticsearch
Data Pipelines
Interactive SQL Queries
ETL

DEV OPS

One-click App Deployment
Resource Templates
Build & Test
Application Lifecycle Management
DevOps Resource Management
Triggers
Containers
Analyze & Debug
Patching

MOBILE SERVICES

API Gateway
Single Integrated Console
Identity
Sync
Mobile Analytics
Mobile App Testing
Targeted Push Notifications

IoT

Rules Engine
Device Shadows
Device SDKs
Device Gateway
Registry
Local Compute

MACHINE LEARNING

Custom Model Training & Hosting
Image & Scene Recognition
Facial Recognition & Analysis
Facial Search
Text to Speech
Conversational Chatbots
Deep Learning (Apache MXNet, TensorFlow, & others)

ENTERPRISE APPS

Virtual Desktops
Sharing & Collaboration
Corporate Email
App Streaming
Communications
Contact Center

HYBRID ARCHITECTURE

Data Integration
Integrated Networking
Integrated Identity & Access
Integrated Resource & Deployment Management
Integrated Devices & Edge Systems

MIGRATION

Schema Conversion
Exabyte-Scale Data Migration
Application Migration
Database Migration
Server Migration

APP SERVICES

Queueing & Notifications
Workflow
Search
Email
Transcoding

INFRASTRUCTURE

Regions
Availability Zones
Points of Presence

CORE SERVICES

Compute
Storage
Networking
Databases
CDN

SECURITY & COMPLIANCE

Identity Management
Access Control
Monitoring & Logs
Assessment & Reporting
Resource & Usage Auditing
Web Application Firewall
DDOS Protection

MANAGEMENT TOOLS

Manage Resources
Monitoring
Service Catalogue
Server Management
Configuration Tracking
Resource Templates

Why Customers Choose AWS for their Microsoft Workloads

Most Experience

10

Years running Windows workloads

Growth of Windows Workload

400%

Between 2015 and 2018 of AWS enterprise customers using Amazon Elastic Compute Cloud (Amazon EC2) for Windows Server

Global Reach & High Availability

61

Availability zones spanning 20 geographic regions

Customer Obsession & Innovation

140+

Service offerings

Security & Compliance

50+

Compliance Certifications

HIPAA, FISMA, ITAR, EU Model Clauses

SOC-1,2,3 FIPS, ISO

Improve TCO

68

price reductions since 2006

GLOBAL COMPUTE PLATFORM FOR COMPUTE EVERYWHERE

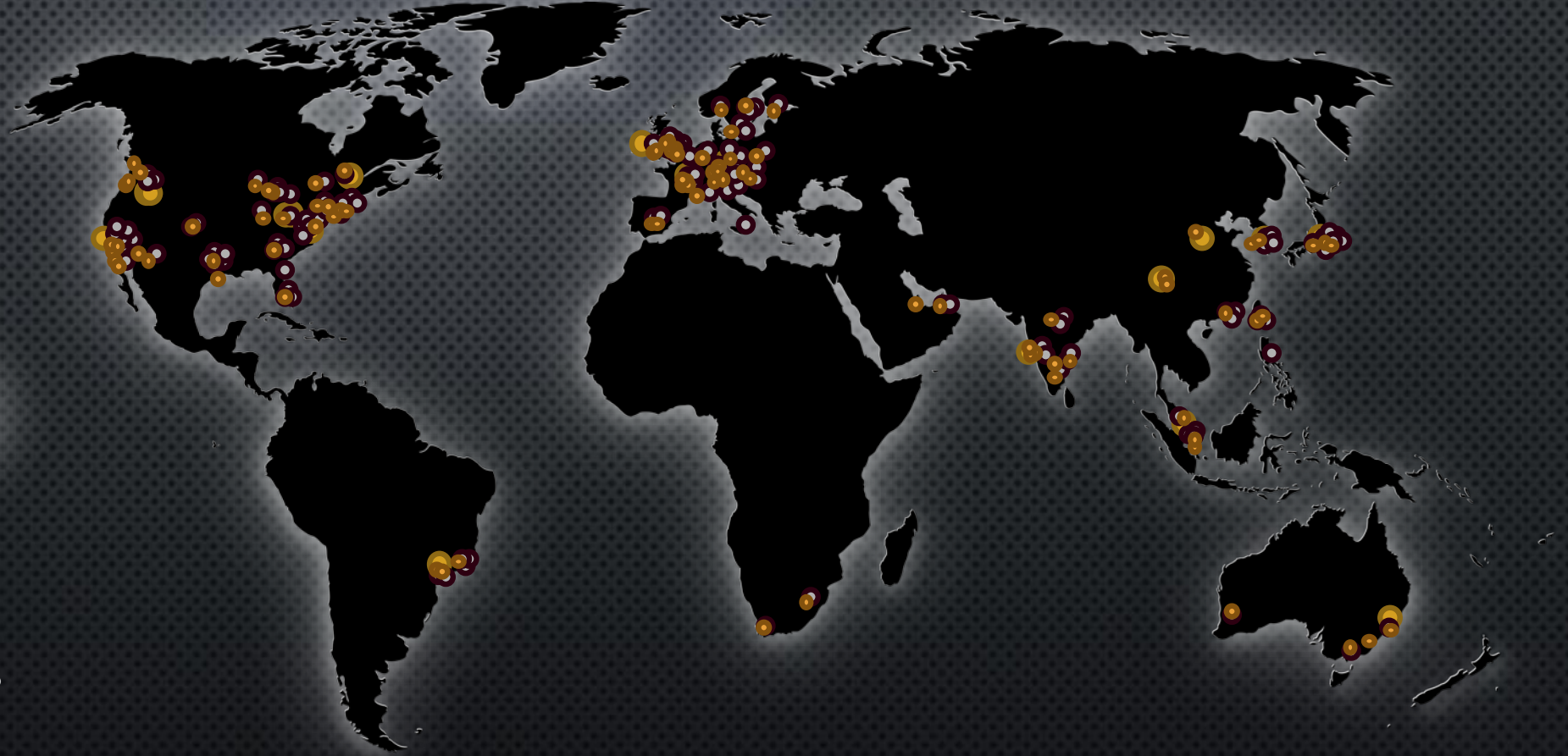
- Regions
- CloudFront PoPs
- Direct Connect locations

Global Availability

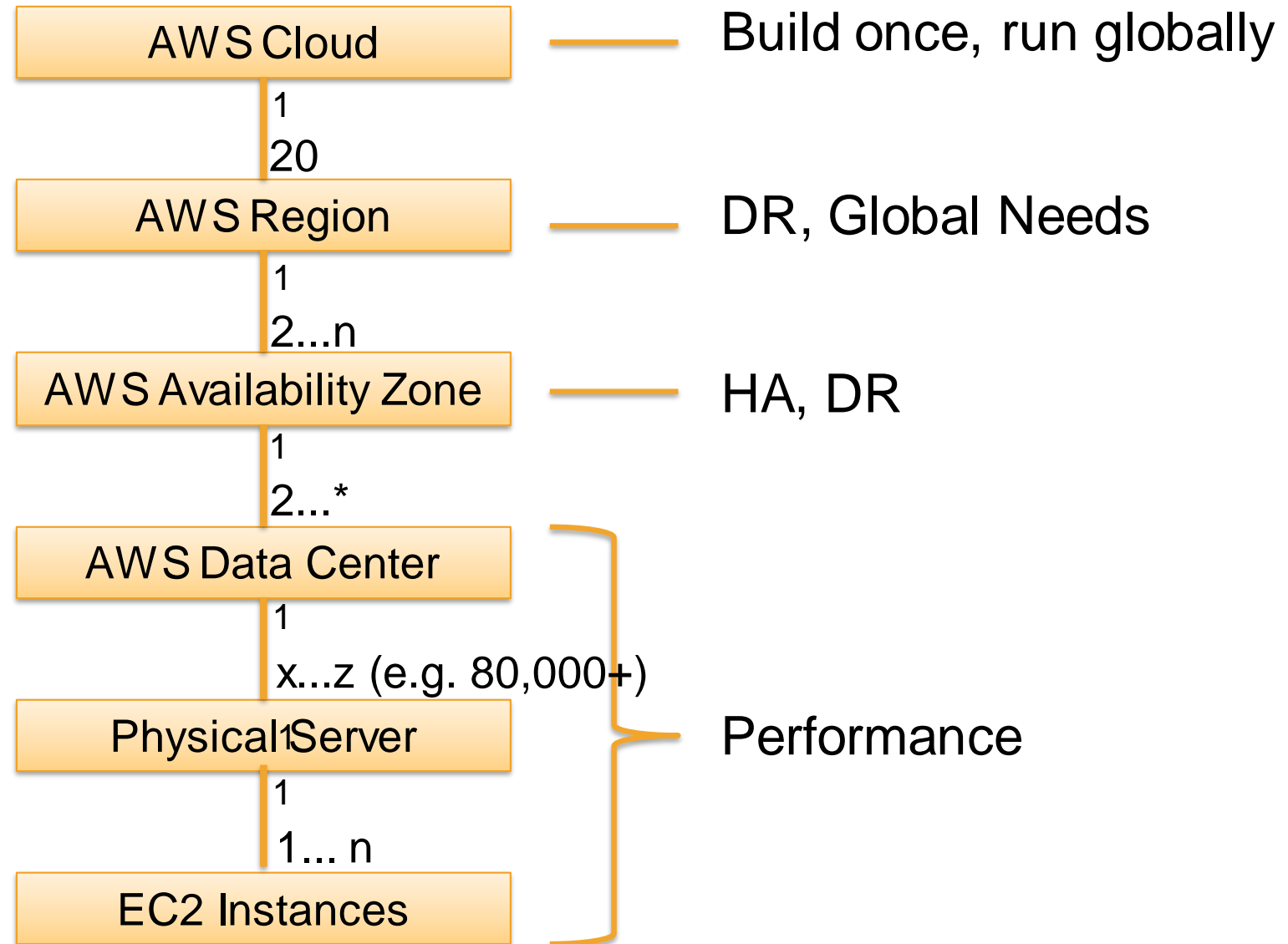
20 Regions
61 Availability Zones

Global Edge Network

160 Points of Presence
110 Direct Connect Locations



Infrastructure: From Regions to Amazon EC2 Instances



.NET on AWS - Development Tools

AWS Tools for
Visual Studio



AWS Tools for
Visual Studio
Code



AWS SDK
for .NET



AWS CLI



AWS Tools for
PowerShell and
PowerShell Core



AWS Tools
for Azure
DevOps



AWS SAM
for
Windows



AWS CDK
for .NET




Demo...

AWS Toolkit for Visual Studio

- AWS Explorer tree view of AWS resources
- Manage S3 Buckets, manage IAM users, groups, and policies, view, create, and delete Amazon DynamoDB tables, manage Amazon SQS queues and SNS topics, and much more
- Right-Click publish Web Apps to AWS Elastic Beanstalk & Lambda
- .NET Framework and .NET Core AWS SDK
- Visual Studio project templates for AWS Services
- Quick Start project templates

AWS Tools
for Visual
Studio




aws

AWS Toolkit for Visual Studio 2017 and 2019

Amazon Web Services | 179,514 installs | 1,280,632 downloads | ★★★★★ (40)

The AWS Toolkit for Visual Studio is an extension for Microsoft Visual Studio on Windows that makes it easier for developers to develop, debug, and deploy .NET applications using Amazon Web Services. With the AWS Toolkit for Visual Studio, you'll be able to get started faster ...

[Download](#)

aws

AWS Toolkit for Visual Studio 2013/2015

Amazon Web Services | 30,131 clicks | ★★★★★ (5)

The AWS Toolkit for Visual Studio (AWS Toolkit) is a plug-in for the Visual Studio IDE that makes it easier for developers to develop, debug, and deploy .NET applications that use Amazon Web Services.

[Get Started](#)

AWS SDK for .NET

The SDK can be downloaded from **NuGet** or installed using the **MSI** package, which also includes the AWS Toolkit for Microsoft Visual Studio 2013 through 2017 editions and the AWS Tools for Windows PowerShell and PowerShell Core.

The SDK helps take the complexity out of coding by providing .NET APIs for AWS services including Amazon S3, Amazon EC2, Amazon DynamoDB and more.

- Amazon DynamoDB Object Persistence Framework
- Amazon DynamoDB Session State Provider for IIS
- Support for Portable Class Library and Xamarin Projects

AWS SDK
for .NET



Demo...

AWS Tools for PowerShell & PowerShell Core

Manage AWS Resources and Services using PowerShell

```
PS C:\> Start-EC2Instance -InstanceIds i-10a64379
```

Perform many of the same actions available in the AWS CLI and SDK for .NET

AWS Tools for
PowerShell and
PowerShell Core



The screenshot shows the PowerShell Gallery website with a search for 'aws'. The search results show 24 items. The first two items are highlighted:

- AWSPowerShell** By: aws-dotnet-sdk-team
Latest Version: 3.3.313.0 Last Updated: 7/9/2018
The AWS Tools for Windows PowerShell lets developers and administrators manage their AWS services from the Windows PowerShell scripting environment.
166,098 downloads
Tags: AWS cloud
Cmdlets: *
- AWSPowerShell.NetCore** By: aws-dotnet-sdk-team
Latest Version: 3.3.313.0 Last Updated: 7/9/2018
The AWS Tools for PowerShell Core lets developers and administrators manage their AWS services from the PowerShell Core scripting environment.
33,427 downloads
Tags: AWS cloud
Cmdlets: *
PowerShell Editions: Core

On the left side, there are filters for 'Filter By' (Item Types: Module, Script; Categories: Cmdlet, DSC Resource, Function, Role Capability, Workflow; Trust Information: Include Prerelease).

AWS Tools for Azure DevOps (VSTS & TFS)

AWS Tools
for Azure
DevOps



- The AWS Tools for Microsoft Visual Studio Team Services (VSTS) adds tasks to easily enable build and release pipelines in VSTS and Team Foundation Server to work with AWS services
- Requirements:
 - Visual Studio Team Services
 - Team Foundation Server 2015 Update 3 (or higher)

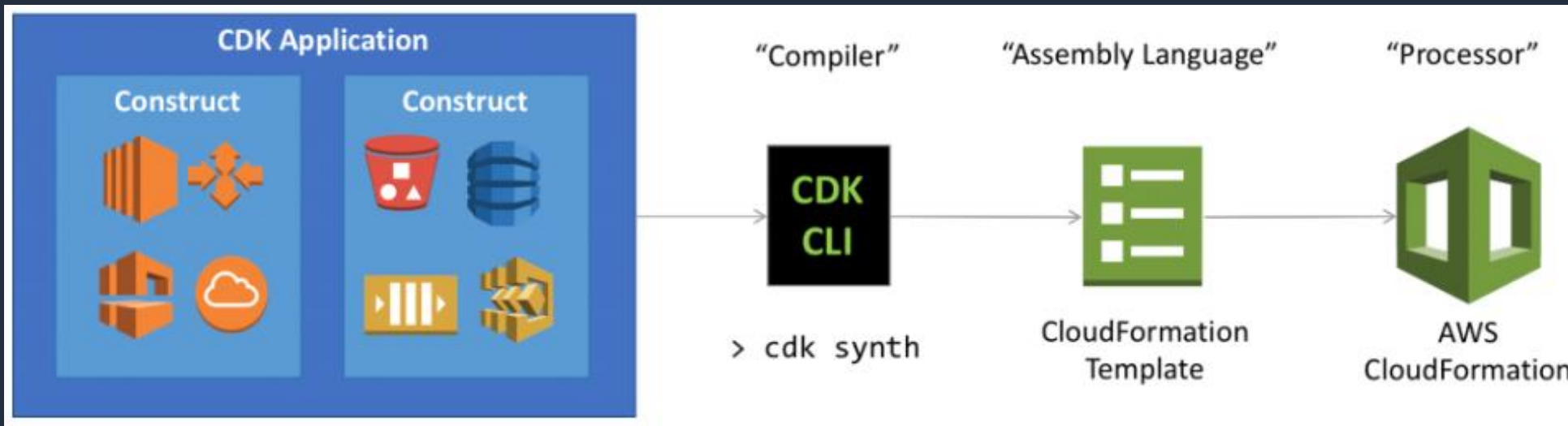
Demo...

AWS Cloud Development Kit (CDK)

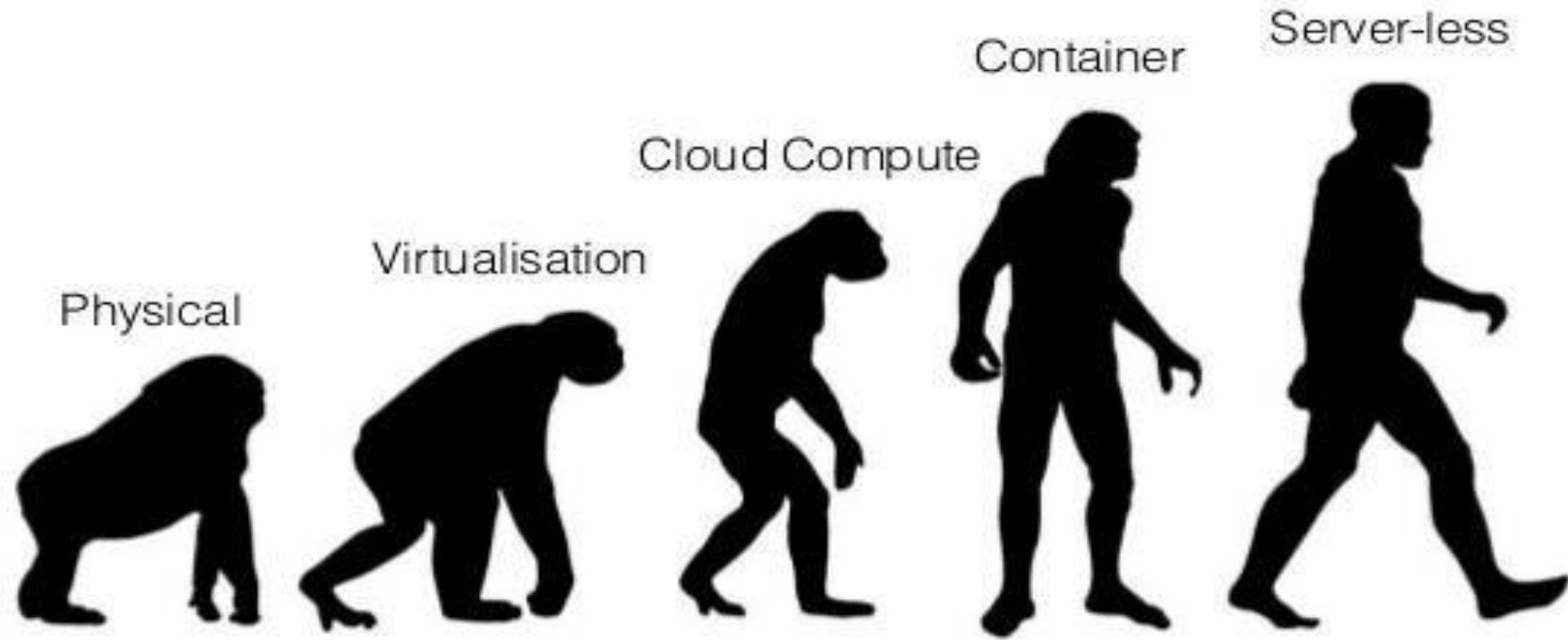
AWS CDK
for .NET



- The AWS CDK is a software development framework to define cloud infrastructure as code and provision it through CloudFormation.
- The CDK integrates fully with AWS services and offers a higher-level object-oriented abstraction to define AWS resources imperatively.

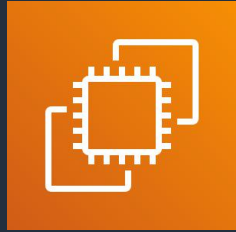


Cloud Compute Arch Pattern Evolution Intro*



I know. I know... **it depends**

AWS compute offerings



Service

**Elastic Compute
Cloud (EC2)**

**EC2 Container
Service (ECS)**

Lambda

Unit of scale

VM

Task

Function

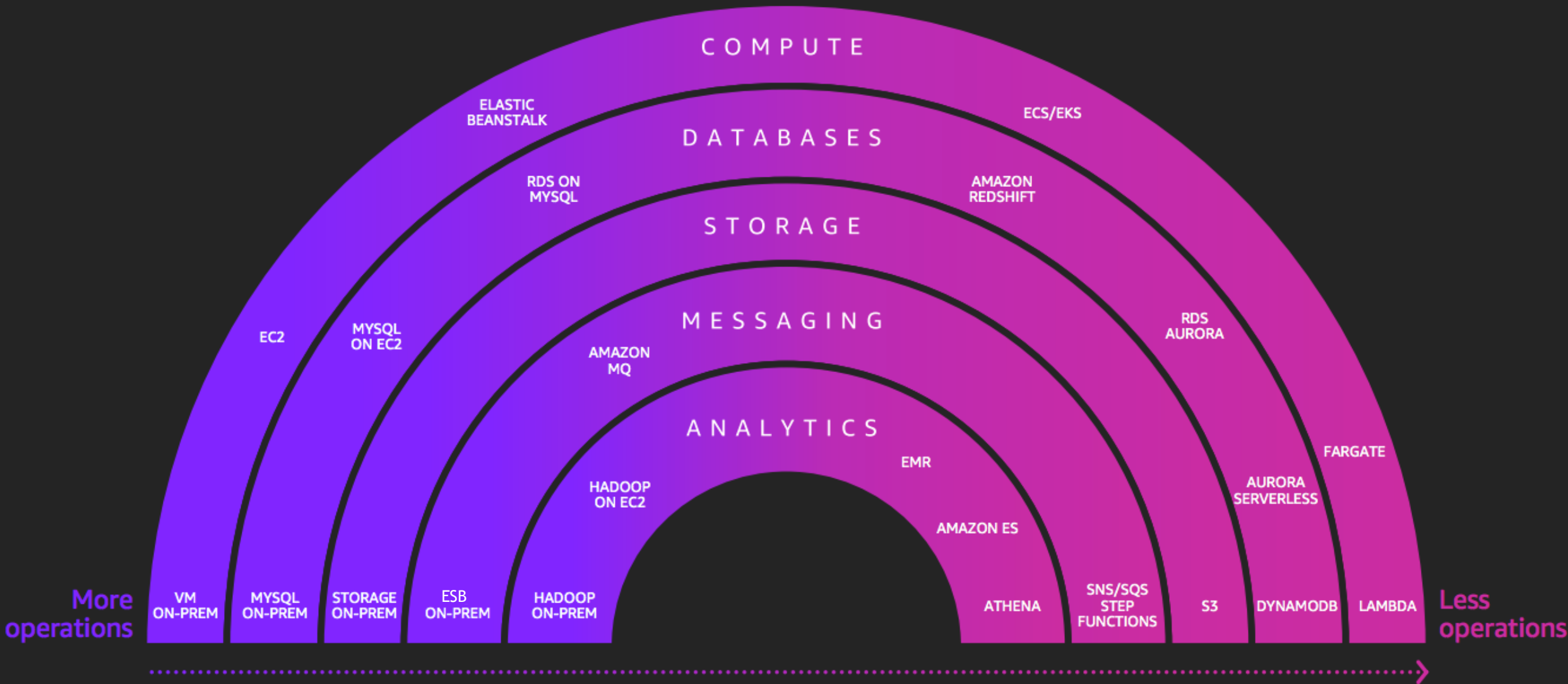
Level of
abstraction

H/W

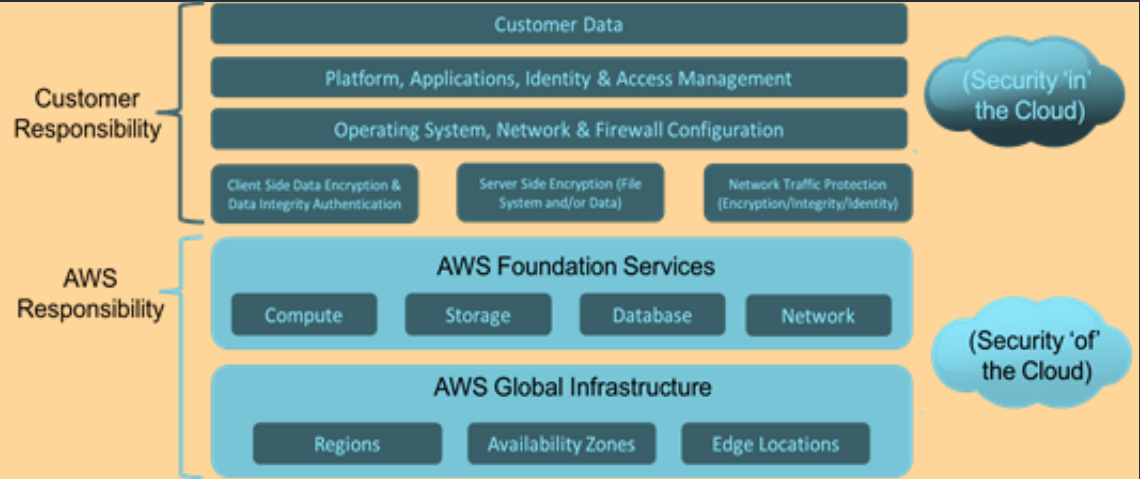
OS

Runtime

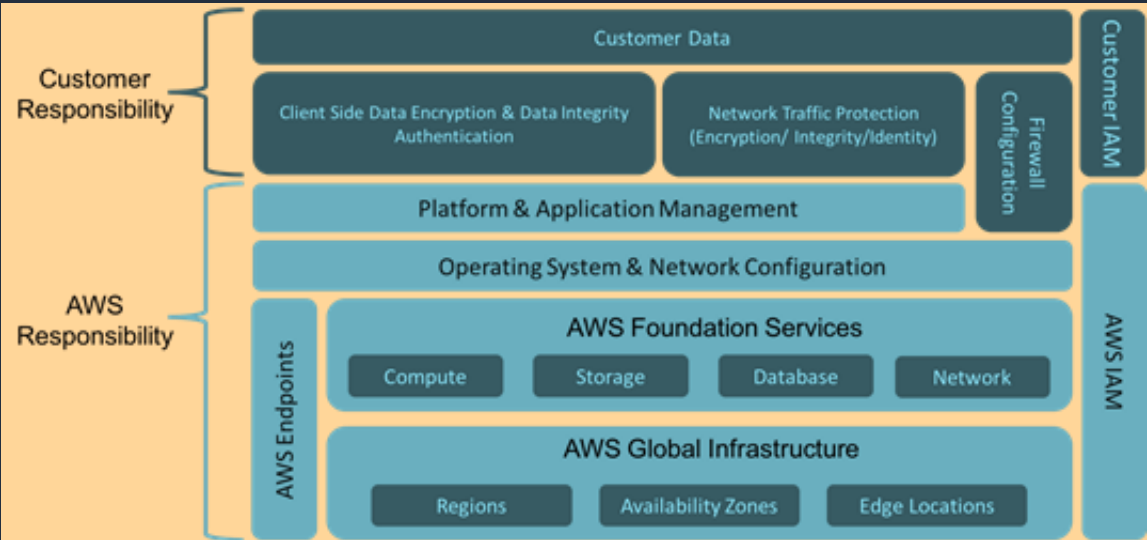
AWS service rainbow



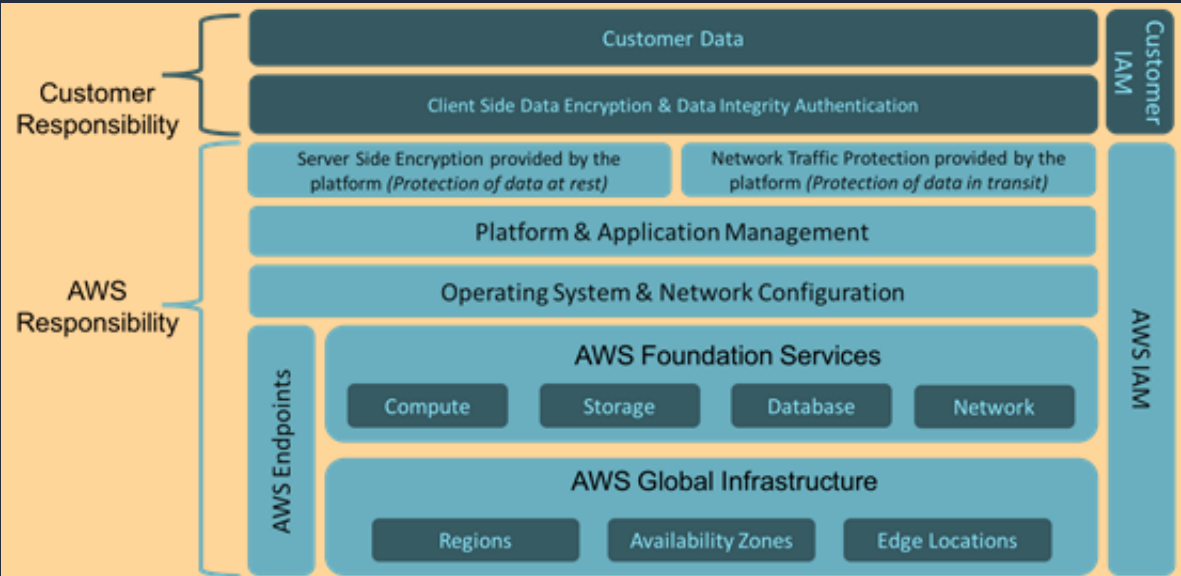
AWS Shared Responsibility Model



Infrastructure Services



Container type Services



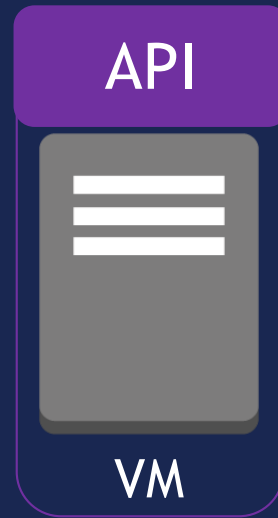
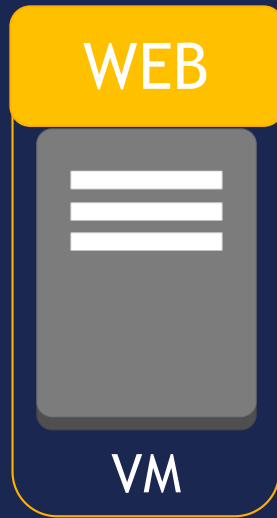
Abstract Services



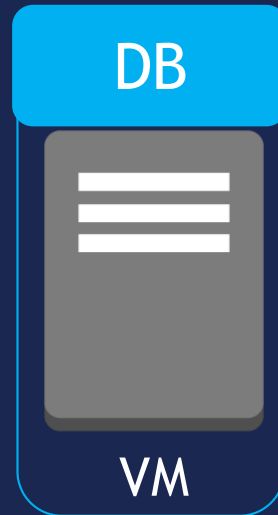
A workload example we are using – Bank Web Property...



VM



Bank Web Property



Storage



WEB



API



Identity



DB



Amazon Elastic Compute Cloud (EC2)

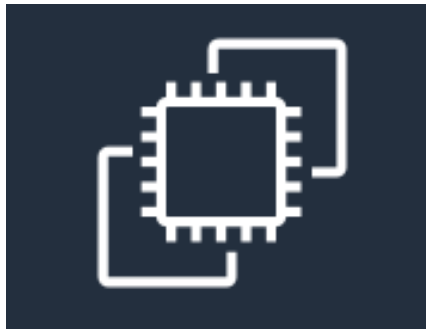


Amazon
EC2

- **Resizable** compute capacity
- Complete control of your computing resources
- **Reduced time required** to obtain and boot new server instances



Broadest and deepest platform choice



Amazon EC2

Linux | Windows

Arm and x86 architectures

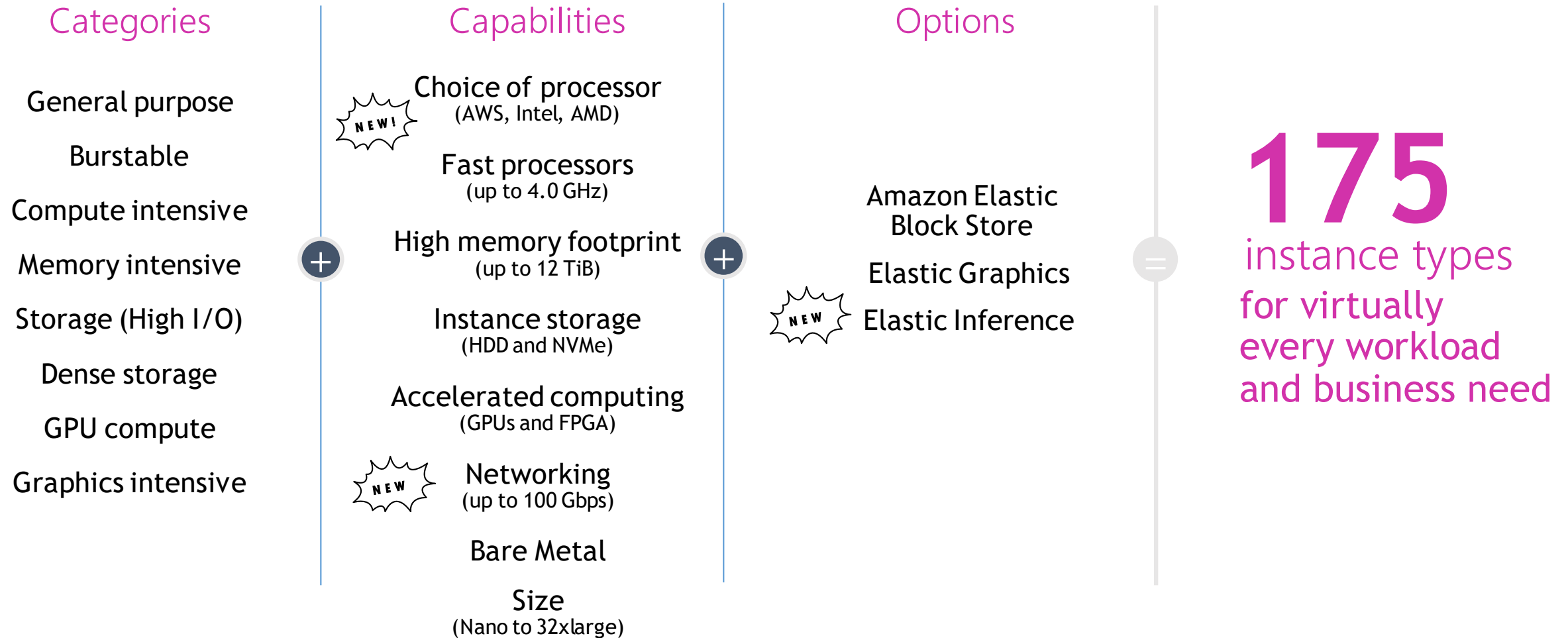
General purpose and workload optimized

Bare metal, disk, networking capabilities

Packaged | Custom | Community AMIs

Multiple purchase options: On-demand, RI, Spot

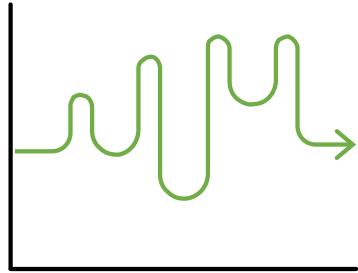
Broadest and deepest platform choice



Amazon EC2 purchase options

On-Demand

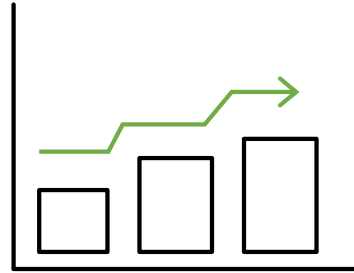
Pay for compute capacity by **the second** with no long-term commitments



Spiky workloads,
to define needs

Reserved Instances

Make a 1- or 3-year commitment and receive a **significant discount** off On-Demand prices



Committed and
steady-state usage

Spot Instances

Spare Amazon EC2 capacity at **savings of up to 90%** off On-Demand prices



Fault-tolerant, flexible,
stateless workloads

To optimize EC2, combine all three purchase options!

Demo...

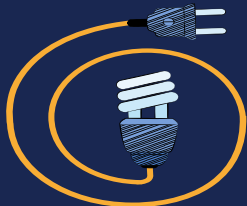
Auto Scaling



Auto
Scaling

- Scale your Amazon EC2 capacity automatically
- Well-suited for applications that experience **variability in usage**
- Available at no additional charge

**Better Fault
Tolerance**



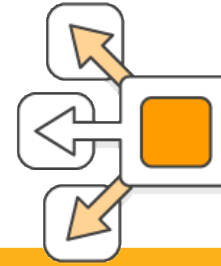
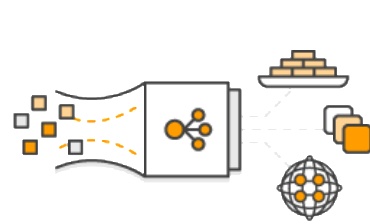
**Better
Availability**



**Better Cost
Management**



Comparison of Load Balancing



Feature	Application Load Balancer	Network Load Balancer	Classic Load Balancer
Protocols	HTTP, HTTPS	TCP	TCP, SSL, HTTP, HTTPS
Platforms	VPC	VPC	EC2-Classic, VPC
Load Balancing to multiple ports on the same instance	✓	✓	
Path-Based Routing	✓		
Static IP		✓	

Storage

WEB



Instances Auto Scaling

Monitor



Amazon CloudWatch

API



Instances Auto Scaling

Identity



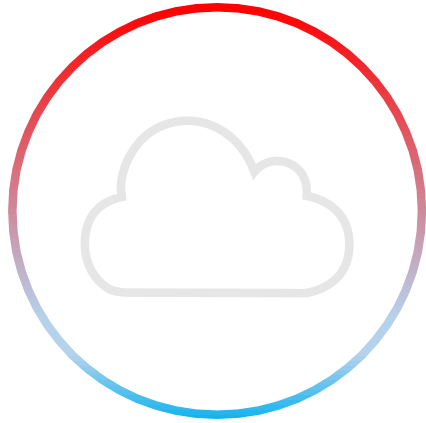
Active
Directory

DB



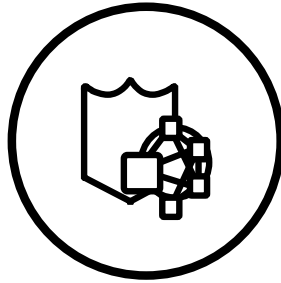
Instance Instance

Amazon Virtual Private Cloud (VPC)

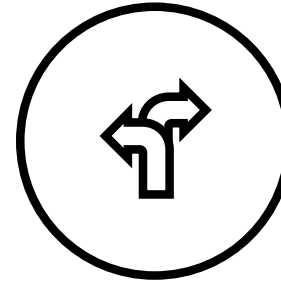


Virtual Private Cloud

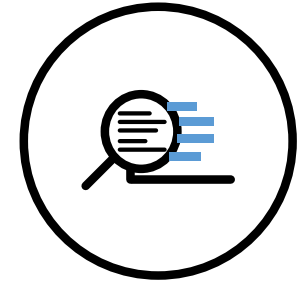
Provision a logically isolated cloud where you can launch AWS resources into a virtual network



Security Groups & ACLs



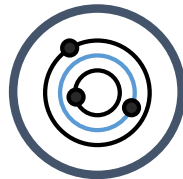
NAT Gateway



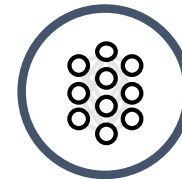
Flow Logs

VPC Endpoints

Private and secure connectivity to Amazon S3 and Amazon DynamoDB



Amazon S3



Amazon DynamoDB

Amazon Relational Database Service (RDS)



Amazon RDS

- Cost-efficient and resizable capacity
- Manages time-consuming database administration tasks, like:
 - Backups
 - Updates
 - Failover

Amazon
Aurora



postgreSQL



ORACLE®



Microsoft
SQL Server





Amazon VPC



Storage

WEB



Instances



Auto Scaling



Monitor



Amazon CloudWatch

API



Instances



Auto Scaling



Identity



Active Directory

DB



RDS DB instance

Availability Zone



RDS DB standby

Availability Zone

Amazon Simple Storage Service (S3)



Amazon S3

- Storage for the Internet
- Natively online, HTTP access
- Storage that allows you to store and retrieve **any amount of data**, any time, from anywhere on the web
- **Highly scalable**, reliable, fast and durable

Storage



Amazon S3

WEB



Web Bucket



Distribution

Monitor



Amazon CloudWatch

API



Instances



Auto Scaling



Identity



AWS Directory Service



IAM

DB



RDS DB
instance

Availability
Zone



RDS DB
standby

Availability
Zone

AWS Identity and Access Management (IAM)



AWS IAM





Amazon VPC



Storage



Amazon S3

Monitor



Amazon CloudWatch

Identity



AWS Directory Service



IAM

WEB



Web Bucket



Auto Scaling



Distribution

API



Instances



Auto Scaling



DB



RDS DB instance

Availability Zone



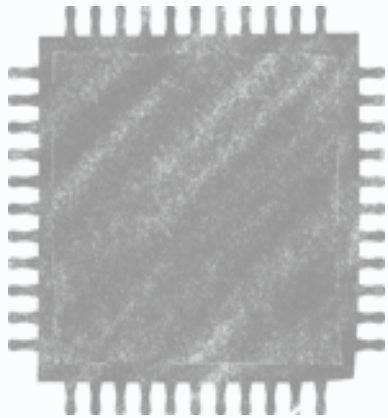
RDS DB standby

Availability Zone

Serverless...

AWS Lambda

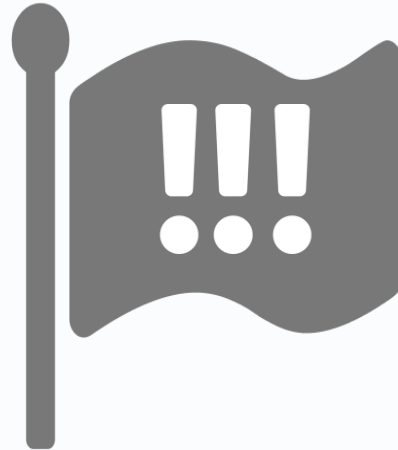
Compute service



Run arbitrary code
without managing
servers.



Event driven



Code only runs
when it needs to
run.

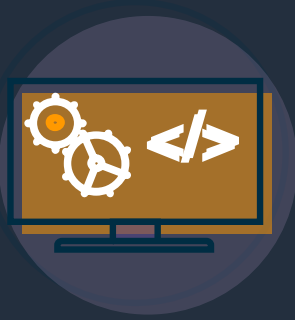


Common use cases



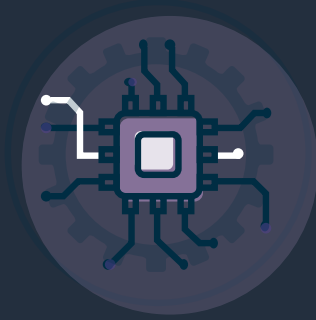
Web Applications

- Static websites
- Complex web apps



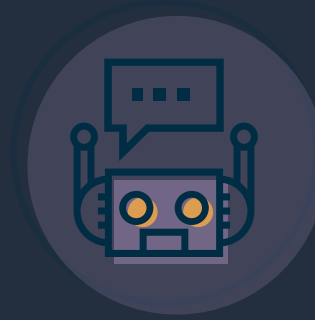
Backends

- Apps & services
- Mobile
- IoT



Data Processing

- Real time
- MapReduce
- Batch



Chatbots

- Powering chatbot logic



Amazon Alexa

- Powering voice-enabled apps
- Alexa Skills Kit



IT Automation

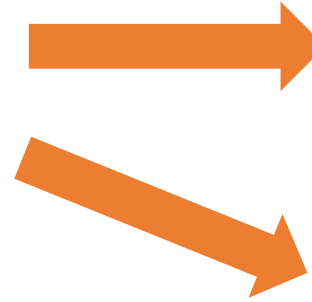
- Policy engines
- Extending AWS services
- Infrastructure management

Application components for serverless apps

EVENT SOURCE

SERVICES (ANYTHING)

FUNCTION



Changes in
data state



Requests to
endpoints



Changes in
resource state



Java
Node.js
C#
Python
Go

Demo...

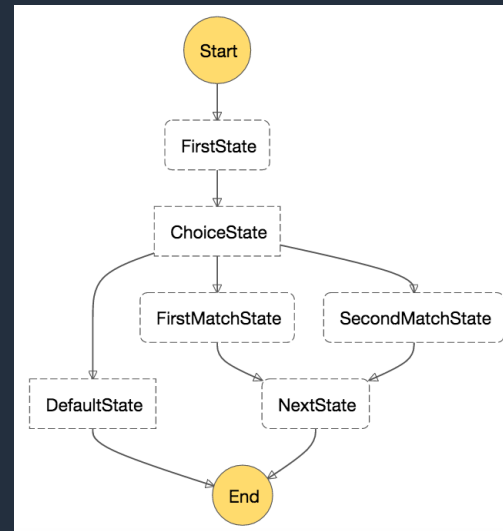
AWS Step Functions

Easily coordinate multiple Lambda functions using visual workflows

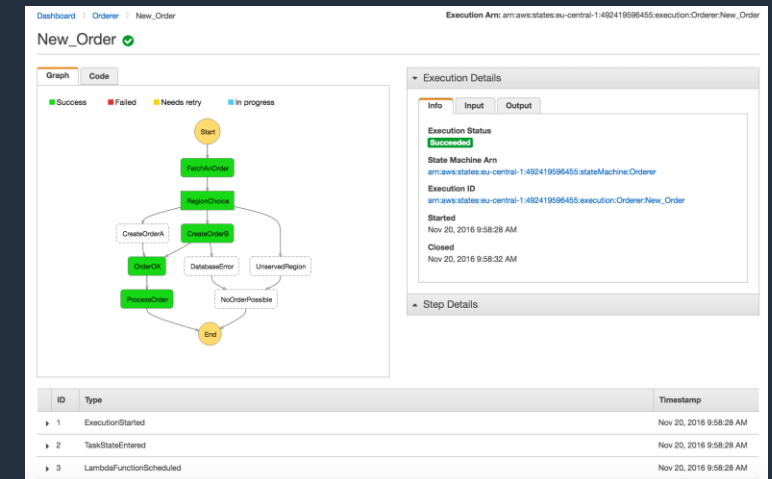
Define workflow
in JSON

```
Code
1 {
2   "Comment": "An AWS example using a choice state.",
3   "StartAt": "FirstState",
4   "States": {
5     "FirstState": {
6       "Type": "Task",
7       "Resource": "arn:aws:lambda:REGION:ACCOUNT_ID:function:FUNCTION_NAME",
8       "Next": "ChoiceState"
9     },
10    "ChoiceState": {
11      "Type": "Choice",
12      "Choices": [
13        {
14          "Variable": "$?.FunctionName",
15          "Match": "Equals",
16          "Next": "FirstMatchState"
17        },
18        {
19          "Variable": "$?.FunctionName",
20          "Match": "NotEquals",
21          "Next": "SecondMatchState"
22        },
23        {
24          "Default": "DefaultState"
25        }
26      ]
27    },
28    "FirstMatchState": {
29      "Type": "Task",
30      "Resource": "arn:aws:lambda:REGION:ACCOUNT_ID:function:FUNCTION_NAME",
31      "Next": "NextState"
32    },
33    "SecondMatchState": {
34      "Type": "Task",
35      "Resource": "arn:aws:lambda:REGION:ACCOUNT_ID:function:FUNCTION_NAME",
36      "Next": "NextState"
37    },
38    "DefaultState": {
39      "Type": "Task",
40      "Resource": "arn:aws:lambda:REGION:ACCOUNT_ID:function:FUNCTION_NAME",
41      "Next": "End"
42    },
43    "NextState": {
44      "Type": "Task",
45      "Resource": "arn:aws:lambda:REGION:ACCOUNT_ID:function:FUNCTION_NAME",
46      "Next": "End"
47    },
48    "End": {
49      "Type": "End"
50    }
51  }
52 }
```

Visualize in the
Console



Monitor
Executions





Amazon API
Gateway



Low Cost and
Efficient



Performance
at Any Scale



Easily Monitor
API Activity



Create RESTful
Endpoints for
Existing Services

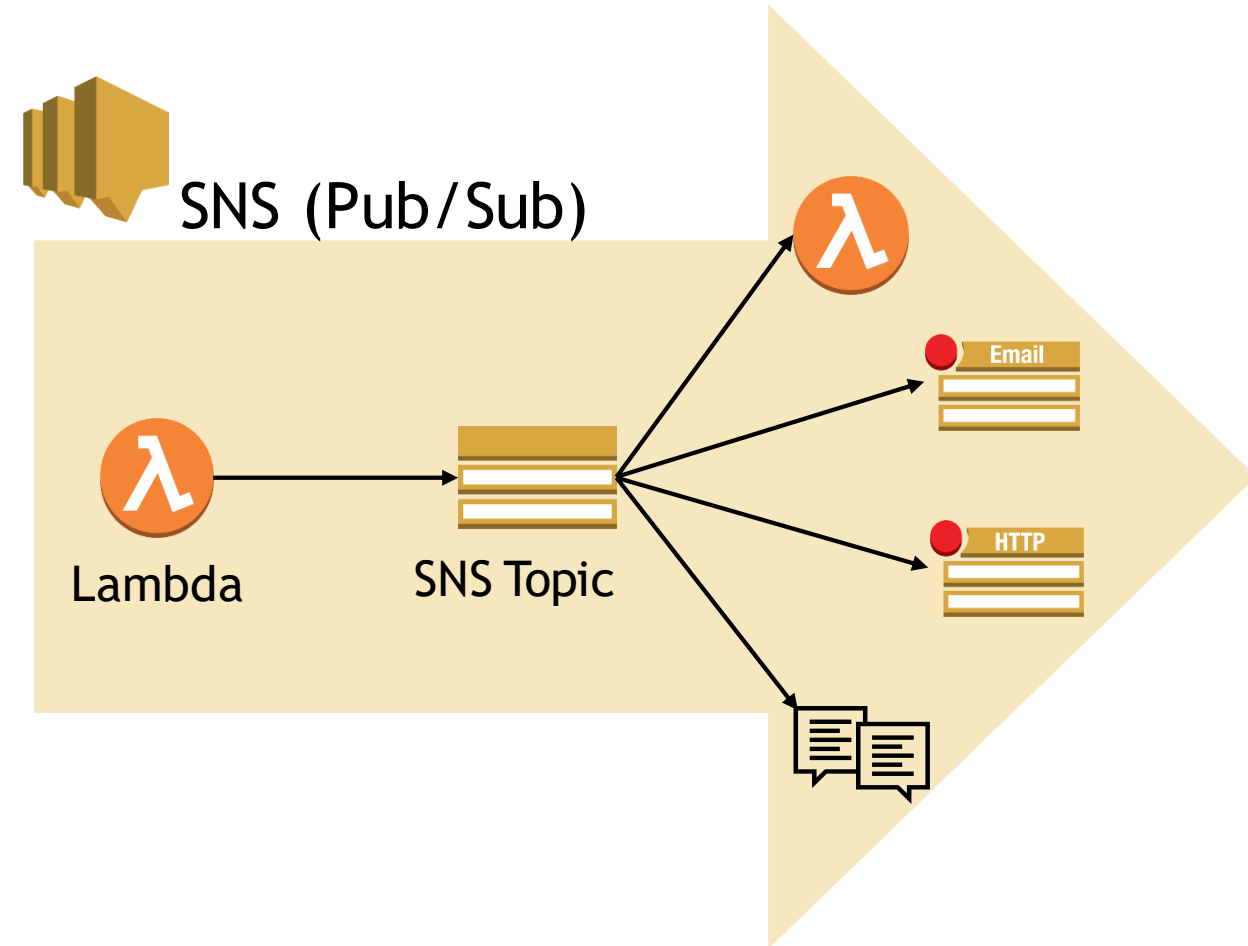
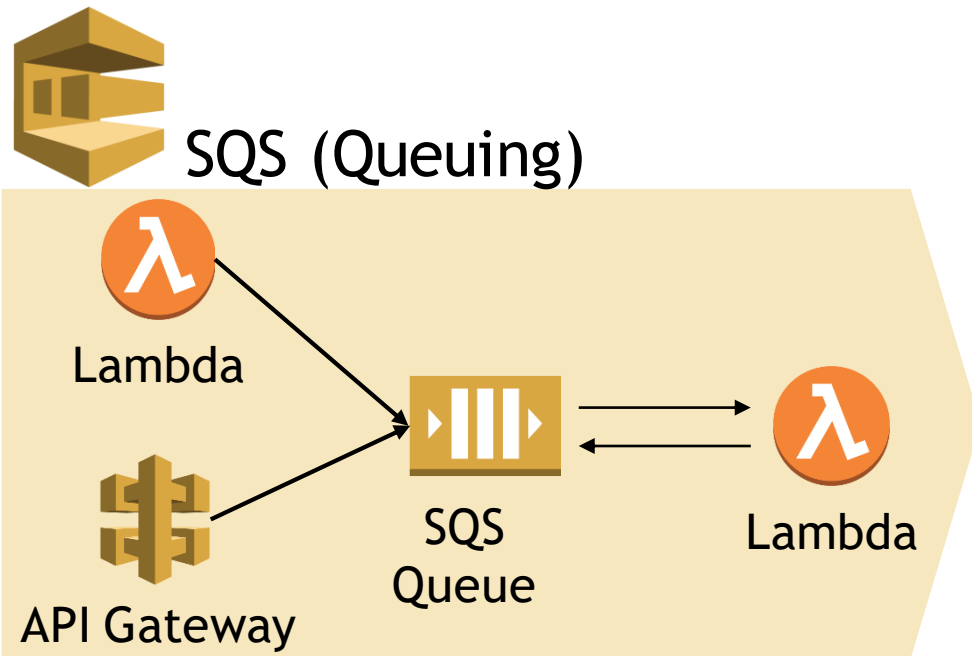


Streamline API
Development



Run Your APIs
Without
Servers

Decoupled Communication



Storage



Amazon S3

WEB



Web Bucket



Distribution

Monitor



Amazon CloudWatch

API



API Gateway



Lambda



SQS Queue



SNS Topic

Identity



AWS Directory Service



IAM

DB



RDS DB
instance

Availability
Zone



RDS DB
standby

Availability
Zone

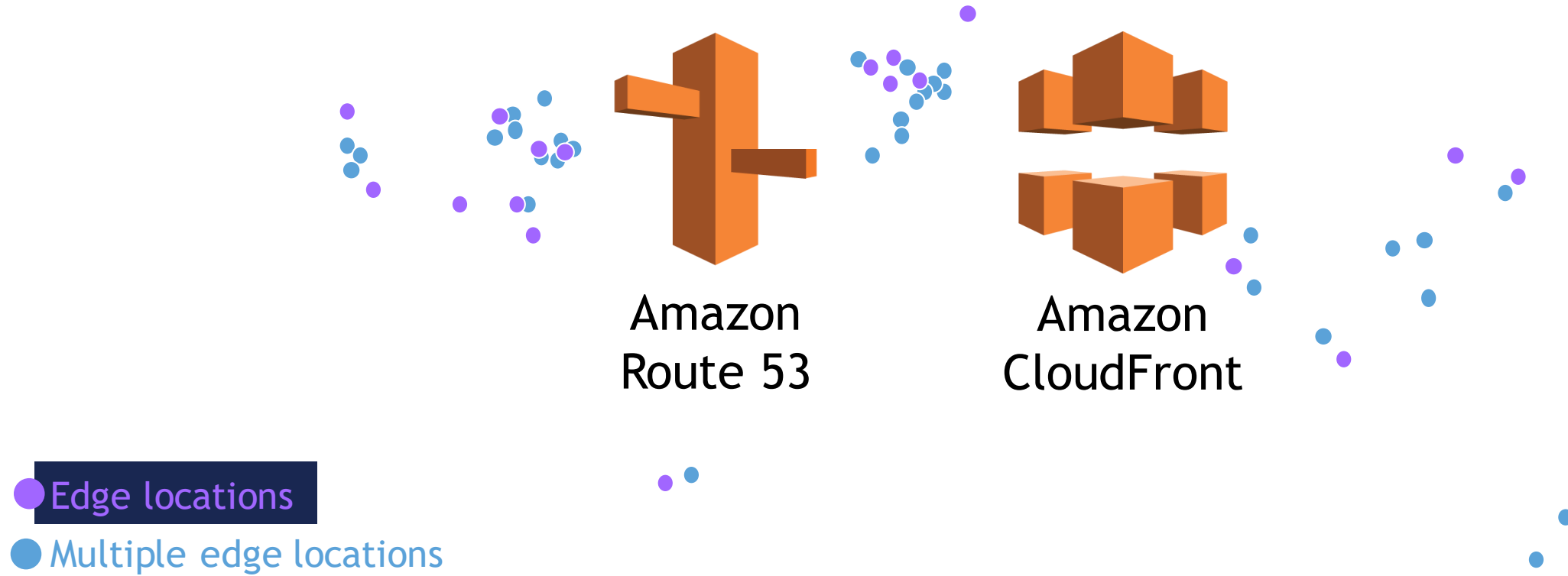
Amazon DynamoDB



Amazon
DynamoDB

- Unlimited Storage
- Fast, Consistent Performance
- **Fully Managed, NoSQL** database service
- Highly Scalable, Flexible
- Event Driven Programming
- Fine-grained Access Control

Amazon Route 53, Amazon CloudFront & Edge Locations



Storage



Amazon S3

WEB



Web Bucket



Distribution



Amazon Route 53

Monitor



Amazon CloudWatch

API



API Gateway



Lambda



SQS Queue



SNS Topic

Identity



AWS Directory Service



IAM

DB



Amazon DynamoDB



Amazon Aurora

Storage

WEB



Instances Auto Scaling

Monitor



Amazon CloudWatch

API



Instances Auto Scaling

Identity



Active
Directory

DB



Instance Instance



Amazon VPC



Storage

WEB



Instances



Auto Scaling

Monitor



Amazon CloudWatch

API



Instances



Auto Scaling

Identity



Active Directory

DB



RDS DB instance



RDS DB standby

Availability Zone

Availability Zone



Amazon VPC



Storage



Amazon S3

Monitor



Amazon CloudWatch

Identity



AWS Directory Service



IAM

WEB



Web Bucket



Auto Scaling



Distribution

API



Instances



Auto Scaling



DB



RDS DB instance

Availability Zone



RDS DB standby

Availability Zone

Storage



Amazon S3

WEB



Web Bucket



Distribution

Monitor



Amazon CloudWatch

API



API Gateway



Lambda



SQS Queue



SNS Topic

Identity



AWS Directory Service



IAM

DB



RDS DB
instance

Availability
Zone



RDS DB
standby

Availability
Zone

Storage



Amazon S3

WEB



Web Bucket



Distribution



Amazon Route 53

Monitor



Amazon CloudWatch

API



API Gateway



Lambda



SQS Queue



SNS Topic

Identity



AWS Directory Service



IAM

DB



Amazon DynamoDB



Amazon Aurora



Amazon
EC2



Amazon
VPC



AWS
Lambda



Elastic Load
Balancing



Amazon ECS



Amazon
Route 53



Amazon
CloudFront



Amazon
RDS



Amazon
DynamoDB



Amazon
Glacier



Amazon
S3



Amazon
SNS



Amazon
SQS



Amazon API
Gateway



IAM



AWS Directory
Service



Amazon
CloudWatch

Containers

Containers...

- A lightweight, stand-alone, executable **package of software** that includes **all dependencies**: code, runtime, system tools, system libraries, settings.
- Containers **isolate** software from its **surroundings**
- Containers **share** a machine's **OS kernel**.
- They **start fast** and use less compute and RAM.
- Images are **constructed** from **filesystem layers** and share common files. This minimizes disk usage and image downloads are much faster.
- Multiple containerization engines: **Docker**, Mesos, LXC, etc.

BUILDING AN ECOSYSTEM



Amazon ECS



Amazon ECR

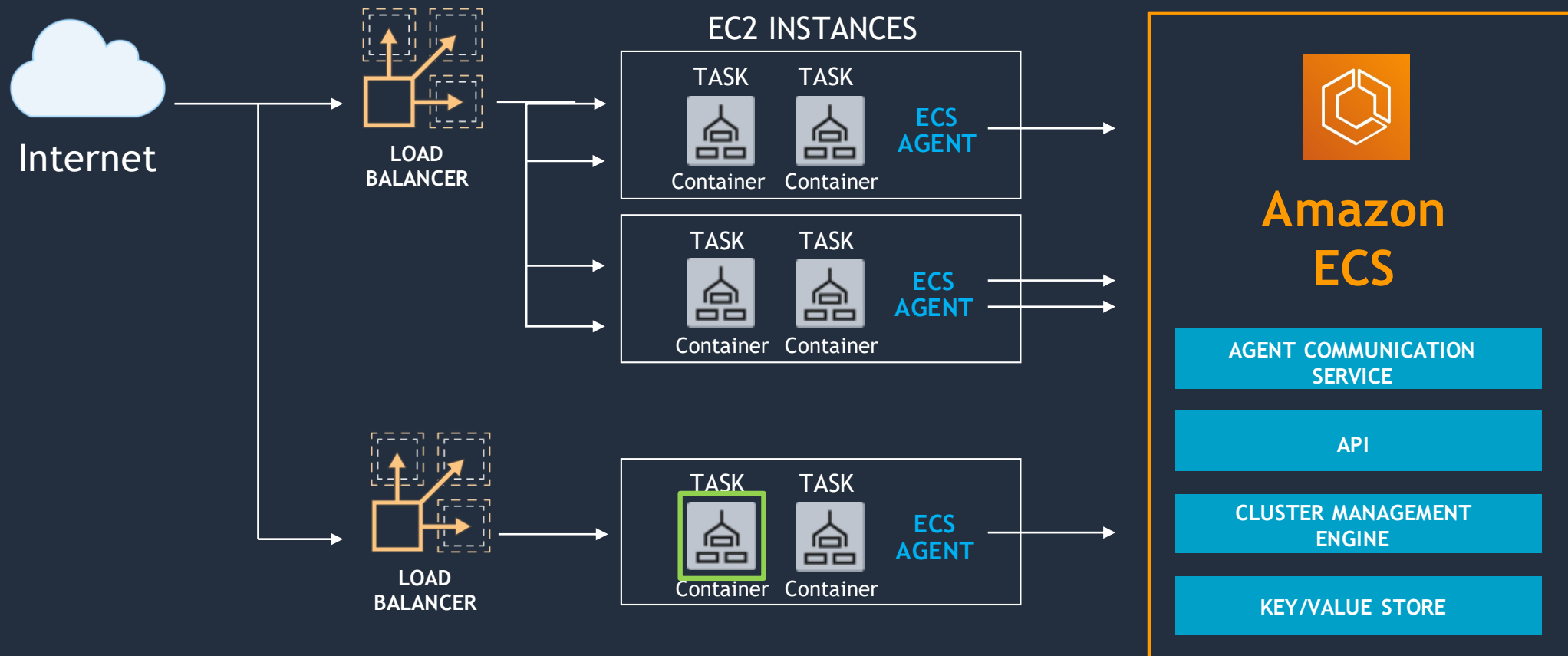


Fargate



Amazon EKS

ECS



Amazon Elastic Container Service for K8s (EKS)



57% of Kubernetes workloads
run on AWS today
— Cloud Native Computing Foundation

Compatibility

	Linux containers	Windows Server Core containers	Windows Nano Server containers
.NET Core	Supported	Supported	Supported
.NET Framework	Not Supported	Supported	Not Supported

	Linux containers	Windows containers
Amazon ECS	Supported	Supported
AWS Fargate	Supported	Not Supported
Amazon EKS	Supported	Supported (Preview)

Choose your base image

Nano Server

[mcr.microsoft.com/
windows/nanoserver:1809](https://mcr.microsoft.com/windows/nanoserver:1809)

Greenfield and
cloud-native applications

.NET Core

250 MB

Windows Server Core

[mcr.microsoft.com/
windows/servercore:1809](https://mcr.microsoft.com/windows/servercore:1809)

Brownfield and
Legacy applications

Full .NET Framework

4.56 GB

Windows

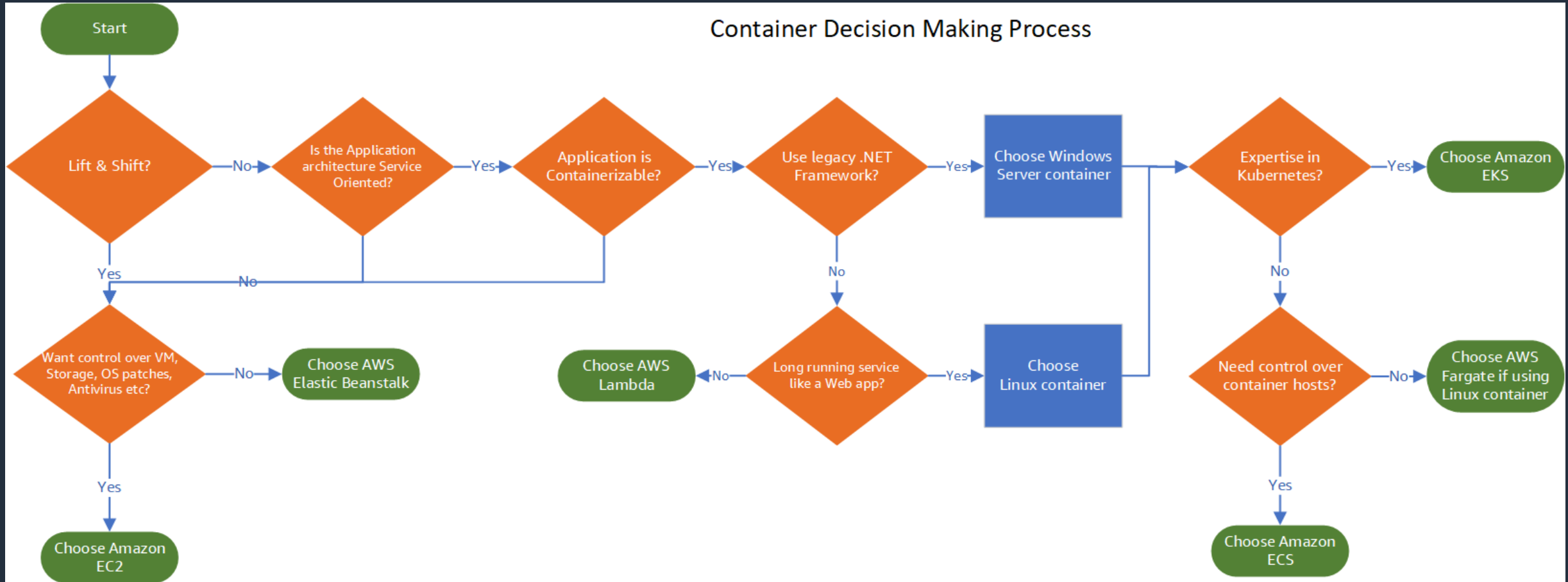
[mcr.microsoft.com/
windows:1809](https://mcr.microsoft.com/windows:1809)

Carries most
Windows OS components

Automation workloads

13.1 GB

Container decision making process



Application containerization



Keep .NET framework the same



Keep existing application architecture



Keep same version of components and application dependencies



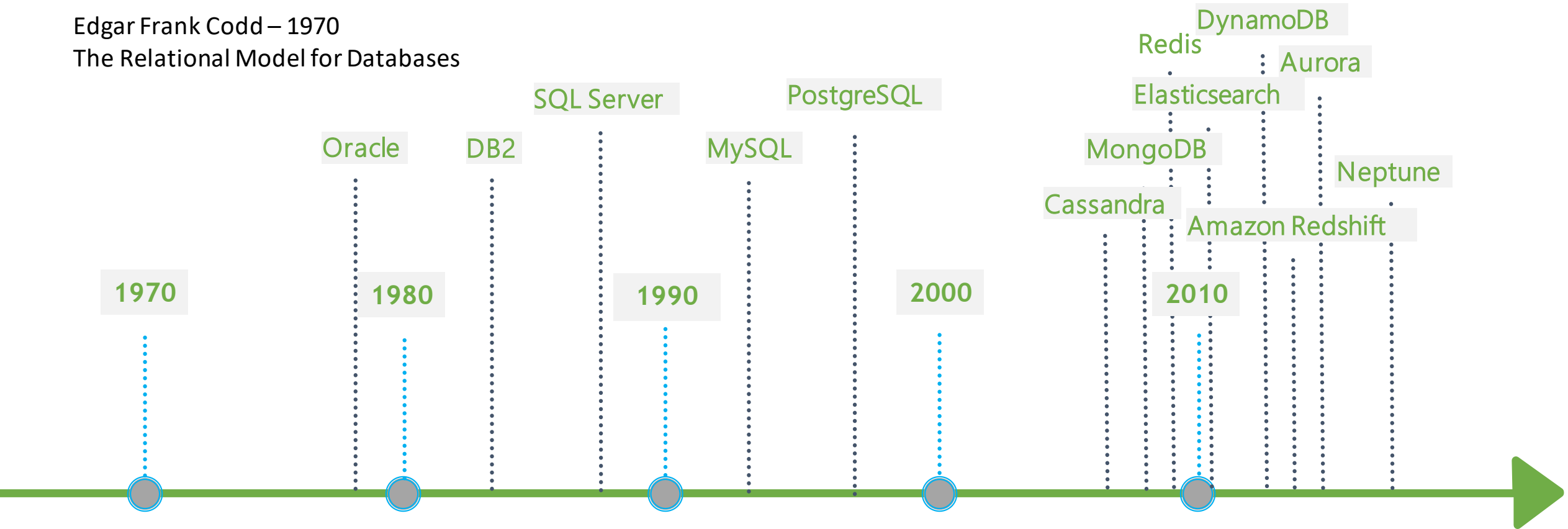
Keep the deployment simple: static and not elastic

Database

Evolution of databases

Edgar Frank Codd – 1970

The Relational Model for Databases



As of today,
DB-Engines is tracking
340+ databases



Common data categories and use cases

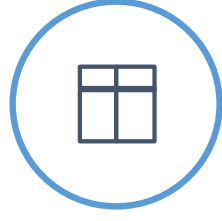


Relational

Referential integrity, ACID transactions, schema-on-write

Lift and shift, ERP, CRM, finance

Aurora, RDS



Key-value

High throughput, low-latency reads and writes, endless scale

Real-time bidding, shopping cart, social, product catalog, customer preferences

DynamoDB

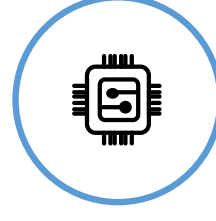


Document

Store documents and quickly access querying on any attribute

Content management, personalization, mobile

DocumentDB

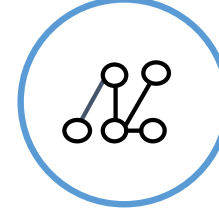


In-memory

Query by key with microsecond latency

Leaderboards, real-time analytics, caching

ElastiCache

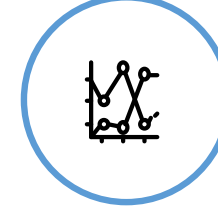


Graph

Quickly and easily create and navigate relationships between data

Fraud detection, social networking, recommendation engine

Neptune

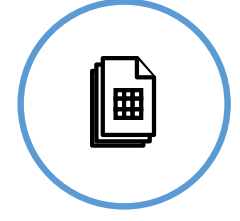


Time-series

Collect, store, and process data sequenced by time

IoT applications, event tracking

Timestream



Ledger

Complete, immutable, and verifiable history of all changes to application data

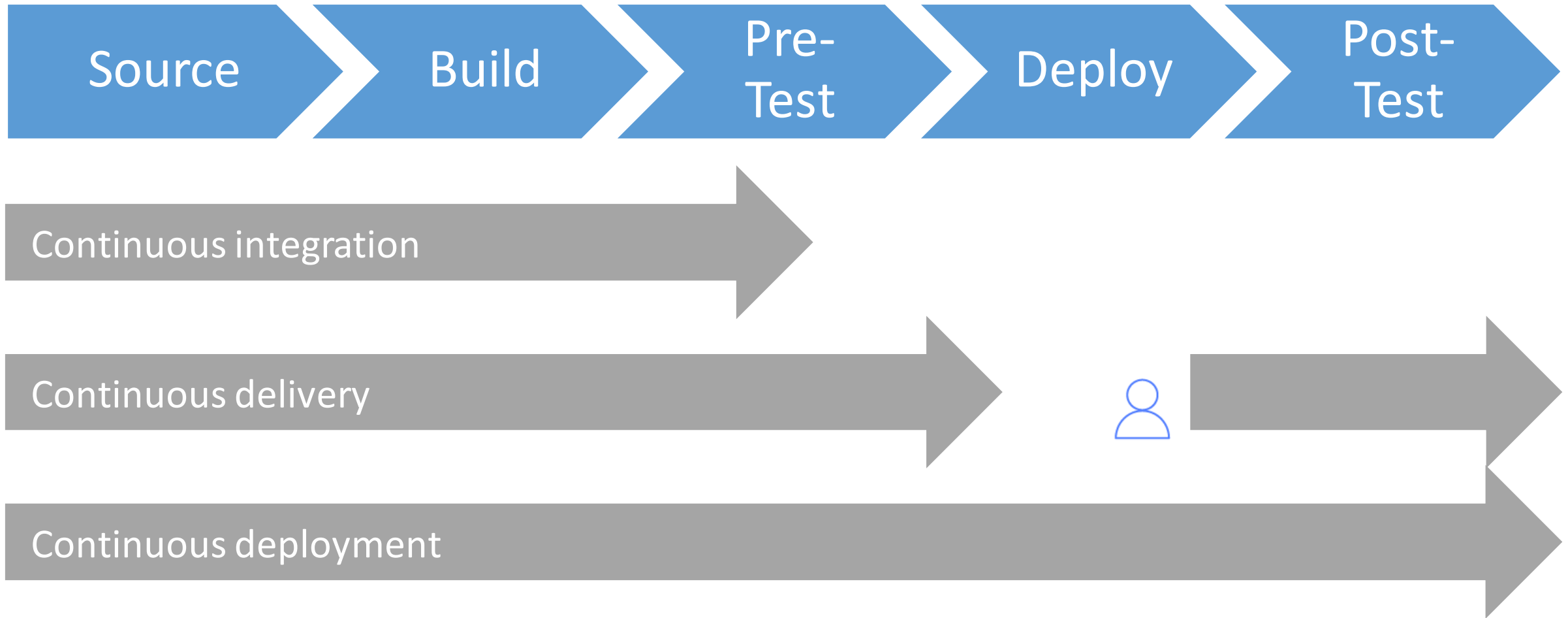
Systems of record, supply chain, health care, registrations, financial

QLDB

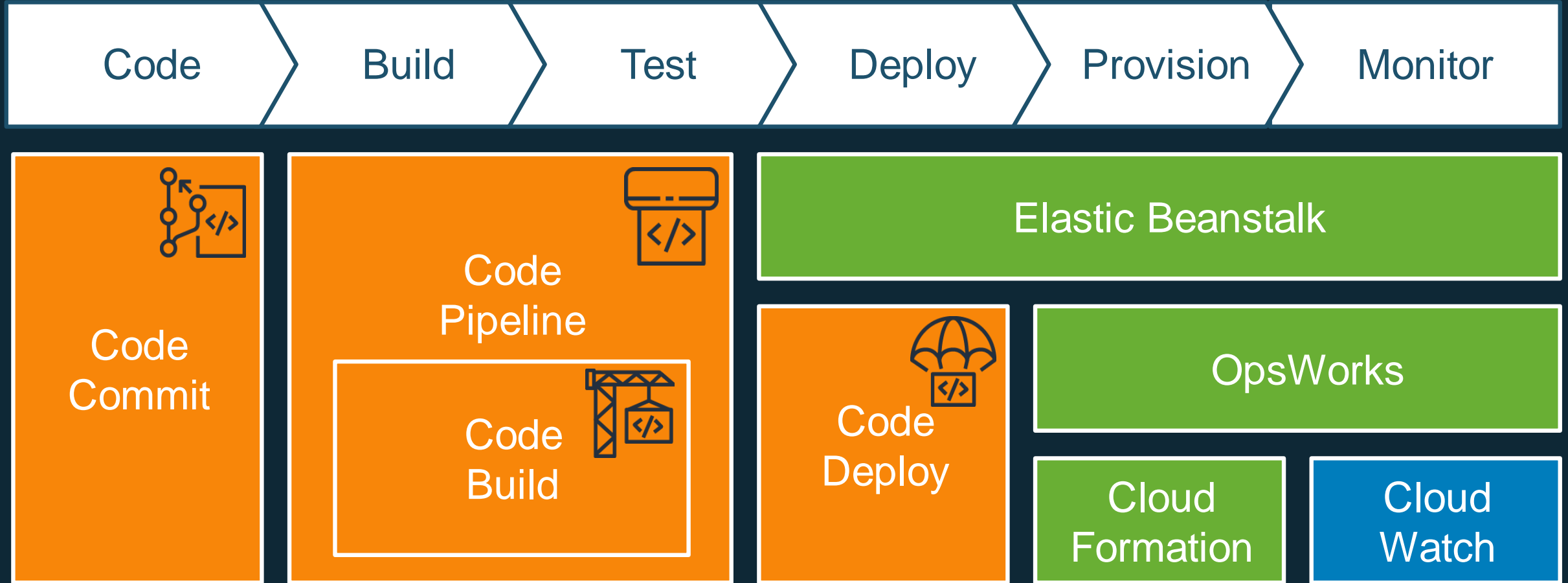
Common Use Cases

AWS Service(s)

What is continuous delivery/deployment?

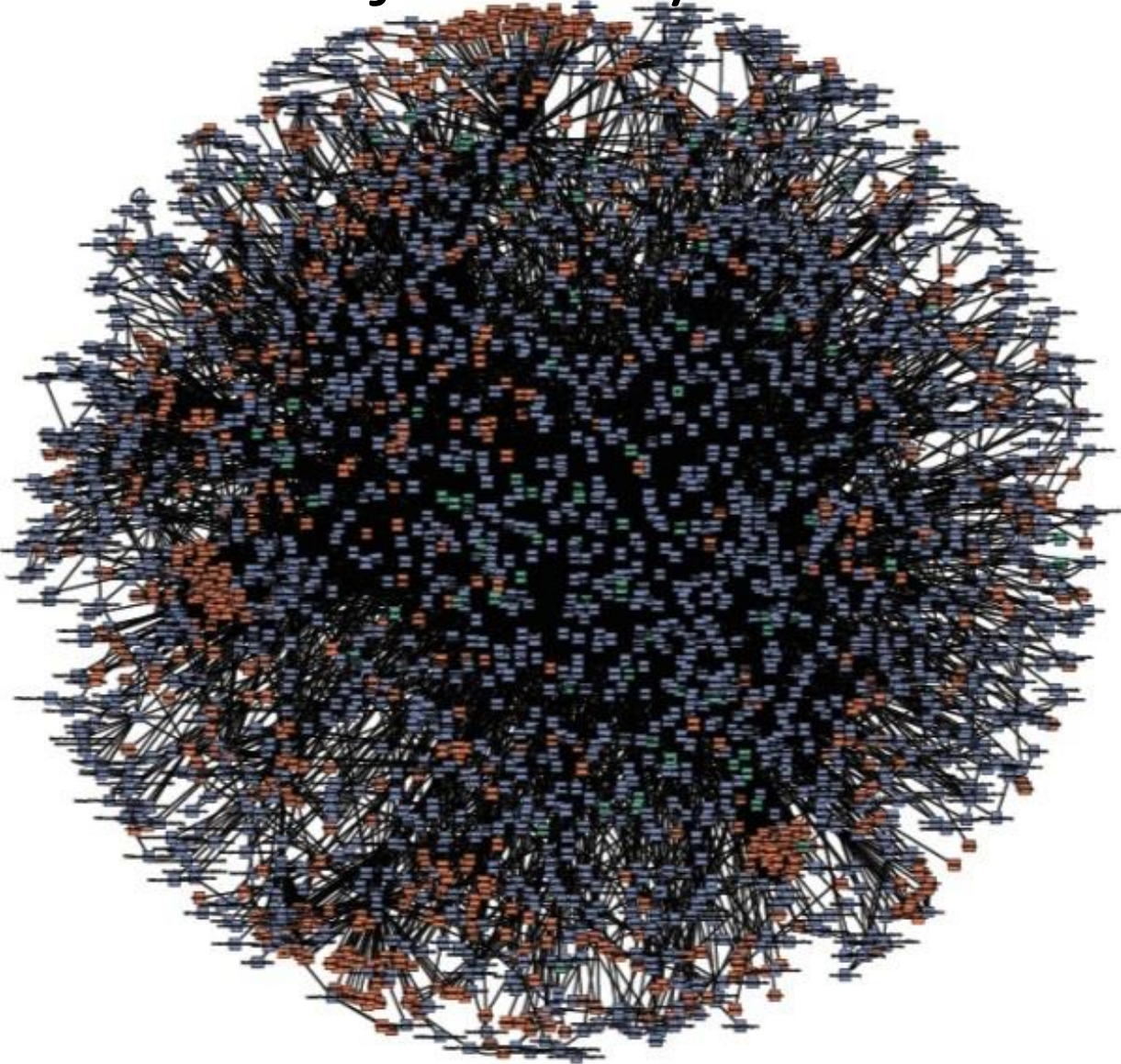


AWS DevOps Services



Demo...

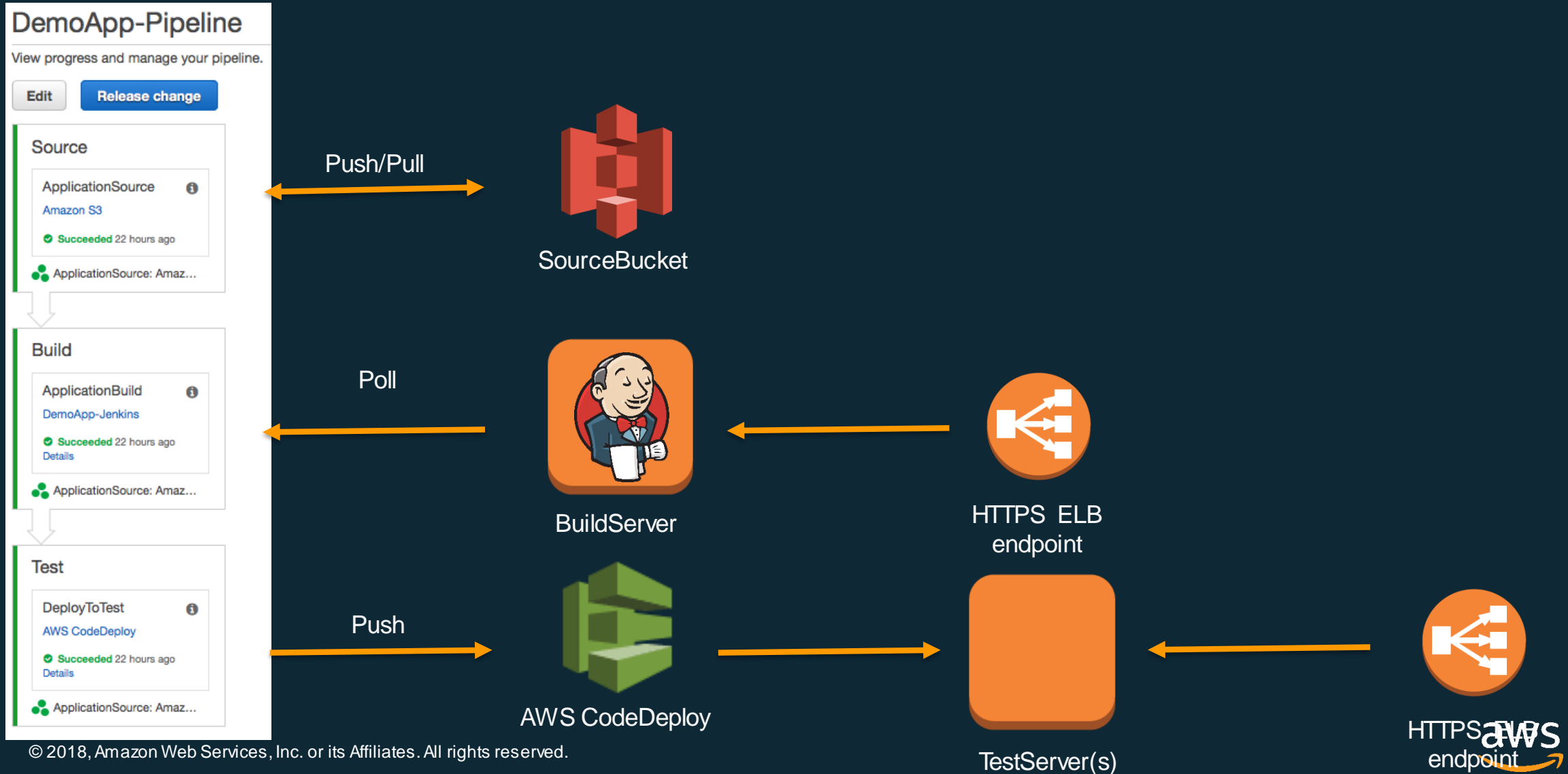
It's a journey...



Expect challenges along the way...

- Understanding of business domains
- Eventual Consistency
- Service discovery
- Lots of moving parts requires increased coordination
- Complexity of testing / deploying / operating a distributed system
- Cultural transformation

Example of a .NET CI/CD Pipeline



.NET on AWS - Development Tools

AWS Tools for
Visual Studio



AWS Tools for
Visual Studio
Code



AWS SDK
for .NET



AWS CLI



AWS Tools for
PowerShell and
PowerShell Core



AWS Tools
for Azure
DevOps



AWS SAM
for
Windows



AWS CDK
for .NET



AWS Services

More services and more functionality within those services

TECHNICAL & BUSINESS SUPPORT

Support Professional Services Optimization Guidance Partner Ecosystem Training & Certification Solutions Management Account Management Security & Billing Reports Personalized Dashboard

MARKETPLACE

Business Apps Business Intelligence DevOps Tools Security Networking Databases Storage

ANALYTICS

Data Warehousing
Business Intelligence
Hadoop/Spark
Streaming Data Analysis
Streaming Data Collection

Elasticsearch
Data Pipelines
Interactive SQL Queries
ETL

DEV OPS

One-click App Deployment
Resource Templates
Build & Test
Application Lifecycle Management
DevOps Resource Management
Triggers
Containers
Analyze & Debug
Patching

MOBILE SERVICES

API Gateway
Single Integrated Console
Identity
Sync
Mobile Analytics
Mobile App Testing
Targeted Push Notifications

IoT

Rules Engine
Device Shadows
Device SDKs
Device Gateway
Registry
Local Compute

MACHINE LEARNING

Custom Model Training & Hosting
Image & Scene Recognition
Facial Recognition & Analysis
Facial Search
Text to Speech
Conversational Chatbots
Deep Learning (Apache MXNet, TensorFlow, & others)

ENTERPRISE APPS

Virtual Desktops
Sharing & Collaboration
Corporate Email
App Streaming
Communications
Contact Center

HYBRID ARCHITECTURE

Data Integration
Integrated Networking
Integrated Identity & Access
Integrated Resource & Deployment Management
Integrated Devices & Edge Systems

MIGRATION

Schema Conversion
Exabyte-Scale Data Migration
Application Migration
Database Migration
Server Migration

APP SERVICES

Queueing & Notifications
Workflow
Search
Email
Transcoding

INFRASTRUCTURE

Regions
Availability Zones
Points of Presence

CORE SERVICES

Compute
Storage
Networking
Databases
CDN

SECURITY & COMPLIANCE

Identity Management
Access Control
Monitoring & Logs
Assessment & Reporting
Resource & Usage Auditing
Web Application Firewall
DDOS Protection

MANAGEMENT TOOLS

Manage Resources
Service Catalogue
Configuration Tracking
Monitoring
Server Management
Resource Templates