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# Module 3: Building in the cloud

Navjot Singh
Technical Trainer
AWS

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# Go beyond servers and storage

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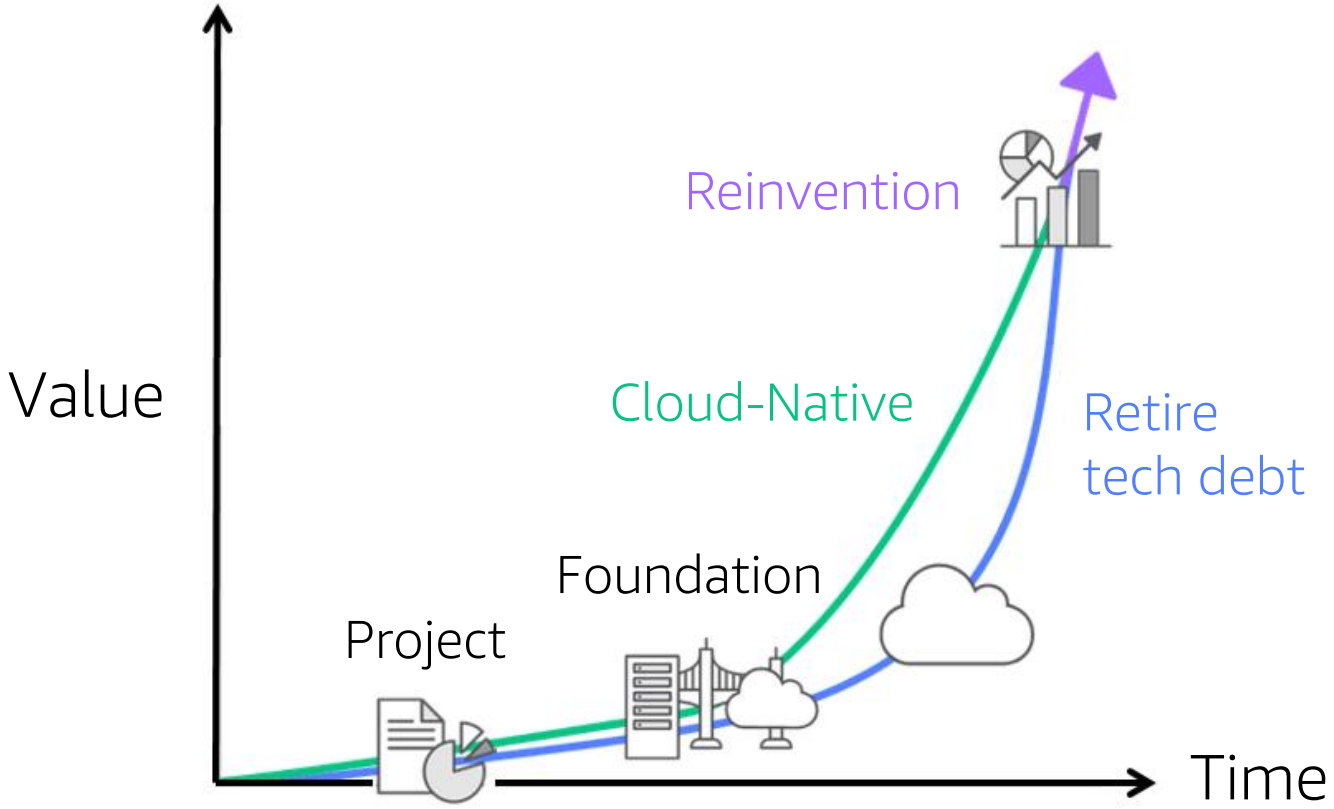
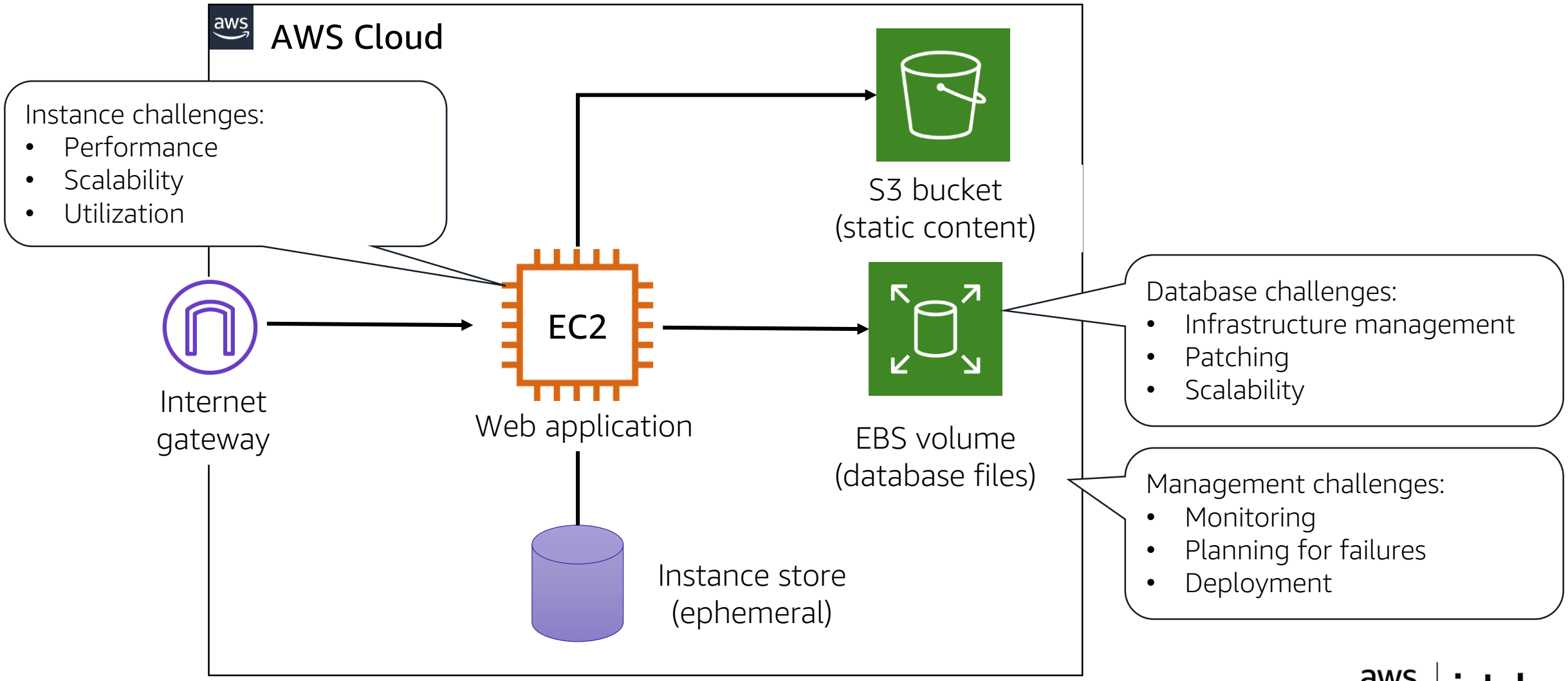
# Migration and reinvention



# Improving your initial project



# Monitor AWS resources

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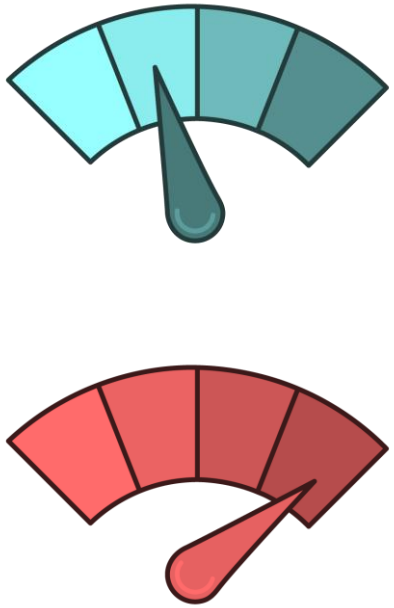
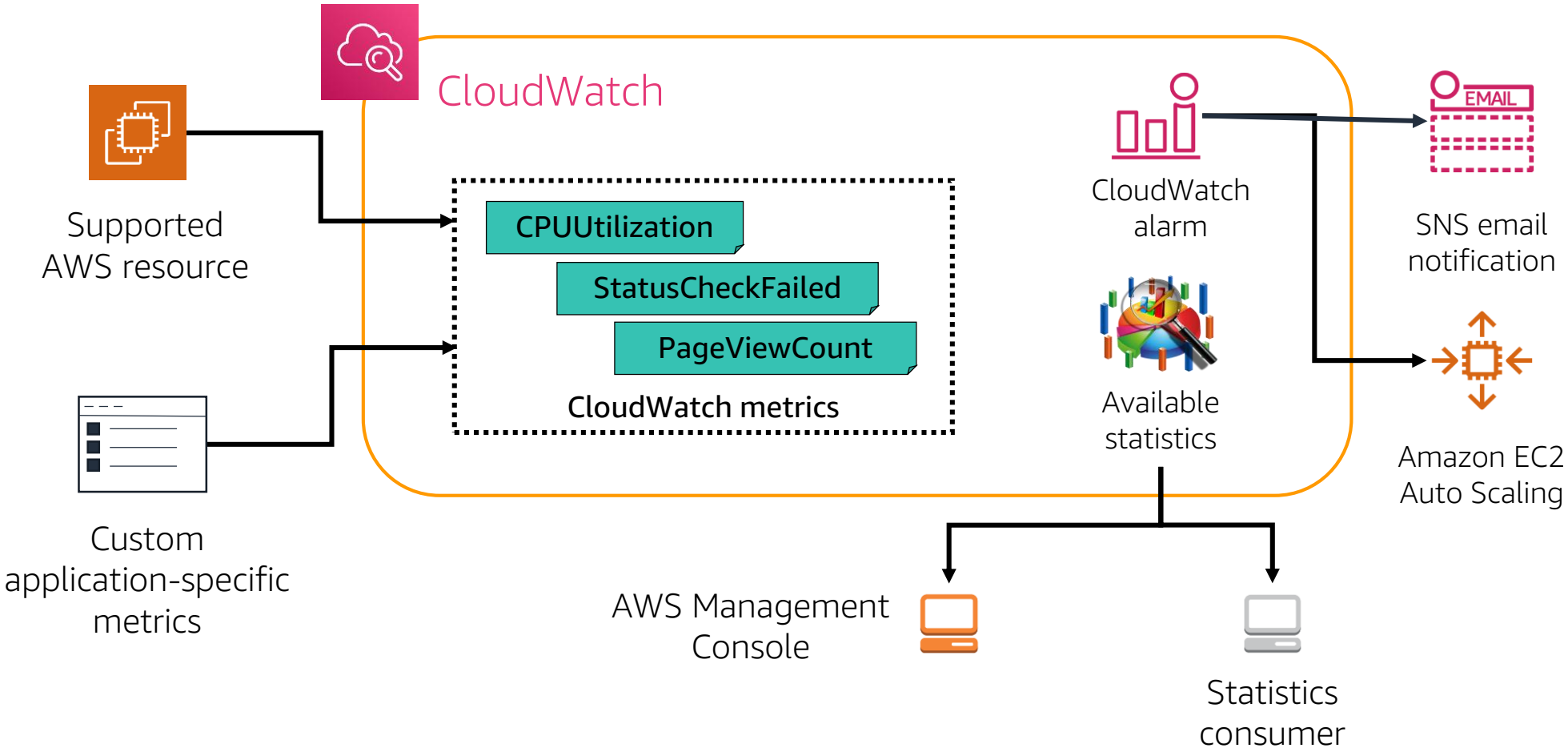
# What is Amazon CloudWatch?



- Monitors:
  - AWS resources
  - Applications running on AWS
- Collects and tracks:
  - Standard metrics
  - Custom metrics
- Alarms:
  - Send notifications
  - Automatically make changes based on rules you define

# How CloudWatch works



# Manage demand efficiently

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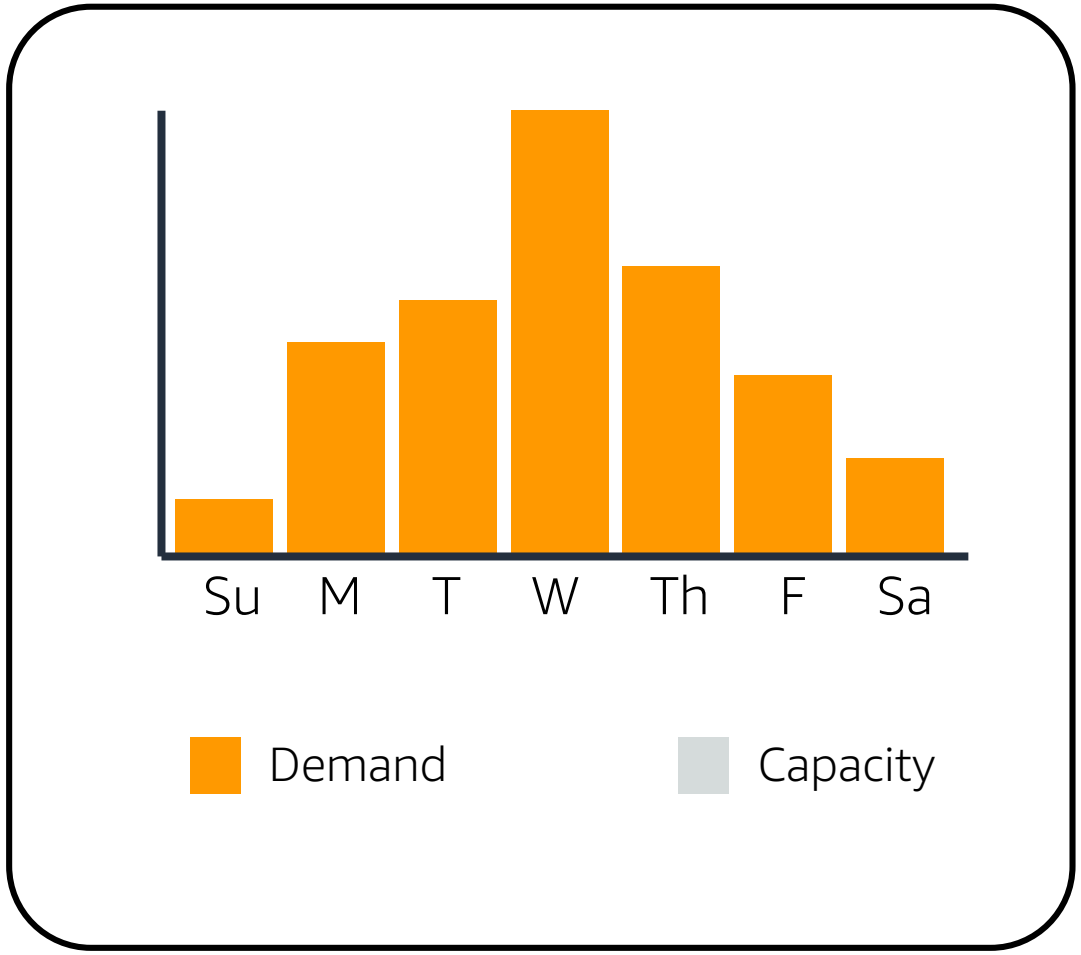
# Why scaling matters



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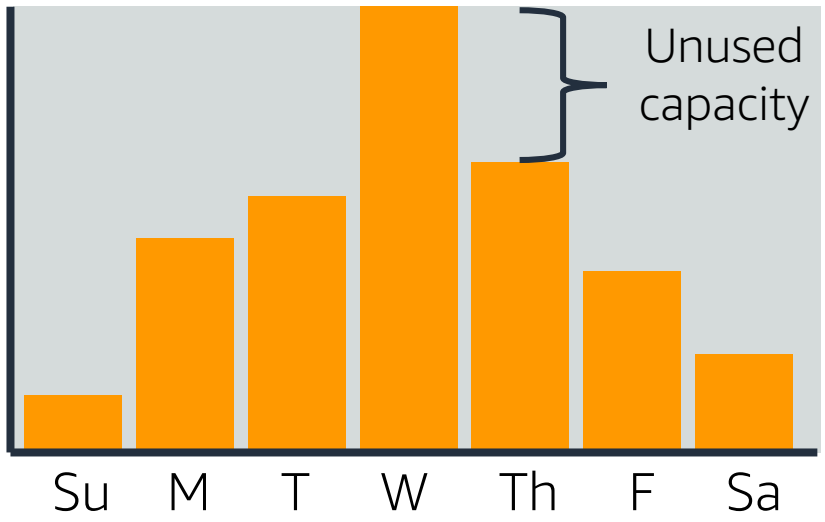

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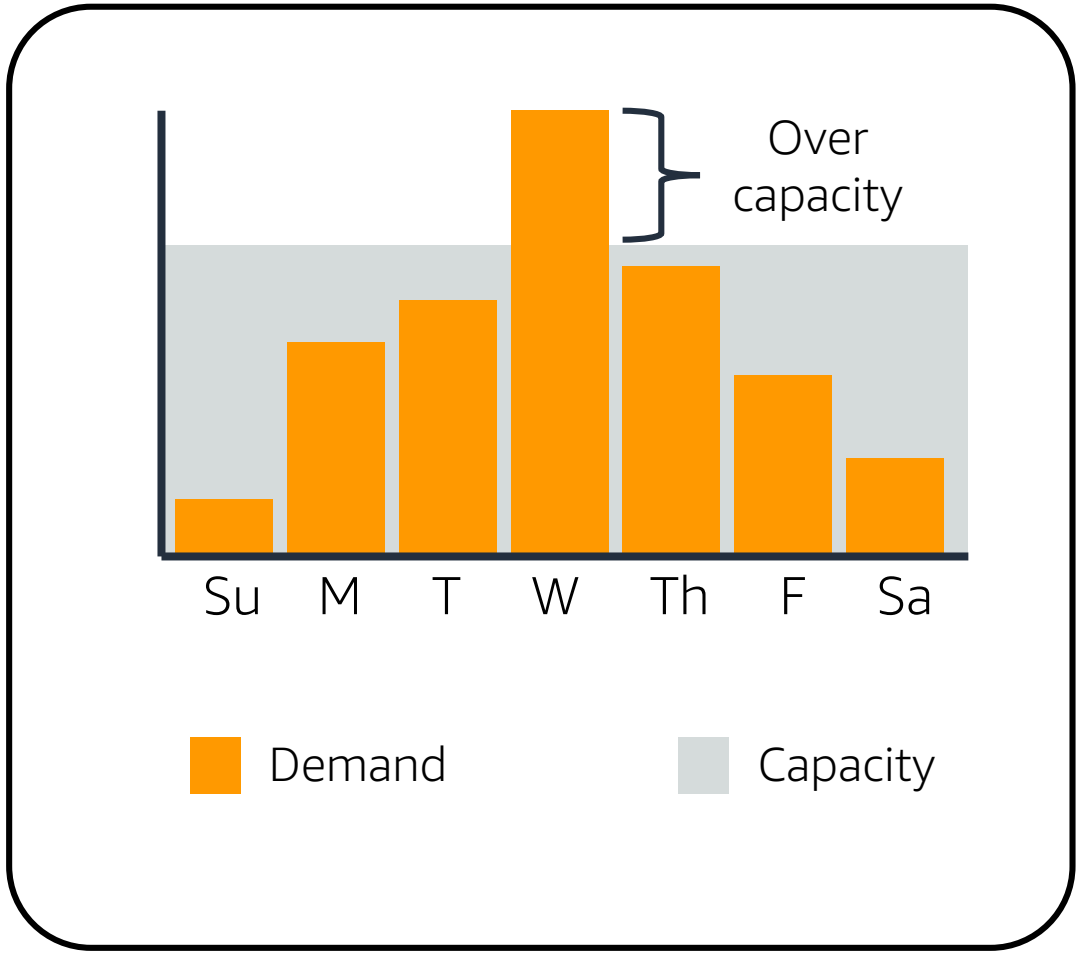


# Why scaling matters


Amazon EC2 Auto Scaling adjusts capacity as needed

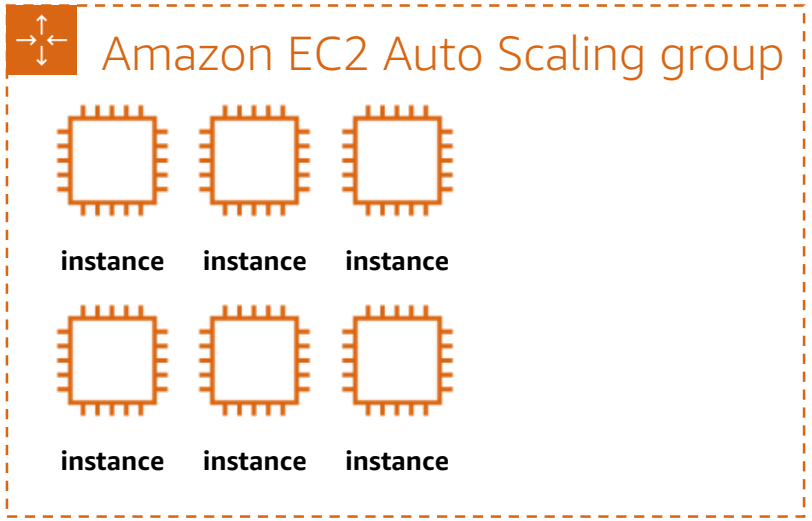
- Scale out for spikes
- Scale in during off-peak
- Replace unhealthy instances
- Pay only for what you use

# Dynamic scaling with Amazon EC2 Auto Scaling

## Follow the demand curve for your applications

- Select a load metric for your application
- Set as conditional and/or scheduled
- Use with CloudWatch, optionally

| | |
|---|---|
| Max | 10 |
| Min | 2 |
| Desired | 6 |




Average Demand

# Dynamic scaling with Amazon EC2 Auto Scaling

Follow the demand curve for your applications

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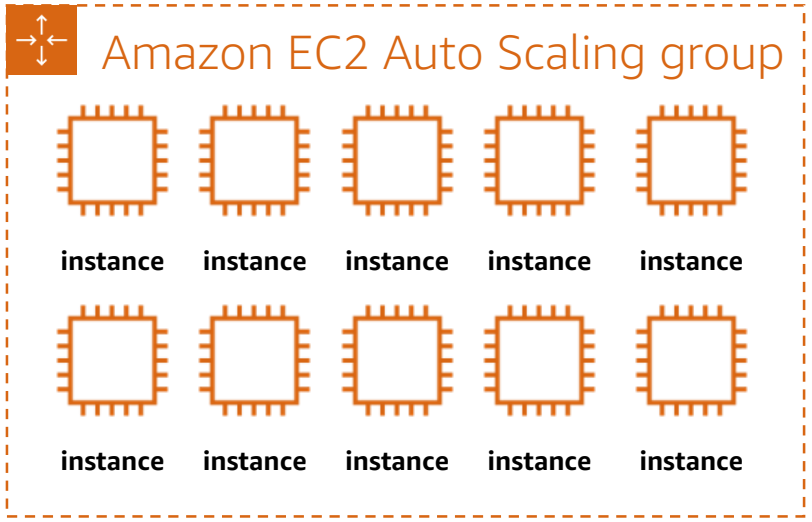
| | |
|---|---|
| Max | 10 |
| Min | 2 |
| Desired | 10 |




High demand

# Dynamic scaling with Amazon EC2 Auto Scaling

Follow the demand curve for your applications

- Select a load metric for your application
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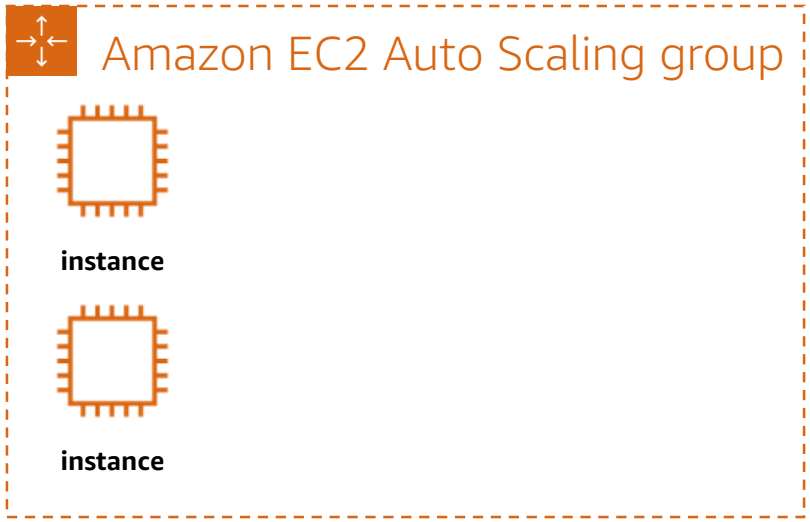
| | |
|---|---|
| Max | 10 |
| Min | 2 |
| Desired | 2 |



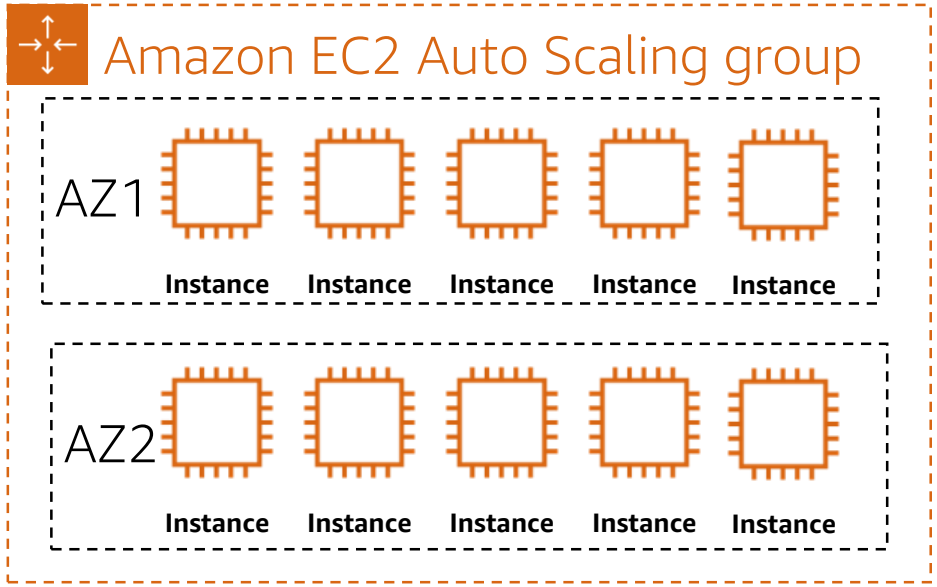

Low demand

# Fleet management with Amazon EC2 Auto Scaling

## Replace impaired Amazon EC2 instances without intervention

- Monitor the health of running instances
- Replace impaired instances automatically
- Balance capacity across Availability Zones

| | |
|---|---|
| Max | 10 |
| Min | 2 |
| Desired | 10 |



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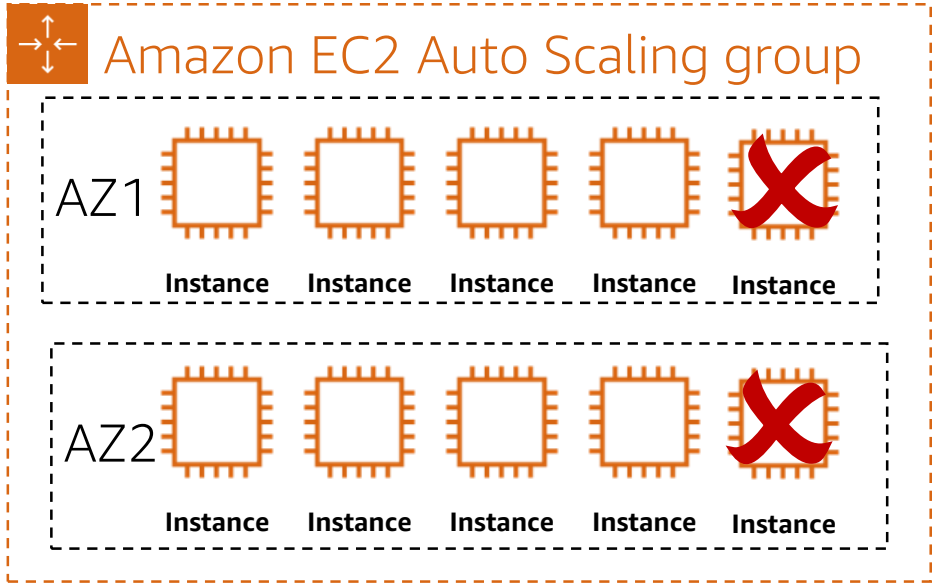

# Fleet management with Amazon EC2 Auto Scaling

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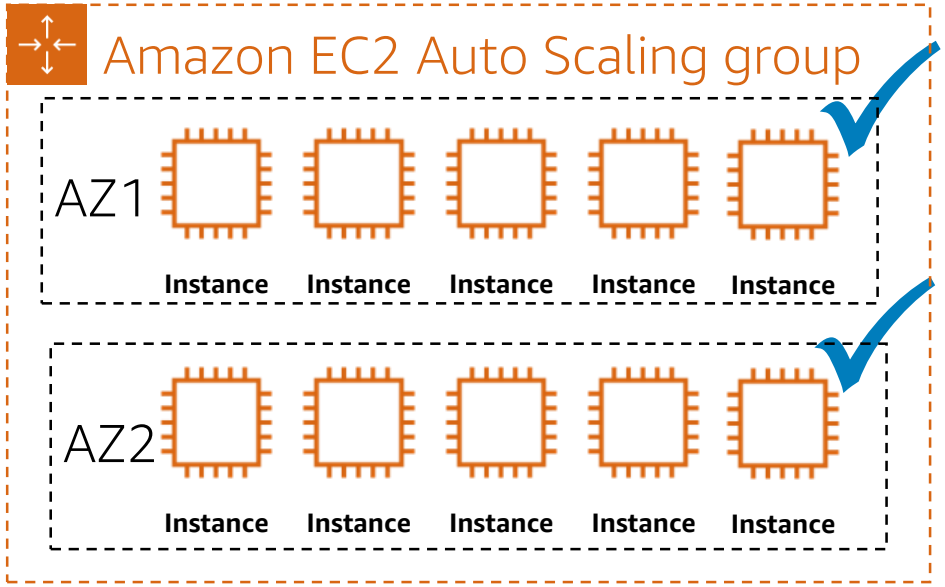
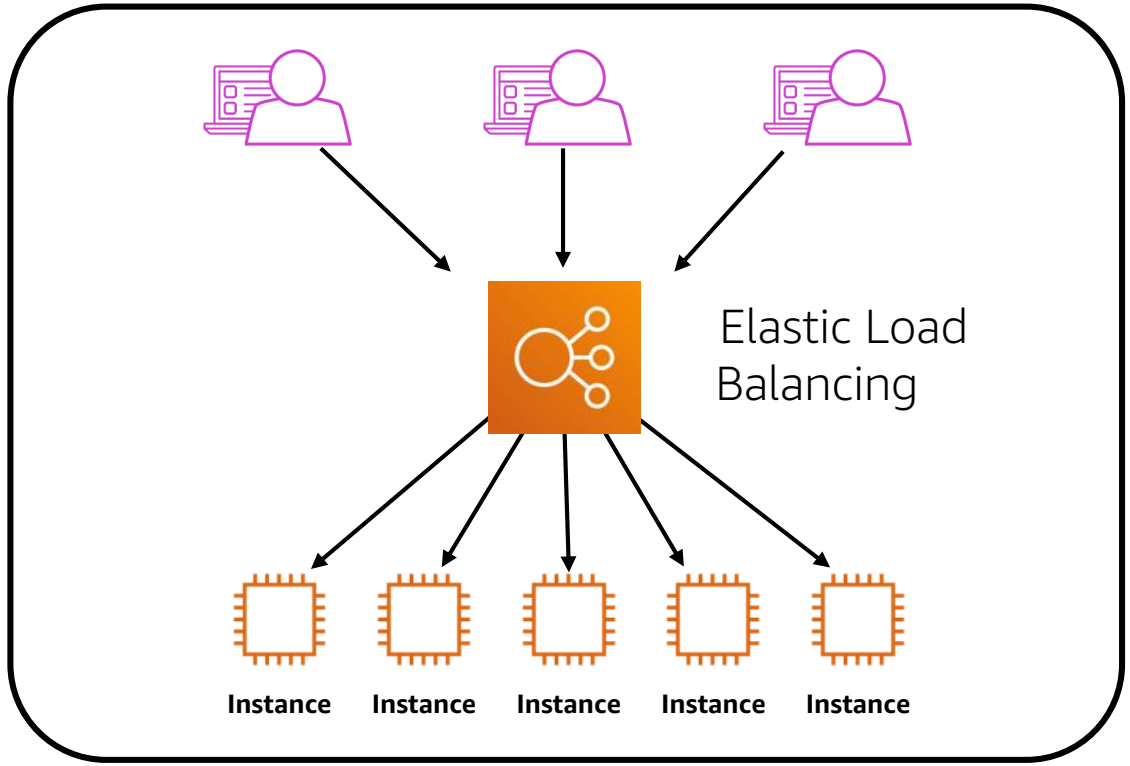


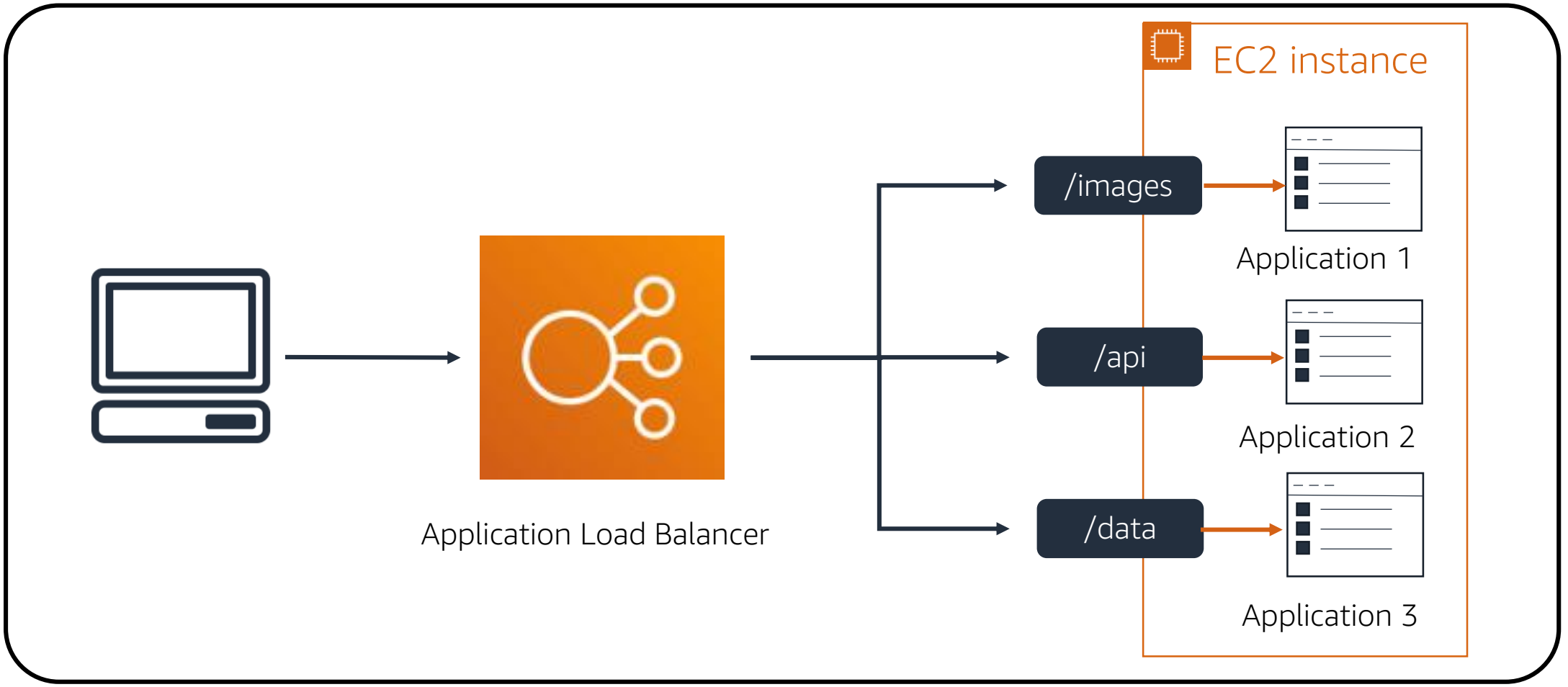
# Elastic Load Balancing

Automatically distribute traffic across multiple targets

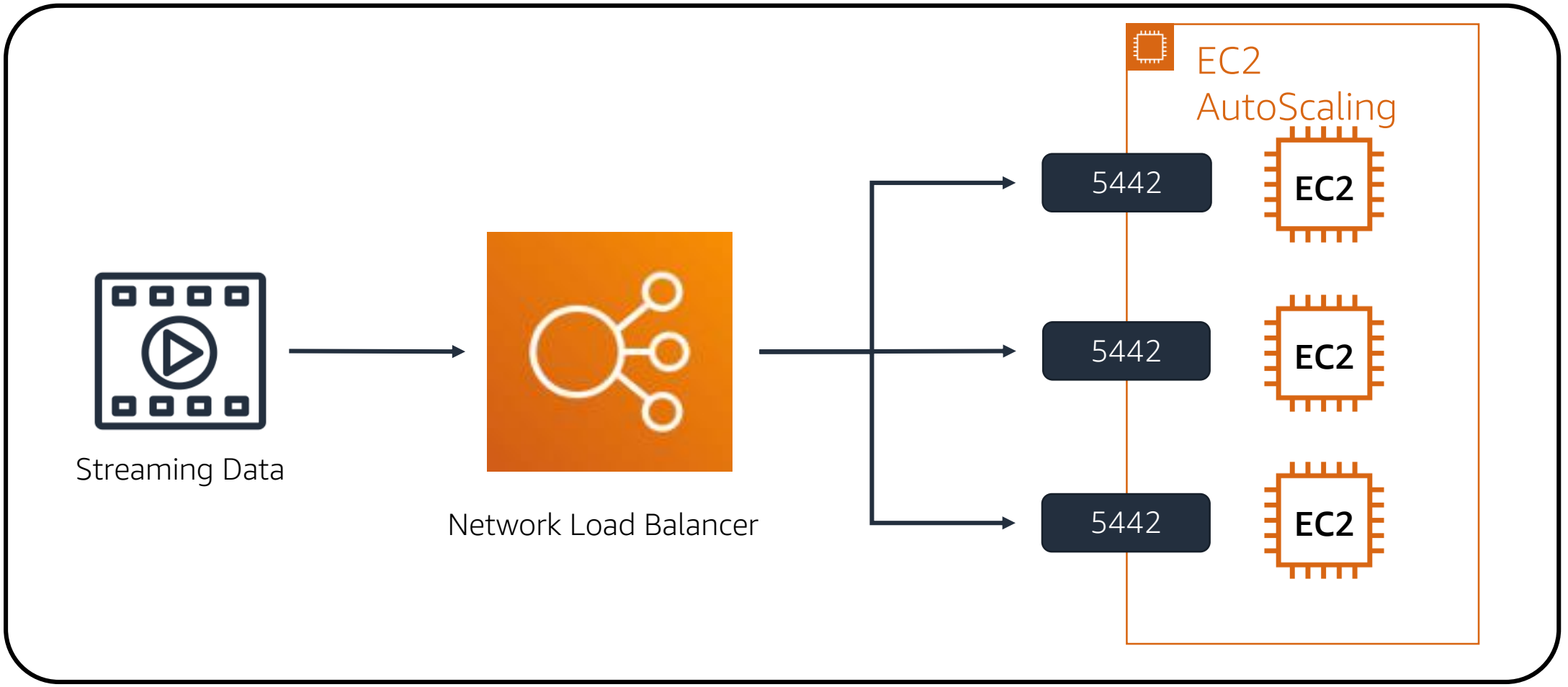
- High availability
- Health checks
- SSL/TLS termination
- Operational monitoring



# Application Load Balancer example



# Network Load Balancer example



# Deploy database services

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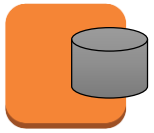
# DIY vs. AWS database services



## Databases on Amazon EC2

- Operating system access
- Need features of specific application

## AWS Database Services

- Easy to set up, manage, maintain
- Push-button high availability
- Focus on performance
- Managed infrastructure

# What is Amazon Relational Database Service?

A database service that makes it easy to set up,
operate, and scale a relational database in the cloud

Amazon RDS Engines


- Easily scalable
- Automatic software patching
- Automated backups
- Database snapshots
- Multi-AZ deployments
- Automatic host replacement
- Encryption at rest and in transit



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# What is Amazon Aurora?

- Enterprise-class relational database
- MySQL- or PostgreSQL-compatible
- Up to 5X faster than standard MySQL databases
- Up to 3X faster than standard PostgreSQL databases
- Continuous backup to Amazon S3
- Up to 15 low-latency read replicas



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# Relational vs key-value databases

<table>
<tr><th></th><th>Relational (SQL)</th><th>Key-value (NoSQL)</th></tr>
<tr><td>Data storage</td><td>Rows and columns</td><td>Key-value, document, graph</td></tr>
<tr><td>Schemas</td><td>Fixed</td><td>Dynamic</td></tr>
<tr><td>Querying</td><td>Using SQL</td><td>Focused on collection of documents</td></tr>
<tr><td>Scalability</td><td>Vertical</td><td>Horizontal</td></tr>
<tr><td>Example</td><td>
<table>
<tr><th>ISBN</th><th>Title</th><th>Author</th><th>Format</th></tr>
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<tr><td>3122222223439</td><td>Wily Willy</td><td>Felton, Maria</td><td>eBook</td></tr>
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</td><td>{<br>ISBN: 3111111223439,<br>Title: “Withering Depths”,<br>Author: ”Tark, Frank”,<br>Format: “Paperback”<br>}</td></tr>
</table>



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# What is Amazon DynamoDB?

Fast and flexible NoSQL database service for any scale

- Fully managed
- Low-latency queries
- Fine-grained access control
- Regional and global options



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# Amazon DynamoDB use cases

- Serverless web applications
- Microservices data store
- Mobile backends
- Ad tech
- Gaming
- Internet of Things (IoT)

# Other purpose-built database services

## Amazon Redshift

Fast, scalable
data warehouse

## Amazon DocumentDB

MongoDB-compatible
database

## Amazon Neptune

Graph database



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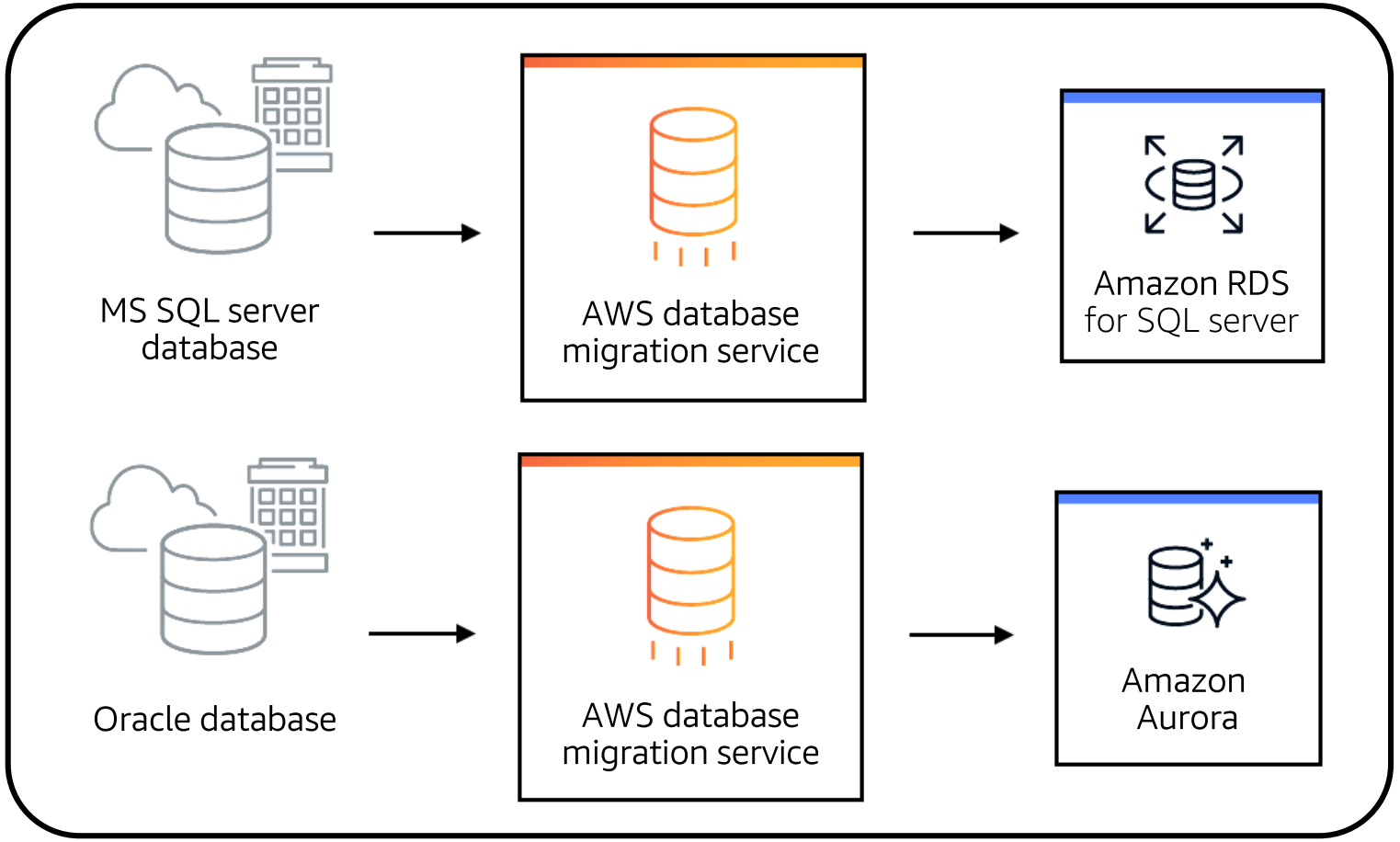
# What is AWS Database Migration Service?

Migrate databases to AWS quickly and securely



# The right tool for the right job

| What are my requirements? | |
|---|---|
| Enterprise class relational database | Amazon Relational Database Service (Amazon RDS) |
| Fast and flexible NoSQL database service for any scale | Amazon DynamoDB |
| Operating system access or application features not supported by AWS database services | Databases on EC2 |
| Specific case-driven requirements (Machine learning, data warehouse, graphs) | AWS purpose-built database services |



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# Automate deployment

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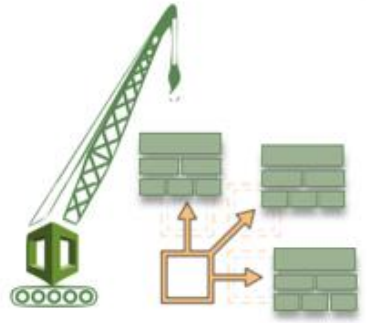
# What is AWS CloudFormation?

Model and provision all your cloud infrastructure resources

Code your infrastructure template in either YAML or JSON format

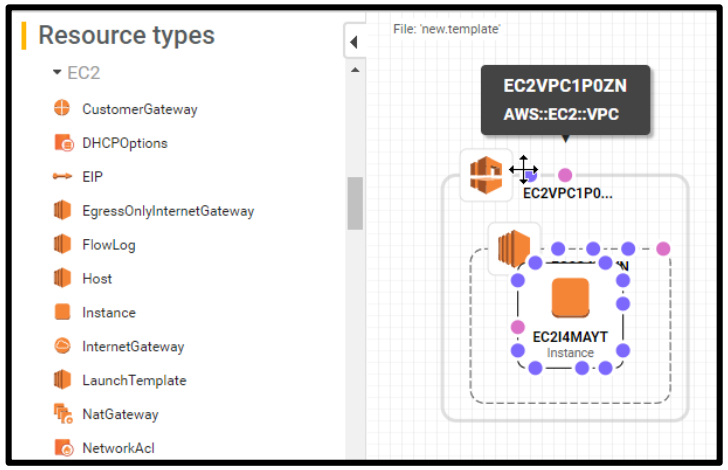
Check out your template code locally or upload to an S3 bucket.

Create a stack based on your template code



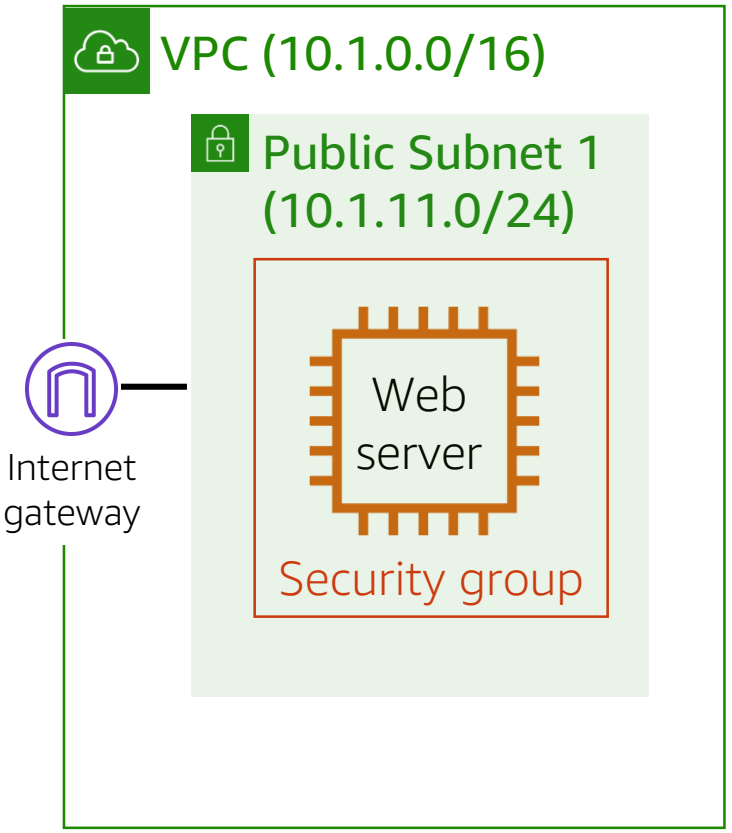
AWS CloudFormation provisions the resources

# AWS CloudFormation example

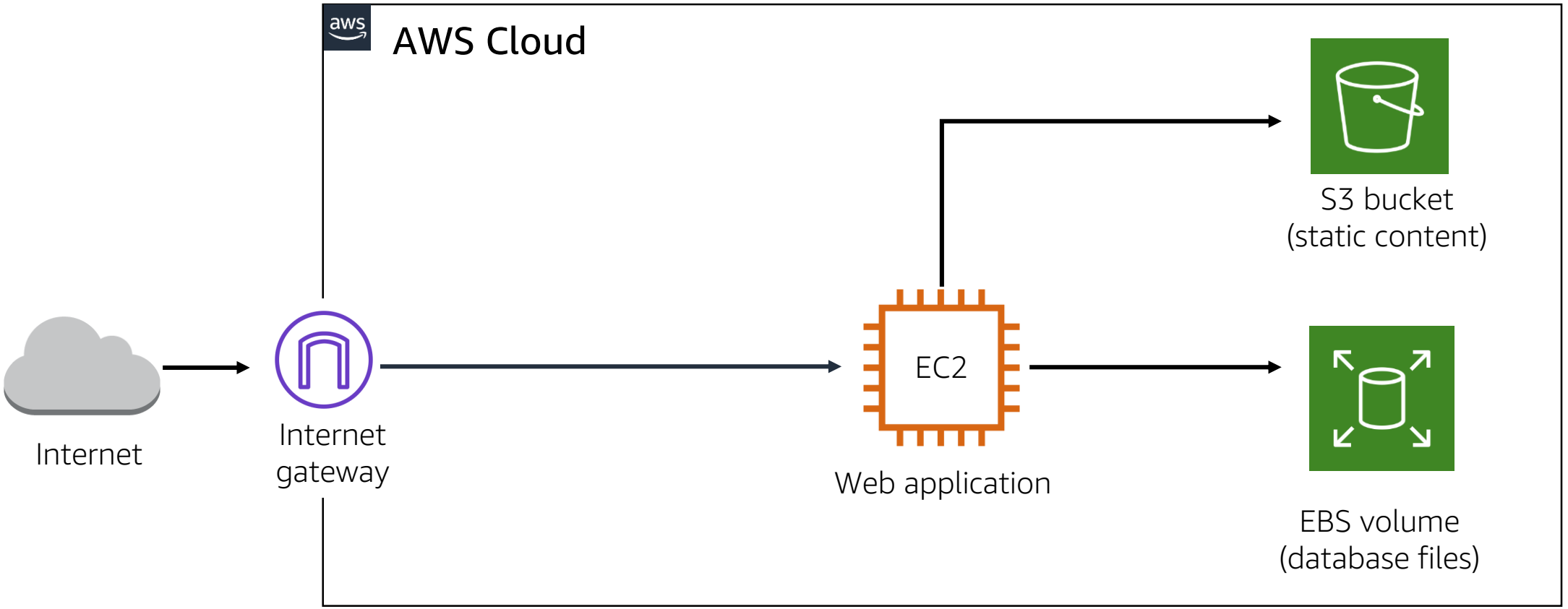



CloudFormation Designer

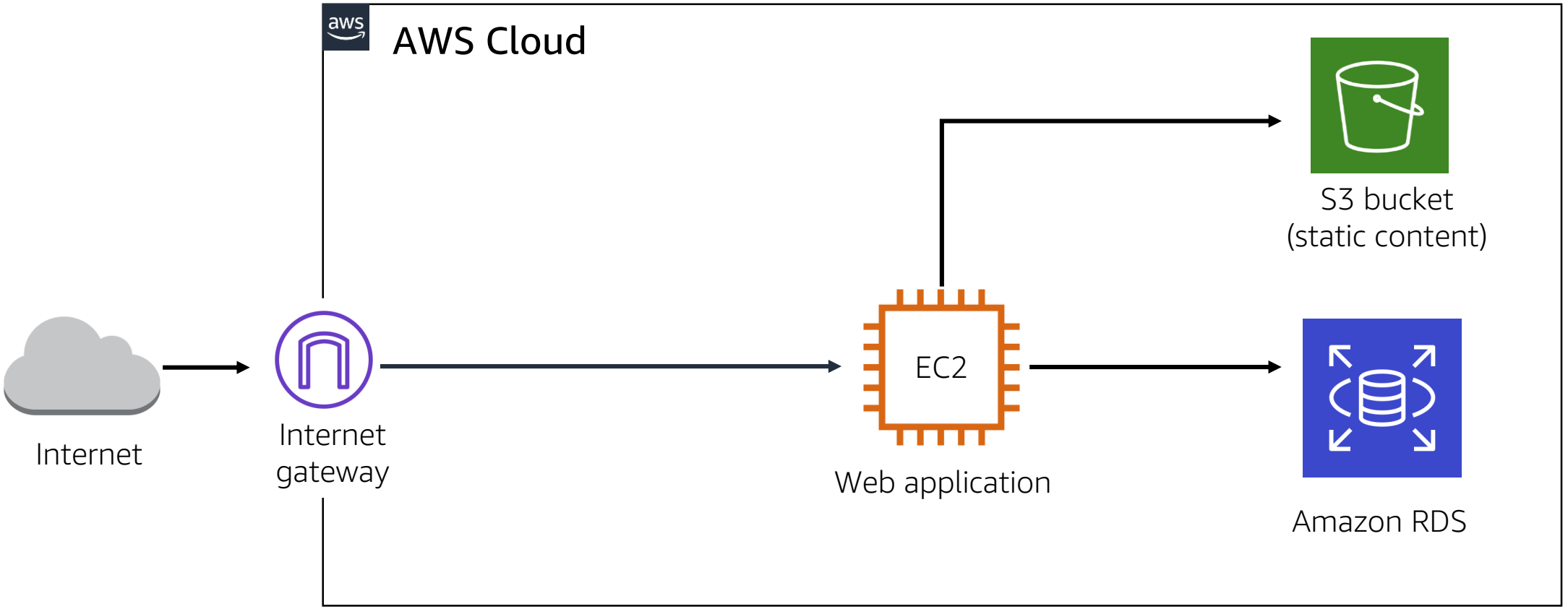
Template-file
(YAML/JSON)
----- -- -- --- -- -----
-- -- --- --
----- -- -- --- --
----- -- -- --- --



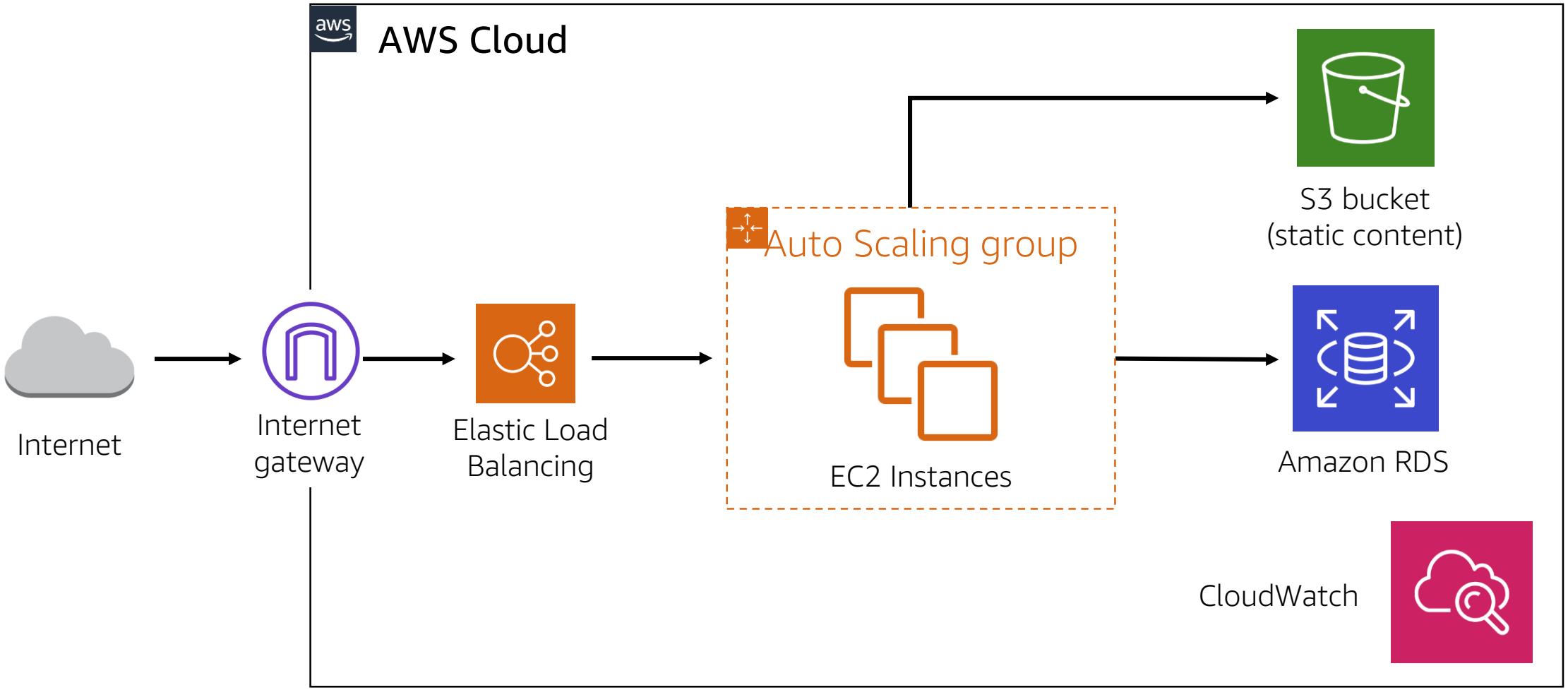
# Putting it all together (1 of 4)



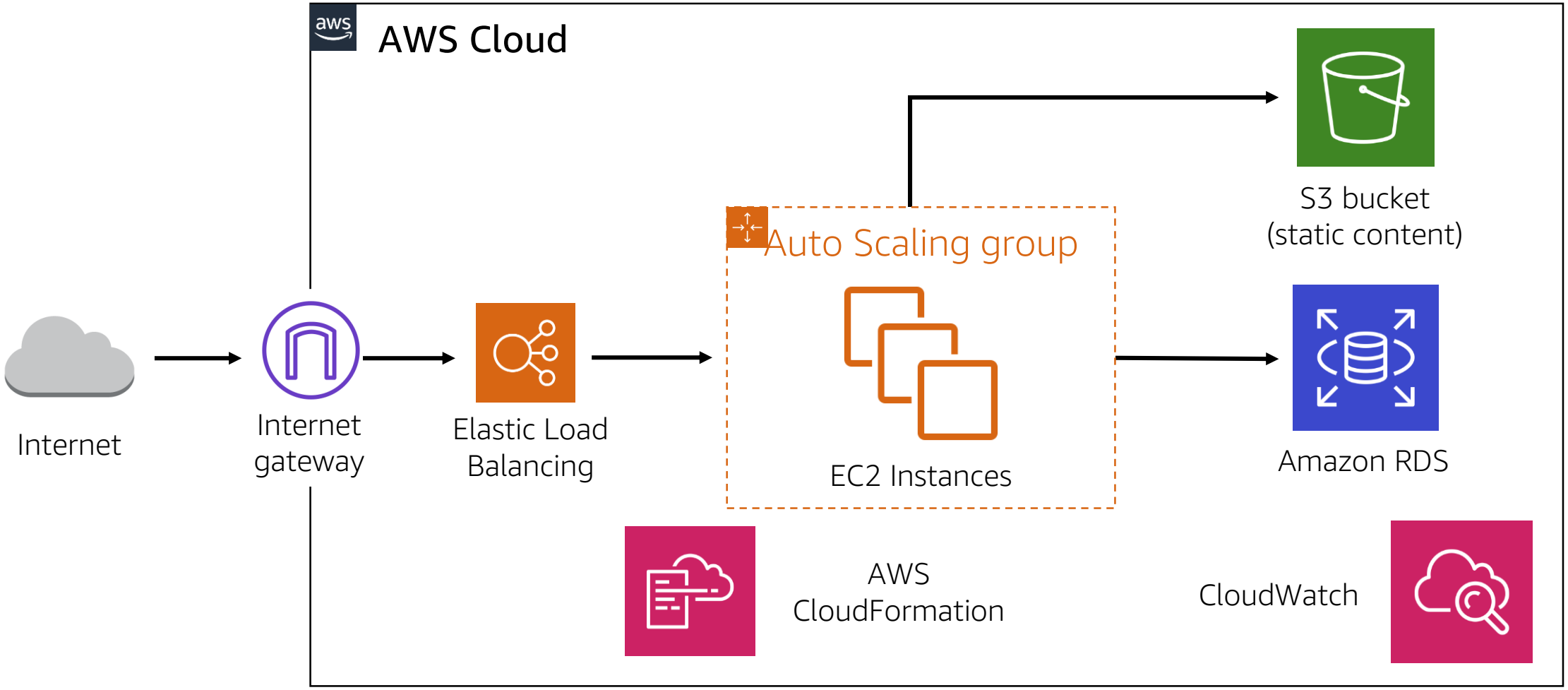
# Putting it all together (2 of 4)



# Putting it all together (3 of 4)



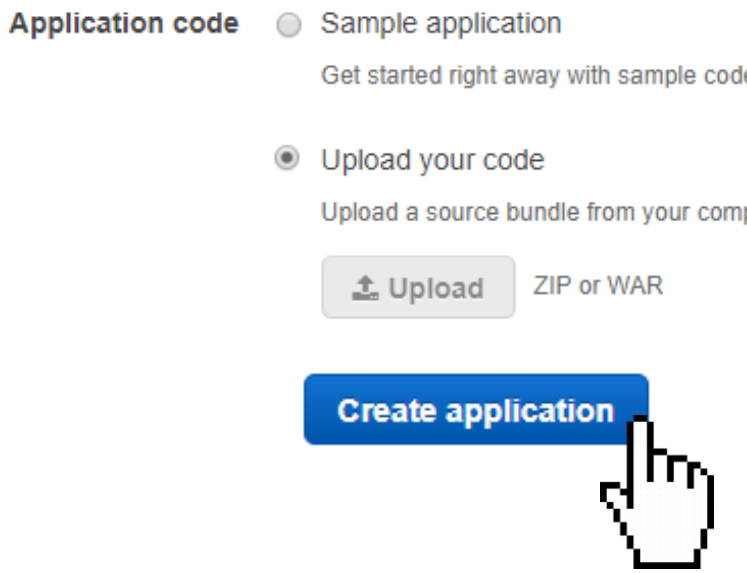
# Putting it all together (4 of 4)



# How can I deploy without managing infrastructure?

## Quickly deploy and manage applications with AWS Elastic Beanstalk

- Upload your application code
- The service handles:
  - ✓Resource provisioning
  - ✓Load balancing
  - ✓Automatic scaling
  - ✓Monitoring
- Support applications that scale to serve millions of users



# Connect and share data

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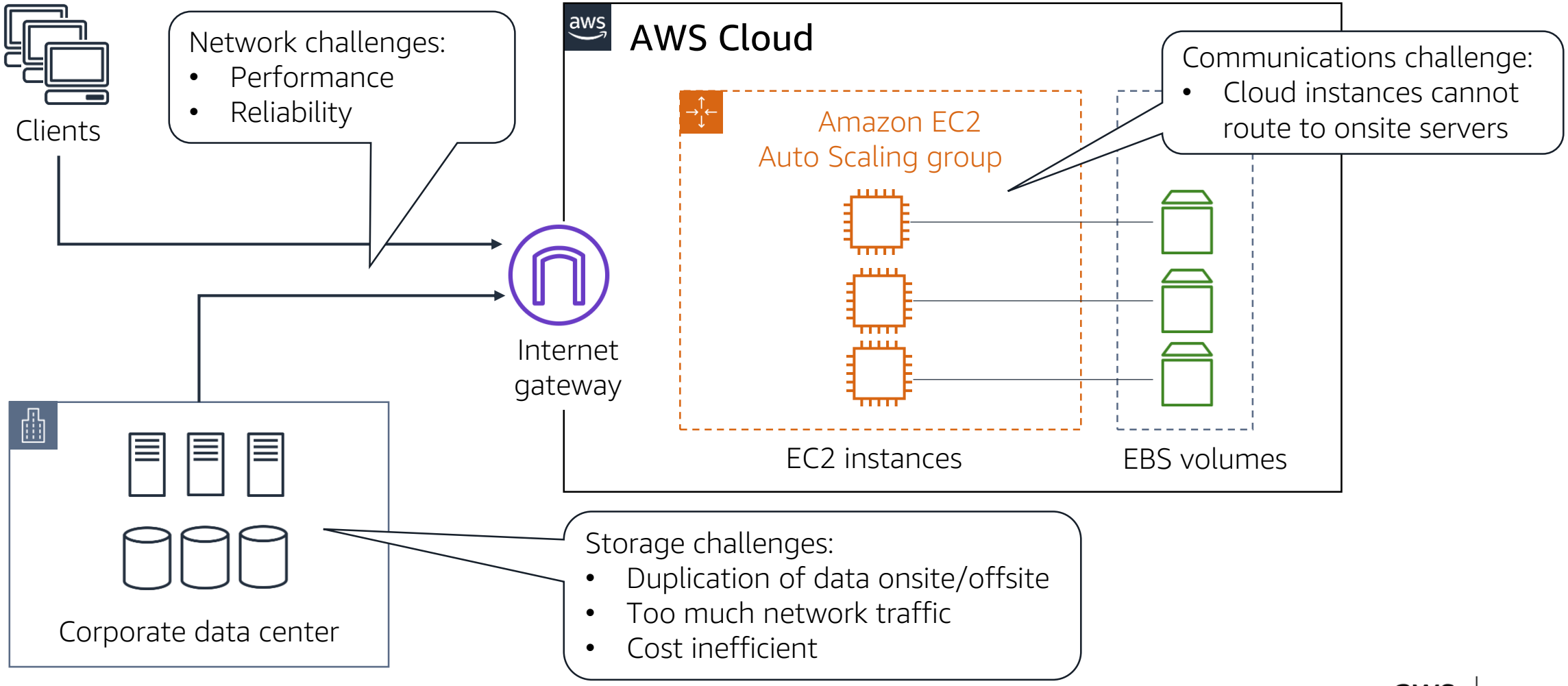
# Challenge: hybrid cloud



# What is AWS Direct Connect?

A dedicated network connection from your premises to AWS

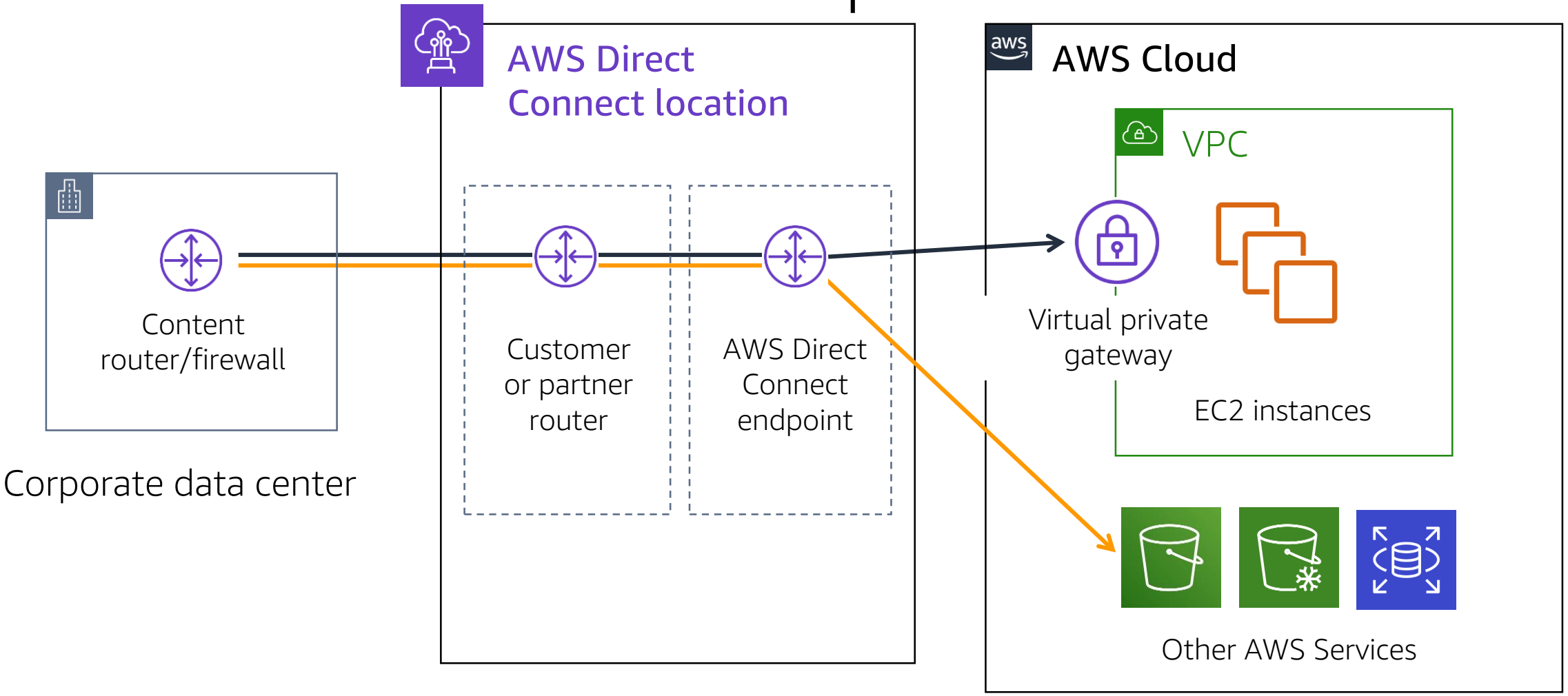
Reduces network costs

Creates consistent network performance

Provides private connectivity to your Amazon VPC

Scales easily

# AWS Direct Connect example



# What is Amazon Route 53?

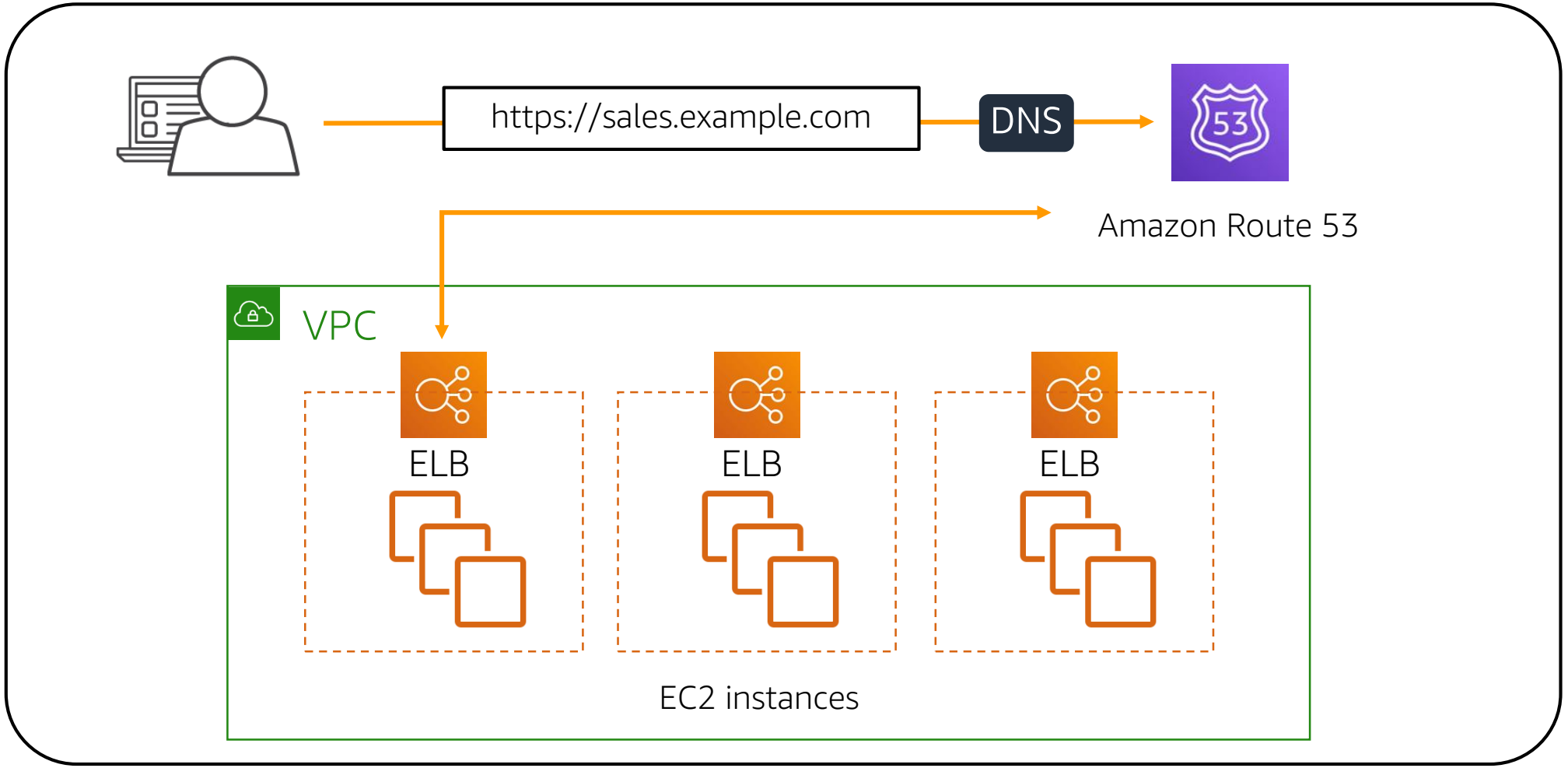
A highly available and scalable Domain Name System (DNS) web service

Register domain names

Route internet traffic to the resources for your domain

Check the health of your resources

# Routing traffic



# What is Amazon Elastic File System (Amazon EFS)?

A scalable, elastic, cloud-native file system for Linux

Dynamic elasticity

Scalable performance

Shared file storage

Fully managed

Cost-effective



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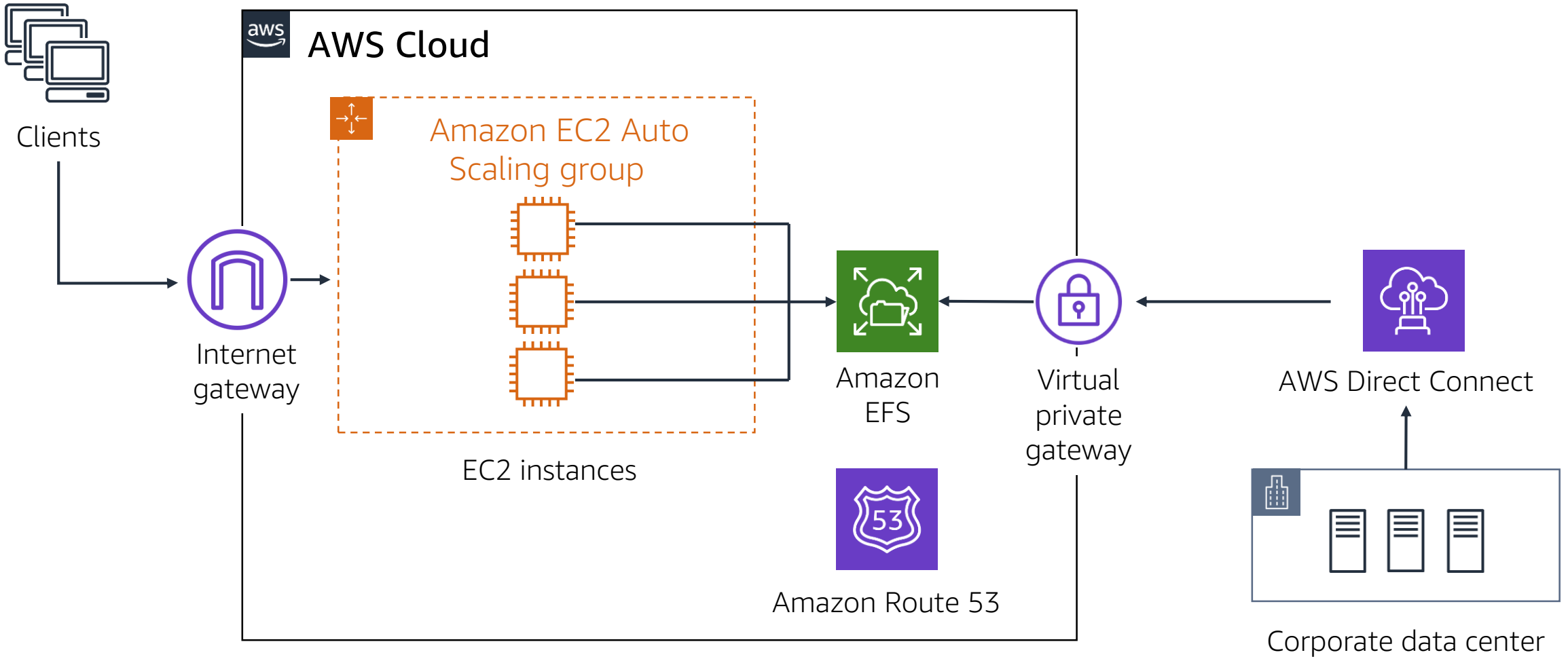
# Putting it all together



# Bringing AWS on premises

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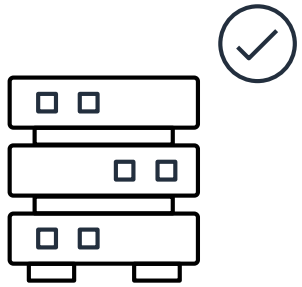
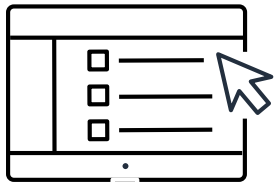
# AWS Outposts: Bringing AWS on premises



Same AWS-designed infrastructure as in AWS data centers (built on AWS Nitro System)

Fully managed, monitored, and operated by AWS as if in AWS Regions



Single pane of management in the cloud providing the same APIs and tools as in AWS Regions



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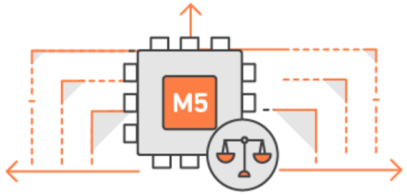
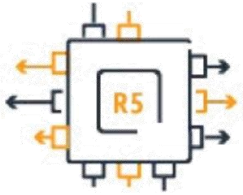
# Build on the same Amazon EC2 instances & Amazon EBS volumes

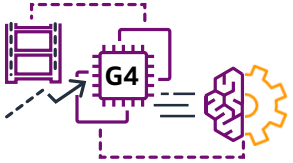



For general-purpose applications

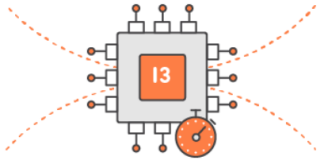

For compute-intensive applications (media transcoding, gaming servers, machine learning inference)




For memory-intensive applications (databases, in-memory caches, real-time data analytics)




For machine learning inference and graphics workstations




For I/O-intensive applications (NoSQL databases, in-memory or transactional databases, distributed file systems)

Local instance storage and EBS gp2 volumes for temporary and persistent storage



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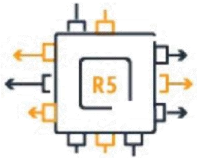
# Amazon EC2 Instances On Premises Powered by Intel Technologies

## Consistent Infrastructure

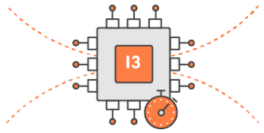
Build on the same EC2 instances featuring Intel Xeon Scalable processors, on premises as in the cloud


2.5 GHz Intel Xeon Scalable Processors **(Skylake)**

## Consistent Application Performance

Leverage the same workload performance enhancements on Outposts as instances running in the cloud.






2nd Generation Intel Xeon Scalable processors (Cascade Lake)

## Ease of Application Migration

Seamlessly migrate your applications on Outposts to AWS



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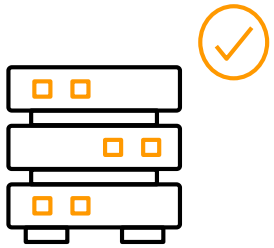
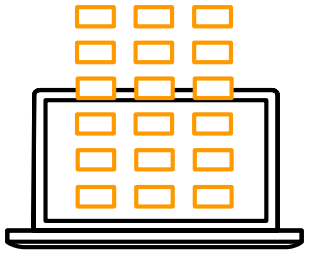
# AWS Local Zones

- New type of AWS infrastructure deployment
- Places compute, storage, database, and other services closer to customers
- For demanding applications that require single-digit latencies

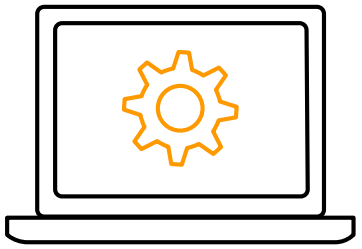


AWS infrastructure at the edge



Local Intel-powered EC2 compute, storage, database, and other services

Connect to services in AWS Regions



Deliver new low latency apps



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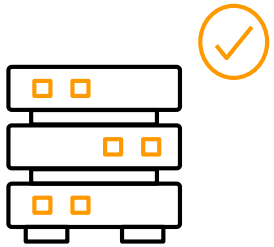
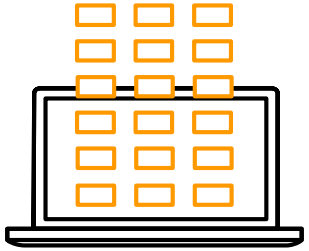
# AWS Wavelength

- Extends AWS infrastructure to 5G networks
- Run latency-sensitive portions of applications in Wavelength Zones and seamlessly connect to your applications and services in AWS Regions
- Same AWS APIs, tools, and functionality
- Global partner network

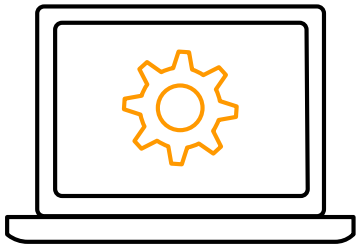


AWS infrastructure in 5G networks



Local Intel-powered EC2 compute, storage, database, and other services

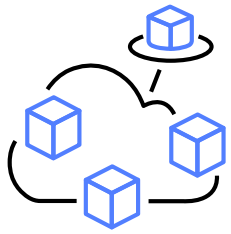
Connect to services in AWS Regions



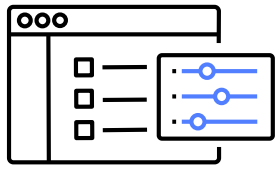
Deliver new mobile app experiences

# VMware Cloud on AWS

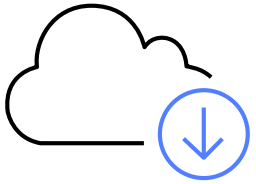
VMware software-defined data center (SDDC) technologies you know and trust, delivered as a service on the world's most popular public cloud



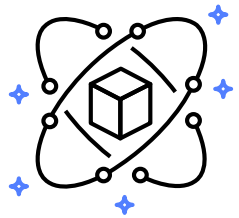
Rich VMware SDDC delivered as a cloud service on AWS



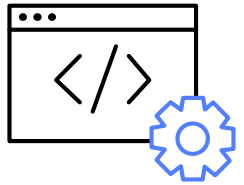
Consistency and familiarity of VMware technologies



Easy workload portability and hybrid capabilities



Direct access to the power of native AWS services



Existing and new apps with containers and VMs



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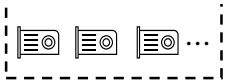
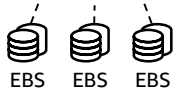
# AWS Bare-metal Host Instance Types available

i3.metal
vSAN



r5.metal
Elastic vSAN

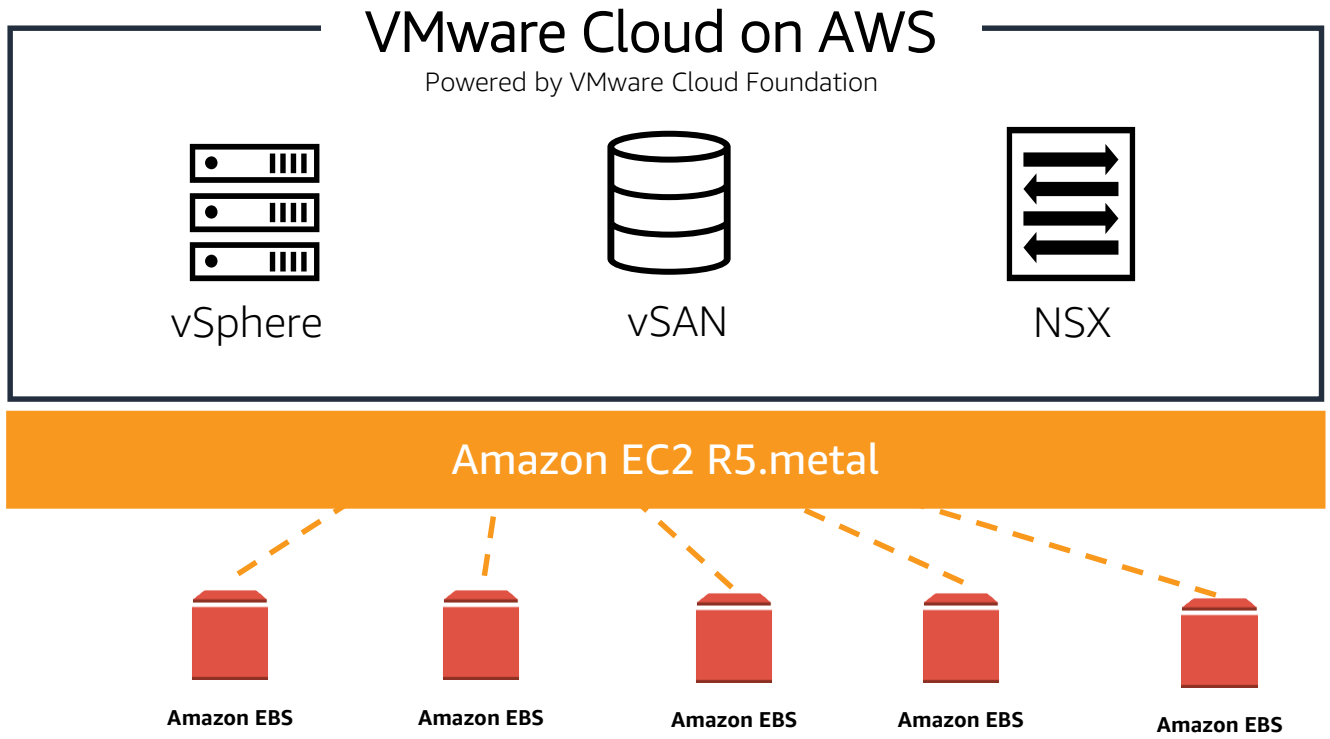



| Typical Use Case | General Purpose Clusters | Storage Bound Clusters |
|---|---|---|
| Suitable for | Workloads with high transaction rates<br>• Databases used in OLTP<br>• High-speed analytics | Workloads with high storage capacity needs and lower transaction rates<br>• Data Warehousing<br>• Batch processing<br>• Disaster Recovery |
| Compute | | |
| CPU Type | Intel Xeon E5-2686 | Intel Xeon Scalable (Skylake) |
| CPU Cores | 36 Cores @ 2.3Ghz | 48 Cores @ 2.5Ghz |
| Memory | | |
| RAM | 512 **GiB** | 768 **GiB** |
| Storage | | |
| Type | vSAN with Local **NVMe Flash** | Elastic vSAN with Amazon EBS Only |
| Capacity Tier | ~10,600 GiB | 15,000 GiB to 35,000 GiB |
| Network | | |
| Physical Speed | 25 Gbps | 25 Gbps |

**For identifying the right host types for specific scenarios, please use the [VMware Cloud on AWS Sizer]**

# VMware vSAN utilizing Amazon Elastic Block Store with VMware Cloud on AWS running on new Amazon EC2 elastic, bare-metal instance

## Augment existing SDDCs for storage-dense workloads to cost-effectively scale storage




- VMware Cloud on AWS new Amazon EC2 R5.metal instance type with flexible storage
- VMware vSAN delivers enterprise class storage utilizing Amazon Elastic Block Storage (EBS) storage
- Storage per host range from 15 to 35 TB in increments of 5 TB
- User chooses amount of storage desired and used on all hosts within the cluster
- R5.metal clusters can be added to an existing SDDC with at least one existing provisioned cluster

Amazon EC2 R5.metal: R5.metal instances are based on 2.5 GHz Intel Platinum 8000 series (Skylake-SP) processors. Each host has 2 sockets, 48 cores, 96 hyper-threads, 768 GiB RAM, and 25 Gbps network bandwidth.

* Preview: Feature released in preview to gather feedback – may not be available to all applicable customers or in all AWS regions . The information in this presentation is for informational purposes only and may not be incorporated into any contract. There is no commitment or obligation that items in 'Preview' will become 'Available'.

# Deliver content faster

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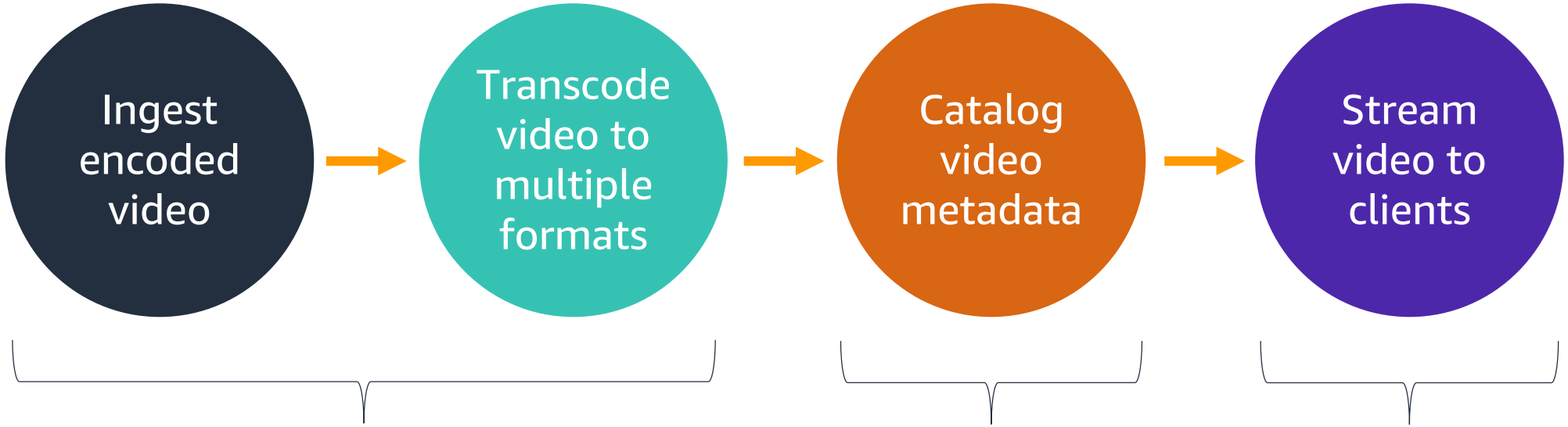
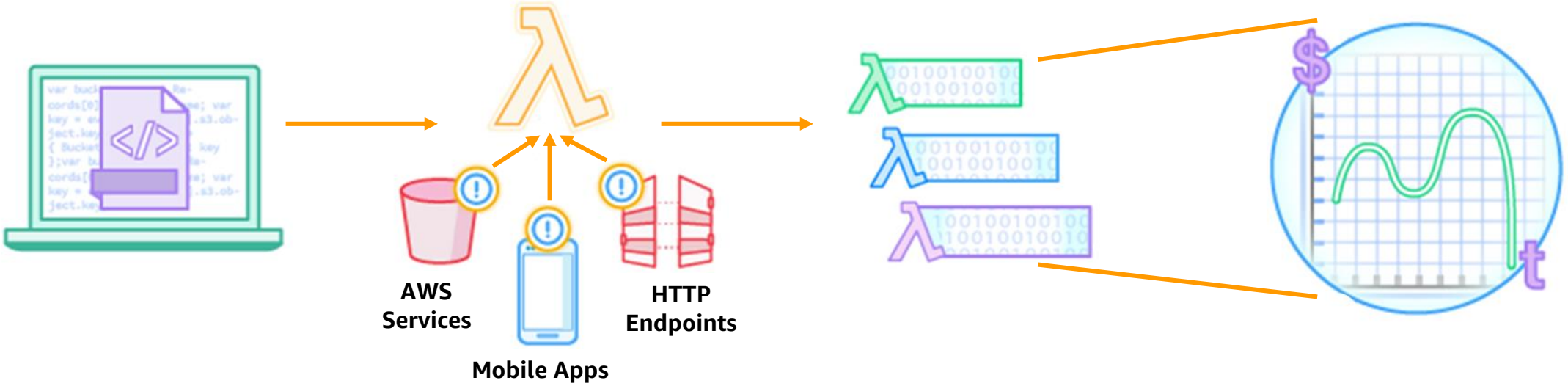
# Challenge: media streaming service

The architecture must meet the following requirements:



# AWS Lambda: run code without servers




Upload your code to AWS Lambda

Set your code to trigger from an event source

Lambda runs your code only when triggered

Pay only for the compute time you use

# Benefits of AWS Lambda

Supports multiple programming languages

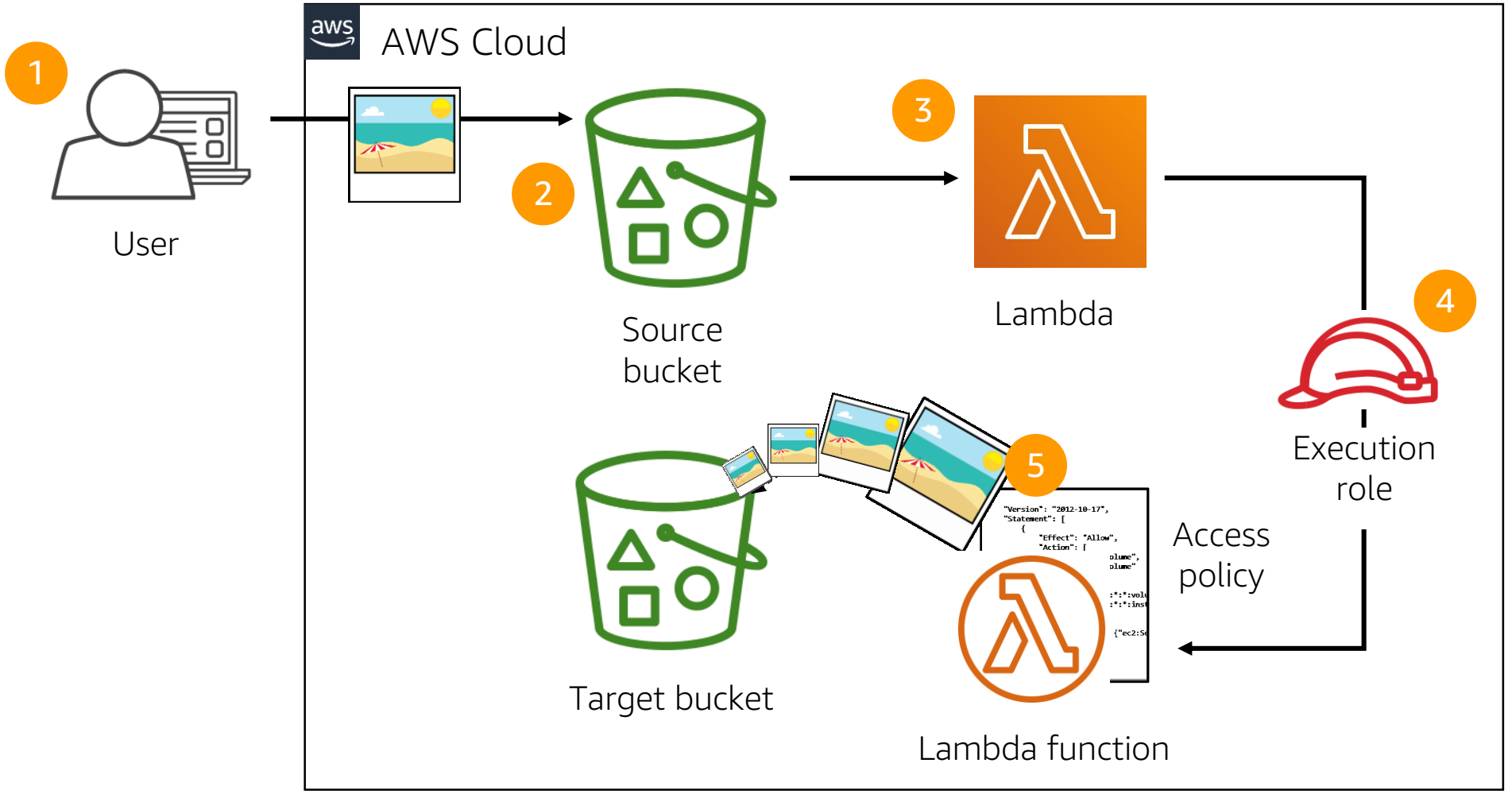
Completely automated administration

Built-in fault tolerance

Supports orchestration of multiple functions

Pay per use pricing

# AWS Lambda example: create thumbnails



# What is Amazon Simple Notification Service (Amazon SNS)?

Fully managed pub/sub messaging for distributed or serverless applications

Reliably deliver messages with durability

Automatically scale your workload

Simplify your architecture

Keep messages private and secure



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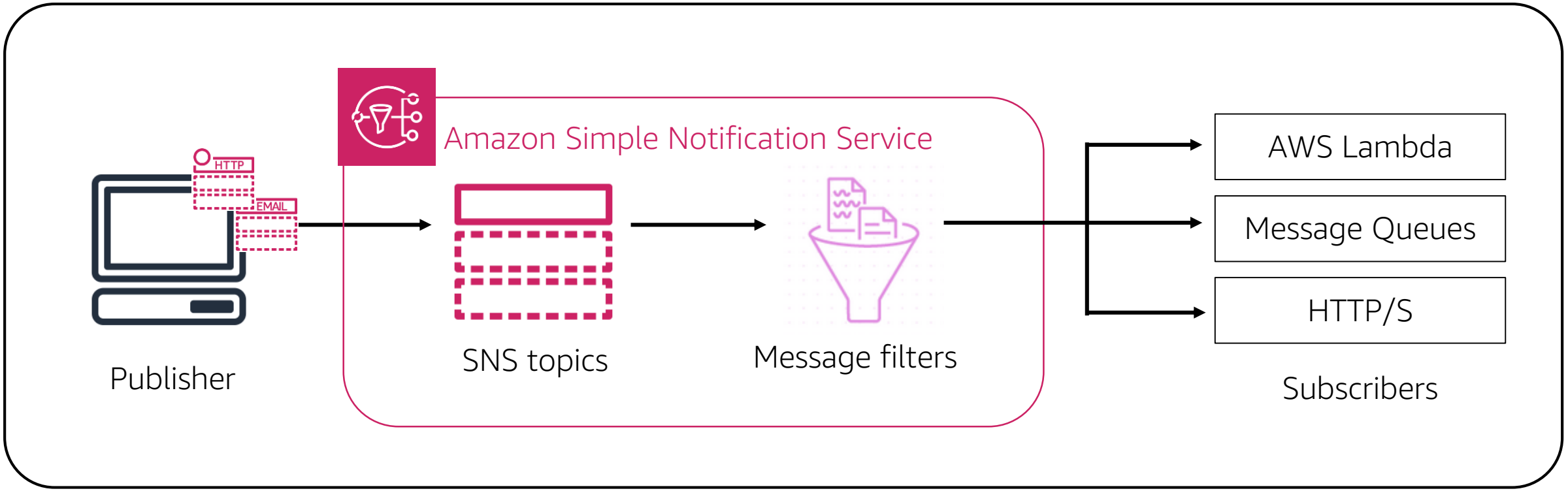
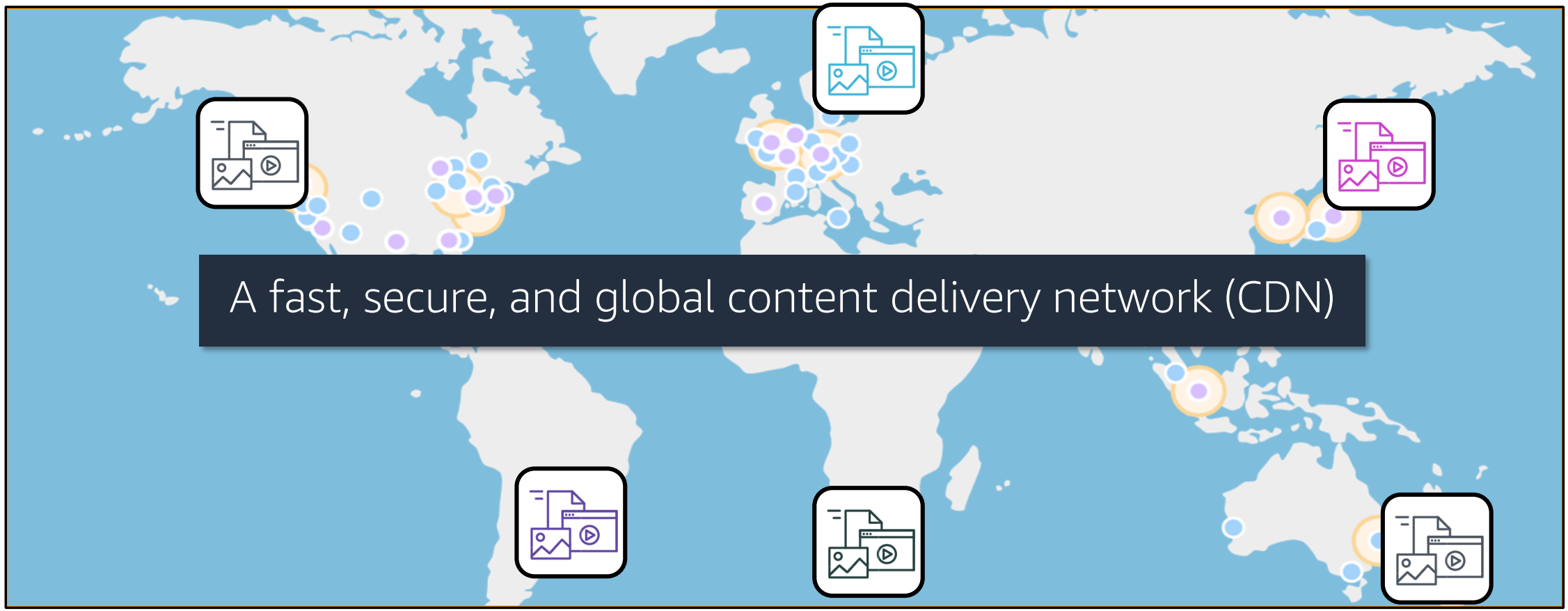
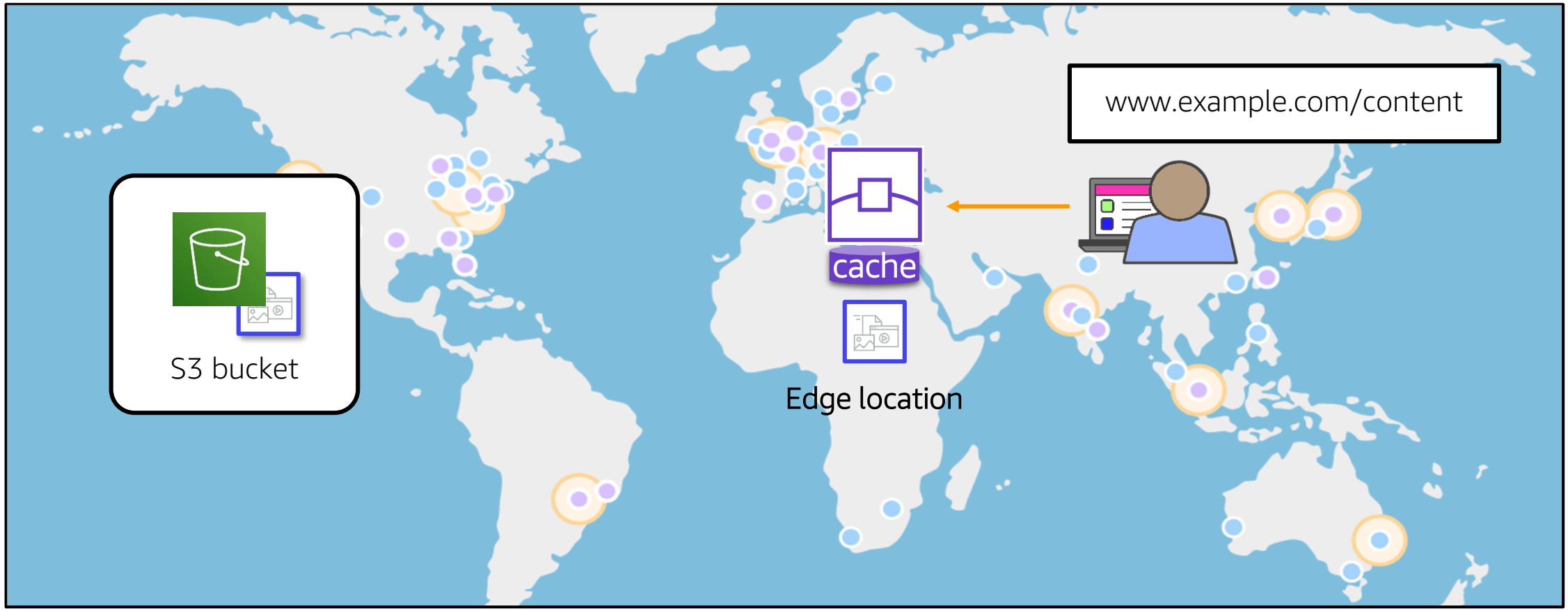
# Amazon SNS overview



# What is Amazon CloudFront?



# How CloudFront delivers content to users



# Demo

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# What is Amazon ElastiCache?

Fully managed Redis or Memcached-compatible in-memory data store

Extreme performance

Fully Managed

Scalable


**Amazon ElastiCache for Redis**

Versatile in-memory data store


**Amazon ElastiCache for Memcached**

Scalable caching tier for data-intensive apps



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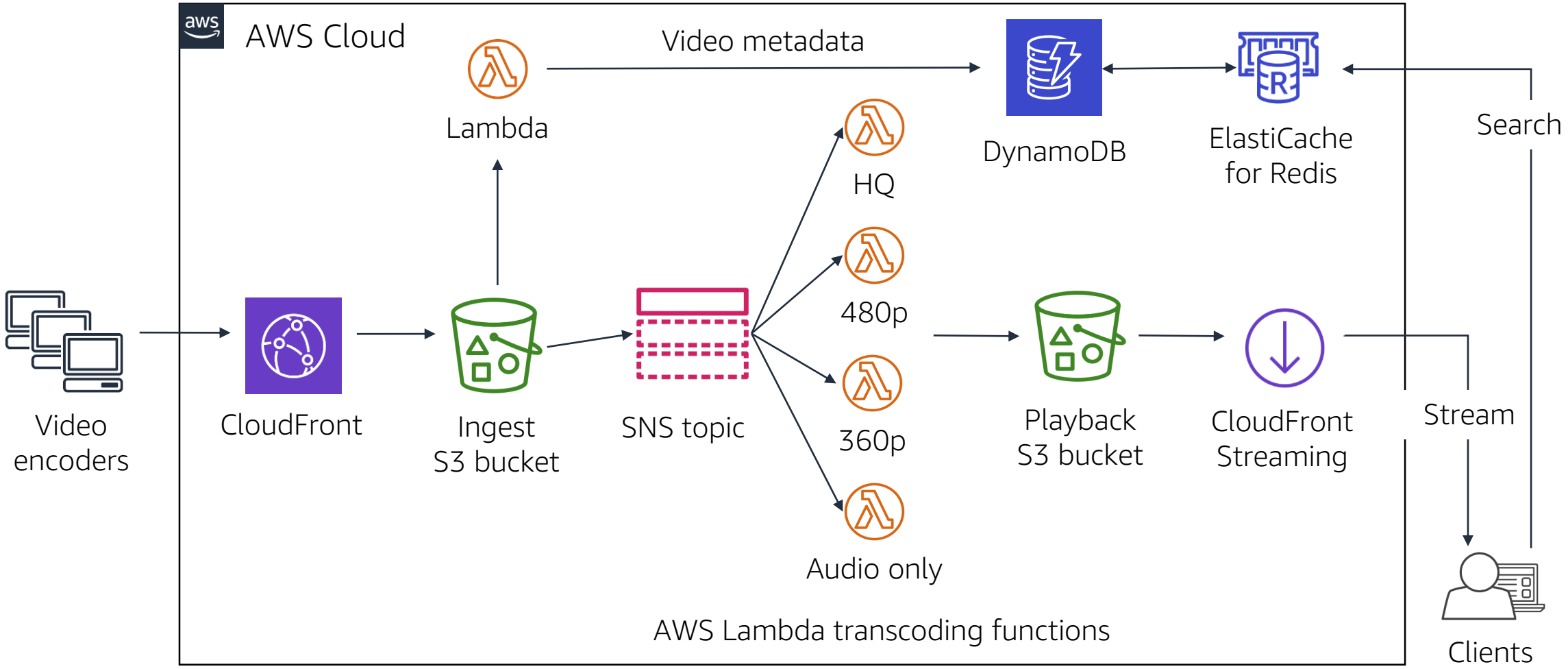
# Challenge: Media streaming service



# Key Takeaways

| | |
|---|---|
| Amazon CloudWatch | Have complete visibility of your cloud resources and applications |
| Elastic Load Balancing<br>Application Auto Scaling | Deploy highly available applications that scale with demand |
| AWS Database Services | Run SQL or NoSQL databases without the management overhead |
| AWS CloudFormation | Programmatically deploy repeatable infrastructure |
| AWS Elastic Beanstalk | Deploy your application in the simplest way possible |
| AWS Direct Connect | Provision a dedicated network connection from your premises to AWS |
| Amazon Route 53 | Run a highly available and scalable Domain Name System (DNS) web service |
| AWS Lambda | Run code without managing servers |
| Amazon CloudFront | Deliver your content across a massively scaled and globally available network |



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# End of Module 3
# Test Your Knowledge

Access the quizzes with the "test your knowledge" button at the bottom of the page.

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