

AWS re:Invent

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Build for resilience using Amazon Route 53 Application Recovery Controller

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Agenda

1. How AWS approaches high availability
2. Building resilient applications in the cloud
3. What is Amazon Route 53 Application Recovery Controller (ARC)?
4. Hands-on workshop on Route 53 ARC

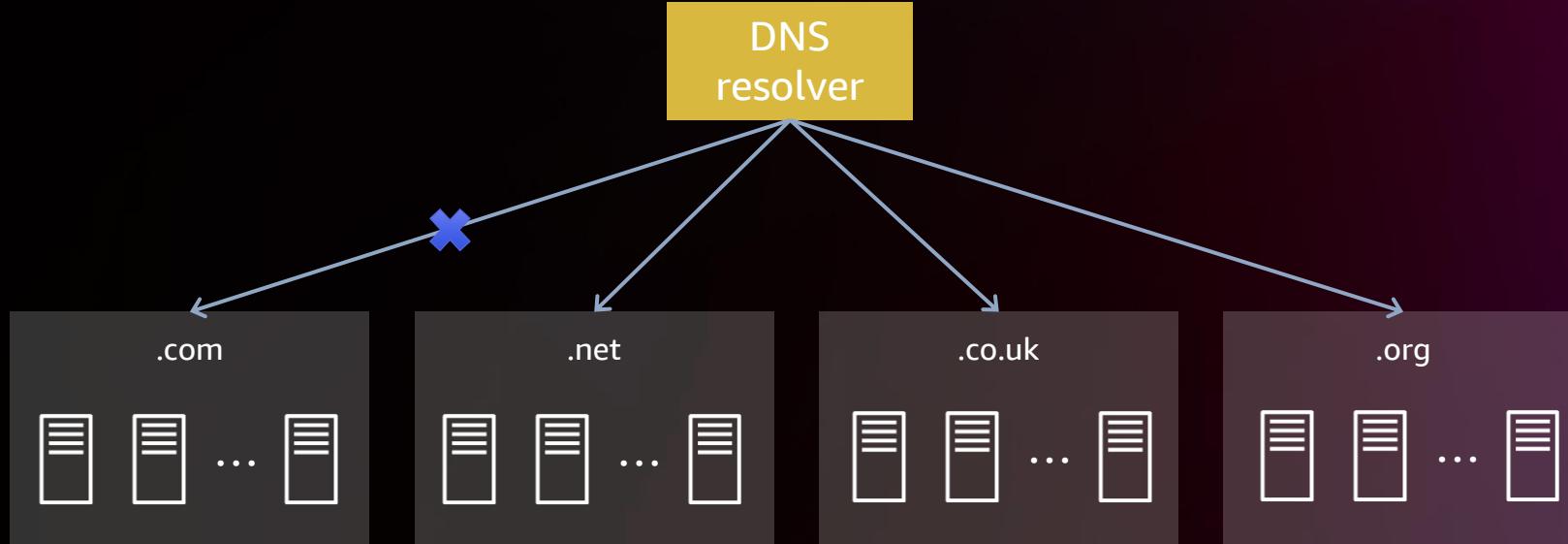
“Everything fails, all the time”

Werner Vogels
VP and CTO, Amazon.com



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Design for failure – Amazon Route 53

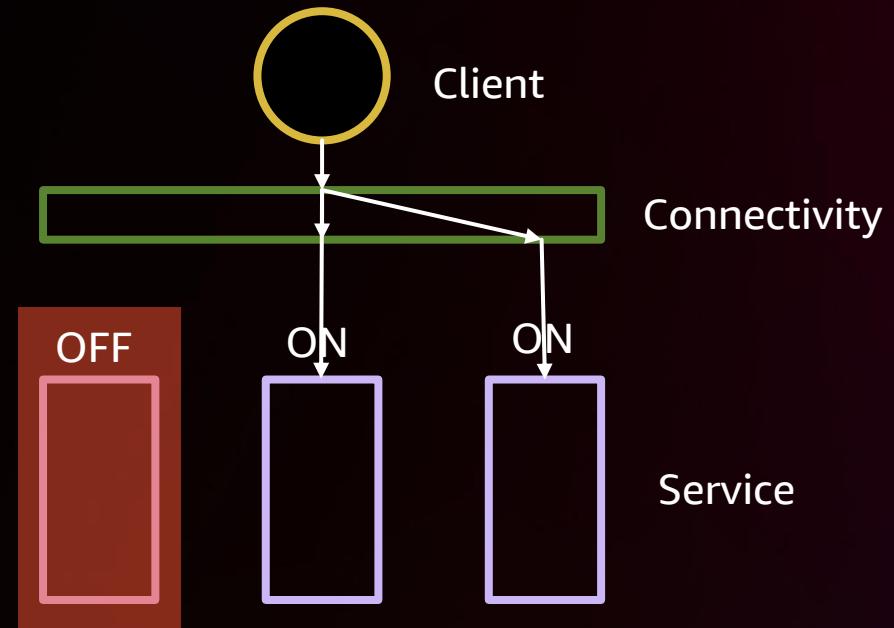


AWS Architecture Blog: “A Case Study in Global Fault Isolation”

<https://aws.amazon.com/blogs/architecture/a-case-study-in-global-fault-isolation/>

Design for application failures

- Anticipate application failures
- Apply cellular architecture – Isolate and contain failures
- Build and leverage robust failure recovery mechanisms



Design for application failures – Challenges

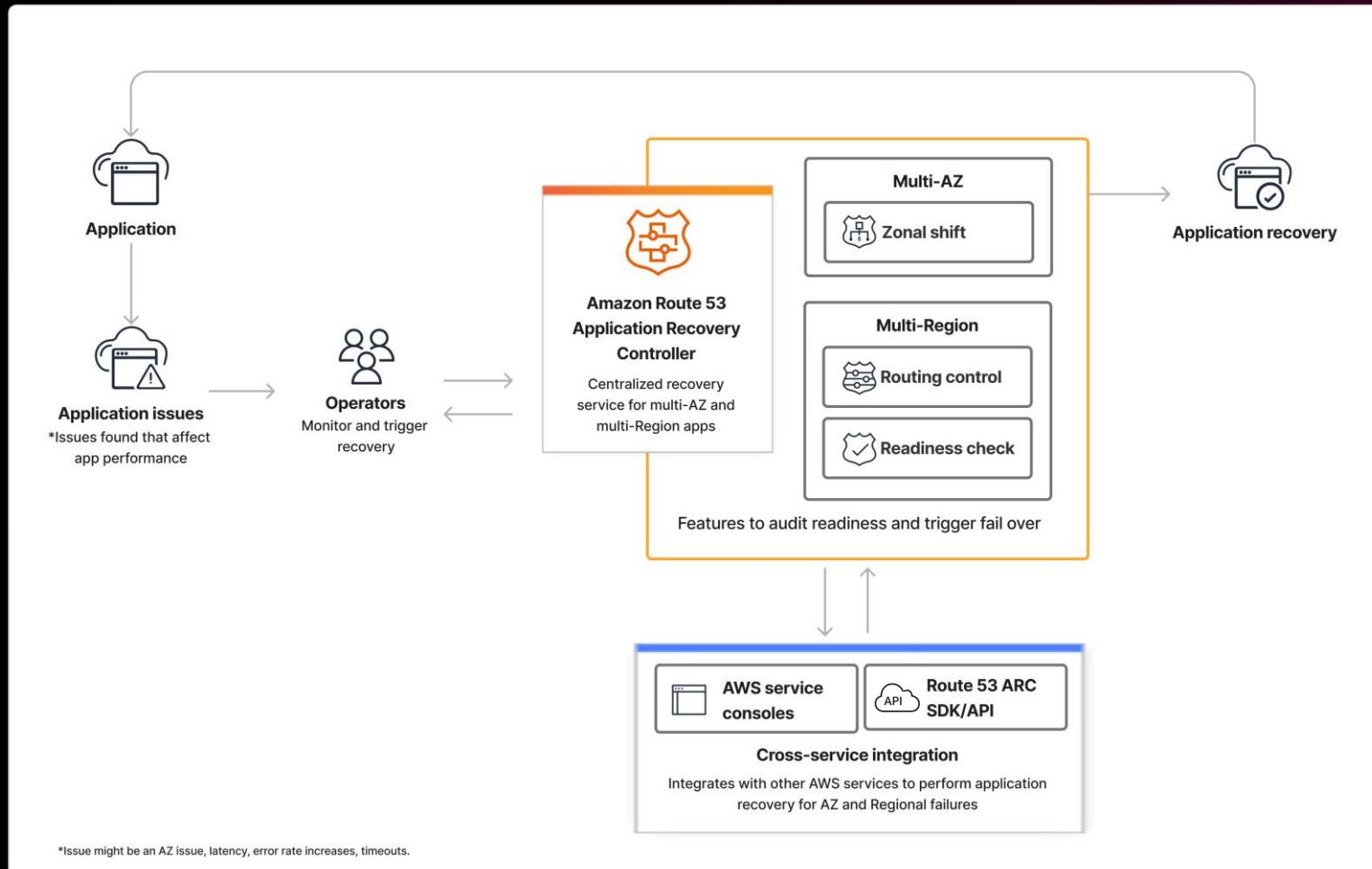
- Recovery mechanisms need to be reliable
- Cell replicas need to be properly scaled and configured
- Strict recovery time objective (RTO) and recovery point objective (RPO) require solid automation and processes

Amazon Route 53 Application Recovery Controller



Centralized, safe, and reliable way to manage cross-region
and cross-AZ recovery

How does Route 53 ARC work?



Multi-AZ key capabilities

Zonal shift (in preview) is a capability that enables customer to reliably recover from an application failure in an AZ by temporarily shifting the application away from the AZ



ARC zonal shift

- Grant access and go – Zonal shift is available for ALB and NLB with cross-zone load balancing off with no cost
- Built-in safety rule – Zonal shift prevents you from accidentally moving application traffic away from more than 1 AZ

Key capabilities



Zonal Shift

- Start/Update/Cancel zonal shift
- Resource level



Auto Expiration

- Customizable auto expiration time for up to 3 days



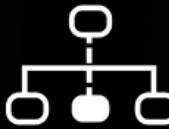
Safety Rules

- Prevent disabling the same resource from more than one AZ

How does a zonal shift work?



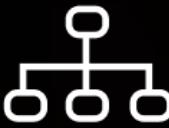
The health checks are passing but the synthetic monitoring on the ALB's or NLB's zonal endpoint indicates an increase in latency in a zone



Start zonal shift to move traffic out from the AZ



Investigate and fix issue in the AZ



Cancel zonal shift to resume the traffic to the AZ

Zonal shift for AZ recovery



Zonal shift for AZ recovery



Zonal shift for AZ recovery

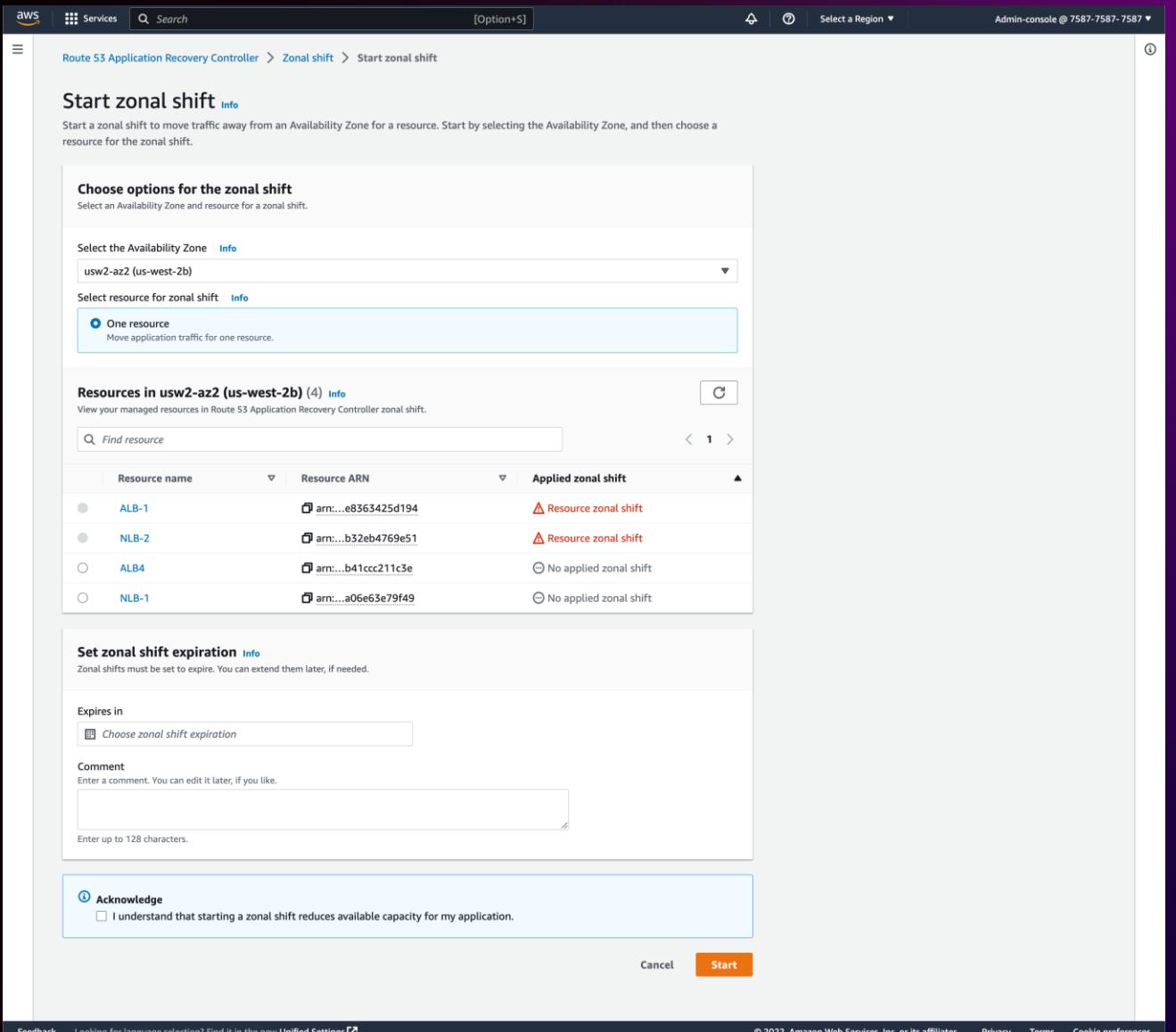


Navigate to Route 53 Application Recovery Controller

The screenshot shows the AWS Route 53 Application Recovery Controller (ARC) console. The left sidebar menu includes 'Get started', 'Multi-AZ New' (with 'Zonal shift' selected), 'Multi-region', 'Routing control', 'Clusters', 'Readiness check', 'Resource sets', and 'Readiness rules'. The main content area is titled 'Zonal shift' and shows 'Active zonal shifts (0)'. It includes buttons for 'Update zonal shift', 'Cancel zonal shift', and 'Start zonal shift'. A search bar and a table with columns 'Zonal shift ID', 'Applied to', 'Away from', 'Expiration time', 'Last modified', and 'Comment'. Below this, a message states 'No active zonal shifts' and 'No active zonal shifts to be displayed'. A 'Start zonal shift' button is available. The 'Resources' section shows 7 items: 'BackupLB', 'BillingLB', 'FrontendLB', 'InternalLB', 'ProdPL', 'RecaLB', and 'ZeleLB', all listed under the 'ELB' service. Each item has a 'Resource ARN' and a 'Zonal shift status' column showing 'No zonal shift' with a circular icon. The bottom of the page includes a feedback link, language selection (English (US)), copyright information (© 2008 - 2019, Amazon Web Services, Inc. or its affiliates. All rights reserved.), and links to 'Privacy Policy' and 'Terms of Use'.



Shift resources away from an AZ



The screenshot shows the 'Start zonal shift' page in the AWS Route 53 Application Recovery Controller. The top navigation bar includes the AWS logo, 'Services' (with 'Route 53' selected), a search bar, and a 'Select a Region' dropdown set to 'Admin-console @ 7587-7587-7587'. The main content area is titled 'Start zonal shift' with a sub-section 'Choose options for the zonal shift'. It prompts the user to 'Select an Availability Zone and resource for a zonal shift'. Under 'Select the Availability Zone', 'usw2-az2 (us-west-2b)' is selected. Under 'Select resource for zonal shift', 'One resource' is chosen, with a note 'Move application traffic for one resource'. Below this, a table lists 'Resources in usw2-az2 (us-west-2b)' with four items: ALB-1, NLB-2, ALB4, and NLB-1. Each item has an 'ARN' column and an 'Applied zonal shift' column showing 'Resource zonal shift' for the first two. The 'Set zonal shift expiration' section allows setting an expiration time and entering a comment. A note at the bottom states 'I understand that starting a zonal shift reduces available capacity for my application'. At the bottom right are 'Cancel' and 'Start' buttons.



Safety rule

AWS Services Search for services, service features, Marketplace products, docs, and more+S N. Virginia MyRole/AWSUser ⓘ

Amazon Route 53 Application Recovery Controller > Zonal shift > Resource: BillingLB

BillingLB

A resource-level zonal shift is currently active in **usw2-az2**. You can't start a zonal shift on a resource in more than 1 Availability Zone at a time unless you cancel the one below.

Applied zonal shift [Info](#)

Each resource can only have one active resource-level zonal shift at a time.

Zonal shift ID	Expiration time	Comment	Last modified time
12345678	Expires in about 6 hours	Alarm in zone, weighing out while we root cause the problem.	July 27, 2022 at 3:59:00 PM UTC-4

[Update zonal shift](#) [Cancel zonal shift](#) [Start zonal shift](#)

Resource details [Open in ELB console](#)

Service	Resource ARN
ELB	arn:aws:loadbalancer/net/billing-lb/89ef606adbecbfb0

▼ AZs resource is deployed in (4)

Availability Zone	Zonal shift status
usw2-az1	ⓘ No zonal shift
usw2-az2	⚠ Active resource-level zonal shift
usw2-az3	ⓘ No zonal shift
usw2-az4	ⓘ No zonal shift

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Best practices of zonal shift

- Turn off cross-zone load balancing for your ALB and NLB
- Provision sufficient capacity in each AZ to withstand the loss of capacity in one AZ
- Ensure all zonal replicas are healthy and taking traffic
- Test in advance
- Practice using the API/CLI

Multi-Region key capabilities



Routing
controls



Safety rules



Readiness
check

Use cases

1. Mitigation of failures: Greater control over multi-Region recovery mechanisms
2. Recovery-oriented apps: Build and manage apps that can **recover within minutes** from almost all failures
3. Central control over application recovery operations across organizations

Feature 1: Routing controls

1. Reliable – Your routing controls are durably stored in five AWS Regions and can be changed through any one of five unique Regional endpoints
2. Single tenant – Your routing controls are hosted on Amazon EC2; changes to your routing control effect changes through Route53 data plane (100% availability SLA)

Feature 1: Routing control

On/off switches that can be used in place of health checks



Routing controls stored in 5 different Regions

Route 53 > Application Recovery Controller > Routing control > Clusters > ExampleCluster

ExampleCluster

[Edit](#) [Delete](#)

Details	
ARN	arn:aws:route53-recovery-control::888985619221:cluster/4f95dd99-f080-4818-b3f9-84eb68f67f0b
Status	Deployed

Endpoints	
API endpoint	Region
https://4db2db90.route53-recovery-cluster.ap-southeast-2.amazonaws.com/v1	ap-southeast-2
https://01b17431.route53-recovery-cluster.us-east-1.amazonaws.com/v1	us-east-1
https://30e5f662.route53-recovery-cluster.eu-west-1.amazonaws.com/v1	eu-west-1
https://8dac7183.route53-recovery-cluster.ap-northeast-1.amazonaws.com/v1	ap-northeast-1
https://78668518.route53-recovery-cluster.us-west-2.amazonaws.com/v1	us-west-2

Feature 2: Safety rules

Safety rules

Customer-configurable rules that set pre-conditions when making changes to routing controls

What are examples of safety rules?

Avoid turning off all the Regions for an application at the same time

Feature 3: Readiness check

Recovery group

Assessment criteria	Cell 1: Primary Region	Cell 2 : Standby Region
Provisioned capacity	500 RCU and 800 WCU	
Resource limits	DynamoDB read throughput limits not matched Remediation in progress	
Replication latency	RPO>30 seconds	
Custom readiness checks	<Custom CloudWatch alarm>	

Checks can also be used for migration between Regions and/or accounts

Hands-on workshop



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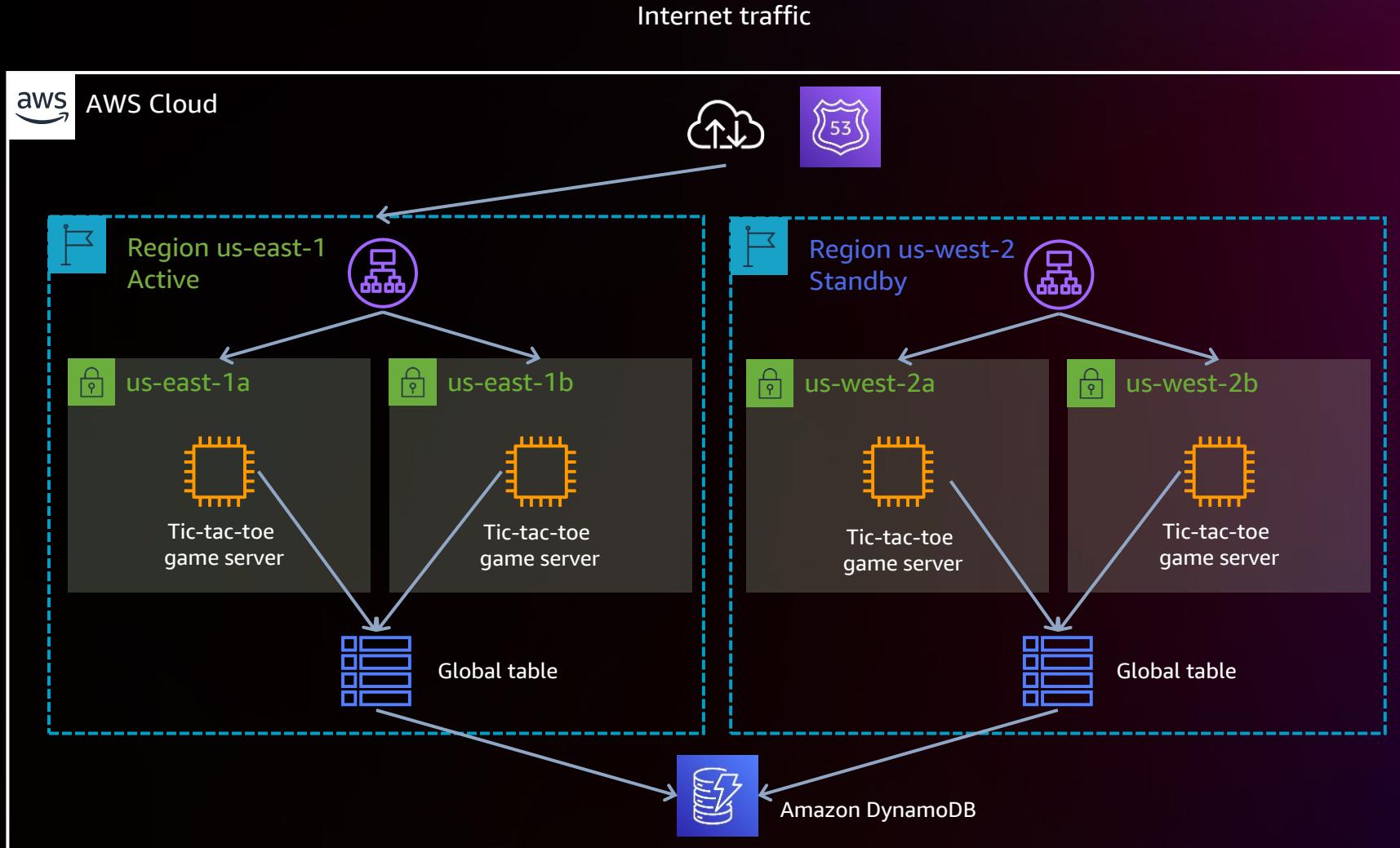
Let's build!

Download the code and instructions from <https://tinyurl.com/ya2kzb44>

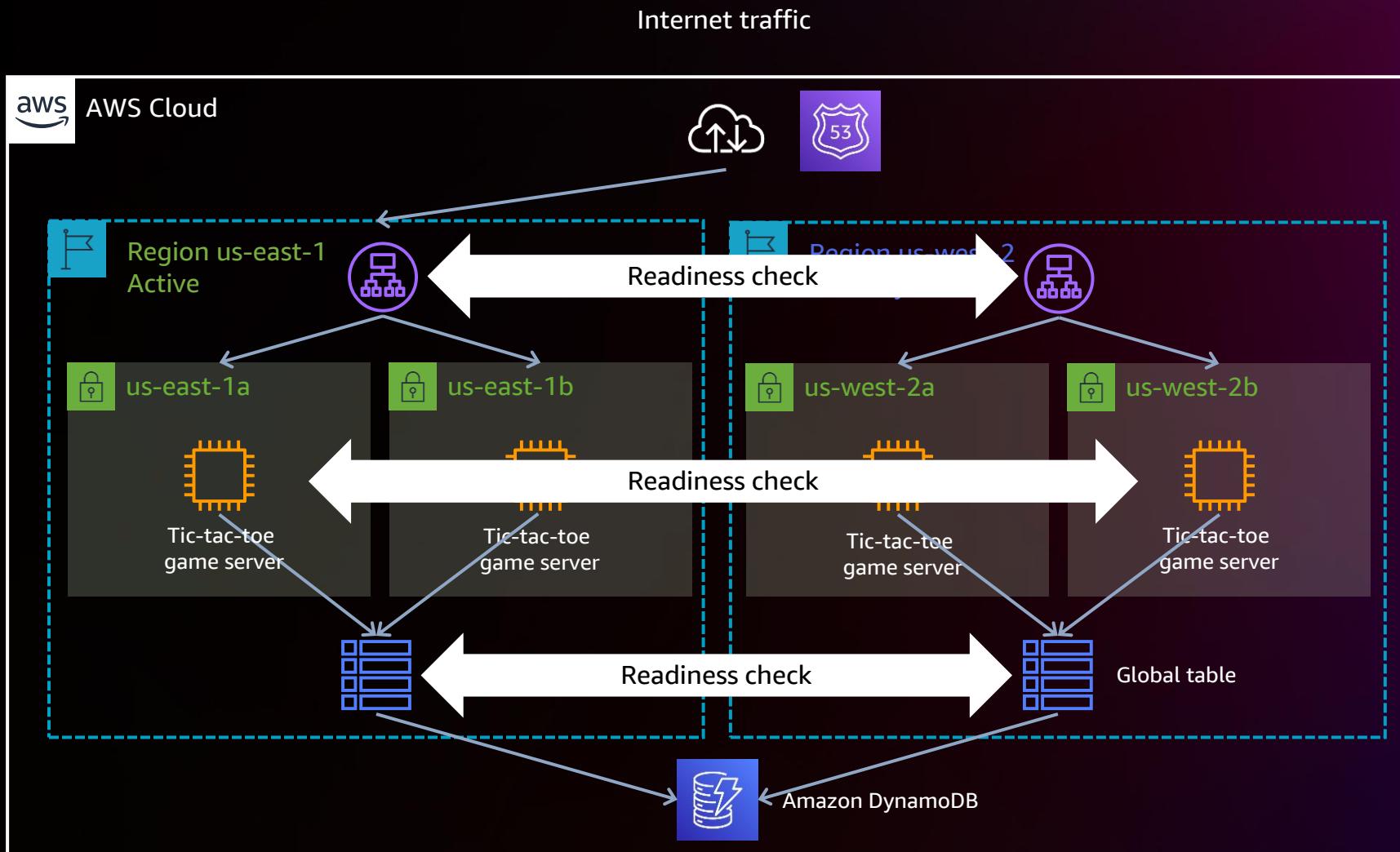


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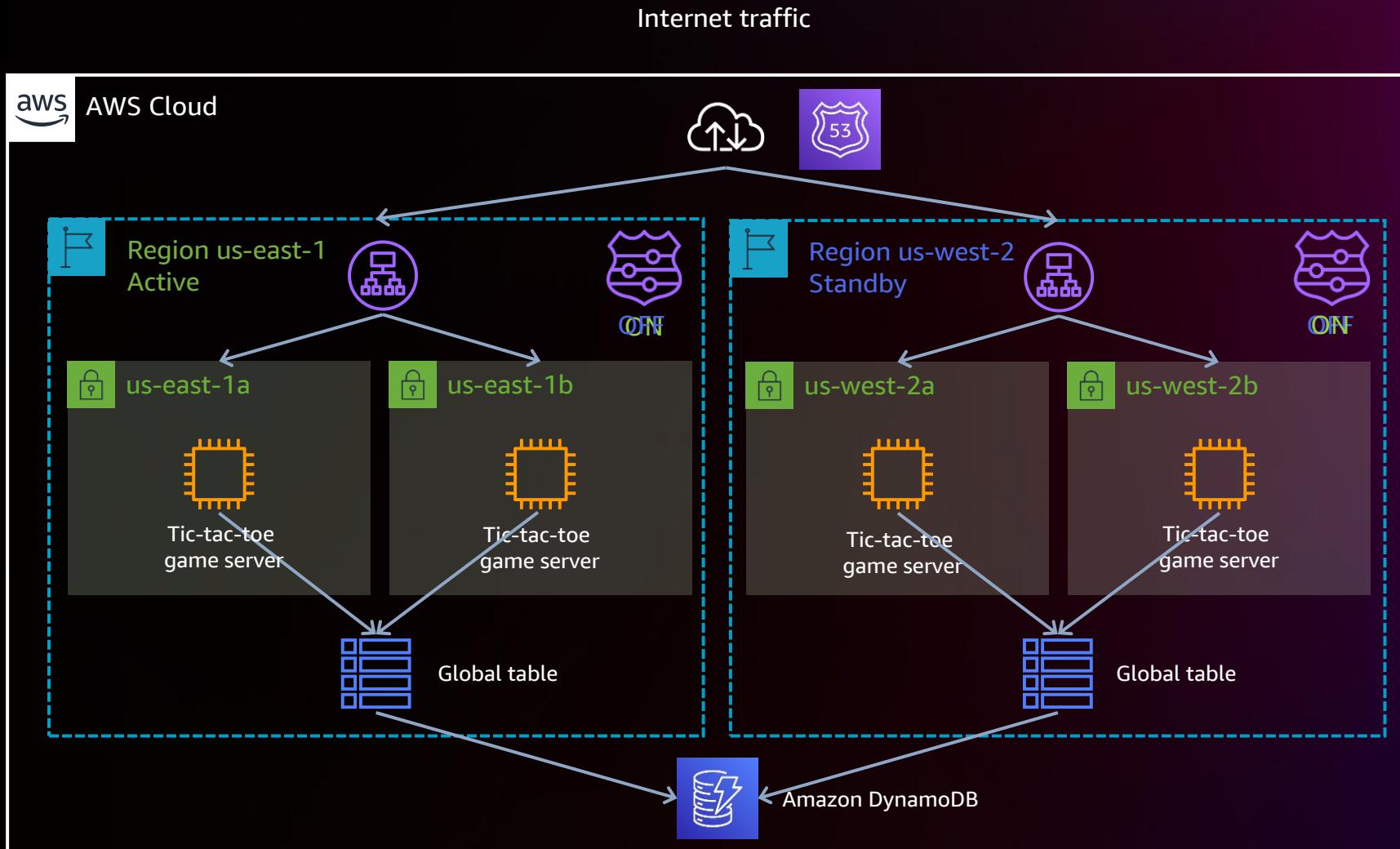
1. Set up a multi-Region application



2. Use readiness checks



3. Use routing controls and perform failover



Thank you!

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