NITTE
EDUCATION TRUST

Unit-5: Resilient Architectures

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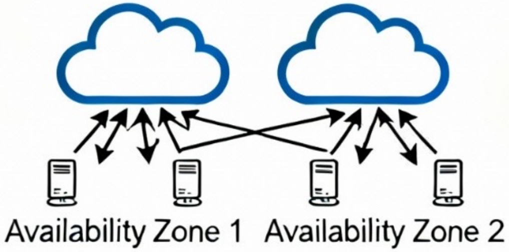
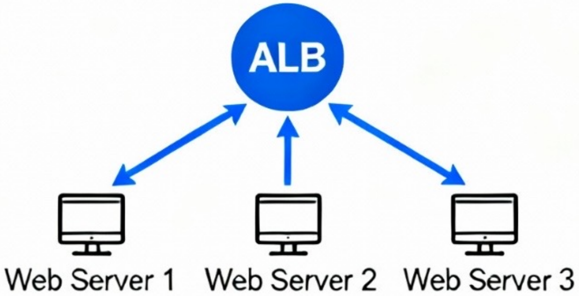
CONTENTS

- Load balancing concepts **(Eg.: Application Load Balancer)**
- Queuing and messaging concepts **(Eg.: publish/subscribe)**
- Serverless technologies and patterns **(Eg.: AWS Fargate, AWS Lambda)**
- AWS database application **(Eg.: dynamo DB)**

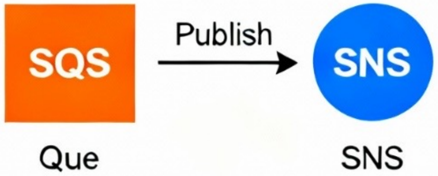
Resilient Architectures (Multi-AZ Deployment)

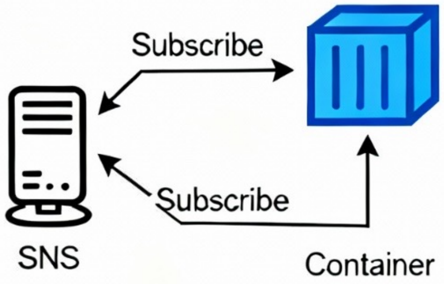


Load Balancing (Application Load Balancer)

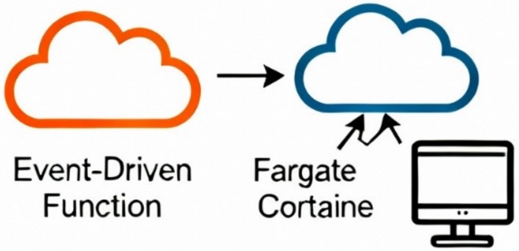


Queuing and Messaging (SQS/SNS)

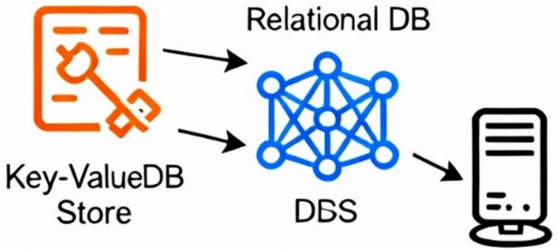




Serverless Technologies (Lambda/Fargate)



AWS Database Application (DynamoDB vs RDS)



INTRODUCTION

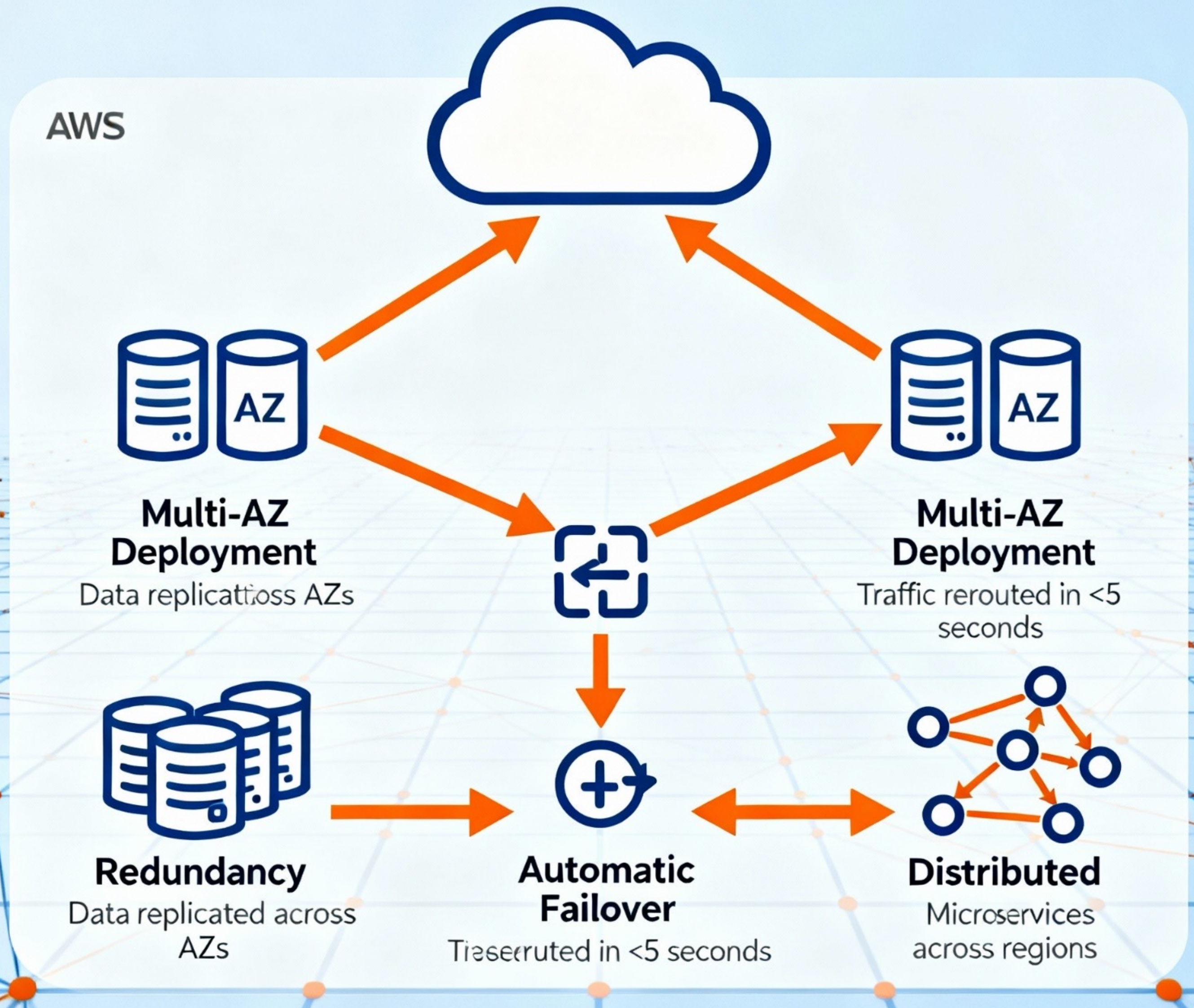
- Building resilient cloud environments ensures reliability.
- Systems recover quickly from unexpected failures.
- AWS provides tools for high availability.
- Design principles emphasize redundancy and automation.
- Distributed services minimize regional dependency risks.
- Resilience drives stability and continuous operations.

INTRODUCTION

AWS Approach to Resilience

- ➢ AWS Regions support fault-tolerant deployments.
- ➢ Auto Scaling adjusts resources-based demand.
- ➢ Multi-AZ design ensures minimal downtime.
- ➢ S3, RDS enhance durability and recovery.
- ➢ Load balancing distributes traffic efficiently everywhere.
- ➢ Monitoring tools detect and remediate issues.

Resilient Architectures in AWS Cloud Computing



Multi-AZ Deployment
Data replicattioss AZs

Multi-AZ Deployment
Traffic rerouted in <5 seconds

Redundancy
Data replicated across AZs

Automatic Failover
Tiesecruted in <5 seconds

Distributed
Microservices across regions

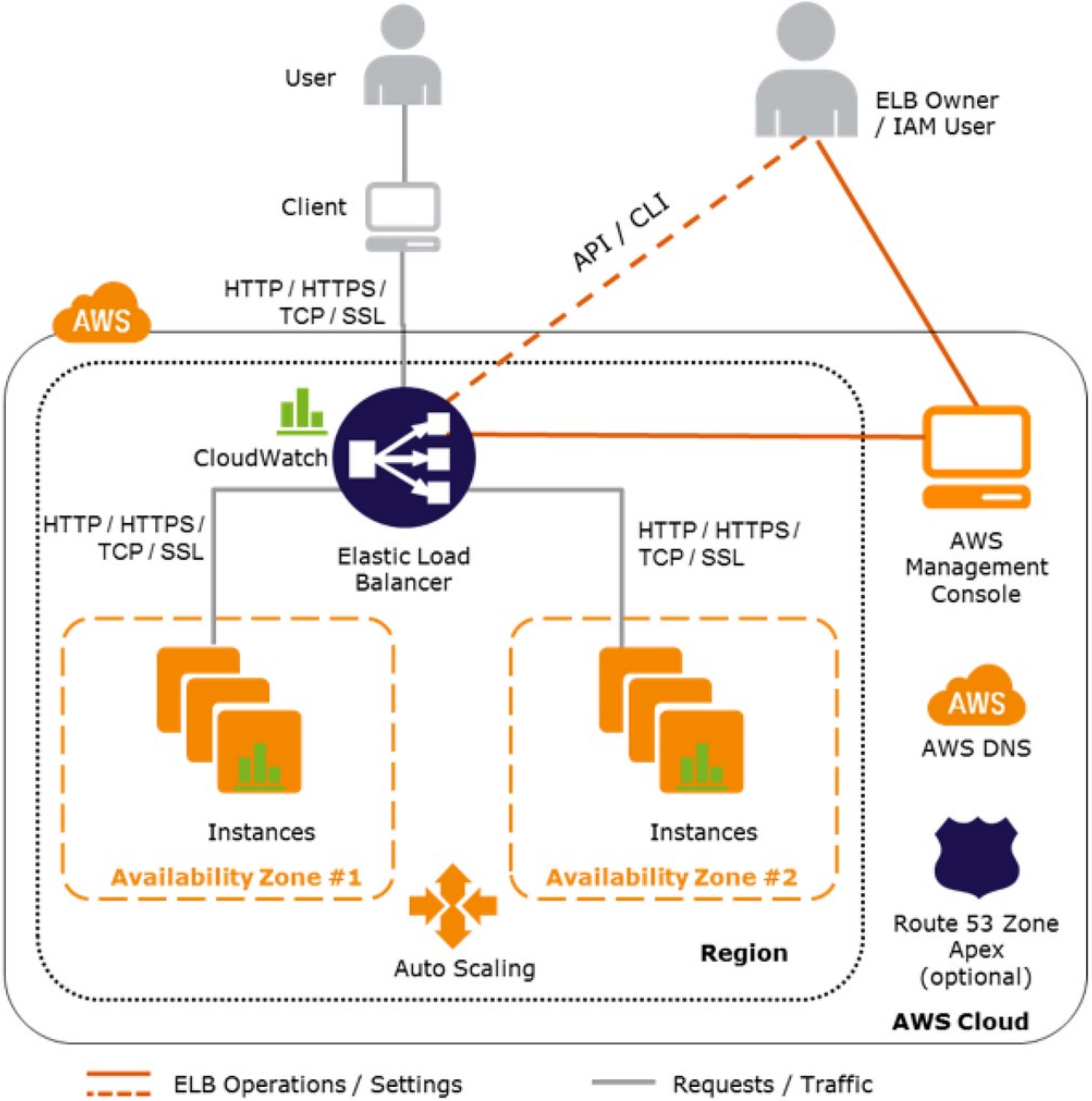
LOAD BALANCING

- Distributes traffic across multiple computing resources.
- Improves application performance, reliability, and scalability.
- Prevents any single server from overloading.
- Balances workloads dynamically under various conditions.
- Enhances fault tolerance for business continuity.
- Essential for resilient cloud-based architectures.

LOAD BALANCING

AWS Application Load Balancer

- Operates at application layer managing requests.
- Routes traffic based on defined routing rules.
- Supports HTTP, HTTPS, and WebSocket protocols.
- Provides advanced content-based routing capabilities.
- Integrates with EC2, ECS, and Lambda.
- Enables secure, responsive, and scalable applications.


User
ELB Owner / IAM User
Client
API / CLI
HTTP / HTTPS / TCP / SSL
AWS
CloudWatch
HTTP / HTTPS / TCP / SSL
Elastic Load Balancer
HTTP / HTTPS / TCP / SSL
AWS Management Console
AWS
AWS DNS
Instances
Availability Zone #1
Instances
Availability Zone #2
Auto Scaling
Region
Route 53 Zone Apex (optional)
AWS Cloud
ELB Operations / Settings
Requests / Traffic

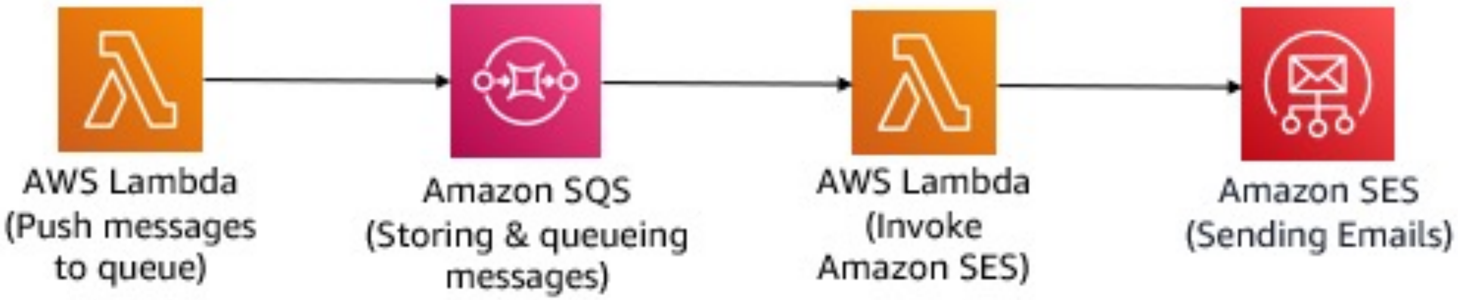
QUEUING AND MESSAGING

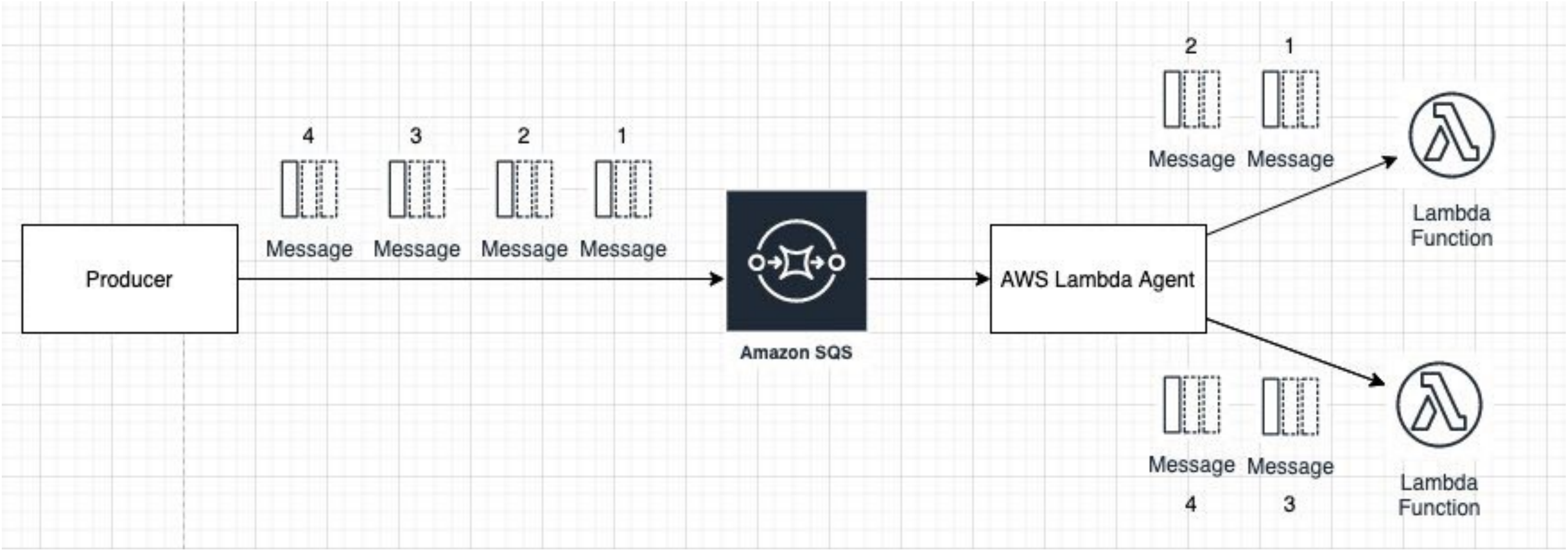
- Enables asynchronous communication between distributed components.
- Decouples services for flexibility and scalability.
- Improves reliability through message persistence mechanisms.
- Handles variable workloads efficiently without blocking.
- Supports both point-to-point and broadcast communication.
- Enhances fault tolerance in cloud architectures.

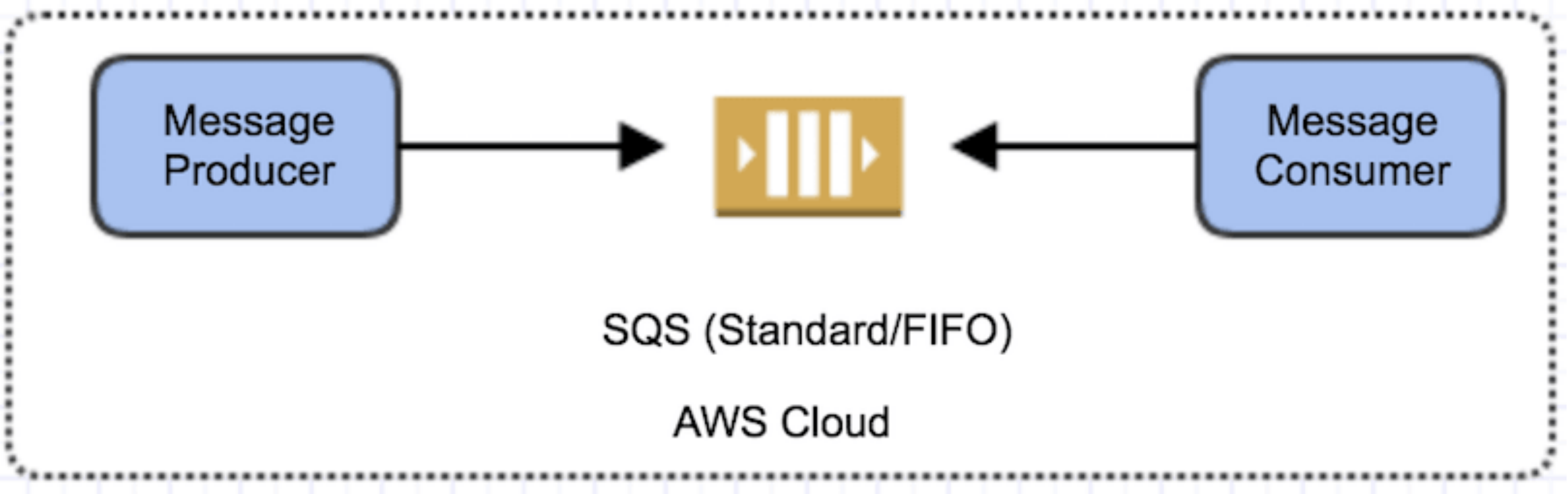
QUEUING AND MESSAGING

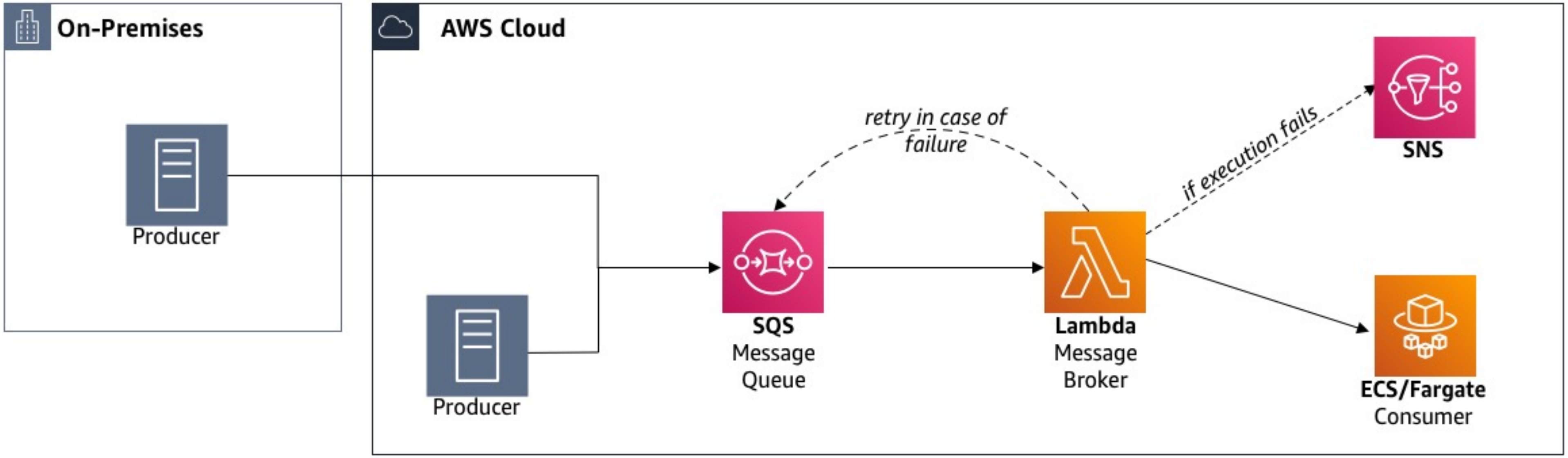
AWS Queuing and Messaging Services

- Amazon SQS manages message queues reliably.
- Supports FIFO and standard message delivery models.
- Amazon SNS enables efficient publish/subscribe messaging.
- Delivers messages to multiple subscribers simultaneously.
- Integrates seamlessly with AWS Lambda functions.
- Facilitates event-driven, scalable cloud-based applications.

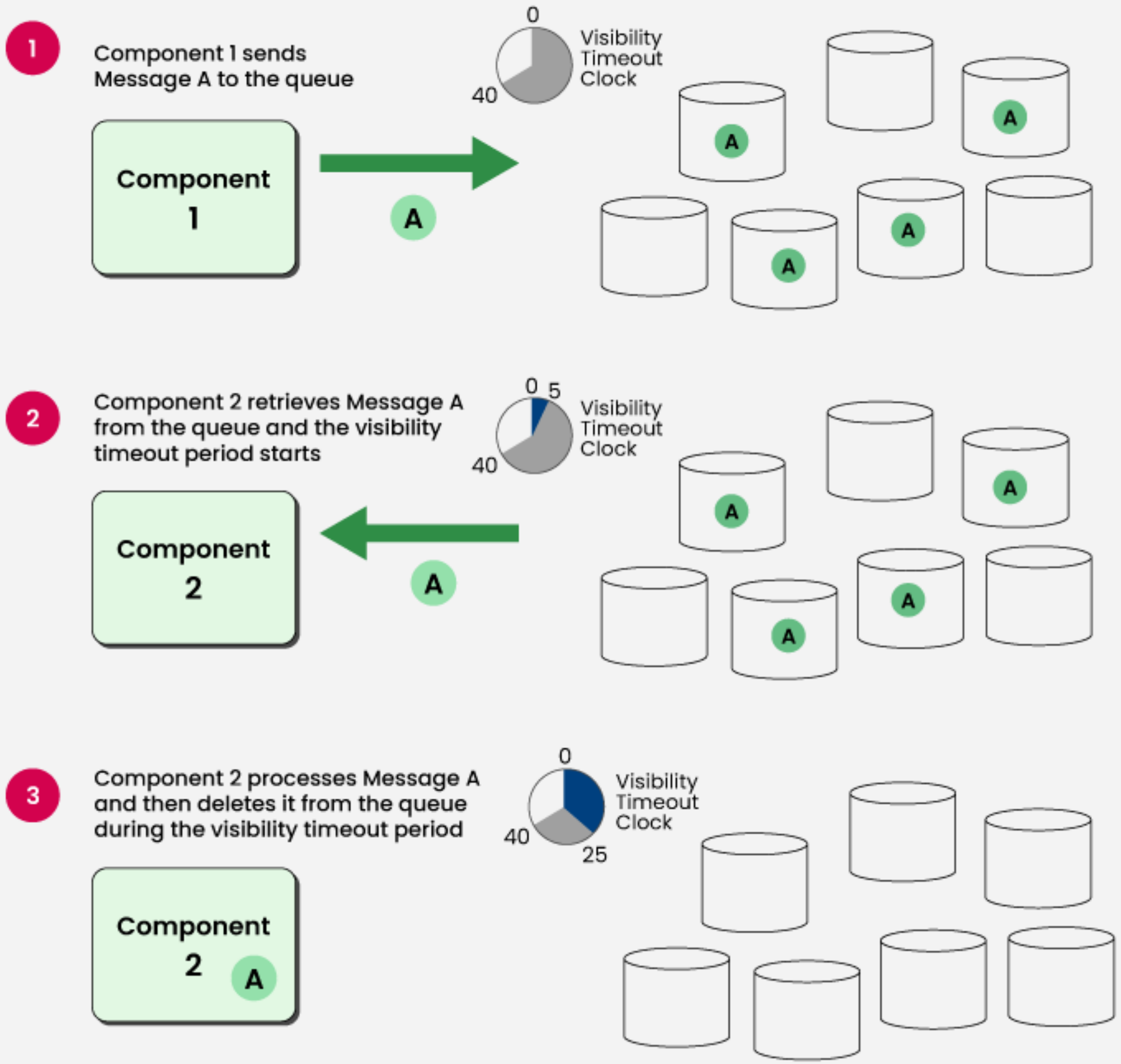

AWS Lambda (Push messages to queue)
Amazon SQS (Storing & queueing messages)
AWS Lambda (Invoke Amazon SES)
Amazon SES (Sending Emails)


Producer
4 Message
3 Message
2 Message
1 Message
Amazon SQS
AWS Lambda Agent
2 Message
1 Message
Lambda Function
Message 4
Message 3
Lambda Function


Message Producer
Message Consumer
SQS (Standard/FIFO)
AWS Cloud


On-Premises
AWS Cloud
Producer
Producer
retry in case of failure
if execution fails
SQS
Message Queue
Lambda
Message Broker
SNS
ECS/Fargate
Consumer

Lifecycle of an Amazon SQS



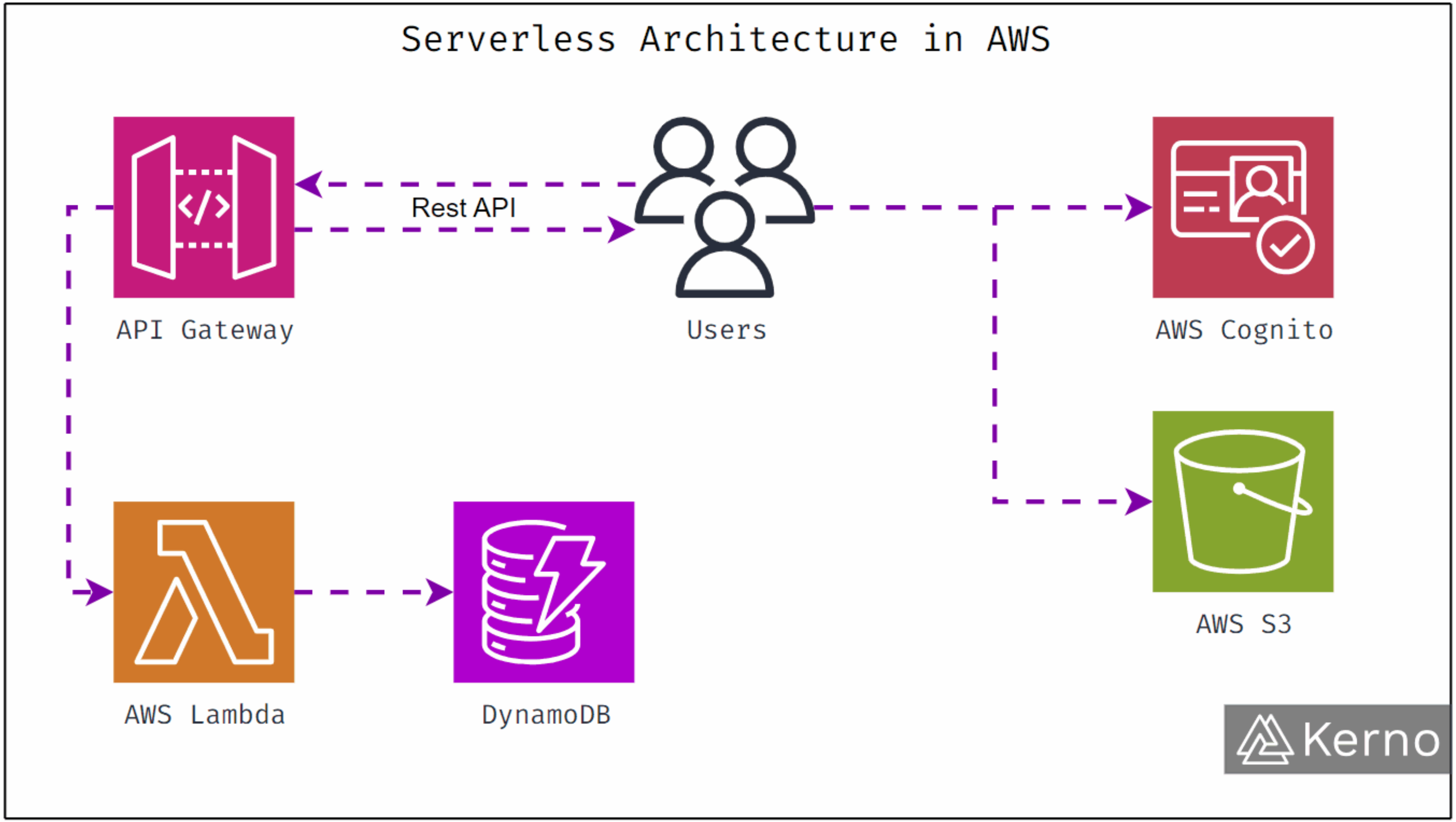
1 Component 1 sends Message A to the queue

2 Component 2 retrieves Message A from the queue and the visibility timeout period starts

3 Component 2 processes Message A and then deletes it from the queue during the visibility timeout period

INTRODUCTION TO SERVERLESS TECHNOLOGIES

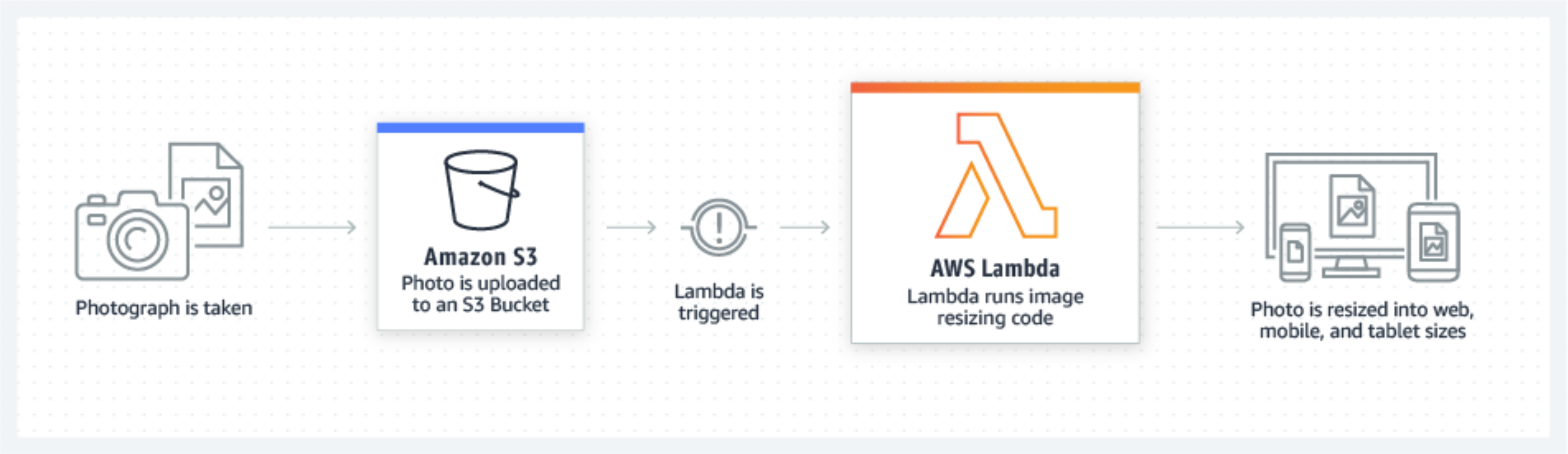
- Eliminates need to manage underlying servers.
- Focuses solely on code and application logic.
- Automatically scales with demand and workload.
- Reduces operational overhead and infrastructure costs.
- Improves agility for modern cloud development.
- Supports event-driven and stateless design principles.

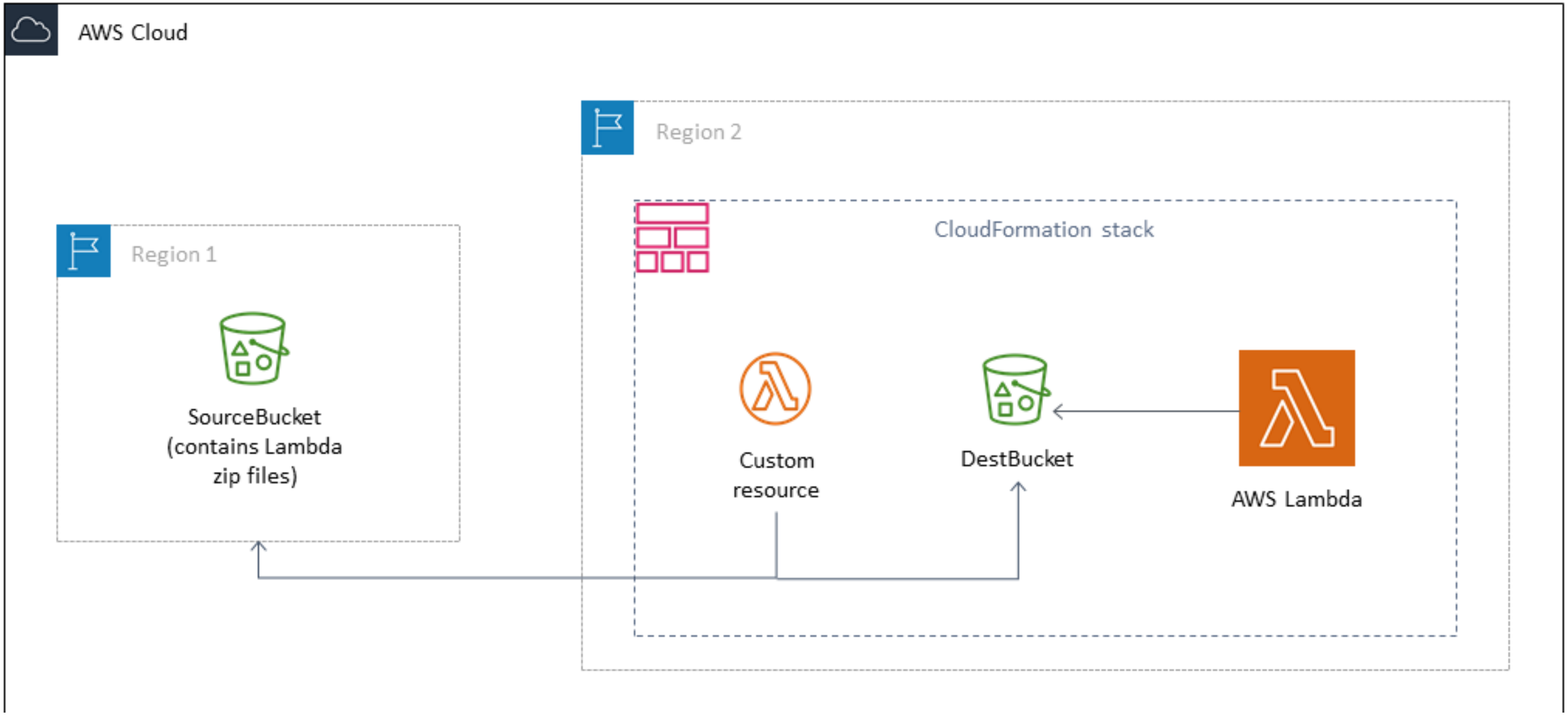

Serverless Architecture in AWS
API Gateway
Rest API
Users
AWS Cognito
AWS S3
AWS Lambda
DynamoDB
Kerno

SERVERLESS TECHNOLOGIES

AWS Lambda Overview

- Executes code instantly on triggered events.
- Scales automatically to match request volume.
- Supports multiple programming languages for flexibility.
- Integrates seamlessly with numerous AWS services.
- Eliminates idle resource costs between invocations.
- Ideal for microservices and event processing.

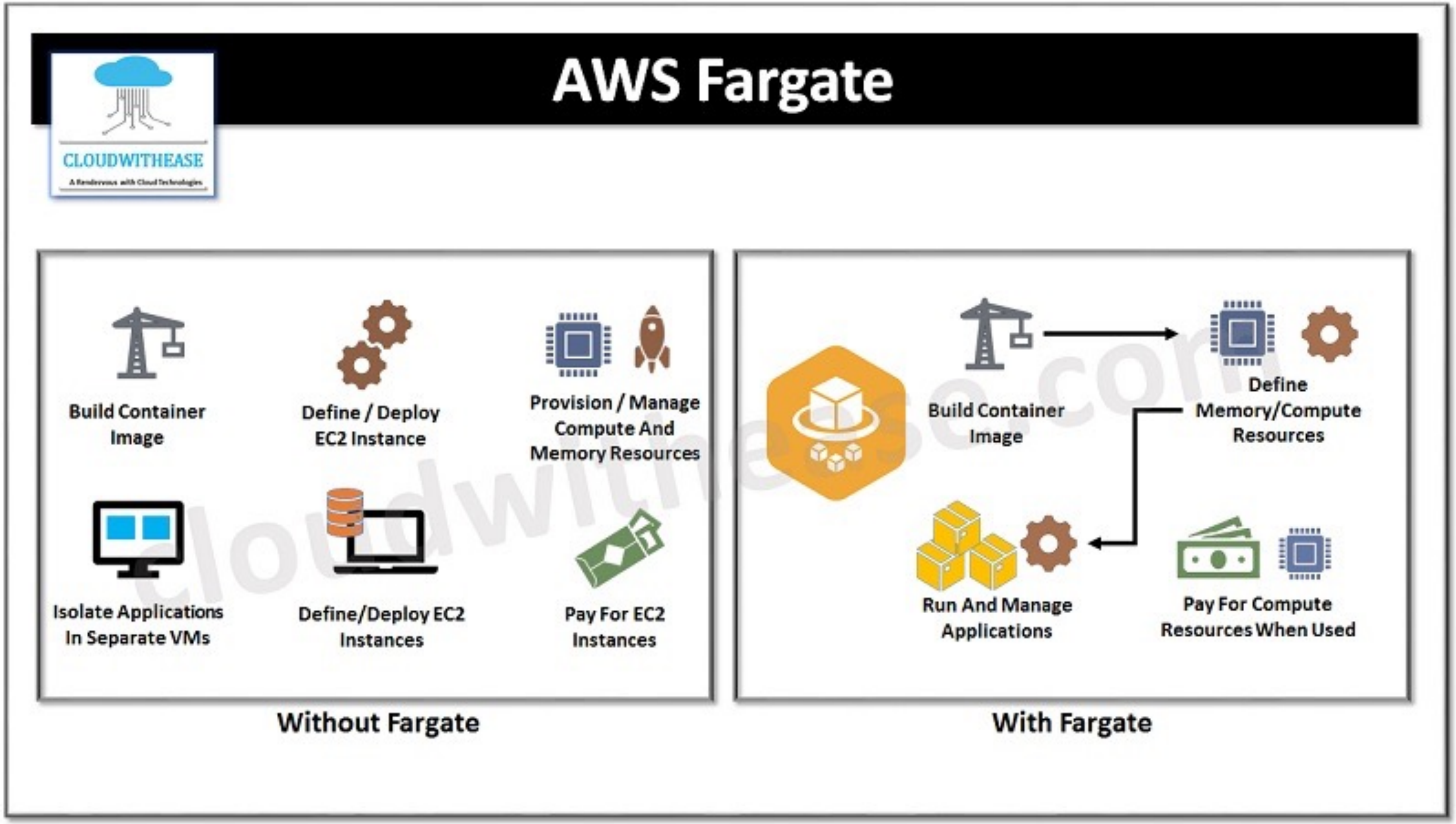

Photograph is taken
Amazon S3
Photo is uploaded to an S3 Bucket
Lambda is triggered
AWS Lambda
Lambda runs image resizing code
Photo is resized into web, mobile, and tablet sizes


AWS Cloud
Region 2
CloudFormation stack
Region 1
SourceBucket (contains Lambda zip files)
Custom resource
DestBucket
AWS Lambda

SERVERLESS TECHNOLOGIES

AWS Fargate Overview

- Runs containers without managing underlying servers.
- Integrates tightly with ECS and EKS.
- Automatically scales container workloads as needed.
- Simplifies operations with full resource abstraction.
- Optimizes performance through efficient task placement.
- Supports pay-per-use cost efficiency model.



AWS Fargate

CLOUDWITHEASE
A Rendezvous with Cloud Technologies

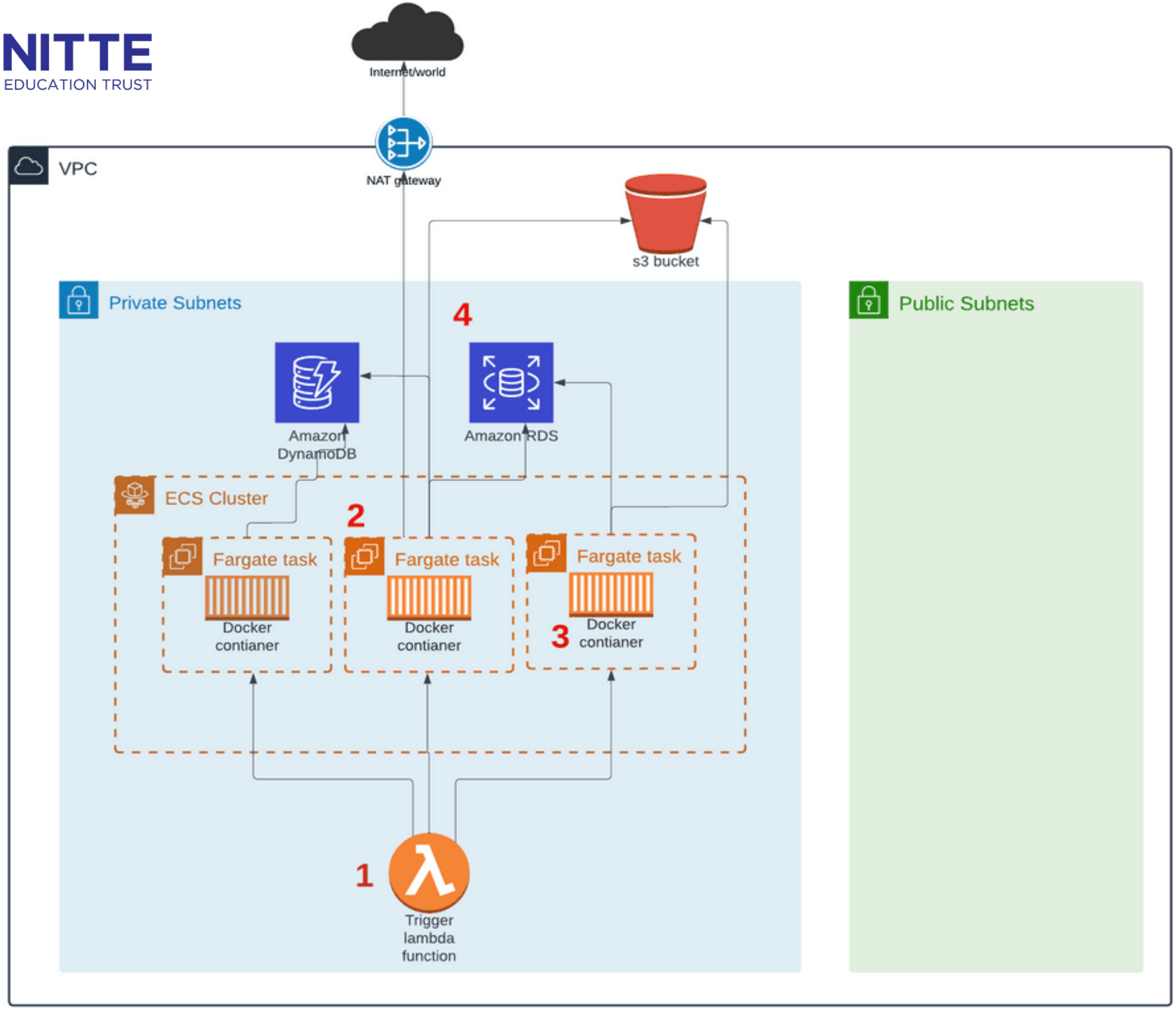
Without Fargate

- Build Container Image
- Define / Deploy EC2 Instance
- Provision / Manage Compute And Memory Resources
- Isolate Applications In Separate VMs
- Define/Deploy EC2 Instances
- Pay For EC2 Instances

With Fargate

- Build Container Image
- Define Memory/Compute Resources
- Run And Manage Applications
- Pay For Compute Resources When Used

cloudwithease.com


Internet/world
NAT gateway
VPC
s3 bucket
Private Subnets
Public Subnets
4
Amazon DynamoDB
Amazon RDS
ECS Cluster
2
Fargate task
Docker contianer
Fargate task
Docker contianer
Fargate task
3
Docker contianer
1
Trigger lambda function

SERVERLESS TECHNOLOGIES

Serverless Patterns and Use Cases

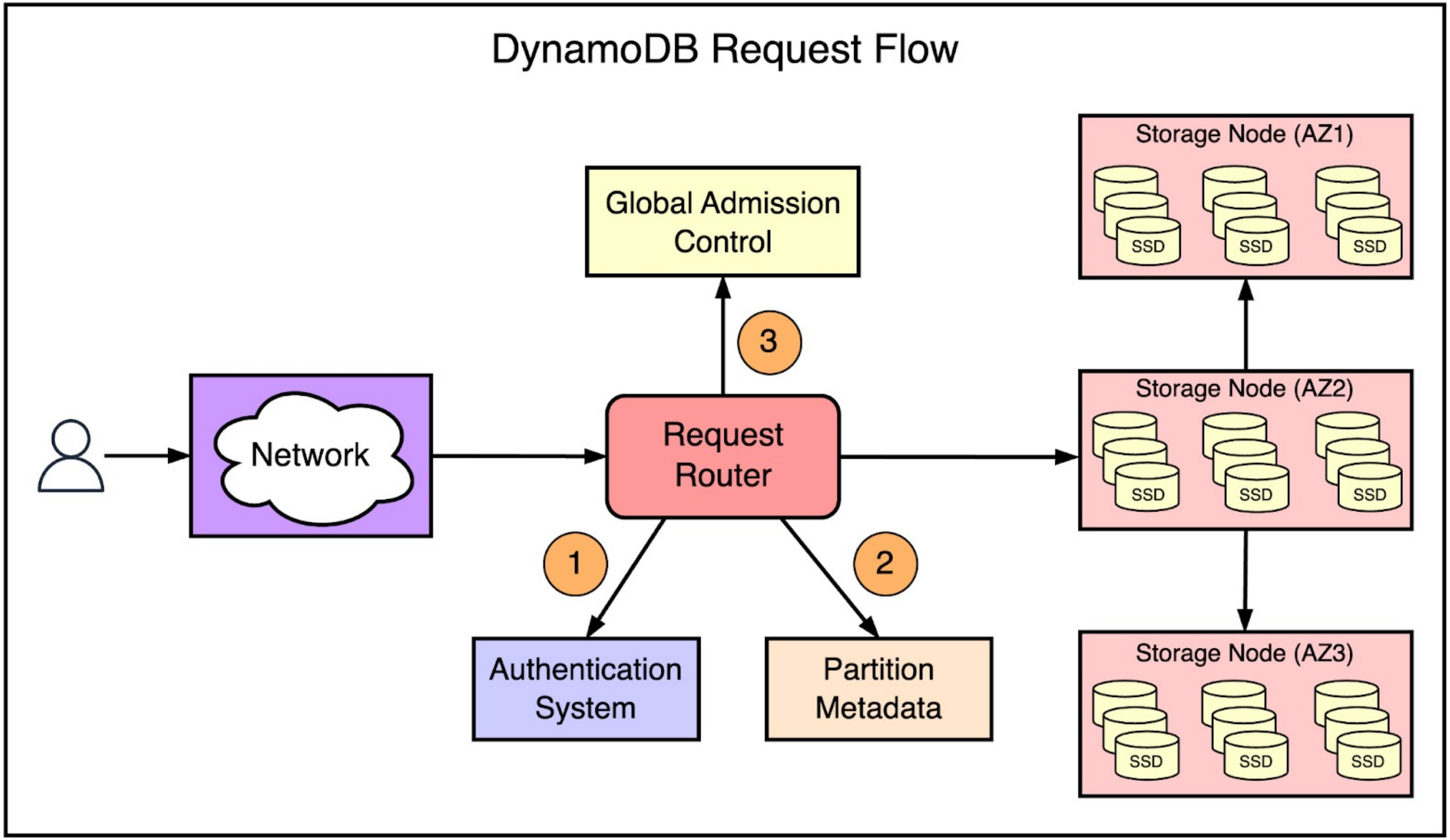
- Implements microservices using lightweight functions.
- Combines API Gateway with Lambda integrations.
- Processes streams with Kinesis and DynamoDB.
- Automates workflows through event-driven orchestration.
- Enhances application scalability and rapid deployment.
- Ideal for cost-optimized cloud-native solutions.

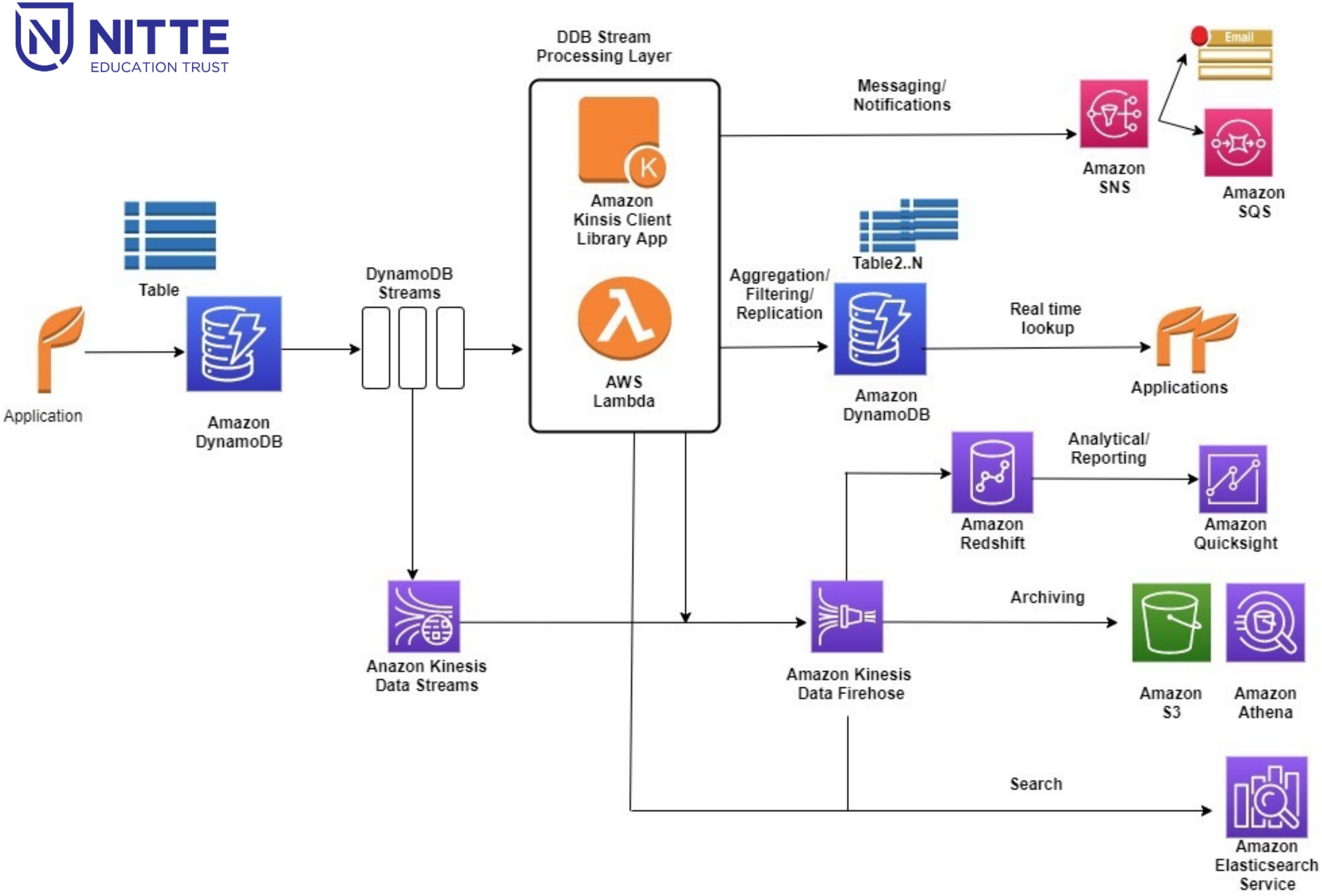
INTRODUCTION TO AWS DATABASE SERVICES

- Databases store and manage application data.
- AWS offers managed relational and NoSQL options.
- Enables scalability, reliability, and high availability.
- Supports diverse workloads across global infrastructures.
- Automates backups, monitoring, and performance tuning.
- Ensures secure, compliant, and optimized data management.

Amazon DynamoDB Overview

- Fully managed NoSQL database for modern applications.
- Delivers single-digit millisecond response times.
- Automatically scales throughput with traffic growth.
- Stores data across multiple availability zones.
- Supports key-value and document data models.
- Ideal for gaming, IoT, and mobile applications.


DynamoDB Request Flow
Network
Request Router
Global Admission Control
Authentication System
Partition Metadata
1
2
3
Storage Node (AZ1)
Storage Node (AZ2)
Storage Node (AZ3)
SSD


DDB Stream
Processing Layer
Amazon
Kinsis Client
Library App
AWS
Lambda
Table
Application
Amazon
DynamoDB
DynamoDB
Streams
Messaging/
Notifications
Email
Amazon
SNS
Amazon
SQS
Table2..N
Aggregation/
Filtering/
Replication
Amazon
DynamoDB
Real time
lookup
Applications
Analytical/
Reporting
Amazon
Redshift
Amazon
Quicksight
Anazon Kinesis
Data Streams
Amazon Kinesis
Data Firehose
Archiving
Amazon
S3
Amazon
Athena
Search
Amazon
Elasticsearch
Service