



AWS in Production

**Building and Operating
Real Systems on AWS**

Joel Bryan Juliano

AWS in Production

Joel Bryan Juliano

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Part 1: Core Serverless

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Route 53 – DNS & Routing Basics

What You'll Learn

- How DNS works and why it matters in AWS
- Creating hosted zones and record sets
- Routing policies: simple, weighted, failover, latency-based
- Connecting a custom domain to your AWS resources

Prerequisites

- An AWS account
- A registered domain (or use Route 53 to register one)

Why Start Here

Most AWS tutorials start with a Lambda function that has no URL anyone would type into a browser. That is backwards. A real system has a real address. Route 53 is how you establish that – and understanding it early means every subsequent chapter connects to something reachable.

DNS is also one of the few AWS services where a misconfiguration is immediately visible and affects real users. Learning it first trains the right habits: make a change, verify propagation, understand the TTL, move on.

How DNS Works

When a browser navigates to `api.example.com`, it does not know the IP address. It asks a series of servers:

1. **Recursive resolver** (usually your ISP or 1.1.1.1) – checks its cache. If it has the answer, returns it.
2. **Root nameserver** – knows who handles .com.
3. **TLD nameserver** – knows who handles example.com. This is where your registrar's nameservers are listed.
4. **Authoritative nameserver** – Route 53 in your case. It returns the actual record.

The final answer is cached for the duration of the TTL you set on the record. Shorter TTL = faster propagation of changes, more DNS queries, slightly higher cost. For most records, 300 seconds (5 minutes) is a reasonable default. During active deployments, drop it to 60 seconds beforehand so you can cut over quickly.

Concepts

Hosted Zones

A hosted zone is Route 53's container for DNS records for a specific domain. You get two types:

Public hosted zone – answers DNS queries from the internet. Use this for anything your users need to reach: `api.example.com`, `www.example.com`, `cdn.example.com`.

Private hosted zone – answers DNS queries only from within a VPC. Use this for internal service names: `orders.internal`, `payments.internal`. Your Lambda functions and ECS tasks can call each other by name instead of by IP, and those names never leak outside your VPC.

When you create a hosted zone in Route 53, AWS gives you four nameserver records (NS records). Copy those into your domain registrar's nameserver settings. Until you do this, Route 53 has no authority over your domain – it is a dead zone.



Do not delete and recreate a hosted zone. AWS assigns different nameservers each time. If you recreate a zone, you must update your registrar's NS records again and wait for propagation. Treat your hosted zone as permanent infrastructure.

```

1 ; NS records given to you by Route 53 – copy all four to your registrar
2 ns-123.awsdns-12.com
3 ns-456.awsdns-34.net
4 ns-789.awsdns-56.org
5 ns-012.awsdns-78.co.uk

```

Record Types

Record	What It Does	When to Use
A	Maps a name to an IPv4 address	Pointing to an EC2 instance or ALB IP
AAAA	Maps a name to an IPv6 address	IPv6-capable resources
CNAME	Maps a name to another name	Pointing a subdomain to an external hostname
ALIAS	AWS-specific: maps a name to an AWS resource	CloudFront, API Gateway, ALB, S3 website endpoints
MX	Mail exchange records	Email routing (usually not touched)
TXT	Arbitrary text	Domain verification, SPF/DKIM for email

The ALIAS vs CNAME distinction matters. CNAME cannot be used at the zone apex (the naked domain: `example.com`). DNS spec forbids it. ALIAS is Route 53's proprietary extension that behaves like CNAME but works at the apex, and resolves the target's IP on your behalf. Always use ALIAS when pointing `example.com` to an AWS resource.



ALIAS records for AWS resources (ALB, API Gateway, CloudFront) incur no per-query charge from Route 53. CNAME records do. At scale the difference is meaningful.

CNAME is fine for `api.example.com` pointing to an ALB or API Gateway endpoint, but ALIAS is cheaper (no per-query charge for Route 53 to resolve the target) and faster.

Routing Policies

Route 53 goes beyond simple DNS – it can make routing decisions based on health, location, and latency.

Simple – one record, one answer. No logic. Use for most cases.

Weighted – distribute traffic across multiple targets by percentage. 80% to the stable version, 20% to the canary. This is how you do gradual rollouts without a load balancer.

```
1 api.example.com A ALIAS alb-stable.us-east-1.elb.amazonaws.com Weight: 80
2 api.example.com A ALIAS alb-canary.us-east-1.elb.amazonaws.com Weight: 20
```

Latency-based – Route 53 routes the user to the AWS region that gives the lowest latency. You run the same service in `us-east-1` and `eu-west-1`, and European users automatically hit the closer region. No logic in your application.

Failover – active/passive pair. Route 53 health-checks the primary; if it fails, DNS automatically points to the secondary. Recovery is automatic once the primary passes health checks again.

Geolocation – route based on where the DNS query originates. European users go to an EU endpoint, North American users go to a US endpoint. Used when data residency matters – GDPR, for instance.

Health Checks work across all routing policies. Route 53 periodically calls an endpoint you specify (HTTP/HTTPS/TCP) and marks it healthy or unhealthy. Unhealthy targets are removed from DNS responses until they recover. You configure the check interval (10s or 30s), the failure threshold, and the path.

Hands-On: Point a Custom Domain at an S3 Static Website

This exercise gives you a live URL before you write a single line of application code.

Step 1: Create an S3 bucket for static hosting

The bucket name must exactly match your domain name.

```
1 aws s3api create-bucket \  
2   --bucket www.example.com \  
3   --region us-east-1  
4  
5 aws s3 website s3://www.example.com/ \  
6   --index-document index.html \  
7   --error-document error.html
```

Upload a minimal index page:

```
1 echo '<h1>Hello from S3</h1>' > index.html  
2 aws s3 cp index.html s3://www.example.com/ --acl public-read
```

Enable public access (for a static website, this is intentional):

```
1 aws s3api put-bucket-policy --bucket www.example.com --policy '{  
2   "Version": "2012-10-17",  
3   "Statement": [{  
4     "Effect": "Allow",  
5     "Principal": "*",  
6     "Action": "s3:GetObject",  
7     "Resource": "arn:aws:s3:::www.example.com/*"  
8   }]  
9 }'
```

Step 2: Create a hosted zone

```
1 aws route53 create-hosted-zone \  
2   --name example.com \  
3   --caller-reference $(date +%s)
```

Copy the four NS values from the output and paste them into your registrar's nameserver settings. Propagation takes minutes to hours depending on the registrar.

Step 3: Create an ALIAS record

```
1 aws route53 change-resource-record-sets \  
2 --hosted-zone-id YOUR_ZONE_ID \  
3 --change-batch '{  
4   "Changes": [{  
5     "Action": "CREATE",  
6     "ResourceRecordSet": {  
7       "Name": "www.example.com",  
8       "Type": "A",  
9       "AliasTarget": {  
10        "HostedZoneId": "Z3AQBSTGFYJSTF",  
11        "DNSName": "www.example.com.s3-website-us-east-1.amazonaws.com",  
12        "EvaluateTargetHealth": false  
13      }  
14    }  
15  ]}  
16 }'
```

The HostedZoneId value Z3AQBSTGFYJSTF is the fixed zone ID for S3 website endpoints in us-east-1. Each region and service has its own – find them in the AWS documentation for “Route 53 alias targets.”

Step 4: Verify

```
1 dig www.example.com  
2 # Should return the S3 website endpoint IP after propagation  
3  
4 curl http://www.example.com  
5 # Should return: <h1>Hello from S3</h1>
```

TTL propagation is the most common source of confusion. If dig still returns old results, check the TTL on the response – you may just be waiting for the cache to expire.



dig www.example.com shows the TTL remaining on the cached answer in the response section. If it shows 300, the record was just cached and you have up to 5 minutes to wait. If it shows 12, the cache expires in 12 seconds.

Production Patterns

Always set low TTLs before a cutover. Drop TTL to 60s at least one TTL-duration before you plan to switch. Once switched and stable, raise it back

to 300s or higher to reduce query volume.

Use health checks on production records. Even simple `HTTP:80:/health` checks catch a dead server before users do.

Separate your internal and external namespaces. Private hosted zones (`*.internal`) prevent internal service names from leaking in public DNS and let you use short names in service-to-service calls.

Key Takeaways

- Route 53 is your DNS authority. Copy its NS records to your registrar or nothing works.
- Use ALIAS records for AWS resources at the zone apex; CNAME everywhere else.
- Routing policies (weighted, latency, failover) give you traffic control at the DNS layer – no application code required.

What's Next

Chapter 2 covers Lambda – once you have a domain pointing somewhere, you'll want real compute behind it.

Lambda – Functions & Execution Model

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The Execution Model

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Function Configuration

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Hands-On: Deploy Your First Function

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Step 2: Build and package

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Step 3: Create the execution role

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Step 4: Create the function

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Step 5: Invoke and inspect

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API Gateway – Building HTTP APIs

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Integration Types

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Step 2: Create a Lambda integration

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Step 3: Create routes

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Step 4: Allow API Gateway to invoke Lambda

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Step 5: Deploy to the default stage

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Step 6: Test

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serverless.yml Structure

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Part 2: AWS Services

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Why IAM Is the Most Important Service You'll Ever

Misconfigure

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Roles Over Users for Services

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Hands-On: Audit and Fix the Part 1 Roles

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Step 1: List what your function is actually doing

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Step 2: Write a scoped policy for each function

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Step 3: Verify with IAM Policy Simulator

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Step 4: Check for unused permissions

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Common IAM Anti-Patterns

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The Three Load Balancer Types

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VPC Quick Start

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Hands-On: ALB in Front of a Lambda Function

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Step 1: Create a VPC (if you don't have one)

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Step 2: Create a security group for the ALB

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Step 3: Create the ALB

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Step 4: Create a Lambda target group

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Step 5: Add an HTTPS listener with routing

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Step 6: Point Route 53 at the ALB

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Hands-On: Upload Pipeline with Lambda Processing

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Step 1: Create two buckets

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Step 2: Lambda function to generate thumbnails

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Step 3: Grant Lambda access to both buckets

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Step 4: Wire the notification

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SNS – Simple Notification Service

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FIFO Topics

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Fan-Out Pattern

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Hands-On: Add Fan-Out to the Order Pipeline

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Step 1: Create the SNS topic

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Step 2: Create three SQS queues

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Step 3: Subscribe queues to the topic with filters

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Step 4: Allow SNS to write to SQS queues

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Step 5: Publish a test event

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SQS – Simple Queue Service

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Step 2: Upload API Lambda (enqueue)

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Step 3: Wire Lambda consumer with ReportBatchItemFailures

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Step 4: DLQ alarm

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Hands-On: Order Store with Single-Table Design

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Step 1: Create the table

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Step 2: Write an order

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Step 3: Fetch all orders for a user

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Part 3: Security & Auth

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JWT – Token-Based Authentication

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Lambda Authorizer

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Hands-On: Protect the Order API with Cognito

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Step 1: Create a test user

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Step 2: Sign in and get tokens

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Step 3: Call the protected endpoint

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Step 4: Read the userId in the order Lambda

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Secret Management – SSM Parameter Store & Secrets Manager

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SSM Parameter Store

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Reading Secrets in Lambda

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Hands-On: Migrate Hardcoded Config to SSM

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Step 1: Store the parameters

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Step 2: Grant Lambda access by path

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Step 3: Load all params at cold start with GetParametersByPath

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Step 4: Set up automatic rotation for the payment API key

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Step 5: Reference SSM in serverless.yml

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Hands-On: Push Your First Application Image to ECR

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Step 2: Build the image

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Step 3: Authenticate and push

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Step 5: Set the lifecycle policy

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Hands-On: Deploy the API Service to ECS Fargate

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Step 2: Create the CloudWatch log group

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Step 3: Register the task definition

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Step 4: Create the service

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Step 5: Watch the deployment

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Step 6: Deploy a new version

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Step 7: Debug a running task

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Logs Insights: Production Query Patterns

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Embedded Metric Format (EMF)

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Hands-On: Production Operations Dashboard

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Step 1: Create the dashboard

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dashboard.json structure

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Step 2: Alarm on SQS DLQ depth

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Step 3: Logs Insights saved query for post-incident analysis

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Map State

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WaitForTaskToken

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IAM Role for GitHub Actions

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Security in CI/CD

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Hands-On: Complete CI/CD Pipeline

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Step 2: Create the workflow file

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Step 3: Test the pipeline

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Request Flow: POST /orders with amount > €500 (approval path)

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Data Model: DynamoDB Single-Table (AppData)

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Appendix B – Code Reference

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Config Loading from SSM (Chapter 14)

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DynamoDB Single-Table Helpers (Chapter 12)

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SQS Consumer with ReportBatchItemFailures (Chapter 11)

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serverless.yml (Chapter 6)

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Appendix C – Cost & Limits Reference

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Free Tier Summary (per month, perpetual unless noted)

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Cost Estimates for This Book's Architecture

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Lambda-Heavy (Parts 1–3)

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With ECS Fargate (Part 4)

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