Generating witty comments...

Let's go!

Getting to know the Amazing Amazon Web Services

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University of Naples, Federico II

A LITTLE BIT OF CONTEXT

Cloud Computing

> Cloud computing is the on-demand delivery of computing resources through a cloud services platform via the internet with pay-as-you-go pricing.

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- **Infrastructure as a Service (IaaS)**
  The service vendor provides users access to computing resources such as servers, storage and networking.

Service Models: a visual comparison

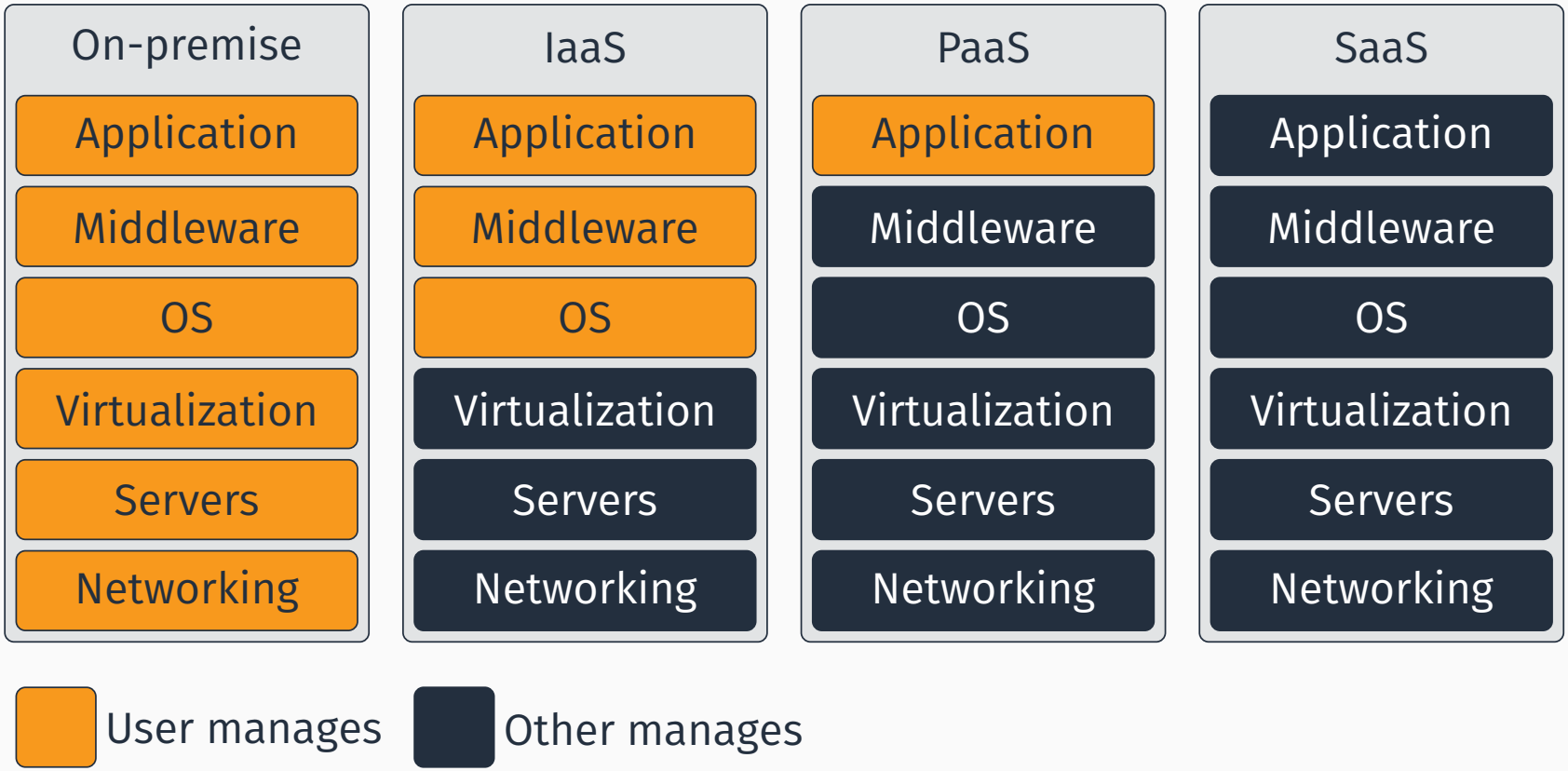
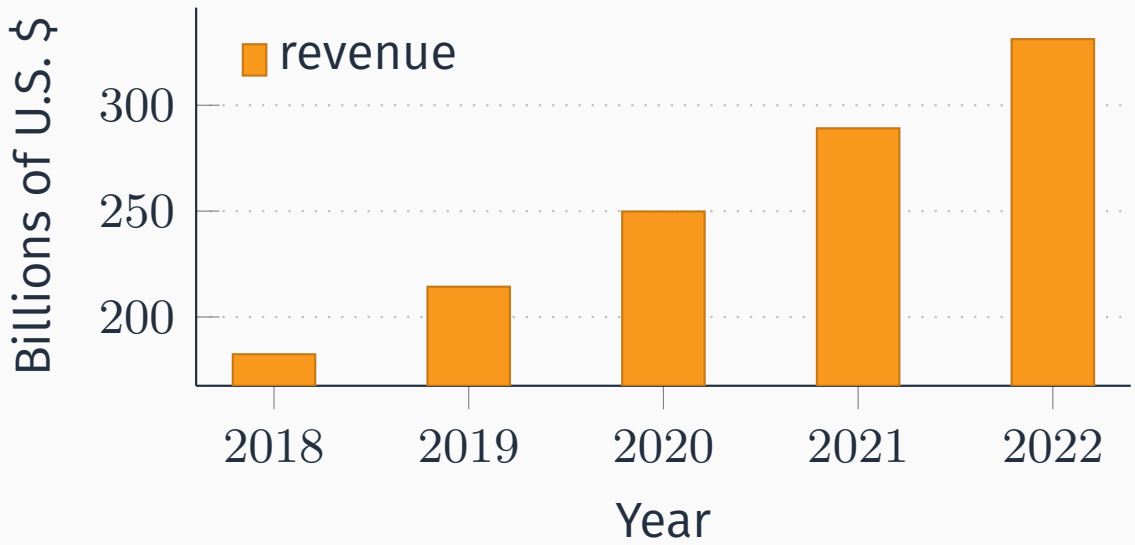


Figure 1: A service models comparison

Some stats

Worldwide Public Cloud Services Revenue Forecast (Billions of U.S. Dollars) [Gar19]

2018	2019	2020	2021	2022
182,4	214,3	249,8	289,1	331,2



The bigwigs

- Google

Google Cloud

The bigwigs

- Google
- IBM

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- Google
- IBM
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- IBM
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Public Cloud Adoption

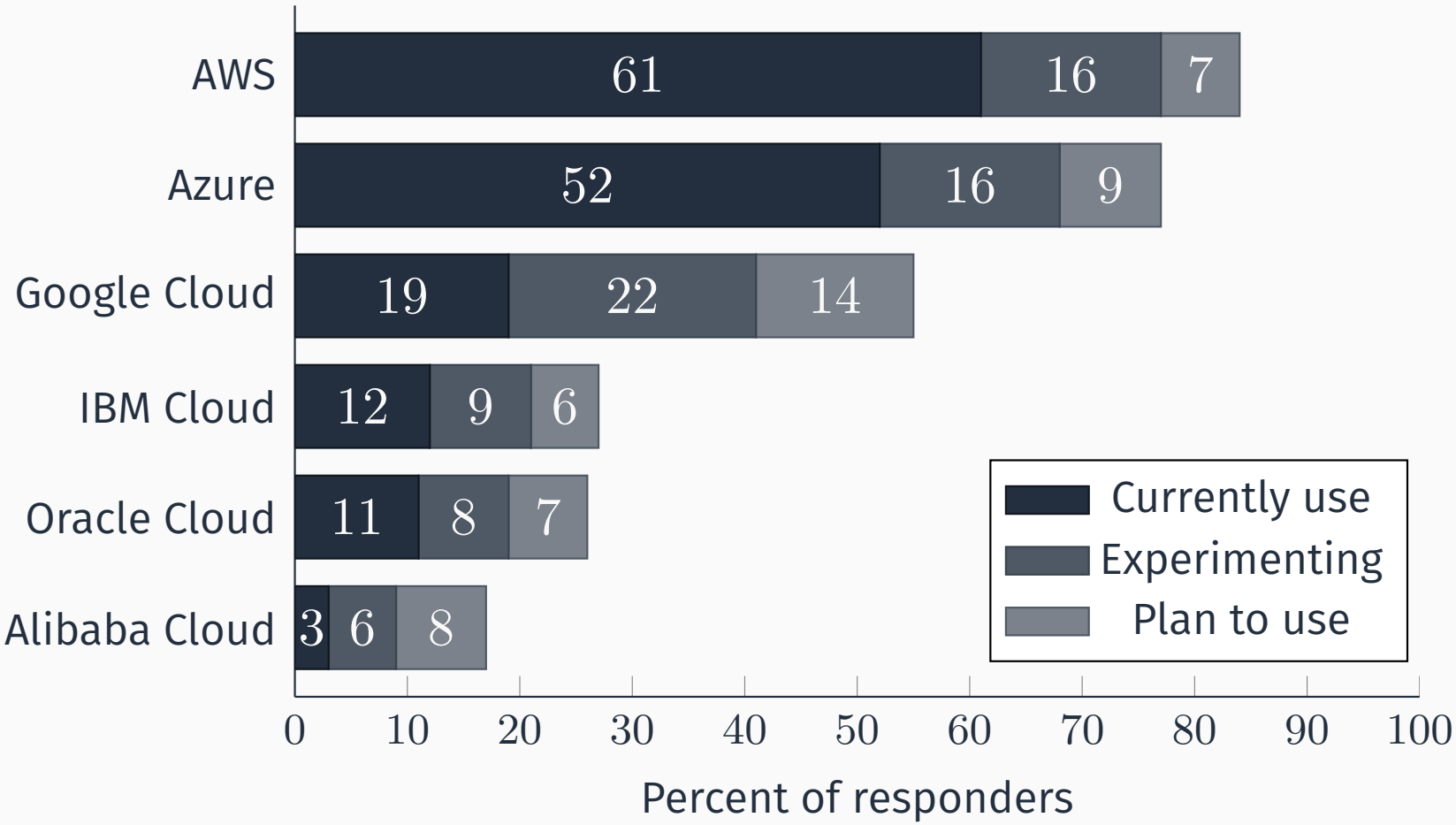

Figure 2: Public Cloud Adoption in January 2019 [Fle19]

The Multi-cloud Trend

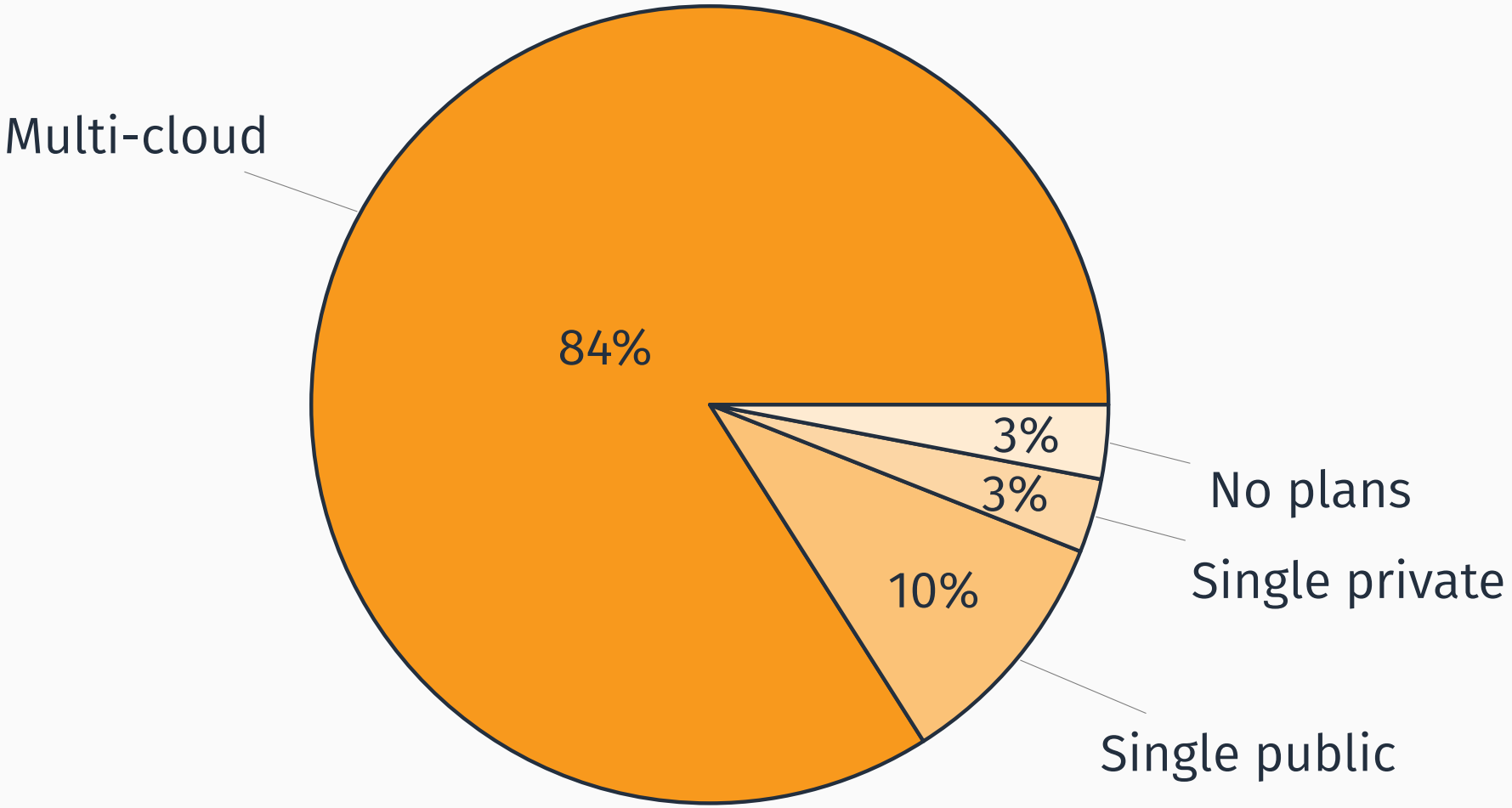

Figure 3: Enterprise cloud strategy in Jan 2019 (1000+ Employees) [Fle19]

An AWS bestiarium

Amazon Web Services

Amazon Web Services is a collection of cloud-based services.

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Database services

Relational Database Service (RDS)

- Set up, operate a relational database in the cloud.

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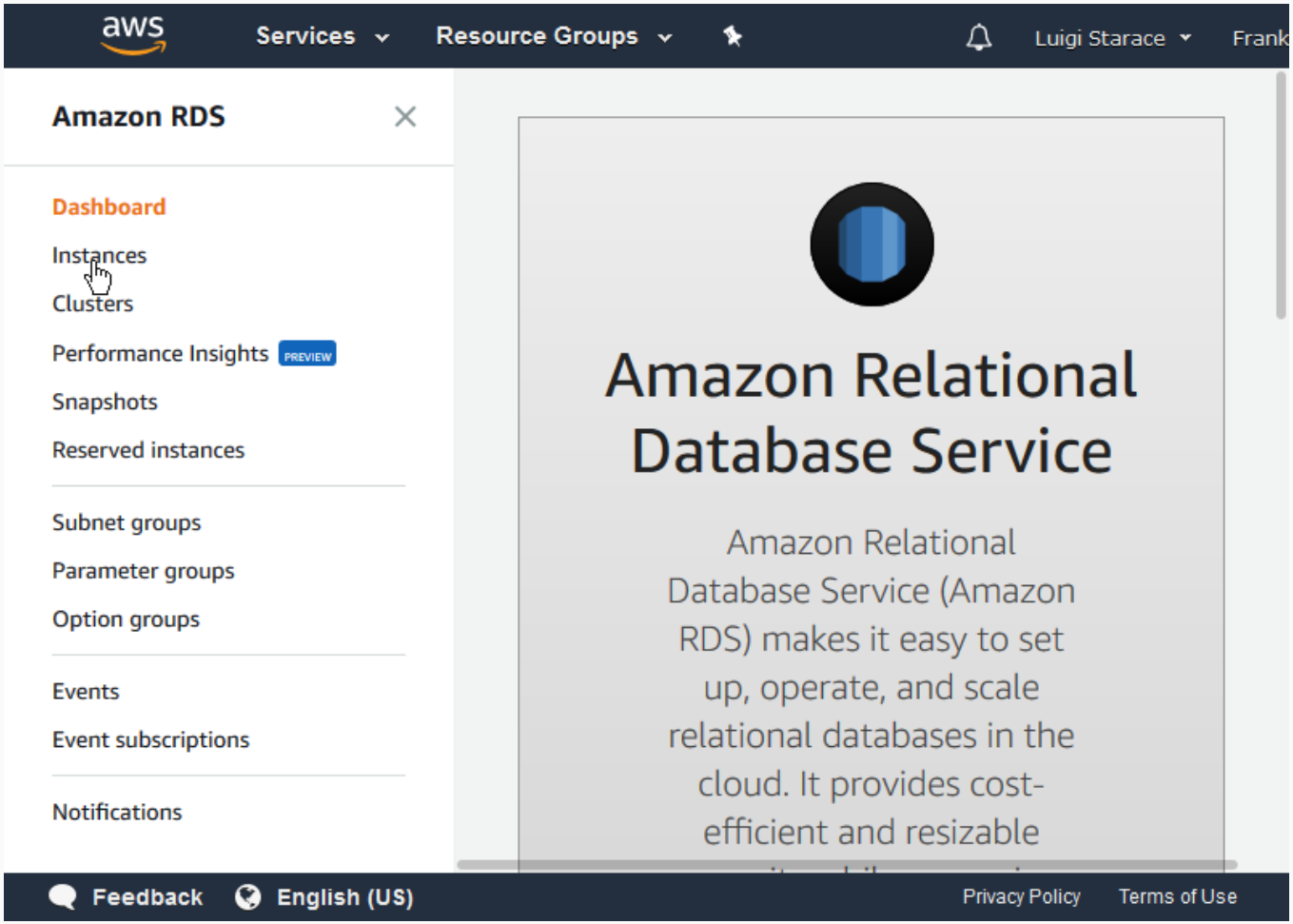
  - Oracle, MS SQL Server
  - Amazon Aurora

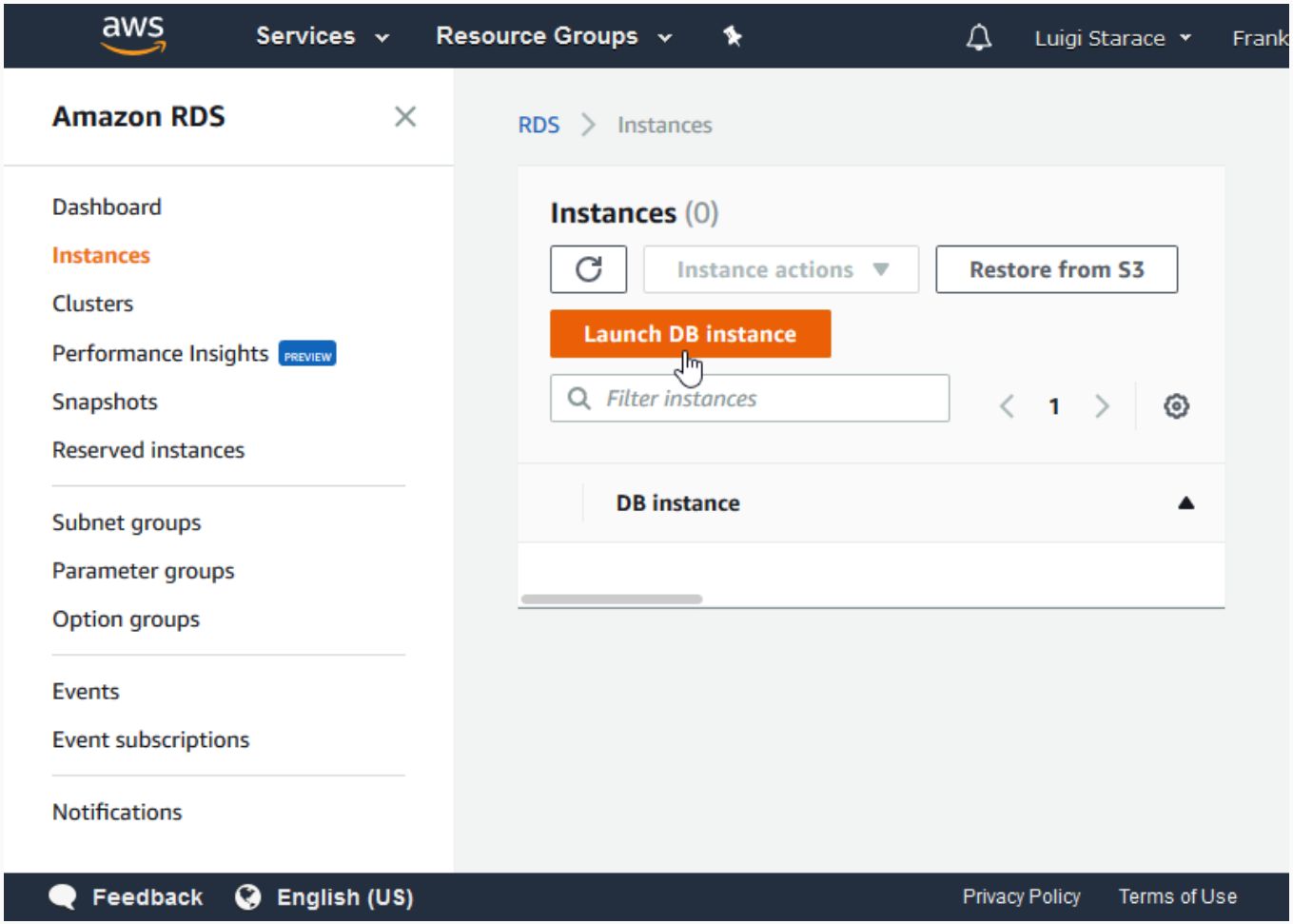
RDS: Create a Database Instance

Go to the RDS Console and select “instances” .



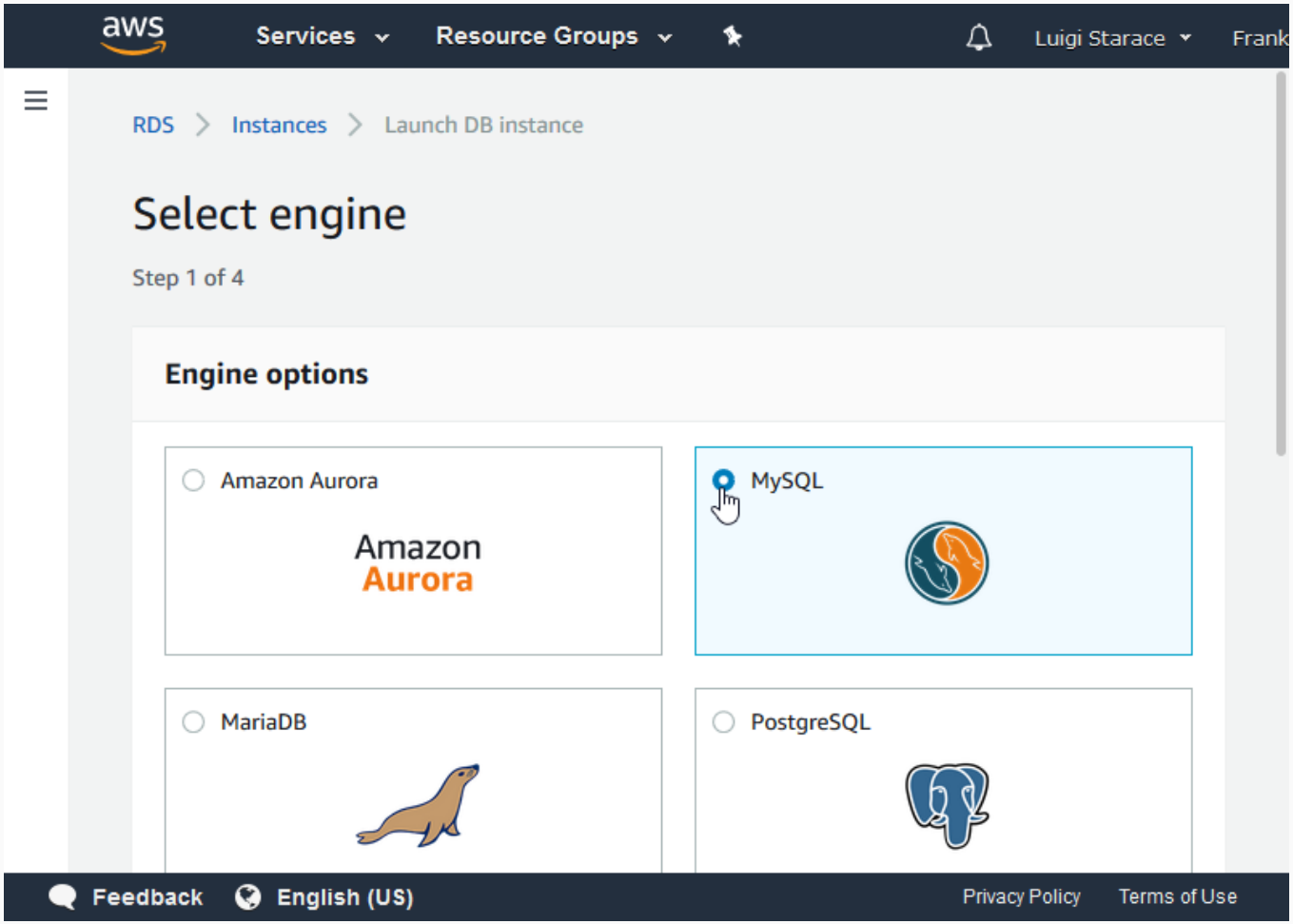
RDS: Create a Database Instance

Select “Launch DB instance” .



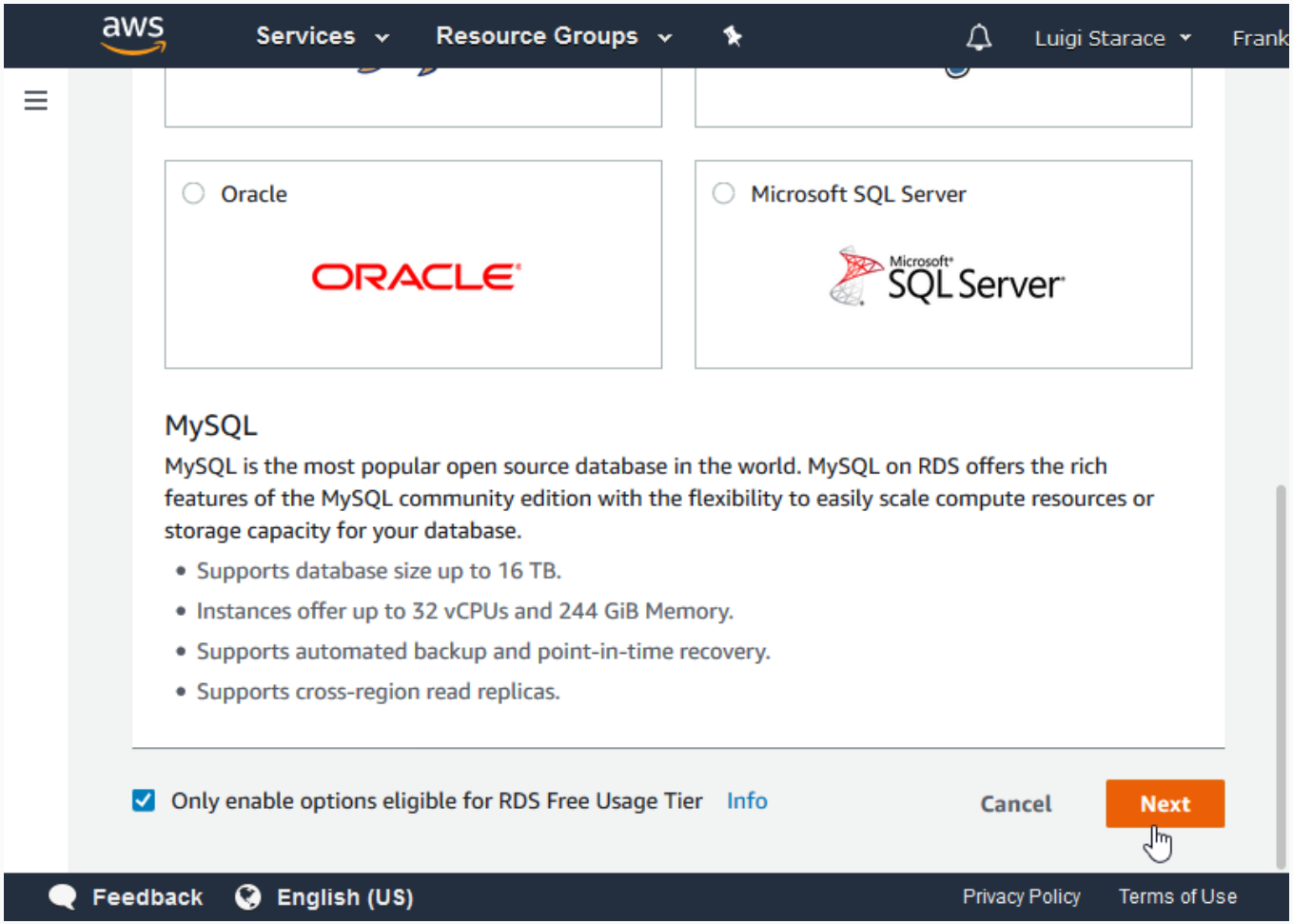
RDS: Create a Database Instance

Select MySQL DBMS.



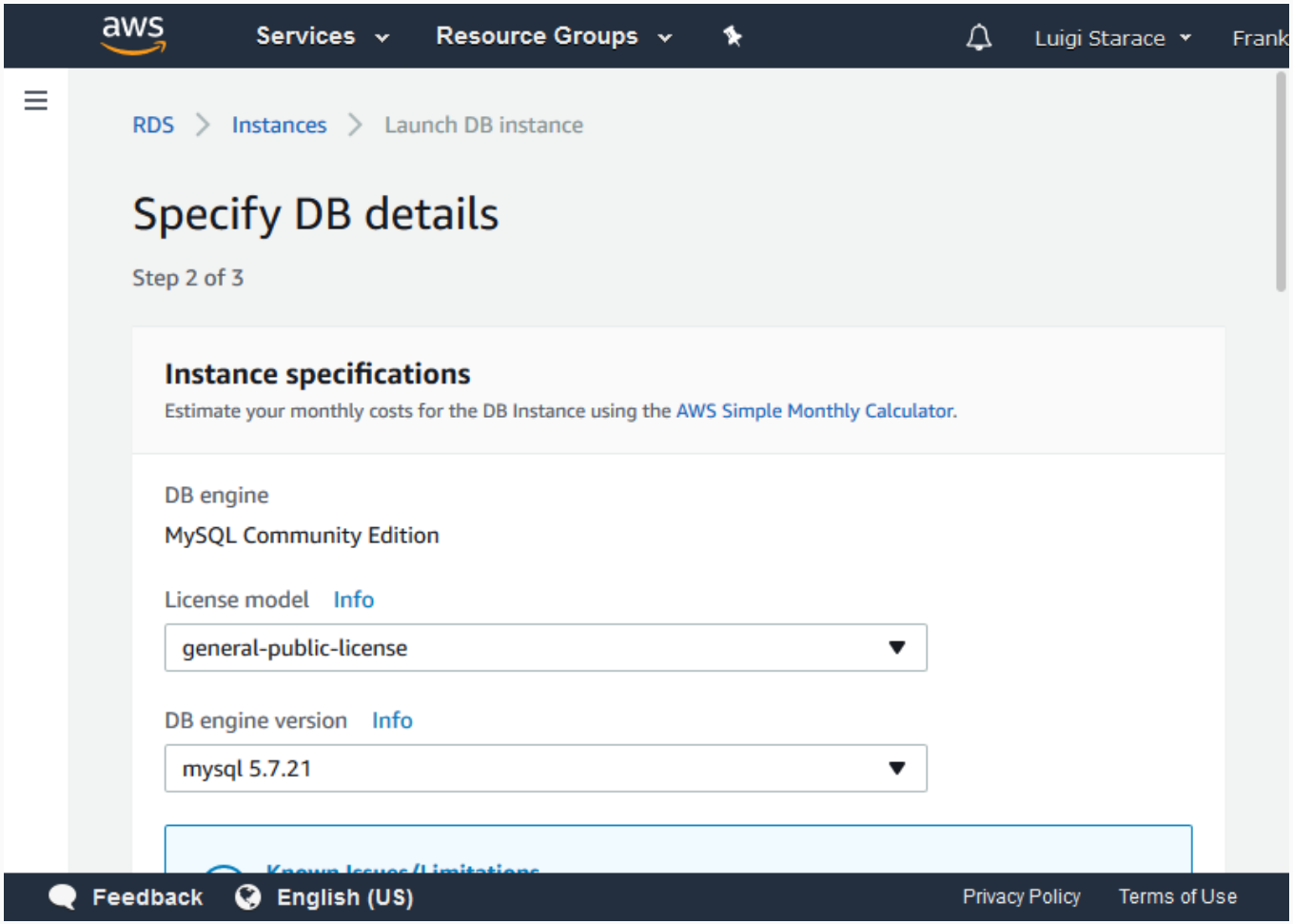
RDS: Create a Database Instance

Enable only free-tier options and continue.



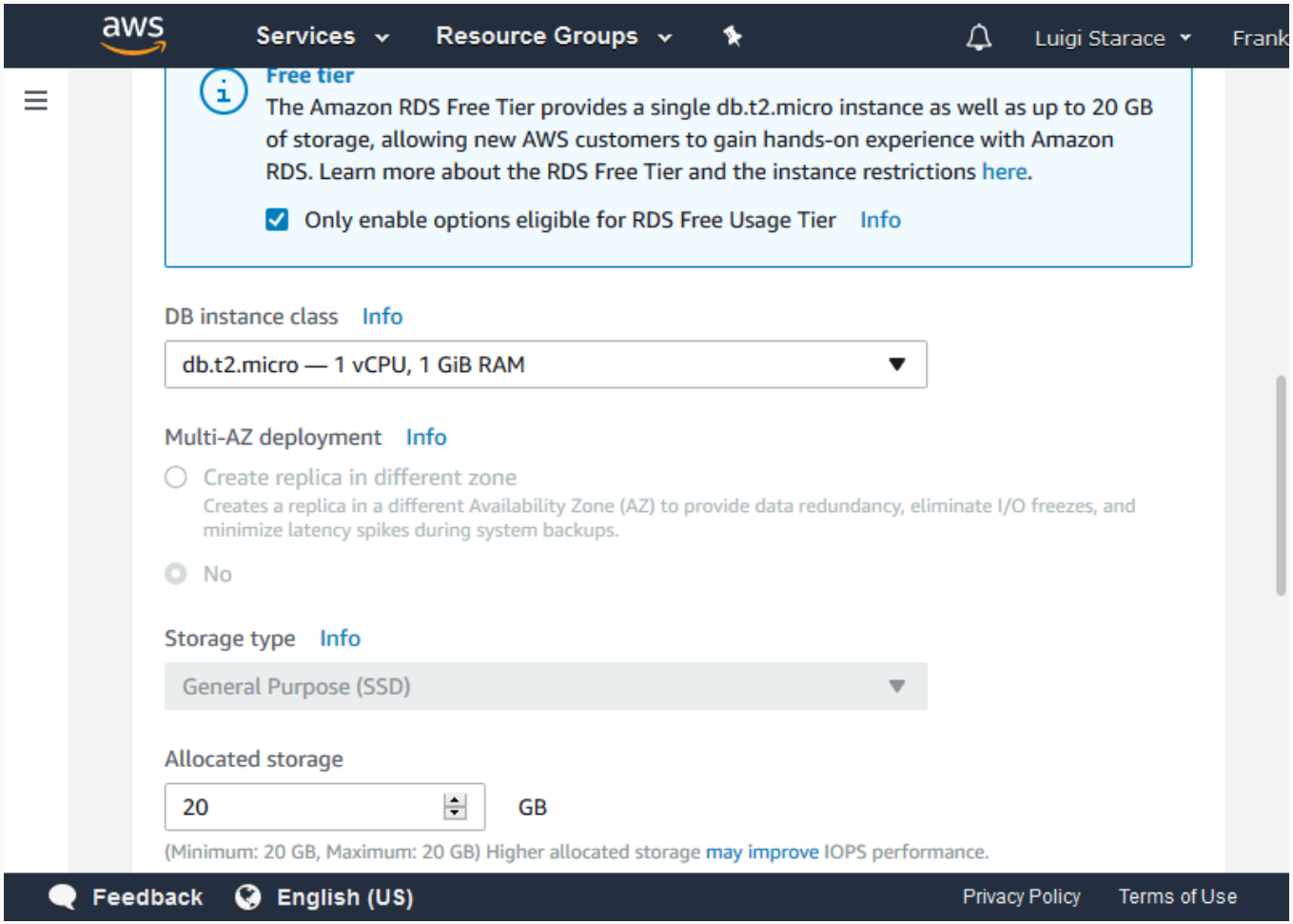
RDS: Create a Database Instance

Select MySQL version `5.7.21`



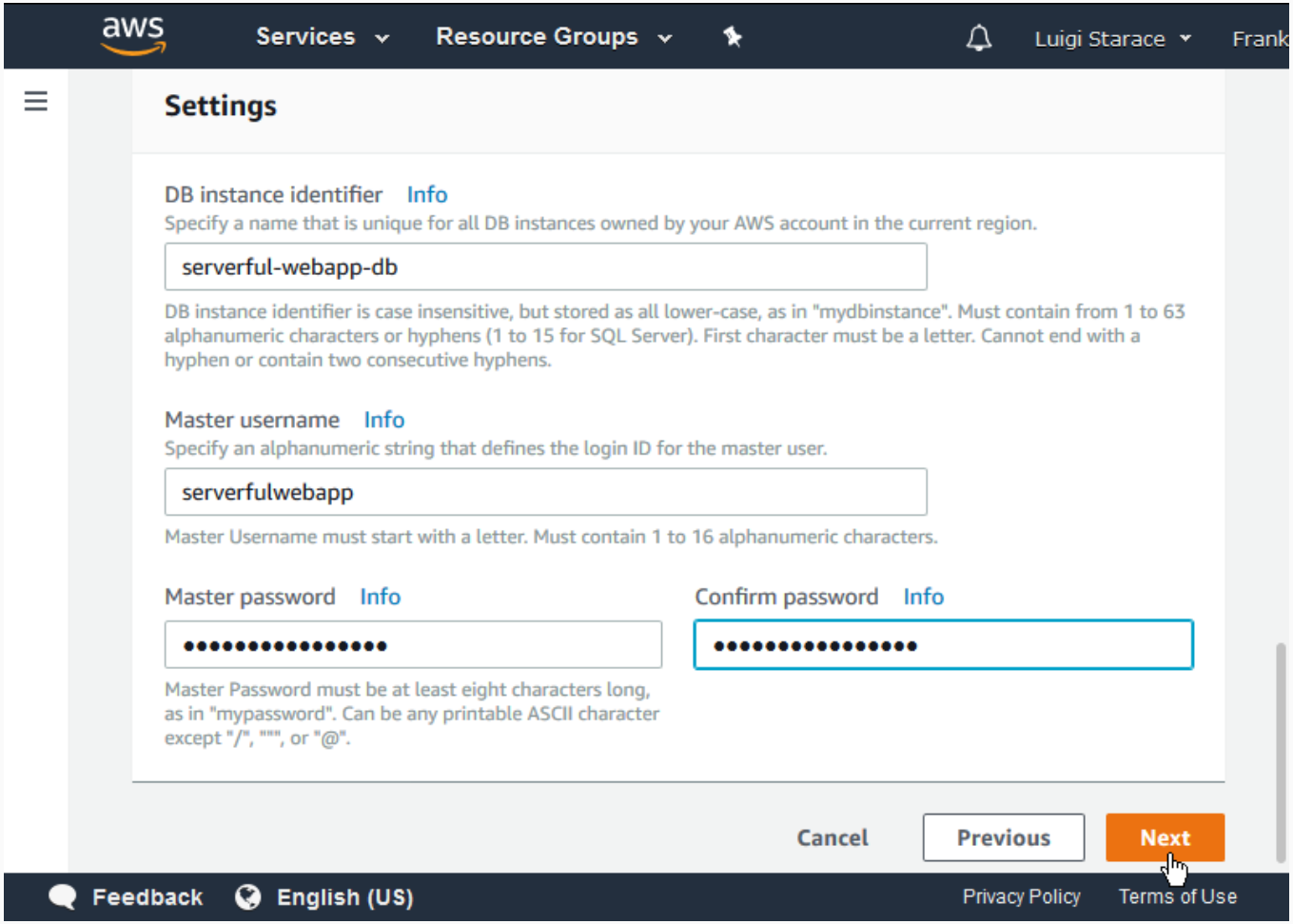
RDS: Create a Database Instance

Select `db.t2.micro` instance.



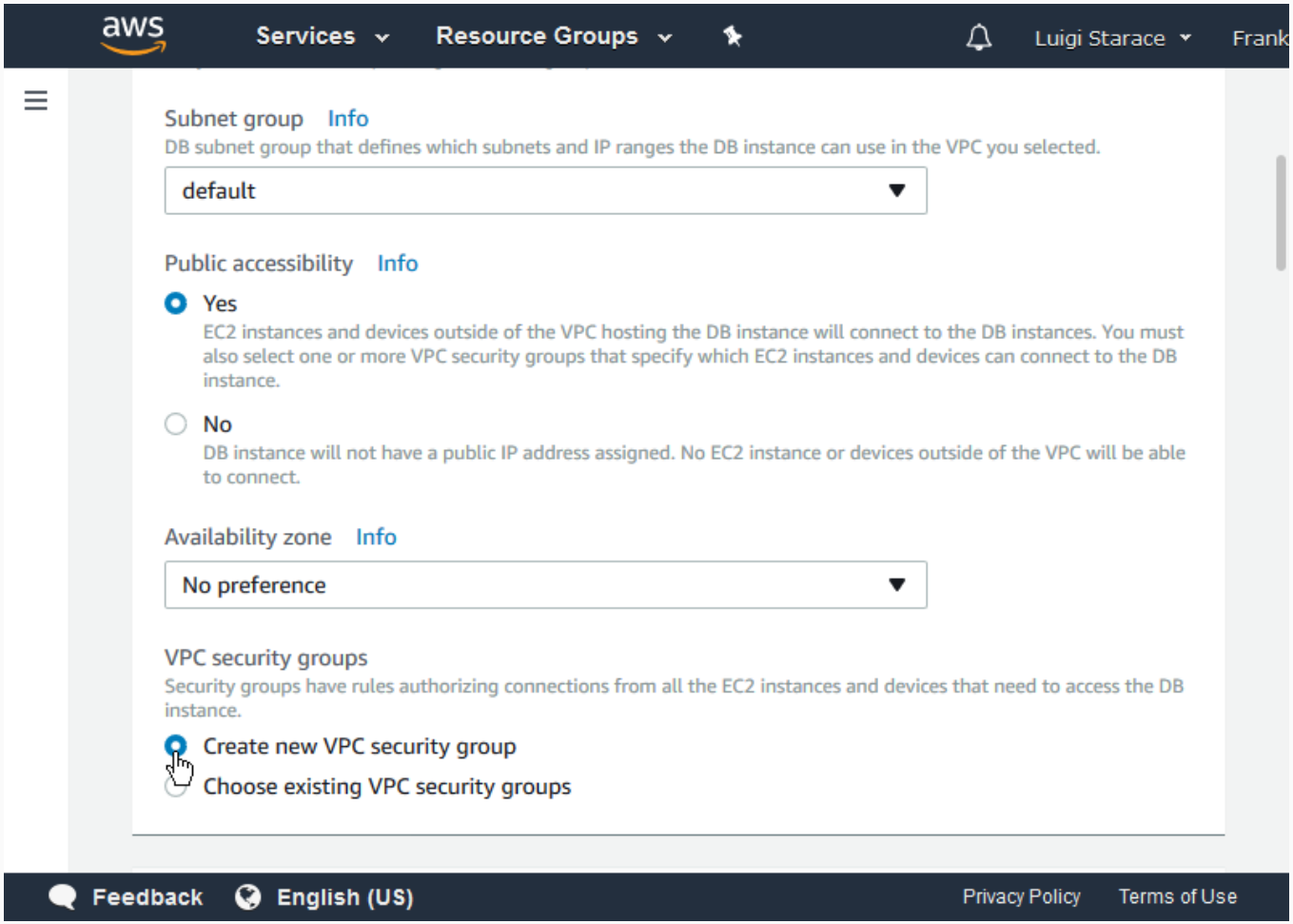
RDS: Create a Database Instance

Enter your desidered settings (**remember the password!** ⚠).



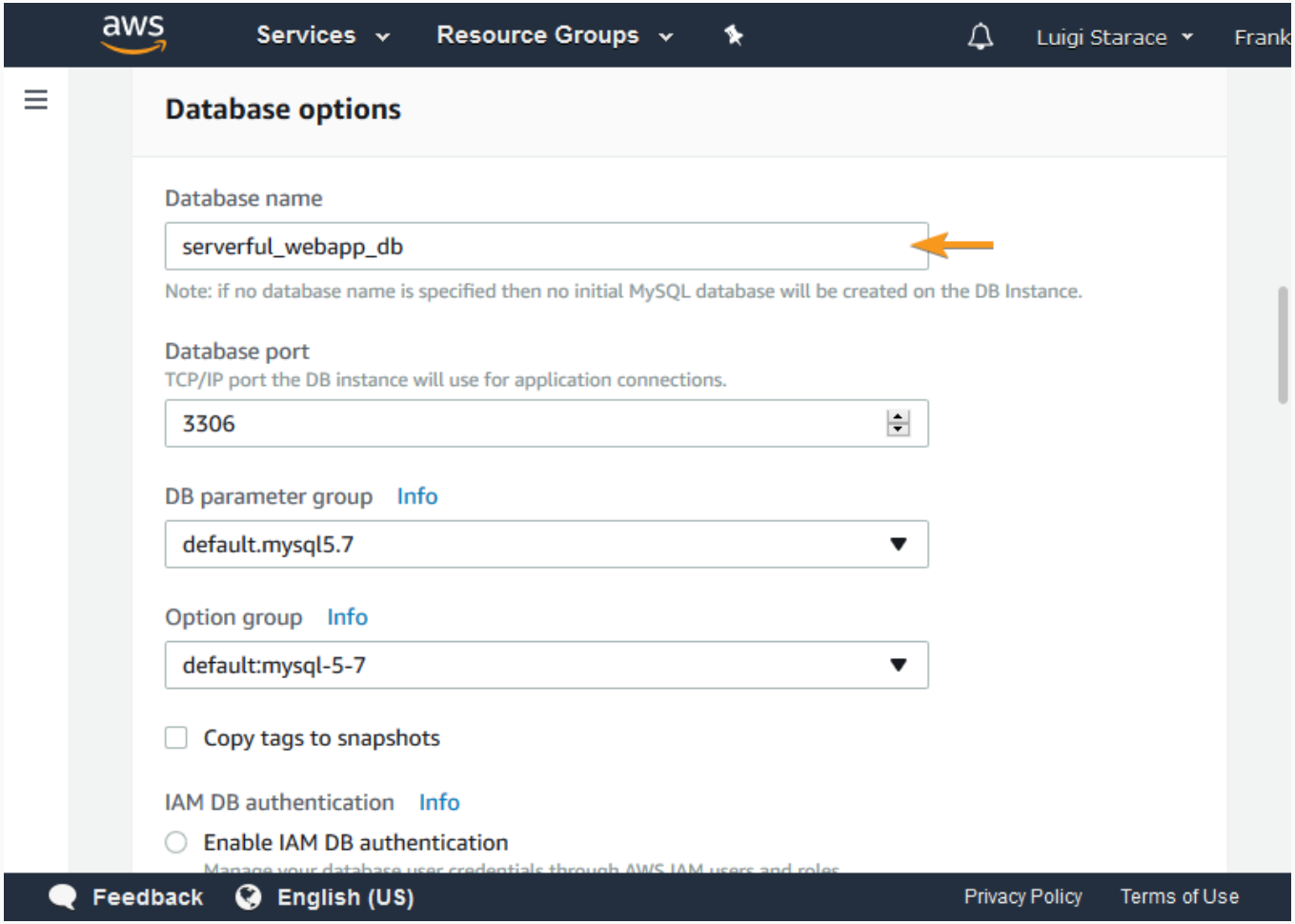
RDS: Create a Database Instance

Be sure to select “create a new security group” .



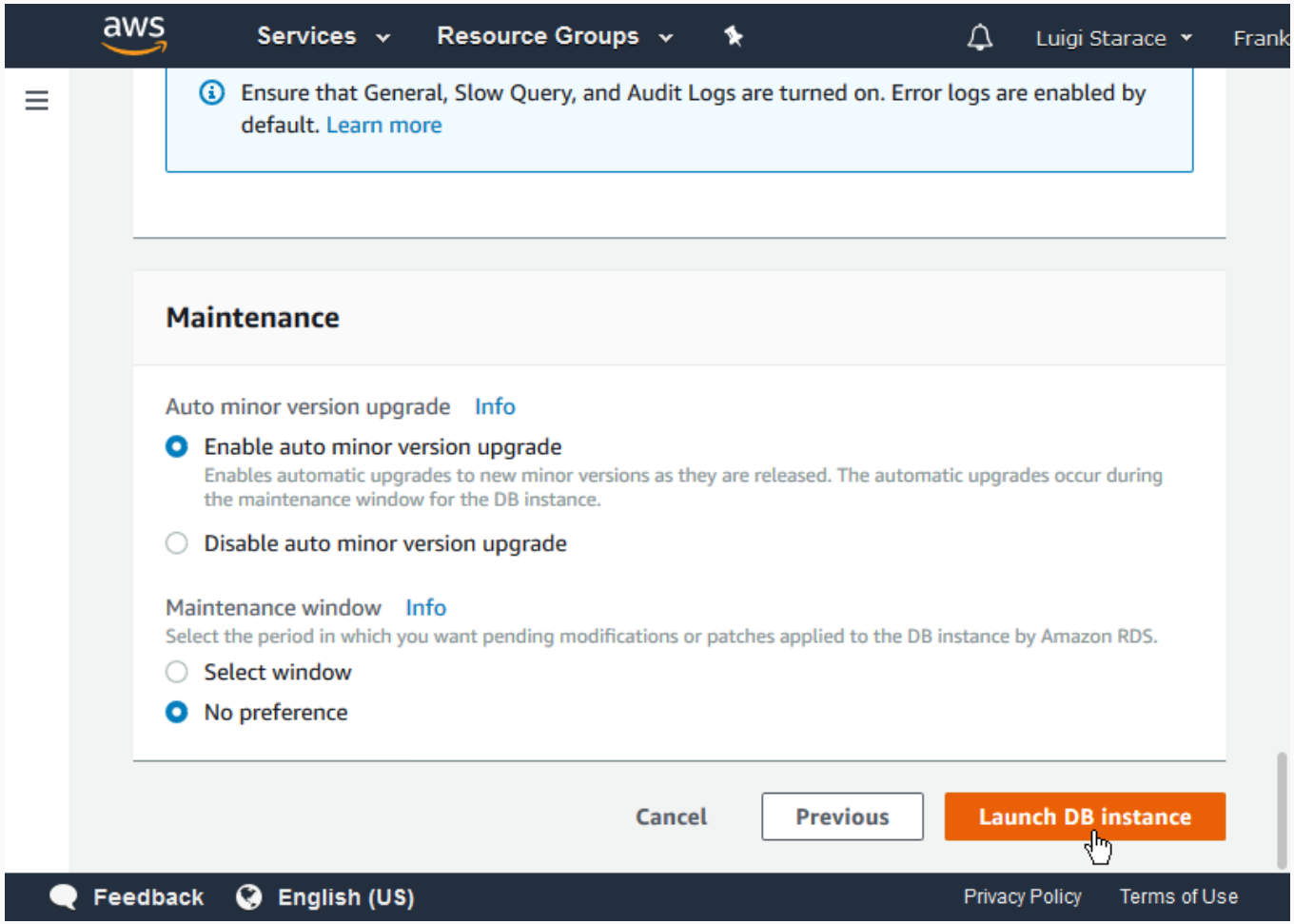
RDS: Create a Database Instance

Enter a database name for the instance (**important!** ⚠) and leave the rest as is.



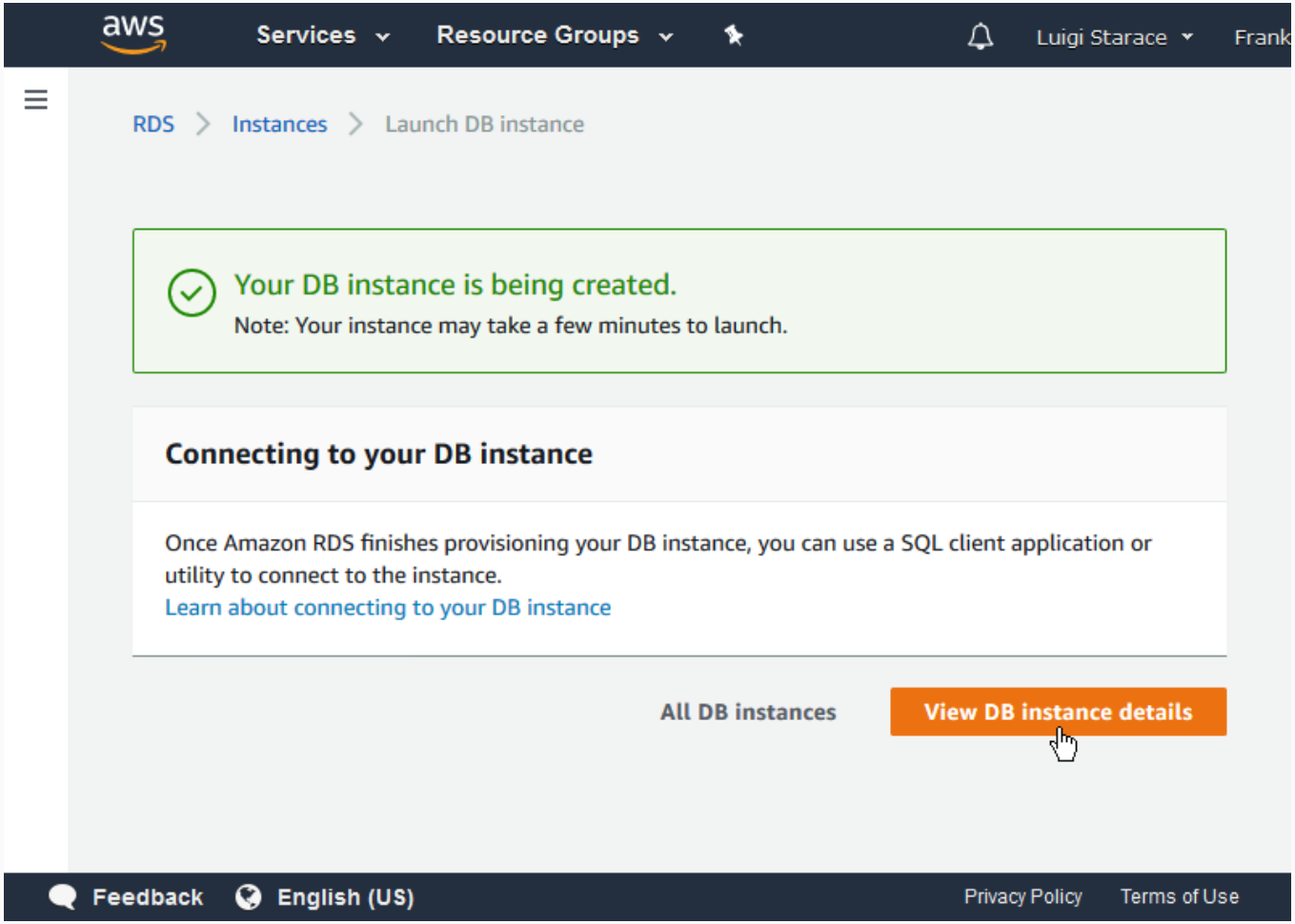
RDS: Create a Database Instance

Click on “Launch DB Instance” .



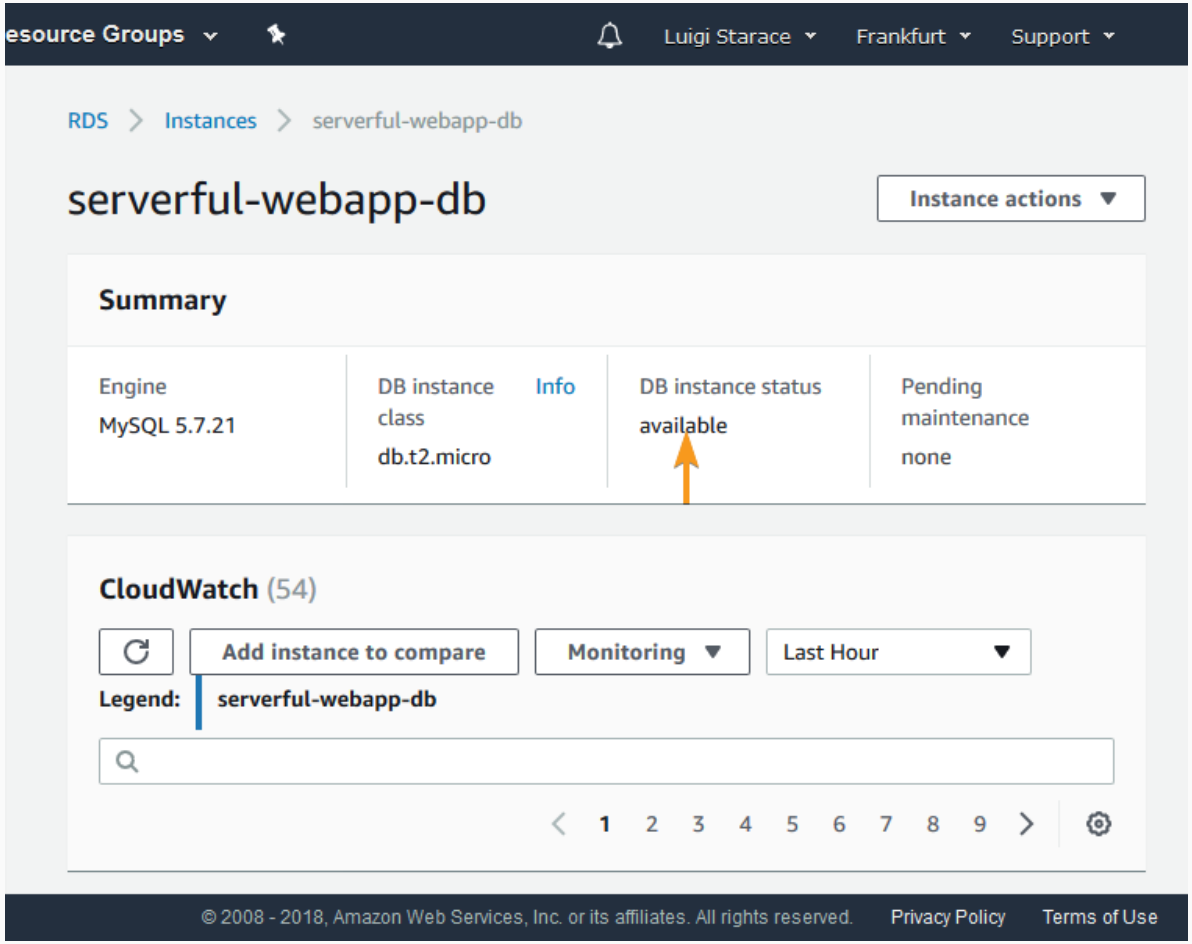
RDS: Create a Database Instance

The creation process takes around 15 minutes. Click on "View DB Instance Details" to visit the detail page for the instance you just created.



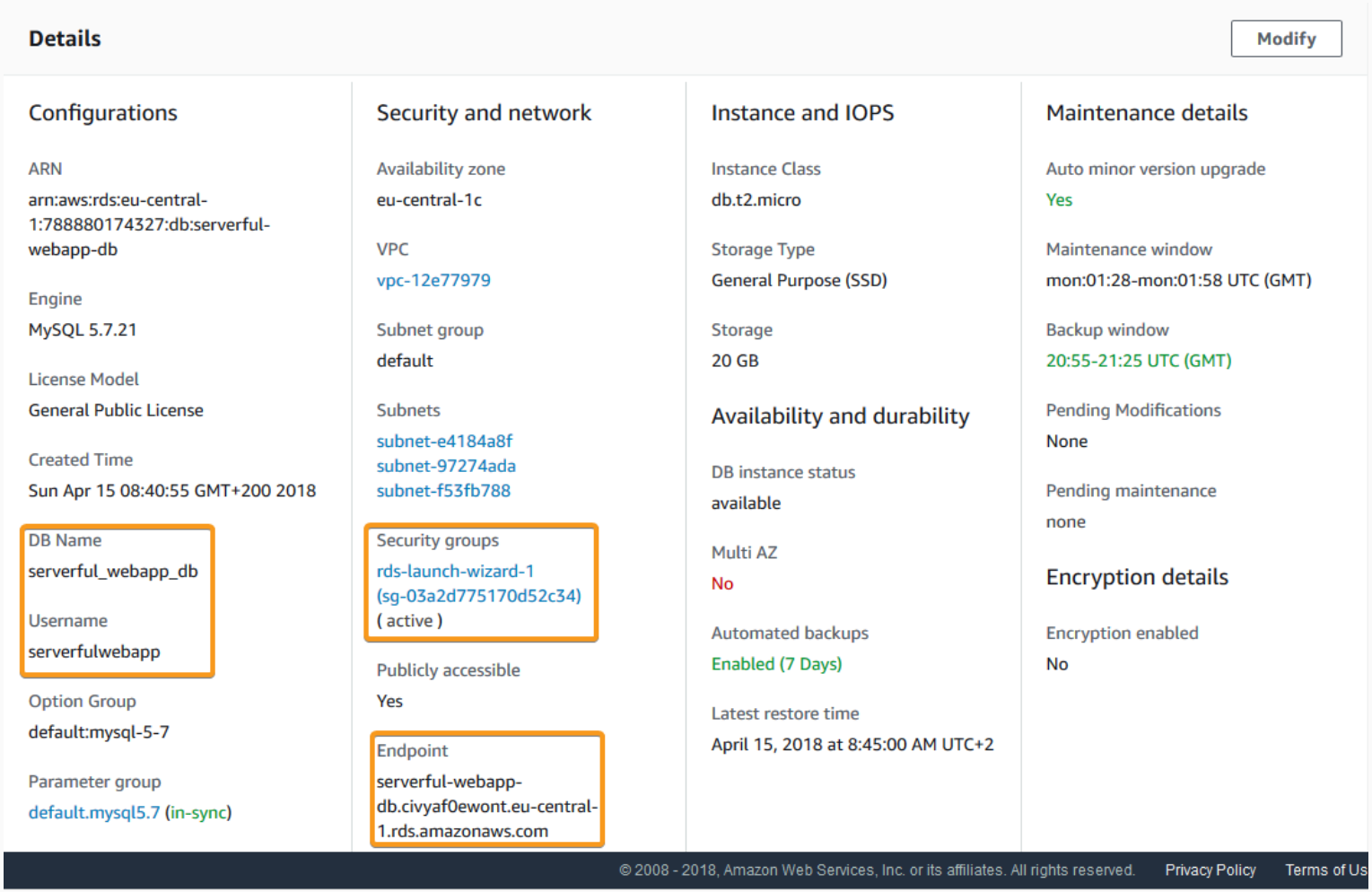
RDS: Create a Database Instance

When done, the status in your instance detail page will change to “available” .



RDS: Create a Database Instance

Notice a few important elements in the details section. We're going to need these later.



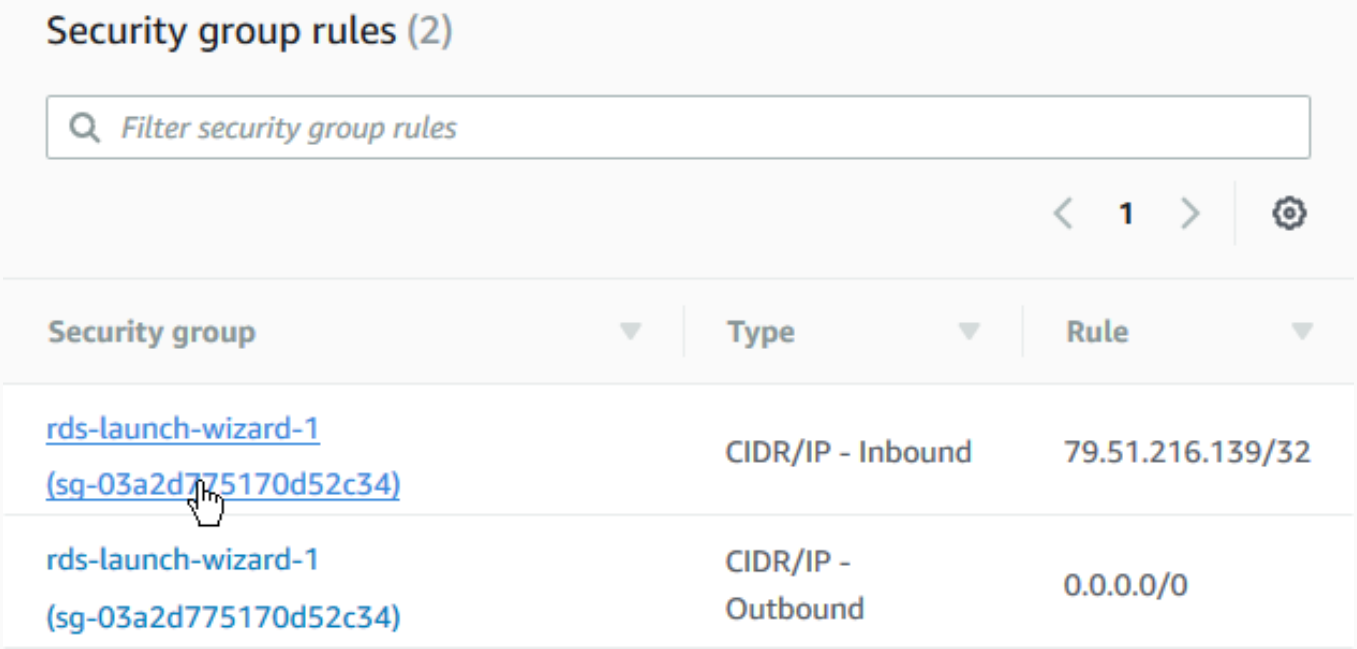
RDS: Create a Database Instance

By default, our newly-created instance will not be publicly accessible. If we want to be able to connect to it from any IP [1] (e.g. from a Java program running on our laptop or from MySQL Workbench), we'll need to add a new rule to the security group to allow all inbound traffic.

[1] notice that this is not a good practice in a production environment! [Sta]

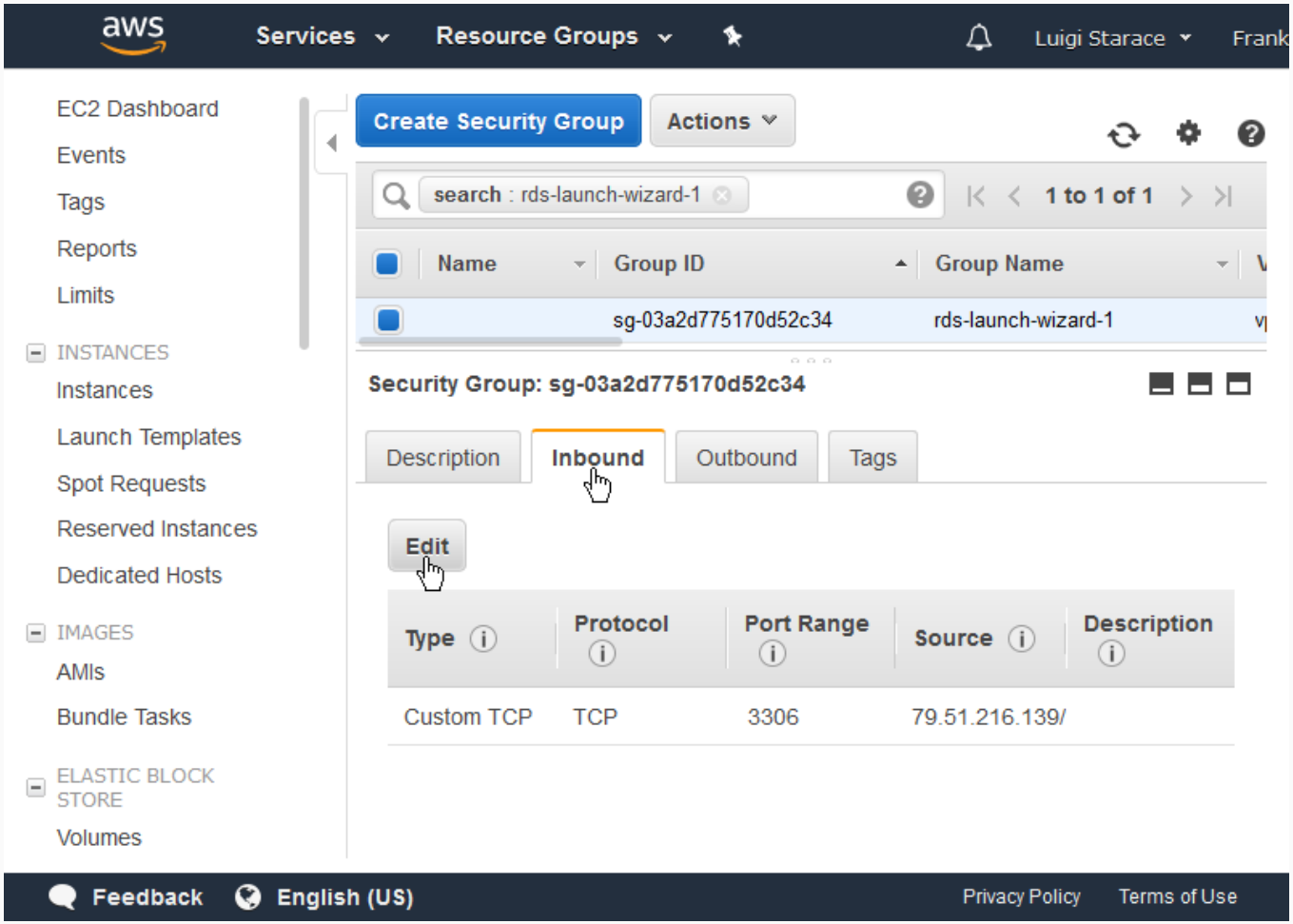
RDS: Create a Database Instance

Click on the security group in the section *Security Group Rules*.



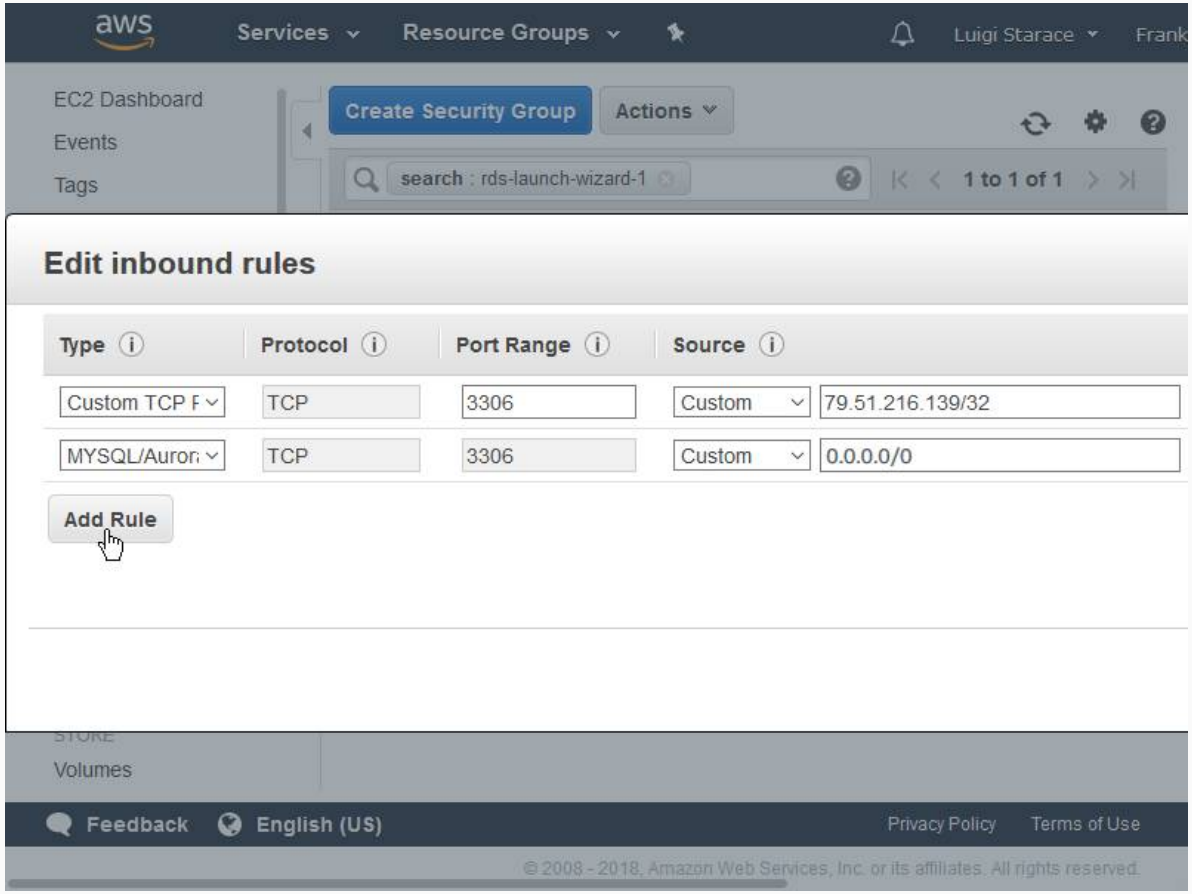
RDS: Create a Database Instance

Select the *Inbound* tab then click on the Edit button.



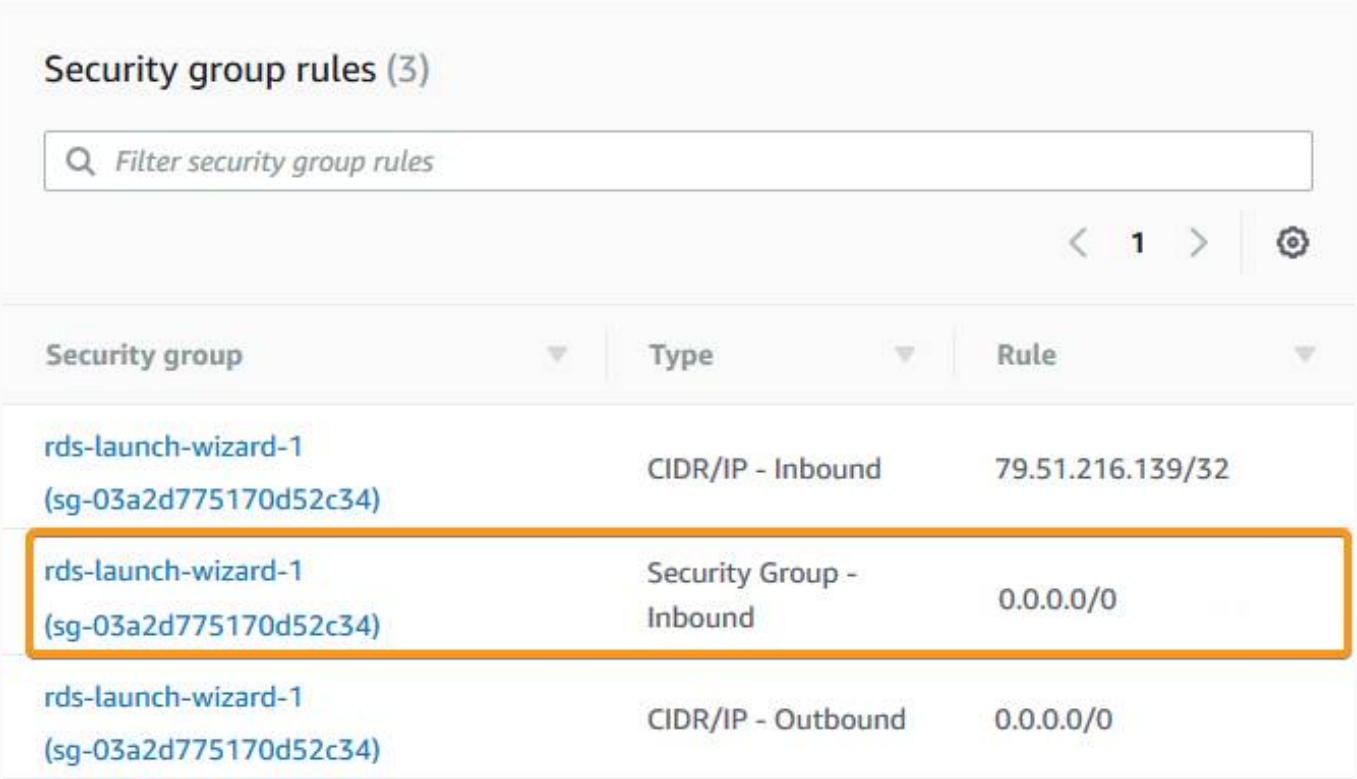
RDS: Create a Database Instance

Add a new rule as shown in the picture below. Then save and return to the RDS instance detail page.



Step 7: Create a Database Instance

The rule you just added should be displayed among the other two.



RDS: Connect to the Database Instance

```
Connection conn = null;
...
try {
  String dbName = "your_db_name";
  String userName = "your_username";
  String password = "your_pwd";
  //Endpoint is the hostname
  String host = "inst_name.1234567.us-east-1.rds.
      amazonaws.com";
  String port = "3306";
  String jdbcUrl = "jdbc:mysql://" + host + ":" + port +
       "/" + dbName + "?user=" + userName + "&password="
      + password;
  conn = DriverManager.getConnection(jdbcUrl);
  // Do something with the Connection
} catch (SQLException ex) {...}
```

Non Relational Database Services

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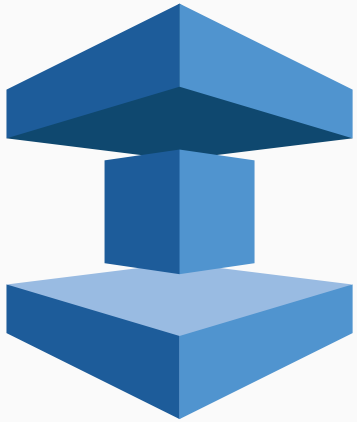

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- ElastiCache
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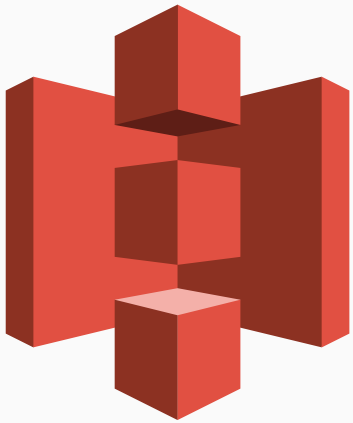
  - Supports memcached, Redis
- Neptune
  - Graph database service
  - Supports RDF, SPARQL, ...

An AWS bestiarium

Cloud storage

Amazon Simple Storage Service (S3)

- *store and retrieve any amount of data from anywhere*



Amazon Simple Storage Service (S3)

- *store and retrieve any amount of data from anywhere*
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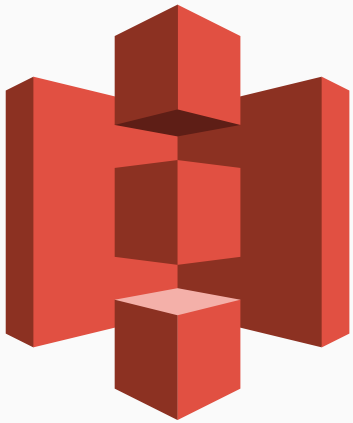

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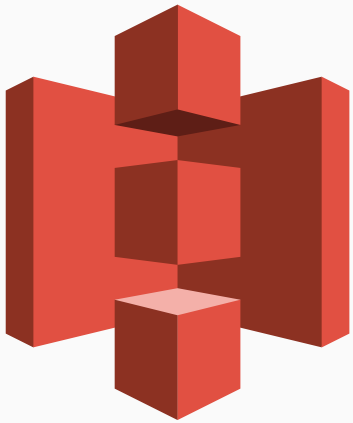

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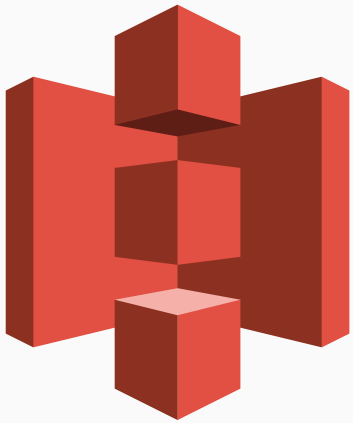

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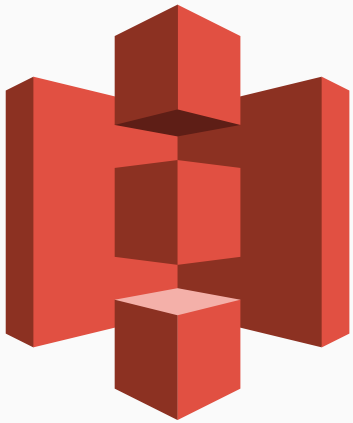

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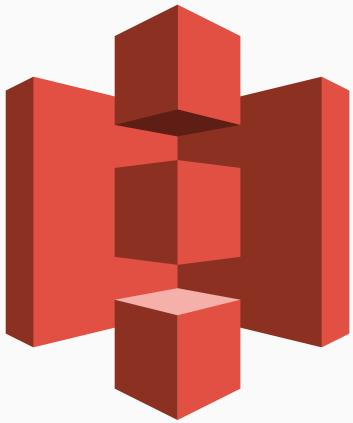
- Multiple storage classes
  - Standard



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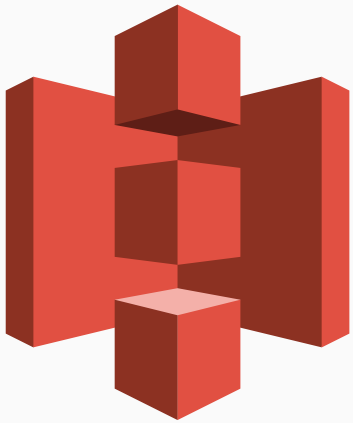
  - Standard
  - Infrequent Access



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  - Standard
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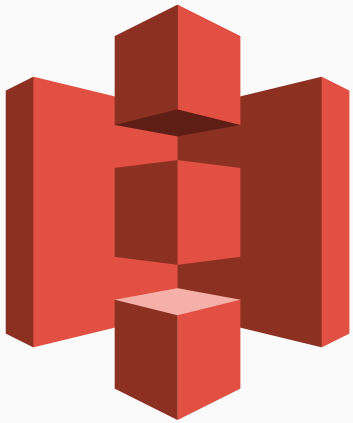
  - One zone-Infrequent Access



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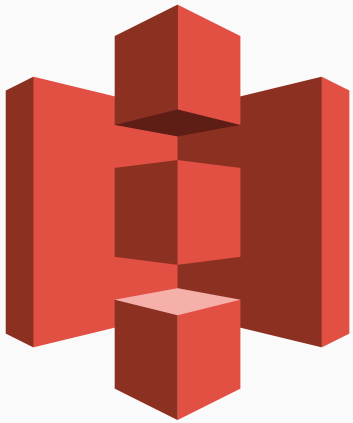
  - Amazon Glacier



Multiple storage classes

Storage class	Storage	Retrieval (per 1K req.)
Standard	$0.022 per GB	$0.0004
Infrequent access	$0.0125 per GB	$0.001
IA single zone	$0.01 per GB	$0.001

Table 1: S3 pricing (Ireland)

Amazon Simple Storage Service (S3) - more

Multiple storage classes

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Table 1: S3 pricing (Ireland)

Example 1: Host 1GB of files for a month with 10M retrievals

With standard class: $0.022 + $4 = $4.022
With IA class: $0.0125 + $10 = $10.0125

Amazon Simple Storage Service (S3) - more

Multiple storage classes

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IA single zone	$0.01 per GB	$0.001

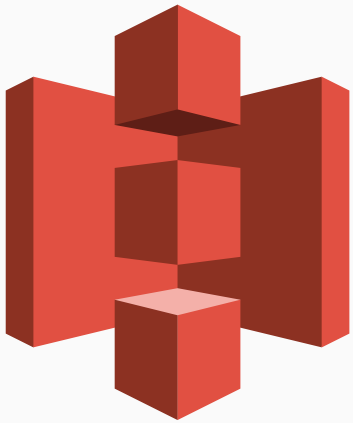
Table 1: S3 pricing (Ireland)

Example 2: Host 1GB of files for a month with 500 retrievals

With standard class: $0.022 + $0.0002 = $0.0222
With IA class: $0.0125 + $0.0005 = $0.013

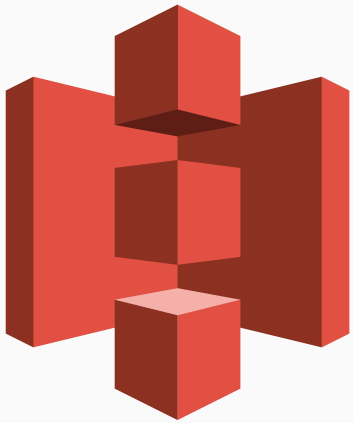
Amazon Simple Storage Service (S3) - more

- Well-integrated with other services



Amazon Simple Storage Service (S3) - more

- Well-integrated with other services
  - Machine Learning



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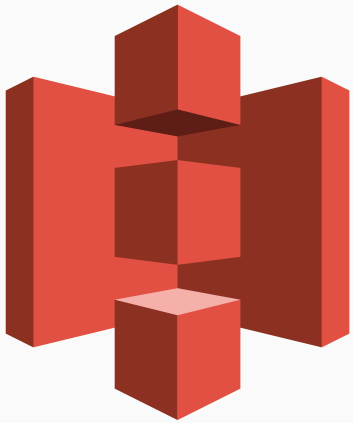
  - Big Data Analysis



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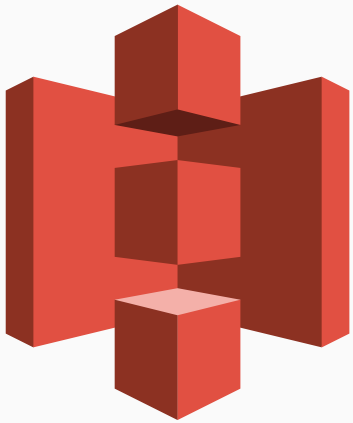
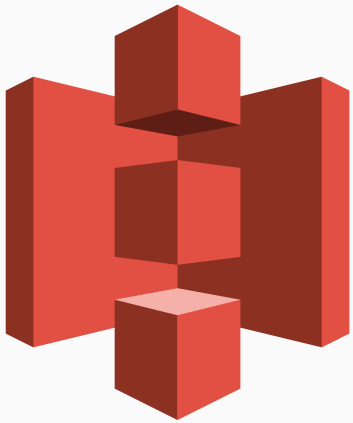


Amazon Simple Storage Service (S3) - more

- Well-integrated with other services
  - Machine Learning
  - Big Data Analysis
- REST API
- Can be used to host static websites



An AWS bestiarium

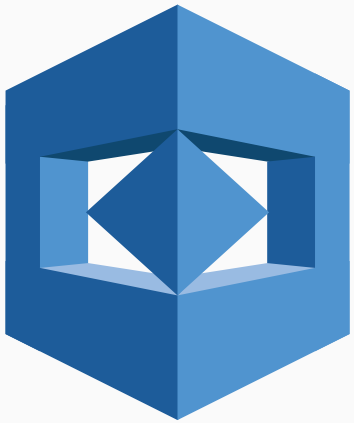
Miscellanea

Machine Learning: application services

- Comprehend (for NLP) Dashboard

Machine Learning: application services

- Comprehend (for NLP) Dashboard
- Rekognition (Visual Analysis) Dashboard



Machine Learning: application services

- Comprehend (for NLP) Dashboard
- Rekognition (Visual Analysis) Dashboard
- Translate

Machine Learning: application services

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Machine Learning: application services

- Comprehend (for NLP) Dashboard
- Rekognition (Visual Analysis) Dashboard
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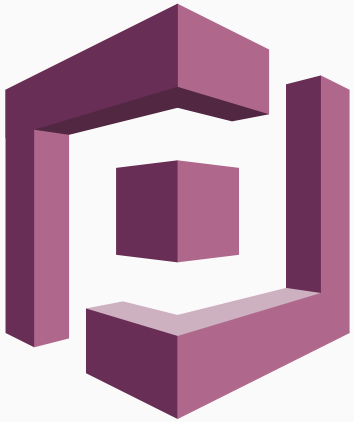
- Polly (text-to-speech)
- Transcribe (speech-to-text)

Using Comprehend from a Node.js app

```
const AWS = require('aws-sdk');
const comprehend = new AWS.Comprehend();
...
var params = {
    LanguageCode: "it",
    Text: "Questo è un testo di esempio."
};
comprehend.detectSentiment(params, (err, data) => {
    if (err) {
        console.log(err, err.stack);
        return;
    }
    else{
        const sentiment = data.Sentiment;
        console.log(sentiment);
    }
});
```

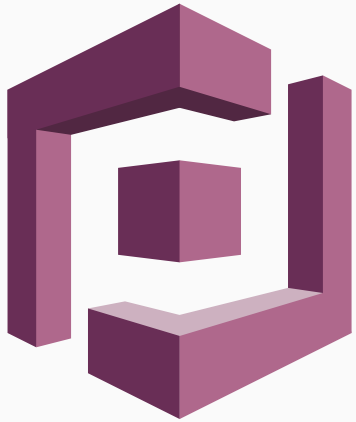
Miscellanea

- Cognito



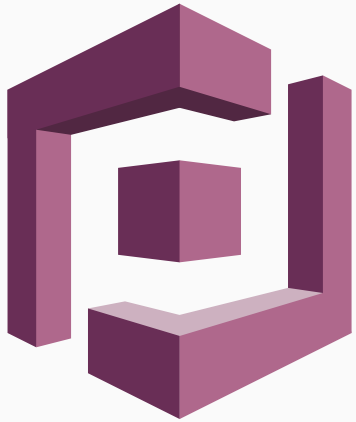
Miscellanea

- Cognito
  - Sign-up and authentication



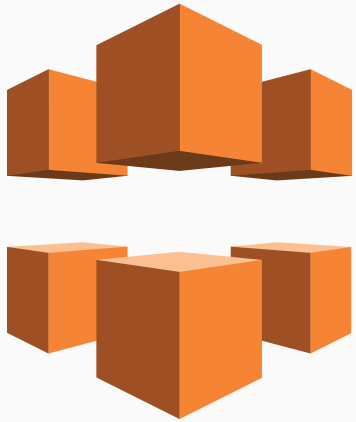
Miscellanea

- Cognito
  - Sign-up and authentication
  - Federated identities



Miscellanea

- Cognito
  - Sign-up and authentication
  - Federated identities
- CloudFront



Miscellanea

- Cognito
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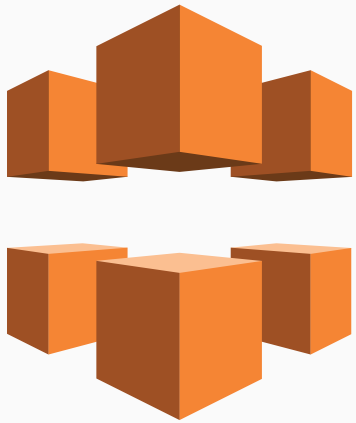
- CloudFront
  - Content Delivery Network



Miscellanea

- Cognito
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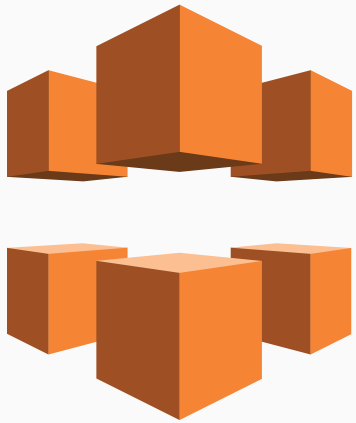

Miscellanea

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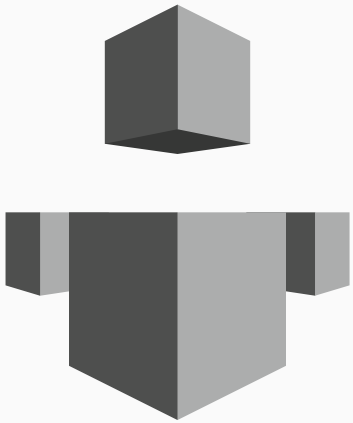
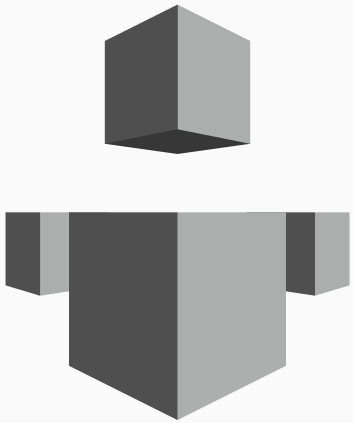
- Mechanical Turk



Amazon MechanicalTurk

- ???



The Turk

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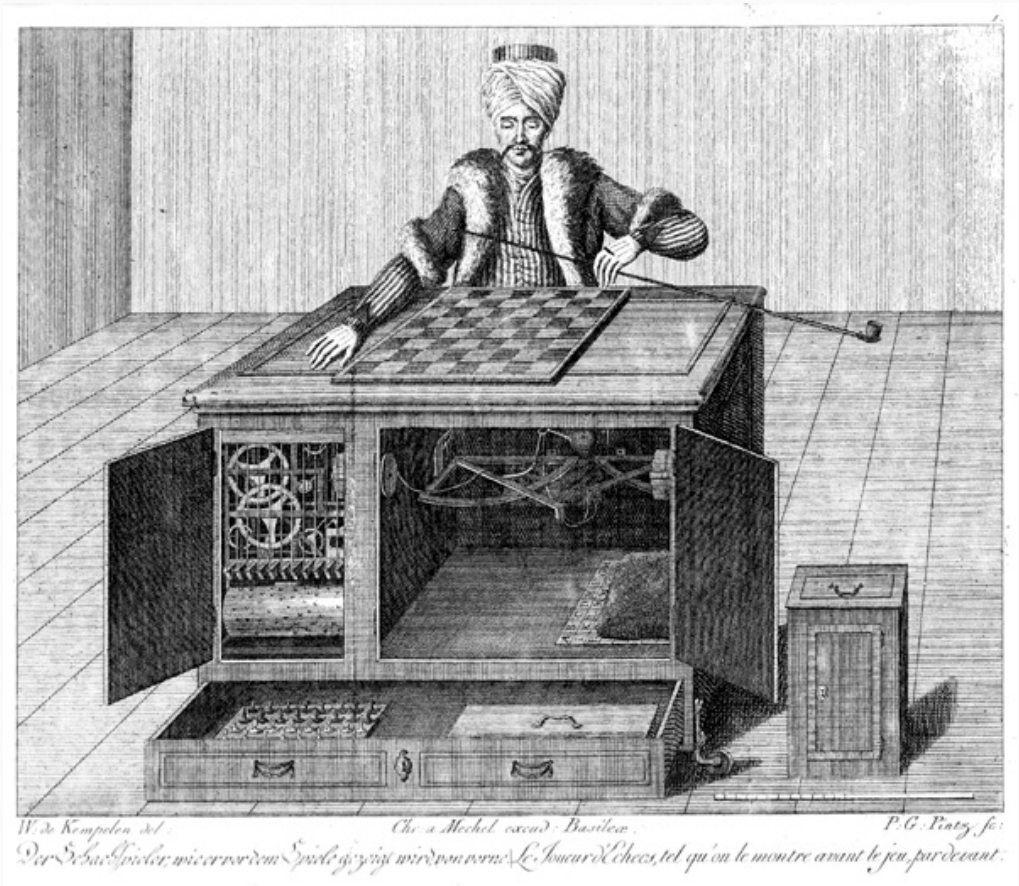
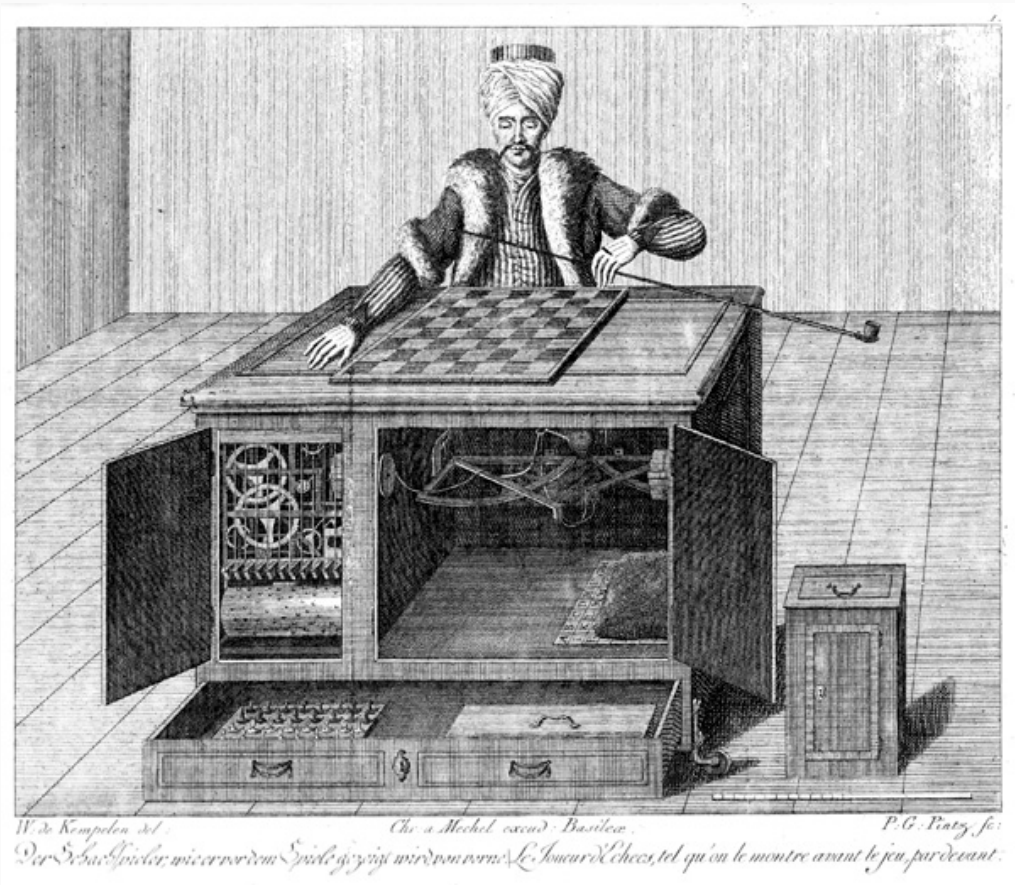


The Turk

The Turk was a chess-playing automaton built in 1770. Obviously it was a fraud.



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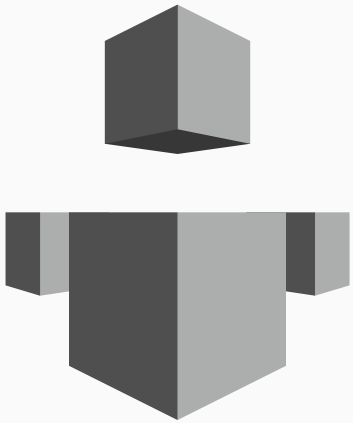
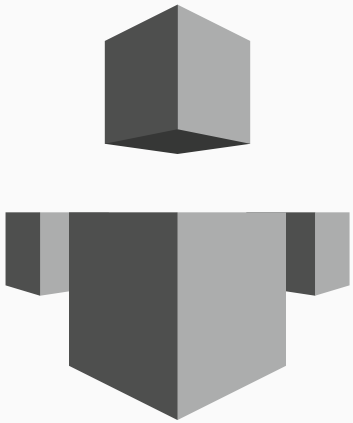


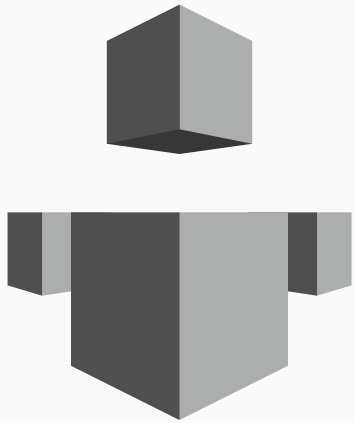
Amazon MechanicalTurk

- Human Intelligence through an API



Amazon MechanicalTurk

- Human Intelligence through an API
- Create HIT (Human Intelligence Task)



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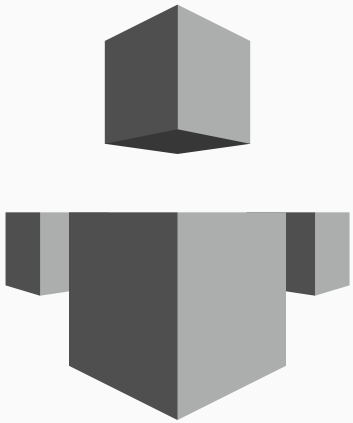
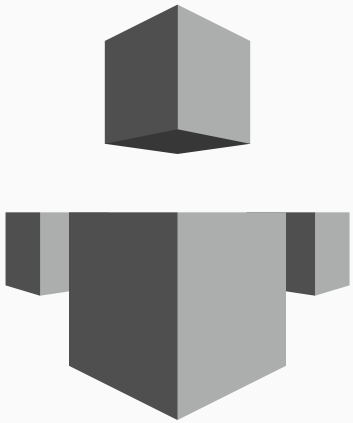


Amazon MechanicalTurk

- Human Intelligence through an API
- Create HIT (Human Intelligence Task)
- Elastic, on-demand workforce
- Available 24/7



An AWS bestiarium

Computing

Amazon Elastic Compute Cloud (EC2)

- (Virtual) Servers on demand

Azure: Virtual Machines web
Google Cloud: Compute Engine web

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- Different types of instances to suit computing needs

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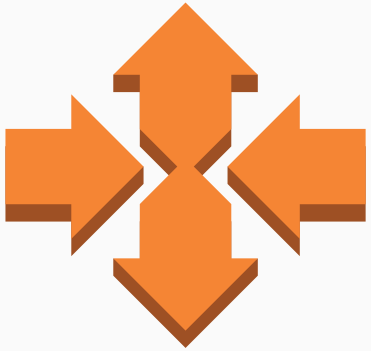
Amazon EC2 Auto Scaling

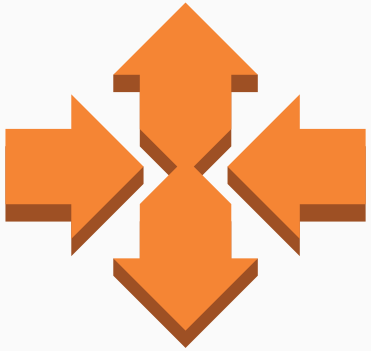
- *Scaling is the ability to increase or decrease the compute capacity of your application*



Azure: Virtual Machine Scale Sets web
Google Cloud: Load Balancing web

Amazon EC2 Auto Scaling

- *Scaling is the ability to increase or decrease the compute capacity of your application*
- Scale your application manually, on a scheduled basis or on demand



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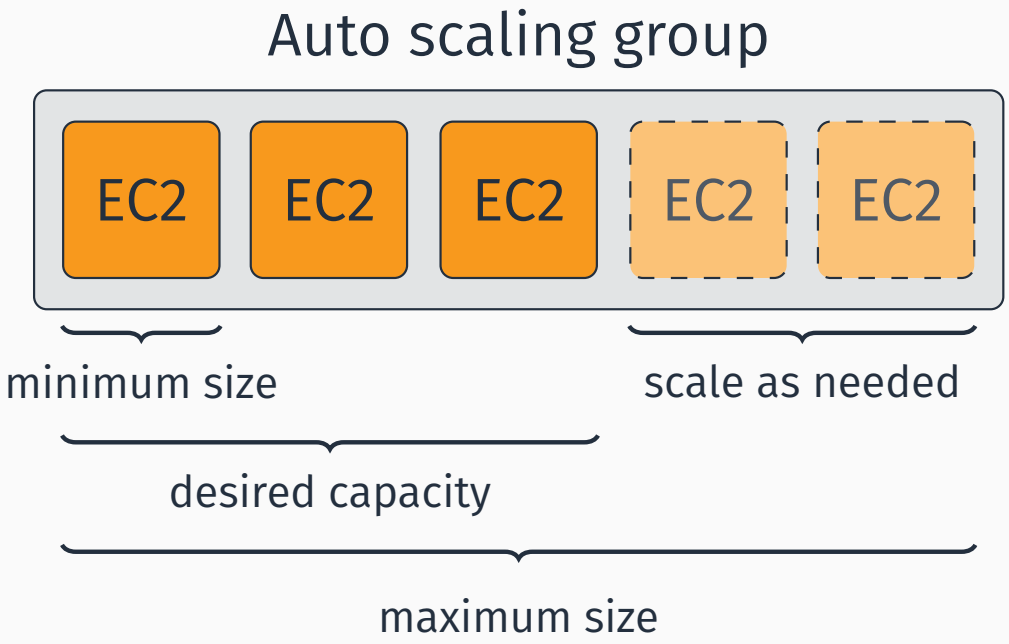
Amazon EC2 Auto Scaling: details



Amazon Elastic Load Balancing (ELB)

- Distributes incoming traffic across multiple EC2 instances

Azure: Load Balancer web

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- Distributes incoming traffic across multiple EC2 instances
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  - Execution time

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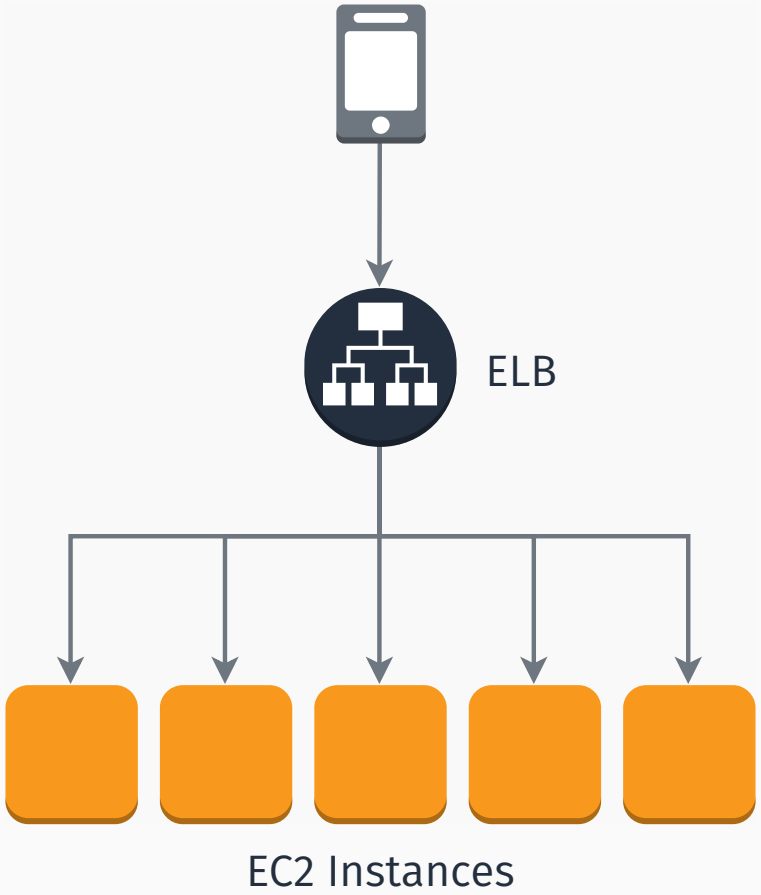

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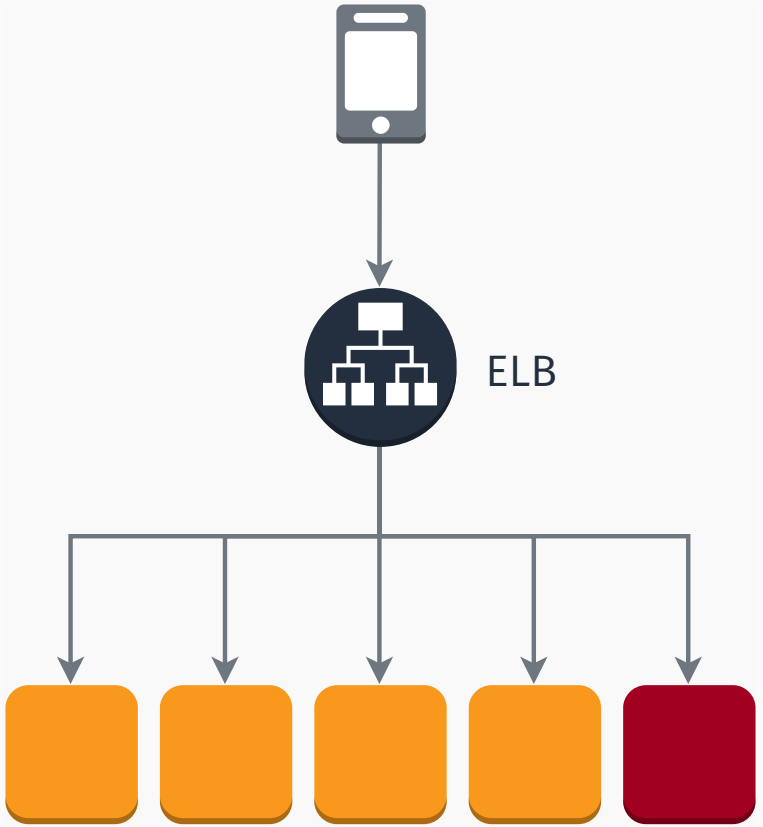

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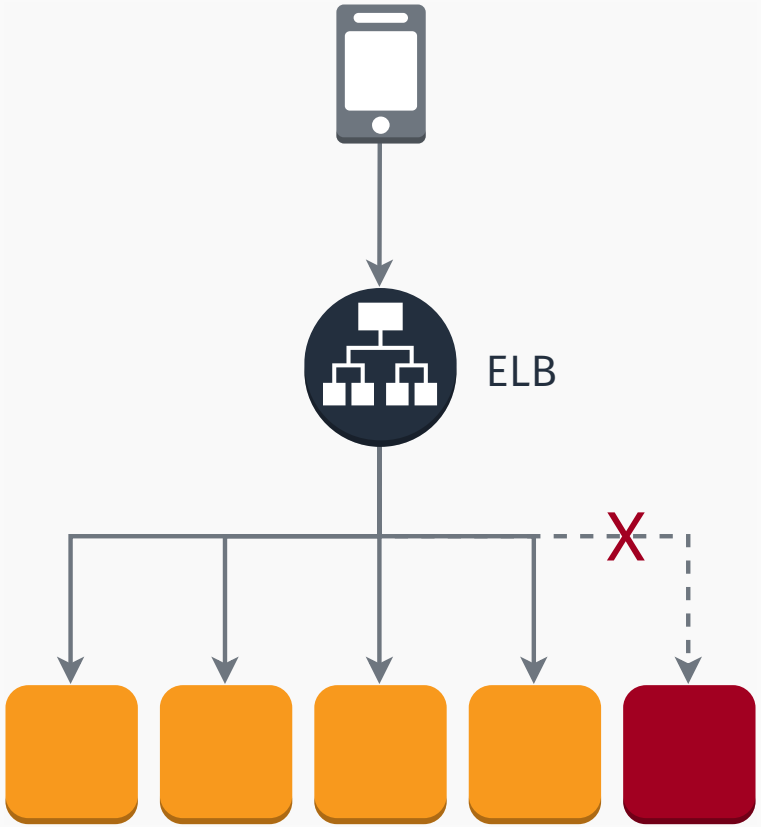
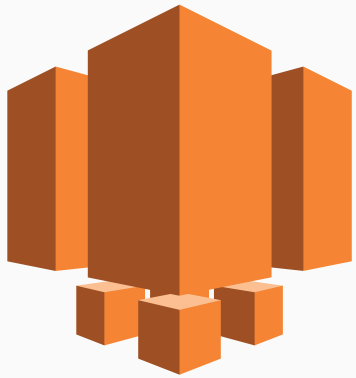


Amazon Lightsail

- A lightweight, simplified offer



Websites: EC2 Lightsail

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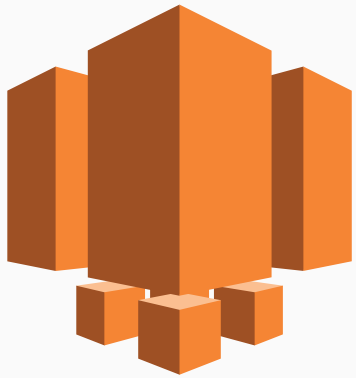

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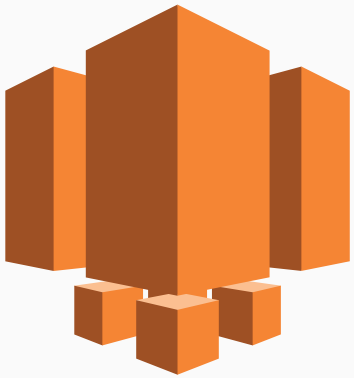

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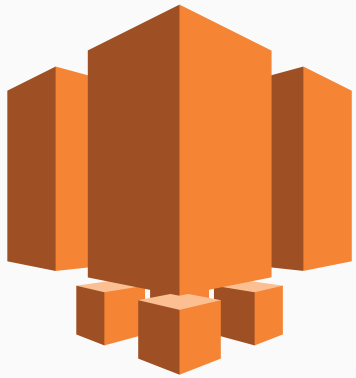

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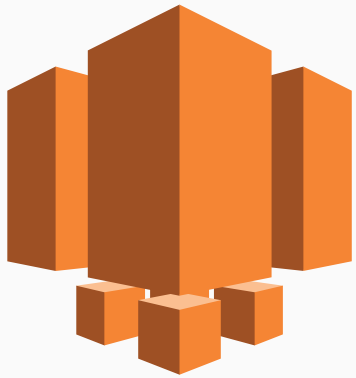

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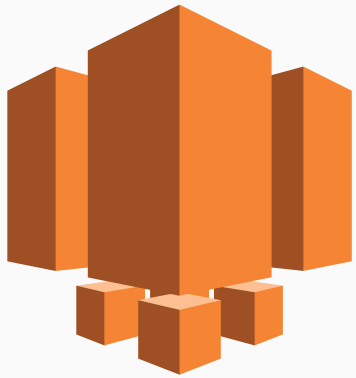

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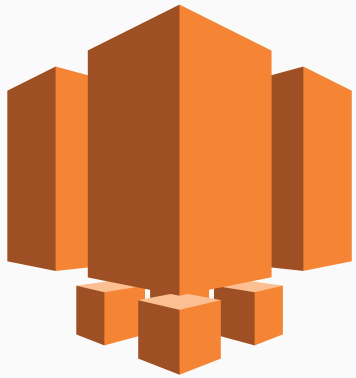
  - LAMP stack, Nginx, ...
- Low and **predictable** monthly costs



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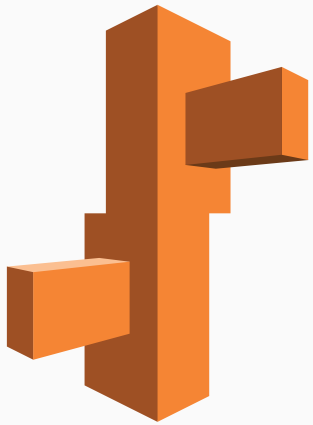
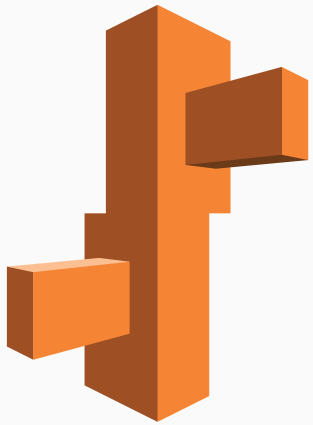
Amazon Elastic Beanstalk

- *"Easy to begin, impossible to outgrow"*



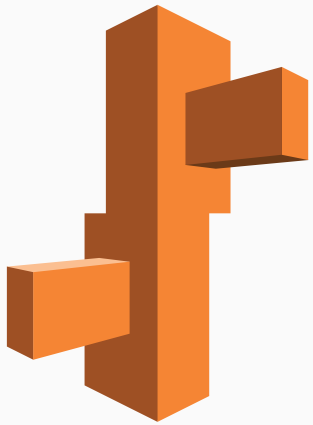
Amazon Elastic Beanstalk

- “*Easy to begin, impossible to outgrow*”
- Easy-to-use service to deploy web apps



Amazon Elastic Beanstalk

- "*Easy to begin, impossible to outgrow*"
- Easy-to-use service to deploy web apps
- Supports Apache, Nginx, IIS and more



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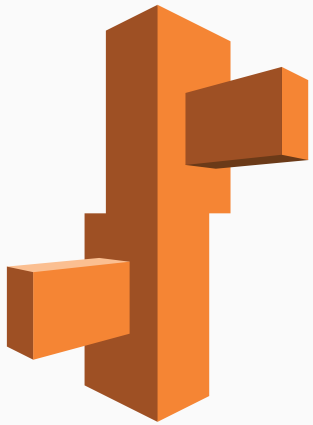

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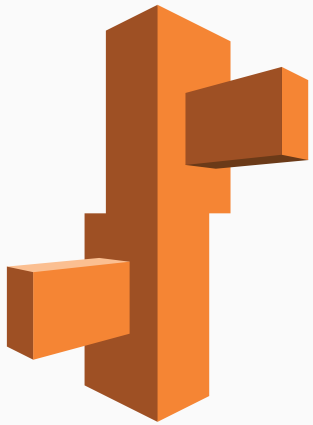

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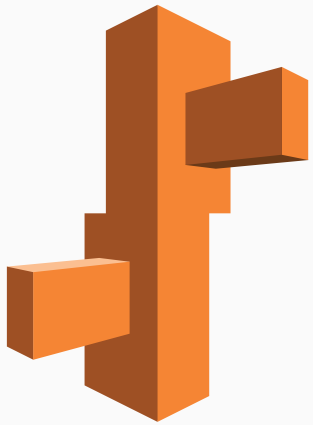

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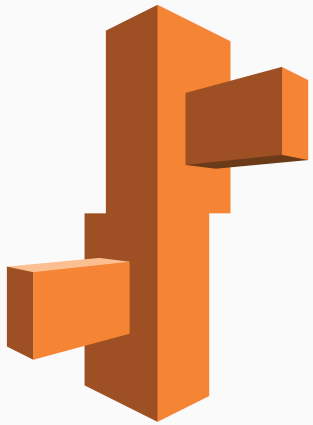
- Customizable
- Free of charge. Pay only for the AWS resources you use.



Is EC2 Elastic enough?

Tricky use cases: sporadic requests

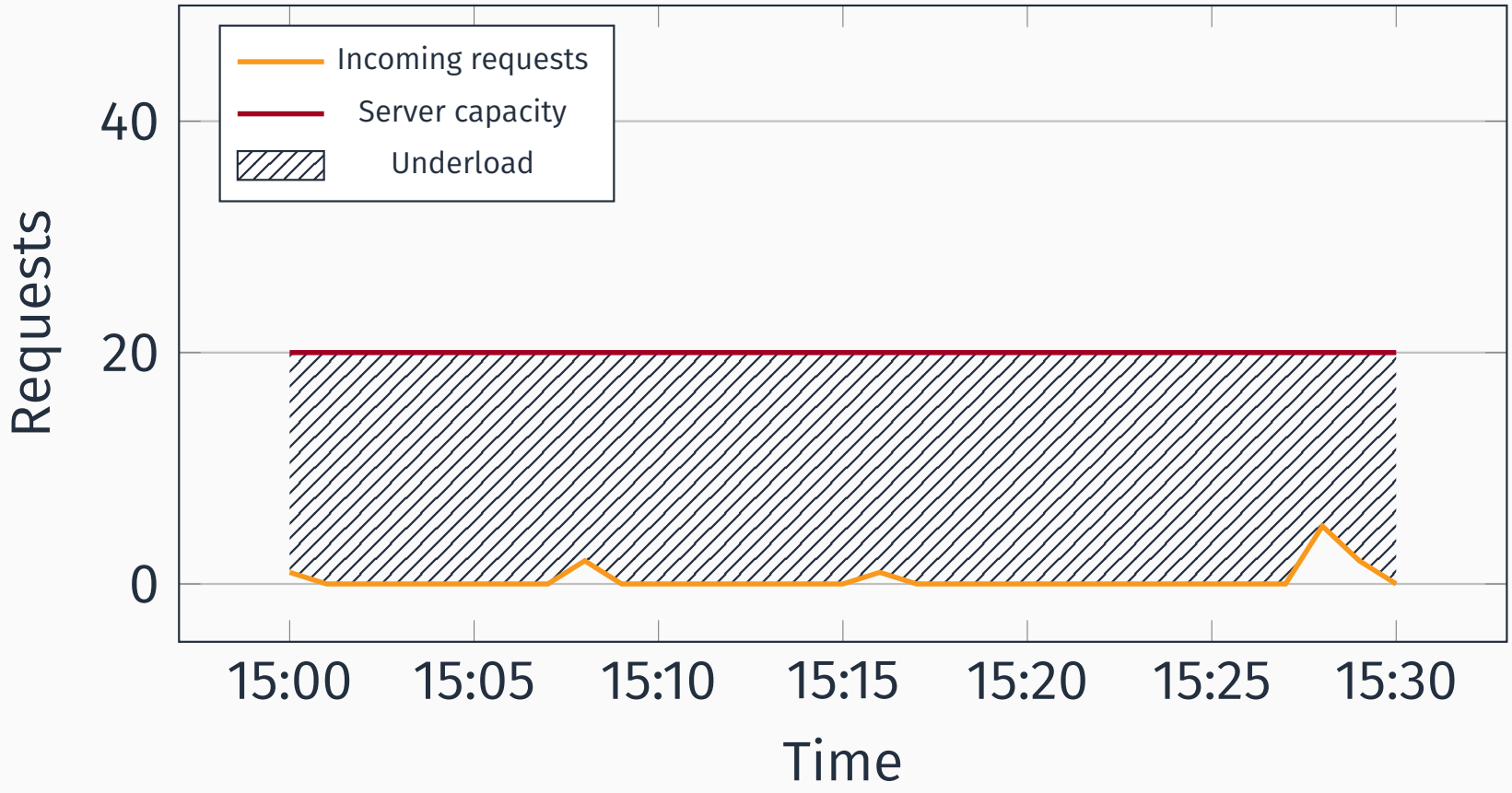


Figure 4: Sporadic requests example

Tricky use cases: inconsistent requests

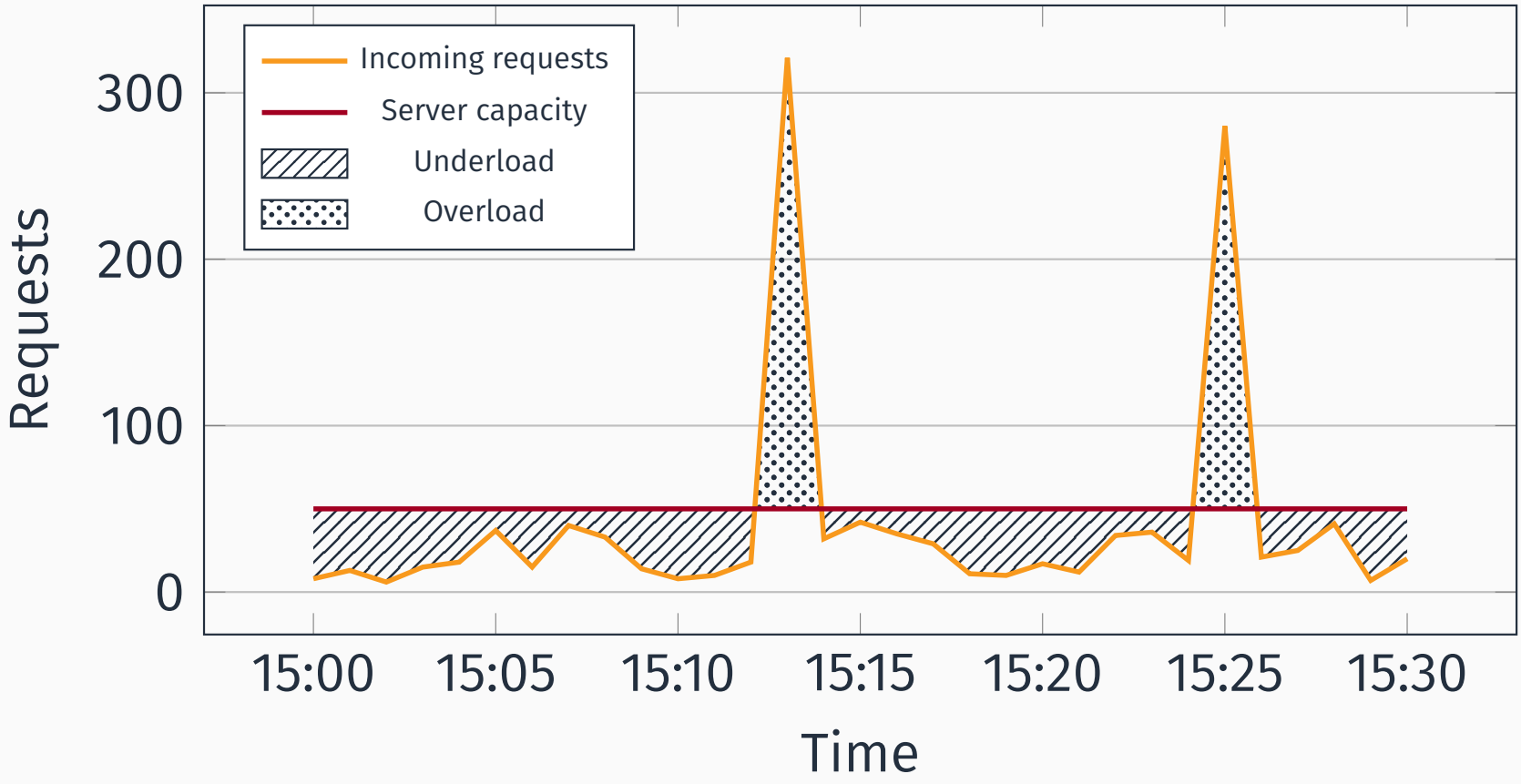


Figure 5: Inconsistent requests example

Amazon Lambda

- You provide the code and say when to run it.

Amazon Lambda

- You provide the code and say when to run it.
- Execution is triggered by events

Amazon Lambda

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- Pay only for **actual** execution time.

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  - CodeCommit, Scheduled Event
- Support for Java, Node.js, C# e Python (more to come).
- Pay only for **actual** execution time.
- Run your code without thinking about infrastructure
  - No need to worry about provisioning, load balancing, scaling...

Amazon Lambda: limits

AWS Lambda imposes some limits

- Max 300 seconds execution time.

Amazon Lambda: limits

AWS Lambda imposes some limits

- Max 300 seconds execution time.
- Max 3008 MB memory allocation.

Amazon Lambda: limits

AWS Lambda imposes some limits

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- Deployment package must be smaller than 50 MB (negotiable).

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- Max 300 seconds execution time.
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- Deployment package must be smaller than 50 MB (negotiable).
- No more than 10000 concurrent invocation of a Lambda function in a given region (negotiable).
- For a complete list: Lambda docs

Amazon Lambda: FaaS

FaaS (Functions as a Service)

- Functions are the unit of deployment

Amazon Lambda: FaaS

FaaS (Functions as a Service)

- Functions are the unit of deployment
- Executed in ephemeral, stateless containers

Amazon Lambda: FaaS

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Nice readings I

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