PW SKILLS | DevOps and Cloud Computing

AWS Core Services

Objective

- Understand AWS Lambda functions, event sources, and layers/versions.
- Learn how to manage Amazon S3 buckets, objects, storage classes, and security.
- Explore EBS & EFS volume types, snapshots, and mounting options.
- Configure Amazon VPC networking components like subnets, route tables, and gateways.
- Understand AWS load balancing services (ALB, NLB, CLB) and Auto Scaling integration.
- Learn how to use Amazon Route 53 for domain management and DNS routing.

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Explaining serverless computing and how AWS Lambda eliminates server management.

Let’s see

Serverless computing allows developers to run code without managing servers. It automatically handles infrastructure, scaling, and maintenance, so you can focus on writing code.

AWS Lambda is a serverless compute service that runs your code in response to events (like HTTP requests or file uploads). It eliminates server management by:

- Automatically provisioning and scaling compute resources.
- Charging only for the time your code runs (per millisecond).
- Handling maintenance, patching, and high availability.

Pop Quiz

Q. How does AWS Lambda eliminate server management?

A

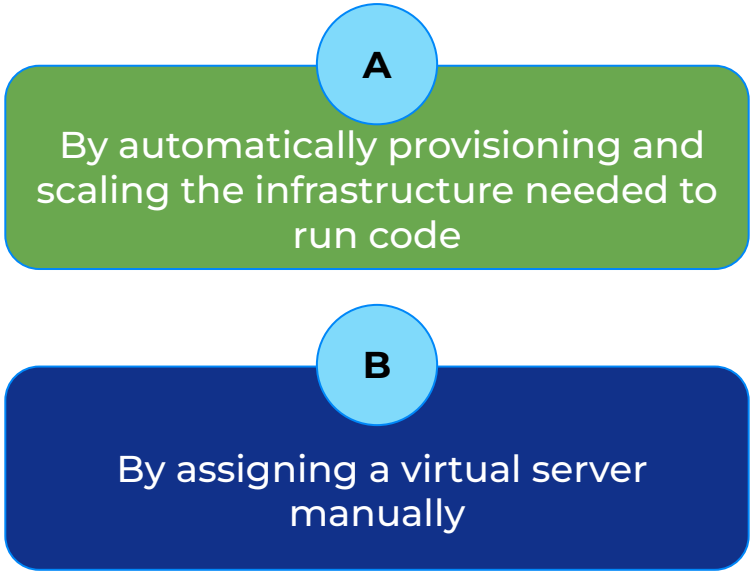
By automatically provisioning and scaling the infrastructure needed to run code

B

By assigning a virtual server manually

Pop Quiz

Q. How does AWS Lambda eliminate server management?



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Demonstrating Lambda function creation and execution.

Let’s do it

1. Create Function:

- Go to AWS Lambda Console.
- Click “Create function” → Choose “Author from scratch”.
- Set a name (e.g., MyFirstLambda) and runtime (e.g., Python 3.12).
- Click “Create function”.

2. Add Code:

In the code editor, enter:

```python
def lambda_handler(event, context):
    return "Hello from Lambda!"
```

Let’s do it

3. Test Execution:

- Click “Test”.
- Configure a test event (use default values).
- Click “Test” again.

4. Result:

- Output: "Hello from Lambda!"

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Discussing event sources that trigger Lambda functions (API Gateway, S3 events, DynamoDB Streams).

Let’s discuss

1. API Gateway

- Triggers Lambda via HTTP requests (e.g., REST APIs).
- Great for web/mobile backend services.

2. S3 Events

- Triggers Lambda when objects are uploaded, deleted, etc.
- Useful for image processing, logging, etc.

3. DynamoDB Streams

- Triggers Lambda on data changes (insert, update, delete).
- Ideal for real-time processing and analytics.

Pop Quiz

Q. Which of the following can trigger a Lambda function?

A

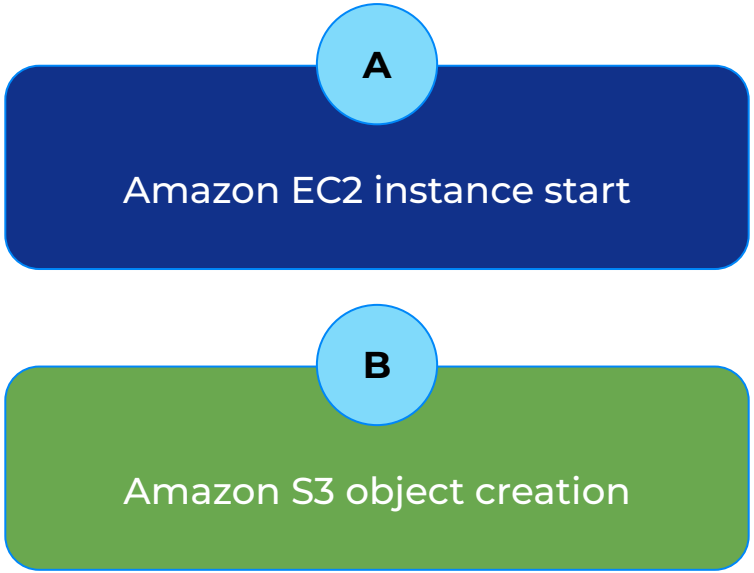
Amazon EC2 instance start

B

Amazon S3 object creation

Pop Quiz

Q. Which of the following can trigger a Lambda function?



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Explaining Lambda layers for reusable code dependencies and versions for function control.

Let’s see

Lambda Layers:

- Used to include reusable code, libraries, or dependencies across multiple functions.
- Helps keep functions lightweight and modular.

Versions:

- Allow you to freeze and manage specific code states.
- Each version is immutable; useful for deployment control and rollback.
- You can create aliases (e.g., prod, dev) pointing to versions.

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Explain S3 concepts:

Let’s see

1. Buckets & Objects:

- **Buckets:** Containers for storing data.
- **Objects:** Files stored in buckets, with metadata and a unique key.

2. Storage Classes:

- **Standard:** Frequent access, high durability.
- **Intelligent-Tiering:** Auto-moves data between access tiers to save cost.
- **Glacier / Glacier Deep Archive:** Low-cost, long-term archival storage.

3. Security (Bucket Policies & ACLs):

- **Bucket Policies:** JSON-based rules for access control at bucket level.
- **ACLs (Access Control Lists):** Grant permissions to specific users on individual objects or buckets.

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Demonstrating static website hosting on S3.

Let’s do it

1. Create a Bucket:

- Name it (must be globally unique).
- Disable "Block all public access".

2. Upload Website Files:

- Upload index.html and optional error.html.

3. Enable Static Hosting:

- Go to Properties → Static website hosting.
- Enable it, set index.html as the index document.

Let’s do it

4. Set Permissions:

- Add a bucket policy to allow public read access:

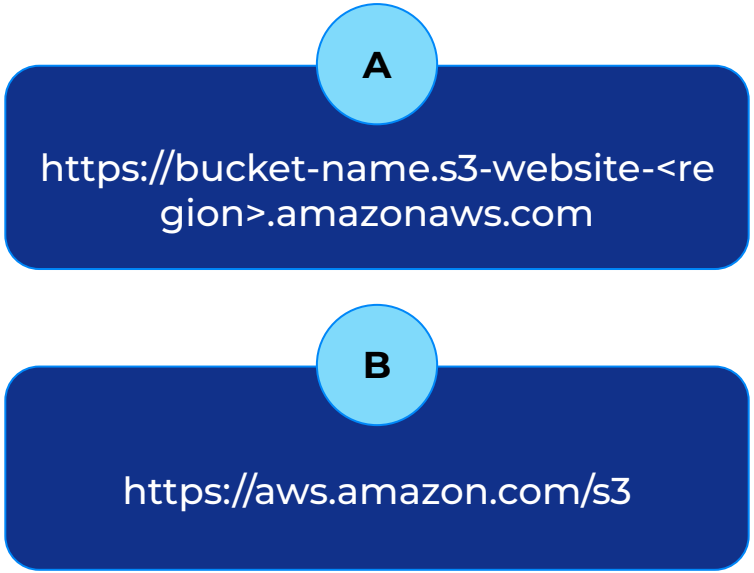
```
{
  "Version": "2012-10-17",
  "Statement": [{
    "Effect": "Allow",
    "Principal": "*",
    "Action": "s3:GetObject",
    "Resource": "arn:aws:s3:::your-bucket-name/*"
  }]
}
```

5. Access Website:

- Use the S3 website endpoint URL to view your site.

Pop Quiz

Q. What is the default URL format for an S3 static website?



Pop Quiz

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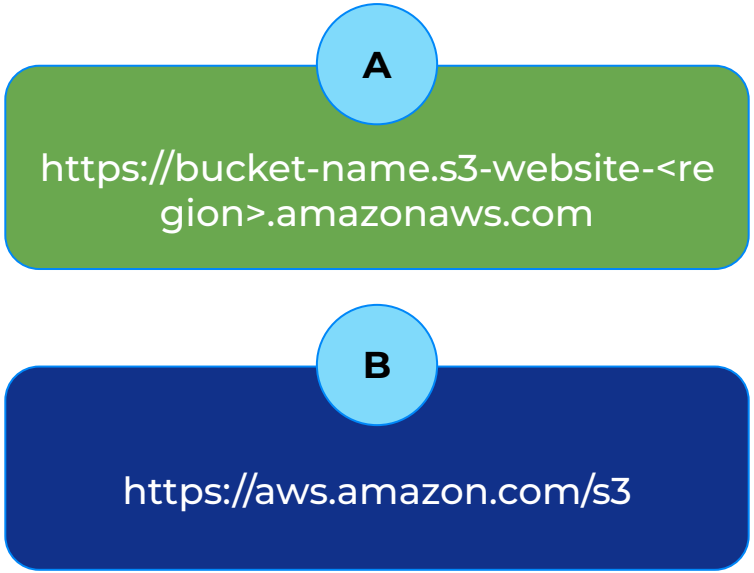

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Explaining Amazon EBS (Elastic Block Store) for EC2 storage.

Let’s see

Amazon EBS (Elastic Block Store) provides block-level storage for EC2 instances.

- Acts like a virtual hard drive attached to EC2.
- Supports persistent storage—data stays even after instance stops.
- Offers different volume types (e.g., gp3, io2) for performance needs.
- Supports snapshots for backup and recovery.

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Discussing EBS volume types (gp3, io1, sc1, etc.) and their performance.

Let’s discuss

1. gp3 (General Purpose SSD):

Balanced performance, cost-effective.

Up to 16,000 IOPS and 1,000 MB/s throughput.

2. io1/io2 (Provisioned IOPS SSD):

High-performance, low-latency.

Designed for I/O-intensive apps (e.g., databases).

Up to 256,000 IOPS (io2 Block Express).

Let’s discuss

3. st1 (Throughput Optimized HDD):

Low-cost for large, sequential workloads.

Ideal for big data, log processing.

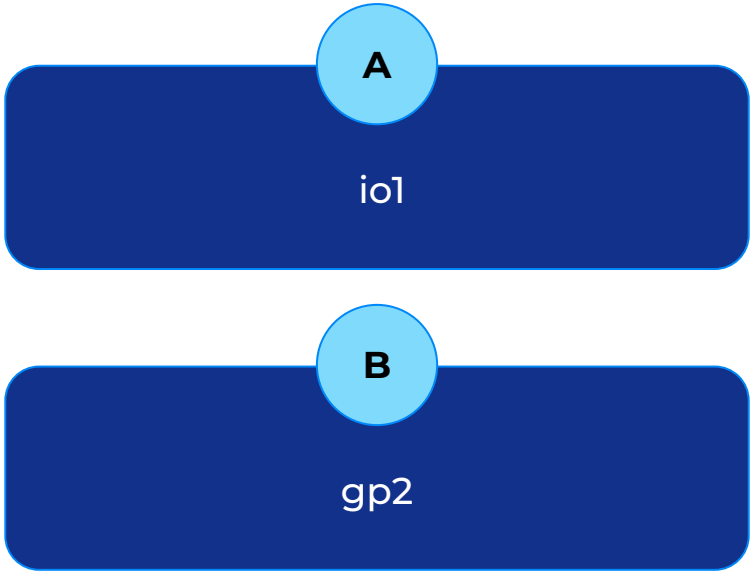
4. sc1 (Cold HDD):

Lowest-cost, infrequent access.

Best for cold data backups.

Pop Quiz

Q. Which EBS volume type is designed for high-performance, low-latency workloads like large databases?



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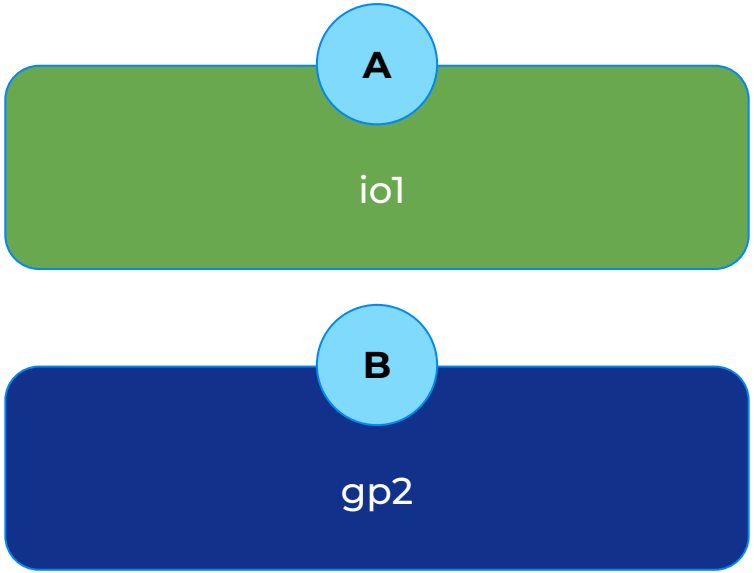

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Demonstrating creating, attaching, and taking snapshots of an EBS volume.

Let’s do it

1. Create Volume:

Go to EC2 Console → Elastic Block Store → Volumes → Create Volume.

Choose size, type (e.g., gp3), and availability zone.

2. Attach Volume:

Select the volume → Actions → Attach Volume.

Choose an EC2 instance in the same zone.

Let’s do it

3. Format & Mount (on EC2):

```
sudo mkfs -t ext4 /dev/xvdf
sudo mkdir /mnt/data
sudo mount /dev/xvdf /mnt/data
```

4. Create Snapshot:

- Go to Volumes → select volume → Actions → Create Snapshot.
- Add a name/description and confirm.

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Explaining Amazon EFS (Elastic File System) and its use cases.

Let’s see

Amazon EFS (Elastic File System) is a scalable, shared file storage for use with EC2 and other AWS services.

- Automatically grows/shrinks as files are added/removed.
- Supports concurrent access from multiple instances.
- Fully managed, with NFS protocol support.

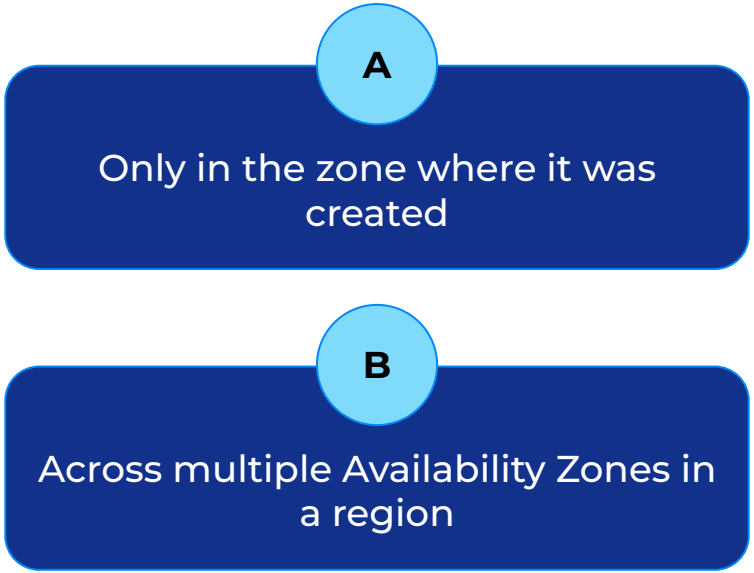
Let’s see

Use Cases:

- Web server file storage
- Shared data across multiple EC2s
- Big data analytics
- Container storage (e.g., with ECS, EKS)

Pop Quiz

Q. In what availability zone(s) can EFS data be accessed by default?



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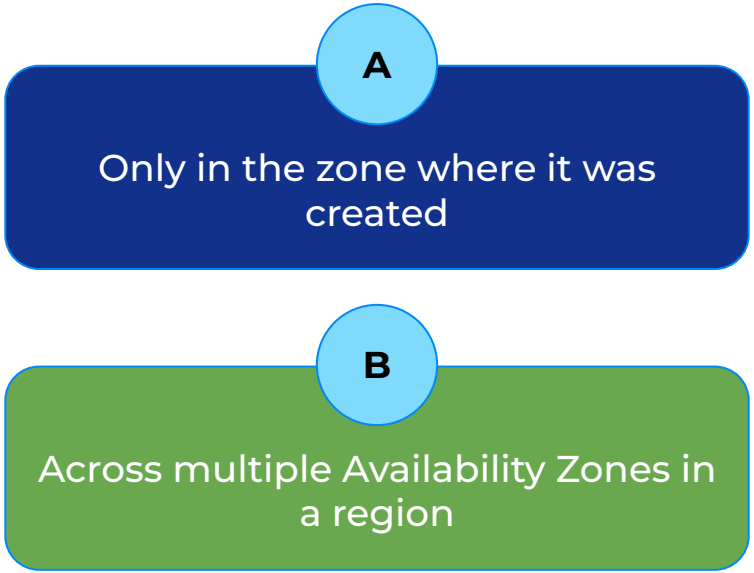

Take A 5-Minute Break!

- Stretch and relax
- Hydrate
- Clear your mind
- Be back in 5 minutes

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Explaining Amazon Virtual Private Cloud (VPC) and its role in AWS networking.

Let’s see

Amazon VPC (Virtual Private Cloud) lets you create a private, isolated network within AWS.

- You define IP ranges, subnets, route tables, and gateways.
- Controls how resources like EC2 instances communicate with each other and the internet.
- Supports security groups and network ACLs for traffic control.

Role:

- VPC provides secure, customizable networking, acting as the foundation for deploying AWS resources in a controlled environment.

Pop Quiz

Q. Which of the following can you define within a VPC?

A

IP address range using CIDR blocks

B

Availability Zone

Pop Quiz

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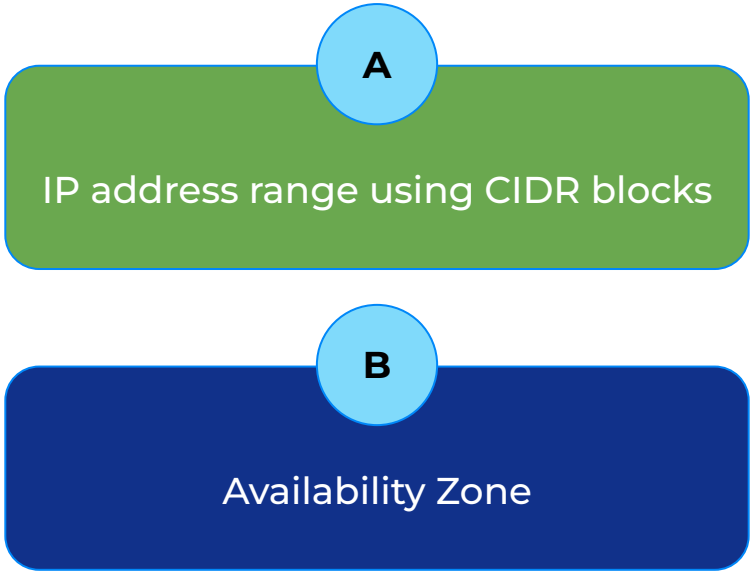

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Discussing subnets (public vs. private) and route tables for traffic flow.

Let’s discuss

Subnets divide a VPC into smaller networks:

- **Public Subnet:** Has a route to the internet gateway, allowing resources (like web servers) to access or be accessed from the internet.
- **Private Subnet:** No direct route to the internet. Used for internal resources (like databases) that shouldn't be publicly accessible.

Let’s discuss

Route Tables control the traffic flow within a VPC:

- **Public Subnet Route Table:** Includes a route to the internet via the internet gateway.
- **Private Subnet Route Table:** No route to the internet directly, but may route traffic through a NAT gateway in a public subnet to access the internet for updates, etc.

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Demonstrating setting up Internet Gateways for public access and NAT Gateways for private instances.

Let’s do it

Setting up Internet Gateway (IGW) for Public Access:

1. Create IGW:

VPC Dashboard > Internet Gateways > Create

2. Attach IGW to VPC.

3. Update Public Subnet Route Table:

Add route: 0.0.0.0/0 → IGW

4. Assign Public IP to instances in the public subnet.

Let’s do it

Setting up NAT Gateway for Private Instances:

1. Create Elastic IP:

EC2 Dashboard > Elastic IPs > Allocate

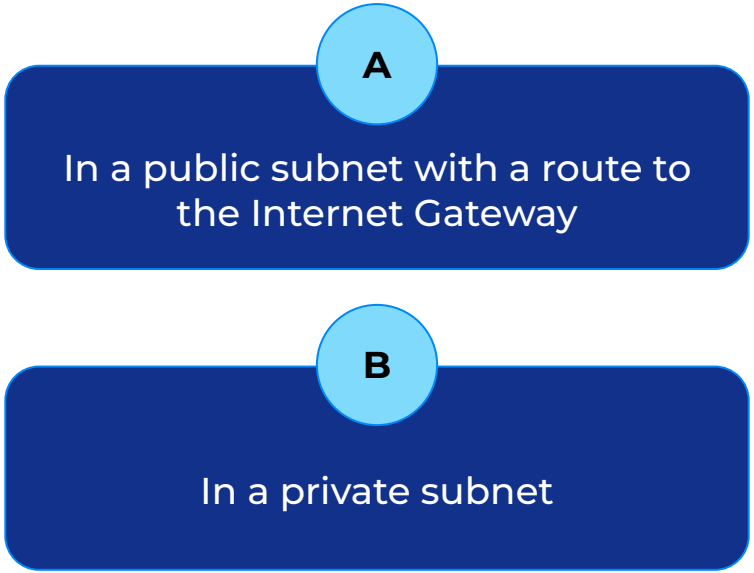
2. Create NAT Gateway in a public subnet using the Elastic IP.

3. Update Private Subnet Route Table:

Add route: 0.0.0.0/0 → NAT Gateway

Pop Quiz

Q Where should a NAT Gateway be deployed?



Pop Quiz

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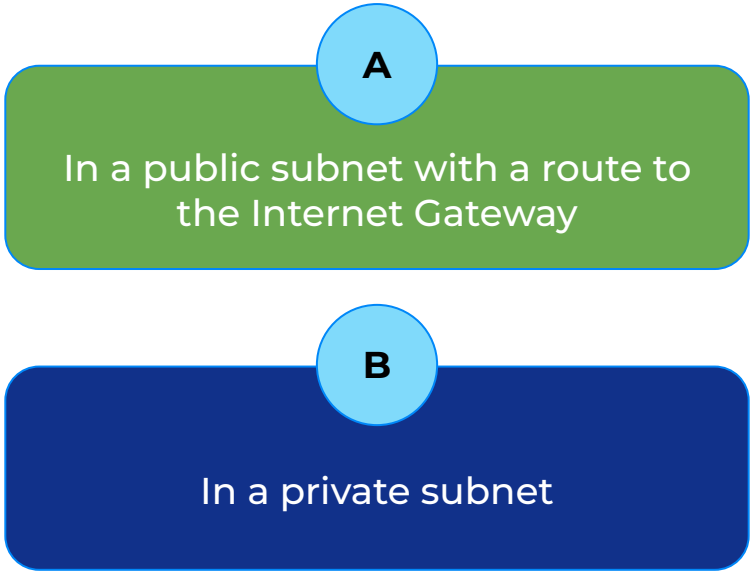

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Explaining Network ACLs (stateless) vs. Security Groups (stateful) for access control.

Let’s see

Network ACLs (NACLs) are stateless:

- Rules apply to inbound and outbound traffic separately.
- Must explicitly allow return traffic.
- Operate at the subnet level.
- Good for broad, layered security.

Let’s see

Security Groups are stateful:

- If inbound is allowed, outbound response is automatically allowed.
- Operate at the instance level.
- Simpler to manage for individual resources.

Pop Quiz

Q. What happens if a NACL has a deny rule for an IP address, but the Security Group allows it?

A

The traffic is denied because NACL rules take precedence

B

The traffic is allowed

Pop Quiz

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B

The traffic is allowed

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Demonstrating configuring inbound/outbound rules for security.

Let’s do it

1. Inbound Rules (Allow traffic to instance):

Example: Allow SSH

- Type: SSH
- Protocol: TCP
- Port Range: 22
- Source: 0.0.0.0/0 (or restrict to your IP)

Let’s do it

2. Outbound Rules (Allow instance to send traffic out):

Default: Allow all

- Type: All traffic
- Protocol: All
- Destination: 0.0.0.0/0

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Introducing VPC Endpoints to privately connect to AWS services without exposing them to the internet.

Let’s introduce

VPC Endpoints allow private connections from your VPC to AWS services without using the internet.

- **Interface Endpoints:** Use ENIs (Elastic Network Interfaces) for services like S3, DynamoDB, or SNS.
- **Gateway Endpoints:** Used specifically for S3 and DynamoDB, routing traffic through a private path.

Pop Quiz

Q. Which statement about VPC Endpoints is TRUE?

A

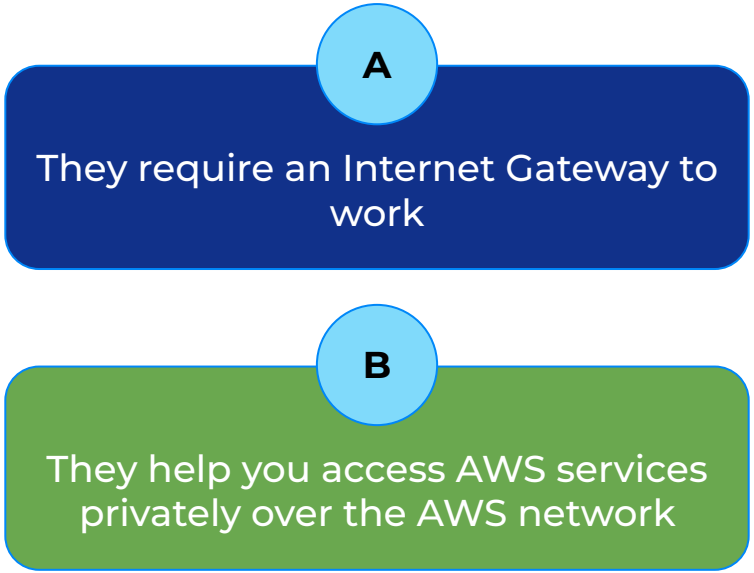
They require an Internet Gateway to work

B

They help you access AWS services privately over the AWS network

Pop Quiz

Q. Which statement about VPC Endpoints is TRUE?



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Explaining Elastic Load Balancing (ELB) types.

Let’s see

1. Application Load Balancer (ALB)

- Handles HTTP/HTTPS (Layer 7)
- Supports path and host-based routing
- Ideal for modern web apps and microservices

2. Network Load Balancer (NLB)

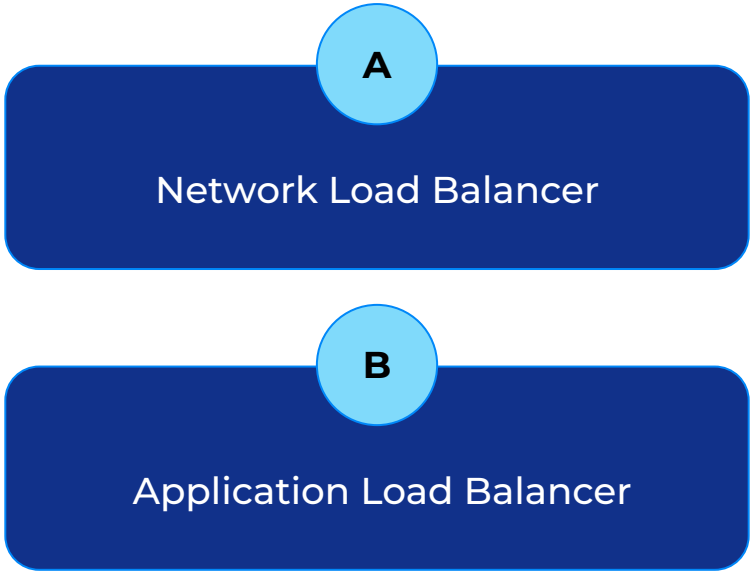
- Handles TCP/UDP (Layer 4)
- High performance and low latency
- Ideal for real-time, high-throughput apps

3. Classic Load Balancer (CLB)

- Legacy option for Layer 4 and Layer 7
- Basic load balancing for older apps
- Limited features compared to ALB/NLB

Pop Quiz

Q. Which load balancer type is best suited for web applications that use HTTP/HTTPS?



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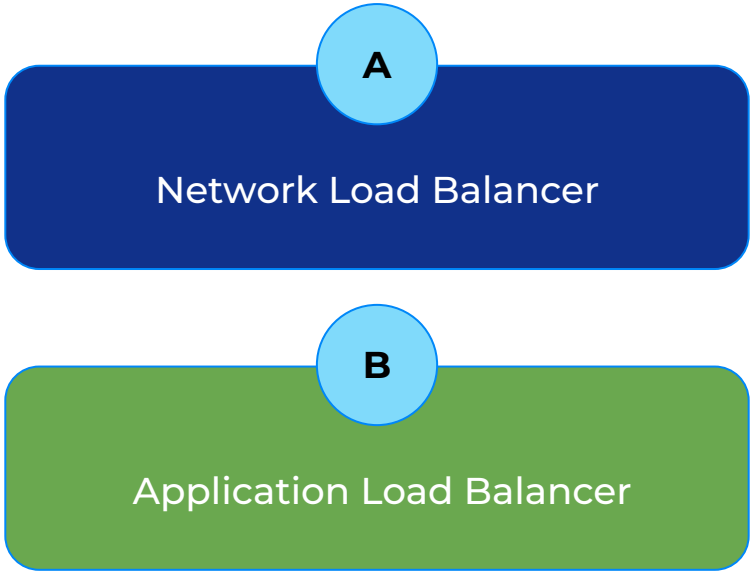

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Demonstrating setting up an ALB with an EC2 Auto Scaling Group.

Let’s do it

1. Create Target Group:

- Type: Instance
- Protocol: HTTP
- Target type: Instance
- Port: 80

2. Create Application Load Balancer (ALB):

- Type: Internet-facing
- Listener: HTTP (port 80)
- Attach to the previously created target group

Let’s do it

3. Create Launch Template:

- Define AMI, instance type, security group, etc.

4. Create Auto Scaling Group:

- Use the launch template
- Select subnets
- Attach to the target group
- Set desired, min, and max capacity

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Explaining how Route 53 manages domain names and DNS resolution.

Let’s see

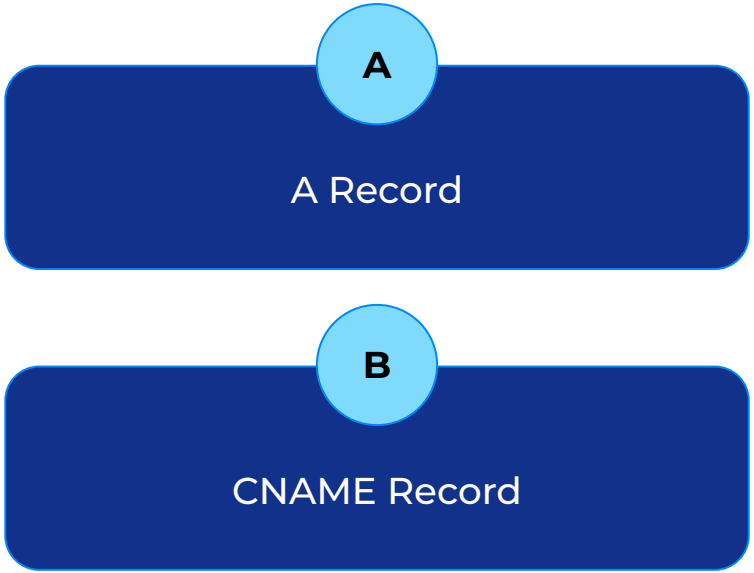
Amazon Route 53 is a scalable DNS service that manages domain names and directs traffic using DNS records.

Key Functions:

- **Domain Registration:** Buy and manage domain names.
- **DNS Routing:** Uses records like A, CNAME, MX to map names to resources (e.g., www.example.com → EC2 IP).
- **Health Checks:** Routes traffic only to healthy endpoints.
- **Routing Policies:** Supports latency-based, geolocation, failover, etc.

Pop Quiz

Q. What type of DNS record maps a domain name to an IP address?



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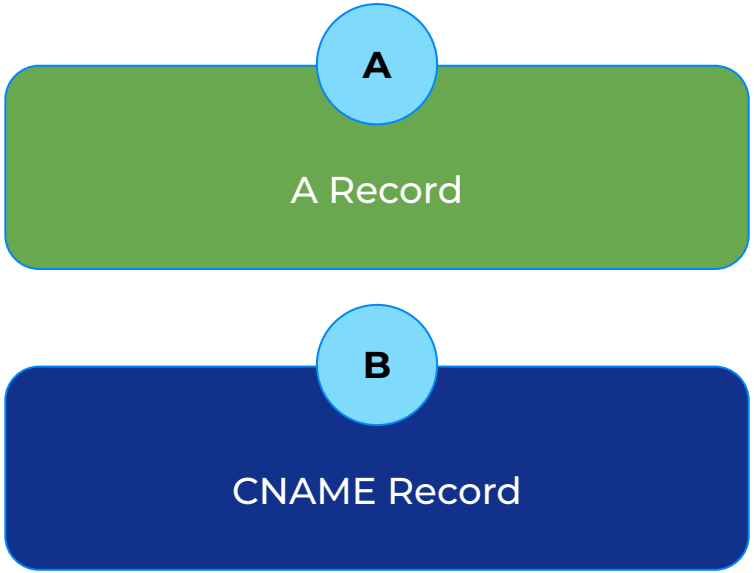

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Discussing routing policies (simple, weighted, failover, geolocation).

Let’s discuss

1. Simple:

- One record per name
- Basic DNS resolution (e.g., example.com → 1 IP)

2. Weighted:

- Split traffic by percentage
- Useful for testing or load balancing

Let’s discuss

3. Failover:

- Primary and secondary records
- Routes to backup if primary fails (uses health checks)

4. Geolocation:

- Routes users based on geographic location
- Improves latency and localization

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Demonstrating configuring a domain and setting up DNS records (A, CNAME, MX, etc.).

Let’s do it

1. Register a Domain (or use an existing one).
   - Route 53 > Registered domains
2. Create a Hosted Zone for the domain.
3. Add DNS Records:
   - A Record: Maps domain to IP

→ example.com → 192.0.2.1

   - CNAME: Alias for another domain

→ www.example.com → example.com

   - MX Record: Routes email

→ Points to mail servers (e.g., Gmail, SES)

   - TXT Record: For SPF, DKIM, or verification

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Time for case study!

Important

- Complete the post-class assessment
- Complete assignments (if any)
- Practice the concepts and techniques taught in this session
- Review your lecture notes
- Note down questions and queries regarding this session and consult the teaching assistants

Thanks !