Resiliency | Continuity | Durability | Observability | Infrastructure as Code | Cost-aware

Multi-Region Disaster Recovery on AWS (IaC)

🚀 Resiliency • 🔁 Regional Failover • 🛡️ Durability • 📈 Observability • ⚙️ Infrastructure as Code

About this Project

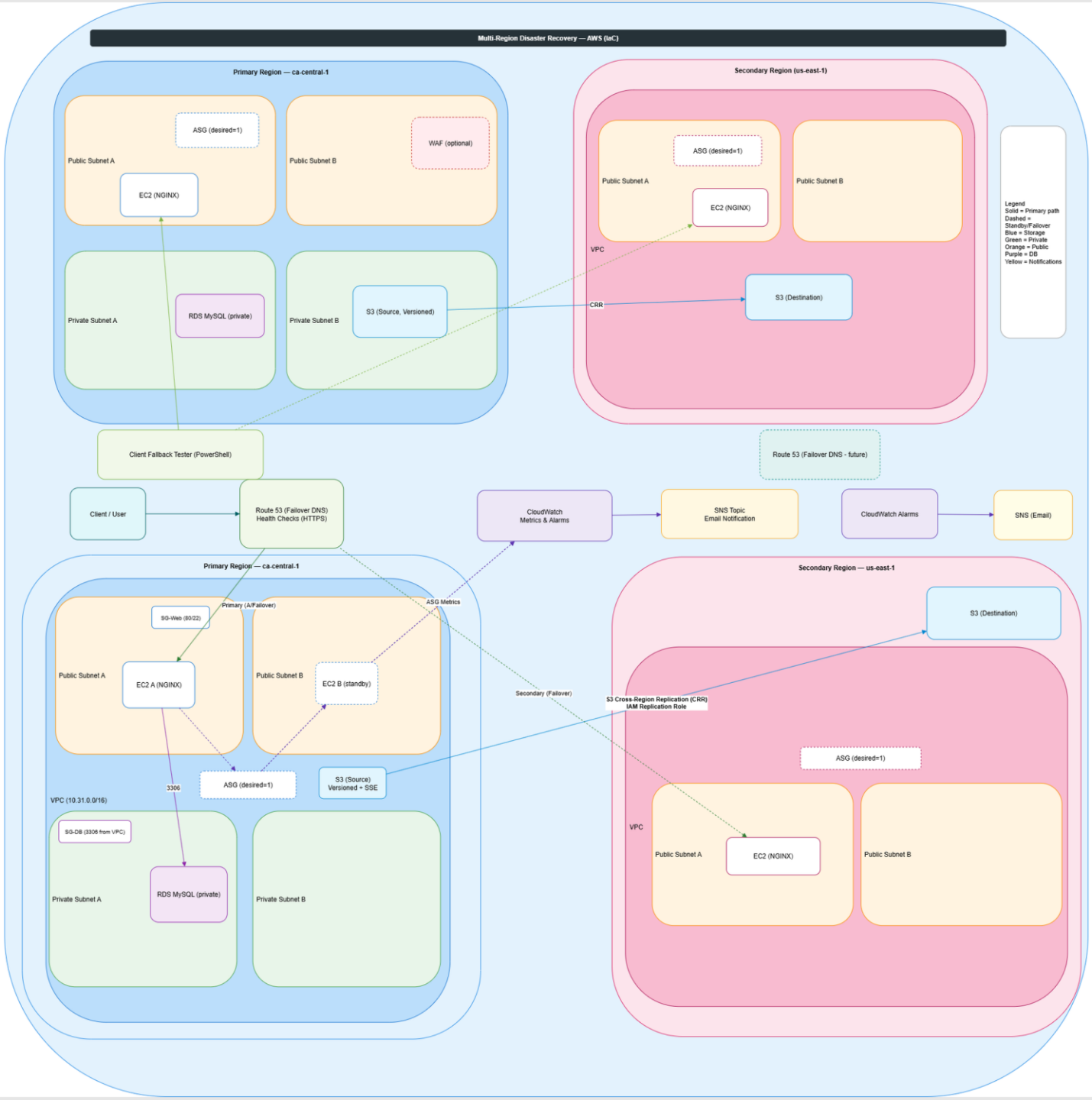
- 🧭 What: Cost-aware DR blueprint across two AWS regions
- 🎯 Goal: Maintain continuity during regional incidents
- 📐 Pattern: Active/standby with automated healing
- 🔧 All IaC with CloudFormation for consistency

What I Built

- 🧱 VPC + EC2/ASG in ca-central-1 and us-east-1
- 🔁 S3 Cross-Region Replication (versioned, encrypted)
- 🗄️ Optional RDS MySQL in private subnets
- 📣 CloudWatch → SNS alarms (ASG, EC2 CPU)
- 🧪 Client-side failover tester (200 OK on secondary)

EXECUTIVE SUMMARY

- 🚀 Resiliency: Active/standby across ca-central-1 & us-east-1 (ASG desired=1)
- 🔁 Continuity: Client tester validates failover to secondary (200 OK)
- 🛡️ Durability: S3 CRR (versioned, encrypted) with least-privilege role
- 📈 Observability: CloudWatch alarms → SNS email notifications
- ⚙️ IaC: CloudFormation for reproducible environments
- 💸 Cost-aware: t3.micro, Single-AZ demo, no NAT/ALB


Multi-Region Disaster Recovery — AWS (IaC)
Primary Region — ca-central-1
Public Subnet A
ASG (desired=1)
EC2 (NGINX)
Public Subnet B
WAF (optional)
Private Subnet A
RDS MySQL (private)
Private Subnet B
S3 (Source, Versioned)
Secondary Region (us-east-1)
Public Subnet A
ASG (desired=1)
EC2 (NGINX)
Public Subnet B
VPC
S3 (Destination)
CRR
Legend
Solid = Primary path
Dashed = Standby/Failover
Blue = Storage
Green = Private
Orange = Public
Purple = DB
Yellow = Notifications
Client Failback Tester (PowerShell)
Route 53 (Failover DNS - future)
Client / User
Route 53 (Failover DNS)
Health Checks (HTTPS)
CloudWatch
Metrics & Alarms
SNS Topic
Email Notification
CloudWatch Alarms
SNS (Email)
Primary Region — ca-central-1
Primary (A/Failover)
ASG Metrics
SG-Web (80/22)
Public Subnet A
EC2 A (NGINX)
Public Subnet B
EC2 B (standby)
Secondary (Failover)
S3 Cross-Region Replication (CRR)
IAM Replication Role
3306
ASG (desired=1)
S3 (Source)
Versioned + SSE
VPC (10.31.0.0/16)
SG-DB (3306 from VPC)
Private Subnet A
RDS MySQL (private)
Private Subnet B
Secondary Region — us-east-1
S3 (Destination)
ASG (desired=1)
VPC
Public Subnet A
EC2 (NGINX)
Public Subnet B

BUILDING BLOCKS

🧱 Networking: Custom VPC (10.31.0.0/16), public/private subnets (2 AZs)

💻 Compute: EC2 + Launch Template + Auto Scaling Group (1/1/1)

🗄️ Storage: S3 (primary) → S3 (secondary) via CRR

🗃️ Database (Optional): RDS MySQL in private subnets (primary)

🔔 Monitoring: CloudWatch metrics & alarms → SNS email

REGIONAL CONTINUITY DEMONSTRATION

Primary Serving (HTTP 200)

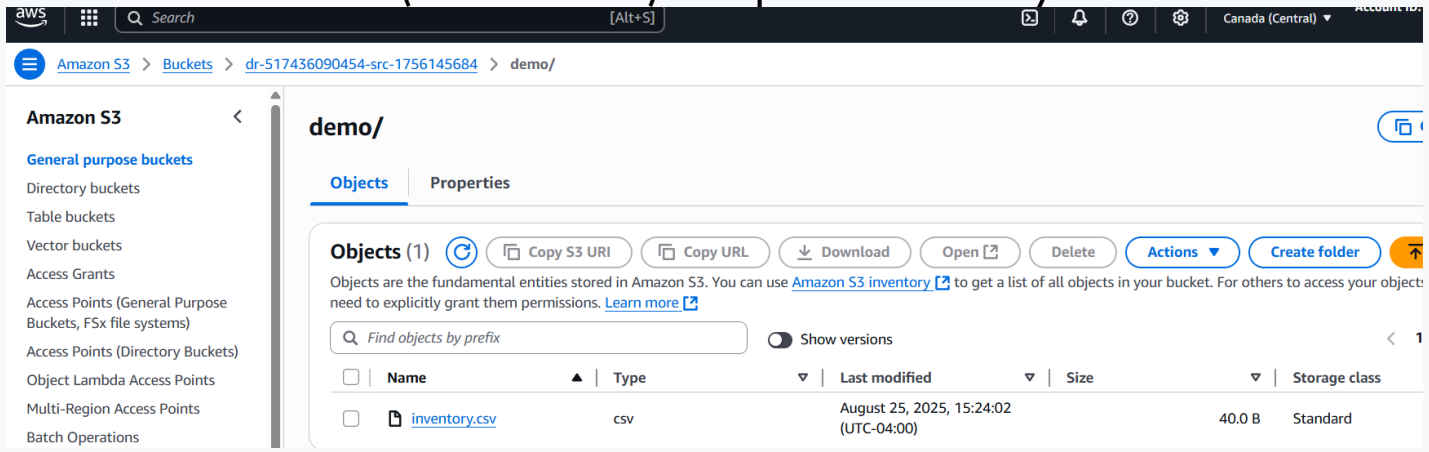
```
PS C:\Users\mansh\OneDrive\Desktop\AWS Projects\Project1-DR-Architecture> .\demo\failover_tester.ps1 `
PS C:\Users\mansh\OneDrive\Desktop\AWS Projects\Project1-DR-Architecture> .\demo\failover_tester.ps1 `
>>   -Primary  ("http://{0}/" -f $PRIMARY_DNS) `
>>   -Secondary ("http://{0}/" -f $SECONDARY_DNS)
2025-08-25T12:49:54.7199122-04:00 PRIMARY OK 200
2025-08-25T12:49:59.7633483-04:00 PRIMARY OK 200
2025-08-25T12:50:04.8161751-04:00 PRIMARY OK 200
2025-08-25T12:50:09.8770862-04:00 PRIMARY OK 200
2025-08-25T12:50:14.9147489-04:00 PRIMARY OK 200
2025-08-25T12:50:19.9532698-04:00 PRIMARY OK 200
2025-08-25T12:50:25.0207285-04:00 PRIMARY OK 200
2025-08-25T12:50:30.0618400-04:00 PRIMARY OK 200
2025-08-25T12:50:35.1239875-04:00 PRIMARY OK 200
```

Secondary Serving After Simulated Outage

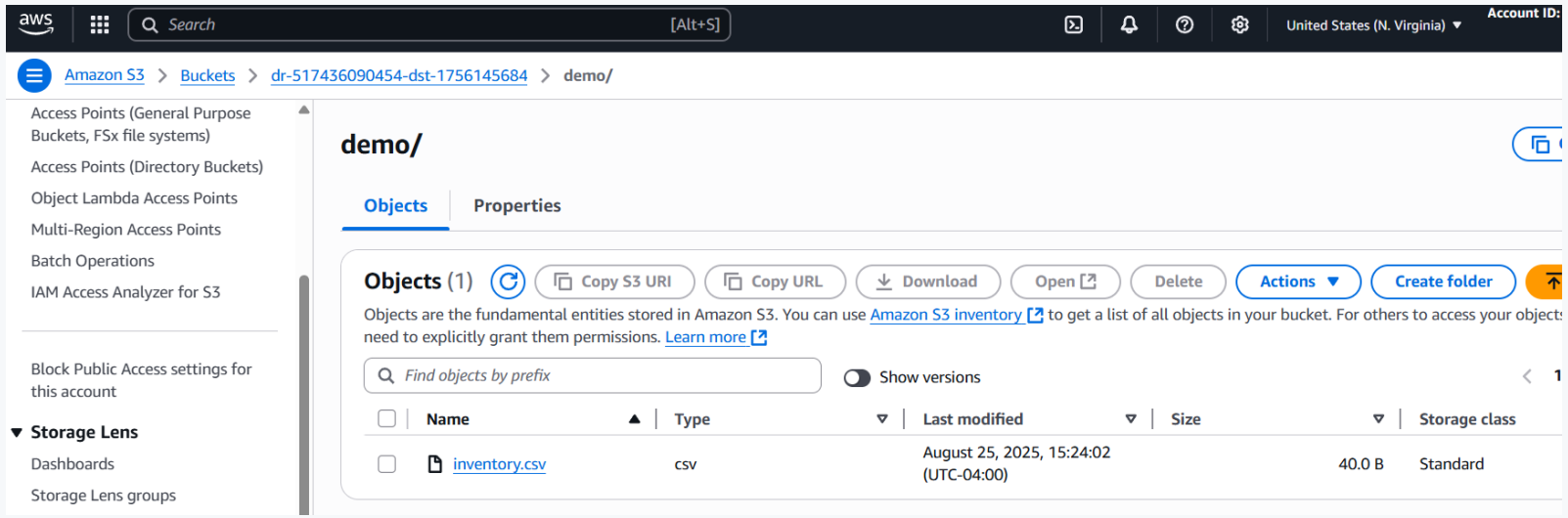
```
PS C:\Users\mansh\OneDrive\Desktop\AWS Projects\Project1-DR-Architecture> .\demo\failover_tester.ps1 `
>>   -Primary  ("http://{0}/" -f $PRIMARY_DNS) `
>>   -Secondary ("http://{0}/" -f $SECONDARY_DNS)
WARNING: 2025-08-25T12:57:17.2705934-04:00 PRIMARY FAIL -> fallback
2025-08-25T12:57:17.3497305-04:00 SECONDARY OK 200
WARNING: 2025-08-25T12:57:25.3513294-04:00 PRIMARY FAIL -> fallback
2025-08-25T12:57:25.3991974-04:00 SECONDARY OK 200
WARNING: 2025-08-25T12:57:33.4276392-04:00 PRIMARY FAIL -> fallback
2025-08-25T12:57:33.4898906-04:00 SECONDARY OK 200
WARNING: 2025-08-25T12:57:41.5027209-04:00 PRIMARY FAIL -> fallback
2025-08-25T12:57:41.5619472-04:00 SECONDARY OK 200
WARNING: 2025-08-25T12:57:49.5845636-04:00 PRIMARY FAIL -> fallback
2025-08-25T12:57:49.6343482-04:00 SECONDARY OK 200
WARNING: 2025-08-25T12:57:57.6604976-04:00 PRIMARY FAIL -> fallback
2025-08-25T12:57:57.7305736-04:00 SECONDARY OK 200
WARNING: 2025-08-25T12:58:05.7473337-04:00 PRIMARY FAIL -> fallback
2025-08-25T12:58:05.8094018-04:00 SECONDARY OK 200
WARNING: 2025-08-25T12:58:13.8254386-04:00 PRIMARY FAIL -> fallback
2025-08-25T12:58:13.8801785-04:00 SECONDARY OK 200
WARNING: 2025-08-25T12:58:21.9055894-04:00 PRIMARY FAIL -> fallback
```

DATA DURABILITY — S3 CROSS-REGION REPLICATION

Source Bucket (ca-central-1) — upload inventory.csv

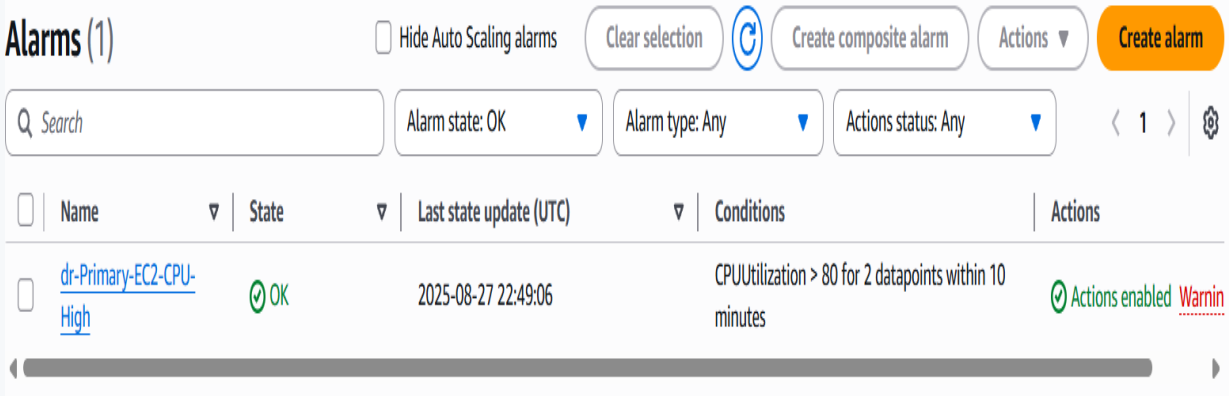


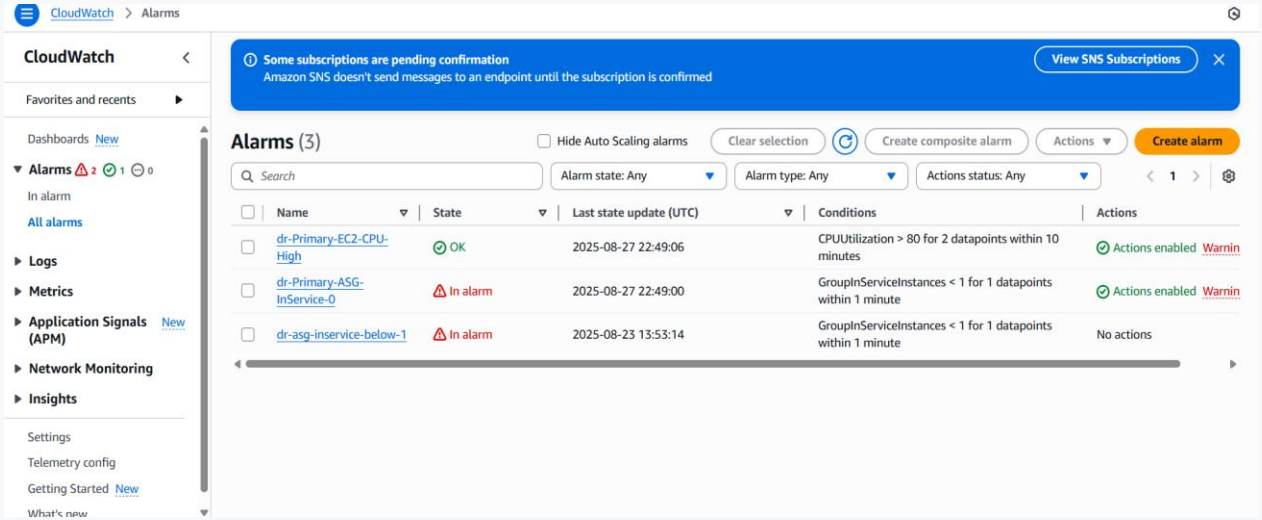
Destination Bucket (us-east-1) — replicated object



MONITORING & ALERTS — CLOUDWATCH + SNS

ASG InService < 1 → ALARM





Email Notification via SNS Topic

ALARM: "dr-Primary-ASG-InService-0" in Canada (Central)

You are receiving this email because your Amazon CloudWatch Alarm "dr-Primary-ASG-InService-0" in the Canada (Central) region has entered the ALARM state, because "Threshold Crossed: no datapoints were received for 1 period and 1 missing datapoint was treated as [Breaching]." at "Wednesday 27 August, 2025 22:49:00 UTC".

AWS Notifications 6:49 PM
To: manashri >

OK: "dr-Primary-EC2-CPU-High" in Canada (Central)

You are receiving this email because your Amazon CloudWatch Alarm "dr-Primary-EC2-CPU-High" in the Canada (Central) region has entered the OK state, because "Threshold Crossed: 2 out of the last 2 datapoints [0.16941581201554753 (27/08/25 22:44:00), 0.14335135499206428 (27/08/25 22:39:00)] were not greater than the threshold (80.0) (minimum 1 datapoint for ALARM -> OK transition)." at "Wednesday 27 August, 2025 22:49:06 UTC".

OPTIONAL: RDS CONNECTIVITY

- 🗃️ RDS MySQL in private subnets (primary)
- 🔐 Security group restricts 3306 to VPC CIDR
- ✅ Verified connectivity from EC2; seeded sample rows

```
Query OK, 2 rows affected (0.009 sec)
Records: 2  Duplicates: 0  Warnings: 0

MySQL [appdb]> SELECT * FROM items;
+----+------+--------+------+
| id | sku  | name   | qty  |
+----+------+--------+------+
|  1 | 1001 | widget |    5 |
|  2 | 1002 | gizmo  |    9 |
+----+------+--------+------+
2 rows in set (0.001 sec)

MySQL [appdb]> EXIT;
Bye
```

KEY RESULTS

- 🤖 Automated healing: ASG replaces terminated instances
- 🌐 Regional continuity: Secondary serves during simulated outage
- 🔁 Durable objects: S3 CRR verified across regions
- 📣 Operational signaling: Alarms + notifications validated

NEXT STEPS

- 🧭 Route 53 Failover + health checks
- ⚖️ Add ALB with health checks
- 🔁 CI/CD for templates; gated releases
- 🕵️ Synthetics canaries; dashboards

REPOSITORY & CONTACT

📦 GitHub: https://github.com/Manshree-cloud/aws-multiregion-dr-architecture

🗺️ Diagram: diagrams/Project1-MultiRegion-DR.drawio

🖼️ Screenshots: demo/failover-test-screenshots/

💬 Contact: www.linkedin.com/in/manshree-patel