



FIN302

Disaster Recovery and Business Continuity for Systemically Important Financial Institutions

Felix Candelario, Solutions Architect
Benjamin Feldon, Solutions Architect

November 28, 2016

The takeaway



Systemically important workloads for Financial Services are running on AWS



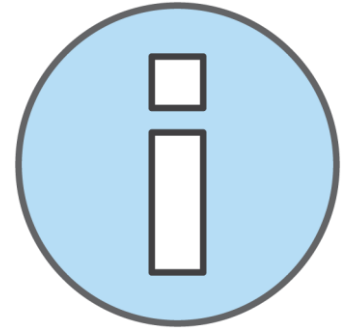
Disaster Recovery can be automated, auditable, & elastic



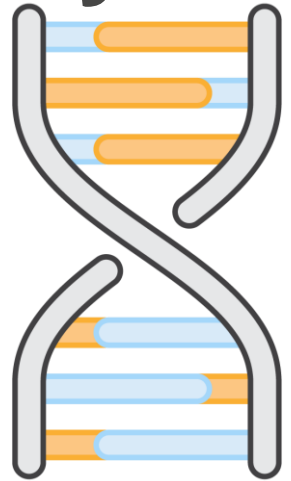
You can leverage AWS for Disaster Recovery while meeting your regulatory requirements

Agenda

- Modernizing Disaster Recovery
- Trading refresher
- Customer Implementation
- Disaster Recovery demo



Modernizing Disaster Recovery



Current Disaster Recovery methods



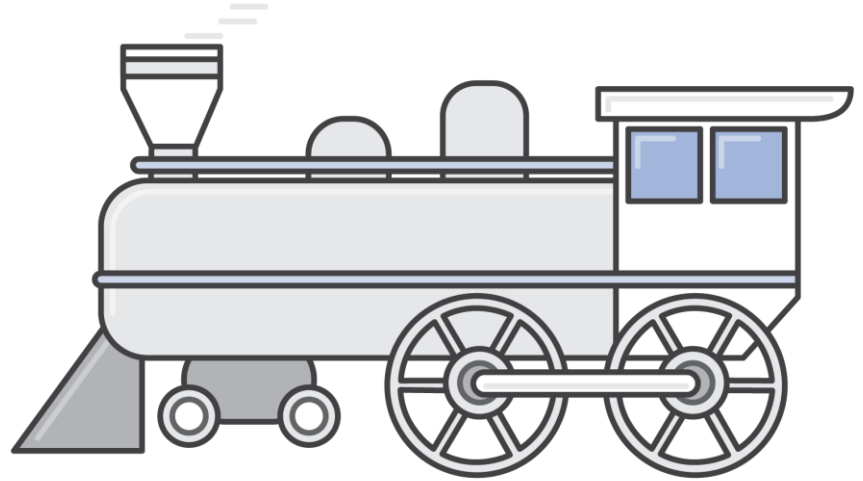
Manual



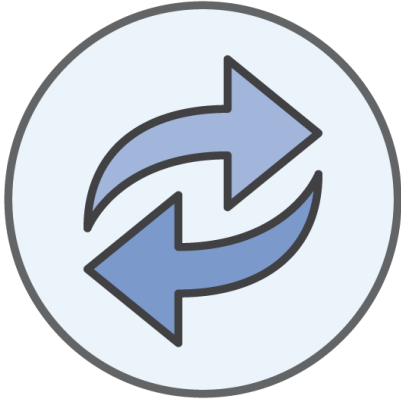
Capital intensive



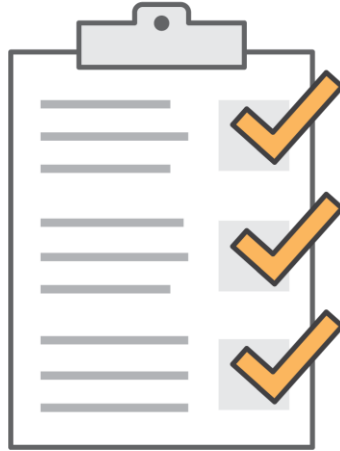
Infrequently tested



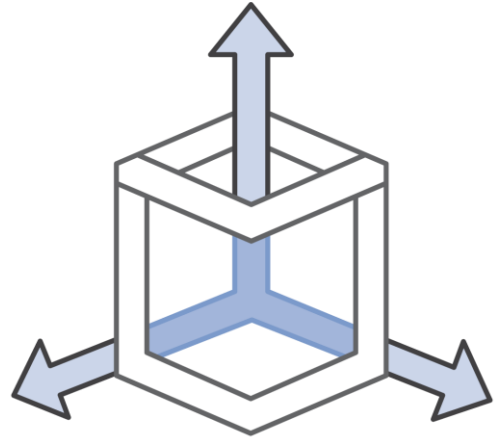
Modernizing Disaster Recovery



Automated



Auditable



Elastic

Securities Exchange Commission



“having due regard for the public interest, the protection of investors, and the maintenance of fair and orderly markets, to use its authority under the Exchange Act to facilitate the establishment of a national market system for securities in accordance with the Congressional findings and objectives set forth in Section 11A(a)(1) of the Exchange Act.”

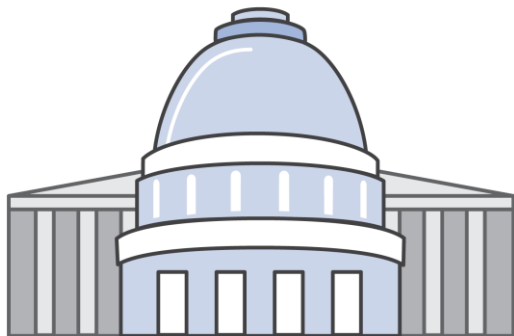
[Release No. 34-73639; File No. S7-01-13]

Regulation Systems Compliance and Integrity



- RegSCI requires
 - “comprehensive policies and procedures in place to help ensure the robustness and resiliency of their technological systems”
 - “geographical diversity”
 - “a two hour recovery goal would be required for recovery facilities”

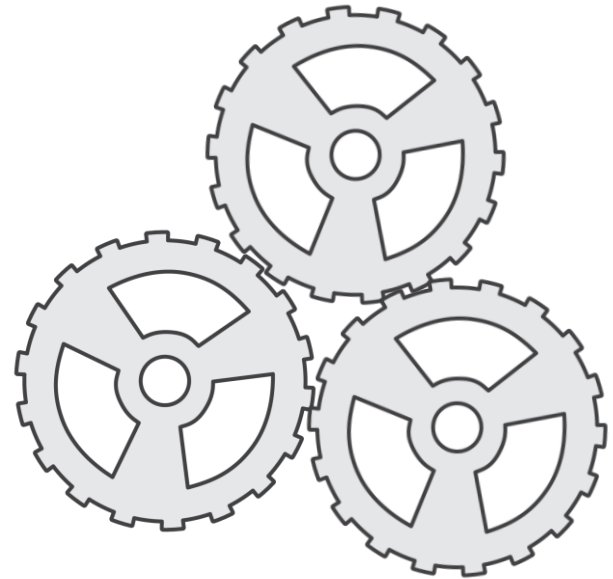
Customer implementation



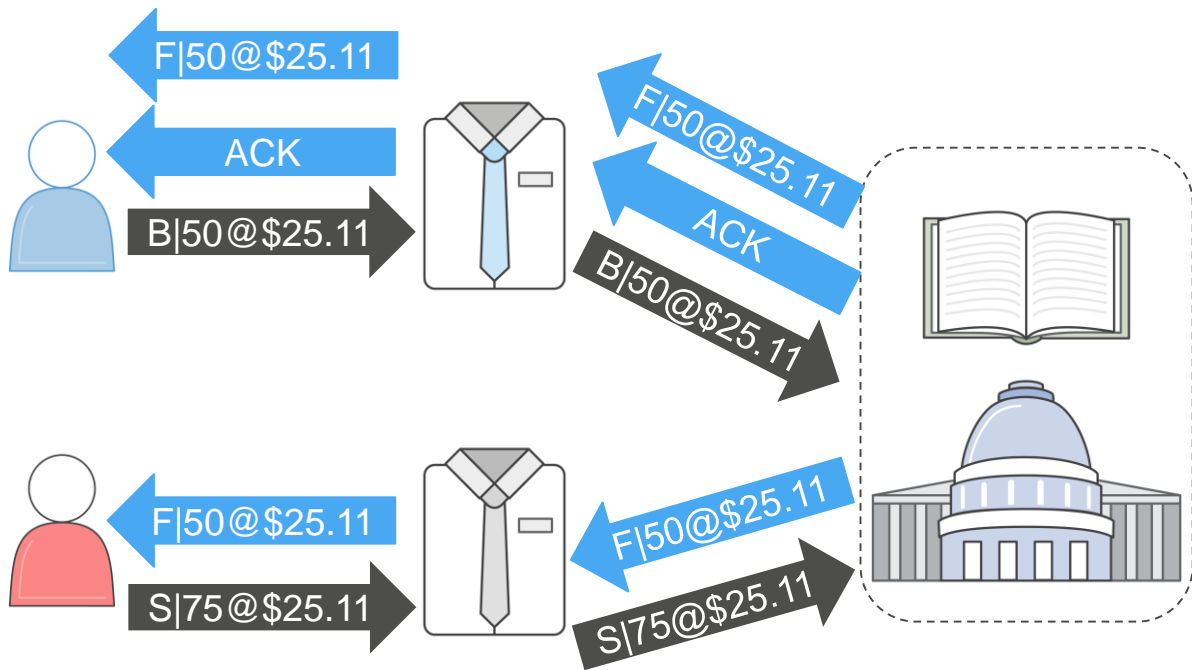
ISE Announces First Implementation of a Securities Exchange on Amazon Web Services Cloud Computing Environment

NEW YORK, March, 30, 2016 – The [International Securities Exchange](#) (ISE) is the first regulated securities exchange to build and operate cloud-based disaster recovery infrastructure as part of disaster preparedness requirements established by the U.S. Securities and Exchange Commission's (SEC) recent Regulation Systems Compliance and Integrity (Reg SCI) initiative.

Trading refresher



Trading at Exchanges



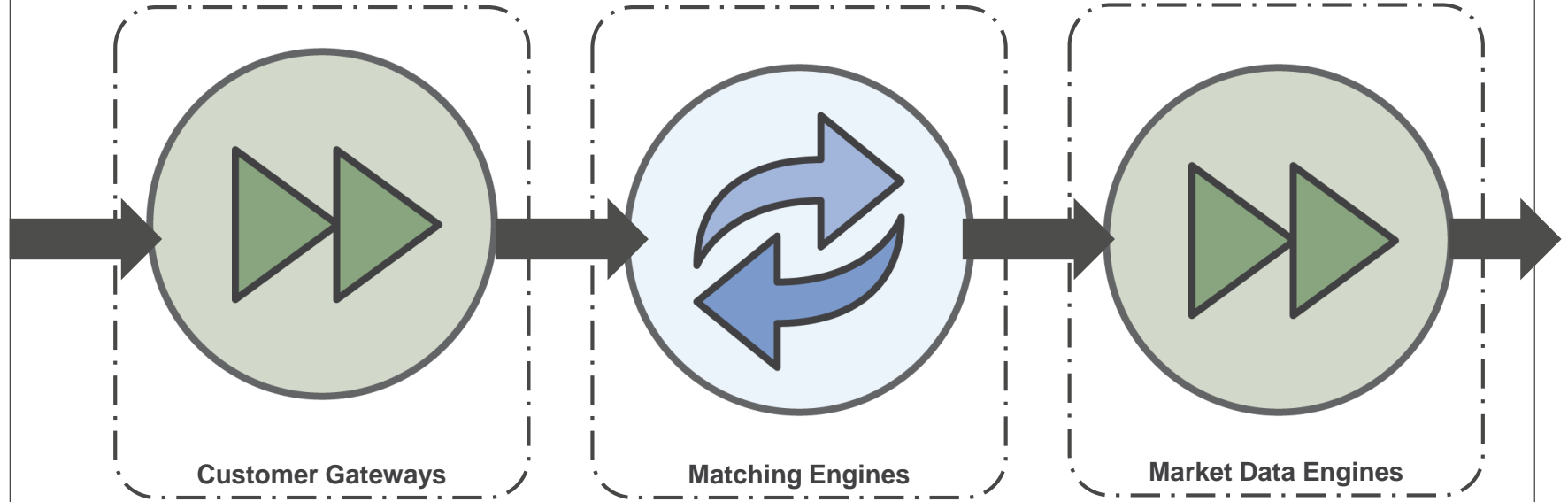
Bid		Ask	
QTY	Price	QTY	Price
50	25.11	25	25.11
300	25.10	500	25.12
400	25.09	600	25.13
150	25.08	300	25.14
900	25.06	250	25.15

Customers

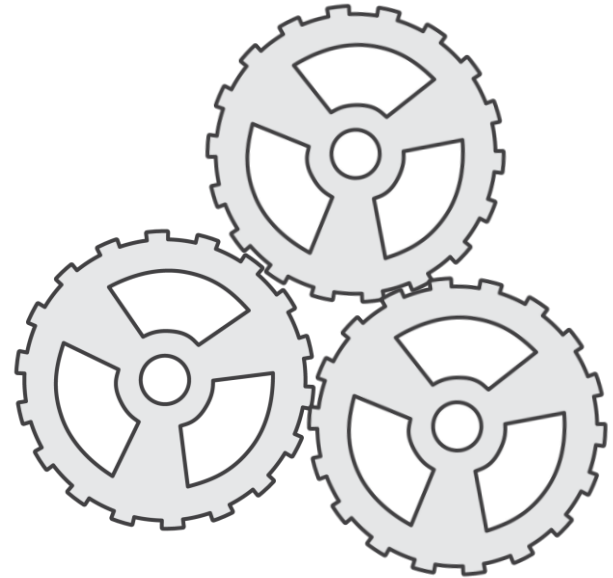
Broker/Dealers

Exchange

General exchange architecture



Demo workload: AEX

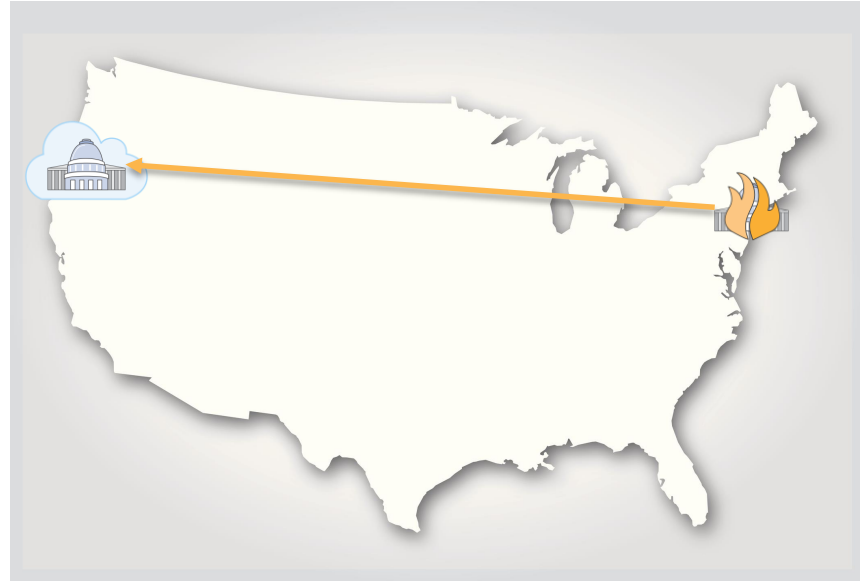


Our fictitious exchange – Amazon EXchange

AEX Properties

- 100 symbols listed
- Simulated 100 Broker/Dealers
- Each Broker/Dealer supports 100 customers
- Every customer sends a Buy or Sell order for a random symbol for a random quantity every second

DR Strategy



AEX Tech Stack



AWS CloudFormation

Infrastructure as code



Troposphere

Generates CloudFormation templates



Amazon EC2 Container Service

Container management service



Weaveworks Weave Net

Provides container overlay network



Amazon Route 53

Highly available and scalable cloud DNS service



Amazon Simple Storage Service (S3)

Secure, durable, highly-scalable cloud storage



Amazon Kinesis Firehose

Captures streaming data to S3

AWS

us-west-2

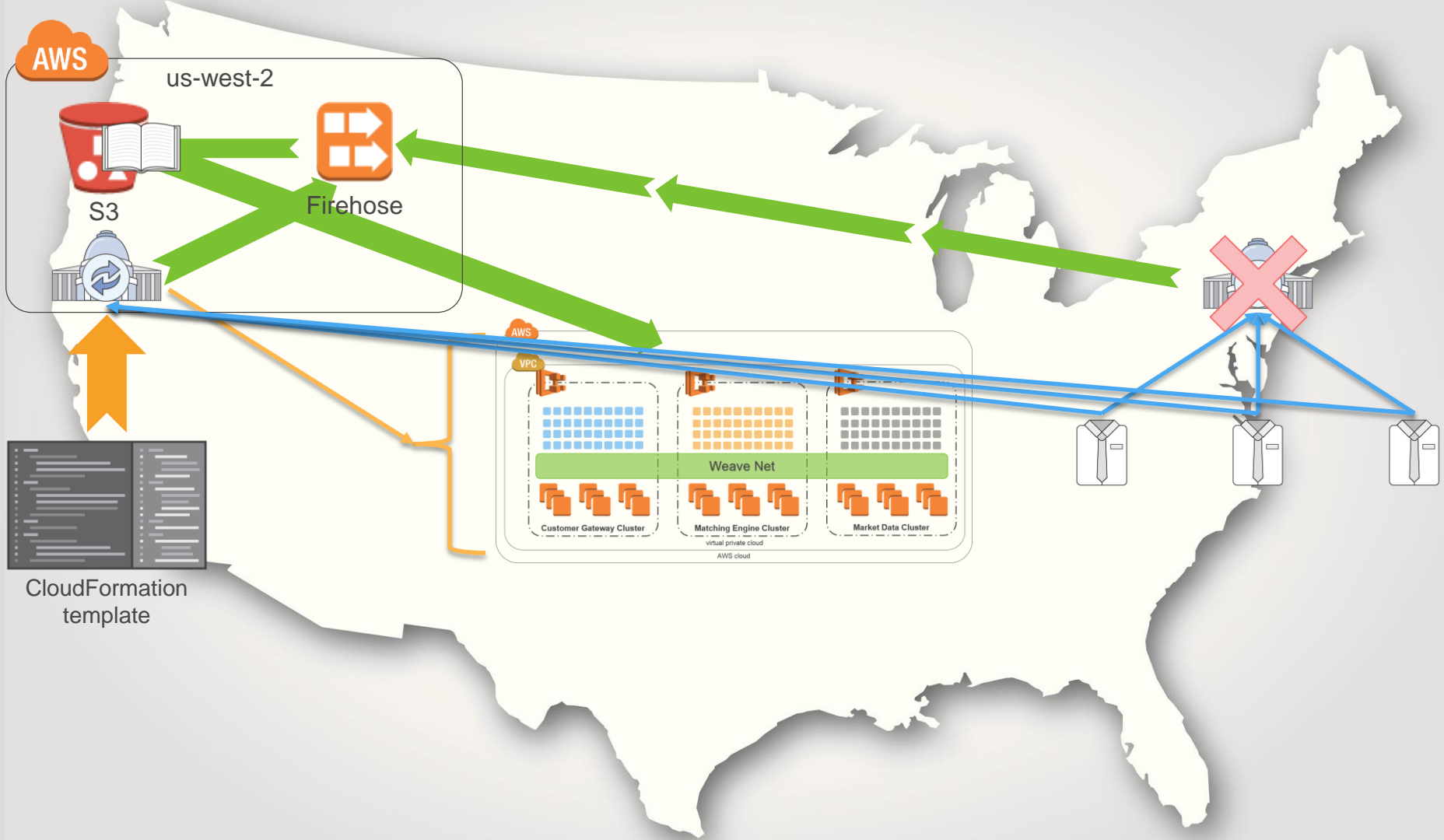


S3

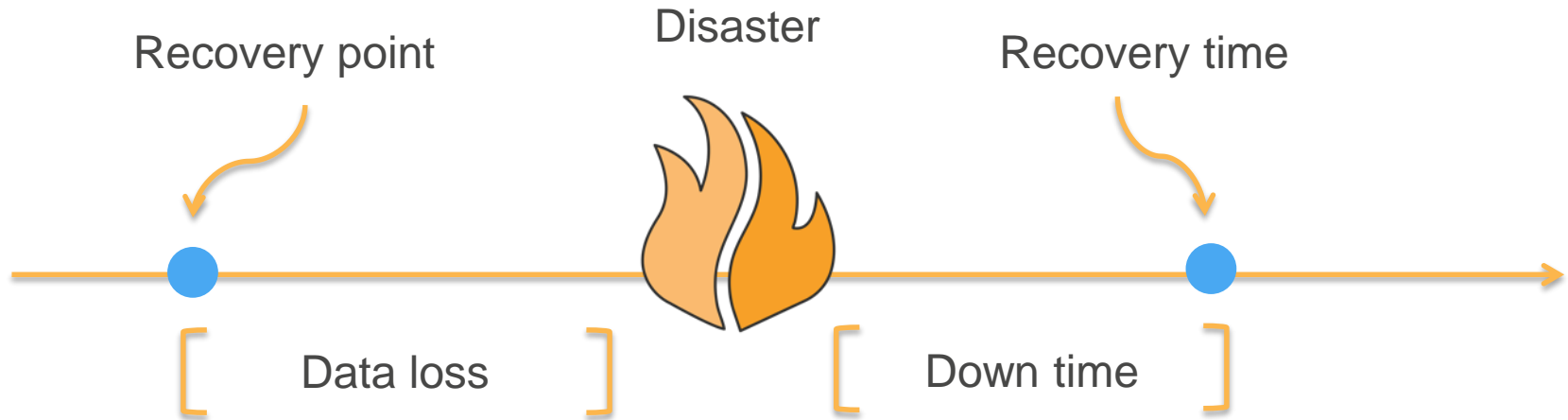


Firehose





Recovery time objective & recovery point objective



AWS

us-west-2

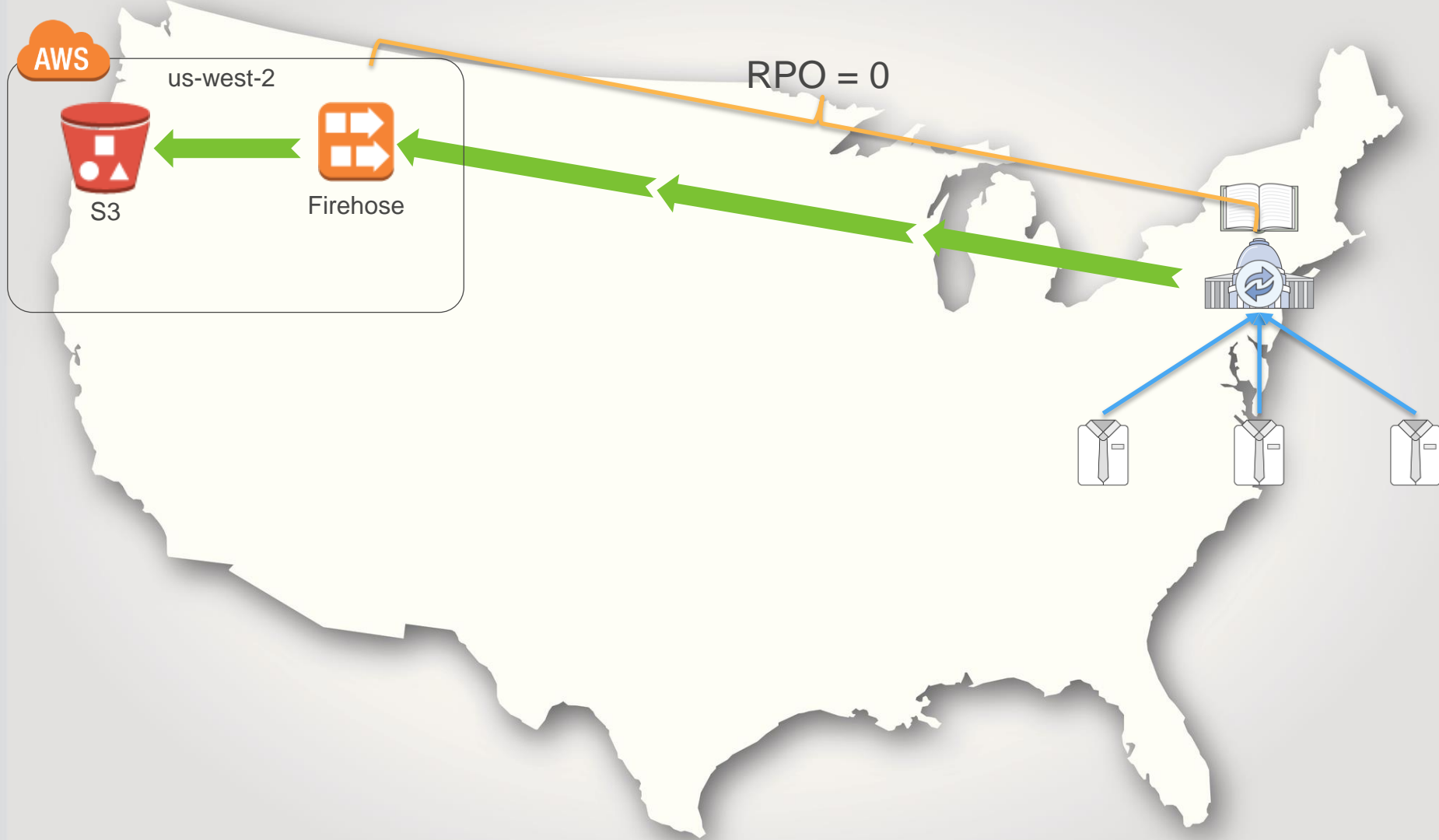
RPO = 0

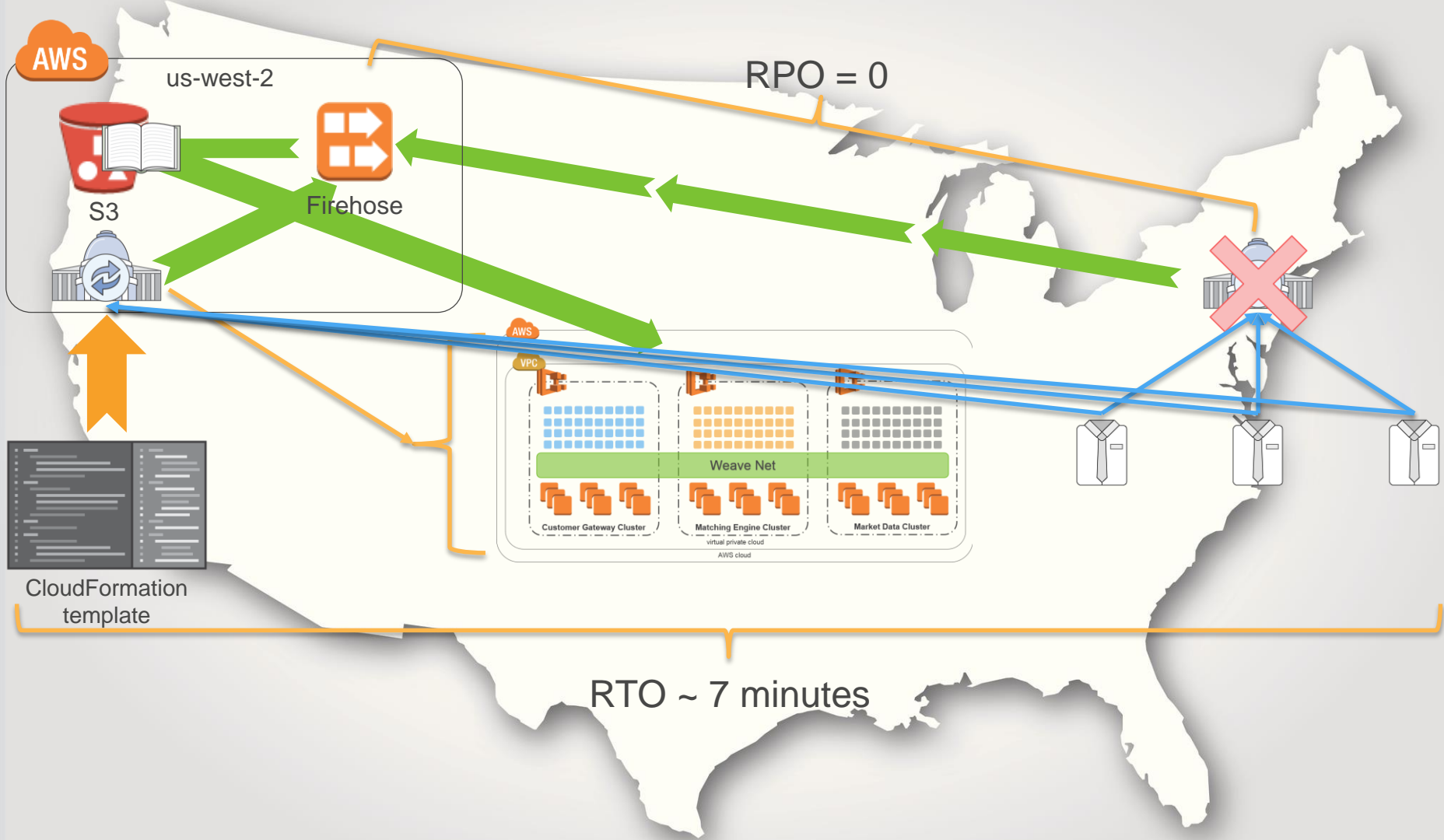


S3



Firehose





Disaster Recovery Demo



AWS

us-west-2



S3



Firehose



AEX Operations

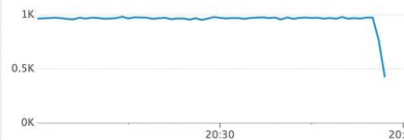


Production status

OK

Message rate

10m



Message rate per second

10m

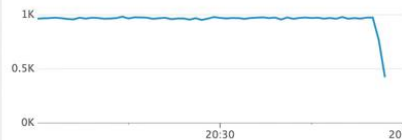


Backup status

OK

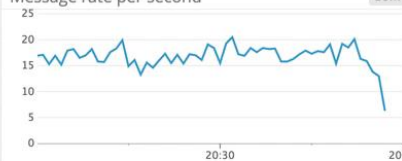
Message rate

10m



Message rate per second

10m



DR status

UNKN

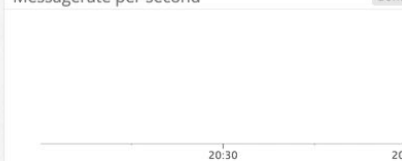
Message Rate

10m



Messengerate per second

10m





AWS

us-west-2



S3



Firehose



AEX Operations

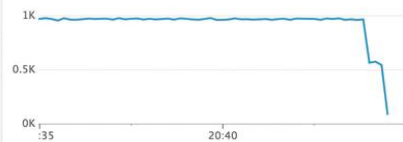


Production status

CRIT

Message rate

10m



Message rate per second

10m

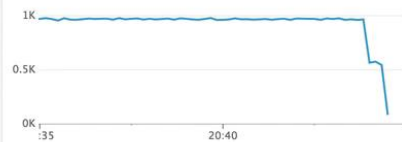


Backup status

CRIT

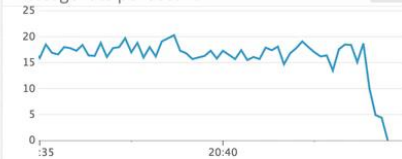
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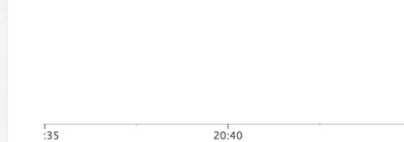


DR status

UNKN

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10m



Messengerate per second

10m



AWS

us-west-2



S3



Firehose



CloudFormation
template



sub.py
symbols.json
symbols.pickle
thread_test.py
trade_monitor.py
.ddtest.py.swp
aex_mode.py
aex_status.py
aex-matching-engin
aex-matching-engin
aex-matching-engin
aex-matching-engin
aex-matching-engin
aex-matching-engin
create_aex_kinesis_s
create_me_dd_alerts
ddtest.py
ebslookup.py
fixpickle.py
format.py
getS3Latest.py
matching-engine-A
readFire.py
readKinesis.py
recover_aex_matchir
saved-book.p
screen2.py
screendraw.py
start_aex_customer_
start_aex_matching_
start_aex_monitoring
start_aex_utility.py
stop_aex_me.py
symbols.pickle
test.py
test.txt
Vagrantfile
writeFire.py
writeFire2.py
writeKinesis.py

aex_us_west_2.json

generate_aex_cloudformation.py

```
1 {  
2   "Resources": {  
3     "AAL": {  
4       "Properties": {  
5         "Comment": "AAL",  
6         "HostedZoneId": "Z2J9AY0IWC7L8U",  
7         "Name": "AAL.aex.com",  
8         "ResourceRecords": [  
9           "239.254.99.46"  
10        ],  
11        "TTL": 60,  
12        "Type": "A"  
13      },  
14      "Type": "AWS::Route53::RecordSet"  
15    },  
16    "ADBE": {  
17      "Properties": {  
18        "Comment": "ADBE",  
19        "HostedZoneId": "Z2J9AY0IWC7L8U",  
20        "Name": "ADBE.aex.com",  
21        "ResourceRecords": [  
22          "239.254.99.49"  
23        ],  
24        "TTL": 60,  
25        "Type": "A"  
26      },  
27      "Type": "AWS::Route53::RecordSet"  
28    },  
29    "ADI": {  
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31        "Comment": "ADI",  
32        "HostedZoneId": "Z2J9AY0IWC7L8U",  
33        "Name": "ADI.aex.com",  
34        "ResourceRecords": [  
35          "239.254.99.58"
```

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[Learn more](#)

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[Create a Group](#)

[Tag Editor](#)

Additional Resources

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AWS re:Invent Announcements

Explore the next generation of AWS cloud capabilities. [See what's new](#)

Service Health

All services operating normally.

Updated: Nov 11 2016 11:51:00 GMT-0500

[Service Health Dashboard](#)

AWS

us-west-2



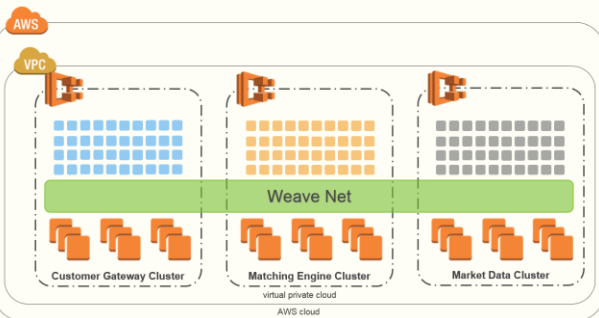
S3



Firehose



CloudFormation
template





AWS

Services

Edit

fcandela @ 0070-3873-2177

Oregon

Support



CloudFormation

Stacks

Create Stack

Actions

Design template



Filter: Active By Stack Name

Showing 1 stack

	Stack Name	Created Time	Status	Description
<input checked="" type="checkbox"/>	AEX-DR	2016-11-11 11:52:08 UTC-0500	CREATE_COMPLETE	

Overview Outputs Resources Events Template Parameters Tags Stack Policy Change Sets

2016-11-11	Status	Type	Logical ID	Status reason
▶ 11:55:46 UTC-0500	CREATE_COMPLETE	AWS::CloudFormation::Stack	AEX-DR	
▶ 11:55:43 UTC-0500	CREATE_COMPLETE	AWS::EC2::EIPAssociation	EIPAssoc12	
▶ 11:55:39 UTC-0500	CREATE_COMPLETE	AWS::EC2::EIPAssociation	EIPAssoc13	
▶ 11:55:39 UTC-0500	CREATE_COMPLETE	AWS::EC2::EIPAssociation	EIPAssoc15	
▶ 11:55:39 UTC-0500	CREATE_COMPLETE	AWS::EC2::EIPAssociation	EIPAssoc14	
▶ 11:55:39 UTC-0500	CREATE_COMPLETE	AWS::EC2::EIPAssociation	EIPAssoc11	
▶ 11:55:27 UTC-0500	CREATE_IN_PROGRESS	AWS::EC2::EIPAssociation	EIPAssoc12	Resource creation Initiated
▶ 11:55:26 UTC-0500	CREATE_IN_PROGRESS	AWS::EC2::EIPAssociation	EIPAssoc12	
▶ 11:55:24 UTC-0500	CREATE_IN_PROGRESS	AWS::EC2::EIPAssociation	EIPAssoc15	Resource creation Initiated
▶ 11:55:24 UTC-0500	CREATE_IN_PROGRESS	AWS::EC2::EIPAssociation	EIPAssoc13	Resource creation Initiated
▶ 11:55:23 UTC-0500	CREATE_IN_PROGRESS	AWS::EC2::EIPAssociation	EIPAssoc11	Resource creation Initiated
▶ 11:55:23 UTC-0500	CREATE_IN_PROGRESS	AWS::EC2::EIPAssociation	EIPAssoc14	Resource creation Initiated
11:55:23 UTC-0500	CREATE_IN_PROGRESS	AWS::EC2::EIPAssociation	EIPAssoc15	
11:55:23 UTC-0500	CREATE_IN_PROGRESS	AWS::EC2::EIPAssociation	EIPAssoc13	

AWS

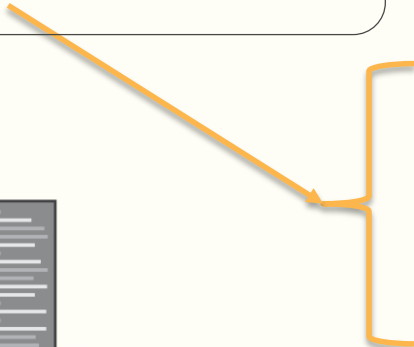
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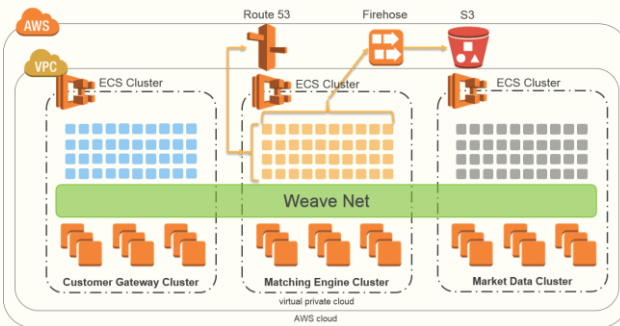
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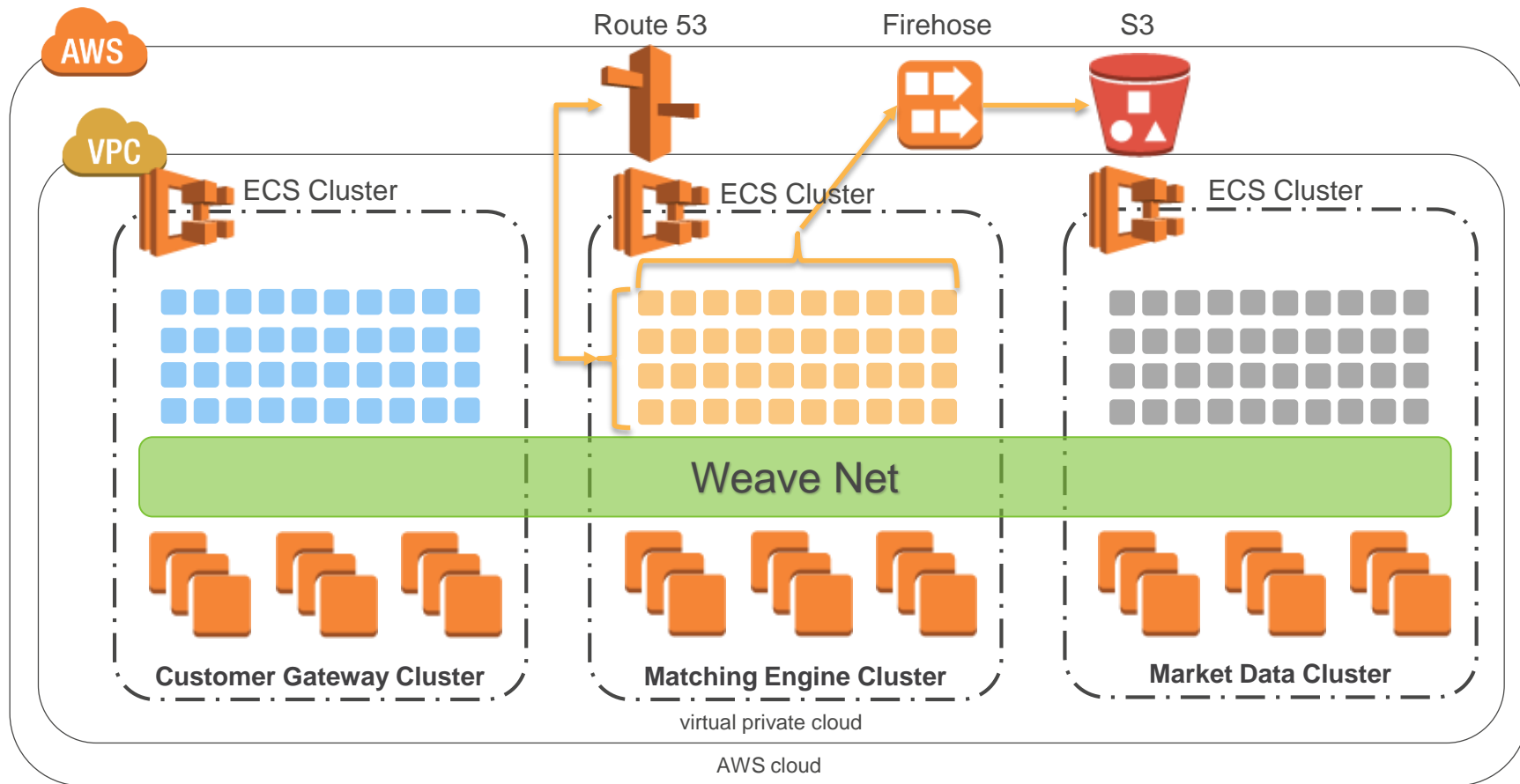
Firehose



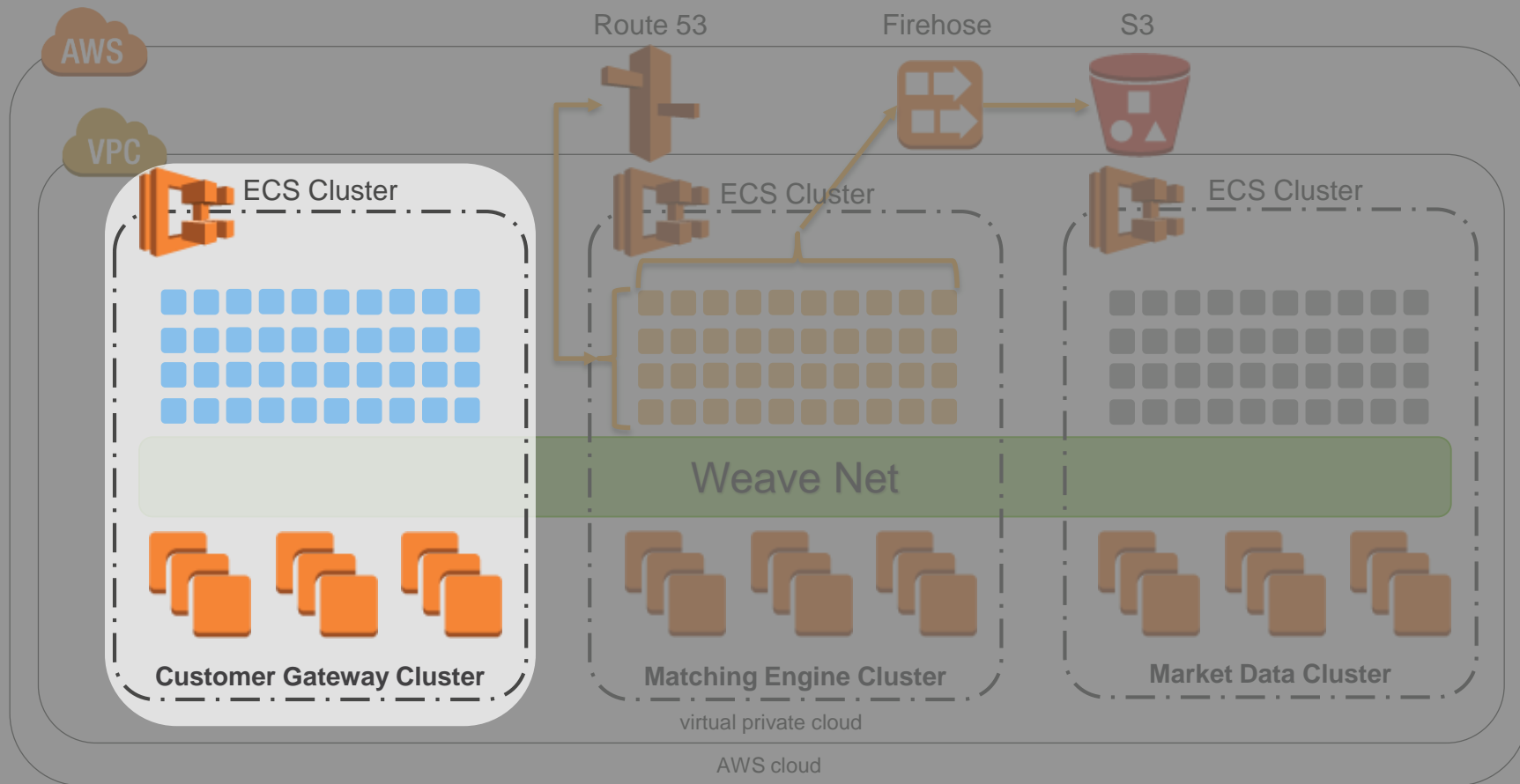
CloudFormation
template



AEX Architecture



AEX Architecture



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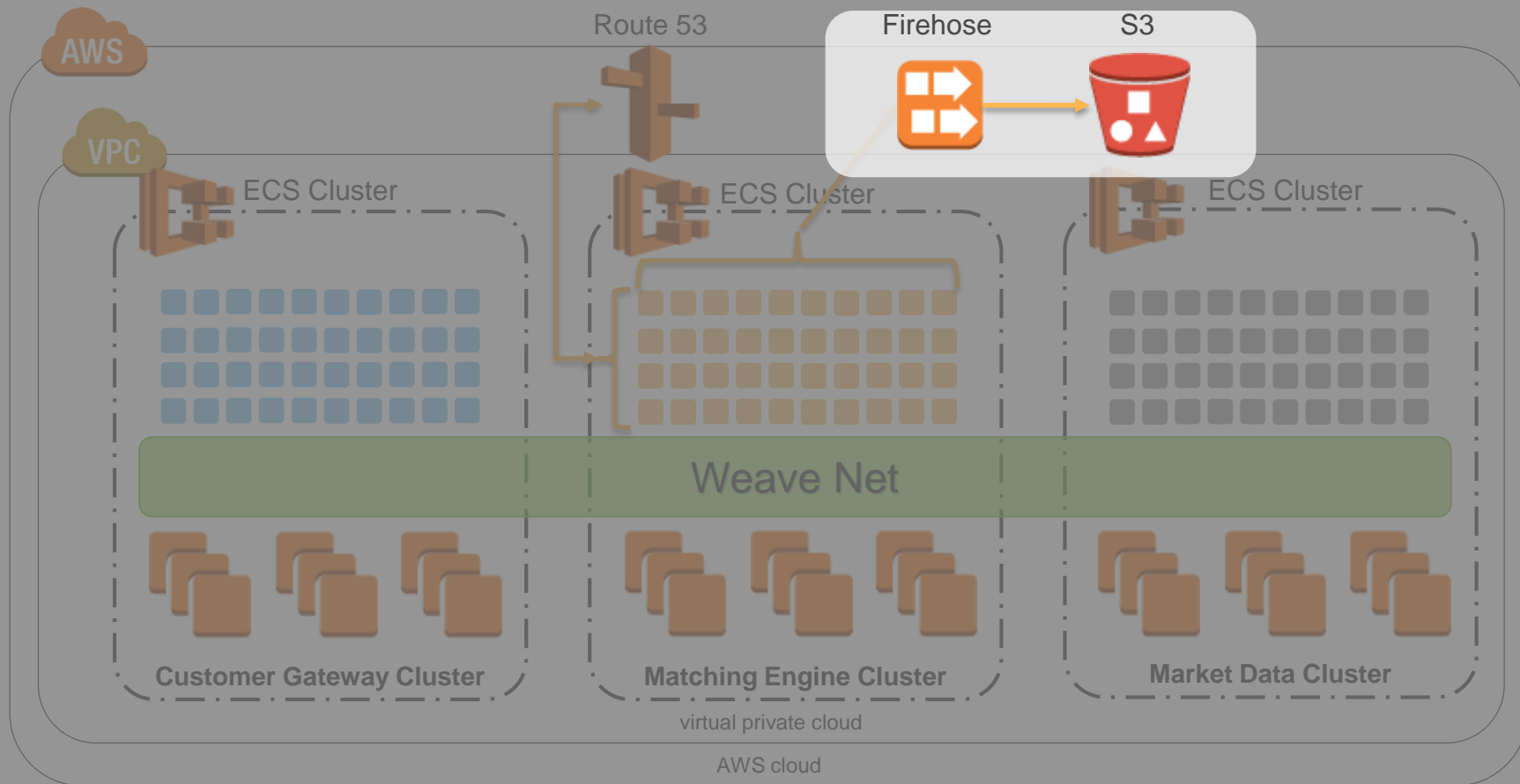
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All services operating normally.

Updated: Nov 14 2016 10:24:00 GMT-0500

[Service Health Dashboard](#)

AEX Architecture



Amazon Kinesis

Delivery Streams



Streams
Firehose
Analytics

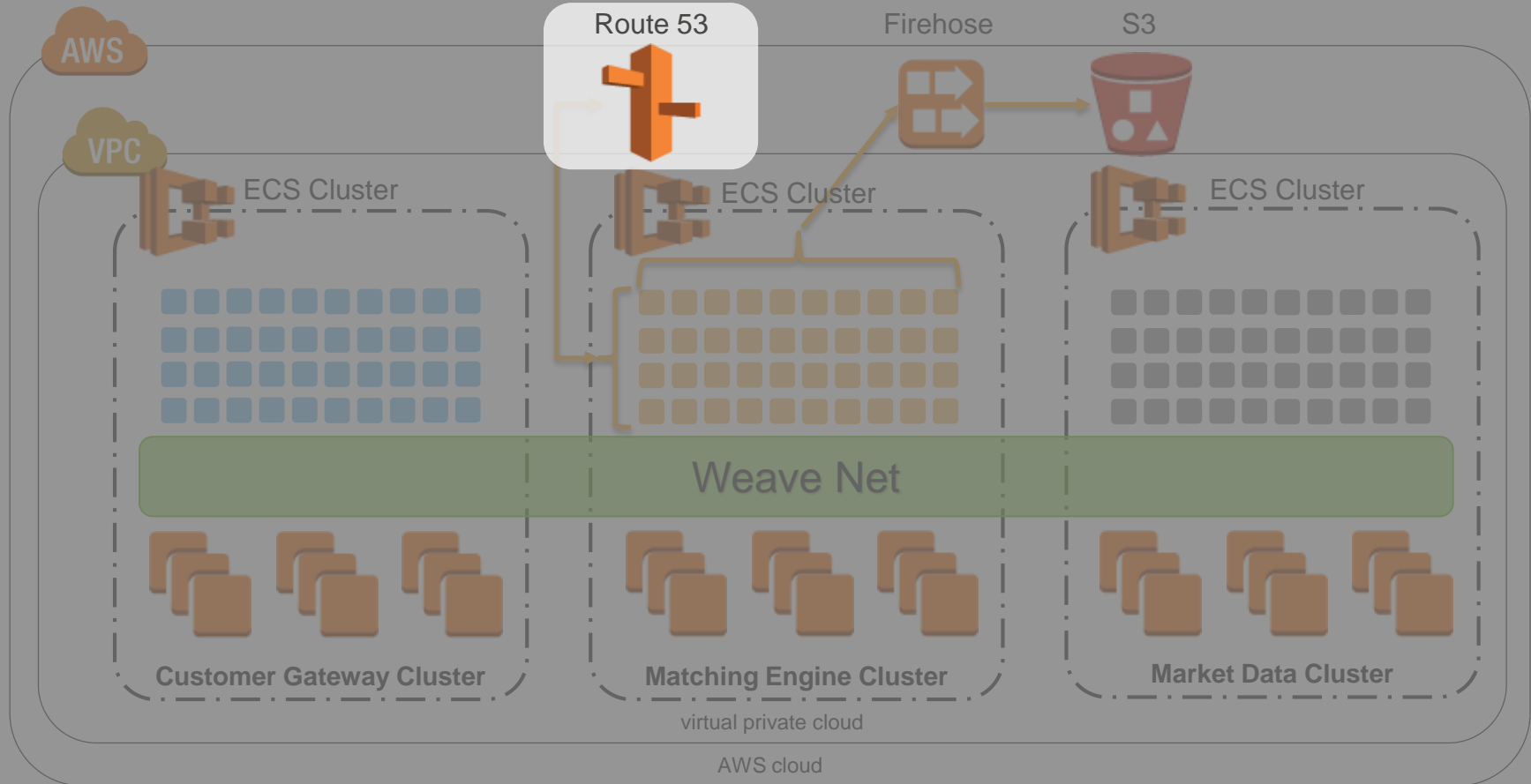
Create Delivery Stream

Actions

S3 Delivery Streams

	Name	S3 Bucket	Compression	Encryption	Status
<input checked="" type="radio"/>	matching-engine-AAL	fcandela-aex	UNCOMPRESSED	No Encryption	ACTIVE
<input type="radio"/>	matching-engine-ADBE	fcandela-aex	UNCOMPRESSED	No Encryption	ACTIVE
<input type="radio"/>	matching-engine-ADI	fcandela-aex	UNCOMPRESSED	No Encryption	ACTIVE
<input type="radio"/>	matching-engine-ADP	fcandela-aex	UNCOMPRESSED	No Encryption	ACTIVE
<input type="radio"/>	matching-engine-ADSK	fcandela-aex	UNCOMPRESSED	No Encryption	ACTIVE
<input type="radio"/>	matching-engine-AKAM	fcandela-aex	UNCOMPRESSED	No Encryption	ACTIVE
<input type="radio"/>	matching-engine-AMGN	fcandela-aex	UNCOMPRESSED	No Encryption	ACTIVE
<input type="radio"/>	matching-engine-AMZN	fcandela-aex	UNCOMPRESSED	No Encryption	ACTIVE
<input type="radio"/>	matching-engine-ATVI	fcandela-aex	UNCOMPRESSED	No Encryption	ACTIVE
<input type="radio"/>	matching-engine-AVGO	fcandela-aex	UNCOMPRESSED	No Encryption	ACTIVE
<input type="radio"/>	matching-engine-BBBY	fcandela-aex	UNCOMPRESSED	No Encryption	ACTIVE
<input type="radio"/>	matching-engine-BIDU	fcandela-aex	UNCOMPRESSED	No Encryption	ACTIVE
<input type="radio"/>	matching-engine-BIIB	fcandela-aex	UNCOMPRESSED	No Encryption	ACTIVE
<input type="radio"/>	matching-engine-BMRN	fcandela-aex	UNCOMPRESSED	No Encryption	ACTIVE
<input type="radio"/>	matching-engine-CA	fcandela-aex	UNCOMPRESSED	No Encryption	ACTIVE

AEX Architecture





AWS

Services

Edit

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Oregon

Support

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Global Content Delivery Network
- Elastic File System**
Fully Managed File System for EC2
- Glacier**
Archive Storage in the Cloud
- Snowball**
Large Scale Data Transport
- Storage Gateway**
Hybrid Storage Integration

Database

- RDS**
Managed Relational Database Service
- DynamoDB**
Managed NoSQL Database
- ElastiCache**
In-Memory Cache
- Redshift**
Fast, Simple, Cost-Effective Data Warehousing
- DMS**
Managed Database Migration Service

Networking

- VPC**
Isolated Cloud Resources
- Direct Connect**
Dedicated Network Connection to AWS
- Route 53**
Scalable DNS and Domain Name Registration

Developer Tools

- CodeCommit**
Store Code in Private Git Repositories
- CodeDeploy**
Automate Code Deployments
- CodePipeline**
Release Software using Continuous Delivery

Management Tools

- CloudWatch**
Monitor Resources and Applications
- CloudFormation**
Create and Manage Resources with Templates
- CloudTrail**
Track User Activity and API Usage
- Config**
Track Resource Inventory and Changes
- OpsWorks**
Automate Operations with Chef
- Service Catalog**
Create and Use Standardized Products
- Trusted Advisor**
Optimize Performance and Security

Security & Identity

- Identity & Access Management**
Manage User Access and Encryption Keys
- Directory Service**
Host and Manage Active Directory
- Inspector**
Analyze Application Security
- WAF**
Filter Malicious Web Traffic
- Certificate Manager**
Provision, Manage, and Deploy SSL/TLS Certificates

Analytics

- EMR**
Managed Hadoop Framework
- Data Pipeline**
Orchestration for Data-Driven Workflows
- Elasticsearch Service**
Run and Scale Elasticsearch Clusters
- Kinesis**
Work with Real-Time Streaming Data
- Machine Learning**
Build Smart Applications Quickly and Easily

Internet of Things

- AWS IoT**
Connect Devices to the Cloud

Game Development

- GameLift**
Deploy and Scale Session-based Multiplayer Games

Mobile Services

- Mobile Hub**
Build, Test, and Monitor Mobile Apps
- Cognito**
User Identity and App Data Synchronization
- Device Farm**
Test Android, iOS, and Web Apps on Real Devices in the Cloud
- Mobile Analytics**
Collect, View and Export App Analytics
- SNS**
Push Notification Service

Application Services

- API Gateway**
Build, Deploy and Manage APIs
- AppStream**
Low Latency Application Streaming
- CloudSearch**
Managed Search Service
- Elastic Transcoder**
Easy-to-Use Scalable Media Transcoding
- SES**
Email Sending and Receiving Service
- SQS**
Message Queue Service
- SWF**
Workflow Service for Coordinating Application Components

Enterprise Applications

- WorkSpaces**
Desktops in the Cloud
- WorkDocs**
Secure Enterprise Storage and Sharing Service
- WorkMail**
Secure Email and Calendaring Service

Resource Groups

[Learn more](#)

A resource group is a collection of resources that share one or more tags. Create a group for each project, application, or environment in your account.

[Create a Group](#)[Tag Editor](#)

Additional Resources

Getting Started

Read our [documentation](#) or view our [training](#) to learn more about AWS.

AWS Console Mobile App

View your resources on the go with our AWS Console mobile app, available from [Amazon Appstore](#), [Google Play](#), or [iTunes](#).

AWS Marketplace

Find and buy software, launch with 1-Click and pay by the hour.

AWS re:Invent Announcements

Explore the next generation of AWS cloud capabilities. [See what's new](#)

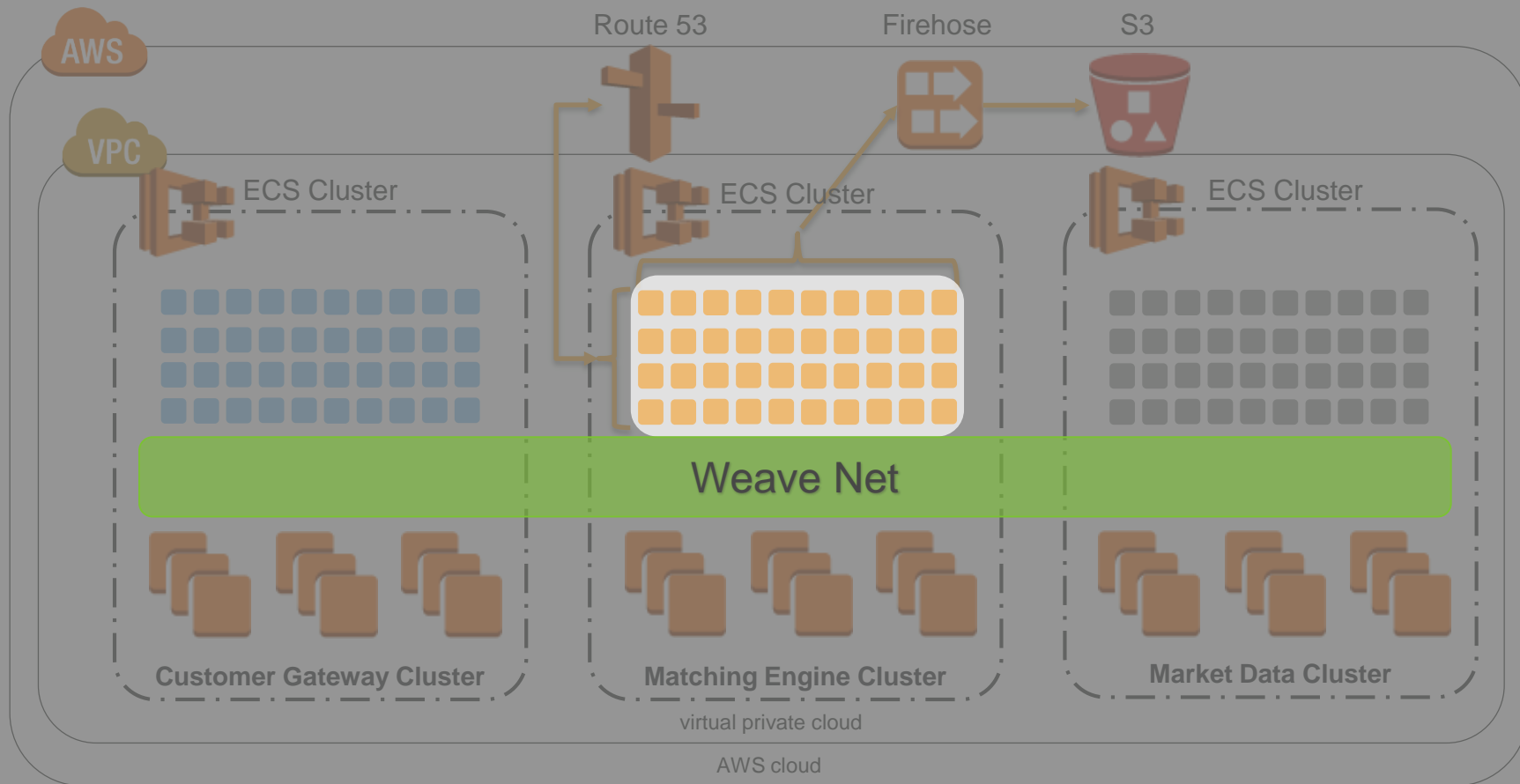
Service Health

All services operating normally.

Updated: Nov 04 2016 12:37:00 GMT-0400

[Service Health Dashboard](#)

AEX Architecture



Amazon ECS

Clusters

Task Definitions

Repositories

Clusters

An Amazon ECS cluster is a regional grouping of one or more container instances on which you can run task requests. Each account receives a default cluster the first time you use the Amazon ECS service. Clusters may contain more than one Amazon EC2 instance type.

Create Cluster

AEX-DR-MarketDataCluster-1I6H1URH1POMN ✕

Registered Container Instances :2
Pending tasks :0
Running tasks :2

AEX-DR-MatchingEngineCluster-1DT1JPF58DET5 ✕

Registered Container Instances :5
Pending tasks :0
Running tasks :100

AEX-DR-CustomerCluster-10LGYV9VQ1H5F ✕

Registered Container Instances :5
Pending tasks :0
Running tasks :99

Additional Information

[Documentation](#)
[Support](#)
[Forums](#)
[Contact us](#)

[ec2-user@ip-172-31-41-206 ~]\$

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AEX Operations



Production status

CRIT

Message rate

10m

21:00

21:05

Message rate per second

10m

21:00

21:05

Backup status

CRIT

Message rate

10m

21:00

21:05

Message rate per second

10m

21:00

21:05

DR status

OK

Message Rate

10m

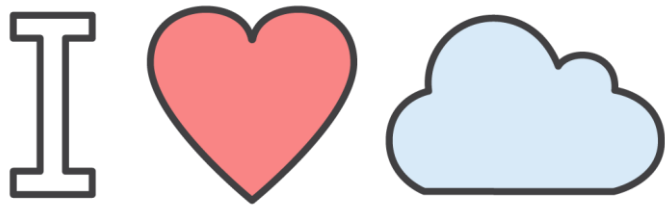


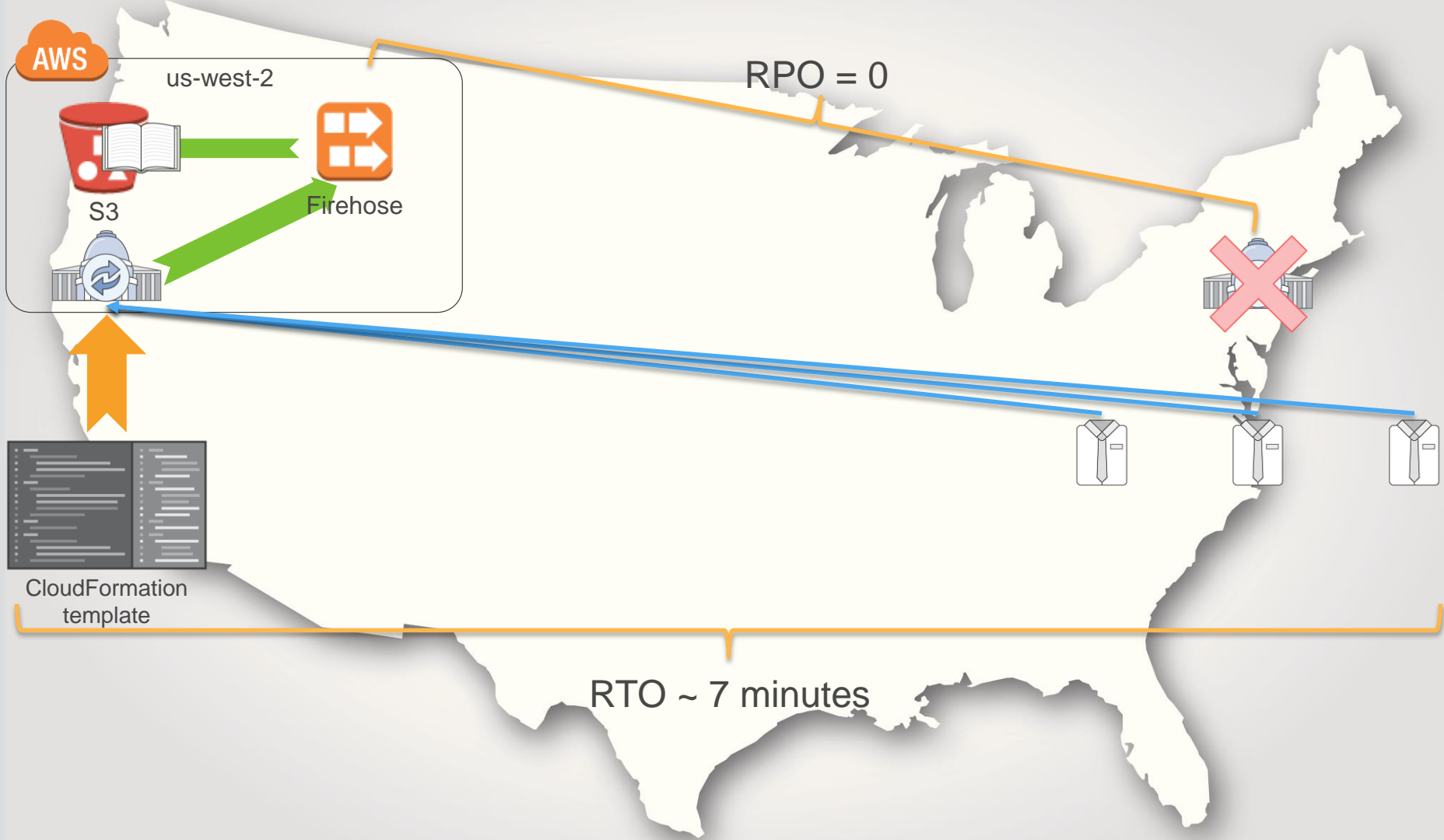
Messengerate per second

10m



Conclusion





Modernizing Disaster Recovery



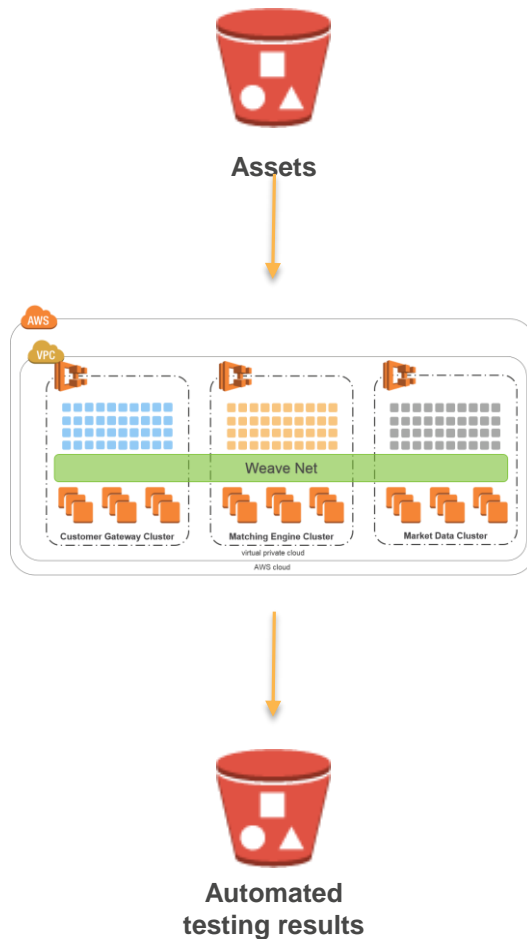
Source code



CloudFormation
template



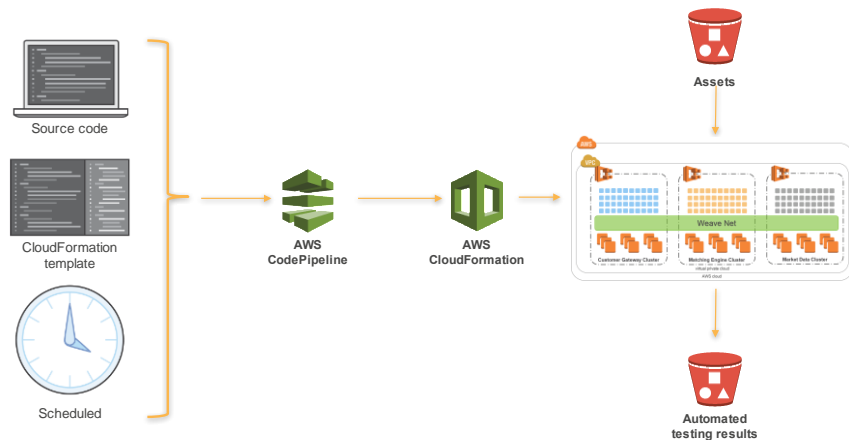
Scheduled



Modernizing Disaster Recovery

Benefits of modernized Disaster Recovery

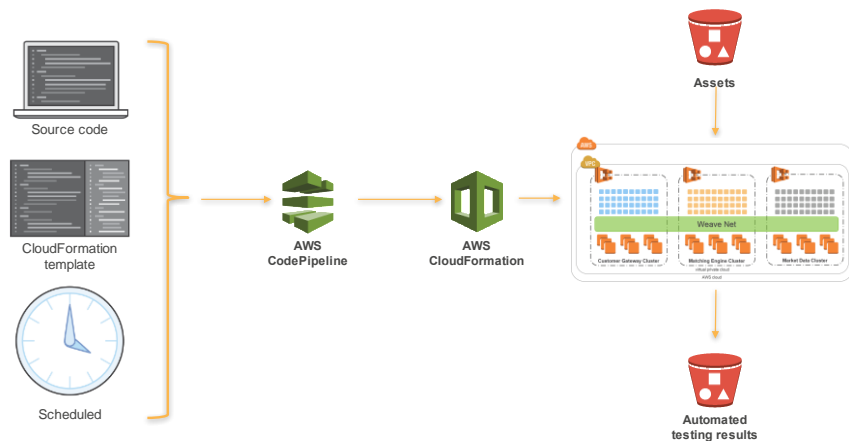
- Elastic
- Auditable
- Reusable
- Easy geolocation
- Reduced attack surface



Modernizing Disaster Recovery

Process of modernizing Disaster Recovery

- Understand your workload
- Evaluate statefulness
- Select and monitor replication techniques
- Architect
 - Infrastructure as code
 - Refactor where necessary
 - Rehydrate state
- Test
- Automate



The background features a large, abstract graphic with blue and orange wavy, ribbon-like shapes. These shapes are overlaid on a pattern of concentric, dotted circles in light gray and orange, creating a sense of motion and depth.

**AWS
re:Invent**

Thank you!



**Remember to complete
your evaluations!**

Related Sessions