



# WELCOME BACK TO AWS CLOUD PRACTITIONER

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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

- 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

AWS Services

CloudWatch Dashboards MyDashboard Alarms ALARM INSUFFICIENT OK Billing Events Rules Event Buses Logs Insights Metrics Favorites + Add a dashboard

Add to this dashboard

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

**Line**  
Compare metrics over time

**Stacked area**  
Compare the total over time

**Number**  
Instantly see the latest value for a metric

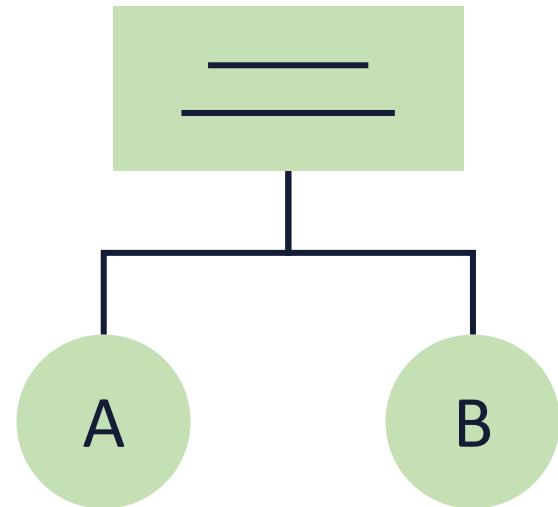
**Text**  
Free text with markdown formatting

**Query results**  
Explore results from Logs Insights

Cancel Configure

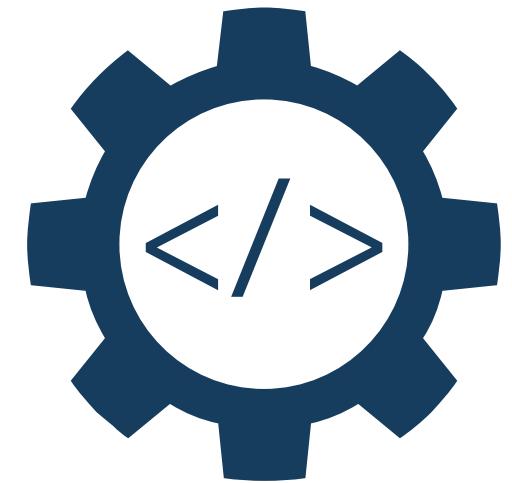
# AWS CLOUDTRAIL

- 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 to 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

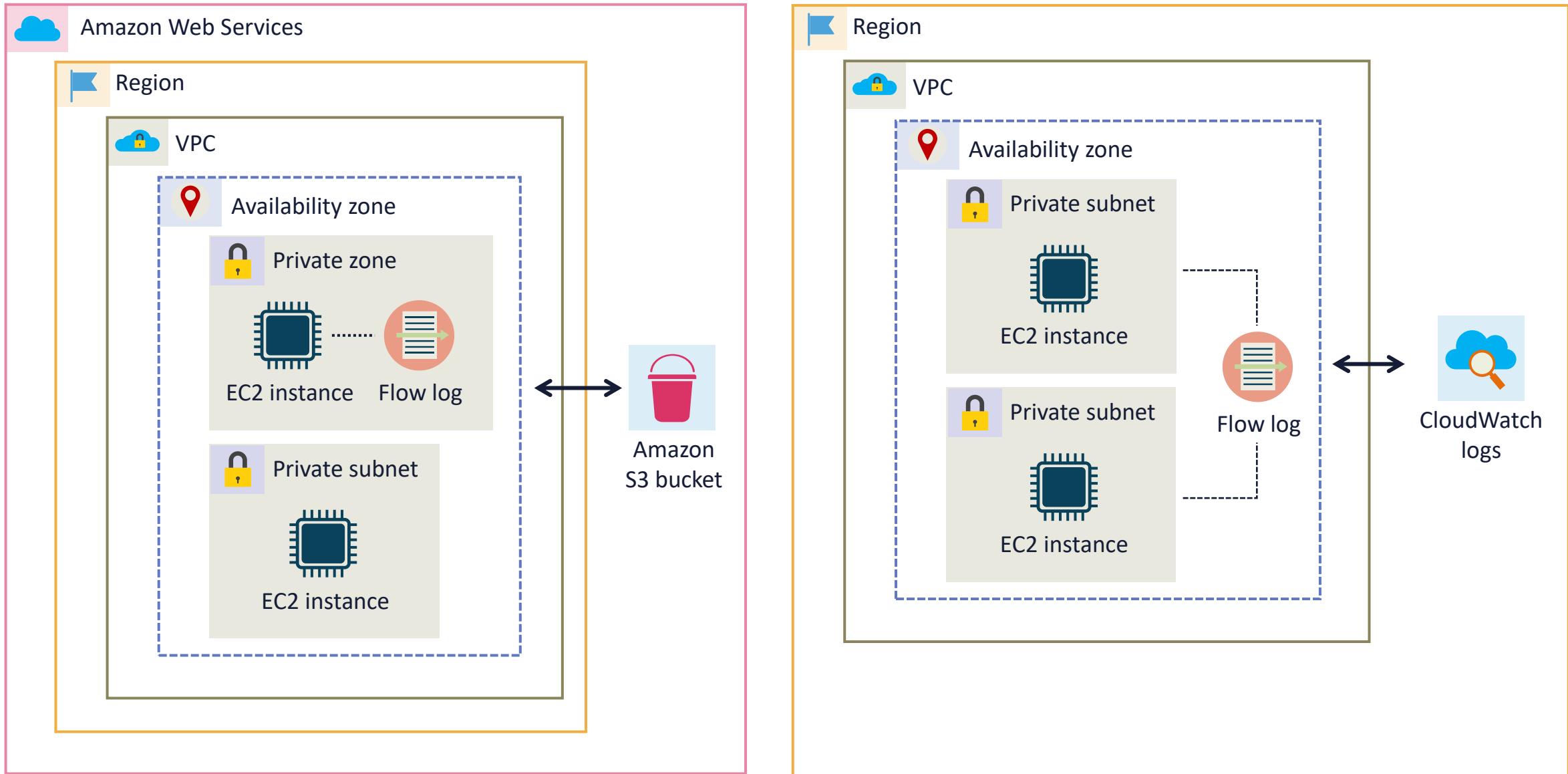


# AWS CLOUDTRAIL USE CASES

- 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



# **EXAMINING AWS SECURITY HUB**

In this demo...

examine AWS Security Hub

<https://aws.amazon.com/security-hub/>



# 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

- 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

- 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

- 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

- 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

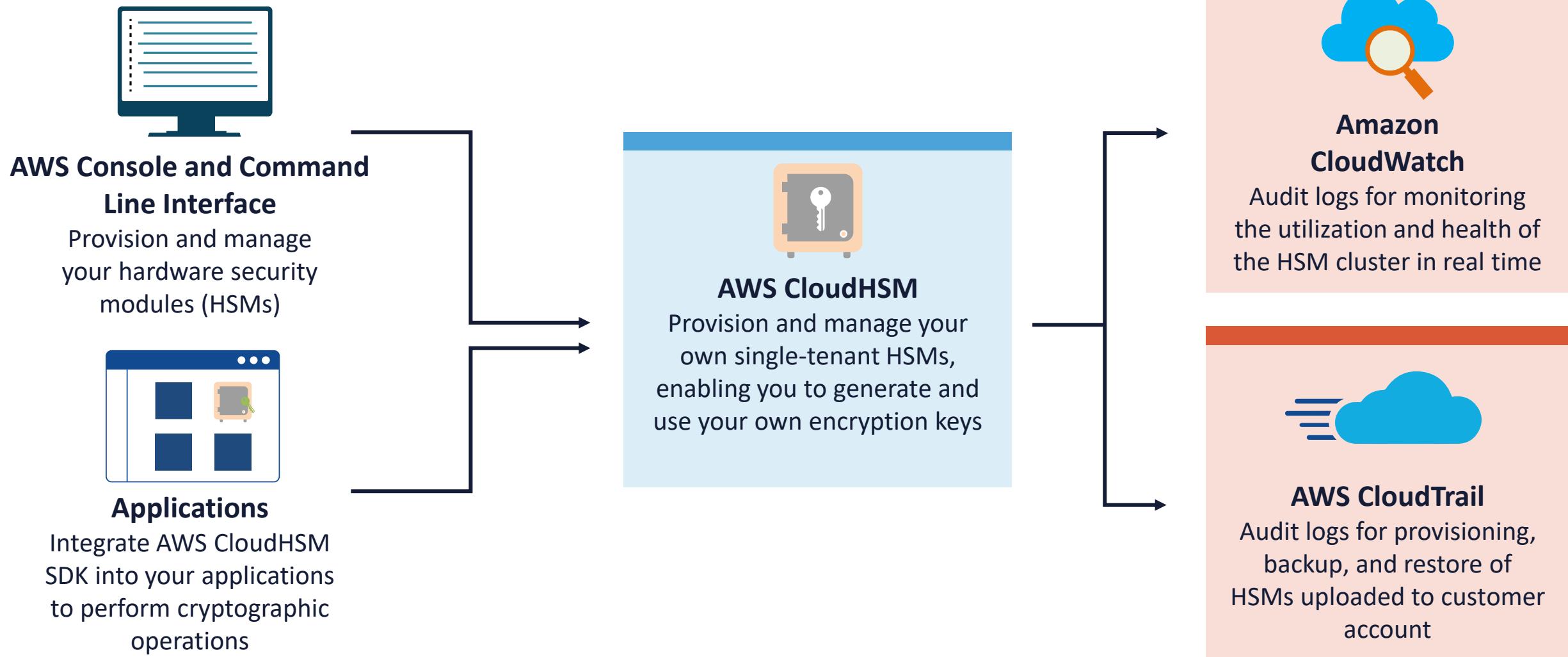
- Amazon Detective streamlines the investigative process and assists security teams in performing rapid and efficient eDiscovery initiatives
- Customers can quickly analyze and determine the nature and extent of possible security issues with Amazon Detective prebuilt data aggregations, summaries, and context
- Detective automatically gathers log data from AWS resources and uses machine learning, 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 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 commonly deployed behind an API gateway with serverless technologies



# ECONOMIES OF SCALE



# AWS SECURITY CENTER



## Prevent

Define user permissions and identities, infrastructure protection, and data protection measures for a smooth and planned AWS adoption strategy



## Detect

Gain visibility into your organization's security posture with logging and monitoring services

Ingest this information into a scalable platform for event management, testing, and auditing



## Respond

Automated incident response and recovery to help shift the primary focus of security teams from response to analyzing root cause



## Remediate

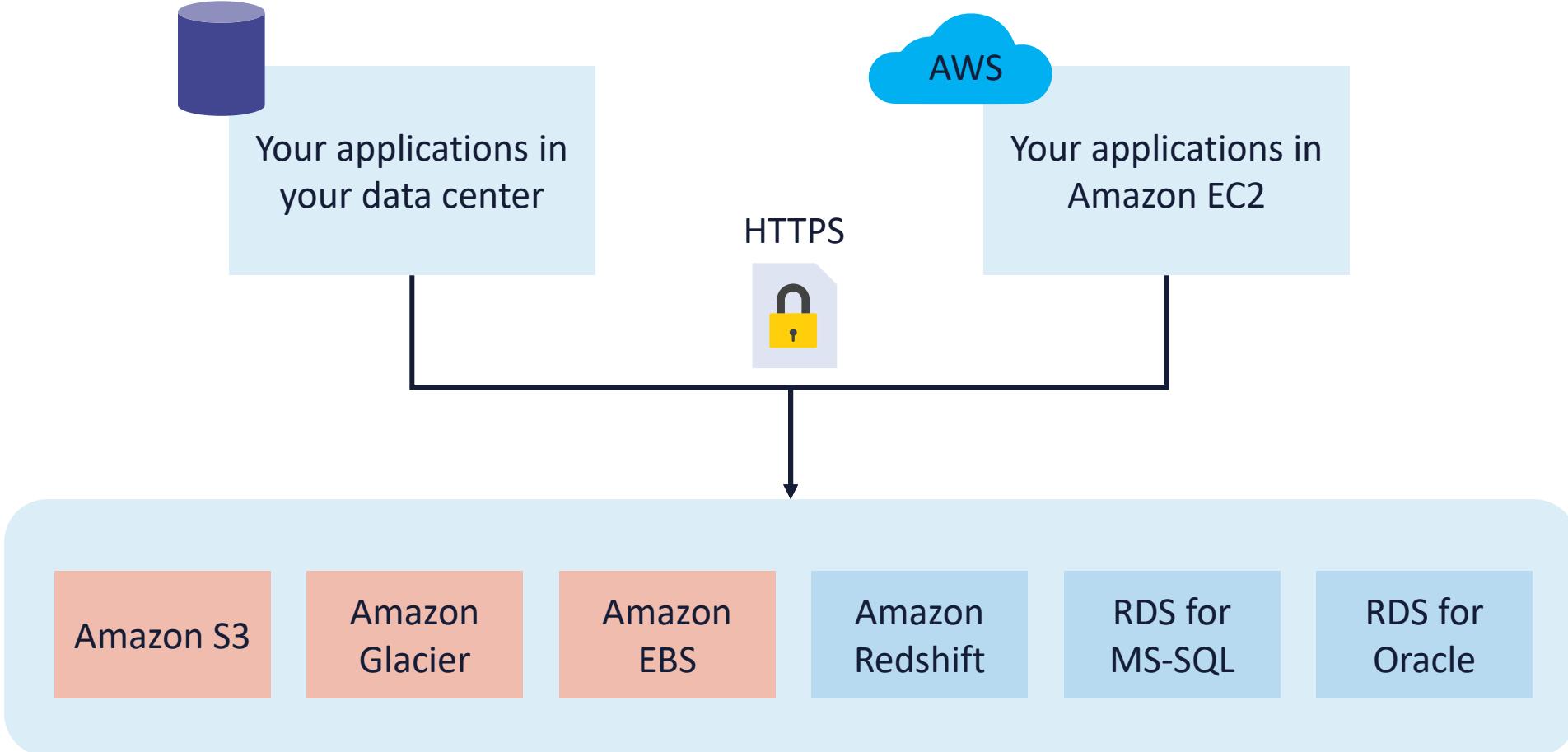
Leverage event driven automation to quickly remediate and secure your AWS environment in near real-time

A photograph showing a person's hands typing on a laptop keyboard. The laptop screen displays a blog post from the AWS Security Blog. The laptop is placed on a white-tiled kitchen counter. In the background, there is a wooden chair, a bunch of bananas on a plate, and a blue mug on the counter.

# AWS SECURITY BLOG

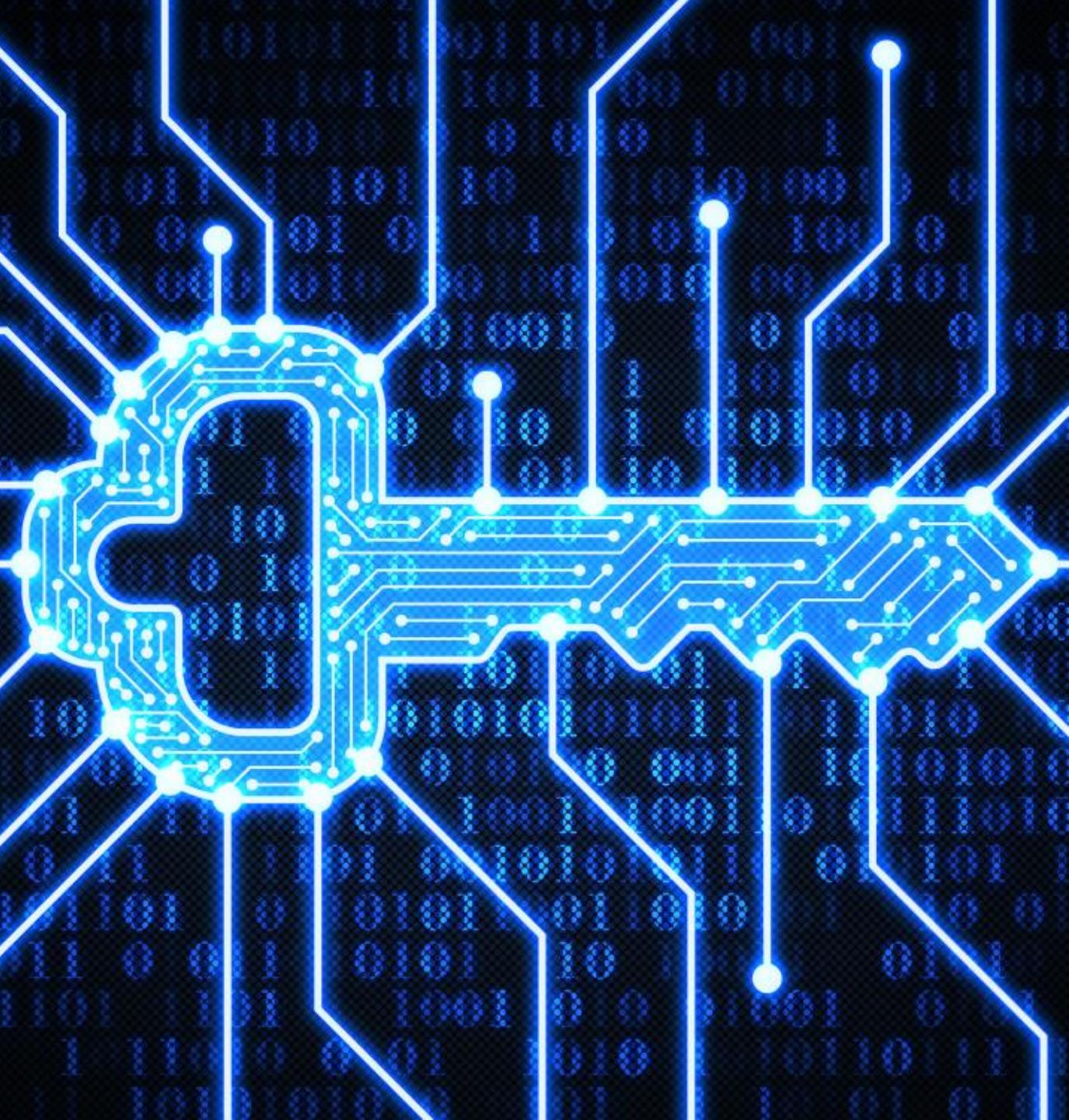
- The AWS Security Blog features regular posts by AWS experts and other industry professionals
- The blog articles are an excellent research and information-gathering source for all things AWS
- Customers can search based on categories, topics, keywords, products, solutions, industries, and even learning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

# CLIENT VS. SERVER-SIDE ENCRYPTION



# AWS KEY MANAGEMENT SERVICE (AWS KMS)

- AWS Key Management Service 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 Encrypte ▾
EBS	/dev/sdb	Search (case-insensit	8	General Purpose SSD (gp2)	100 / 3000	N/A	<input type="checkbox"/>	Not Encrypte ▾

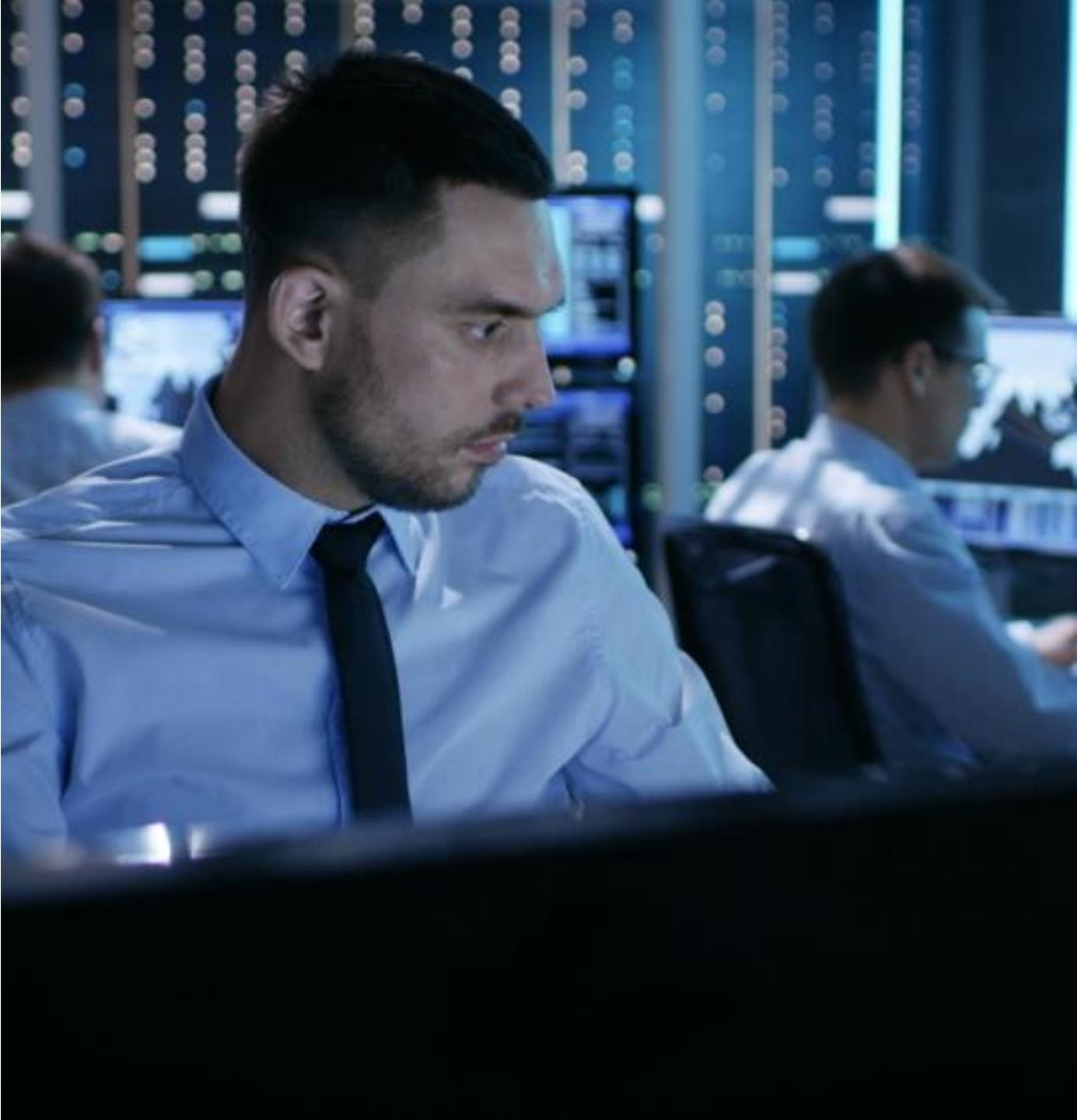


# ONE-TIME OPERATIONS

- Run ad hoc serverless workloads such as Bastion (jump) services
- Automate extract, transform, and load (ETL) processes to ensure that multiple long-running ETL jobs run in order and complete successfully, without the need for manual orchestration
- Combine multiple AWS Lambda functions into a one-time responsive serverless application and microservice
- Use code to process data on demand with large-scale parallel workflows

# REPEATABLE OPERATIONS

- Application orchestration of web applications
- Machine learning collection and processing of image data to detect objects within a video stream or to provide visual and metadata information for data cataloging
- Security automation of scheduled analysis or security incident response initiated by managed resource events
- Media processing by extracting data from PDF documents or images for processing



# AWS CloudFormation

- 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, AND AWS BATCH**

In this demo...

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

# RESERVED INSTANCE BEHAVIOR AND FLEXIBILITY

- 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 photograph of a young woman with long dark hair, wearing a light purple t-shirt, sitting in a server room. She is looking down at a tablet device she is holding in her hands. Behind her are several server racks with blue and white cables running across them.

# AMAZON EC2 RI INSTANCE TYPES

- **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

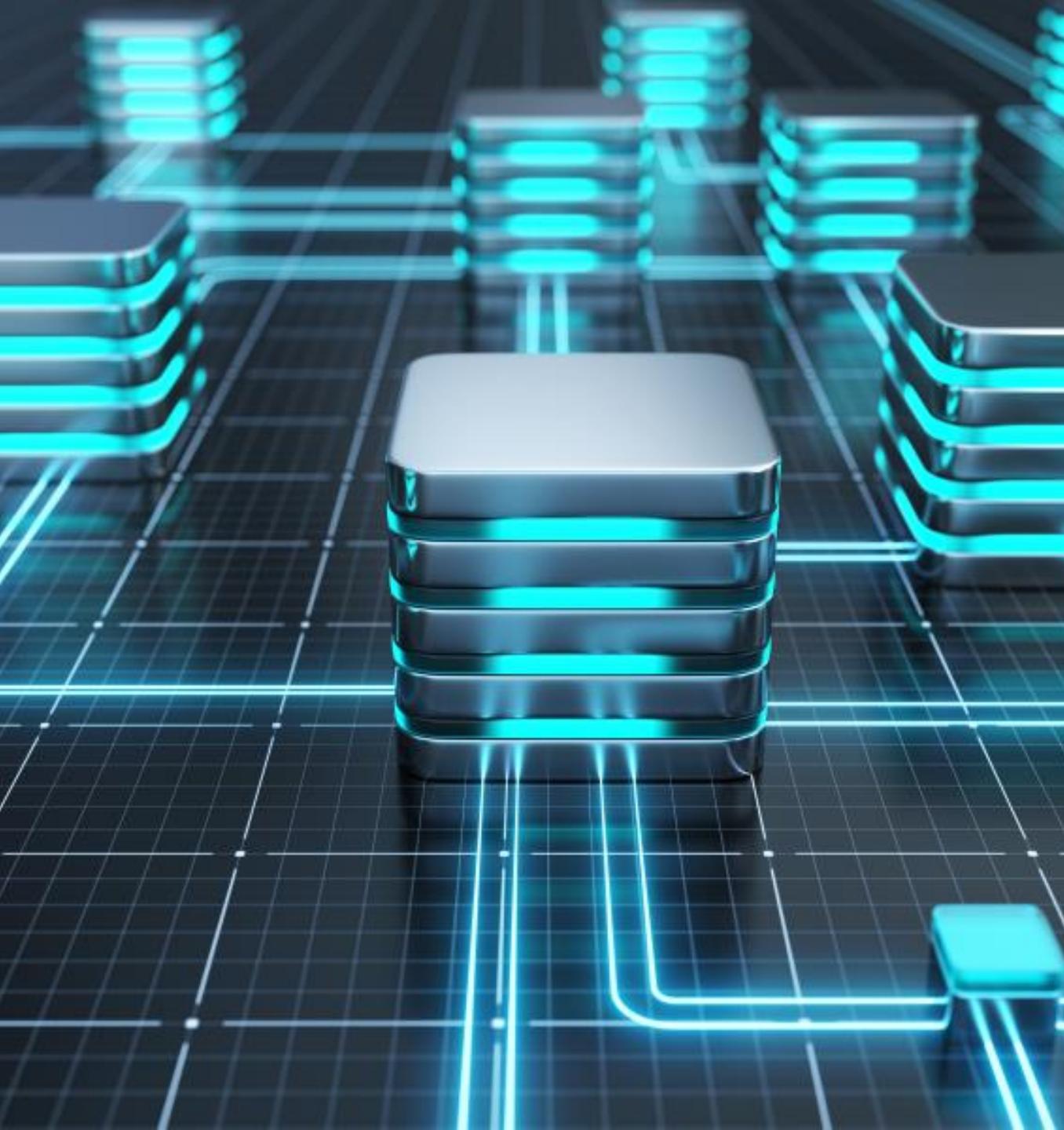
# INSTANCE TYPE COMPARISONS

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

# RESERVED INSTANCE BEHAVIOR AND FLEXIBILITY

- For billing purposes, the consolidated billing feature of AWS Organizations treats all the accounts in the organization as one account
- All accounts in the organization can receive the hourly cost benefit of Reserved Instances that are purchased by any other account
- Customers can turn off Reserved Instance discount sharing on the Preferences page on the Billing and Cost Management console





# SPOT INSTANCES

- 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

- 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



- 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

- 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



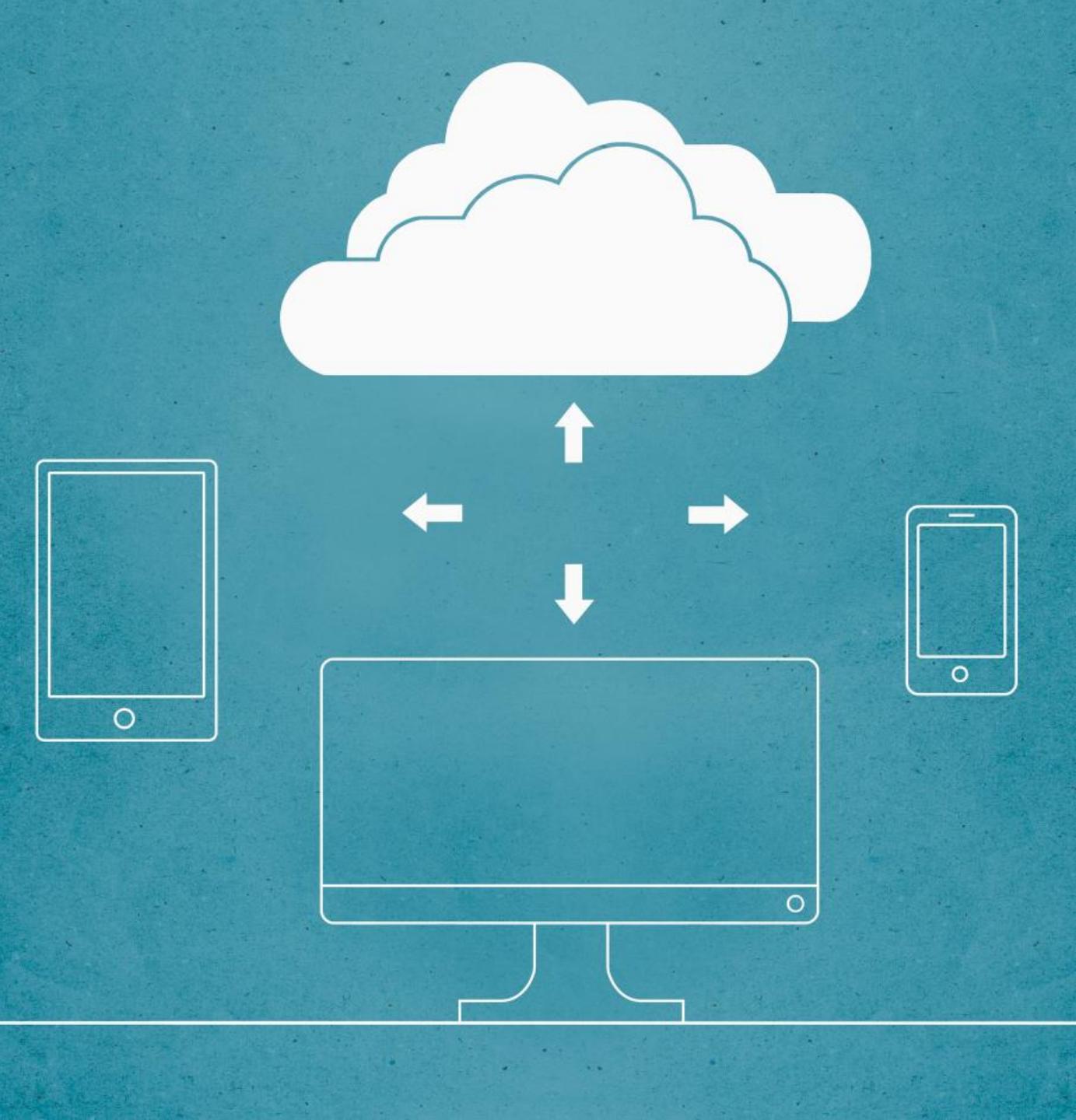


# AWS BATCH

- AWS Batch lets developers, scientists, and engineers powerfully run hundreds of thousands of batch and ML computing jobs while optimizing compute resources
- Customers can focus on analyzing results and solving problems
  - Financial services
  - Life sciences
  - Digital media

# CONTAINERS DEFINED

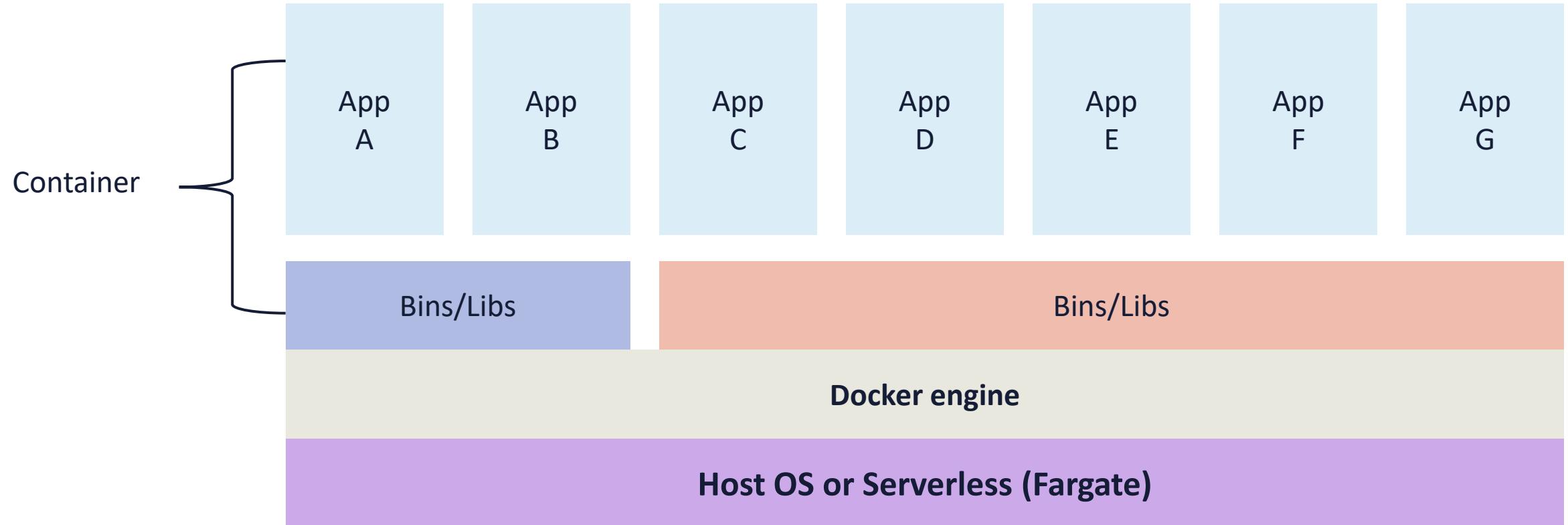
- In AWS, customers can also build and run containerized applications
- A container is a discrete environment within an operating system (or a serverless architecture) where one or more applications can run that is typically assigned all the resources and dependencies needed to function
- It is a modular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



# CONTAINERS

- Containers are commonly used for processes and workflows in which there are important requirements for security, reliability, and scalability
- All cloud providers offer managed container development, automation, and orchestration services
- Containers can be server-based or serverless (AWS Fargate)
- While a VM is a full abstraction of an operating system, a container is a constrained place to run segregated processes while still utilizing the kernel and other capabilities of the base OS

# APPLICATION CONTAINERS





# MICROSERVICES

- 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

- 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



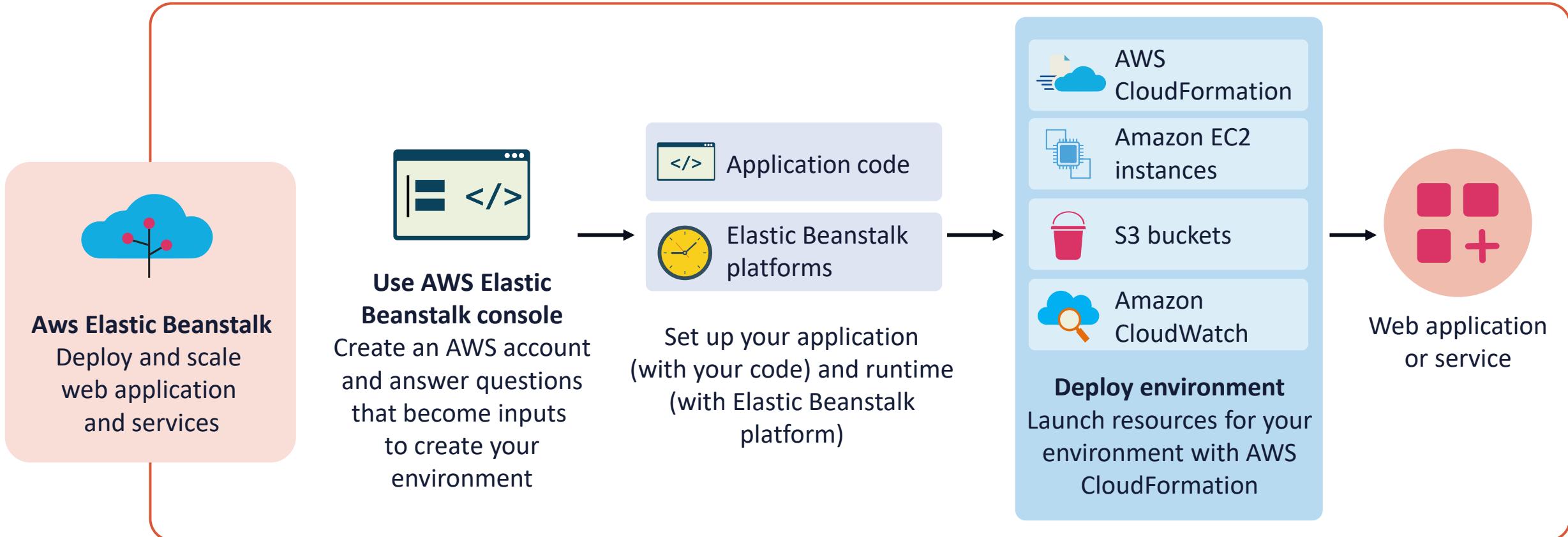
- Elastic Beanstalk is an AWS service for deploying and scaling web applications and services
- Customers can upload their code and let Elastic Beanstalk automatically handle the deployment
- Beanstalk does everything from capacity provisioning, load balancing, and auto scaling to application health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

# AWS ELASTIC BEANSTALK

- Rapidly launch web applications
  - Deploy scalable web applications in minutes without the overhead of provisioning and handling the underlying infrastructure
- Create mobile 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



# APPLICATION CONTAINERS

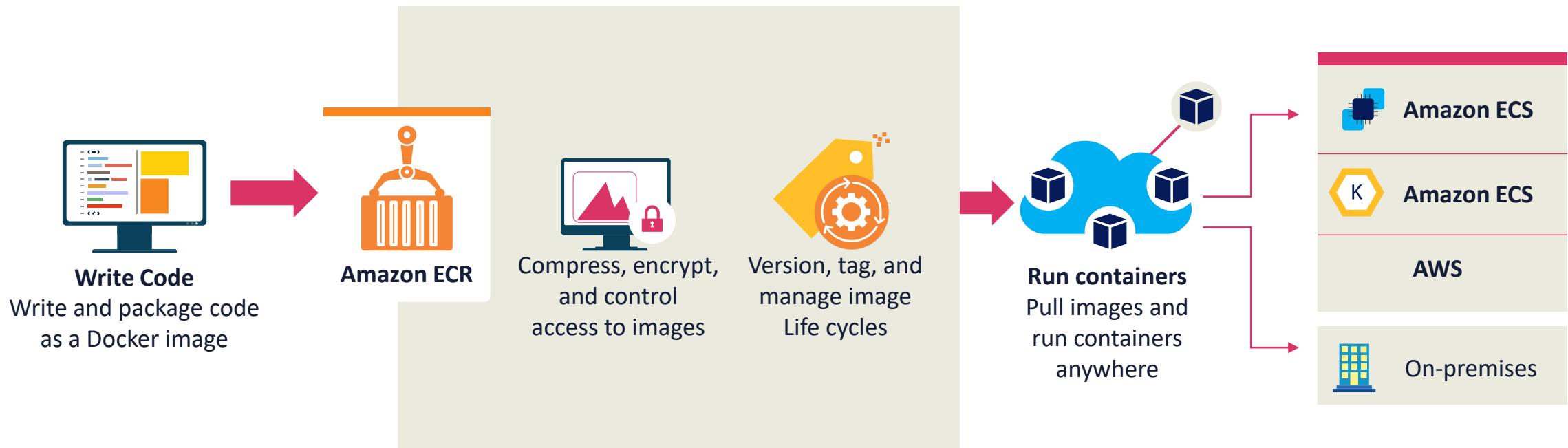


A close-up photograph of a young man with dark hair and brown eyes, looking directly at the camera with a neutral expression. The background is heavily blurred, showing a digital interface with various data points, numbers, and what appears to be a map or chart, suggesting a high-tech or analytical environment.

# AMAZON ELASTIC CONTAINER REGISTRY (AMAZON ECR)

- Amazon Elastic Container Registry 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 life cycle policies

# AMAZON ELASTIC CONTAINER REGISTRY



# 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



A professional man in a light grey button-down shirt stands in profile, facing right. He has his left hand resting against his chin in a contemplative pose. In front of him is a large, translucent, glowing blue network diagram composed of numerous small dots connected by thin lines, forming a complex web. The background is dark and out of focus, showing blurred lights and shapes that suggest a modern office or data center environment.

# SERVERLESS COMPUTE OPTIONS

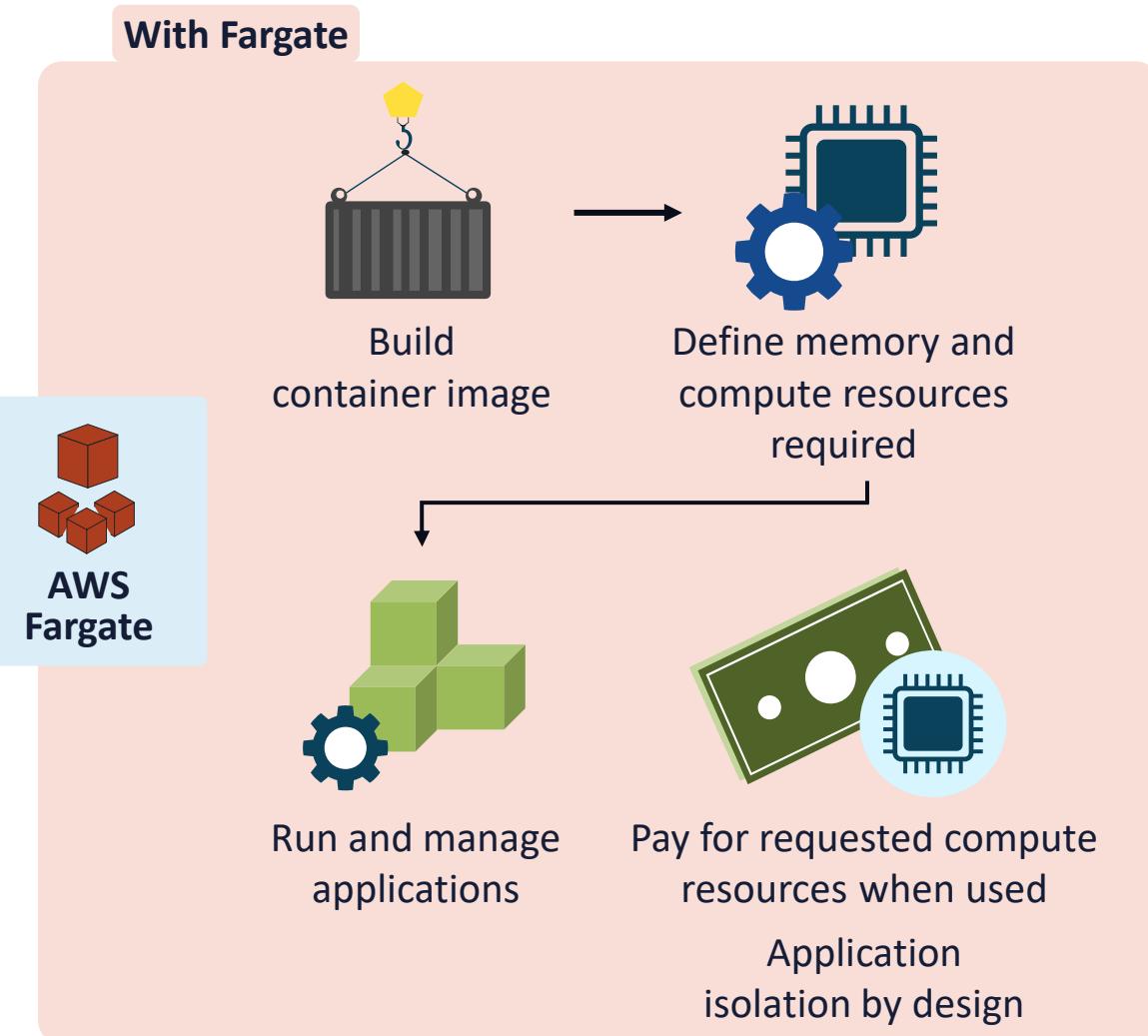
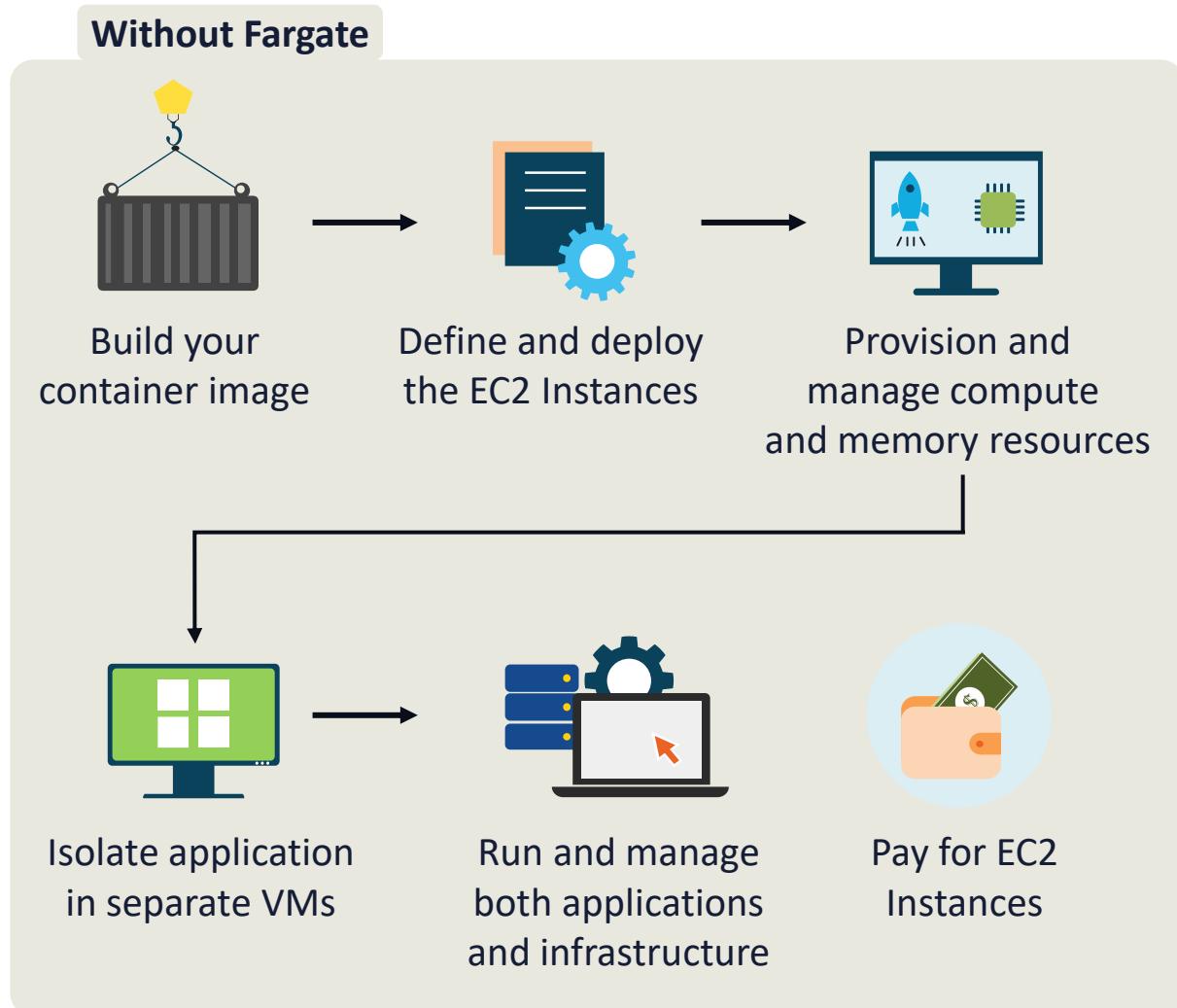
- Modern serverless solutions often leverage modern cloud infrastructures that emulate the network operating system environment without the need for a Windows or Linux-based server
- These are technologies for running code, managing data, and integrating applications, all without managing servers
- Serverless technologies feature automatic scaling, built-in high availability, and a pay-for-use billing model to increase agility and optimize costs
- Functions are a form of serverless technology

# AWS FARGATE

- AWS Fargate is a serverless, pay-as-you-go compute engine that lets customers construct applications without servers
- Fargate is attuned with Amazon ECS and Amazon 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

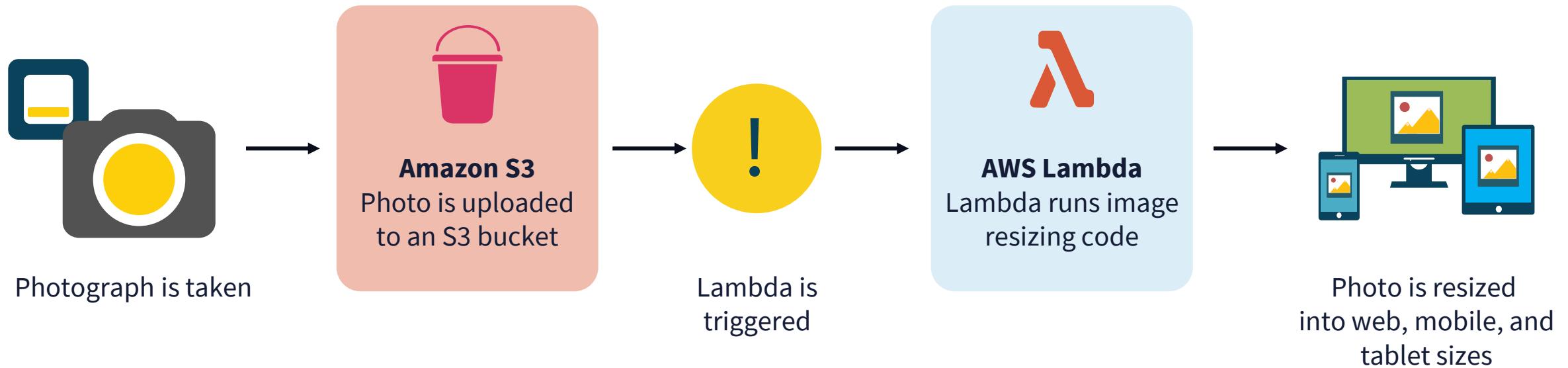




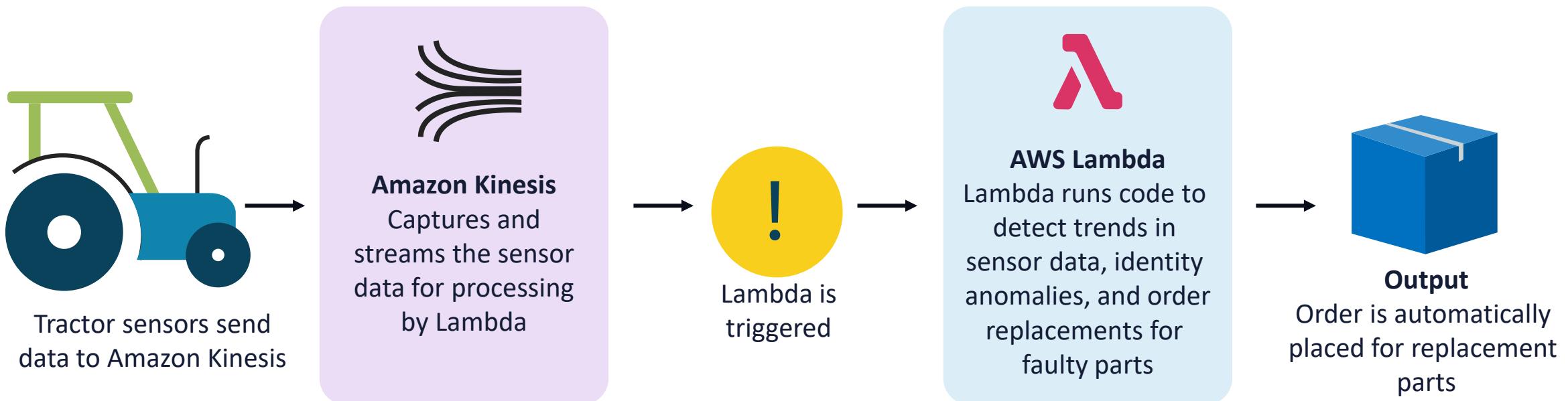
# AWS LAMBDA

- 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

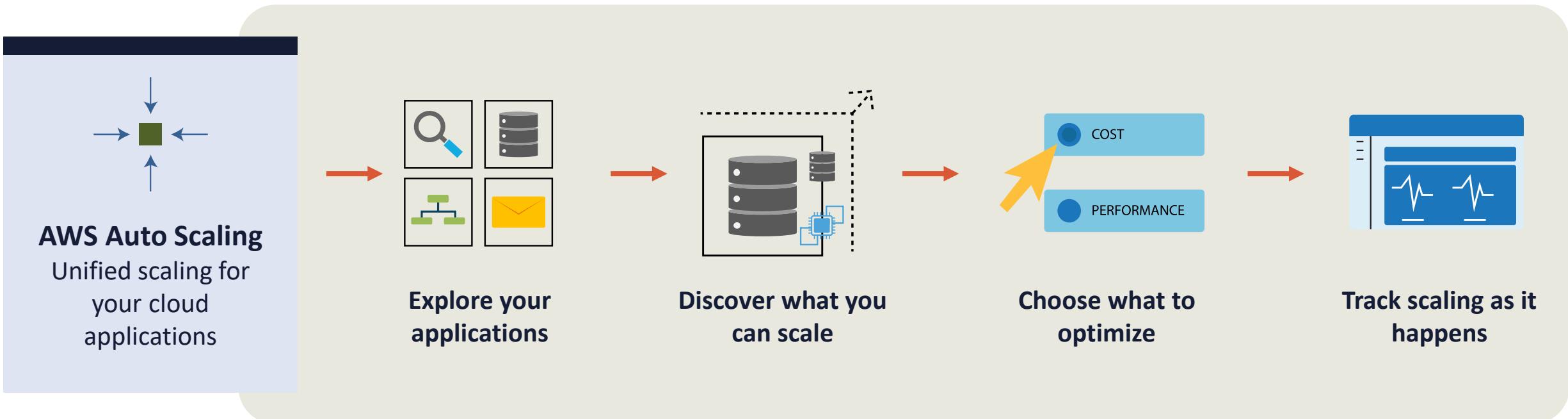
- AWS Auto Scaling monitors client applications and routinely regulates capacity to maintain stable, predictable performance at the lowest probable cost
- It is simple to set up application scaling for multiple resources across multiple services in a matter of minutes
- This service offers an efficient 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

- 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



A 3D grid of binary code blocks, represented by a 4x4x4 cube of binary digits (0s and 1s) in a dark blue space with glowing nodes at the intersections. The blocks are translucent, showing the binary data inside.

# 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)



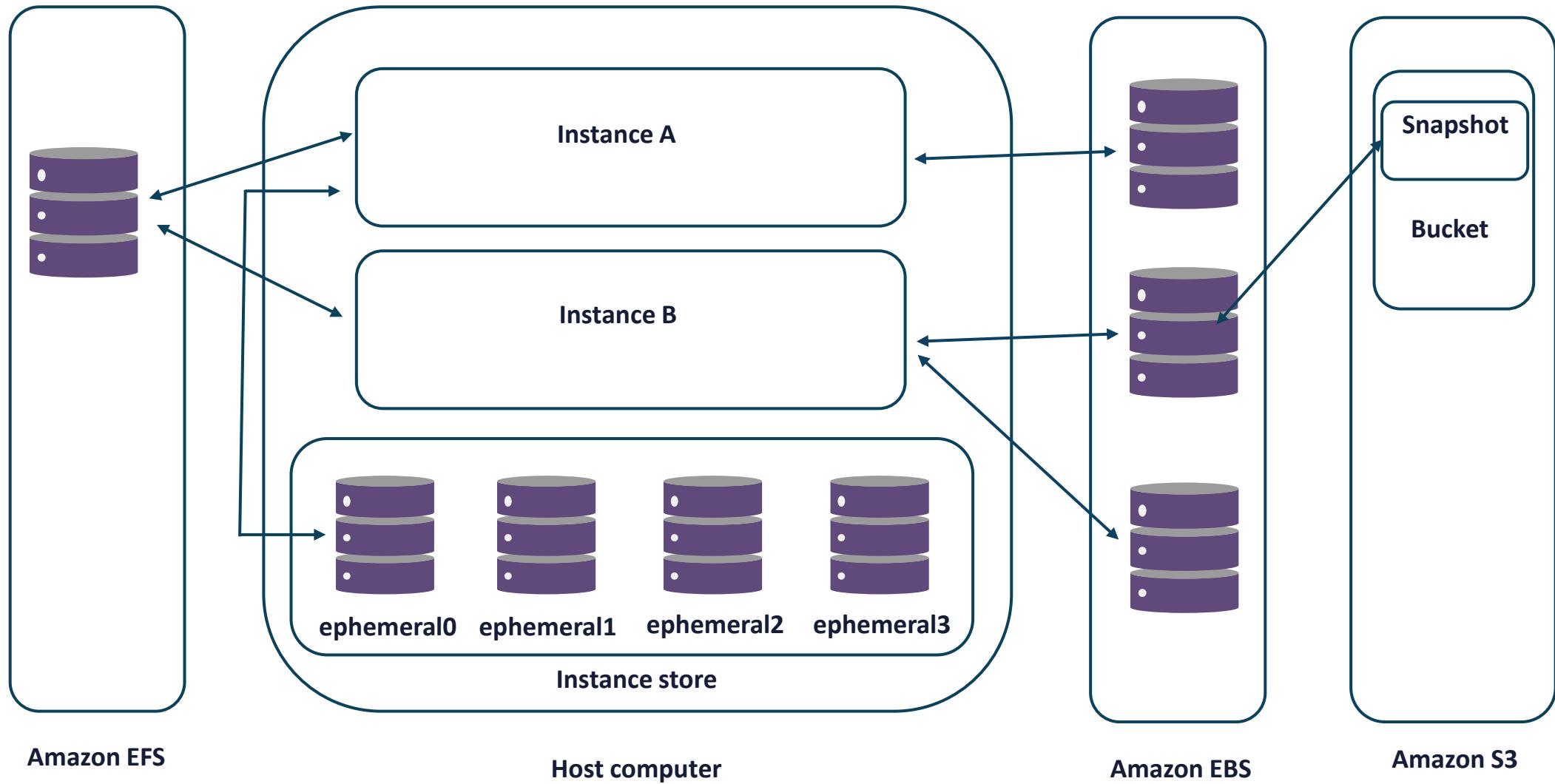
# BLOCK STORAGE

- 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

- Storage area networks (SANs)
- Containerized applications
- Transactional workloads
- Analytics and data warehousing
- Virtual machines

## **BLOCK STORAGE USE CASES**

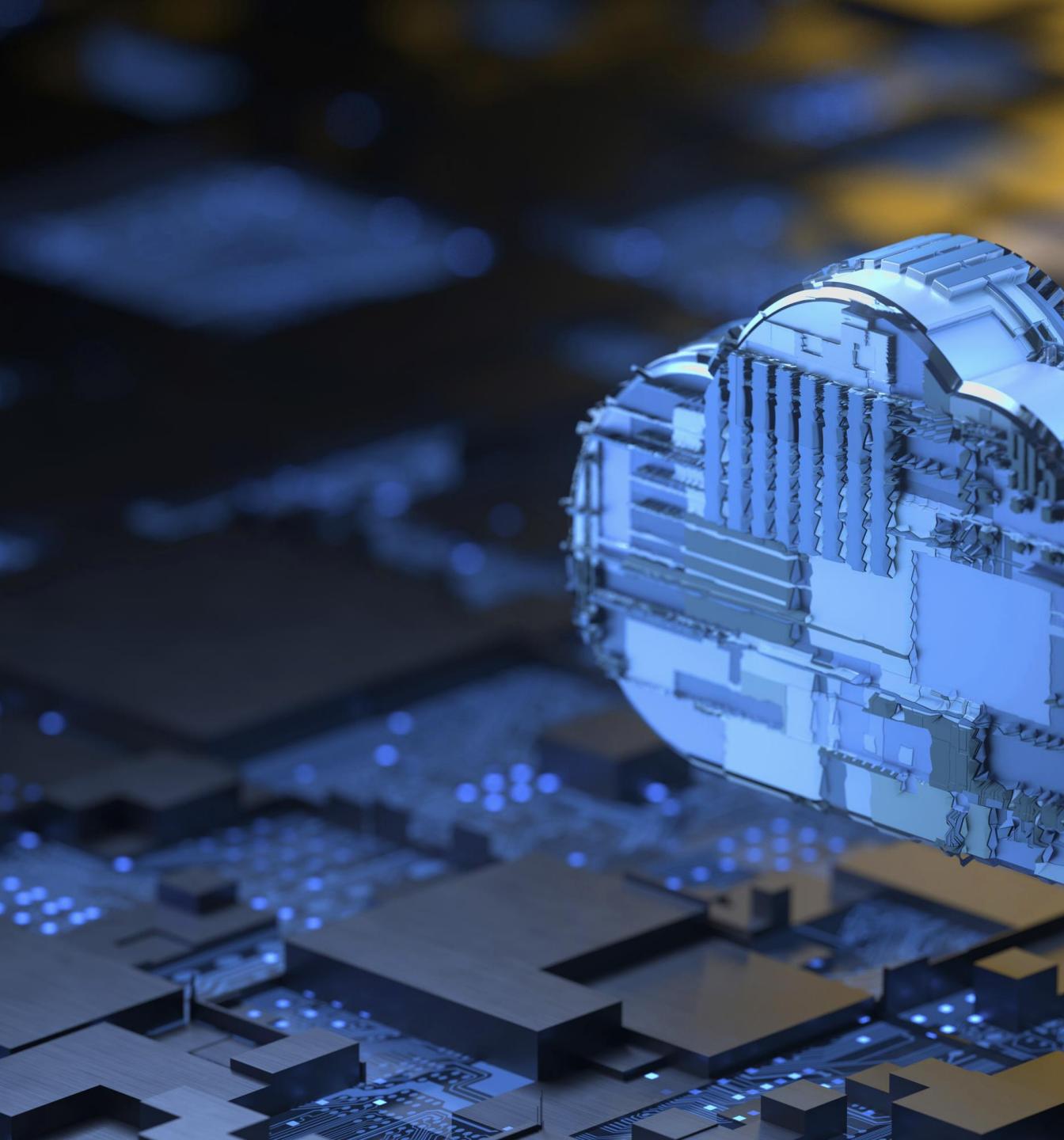
# BLOCK, FILE, AND OBJECT STORAGE AT AWS



# **EXPLORING BLOCK STORAGE SOLUTIONS**

In this demo...

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



# OBJECT STORAGE

- 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

- Metadata is critical to object storage technology, and objects are kept in a bucket instead of files in folders
- Object storage combines the chunks of data that make up a file, adds all the user-created metadata to that file, and assigns a custom identifier
- Users can get and analyze any object in the bucket, no matter the file type, based on its function and attributes



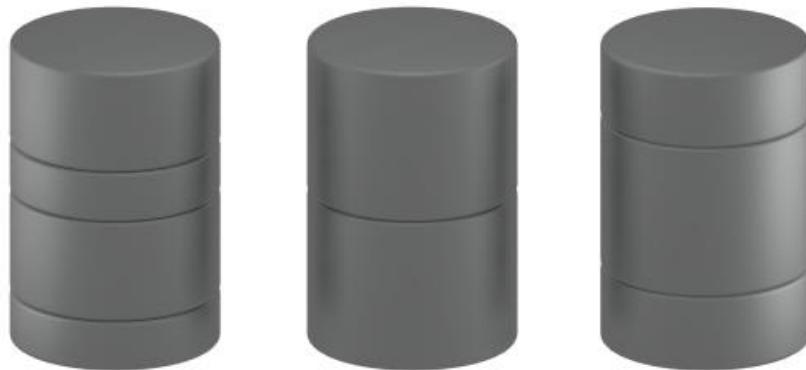


# OBJECT STORAGE USE CASES

- **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

- **Cloud-native applications** – use technologies like containerization and serverless to address customer needs in a rapid and flexible way
- **Machine learning** – 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



## In this demo...

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

# COMPARING S3 STORAGE CLASSES

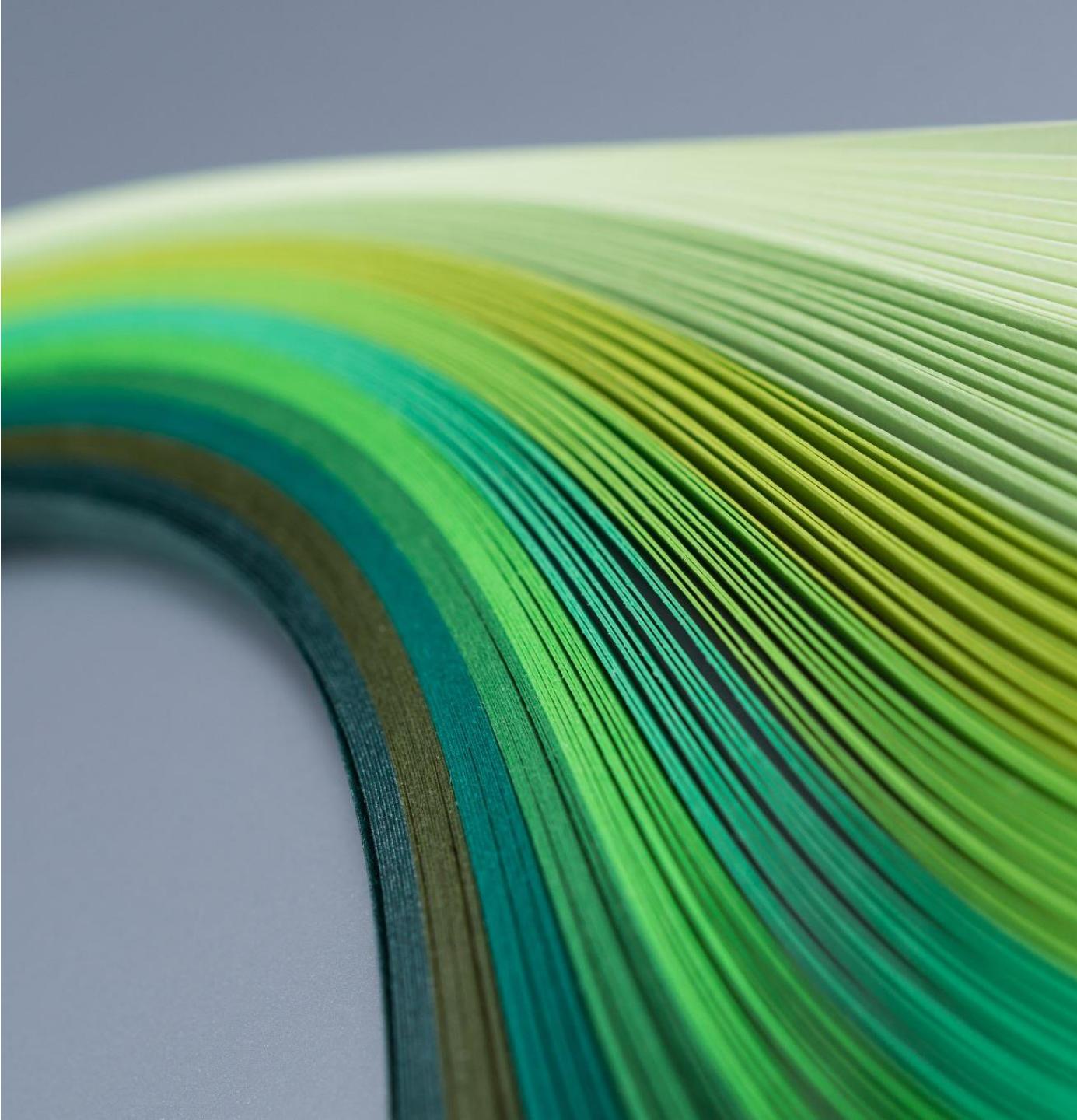


# AWS ELASTIC FILE SYSTEM (EFS)

- Amazon Elastic File System 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

- 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



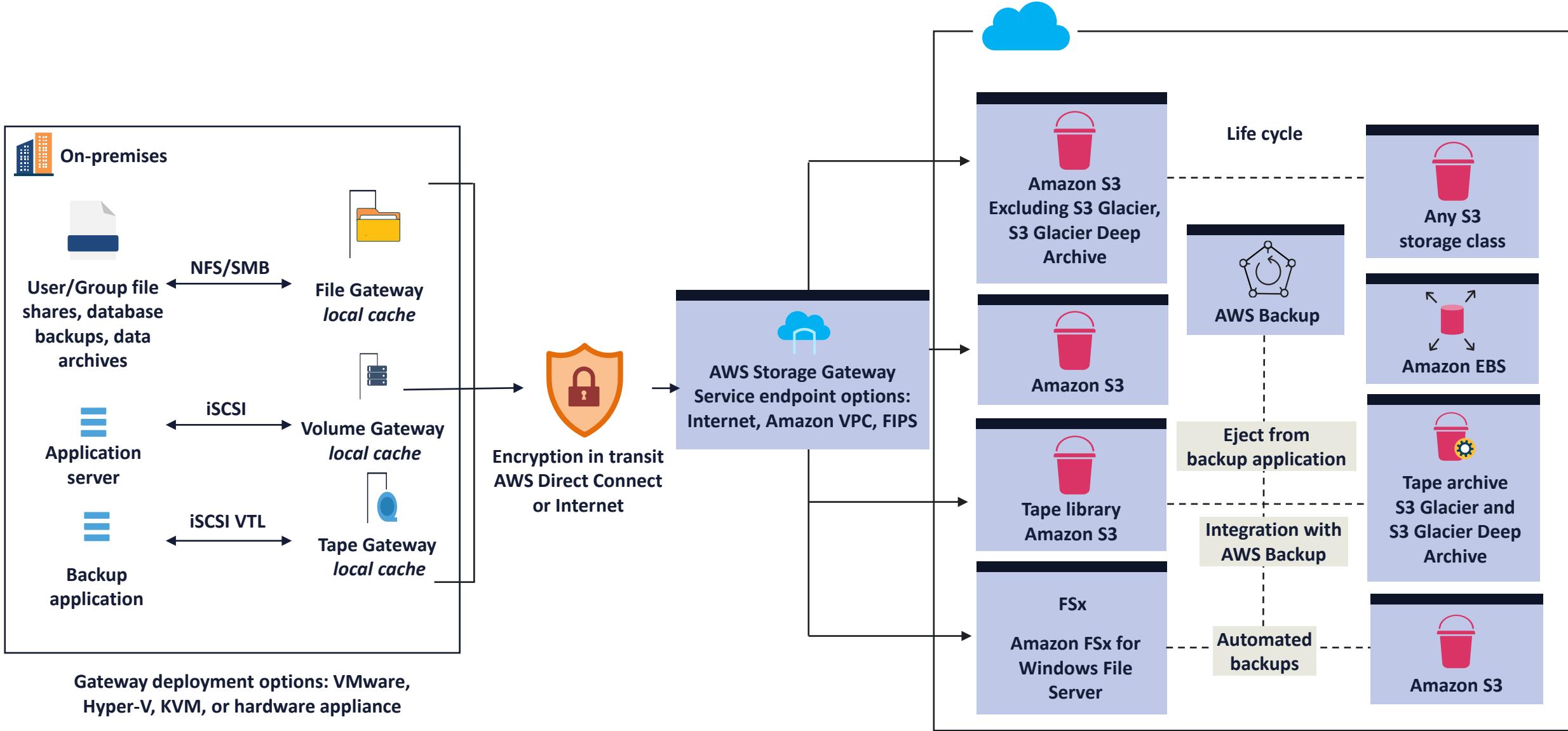
- AWS Storage Gateway is a hybrid storage service that enables your on-premises applications to seamlessly use AWS cloud storage
- You can use the service for backup and archiving, disaster recovery, cloud data processing, storage tiering, and migration
- Can be appliance-based or in a hypervisor
- Often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

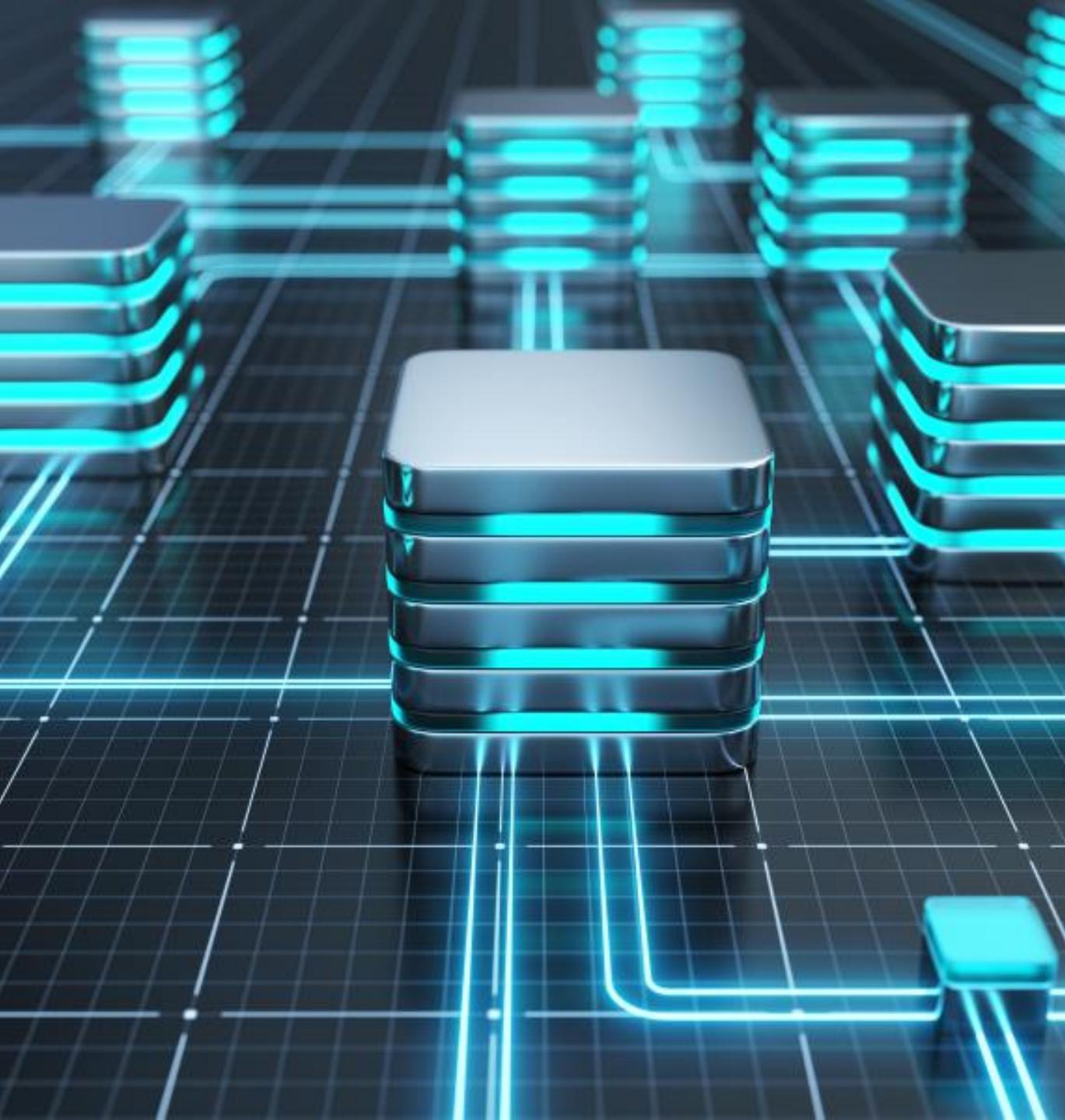
# AWS STORAGE GATEWAY

- AWS Storage Gateway is a collection of hybrid cloud storage solutions that offer on-premises access to virtually unlimited cloud storage
- This service is commonly used to facilitate the data life cycle
- Storage Gateway distributes low-latency data access to on-premises applications while leveraging the agility, economics, and security capabilities of AWS in the cloud



# AWS STORAGE GATEWAY



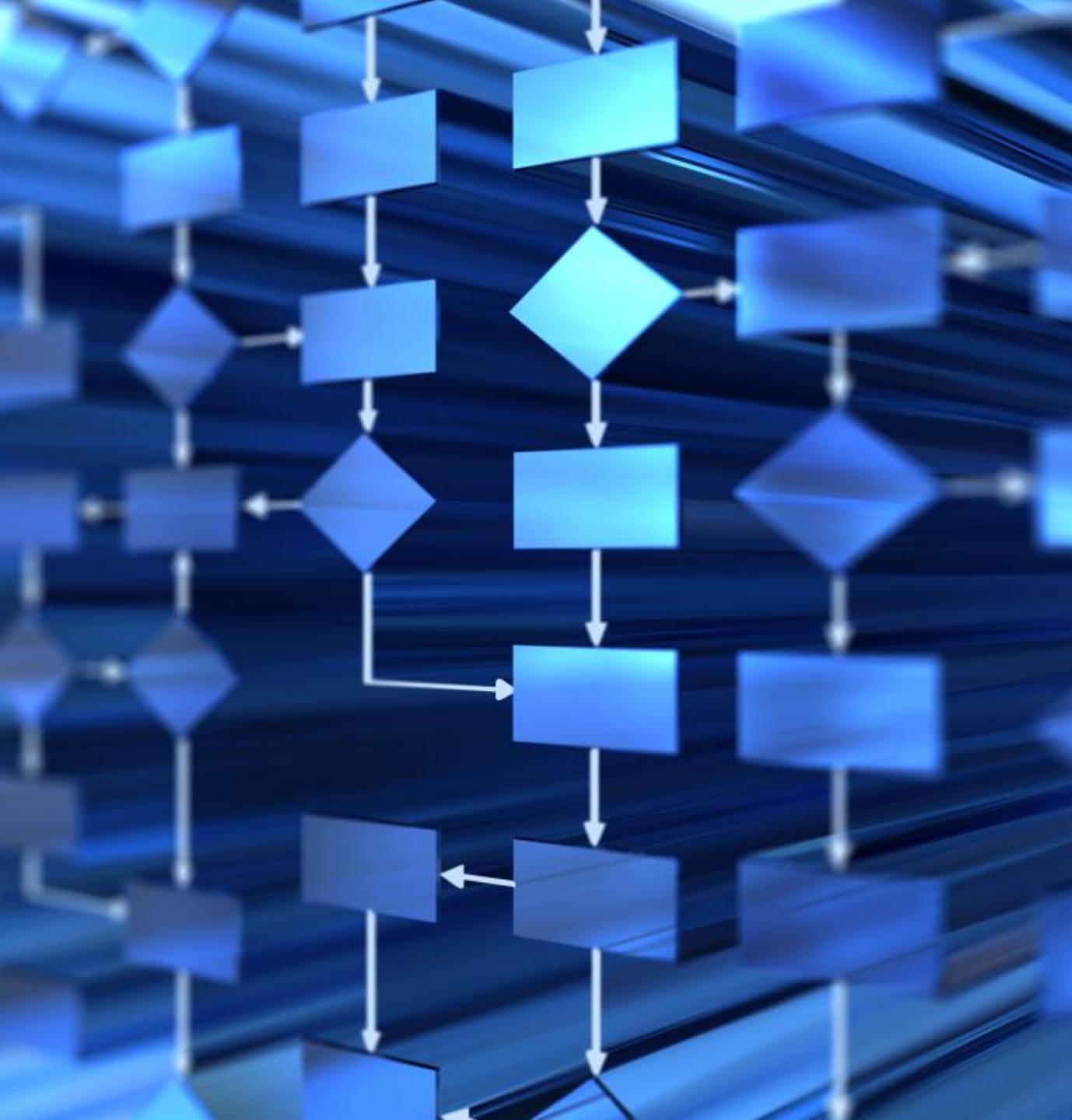


# RELATIONAL DATABASES

- 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

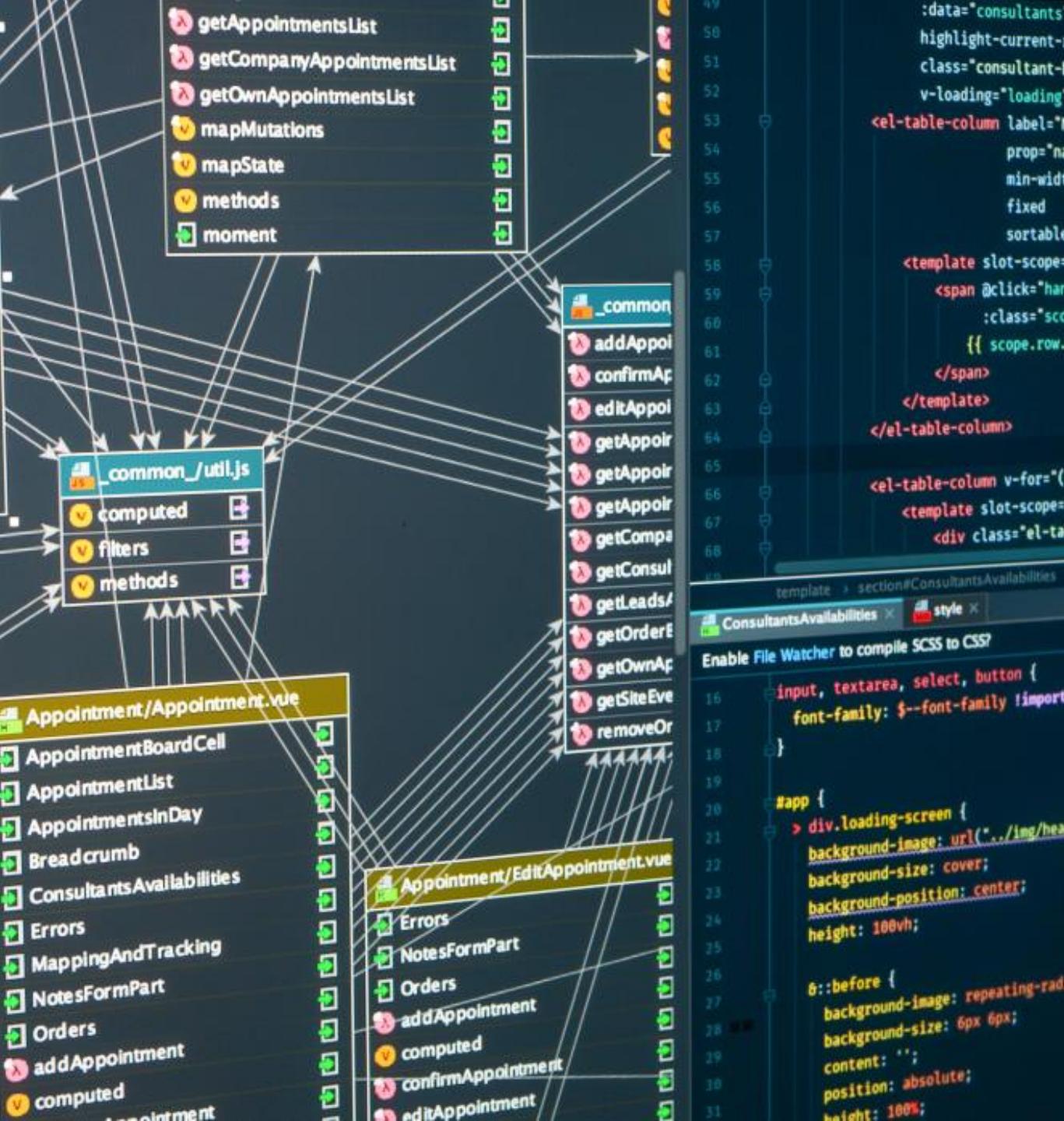
# RELATIONAL DATABASES

- The rows in the table embody a collection of related values of one object or entity
- Each row in a table could be marked with a unique identifier called a primary key, and rows among multiple tables can be made related using foreign keys
- This data can be accessed in many ways without rearranging the database tables themselves
- Structured Query Language (SQL) is the main interface used to communicate with relational databases



# 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

- 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



A photograph of a young man with dark hair, wearing a light grey button-down shirt. He is looking off to his left with a thoughtful expression, his right hand resting against his chin. In the upper left corner of the image, there is a translucent, glowing blue wireframe cube representing a complex network or data structure.

# NOSQL DATABASES

- 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

NoSQL databases are an excellent solution for many modern applications like mobile, web, and gaming:

- **Flexibility** – provide flexible schemas that enable faster and more iterative development
- **Scalability** – generally designed to scale out by using distributed clusters of hardware instead of scaling up by adding expensive and robust servers



# NOSQL DATABASES

NoSQL databases are an excellent solution for many modern applications like mobile, web, and gaming:

- **High-performance** – optimized for specific data models and access patterns that enable higher performance than relational databases
- **Highly functional** – offer highly functional APIs and data types that are purpose-built for their respective data models

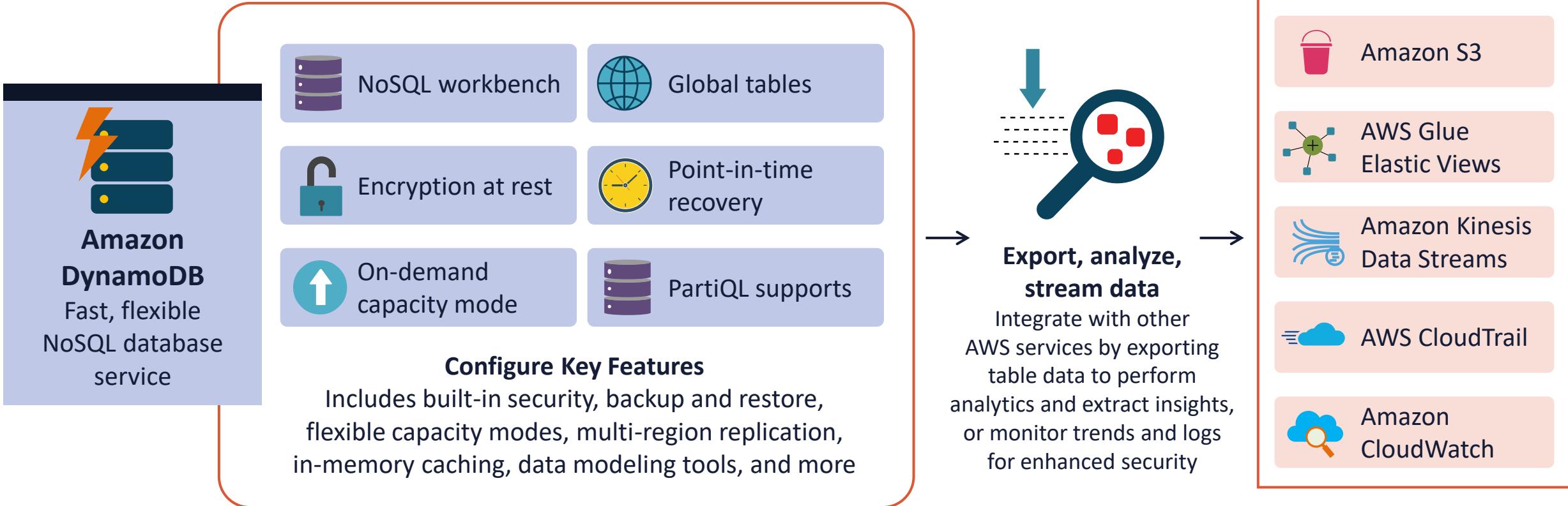


A close-up, low-angle shot of many optical fibers. The fibers are illuminated from within, creating a vibrant blue glow that fans out across the frame. The light is最亮 at the top left and gradually fades towards the bottom right. The individual fibers are visible as thin, curved lines, and the overall effect is one of high-speed data transfer or digital connectivity.

# AMAZON DYNAMODB

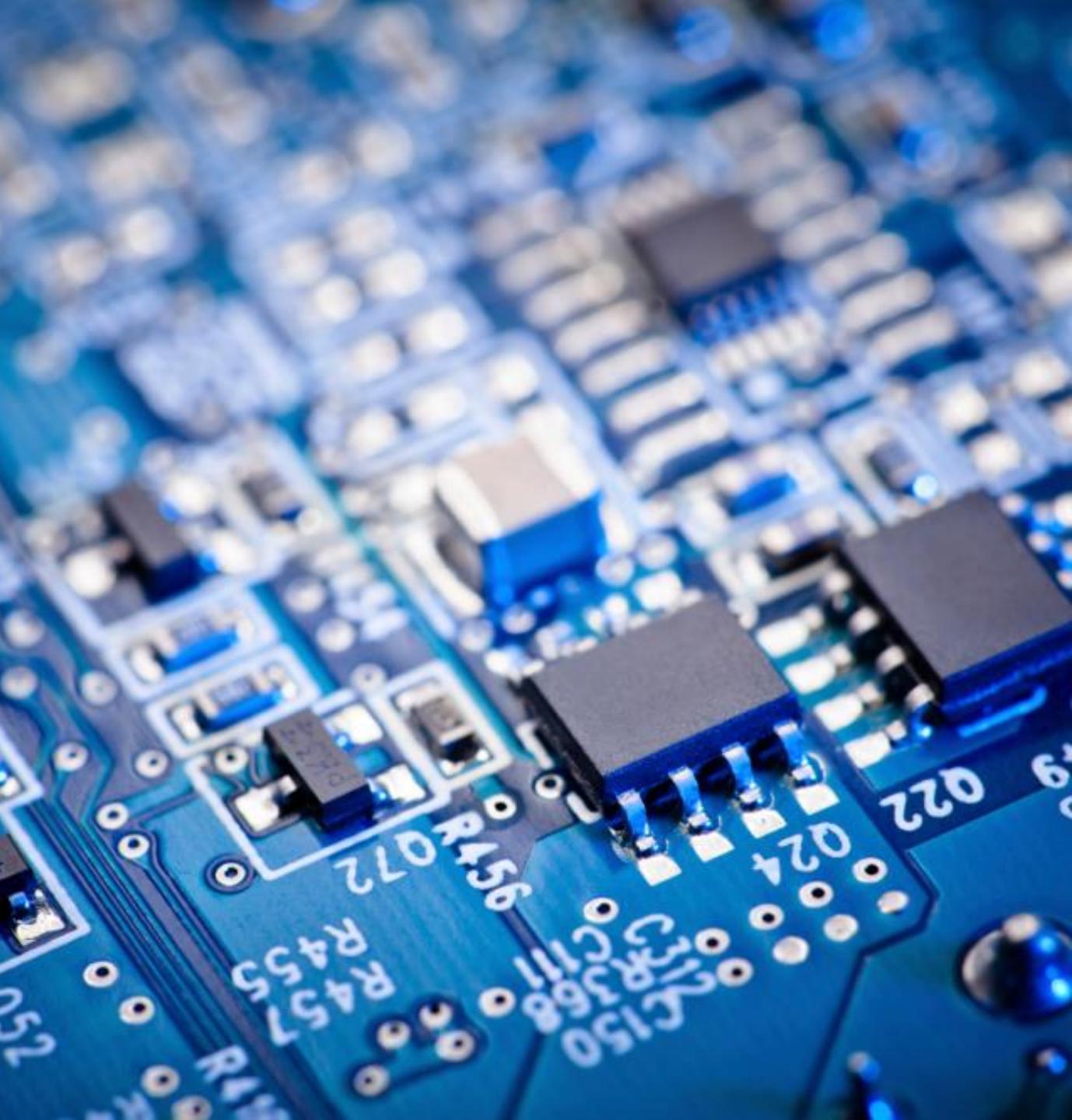
- Is a fast, malleable NoSQL database service for single-digit millisecond performance at any scale
- Is a fully managed, serverless, key-value NoSQL database designed to run high-performance applications
- Delivers built-in security, nonstop backups, automated multi-region replication, in-memory caching, and powerful data import and export tools

# DYNAMO DB



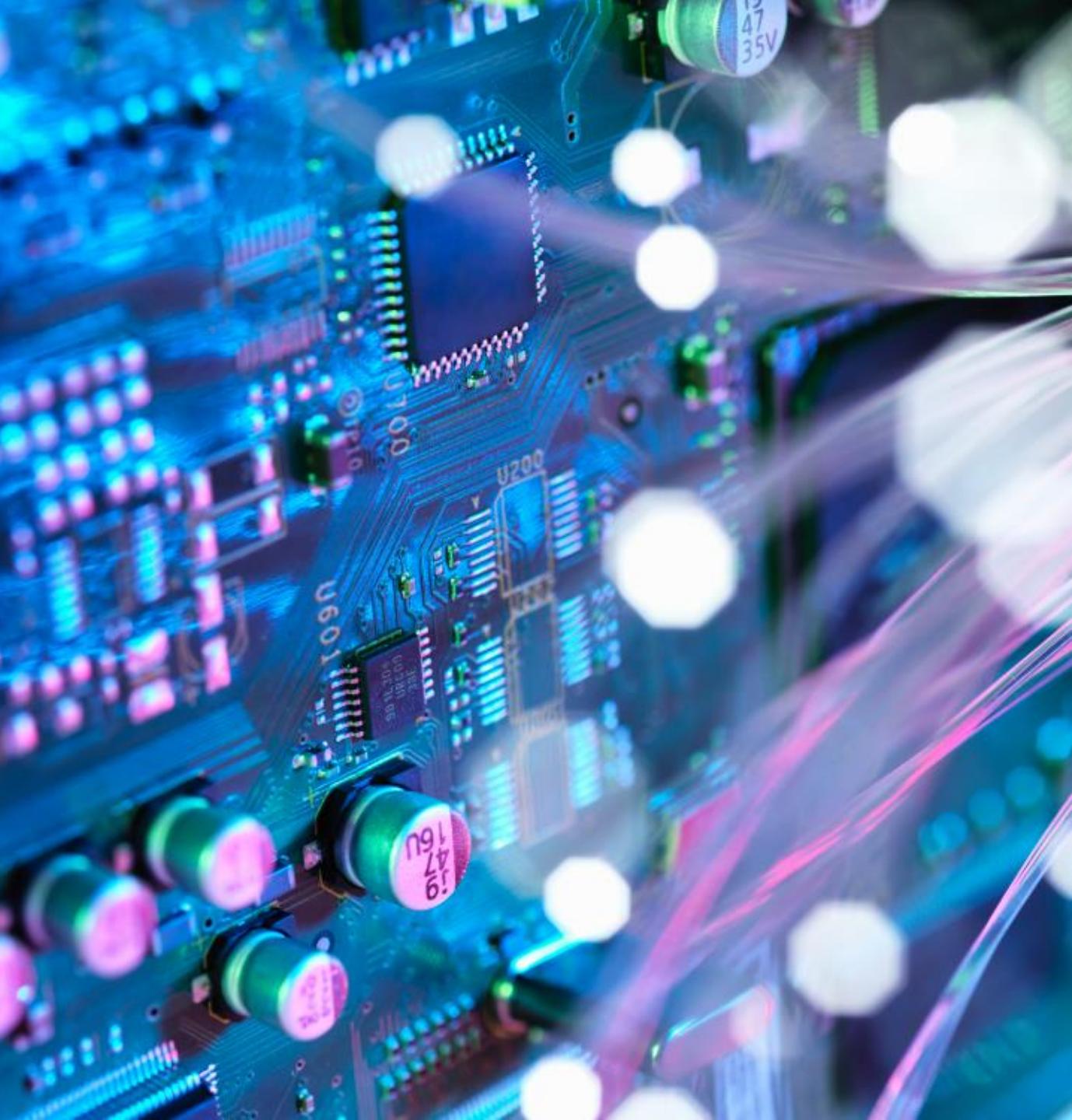
# MEMORY-BASED DATABASES

- 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



# MEMORY-BASED DATABASES

- Since all data is stored and managed exclusively in main memory, memory-based databases do risk losing data if there is a process or server failure
- This is often called ephemeral storage:
  - In-memory databases can persist data on disks by storing each operation in a log or in a snapshot
- In-memory databases are best for caching and applications that need microsecond response times or have big spikes in traffic, like gaming leaderboards, session stores, and real-time analytics

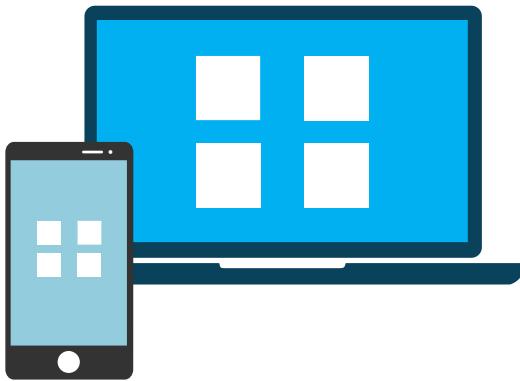




# AMAZON ELASTICACHE FOR REDIS

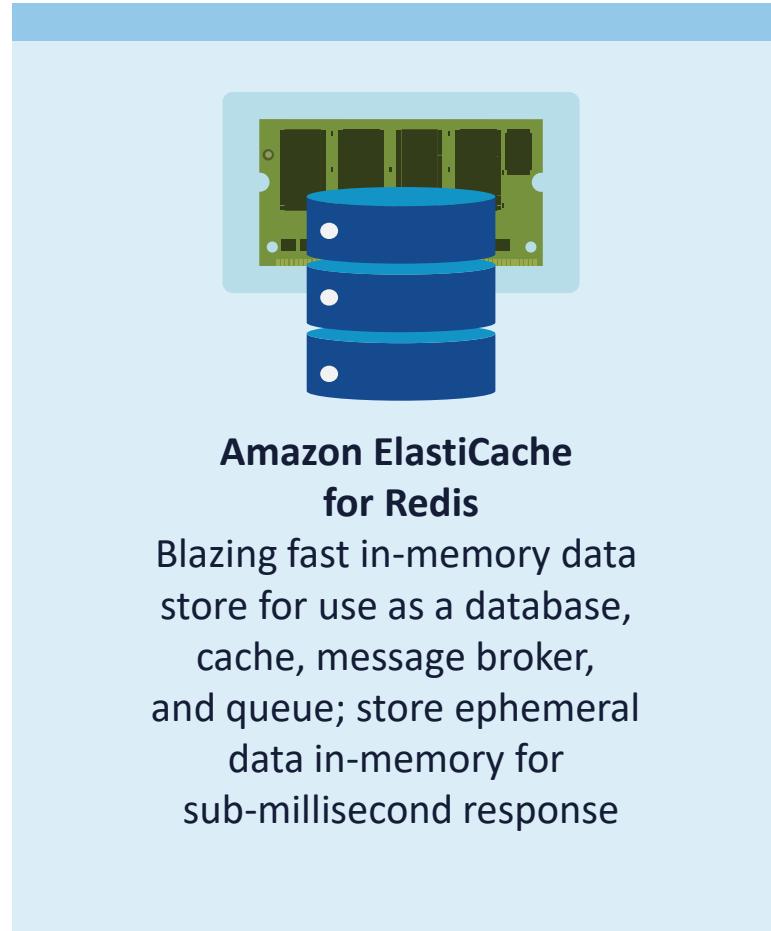
- ElastiCache is an extremely fast in-memory data store that provides sub-millisecond latency to enable Internet-scale real-time applications
- It is constructed on open-source Redis and compatible with the Redis APIs
- Self-managed Redis applications can function effortlessly with Redis ElastiCache 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



## Amazon ElastiCache for Redis

Blazing fast in-memory data store for use as a database, cache, message broker, and queue; store ephemeral data in-memory for sub-millisecond response

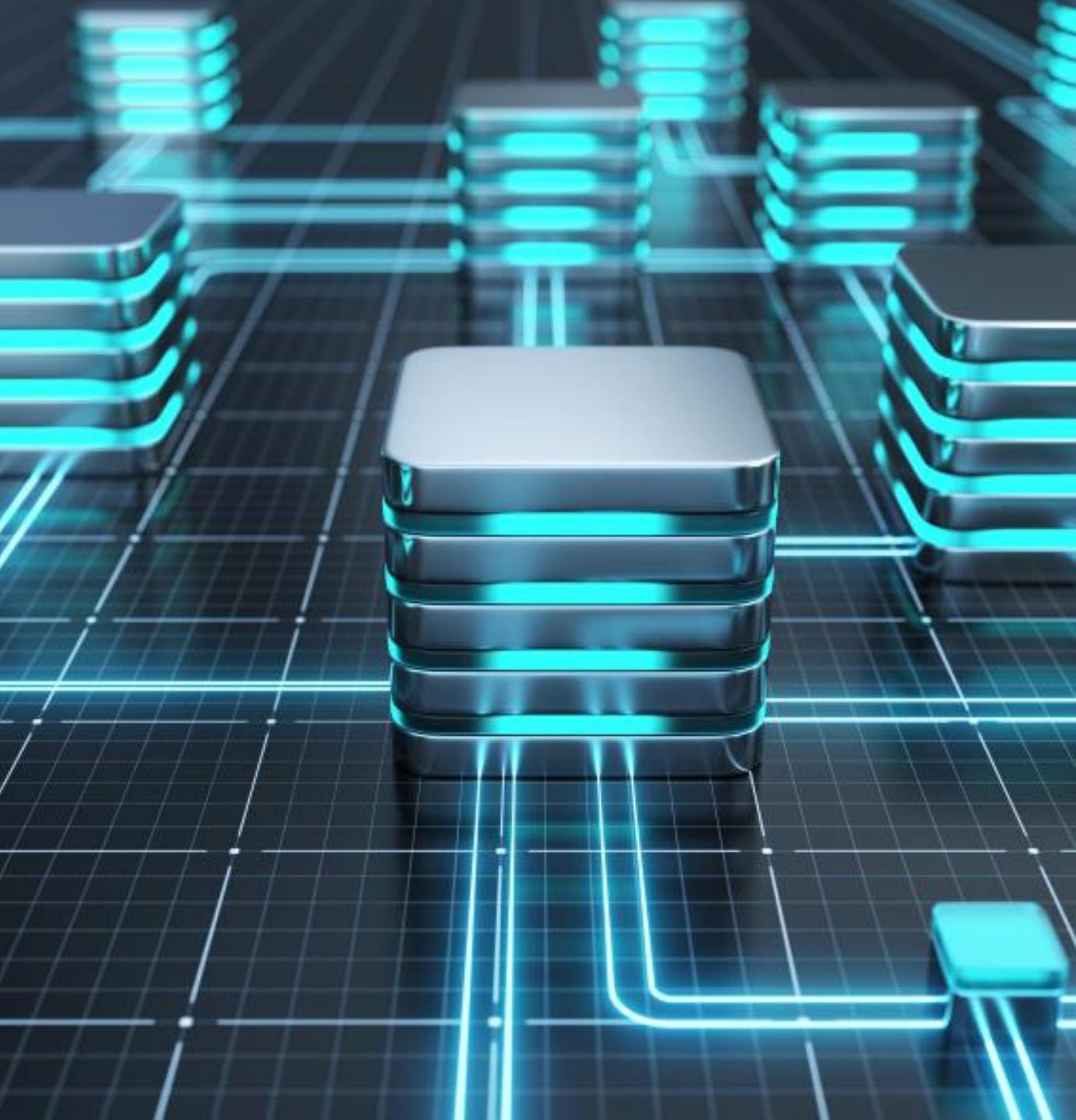


## Use cases

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

# APPROPRIATE MIGRATION STRATEGIES: DATABASE REPLICATION

- 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

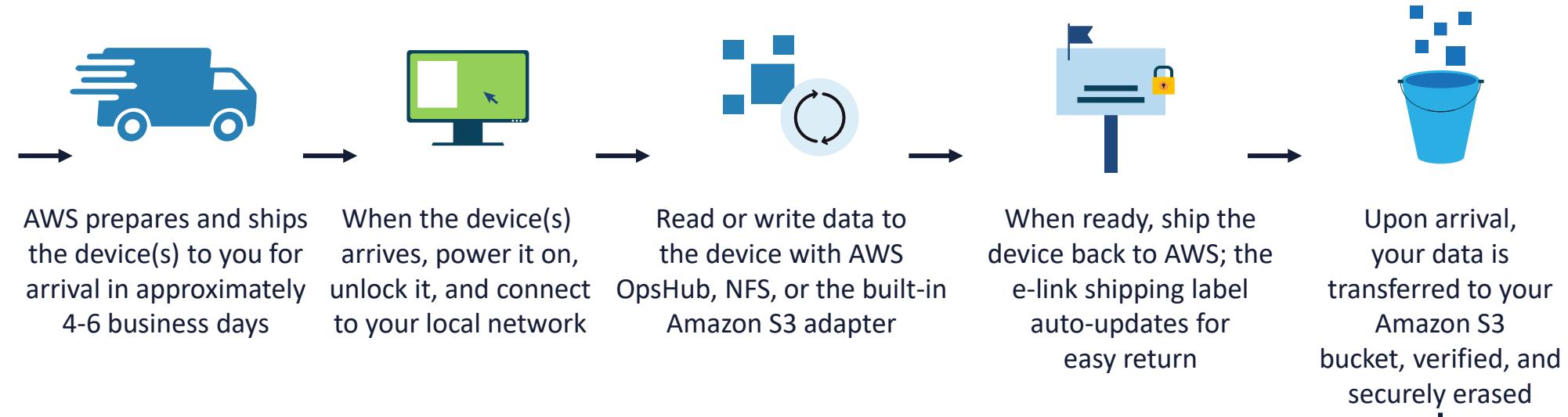




# **DATABASE REPLICATION USE CASES**

- 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



Create large data migration plan\*



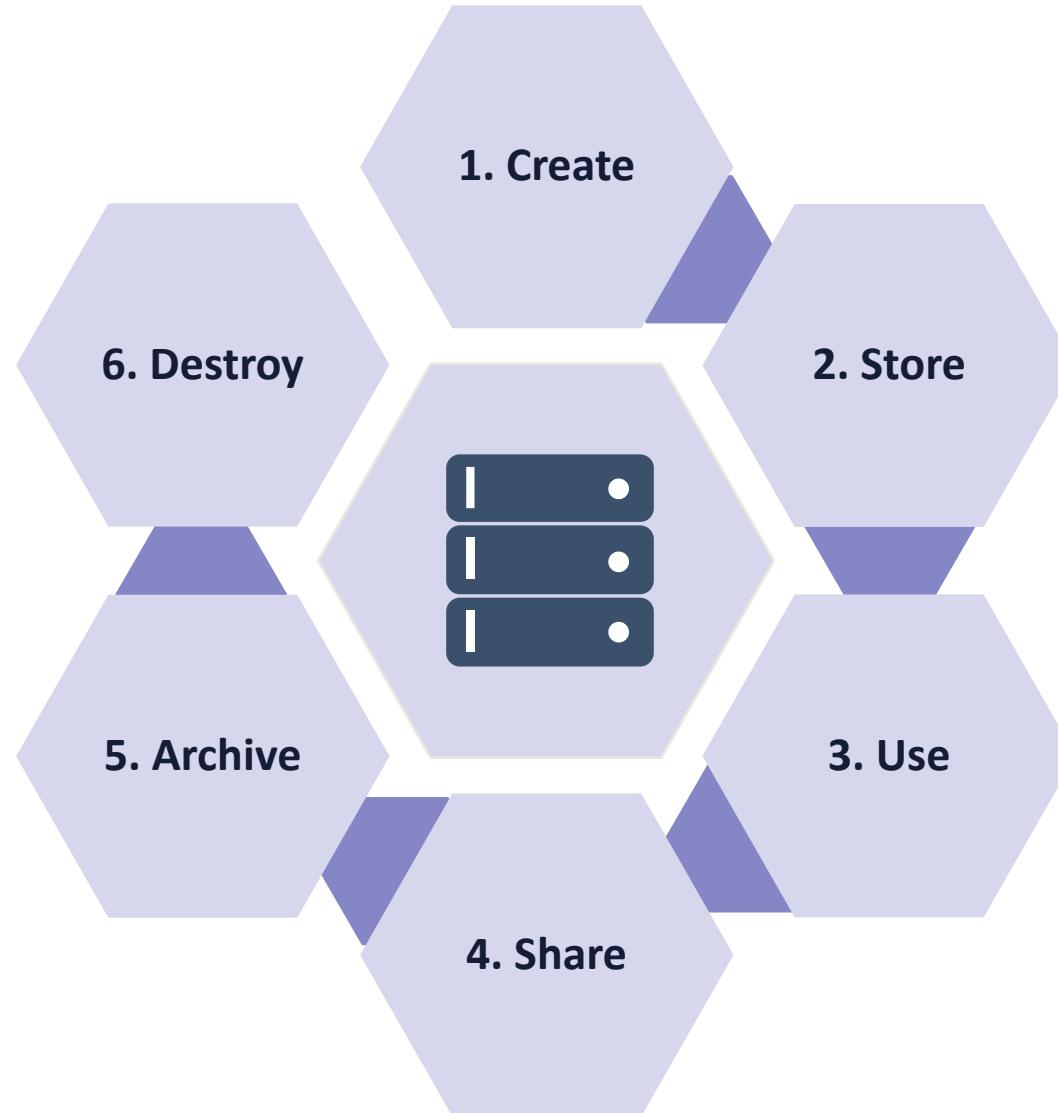
Track progress of data migration plan\*

# 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 LIFE CYCLE





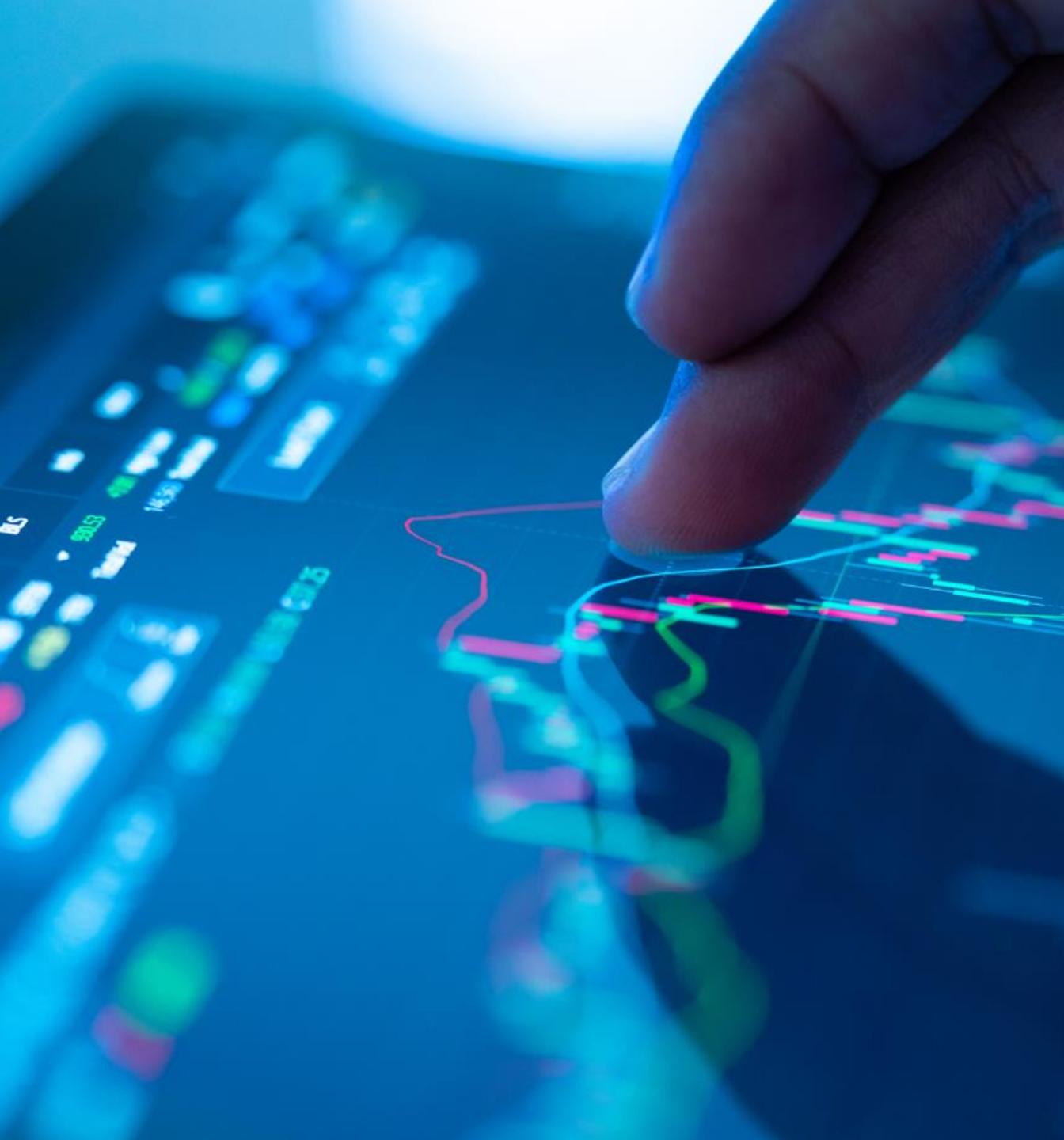
# DATA LIFE CYCLE MANAGEMENT

- Amazon S3 supports tools to manage data throughout its life cycle
- 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 life cycle policies to move a data set to a cheaper storage class or an archival storage class for maximum savings
- S3 life cycle management policies are used to schedule object deletes that have come to the end of their life cycle

# DATA LIFE CYCLE POLICIES

- Customers can formulate a data life cycle 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

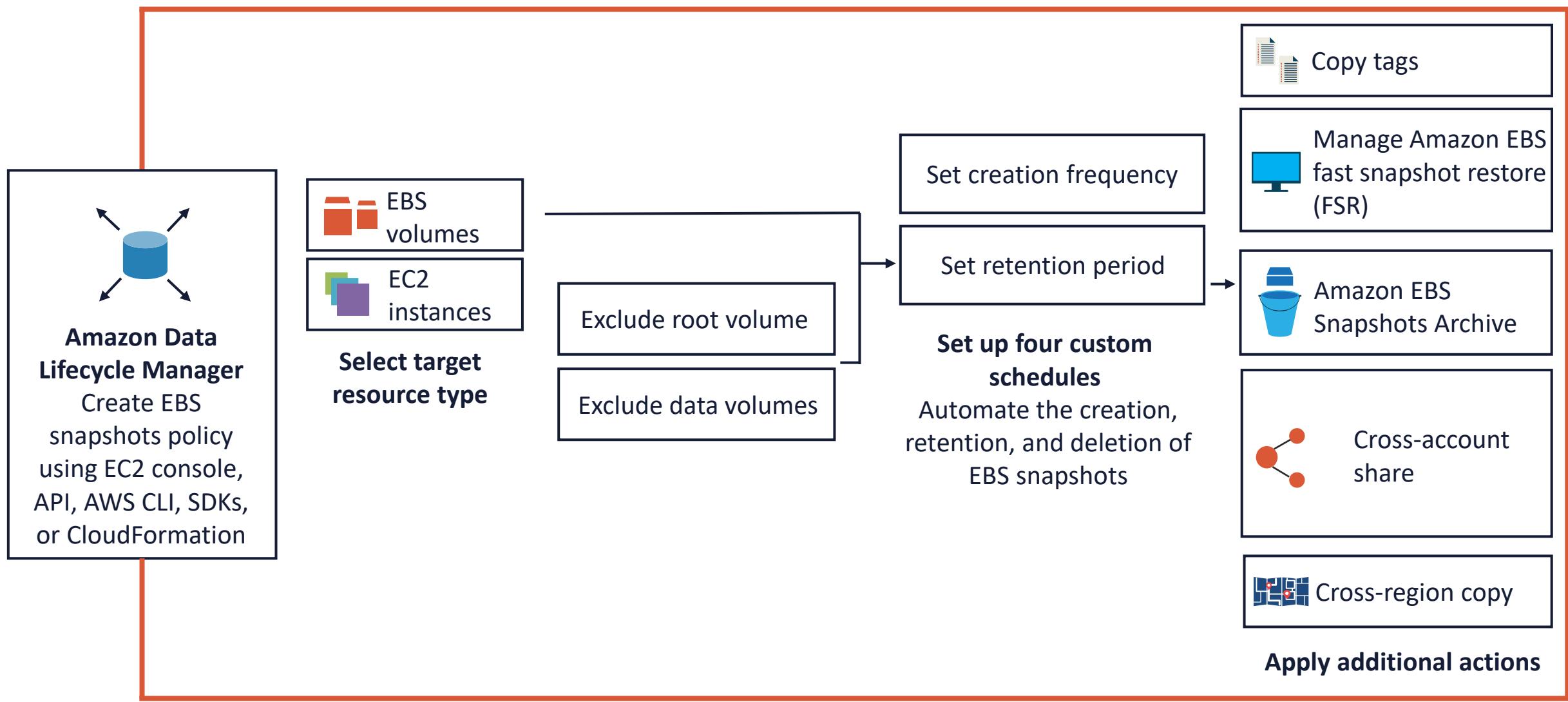




# AMAZON DATA LIFE CYCLE MANAGER

- 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

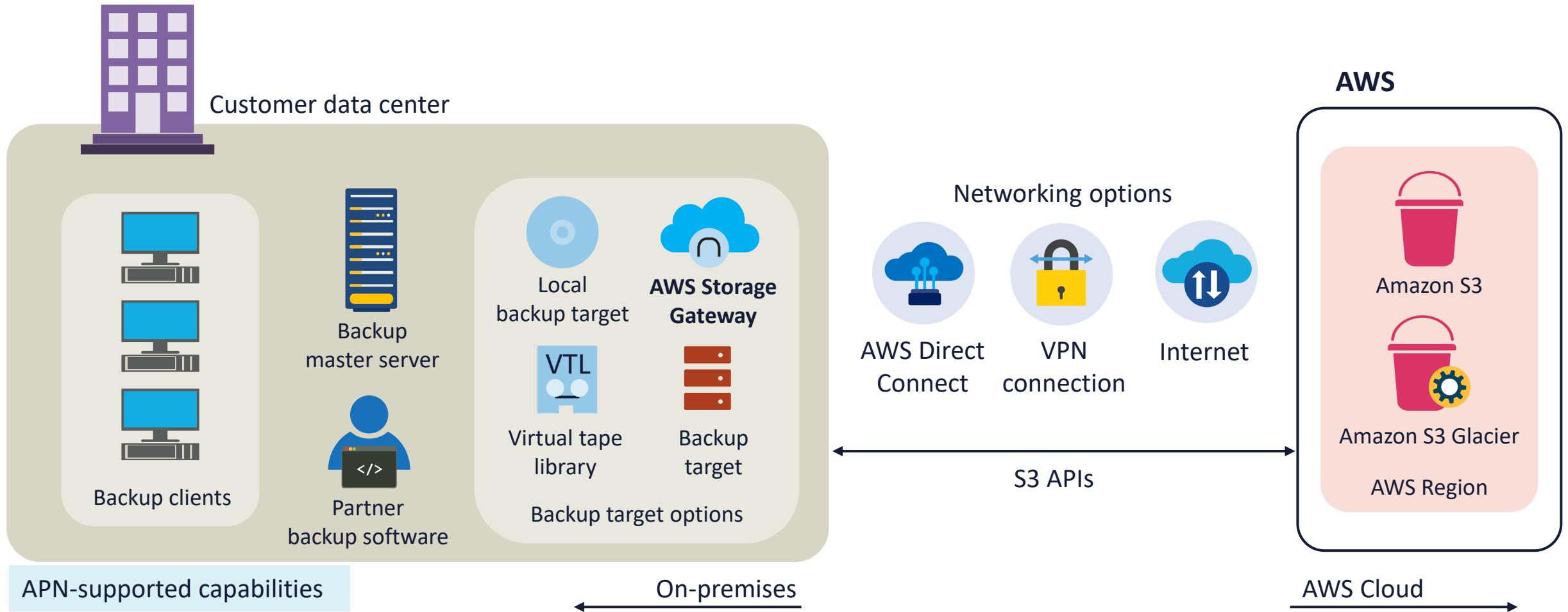


# HYBRID CLOUD BACKUP

- 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

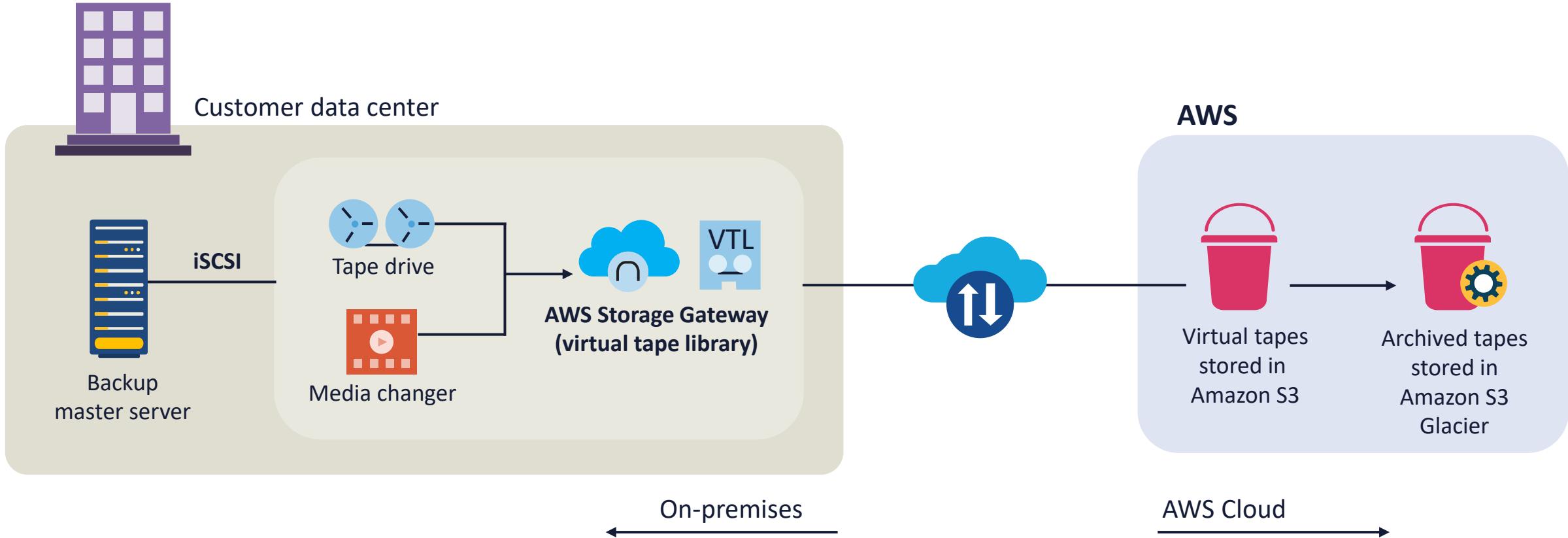




# TAPE REPLACEMENT

- 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 life cycle policy

An S3 life cycle 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

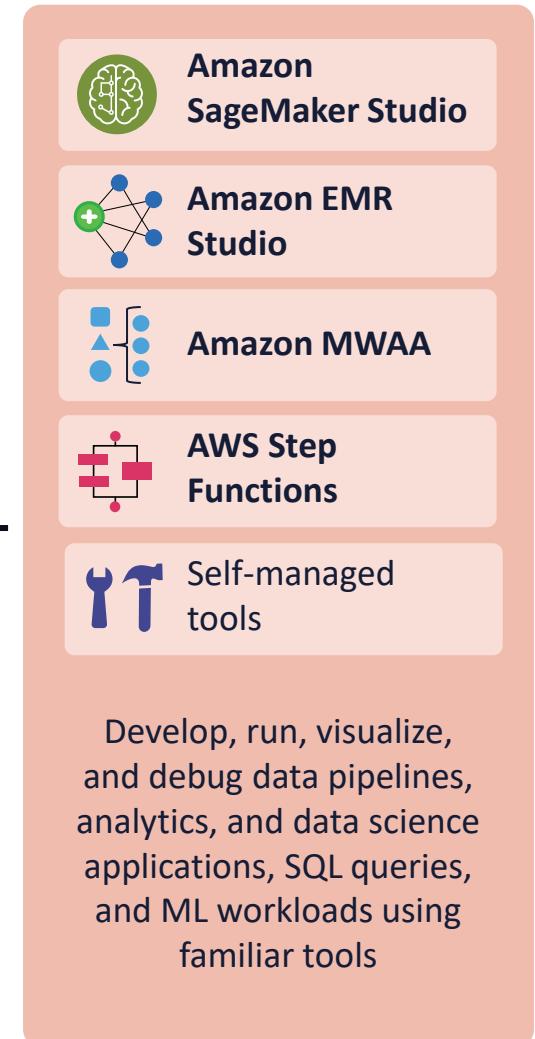
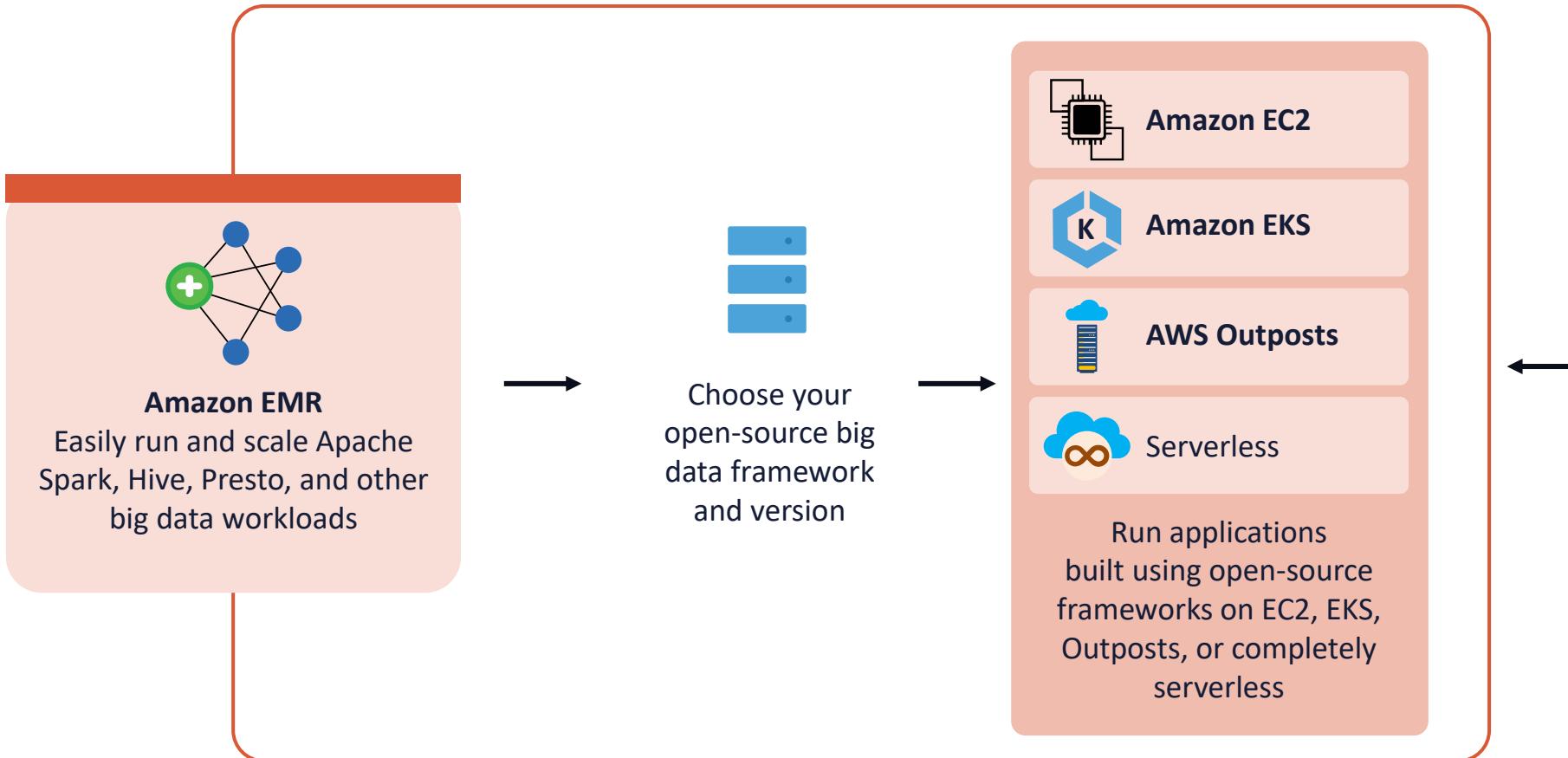
After configured, S3 life cycle policies automate tiering and expiration of data sets for cost saving and resource optimization

# 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 EMR

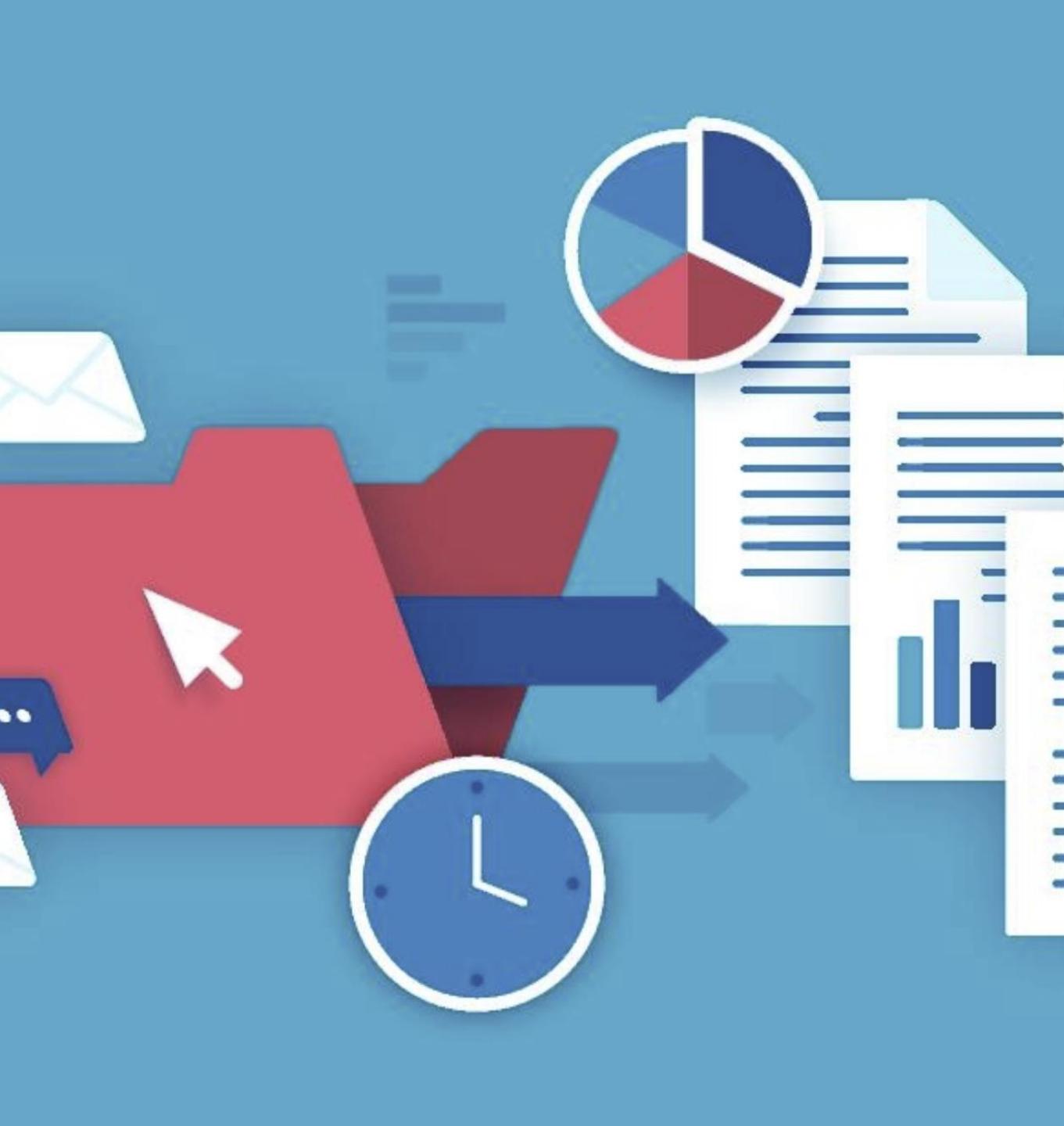


# AMAZON EVENTBRIDGE

- 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 AI/ML services and get valuable insights

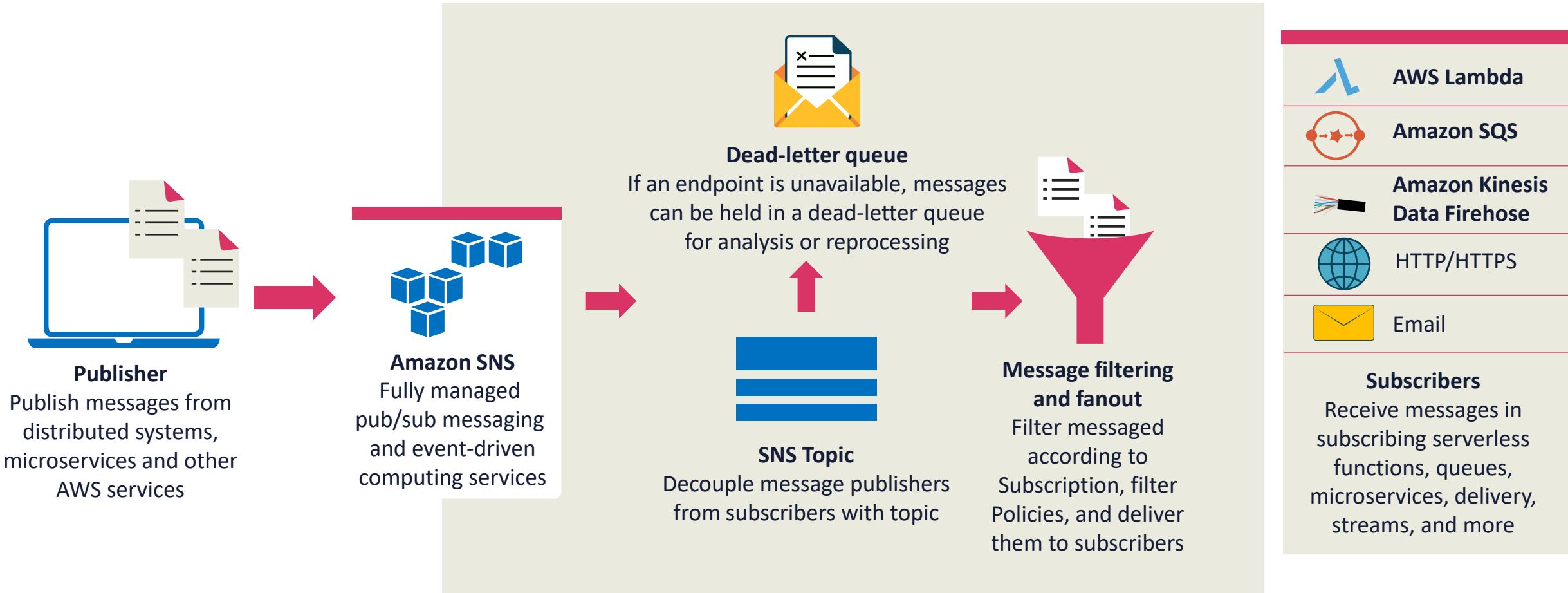


# AMAZON SIMPLE NOTIFICATION SERVICE (AMAZON SNS)



- Amazon Simple Notification Service (Amazon SNS) sends notifications two ways, A2A and A2P
- A2A offers high-throughput, push-based, many-to-many messaging between distributed systems, microservices, and event-driven serverless applications
  - Applications include Amazon Simple Queue Service (SQS), Amazon Kinesis Data Firehose, AWS Lambda, and other HTTPS endpoints
- A2P functionality lets you send messages to customers with SMS texts, push notifications, and email

# AMAZON SIMPLE NOTIFICATION SERVICE

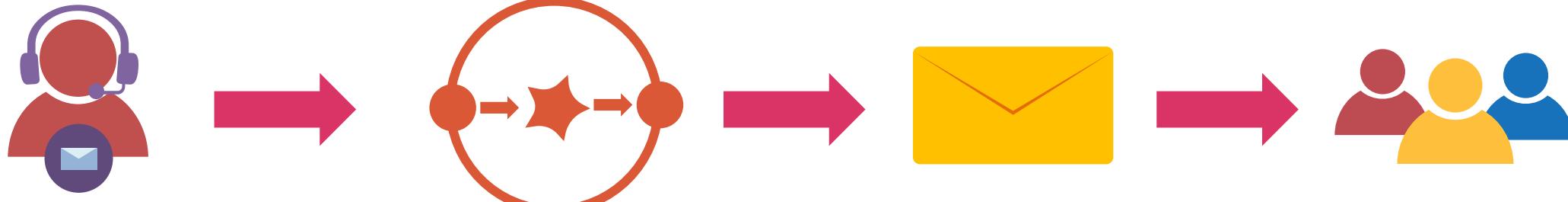


# AMAZON SIMPLE QUEUE SERVICE (AMAZON SQS)

- Amazon Simple Queue Service 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



## 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 pre-provision capacity

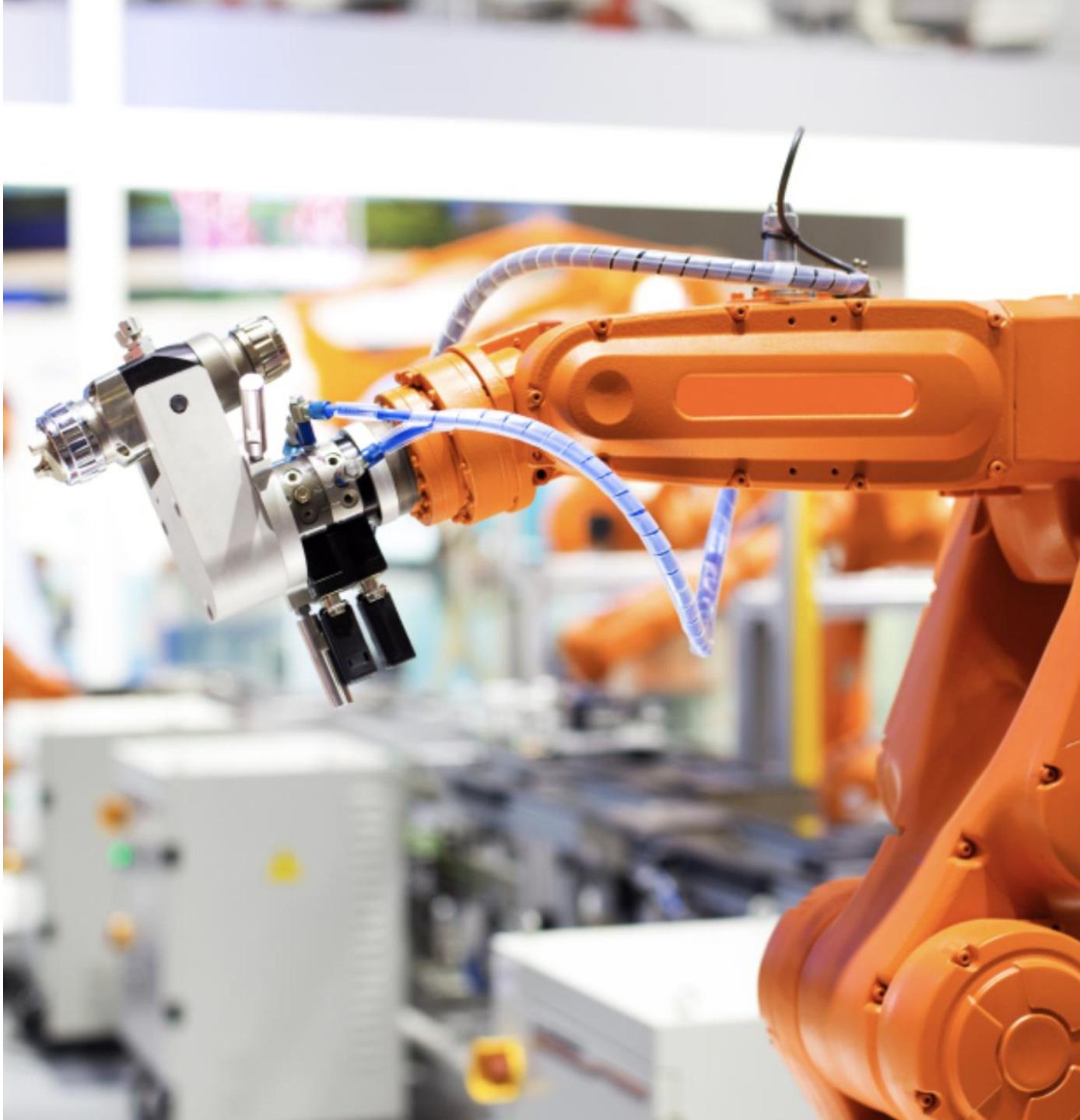


# MACHINE LEARNING IN A NUTSHELL

- Machine learning 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:
  - ML 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

- **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

- **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

# MACHINE LEARNING ALGORITHMS

## Supervised machine learning

Data scientists offer algorithms with branded and distinct training data to evaluate for correlations



## Unsupervised machine learning

A technique that trains on unlabeled data by scanning new data and establishing significant links between the inputs and predetermined outputs



## Semi-supervised learning

This combines supervised and unsupervised learning by leveraging a small amount of labeled data and a large amount of unlabeled data to train systems



## Reinforcement machine learning

A technique that associates reward values with the different steps that the algorithm must follow



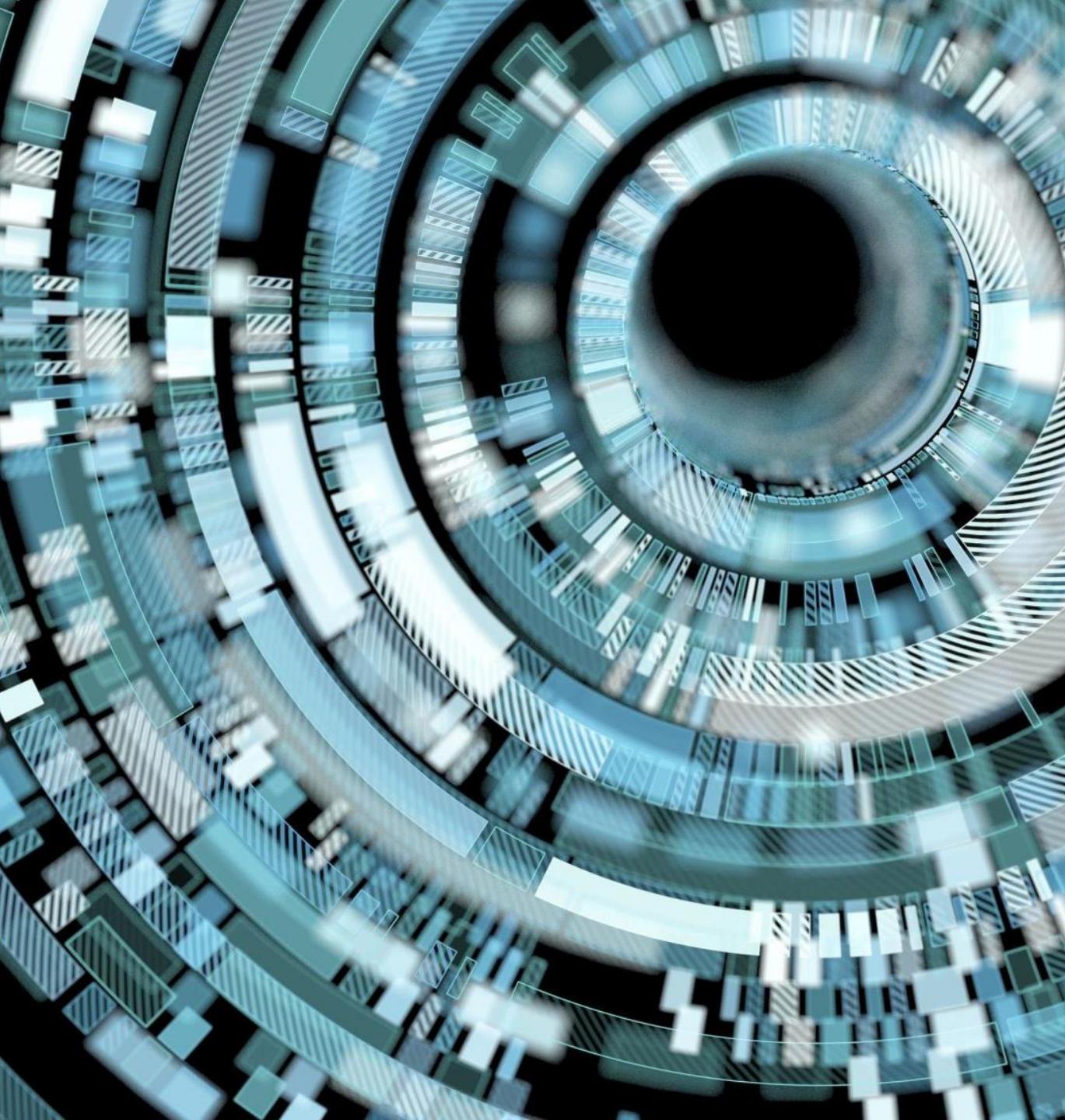
# ARTIFICIAL INTELLIGENCE IN A NUTSHELL

- 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

# AI AT AMAZON WEB SERVICES

- AWS offers ready-made intelligence for customer applications and workflows with pre-trained AI services
- These AI services effortlessly integrate with applications to support common use cases:
  - Personalized recommendation engines
  - Contact center modernization
  - Safety and security enhancement
  - Customer engagement improvement
- AWS AI services leverage the same deep learning technology that powers Amazon
- Customers attain quality and accuracy from continuously learning APIs without the need for ML experience



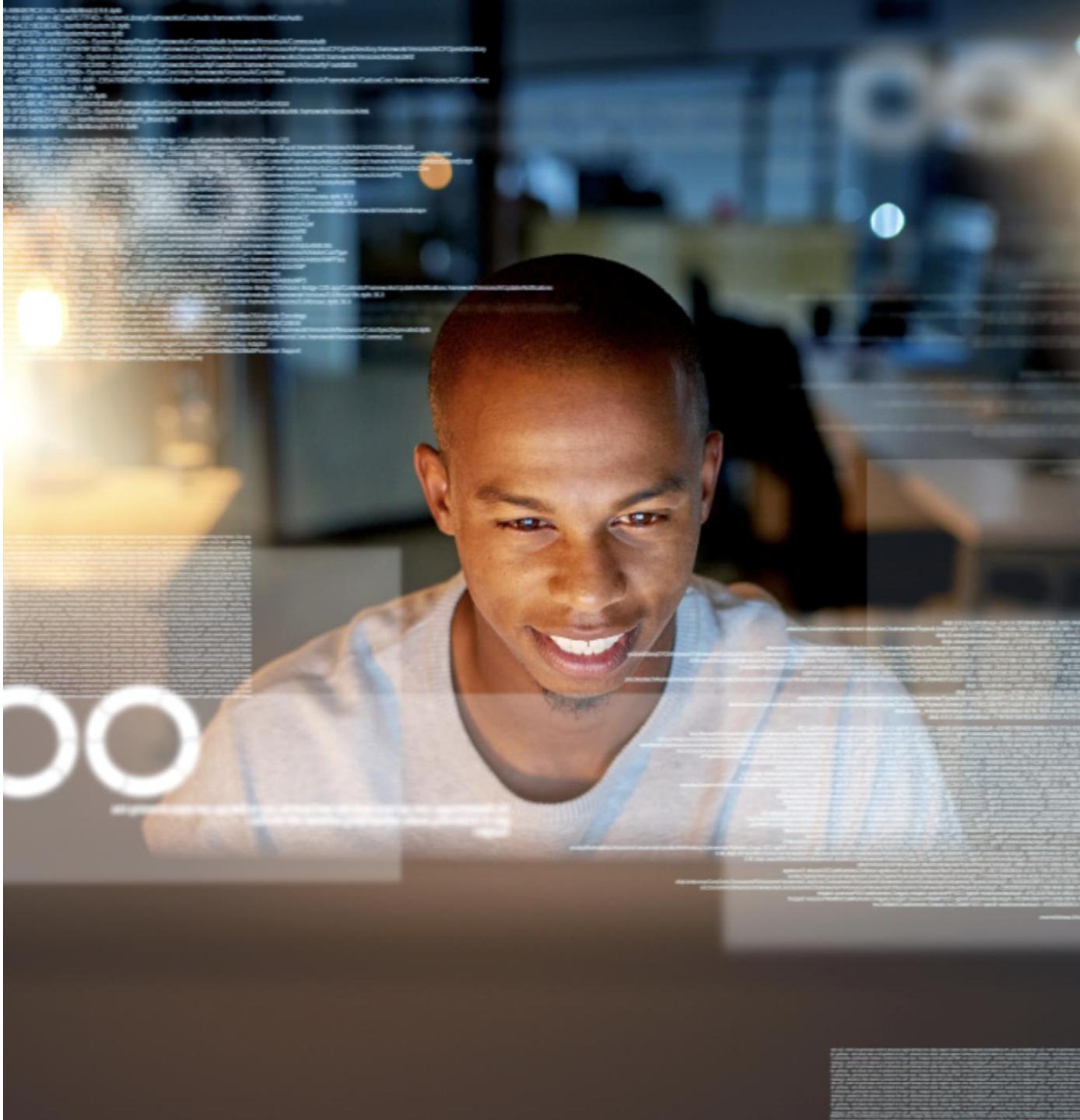


# AMAZON SAGEMAKER

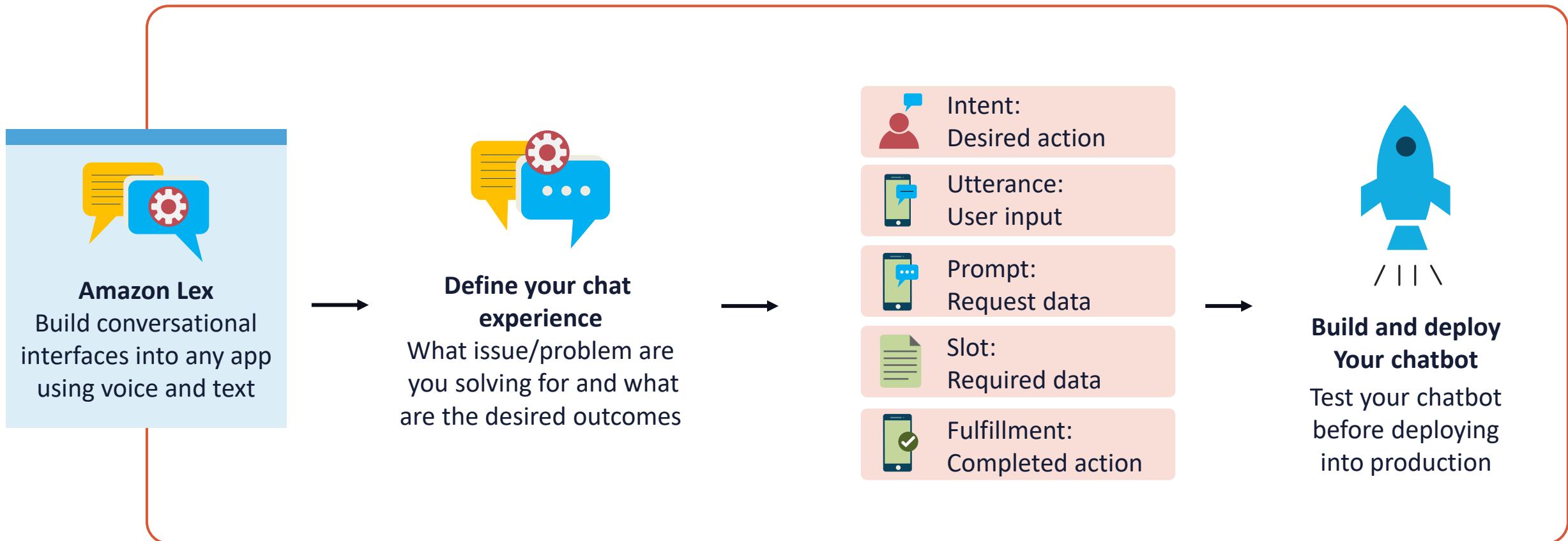
- SageMaker empowers AWS customers to build, train, and deploy machine learning models for any use case with fully managed infrastructure, tools, and workflows
- Amazon SageMaker JumpStart offers a set of solutions for common use cases that can be deployed with just a few clicks to make it easier to get started
- The solutions are fully customizable and support 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

- 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



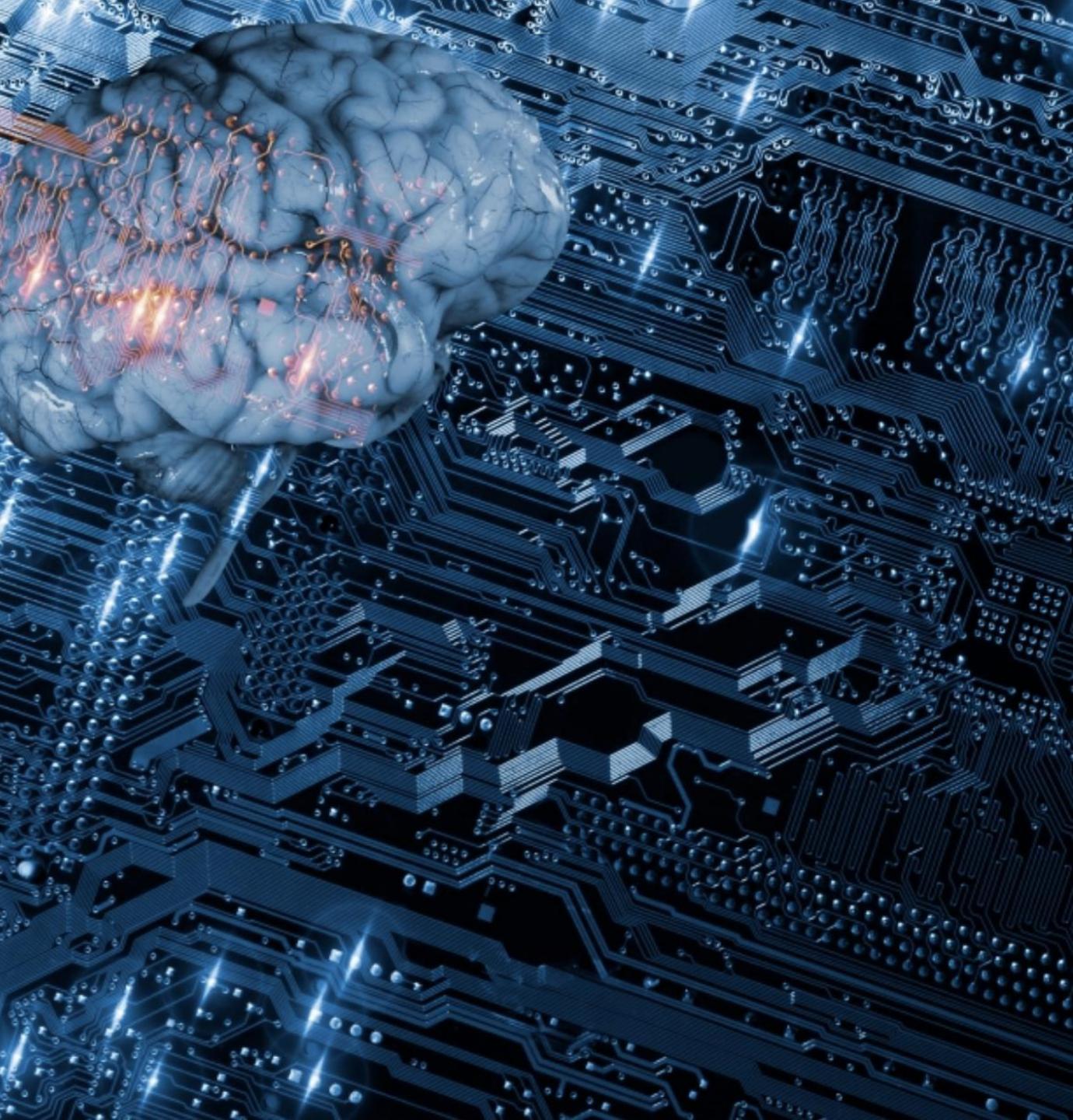


# AMAZON KENDRA

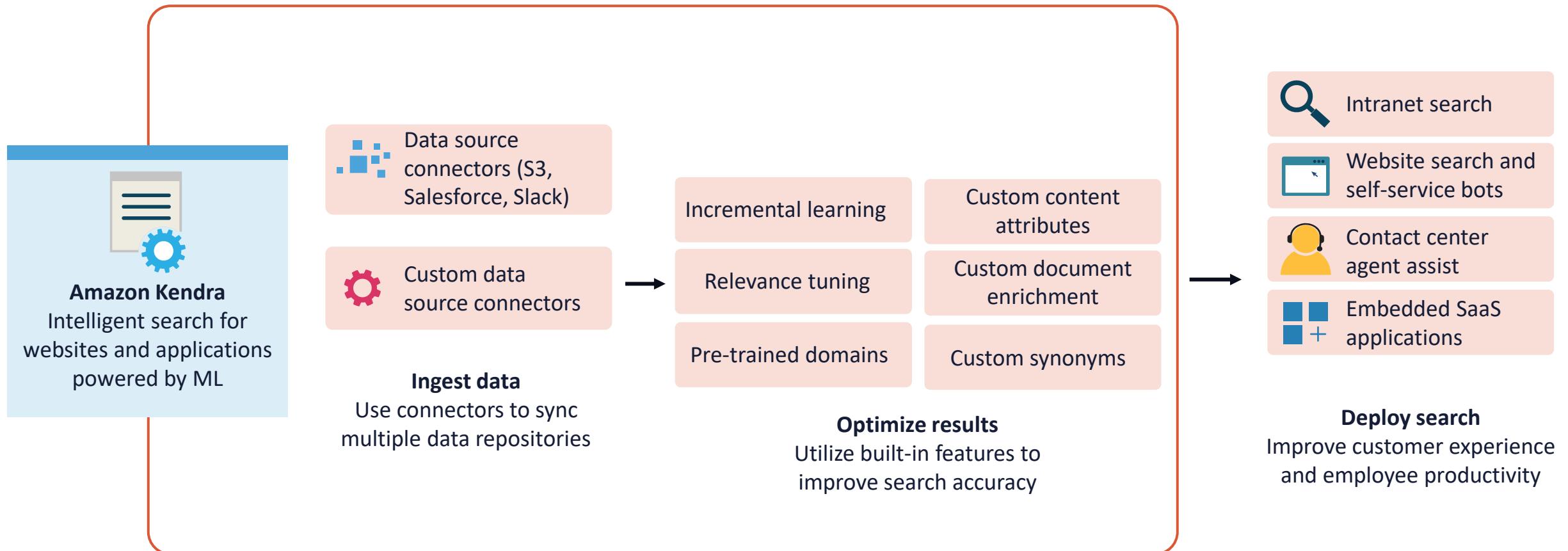
- Generative AI is a type of AI that can create new content and ideas, including conversations, stories, images, videos, and music
- It is powered by very large ML models that are pre-trained on large amounts of data and is usually referred to as a foundation model (FM)
- Customers use Amazon Kendra 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

- 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



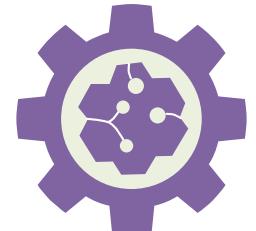
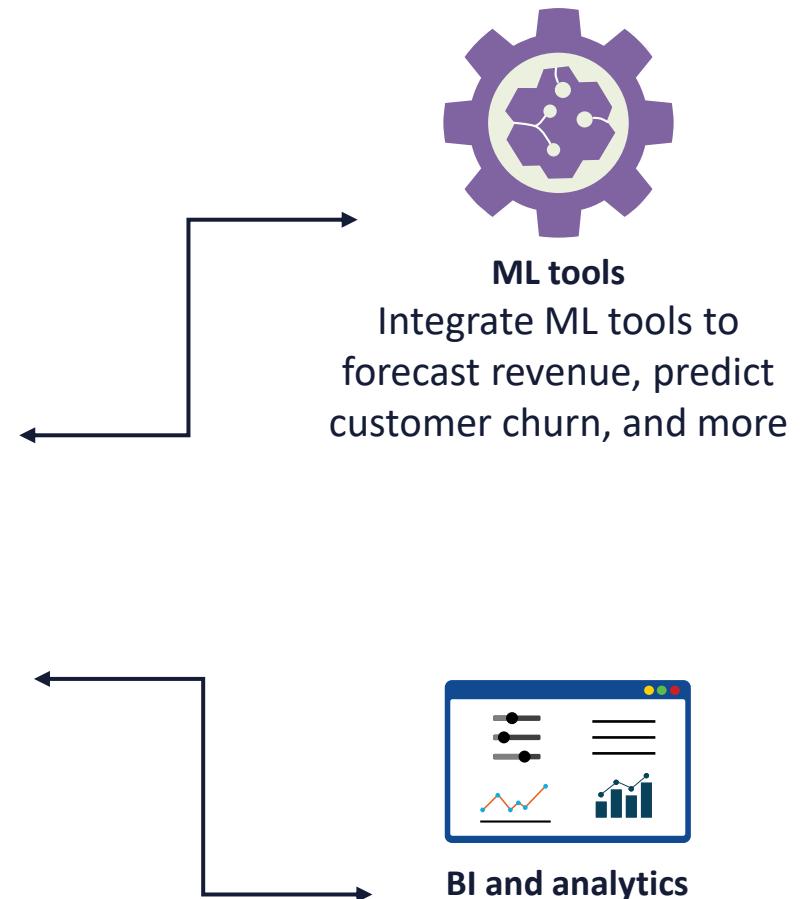
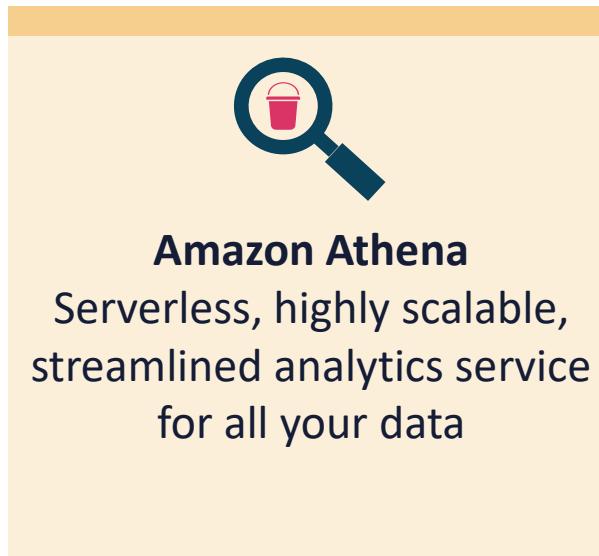
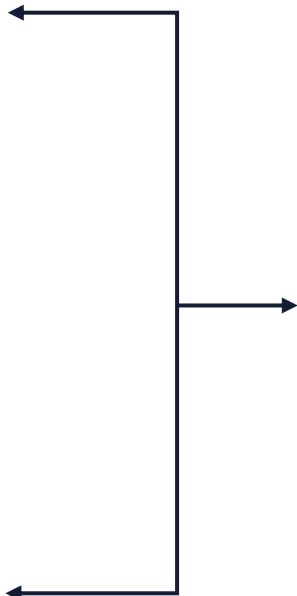
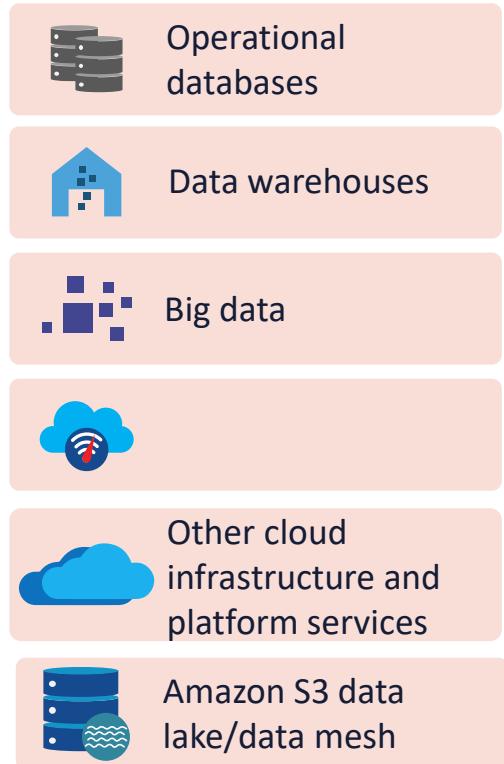
- Amazon Athena is a serverless, interactive analytics solution built on open-source frameworks
- It supports open-table and file formats
- Athena delivers a flexible and easy way to analyze petabytes of data right where it resides
- There is no provisioning or configuration effort required on the client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

# AMAZON ATHENA

- Customers use Athena to analyze data or build applications from an Amazon 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



# AMAZON ATHENA



## ML tools

Integrate ML tools to forecast revenue, predict customer churn, and more



## BI and analytics applications

Build applications to analyze and visualize data

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



# AMAZON KINESIS

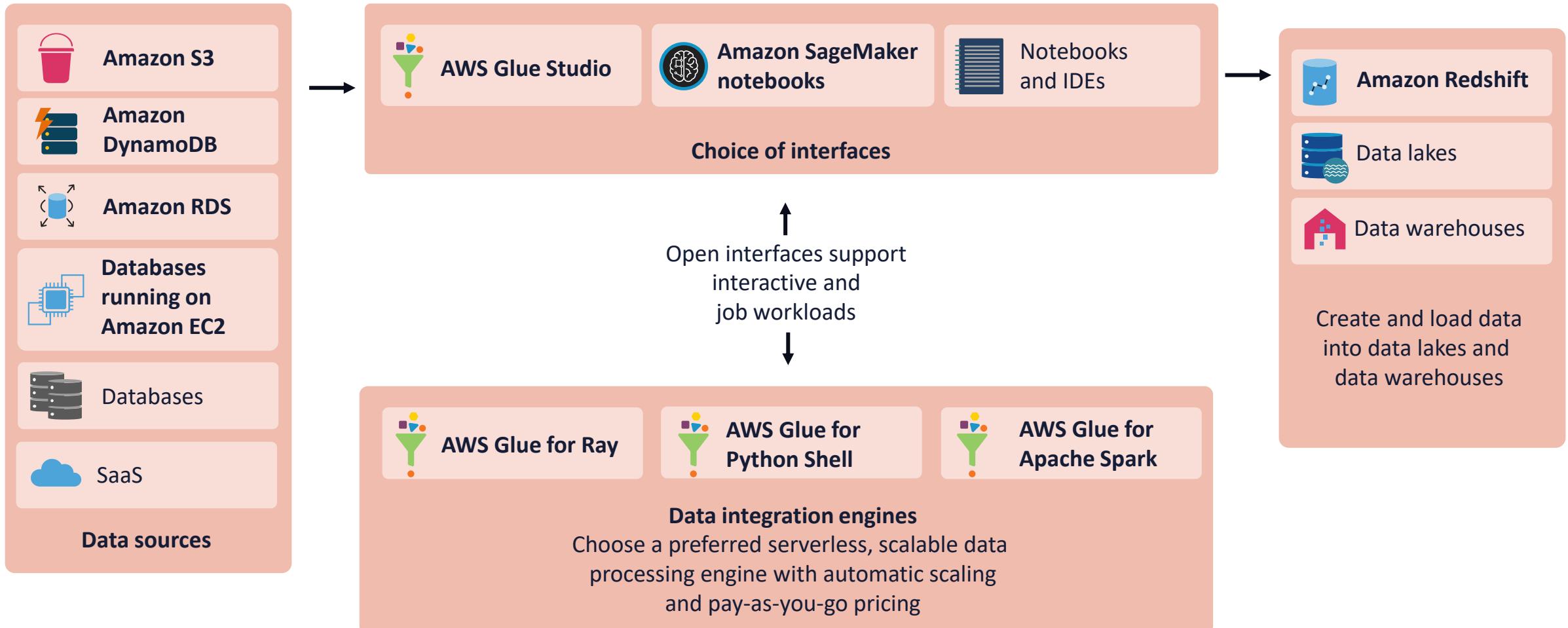
- With Amazon Kinesis customers can:
  - Collect, process, and analyze real-time, streaming data to gain timely insights and react quickly to new information
  - Ingest real-time data such as video, audio, application logs, website clickstreams, and IoT telemetry data for machine learning, analytics, 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 ETL pipelines to load data into data lakes



# AWS GLUE



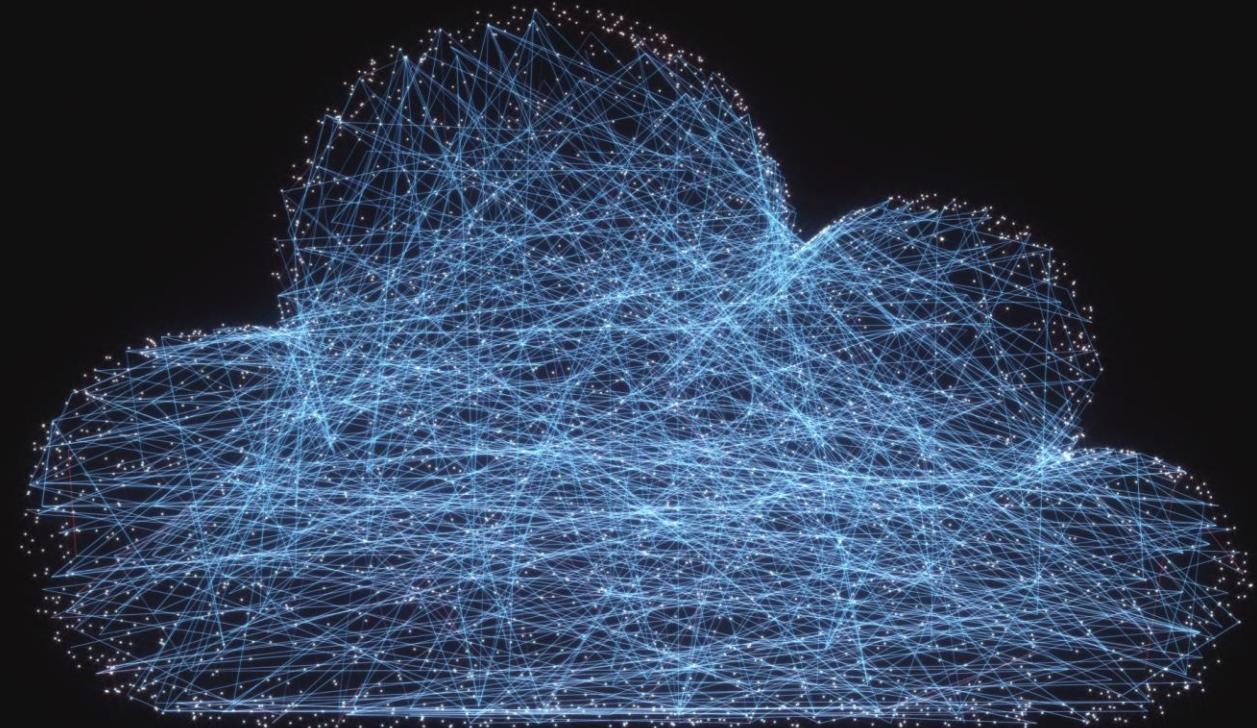


# AMAZON QUICKSIGHT

- 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

- AWS Cloud9 is a cloud-based integrated development environment (IDE) that enables DevOps professionals to construct, run, and debug the code with only a browser
  - It includes a code editor, debugger, and terminal
- Cloud9 comes prepackaged with vital tools for popular programming languages, including JavaScript, Python, and PHP
- There is no need to install files or configure the development machine for new projects

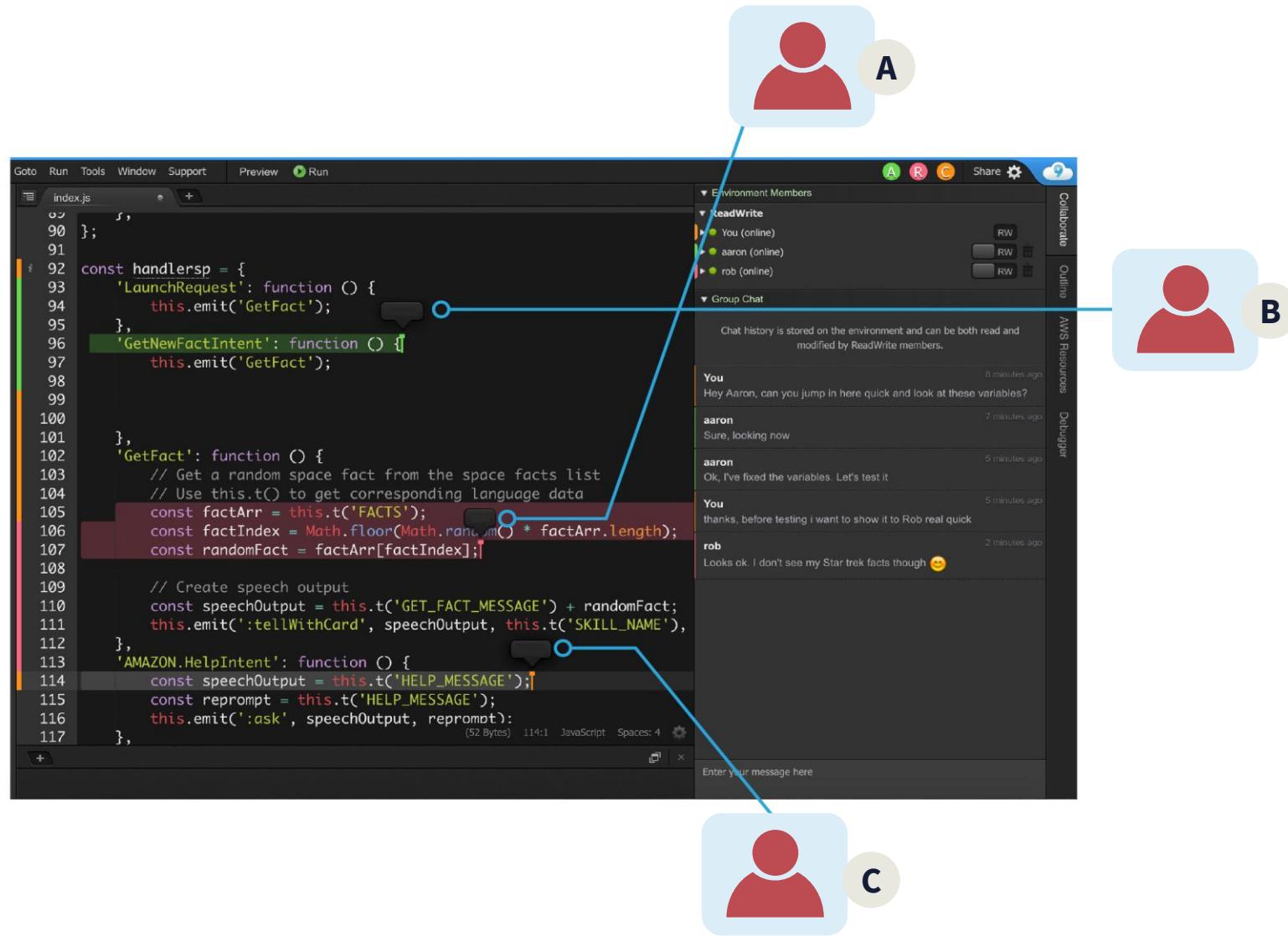


# AWS CLOUD9

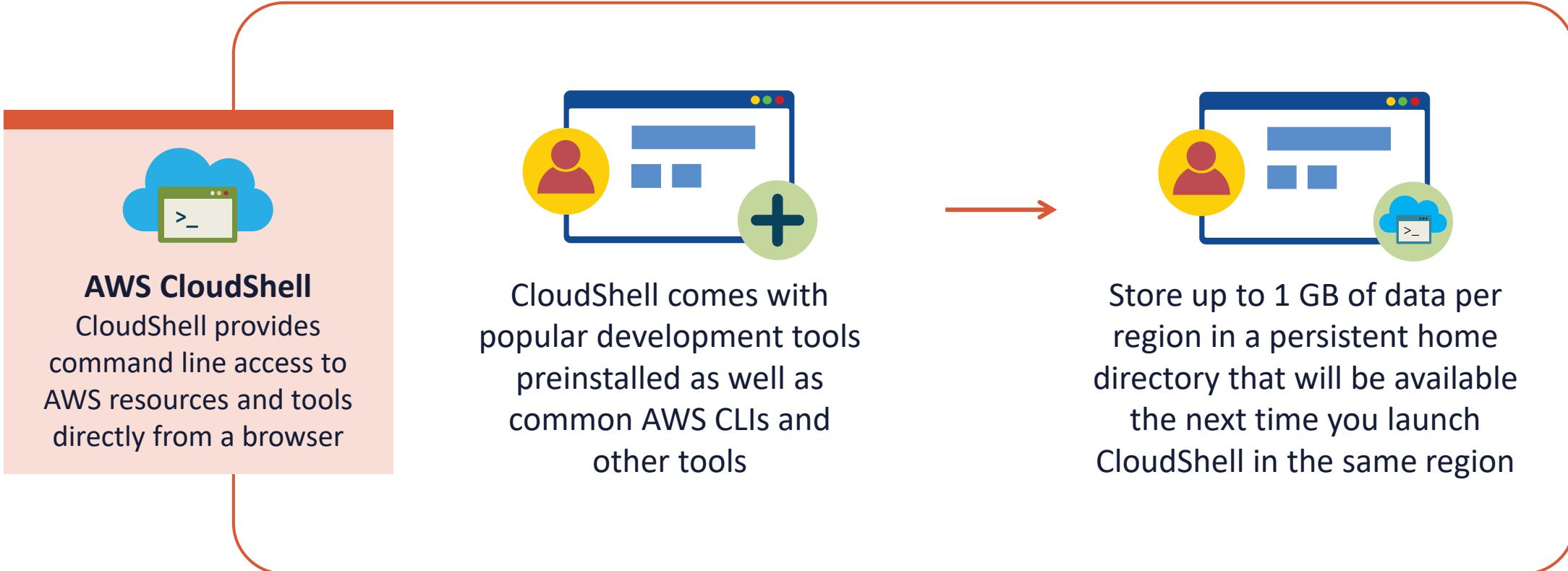
- As the Cloud9 IDE is cloud-based, teams can work on their projects from anywhere using an Internet-linked machine
- Cloud9 also offers a unified environment for developing serverless application
- Developers can simply define resources, debug, and switch between local and remote execution of serverless applications



# AWS CLOUD9 IDE



# AWS CLOUDSHELL





# AWS APPCONFIG

- 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

# 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 CodePipeline

a fully managed **continuous delivery** service that automates release pipelines for fast and reliable application and infrastructure updates



## AWS CodeStar\*

Enables rapid developing, building, and deploying applications with a unified user interface

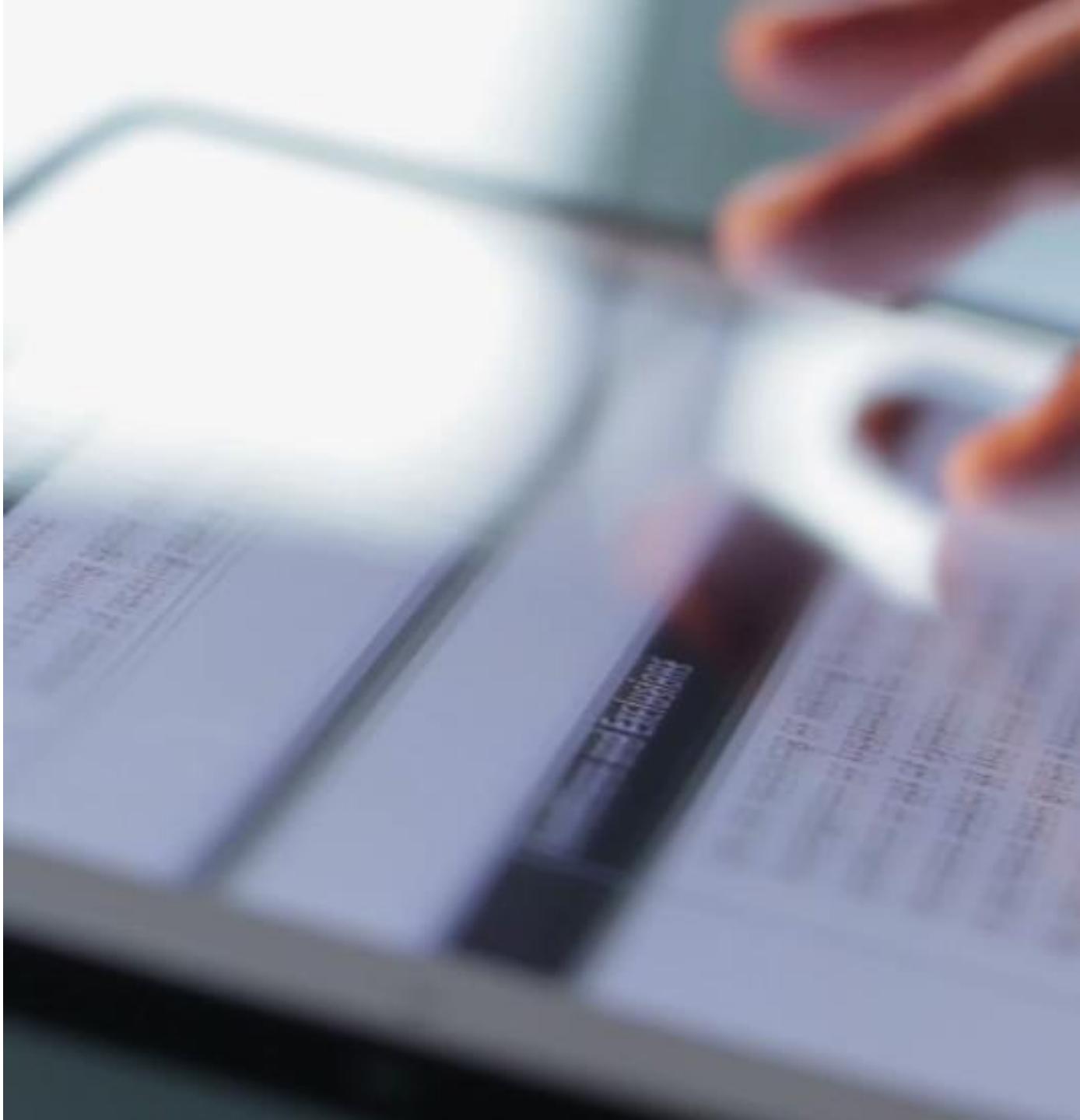


## AWS X-Ray

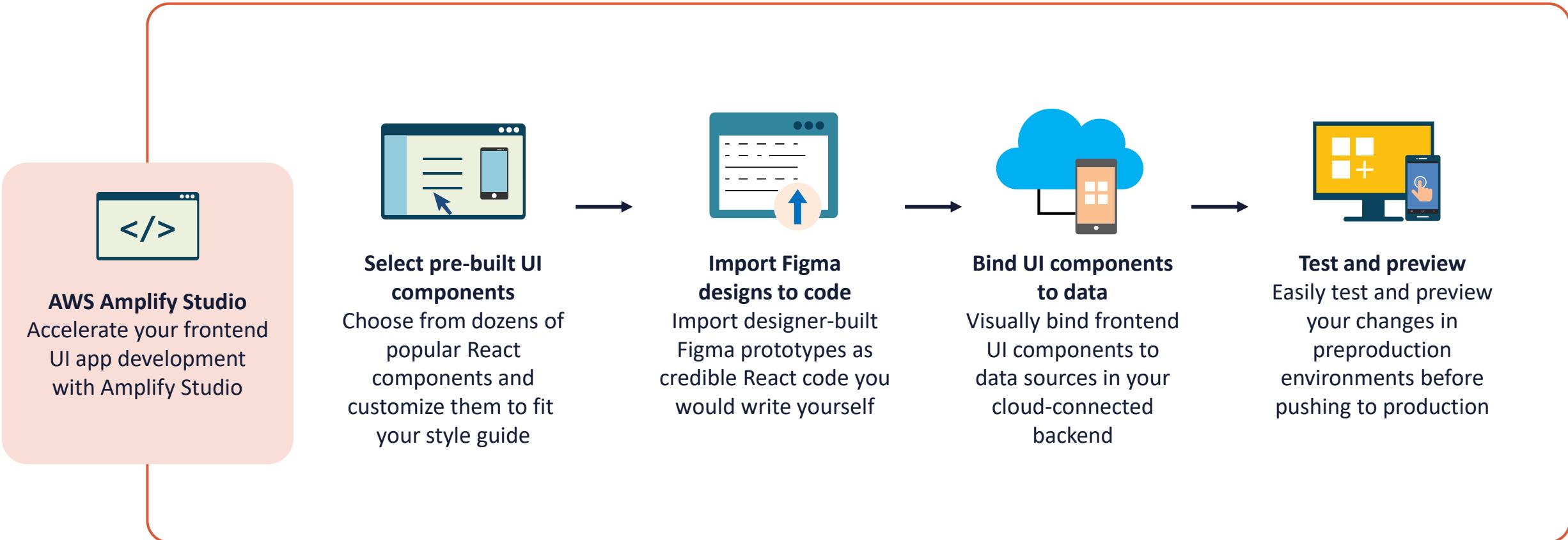
Offers a complete **view of requests** as they travel through the application and filters visual data across payloads, functions, traces, services, APIs, and more

# AWS AMPLIFY

- 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

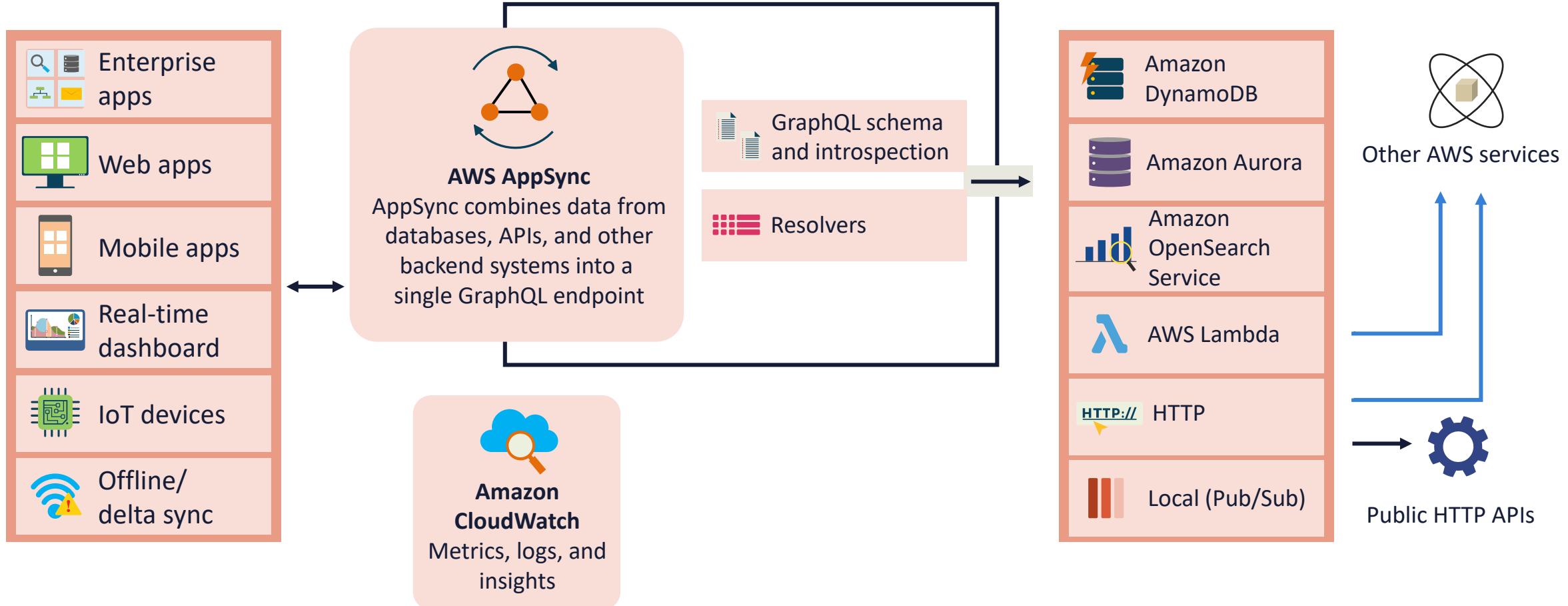




# AWS APPSYNC

- 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 SaaS applications from existing web browsers, without appliances, infrastructure, special client software, or VPN connections



A photograph showing two customer service agents in a contact center. A woman in the foreground is looking down at her computer screen, while a man behind her is also focused on his work. They are both wearing professional headsets with microphones. Several computer monitors are visible in the background, displaying various data and graphs, suggesting a high-tech, analytical environment.

# AMAZON CONNECT

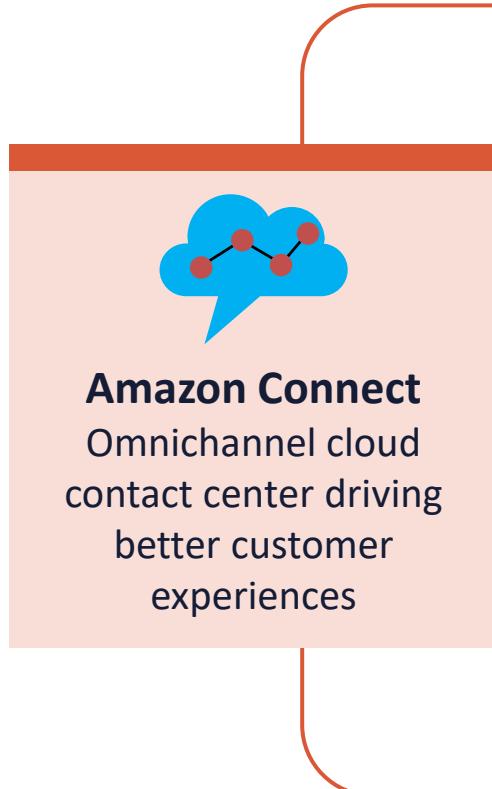
- Connect allows customers to roll out a scalable contact center in minutes
- Amazon Connect offers powerful analytics, insights, and optimization
- Customers can use a few clicks and onboard agents to assist customers immediately
- Expand agent productivity and customer experience over voice and digital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

# AMAZON CONNECT



## Customers

Fast, secure, high-quality, personalized customer service



## Agents

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



## Managers

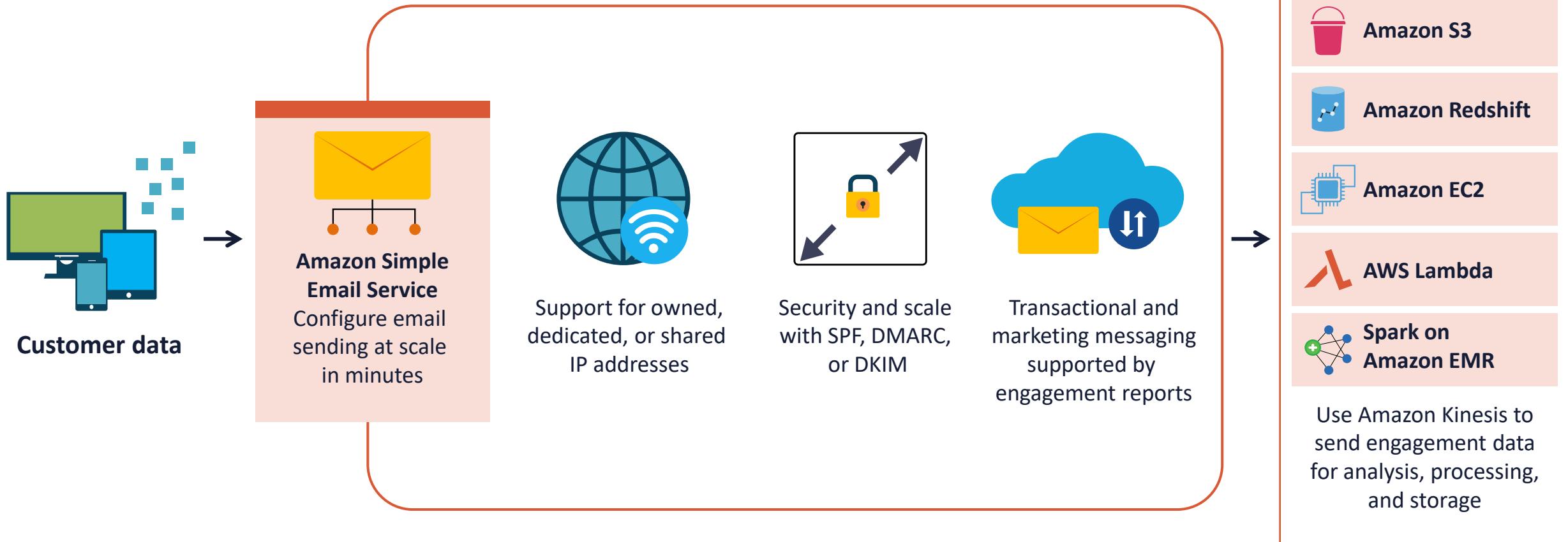
An ML-powered contact center you can set up quickly and make changes in minutes, not months

# AMAZON SIMPLE EMAIL SERVICE (AMAZON SES)

- Amazon Simple Email Service 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

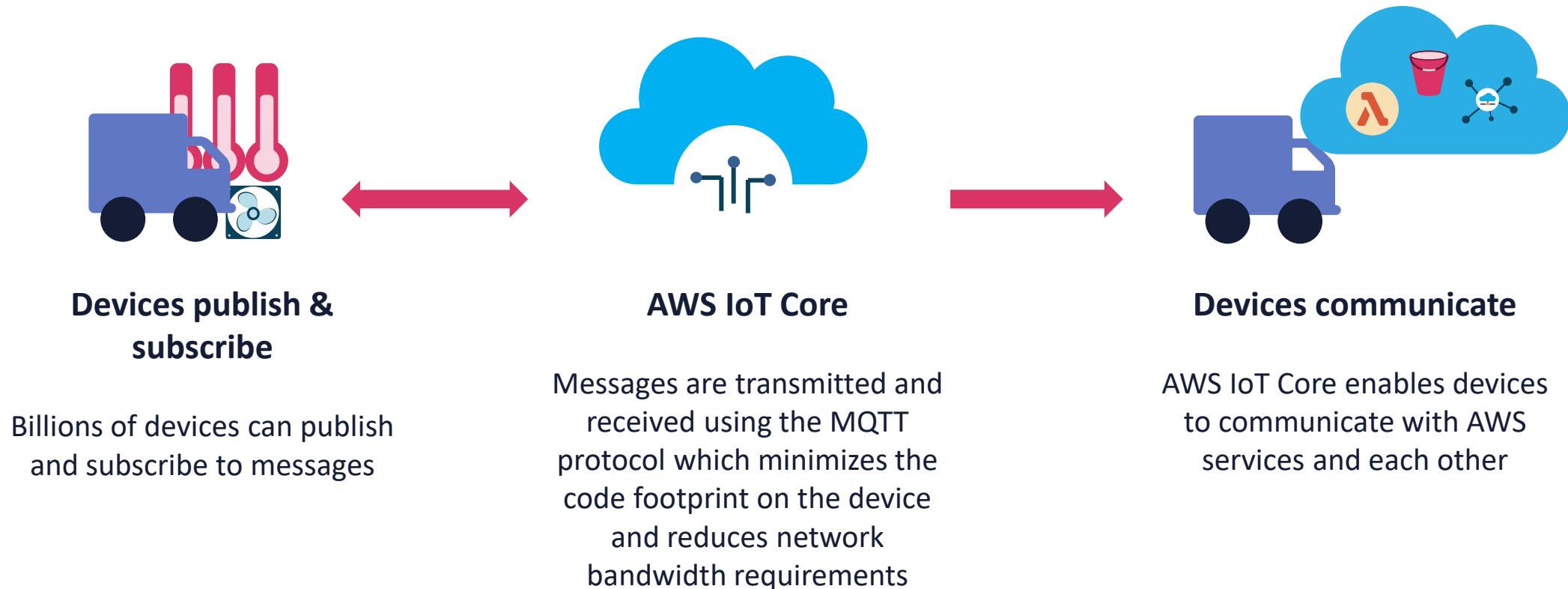




# IOT CORE

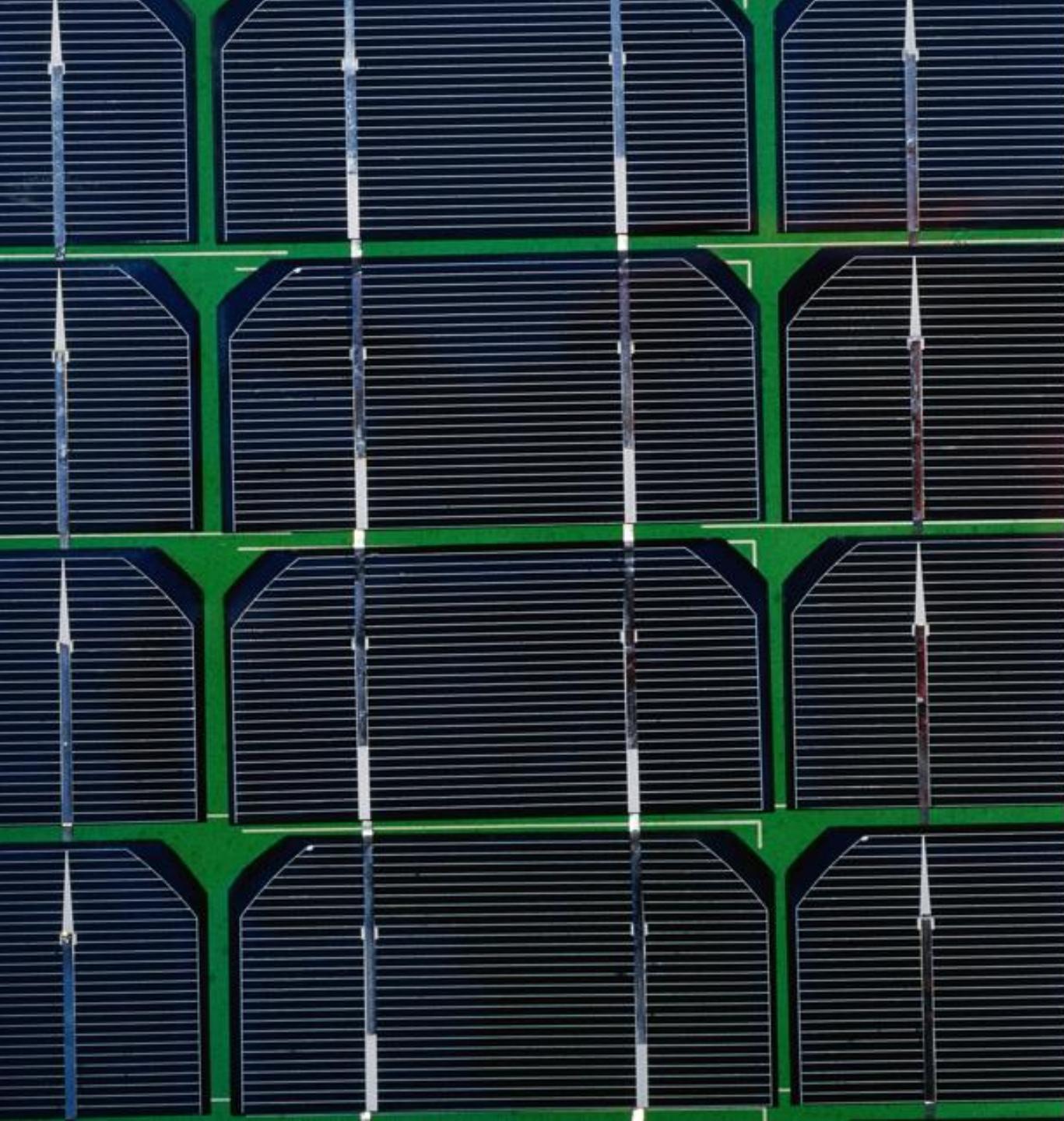
- AWS IoT Core lets customers potentially connect billions of IoT devices and route trillions of messages to AWS services without managing an infrastructure
- Provides secure device connections and data with mutual authentication and end-to-end encryption
- Customers can choose among several communication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

# AWS IOT CORE



# IOT GREENGRASS

- 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



A professional photograph of a woman with long dark hair, wearing a dark blazer over a striped shirt, smiling and shaking hands with a man whose back is to the camera. They are in an office setting with papers on a desk.

# AWS ACTIVATE FOR STARTUPS

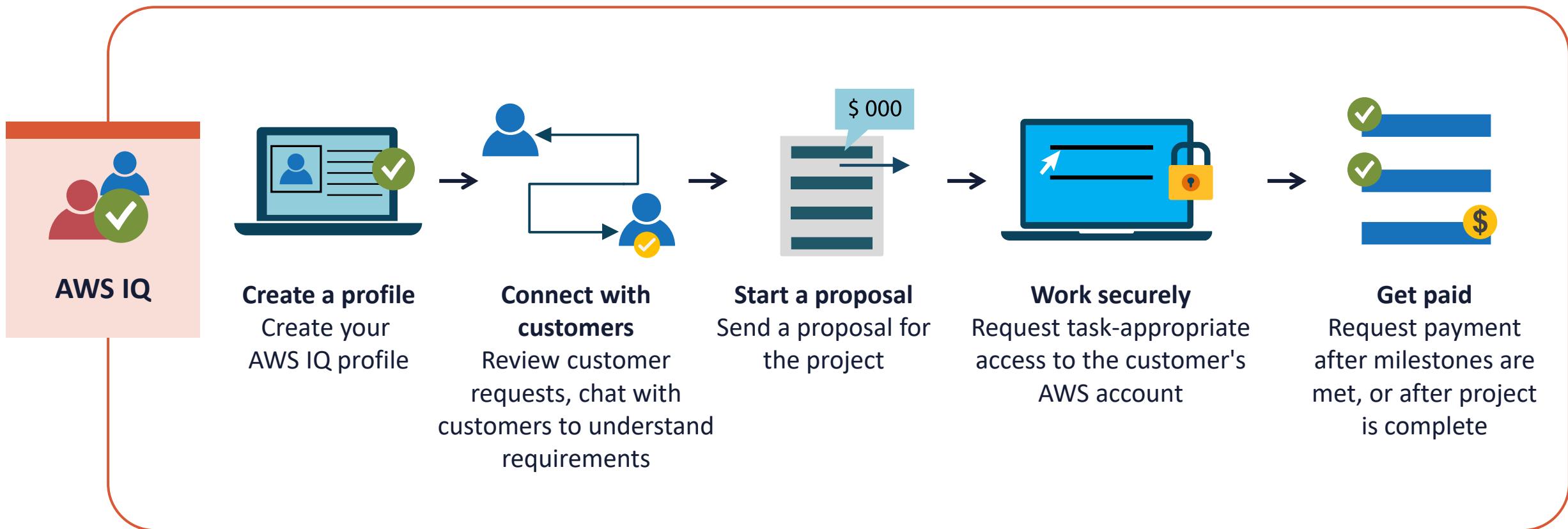
- AWS Activate offers eligible\* startup organizations free tools, resources, and content meant to streamline every phase of the startup initiative
- New members get benefits such as:
  - AWS curated expert advice on business and technical needs
  - Training and support
  - Pre-built infrastructure templates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

# AWS IQ

- 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

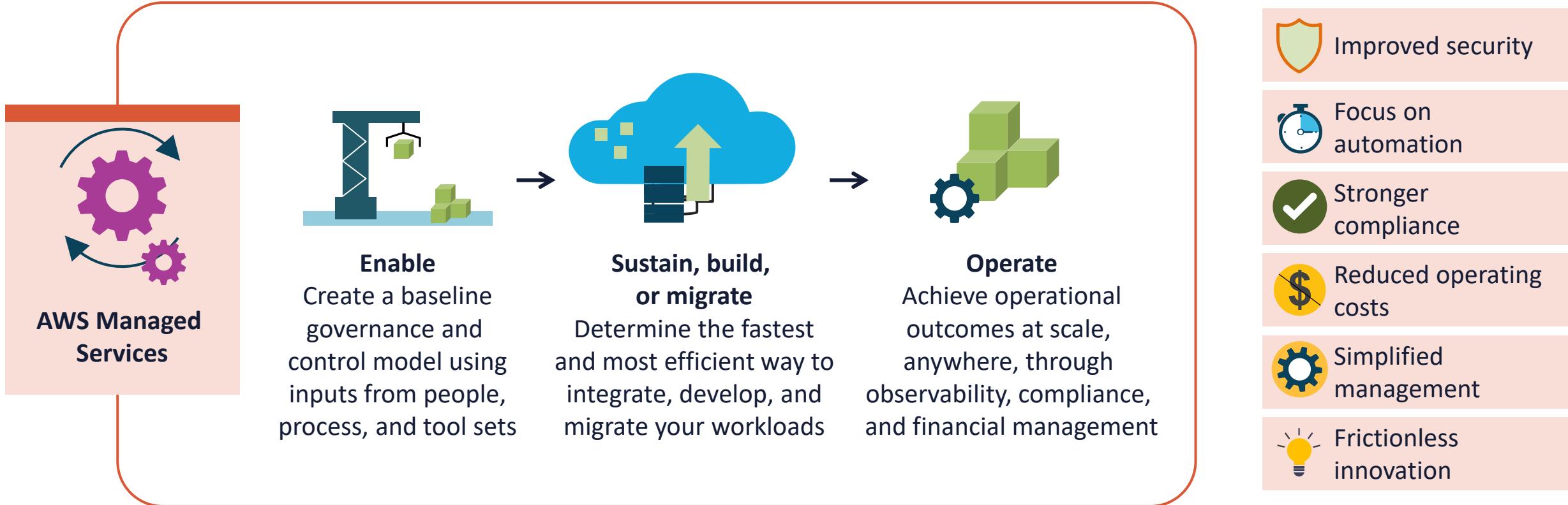


A photograph showing two people in an office environment. One person, a woman with short curly hair, is leaning over another person's shoulder, looking at a computer screen together. They are both wearing headsets. The person being looked at has their hands on a keyboard and mouse. There are multiple computer monitors on the desk. The scene is lit with warm, ambient light.

# 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





# AWS SUPPORT

- AWS Support is one-on-one, fast-response support from expert technical support engineers
- The service assists customers in best leveraging the AWS product line and features
- It utilizes pay-by-the-month pricing with unlimited support cases
- Customers are unfettered from long-term obligations

# **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!**