📘 Amazon Route 53 — Complete Guide (Beginner → Advanced)

1️⃣ What is Amazon Route 53?

- **Amazon Route 53** is a **highly available and scalable DNS (Domain Name System) web service**
- It connects:
  - **User requests (domain names)**
  - To **AWS resources** like EC2, ALB, CloudFront, S3, etc.
- It is also used for:
  - **Domain registration**
  - **Health checking**
  - **Traffic routing**

📌 Simple Definition

Route 53 converts human-readable domain names (example.com) into machine-readable IP addresses (IPv4/IPv6).

2️⃣ Why Route 53 is IMPORTANT for Cloud Engineers

- Used in **almost every production AWS architecture**
- Required for:
  - High availability
  - Disaster recovery
  - Multi-region applications
- Core service in:
  - **AWS Solutions Architect**
  - **DevOps**

- **Cloud Engineer**
- Frequently asked in:
  - Interviews
  - Certification exams

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3 Why is it called “Route 53”?

- **Route** → Routes internet traffic
- **53** → DNS uses **port 53 (TCP/UDP)**

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4 What is DNS? (Foundation Concept)

DNS = Phonebook of the Internet

- Humans remember **names** → `google.com`
- Computers understand **IP addresses** → `142.250.182.14`

DNS Flow (Simple)

1. User types `www.example.com`
2. DNS server looks up the name
3. Returns IP address
4. Browser connects to that IP

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5 Core Components of Route 53

A. Domain Registration

- Buy domains directly from AWS
- Example:
  - `mycompany.com`
  - `cloudlab.net`

- AWS becomes your **domain registrar**

B. Hosted Zones

A **Hosted Zone** is a **container for DNS records**

Types of Hosted Zones

1. **Public Hosted Zone**
   - Used for internet-facing domains
   - Example:
     - `www.example.com`
2. **Private Hosted Zone**
   - Used inside a **VPC**
   - Example:
     - `db.internal.local`

📌 One domain = One hosted zone

C. DNS Records (Very Important)

DNS records tell Route 53 **how to respond to DNS queries**.

Common Record Types

Record	Purpose
A	Maps domain → IPv4
AAAA	Maps domain → IPv6
CNAME	Alias to another domain
MX	Mail server
TXT	Verification, SPF
NS	Name servers
SOA	Start of authority

Record	Purpose
Alias	AWS-specific DNS

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6 Alias Record vs CNAME (VERY IMPORTANT)

Alias Record (AWS Special)

- Works like CNAME but **better**
- Can point to:
  - ALB
  - CloudFront
  - S3 Static Website
  - API Gateway
- No extra DNS cost
- Works at **root domain**

CNAME Record

- Cannot be used at root domain
- Adds extra DNS lookup
- Not recommended for AWS resources

📌 **Always use Alias record for AWS services**

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7 Routing Policies (CORE ROUTE 53 FEATURE)

Routing policy decides **how Route 53 responds to DNS queries**.

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1 Simple Routing

- Single resource
- No health check

- Example:
  - One EC2 server

📌 Used for basic websites

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2 Weighted Routing

- Split traffic by percentage
- Example:
  - EC2-1 → 70%
  - EC2-2 → 30%

Use cases:

- A/B testing
- Gradual deployment

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3 Latency-Based Routing

- Routes user to **lowest latency region**
- Example:
  - US users → us-east-1
  - Europe users → eu-west-1

Used for:

- Global applications

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4 Failover Routing (Disaster Recovery)

- Primary + Secondary
- Health checks enabled
- If primary fails → traffic goes to secondary

Used for:

- High availability
- DR architectures

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5 Geolocation Routing

- Routes traffic based on **user location**
- Example:
  - India users → India server
  - US users → US server

Use cases:

- Compliance
- Localization

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6 Geoproximity Routing (Advanced)

- Routes traffic based on **distance**
- Requires **Traffic Flow**
- Can shift traffic using **bias**

Used for:

- Advanced global control

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7 Multi-Value Answer Routing

- Returns multiple healthy IPs
- Client chooses one
- Improves availability

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8 Health Checks

Route 53 can monitor the health of:

- EC2 instances
- Load balancers
- Any public endpoint

Health Check Types

- HTTP
- HTTPS
- TCP

Health Check Features

- Automatic failover
- CloudWatch integration
- Alarms

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9 Route 53 + AWS Services Integration

Route 53 integrates with:

- EC2
- Application Load Balancer
- Network Load Balancer
- CloudFront
- S3 Static Website
- API Gateway
- Elastic Beanstalk

📌 This makes it a **central traffic controller**

🔟 Route 53 Private DNS (VPC DNS)

- Used inside VPC
- No public internet access
- Useful for:
  - Microservices
  - Internal APIs
  - Databases

Example:

```
db.myapp.internal
```

1️⃣1️⃣ Route 53 Traffic Flow (Advanced)

- Visual DNS routing editor
- Create complex routing logic
- Combine:
  - Latency
  - Failover
  - Geo rules

Used in:

- Enterprise architectures

1️⃣2️⃣ Security in Route 53

- IAM permissions for DNS management
- DNSSEC support (Domain Name System Security Extensions)
- Prevent DNS spoofing

13 Pricing Model (Basic Understanding)

You pay for:

- Hosted zones
- DNS queries
- Health checks
- Traffic Flow policies

📌 Alias records are **free**

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14 Route 53 Use Cases (Real World)

- Hosting a public website
- Multi-region failover
- Global SaaS applications
- Disaster recovery
- Blue/Green deployments
- Hybrid cloud DNS

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15 Common Interview Questions

- Difference between CNAME and Alias?
- Which routing policy supports DR?
- Can Route 53 work without AWS resources?
- How does health check failover work?
- Root domain vs subdomain routing?

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16 Beginner → Advanced Learning Path (Recommended)

Beginner

- DNS basics
- Hosted zones
- A / Alias records

Intermediate

- Routing policies
- Health checks
- ALB integration

Advanced

- Multi-region routing
- Traffic Flow
- DNSSEC
- Private hosted zones

1️⃣7️⃣ Next Step (Hands-on Labs – IMPORTANT)

After theory, **labs are mandatory**.

I recommend next labs:

1. Create public hosted zone
2. Route domain to EC2
3. Route to ALB using Alias
4. Configure failover routing
5. Latency-based routing (multi-region)
6. Private hosted zone inside VPC

📄 Amazon Route 53 Records, Hosted Zones & DNS Entries (Beginner → Clear Mastery)

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1 What is a Hosted Zone?

A **Hosted Zone** is a **DNS database** in Route 53 that contains **DNS records** for a domain.

📌 Think of it as:

A **folder** that holds all DNS entries for one domain.

Types of Hosted Zones

🔹 Public Hosted Zone

- Used for **internet-facing domains**
- Accessible from anywhere on the internet
- Example:

```
example.com
www.example.com
```

Used for:

- Websites
- Public APIs
- SaaS applications

🔹 Private Hosted Zone

- Used **inside a VPC**
- Not accessible from the internet
- Used for **internal services**

Example:

```
db.myapp.internal
```

```
api.backend.local
```

Used for:

- Microservices
- Databases
- Internal APIs

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2 What is a DNS Record?

A **DNS record** tells Route 53 **how to answer DNS queries**.

📌 Example:

When someone asks for `www.example.com`, what should Route 53 return?

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3 Common Route 53 DNS Record Types (Most Important)

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1 A Record (Address Record)

- Maps **domain name → IPv4 address**
- Most commonly used record

Example:

```
www.example.com → 54.210.123.10
```

Use case:

- EC2 instance with public IP

2 AAAA Record

- Maps **domain name → IPv6 address**

Example:

```
www.example.com → 2001:db8::ff00:42
```

Use case:

- IPv6-enabled resources

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3 CNAME Record (Canonical Name)

- Maps one domain to **another domain name**
- Cannot be used at **root domain**

Example:

```
app.example.com → my-alb-123.us-east-1.elb.amazonaws.com
```

Limitations:
❌ Cannot use for `example.com`
❌ Extra DNS lookup

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4 Alias Record (AWS Special ⭐)

- AWS replacement for CNAME
- Works at **root domain**
- No extra cost
- Automatically updates IPs

Can point to:

- ALB / NLB

- CloudFront
- S3 Static Website
- API Gateway

Example:

```
example.com → ALB
```

📌 Always use Alias for AWS services

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5 MX Record (Mail Exchange)

- Defines **mail server**
- Used for email delivery

Example:

```
example.com → mail.example.com
```

Used with:

- Amazon SES
- Google Workspace
- Microsoft 365

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6 TXT Record

- Stores **text-based info**
- Used for verification

Use cases:

- SPF
- DKIM
- Domain ownership verification

Example:

```
"v=spf1 include:amazonses.com ~all"
```

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7 NS Record (Name Server)

- Tells **which DNS servers** are authoritative
- Automatically created by Route 53

Example:

```
ns-123.awsdns-45.net
```

📌 Must be copied to domain registrar

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8 SOA Record (Start of Authority)

- DNS administrative info
- Automatically managed by AWS

Contains:

- Primary name server
- TTL
- Refresh timing

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9 PTR Record (Reverse DNS)

- Maps **IP → domain name**
- Used for email reputation

Less common in Route 53

4 DNS Entries Explained (Simple)

A **DNS entry** is simply:

A record inside a hosted zone

Example DNS Entries:

Name	Type	Value
example.com	A (Alias)	ALB
www.example.com	A	54.1.2.3
mail.example.com	MX	mail server
_amazonses.example.com	TXT	verification

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5 Root Domain vs Subdomain

Root Domain

```
example.com
```

- Cannot use CNAME
- Must use Alias or A record

Subdomain

```
www.example.com
api.example.com
```

- Can use CNAME
- Can use Alias

6 TTL (Time To Live)

TTL defines **how long DNS responses are cached**

Example:

```
TTL = 300 seconds
```

Effects:

- Low TTL → fast changes, more cost
- High TTL → slower changes, less cost

📌 Use low TTL during migration

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7 Routing Policies with Records

Each DNS record can use a **routing policy**:

- Simple
- Weighted
- Latency
- Failover
- Geolocation
- Geoproximity
- Multi-value

📌 Routing policy controls **which record is returned**

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8 Health Checks + Records

- Route 53 can check resource health
- Only healthy records are returned

- Used in:
  - Failover routing
  - Multi-value routing

Example:

```
Primary EC2 → healthy
Secondary EC2 → unhealthy
```

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9 Public vs Private DNS Example

Public Hosted Zone

```
www.example.com → 3.91.12.44
```

Private Hosted Zone

```
db.example.local → 10.0.2.15
```

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10 Real-World Architecture Example

```
User
 ↓
Route 53
 ↓
Alias Record
 ↓
Application Load Balancer
 ↓
EC2 Instances
```

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11 Common Beginner Confusion (Important)

Confusion	Correct Concept
Hosted zone = domain	Hosted zone holds records
Alias = CNAME	Alias is better
DNS = IP only	DNS has many record types

Confusion	Correct Concept
Route 53 only for AWS	Works with non-AWS too

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12 Interview-Ready Summary

- **Hosted Zone** → DNS container
- **Record** → DNS instruction
- **DNS Entry** → One record inside zone
- **Alias** → AWS optimized record
- **TTL** → Cache duration
