



# ARCHITECTING FOR AWS

Carlos Conde | Solutions Architect

AWS Summit 2012 | Navigate the Cloud

1. ELASTICITY
2. DESIGN FOR FAILURE
3. LOOSE COUPLING
4. SECURITY
5. PERFORMANCE

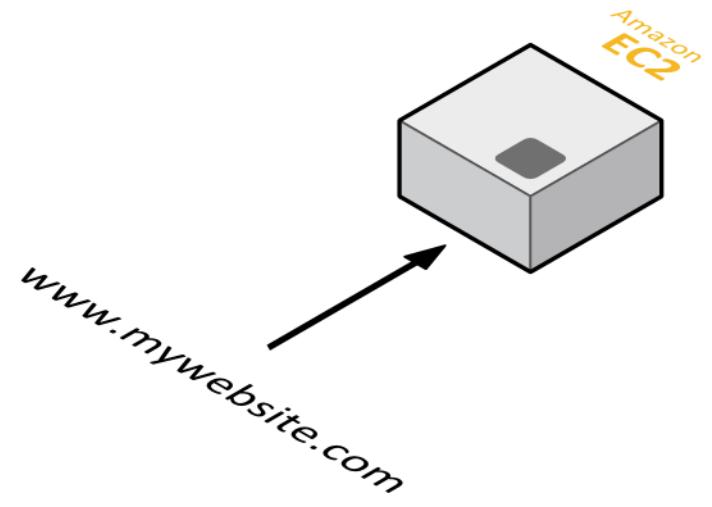
#1

# ELASTICITY



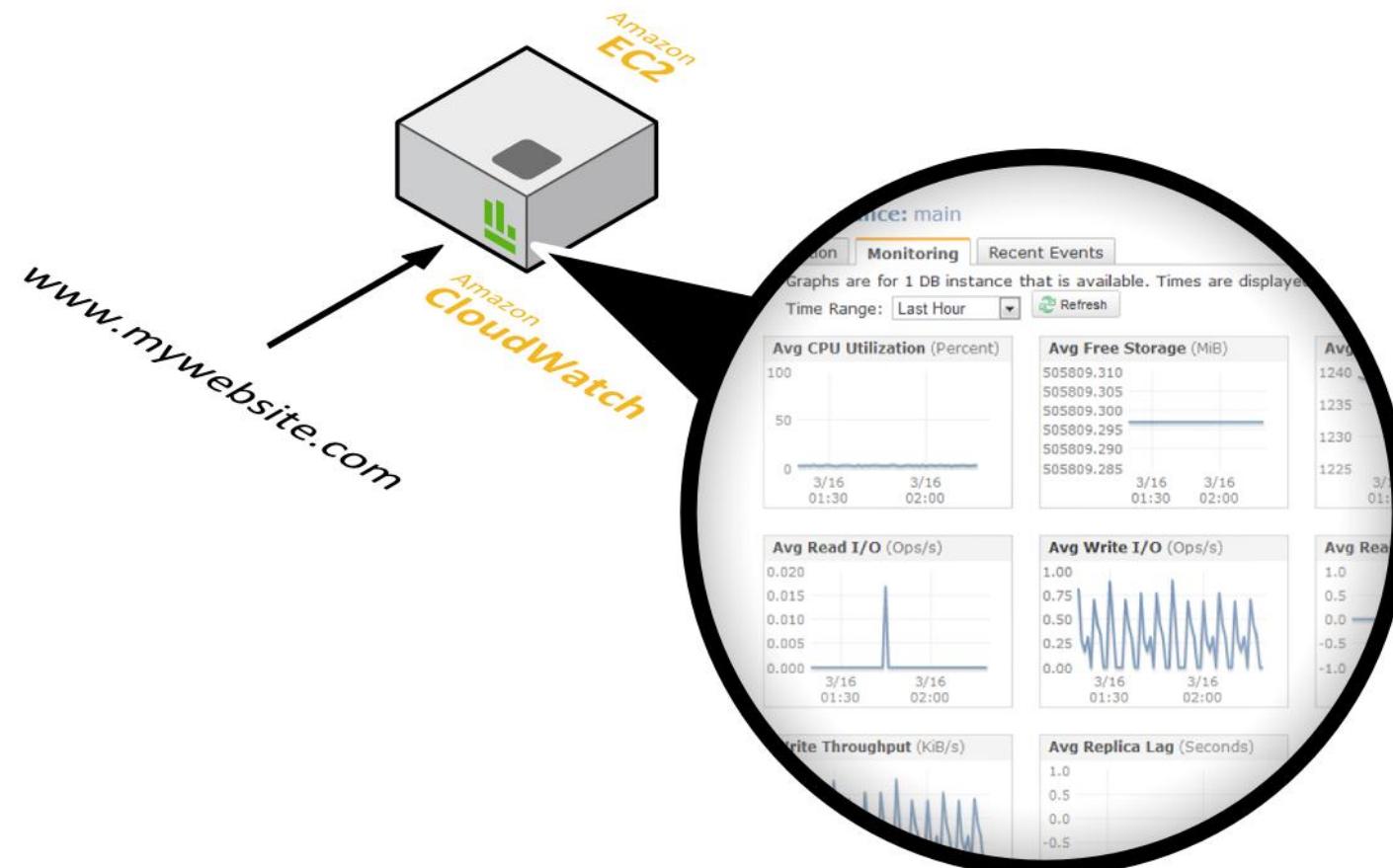
# AMAZON EC2

## ELASTIC COMPUTE CLOUD



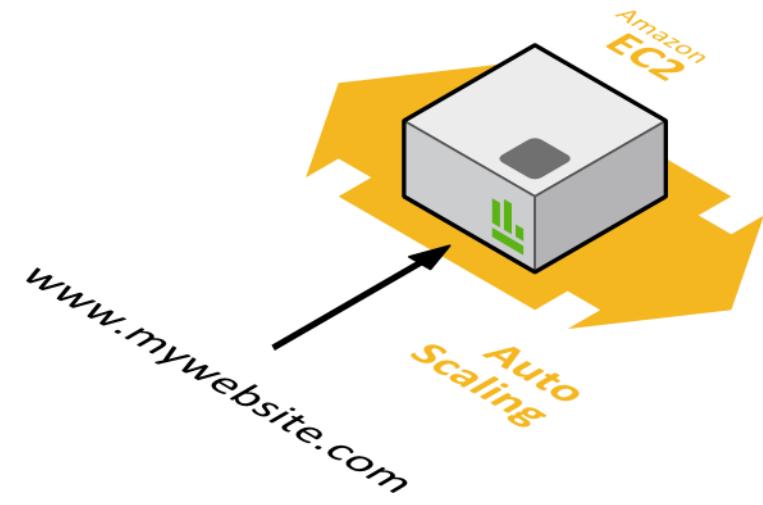
# AMAZON CLOUDWATCH

MONITORING FOR AWS RESOURCES



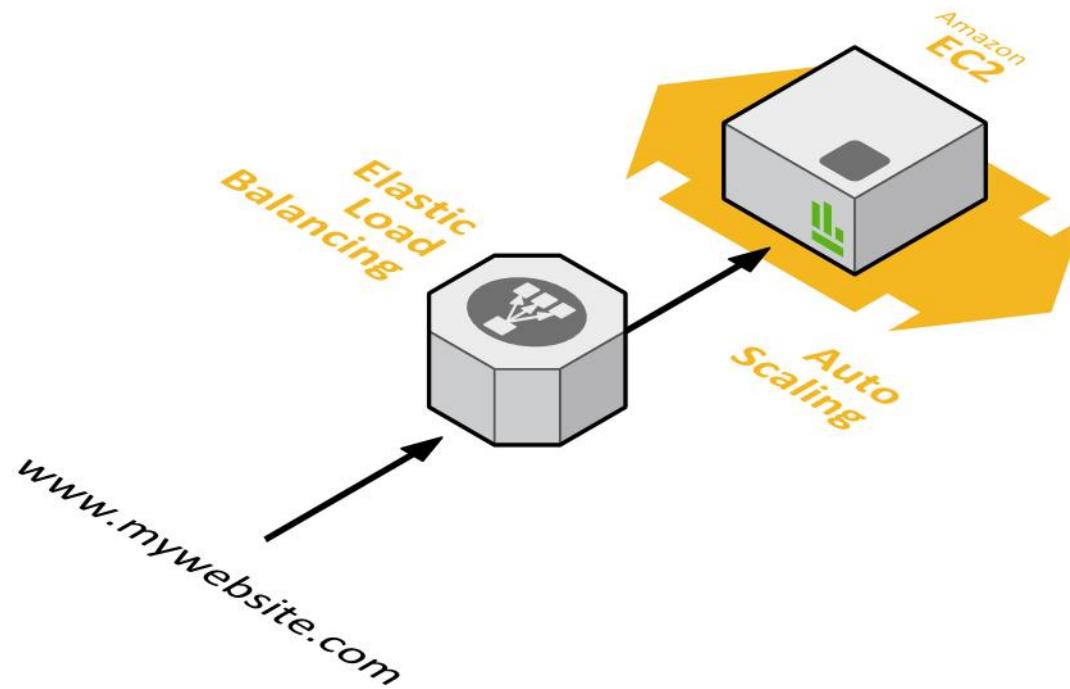
# AUTO SCALING

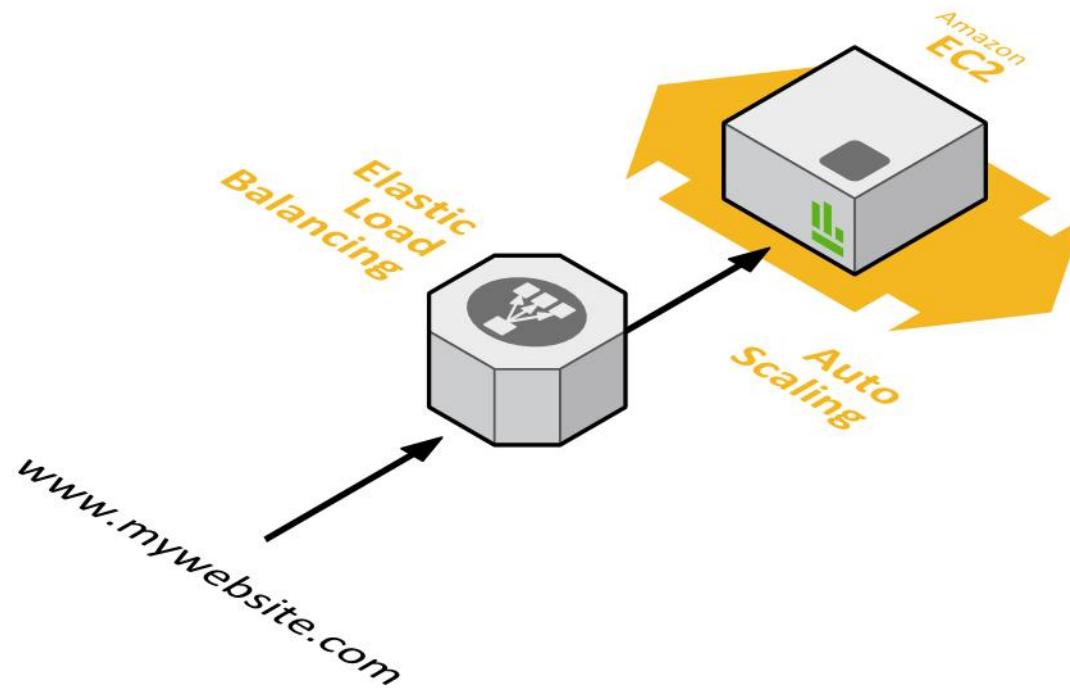
## SCALE UP/DOWN EC2 CAPACITY



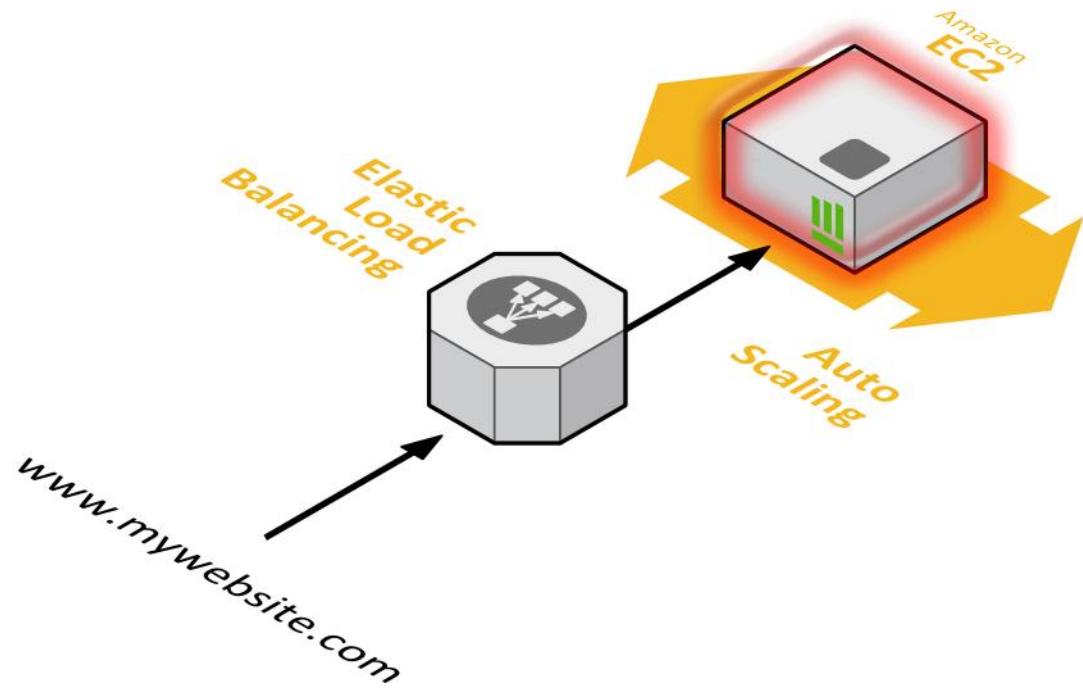
# **ELASTIC LOAD BALANCING**

**NETWORK TRAFFIC DISTRIBUTION**

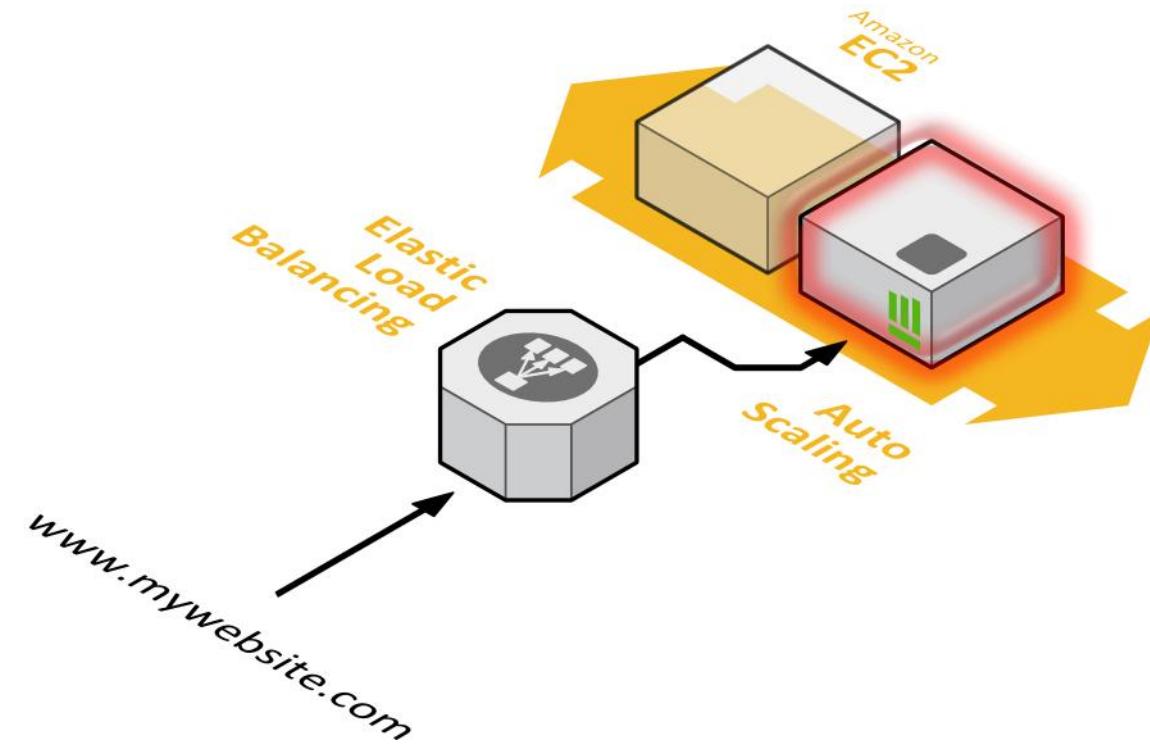




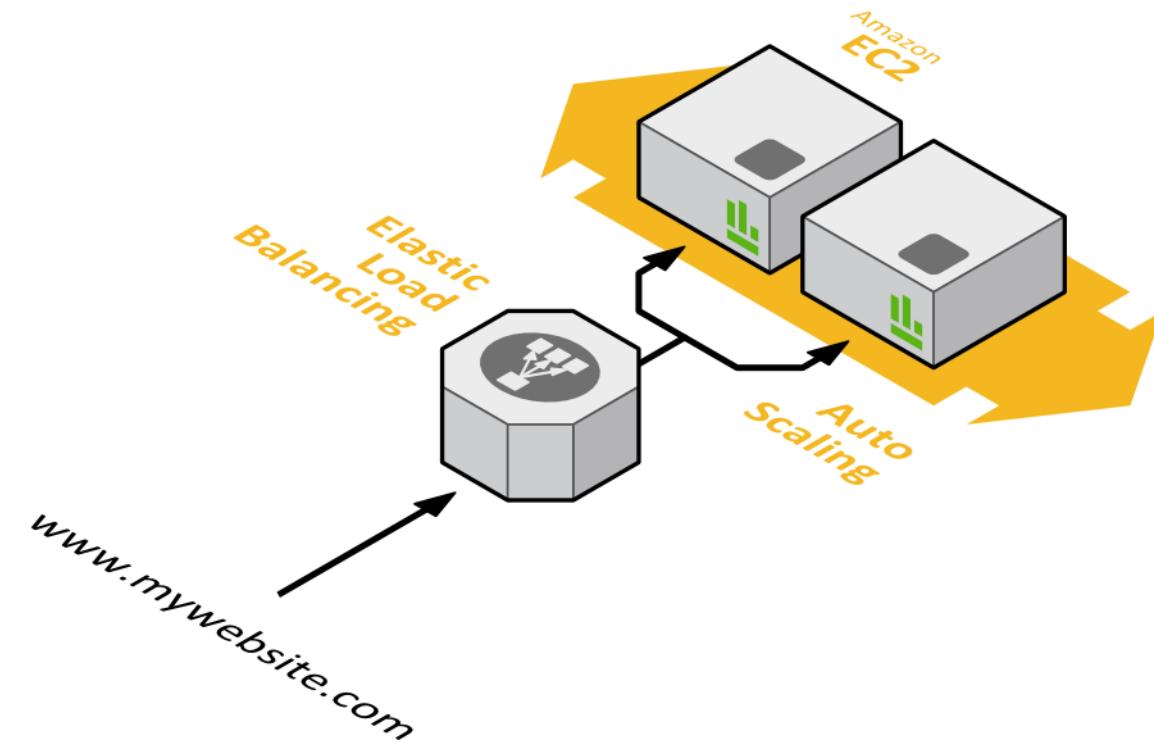
6 am



10 am

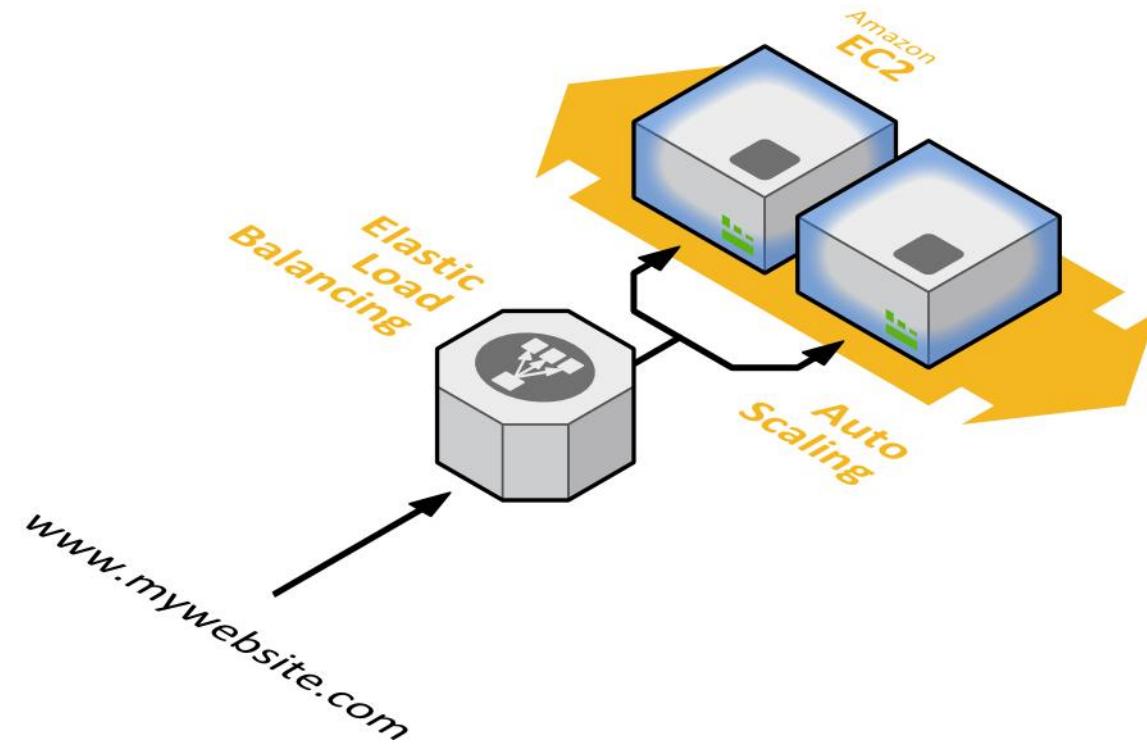


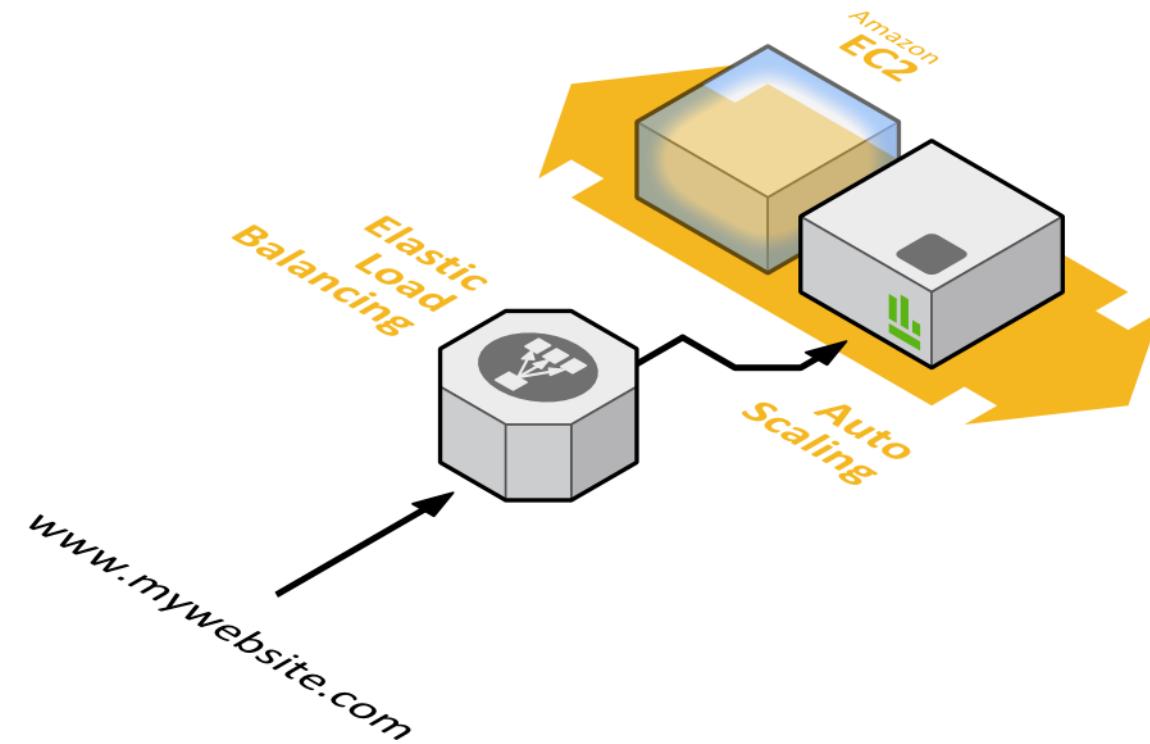
10 am



10 am

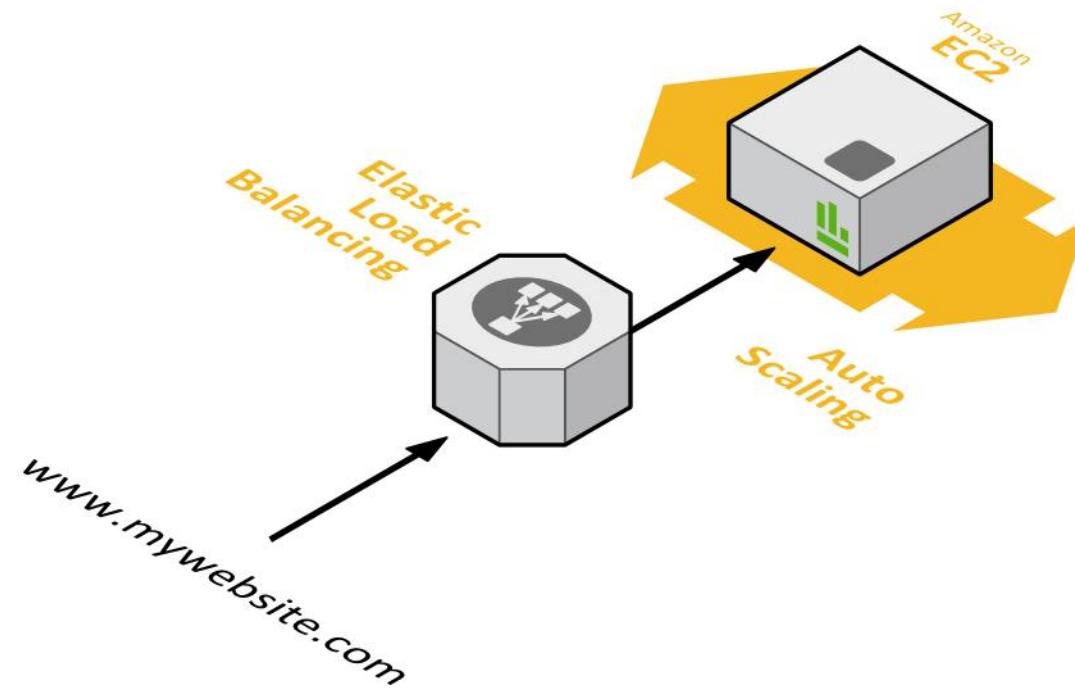
# 7 pm





7 pm

# 7 pm





without elasticity you can't accelerate



what you **really** need is...

...adjustable capacity

#2

# DESIGN FOR FAILURE



« Everything fails  
all the time »

Werner Vogels  
CTO of Amazon

# YOUR GOAL



Applications should **continue to function** even if  
the underlying physical hardware **fails** or is  
**removed or replaced**



**Avoid single points of failure.**

**Avoid single points of failure.**

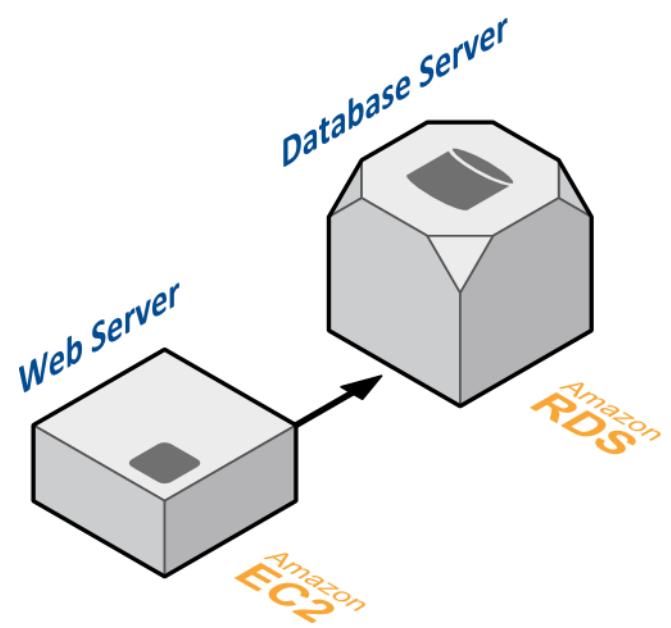


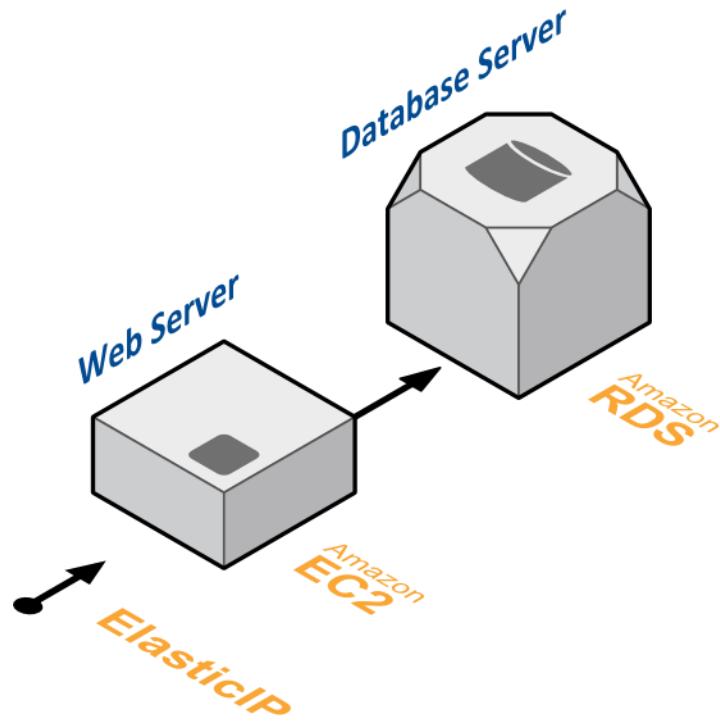
**Assume everything fails, and design backwards.**



# AMAZON RDS

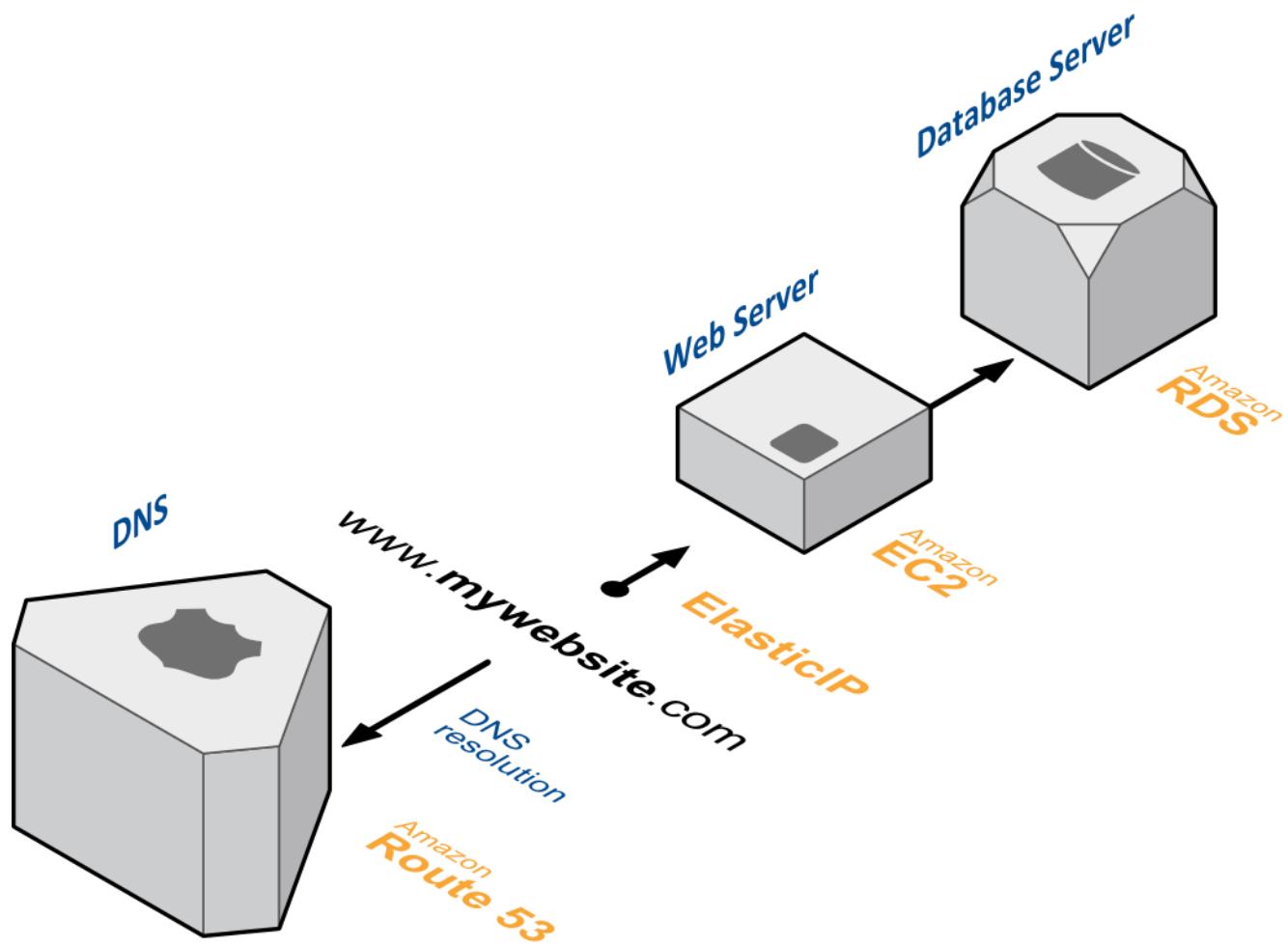
## RELATIONAL DATABASE SERVICE

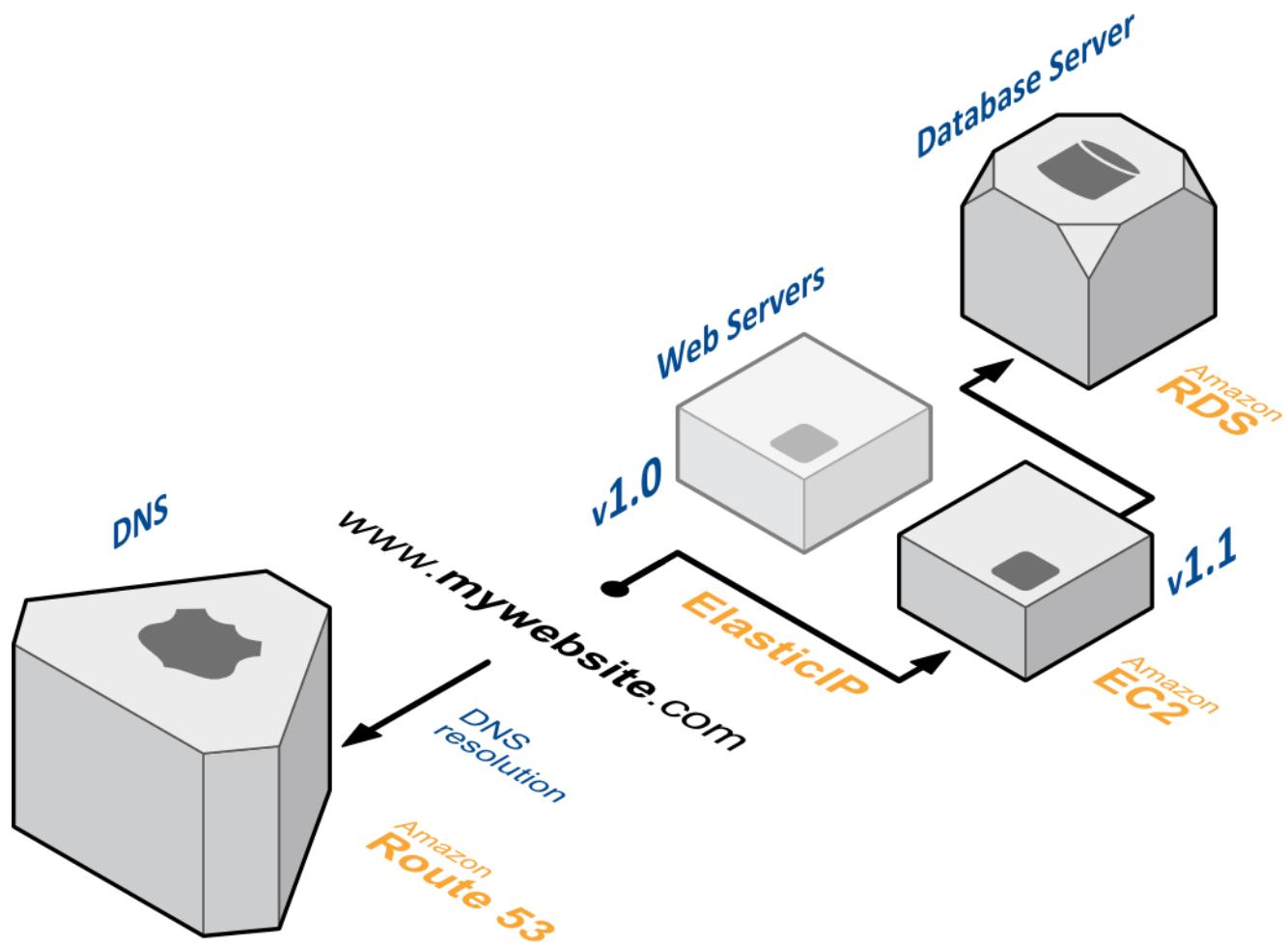


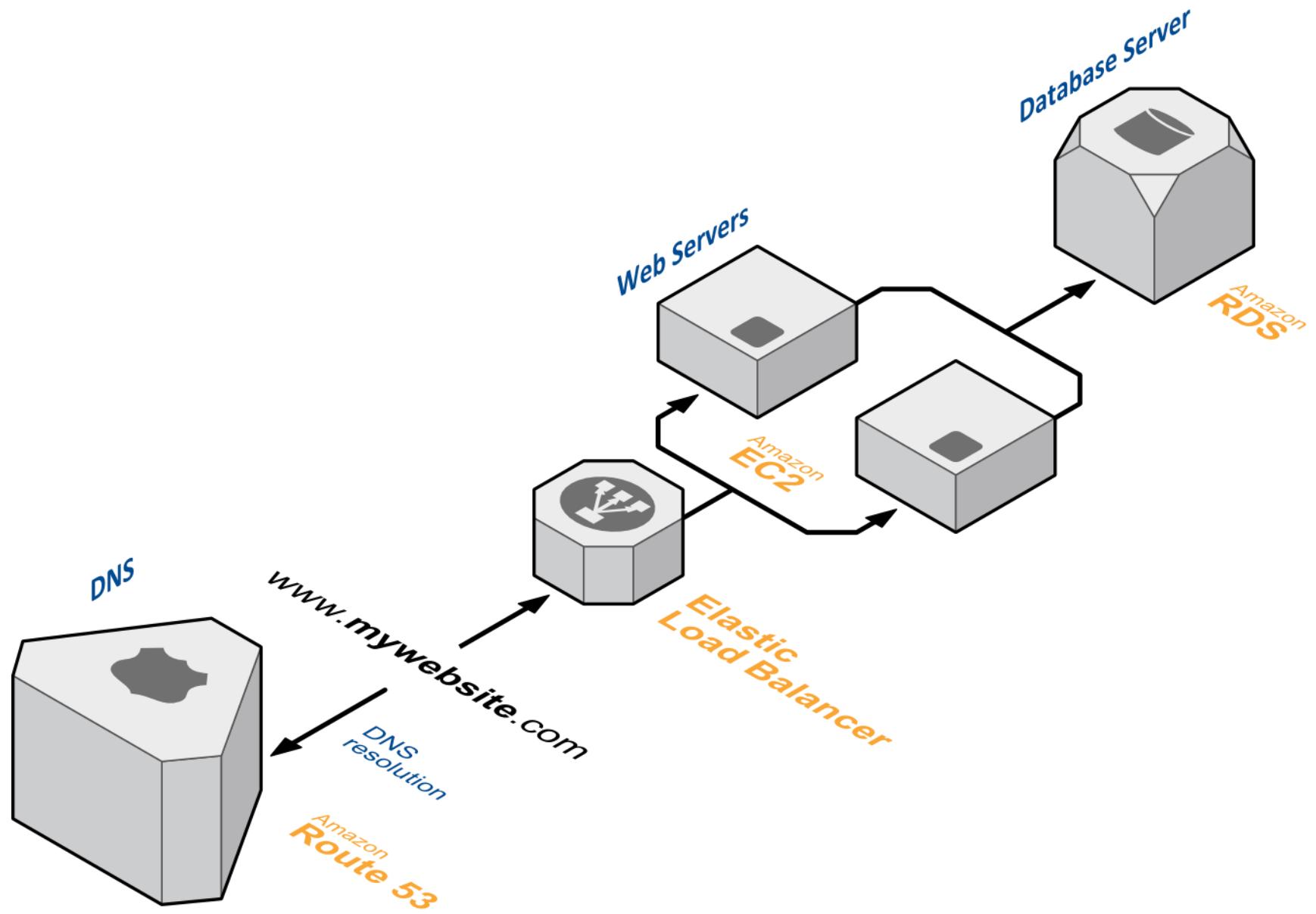


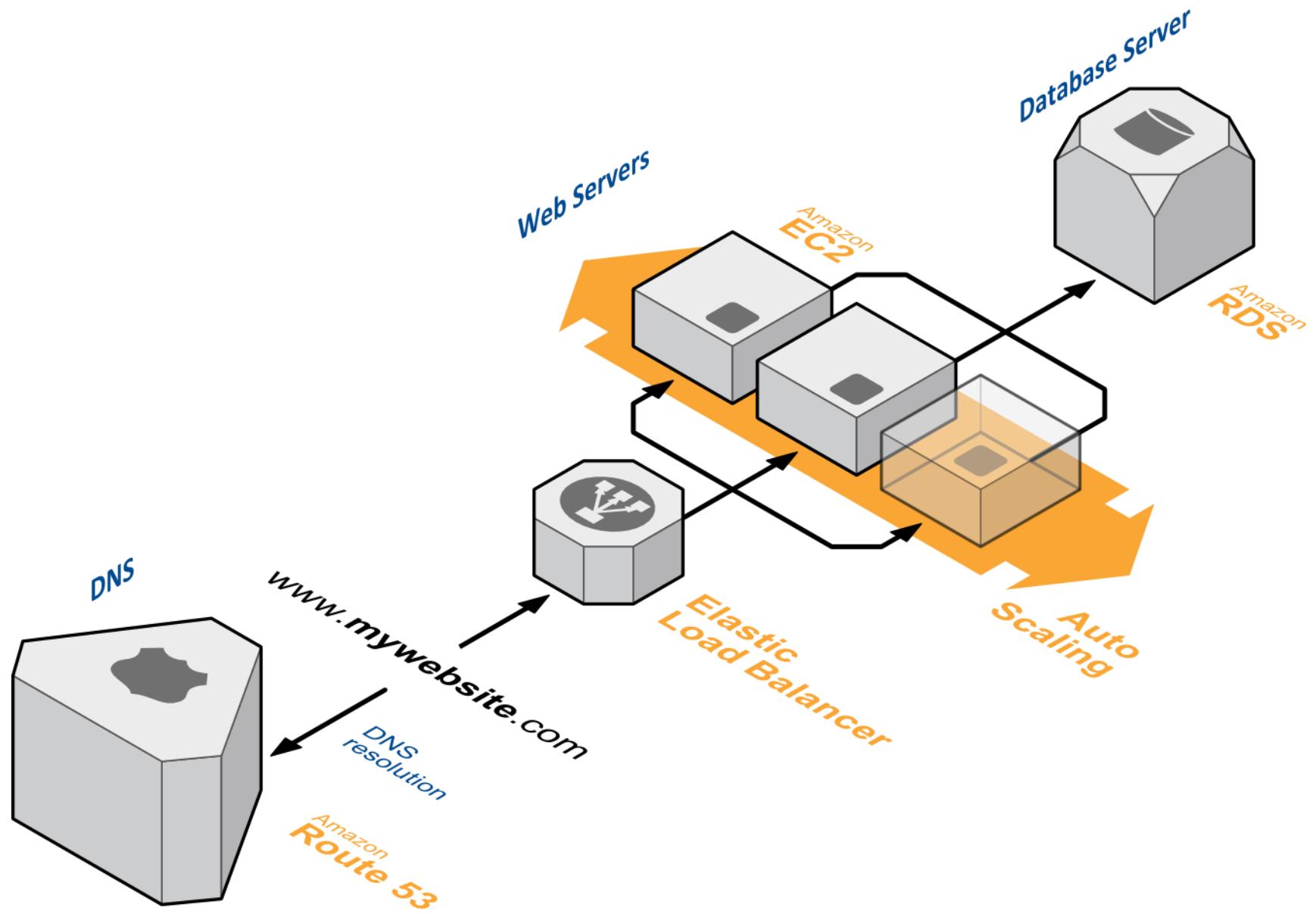
# AMAZON ROUTE 53

## DOMAIN NAME SERVICE

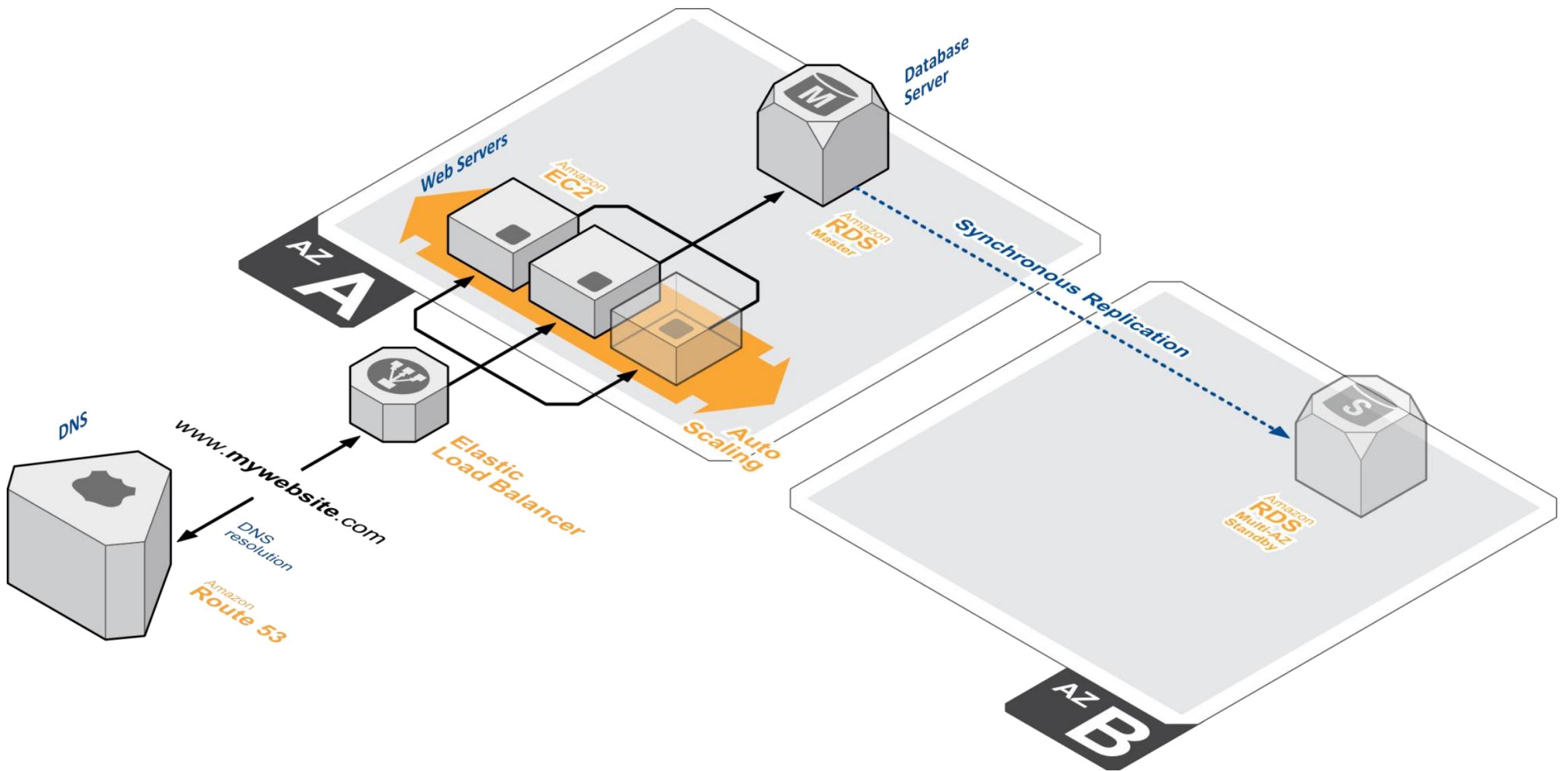


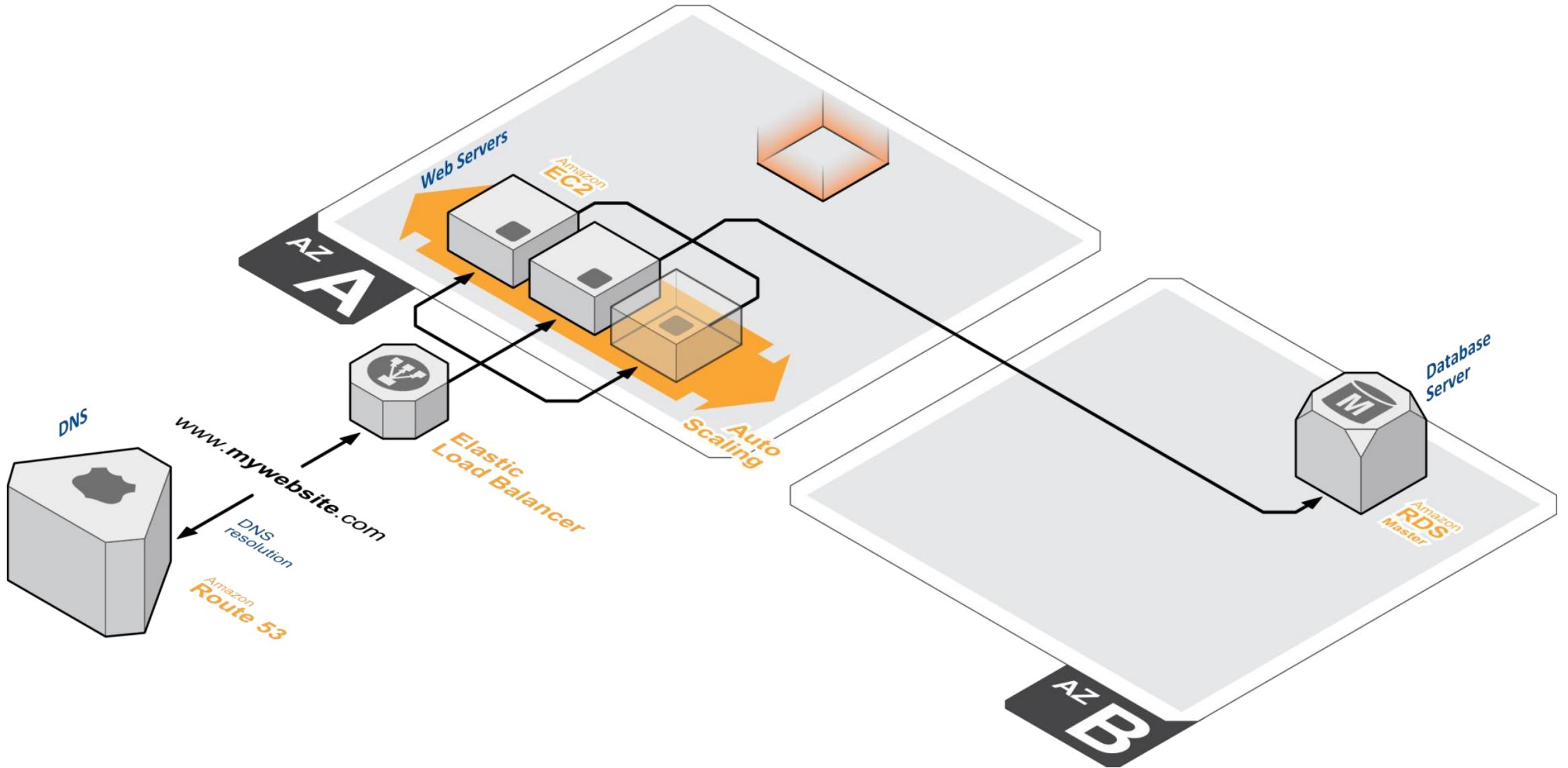


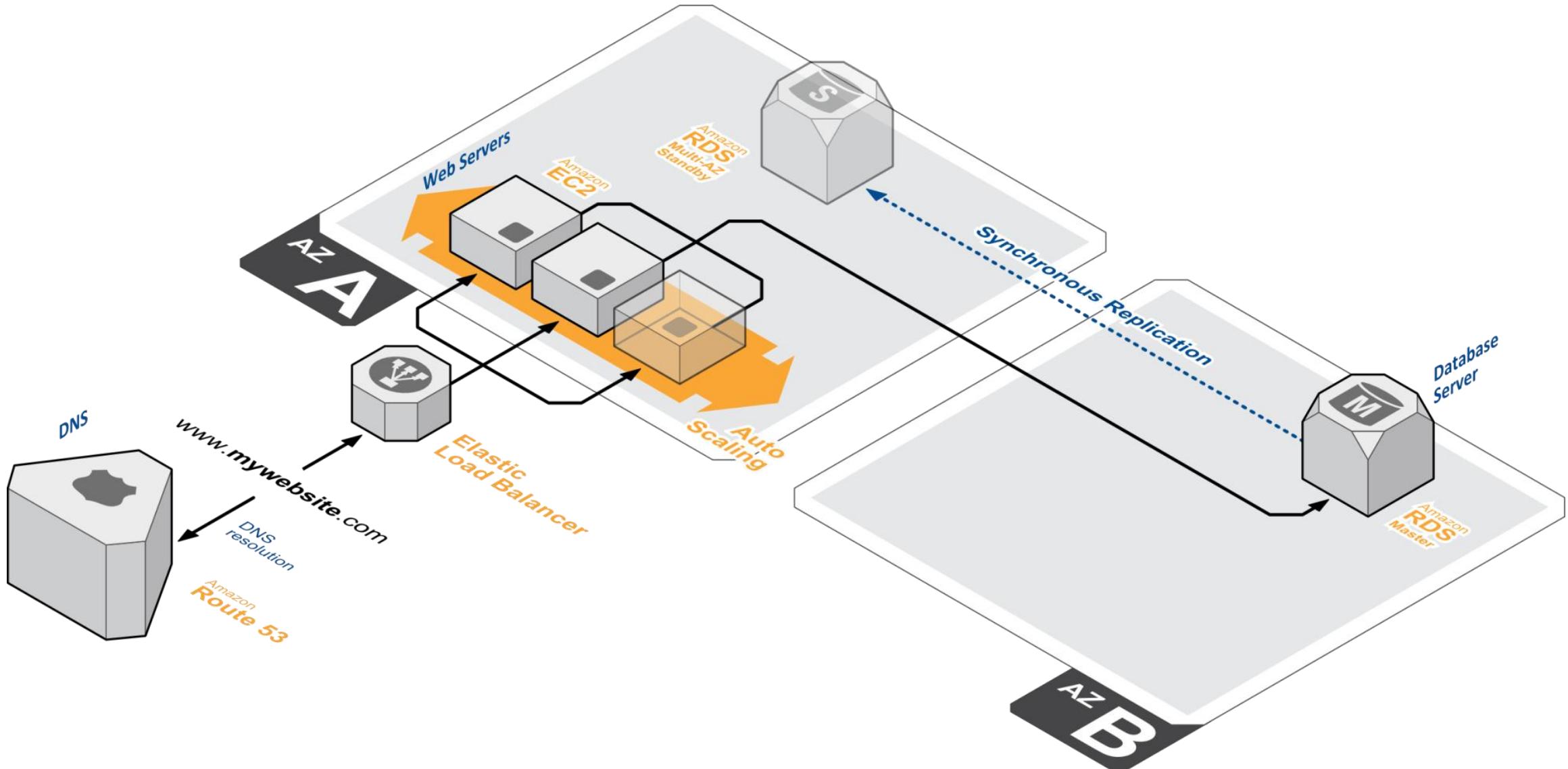


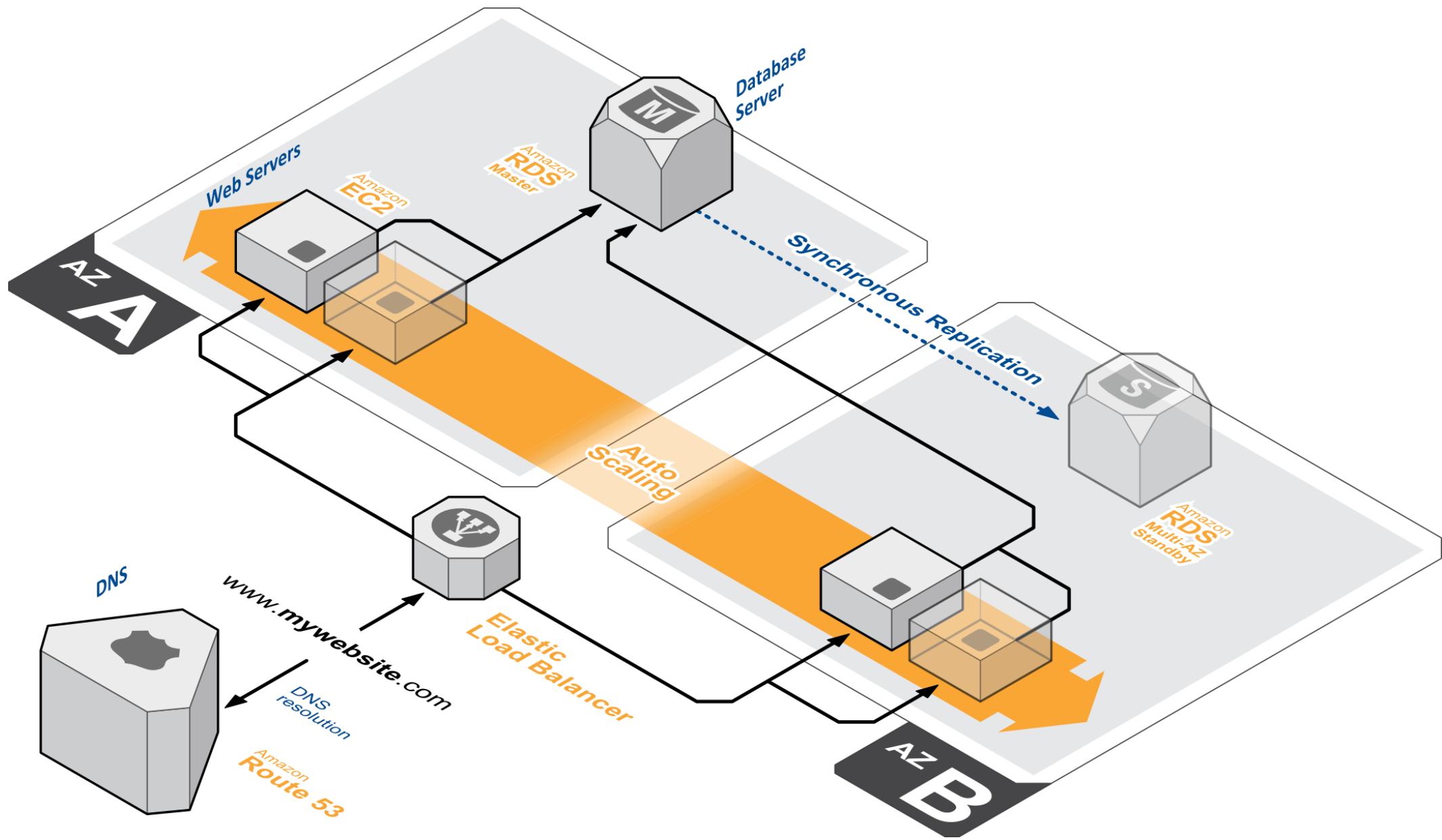


# AMAZON RDS MULTI-AZ DEPLOYMENT

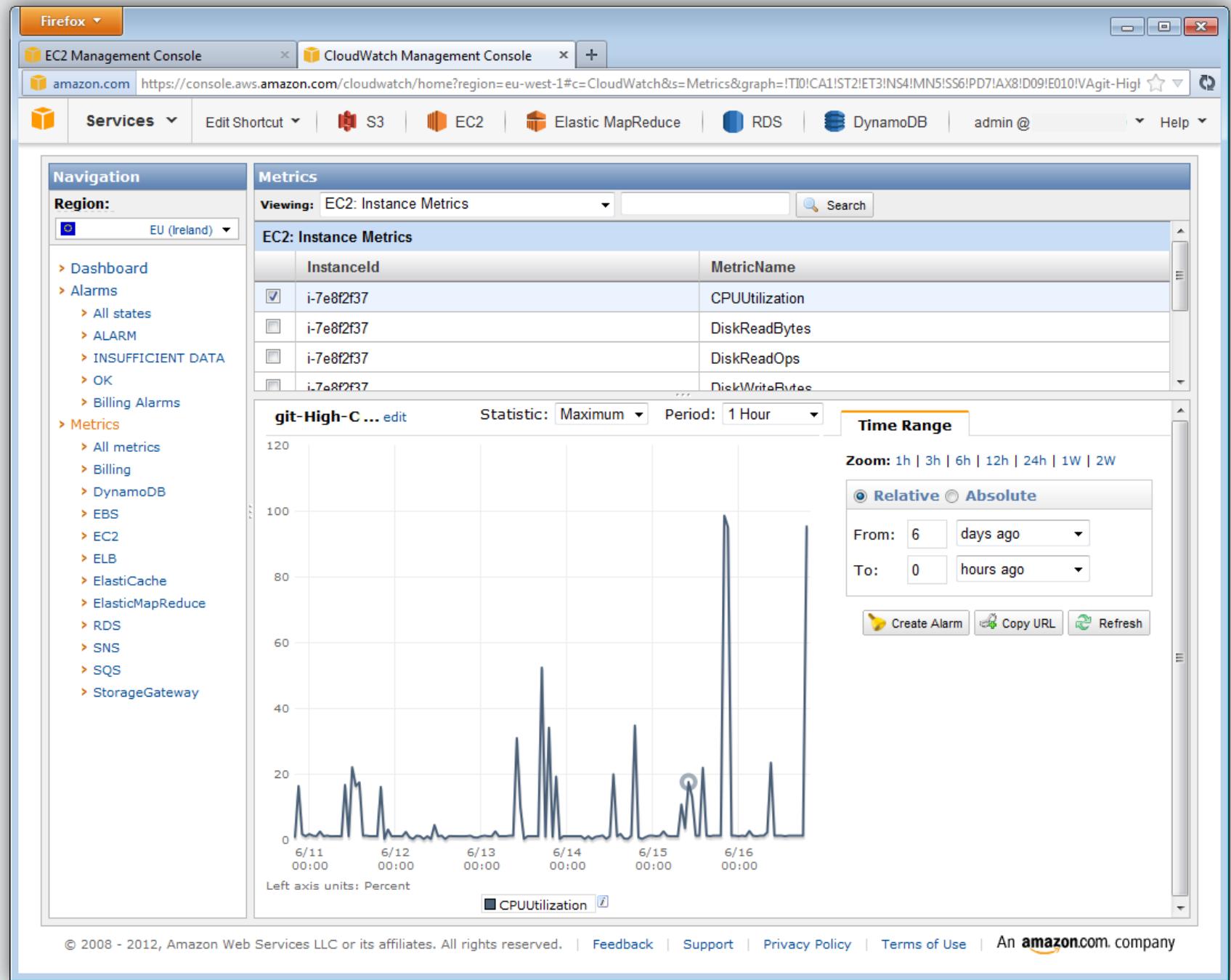








# **AMAZON CLOUDWATCH ALARMS**



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EC2 Management Console CloudWatch Management Console

amazon.com https://console.aws.amazon.com/cloudwatch/home?region=eu-west-1#s=CreateAlarmWizard

Services S3 EC2 Elastic MapReduce RDS DynamoDB admin @ Help

**Create Alarm Wizard**

SELECT METRIC DEFINE ALARM CONFIGURE ACTIONS REVIEW

Set an alarm for any of your CloudWatch metrics. Your alarm will react automatically when a metric reaches your specified threshold. Available actions include sending Amazon SNS notifications and executing Auto Scaling policies. To get started, select a metric. Then preview it, select a statistic and sampling period, and click Continue.

Viewing: All Metrics

NetworkOut (Bytes)

Statistic: Average Period: 1 Minute

Important: select a sample period. A shorter period allows a more sensitive alarm. A longer period smooths out brief spikes.

15,000,000  
10,000,000  
5,000,000  
0

6/16 18:00 6/16 19:00 6/16 20:00

vol-49282f20 VolumeWriteBytes  
vol-49282f20 VolumeWriteOps

EC2: Aggregated Across Instances

MetricName

CPUUtilization

DiskReadBytes

DiskReadOps

DiskWriteBytes

DiskWriteOps

NetworkIn

NetworkOut

Continue ▶

Navigation Your CloudWatch Alarms

Cancel Help

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EC2 Management Console CloudWatch Management Console

amazon.com https://console.aws.amazon.com/cloudwatch/home?region=eu-west-1#s=CreateAlarmWizard

Services S3 EC2 Elastic MapReduce RDS DynamoDB admin @ Help

**Create Alarm Wizard**

SELECT METRIC DEFINE ALARM CONFIGURE ACTIONS REVIEW

Provide the details and threshold for your alarm. Use the graph below to help set the appropriate threshold.

**Identify Your Alarm**

Assign your alarm a name and description.

Name: network\_out\_warning

Description: network output is high (> 8MB)

**Define Alarm Threshold**

Alarms have three states: ALARM, OK, and INSUFFICIENT DATA. The state of your alarm changes according to a threshold you specify. First, define the criterion for entering the ALARM state. Later, you can specify an action to be taken when your alarm enters any of the three states.

This alarm will enter the ALARM state when NetworkOut is  $\geq$  8000000 for 1 minutes.

Metric: NetworkOut  
Period: 1 Minute  
Statistic: Average

**NetworkOut (Bytes)**

15,000,000  
10,000,000  
5,000,000  
0  
17:30 18:00 18:30 19:00 19:30 20:00  
6/16 6/16 6/16 6/16 6/16 6/16

< Back Continue ▶

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EC2 Management Console CloudWatch Management Console

amazon.com https://console.aws.amazon.com/cloudwatch/home?region=eu-west-1#s=CreateAlarmWizard

Services S3 EC2 Elastic MapReduce RDS DynamoDB admin @ Help

**Create Alarm Wizard**

SELECT METRIC DEFINE ALARM CONFIGURE ACTIONS REVIEW

Define what actions are taken when your 'network\_out\_warning' alarm changes.

You can define multiple actions for a single alarm. For example, you may want to scale out your fleet and send an email to your pager when this alarm enters the ALARM state, and then send another all-clear email when it returns to the OK state.

**Define Your Actions**

Actions define what steps you want to automate when the alarm state changes. For example, you can send a message using email via the Simple Notification Service (SNS). You can also execute an Auto Scaling Policy, if you have one configured (learn about policies).

| When Alarm state is | Take action       | Action details   |  |
|---------------------|-------------------|--|--|
| ALARM               | Send Notification | Topic: NotifyMe Email(s): [REDACTED]@amazon.com REMOVE |  |
| ALARM               | Send Notification | Topic: Select or create email topic... ADD ACTION      |  |

< Back Continue ➤

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EC2 Management Console CloudWatch Management Console

amazon.com https://console.aws.amazon.com/cloudwatch/home?region=eu-west-1#s=CreateAlarmWizard

Services S3 EC2 Elastic MapReduce RDS DynamoDB admin @ Help

**Create Alarm Wizard**

SELECT METRIC DEFINE ALARM CONFIGURE ACTIONS REVIEW

Please review the alarm information below. If you would like to proceed with this configuration, click **Create Alarm**. If you want to make any changes to this alarm, click **Back** or select a step on the right to edit.

**Alarm Definition**

Name: network\_out\_warning  
Description: network output is high (> 8MB)  
In ALARM state when: the value is  $\geq 8000000$  for 1 minutes

**Metric**

Namespace: AWS/EC2  
MetricName: NetworkOut  
Period / Statistic: 1 Minute / Average

**Alarm Actions**

Actions:

When alarm state is "ALARM"  
Action Type: Send Notification  
Action: Notify topic: NotifyMe ([REDACTED]@amazon.com)

< Back Create Alarm ▶

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EC2 Management Console CloudWatch Management Console

amazon.com https://console.aws.amazon.com/cloudwatch/home?region=eu-west-1#s=Alarms&alarmFilter=ANY

Services S3 EC2 Elastic MapReduce RDS DynamoDB admin @ Help

**Navigation**

Region: EU (Ireland)

- Dashboard
- Alarms
  - All states
  - ALARM
  - INSUFFICIENT DATA
  - OK
  - Billing Alarms
- Metrics
  - All metrics
  - Billing
  - DynamoDB
  - EBS
  - EC2
  - ELB
  - ElasticCache
  - ElasticMapReduce
  - RDS
  - SNS
  - SQS
  - StorageGateway

**Your CloudWatch Alarms**

Create Alarm Modify Delete Show/Hide Refresh Help

Viewing: All alarms

|                                     | State | Name                     | Threshold                             |
|-------------------------------------|-------|--------------------------|---------------------------------------|
| <input checked="" type="checkbox"/> | ALARM | network_out_warning      | NetworkOut >= 8,000,000 for 1 minutes |
| <input type="checkbox"/>            | OK    | git-High-CPU-Utilization | CPUUtilization >= 80 for 5 minutes    |

1 Alarm selected

**Alarm: network\_out\_warning**

Description Metric

**State Details:**  
State changed to 'ALARM' at 2012/06/16 20:43 UTC. Reason: Threshold Crossed: 1 datapoint (8845180.0) was greater than or equal to the threshold (8000000.0).

**Description:**  
network output is high (> 8MB)

**Threshold:**  
NetworkOut >= 8,000,000 for 1 minutes

**Actions:**  
in ALARM Send message to topic "NotifyMe"  
state - [REDACTED]@amazon.com

**network\_out\_warning**  
NetworkOut >= 8,000,000

18:00 19:00 19:30 20:00 20:30 21:00  
6/16 6/16 6/16 6/16 6/16 6/16

> View metrics graph

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ALARM: "network\_out\_warning" in EU - Ireland - Message (Plain Text)

File Message

From: AWS Notifications <no-reply@sns.amazonaws.com>  
To: Conde, Carlos  
Cc:  
Subject: ALARM: "network\_out\_warning" in EU - Ireland

Sent: Sat 6/16/2012 10:44 PM

You are receiving this email because your Amazon CloudWatch Alarm "network\_out\_warning" in the EU - Ireland region has entered the ALARM state, because "Threshold Crossed: 1 datapoint (8845180.0) was greater than or equal to the threshold (8000000.0)." at "Saturday 16 June, 2012 20:43:29 UTC".

View this alarm in the AWS Management Console:  
[https://console.aws.amazon.com/cloudwatch/home?region=eu-west-1#s=Alarms&alarm=network\\_out\\_warning](https://console.aws.amazon.com/cloudwatch/home?region=eu-west-1#s=Alarms&alarm=network_out_warning)

Alarm Details:

- Name: network\_out\_warning
- Description: network output is high (> 8MB)
- State Change: OK -> ALARM
- Reason for State Change: Threshold Crossed: 1 datapoint (8845180.0) was greater than or equal to the threshold (8000000.0).
- Timestamp: Saturday 16 June, 2012 20:43:29 UTC
- AWS Account: [REDACTED]

Threshold:

- The alarm is in the ALARM state when the metric is GreaterThanOrEqualToThreshold 8000000.0 for 60 seconds.

Monitored Metric:

- MetricNamespace: AWS/EC2
- MetricName: NetworkOut
- Dimensions:
- Period: 60 seconds
- Statistic: Average
- Unit: not specified

State Change Actions:

- OK:
- ALARM: [arn:aws:sns:eu-west-1:670934762290:NotifyMe]

AWS Notifications

Firefox ▾

EC2 Management Console CloudWatch Management Console

amazon.com https://console.aws.amazon.com/cloudwatch/home?region=eu-west-1#s=Alarms

Services S3 EC2 Elastic MapReduce RDS DynamoDB admin @ Help

**Navigation**

Region: EU (Ireland)

- > Dashboard
- > Alarms
  - > All states
  - > ALARM
  - > INSUFFICIENT DATA
  - > OK
  - > Billing Alarms
- > Metrics
  - > All metrics
  - > Billing
  - > DynamoDB
  - > EBS
  - > EC2
  - > ELB
  - > ElastiCache
  - > ElasticMapReduce
  - > RDS
  - > SNS
  - > SQS
  - > StorageGateway

**Your CloudWatch Alarms**

Create Alarm Modify Delete Show/Hide Refresh Help

Viewing: All alarms 1 to 1 of 1 Items

| State                                  | Name                     | Threshold                          |
|--|--------------------------|------------------------------------|
| <input checked="" type="checkbox"/> OK | git-High-CPU-Utilization | CPUUtilization >= 80 for 5 minutes |

**1 Alarm selected**

Alarm: git-High-CPU-Utilization

Description Metric

**State Details:**  
State changed to 'OK' at 2012/06/16 20:13 UTC.  
Reason: Threshold Crossed: 1 datapoint (72.535) was not greater than or equal to the threshold (80.0).

**Description:**  
Created from EC2 Console

**Threshold:**  
CPUUtilization >= 80 for 5 minutes

**Actions:**  
in ALARM Send message to topic "NotifyMe"  
state - ( [REDACTED]@amazon.com)

git-High-CPU-Utilization CPUUtilization >= 80

View metrics graph

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# AWS BUILDING BLOCKS

## Inherently Fault-Tolerant Services

- ✓ Amazon S3
- ✓ Amazon SimpleDB
- ✓ Amazon DynamoDB
- ✓ Amazon CloudFront
- ✓ Amazon SWF
- ✓ Amazon SQS
- ✓ Amazon SNS
- ✓ Amazon SES
- ✓ Amazon Route53
- ✓ Elastic Load Balancing
- ✓ AWS IAM
- ✓ AWS Elastic Beanstalk
- ✓ Amazon ElastiCache
- ✓ Amazon EMR
- ✓ Amazon CloudSearch

## Fault-Tolerant with the right architecture

- ▶ Amazon EC2
- ▶ Amazon EBS
- ▶ Amazon RDS
- ▶ Amazon VPC





**NETFLIX**  
**CHAOS MONKEY**

# High Scalability

Building bigger, faster, more reliable websites.

HOME REAL LIFE ARCHITECTURES STRATEGIES ALL POSTS ADVERTISING CONTACT BOOK STORE START HERE RSS  
ALL TIME FAVORITES

« [Pinboard.in Architecture - Pay to Play to Keep a System Small](#) | Main | Paper: CRDTs: Consistency without concurrency control »

## Netflix: Continually Test By Failing Servers With Chaos Monkey

TUESDAY, DECEMBER 28, 2010 AT 10:18AM

In [5 Lessons We've Learned Using AWS](#), Netflix's John Ciancutti says the **best way to avoid failure is to fail constantly**. In the cloud it's expected instances can fail at any time, so you always have to be prepared. In the real world we prepare by running drills. Remember all those exciting fire drills? It's not just fire drills of course. The military, football teams, fire fighters, beach rescue, virtually any entity that must react quickly and efficiently to disaster hones their responsiveness by running drills.



Netflix aggressively moves this strategy into the cloud by randomly failing servers using a tool they built called Chaos Monkey. The idea is:

*If we aren't constantly testing our ability to succeed despite failure, then it isn't likely to work when it matters most – in the event of an unexpected outage.*

... Your service, but they always respond:

#3

# LOOSE COUPLING



# BUILD LOOSELY COUPLED SYSTEMS



The **looser** they are coupled,  
the **bigger** they scale



**Create independent components**

**Create independent components**



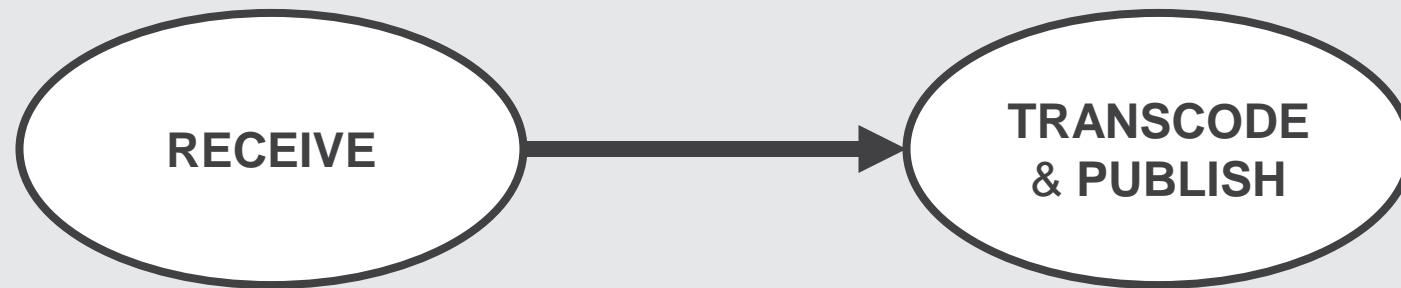
**Design everything as a Black Box**

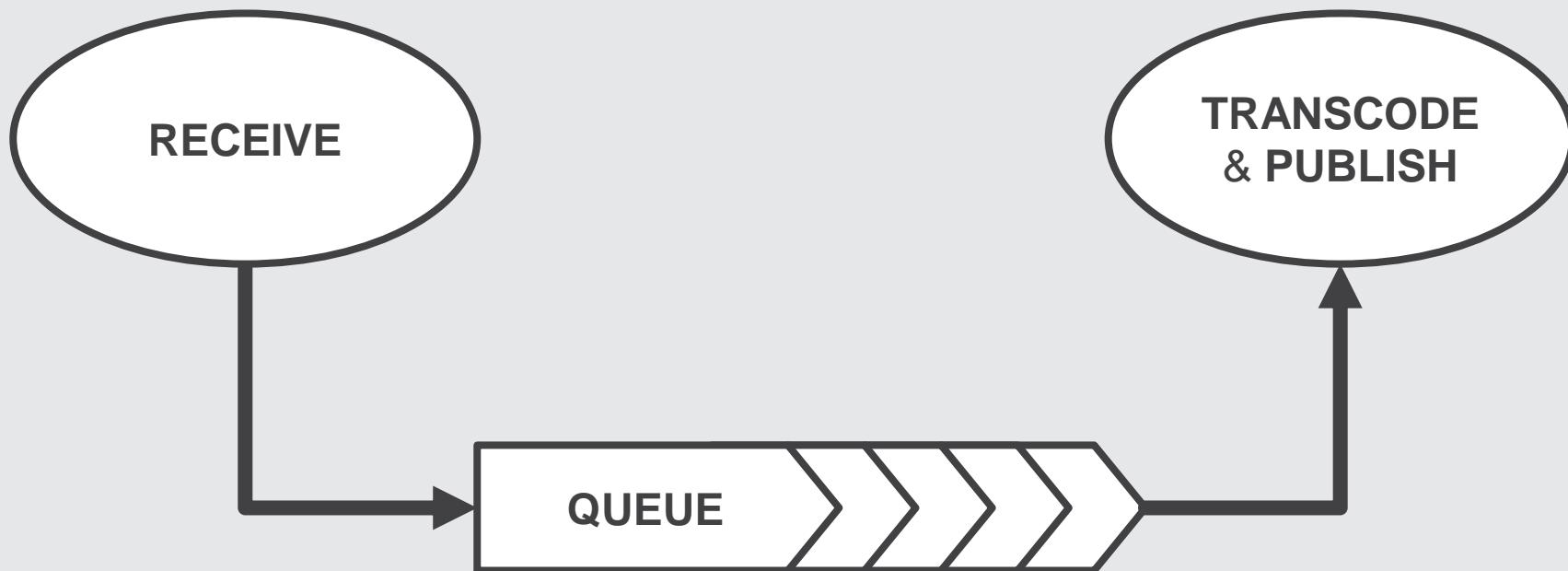
**Create independent components**

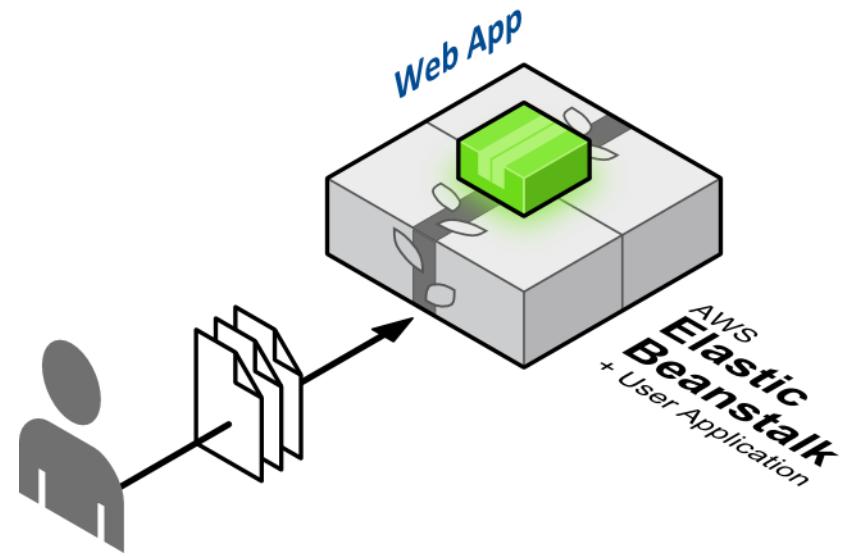
**Design everything as a Black Box**

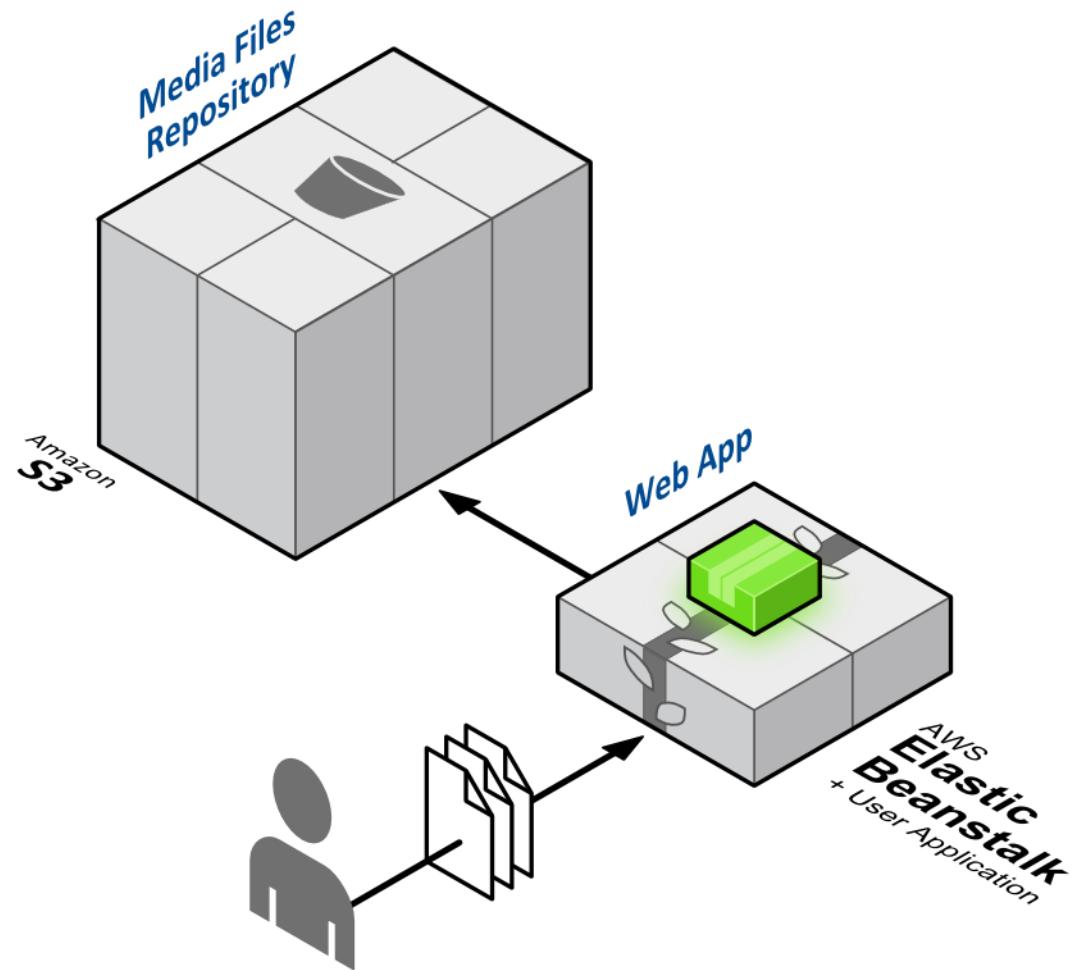
**Think in terms of services**





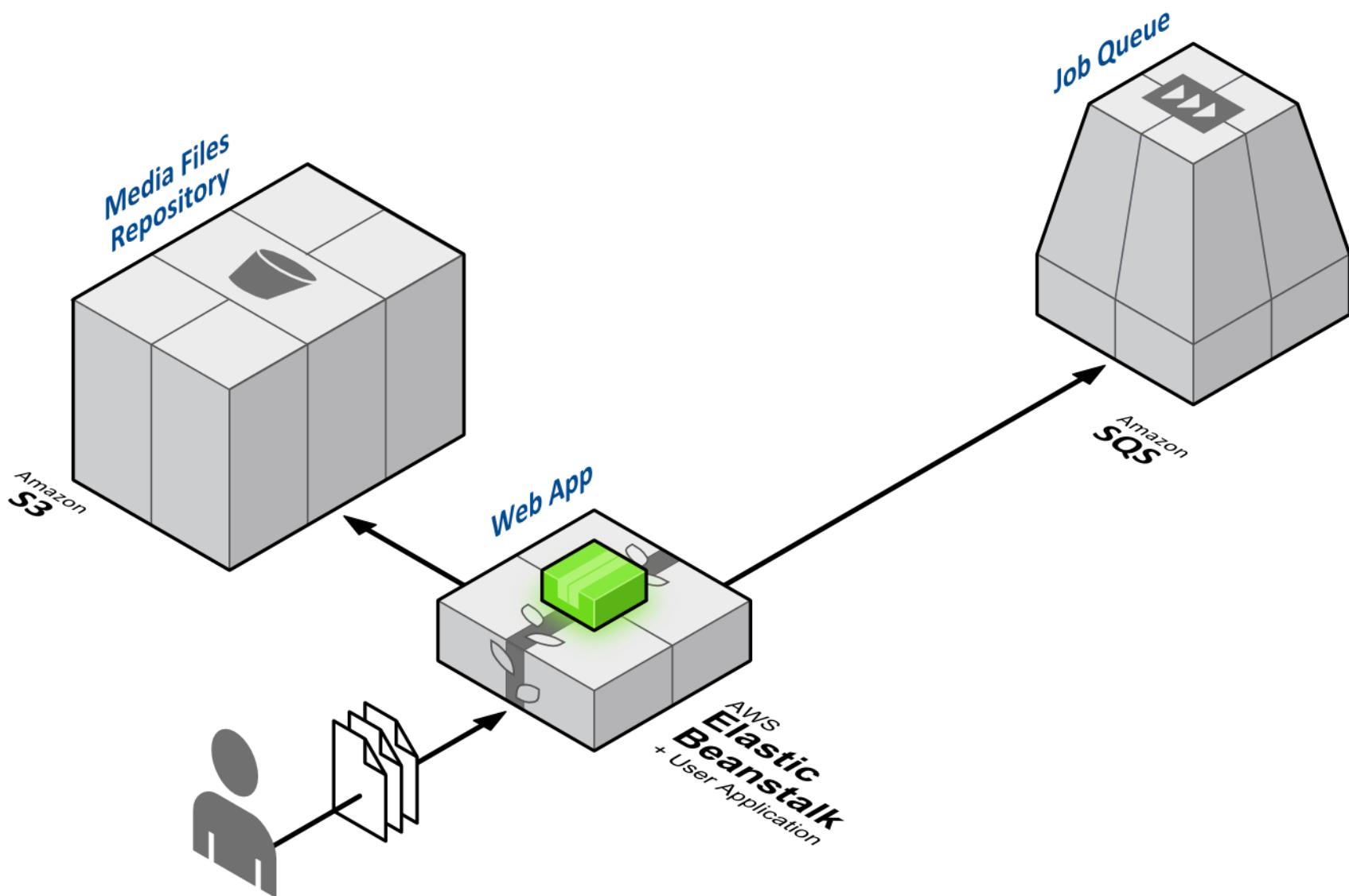


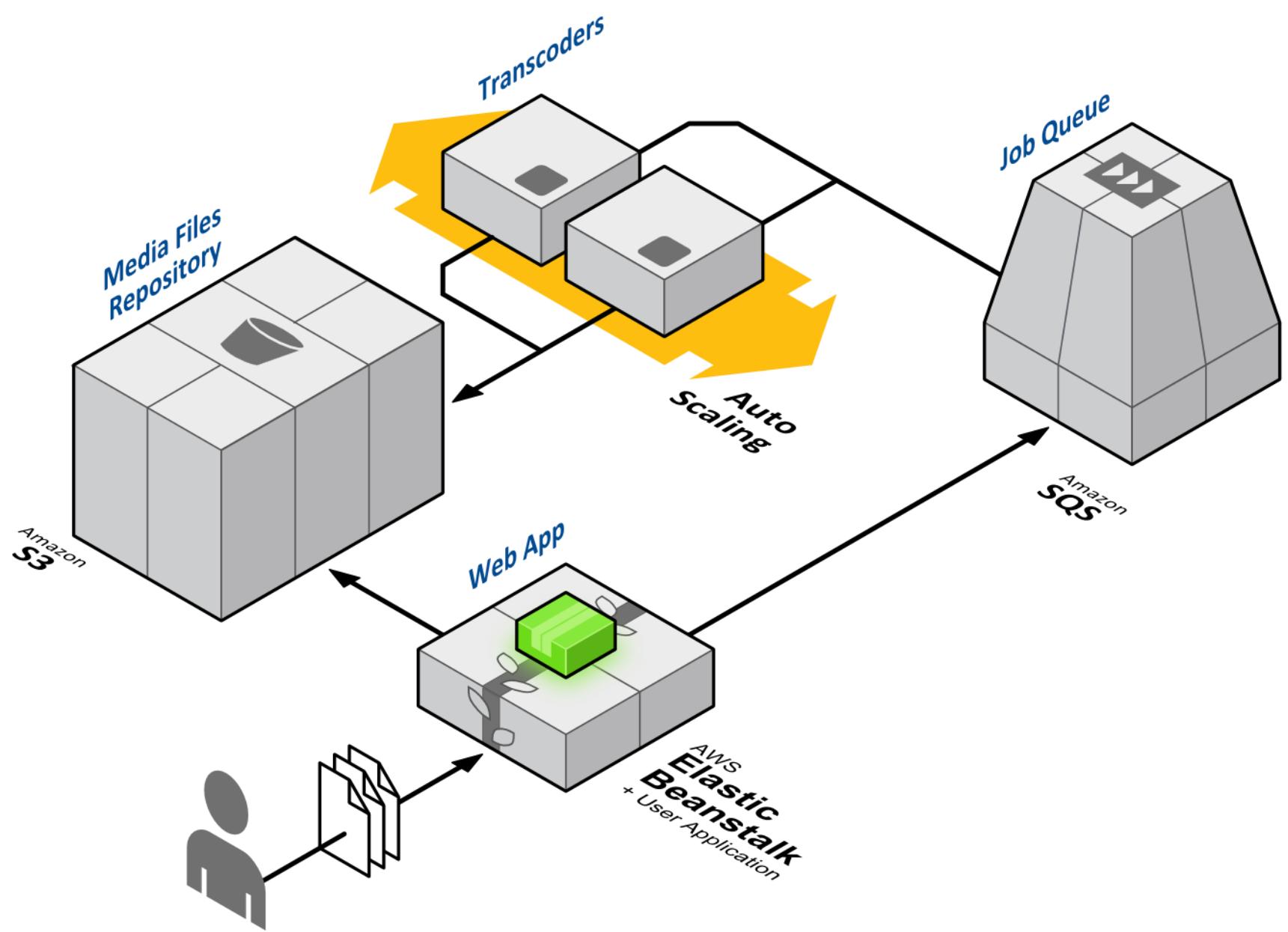


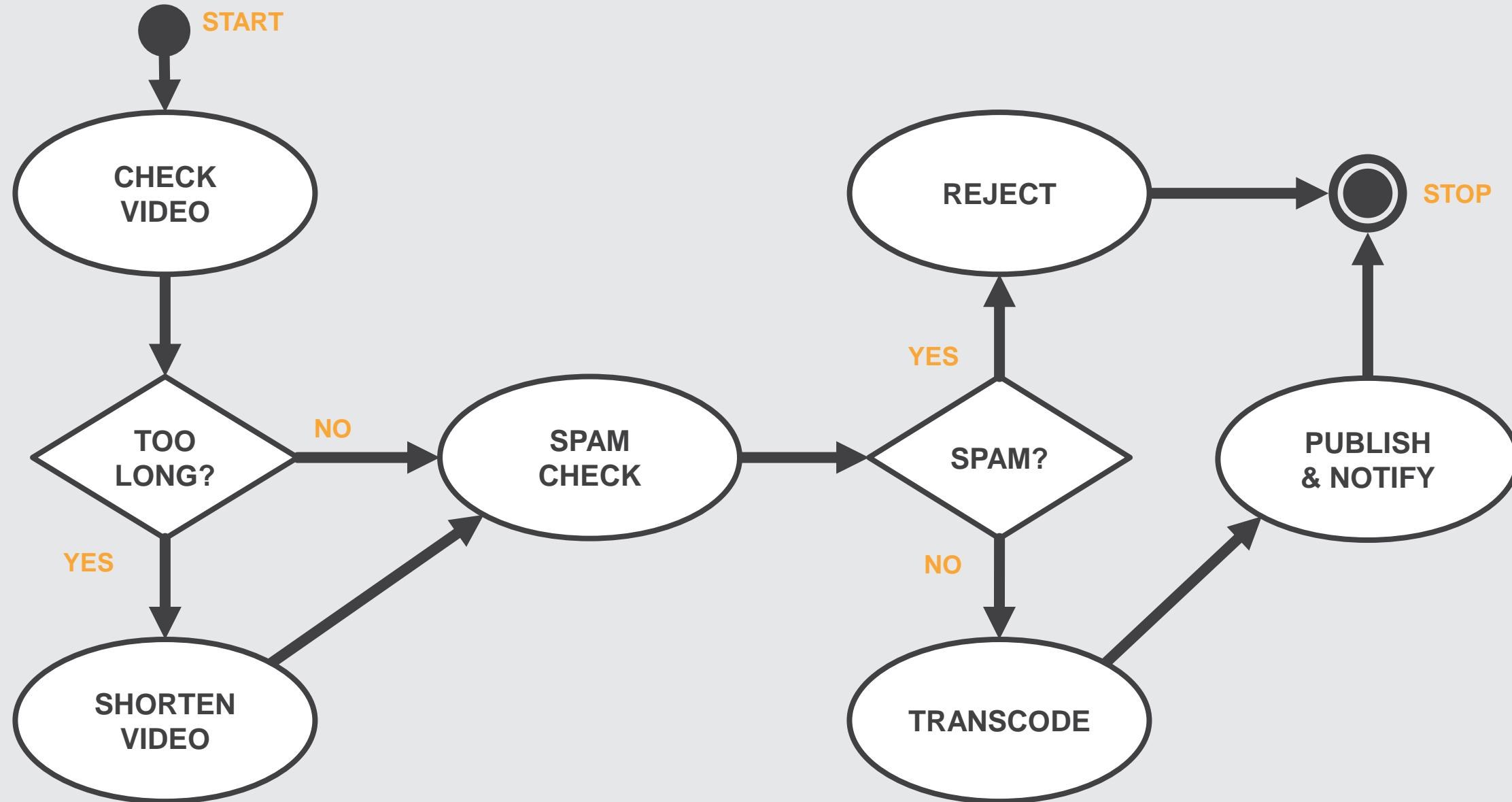


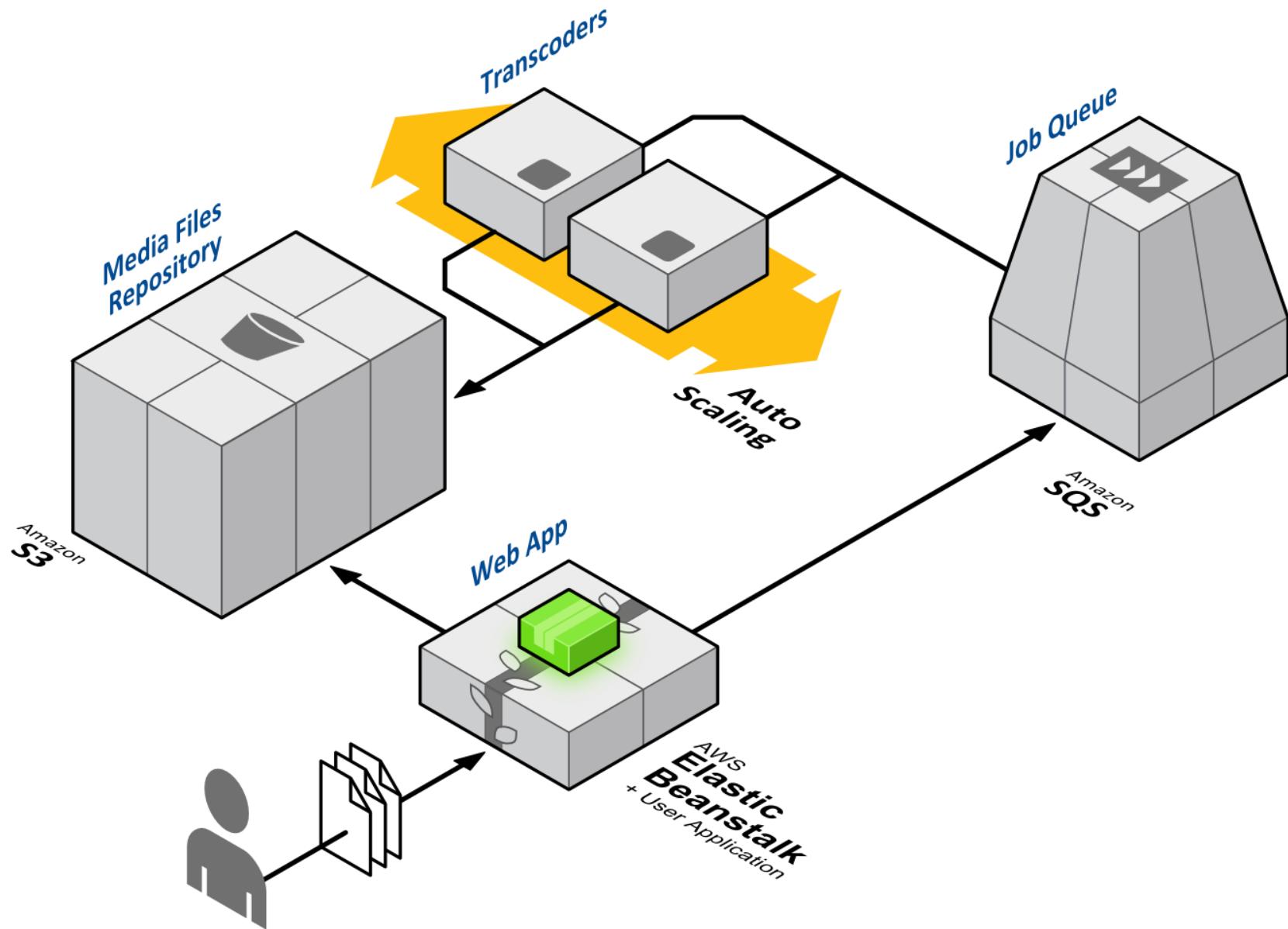
# AMAZON SQS

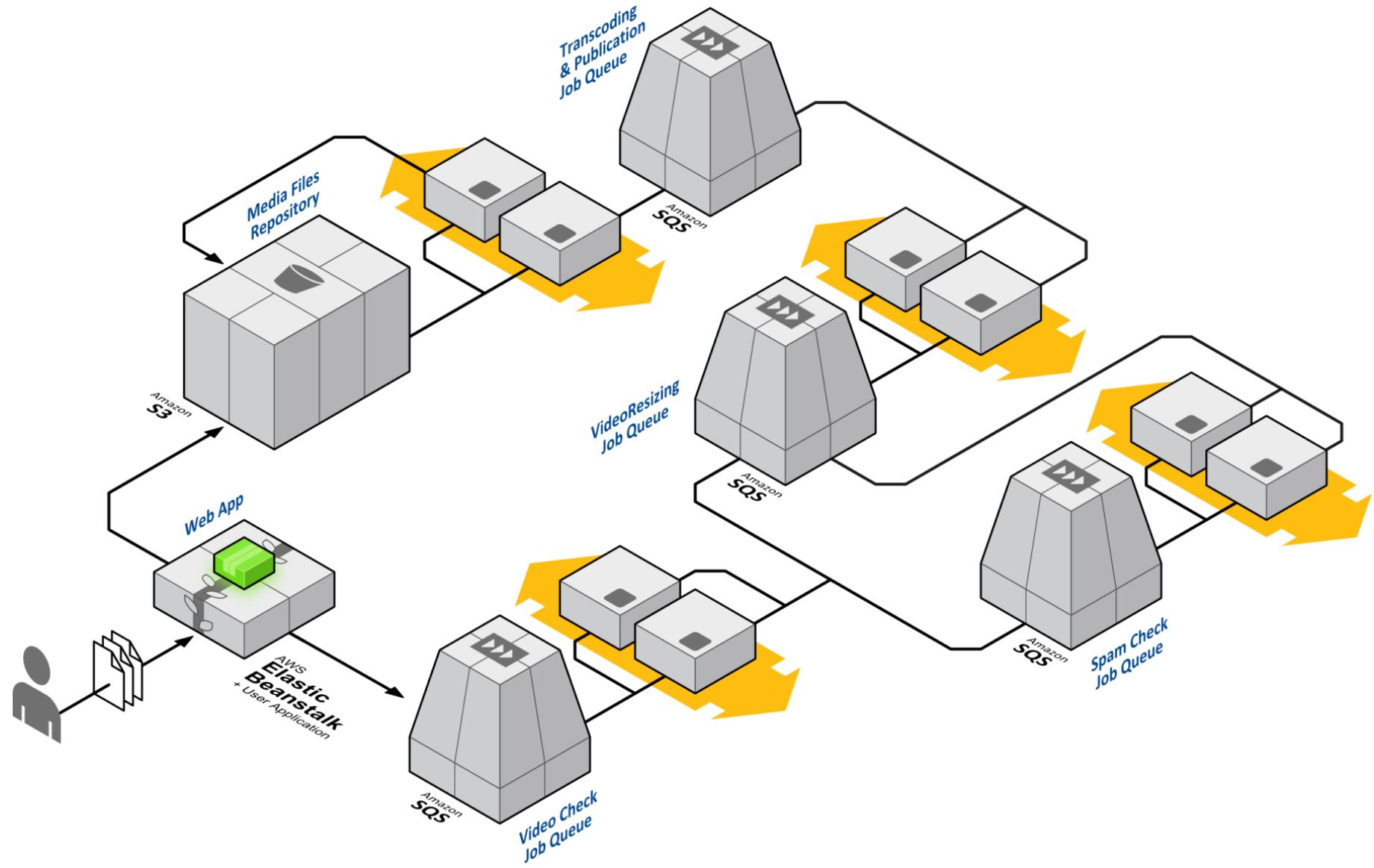
## SIMPLE QUEUE SERVICE

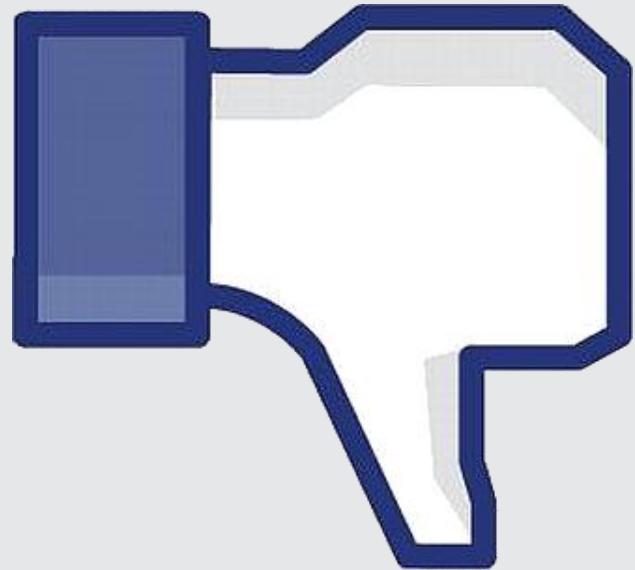






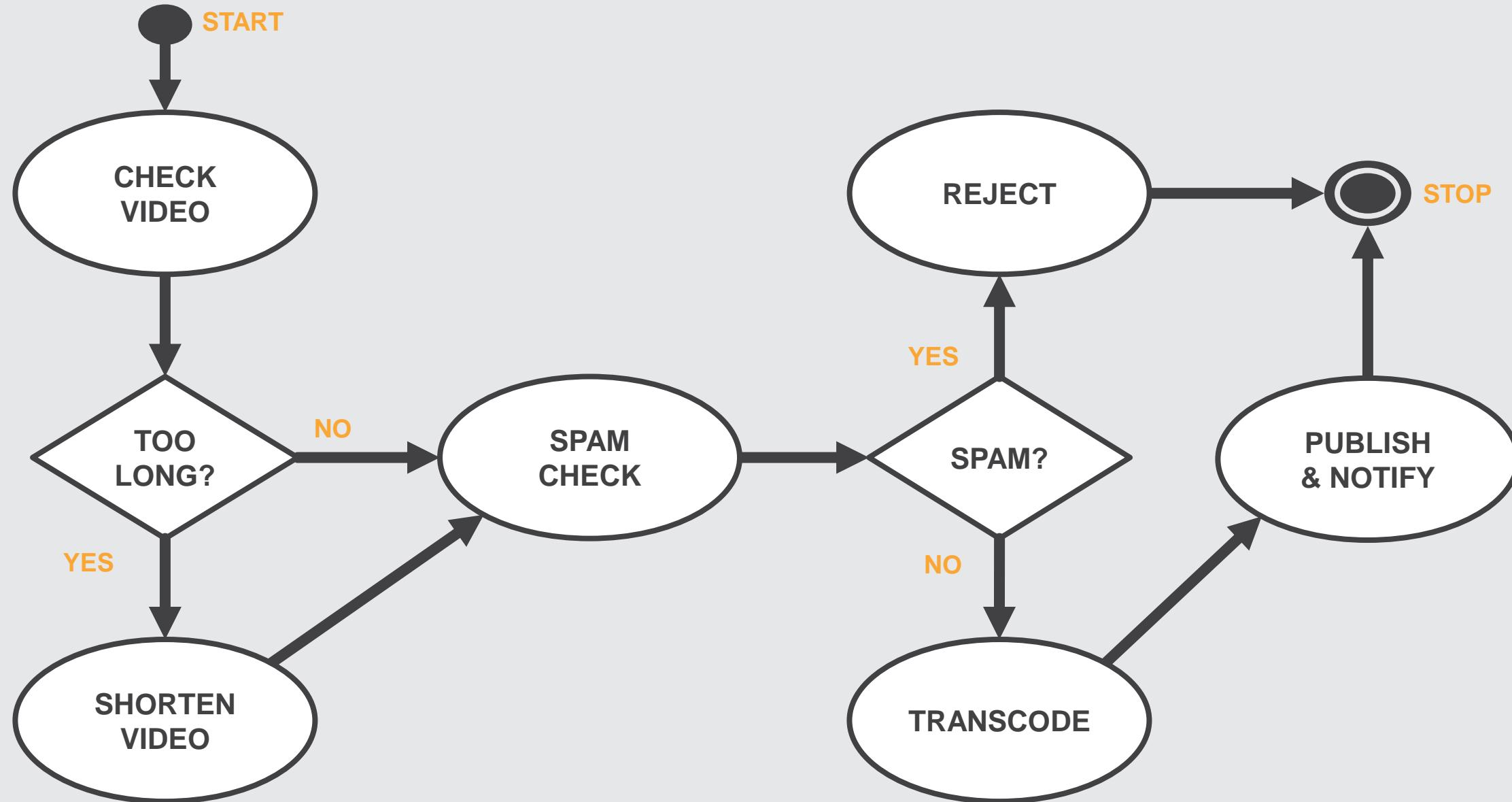


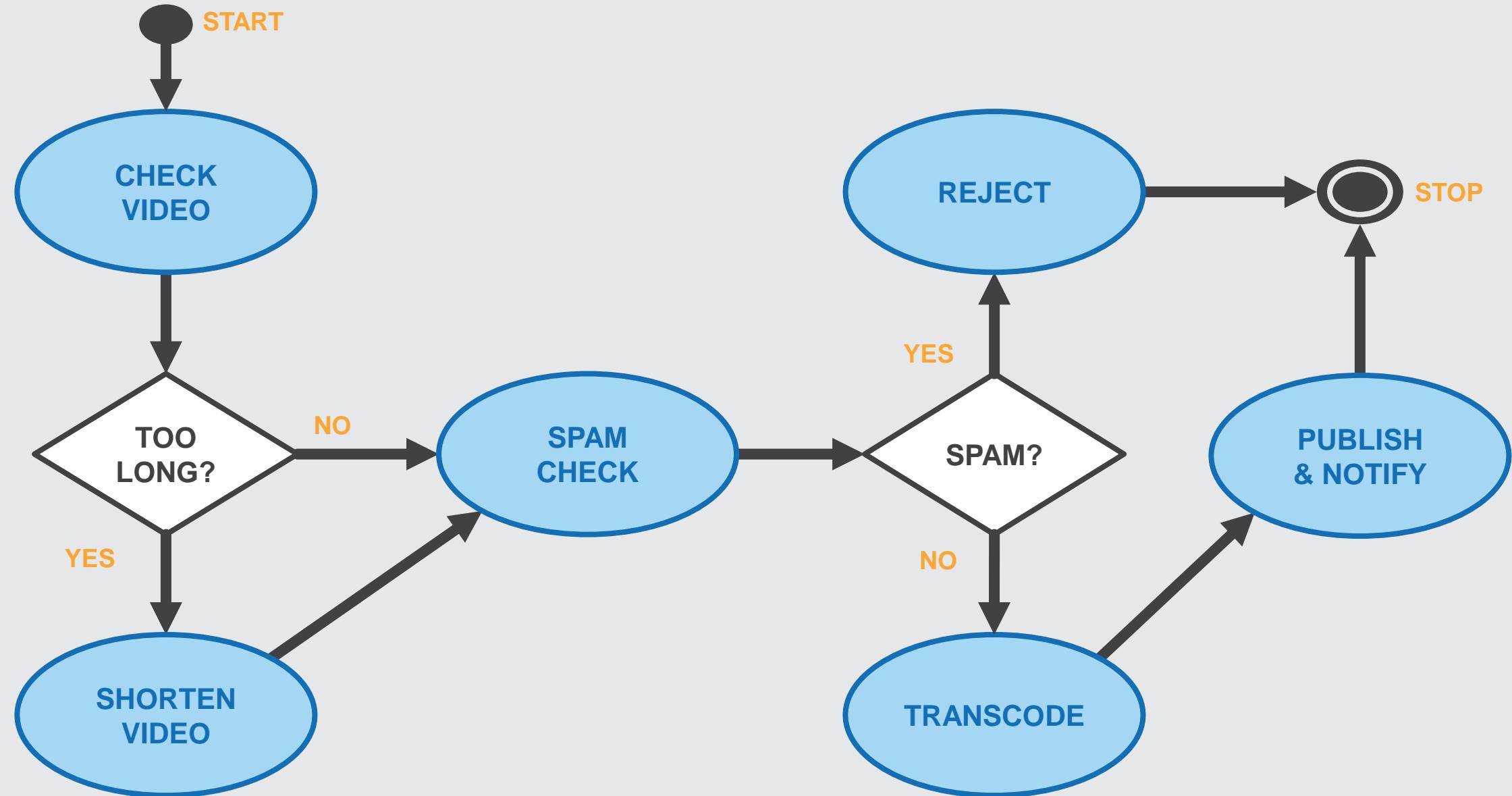


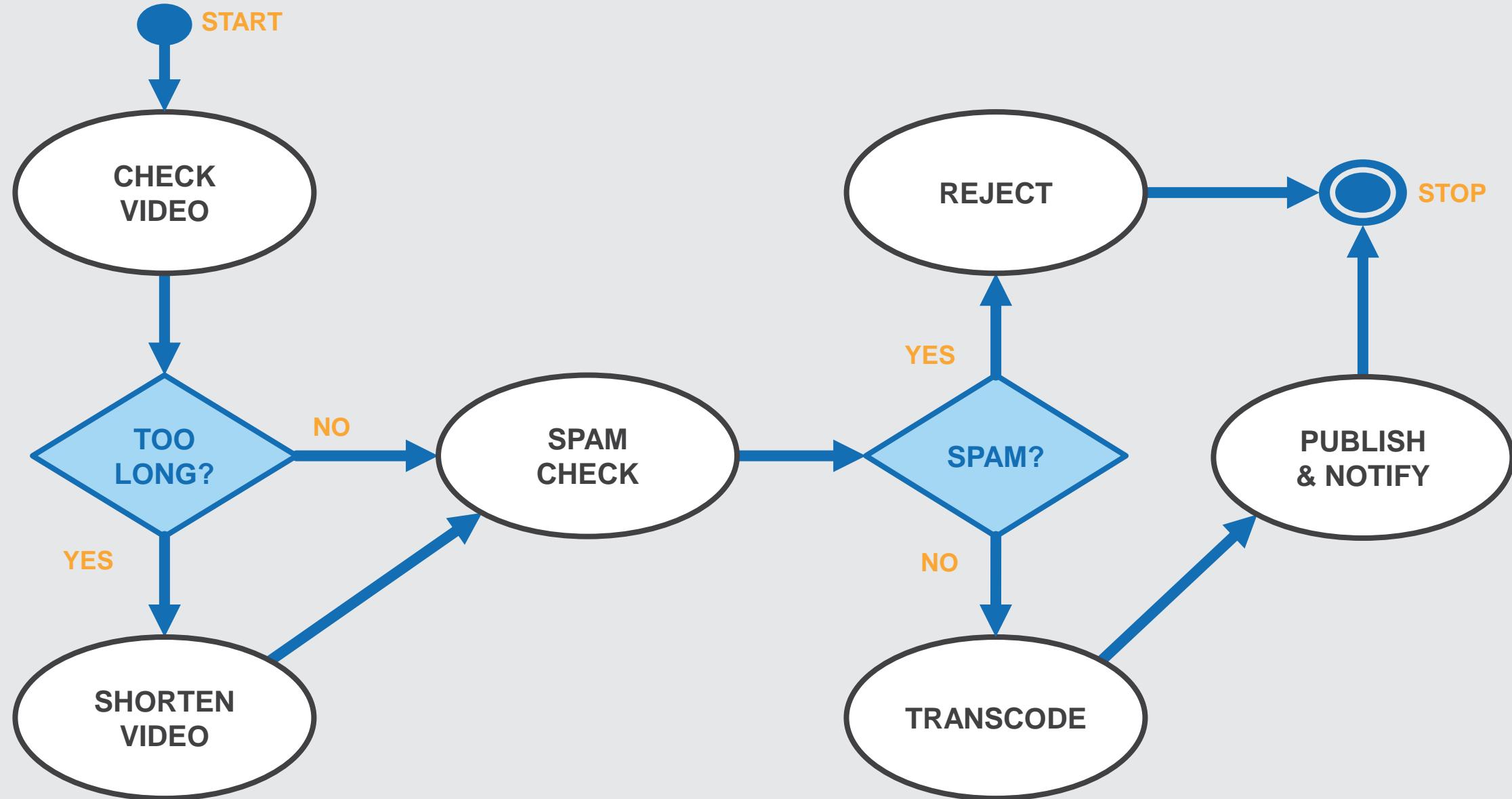


**MAINTENANCE  
AUDITABILITY  
FLEXIBILITY  
LOW-LEVEL**

**WHAT ARE WE  
TRYING TO DO?**







# TASKS

# DECISIONS

# HISTORY



STATELESS !



STATELESS SCALES  
HORIZONTALLY

# AMAZON SWF

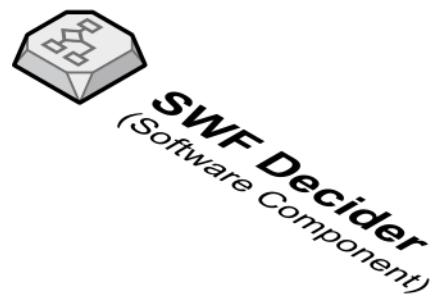
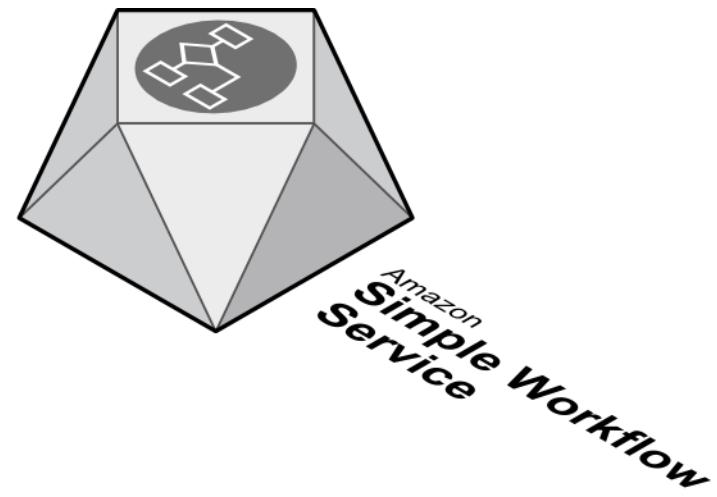
## WORKFLOW SERVICE FOR SCALABLE, RESILIENT APPLICATIONS

# AMAZON SWF

Keeps track of :

- ▶ **State**
- ▶ **Executed tasks**
- ▶ **Timeouts**
- ▶ **Errors**

# WORKFLOW ACTORS



# DECIDERS

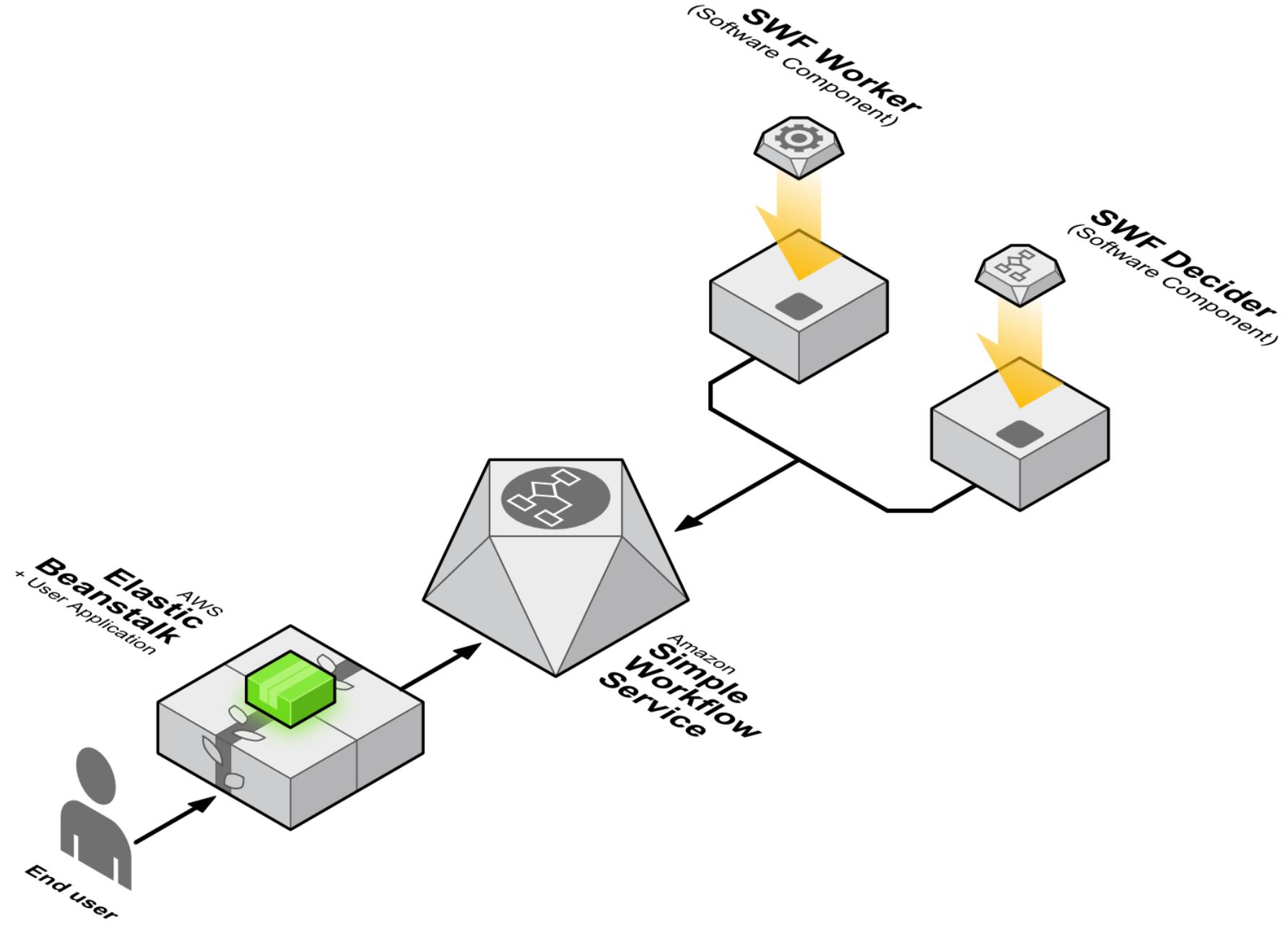
## COORDINATION LOGIC

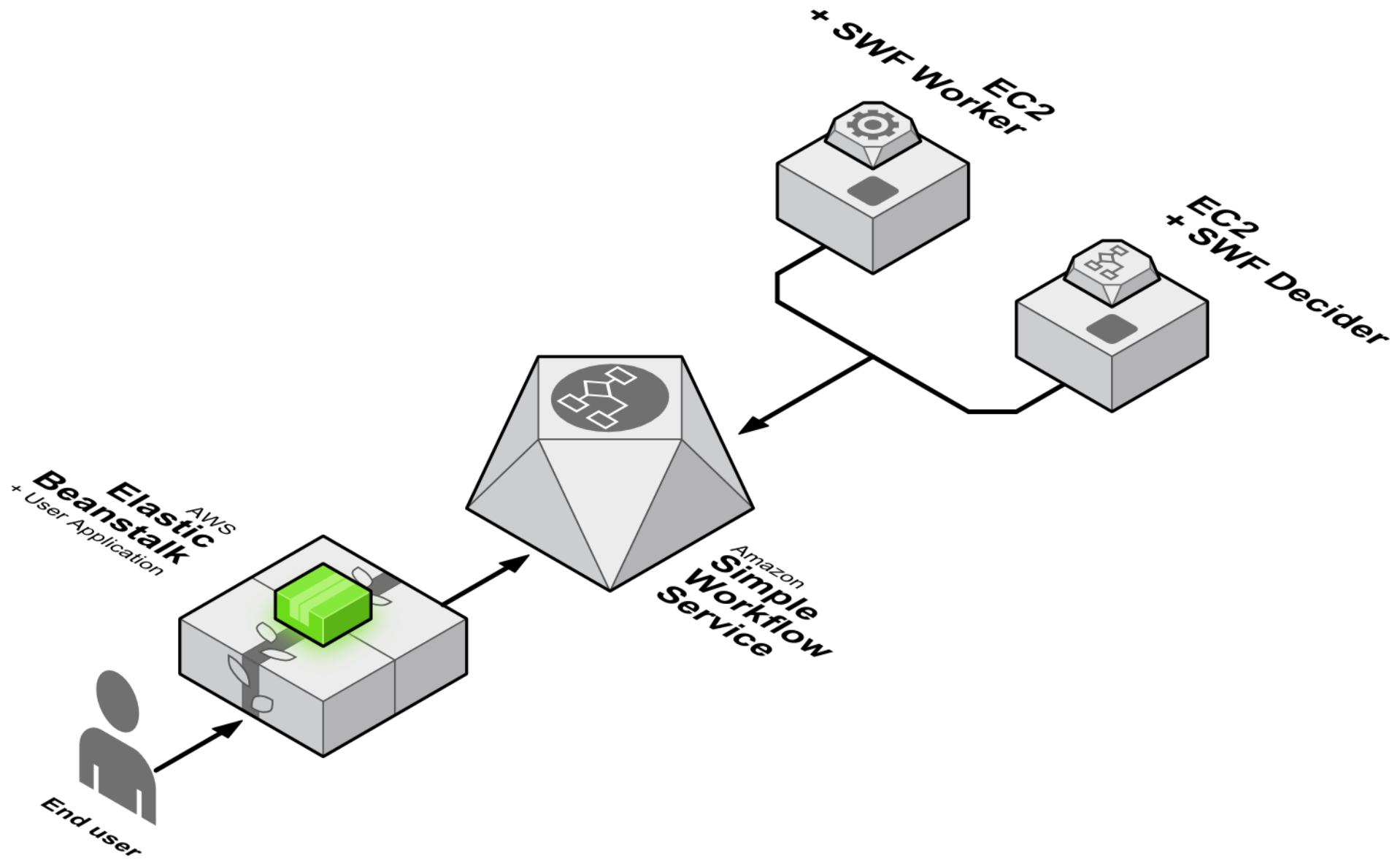
- 
1. Poll for work on a decision list  
Long polling: 60 seconds
  2. Evaluate workflow execution history  
SWF sends full history in JSON format
  3. Return decision to Amazon SWF  
Usually scheduling another task

# WORKERS

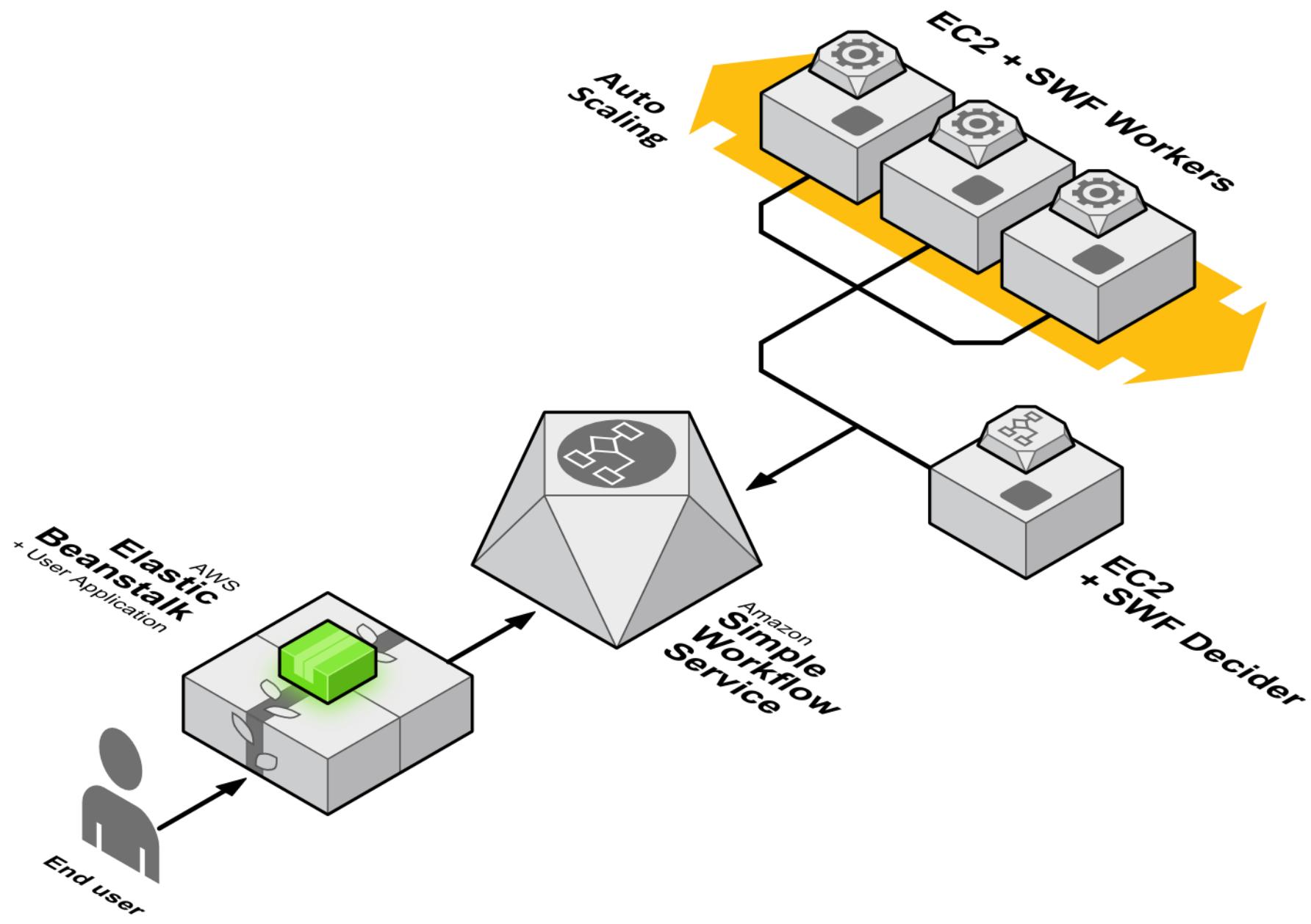
## COORDINATION LOGIC

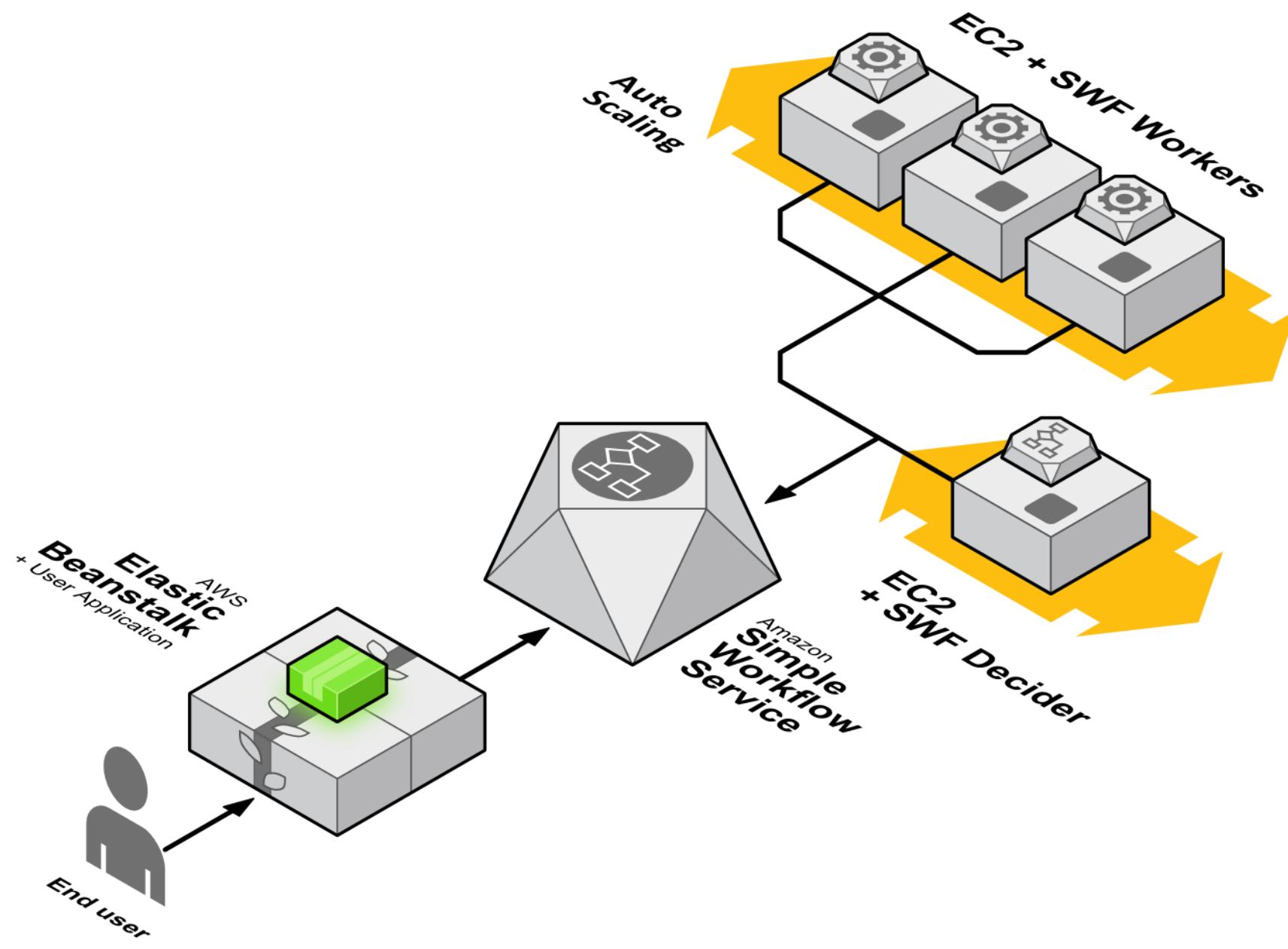
- 
1. Poll for work on a specific task list  
Long polling: 60 seconds
  2. Execute works, send heartbeats  
SWF sends input data from deciders
  3. Return success / failure  
Detailed data can be provided to deciders

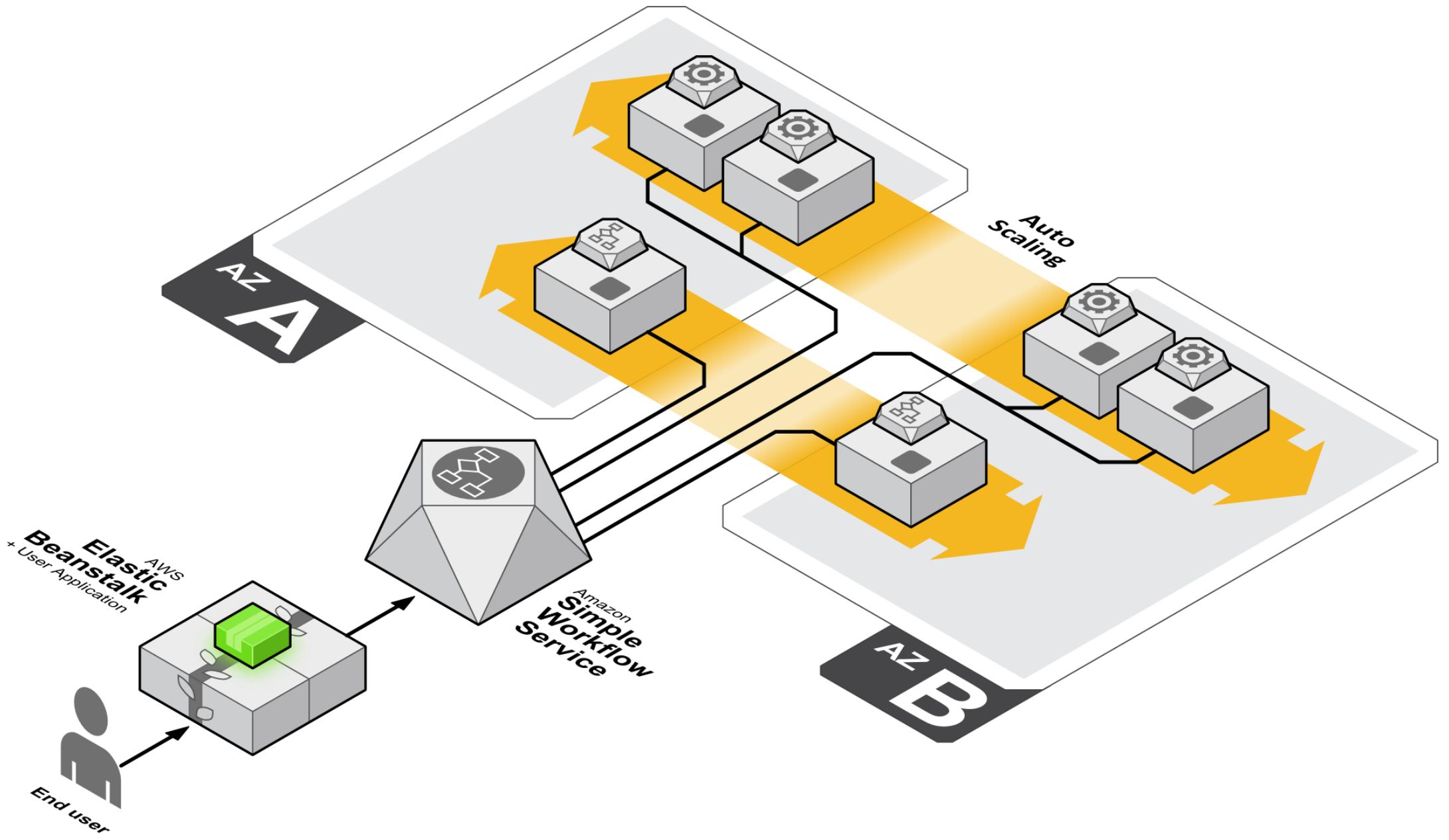


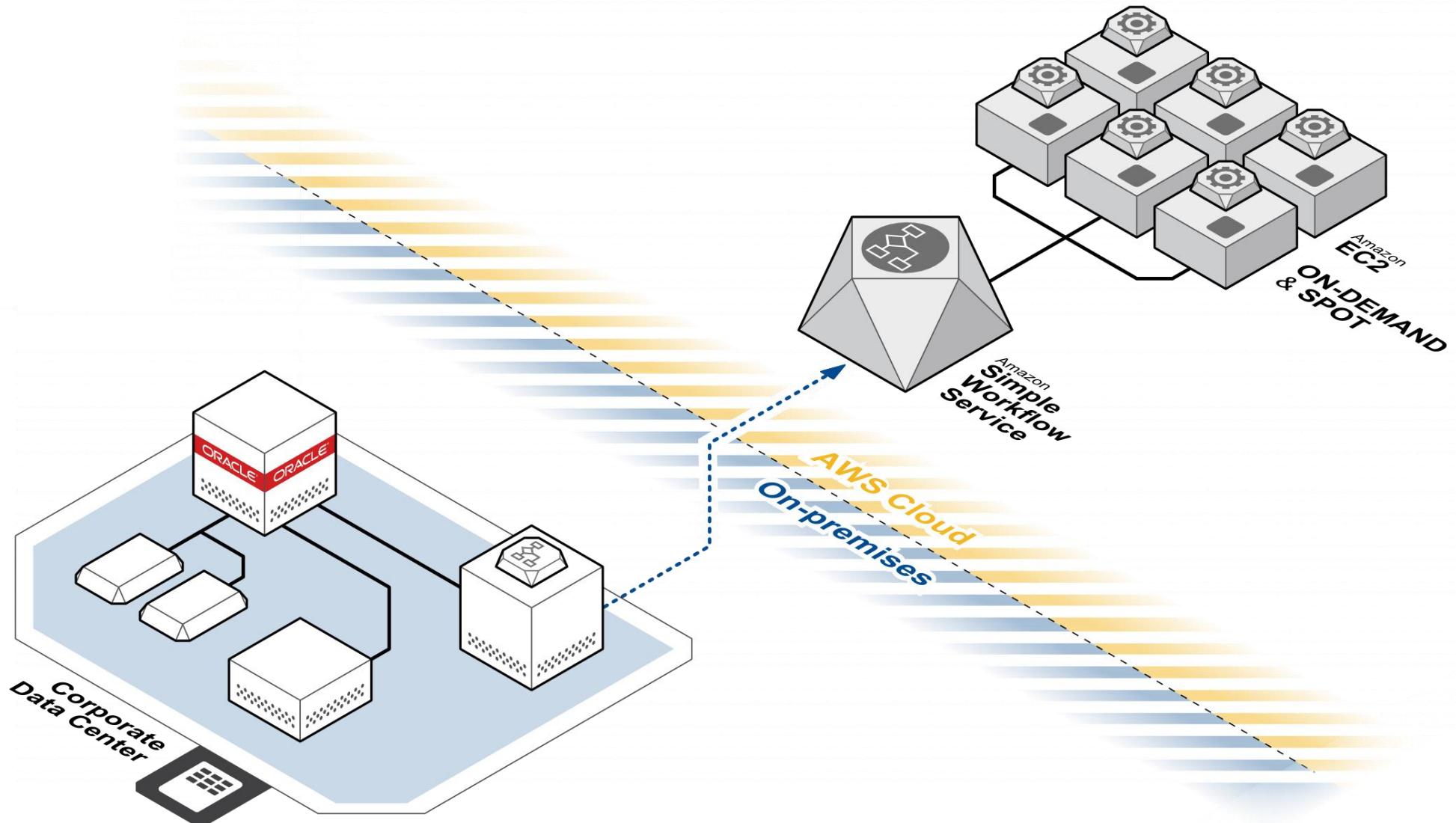


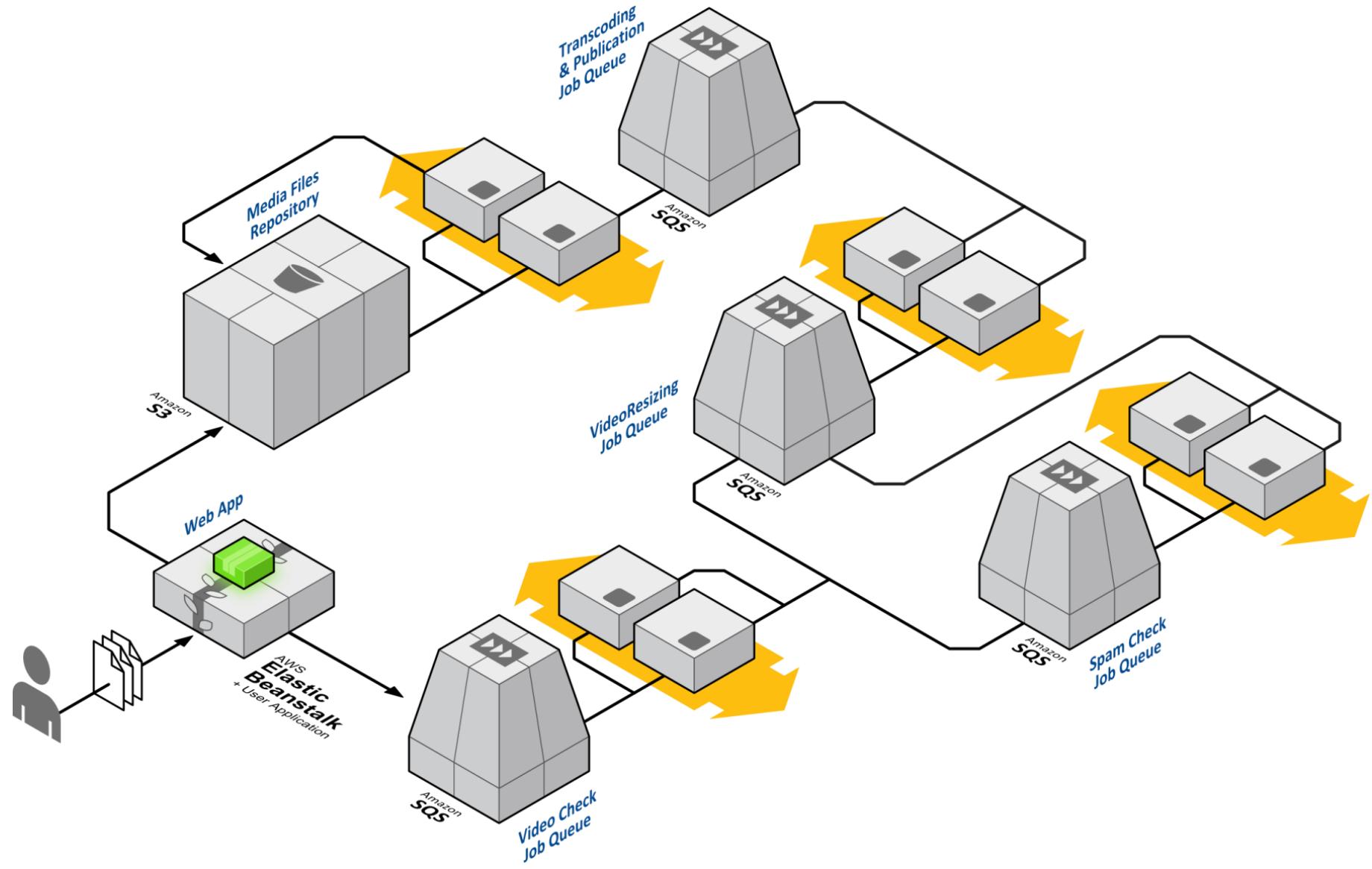
**ALL  
HORIZONTAL SCALING  
PATTERNS APPLY**

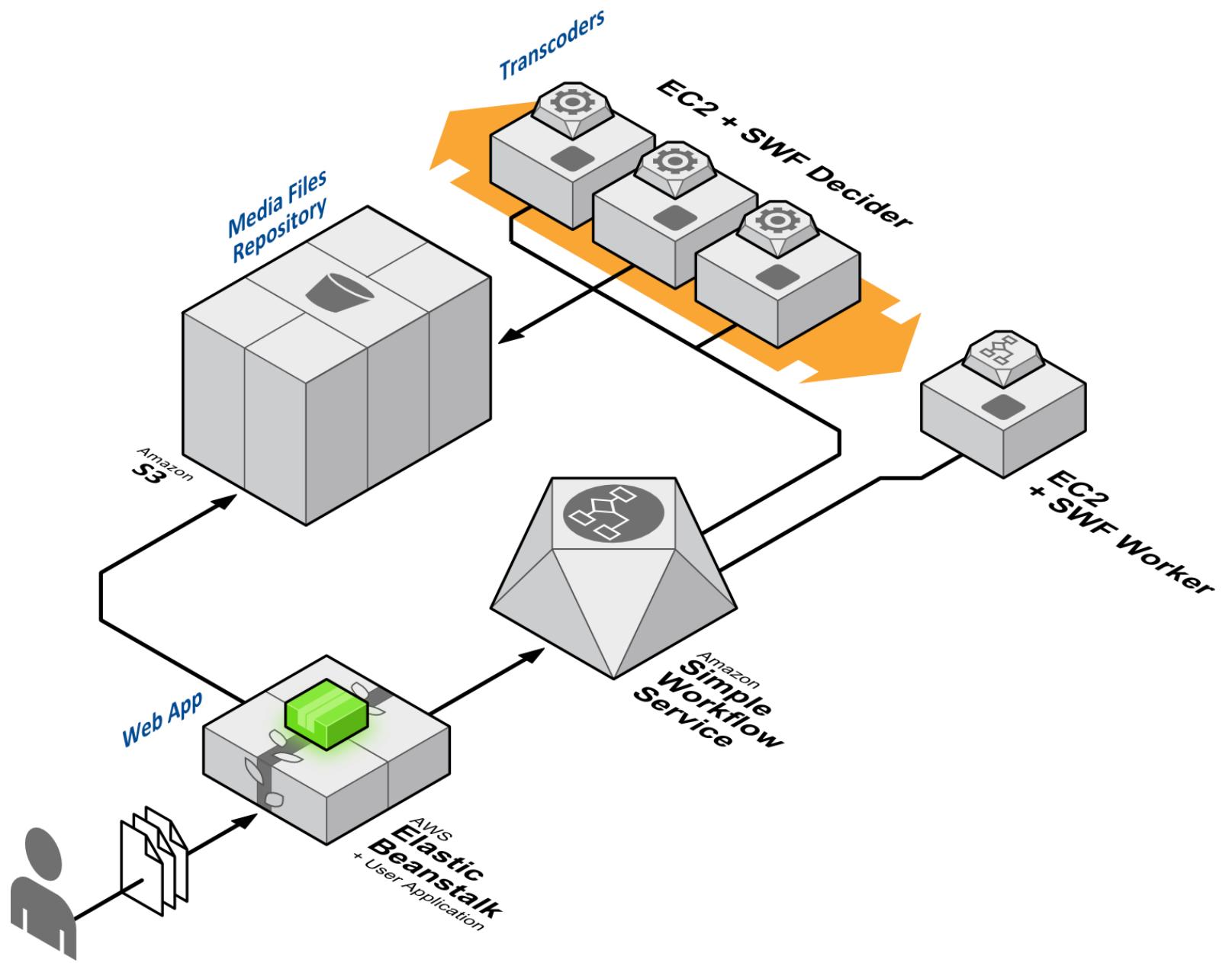














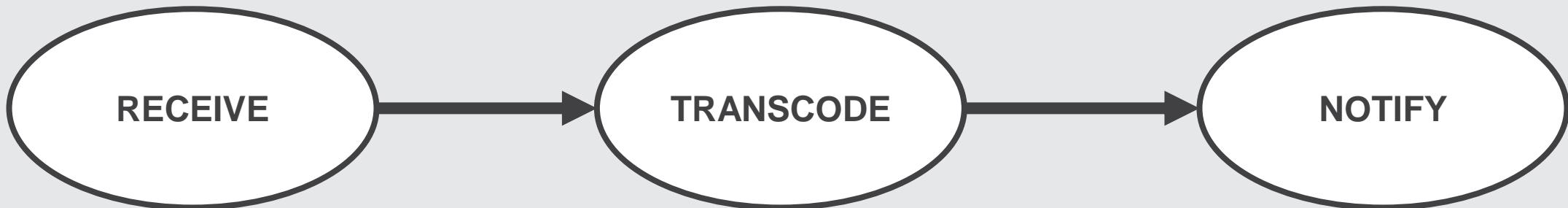
# NO NEW LANGUAGE TO LEARN

YOUR CODE IS YOUR WORKFLOW LANGUAGE  
SWF MAINTAINS STATE

# AWS FLOW FRAMEWORK

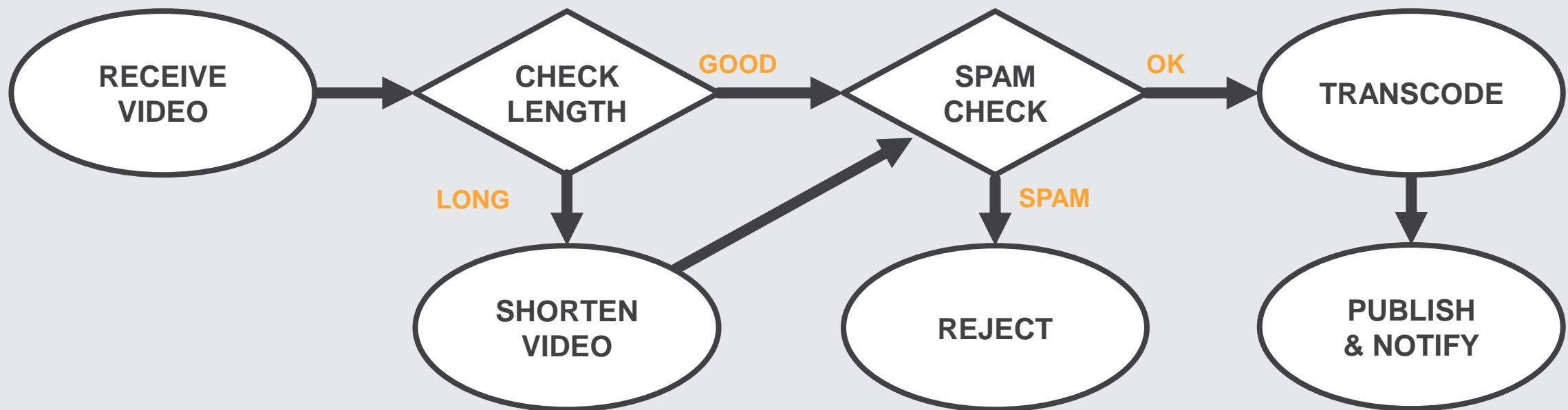
Java Library • Entire workflow can be  
expressed in sequential code •  
Integrated with Java Utils API

# CHAINED TASKS WITHOUT DECISIONS?



use **AMAZON SQS**

# TASK GRAPH WITH DECISIONS?



use AMAZON SWF

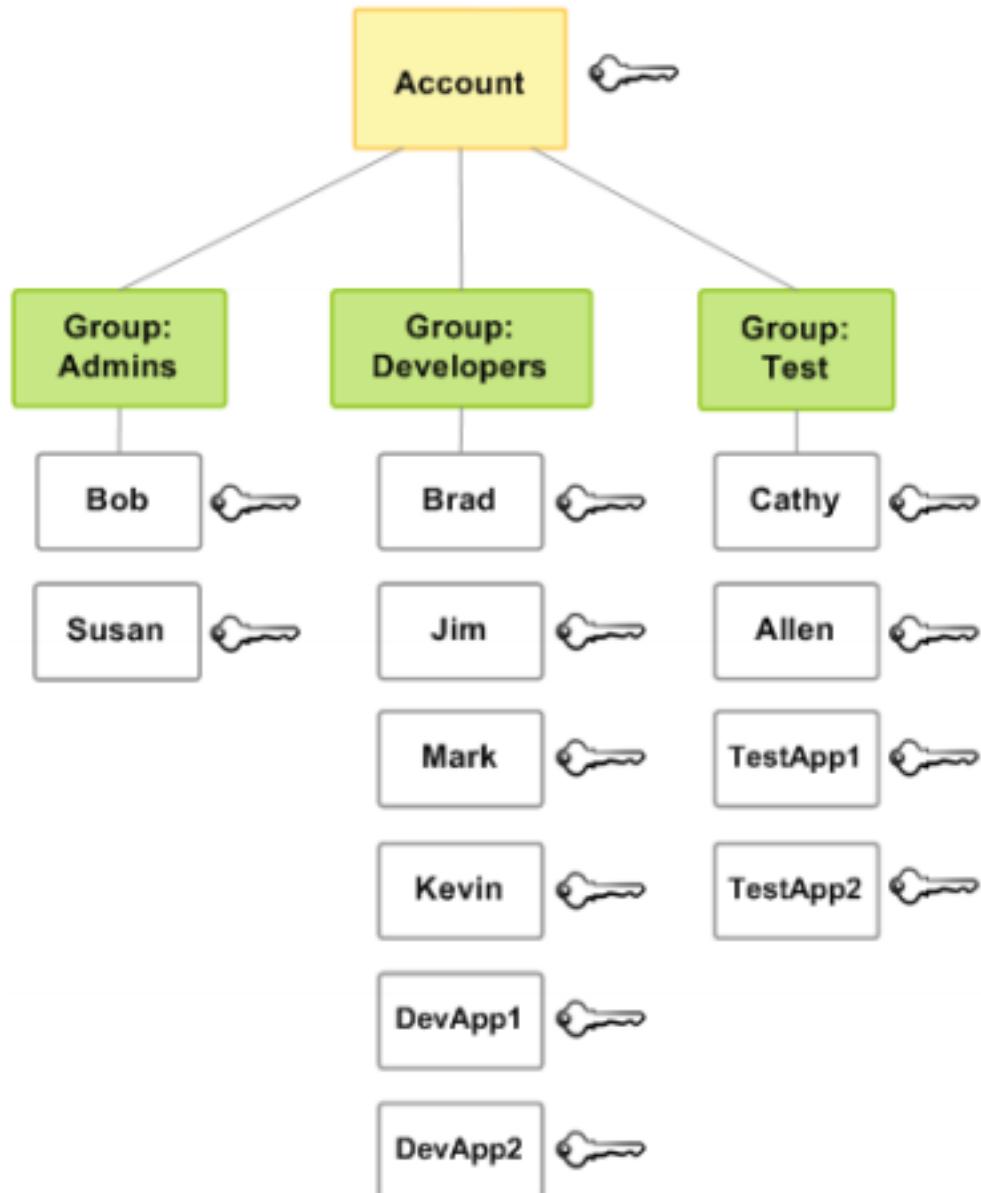
#4

# SECURITY



# AWS IAM

## IDENTITY AND ACCESS MANAGEMENT

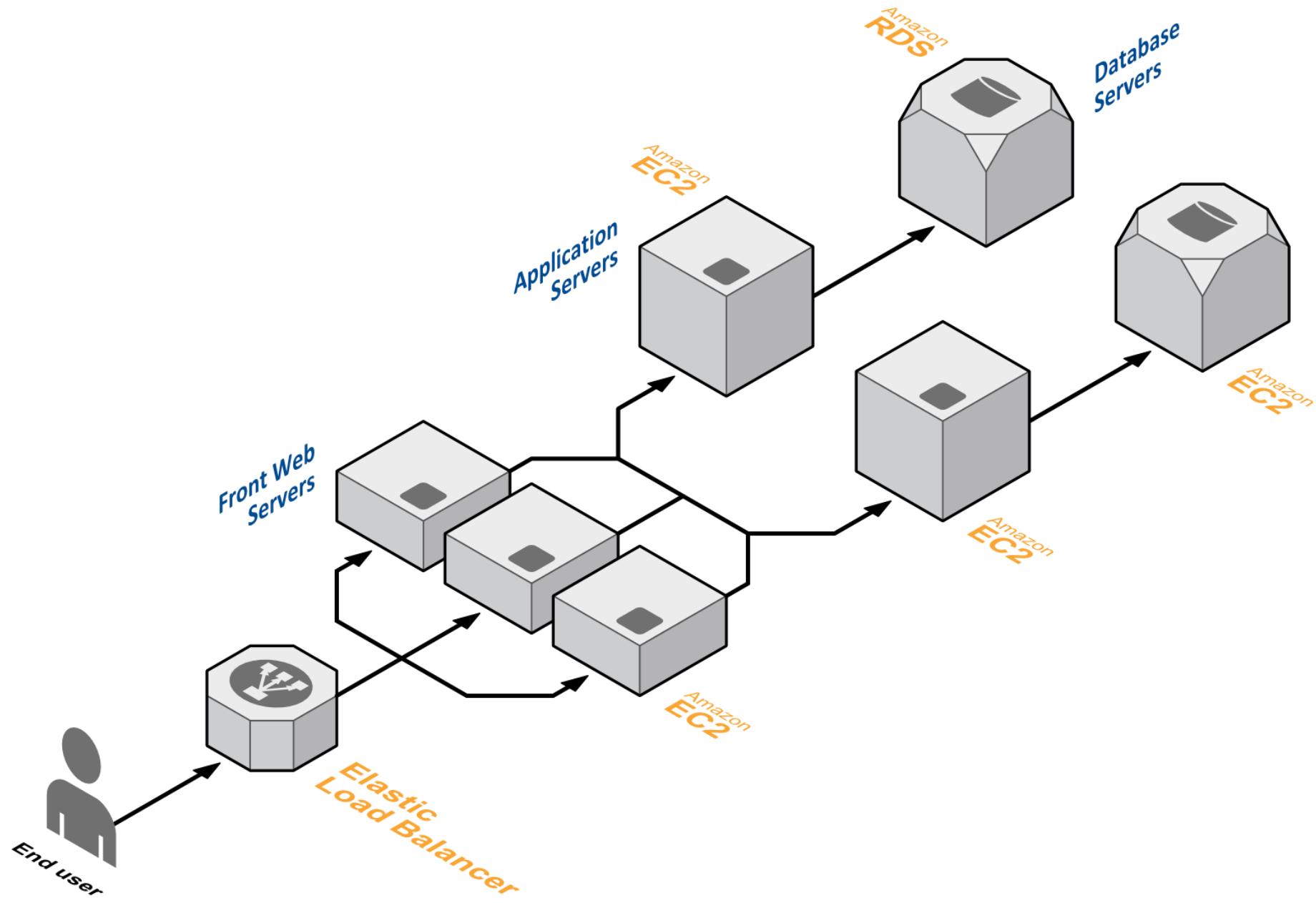


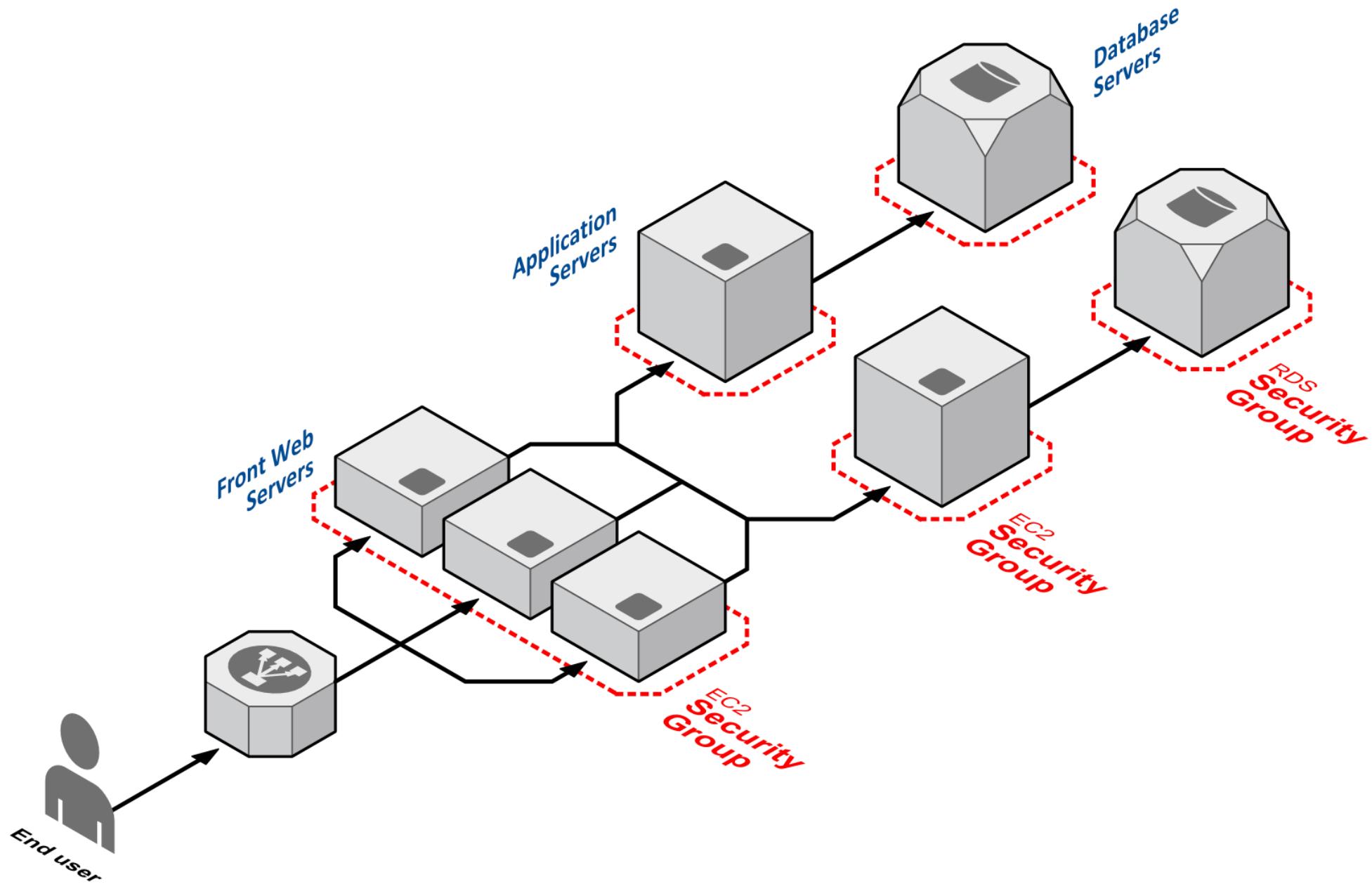
# MULTI-FACTOR AUTHENTICATION

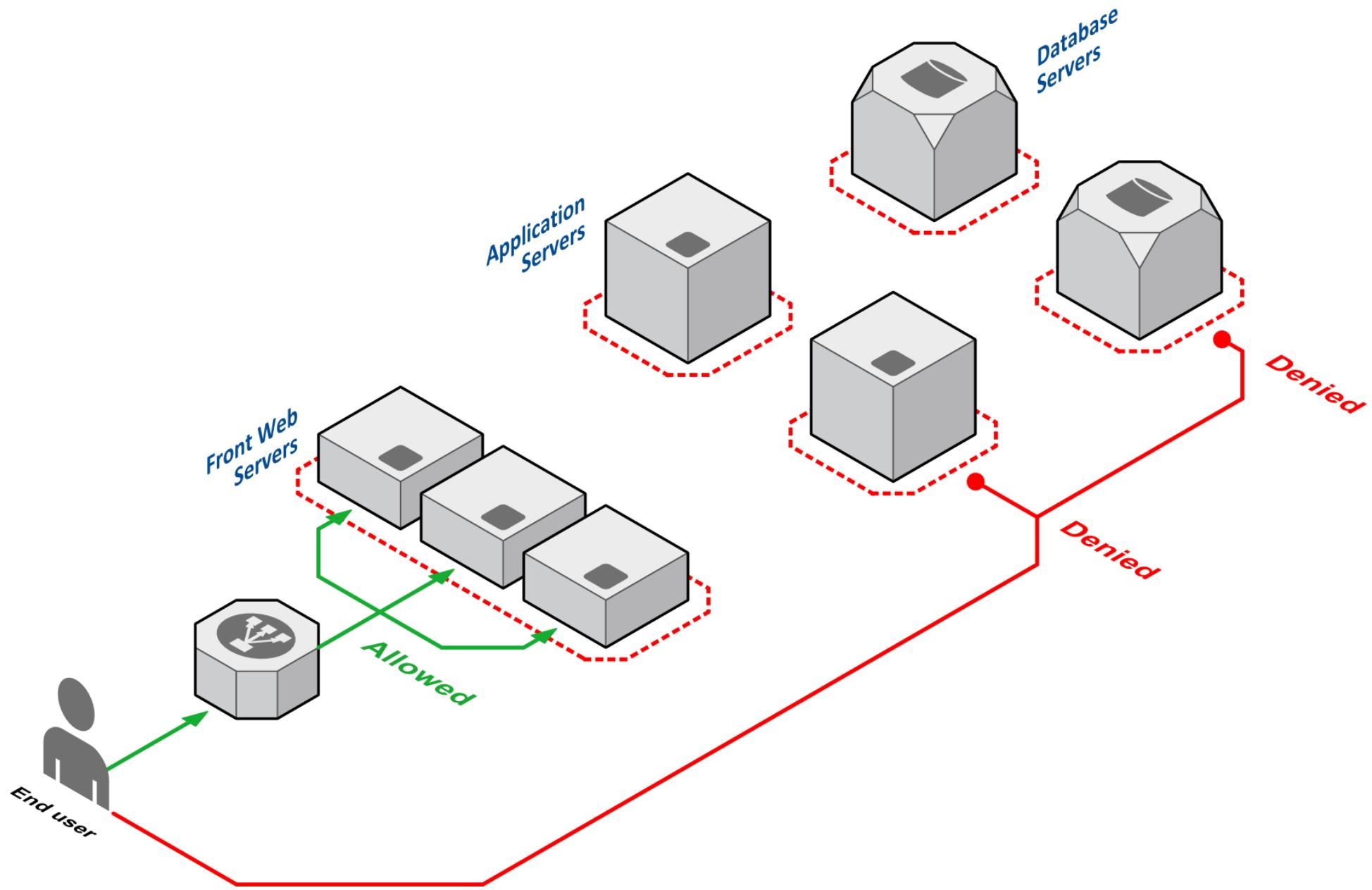


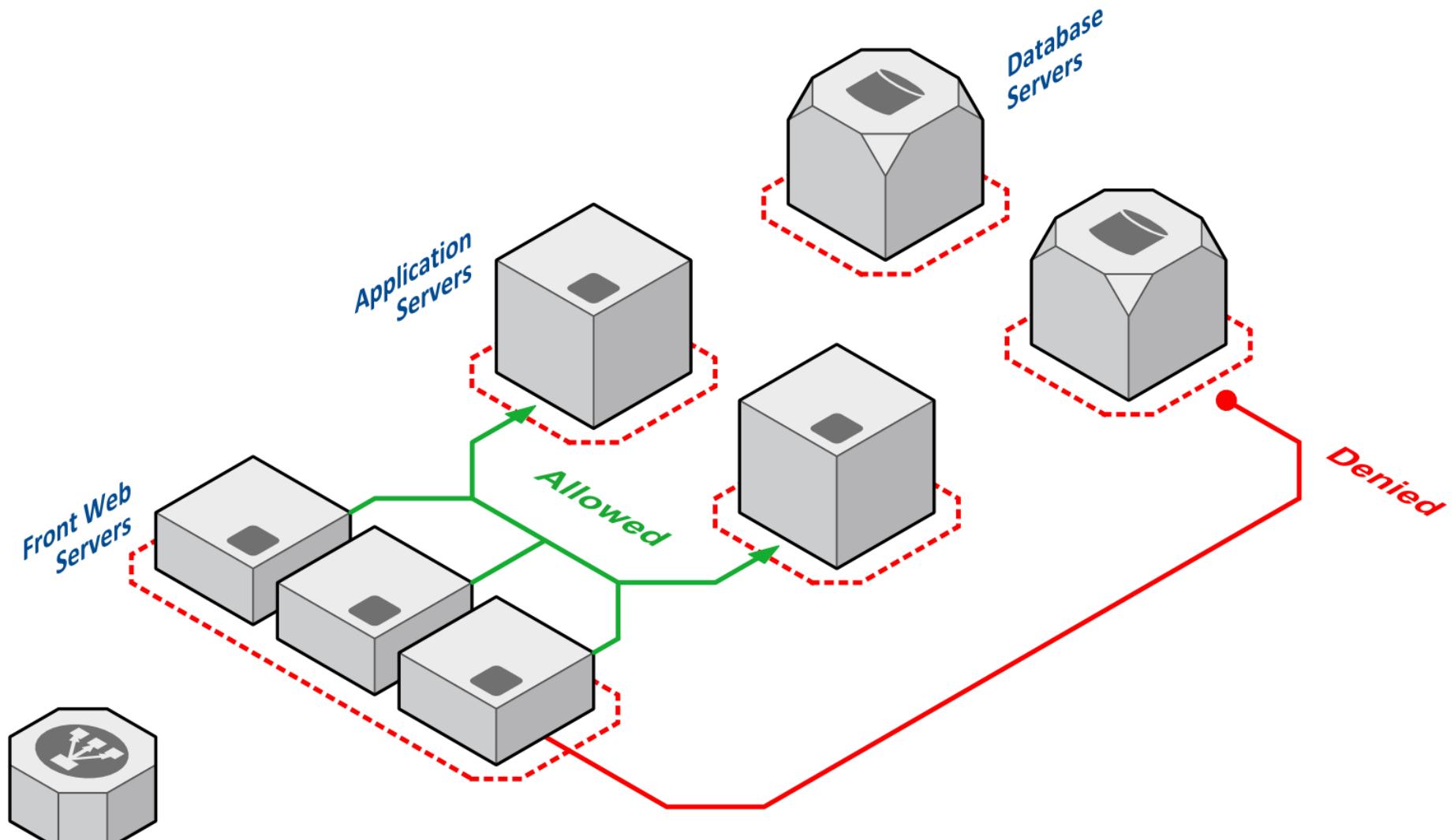
# SECURITY GROUPS

LAYERED SECURITY









# CERTIFICATIONS & COMPLIANCE

- ✓ SAS 70 Type II audit
- ✓ ISO 27001 Certification
- ✓ Sarbanes-Oxley sox
- ✓ HIPAA healthcare
- ✓ FISMA US Federal Government
- ✓ DIACAP MAC III Sensitive IATO



**PCI DSS Compliant**  
LEVEL 1 SERVICE PROVIDER

#5

# PERFORMANCE



# VERTICAL SCALING

| Region: US East (Virginia)             | +                |                  |
|--|------------------|------------------|
|  | Linux/UNIX Usage | Windows Usage    |
| <b>Standard On-Demand Instances</b>    |                  |                  |
| Small (Default)                        | \$0.080 per Hour | \$0.115 per Hour |
| Medium                                 | \$0.160 per Hour | \$0.230 per Hour |
| Large                                  | \$0.320 per Hour | \$0.460 per Hour |
| Extra Large                            | \$0.640 per Hour | \$0.920 per Hour |
| <b>Micro On-Demand Instances</b>       |                  |                  |
| Micro                                  | \$0.020 per Hour | \$0.030 per Hour |
| <b>High-Memory On-Demand Instances</b> |                  |                  |
| Extra Large                            | \$0.450 per Hour | \$0.570 per Hour |
| Double Extra Large                     | \$0.900 per Hour | \$1.140 per Hour |
| Quadruple Extra Large                  | \$1.800 per Hour | \$2.280 per Hour |
| <b>High-CPU On-Demand Instances</b>    |                  |                  |
| Medium                                 | \$0.165 per Hour | \$0.285 per Hour |
| Extra Large                            | \$0.660 per Hour | \$1.140 per Hour |
| <b>Cluster Compute Instances</b>       |                  |                  |
| Quadruple Extra Large                  | \$1.300 per Hour | \$1.610 per Hour |
| Eight Extra Large                      | \$2.400 per Hour | \$2.970 per Hour |
| <b>Cluster GPU Instances</b>           |                  |                  |
| Quadruple Extra Large                  | \$2.100 per Hour | \$2.600 per Hour |

CLUSTER COMPUTE  
**EIGHT EXTRA LARGE**

**2X** Intel Xeon E5-2670, eight-core  
**Sandy Bridge** architecture

60.5 GB of memory – 3.3 TB of storage

# CLUSTER GPU QUADRUPLE EXTRA LARGE

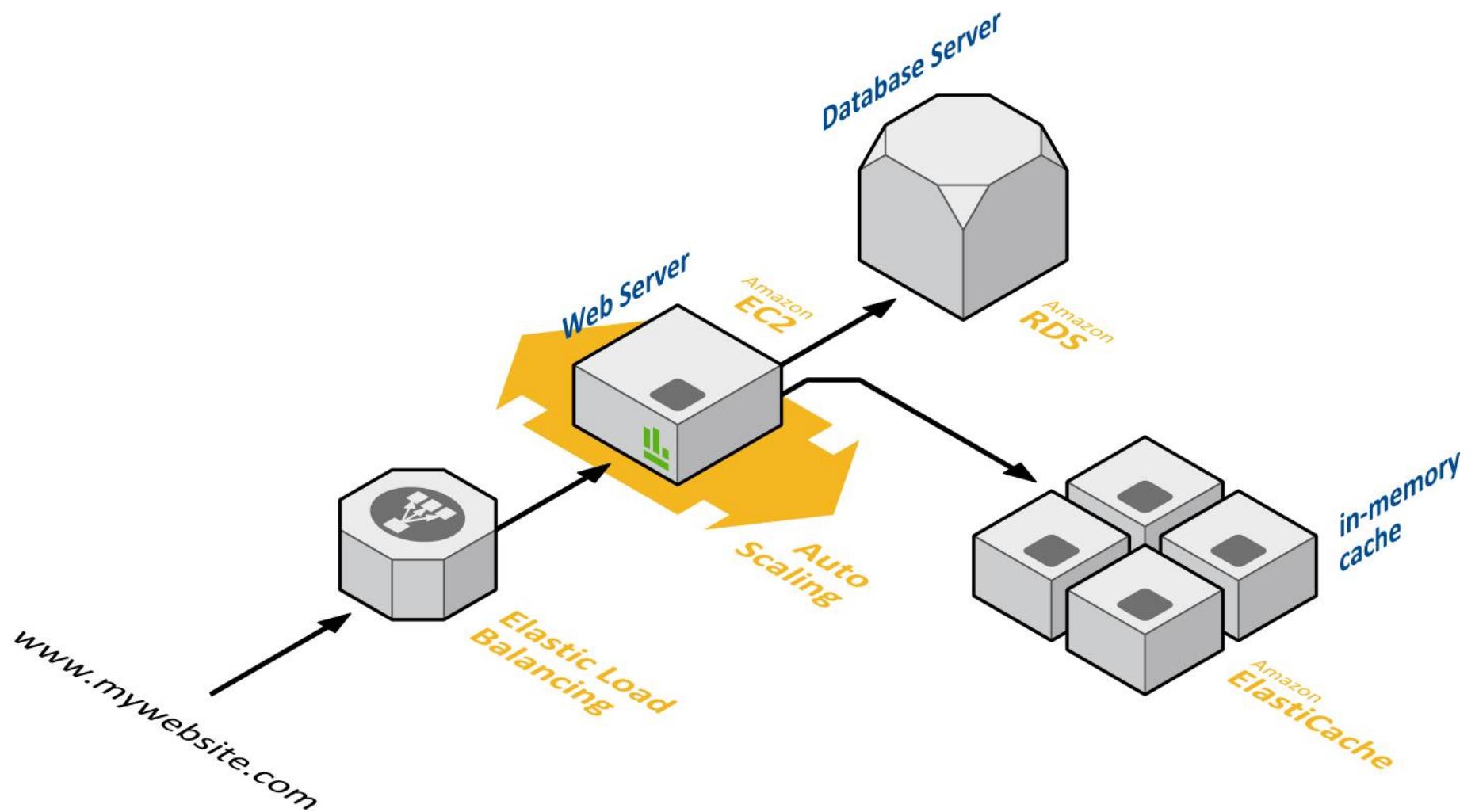
**2x** Intel Xeon X5570, quad-core  
**Nehalem** architecture

**2x** NVIDIA Tesla Fermi  
**M2050 GPUs**

22 GB of memory – 1.7 TB of storage

# AMAZON ELASTICACHE

MEMCACHED COMPATIBLE  
IN-MEMORY CACHE



# SEARCH ENGINES

Firefox ▾

a. Amazon.com: arduino: Electronics +

www.amazon.com/s/ref=nb\_sb\_noss\_1?url=search-alias%3Delectronics&field-keywords=arduino#/ref=nb\_sb\_noss\_1?url=search-alias%3Delectronics&field-keywords=ardu ⌂ ⌃ ⌁

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Computers & Accessories (23)  
Accessories & Supplies (4)  
Camera & Photo (1)

**International Shipping** ([What's this?](#))  
AmazonGlobal Eligible

**Shipping Option** ([What's this?](#))  
Free Super Saver Shipping

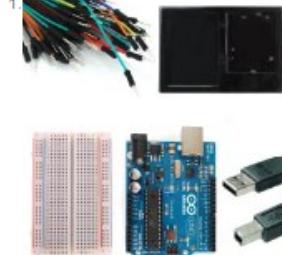
**Brand**  
 Newsite (1)  
 SparkFun (5)  
 NKC Electronics (4)  
 CanaKit (3)  
 Arduino (8)  
 hacktronics (2)  
 microtivity (5)  
[See more...](#)

**Avg. Customer Review**  
 & Up (25)  
 & Up (30)  
 & Up (31)  
 & Up (31)

**Electronics > "arduino starter kit"**

Related Searches: [arduino](#), [arduino kit](#), [arduino uno](#).

Showing 1 - 24 of 37 Results Sort by Relevance

1.   
Arduino Uno Rev 3 Starter Kit -- 3' USB Cable --Solderless Breadboard -- 65 Jumper Wires -- Breadboard Holder  
Buy new: \$36.99  
4 new from \$36.99  
In stock on June 6, 2012  
 (31)  
Eligible for FREE Super Saver Shipping.  
**Product Description** – "... Overview The Arduino Uno is a microcontroller board based on the ATmega ..."

2.   
Sparkfun Inventor's Kit, a professional kit for Arduino, with retail case  
Buy new: \$99.95  
3 new from \$99.95  
Get it by Wednesday, Jun 6 if you order in the next 23 hours and choose one-day shipping.  
Only 4 left in stock - order soon.  
 (9)  
Eligible for FREE Super Saver Shipping.  
**Product Description** – "... simple recombinations. Kit includes: Arduino Uno USB (SMD ATmega328 ..."

3.   
Sparkfun Starter Kit for Arduino - Flex  
Buy new: \$59.95  
2 new from \$59.95  
Get it by Tuesday, Jun 5 if you order in the next 2 hours and choose one-day shipping.  
Only 17 left in stock - order soon.  
 (5)  
Eligible for FREE Super Saver Shipping.  
**Product Description** – "... DEV-10174 Description: The Arduino Starter Kit is a great raw parts re ..."

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a. Amazon.com: arduino: Electronics

www.amazon.com/s/ref=nb\_sb\_noss\_1?url=search-alias%3Delectronics&field-keywords=arduino#/ref=nb\_sb\_noss\_1?url=search-alias%3Delectronics&field-keywords=ardu

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Shipping Option (What's this?)  
Free Super Saver Shipping

Brand

- Newsite (1)
- SparkFun (5)
- NKC Electronics (4)
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- Arduino (8)
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- microtivity (5)

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Avg. Customer Review

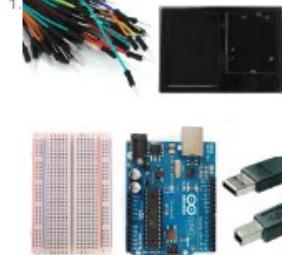
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Related Searches: [arduino](#), [arduino kit](#), [arduino uno](#).

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Relevance & Ranking

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a. Amazon.com: arduino: Electronics

www.amazon.com/s/ref=nb\_sb\_noss\_1?url=search-alias%3Delectronics&field-keywords=arduino#/ref=nb\_sb\_noss\_1?url=search-alias%3Delectronics&field-keywords=ardu

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Department

< Any Department

Electronics

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Accessories & Supplies (4)

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International Shipping (What's this?)

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Shipping Option (What's this?)

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Brand

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SparkFun (5)

NKC Electronics (4)

CanaKit (3)

Arduino (8)

hacktronics (2)

micrötivity (5)

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Avg. Customer Review

★★★★★ & Up (25)

★★★★☆ & Up (30)

★★★★☆ & Up (31)

★★★★★ & Up (31)

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a. Amazon.com: arduino: Electronics

www.amazon.com/s/ref=nb\_sb\_noss\_1?url=search-alias%3Delectronics&field-keywords=arduino#/ref=nb\_sb\_noss\_1?url=search-alias%3Delectronics&field-keywords=arduino

CanaKit (3)  
Arduino (8)  
hacktronics (2)  
micrötivity (5)  
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Avg. Customer Review  
★★★★★ & Up (25)  
★★★★☆ & Up (30)  
★★☆☆☆ & Up (31)  
★☆☆☆☆ & Up (31)

Condition  
New (37)  
Used (6)

Price  
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\$25 to \$50 (11)  
\$50 to \$100 (6)  
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NKC Electronics (8)  
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In stock on June 6, 2012  
★★★★★ (31)  
Eligible for FREE Super Saver Shipping.

Product Description - "... Overview The controller board based on"

Buy new: \$99.95  
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Get it by Wednesday, Jun 6 if you order in the next 23 hours and choose one-day shipping.  
Only 4 left in stock - order soon.  
★★★★★ (9)  
Eligible for FREE Super Saver Shipping.

Product Description - "... simple recombinations. Kit includes: Arduino Uno USB (SMD ATmega328 ...)"

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Get it by Tuesday, Jun 5 if you order in the next 2 hours and choose one-day shipping.  
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★★★★★ (5)  
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Product Description - "... DEV-10174 Description: The Arduino Starter Kit is a great raw parts re ..."

5. SparkFun Inventor's Kit for Arduino with Retail Case  
Buy new: \$99.95  
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Get it by Tuesday, Jun 5 if you order in the next 2 hours and choose one-day shipping.  
Only 15 left in stock - order soon.  
★★★★★ (11)  
Eligible for FREE Super Saver Shipping.

6. Arduino UNO board  
Buy new: \$30.95 \$21.95  
7 new from \$21.95  
Get it by Tuesday, Jun 5 if you order in the next 2 hours and choose one-day shipping.  
★★★★★ (75)  
Eligible for FREE Super Saver Shipping.

7. Electronic Parts for Getting Started With Arduino book (BOOK NOT INCLUDED)  
Buy new: \$12.95  
2 new from \$10.99  
Get it by Wednesday, Jun 6 if you order in the next 23 hours and choose one-day shipping.  
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8. Product Description - "SparkFun Inventor's Kit for Arduino with Retail Case"

9. CanaKit (3)  
Arduino (8)  
hacktronics (2)  
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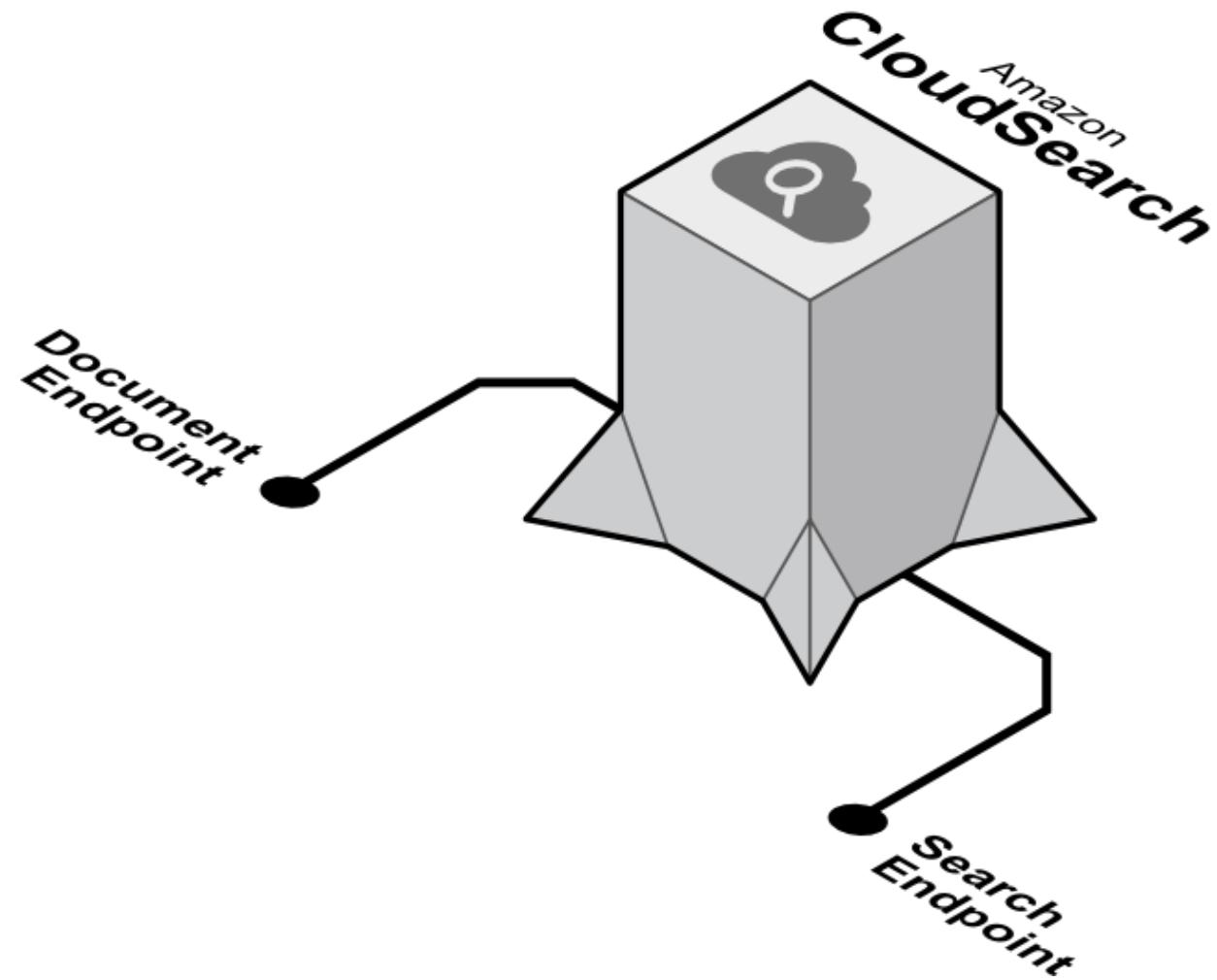
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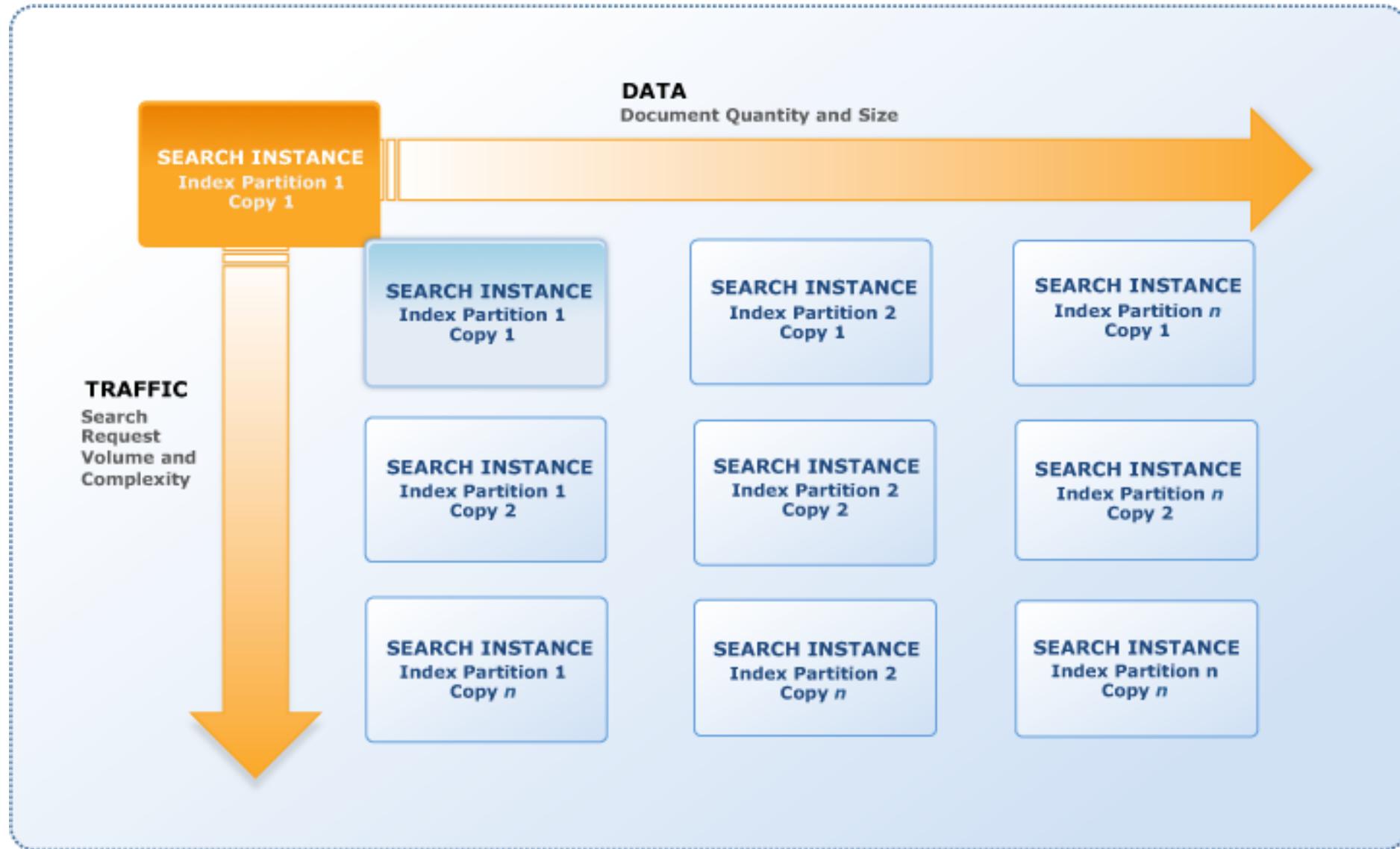
## FULLY-MANAGED SEARCH SERVICE

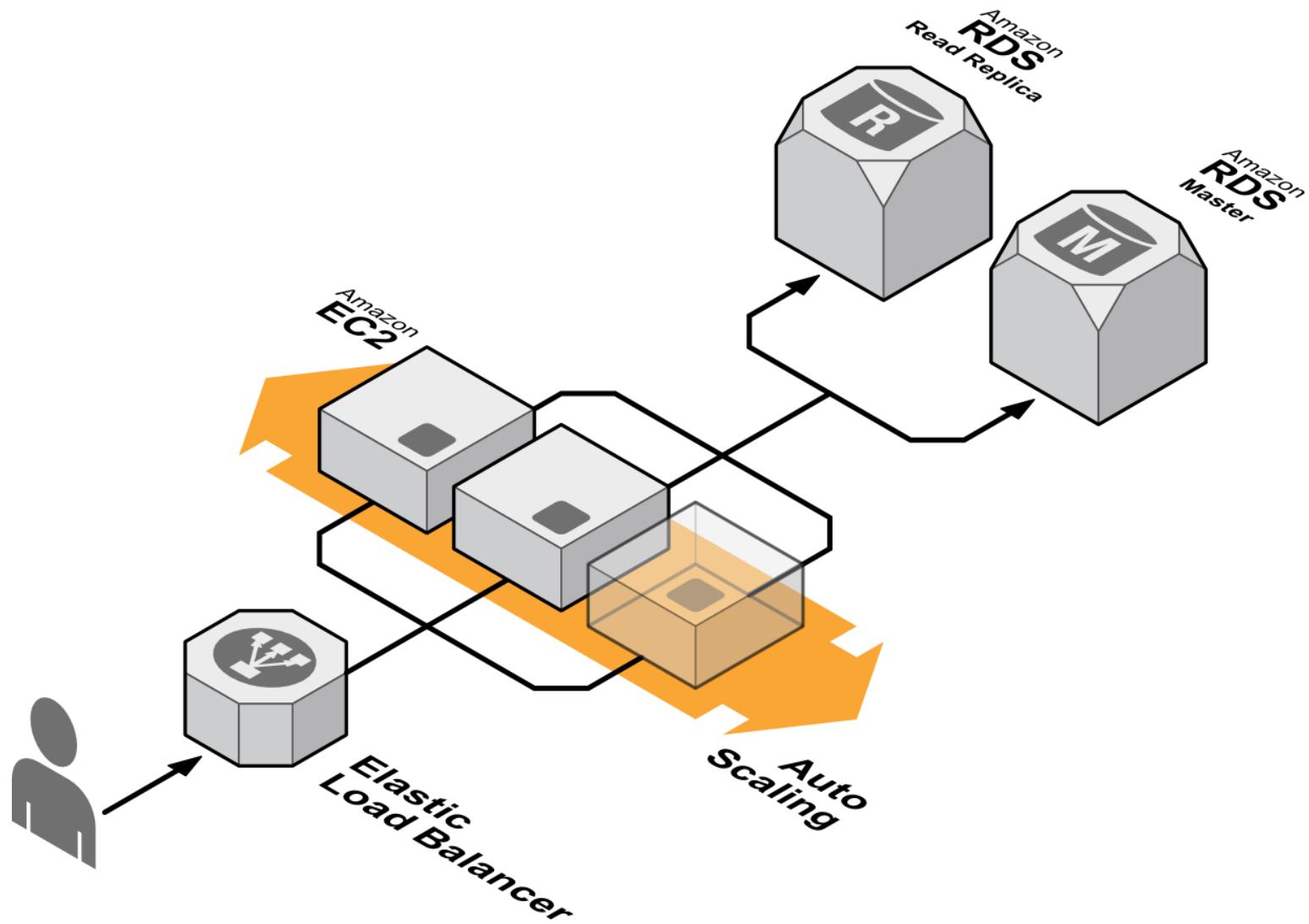


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Amazon CloudSearch delivers a **fully-managed search service** in the cloud that can be set up and running in less than 1 hour, with **automatic scaling for data & traffic**, at a price starting at **less than \$100 per month**.



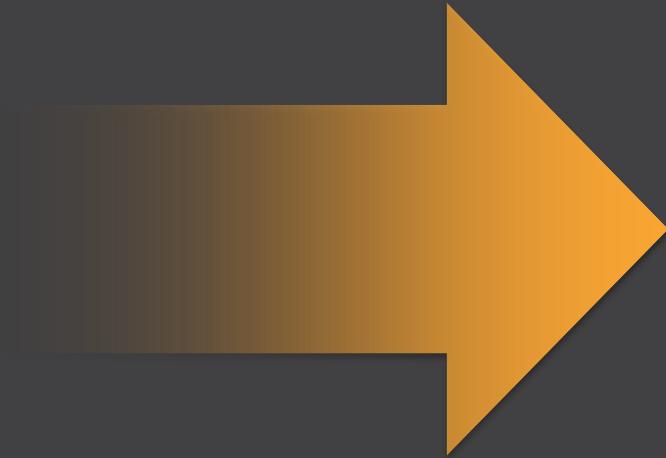


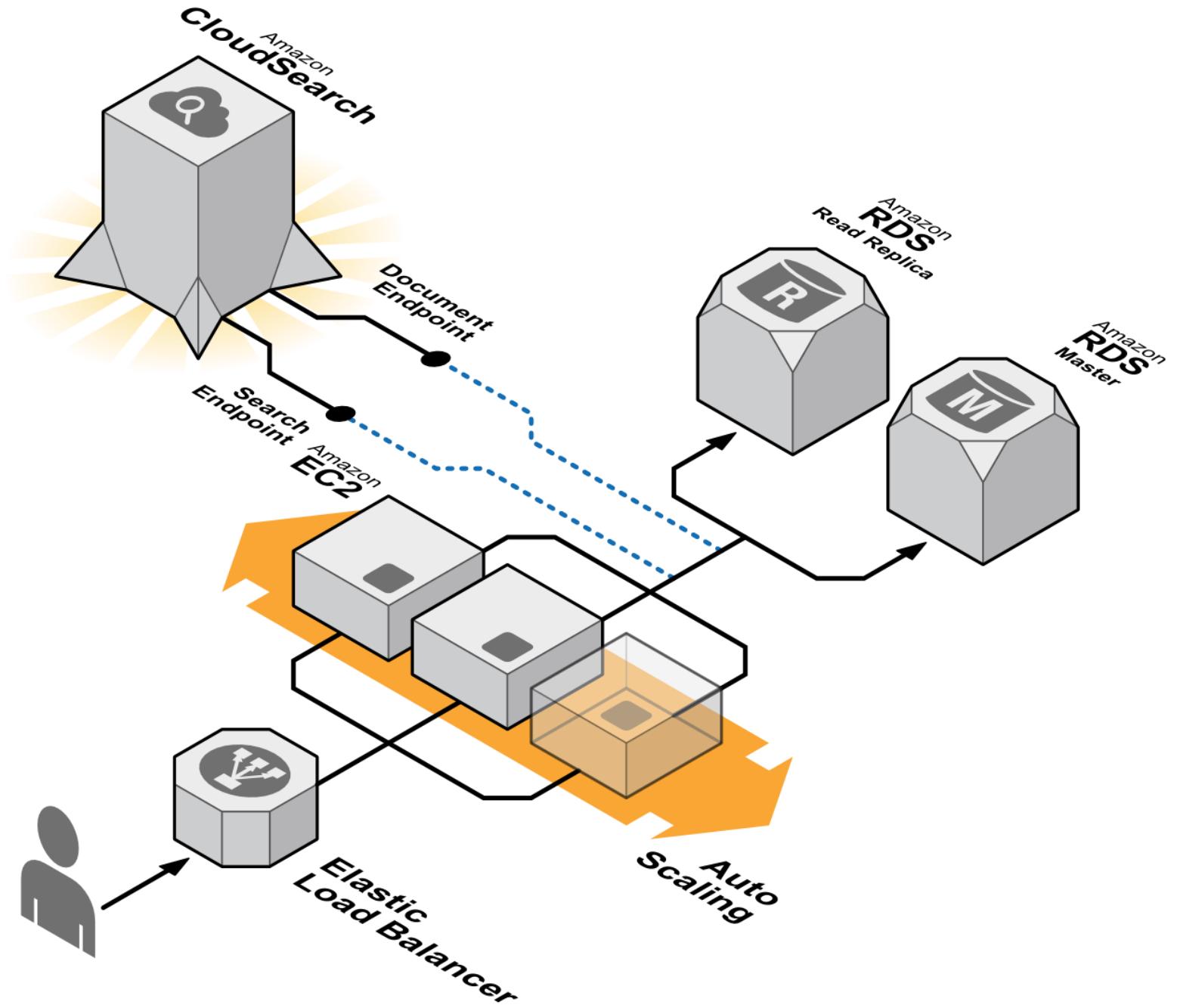


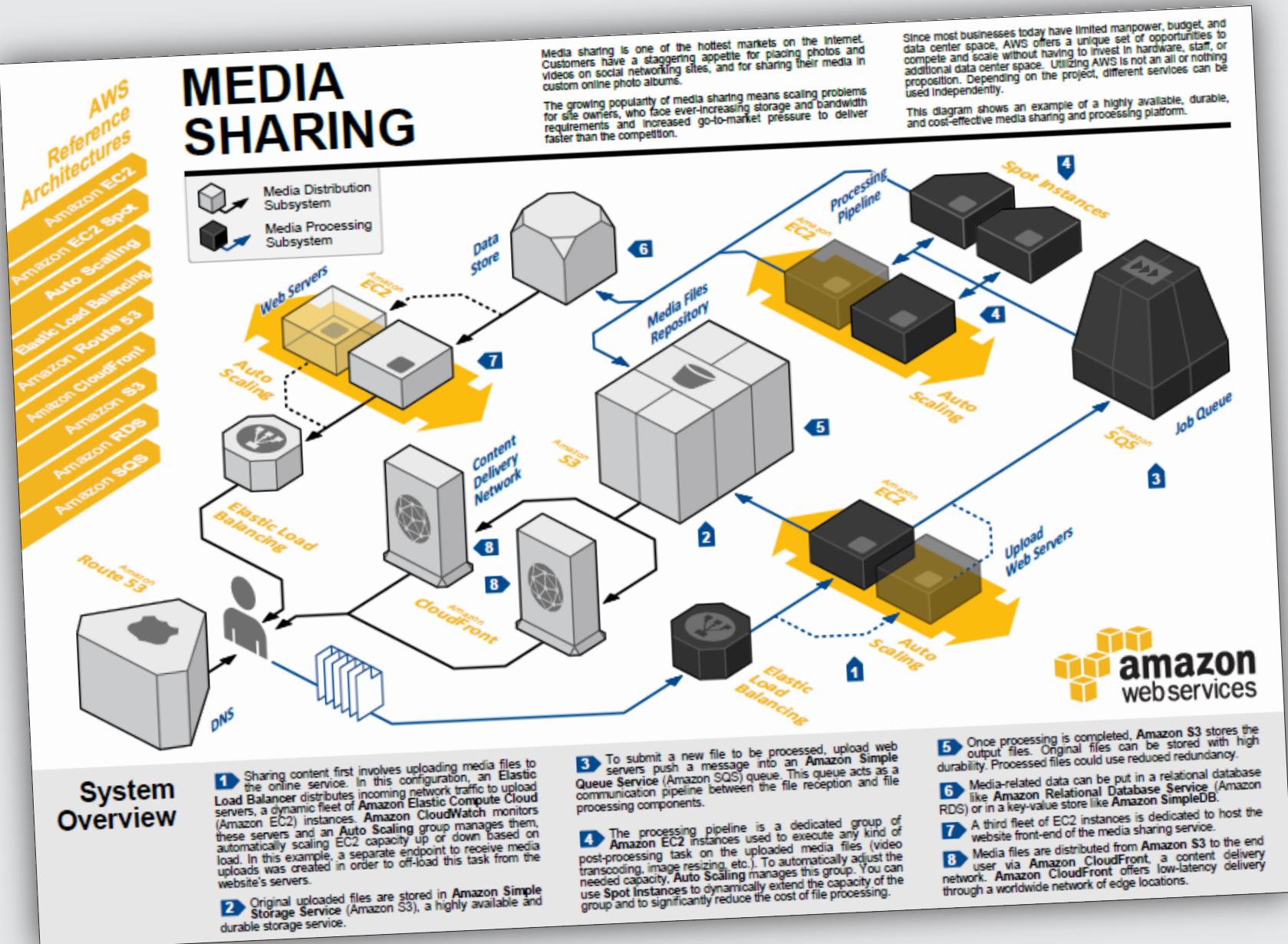
# HTTP POST

author=carlos;  
date=2012-06-07;  
article=text;

...

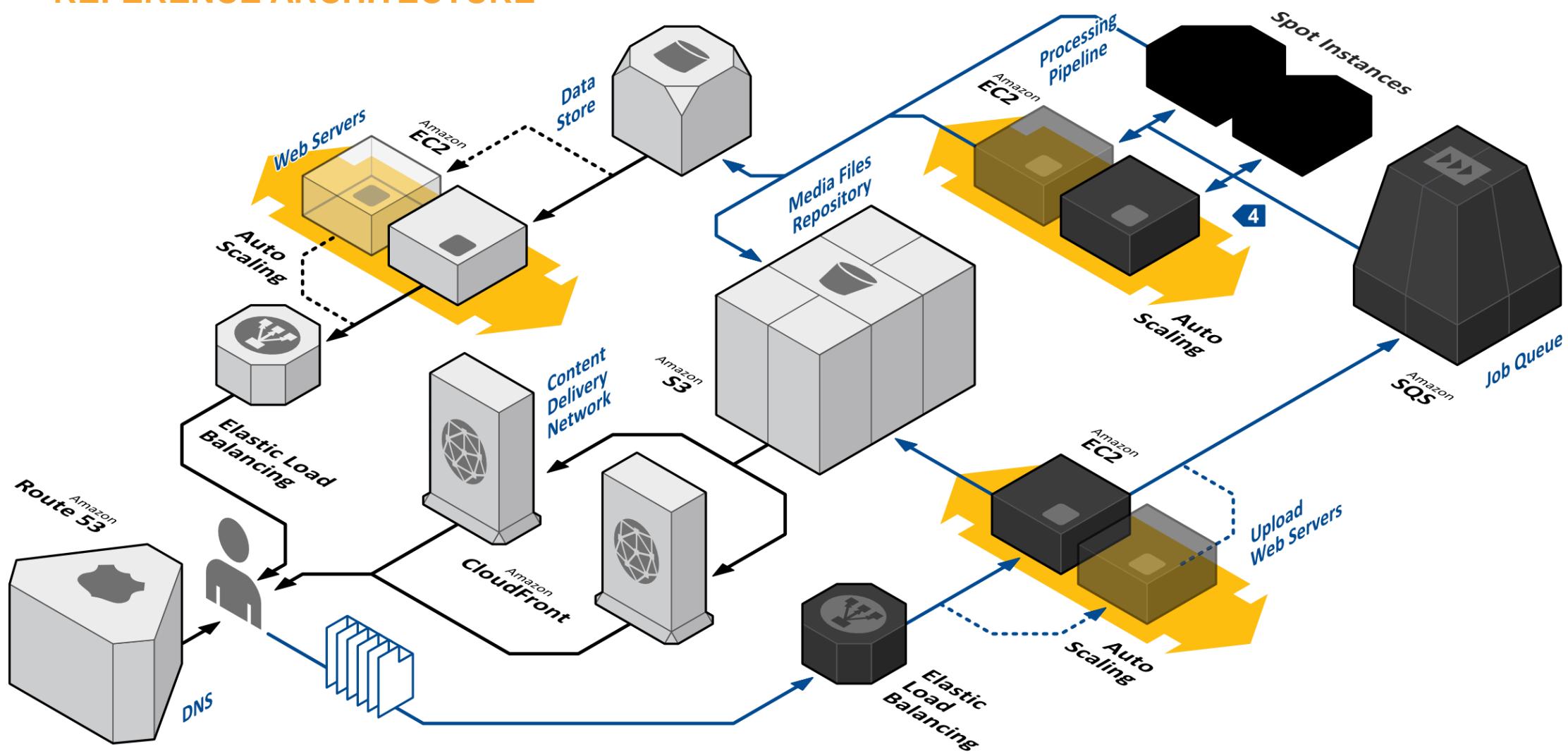






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## REFERENCE ARCHITECTURE



**MEDIA**

PDF

IMAGE

MP3...

**SDF**

JSON

# HTTP POST

author=carlos;  
date=2012-06-07;  
article=text;

...

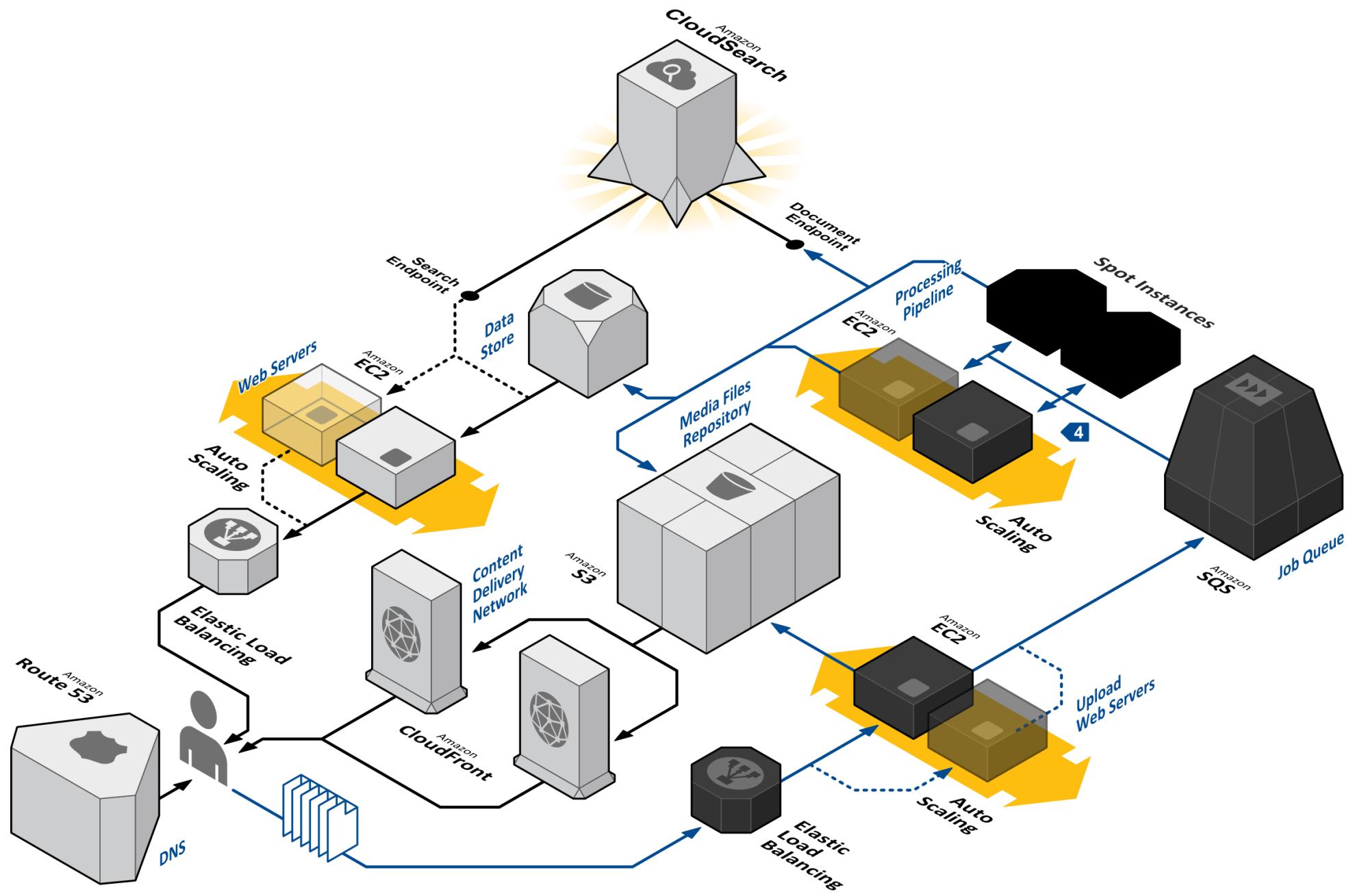


**MEDIA**

PDF  
IMAGE  
MP3...



**SDF**  
**JSON**



1. ELASTICITY
2. DESIGN FOR FAILURE
3. LOOSE COUPLING
4. SECURITY
5. PERFORMANCE



« If you're not embarrassed when you ship  
your first version you waited too long »

Matt Mullenweg  
CEO & Founder of WordPress



