



# Welcome Back to AWS Cloud Practitioner

## With Michael and Irfan

Class will begin at 10:00 am Central Standard Time

# Amazon CloudWatch

- Amazon CloudWatch is used for management and governance
- It is a monitoring and management service designed for developers, system operators, site reliability engineers (SRE), and managers
- CloudWatch offers data, meaningful metrics, and actionable insights to:
  - Monitor applications
  - Recognize and respond to system-wide performance changes
  - Optimize resource utilization
  - Gain a unified view of operational health





# CloudWatch Use Cases

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- Monitor critical metrics and logs, visualize application and infrastructure stacks, generate alarms, and correlate metrics and logs to recognize and resolve the root cause of performance issues
- Monitor applications and Trigger automated CloudWatch Alarms and Lambda workflows to enhance the customer experience
- Explore, analyze, and visualize logs instantly to optimize resources, leverage CloudWatch Alarms to automate capacity, and do resource planning for Auto Scaling

# Amazon CloudWatch Dashboards

Screenshot of the Amazon CloudWatch Dashboards interface showing the "Add to this dashboard" modal.

The sidebar on the left shows the navigation menu:

- CloudWatch
- Dashboards** (selected)
- MyDashboard
- Alarms
  - ALARM (0)
  - INSUFFICIENT (0)
  - OK (0)
- Billing
- Events
- Rules
- Event Buses
- Logs
- Insights
- Metrics
- Favorites
- + Add a dashboard

The main area displays the "Add to this dashboard" modal with the following content:

Add to this dashboard

Select a widget type to configure and add to this dashboard.

Line

Stacked area

Number

Text

Query results

Compare metrics over time

Compare the total over time

Instantly see the latest value for a metric

Free text with markdown formatting

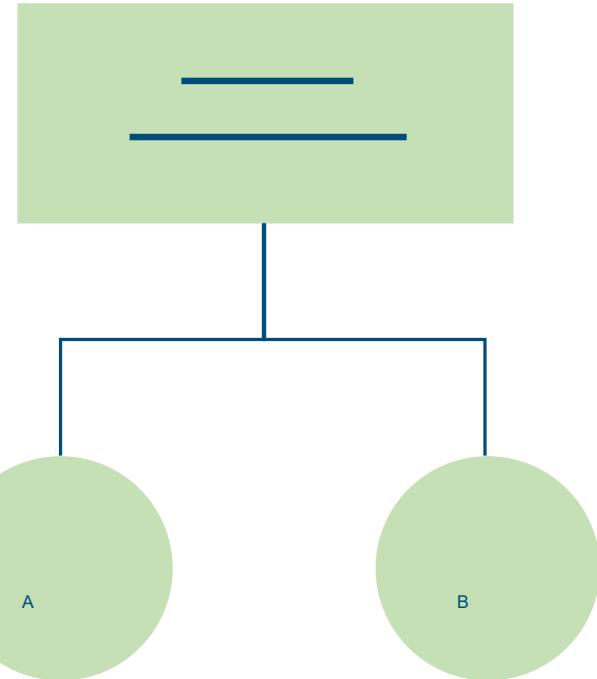
Explore results from Logs Insights

Cancel

Configure

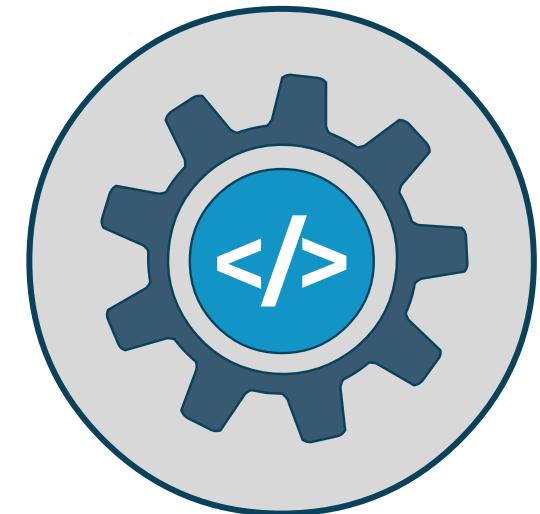
# AWS CloudTrail

- With CloudTrail, customers can log, continuously monitor, and retain account activity related to all API calls across the AWS infrastructure
- Within CloudTrail, CloudTrail Insights can be enabled where CloudTrail can automatically detect unusual API activities in AWS accounts
- Example:** CloudTrail Insights could detect that a higher number of Amazon EC2 instances than usual have recently launched in an account or abnormal account activity has occurred then review the full event details to determine which actions need to be taken next

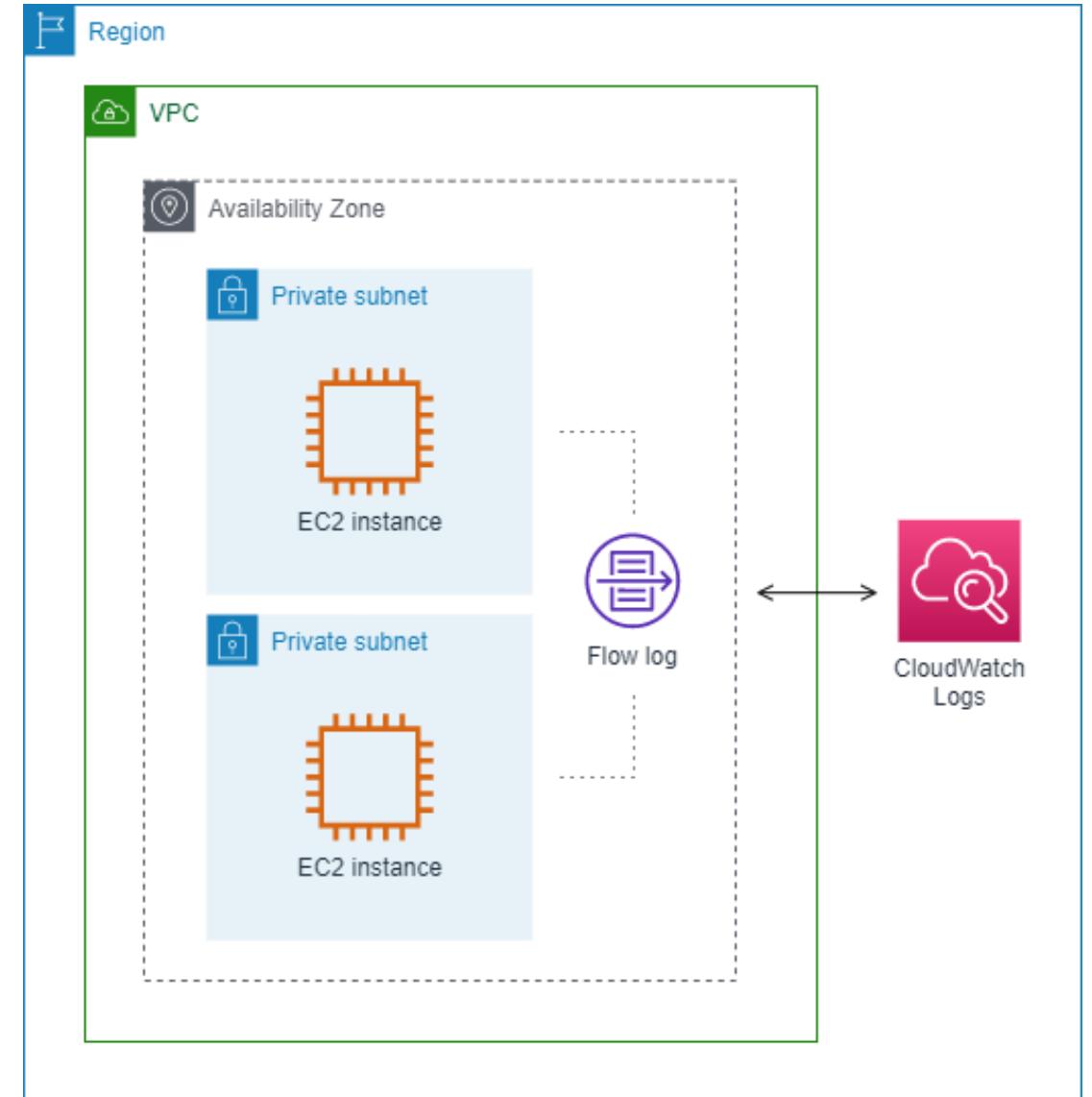
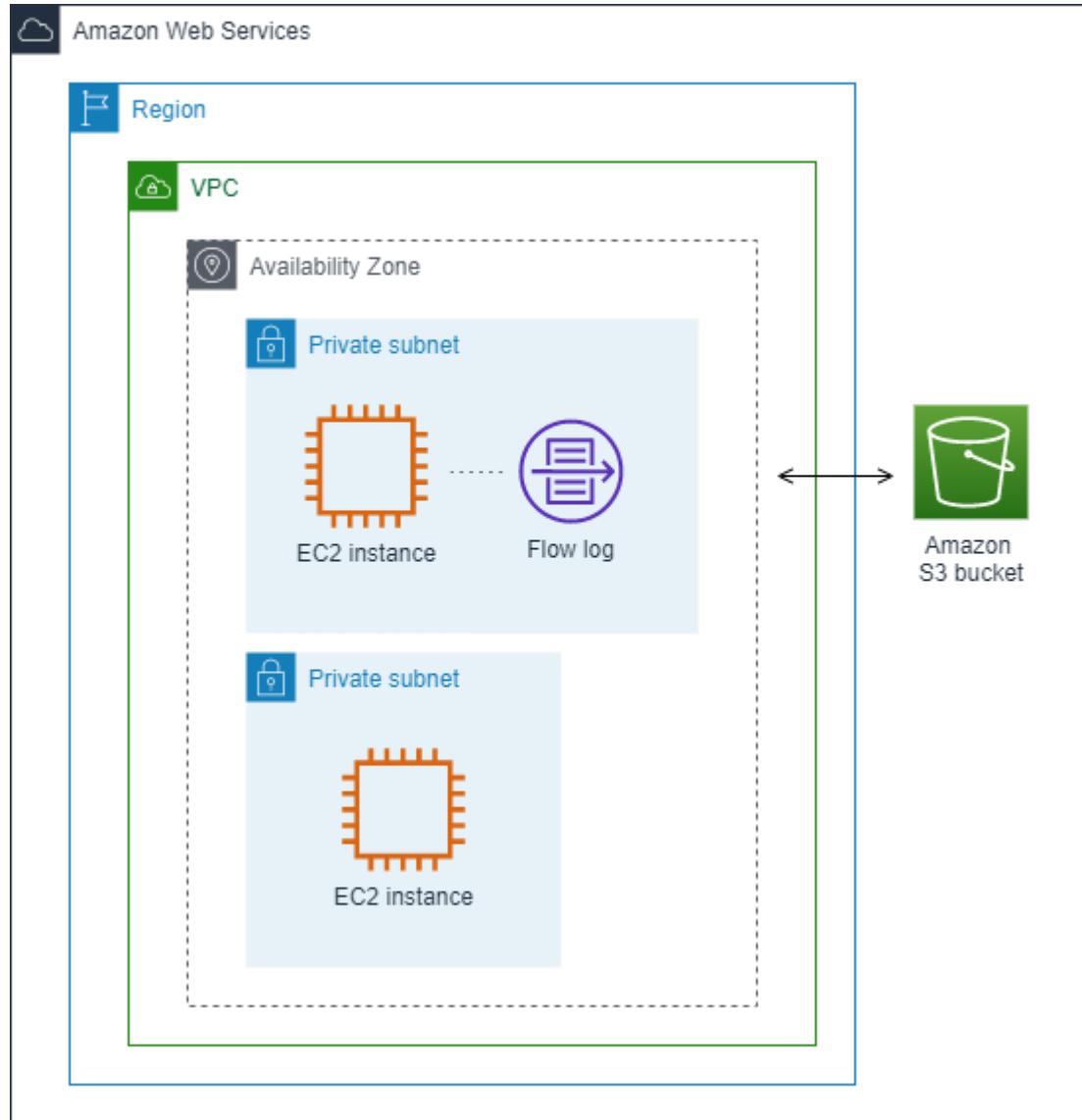


# AWS CloudTrail Use Cases

- Detect that a higher number of Amazon EC2 instances than usual have recently launched
- Identify which users and accounts called AWS, the source IP address from which the calls were made, and when the calls occurred
- Create a workflow to add a specific policy to an Amazon S3 bucket when CloudTrail logs an API call that makes that bucket public
- Connect your VPC to CloudTrail by defining an interface VPC endpoint for CloudTrail
- **Exam: CloudTrail is one of the most common tools for getting insights into security events at AWS**



# AWS Flow Logs



# Security Hub

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- Customers can use AWS Security Hub to automate security best practice checks, combine security alerts into a single place and format, and understand the global overall security posture across accounts
- It is similar to a virtual security operations center (SOC) for the public and hybrid cloud deployment
- **Exam: Use security Hub to generate a unified report across all security services**

# Security Hub Use Cases

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- Conduct continuous monitoring and visibility
- Trigger automated responses
- Visualize the security posture of AWS-based applications
- Perform Cloud Security Posture Management (CSPM)
- Initiate Security Orchestration, Automation, and Response (SOAR) workflows
- Save time and money by simplifying integrations
- Discover new security findings and insights

# Amazon Inspector

- Inspector is an automated vulnerability management service that continually scans AWS workloads for weaknesses and inadvertent network exposures
- It automatically finds and scans running Elastic Compute Cloud (EC2) instances, container images in Amazon Elastic Container Registry (ECR) and AWS Lambda functions for known vulnerabilities and unintended exposure



# Amazon Inspector

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- Amazon Inspector creates a finding when it discovers a software vulnerability or network configuration issue
- A finding describes the vulnerability, identifies the affected resource, rates the severity of the vulnerability, and provides remediation guidance
- Customers can analyze results using the Amazon Inspector console or visualize and process discoveries through other associated AWS services

# AWS Shield Standard and Advanced

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- Standard provides DDoS protection provided at no extra cost
- Basic protection against common DoS floods and exploits
- Most common DDoS comes from botnet servers
- Combined with GuardDuty, NACLs, SGs, and WAF for layered defense
- Additional protection from known DDoS attacks with Shield Advanced
  - **Advanced must also have a Business or Enterprise support plan for 24/7 DRT**



# AWS GuardDuty

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- GuardDuty is a managed threat detection service that constantly monitors for malevolent and unauthorized behavior
- Watches out for unusual application programming interface (API) calls or potentially unauthorized deployments that indicate a possible account compromise (zero day)
- Detects potentially compromised instances or reconnaissance by advanced persistent threat actors
- Utilizes proprietary machine learning (ML) and artificial intelligence (AI) along with strategic partners like CrowdStrike, Splunk, Trend Micro, Trustwave, Rapid7, and Alert Logic



# AWS GuardDuty

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- The finding details include information about what occurred, what AWS resources were involved in the suspicious activity, when this activity took place, and other data
- The finding type provides a description of the potential security issue:  
Recon:EC2/PortProbeUnprotectedPort
- GuardDuty now uses AI to conduct “pre-crime” identification of bad actors 7-10 days in advance of malware release



# Amazon Detective

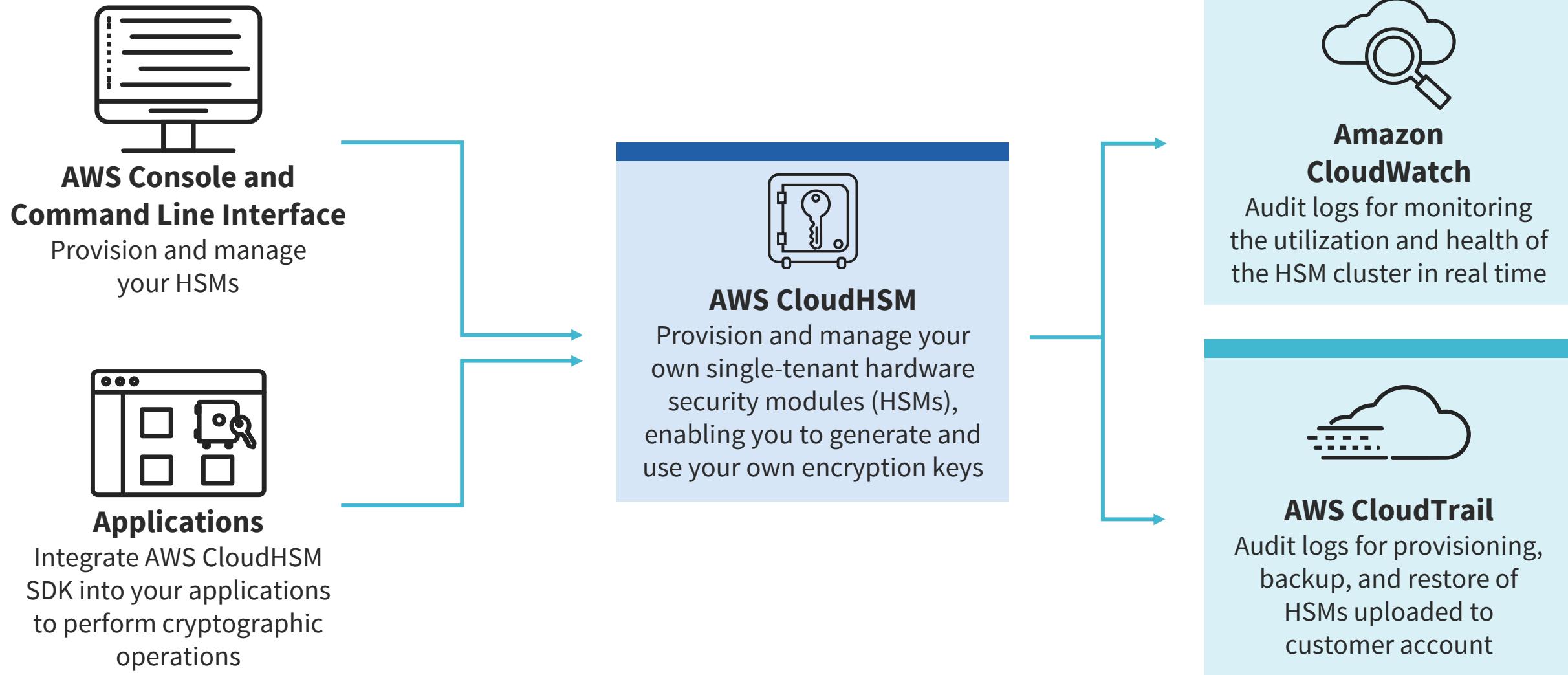
- Amazon Detective streamlines the investigative process and assists security teams in performing rapid and efficient eDiscovery initiatives
- Customers can quickly analyze and determine the nature and extent of possible security issues with Amazon Detective prebuilt data aggregations, summaries, and context
- Detective automatically gathers log data from AWS resources and uses machine learning (ML), statistical analysis, and graph theory to generate a linked dataset to drive more efficient security inquiries

# Amazon Macie

- Amazon Macie is a data security service that uses machine learning (ML) and pattern matching to discover and help protect the customer's sensitive data
- Macie discovers sensitive data and provides visibility into data security risks, allowing automated protection against those risks
- It is also a common service to deploy behind an API gateway with serverless technologies



# AWS CloudHSM



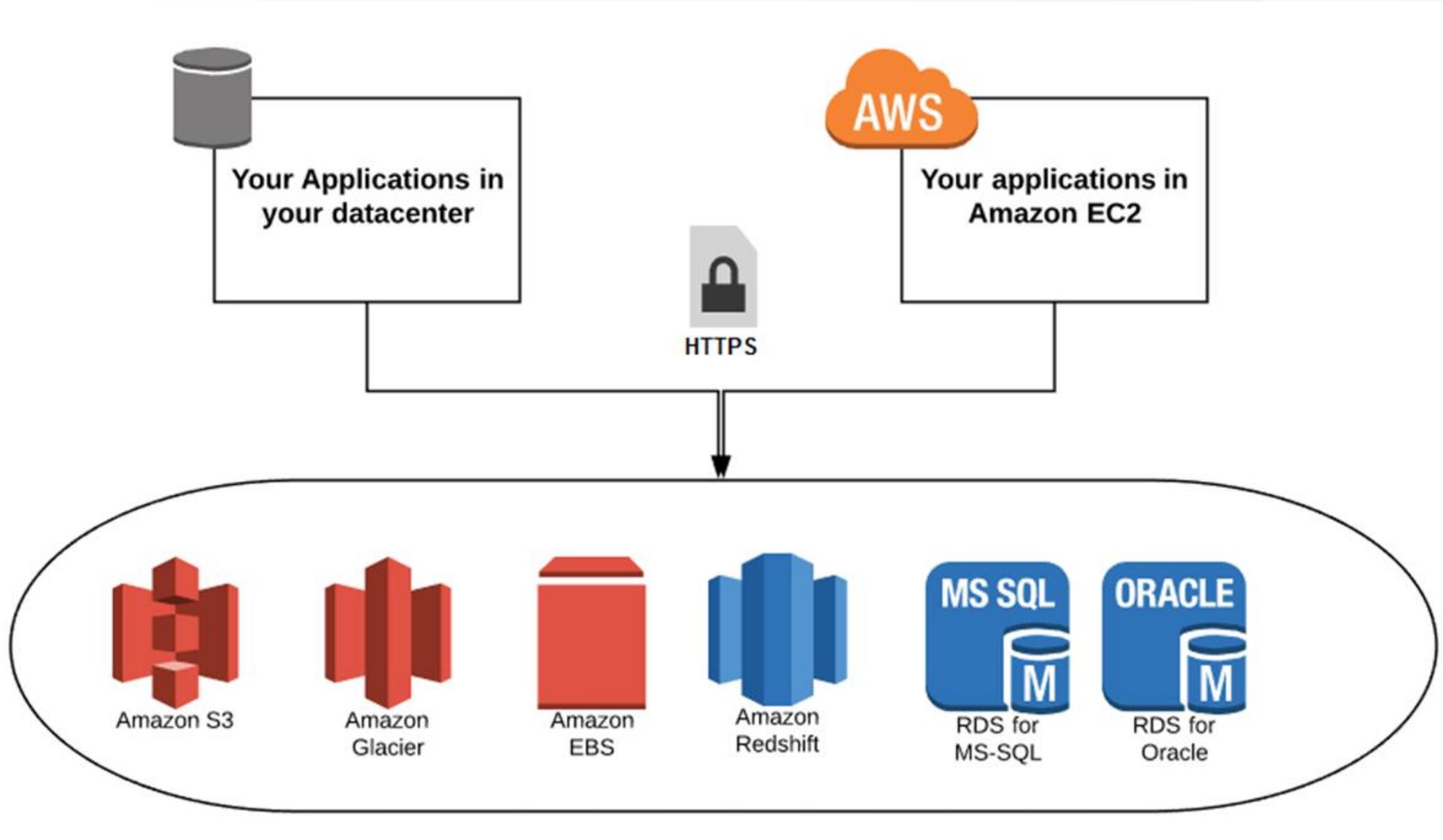
# AWS Security Blog

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- The AWS Security Blog features regular posts by AWS experts and other industry professionals
- The blog articles are an excellent research and information-gathering source for all things AWS
- Customers can search based on various categories, topics, keywords, products, solutions, industries, and even learning levels



# Client vs. Server-side Encryption



# AWS Key Management Service (AWS KMS)

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- AWS Key Management Service (AWS KMS) lets customers create, manage, and control cryptographic keys across most applications and services
- AWS KMS can encrypt data across AWS workloads, digitally sign data, encrypt within applications using the AWS Encryption SDK, and generate and verify message authentication codes (MACs)
- The customer managed keys (CMKs) never leave the AWS FIPS 140-validated HSMs unencrypted
- Customers have complete control over permissions, administration, and usage across AWS services

**KMS**

Volume Type	Device	Snapshot	Size (GiB)	Volume Type	IOPS	Throughput (MB/s)	Delete on Termination	Encryption
Root	/dev/xvda	snap-04a92f3aceecdbef	8	General Purpose SSD (gp2)	100 / 3000	N/A	<input checked="" type="checkbox"/>	Not Encrypted
EBS	/dev/sdb	Search (case-insensit	8	General Purpose SSD (gp2)	100 / 3000	N/A	<input type="checkbox"/>	Not Encrypted

# AWS CloudFormation

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- AWS CloudFormation empowers customers to model, deploy, and manage AWS and third-party resources by handling infrastructure as code
- The cloud template language comes in either JSON or YAML formats
- Customers can automate, test, and deploy infrastructure templates with continuous integration and delivery (CI/CD) automations

# Working with AWS EC2 Instance Types

In this demo...

- You will explore AWS EC2, Instance Types
- <https://aws.amazon.com/ec2/instance-types/>



## AWS Batch

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- AWS Batch lets developers, scientists, and engineers powerfully run batch jobs
- Customers can analyze:
  - Financial services
  - Life sciences
  - Digital media
- **Exam: AWS Batch for running hundreds of thousands of batch and machine learning computing jobs without installing software or servers**

# Reserved Instance Behavior and Flexibility

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- Amazon EC2 Reserved Instances (RIs) offer a substantial discount (up to 72%) when compared to On-Demand pricing
- RIs can deliver a capacity reservation, offering extra confidence in the ability to launch the number of instances reserved when needed
- Customers have the flexibility to change families, OS types, and tenancies while benefitting from RI pricing when they use **Convertible RIs**



A circular inset photograph in the bottom-left corner shows a young woman with long dark hair, wearing a light-colored top, looking down at a tablet device she is holding. She is positioned in front of a server rack with numerous blue cables and lights visible behind her.

# Amazon EC2 RI Instance Types

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- **Standard RIs** provide the most significant discount (up to 72% off On-Demand) for regular usage
- **Convertible RIs** provide a discount (up to 54% off On-Demand) and the capability to change the attributes of the RI if the exchange leads to the creation of Reserved Instances of equal or greater value
- **Scheduled RIs** are available to launch within the time windows you reserve

# Instance Type Comparisons

Characteristic	Standard	Convertible
Terms (avg. discount off On-Demand)	1Yr (40%), 3yr (60%)	1yr (31%) 3yr ( 54%)
Charge Availability Zone, instance size (for Linux OS), networking type	Yes (using ModifyReservedInstances API and console)	Yes (using ExchangeReservedInstances API and console)
Change instance families, operating system, tenancy, and payment option		Yes
Benefit from price reductions		Yes

# Spot Instances

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- EC2 Spot Instances leverage unused EC2 capacity in the AWS cloud
- They are available at up to a 90% discount compared to On-Demand prices
- Spot Instances for various stateless, fault-tolerant, or flexible applications such as big data, containerized workloads, CI/CD, web servers, high-performance computing (HPC), and test & development workloads



# Savings Plans

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- Savings Plans provides low prices in exchange for commitment and the commitment cannot be changed after purchase
- **Compute** Savings Plans offer the most flexibility and prices that are up to 66 percent off On-Demand rates
- **EC2 Instance** Savings Plans provide savings up to 72 percent off On-Demand
- **SageMaker** Savings Plans provide savings up to 64 percent off On-Demand rates





## Dedicated Hosts and Instances

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- An important difference between a Dedicated Host and a Dedicated instance is that a Dedicated Host gives the customer additional visibility and control over how instances are placed on a physical server
- Customers can consistently deploy their instances to the same physical server over time

# AWS Placement Groups

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- A placement group is a configuration option that AWS offers that lets customers house a group of interdependent EC2 instances in a certain way across the underlying hardware on which those instances reside
- The instances could be placed close together, spread through different racks, or spread through different AZs



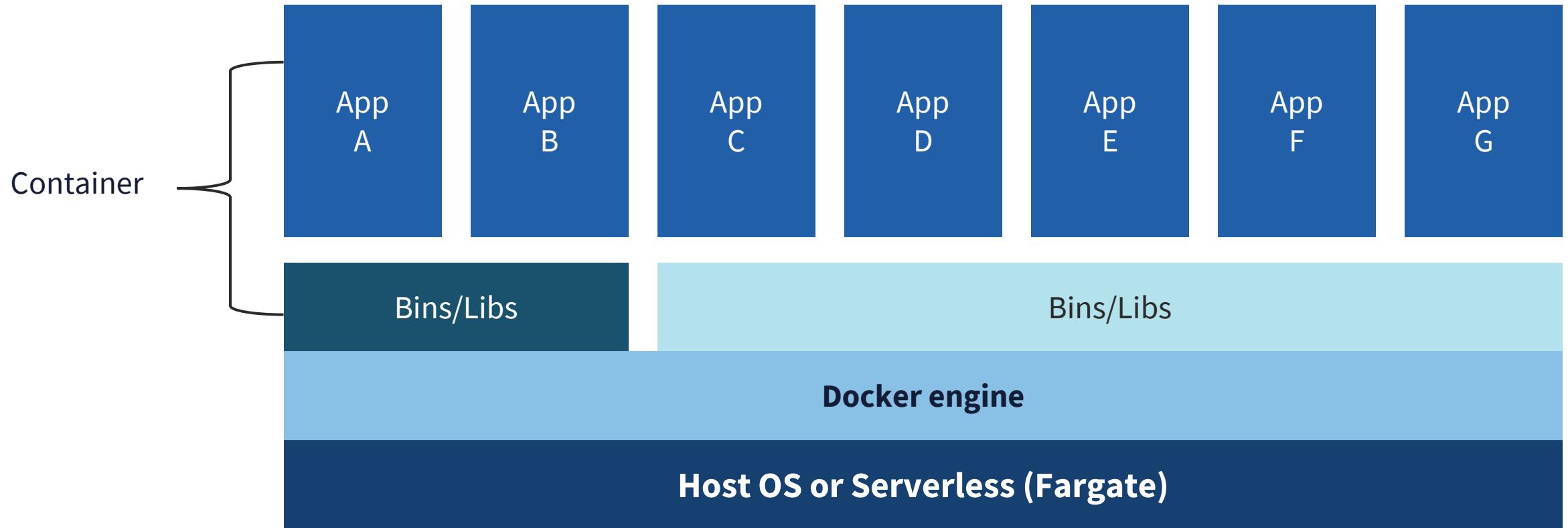
# Containers Defined

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- In AWS, customers can also build and run containerized applications
- A container is a discrete environment within an operating system (or a serverless architecture) where one or more applications can run that is typically assigned all the resources and dependencies needed to function
- It is a modular and portable environment that includes the application binaries, software dependencies, and hardware requirements wrapped up into an independent, self-contained unit

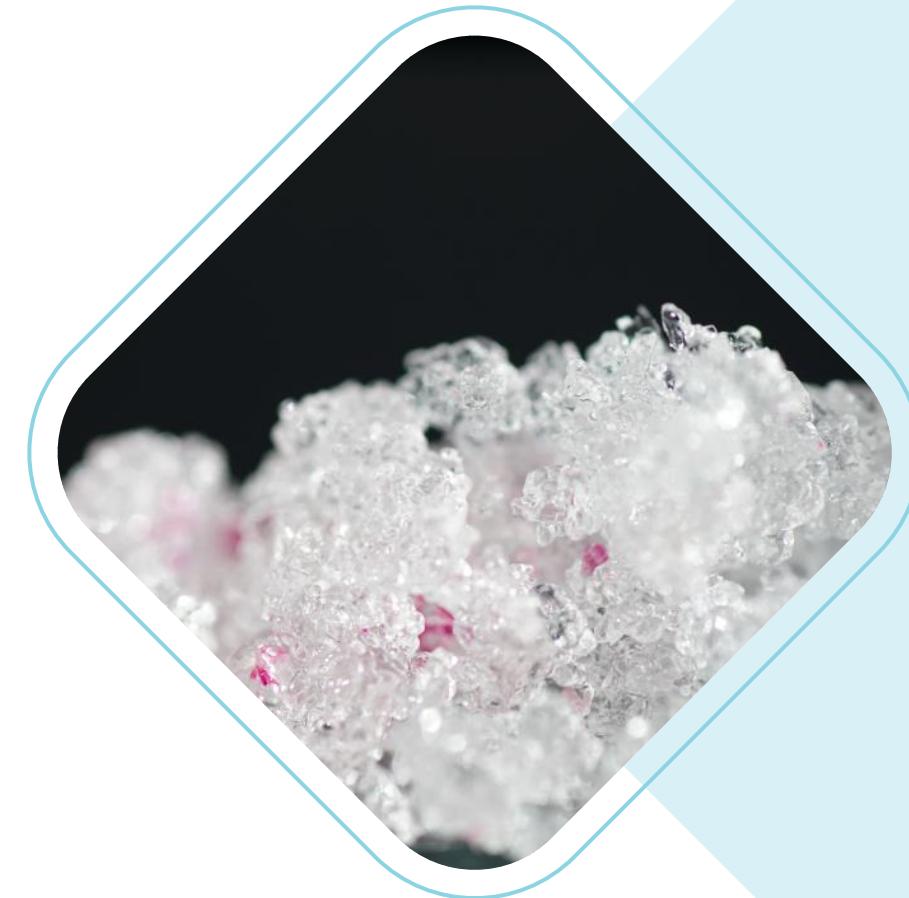
# Application Containers



# Microservices

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- Microservices are specific service-oriented application components made up of small independent services that communicate over well-defined APIs for notification and process queueing
- Microservices make applications and apps faster to develop and easier to scale by small, self-contained teams of developers
  - **Microservices are about the design of software**
  - **Containers are about packaging software for deployment**





## Lightsail

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- Lightsail allows companies to build small business applications such as file storage and sharing, backups, financial and accounting software, and more
- Customers can build a website in just a few clicks, with pre-configured applications like WordPress, Magento, Prestashop, and Joomla
- Some customers can easily create and delete development sandboxes and test environments risk free

# AWS Elastic Beanstalk

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- Elastic Beanstalk is an AWS service for deploying and scaling web applications and services
- Customers can upload their code and let Elastic Beanstalk automatically handle the deployment
- Beanstalk does everything from capacity provisioning, load balancing, and auto scaling to application health monitoring



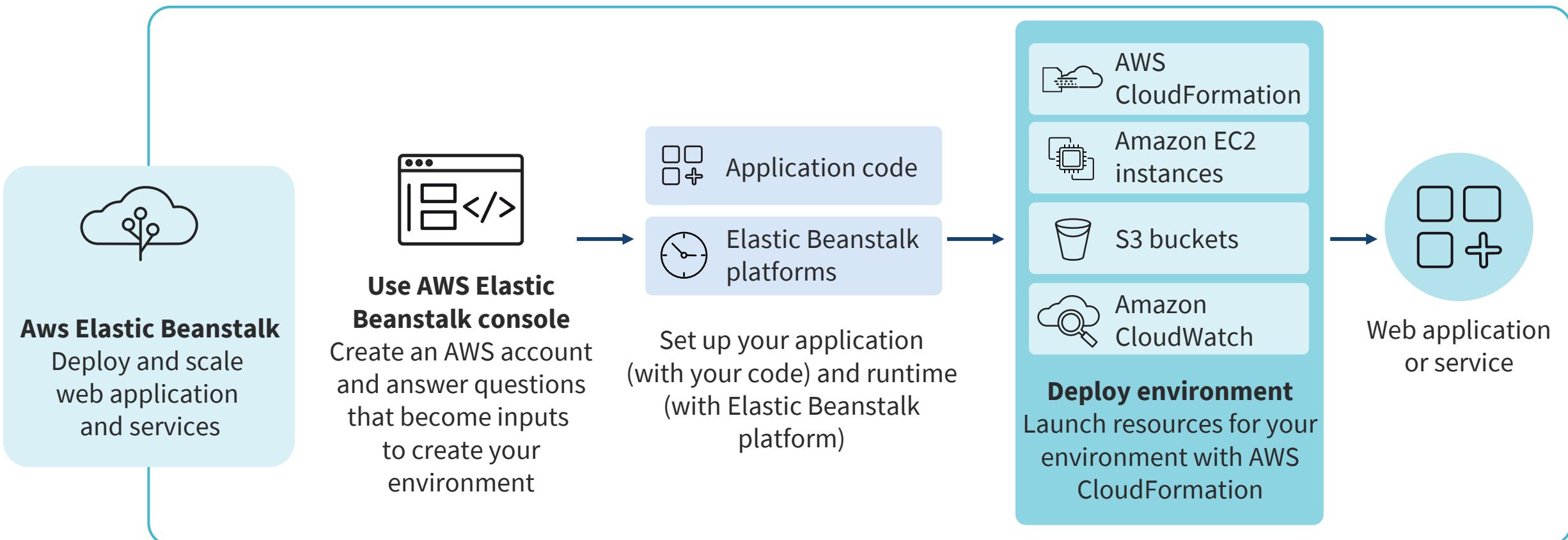


# AWS Elastic Beanstalk

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- Rapidly launch web applications
  - Deploy scalable web applications in minutes without the overhead of provisioning and handling the underlying infrastructure
- Create mobile application programming interface (API) backends for the applications
  - Use the desired programming language to build mobile API backends
- Replatform critical business applications
  - Customers can migrate stateful applications based on legacy infrastructure to Elastic Beanstalk and then connect securely to private networks if desired

# Elastic Beanstalk

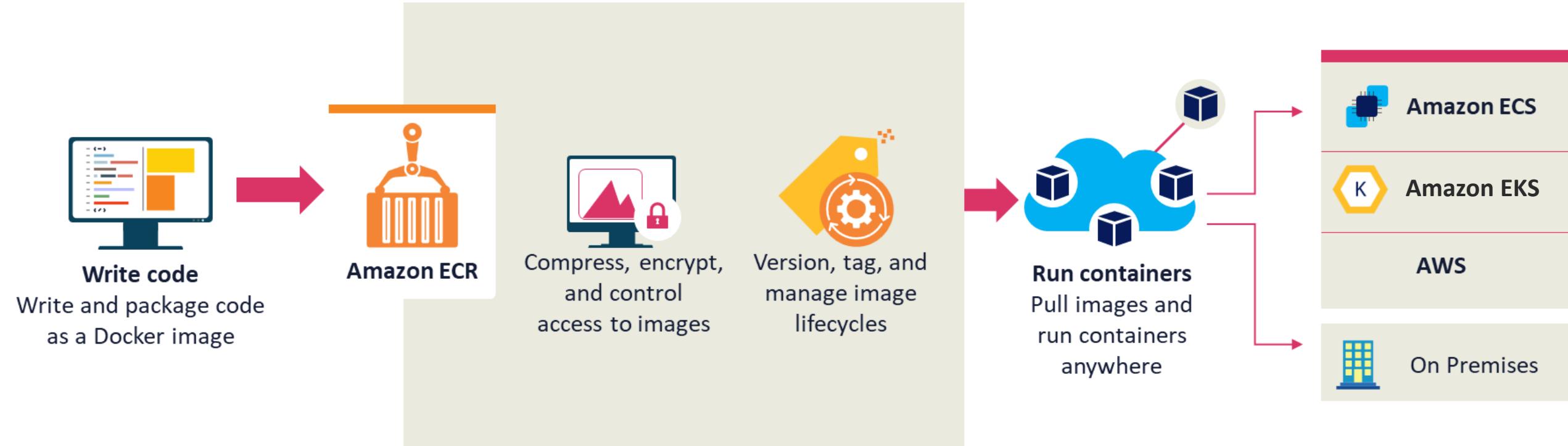


# Amazon Elastic Container Registry (Amazon ECR)

- Amazon Elastic Container Registry (Amazon ECR) is a fully managed container registry offering high-performance hosting
- Customers can dependably deploy application images and artifacts anywhere
- Developers can manage software vulnerabilities, streamline deployment workloads, and manage image lifecycle policies



# Amazon Elastic Container Registry (Amazon ECR)



# Amazon Elastic Kubernetes Service (Amazon EKS)

- Amazon EKS is a managed Kubernetes service that makes it easy to run Kubernetes on AWS and on-premises
- EKS automatically manages the availability and scalability of the Kubernetes control plane nodes responsible for scheduling containers, managing application availability, storing cluster data, and more
- EKS offers all the performance, scalability, reliability, and availability of the AWS infrastructure





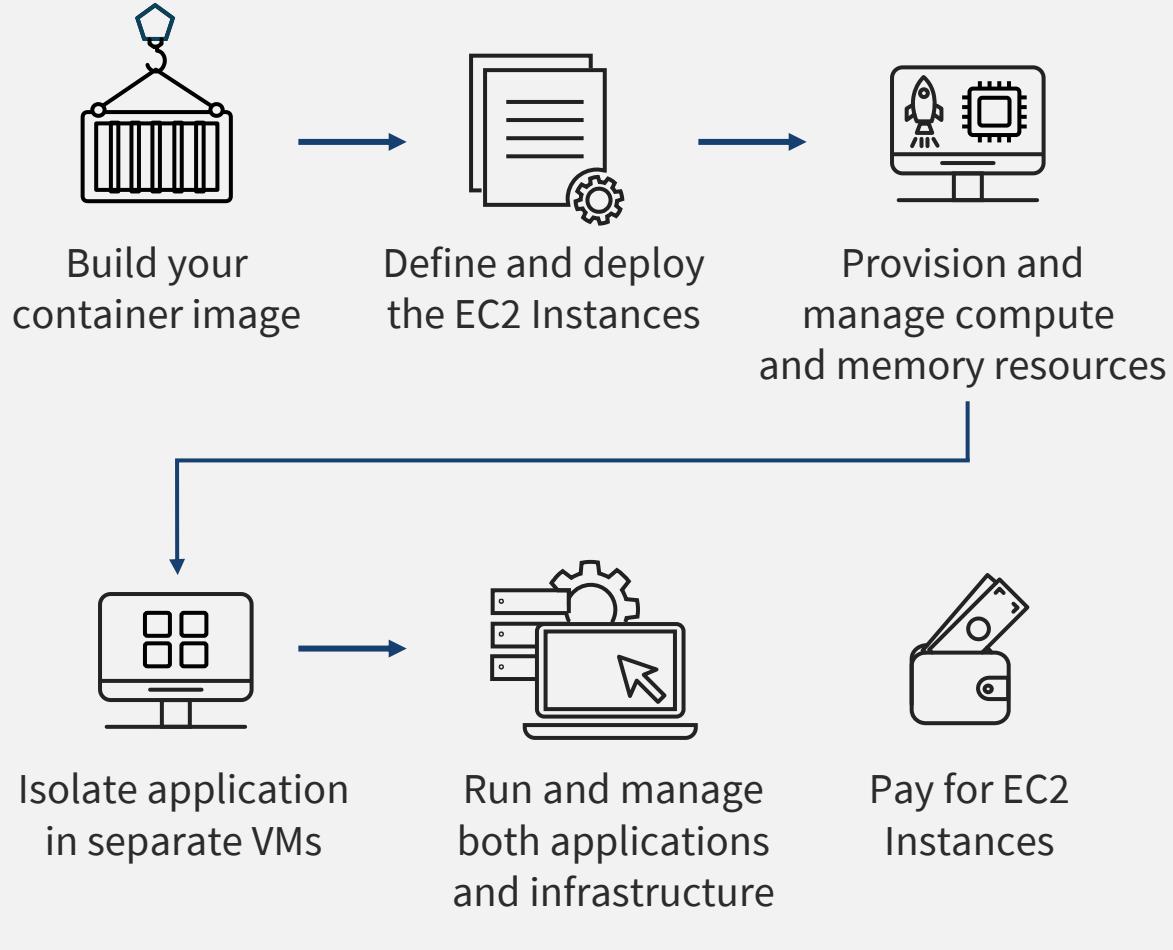
# AWS Fargate

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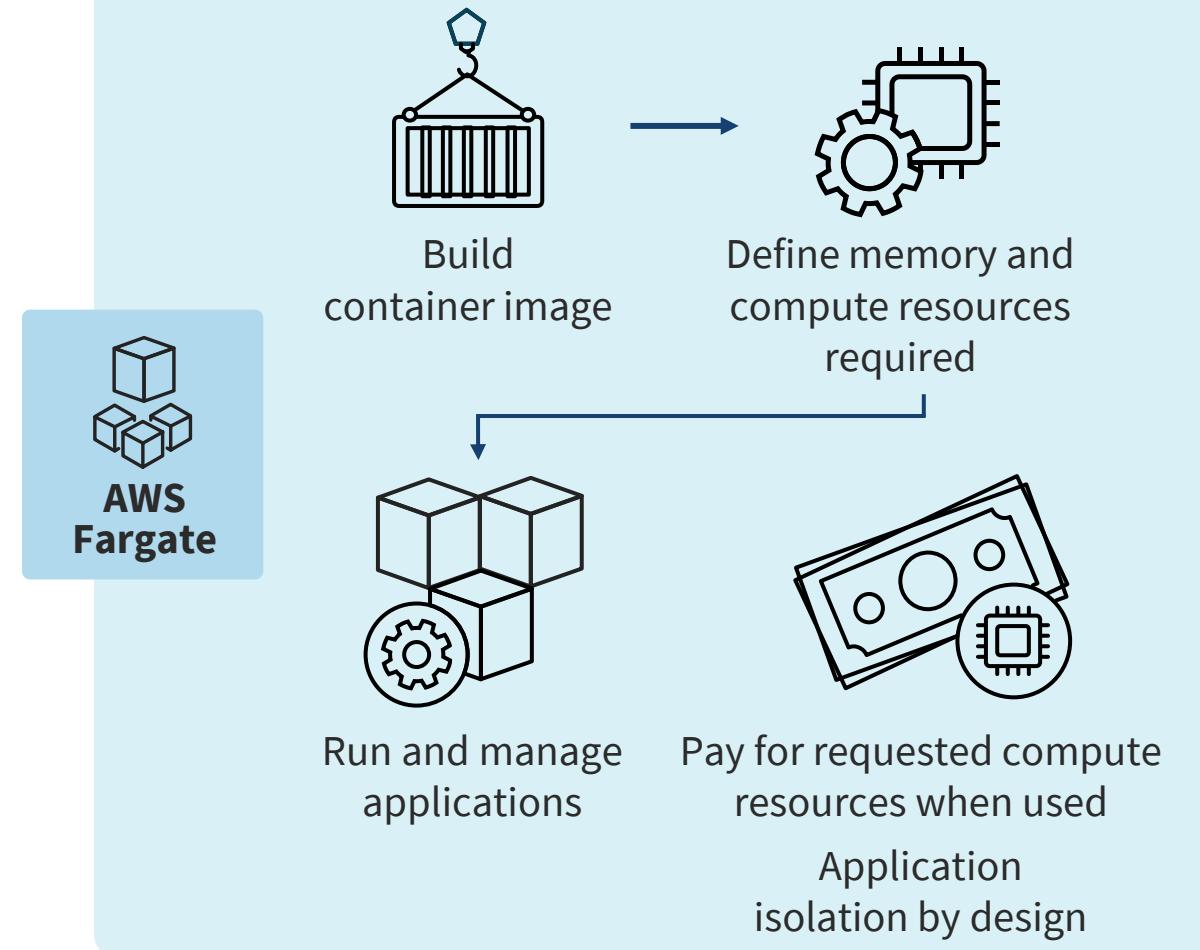
- AWS Fargate is a serverless, pay-as-you-go compute engine that lets customers construct applications without servers
- Fargate is attuned with Amazon Elastic Container Service (ECS) and Amazon Elastic Kubernetes Service (EKS)
- Tasks include choosing an Open Container Initiative (OCI)-compliant container image, defining memory and compute resources, and running the container with serverless compute
- Multiple CPU architectures and operating systems are supported

# AWS Fargate

## Without Fargate



## With Fargate



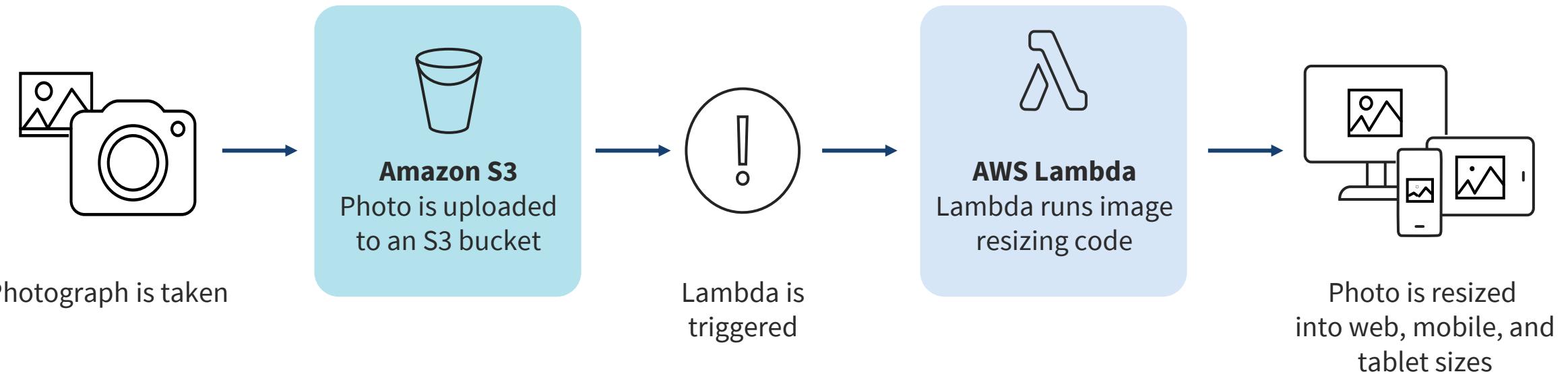
# AWS Lambda

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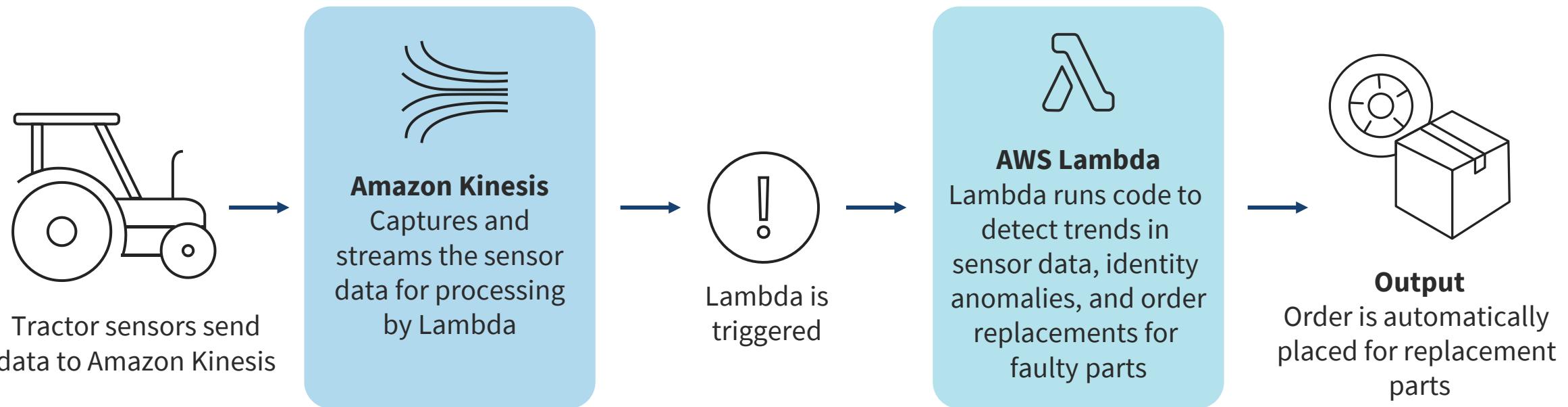
- AWS Lambda is a serverless, event-driven compute service that enables customers to run code for practically any application or backend service without deploying or managing servers
- Customers can trigger Lambda from over 200 AWS services and Software as a Service (SaaS) applications
- It uses the pay-as-you-go model



# AWS Lambda for File Processing



# AWS Lambda for Internet of Things (IoT) Backends



# Auto Scaling Services

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- AWS Auto Scaling monitors client applications and routinely regulates capacity to maintain stable, predictable performance at the lowest probable cost
- It is simple to set up application scaling for multiple resources across multiple services in a matter of minutes
- This service offers an efficient graphical user interface (GUI) to construct scaling plans and launch templates for resources, including EC2 instances, Spot Fleets, ECS tasks, DynamoDB tables, indexes, and even Amazon Aurora (RDS) Replicas



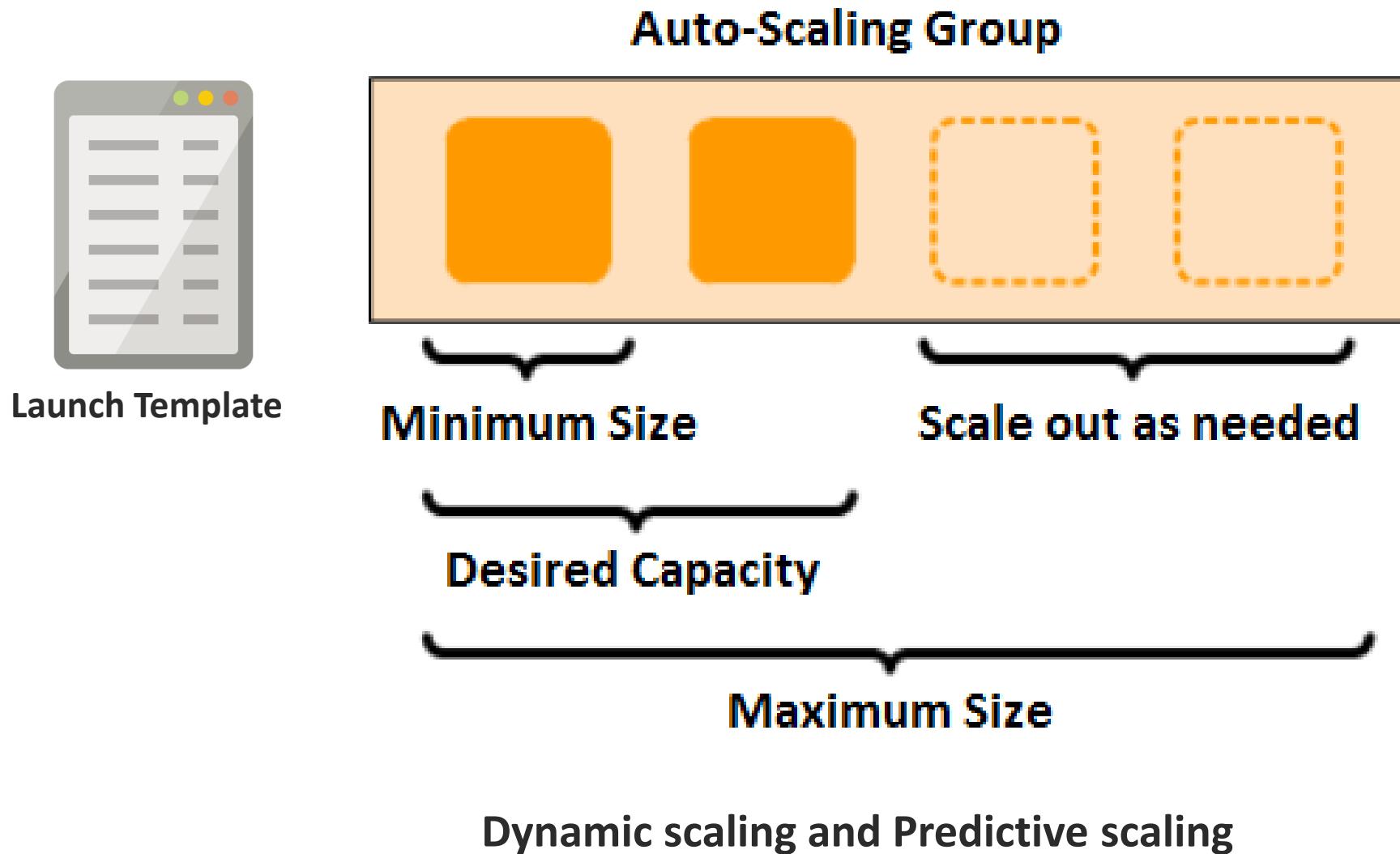


## AWS Auto Scaling

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- AWS Auto Scaling makes scaling easy with common suggestions that let customers optimize performance, costs, or balance between them
- Customers often combine existing EC2 instances with AWS Auto Scaling to scale out extra resources for other AWS services
- Applications always have the proper resources at the right time with AWS

# AWS Auto-Scaling



# Block Storage

- There are three types of cloud storage: object, file, and block – each having specific use cases and storage needs
- Block storage is a classic technology that manages data storage and storage devices
- It takes any data, like a file or database entry, and distributes it into equal size blocks (512-bit is legacy, 4K is common)



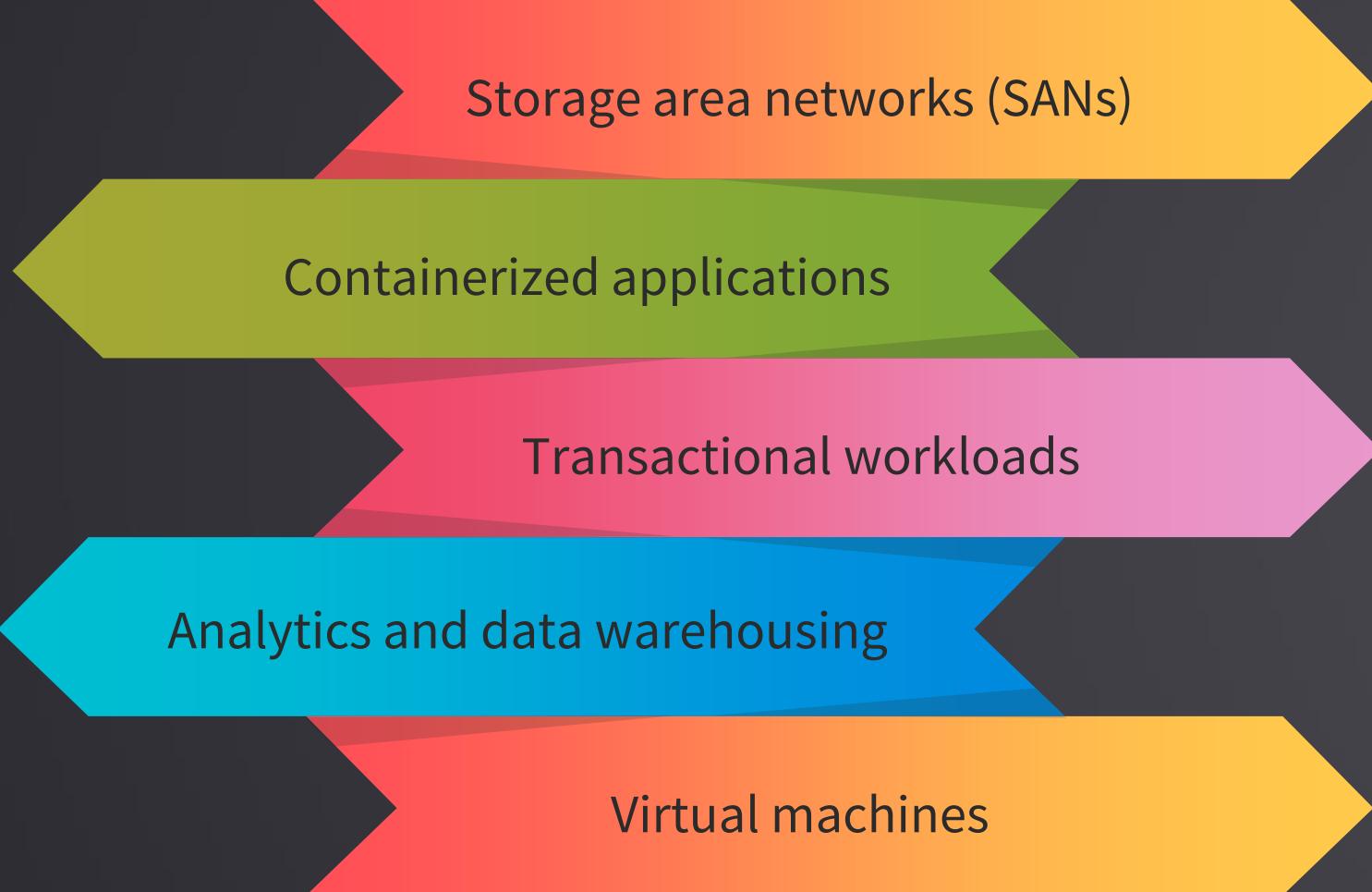
# Block Storage

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- The block storage system stores the data block on supporting physical storage in a manner that is optimized for fast access and retrieval (RAID arrays)
- Developers prefer block storage for applications that require efficient, fast, and reliable data access
- Block storage offers a more direct pipeline to the data
- By comparison, file storage has an extra layer consisting of a file system (NFS, SMB, CIFS) to process before accessing the data



# Block Storage Use Cases



Storage area networks (SANs)

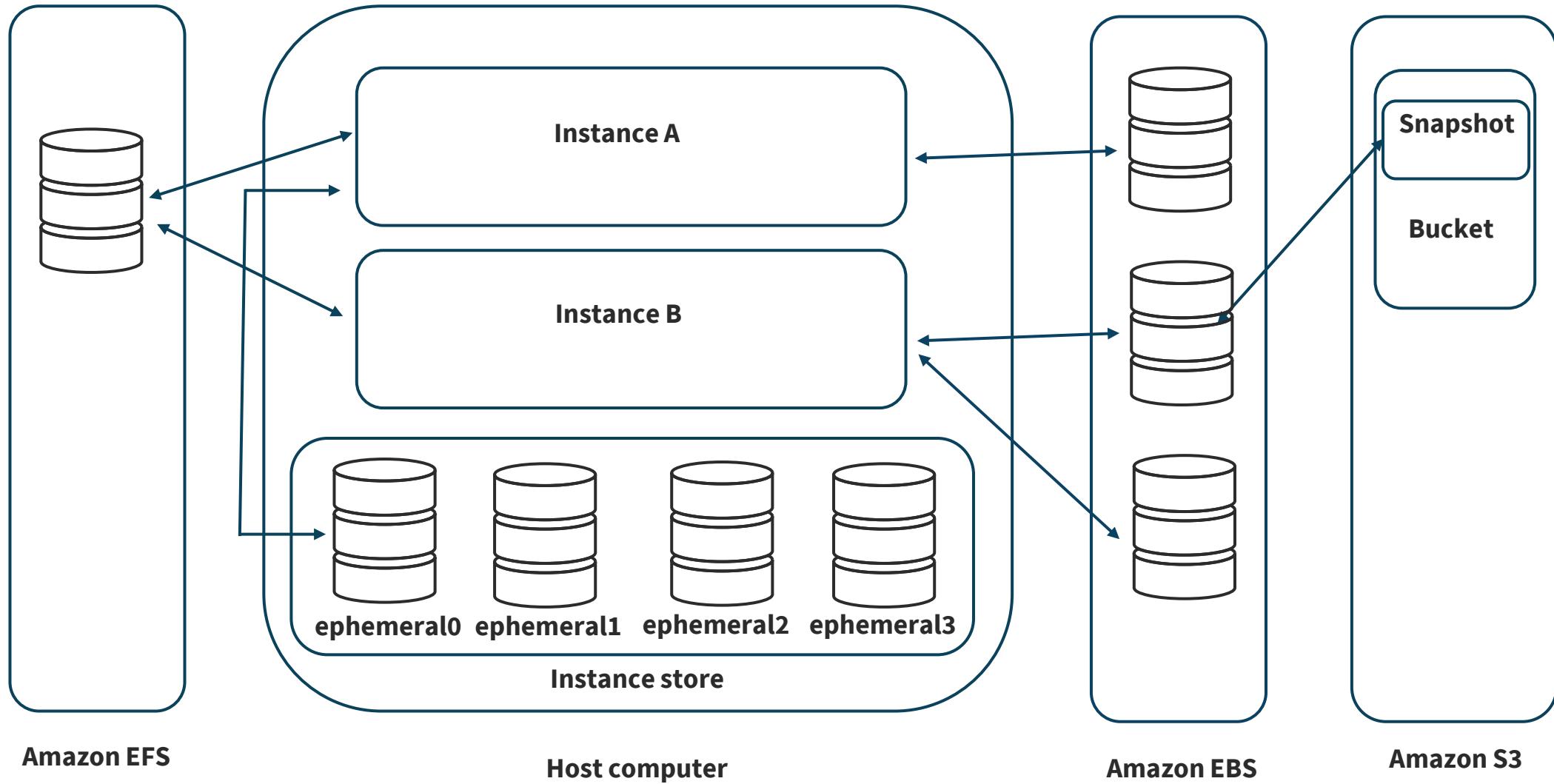
Containerized applications

Transactional workloads

Analytics and data warehousing

Virtual machines

# Block, File, and Object Storage at AWS



# Exploring Block Storage Solutions

In this demo...

Explore block storage solutions like Amazon Elastic Block Store (EBS)



# Object Storage

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- Object storage is a technology that stores and controls data in an unstructured format called objects
- Modern enterprises generate and analyze large amounts of unstructured data such as photos, graphics, audio files, videos, email, web pages, and sensor data
- This solution creates a flat structure instead of a hierarchical or tiered storage



# Object Storage Use Cases

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- **Analytics** – collect and store virtually unlimited data of any type in cloud object storage
- **Data lakes** – use cloud object storage as its core since it has virtually unlimited scalability and high durability
- **Data archiving** – cloud object storage is exceptional for long-term data retention
- **Rich media** – speed up applications and lower the cost of storing media files like videos, digital images, and music

# Object Storage Use Cases

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- **Cloud-native applications** – use technologies like containerization and serverless to address customer needs in a rapid and flexible way
- **Machine learning (ML)** – requires object storage because of the scale and cost efficiency to "teach" a computer system to make predictions or inferences
- **Backup and recovery** – deploy object storage systems to duplicate content in case a physical device fails

# Comparing S3 Storage Classes

In this demo...

- Compare S3 storage classes
- <https://aws.amazon.com/s3/storage-classes/>

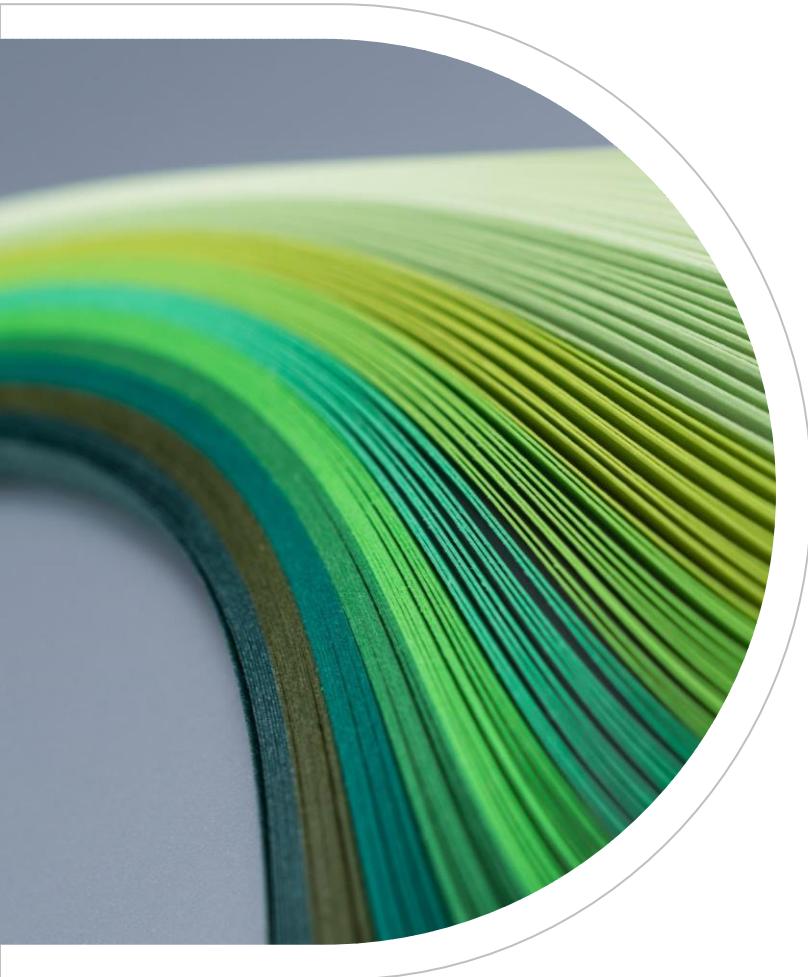
# AWS Elastic File System (EFS)

- Amazon Elastic File System (Amazon EFS) offers a simple, scalable, elastic file system for workloads using AWS Cloud services and on-premises resources
- EFS automatically grows and shrinks as files are added or removed with no need for management or provisioning
- It is built to scale on demand to petabytes without disrupting applications, growing and shrinking automatically as you add and remove files
- It is a fully managed service that requires no changes to existing applications and tools



# Amazon FSx

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- Amazon FSx makes it easy and cost effective to launch, run, and scale feature-rich, high-performance file systems in the cloud supporting a wide range of workloads with its reliability, security, scalability, and broad set of capabilities
- Amazon FSx is built on the latest AWS compute, networking, and disk technologies to provide high performance and lower TCO
- Customers can choose between four widely-used file systems: NetApp ONTAP, OpenZFS, Windows File Server, and Lustre

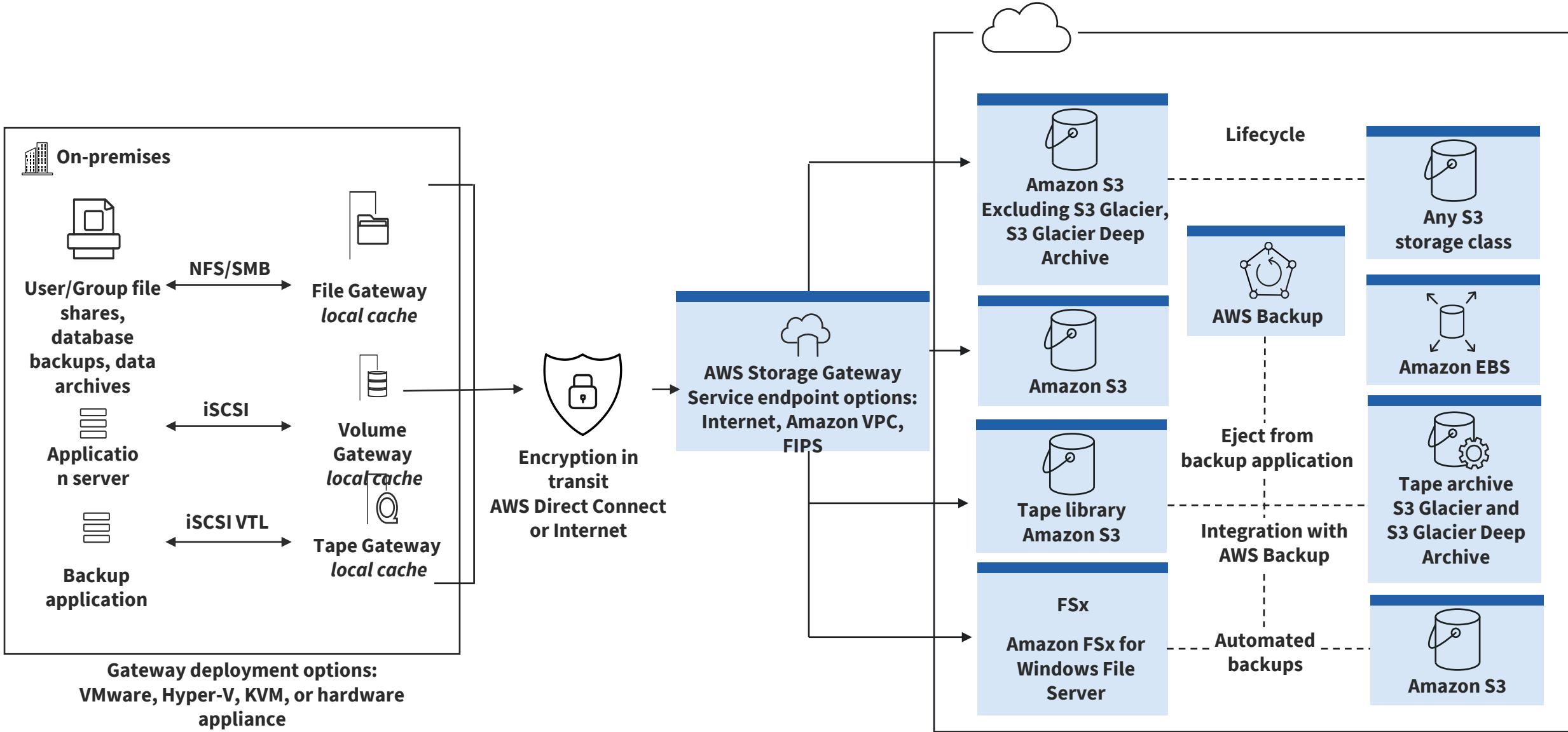


# AWS Storage Gateway

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- AWS Storage Gateway is a hybrid storage service that enables your on-premises applications to seamlessly use AWS cloud storage
- You can use the service for backup and archiving, disaster recovery, cloud data processing, storage tiering, and migration
- Can be appliance-based or in a hypervisor
- Often used in conjunction with AWS Direct Connect 10 or 100 Gbps connections

# AWS Storage Gateway



# Relational Databases

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- A relational database is a collection of structured data items with pre-defined relationships between them
- These items are ordered as a set of tables with associated columns and rows
- Tables are used to hold information about the objects to be represented in the database
- Each column in a table holds a specific format of data, and a field stores the actual value of an attribute



# Relational Databases

- A database transaction is one or more "all-or-nothing" SQL statements that are performed as a series of operations that establish a single logical unit of work
- Data integrity is the general fullness, accuracy, and consistency of data
- Relational databases use a set of constraints called keys to enforce data integrity in the database
- To ensure data integrity, all database transactions must be ACID compliant: Atomic, Consistent, Isolated and Durable



# Using RDS Services

In this demo...

Evaluate RDS Services and Aurora

Explore Amazon Redshift and Amazon Neptune

<https://aws.amazon.com/free/database/>

# NoSQL Databases

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- Are purpose-built for designated data models
- Have elastic schemas for constructing modern applications
- Are commonly known for their simplicity of development, functionality, and scalable performance





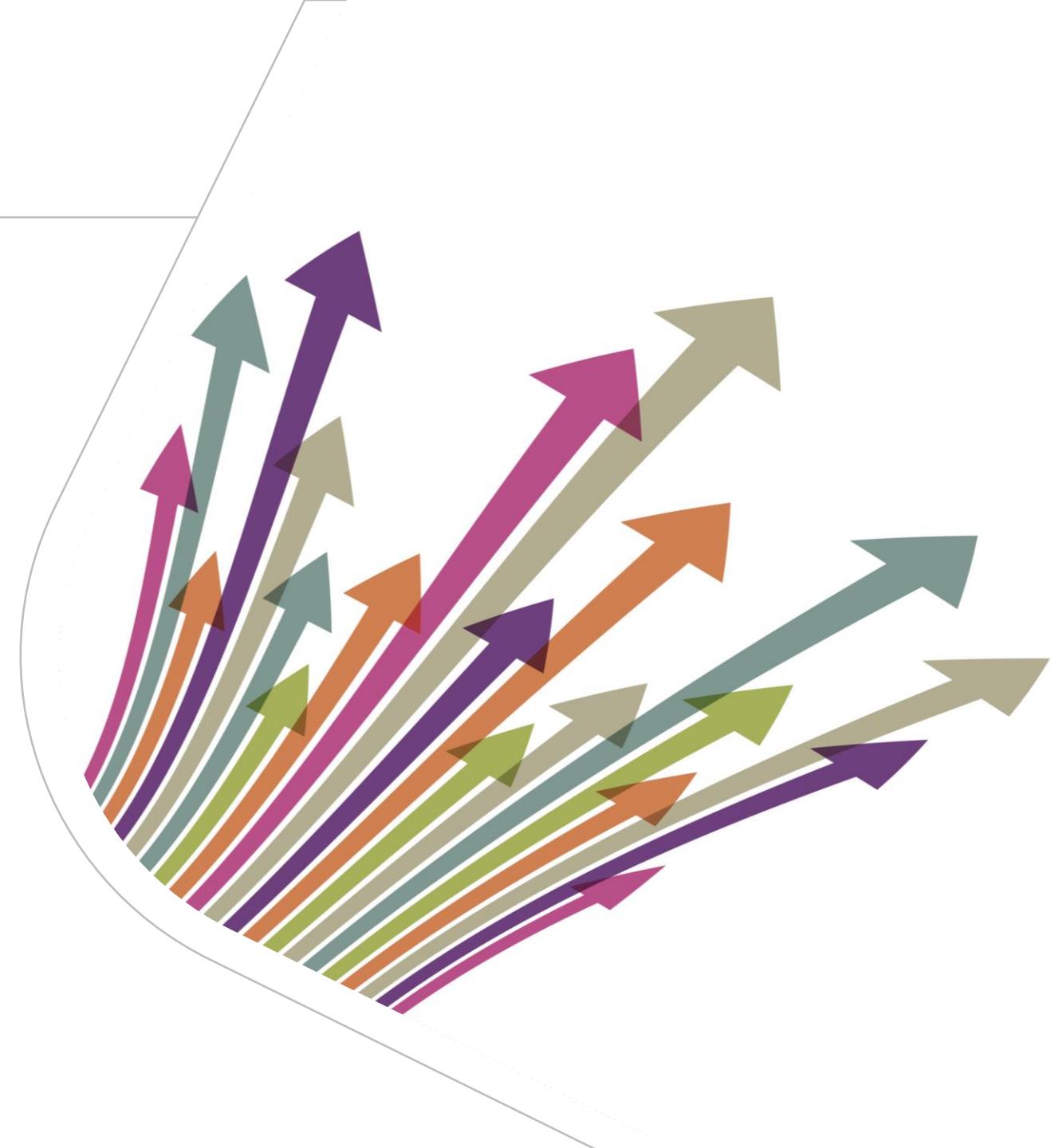
# NoSQL Databases

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- NoSQL databases use a diversity of data models for accessing and controlling data
- These database types are optimized explicitly for applications that demand large data volume, low latency, and flexible data models
- This is accomplished by bypassing some of the data consistency restrictions of other databases, such as the relational type

# NoSQL Databases Benefits

- **Flexibility** - provide flexible schemas that enable faster development
- **Scalability** – generally designed to scale out by using distributed clusters of hardware
- **High-performance** – optimized for specific data models and access patterns
- **Highly functional** - offer highly functional APIs and data types that are purpose-built for their respective data models



# Amazon DynamoDB

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- Is a fast, malleable NoSQL database service for single-digit millisecond performance at any scale
- Is a fully managed, serverless, key-value NoSQL database designed to run high-performance applications
- Delivers built-in security, nonstop backups, automated multi-Region replication, in-memory caching, and powerful data import and export tools
- **Exam: they refer to DynamoDB as a “non-relational” database**

# DynamoDB



**Amazon  
DynamoDB**  
Fast, flexible  
NoSQL database  
service



NoSQL Workbench



Global tables



Encryption at rest



Point-in-time  
recovery



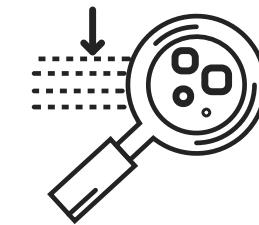
On-demand  
capacity mode



PartiQL supports

## Configure Key Features

Includes built-in security, backup and restore, flexible capacity modes, multi-Region replication, in-memory caching, data modeling tools, and more



## Export, analyze, stream data

Integrate with other AWS services by exporting table data to perform analytics and extract insights, or monitor trends and logs for enhanced security



Amazon S3



AWS Glue  
Elastic Views



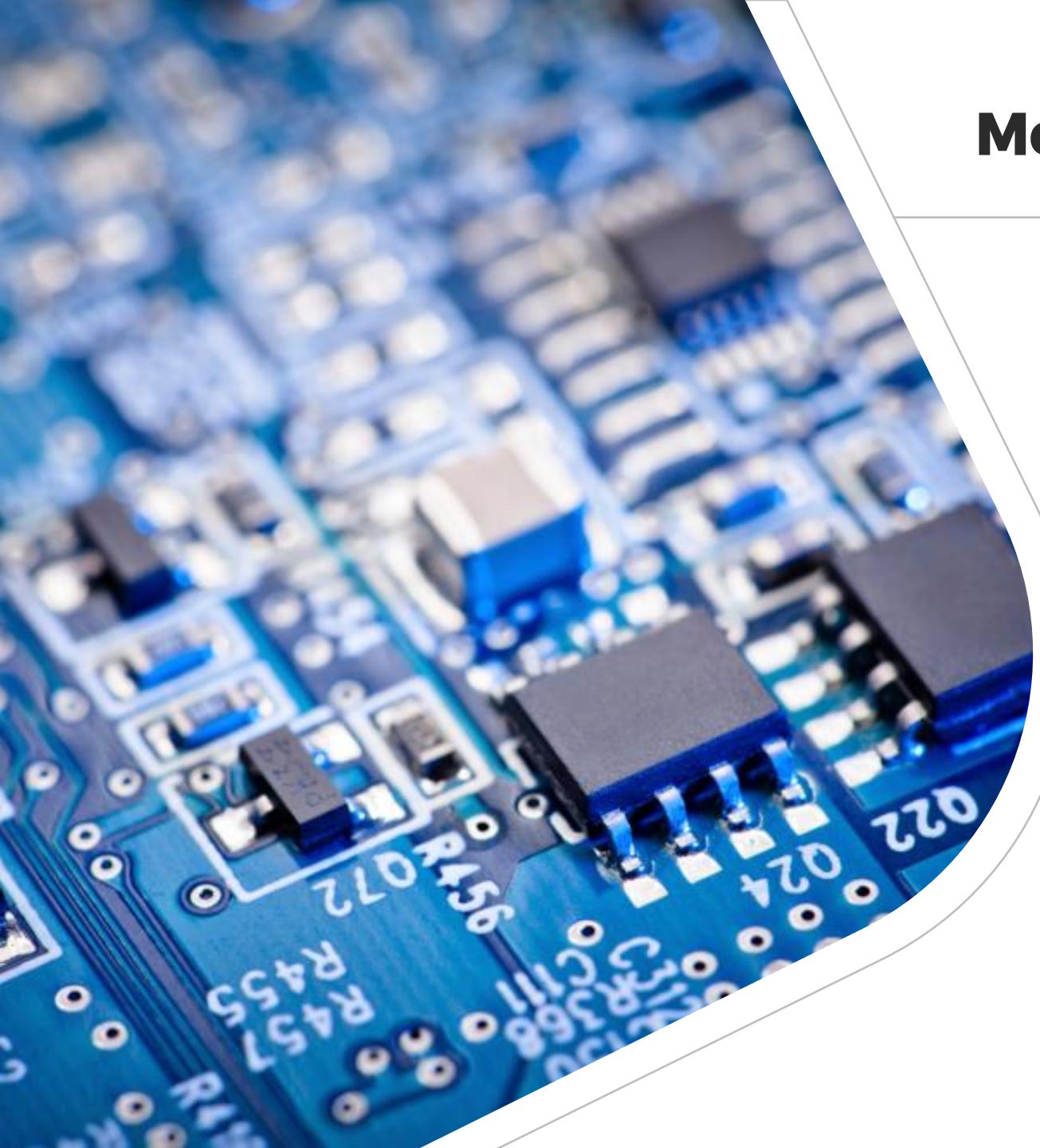
Amazon Kinesis  
Data Streams



AWS CloudTrail



Amazon  
CloudWatch



# Memory-based Databases

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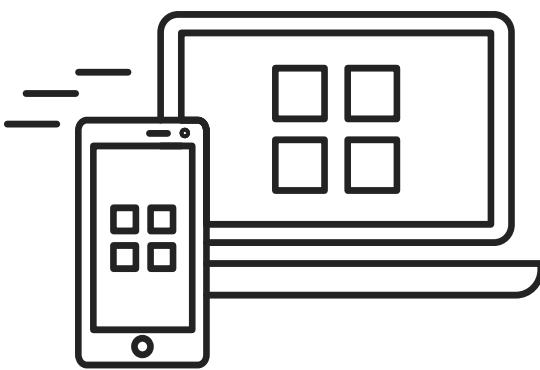
- In-memory databases are purpose-built databases that typically depend on high-speed memory chip clusters for data storage, as opposed to databases that store data on disk or solid-state drives (SSDs)
- In-memory data storage is intended to allow for nominal response times by abolishing the need to access physical disks

# **Amazon ElastiCache for Redis**

- ElastiCache is an extremely fast in-memory data store that provides sub-millisecond latency to enable internet-scale real-time applications
- It is constructed on open-source Redis and compatible with the Redis APIs
- Self-managed Redis applications can function effortlessly with Redis ElastiCache without any code changes
- It joins the speed, ease, and flexibility of open-source Redis with manageability, security, and scalability from AWS

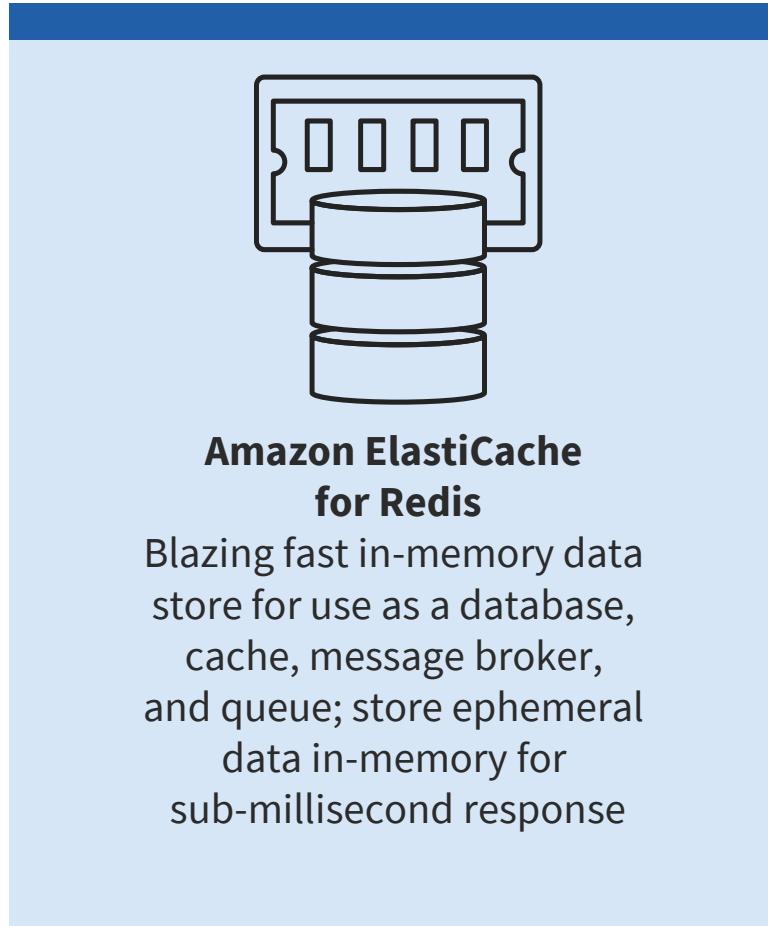


# Amazon ElastiCache for Redis



## Internet-scale applications

Real-time apps in gaming,  
ride-hailing, media streaming,  
dating, and social media  
need fast data access



## Use cases

Real-time transactions,  
chat, BI and analytics,  
session store, gaming  
leaderboards, and cache

# Appropriate Migration Strategies: Database Replication

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- Database replication refers to the process of copying data from a primary database to one or more replica databases to improve data availability and system fault-tolerance and reliability
- Database replication is usually a continual process occurring in real-time as data is created, modified, or deleted in the primary database
  - It can also occur as one-time or scheduled batch projects

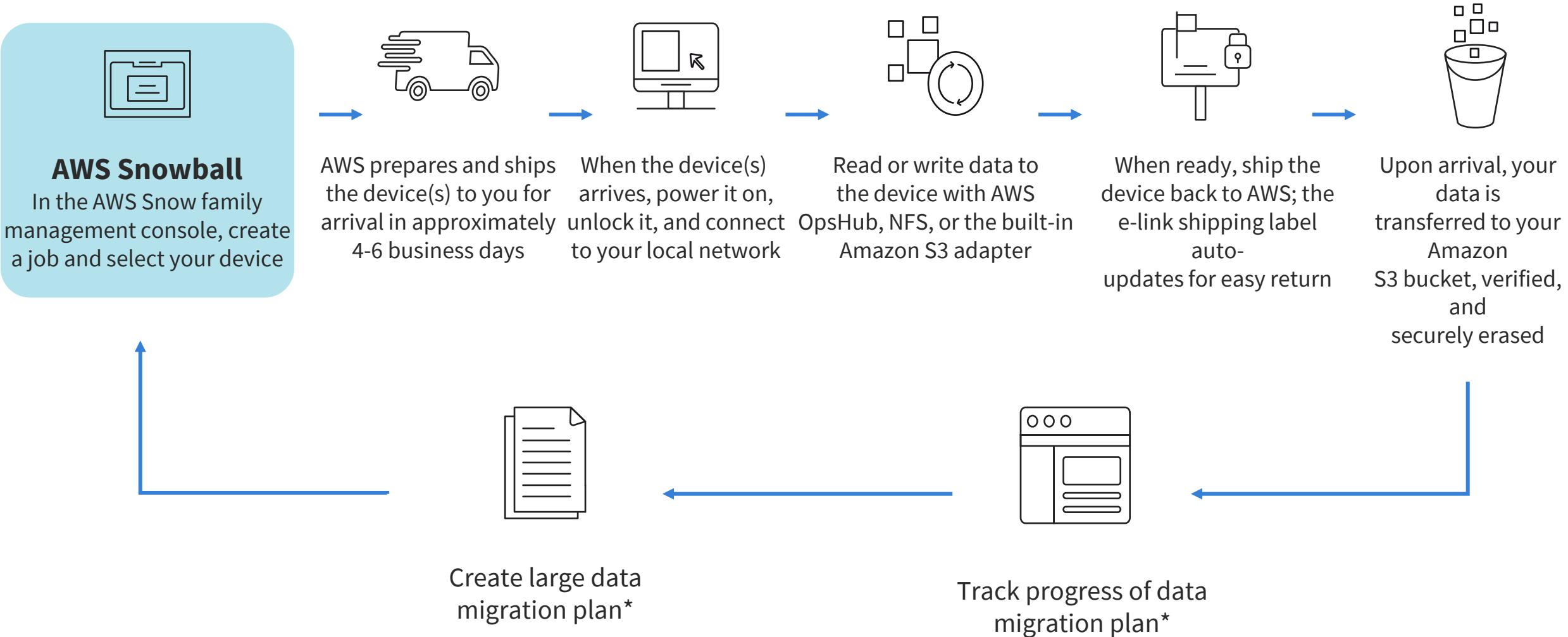
# Database Replication Use Cases

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- Customers can create tasks for ongoing replication using AWS Database Migration Service (DMS)
- Data can be migrated to S3 storage to match the organizational data life cycle
- A newer solution would be to use Amazon Elastic File System (EFS) replication to create a replica of their EFS file system in the AWS Region of their choosing
- AWS customers may decide to innovate and build new database applications with Amazon Relational Database Service (RDS)



# AWS Appropriate Migration Strategies: AWS Snowball

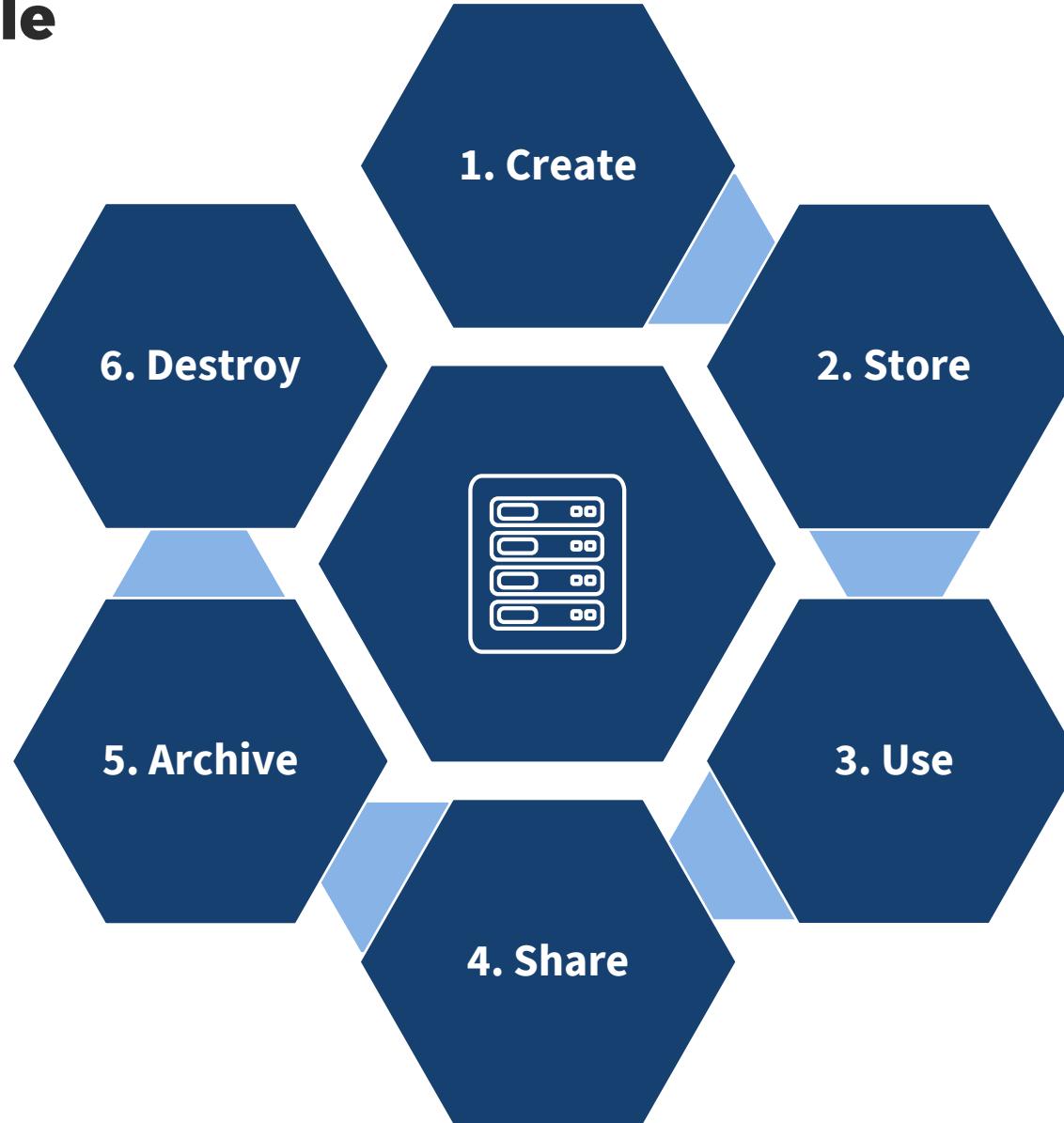


# Database Migration Tools

- **AWS Database Migration Service (AWS DMS)** is a managed migration and replication service that helps move databases and analytics workloads to AWS quickly, securely, and with minimal downtime and zero data loss
  - DMS supports migration between 20-plus database and analytics engines
- **AWS Schema Conversion Tool (AWS SCT)** AWS offers two schema conversion solutions to make heterogeneous database migrations predictable, fast, secure, and simple. Customers have the choice to:
  - Log in to the AWS DMS console to initiate the AWS DMS Schema Conversion (DMS SC) workflow for a fully managed experience **or**
  - Download the AWS Schema Conversion Tool (AWS SCT) software to their local drive



# Cloud Data Lifecycle





# Data Lifecycle Management

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- Amazon S3 supports tools to manage data throughout its lifecycle
- S3 storage class analysis can monitor data access patterns and identify data sets that should be moved to more cost-effective storage classes
  - Customers can configure lifecycle policies to move a data set to a cheaper storage class or an archival storage class for maximum savings
- S3 Lifecycle management policies are used to schedule object deletes that have come to the end of their lifecycle

# Data Lifecycle Policies

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- Customers can formulate a data lifecycle initiative for several areas:
  - Block storage using levels of SSD/HDD
  - Object storage using S3 storage tiers
  - S3 Glacier archiving retrieval plans
  - Manage EBS snapshots and EBS-backed Amazon Machine Images (AMIs)
  - Moving data to AWS with AWS Snow services
  - Supporting enterprise backup and restore policies
  - Enabling cloud disaster recovery
  - Database replication plans



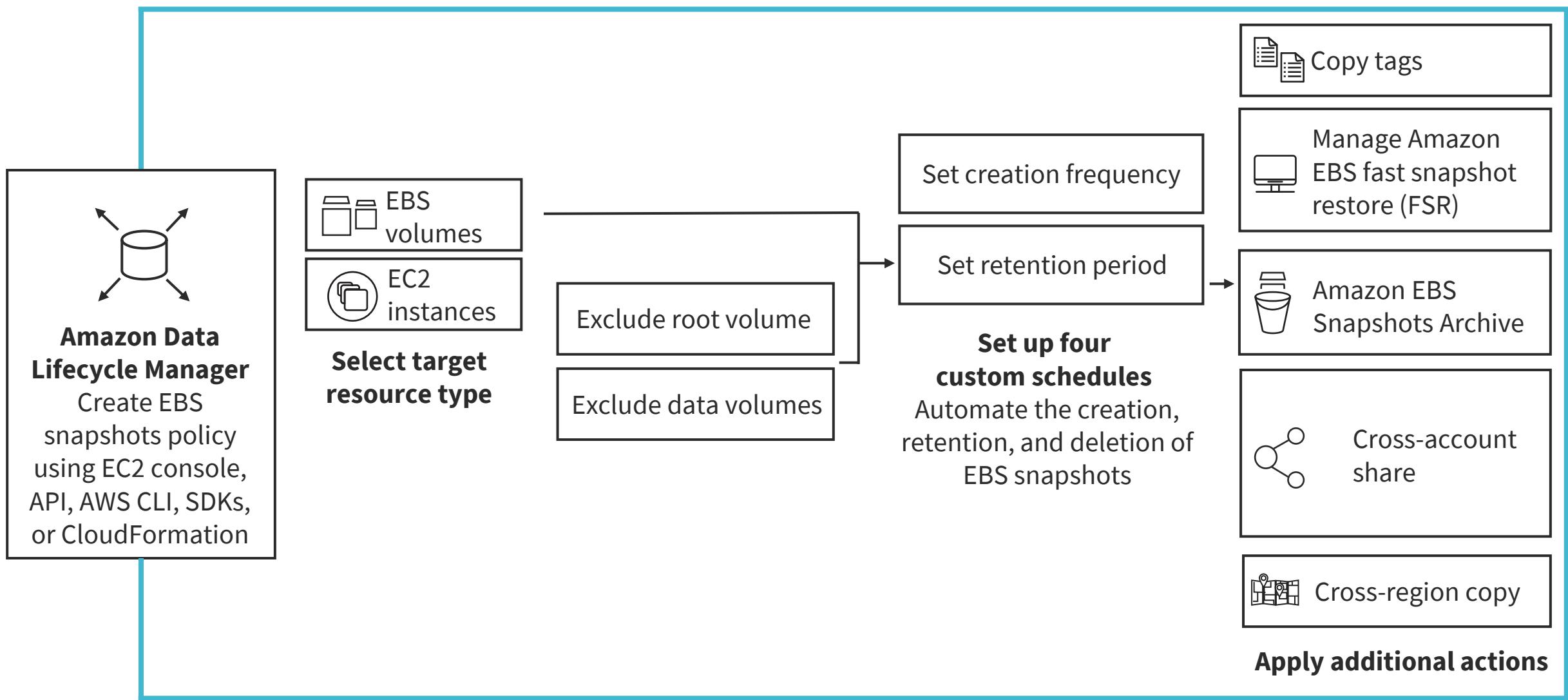


## Amazon Data Lifecycle Manager

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- DLM is used to automate the creation, retention, and deletion of EBS snapshots and EBS-backed AMIs
- It helps to:
  - Protect valuable data by enforcing a regular backup schedule
  - Create standardized AMIs that can be refreshed at regular intervals
  - Retain backups as required by auditors or internal compliance
  - Reduce storage costs by deleting outdated backups
  - Create disaster recovery backup policies that back up data to isolated accounts

# Amazon Data Lifecycle Manager

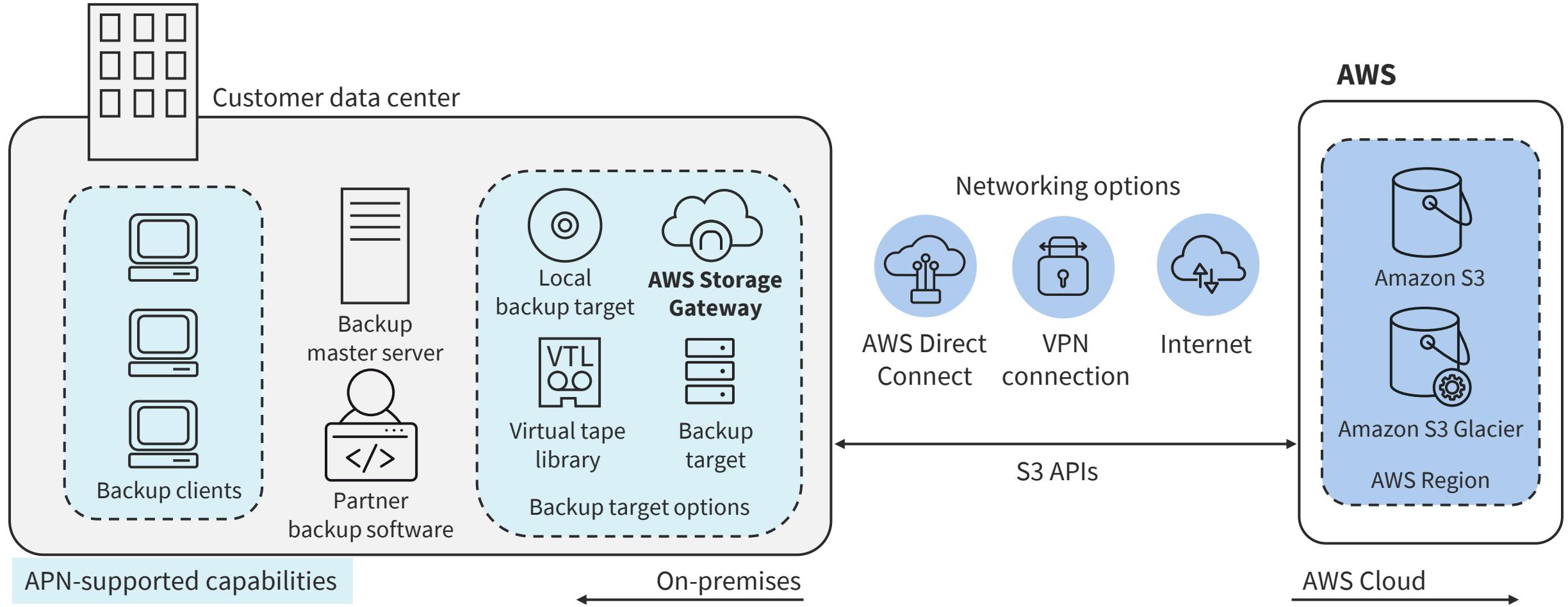


# Hybrid Cloud Backup

- Many third-party backup services have built-in cloud connectors that can be used to send data backups to AWS smoothly
- In other scenarios, customers use gateway services like AWS Storage Gateway to create a seamless connection between on-premises environments and AWS
- During a restoration, backup data is brought back to the on-premises environment and reinstated for production
- Backups are generated on-premises where the backup master server is hosted and sent to AWS to be stored in Amazon S3, S3 Glacier, and S3 Glacier Deep Archive



# Hybrid Cloud Backup



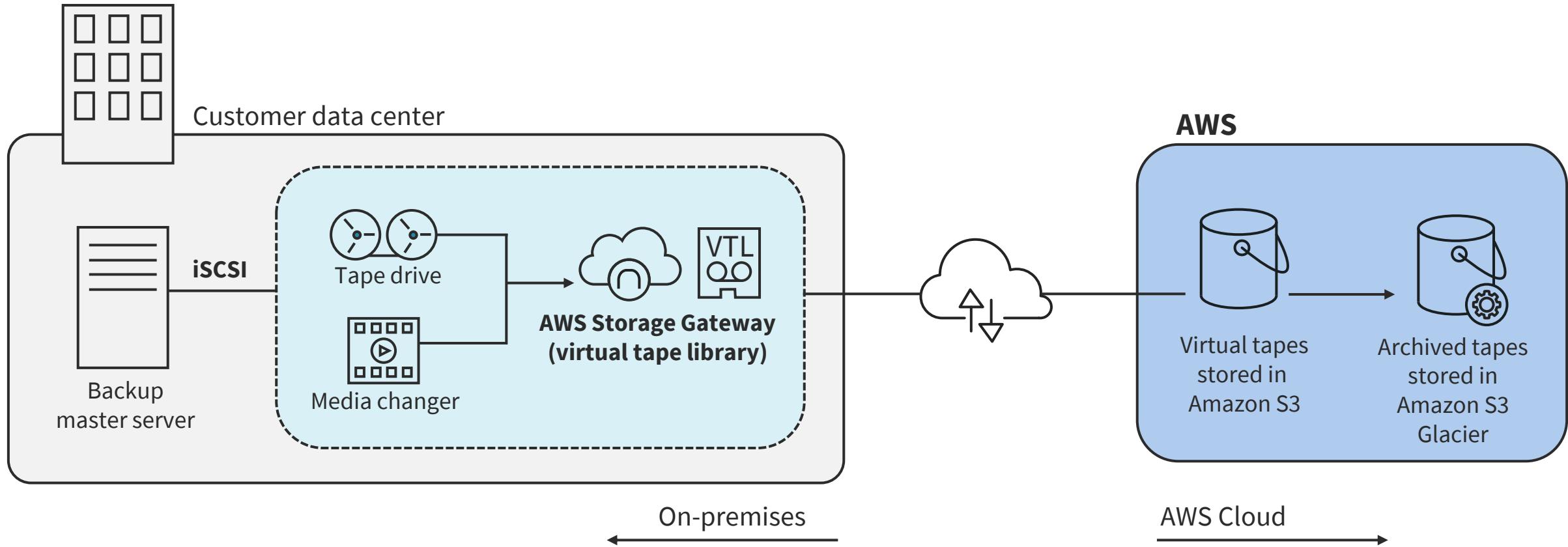
# Tape Replacement

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- With Storage Gateway, customers can retire physical tape libraries and replace them with sturdy and secure cloud-enabled storage solutions
  - This enables IT groups to transfer backup jobs from on-premises tape or virtual tape library systems to AWS without disrupting existing on-premises workflows
- The Storage Gateway's virtual tape library interface can help customers update their backup infrastructure, lower the need to transport storage media to and from offsite facilities, and remove upfront capital investments of maintaining old tape media

# Tape Replacement



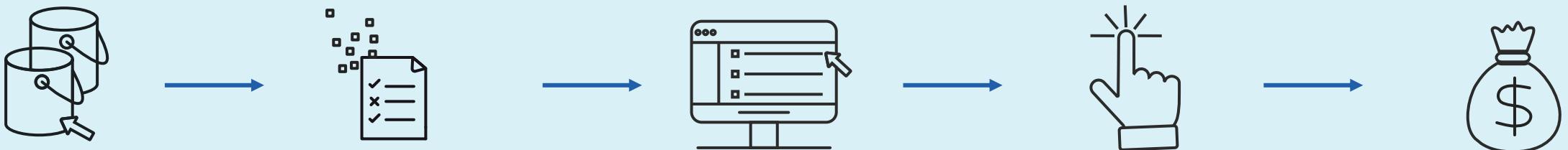
# Database Backup

---

- AWS provides the widest array of database services to support virtually any use case
- Services such as Amazon Relational Database Service (Amazon RDS) and Amazon DynamoDB have built-in backup functionalities to protect data and related applications
- Customers can also use EBS snapshots to backup Amazon EBS volumes that support other database services running on Amazon EC2



# Database Backup



## Apply S3 storage class analysis

S3 storage class analysis can be configured to monitor objects by S3 bucket, prefix, or object tag

## Identify data sets to transfer

Use reports from S3 storage class analysis to identify data sets for transition to other storage class or expiration

## Configure an S3 Lifecycle policy

An S3 Lifecycle policy is a set of rules that define actions for a data set – by S3 bucket, prefix, or object tag

## Specify the policy type

There are two policy types: *transitions* that move objects to other storage classes and *expirations* that delete objects

## Realize storage efficiencies

After configured, S3 Lifecycle policies automate tiering and expiration of data sets for cost saving and resource optimization

# Amazon EMR (Formerly Amazon Elastic MapReduce)

- Amazon EMR is the industry-leading cloud big data solution for petabyte-scale data processing, interactive analytics, and machine learning
- It utilizes open-source frameworks such as Apache Spark, Apache Hive, and Presto
- **Amazon EMR Serverless is a new option in EMR**
  - It makes it simple and cost-effective for engineers and analysts to run applications built using open-source big data frameworks like Apache Spark, Hive, or Presto
  - There is no need to tune, operate, optimize, secure, or manage clusters





# Amazon EventBridge

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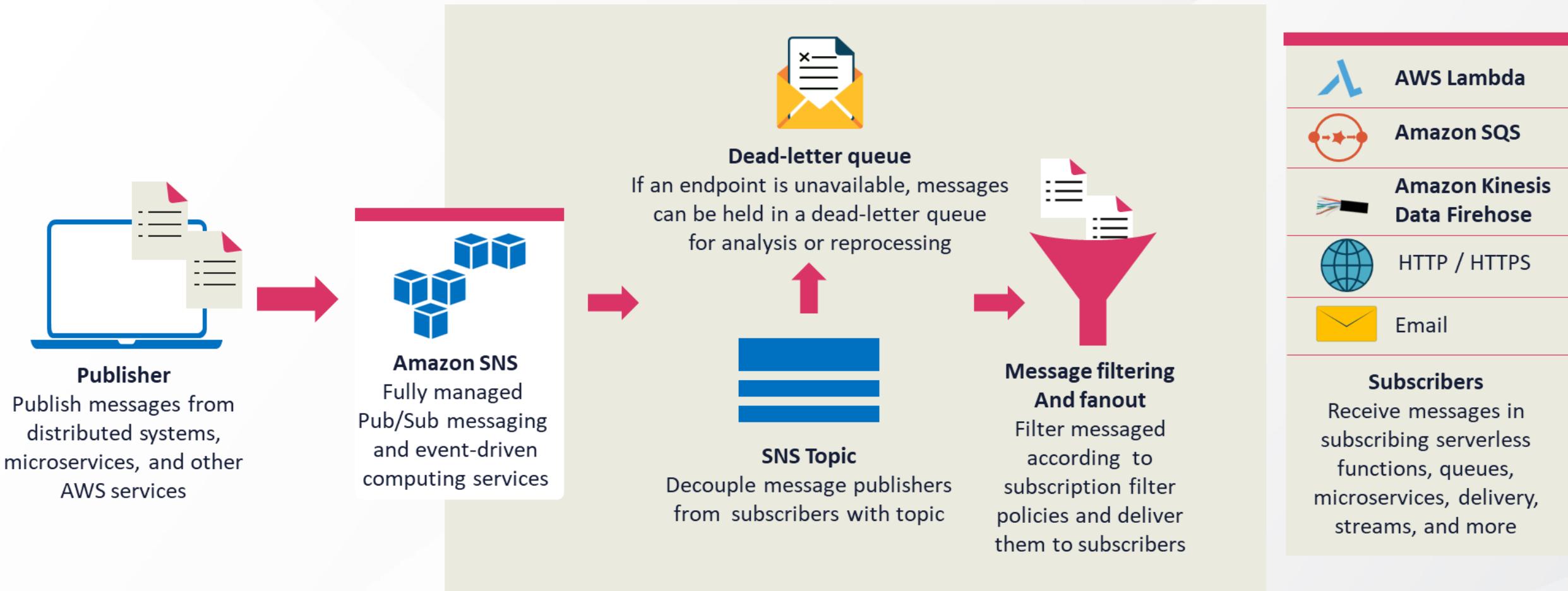
- Amazon EventBridge is a serverless event bus to assist customers in constructing event-driven or SaaS applications at scale
- The event bus delivers streams of real-time data from event sources such as Shopify to targets like AWS Lambda and other SaaS applications
- Customers can accelerate modernizing and re-orchestrating their architecture with decoupled services and applications
- Leverage AWS Artificial Intelligence/Machine Learning services and get valuable insights

# Amazon Simple Notification Service (Amazon SNS)

- Amazon SNS sends notifications two ways:
  - Application-to-Application (A2A)
  - Application-to-Person (A2P)
- A2A offers high-throughput, push-based, many-to-many messaging between distributed systems, microservices, and event-driven serverless applications
  - **Exam: Call SNS notifications with AWS Step Functions**
- A2P functionality lets you send messages to customers with SMS, push notifications, and email

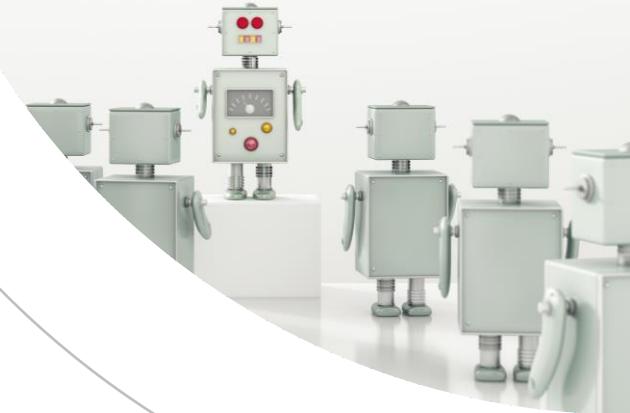


# Amazon Simple Notification Service (Amazon SNS)



# Amazon Simple Queue Service (Amazon SQS)

- Amazon Simple Queue Service (SQS) is a fully managed message queuing for microservices, distributed systems, and serverless applications
- SQS lets customers send, store, and receive messages between application components at any volume, without losing messages or requiring other services to be available
- Sensitive data can be securely sent between applications and the keys centrally managed by leveraging AWS Key Management Service (KMS)



# Amazon Simple Queue Service (Amazon SQS)



## Producer

Sends messages to Amazon SQS

## Amazon SQS

Fully managed message queuing service to reliably and continually exchange any volume of messages from anywhere

## Encryption

Messages are encrypted at rest (AWS KMS) and in flight with HTTPS/TLS

## Consumers

Nearly infinite scalability and ability to increase message throughput to consumer without the need to preprovision capacity

# Machine Learning in a Nutshell

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- Machine learning (ML) assists organizations in generating growth, discovering new revenue streams, and fixing challenging issues
- Data is a critical success factor (CSF) in business decision-making, and companies have typically leveraged data from various sources, such as customer feedback, employees, finance, and consultants:
  - Machine learning research automates and optimizes this process
- Businesses can get results quicker by using code that analyzes very large data sets at high speeds

# Machine Learning Use Cases

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- **Manufacturing** – support predictive maintenance, quality control, and inventive research in the manufacturing sector:
  - ML technology also assists companies in improving logistical solutions, supply chains, and inventory control
- **Healthcare and life sciences** – the explosion of wearable sensors has resulted in a substantial amount of health data being generated:
  - ML solutions can analyze the data and support physicians in real-time diagnosis and treatment





# Machine Learning Use Cases

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- **Financial services** – projects enhance risk analytics and regulation adherence:
  - ML technology can help investors recognize new prospects by analyzing stock market trends, appraising hedge funds, or adjusting portfolios
- **Retail** – initiatives can improve customer service, stock management, upselling, and cross-channel marketing

# Machine Learning Use Cases

- **Media and entertainment** – this sector uses ML to better appreciate their target audiences and distribute immersive, tailor-made (bespoke), and on-demand content:
  - ML algorithms are used to help design trailers and other advertisements, offer customers content recommendations, and streamline production



# Artificial Intelligence in a Nutshell

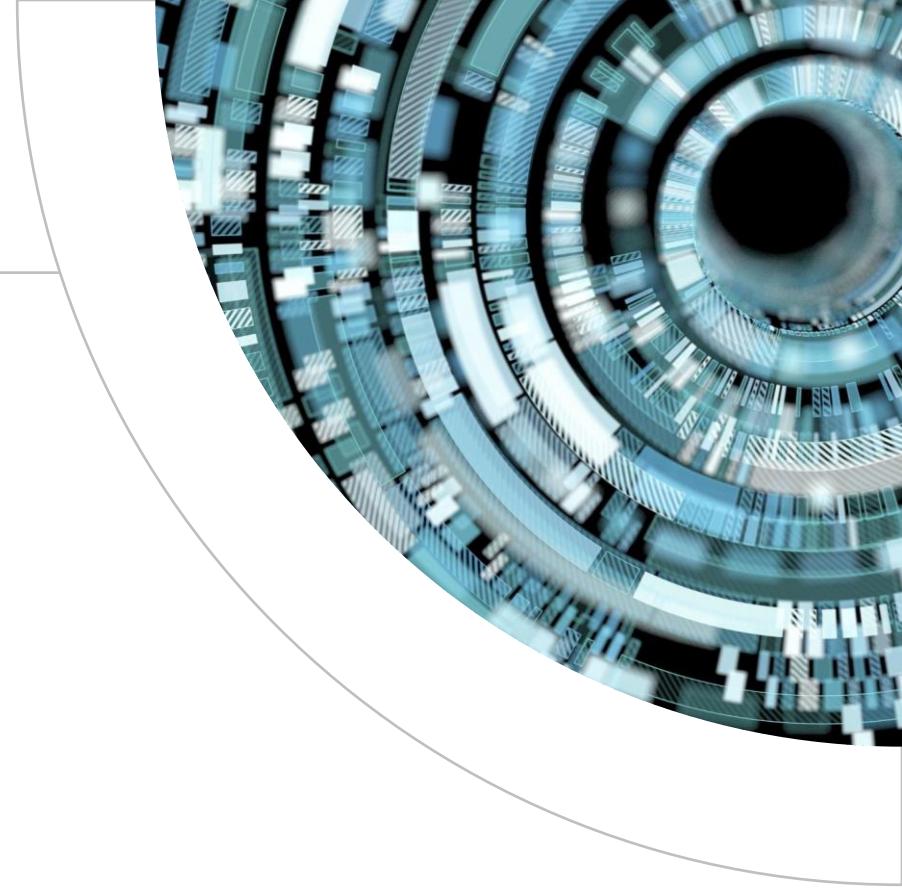
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- This is a domain of computer science focused on solving cognitive problems universally associated with human intelligence:
  - Learning
  - Problem solving
  - Pattern recognition
- Although AI can often invoke robotics or even futuristic dystopian panoramas, it transcends the automatons of science fiction into the non-fiction of modern-day advanced computer science



# Amazon SageMaker

- SageMaker empowers AWS customers to build, train, and deploy machine learning models for any use case with fully managed infrastructure, tools, and workflows
- Amazon SageMaker JumpStart offers a set of solutions for common use cases that can be deployed with just a few clicks to make it easier to get started
- The solutions are fully customizable and supports one-click deployment and fine-tuning of more than 150 popular open-source models such as natural language processing, object detection, and image classification



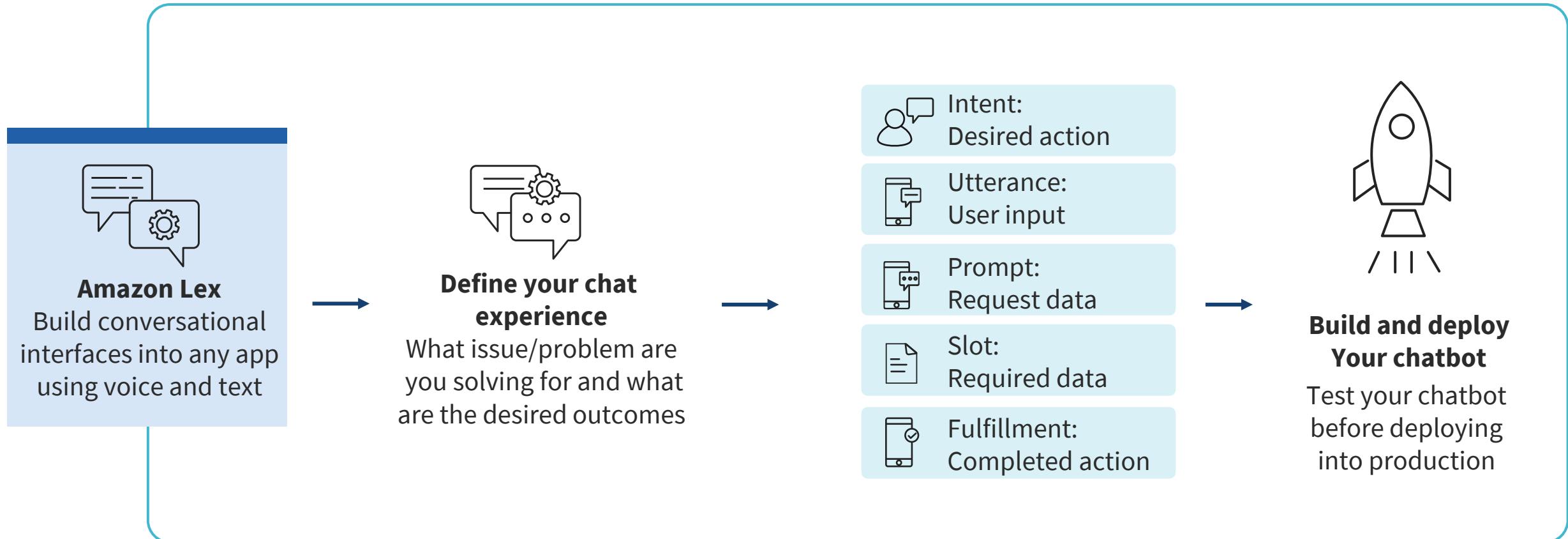
# Amazon Lex

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- Amazon Lex is a fully managed artificial intelligence service with cutting-edge natural language models for designing, constructing, testing, and releasing conversational interfaces in applications and mobile apps:
  - Virtual agents and voice assistants
  - Informational response automation
  - Application bots for enhancing productivity
  - Chatbots using existing contact center transcripts



# Amazon Lex



# Amazon Kendra

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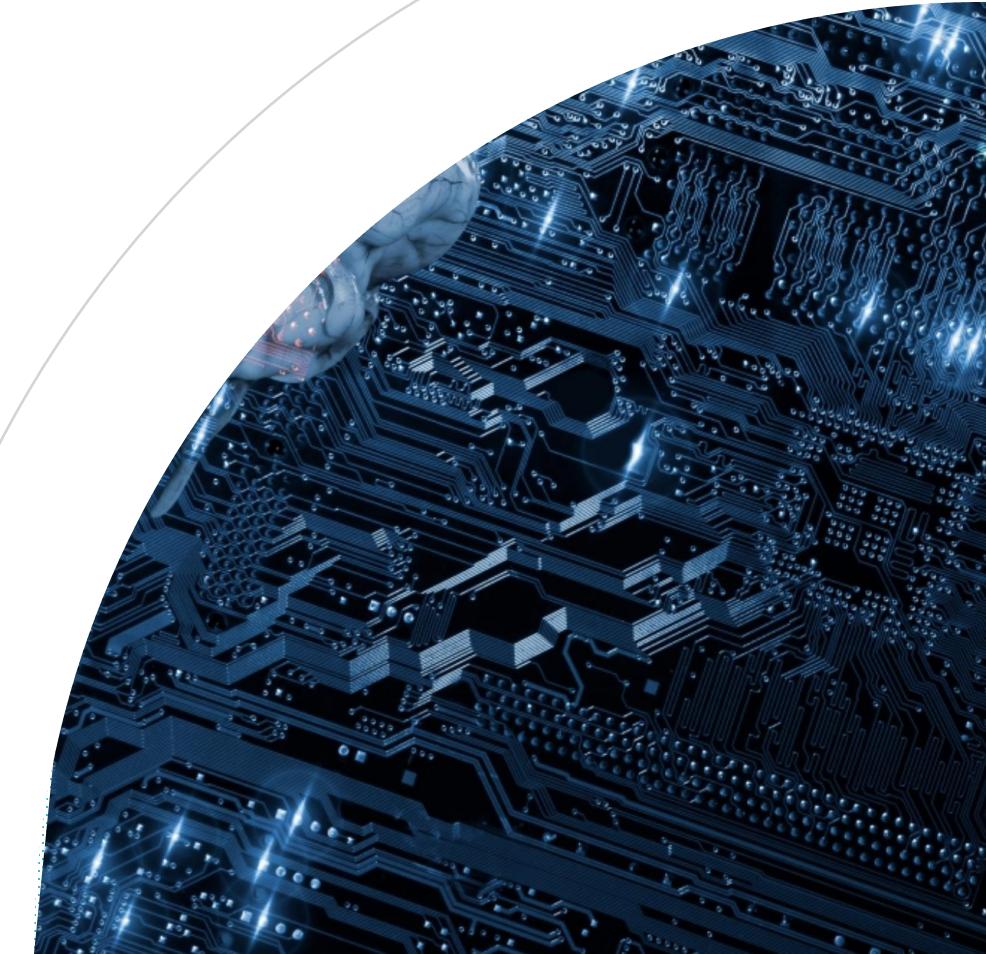


- Generative AI is a type of AI that can create new content and ideas, including conversations, stories, images, videos, and music
- It is powered by very large ML models that are pre-trained on large amounts of data and is usually referred to as a foundation model (FM)
- Customers use Amazon Kendra with large language models (LLMs) to rapidly construct secure, generative AI-powered conversational experiences for users on top of enterprise content

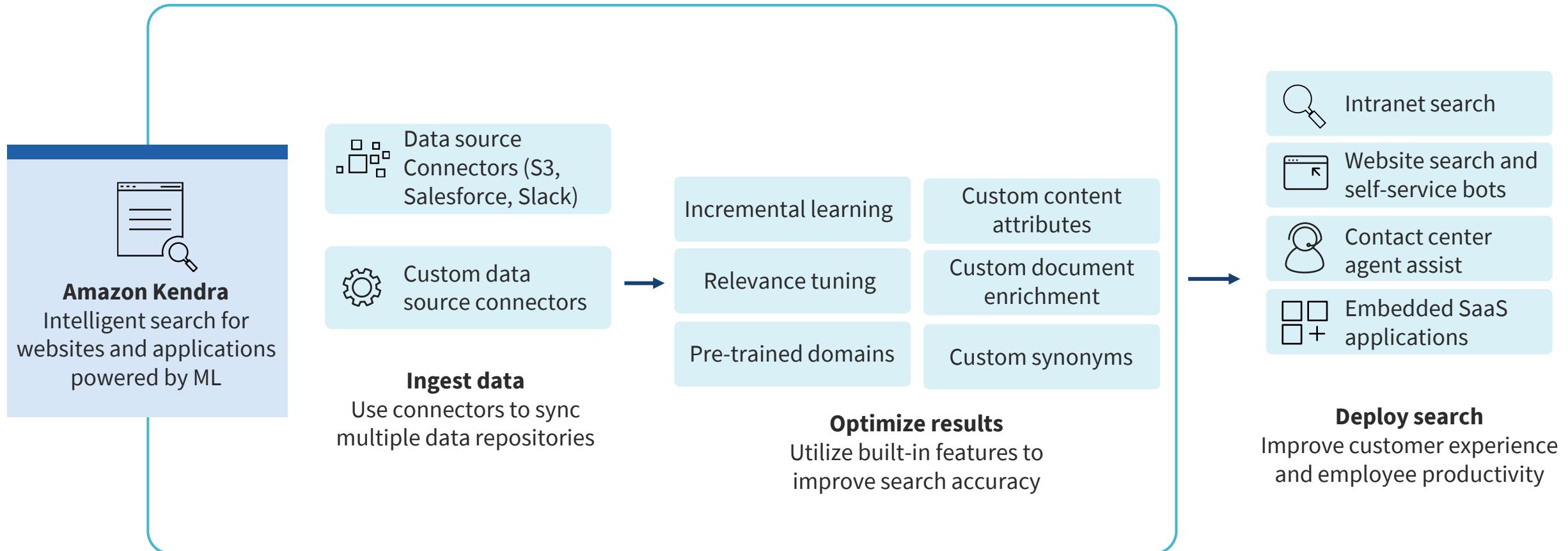
# Amazon Kendra Use Cases

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- Deploy a fine-tuned and cohesive search experience across multiple structured and unstructured content sources
- Use natural language processing (NLP) to attain decidedly accurate answers without any ML experience
- Provide ML-powered instant answers, FAQs, and document ranking using a fully managed service



# Amazon Kendra





## Amazon Athena

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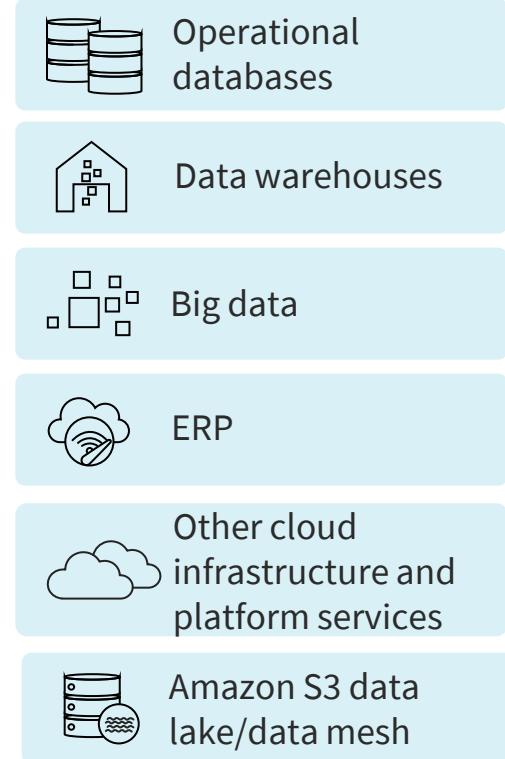
- Amazon Athena is a serverless, interactive analytics solution built on open-source frameworks
- It supports open-table and file formats
- Athena delivers a flexible and easy way to analyze petabytes of data right where it resides
- There is no provisioning or configuration effort required on the client side

# Amazon Athena

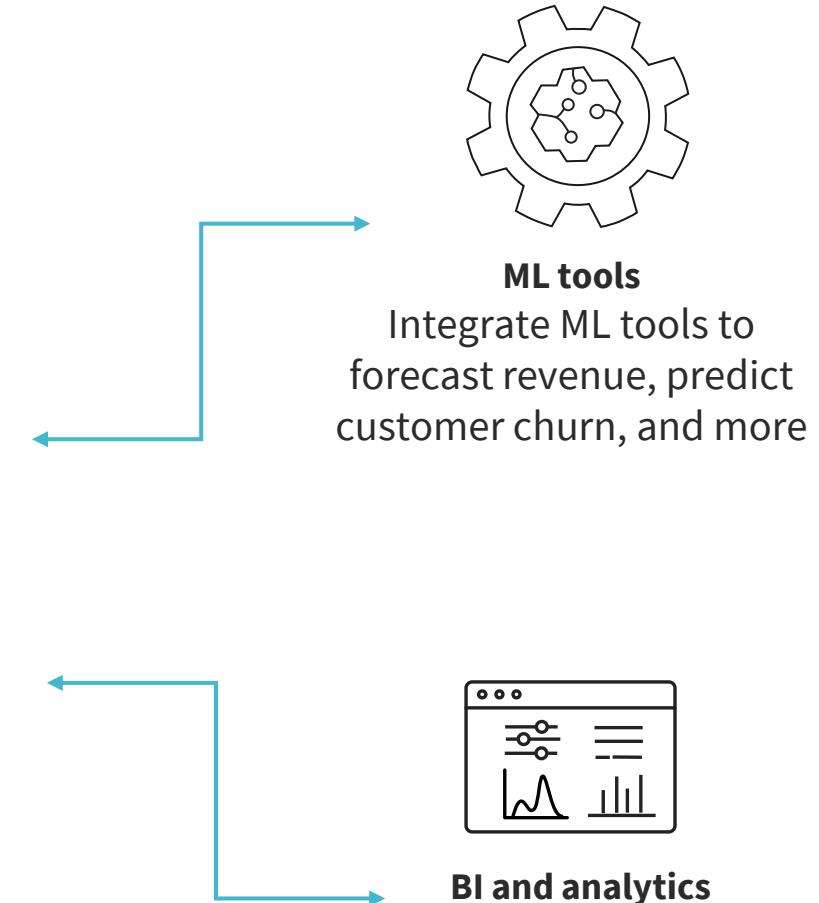
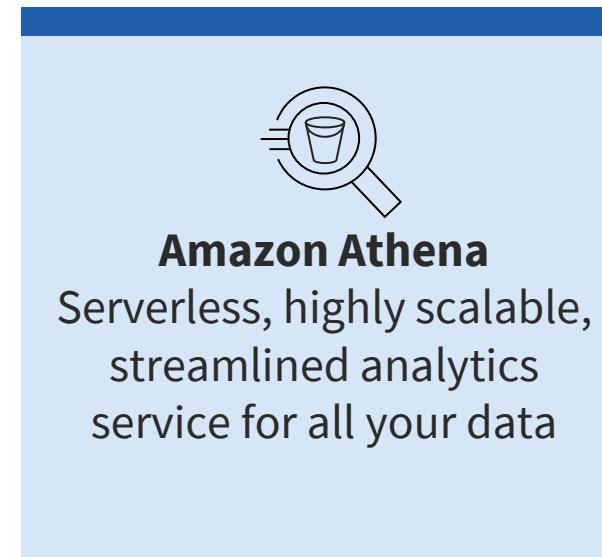
- Customers use Athena to analyze data or build applications from an Amazon Simple Storage Service (S3) data lake and 30 data sources, including on-premises data sources or other cloud solutions using SQL or Python
- Athena is built on open-source Trino and Presto engines and Apache Spark frameworks
- **Exam: Use Athena if you need to search through large amounts of S3 bucket data**



# Amazon Athena



Query data from data lakes, warehouses, transactional systems, big data frameworks, and more running on-premises or in the cloud



# Other AI Services at AWS

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- **Amazon Polly** is for deploying high-quality, natural-sounding human voices in dozens of languages
- **Amazon Rekognition** is for analyzing millions of images, streaming, and stored videos within seconds, and augment human review tasks with artificial intelligence (AI)



# Amazon Kinesis

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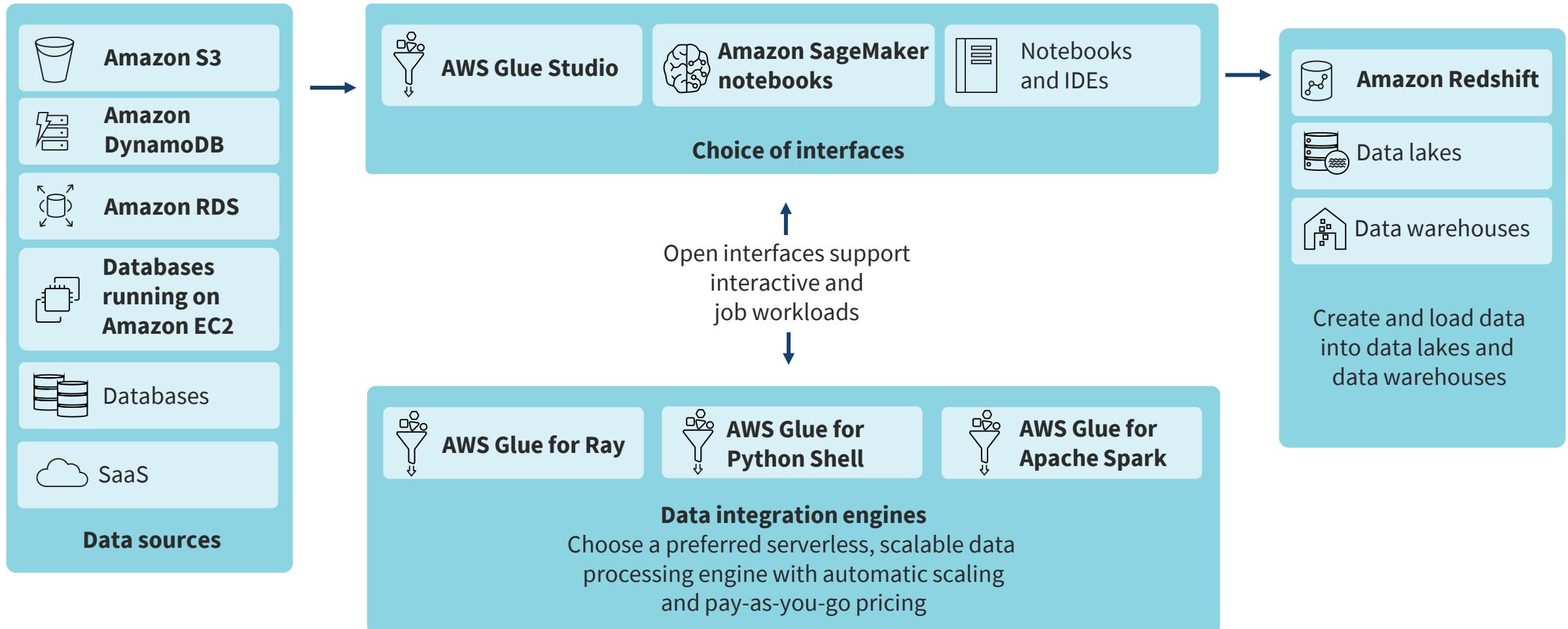
- With Amazon Kinesis customers can:
  - Collect, process, and analyze real-time, streaming data to gain timely insights and react quickly to new information
  - Ingest real-time data such as video, audio, application logs, website clickstreams, and IoT telemetry data for machine learning, analytics, and other applications
  - Process and analyze data as it arrives and respond instantly instead of having to wait until all the data is collected before the processing can begin

# AWS Glue

- AWS Glue is a serverless data integration service that makes it easier to discover, prepare, move, and integrate data from multiple sources
- Glue is used for analytics, ML, and application development
- AWS customers can use Glue to
  - Discover and connect to over 70 varied data sources
  - Manage data in a centralized data catalog
  - Visually create, run, and monitor extract, transform, and load (ETL) pipelines to load data into data lakes



# AWS Glue





# Amazon QuickSight

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- QuickSight is a popular cloud-native, serverless Business Intelligence (BI) service
- Customers can easily embed analytics to differentiate their applications in a scalable way
- End-users can ask questions in their natural language and receive answers with pertinent visualizations
- Business analysts can generate and share pixel-perfect dashboards and visualizations without needing any client software or a server infrastructure

# AWS Cloud9 IDE

The screenshot shows the AWS Cloud9 IDE interface. On the left is the code editor with a file named index.js. The code defines several handlers for intents like LaunchRequest, GetNewFactIntent, GetFact, and AMAZON.HelpIntent. The code uses the AWS Lambda SDK (`this.t()`) to get facts from a space facts list. The right side of the interface shows the environment members (You, aaron, rob) and a group chat window where users are discussing the testing of a skill.

```
index.js
85     },
86     },
87   ];
88 }
89
90 const handlers = {
91   'LaunchRequest': function () {
92     this.emit('GetFact');
93   },
94   'GetNewFactIntent': function () {
95     this.emit('GetFact');
96   },
97
98   },
99
100 },
101
102   'GetFact': function () {
103     // Get a random space fact from the space facts list
104     // Use this.t() to get corresponding language data
105     const factArr = this.t('FACTS');
106     const factIndex = Math.floor(Math.random() * factArr.length);
107     const randomFact = factArr[factIndex];
108
109     // Create speech output
110     const speechOutput = this.t('GET_FACT_MESSAGE') + randomFact;
111     this.emit(':tellWithCard', speechOutput, this.t('SKILL_NAME'));
112   },
113   'AMAZON.HelpIntent': function () {
114     const speechOutput = this.t('HELP_MESSAGE');
115     const reprompt = this.t('HELP_MESSAGE');
116     this.emit(':ask', speechOutput, reprompt);
117   },
118 }
```

**Environment Members:**

- You (online)
- aaron (online)
- rob (online)

**Group Chat:**

- You: Hey Aaron, can you jump in here quick and look at these variables?
- aaron: Sure, looking now
- aaron: Ok, I've fixed the variables. Let's test it
- You: thanks, before testing i want to show it to Rob real quick
- rob: Looks ok. I don't see my Star trek facts though 😊

**User Icons:**

- A:** Associated with the environment member You.
- B:** Associated with the environment member aaron.
- C:** Associated with the environment member rob.

# AWS Cloud9

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- “After careful consideration, we have made the decision to close new customer access to AWS Cloud9, effective July 25, 2024. ”
- Customers are encouraged to migrate from AWS Cloud9 to AWS IDE Toolkits or AWS CloudShell.



# CloudShell

The screenshot shows the AWS CloudShell interface. At the top, there's a navigation bar with the AWS logo, a 'Services' dropdown, a search bar containing 'Search [Alt+S]', and various status icons like signal strength and battery level. To the right of the search bar are region ('N. Virginia') and user ('mjshannawtest') dropdowns.

The main content area is titled 'Resources' and displays a summary of Amazon EC2 resources in the US East (N. Virginia) Region. The resources listed are:

Resource Type	Count
Instances (running)	0
Auto Scaling Groups	0
Dedicated Hosts	0
Elastic IPs	1
Instances	1
Key pairs	1
Load balancers	0
Placement groups	0
Security groups	2
Snapshots	0
Volumes	2

On the left side, there's a sidebar titled 'EC2 Dashboard' with the following menu items:

- EC2 Global View
- Events
- Instances** (selected, indicated by a red box)
  - Instances
  - Instance Types
  - Launch Templates
  - Spot Requests
  - Savings Plans
  - Reserved Instances
  - Dedicated Hosts
  - Capacity Reservations
- Images

At the bottom of the page, there's a footer with links for 'CloudShell' (which is highlighted with a red box), 'Feedback', 'Privacy', 'Terms', and 'Cookie preferences'. The footer also includes a copyright notice: '© 2023, Amazon Web Services, Inc. or its affiliates.'

# CloudShell

The screenshot shows the AWS CloudShell interface. At the top, there's a header bar with the AWS logo, a search bar containing "aws cloudshell", and a "CloudShell" button. Below the header is a navigation bar with "CloudShell" and "Feedback" buttons. The main area is a terminal window titled "AWS CloudShell" with the region "us-east-1" selected. The terminal prompt is "[cloudshell-user@ip-10-4-36-189 ~]\$". On the right side of the terminal window, there are "Actions" dropdown, "Copy", and "Share" icons. At the bottom of the screen, there's a footer bar with links for "Privacy", "Terms", and "Cookie preferences", along with the copyright notice "© 2023, Amazon Web Services, Inc. or its affiliates."

# AWS AppConfig and OpsWorks

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- AWS AppConfig is a feature of AWS Systems Manager that enables customers to generate, manage, and rapidly install application configurations
  - A configuration is a pool of settings that impact the functionality of applications
  - AppConfig is used with applications hosted on EC2 instances, AWS Lambda, containers, mobile applications, or Internet of Things (IoT) devices
- **Exam: AWS OpsWorks is a configuration management service that helps you configure and operate applications in a cloud enterprise by using Puppet or Chef.**

# Survey of Developer Services

## AWS CodeArtifact

A managed artifact **repository** service that lets you securely store, publish, and share software packages



## AWS CodeBuild

A fully managed continuous integration service that **compiles** source code, runs tests, and produces ready-to-deploy software



## AWS CodeCommit

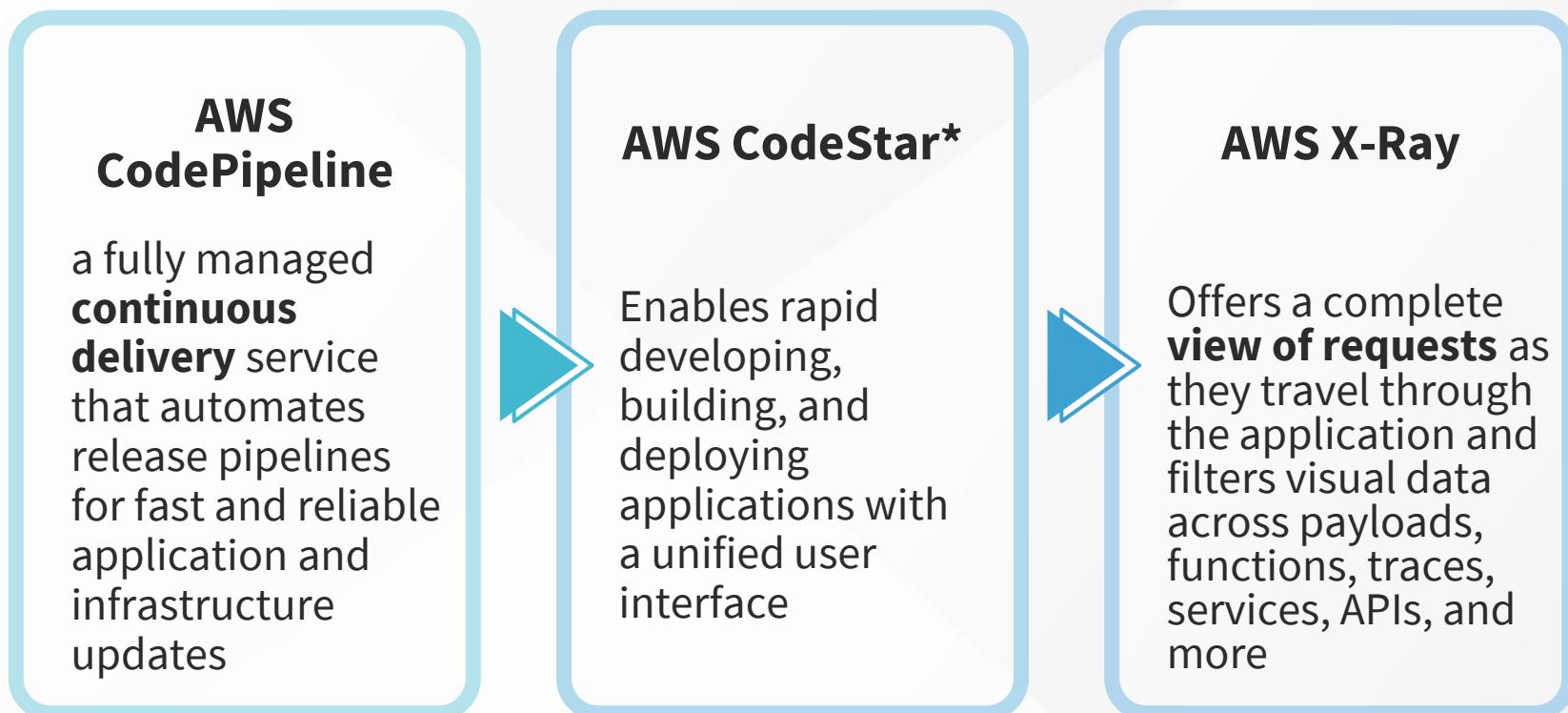
A managed source control service that makes it easier to securely host highly scalable private **Git repositories**



## AWS CodeDeploy

a fully managed deployment service that **automates software deployments** to various compute services, such as EC2

# Survey of Developer Services



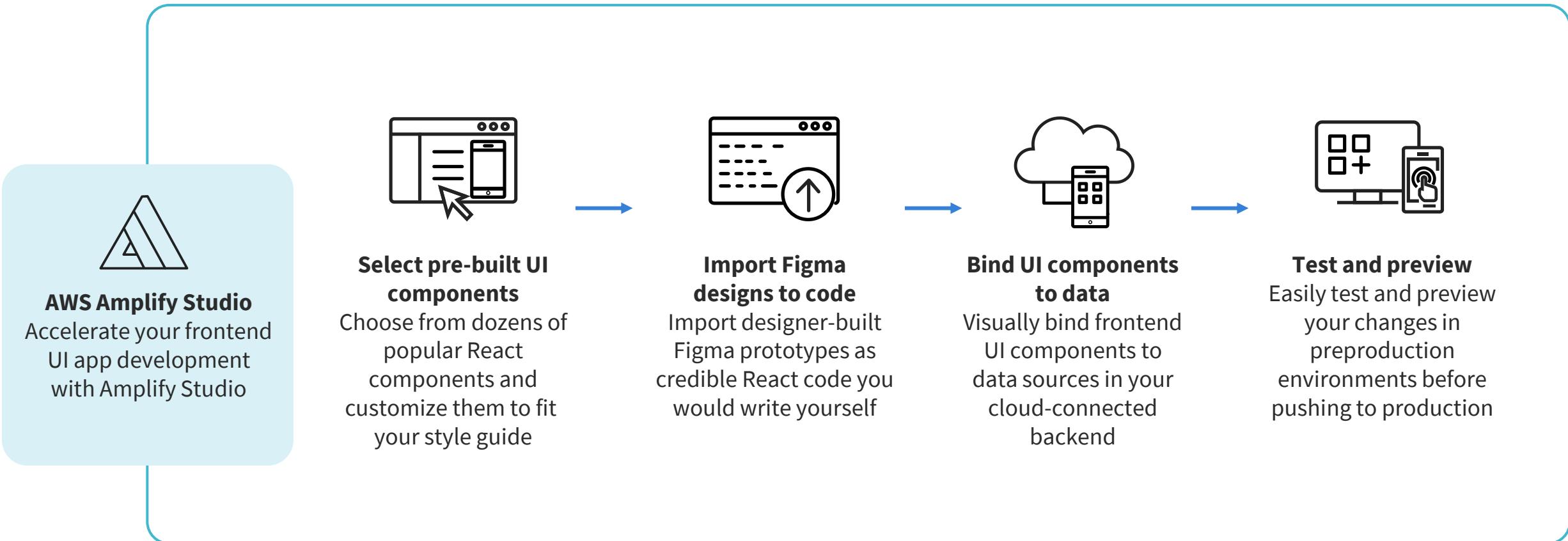
# AWS Amplify

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- AWS Amplify is a total solution that enables frontend web and mobile developers to rapidly and seamlessly build, deploy, and host full stack applications on AWS
- It has the flexibility to leverage the range of AWS services as use cases introduce themselves without any necessary cloud expertise



# Create a Frontend UI with AWS Amplify



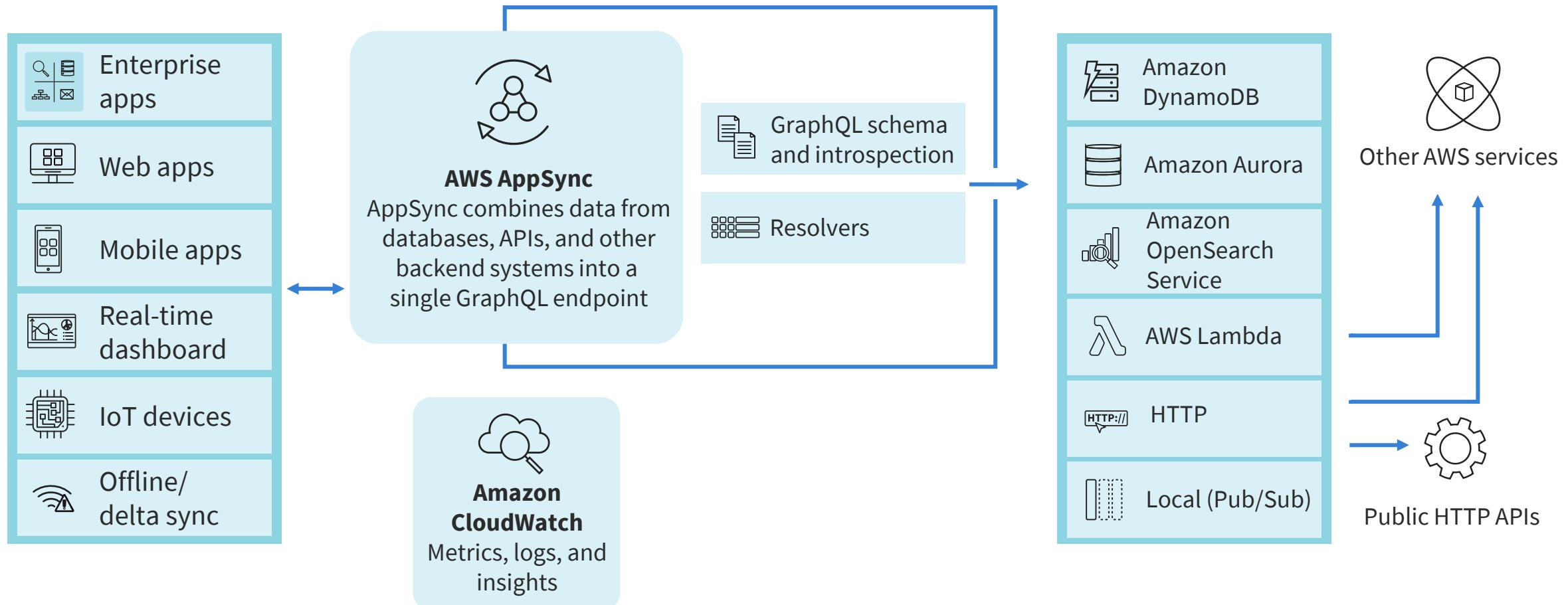


# AWS AppSync

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- AWS AppSync generates serverless GraphQL and pub/sub APIs that make application development easy
- It offers a single endpoint to securely query, update, or publish data
- Customers can connect apps to data and events with secure, serverless, and high-performing APIs

# AWS AppSync



# End User Computing (EUC) Services

**Amazon AppStream 2.0** is a fully managed non-persistent desktop and application service for remotely accessing work

**Amazon WorkDocs & WorkSpaces** bundle is a managed, content creation, file collaboration, secure cloud desktop service

**Amazon WorkSpaces Web** is a low cost, fully managed, Linux-based service, designed to facilitate secure browser access to internal websites and software-as-a-service (SaaS) applications from existing web browsers, without appliances, infrastructure, special client software, or VPN connections



# Amazon Connect

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- Connect allows customers to roll out a scalable contact center in minutes
- Amazon Connect offers powerful analytics, insights, and optimization
- Customers can use a few clicks and onboard agents to assist customers immediately
- Expand agent productivity and customer experience over voice and digital channels with the AI/ML-powered contact center



# Amazon Connect

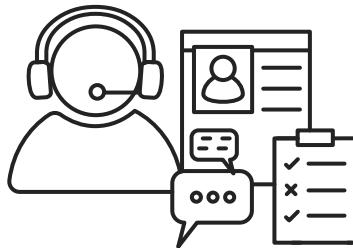


## Customers

Fast, secure, high-quality, personalized customer service



**Amazon Connect**  
Omnichannel cloud contact center driving better customer experiences



## Agents

Efficient tools in one UI to deliver productive customer conversations and improve CSAT



## Managers

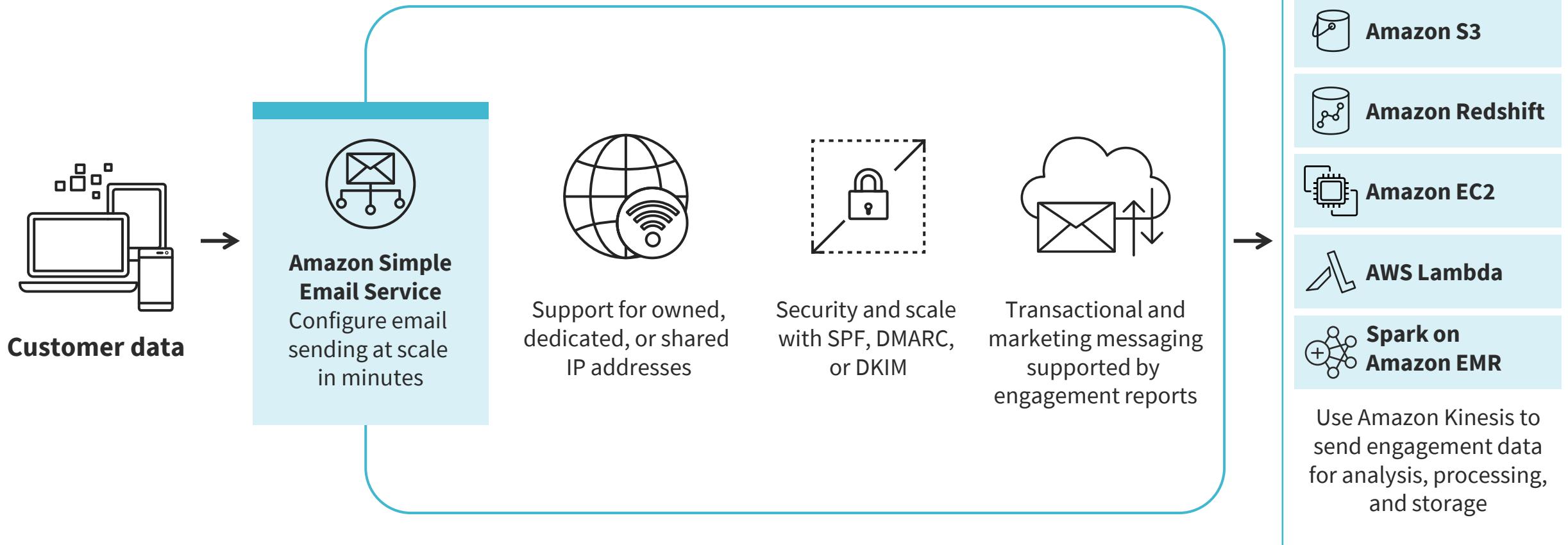
An ML-powered contact center you can set up quickly and make changes in minutes, not months

# Amazon Simple Email Service (Amazon SES)

- Amazon Simple Email Service (Amazon SES) lets AWS customers reach *their* customers assertively without an on-premises Simple Mail Transfer Protocol (SMTP) email server
- It can use the Amazon SES API or SMTP interface



# Amazon Connect





## IoT Core

---

- AWS IoT Core lets customers potentially connect billions of IoT devices and route trillions of messages to AWS services without managing an infrastructure
- Provides secure device connections and data with mutual authentication and end-to-end encryption
- Customers can choose among several communication protocols including MQTT, HTTPS, MQTT over WSS, and LoRaWAN

# AWS IoT Core



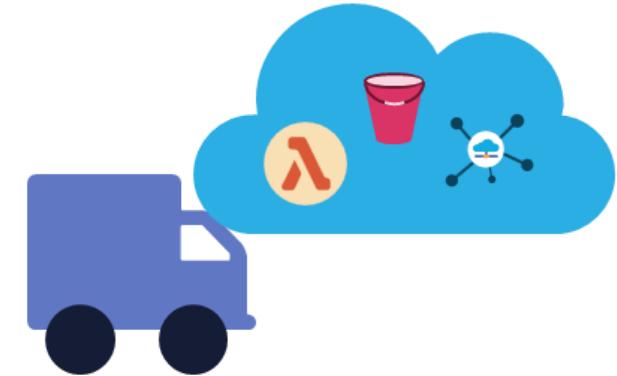
## Devices publish & subscribe

Billions of devices can publish and subscribe to messages



## AWS IoT Core

Messages are transmitted and received using the MQTT protocol which minimizes the code footprint on the device and reduces network bandwidth requirements



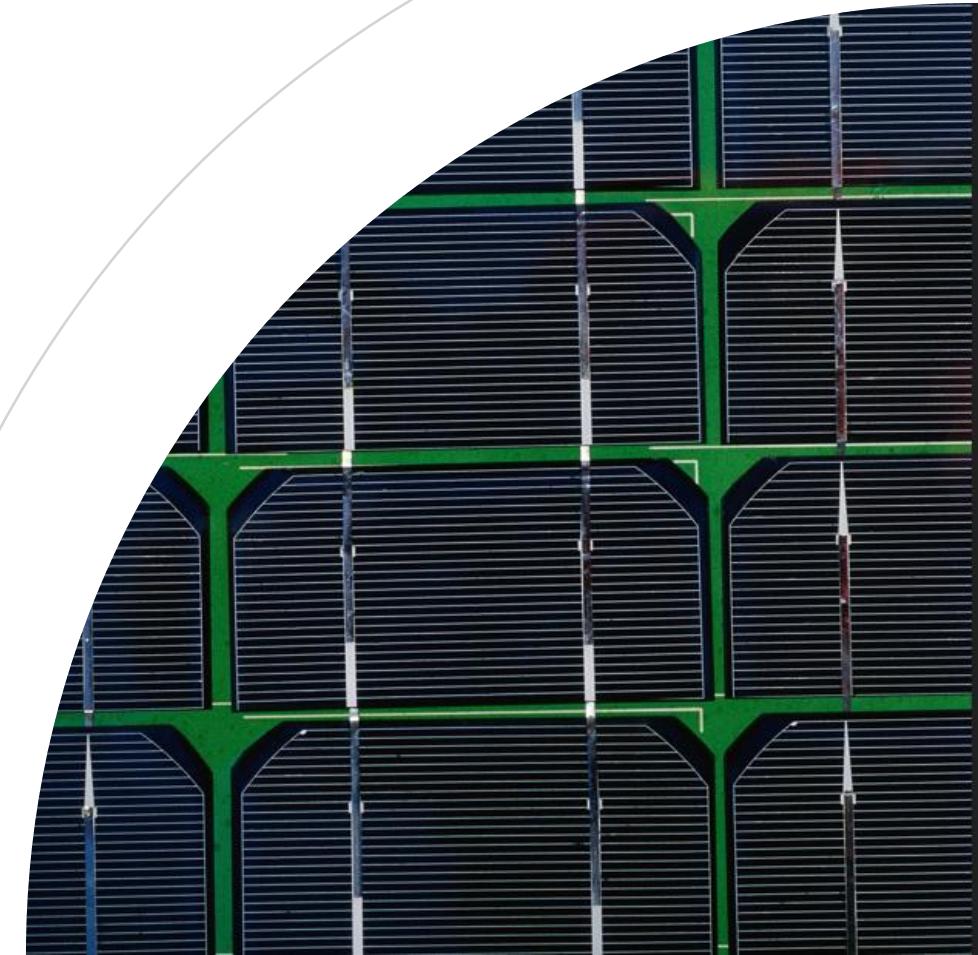
## Devices communicate

AWS IoT core enables devices to communicate with AWS services and each other

# IOT Greengrass

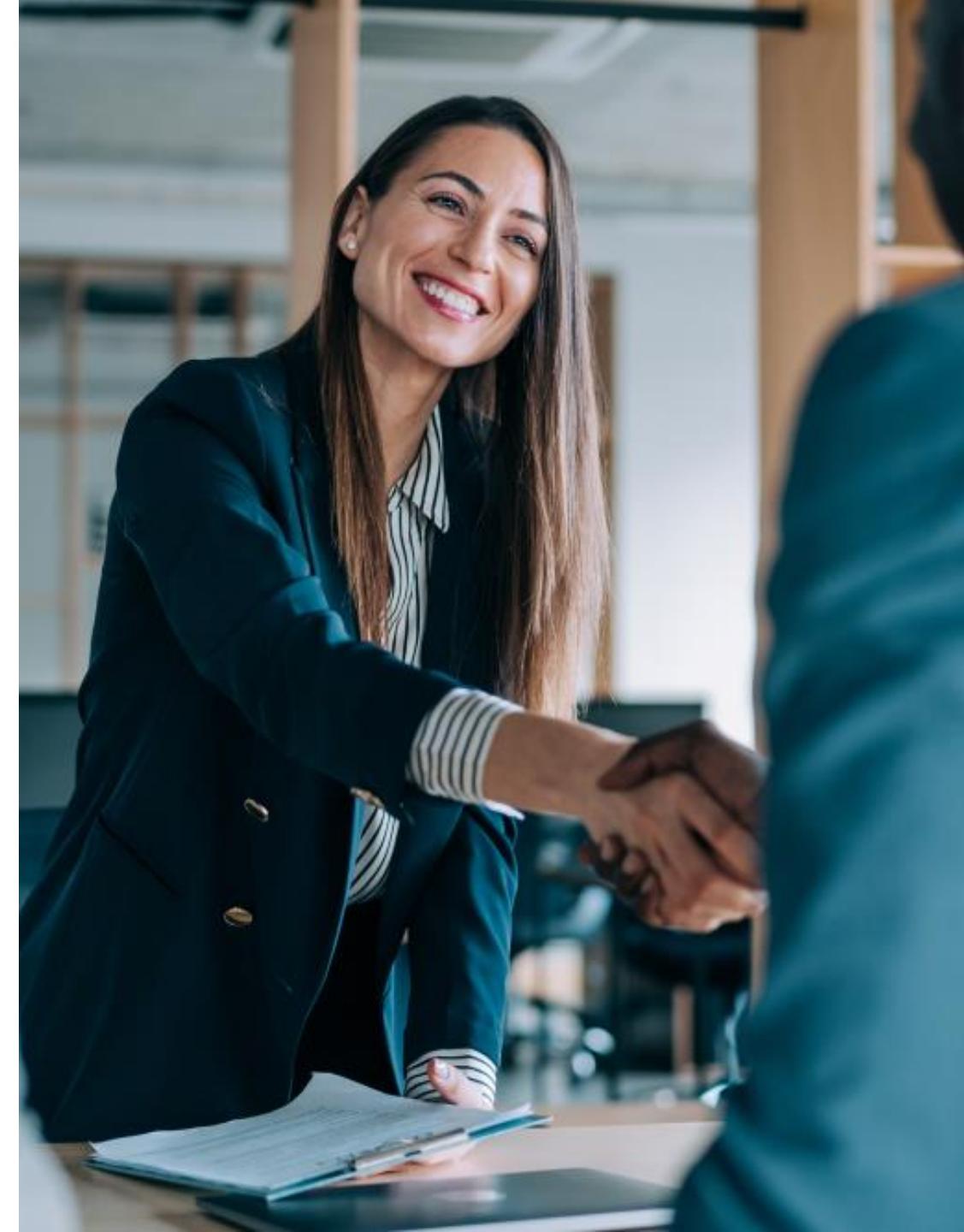
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- AWS IoT Greengrass is an open-source edge runtime and cloud service for building, deploying, and managing device software
- Greengrass makes it easy to bring intelligence to edge devices, such as for anomaly detection in precision agriculture or powering autonomous devices
- Collect, aggregate, filter, and send data locally or manage and control which data goes to the cloud for optimized analytics and storage



# AWS Activate for Startups

- AWS Activate offers eligible\* startup organizations free tools, resources, and content meant to streamline every phase of the startup initiative
- New members get benefits such as:
  - AWS curated expert advice on business and technical needs
  - Training and support
  - Pre-built infrastructure templates
- Startups can apply for AWS Activate credits to offset their AWS bill and build a new scalable, dependable, secure, and efficient infrastructure



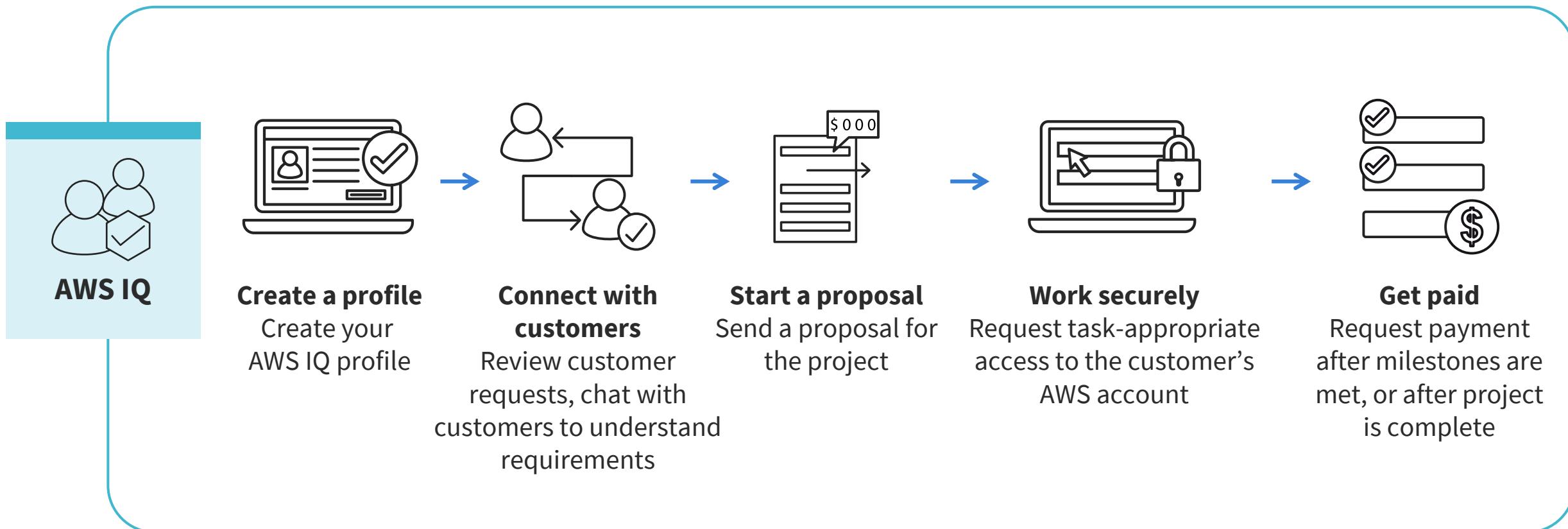
A circular inset photograph of a young woman with blonde hair, wearing blue-framed glasses and a small hoop earring. She is resting her chin on her hand and looking thoughtfully upwards and to the side. In the background, another person in a blue shirt is visible.

## AWS IQ

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- AWS IQ enables customers to quickly find, engage, and pay AWS Certified third-party experts for on-demand project work
- AWS IQ also makes it easy for you to use your AWS Certifications to help AWS customers
- With AWS IQ, you have a secure collaborative workspace for project consultations and an easy way to get paid

# AWS IQ

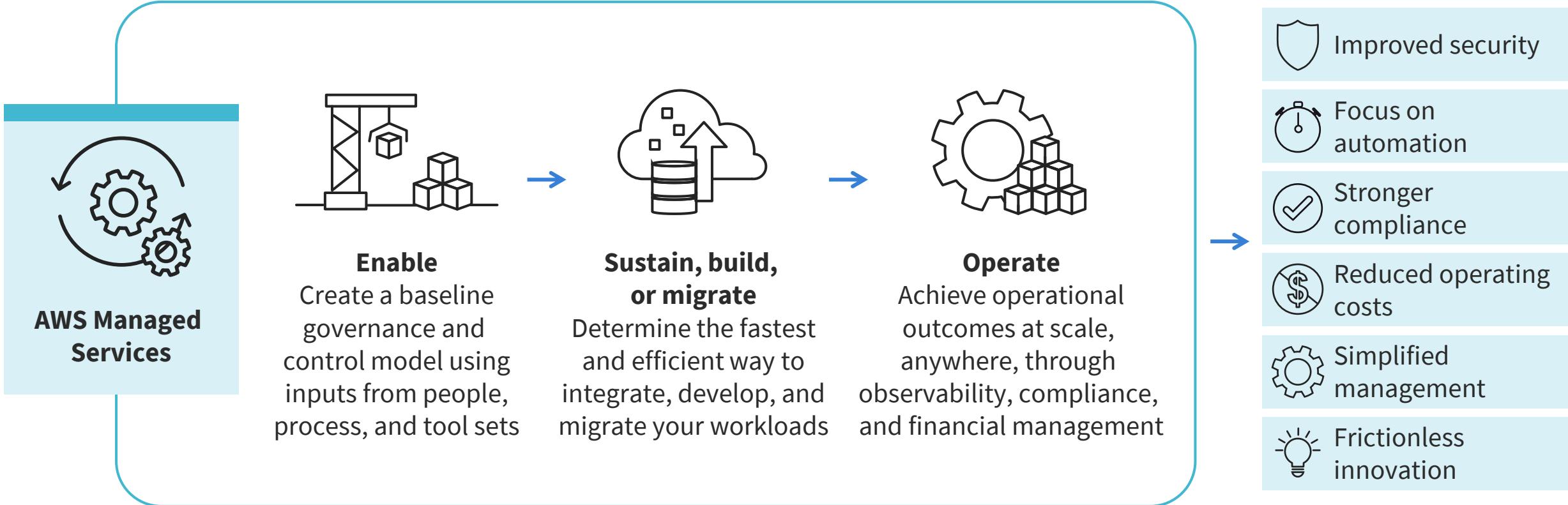


# AWS Managed Services (AMS)

- AWS AMS with the adoption of AWS at scale to operate more efficiently and securely
- Enables customers to leverage standard AWS services and offers guidance and execution of operational best practices with specialized automation, skills, and experience for:
  - Monitoring
  - Incident management
  - AWS Incident Detection and Response
  - Security
  - Patch and backup
  - Cost optimization



# AWS Managed Services





**Thank you for attending!**

**Michael J Shannon**  
**CISSP, CCSP, CCSK, ITIL 4 Managing Professional**

**May you all have great success with your cloud computing future!**