DocStore

by aMedia Corp.

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DocStore

aMedia DocStore allows customers to upload and manage their documents

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DocStore

aMedia DocStore allows customers to upload and manage their documents

- **Upload and access content from anywhere** – browser and mobile apps
- **PDF, Office docs, images, videos** – text content extracted, indexed, and searchable

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Two Account Types

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Two Account Types

- **Free**

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Two Account Types

- **Free**
  - 5Gb storage
  - Search on name, created/modified date, and tags
    - No full-text indexing
  - All content may be securely downloaded by owner

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Two Account Types

- **Premium**

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Two Account Types

- **Premium**
  - 20 Gb storage
  - Full-text indexing and search for all documents (OCR on images)
  - All content may be securely downloaded by owner

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Two Major Components

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#1: Web Application

- Allow users to upload, manage, and view all documents
- All content uploaded directly to S3

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#1: Web Application

- Both powered by public DocStore API
- Both must scale
- Both must be highly available

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#1: Web Application

- Multi-region deployment for global support
- User can log in to any region
  - Always redirected to “home” region (i.e., region where account was created)

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#1: Web Application

– Work in groups to design architecture that drives the web and mobile applications, including the DocStore API

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DocStore Requirements

Account Types

- **Free** – 5GB cap, basic document indexing, download original files
- **Premium** – 20GB cap, full-text indexing/search + OCR

Web App/API

- **User authentication**
- **Session state stored off-instance**
- **Powered by API tier**
- **Highly Available**

Content

- **Stored in S3**
- **Efficient upload/download to/from S3**
- **Static assets in one S3 bucket; distributed globally**

Deployment

- **Oregon (us-west-2) and Sydney (ap-southeast-2)**
- **Replicate minimal information (i.e., don't replicate uploaded content)**

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Sample Architecture

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Application deployed in two regions: us-west-2 (Oregon) and ap-southeast-2 (Sydney)

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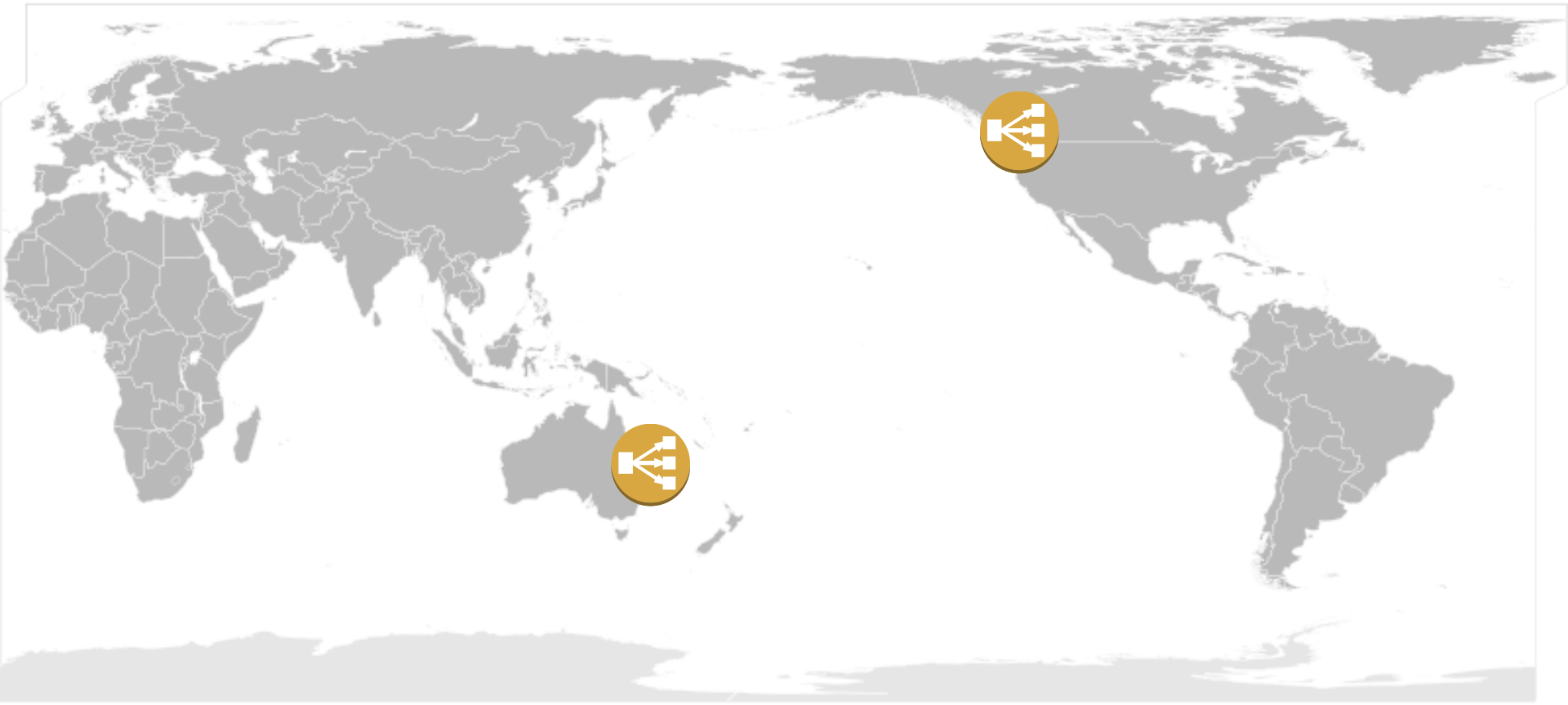

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Each ELB has a region-specific CNAME in Route 53

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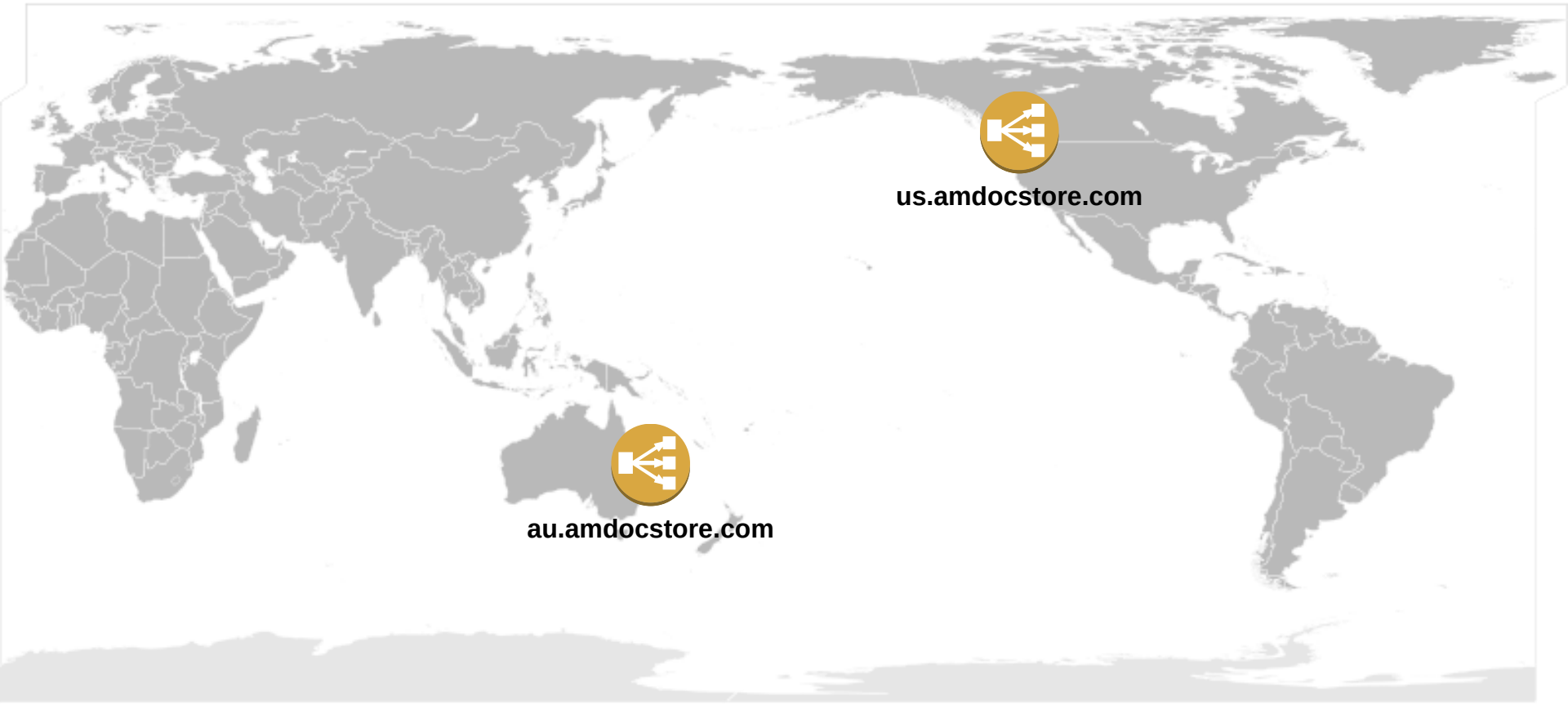

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Latency Based Routing feature of **Route 53** directs customers to closest endpoint

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Closer to Oregon? That's where you go. In Perth? Head to the ELB in Sydney.

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Closer to Oregon? That's where you go.

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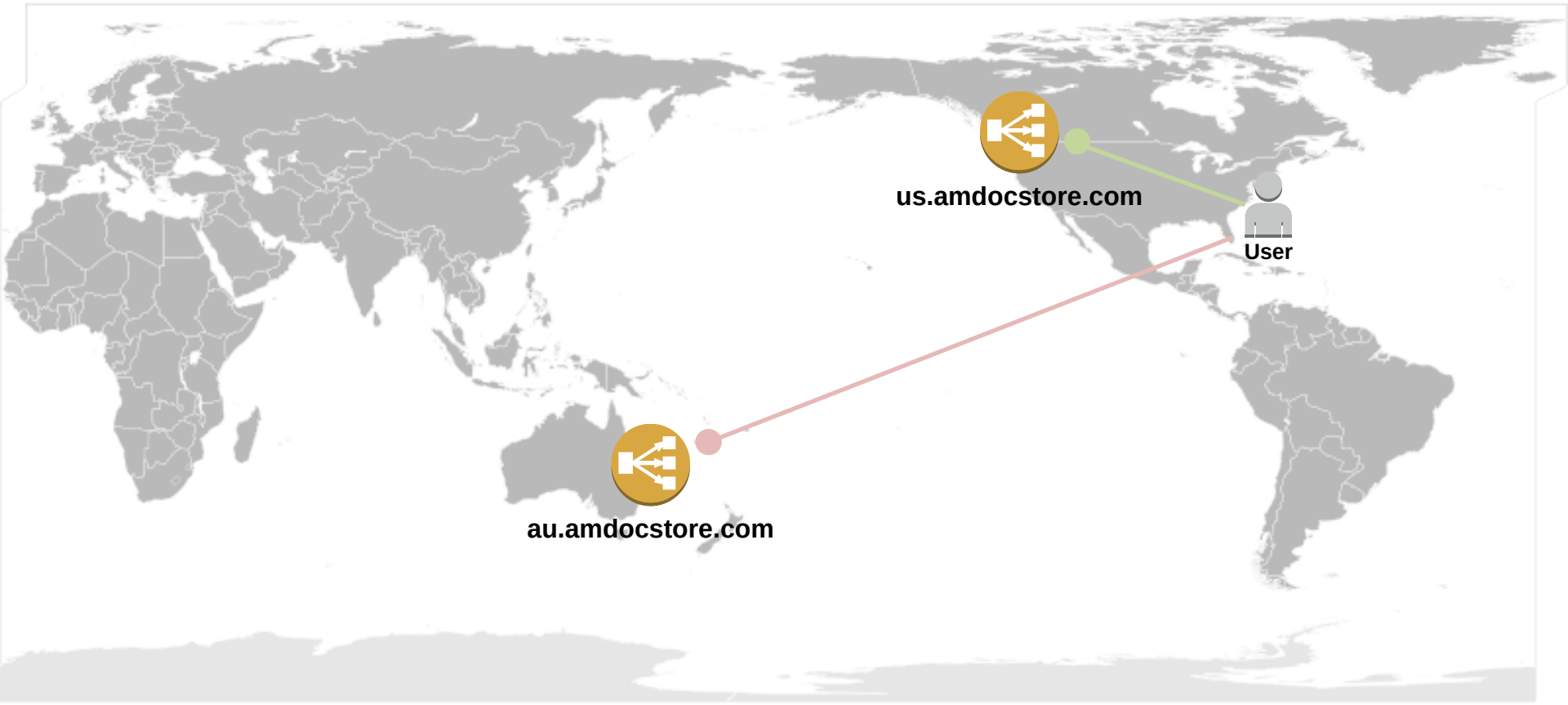

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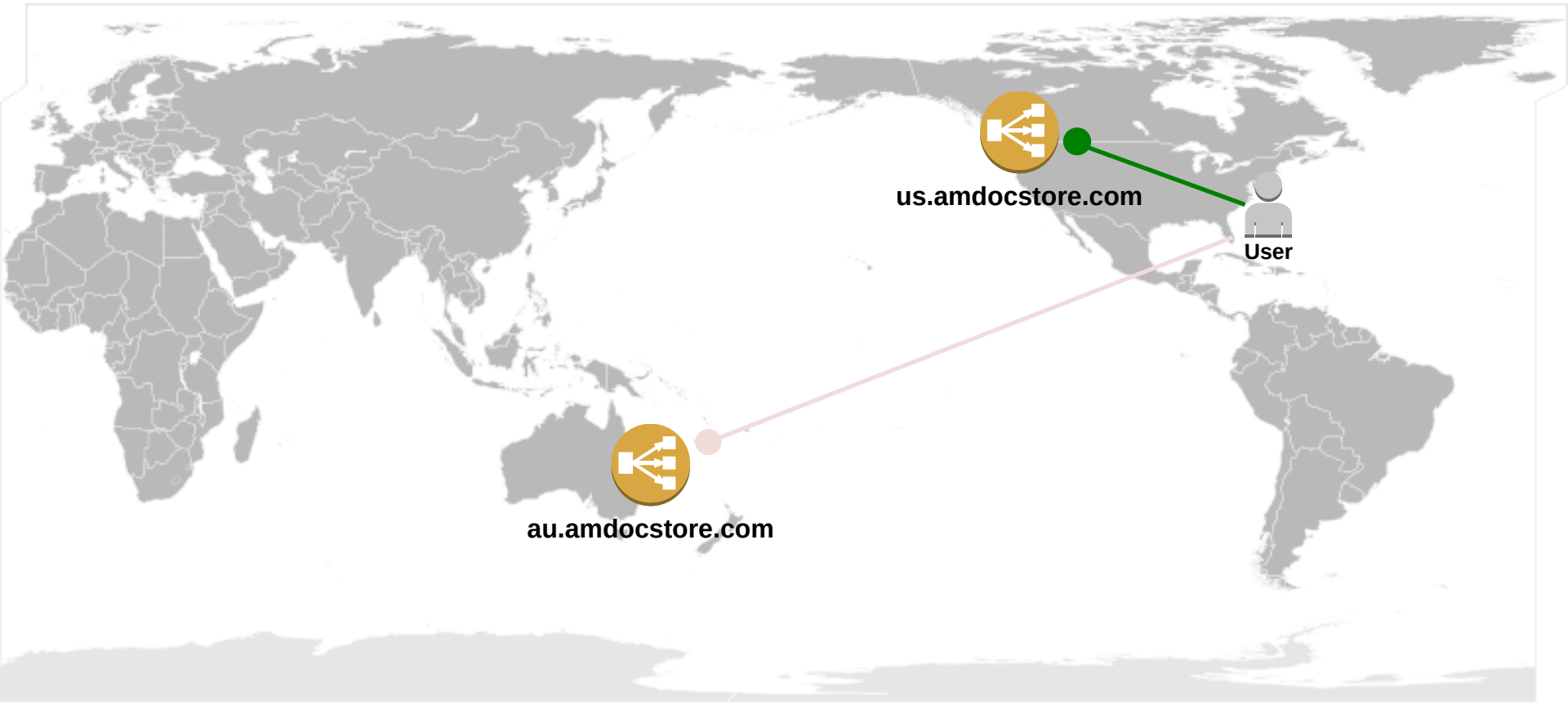

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Let’s focus on one region

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us.amdocstore.com

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Route 53 LBR directs a user to the **nearest Elastic Load Balancer** (in this case, the ELB in us-west-2)

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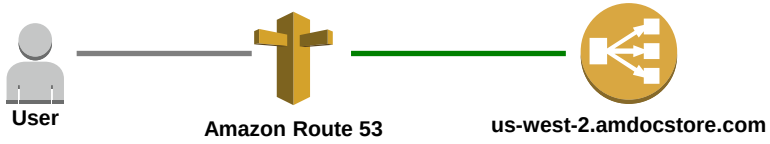

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DocStore stores all **static web assets** (CSS, images, JavaScript, etc) **in S3**

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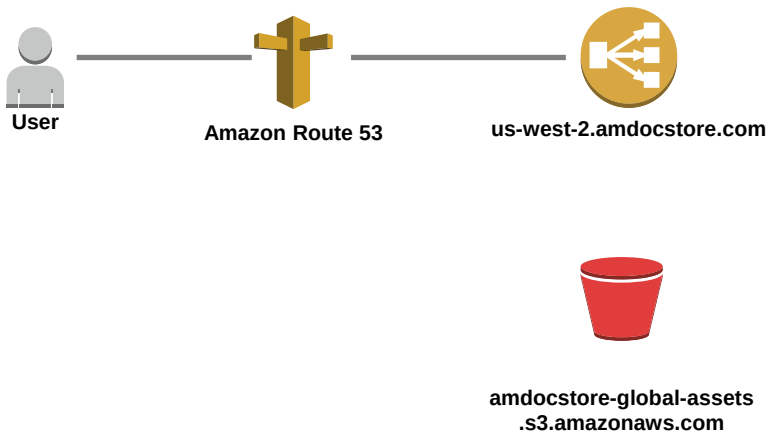

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This bucket exists in the us-west-2 origin, but is the **canonical source for static asset requests globally**

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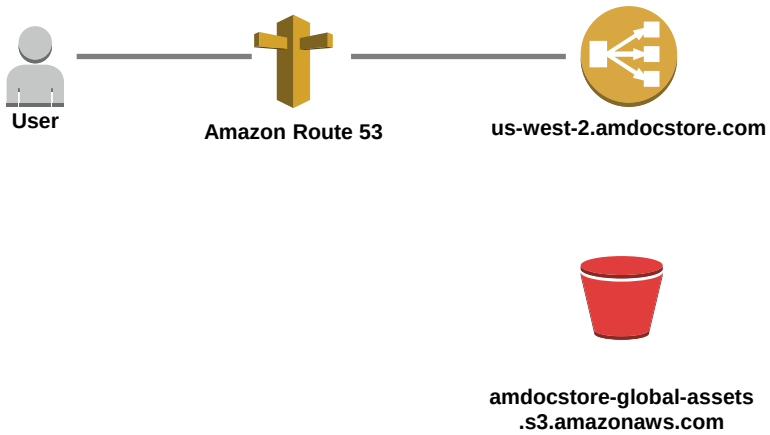

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CloudFront distributes static web assets in S3 to end users with low latency using a **global network of edge locations**

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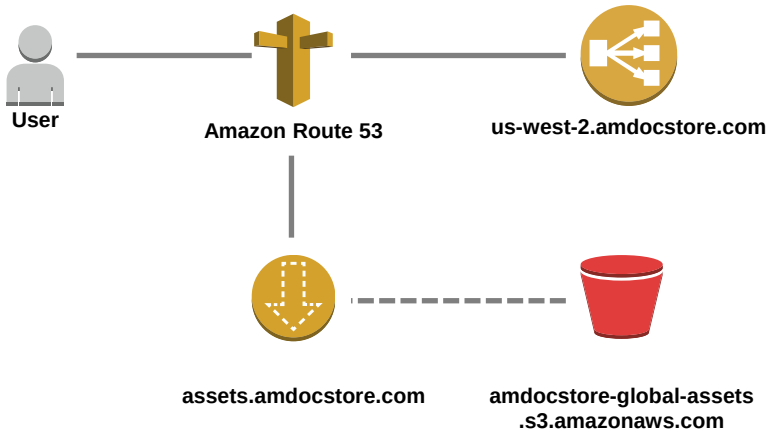

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Let's see how a user in **Tokyo** would access **http://assets.amdocstore.com/css/style.css**

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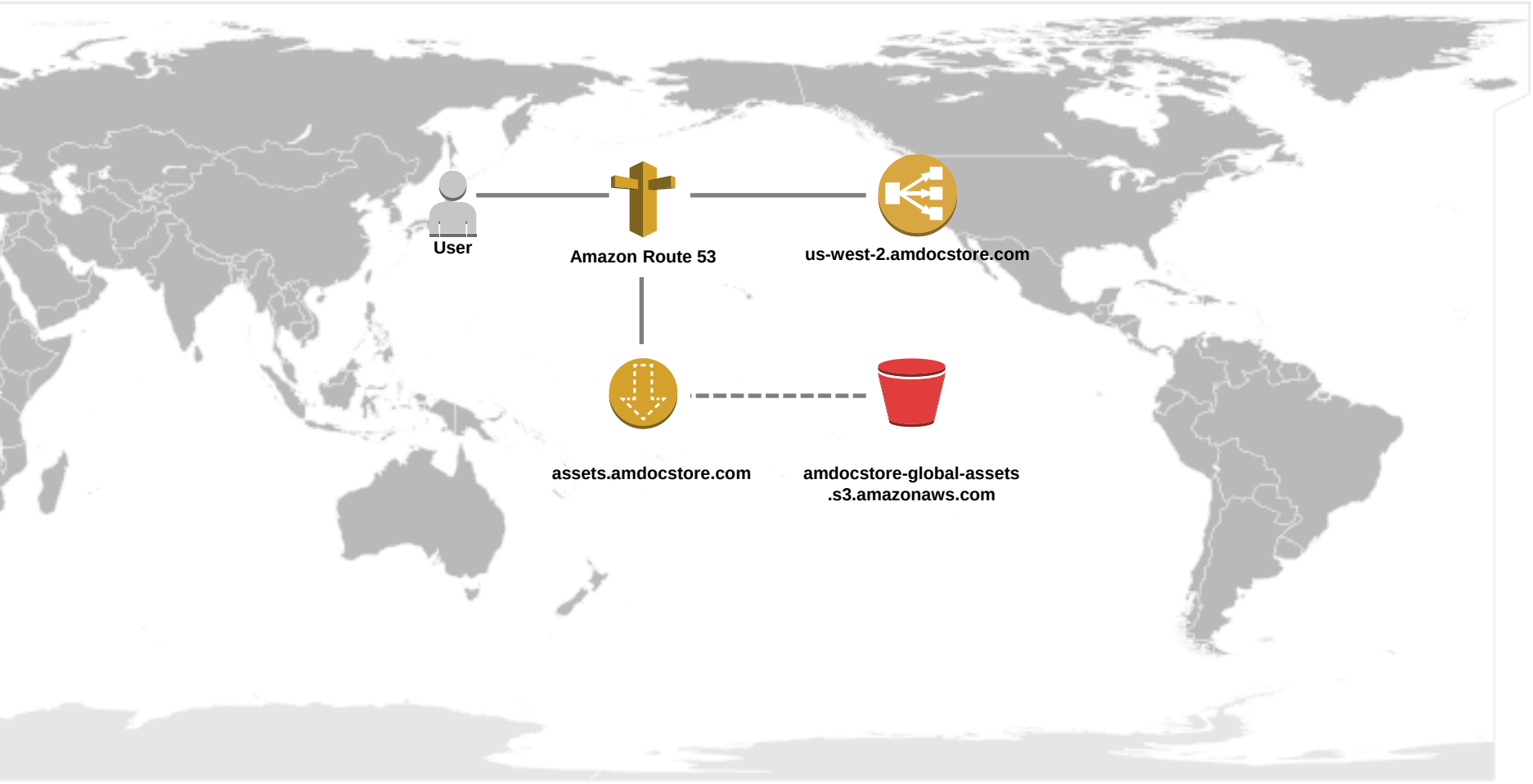

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Any user request for assets.amdocstore.com will **automatically route to the nearest edge location**

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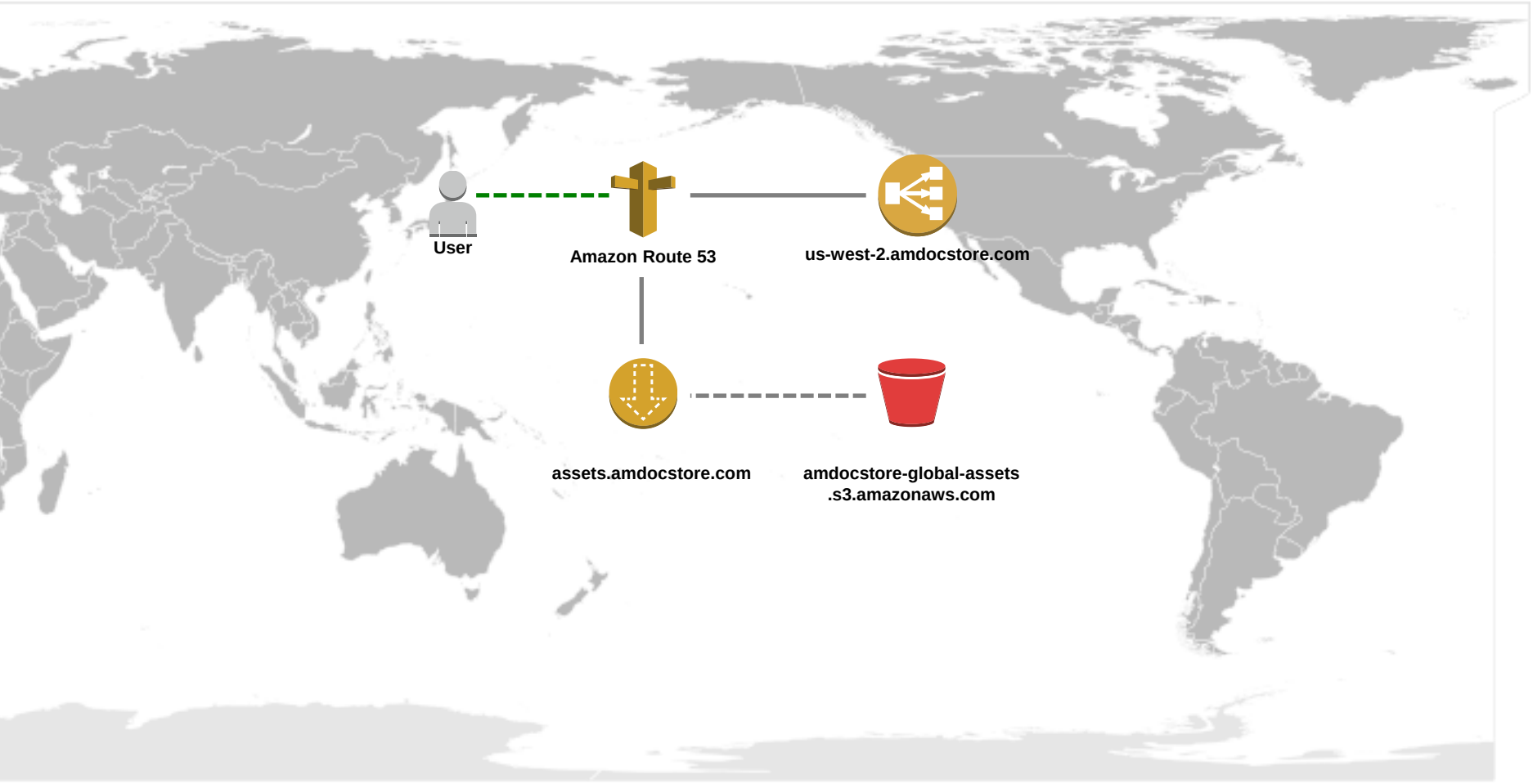

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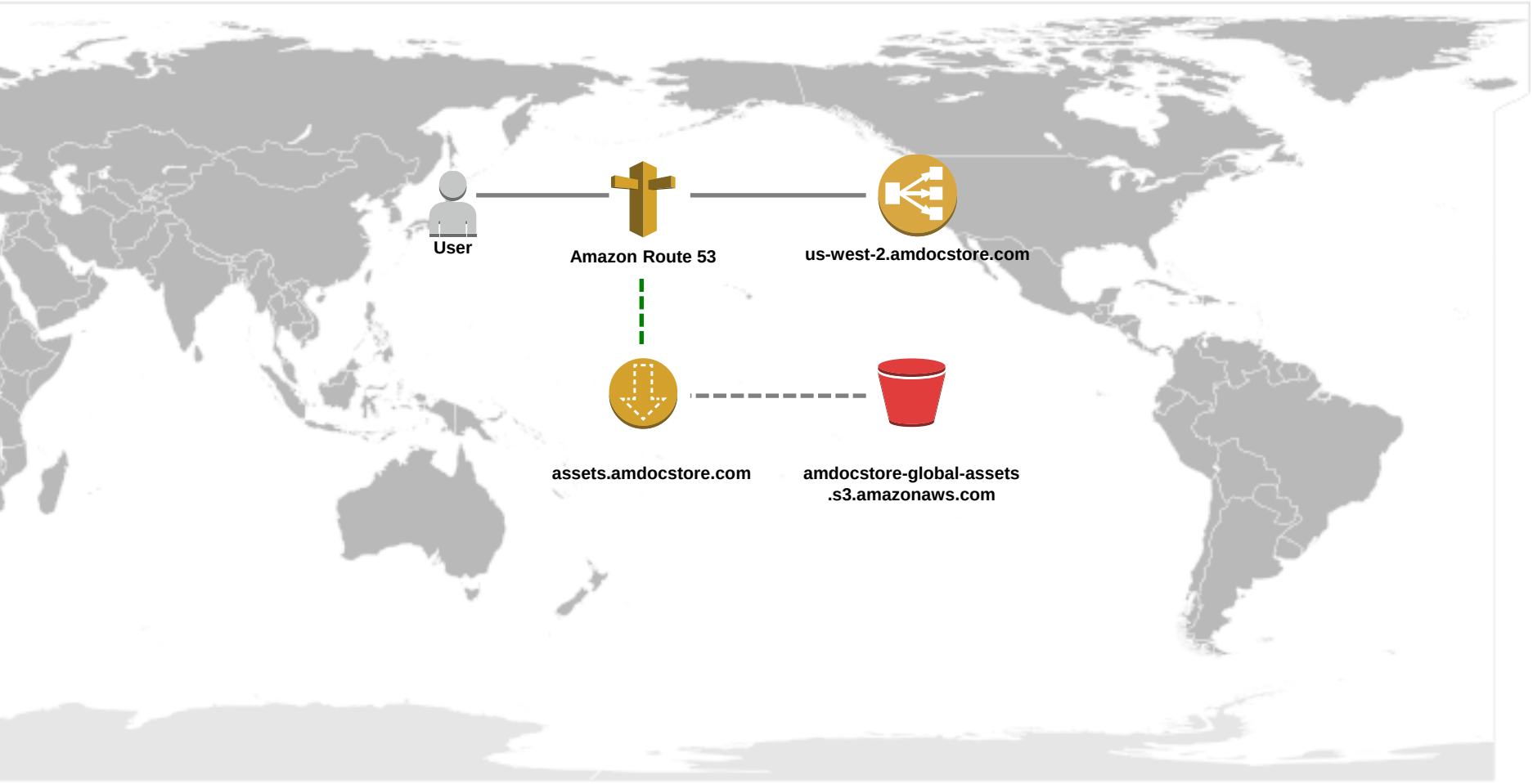

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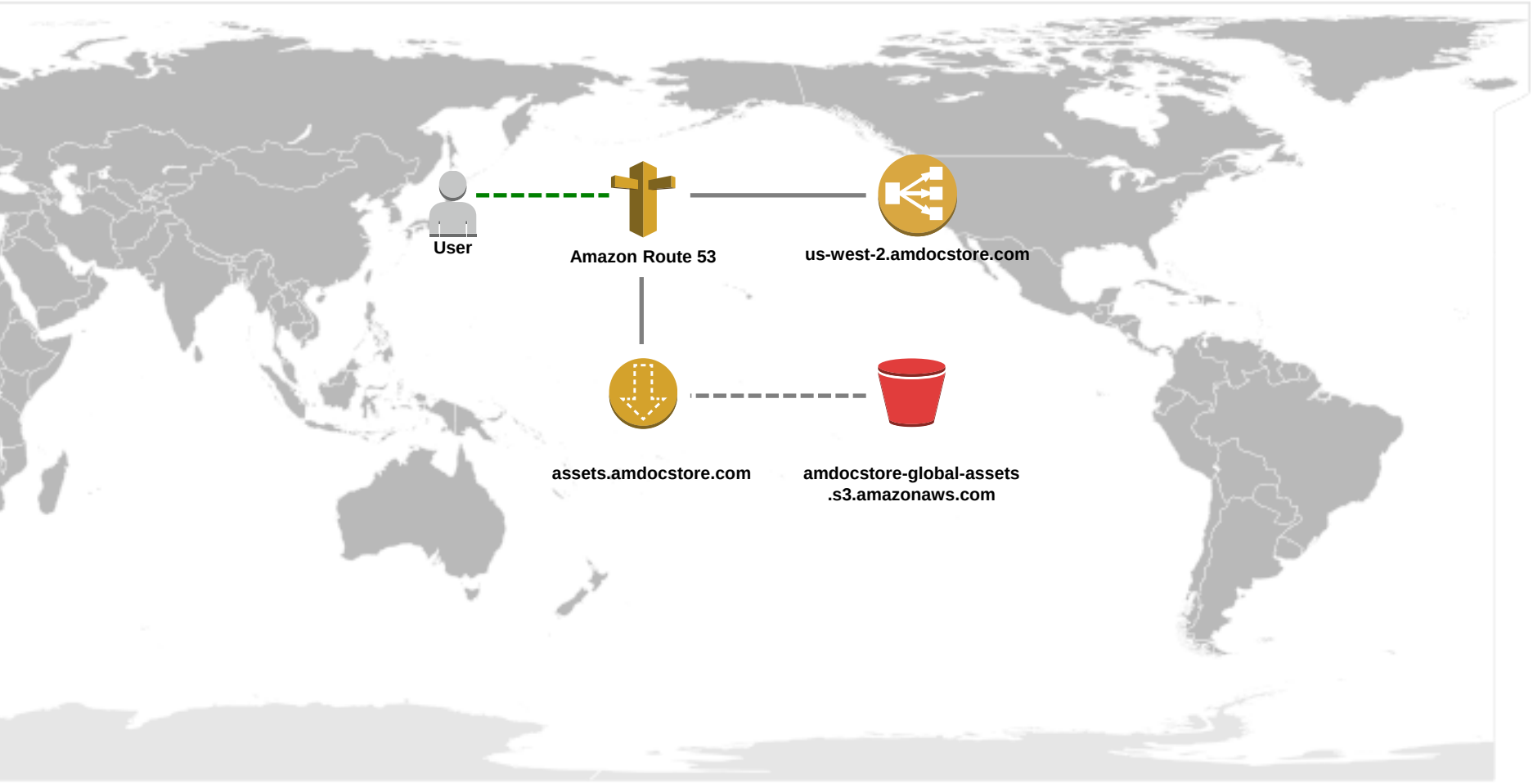

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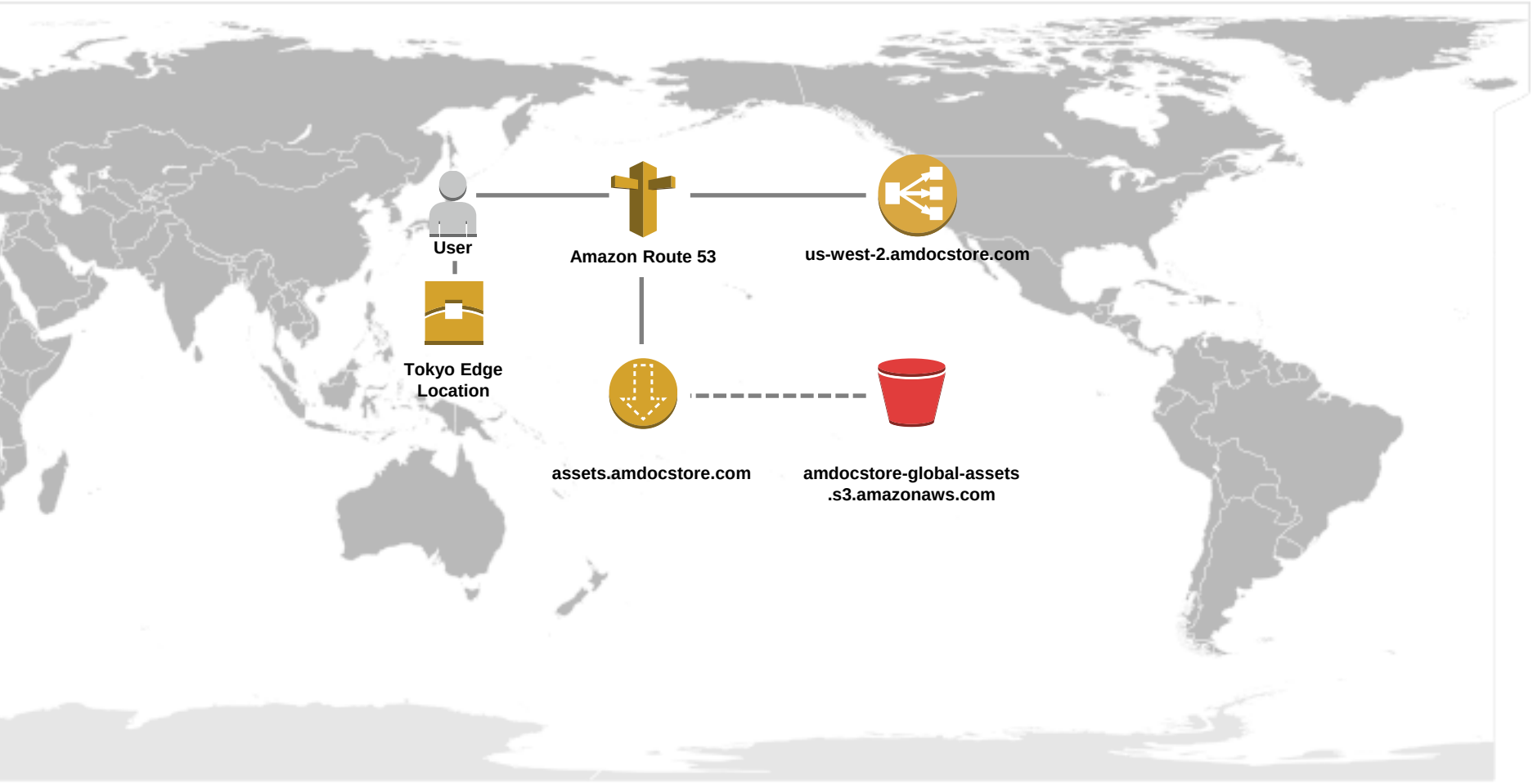

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The requested **file will be served from the Tokyo edge** if it is in the cache

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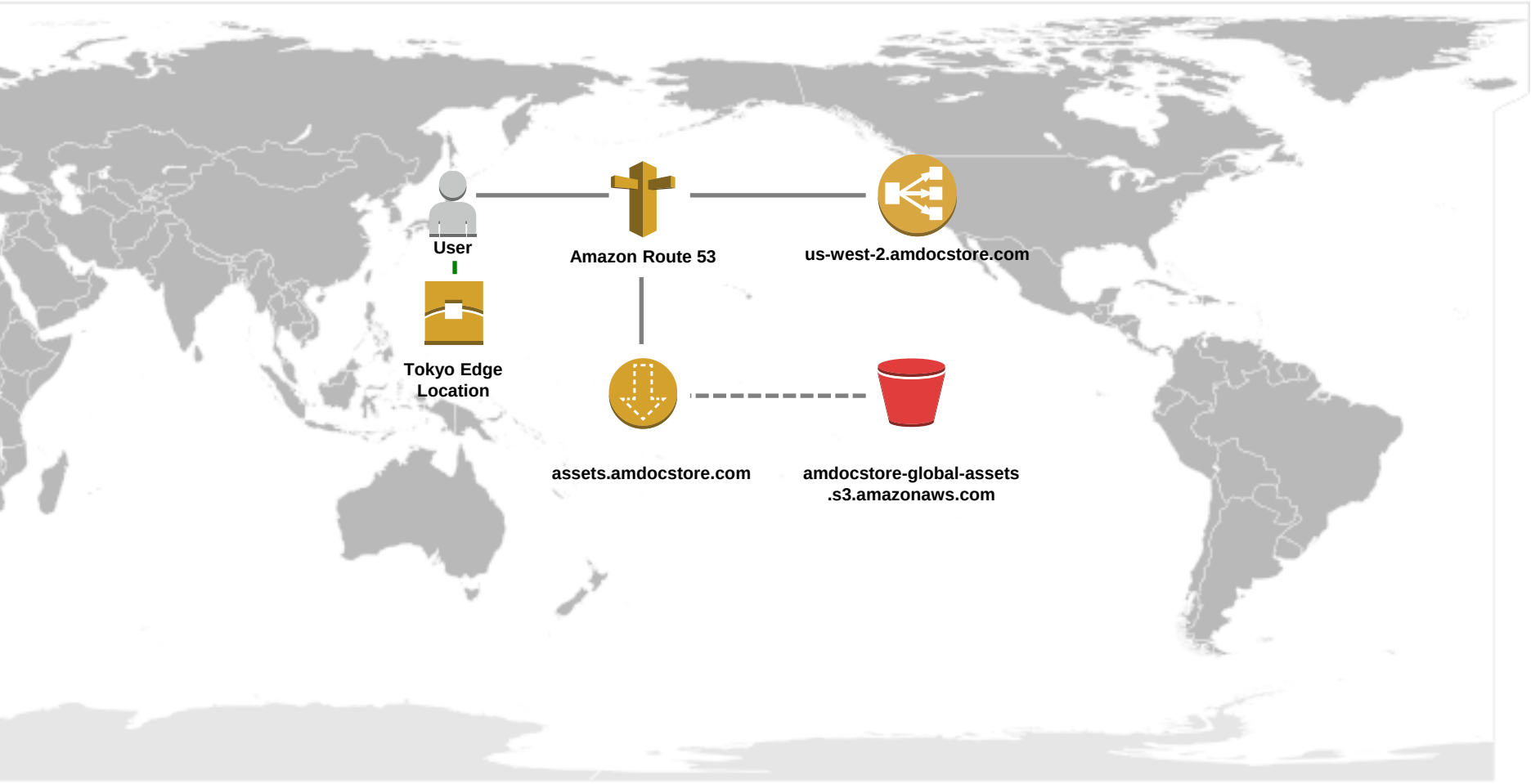

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The requested file will be served from the Tokyo edge if it is in the cache, or **retrieved from the origin and cached at the edge** for future requests

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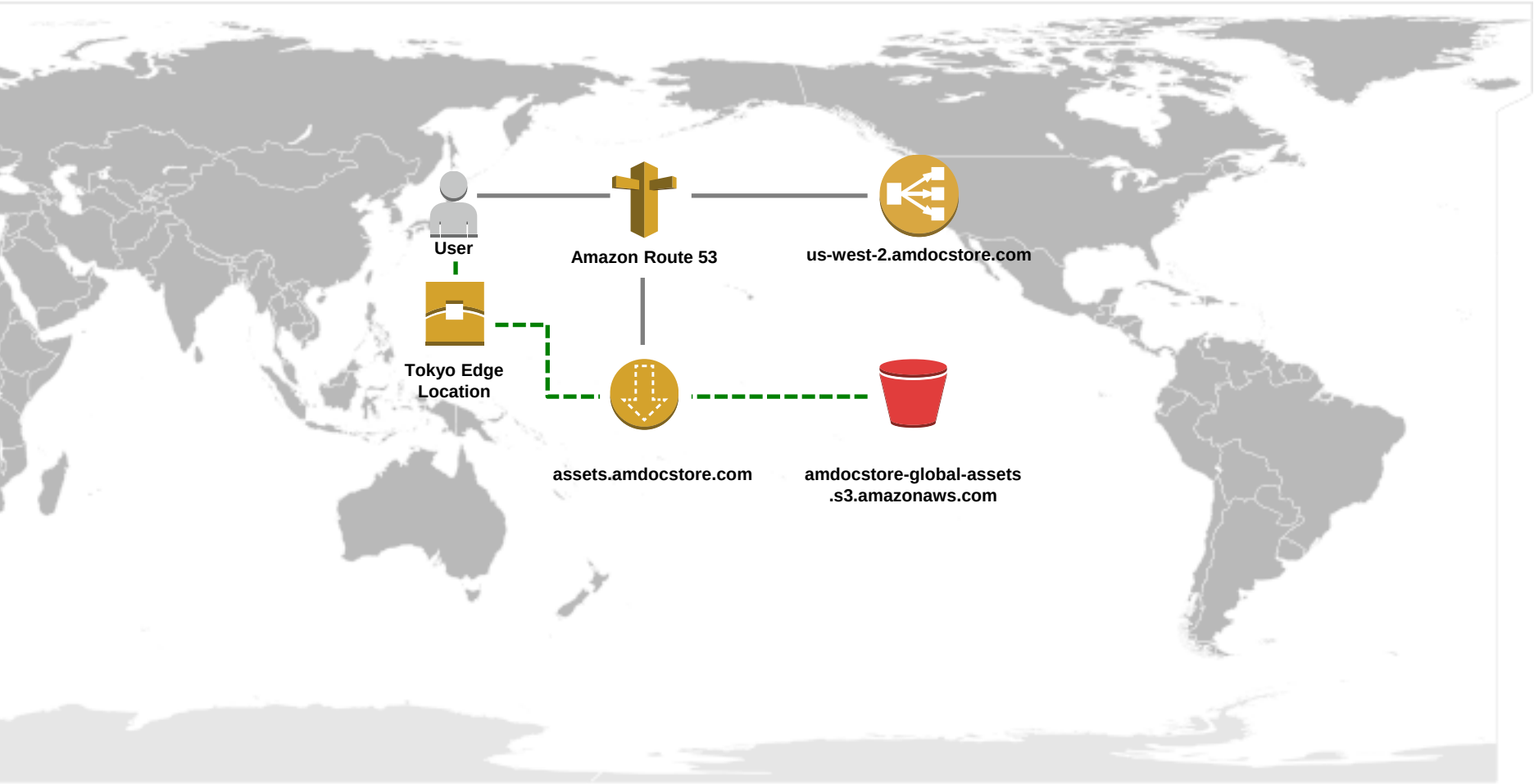

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Let's go back to our application deployment in **us-west-2**

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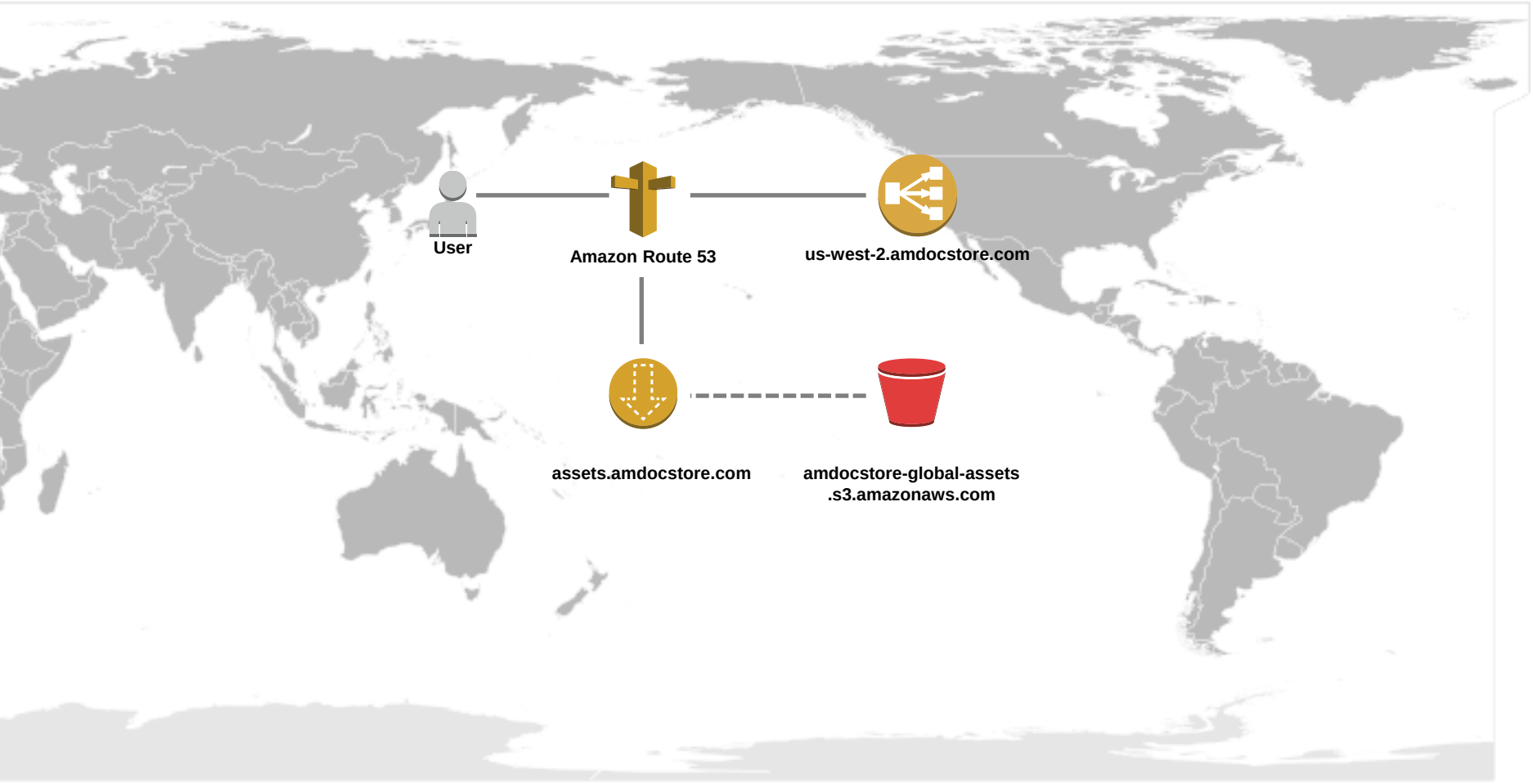

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Let’s go back to our application deployment in **us-west-2**

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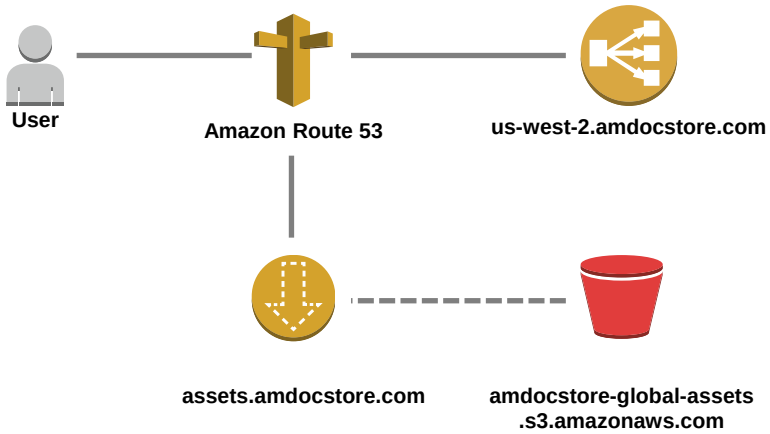

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Let's go back to our application deployment in **us-west-2** and **focus on the browser component of DocStore**

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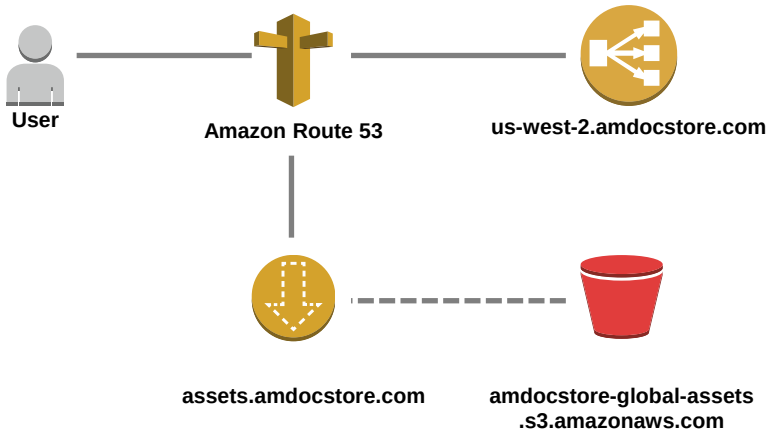

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Web servers will be deployed across multiple Availability Zones using Auto Scaling

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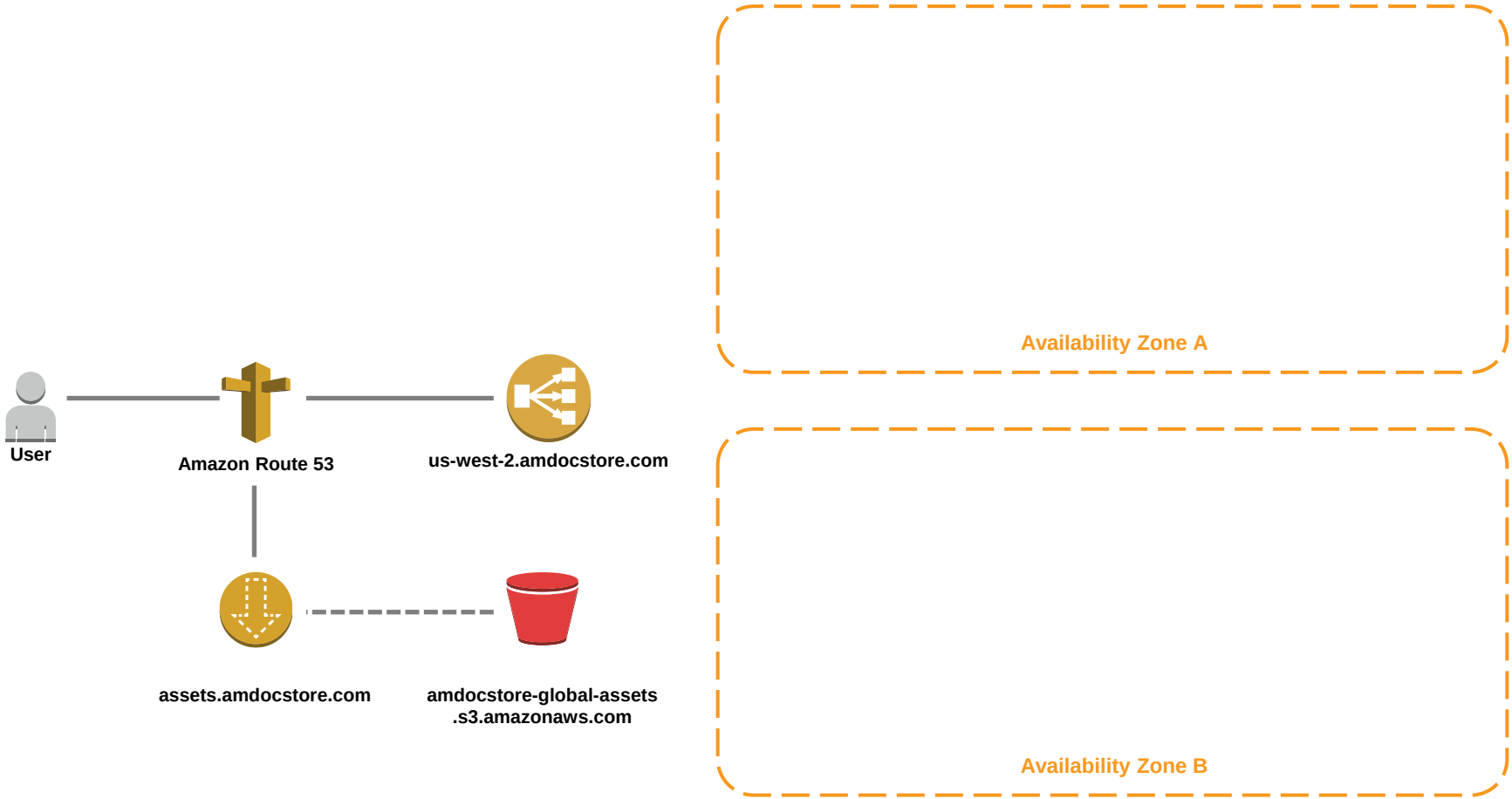

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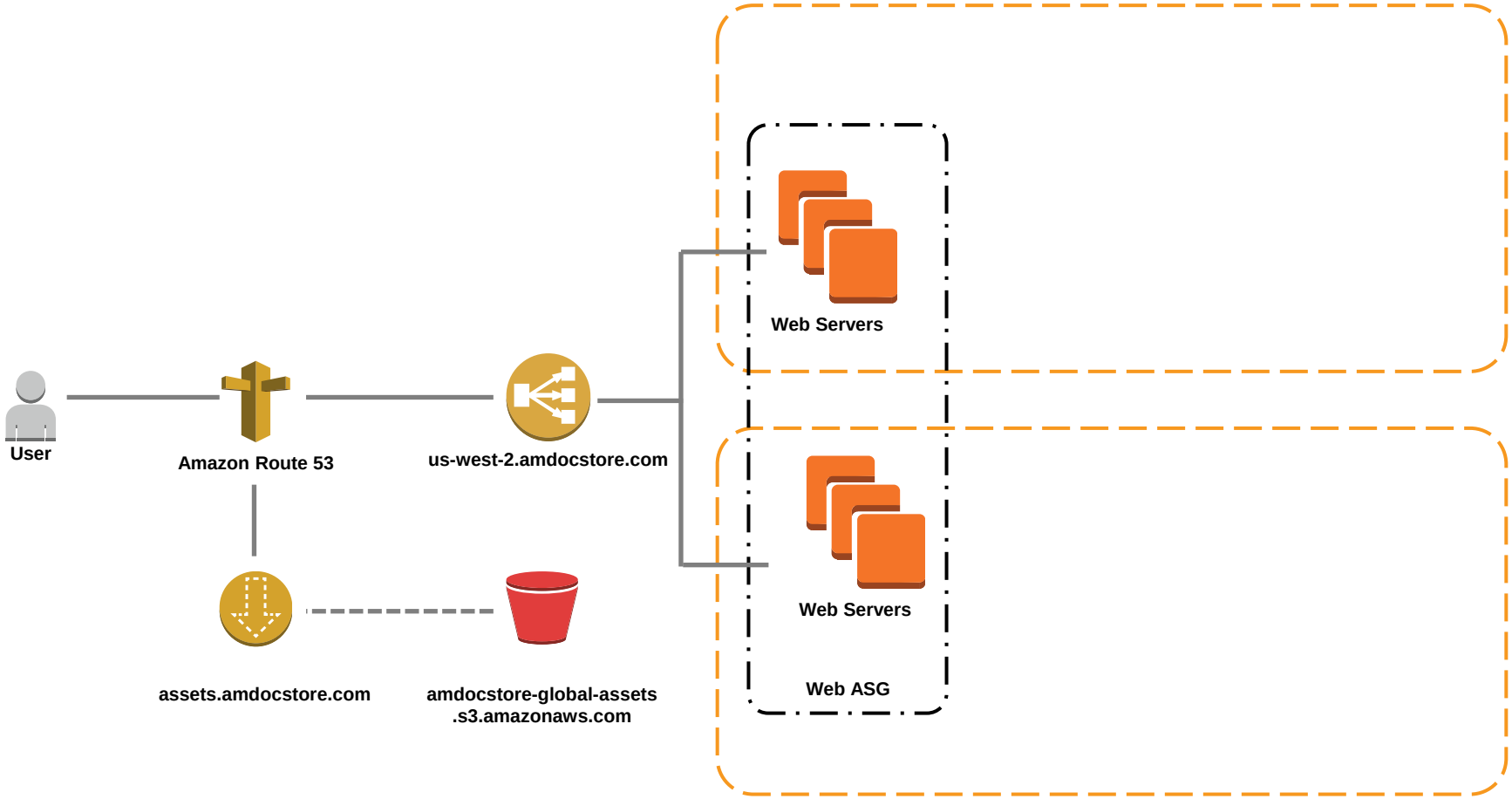

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Web servers host the DocStore interface that users will access with their web browsers

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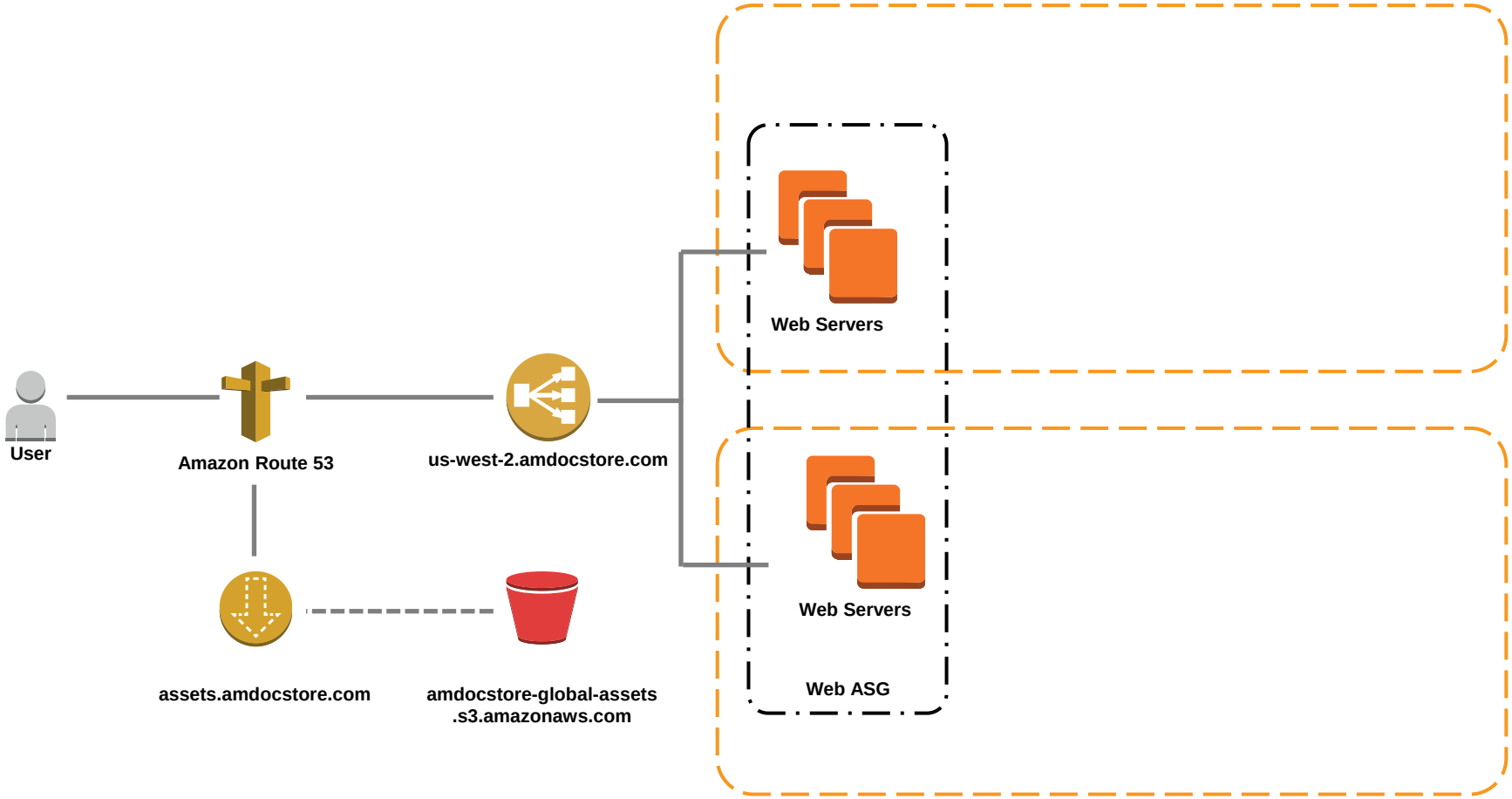

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Web servers might run a Ruby/Rails, PHP, Python, or other tool to render the user's interface/view

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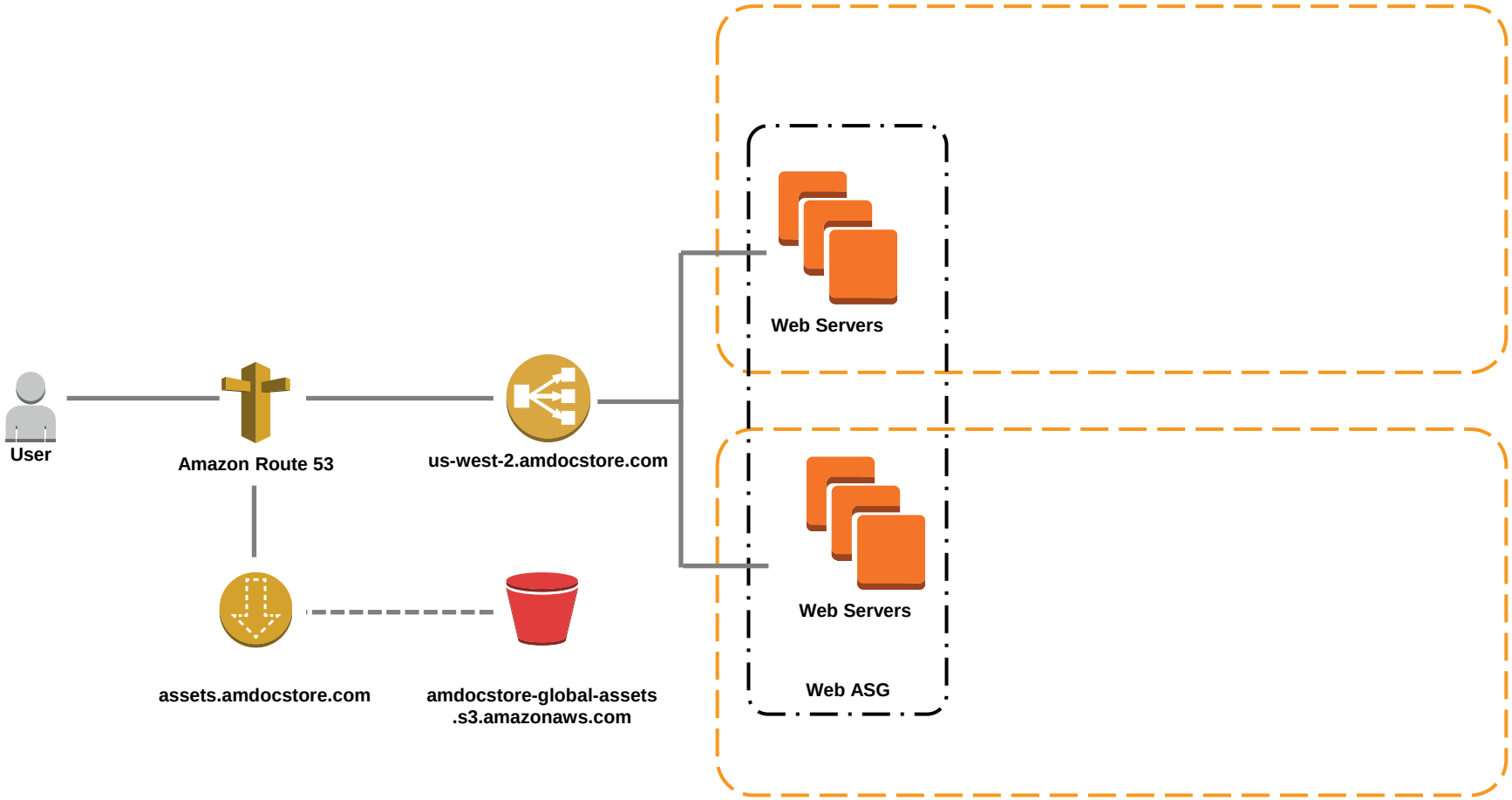

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Session state is stored out of the web tier in a **DynamoDB** table. DynamoDB is a regional service, meaning the data is automatically distributed across AZs

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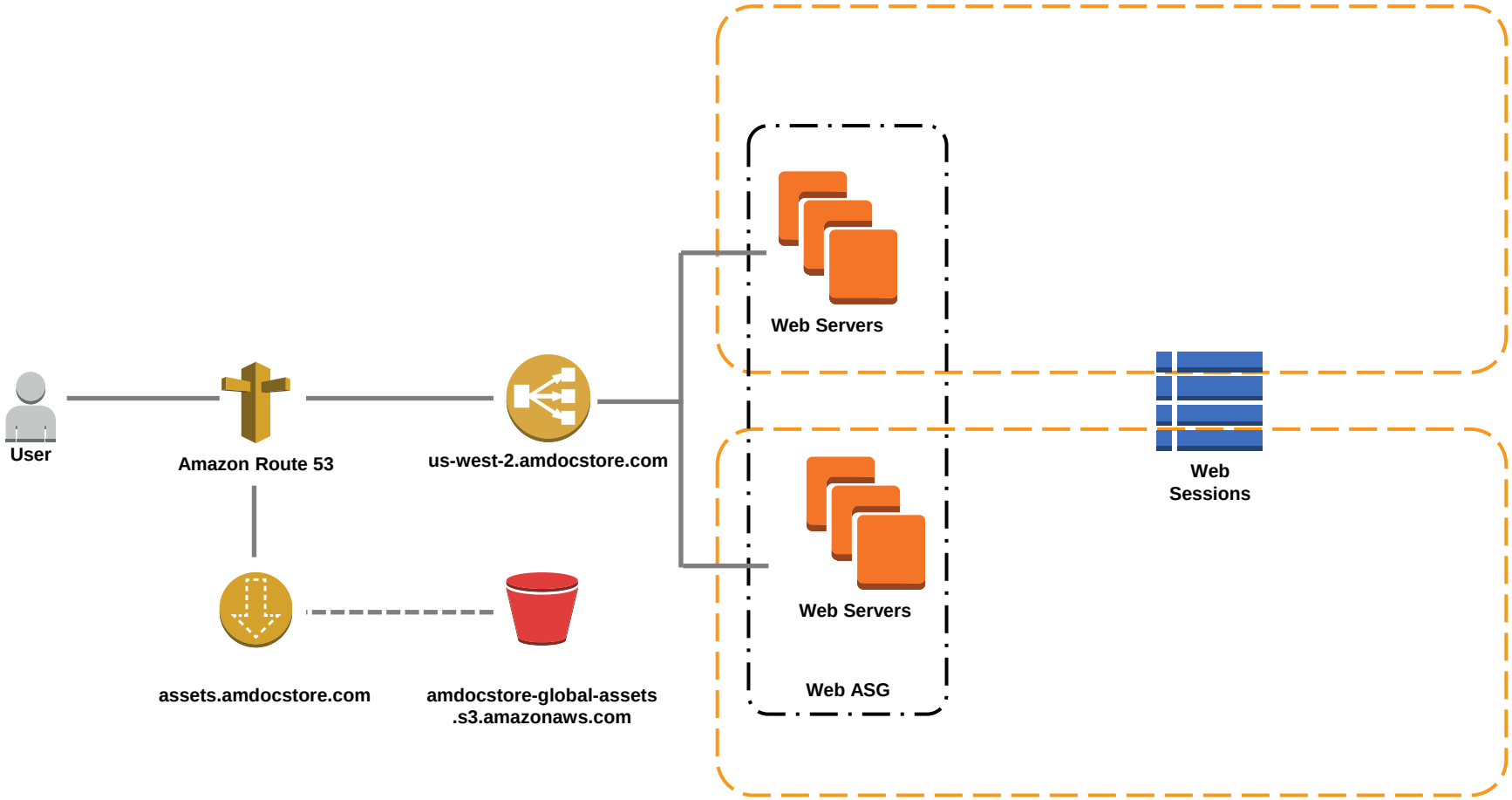

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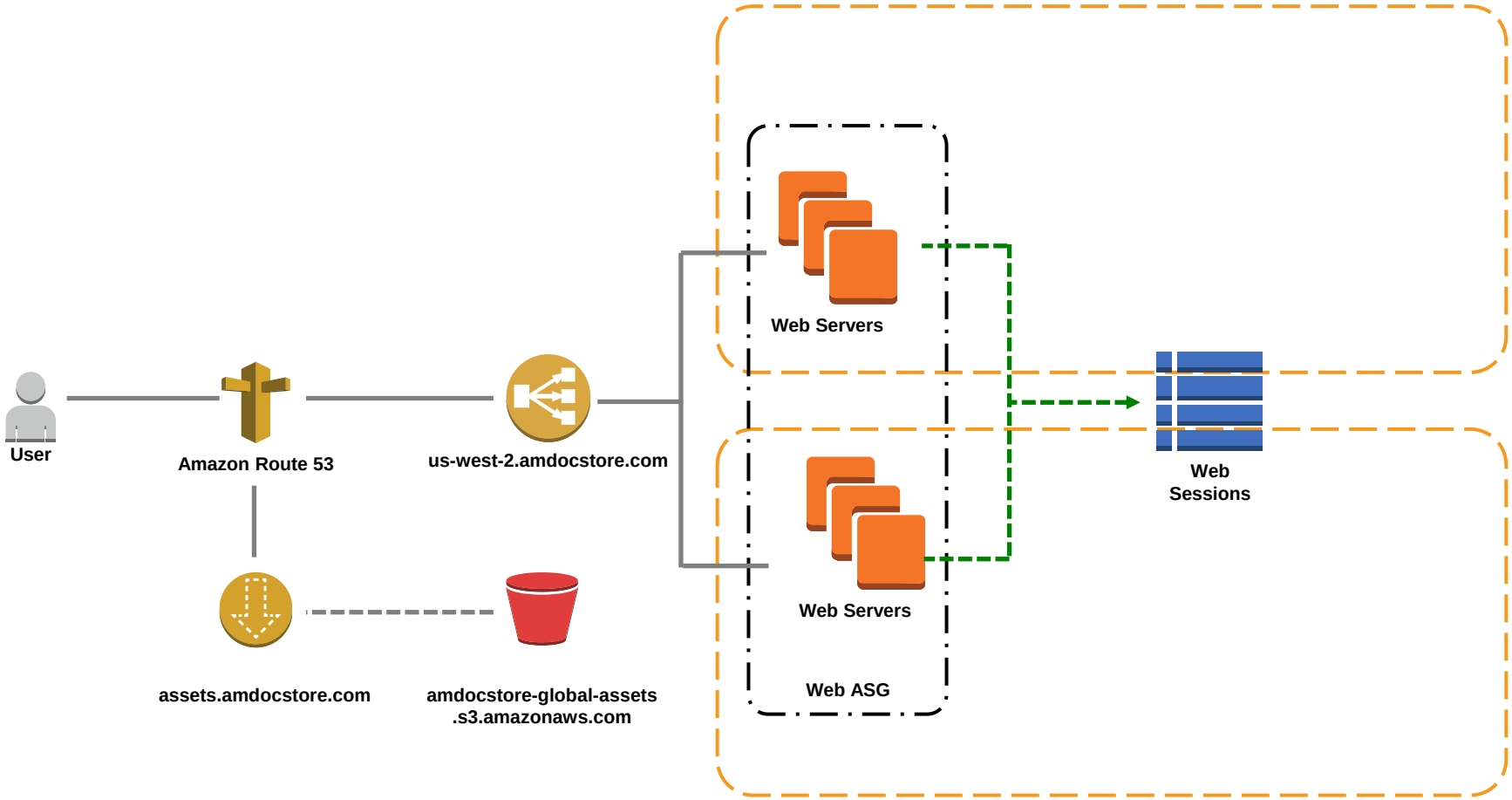

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Core functionality is provided by the **DocStore API.** Web servers consume this API

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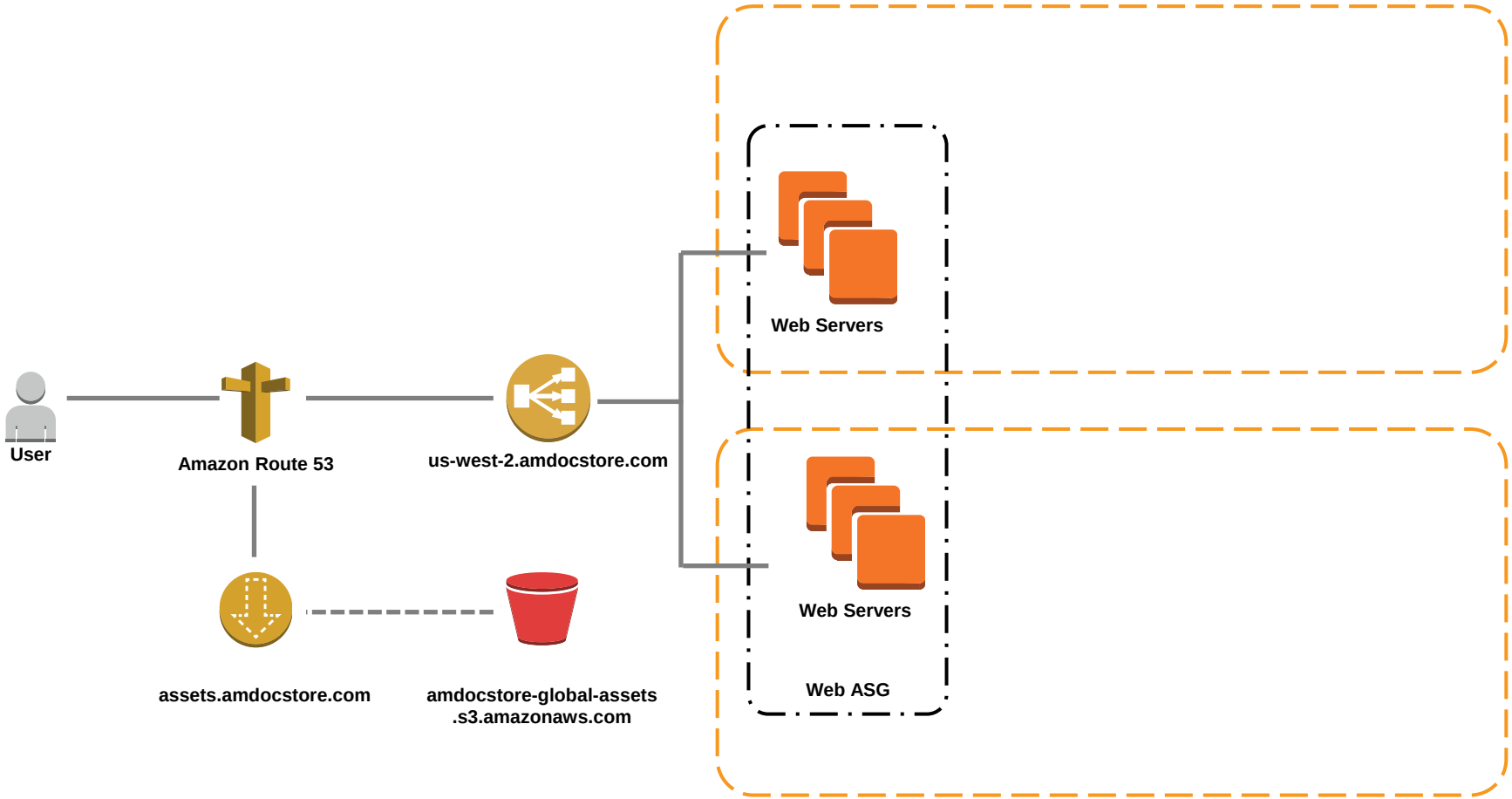

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The DocStore API will be deployed as an application in an **Elastic Beanstalk container**

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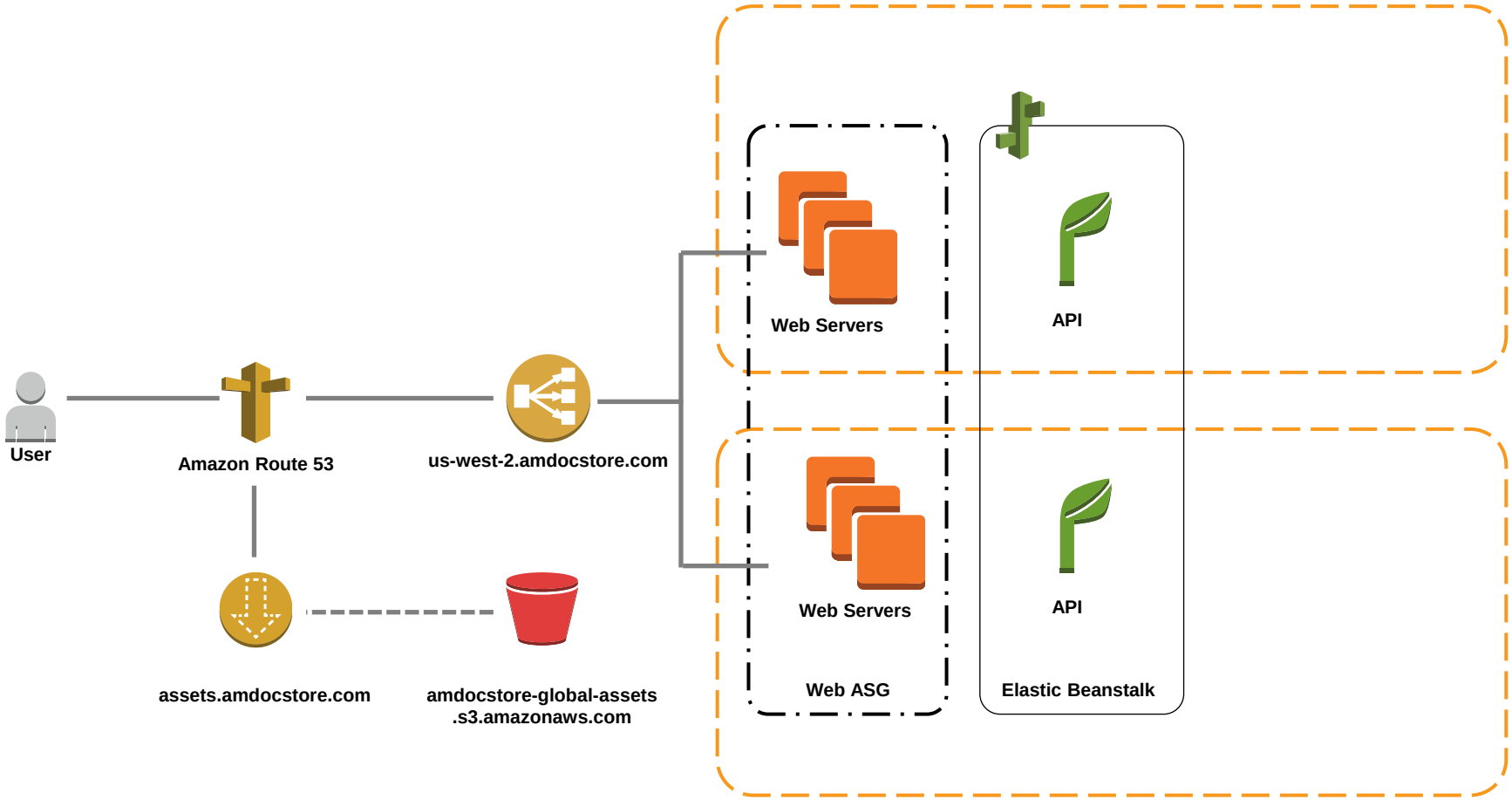

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Elastic Beanstalk provides Multi-AZ deployment, Auto Scaling, and load balancing

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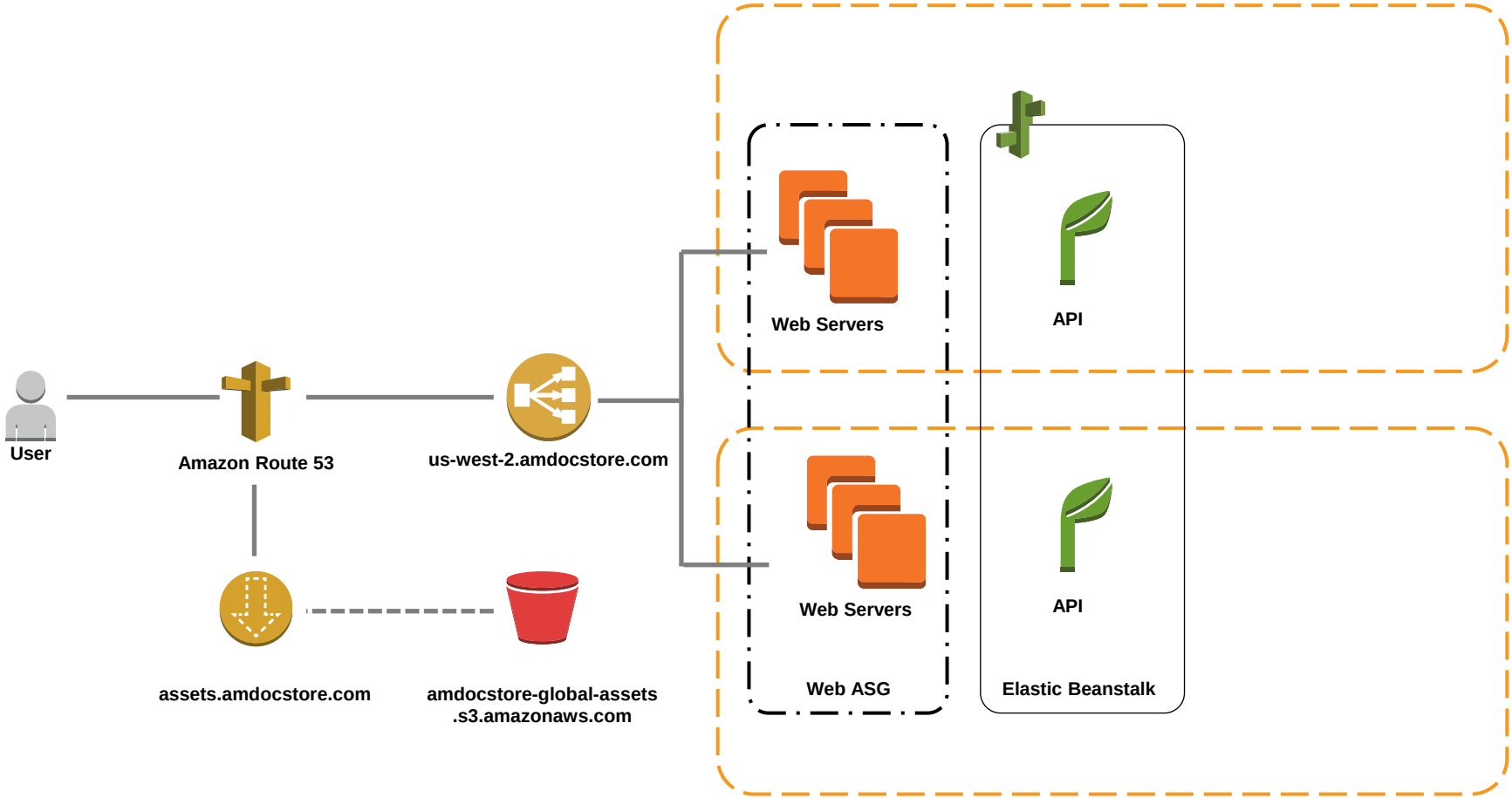

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Elastic Beanstalk supports Java, .NET, Python, PHP, Ruby, and node.js applications

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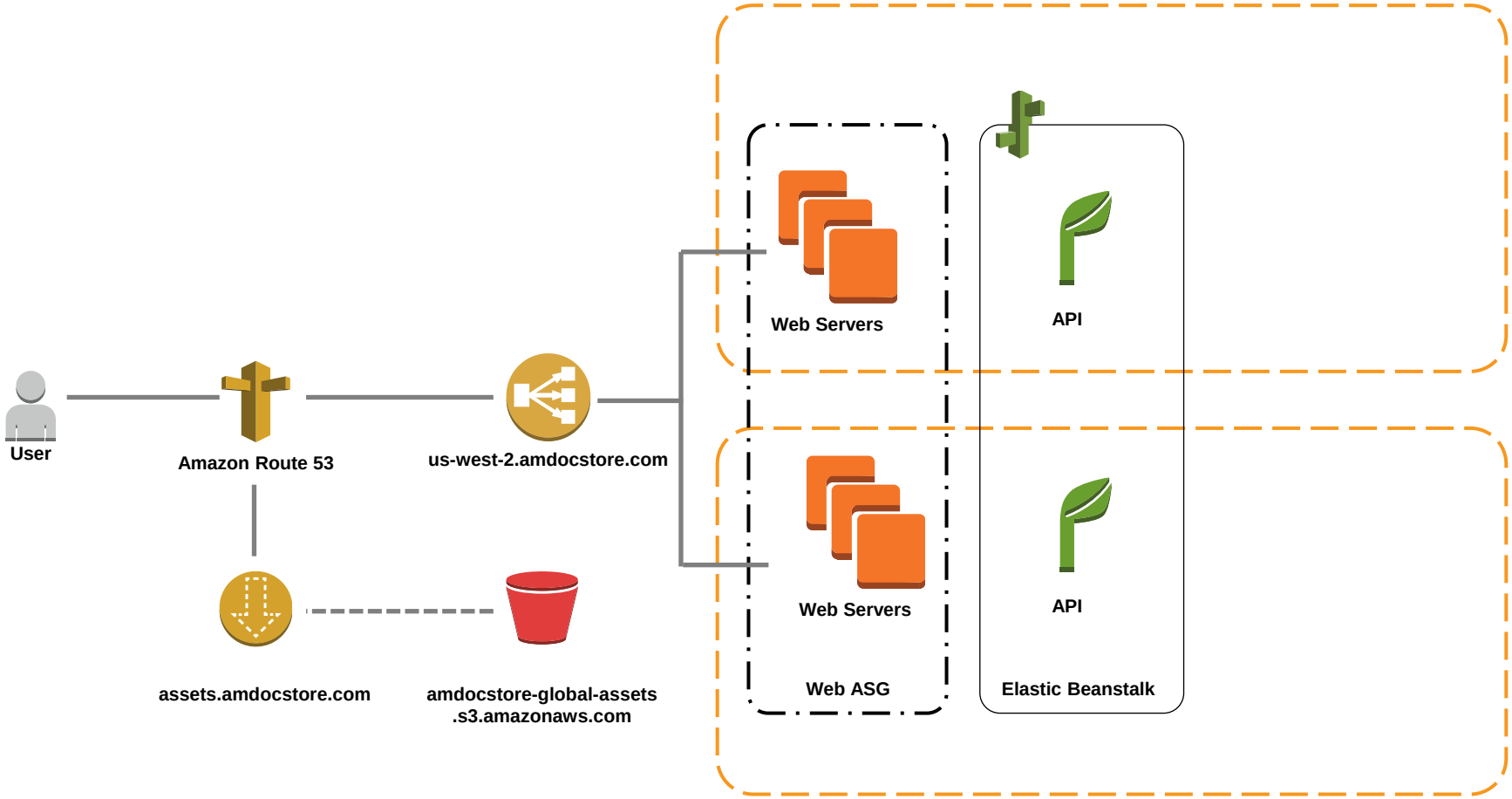

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The API will use several different data stores for different types of data

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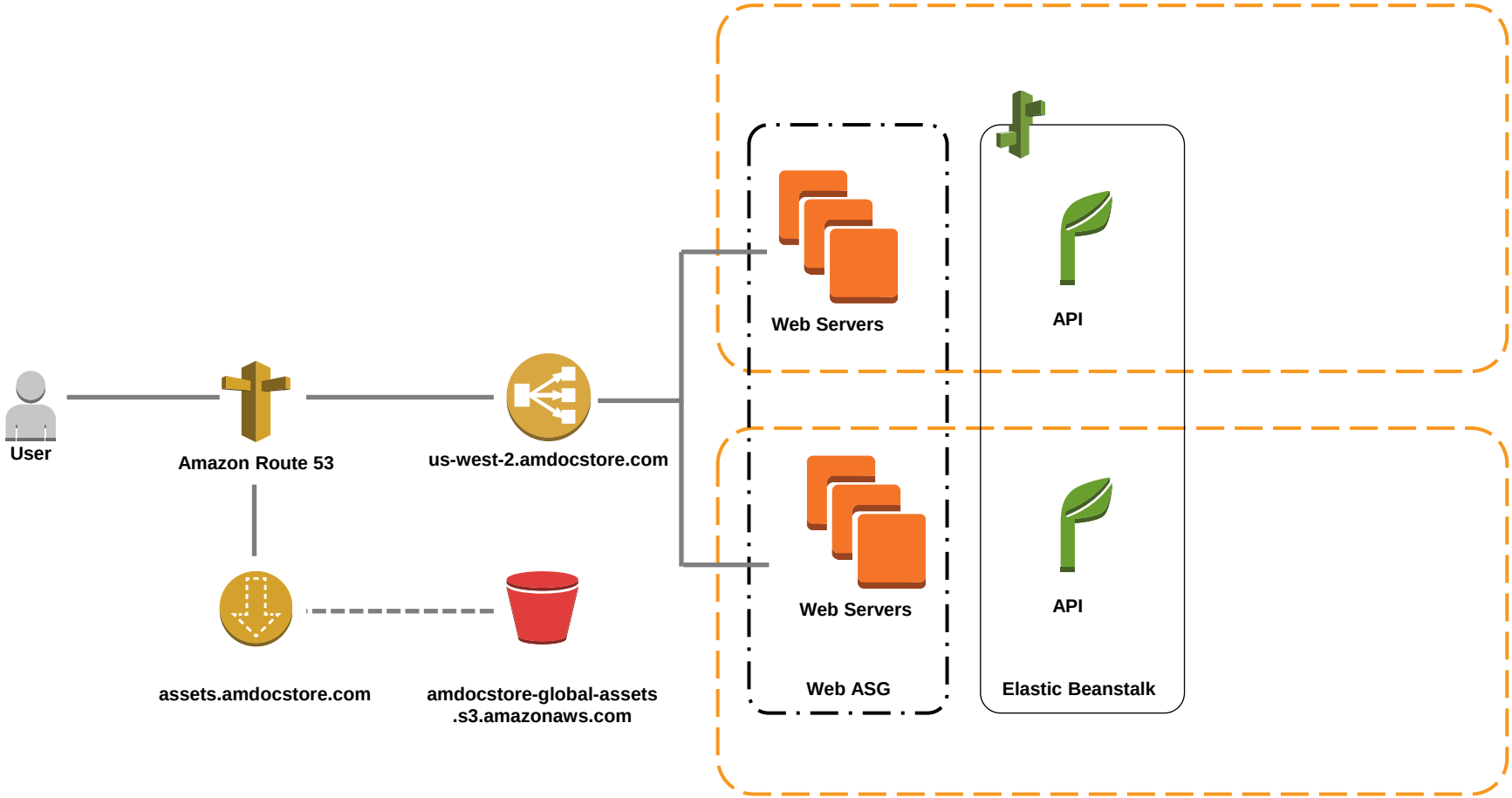

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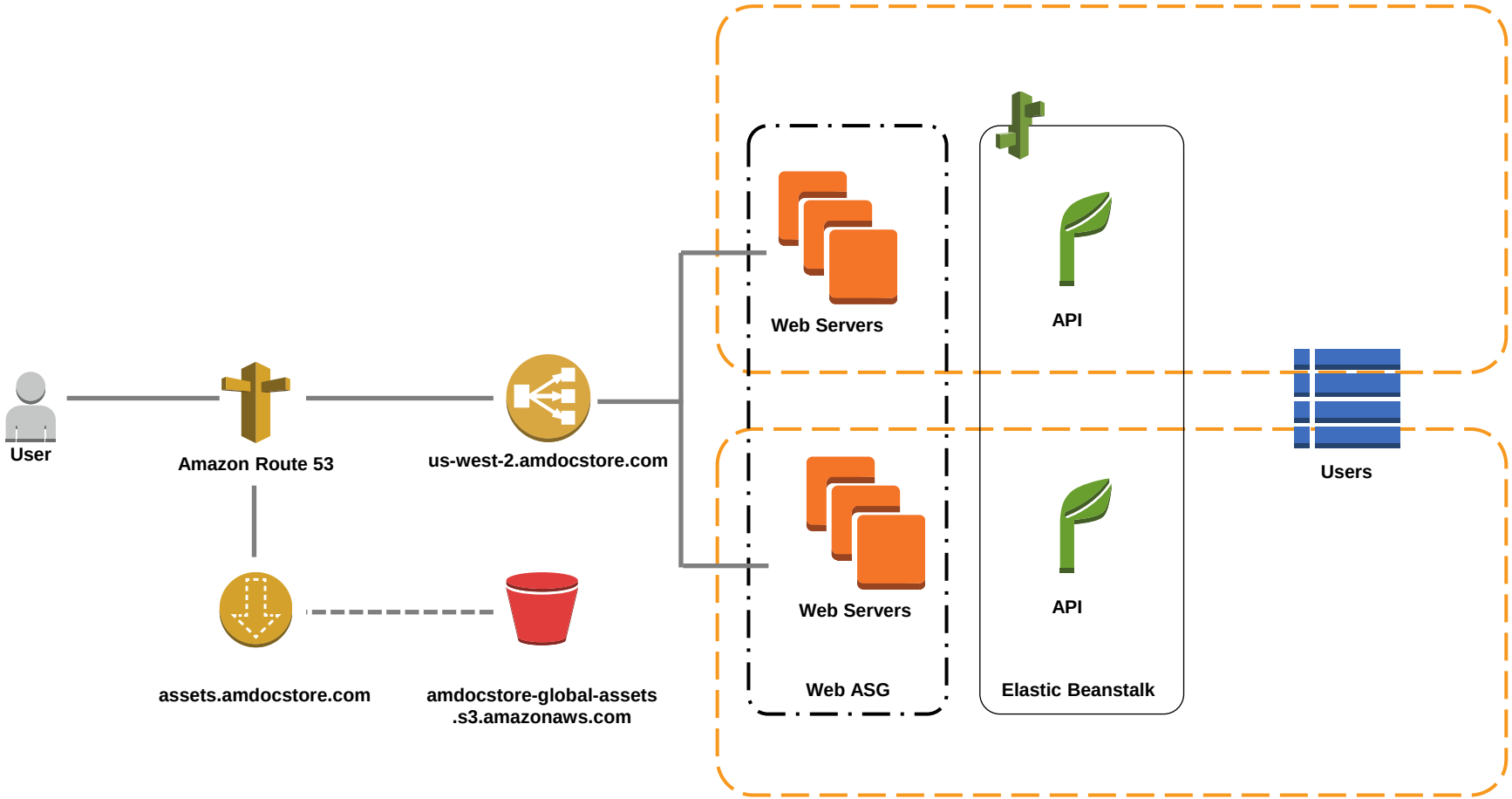
User account information will be stored in a **DynamoDB** table

DocStore



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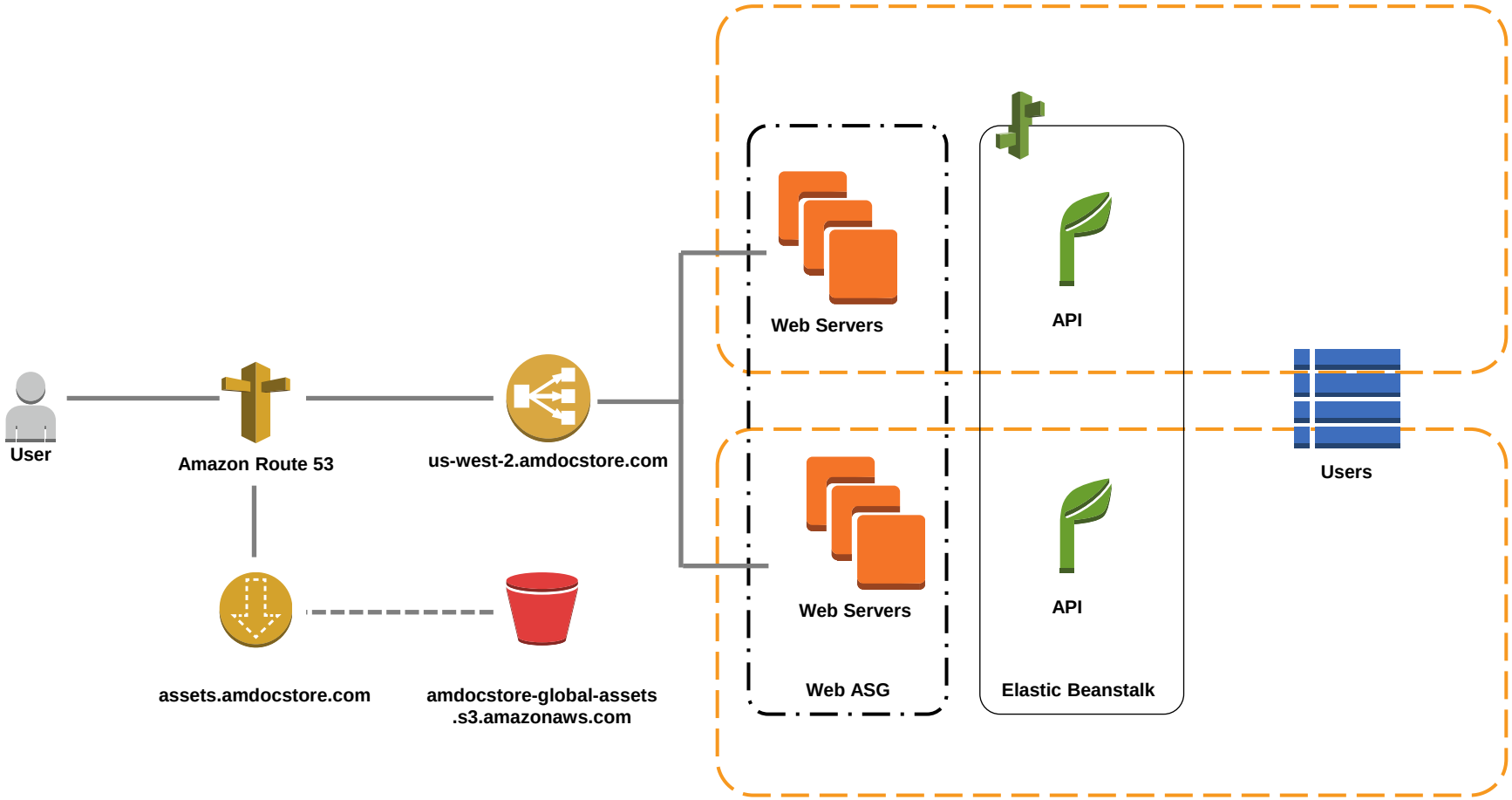
Let's see what happens when a **new user signs up for DocStore**

DocStore



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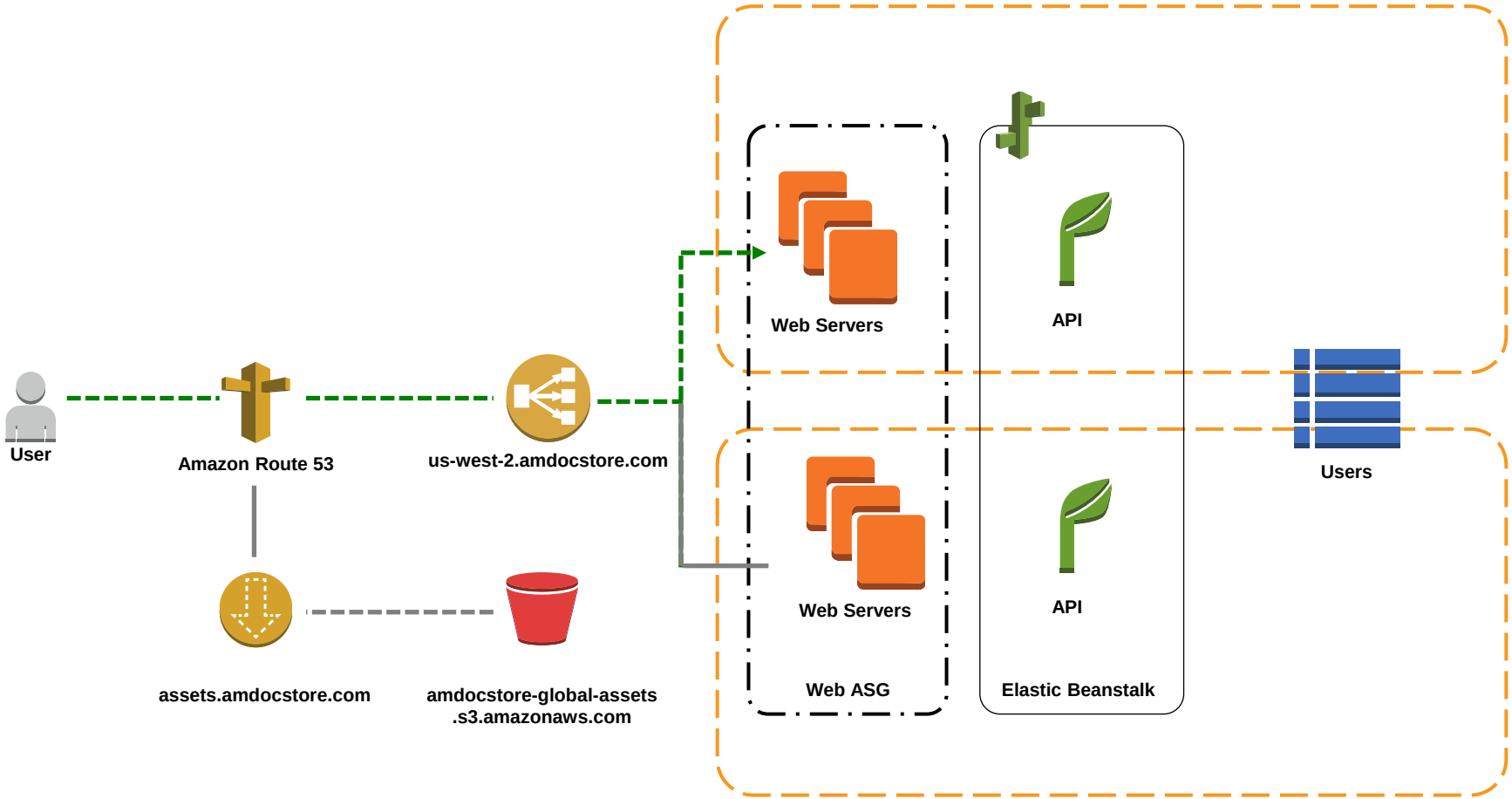
Create Account: User submits sign-up form to web servers with username, password, etc.

DocStore



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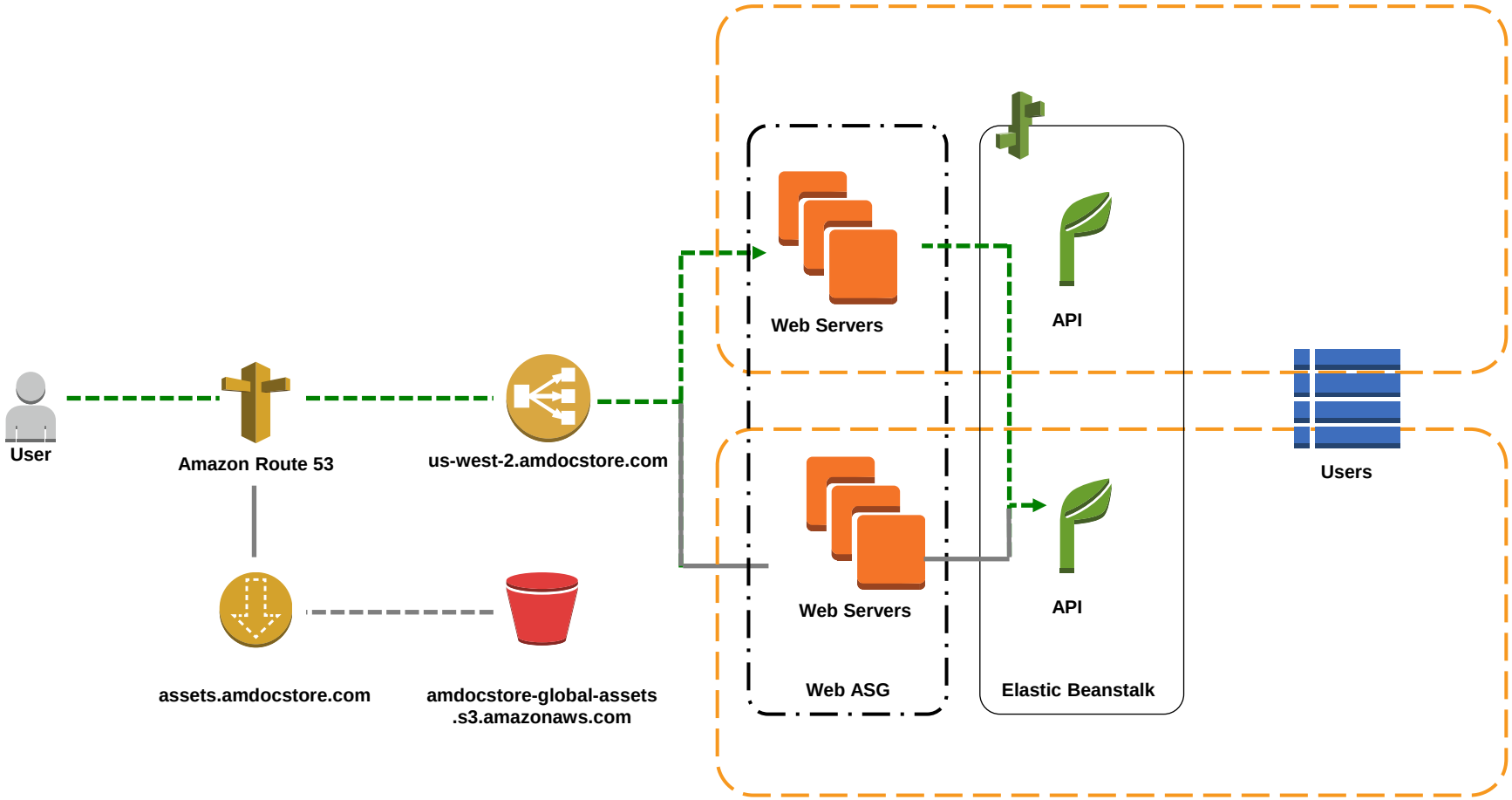
Create Account: Web servers invoke CreateAccount API

DocStore



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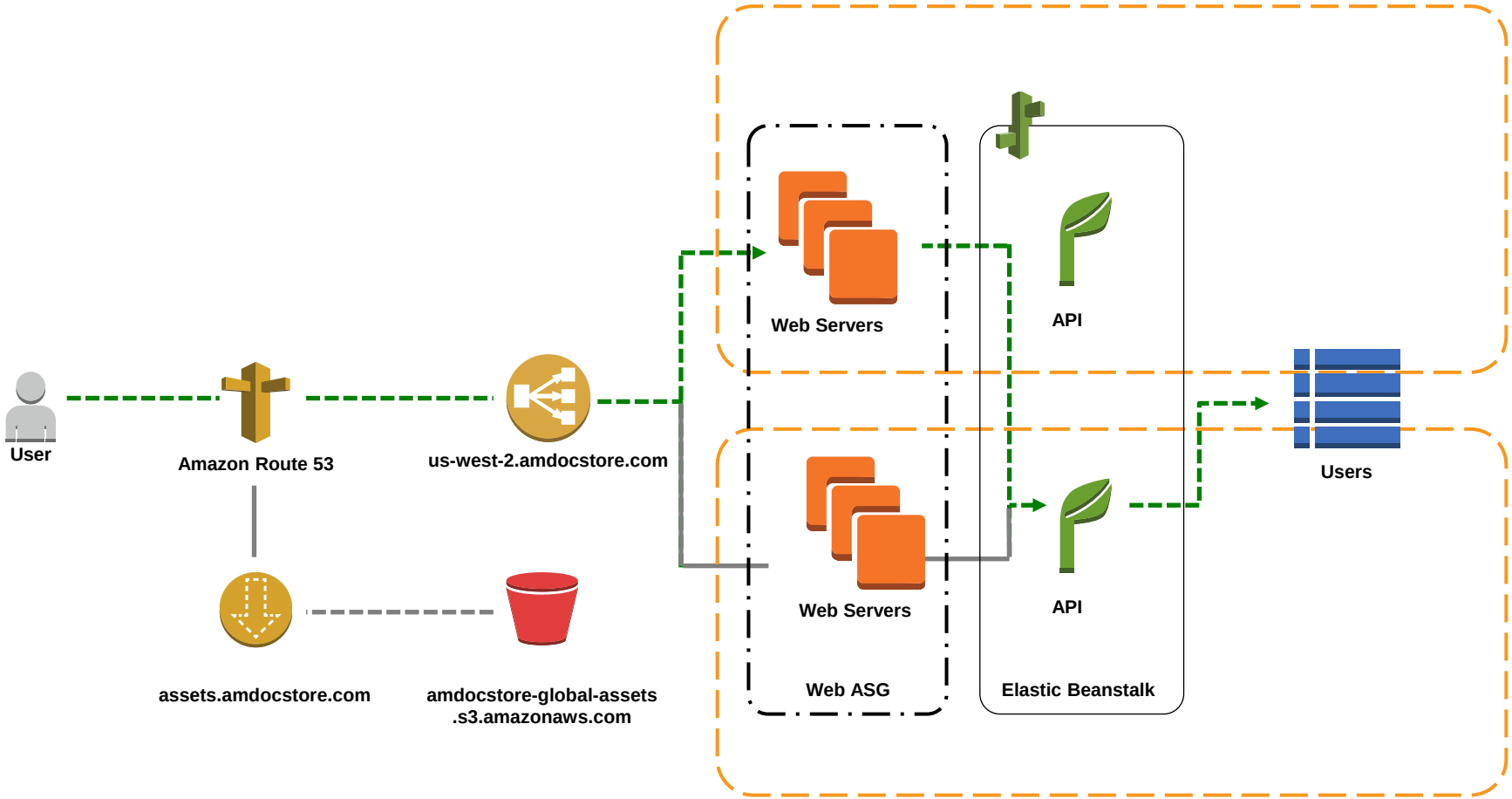
Create Account: API creates a new item in the DynamoDB table

DocStore



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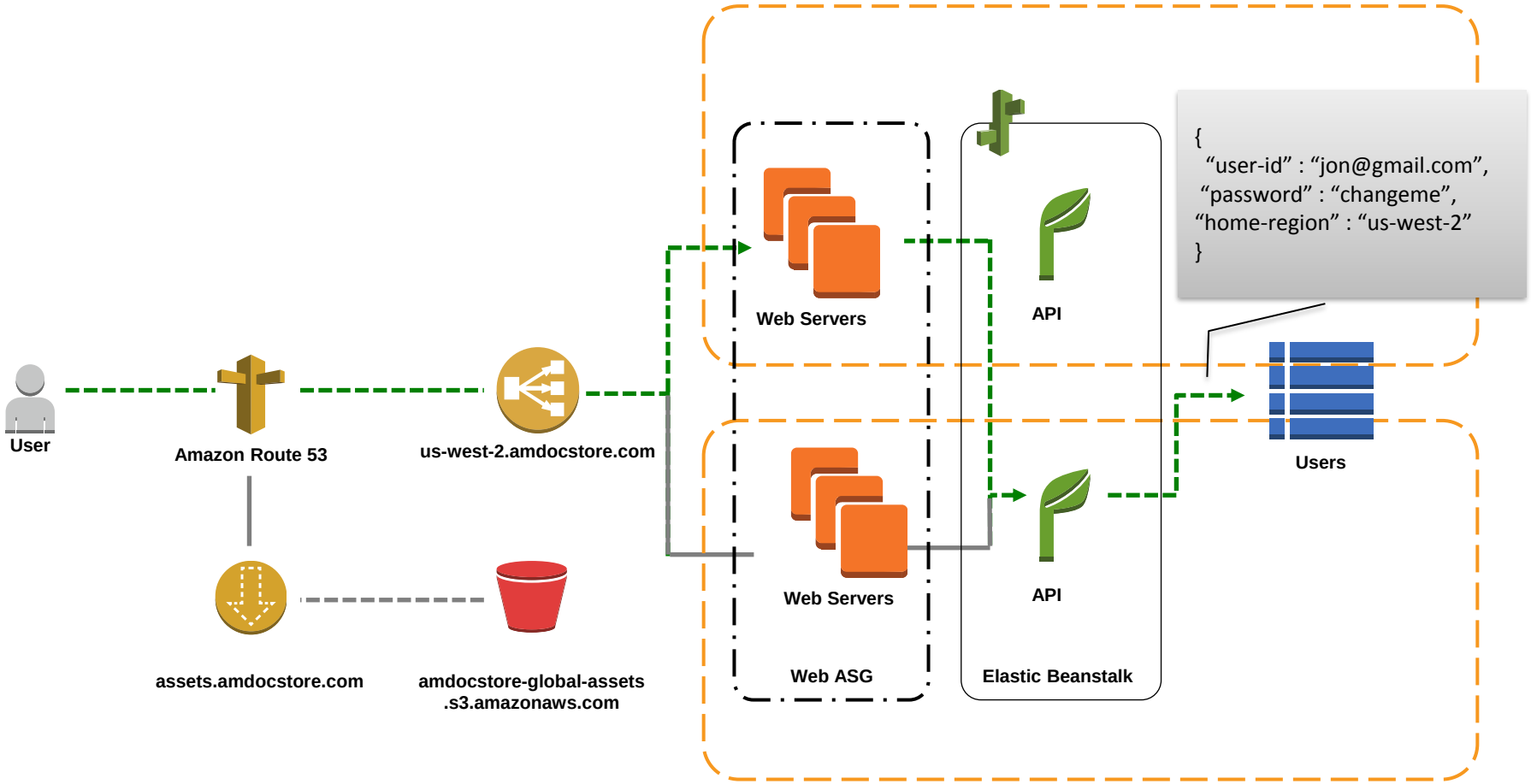
Create Account: API creates a **new item** in the datastore

DocStore



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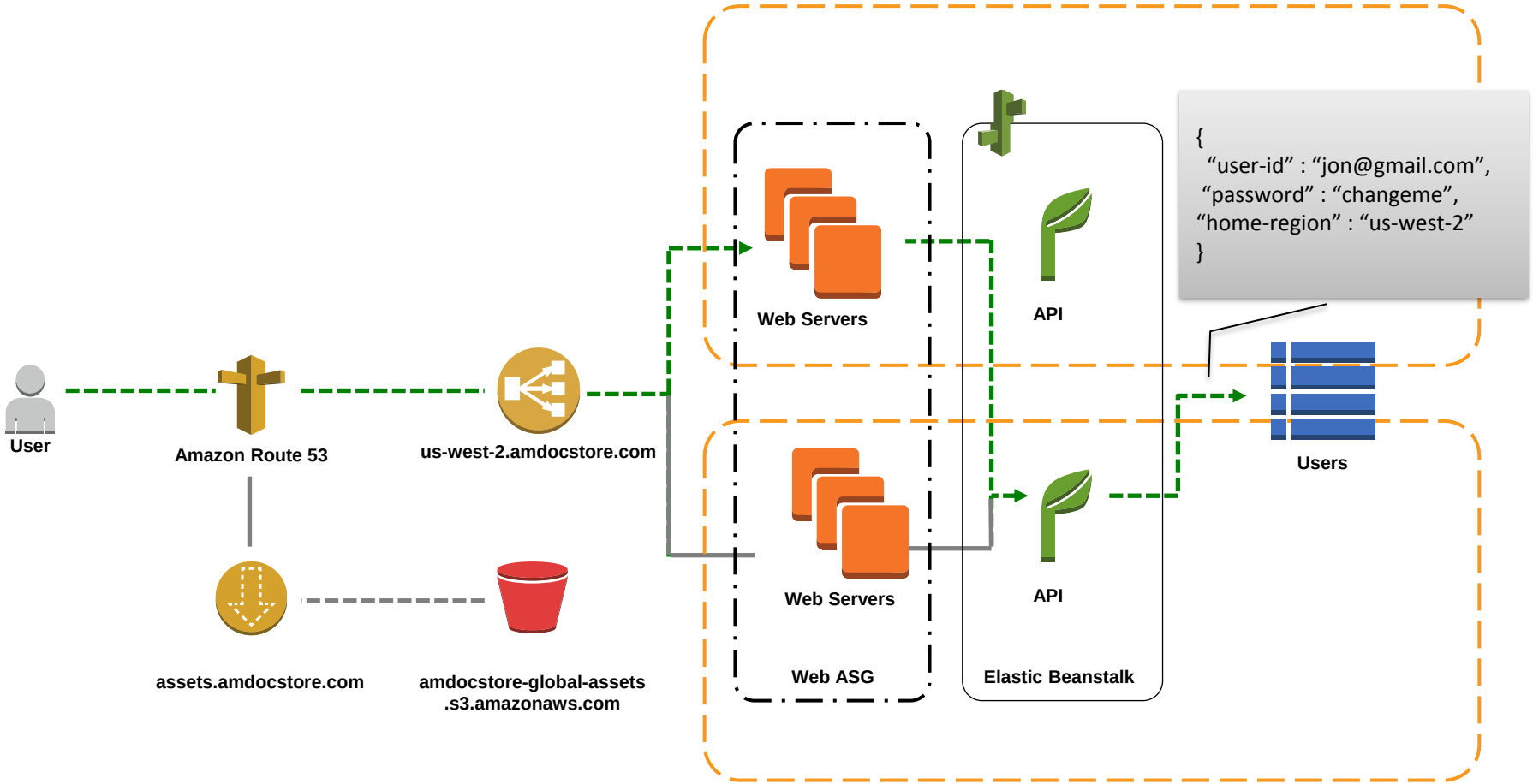
Create Account: The API app deployed in Elastic Beanstalk has a configuration setting making it aware of the region it is running in

DocStore



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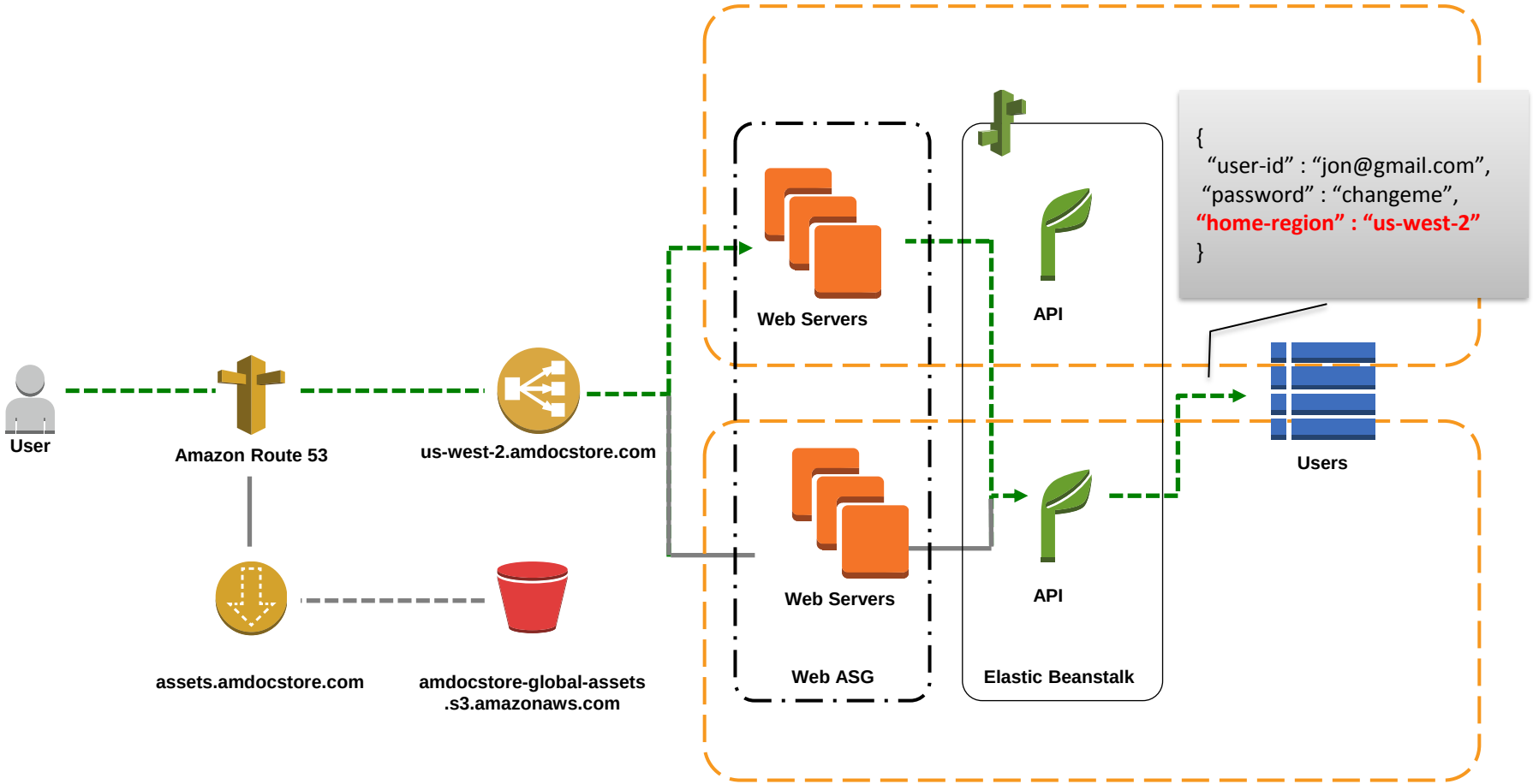
Create Account: In addition to standard information, the API stores the user's "home region", i.e., the region the user signed up in

DocStore



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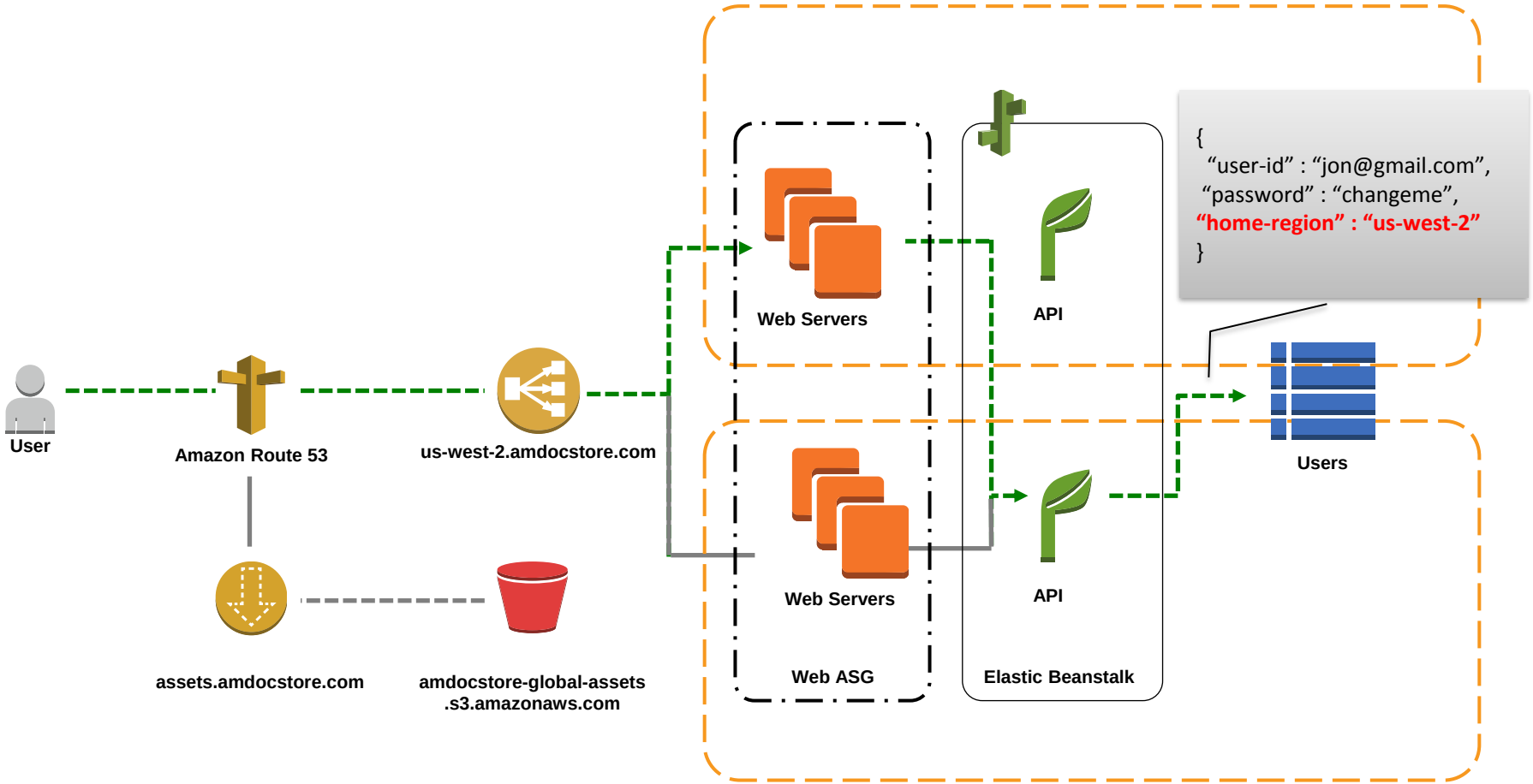
Create Account: Replicating account data to our Sydney deployment will allow the API in that region to redirect the user to his home region if he ever accesses from there

DocStore



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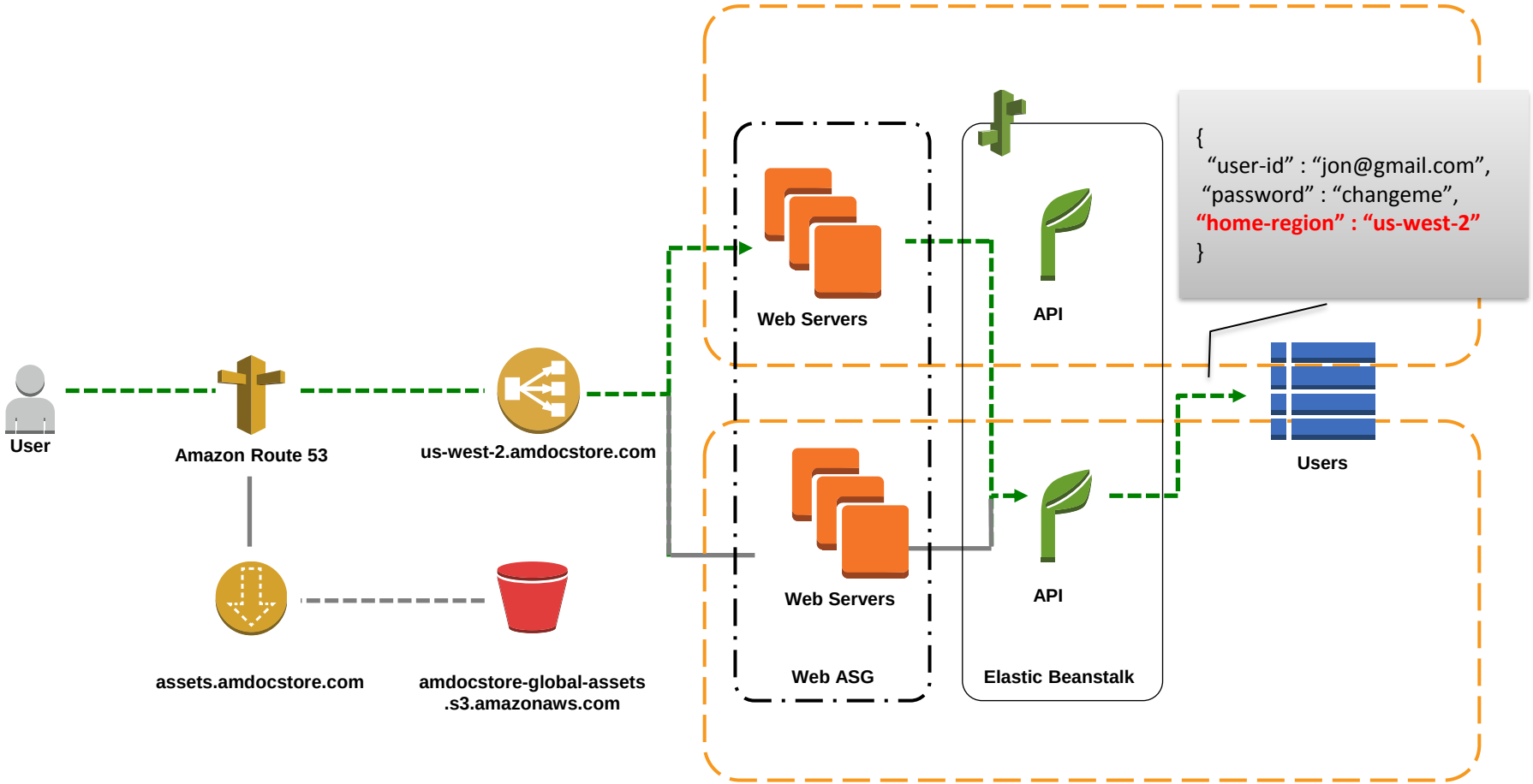
Create Account: We'll consider **account signup an event** that other components of our application might be interested in.

DocStore



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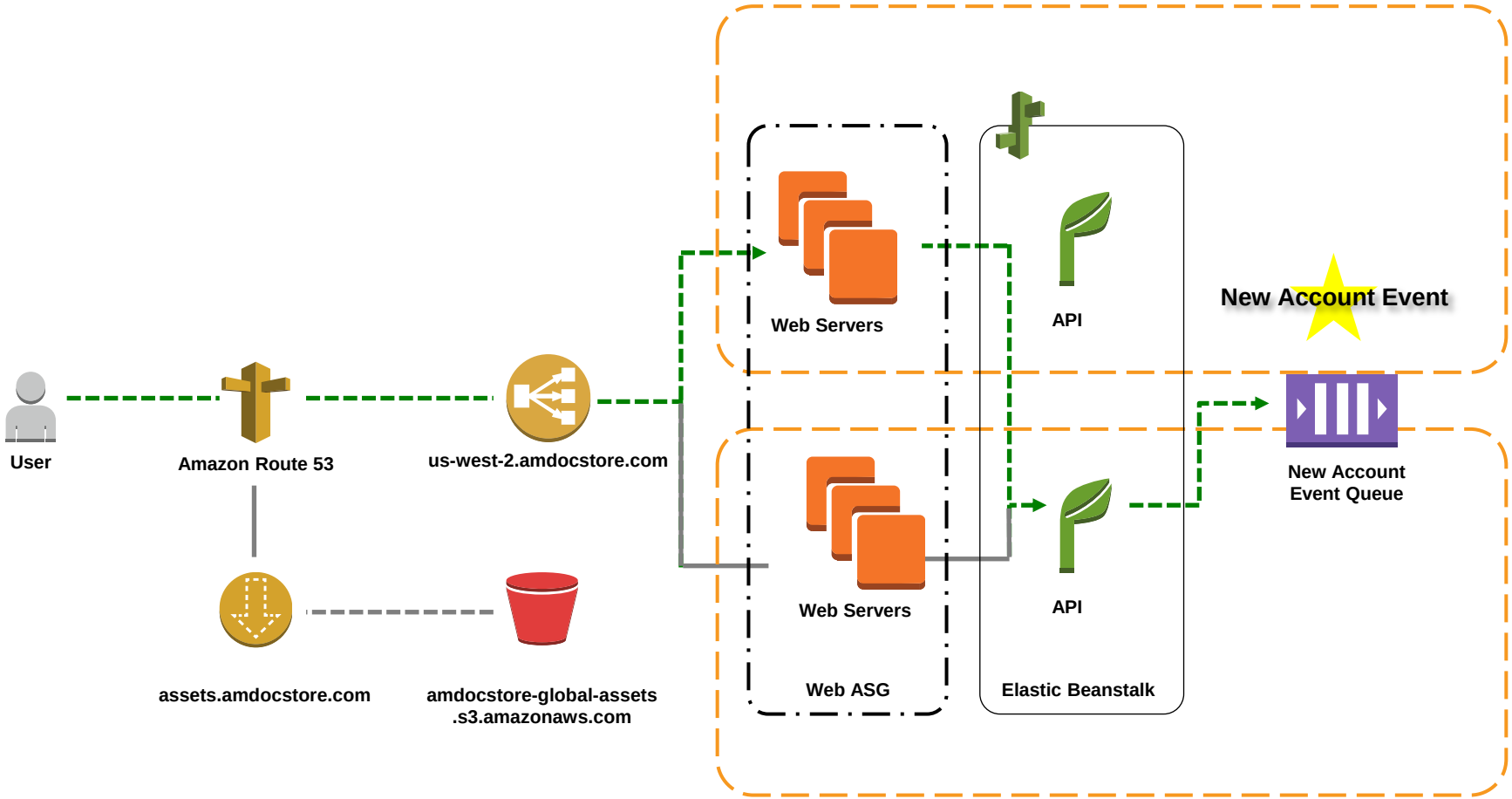
Create Account: We'll let listeners interested in the event (i.e., a cross-region account replication service) receive the event by putting a message in a queue

DocStore



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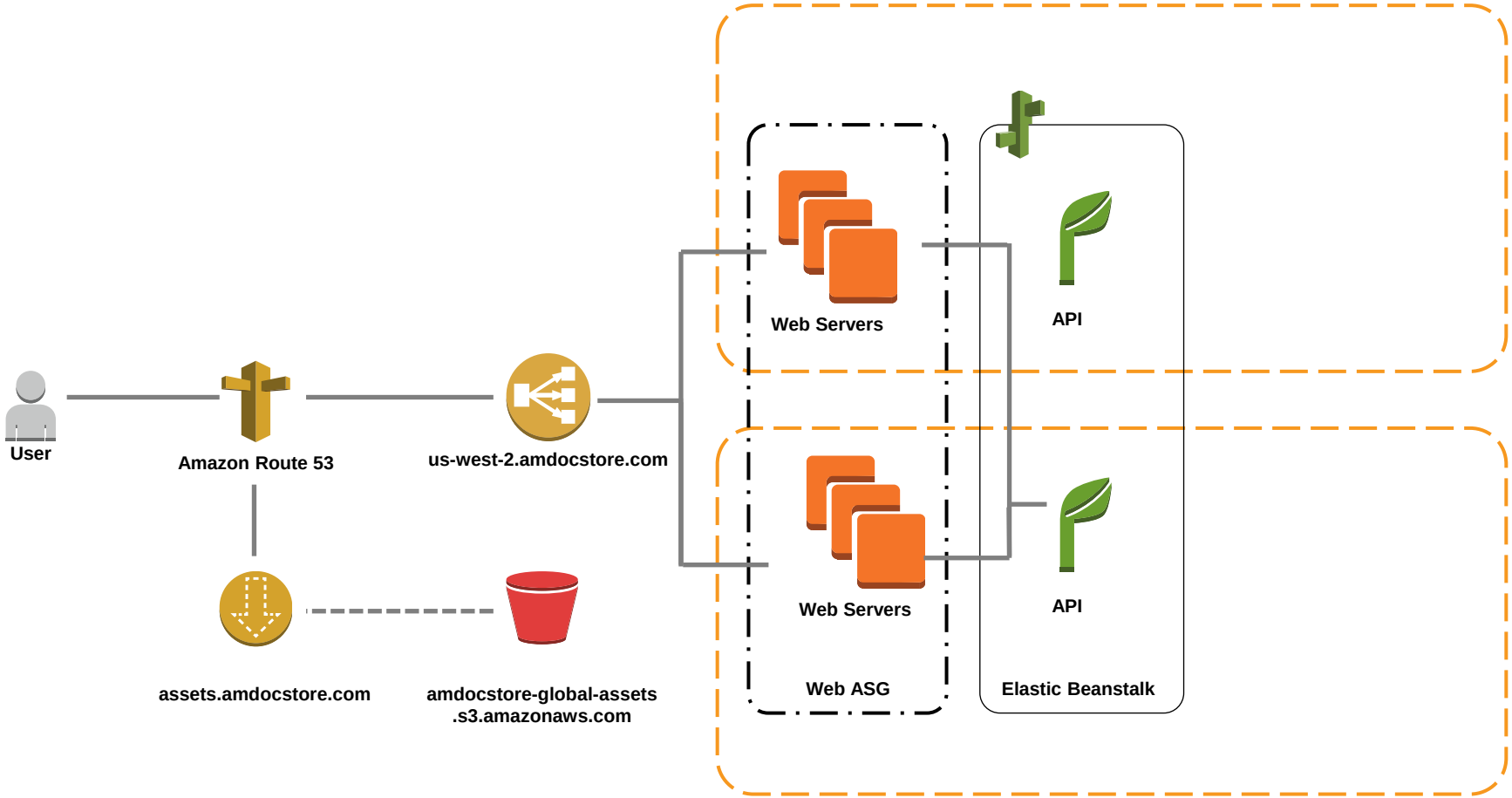
Documents uploaded by a user are stored in an S3 bucket

DocStore



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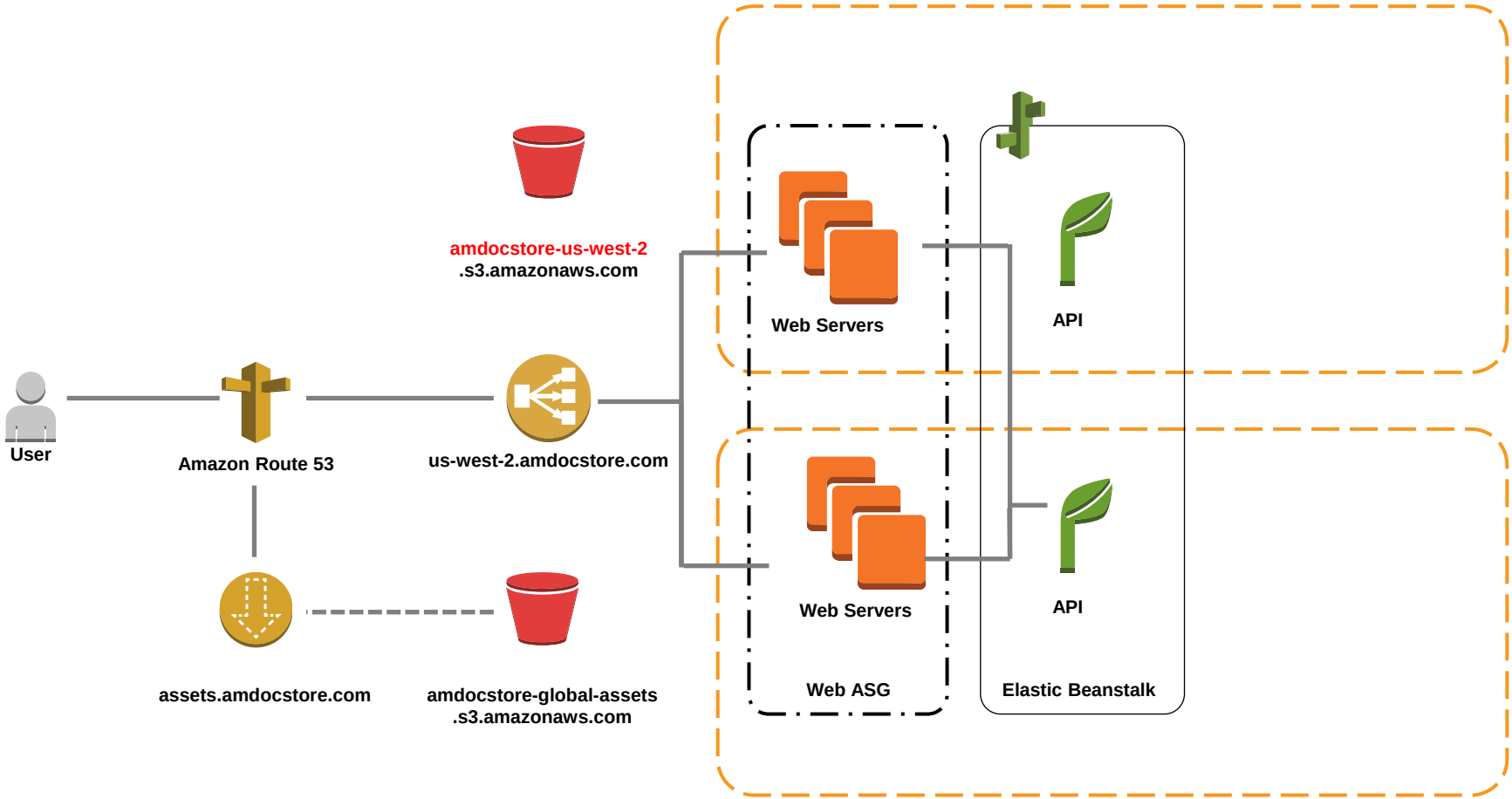
The S3 bucket name includes the name of the region it was created it in.

DocStore



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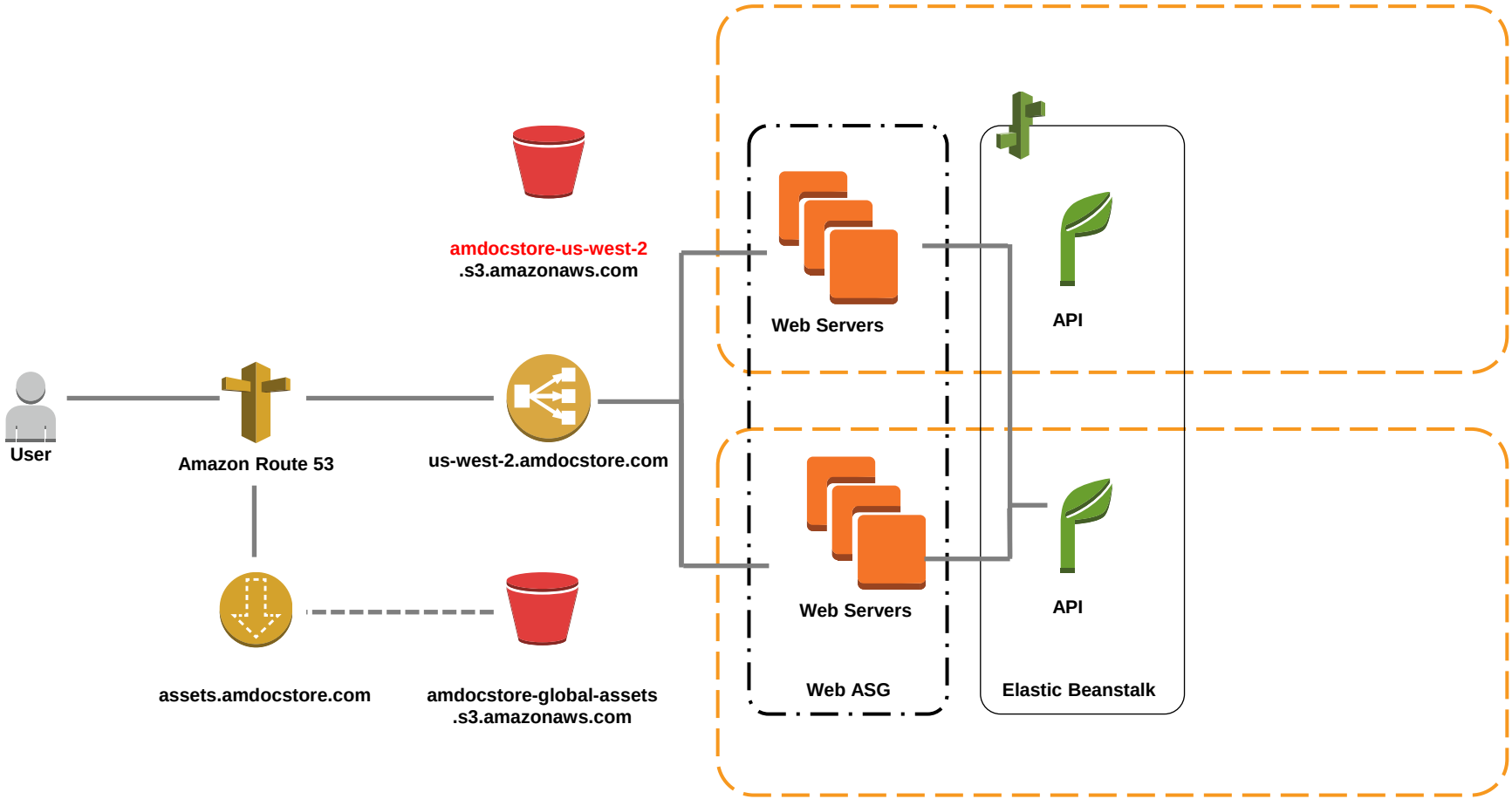
The S3 bucket name includes the name of the region it was created it in. Users **upload documents to the bucket in their home region**

DocStore



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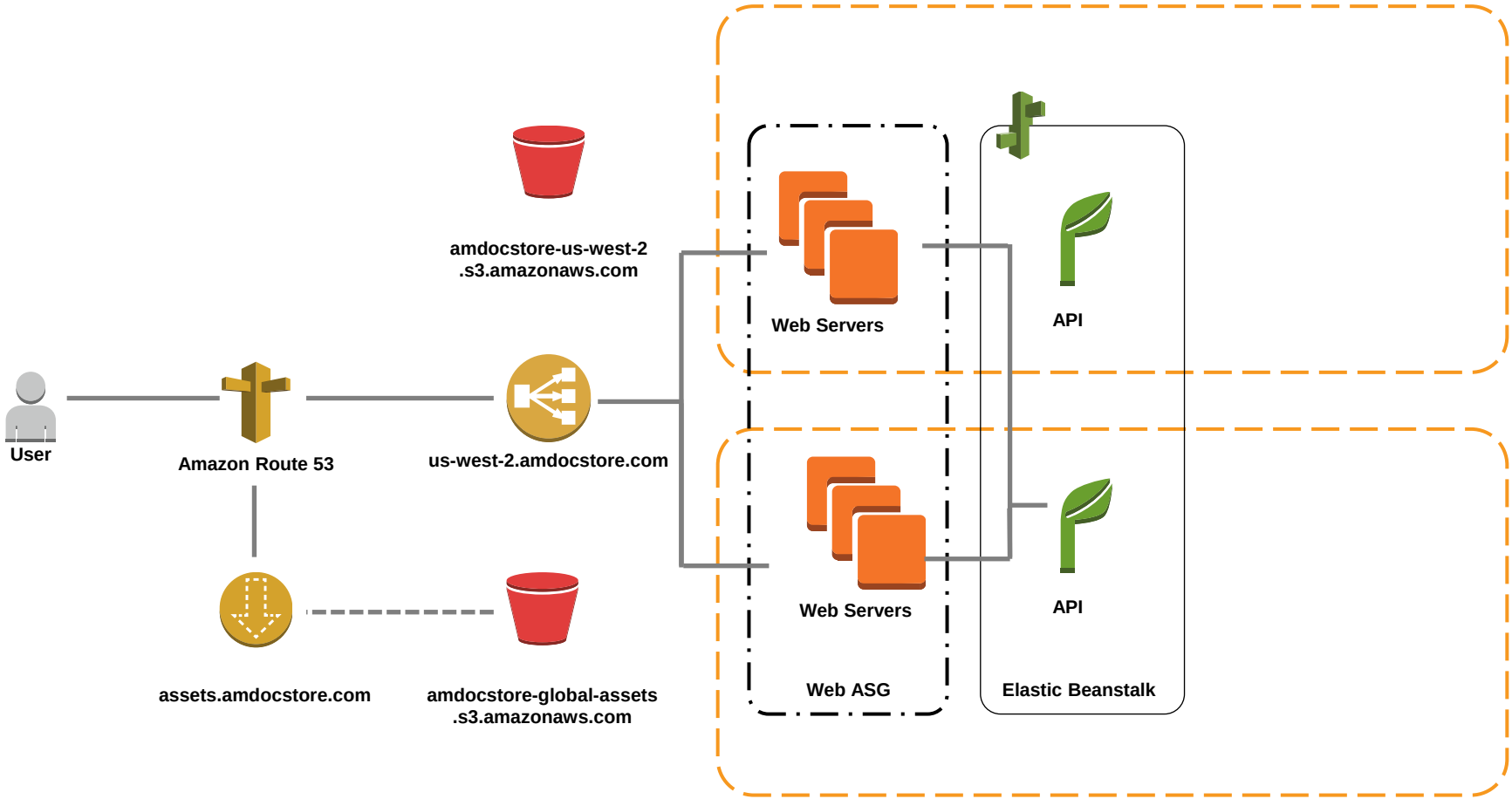
Let's see what happens when a user wants to **upload a PDF document**

DocStore



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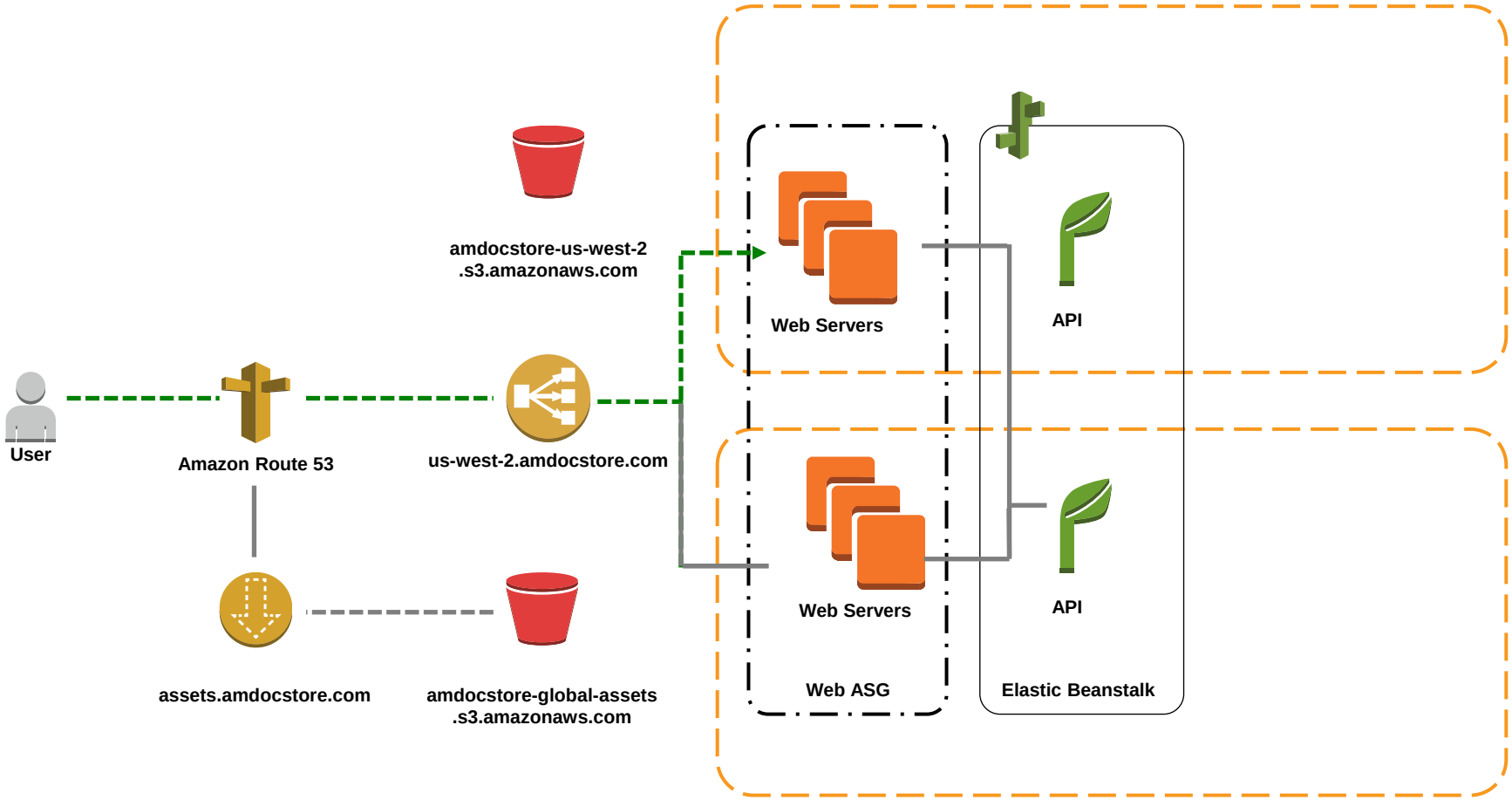
Upload Document: An authenticated user requests the upload document page from the web servers

DocStore



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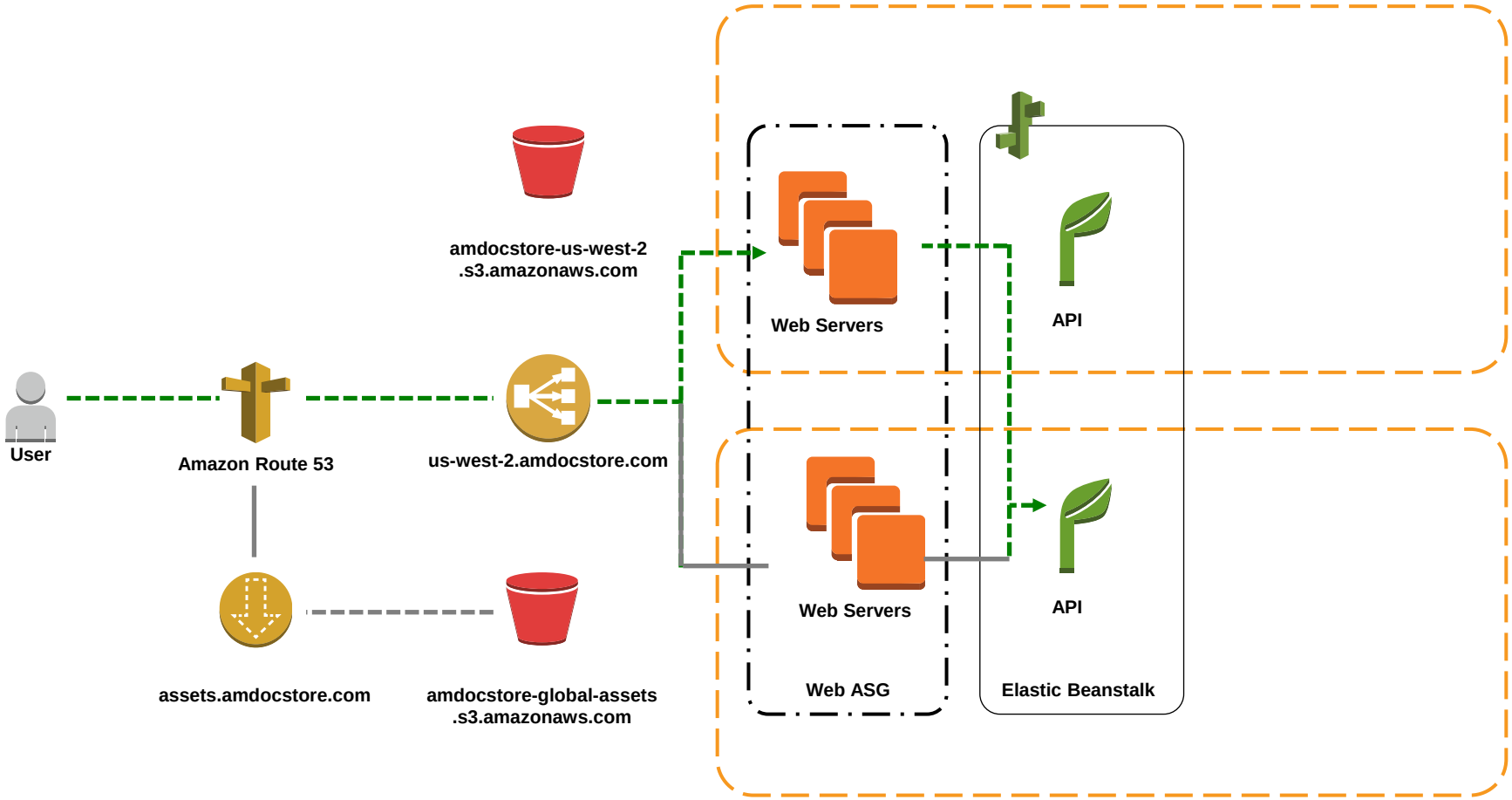
Upload Document: The web servers request a signed HTML form from the API and return it to the user's browser

DocStore



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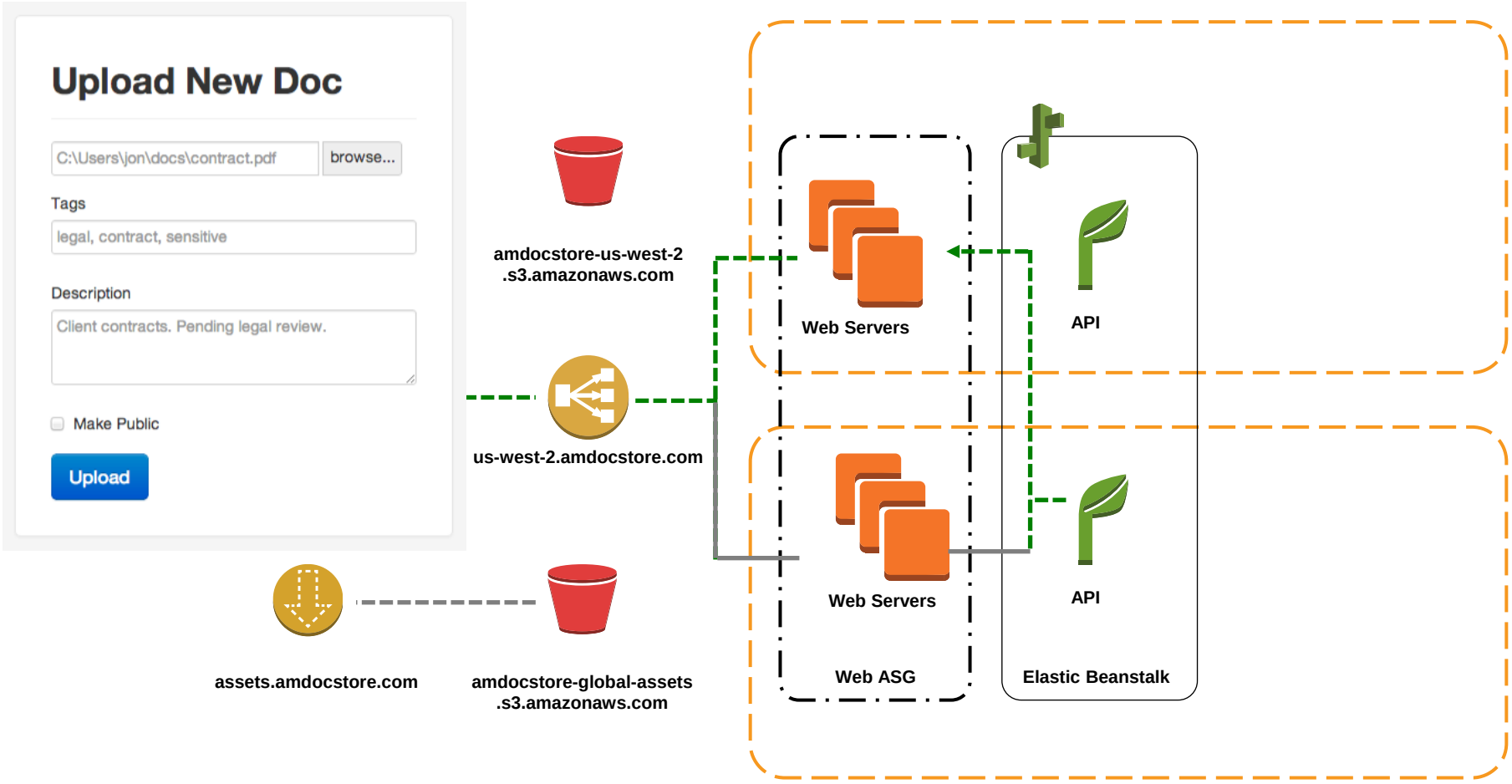
Upload Document: The signed form is delivered to the user's browser

DocStore



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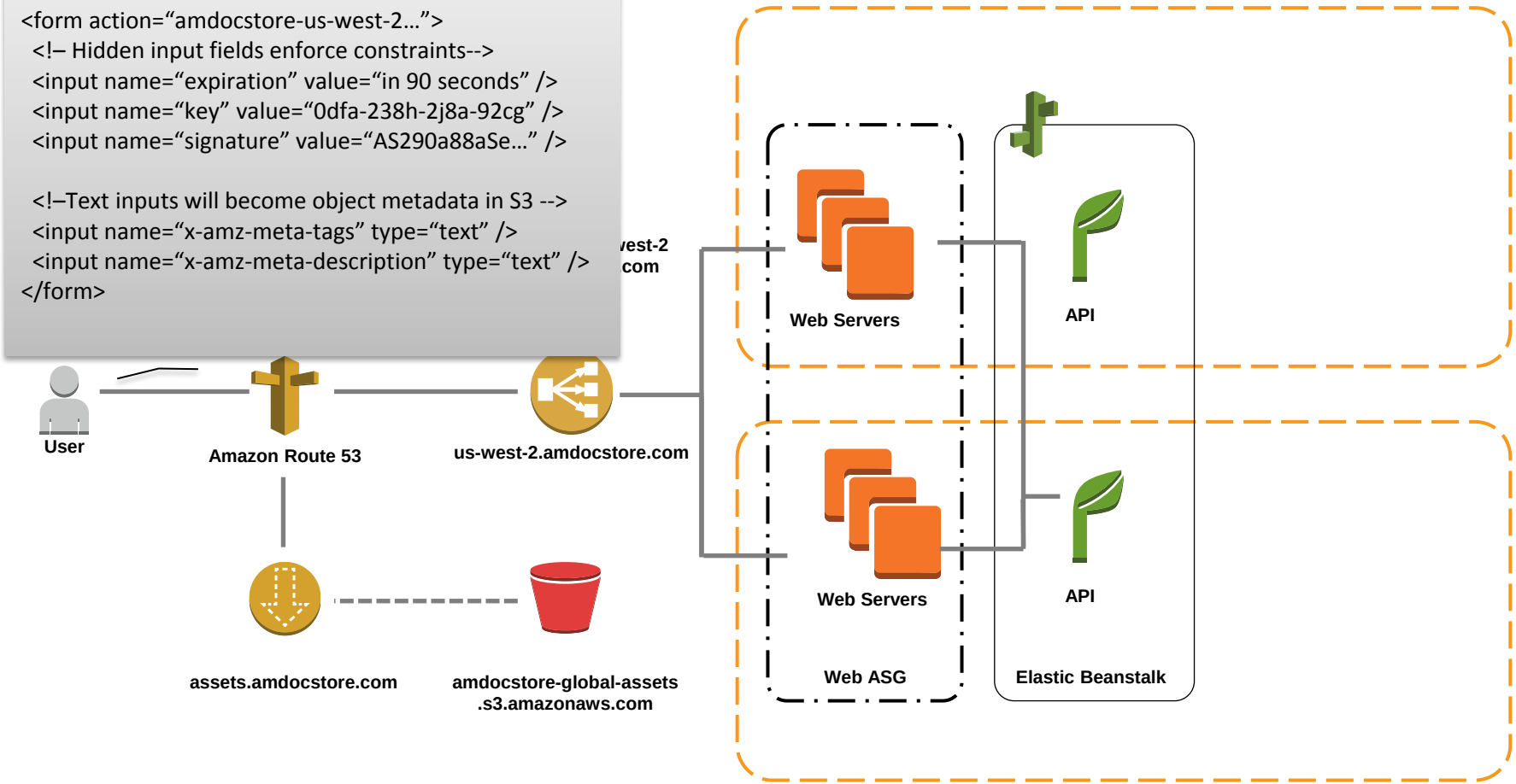
Upload Document: The signed form allows the user to upload his document **directly to S3**

DocStore

```
<form action="amdocstore-us-west-2…">
  <!– Hidden input fields enforce constraints-->
  <input name="expiration" value="in 90 seconds" />
  <input name="key" value="0dfa-238h-2j8a-92cg" />
  <input name="signature" value="AS290a88aSe…" />

  <!–Text inputs will become object metadata in S3 -->
  <input name="x-amz-meta-tags" type="text" />
  <input name="x-amz-meta-description" type="text" />
</form>
```



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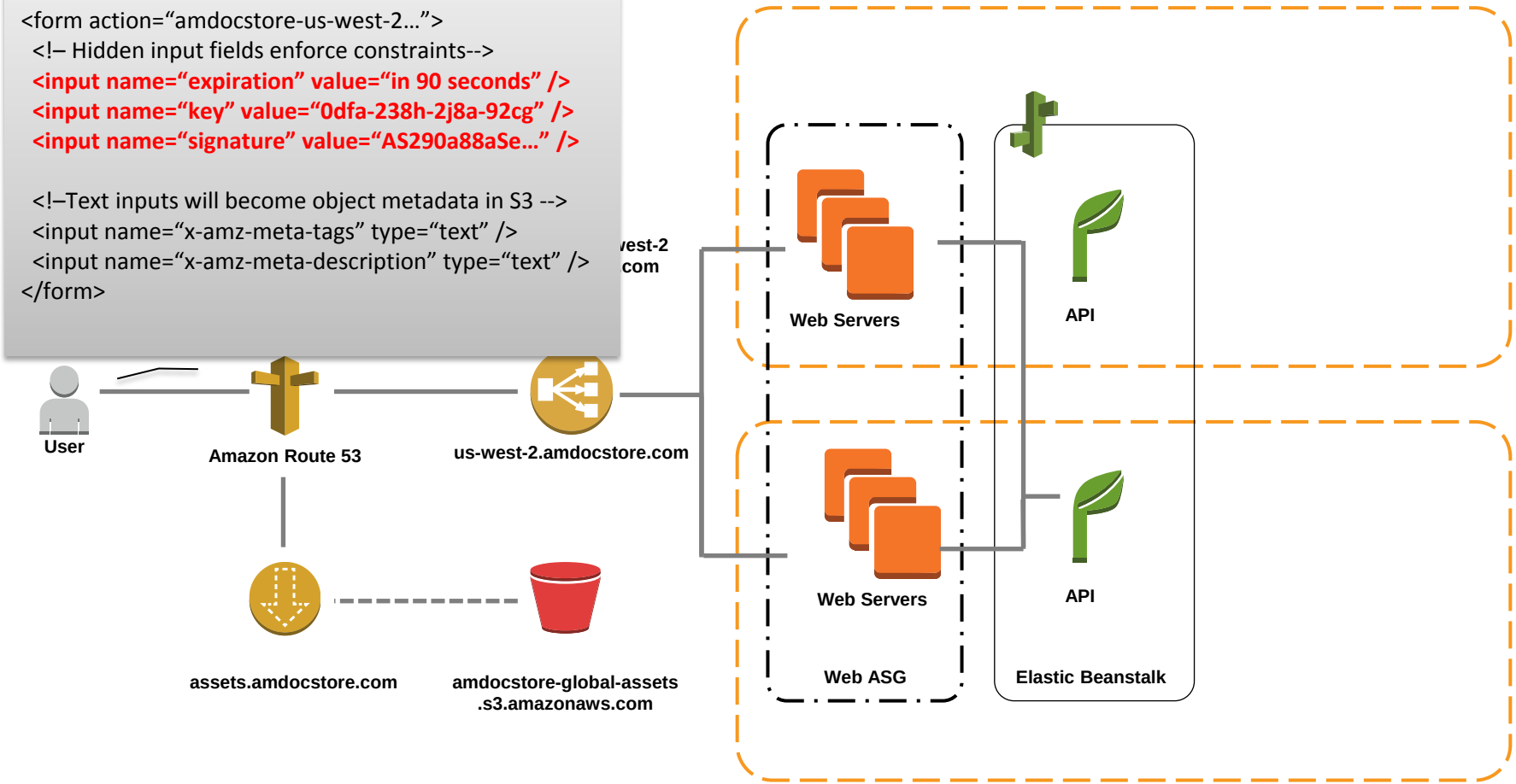
Upload Document: The form includes some **hidden inputs that constrain** what the user can upload.

DocStore

```
<form action="amdocstore-us-west-2…">
  <!– Hidden input fields enforce constraints-->
  <input name="expiration" value="in 90 seconds" />
  <input name="key" value="0dfa-238h-2j8a-92cg" />
  <input name="signature" value="AS290a88aSe…" />

  <!–Text inputs will become object metadata in S3 -->
  <input name="x-amz-meta-tags" type="text" />
  <input name="x-amz-meta-description" type="text" />
</form>
```



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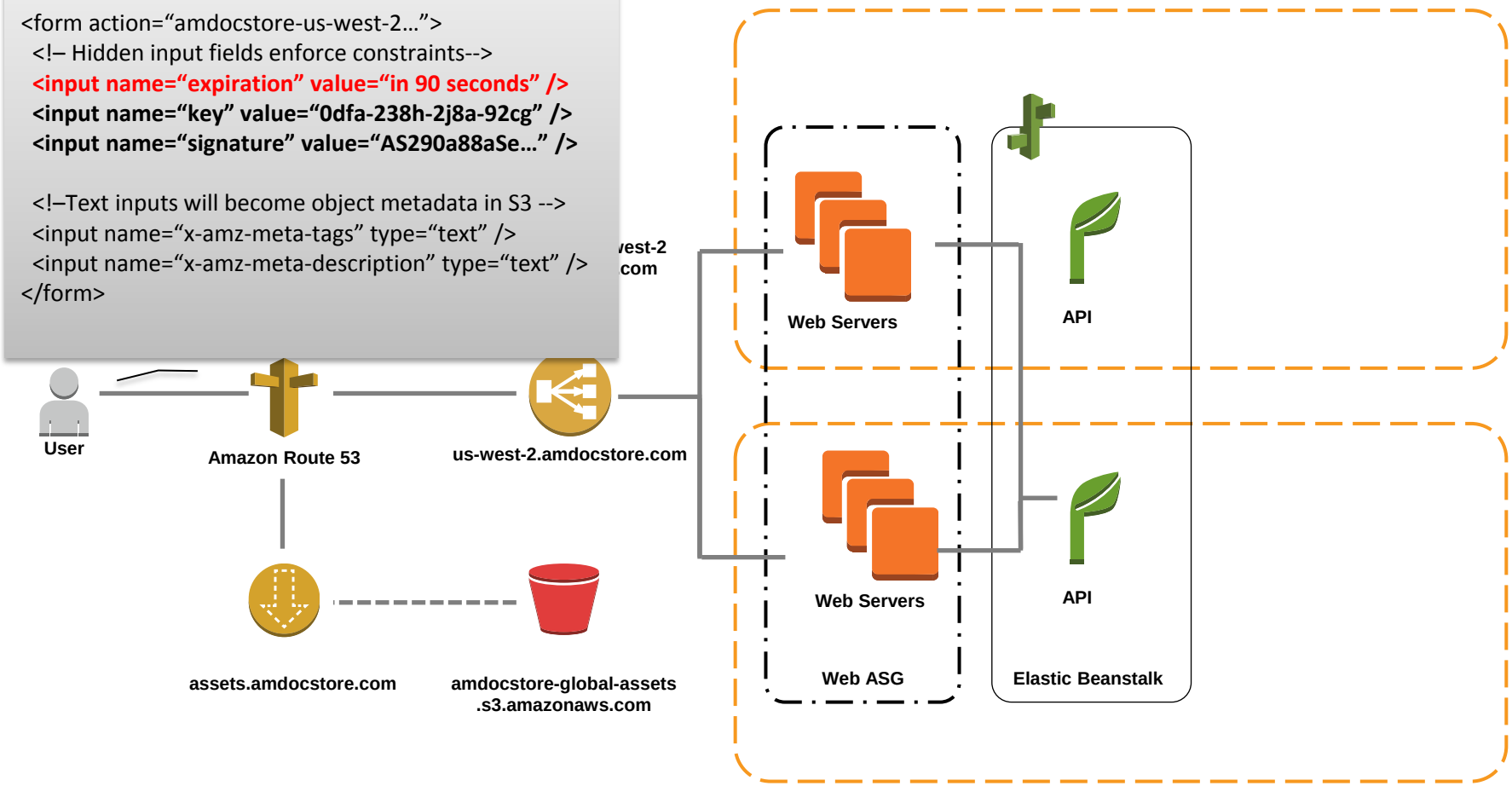
Upload Document: The form includes some **hidden inputs that constrain** what the user can upload. **The expiration** indicates for how long the form is valid

DocStore

```
<form action="amdocstore-us-west-2…">
  <!– Hidden input fields enforce constraints-->
  <input name="expiration" value="in 90 seconds" />
  <input name="key" value="0dfa-238h-2j8a-92cg" />
  <input name="signature" value="AS290a88aSe…" />

  <!–Text inputs will become object metadata in S3 -->
  <input name="x-amz-meta-tags" type="text" />
  <input name="x-amz-meta-description" type="text" />
</form>
```



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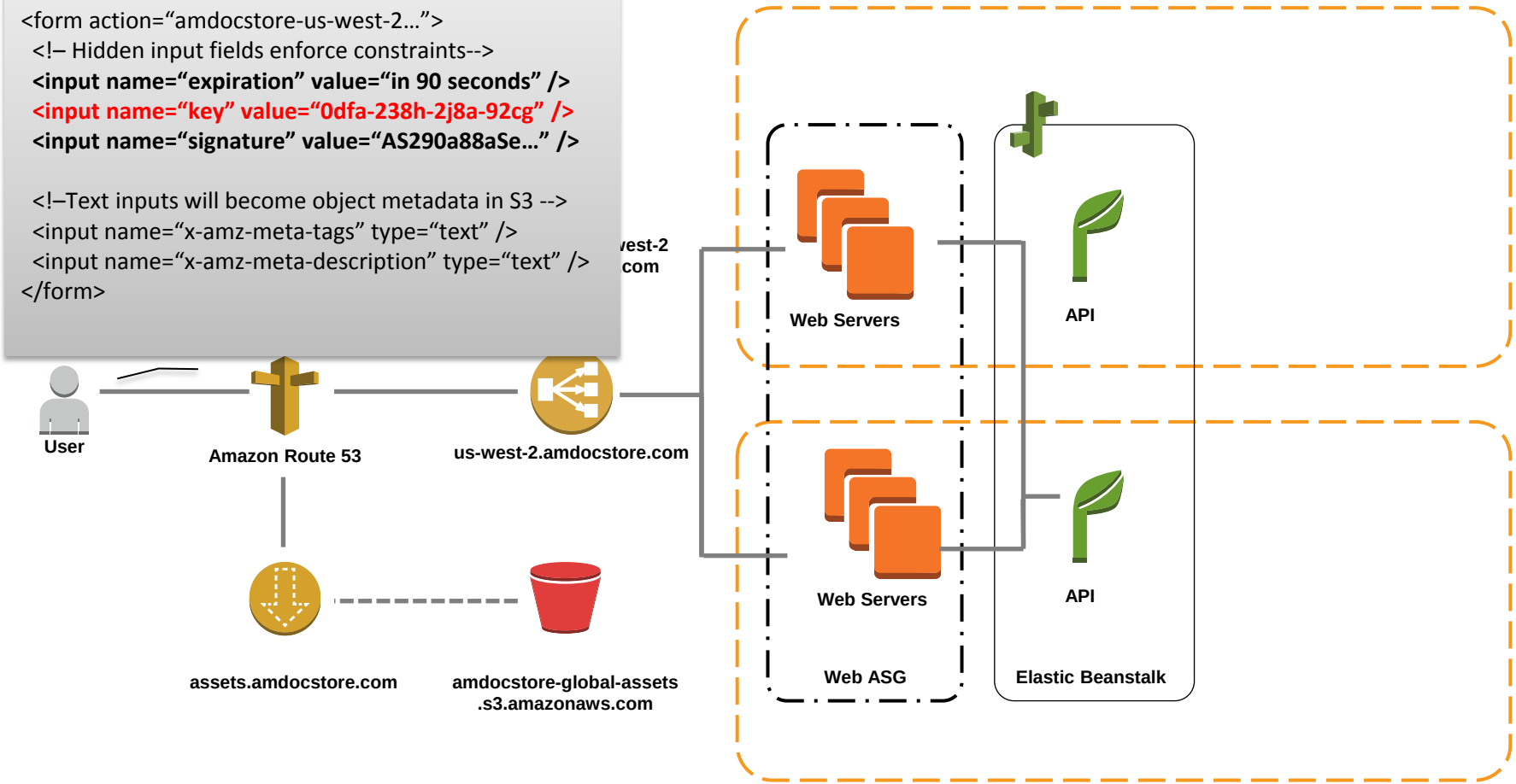
Upload Document: The form includes some **hidden inputs that constrain** what the user can upload. **The key** allows us to specify what the object will be called in S3 (thus avoiding naming conflicts)

DocStore

```
<form action="amdocstore-us-west-2…">
  <!– Hidden input fields enforce constraints-->
  <input name="expiration" value="in 90 seconds" />
  <input name="key" value="0dfa-238h-2j8a-92cg" />
  <input name="signature" value="AS290a88aSe…" />

  <!–Text inputs will become object metadata in S3 -->
  <input name="x-amz-meta-tags" type="text" />
  <input name="x-amz-meta-description" type="text" />
</form>
```



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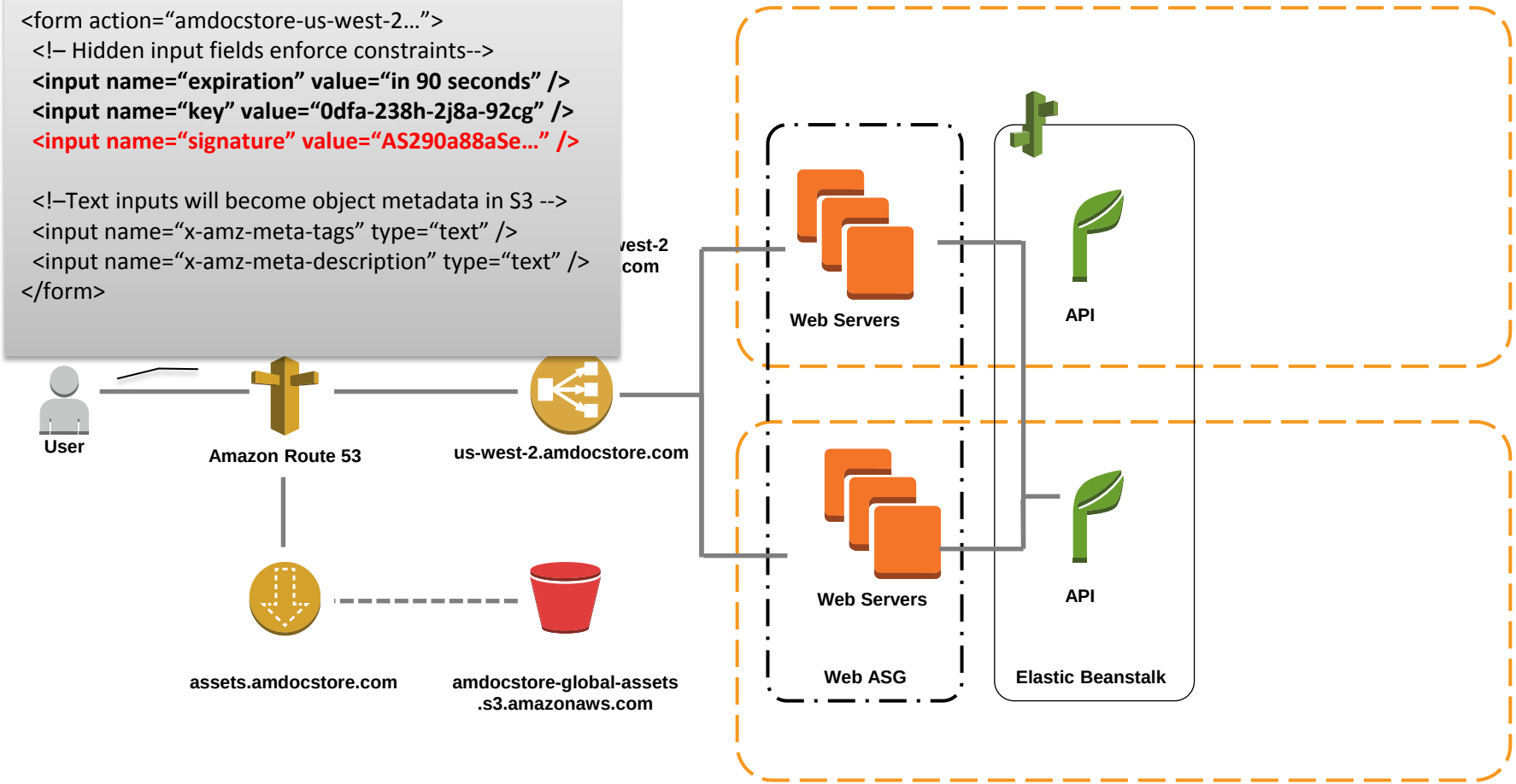
Upload Document: The form includes some **hidden inputs that constrain** what the user can upload. **The signature** ensures the upload will be rejected if the form is tampered with (e.g., user alters the expiration)

DocStore

```
<form action="amdocstore-us-west-2…">
  <!– Hidden input fields enforce constraints-->
  <input name="expiration" value="in 90 seconds" />
  <input name="key" value="0dfa-238h-2j8a-92cg" />
  <input name="signature" value="AS290a88aSe…" />

  <!–Text inputs will become object metadata in S3 -->
  <input name="x-amz-meta-tags" type="text" />
  <input name="x-amz-meta-description" type="text" />
</form>
```



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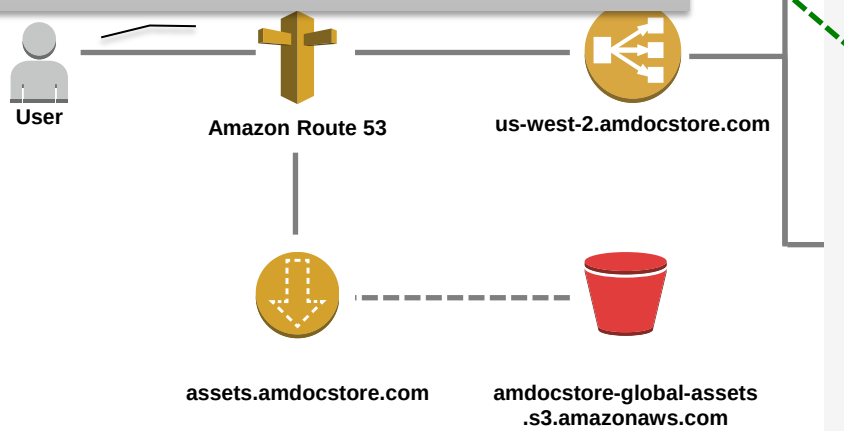
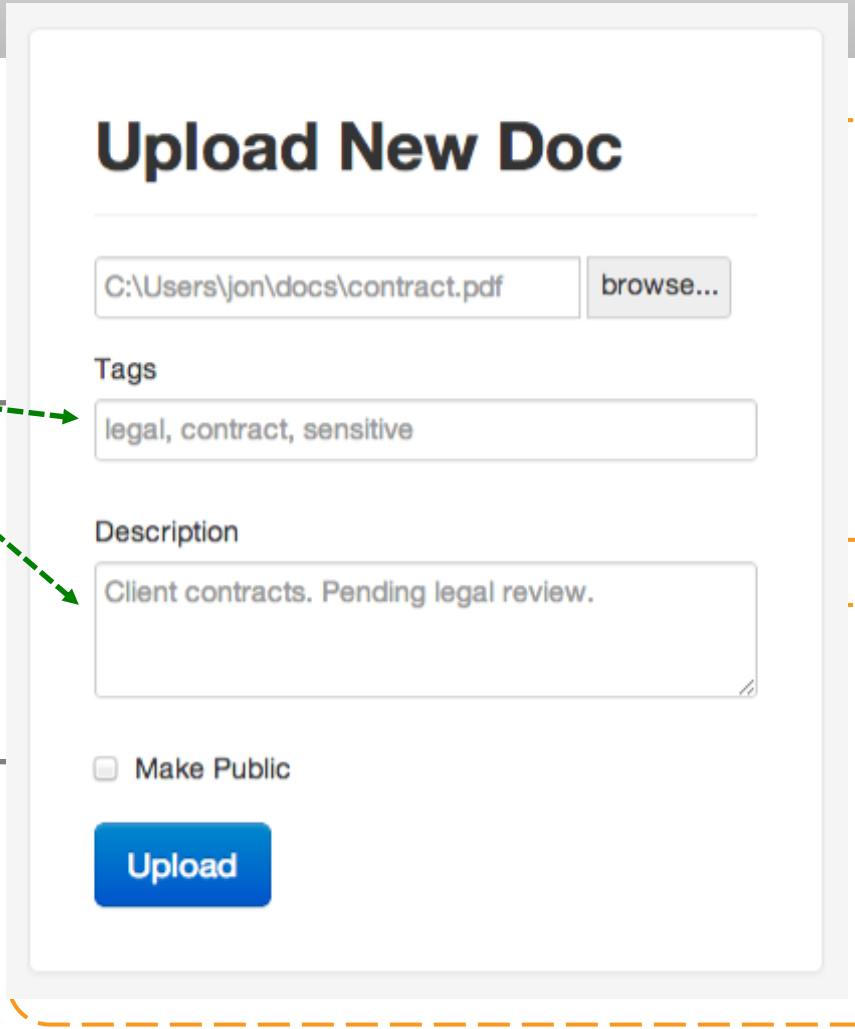
Upload Document: User-editable **text input fields** prefixed with **x-amz-meta-** will be associated with the uploaded object as **S3 object metadata**

DocStore

```
<form action="amdocstore-us-west-2…">
  <!– Hidden input fields enforce constraints-->
  <input name="expiration" value="in 90 seconds" />
  <input name="key" value="0dfa-238h-2j8a-92cg" />
  <input name="signature" value="AS290a88aSe…" />

  <!–Text inputs will become object metadata in S3 -->
  <input name="x-amz-meta-tags" type="text" />
  <input name="x-amz-meta-description" type="text"
/>
</form>
```





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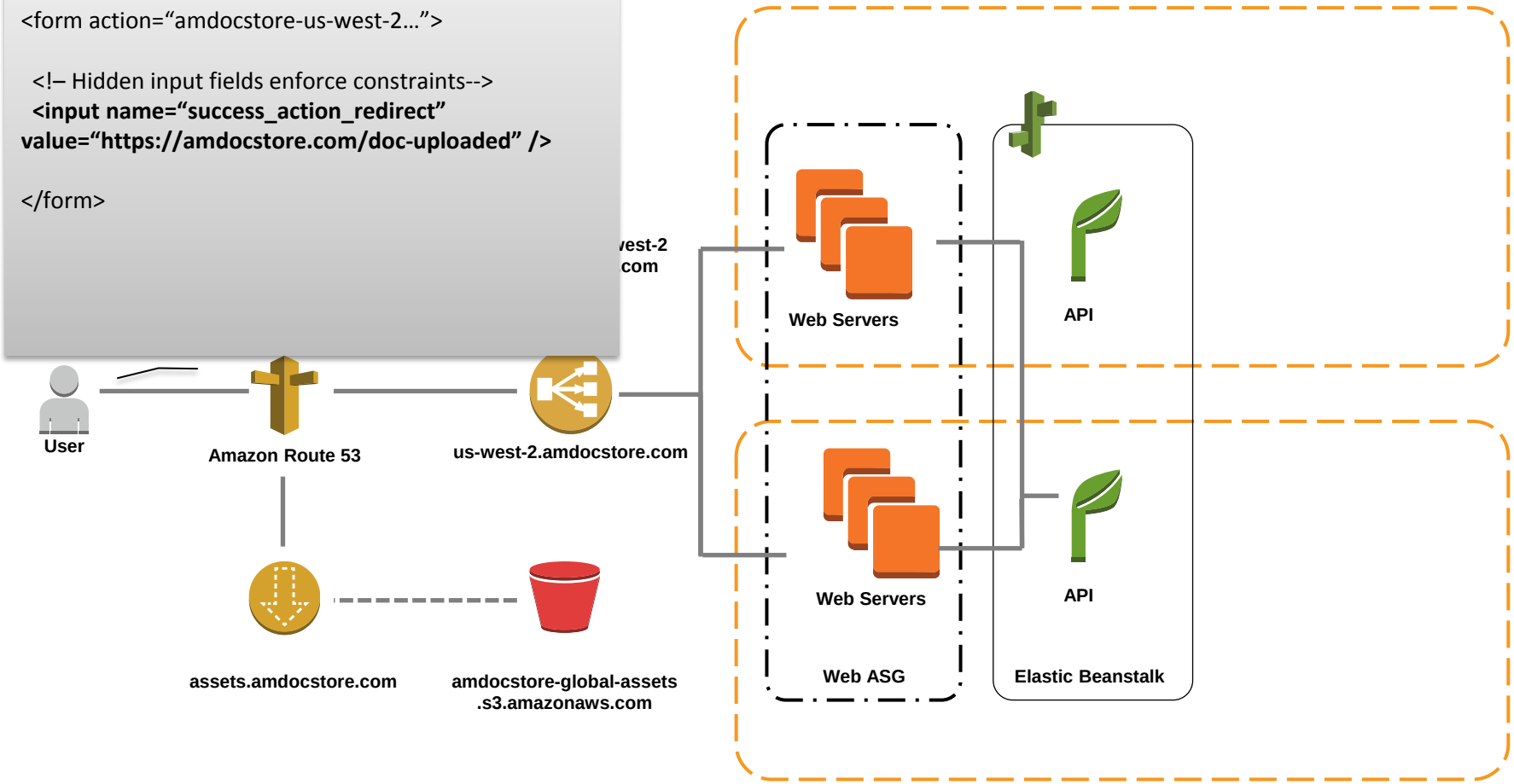
Upload Document: Finally, the **success_action_redirect** specified when the API generated the form tells S3 where to redirect the user's browser when the upload completes

DocStore

```
<form action="amdocstore-us-west-2…">

  <!– Hidden input fields enforce constraints-->
  <input name="success_action_redirect"
value="https://amdocstore.com/doc-uploaded" />

</form>
```



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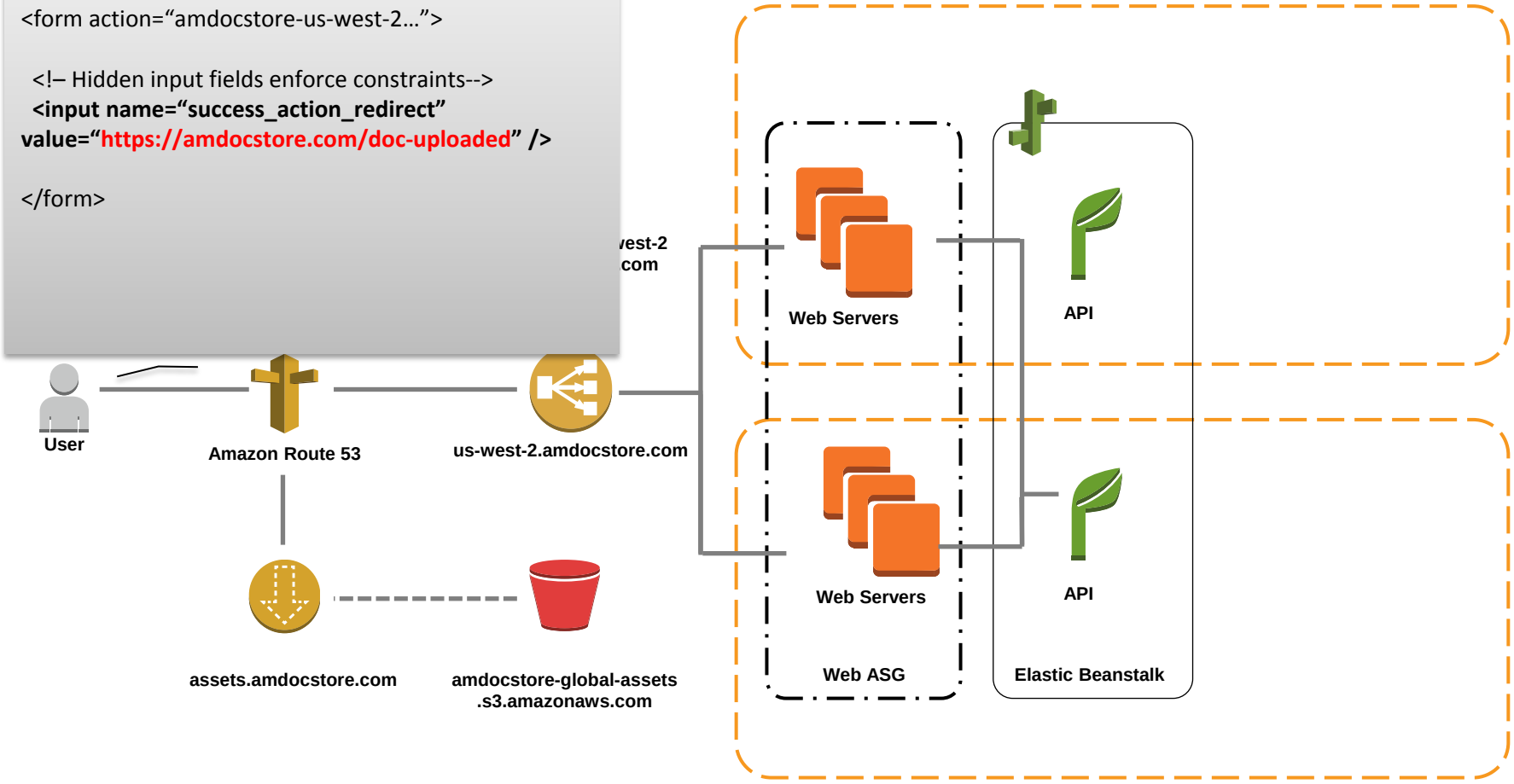
Upload Document: We send the user to a special page on the web servers that will capture this event

DocStore

```
<form action="amdocstore-us-west-2…">

  <!– Hidden input fields enforce constraints-->
  <input name="success_action_redirect"
value="https://amdocstore.com/doc-uploaded" />

</form>
```



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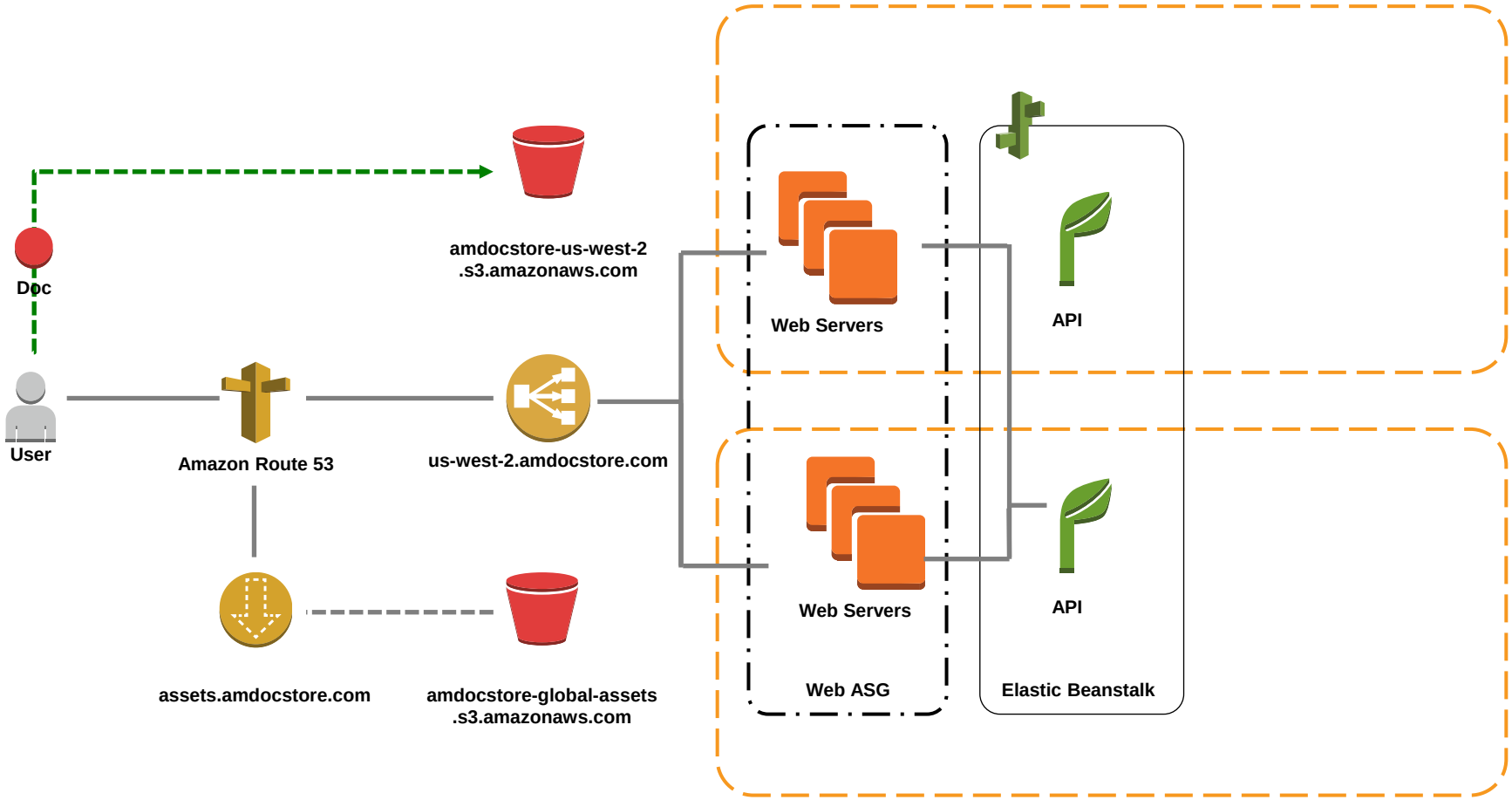
Upload Document: While uploading the document to S3,

DocStore



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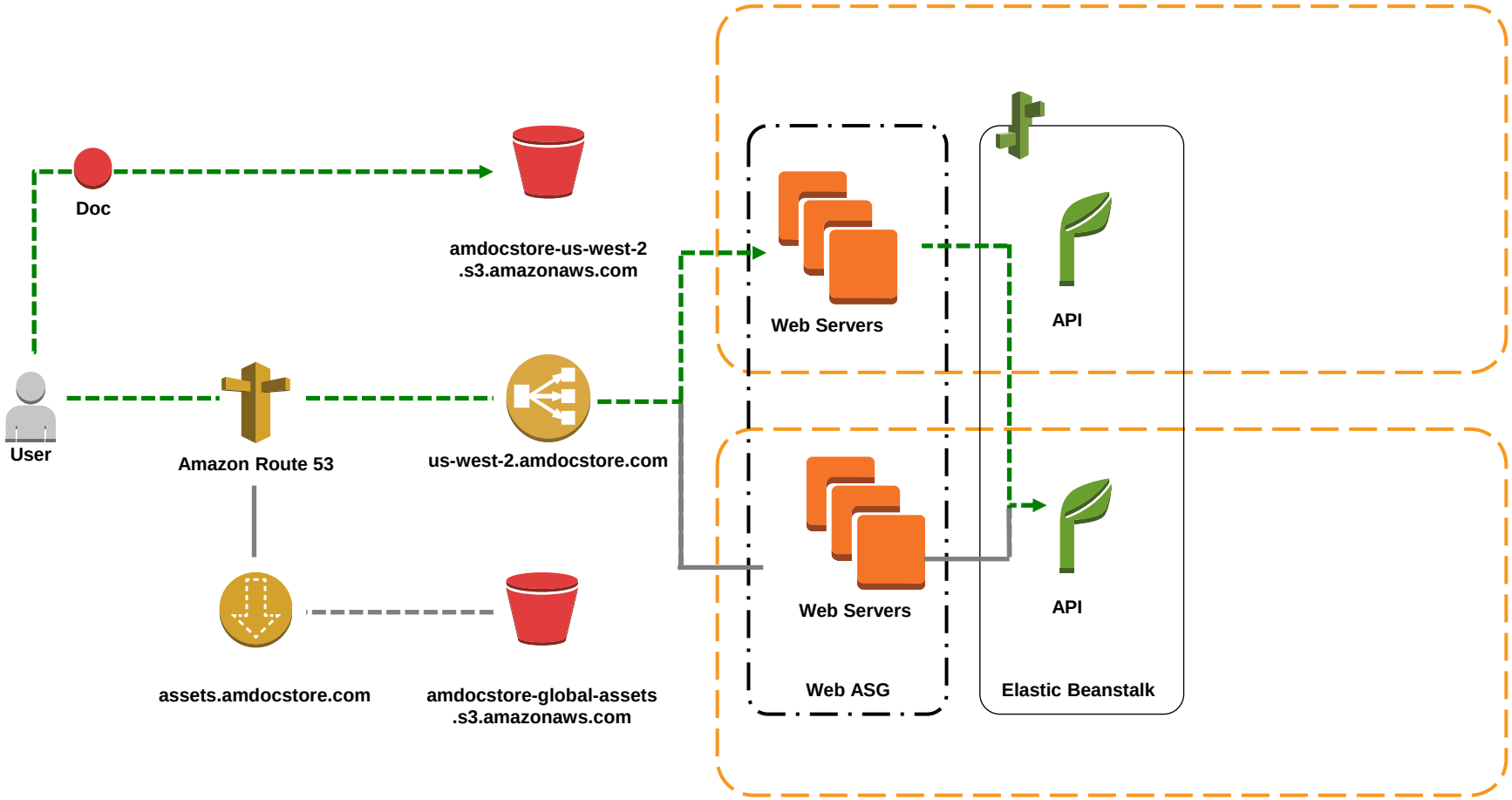
Upload Document: While uploading the document to S3, we **asynchronously notify** the web servers that the upload has begun

DocStore



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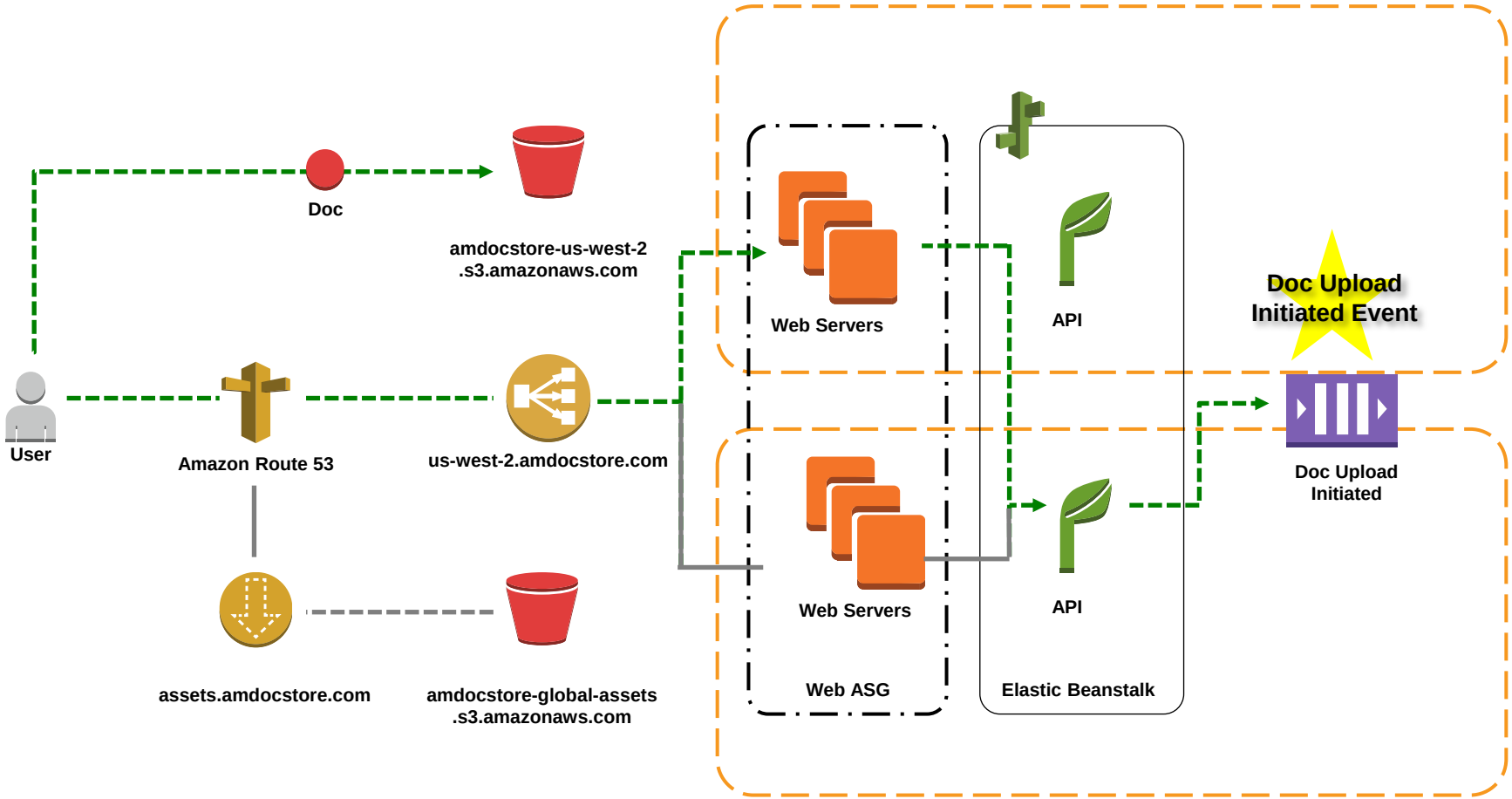
Upload Document: The API places a message in a queue indicating as much. Other components of DocStore may be interested in this event later

DocStore



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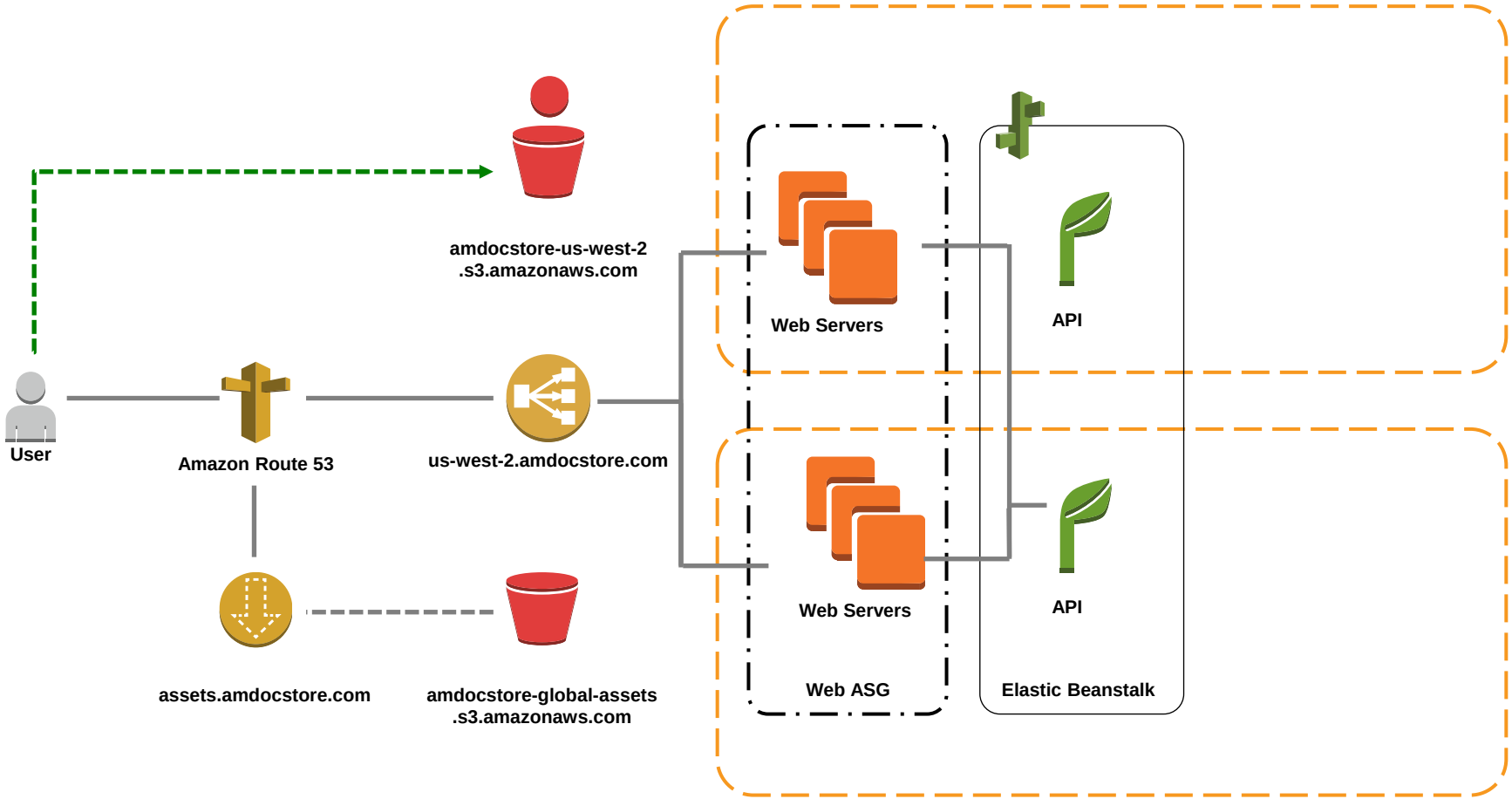
Upload Document: When the upload completes

DocStore



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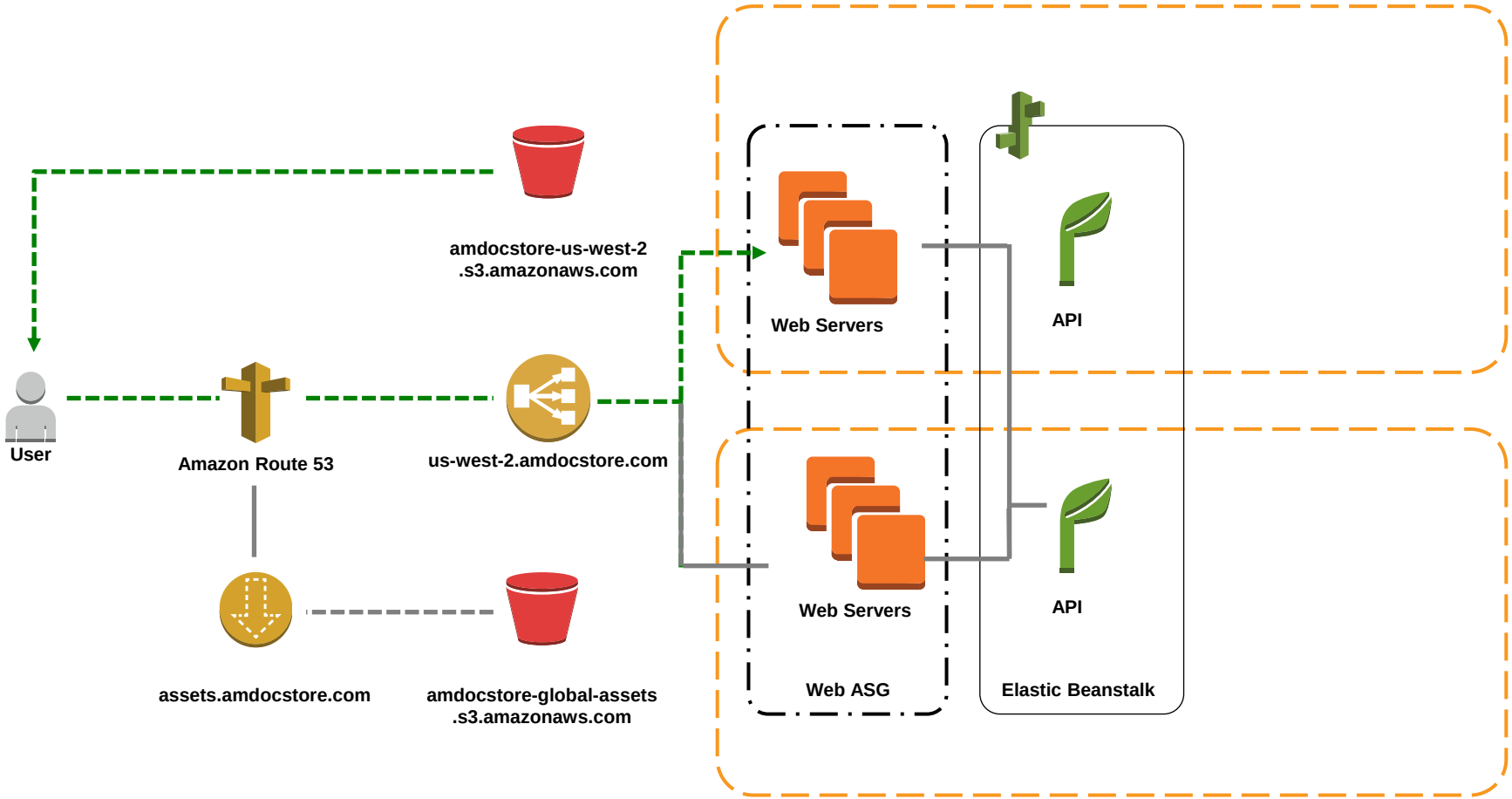
Upload Document: When the upload completes **S3 redirects the user to the URL we specified earlier**

DocStore



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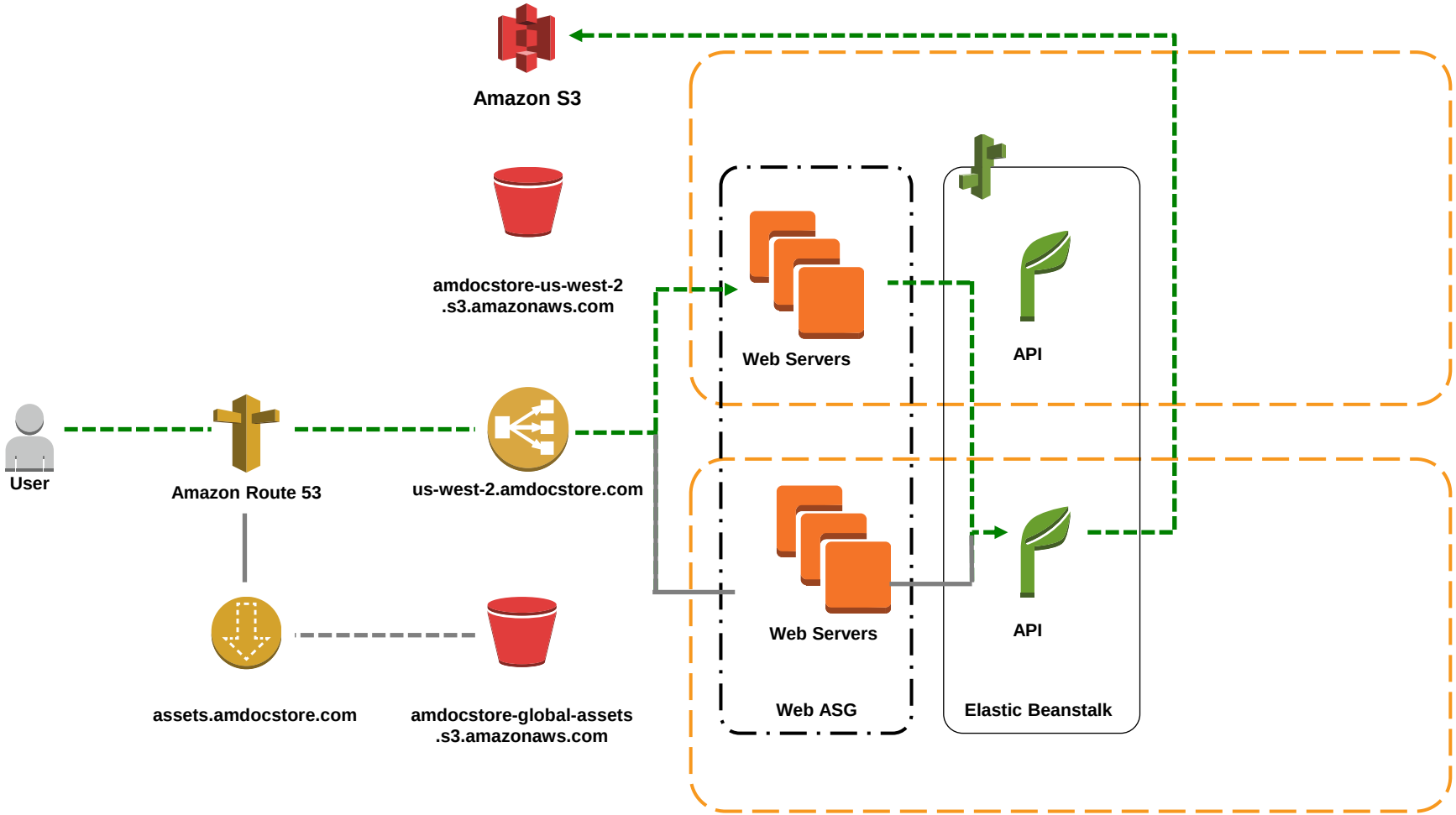
Upload Document: The API **retrieves metadata about the object** (i.e., size, type, and user-provided custom information like tags and description) from the S3 API

DocStore



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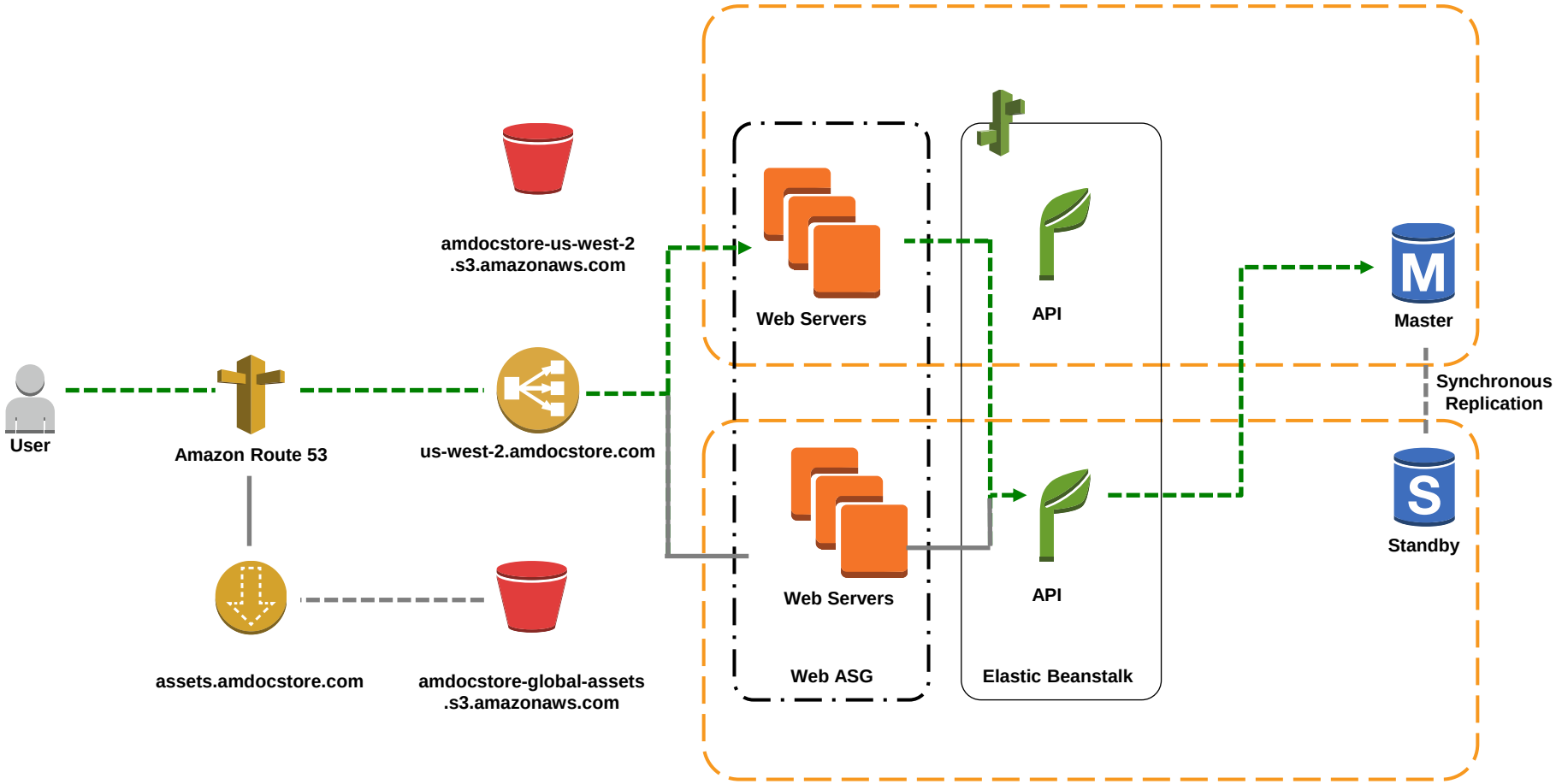
Upload Document: The object metadata is stored in an **RDS** instance running in **Multi-AZ** mode for **high availability**

DocStore



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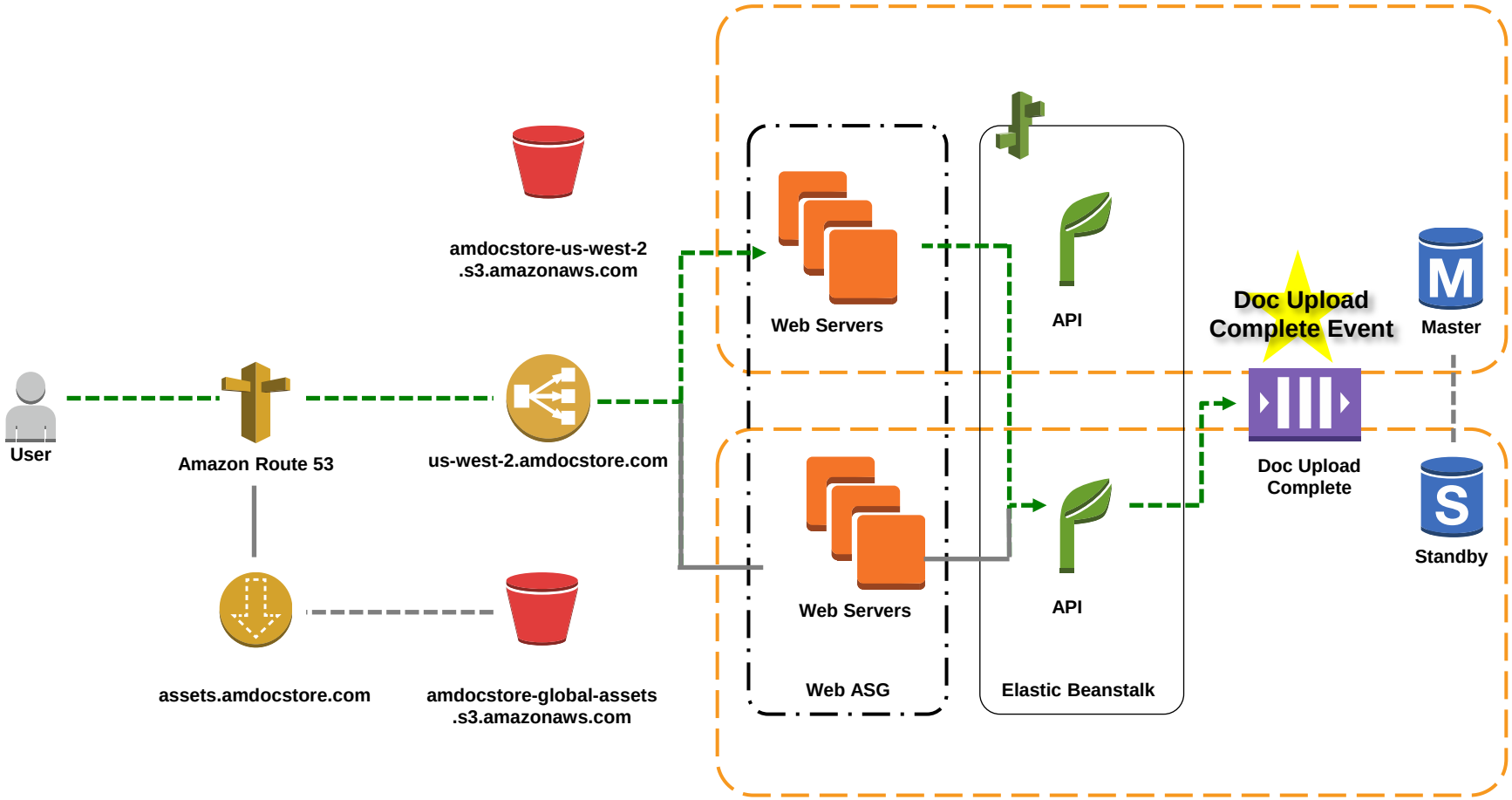
Upload Document: Finally, the API **places a message in a queue** indicating that the document upload was complete, and includes the ID of the newly uploaded object in S3

DocStore



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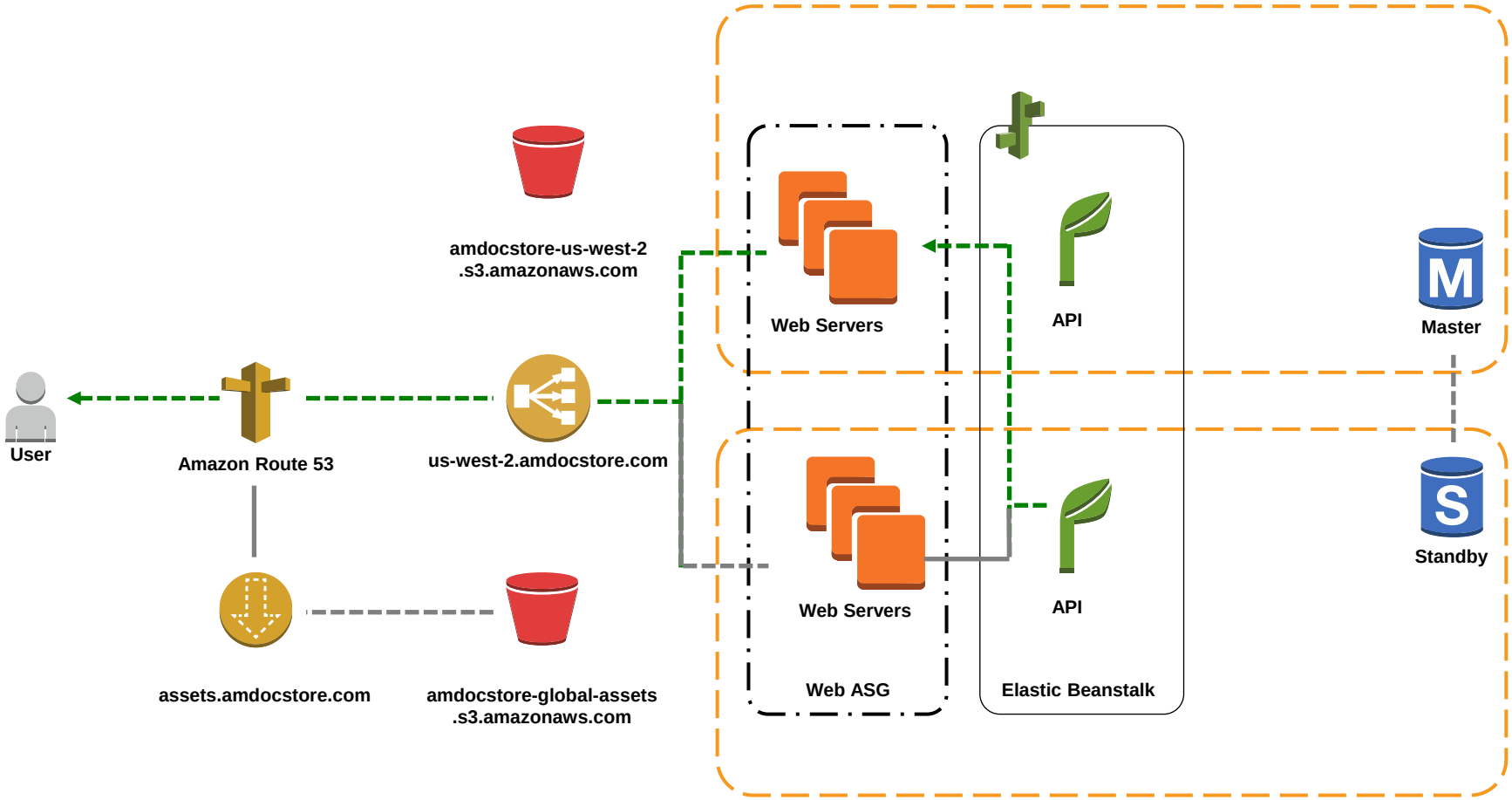
Upload Document: The user is redirected to a list of his documents

DocStore



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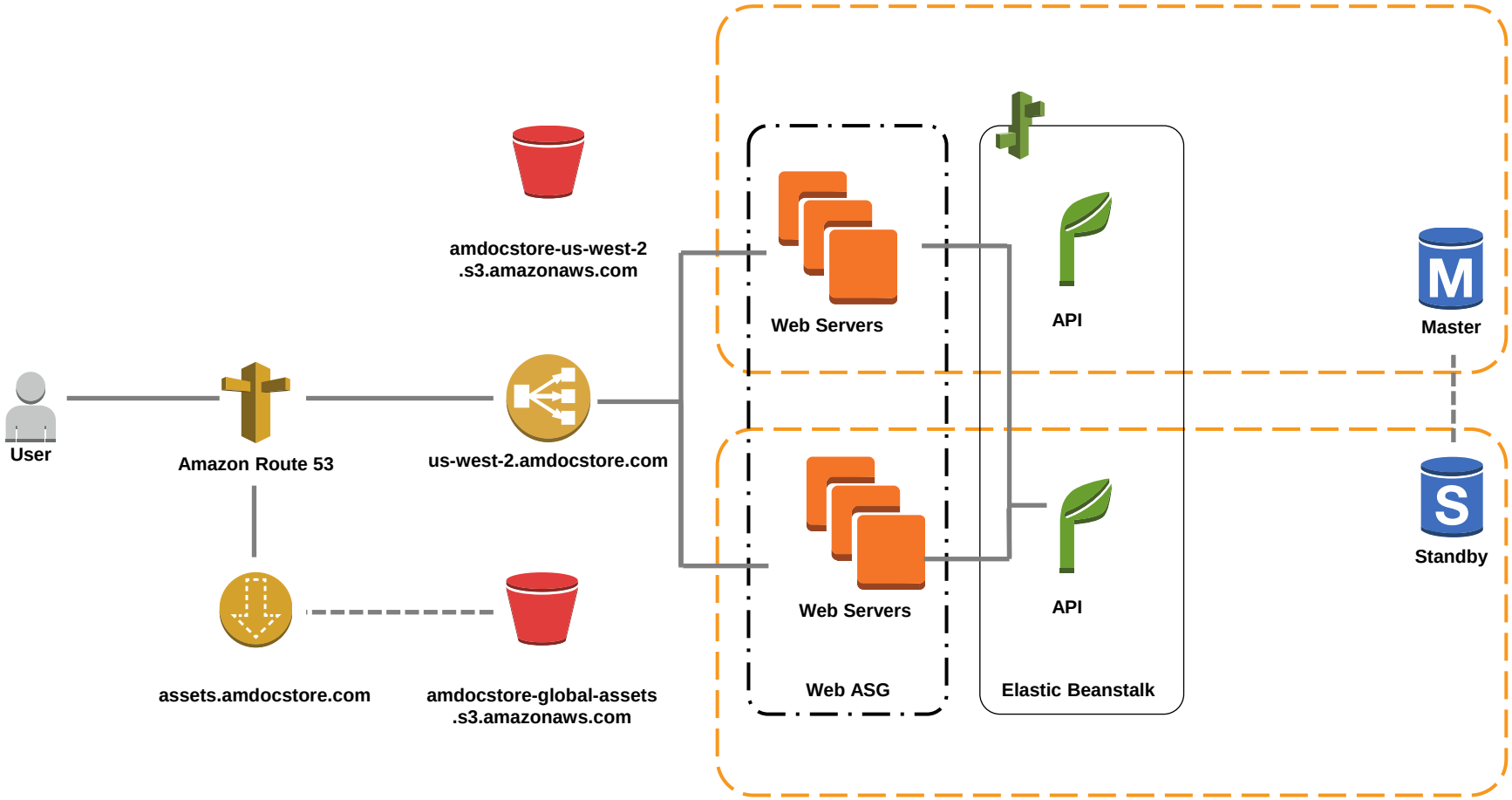
Let's see what happens when a user wants to **view and download his documents**

DocStore



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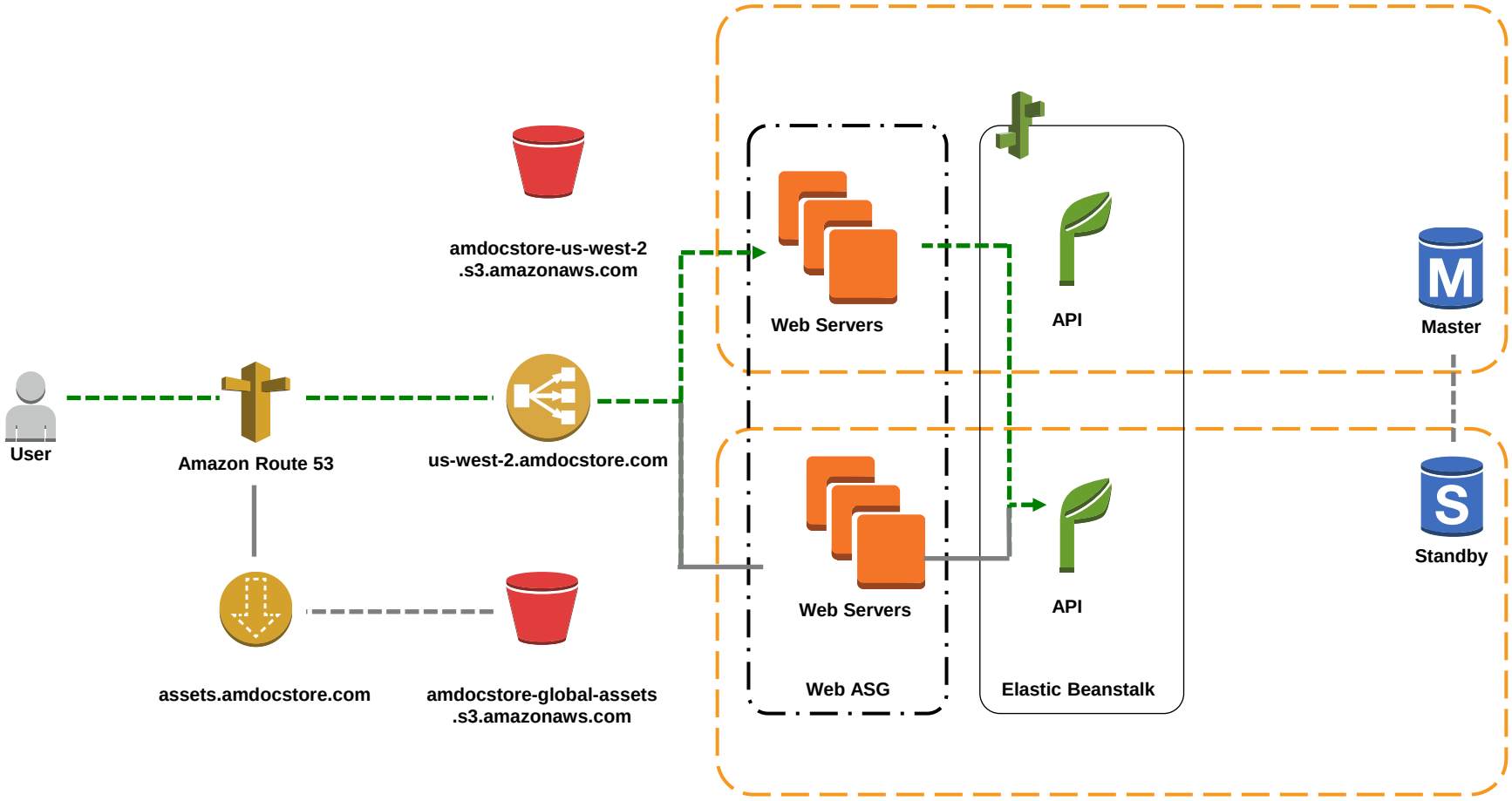
View and Download Docs: An authenticated user requests the web site URL to view his docs

DocStore



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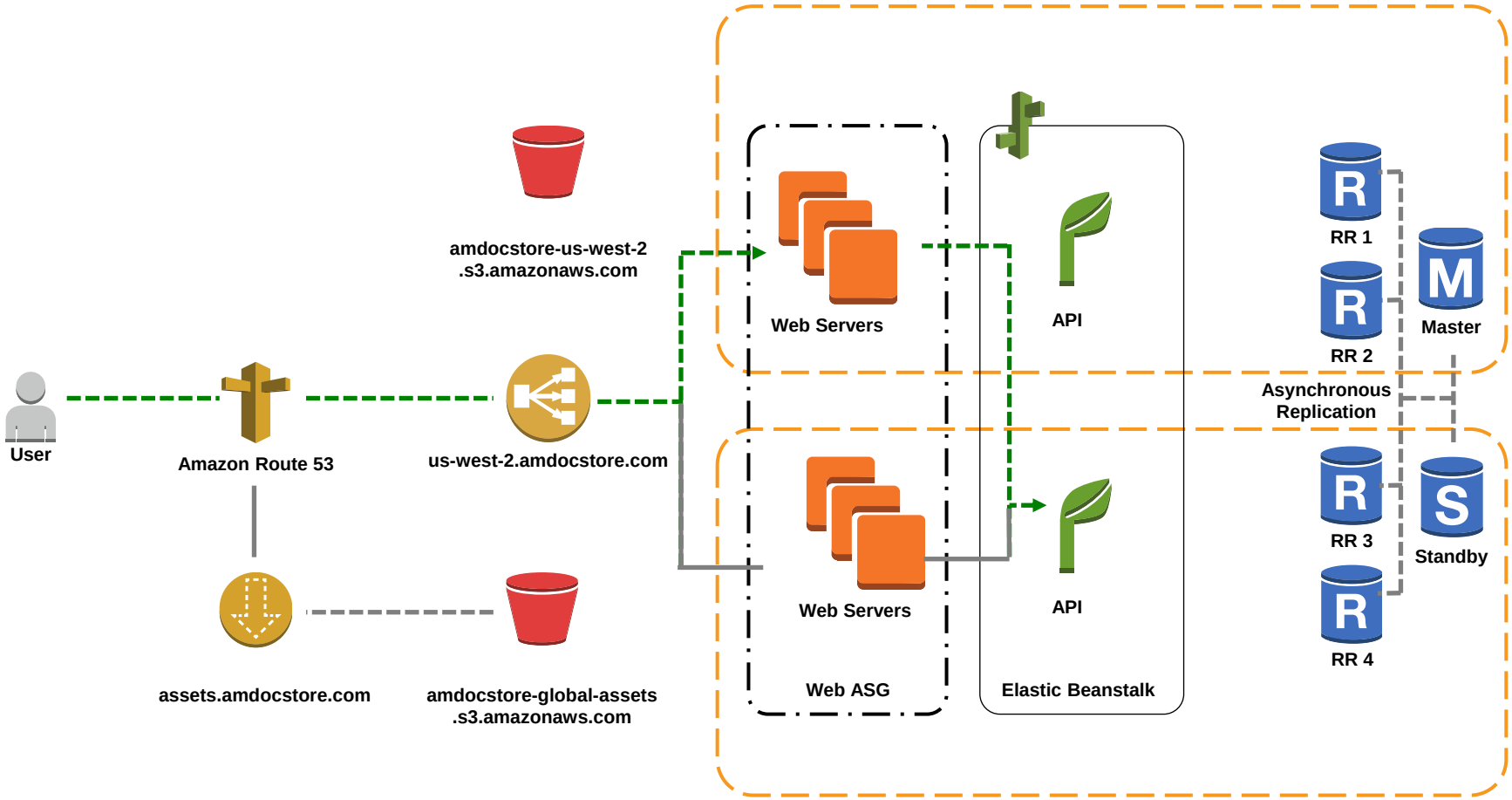
View and Download Docs: To **increase read performance** of the relational database, multiple **RDS Read Replicas** are provisioned. Read Replicas are **suitable for read workloads**, like the API selecting a list of documents owned by a user

DocStore



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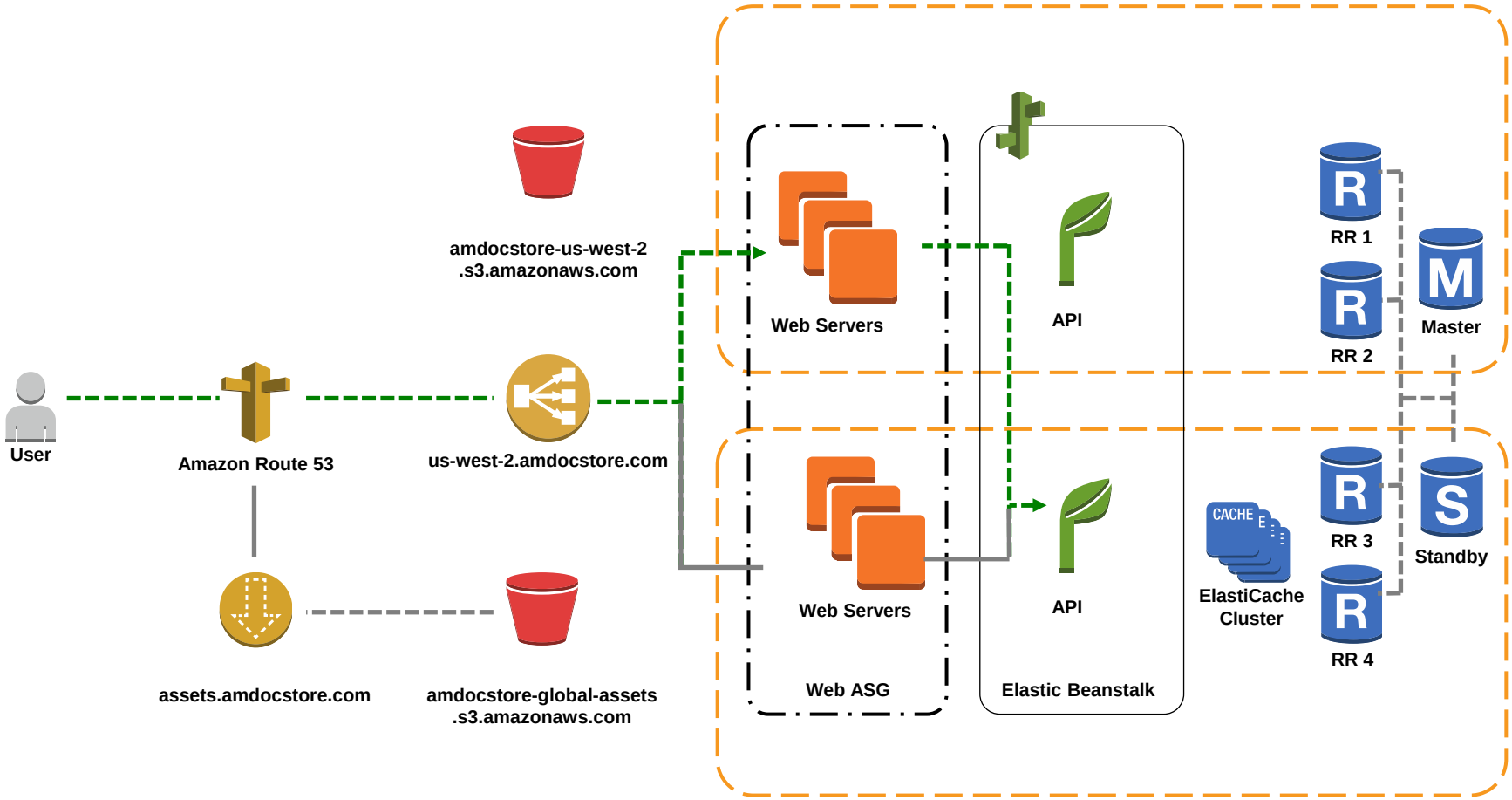
View and Download Docs: ElastiCache Cluster in front of the Read Replicas would provide additional performance when listing the user's documents

DocStore



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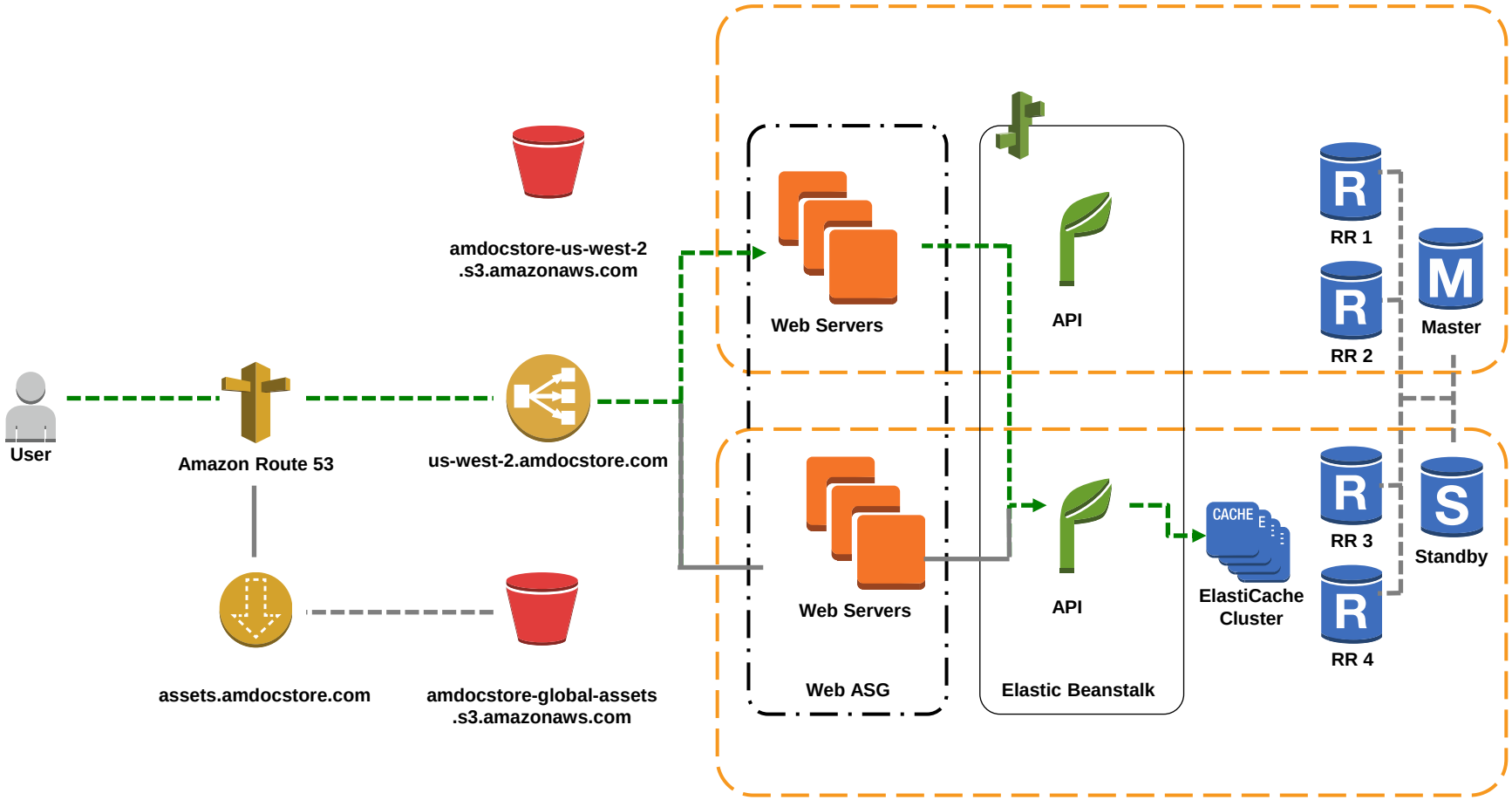
View and Download Docs: The API **first checks the cache** for a recent list of the user's documents

DocStore



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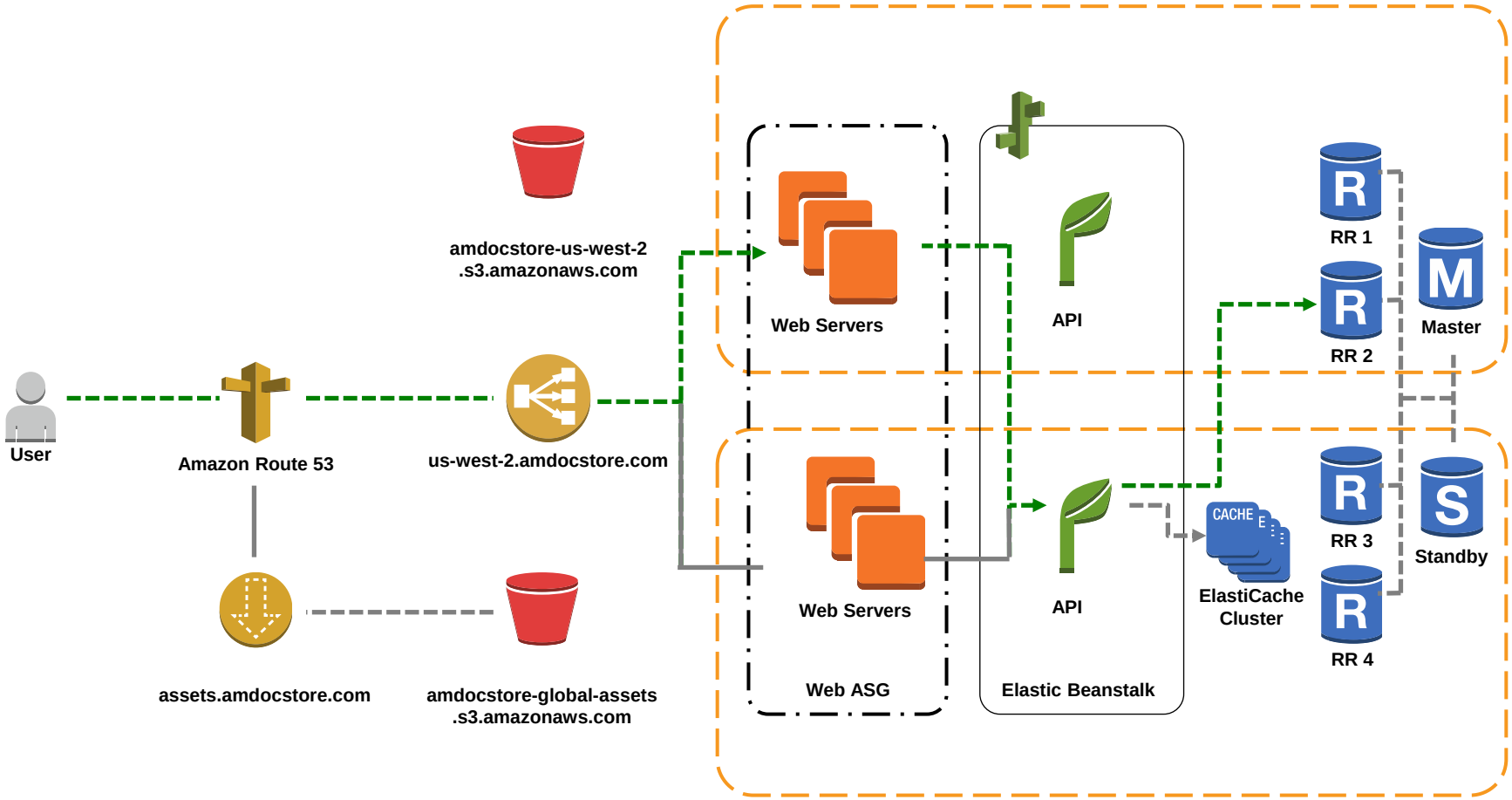
View and Download Docs: If no cached data is available, the API chooses one of the Read Replicas and queries for the list of documents

DocStore



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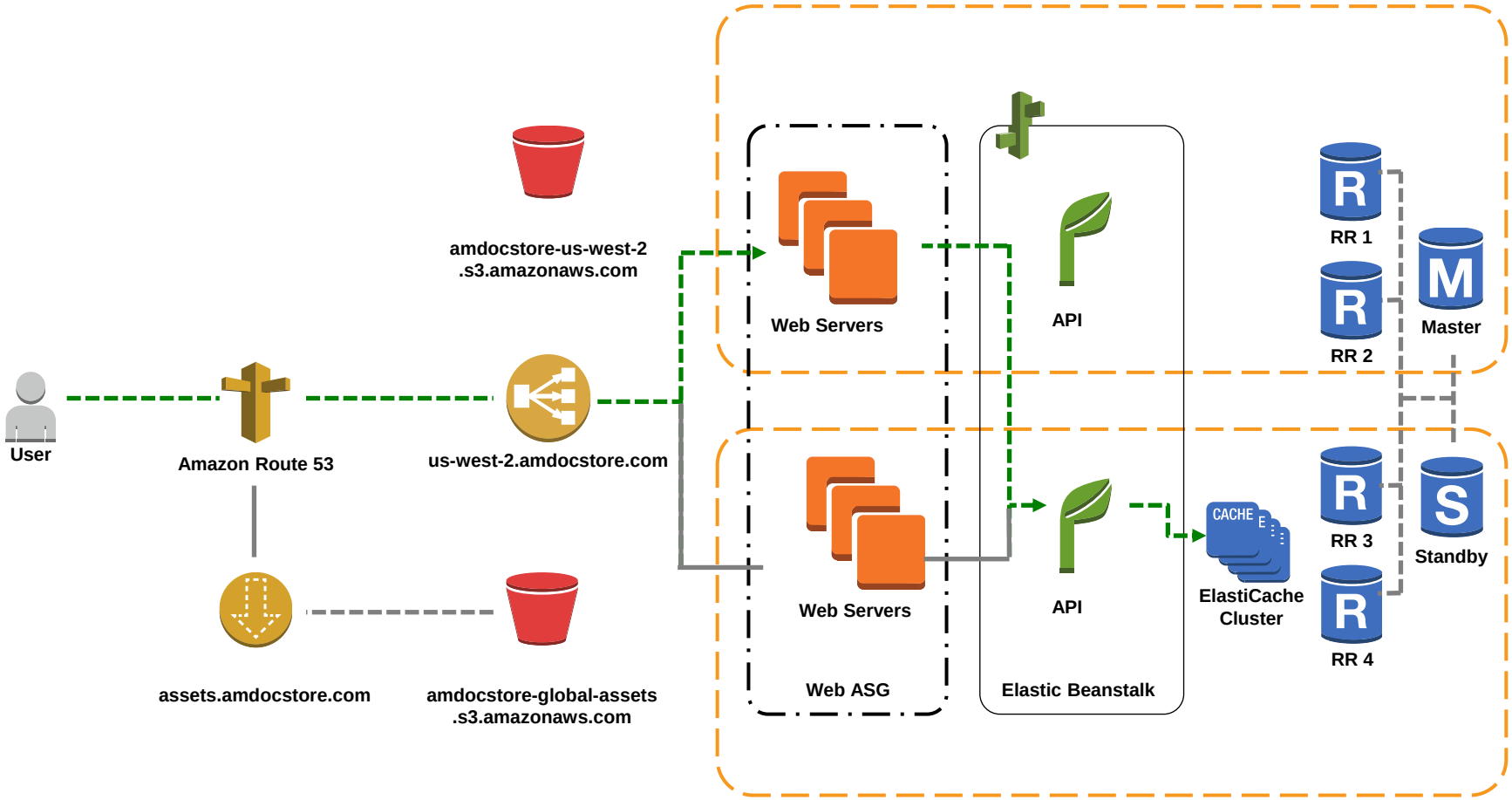
View and Download Docs: The result of the query is stored in the cache for future access

DocStore



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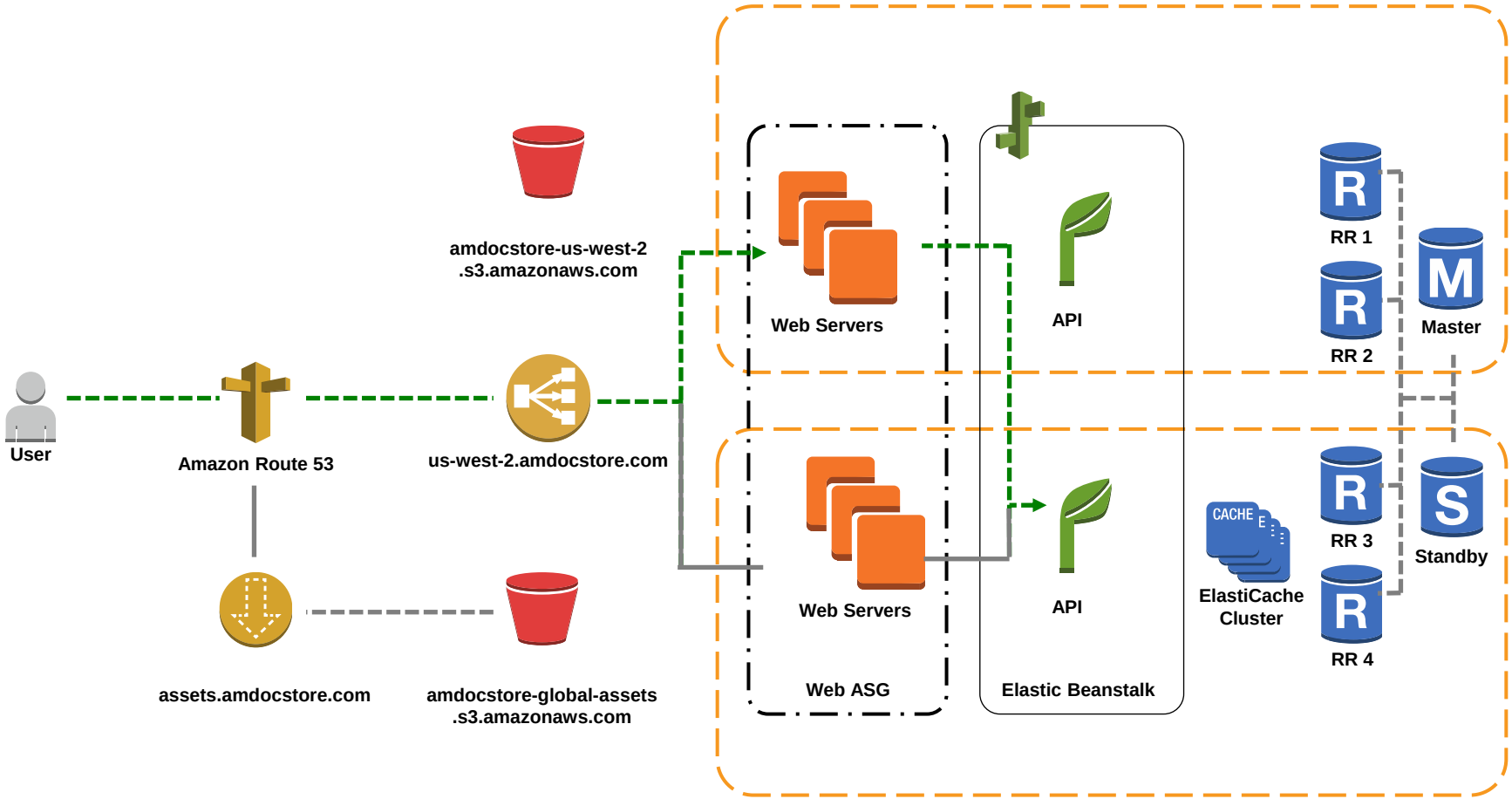
View and Download Docs: For each document, the API constructs a secure, auto-expiring, signed URL that will allow the user to download the document directly from S3

DocStore



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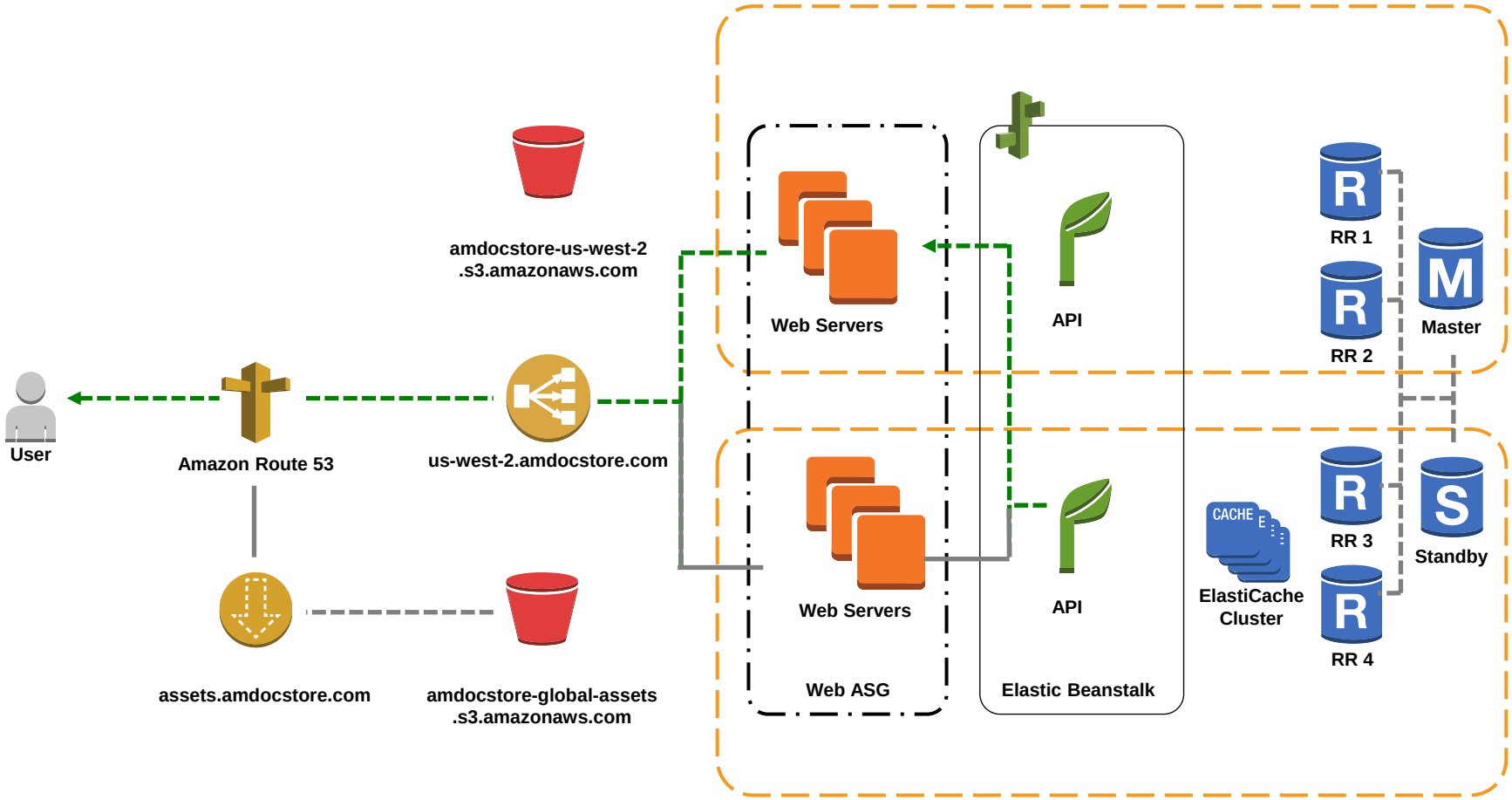
View and Download Docs: The list of documents – and links for direct, secure download – are delivered to the user's browser

DocStore



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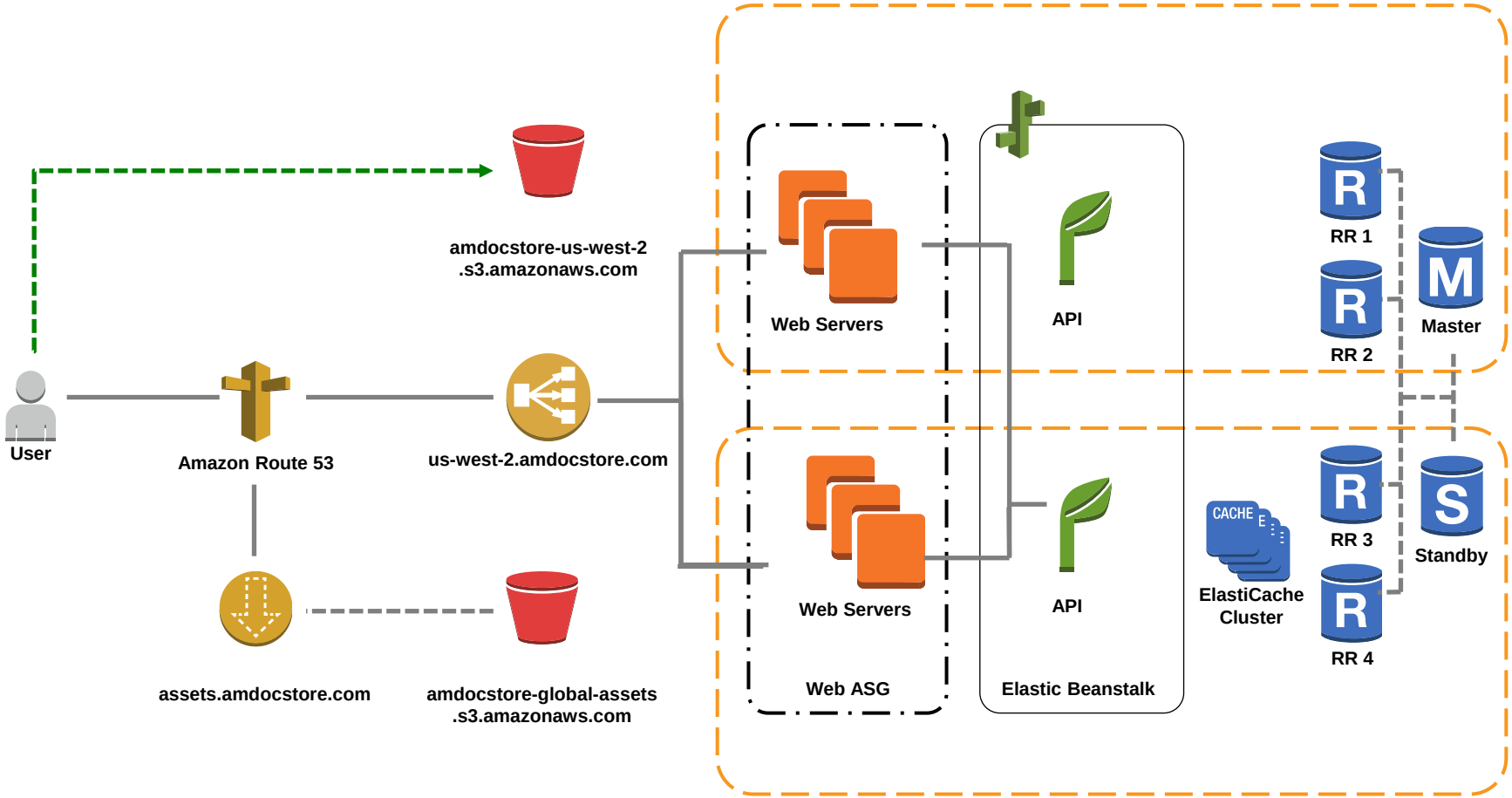
View and Download Docs: The user may download documents directly from S3

DocStore



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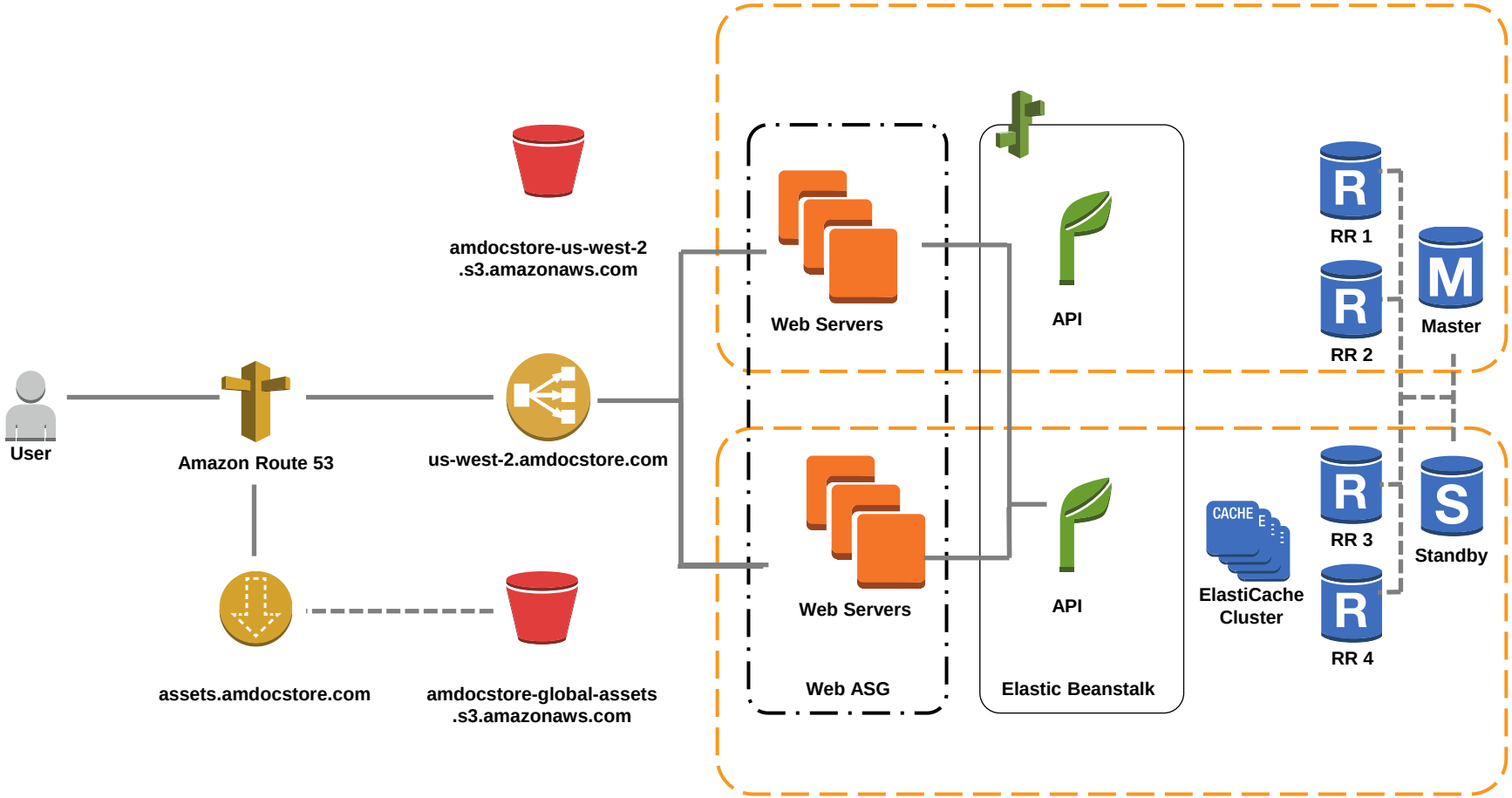
Let's look at options for **security**

DocStore



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Security: Where can security measures and controls be implemented in this architecture?

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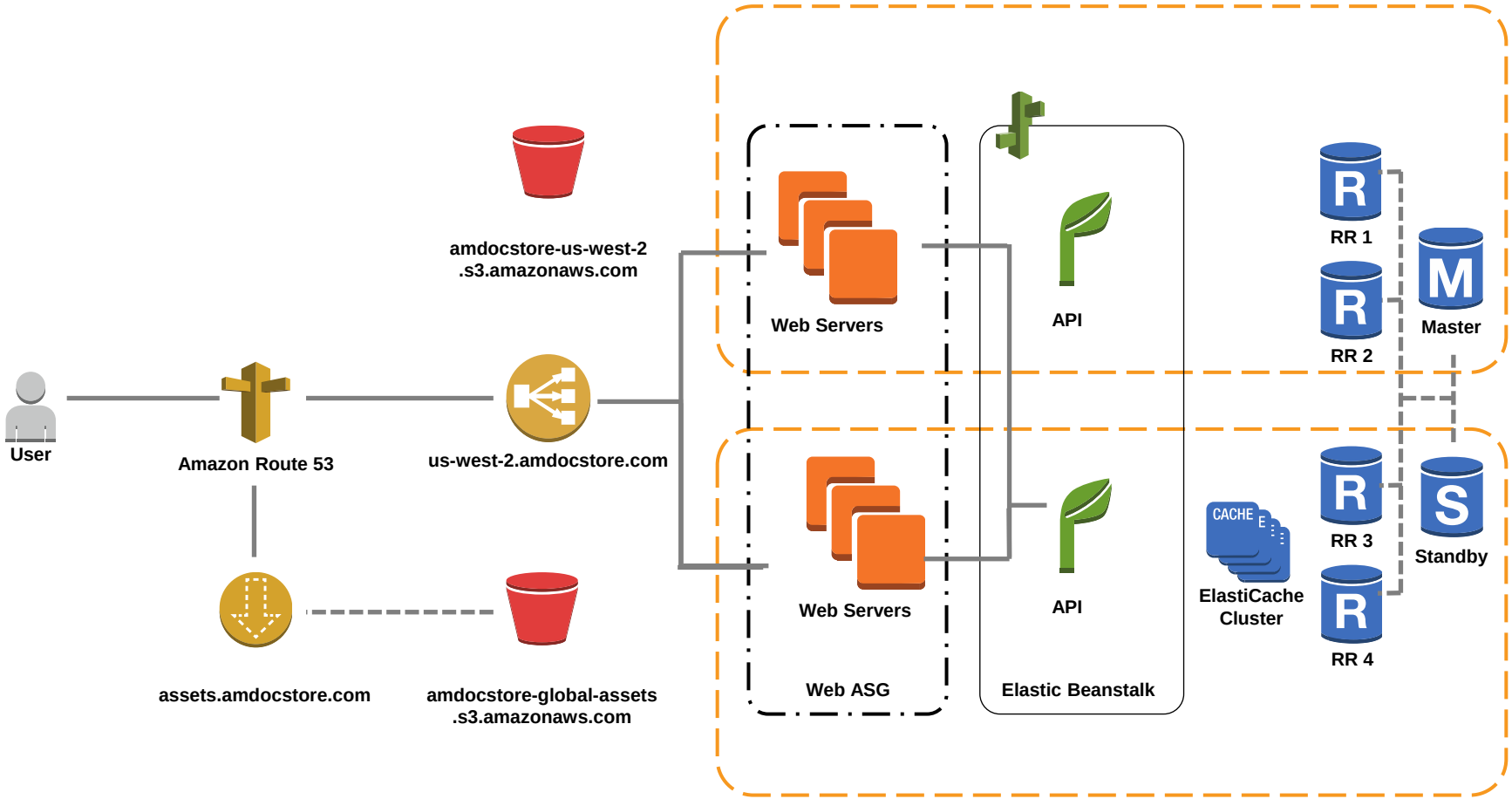

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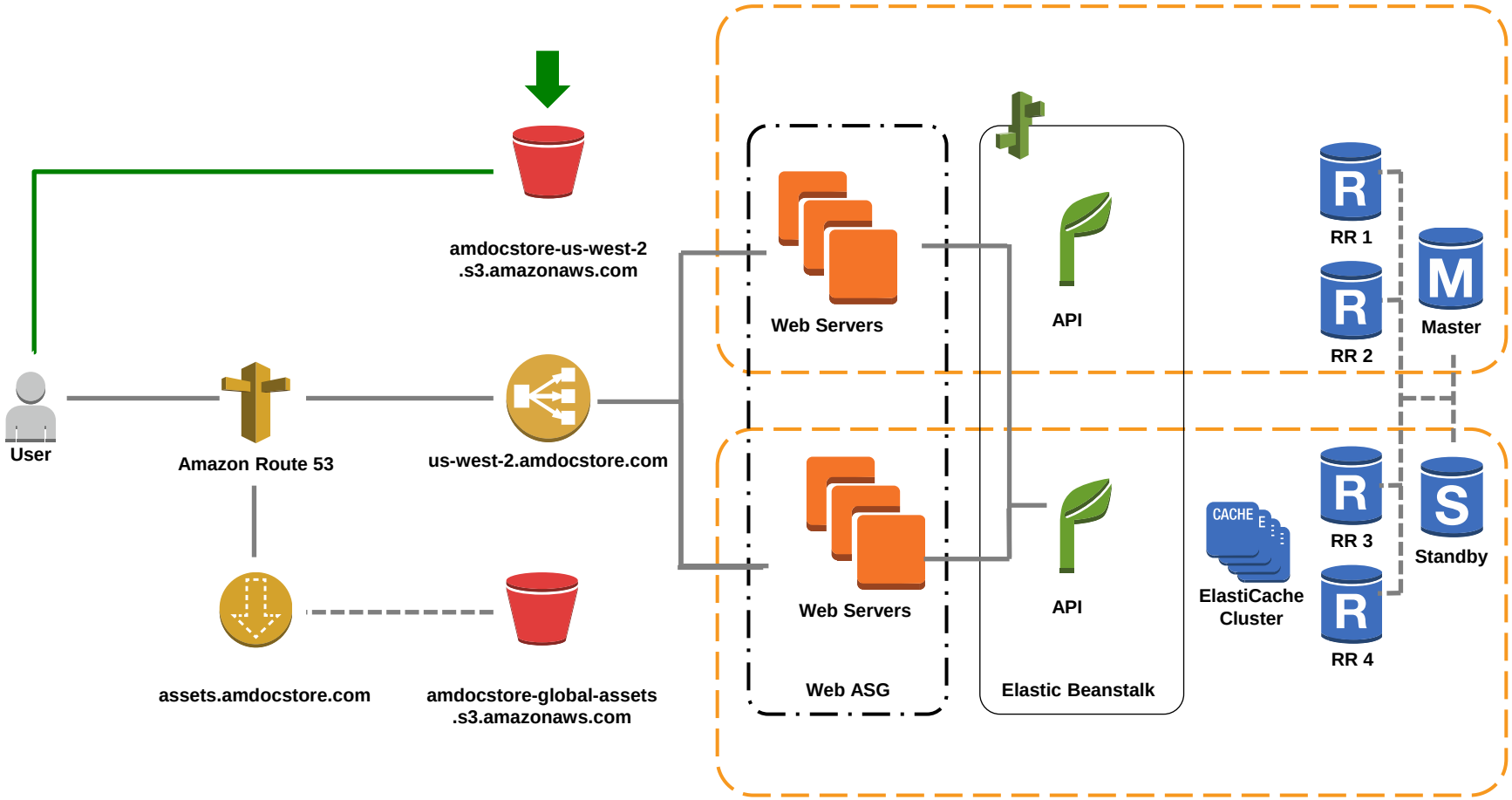
Security: User downloads documents directly from S3 using a secure, signed URL and over SSL

DocStore



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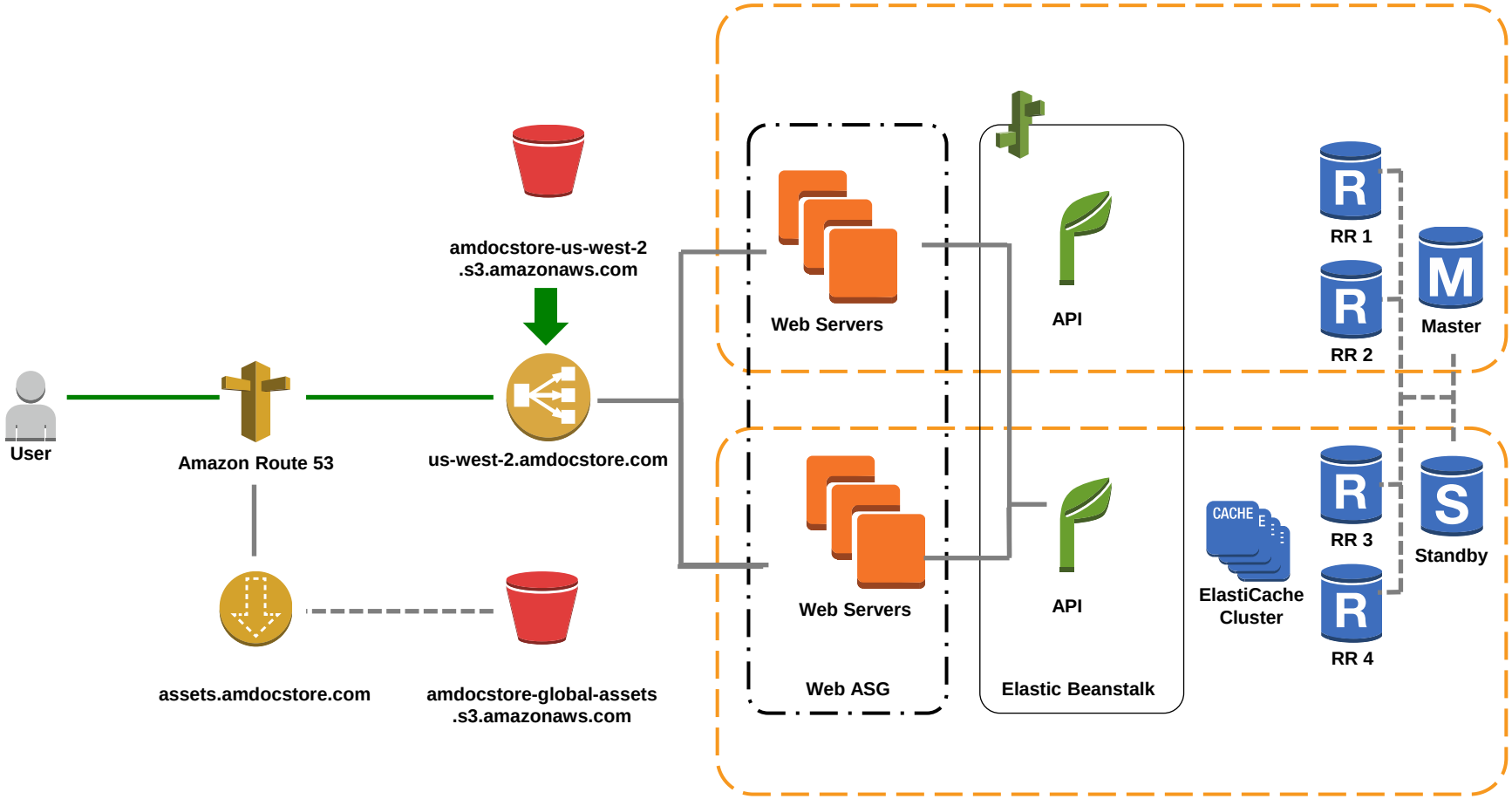
Security: SSL connection between user and ELB

DocStore



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Security: Security Groups restrict inbound traffic

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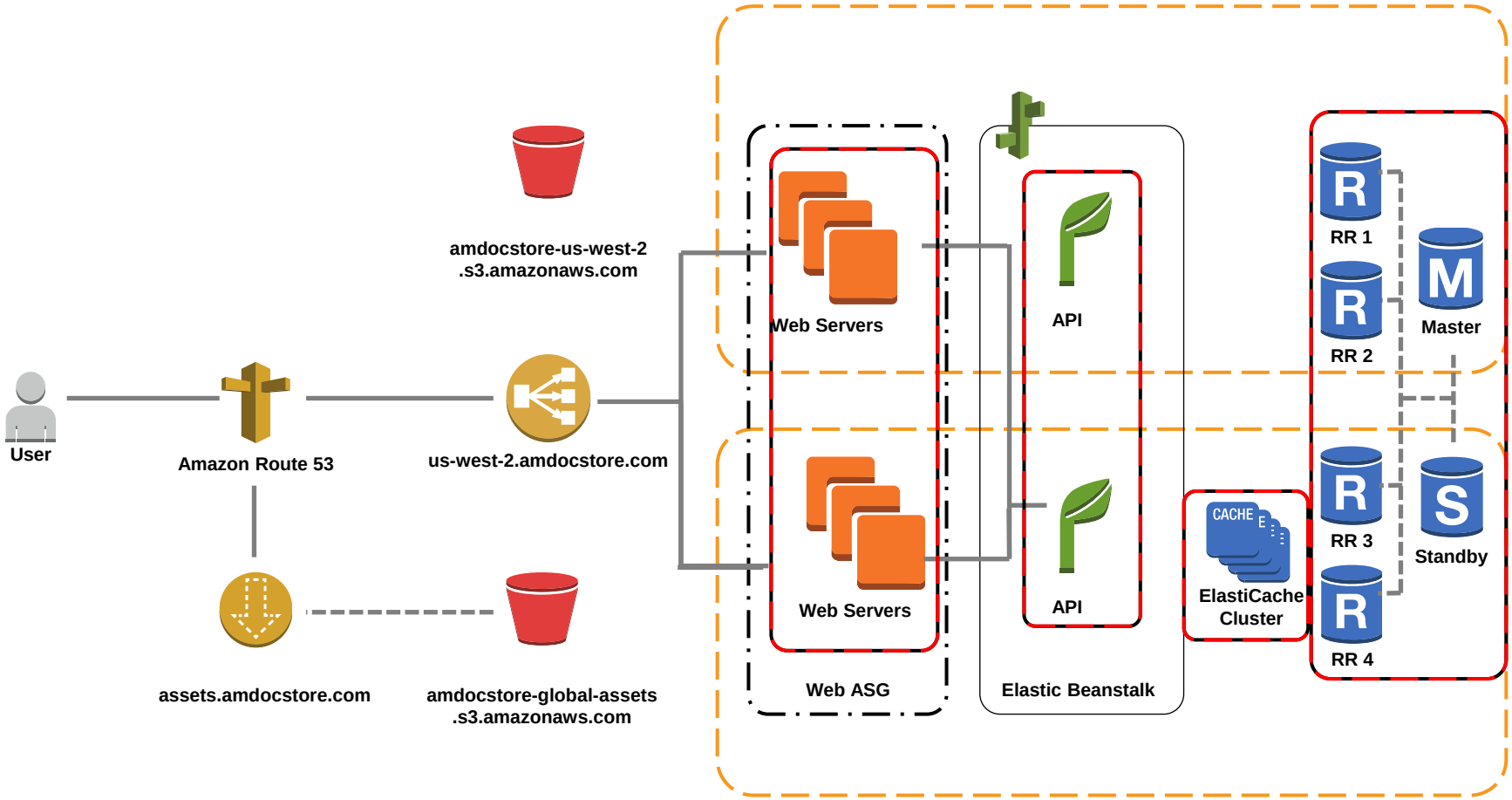

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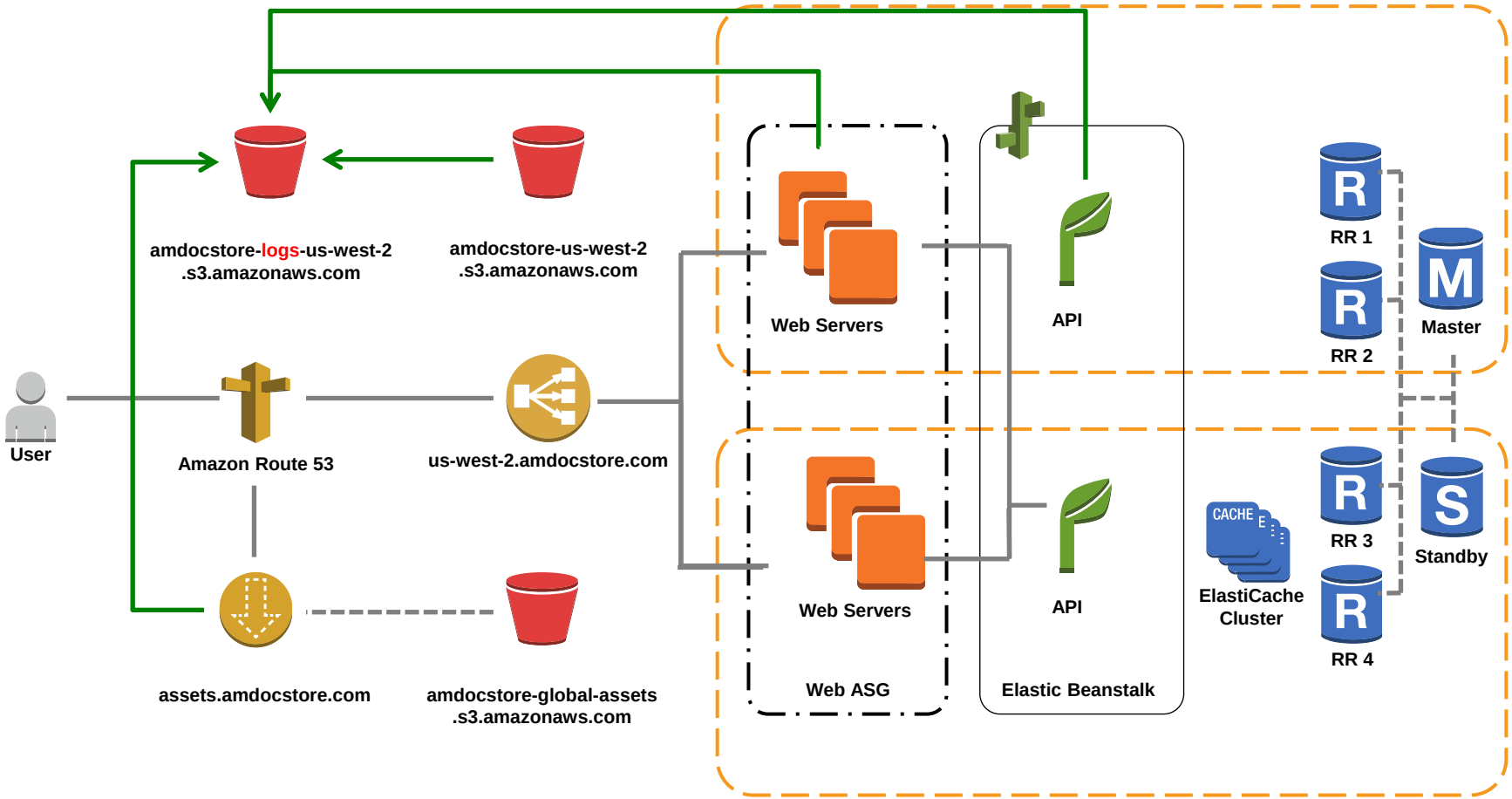
Security: Access logs from CloudFront, EC2, and S3 are pushed to S3

DocStore



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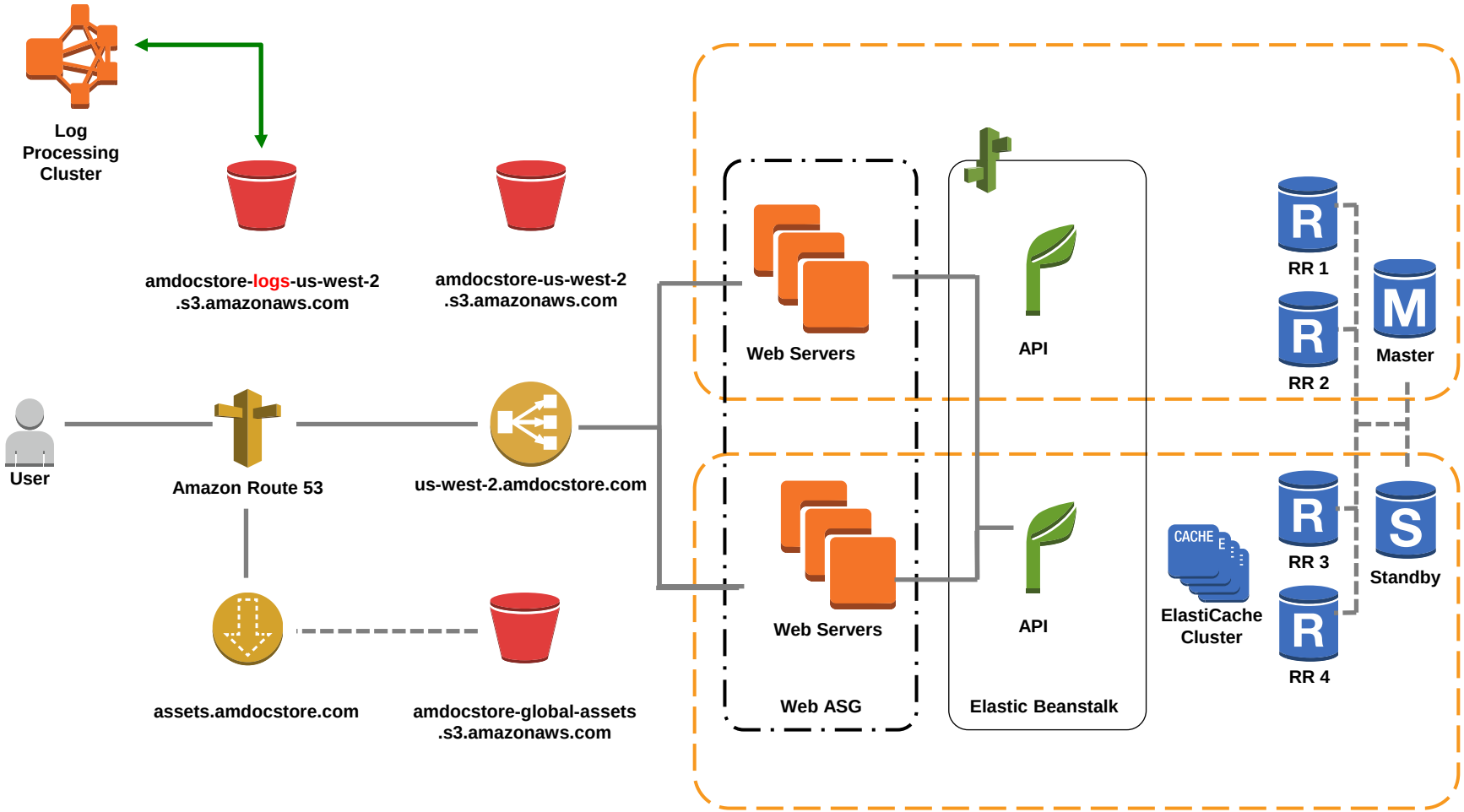
Security: Logs are processed on a schedule using an Elastic MapReduce cluster

DocStore



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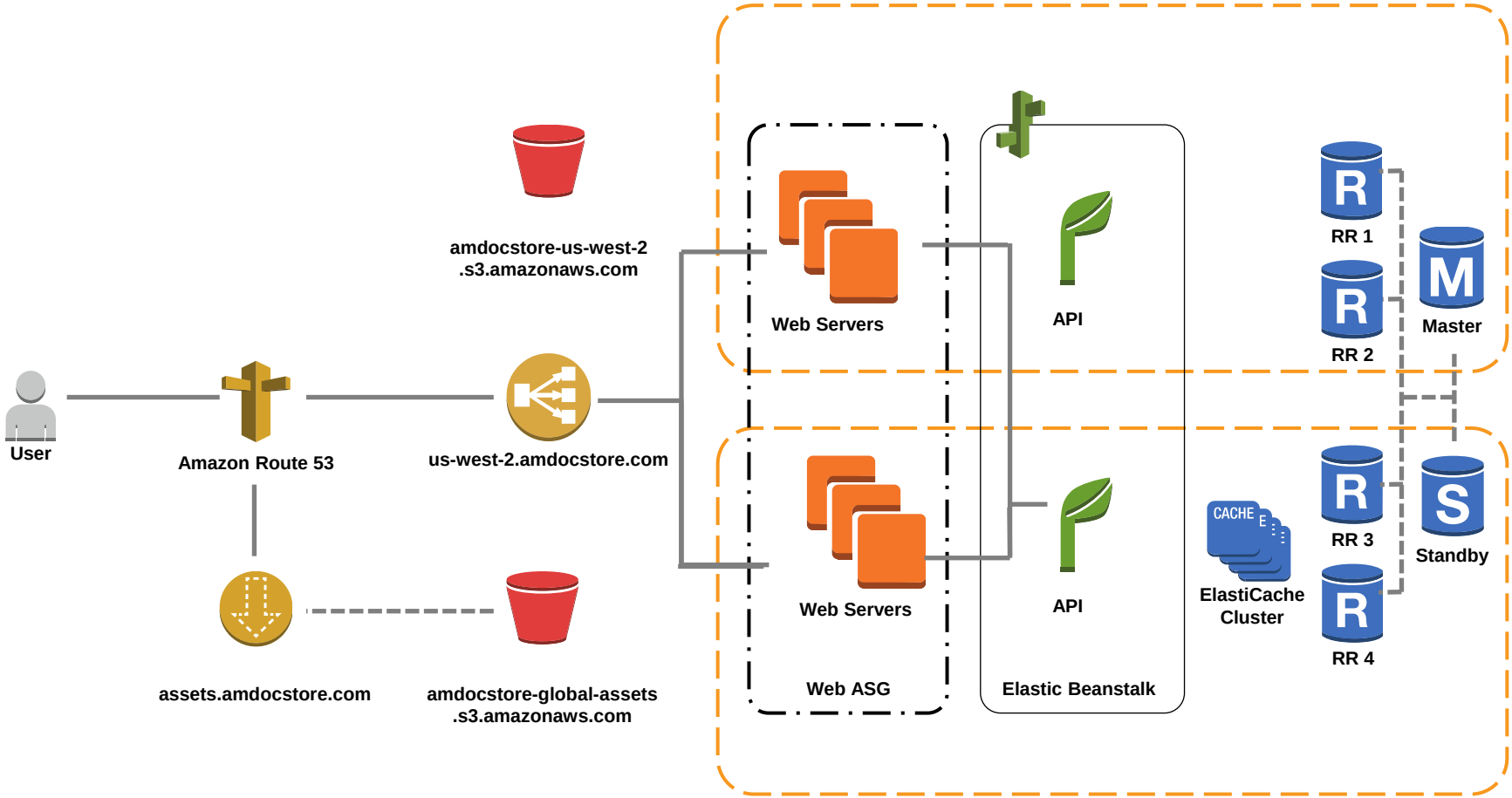
Let's focus on the networking environment

DocStore



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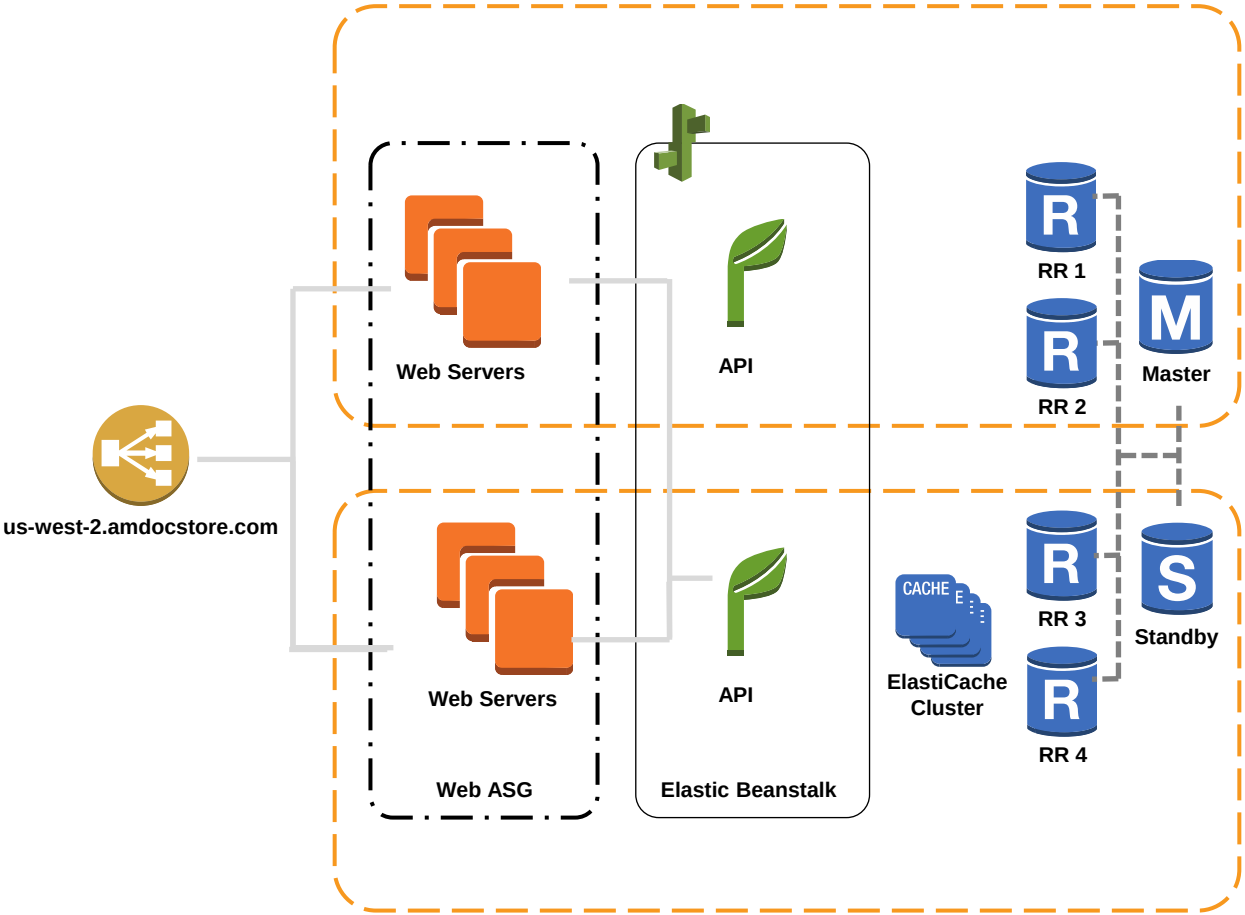
Let's focus on the networking environment

DocStore



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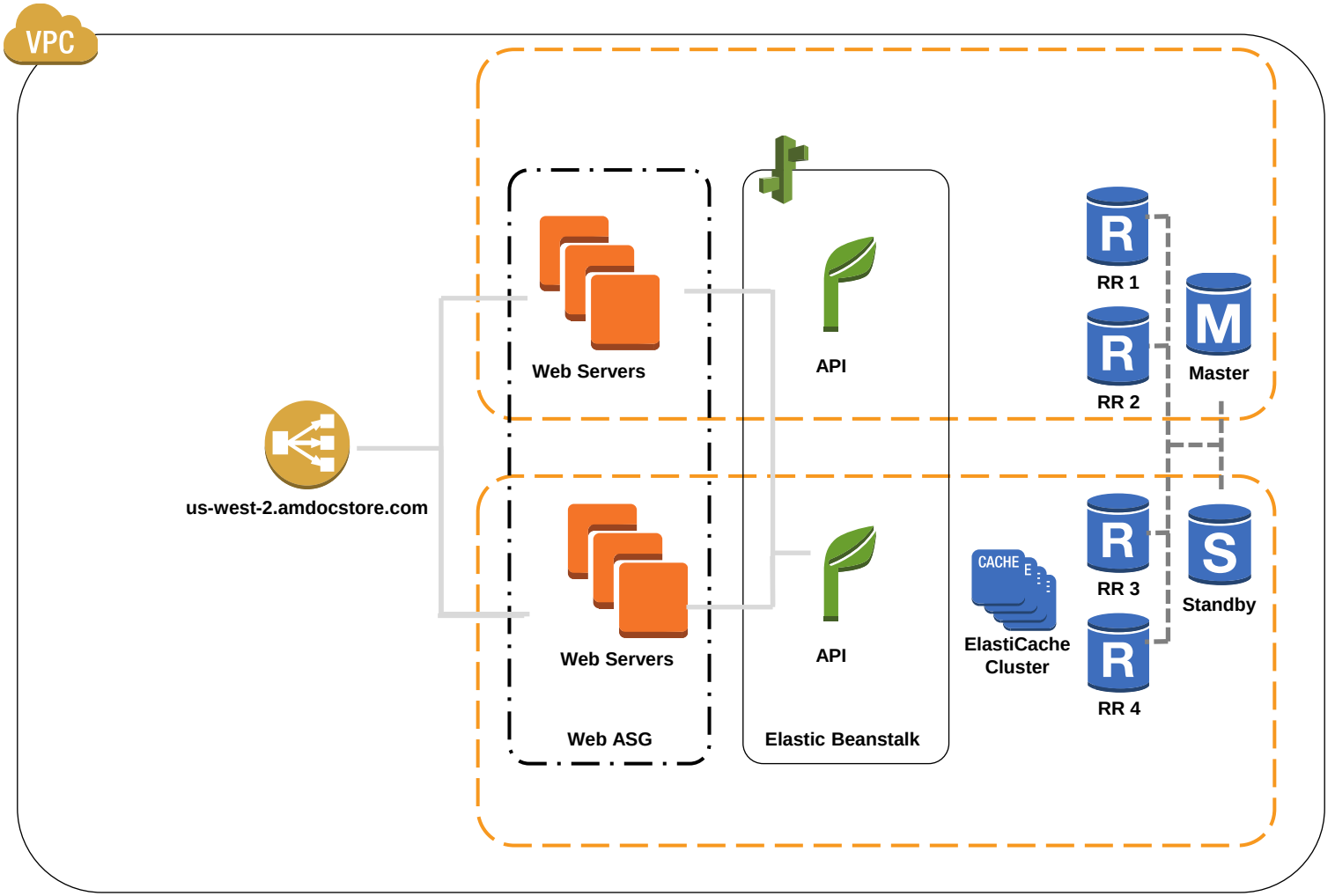
VPC: This VPC is in us-west-2 and has a 10.0.0.0/16 CIDR block

DocStore



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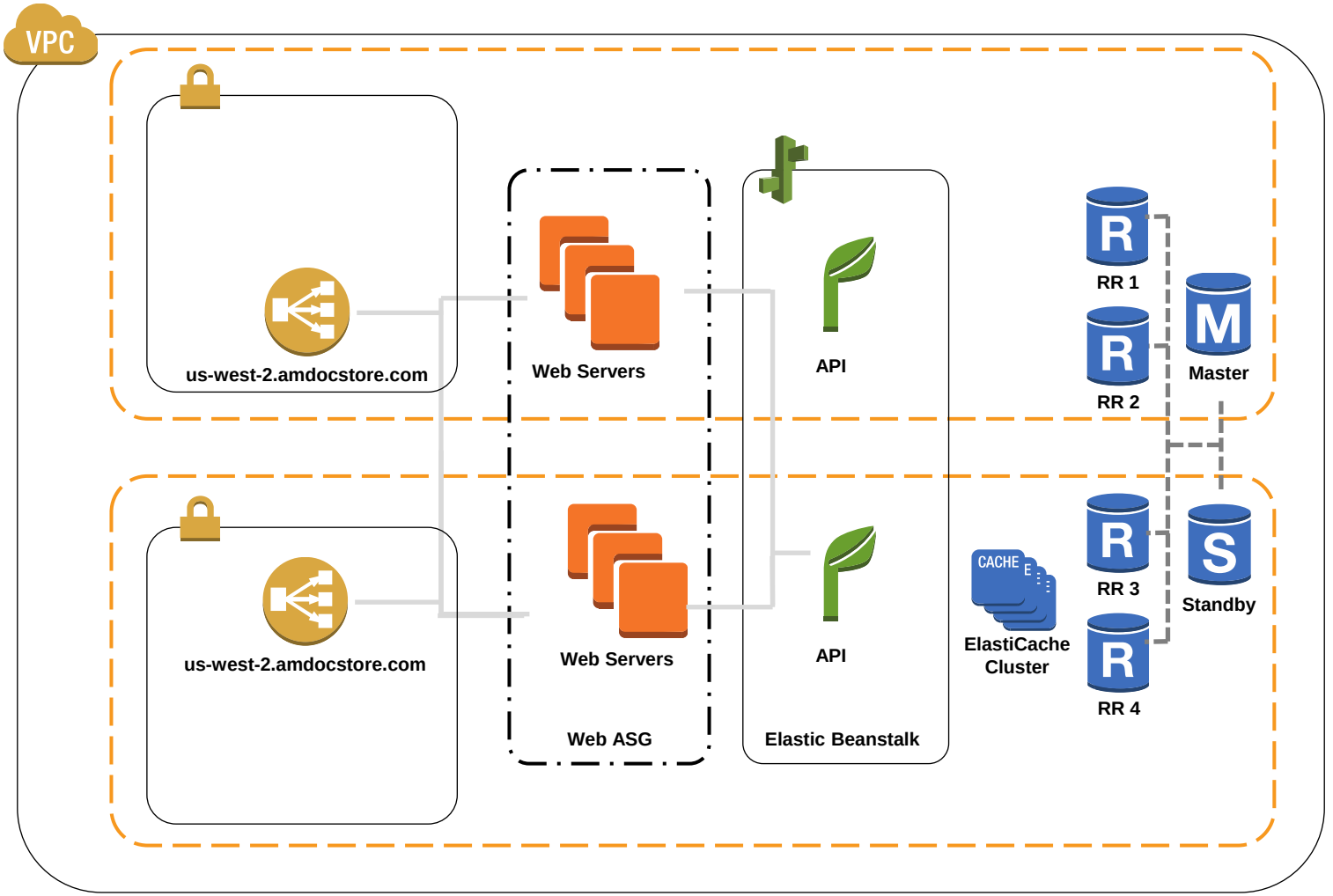
VPC: We define two subnets that our ELB will run in (note: although we show the ELB in multiple subnets, this is still a single ELB)

DocStore



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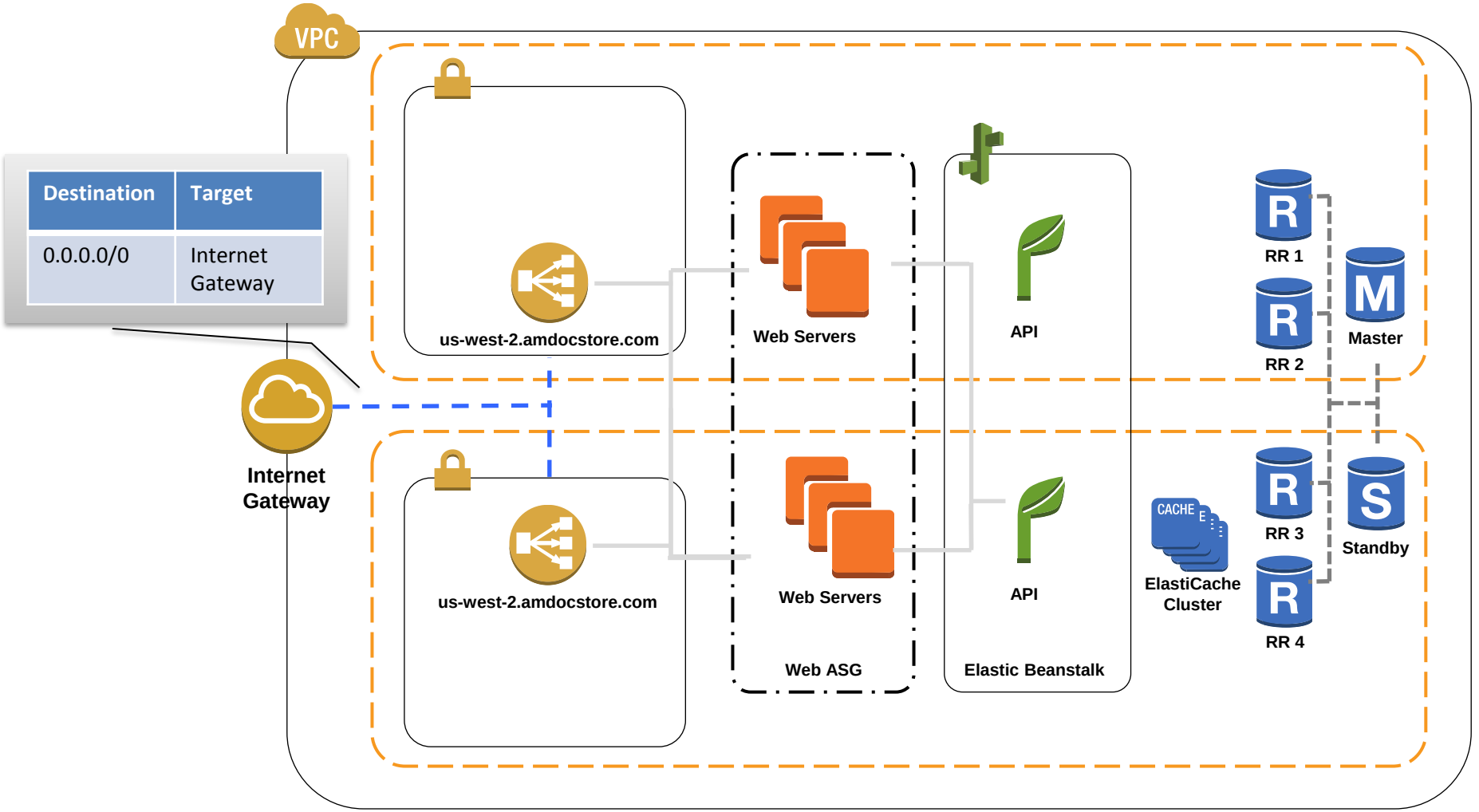
VPC: These subnets should be public. We will attach an **Internet Gateway** and **define a Route Table entry** to make them public

DocStore



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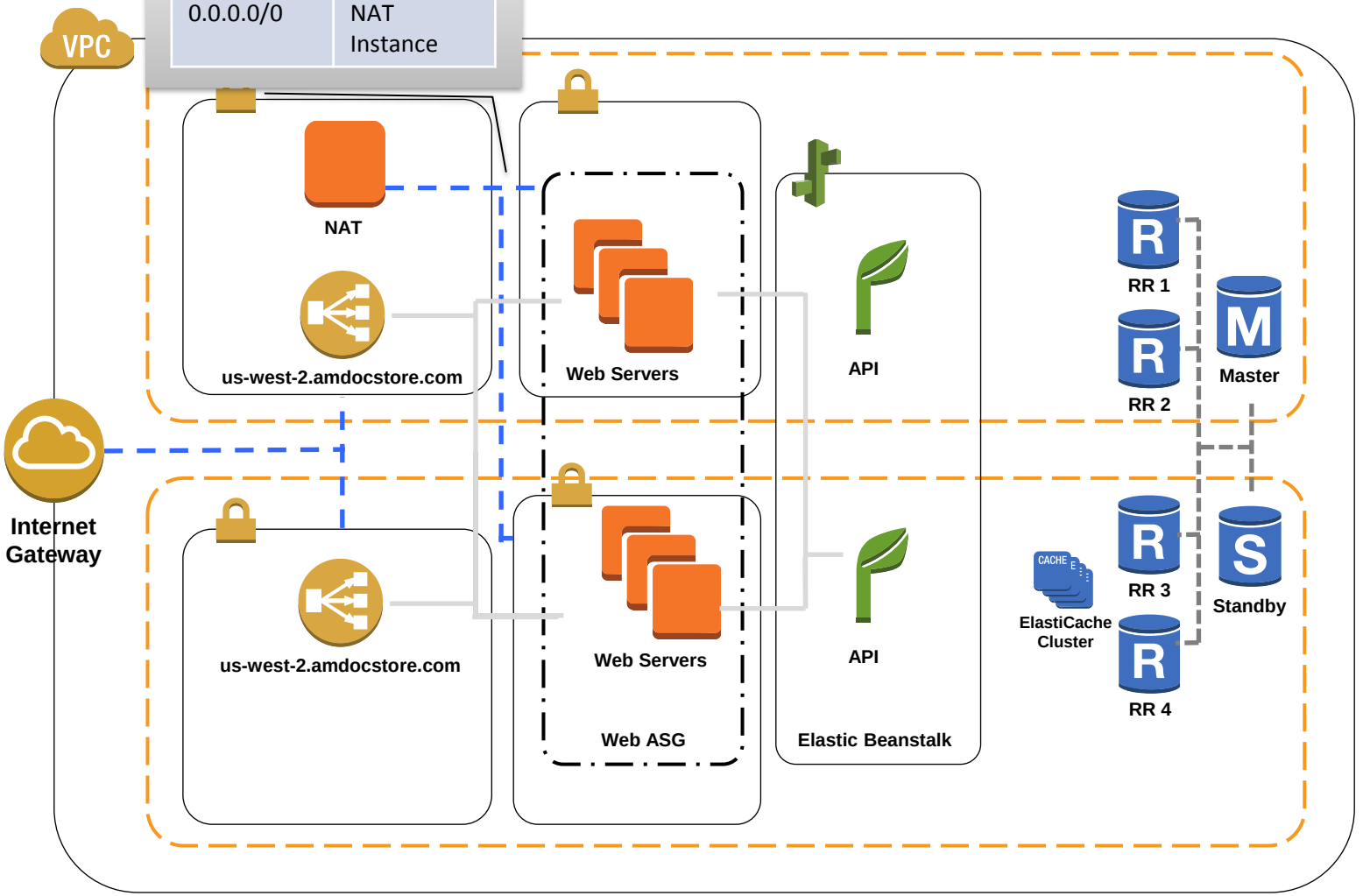
VPC: Web servers run in a private subnet, but have **outbound internet access** via an EC2 instance in the public subnet running NAT

DocStore

Destination	Target
0.0.0.0/0	NAT Instance



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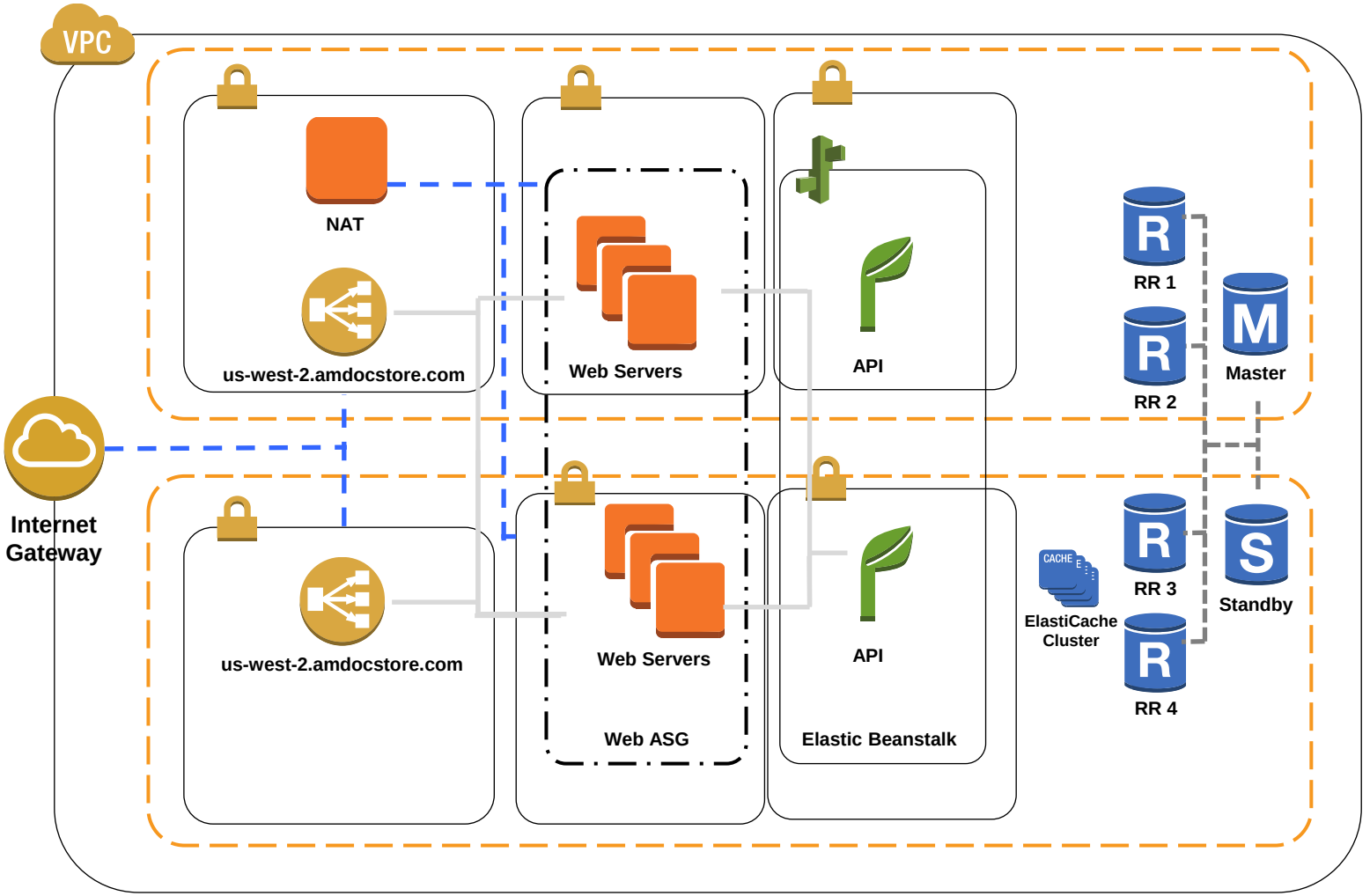
VPC: The DocStore API running on Elastic Beanstalk is deployed in both a public (for ELB) and private (for EC2) subnet

DocStore



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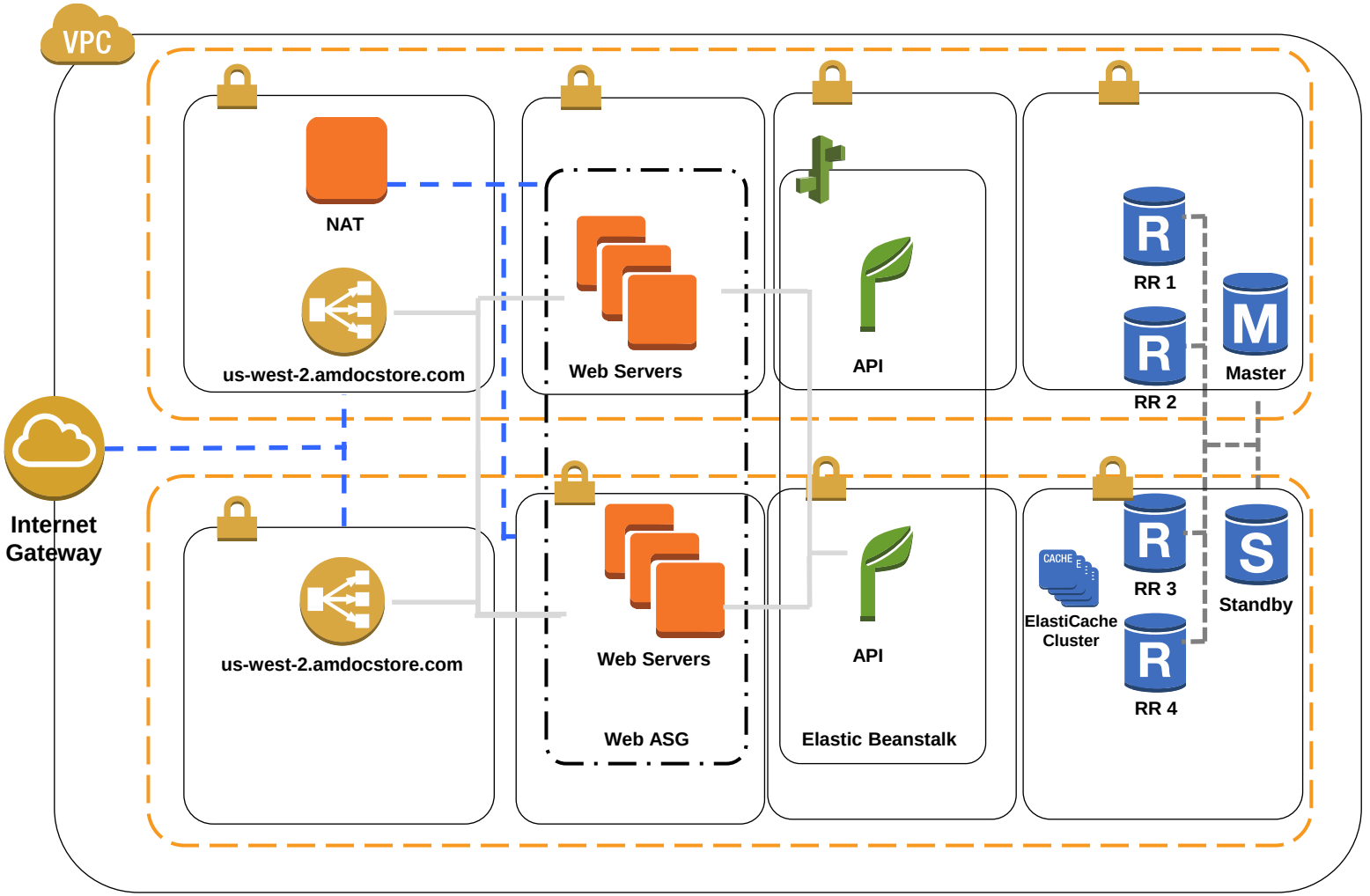
VPC: Finally, the RDS and ElastiCache instances are deployed in a private subnet

DocStore



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CloudFormation: Entire application is deployed as a stack from a template file

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CloudFormation: The sample template file is used to deploy to us-west-2

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CloudFormation: and ap-southeast-2

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#2: Batch Processing Back-End

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#2: Batch Processing Back-End

- Sync user accounts
- Enforce max storage limits
- Extract and index text based on document type (i.e., PDF uses different filter than DOCX, etc.)
- Detailed dashboard with system-wide totals:
  - # docs, avg. doc size, total storage

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#2: Batch Processing Back-End

– Responds to events triggered by Web interface:

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#2: Batch Processing Back-End

– Responds to events triggered by Web interface:

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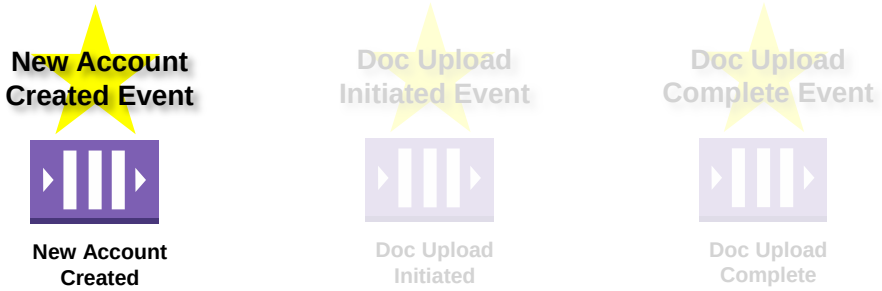
#2: Batch Processing Back-End

– Responds to events triggered by Web and Mobile interfaces:



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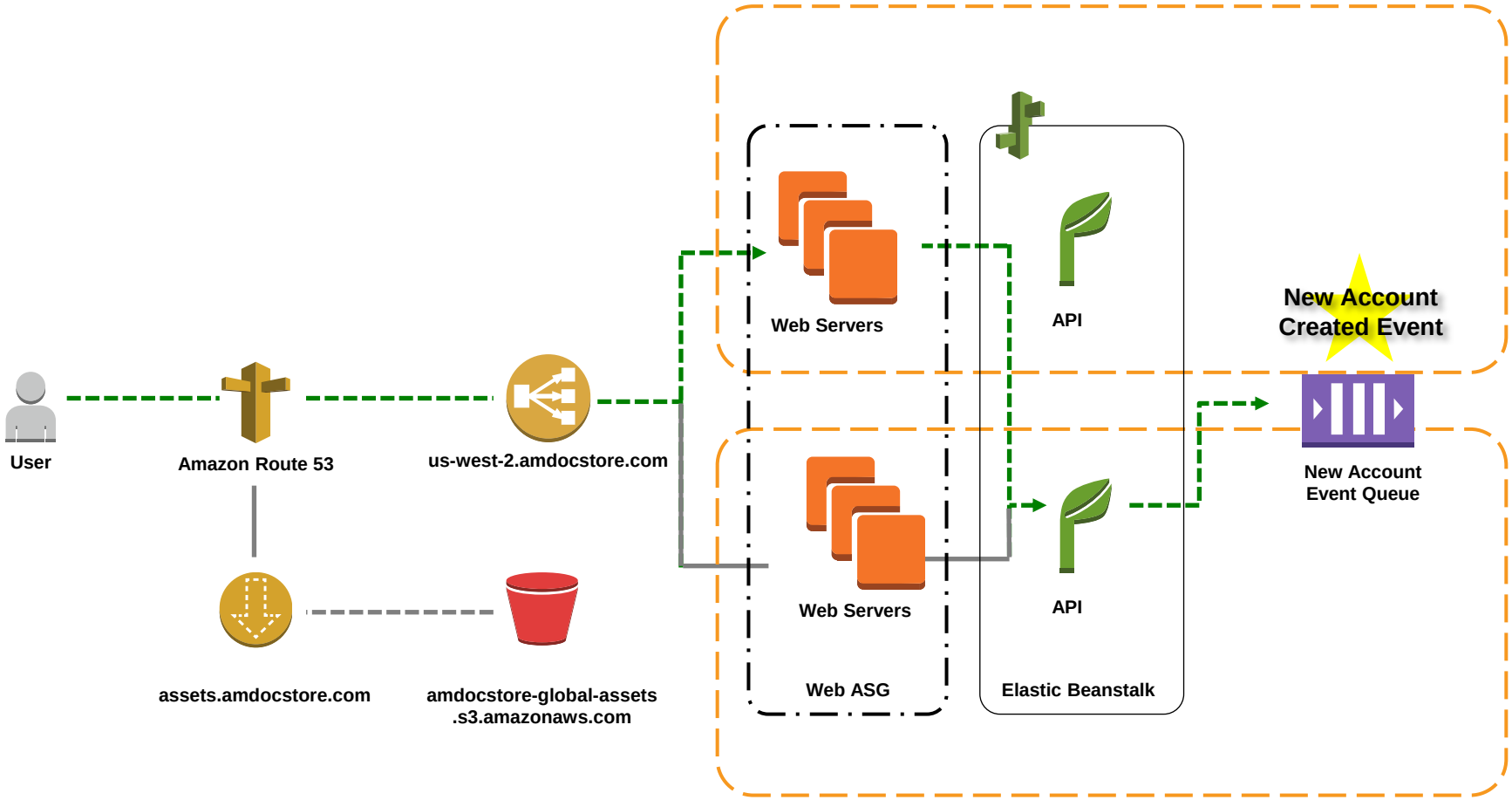
New Account Created Event: Triggered when a user creates a new account. Event message in queue includes username, password, and home region.

DocStore



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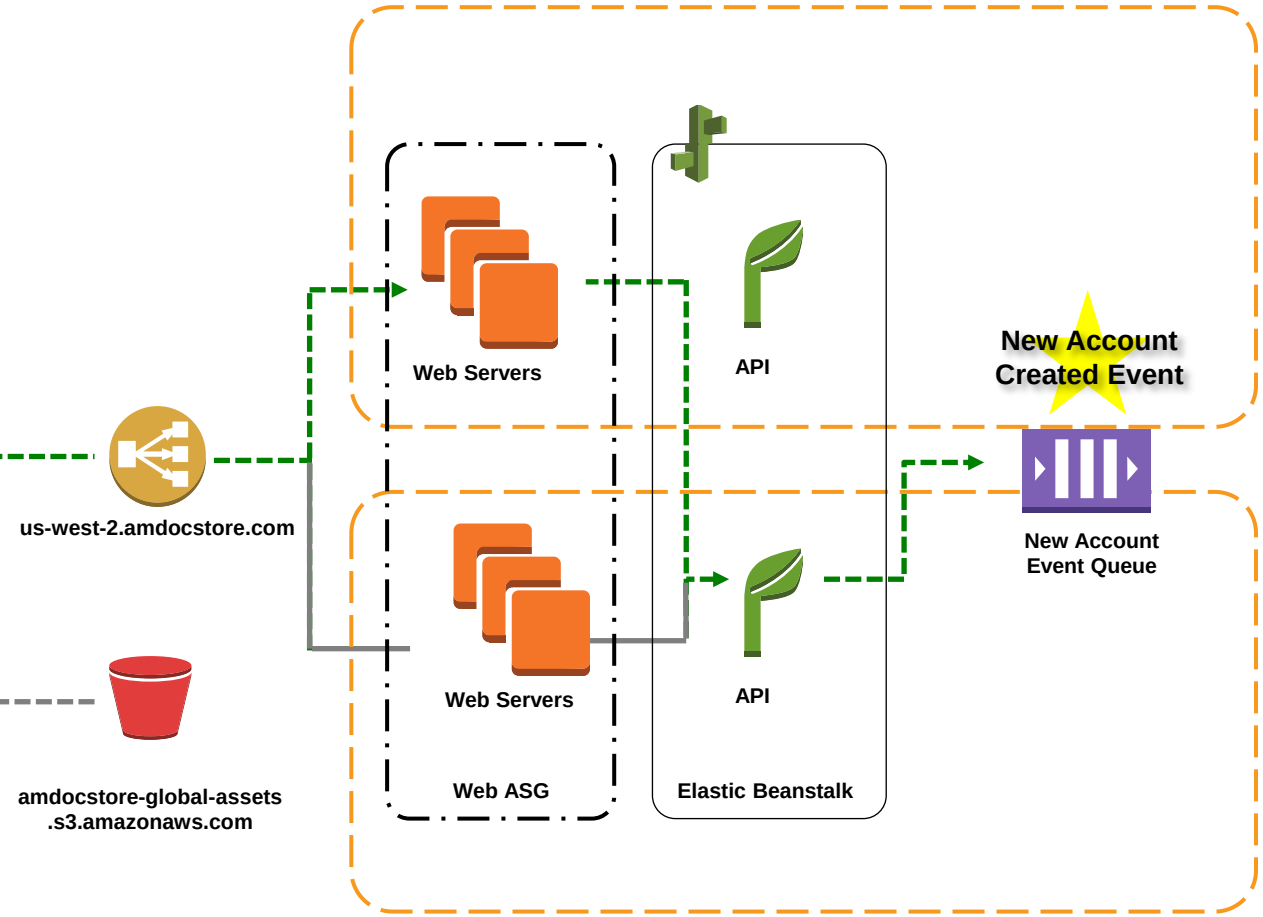
New Account Created Event: Triggered when a user creates a new account. Event message in queue includes username, password, and home region.

DocStore



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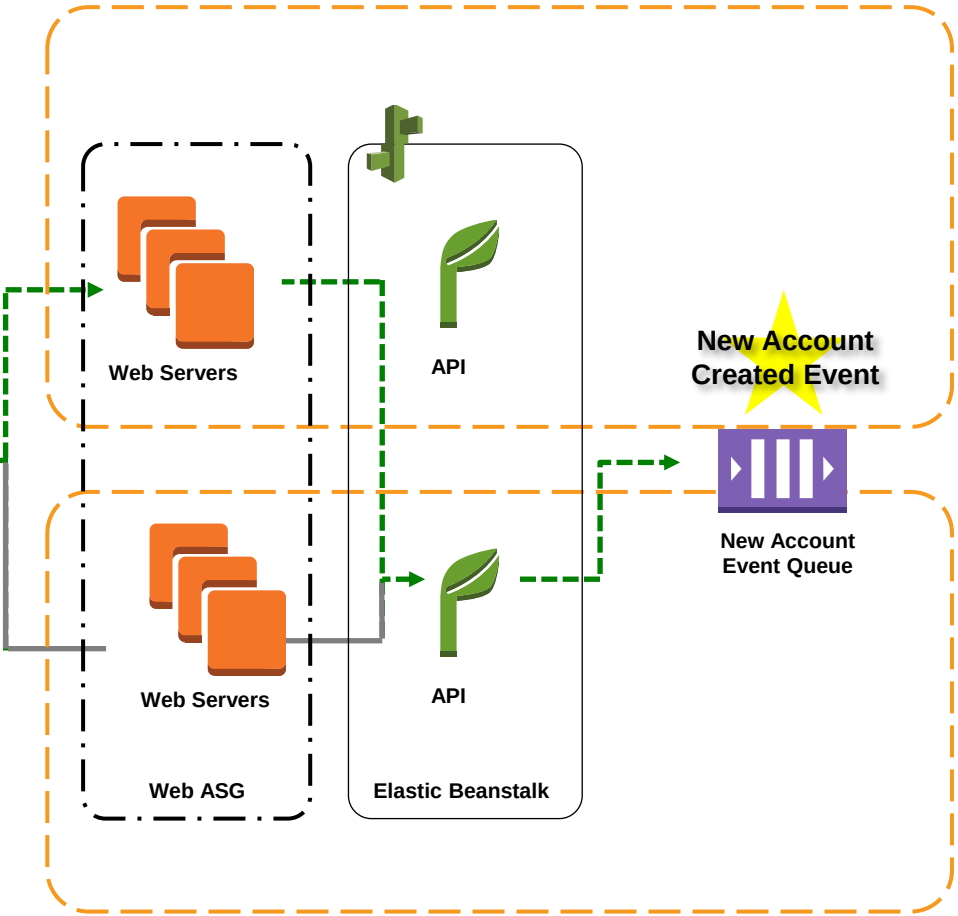
New Account Created Event: Triggered when a user creates a new account. Event message in queue includes username, password, and home region.

DocStore



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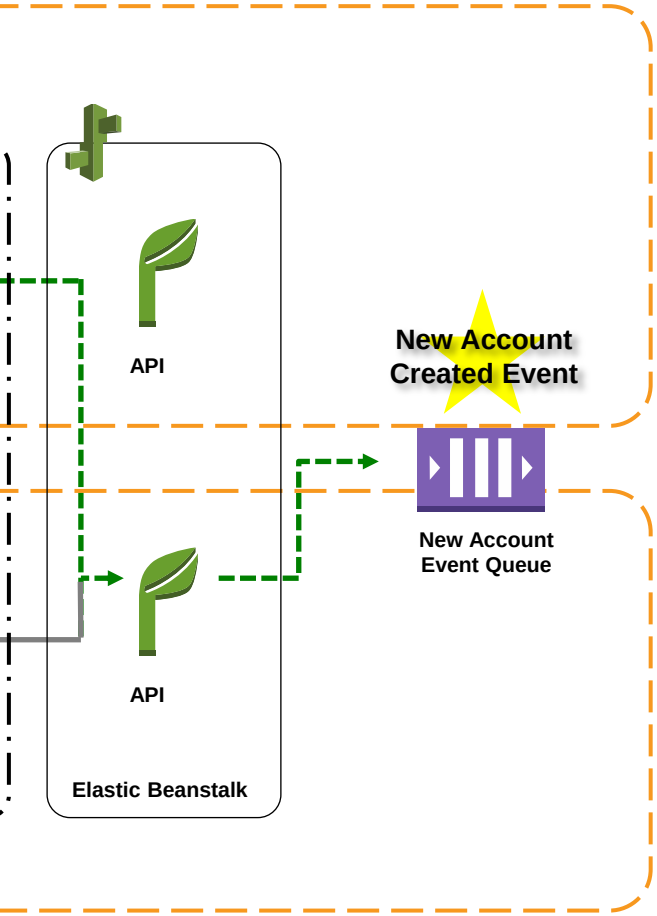
New Account Created Event: Triggered when a user creates a new account. Event message in queue includes username, password, and home region.

DocStore



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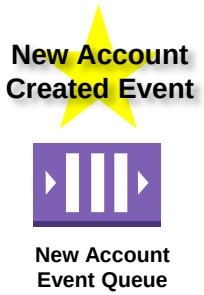
New Account Created Event: Triggered when a user creates a new account. Event message in queue includes username, password, and home region.

DocStore



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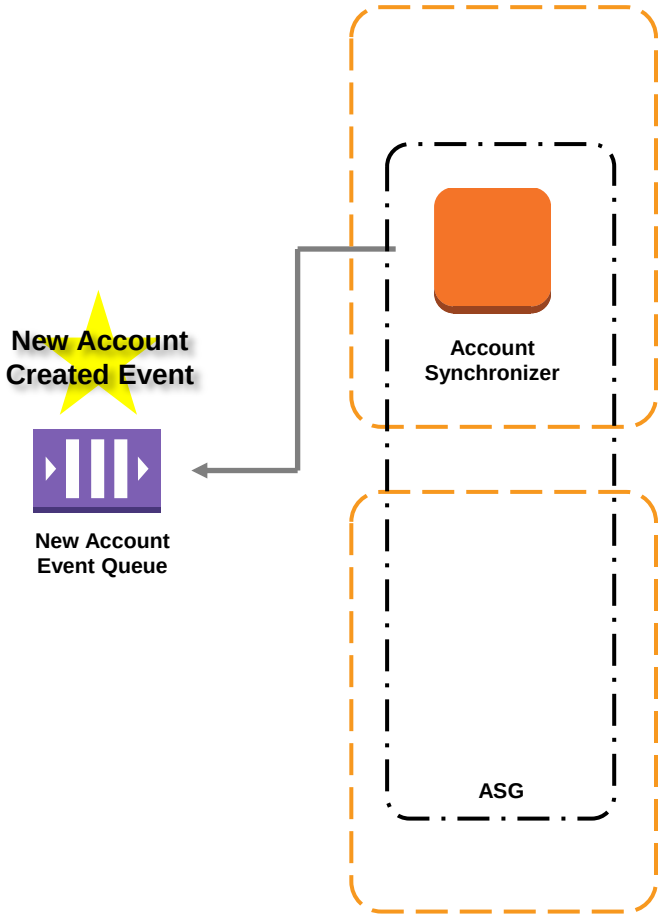
New Account Created Event: An instance running the **Account Synchronization servic**e polls the New Account Event Queue

DocStore



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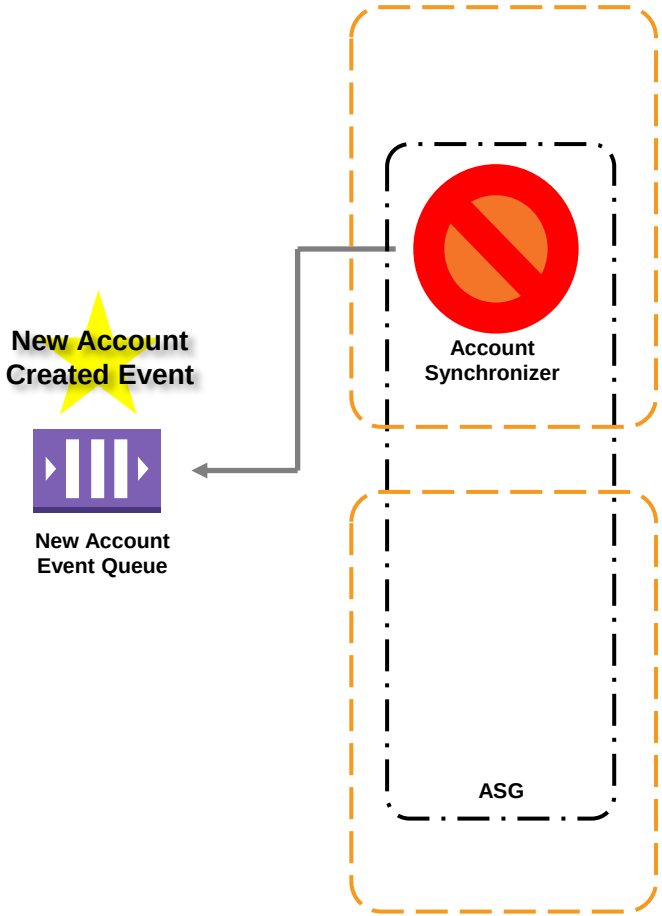
New Account Created Event: If the instance fails, Auto Scaling will launch a replacement

DocStore



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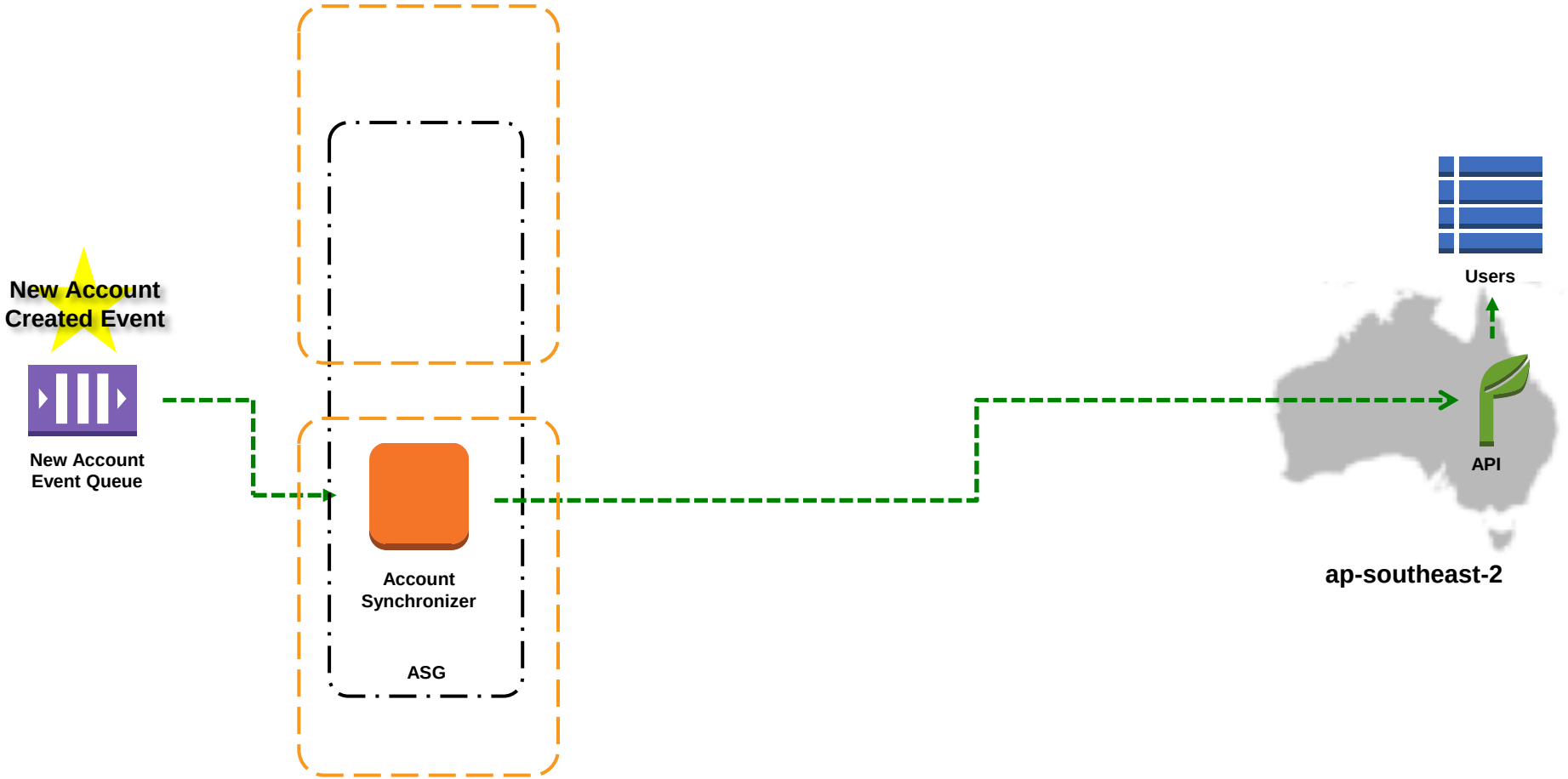
New Account Created Event: Account Synchronizer invokes API in ap-southeast-2 to synchronize new user's account data

DocStore



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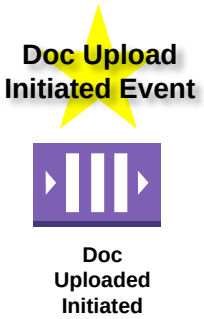
Doc Uploaded Initiated Event: When a user begins uploading a document to S3, an event is triggered so the upload can be tracked via a workflow

DocStore



Doc
Uploaded
Initiated

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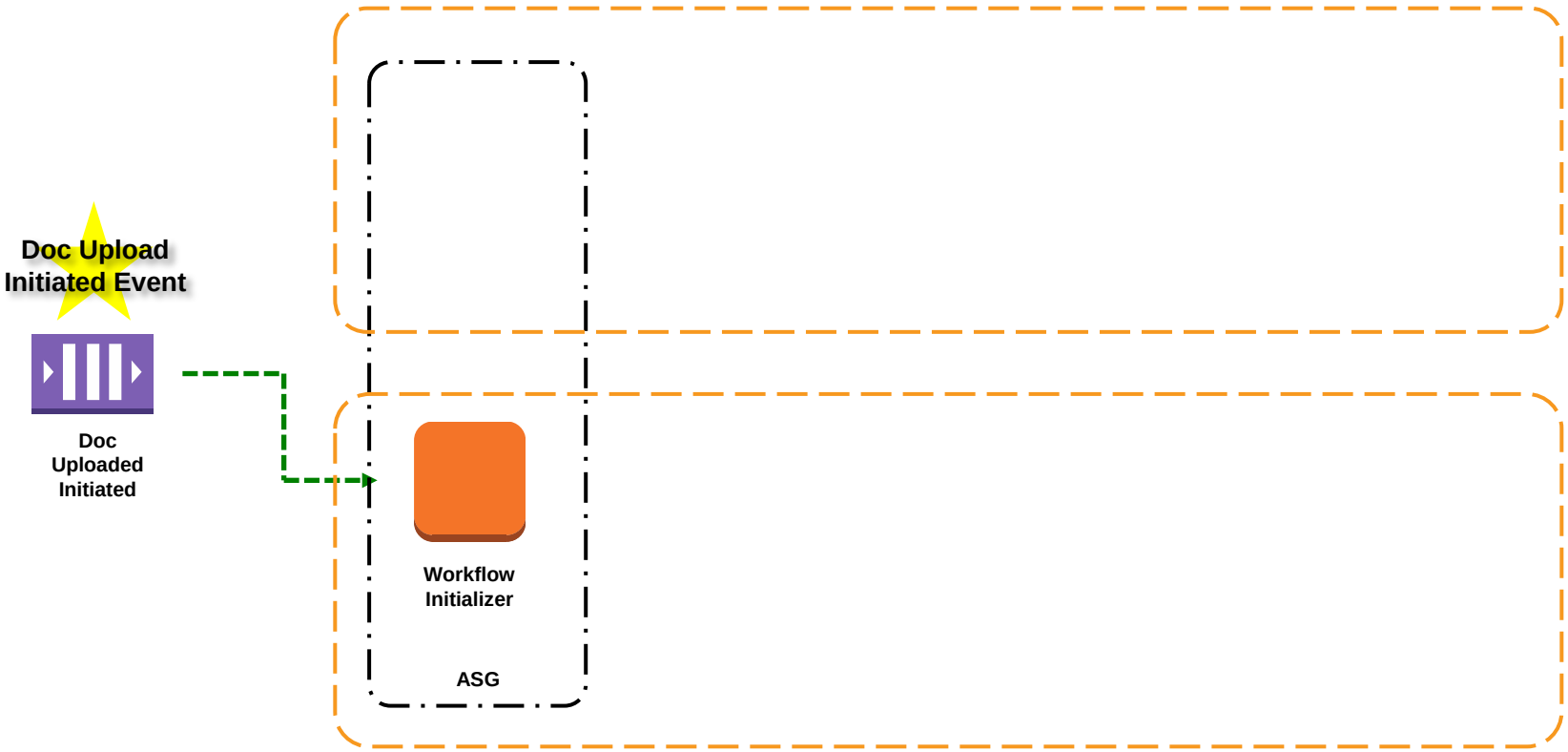
Doc Uploaded Initiated Event: When an event is received from the queue, the Workflow Initializer kicks off a SWF workflow execution

DocStore



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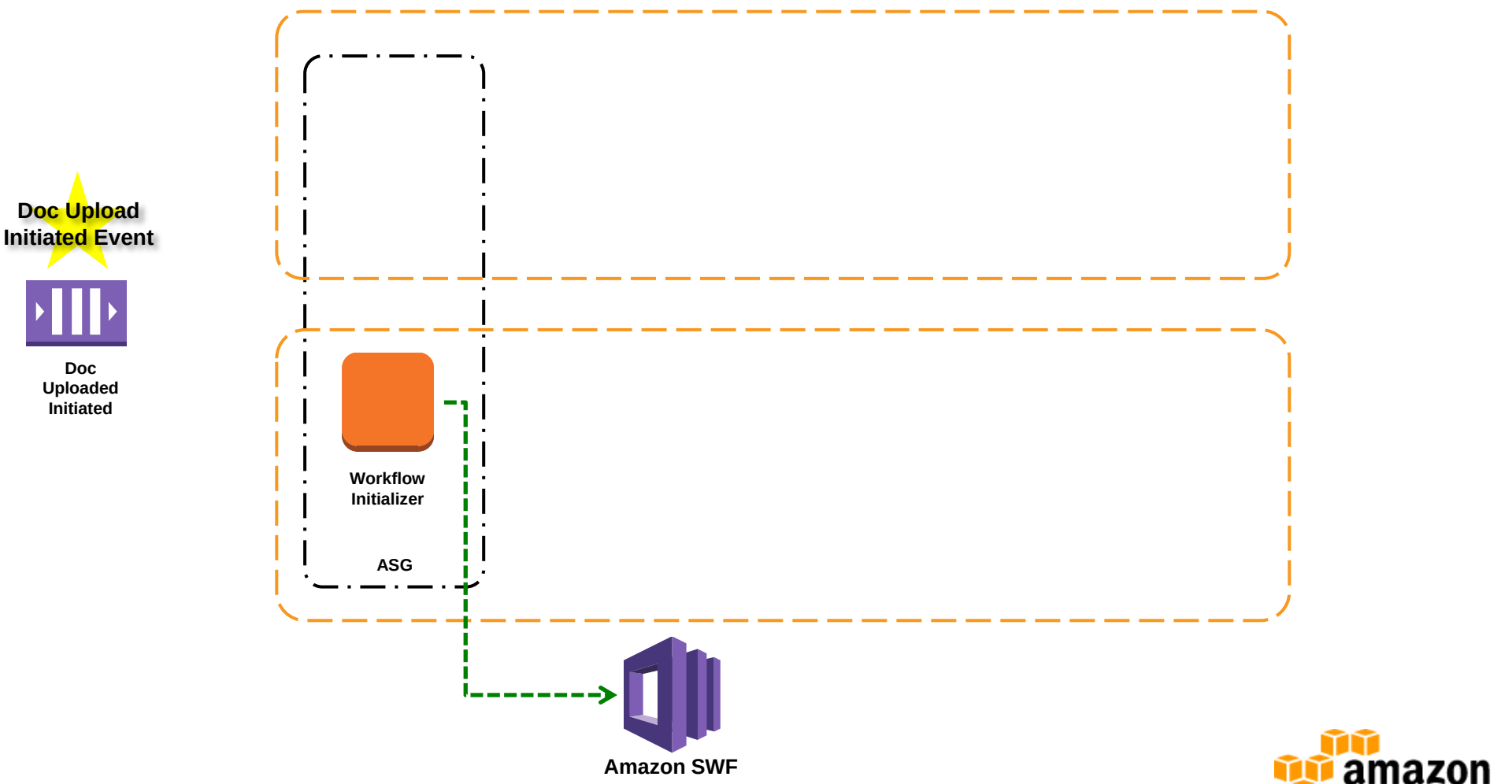

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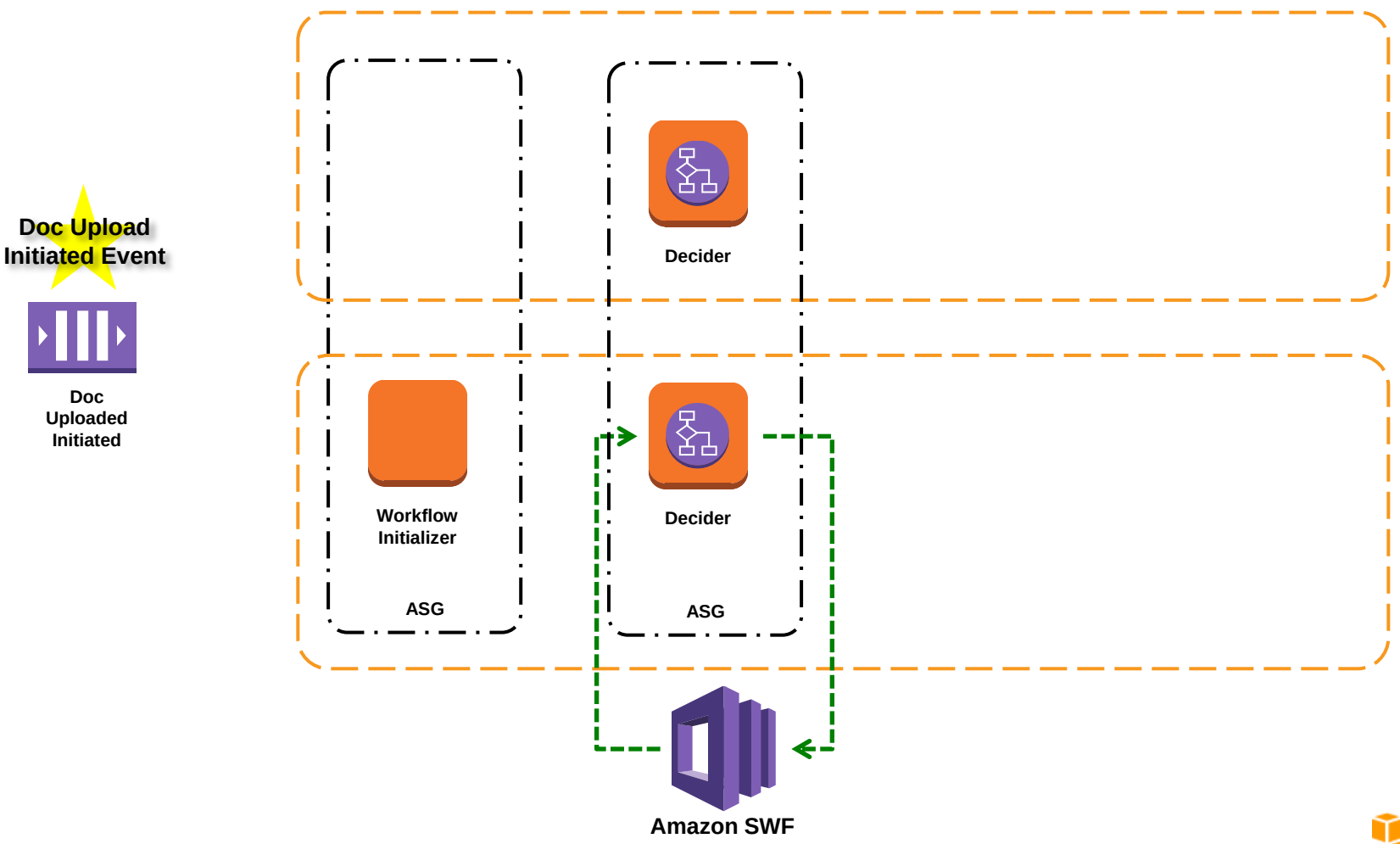
Doc Uploaded Initiated Event: A an instance running Decider code receives the **workflow execution started** task, and schedules a *Check Upload Status* activity

DocStore



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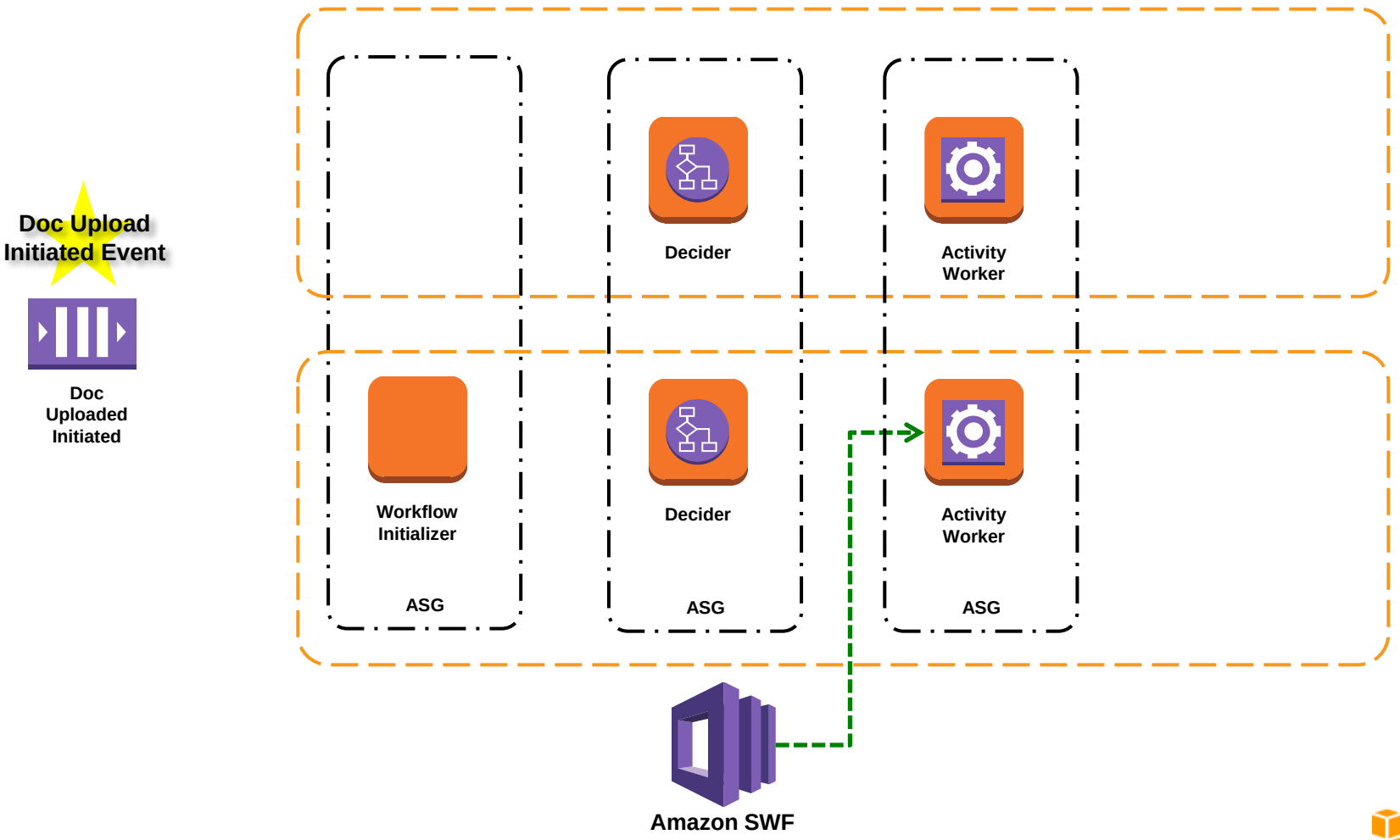
Doc Uploaded Initiated Event: A an instance running the Activity Worker code receives the *Check Upload Status* task

DocStore



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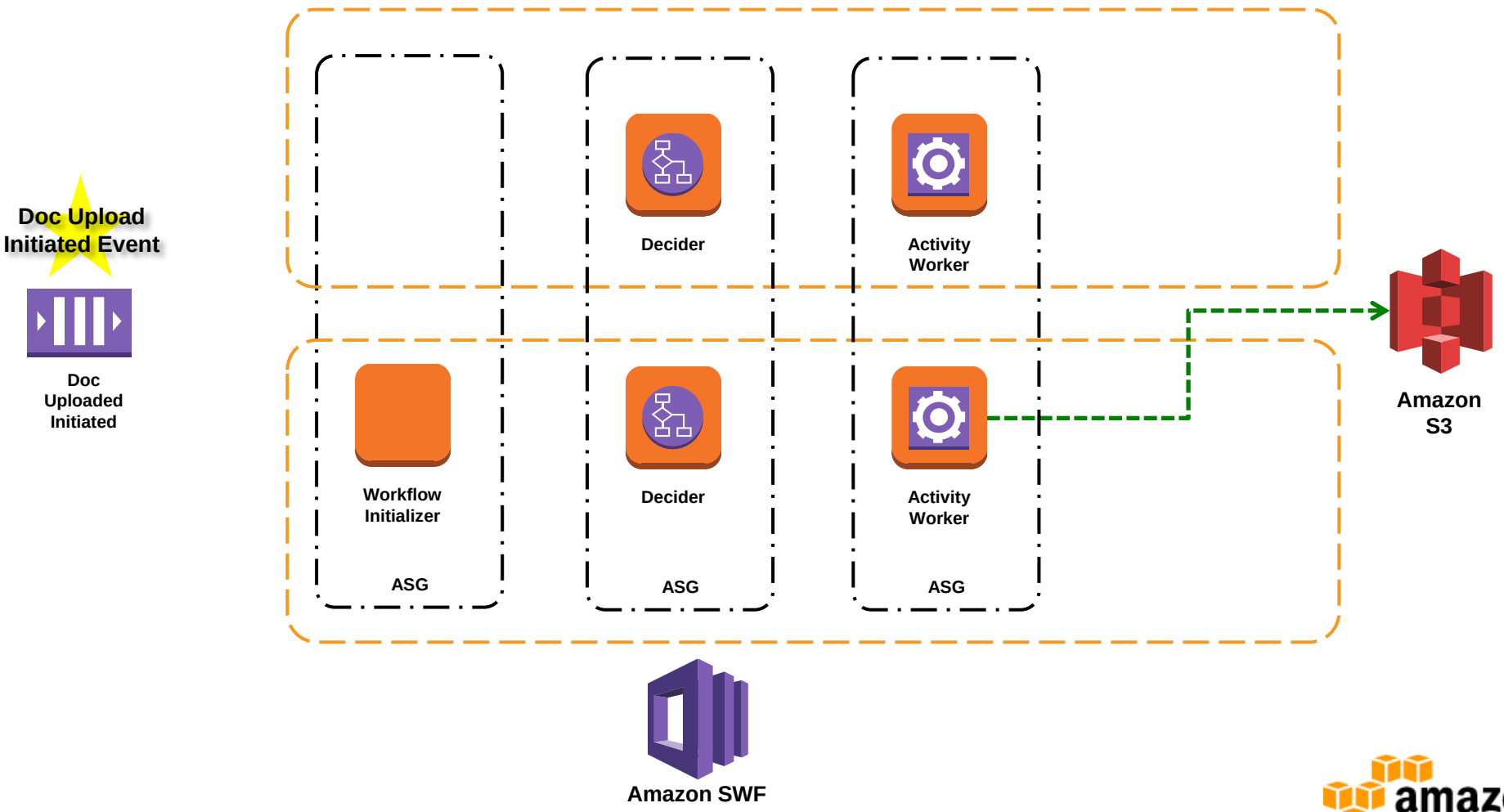
Doc Uploaded Initiated Event: The Activity Worker periodically checks S3 to determine if the doc upload has completed (i.e., the object exists in S3)

DocStore



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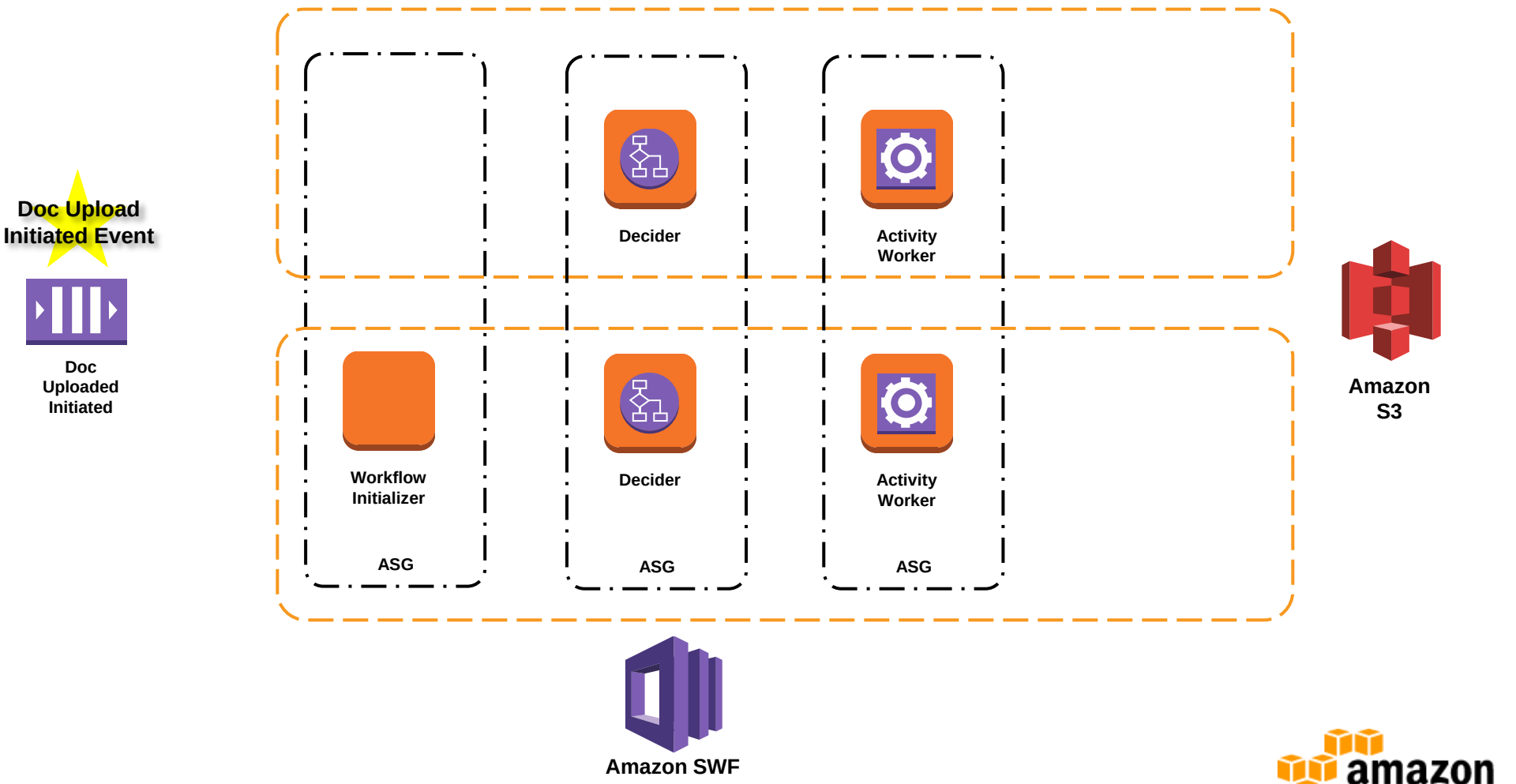
Doc Uploaded Initiated Event: Once the document is detected in S3, a final task is scheduled in the near future to ensure that the document has been properly processed by the **Doc Upload Complete** workflow

DocStore



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Doc Uploaded Complete Event: When a document upload has been complete, it needs to be processed

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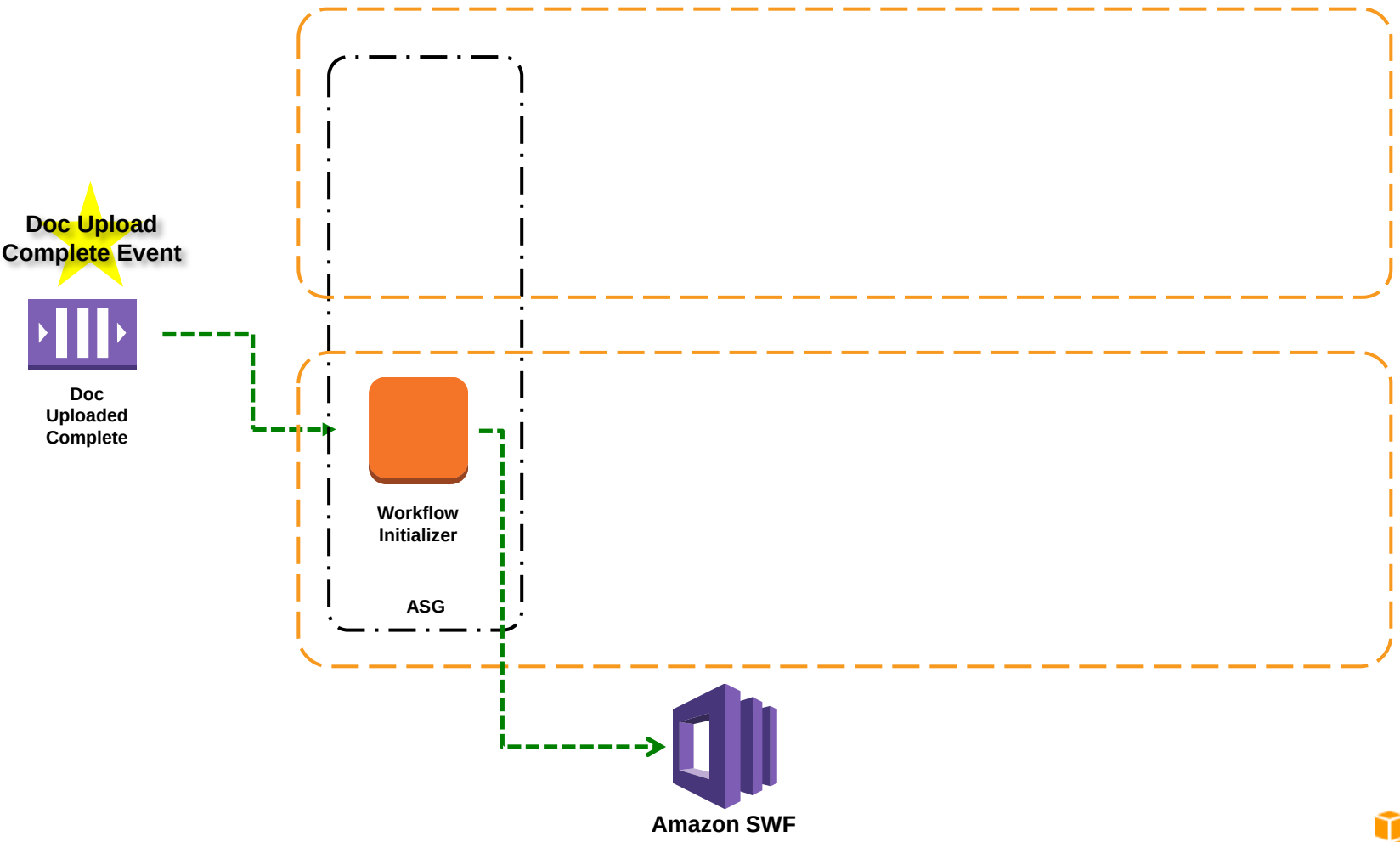
Doc Uploaded Complete Event: A workflow initiaizer determines the appropriate workflow to initiate (based on customer type, document type, etc)

DocStore



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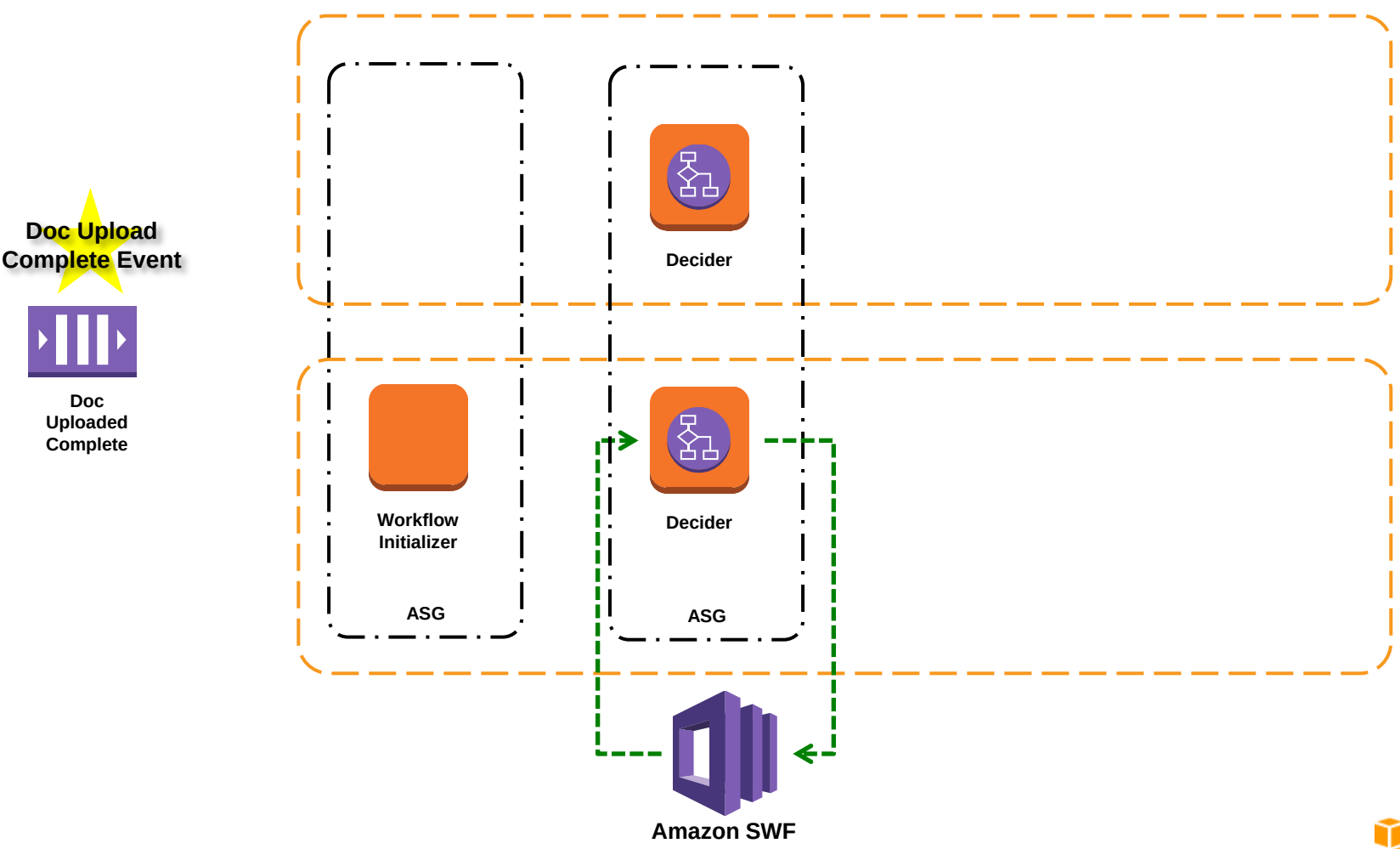
Doc Uploaded Complete Event: A decider schedules the appropriate activity based on the document type.

DocStore



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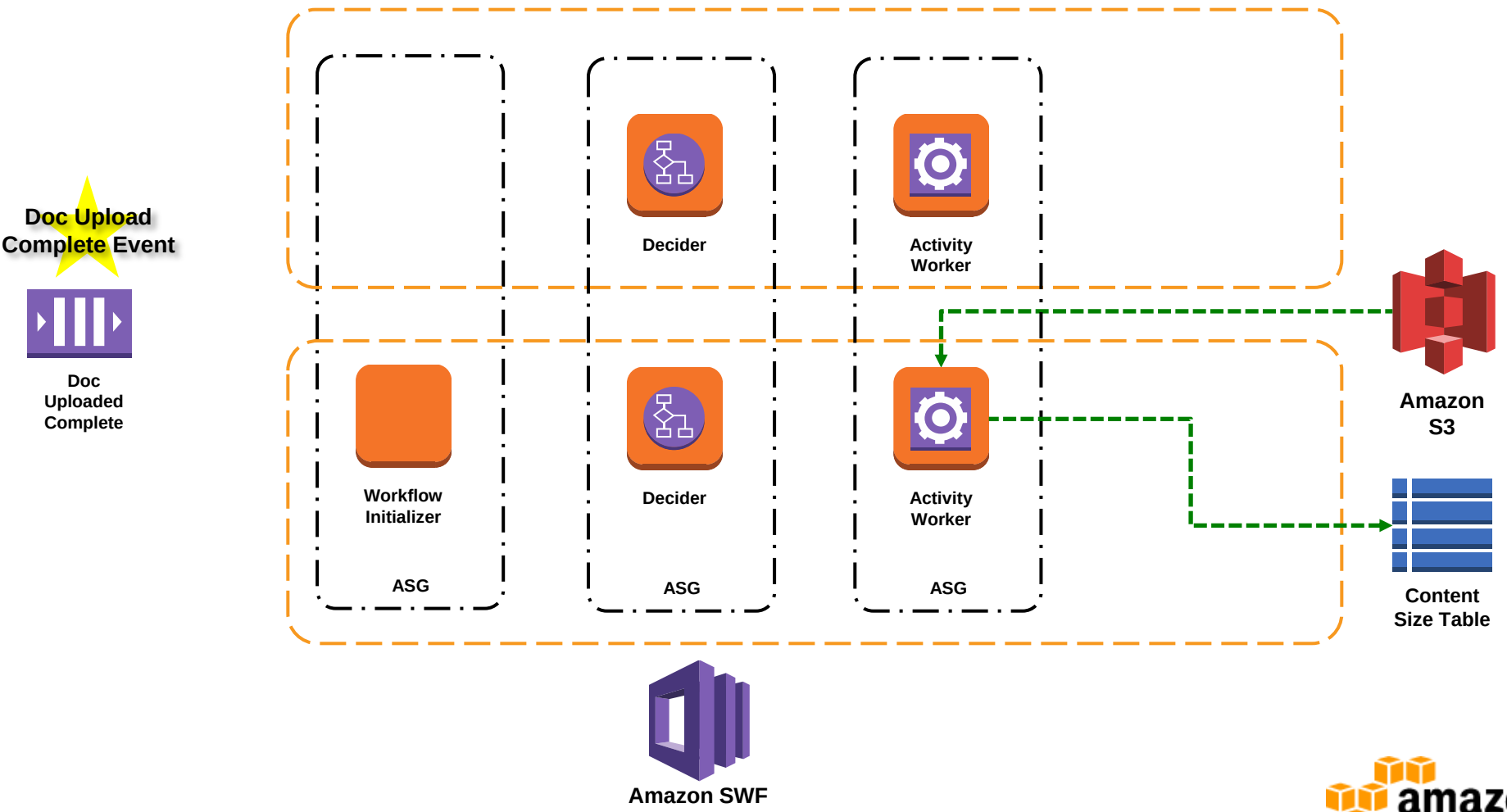
Doc Uploaded Initiated Event: The **content-length** metadata property of every object should be retrieved from S3 and used to increment a **counter tracking the total size of all uploaded objects**

DocStore



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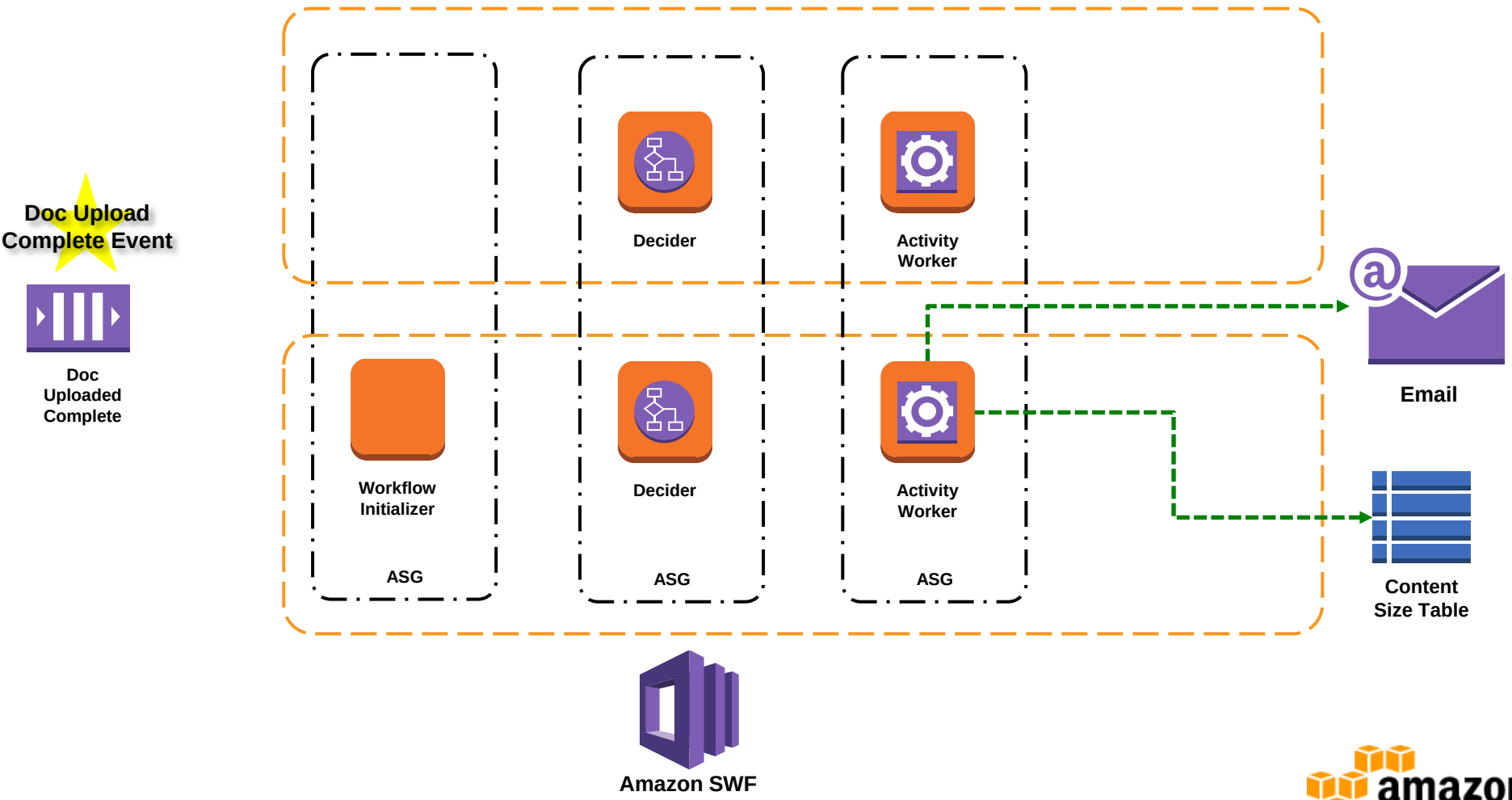
Doc Uploaded Initiated Event: A counter tracking the total content size uploaded by each user is also incremented. If the new doc causes the user to exceed his allocated amount, a flag is set and the user will receive an email via **SES**

DocStore



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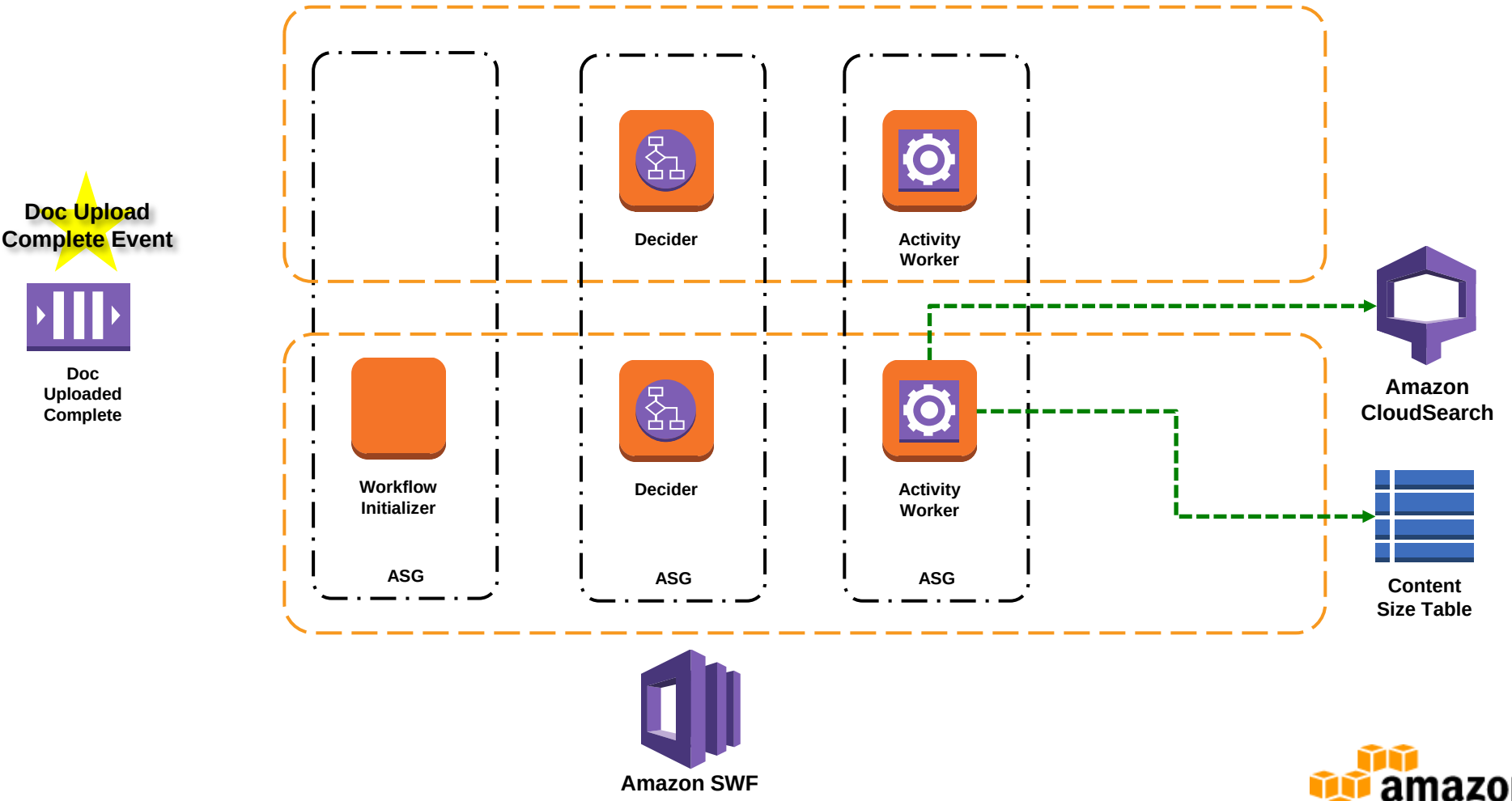
Doc Uploaded Initiated Event: If the document was uploaded by a premium user and it has text content (e.g., PDF, DOCX, etc), the full-text content will be indexed in **CloudSearch**

DocStore



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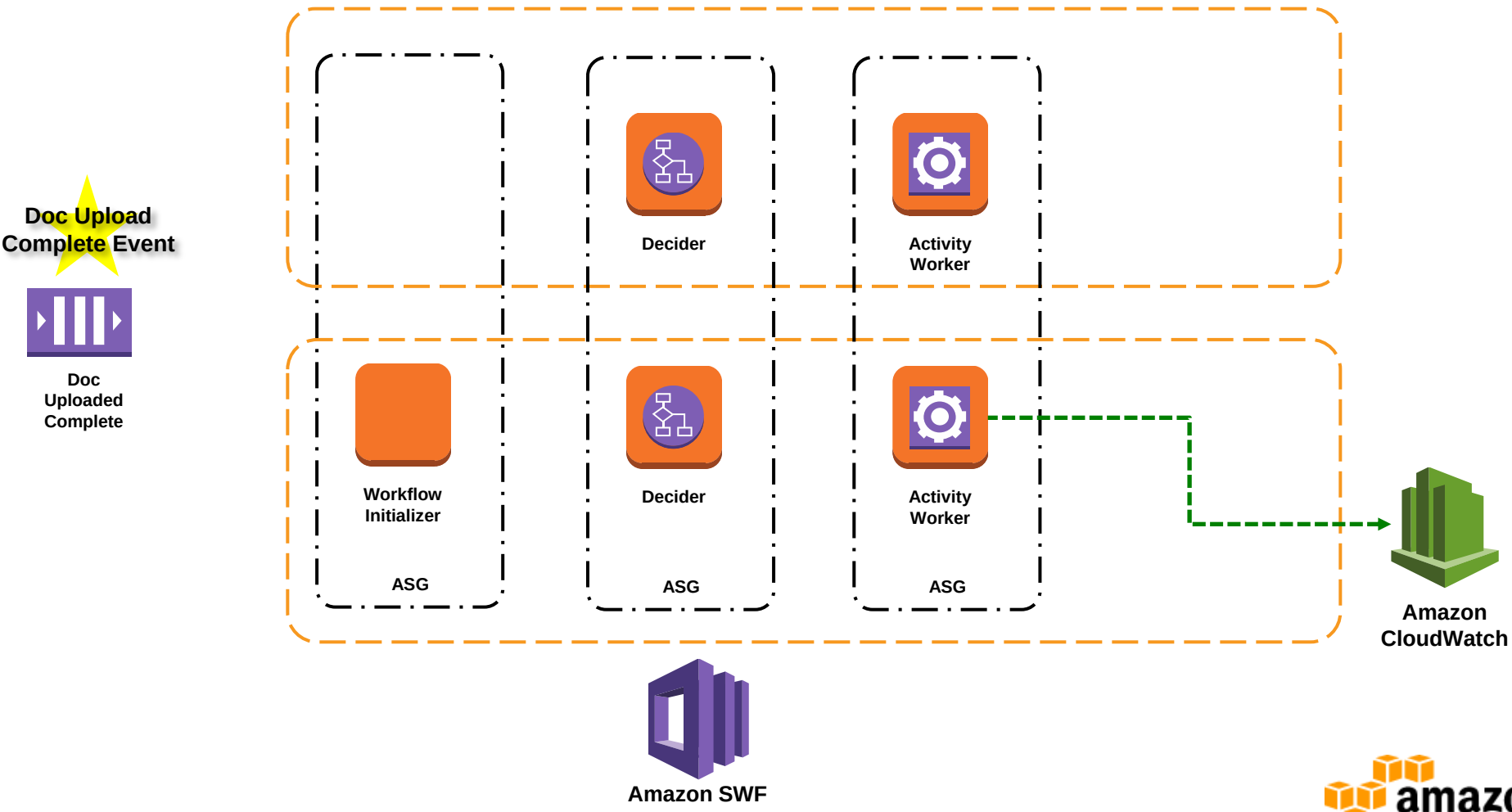
Doc Uploaded Initiated Event: Finally, several **custom metrics** are also put to **CloudWatch**, allowing us to monitor how many new documents are being uploaded by user type, how big the documents are, etc.

DocStore



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