

Important: please read these statements

- Amazon Web Service (AWS) Elastic Compute Cloud (EC2) is a pay per use service.
- By using AWS, the user may be charged with a certain amount of money according to AWS pricing model and policy. We are not responsible for any amount charged.
- Before using any service provided by AWS, consult the official documentation.
- **The aim of this presentation is purely illustrative.** We recommend to always follow the official Amazon Web Service documentation (https://aws.amazon.com/?nc1=h_ls).

Introduction

- Running pharmacometrics analysis on laptops and desktops often requires large computational times.
- Outsourcing computation on the cloud can reduce run times and free personal computers from the computational burden of complex analyses (e.g., population PK/PD).
- In this presentation we will explain, step by step, how to configure R, RStudio and [nlmixr](#) (an open source package for performing nonlinear mixed effect modelling) in an environment running Ubuntu (Linux) on Amazon Web Services (AWS) Elastic Compute Cloud (EC2).
- Enjoy!

Outline

1. Introduction - [useful links](#)
2. Using AWS - [prerequisites](#)
3. [Setting up](#) an instance
4. [Accessing](#) an instance
5. [Installing cmake](#) and [using Rstudio and nlmixr](#)

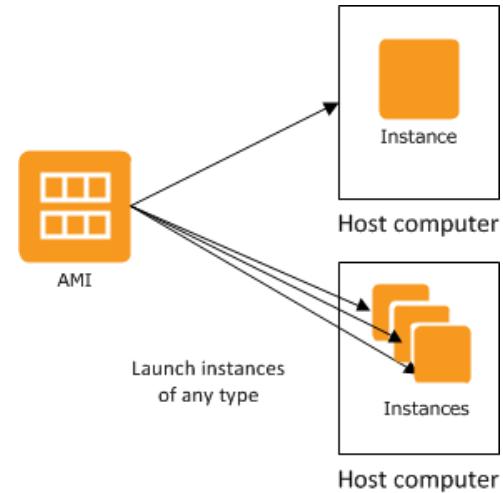
Introduction - useful links

Amazon Web Services (AWS) Elastic Compute Cloud (EC2)

- “*Amazon Web Services offers a broad set of global cloud-based products*”, in particular, “*Amazon Elastic Compute Cloud (Amazon EC2) is a web service that provides resizable computing capacity—literally, servers in Amazon's data centers—that you use to build and host your software systems.*”
- AWS EC2 allows the user to easily create her/his own “machines”, called *instances*, with an user-defined hardware and software configuration.
- Most interestingly, the user can change both the software and the hardware configuration (i.e., type of CPUs, number of cores, RAM...) according to the need.
- **The pricing model is pay-per-use.**

Instance

- “An Amazon Machine Image (AMI) is a template that contains a software configuration (for example, an operating system, an application server, and applications). From an AMI, you launch an instance, which is a copy of the AMI running as a virtual server in the cloud. You can launch multiple instances of an AMI, as shown in the following figure. Your instances keep running until you stop, hibernate, or terminate them, or until they fail. If an instance fails, you can launch a new one from the AMI.” ([Instances and AMIs - Amazon Elastic Compute Cloud](#))
- In this tutorial we will create a linux instance, choosing an AMI preconfigured with ubuntu operating system, R and RStudio. Than we will install the software cmake that is needed to run nlmixr R package.



Useful links

- This presentation will follow the AWS official tutorial:

[Tutorial: Get started with Amazon EC2 Linux instances - Amazon Elastic Compute Cloud](#)

- Other consulted resources can be found at the following links:

[Overview of Amazon Web Services, Cloud Products, Free Tier](#)

[Amazon Elastic Compute Cloud Documentation](#)

[Connect to your Linux instance from Windows using PuTTY](#)

[PuTTY download page](#)

[RStudio Server Amazon Machine Image \(AMI\) - Louis Aslett](#)

[How to install CMake on Ubuntu | FOSS Linux](#)

Using AWS prerequisites

Prerequisites

- Complete the following tasks (explained step by step in the next slides) to be ready for launching your first Amazon EC2 instance.
 1. Sign up for AWS
 2. Create a key pair
 3. Create a security group

Sign up for AWS

- When you sign up for AWS, your AWS account is automatically signed up for all services in AWS (EC2 plus all the other services). In this presentation, we will only use EC2.
- Remember, with AWS you pay only for what you use. If you are a new AWS customer, you can get started with Amazon EC2 for free. For more information, see [AWS Free Tier](#).
- If you already have an AWS account, you can skip to the next task. If you do not have an AWS account, use the following procedure to create one:

To create an AWS account

1. Open <https://portal.aws.amazon.com/billing/signup>.
2. Follow the online instructions (part of the sign-up procedure involves receiving a phone call and entering a verification code on the phone keypad).

The screenshot shows the 'Sign up for AWS' page. At the top right is the AWS logo. Below it, the heading 'Sign up for AWS' is displayed. The page contains several input fields: 'Email address' (placeholder: 'You will use this email address to sign in to your new AWS account.'), 'Password' (with a visibility icon), 'Confirm password' (with a visibility icon), and 'AWS account name' (placeholder: 'Choose a name for your account. You can change this name in your account settings after you sign up.'). A large orange 'Continue (step 1 of 5)' button is at the bottom. To the left of the form, there is a graphic of a hand holding three small cubes, with blue curved arrows around them, symbolizing cloud computing or data flow.

Choosing a Region (*EC2 instances are region dependent*)

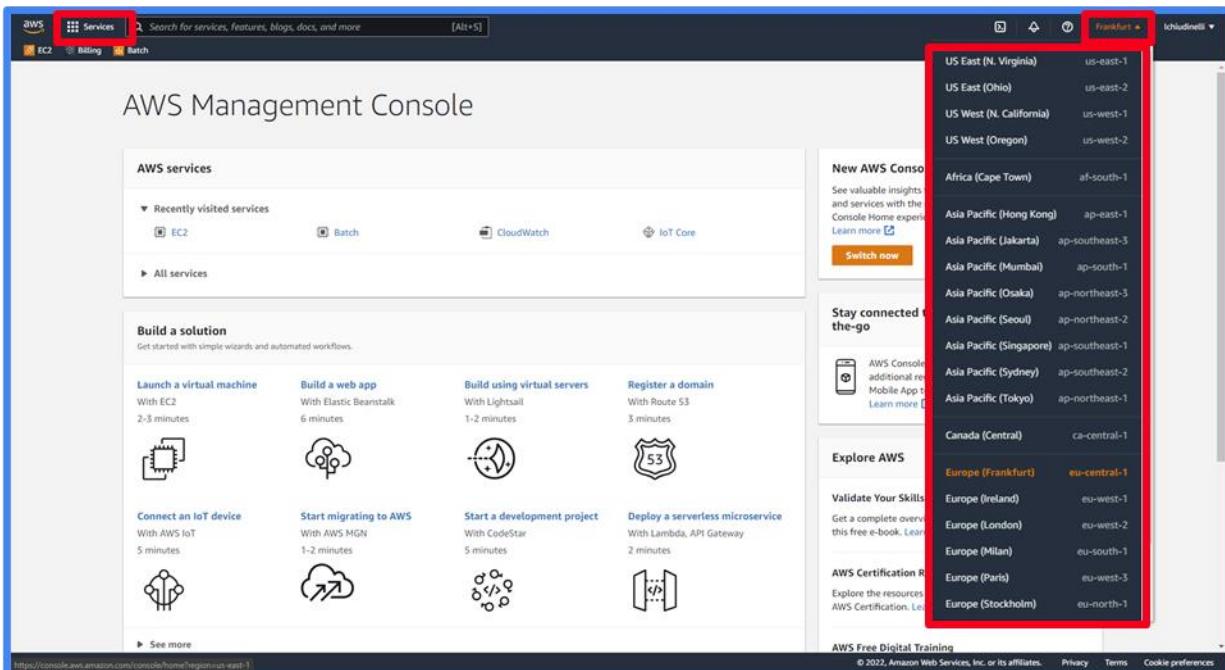
For many services (e.g., EC2), the user has to choose an AWS Region that specifies where the resources are managed. Basically, this is where the server resides.

To choose a Region

1. In the [AWS Management Console](#), choose **EC2** service. To [choose a service](#), press “Services” on the top-left corner of the navigation bar. This will bring you to the service console.
2. On the navigation bar (top-right corner), press the name of the currently displayed Region (in our case “Frankfurt”).
3. Choose your preferred region. That Region will then become the default in the console. It would be good to choose a region close to your place of work.

Note

Some resources (such as EC2 instances) are created in a specific Region. For example, if we create an EC2 instance in “Frankfurt”, this EC2 instance would not be displayed if another region is selected (e.g. Milan).



Create a key pair

- “A key pair, consisting of a public key and a private key, is a set of security credentials that you use to prove your identity when connecting to an Amazon EC2 instance”.
- AWS uses public-key cryptography to secure the login information for your instance.
- A Linux instance (the one that we will use in this guideline) has no password; the user uses a key pair to log in to the instance securely. The name of the key pair will be specified when the instance is launched (we will see this step later). The private key will be used when login is performed through SSH (secure shell, a cryptographic protocol allowing to connect to remote servers).
- **If you haven't created a key pair already, you can create one by using the Amazon EC2 console, as outlined in the next slides.**
- Note that if you plan to launch instances in multiple Regions, you'll need to create a key pair in each Region. For more information about Regions, see [Regions and Zones](#).
- For more information, see [Amazon EC2 key pairs and Linux instances](#).

Create a key pair: step-by-step

1. Open the Amazon EC2 console at <https://console.aws.amazon.com/ec2/>.
2. In the navigation pane, choose **Key Pairs**.
3. Choose **Create key pair**.
4. For **Name**, enter a descriptive name for the key pair. Amazon EC2 associates the public key with the name that you specify as the key name. A key name can include up to 255 ASCII characters. It cannot include leading or trailing spaces.
5. For **Key pair type**, choose either **RSA** or **ED25519**. Note that **ED25519** keys are not supported for Windows instances.
6. For **Private key file format**, choose the format in which to save the private key. To save the private key in a format that can be used with OpenSSH, choose **pem**. To save the private key in a format that can be used with PuTTY, choose **ppk**. In this tutorial, we will use PuTTY. If you chose **ED25519** in the previous step, the **Private key file format** options do not appear, and the private key format defaults to **pem**.
7. Choose **Create key pair**.
8. The private key file is automatically downloaded by your browser. The base file name is the name you specified as the name of your key pair, and the file name extension is determined by the file format you chose. Save the private key file in a safe place.

Important: This is the only chance for you to save the private key file.
9. If your PC runs a macOS or Linux operating system and you use an SSH client to connect to your Linux instance on AWS, use the following command to set the permissions of your private key file so that only you can read it (open the terminal in the key pair file directory and run the following command). This is not needed in case the operating system of your PC is Windows.
 - a) `chmod 400 my-key-pair.pem`
 - b) If you do not set these permissions, then you cannot connect to your instance using this key pair. For more information, see [Error: Unprotected private key file](#).

Some useful screenshots are in the next slides...

The screenshot shows the AWS EC2 Dashboard. On the left sidebar, under the 'Instances' section, the 'Key Pairs' link is highlighted with a red box and a red arrow pointing from the bottom-left towards it. The main content area displays 'Resources' and 'Account attributes'.

Resources

You are using the following Amazon EC2 resources in the Europe (Frankfurt) Region:

Instances (running)	0	Dedicated Hosts	0	Elastic IPs	0
Instances	0	Key pairs	1	Load balancers	0
Placement groups	0	Security groups	1	Snapshots	0
Volumes	0				

Account attributes

Supported platforms:

- VPC

Default VPC: vpc-00000000

Settings

EBS encryption

Zones

EC2 Serial Console

Default credit specification

Console experiments

Explore AWS

10 Things You Can Do Today to Reduce AWS Costs

Get Up to 40% Better Price Performance

Enable Best Price-Performance with AWS Graviton2

Additional information

Feedback English (US) ▾

© 2022, Amazon Web Services, Inc. or its affiliates. Privacy Terms Cookie preferences

choose one of these links to create a key pair

EC2 Dashboard

EC2 Global View

Events

Tags

Limits

▼ Instances

Instances [New](#)

Instance Types

Launch Templates

Spot Requests

Savings Plans

Reserved Instances [New](#)

Dedicated Hosts

Capacity Reservations

▼ Images

AMIs [New](#)

AMI Catalog

▼ Elastic Block Store

Volumes [New](#)Snapshots [New](#)Lifecycle Manager [New](#)

▼ Network & Security

Security Groups

Elastic IPs

Placement Groups

Key Pairs

Network Interfaces

Key pairs (1) [Info](#)

Filter key pairs

Actions ▾

Create key pair

Name Type Fingerprint ID



now a page listing all the available key pairs appears. Press the button “Create key pair”

Create key pair Info

Key pair

A key pair, consisting of a private key and a public key, is a set of security credentials that you use to prove your identity when connecting to an instance.

Name

The name can include up to 255 ASCII characters. It can't include leading or trailing spaces.

Key pair type Info

- RSA
- ED25519

Private key file format

- .pem
For use with OpenSSH
- .ppk
For use with PuTTY

Tags (Optional)

No tags associated with the resource.

Add tag

You can add 50 more tags.

Is useful to use a name that recalls the name of the instance (that we will define later)

Please choose RSA key type, they are supported also for Windows instances

Choose file format according to your software (PuTTy in this tutorial, therefore we will choose .ppk)

Cancel

Create key pair

Key pairs | EC2 Management Console

https://eu-central-1.console.aws.amazon.com/ec2/v2/home?region=eu-central-1#KeyPairs:

New EC2 Experience Tell us what you think

EC2 Dashboard EC2 Global View Events Tags Limits Instances Instances New Instance Types Launch Templates Spot Requests Savings Plans Reserved Instances New Dedicated Hosts Capacity Reservations Images AMIs New AMI Catalog Elastic Block Store Volumes New Snapshots New Lifecycle Manager New Network & Security Security Groups Elastic IPs Placement Groups

Search for services, features, blogs, docs, and more [Alt+S]

Download nameTutorial.ppk (Pem file)

Successfully created key pair

Key pairs (2) Info

Name	Type	Fingerprint	ID
nameTutorial	rsa	1a:c4:9e:80:85:c1:ca:15:e5:2f:eb:de:57:...	key-08d766833715d2316

Filter key pairs

Create key pair

Visualizza altro

later, we will use this key and associate it to future instances

Save the private key file in a safe place.
Important
This is the only chance for you to save the private key file.

Feedback English (US) © 2022, Amazon Web Services, Inc. or its affiliates. Privacy Terms Cookie preferences

Create a security group: step-by-step

Security groups act as a firewall for associated instances, controlling both inbound and outbound traffic at the instance level. You must add rules to a security group that enable you to connect to your instance from your IP address using SSH. You can also add rules that allow inbound and outbound HTTP and HTTPS access from anywhere.

To create a security group with least privilege

1. Open the Amazon EC2 console at <https://console.aws.amazon.com/ec2/>.
2. From the top navigation bar, select a Region for the security group. Security groups are specific to a Region, so you should select the same Region in which you created your key pair.
3. In the left navigation pane, choose **Security Groups**.
4. Choose **Create security group**.
5. For **Basic details**, do the following:
 - a. Enter a name for the new security group and a description. Use a name that is easy for you to remember, such as your user name, followed by `_SG_`, plus the Region name. For example, `me_SG_uswest2`.
 - b. In the **VPC** list, select your default VPC for the Region.
6. For **Inbound rules**, create rules that allow specific traffic to reach your instance. For example, use the following rules for a web server that accepts HTTP and HTTPS traffic. For more examples, see [Security group rules for different use cases](#).
 - a. Choose **Add rule**. For **Type**, choose **HTTP**. For **Source**, choose **Anywhere**.
 - b. Choose **Add rule**. For **Type**, choose **HTTPS**. For **Source**, choose **Anywhere**.
 - c. Choose **Add rule**. For **Type**, choose **SSH**. For **Source**, do one of the following:
 - Choose **My IP** to automatically add the public IPv4 address of your local computer.
 - Choose **Custom** and specify the public IPv4 address of your computer or network in CIDR notation. To specify an individual IP address in CIDR notation, add the routing suffix `/32`, for example, `203.0.113.25/32`. If your company or your router allocates addresses from a range, specify the entire range, such as `203.0.113.0/24`.
 - d. **Warning:** For security reasons, do not choose **Anywhere** for **Source** with a rule for SSH. This would allow access to your instance from all IP addresses on the internet. This is acceptable for a short time in a test environment, but it is unsafe for production environments.
7. For **Outbound rules**, keep the default rule, which allows all outbound traffic.
8. Choose **Create security group**.

Some useful screenshots are in the next slides...

AWS Services Search for services, features, blogs, docs, and more [Alt+S] Frankfurt Ichiudinelli

EC2 Dashboard EC2 Billing Batch

EC2 Global View Events Tags Limits Instances Instances New Instance Types Launch Templates Spot Requests Savings Plans Reserved Instances New Dedicated Hosts Capacity Reservations Images AMIs New AMI Catalog Elastic Block Store Volumes New Snapshots New Lifecycle Manager Network & Security Security Groups Elastic IPs Placement Groups Key Pairs Network Interfaces

Feedback English (US) ▾

Resources

You are using the following Amazon EC2 resources in the Europe (Frankfurt) Region:

Instances (running)	0	Dedicated Hosts	0	Elastic IPs	0
Instances	0	Key pairs	1	Load balancers	0
Placement groups	0	Security groups	1	Snapshots	0
Volumes	0				

(1) Easily size, configure, and deploy Microsoft SQL Server Always On availability groups on AWS using the AWS Launch Wizard for SQL Server. Learn more X

Account attributes

Supported platforms VPC Default VPC vpc Settings EBS encryption Zones EC2 Serial Console Default credit specification Console experiments

choose one of these links

Note: Your instances will launch in the Europe (Frankfurt) Region

Scheduled events

Europe (Frankfurt)
No scheduled events

Migrate a server

Service health

(Frankfurt) Status This service is operating normally

Zones

Zone name	Zone ID
eu-central-1a	euc1-az2
eu-central-1b	euc1-az3
eu-central-1c	euc1-az1

Enable additional Zones

Explore AWS

10 Things You Can Do Today to Reduce AWS Costs Explore how to effectively manage your AWS costs without compromising on performance or capacity. Learn more

Get Up to 40% Better Price Performance T4g instances deliver the best price performance for burstable general purpose workloads in Amazon EC2. Learn more

Enable Best Price-Performance with AWS Graviton2 AWS Graviton2 powered EC2 instances enable up to 40% better price performance for a broad spectrum of cloud workloads. Learn more

Additional information

© 2022, Amazon Web Services, Inc. or its affiliates. Privacy Terms Cookie preferences



Services

Search for services, features, blogs, docs, and more

[Alt+S]



Frankfurt ▾

Ichiudinelli ▾

EC2 Billing Batch

Events

Tags

Limits

Instances

Instances New

Instance Types

Launch Templates

Spot Requests

Savings Plans

Reserved Instances New

Dedicated Hosts

Capacity Reservations

Images

AMIs New

AMI Catalog

Elastic Block Store

Volumes New

Snapshots New

Lifecycle Manager New

Network & Security

Security Groups

Elastic IPs

Placement Groups

Key Pairs

Network Interfaces

Load Balancing

Load Balancers

Feedback English (US) ▾

© 2022, Amazon Web Services, Inc. or its affiliates.

Privacy

Terms

Cookie preferences

Security Groups (1) Info



Actions ▾

Export security groups to CSV

Create security group

Filter security groups

Name Security group ID Security group name VPC ID Description Owner Inbound rules count Outbound rules count

Name	Security group ID	Security group name	VPC ID	Description	Owner	Inbound rules count	Outbound rules count

now a page listing all the available security groups appears. Press the button “Create security group”

Create security group Info

A security group acts as a virtual firewall for your instance to control inbound and outbound traffic. To create a new security group, complete the fields below.

Basic details

Security group name Info

Name cannot be edited after creation.

Description Info

VPC Info

Inbound rules Info

Type Info

Protocol Info

Port range Info

Source Info

It is useful to use a name that recalls the desired method of connection

Outbound rules Info

Type Info

Protocol Info

Port range Info

Destination Info

Tags - optional

A tag is a label that you assign to an AWS resource. Each tag consists of a key and an optional value. You can use tags to search and filter your resources or track your AWS costs.

No tags associated with the resource.

You can add up to 50 more tag

SSH from “anywhere ipv4” inbound rule is acceptable for a short time in a test environment, but it is unsafe for production environments

Leave outbound as default

Cancel

Create security group

Security Groups (1/2) Info



Actions ▾

Export security groups to CSV

Create security group

Name	Security group ID	Security group name	VPC ID	Description	Owner	Inbound rules count	Outbound rules count
<input checked="" type="checkbox"/> -	sg-00d7894cab1cf5f64	nameTutorial	vpc-00d7894cab1cf5f64	description tutorial		1 Permission entry	1 Permission entry

sg-00d7894cab1cf5f64 - nameTutorial

Details

Inbound rules

Outbound rules

Tags

later, we will use this group and regulate inbound and outbound connection of instances

Details

Security group name

nameTutorial

Security group ID

sg-00d7894cab1cf5f64

Description

description tutorial

VPC ID

vpc-00d7894cab1cf5f64

Owner

Inbound rules count

1 Permission entry

Outbound rules count

1 Permission entry

Using AWS setting up an instance

Create an instance

- You can launch a Linux instance using the AWS Management Console as described in the procedure on next slides.
- This tutorial is intended to help you launch your first instance quickly, so it doesn't cover all possible options. For more information about the advanced options, see [Launch an instance using the Launch Instance Wizard](#). For information about other ways to launch your instance, see [Launch your instance](#).
- A free instance can be created only with `t2.micro` instance type or lower. Unfortunately, we found that this instance type is not adequate for running RStudio and nlmixr. We found that at least 2 cores are needed, therefore, in this tutorial, the `t2.xlarge` instance type was used, whose price was (at the time of preparing this tutorial) 0.2144 USD per Hour. Other instances can as well be used (e.g., `c6i.large` and many others).
- In the next slides, we reported both how to create a free instance and how to create an instance to run RStudio.

ATTENTION

**following the steps for creating an instance for running
RStudio will have a certain cost**

**Please consult the official Amazon documentation
(https://aws.amazon.com/ec2/pricing/on-demand/?nc1=h_ls)**

Create an instance - step by step

- Open the Amazon EC2 console at <https://console.aws.amazon.com/ec2/>. From the console dashboard, choose **Launch Instance**.
- **Step 1:** the **Choose an Amazon Machine Image (AMI)** page displays a list of basic configurations, called *Amazon Machine Images (AMIs)*, that serve as templates for your instance.
 - For the free instance, select an HVM version of Amazon Linux 2. Notice that these AMIs are marked "Free tier eligible."
 - For using RStudio, in the community AMIs, filter for Ubuntu OS and search "rstudio". Select the AMI with the most recent version of R and RStudio installed. **NOTE:** some AMI are not available in certain Regions.
- **Step 2:** on the **Choose an Instance Type** page, you can select the hardware configuration of your instance. Then, choose **Review and Launch** to let the wizard complete the other configuration settings for you.
 - For the free instance, select the `t2.micro` instance type, which is selected by default. The `t2.micro` instance type is eligible for the free tier. In Regions where `t2.micro` is unavailable, you can use a `t3.micro` instance under the free tier. For more information, see [AWS Free Tier](#).
 - For using RStudio, we found that at least 2 core are needed. In this tutorial, we used the `t2.xlarge` instance type.

Create an instance - step by step

- **Steps 3, 4, 5:** for this tutorial, you can use the default selected options.
- **Step 6:** on the **Review Instance Launch** page, under **Security Groups**, you'll see that the wizard created and selected a security group for you. You can use this security group, or alternatively you can select the security group that you created when getting set up using the following steps:
 - Choose **Edit security groups**.
 - On the **Configure Security Group** page, ensure that **Select an existing security group** is selected.
 - Select your security group from the list of existing security groups, and then choose **Review and Launch**.
- **Step 7:** on the **Review Instance Launch** page, choose **Launch**.
 - When prompted for a key pair, select **Choose an existing key pair**, then select the key pair that you created when getting set up.
 - **Warning:** Don't select **Proceed without a key pair**. If you launch your instance without a key pair, then you can't connect to it.
When you are ready, select the acknowledgement checkbox, and then choose **Launch Instances**.
 - A confirmation page lets you know that your instance is launching. Choose **View Instances** to close the confirmation page and return to the console.

Some useful screenshots are in the next slides...

AWS Services Search for services, features, blogs, docs, and more [Alt+S] Frankfurt Ichiudinelli

EC2 Billing Batch

New EC2 Experience Tell us what you think X

EC2 Dashboard

EC2 Global View

Events

Tags

Limits

Instances

- Instances New
- Instance Types
- Launch Templates
- Spot Requests
- Savings Plans
- Reserved Instances New
- Dedicated Hosts
- Capacity Reservations

Images

- AMIs New
- AMI Catalog

Elastic Block Store

- Volumes New
- Snapshots New
- Lifecycle Manager New

Network & Security

- Security Groups
- Elastic IPs
- Placement Groups

Feedback English (US) ▾

Resources

You are using the following Amazon EC2 resources in the Europe (Frankfurt) Region:

Instances (running)	0	Dedicated Hosts	0	Elastic IPs	0
Instances	0	Key pairs	2	Load balancers	0
Placement groups	0	Security groups	2	Snapshots	0
Volumes	0				

ⓘ Easily size, configure, and deploy Microsoft SQL Server Always On availability groups on AWS using the AWS Launch Wizard for SQL Server. [Learn more](#) X

Launch instance

To get started, launch an Amazon EC2 instance, which is a virtual server in the cloud.

Launch instance ▲ Migrate a server ▾

Launch instance Launch instance from template Frankfurt Region

Scheduled events

Europe (Frankfurt)
No scheduled events

Migrate a server

Service health

Region: Europe (Frankfurt) Status: This service is operating normally

Zones

Zone name	Zone ID
euc1-central-1a	euc1-az2
euc1-central-1b	euc1-az3
euc1-central-1c	euc1-az1

Enable additional Zones

Account attributes

Supported platforms VPC

Default VPC vpc- []

Settings

- EBS encryption
- Zones
- EC2 Serial Console
- Default credit specification
- Console experiments

Explore AWS

Get Up to 40% Better Price Performance
T4g instances deliver the best price performance for burstable general purpose workloads in Amazon EC2. [Learn more](#)

Run Containerized Workloads For Less
Deploy containerized workloads and manage clusters at up to 90% off with Amazon EC2 Spot Instances. [Learn More](#)

10 Things You Can Do Today to Reduce AWS Costs
Explore how to effectively manage your AWS costs without compromising on performance or capacity. [Learn more](#)

Additional information

Getting started guide



Services

Search for services, features, blogs, docs, and more

[Alt+S]

EC2 Billing Batch

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Add Tags 6. Configure Security Gro

Step 1 for a free linux (ubuntu) account no RStudio

Frankfurt ▾ Ichiudinelli ▾

Step 1: Choose an Amazon Machine Image (AMI)

Cancel and Exit

An AMI is a template that contains the software configuration (operating system, application server, and applications) required to launch your instance. You can select an AMI provided by AWS, our user community, or the AWS Marketplace; or you can select one of your own AMIs.

Search for an AMI by entering a search term e.g. "Windows"

Search by Systems Manager parameter

Quick Start

My AMIs

AWS Marketplace

Community AMIs

 Free tier only ⓘ**Amazon Linux 2 AMI (HVM) - Kernel 5.10, SSD Volume Type** - ami-05cafdf7c9f772ad2 (64-bit x86) / ami-024ae25a9e4aec250 (64-bit Arm)Amazon Linux
Free tier eligible

Amazon Linux 2 comes with five years support. It provides Linux kernel 5.10 tuned for optimal performance on Amazon EC2, systemd 219, GCC 7.3, Glibc 2.26, Binutils 2.29.1, and the latest software packages through extras. This AMI is the successor of the Amazon Linux AMI that is now under maintenance only mode and has been removed from this wizard.

Root device type: ebs Virtualization type: hvm ENA Enabled: Yes

Select

 64-bit (x86)
 64-bit (Arm)**Amazon Linux 2 AMI (HVM) - Kernel 4.14, SSD Volume Type** - ami-095e0f8062e0e8216 (64-bit x86) / ami-0d323e204cce5a382 (64-bit Arm)Amazon Linux
Free tier eligible

Amazon Linux 2 comes with five years support. It provides Linux kernel 4.14 tuned for optimal performance on Amazon EC2, systemd 219, GCC 7.3, Glibc 2.26, Binutils 2.29.1, and the latest software packages through extras. This AMI is the successor of the Amazon Linux AMI that is now under maintenance only mode and has been removed from this wizard.

Select

 64-bit (x86)
 64-bit (Arm)

Not all the AMIs are free. Ensure to check the Free tier only checkbox

**SUSE Linux Enterprise Server 15 SP3 (HVM), SSD Volume Type** - ami-02930a5921348d135 (64-bit x86) / ami-06ac07a27ef68f2d9 (64-bit Arm)SUSE Linux
Free tier eligible

SUSE Linux Enterprise Server 15 Service Pack 3 (HVM). EBS General Purpose (SSD) Volume Type. Amazon EC2 AMI Tools preinstalled; Apache 2.2, MySQL 5.5, PHP 5.3, and Ruby 1.8.7 available.

Root device type: ebs Virtualization type: hvm ENA Enabled: Yes

Select

 64-bit (x86)
 64-bit (Arm)**Ubuntu Server 20.04 LTS (HVM), SSD Volume Type** - ami-0d527b8c289b4af7f (64-bit x86) / ami-0b168c89474ef4301 (64-bit Arm)Ubuntu Server 20.04 LTS (HVM). EBS General Purpose (SSD) Volume Type. Support available from Canonical (<http://www.ubuntu.com/cloud/services>).

Root device type: ebs Virtualization type: hvm ENA Enabled: Yes

Select

 64-bit (x86)
 64-bit (Arm)**Microsoft Windows Server 2019 Base** - ami-07dfec7a6d529b77a

Select

Step 1 for using RStudio

You've been invited to try an early, beta iteration of the new launch instance wizard. We will continue to improve the experience over the next few months. We're asking customers for their feedback on this early release. To exit the new launch instance wizard at any time, choose the **Cancel** button.

Try it now! X

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Add Tags 6. Configure Security Group 7. Review

Step 1: Choose an Amazon Machine Image (AMI)

An AMI is a template that contains the software configuration (operating system, application server, and applications) required to launch your instance. You can select an AMI provided by AWS, our user community, or the AWS Marketplace; or you can select one of your own AMIs.

Cancel and Exit

Search by Systems Manager parameter

Quick Start (0)
My AMIs (0)
AWS Marketplace (17)
Community AMIs (2)

Operating system

- Amazon Linux
- Cent OS
- Debian
- Fedora
- Gentoo
- openSUSE
- Other Linux
- Red Hat

Ubuntu Select

macOS Select

Architecture

- 32-bit (x86)
- 64-bit (x86)
- 64-bit (Arm)
- 64-bit (Mac)

Root device type

- EBS
- Instance store

RStudio-1.3.1073_R-4.0.2_CUDA-10.1_cuDNN-7.6.5_ubuntu-18.04-LTS-64bit - ami-0b4be5cd9e848fabb

Ready to run RStudio server for statistical computation (www.louisaslett.com). Connect to instance public DNS in web browser (standard port 80), username rstudio and password is instance ID

Root device type: ebs Virtualization type: hvm ENA Enabled: Yes

Select 64-bit (x86)

RStudio-1.2.1335_R-3.6.0_CUDA-10.0_cuDNN-7.5.1_ubuntu-18.04-LTS-64bit - ami-0e9e5245ffe34a3e

Ready to run RStudio server for statistical computation (www.louisaslett.com). Connect to instance public DNS in web browser (standard port 80), username rstudio and password is instance ID

Root device type: ebs Virtualization type: hvm ENA Enabled: Yes

Select 64-bit (x86)

The following results for "rstudio" were found in other catalogs:

- 17 results in AWS Marketplace

AWS Marketplace provides prepartnered Software that is pre-configured to run on AWS.

in the community AMIs, filter for Ubuntu OS and search “rstudio”.

this AMIs are provided from the community. We will use AMI described in https://www.louisaslett.com/RStudio_AMI/

This UBUNTU free image has R and Rstudio already installed and Rstudio Graphical User Interface is already reachable via instance IP

Once created our instance, OS user is “ubuntu”, Rstudio username is “rstudio” and password is the instance ID.

Step 2 for a free linux (ubuntu) account no RStudio

Step 2: Choose an Instance Type

Amazon EC2 provides a wide selection of instance types optimized to fit different use cases. Instances are virtual servers that can run applications. They have varying combinations of CPU, memory, storage, and networking capacity, and give you the flexibility to choose the appropriate mix of resources for your applications. [Learn more](#) about instance types and how they can meet your computing needs.

Filter by: All instance families ▾ Current generation ▾ Show/Hide Columns

Currently selected: t2.micro (- ECUs, 1 vCPUs, 2.5 GHz, -, 1 GiB memory, EBS only)

	Family	Type	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance	IPv6 Support
<input type="checkbox"/>	t2	t2.nano	1	0.5	EBS only	-	Low to Moderate	Yes
<input checked="" type="checkbox"/>	t2	t2.micro Free tier eligible	1	1	EBS only	-	Low to Moderate	Yes
<input type="checkbox"/>	t2	t2.small	1	2	EBS only	-	Low to Moderate	Yes
<input type="checkbox"/>	t2	t2.medium	2	4	EBS only	-	Low to Moderate	Yes
<input type="checkbox"/>	t2	t2.large	2	8	EBS only	-	Low to Moderate	Yes
<input type="checkbox"/>	t2	t2.xlarge	4	16	EBS only	-	Moderate	Yes
<input type="checkbox"/>	t2	t2.2xlarge	8	32	EBS only	-	Moderate	Yes
<input type="checkbox"/>	t3	t3.nano	2	0.5	EBS only	Yes	Up to 5 Gigabit	Yes
<input type="checkbox"/>	t3	t3.micro	2	1	EBS only	Yes	Up to 5 Gigabit	Yes
<input type="checkbox"/>	t3	t3.small	2	2	EBS only	Yes	Up to 5 Gigabit	Yes
<input type="checkbox"/>	t3	t3.medium	2	4	EBS only	Yes	Up to 5 Gigabit	Yes
<input type="checkbox"/>	t3	t3.large	2	8	EBS only	Yes	Up to 5 Gigabit	Yes
<input type="checkbox"/>	t3	t3.xlarge	4	16	EBS only	Yes	Up to 5 Gigabit	Yes

Cancel **Previous** **Review and Launch** **Next: Configure Instance Details**

Feedback English (US) ▾ © 2022, Amazon Web Services, Inc. or its affiliates. Privacy Terms Cookie preferences

Step 2 for using RStudio

ATTENTION: a certain amount will be charged to your account

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Add Tags 6. Configure Security Group 7. Review

Step 2: Choose an Instance Type

Amazon EC2 provides a wide selection of instance types optimized to fit different use cases. Instances are virtual servers that can run applications. They have varying combinations of CPU, memory, storage, and networking capacity, and give you the flexibility to choose the appropriate mix of resources for your applications. Learn more about instance types and how they can meet your computing needs.

Filter by: All instance families Current generation Show/Hide Columns

Currently selected: t2.micro (- ECU, 1 vCPUs, 2.5 GHz, ~1 GiB memory, EBS only)

Family	Type	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available	Network Performance	IPv6 Support
i2	t2.nano	1	0.5	EBS only	-	Low to Moderate	Yes
<input checked="" type="checkbox"/> t2	t2.micro Free tier eligible	1	1	EBS only	-	Low to Moderate	Yes
i2	t2.small	1	2	EBS only	-	Low to Moderate	Yes
i2	t2.medium	2	4	EBS only	-	Low to Moderate	Yes
i2	t2.large	2	8	EBS only	-	Low to Moderate	Yes
<input checked="" type="checkbox"/> i2	t2.xlarge	4	16	EBS only	-	Moderate	Yes
i2	t2.2xlarge	8	32	EBS only	-	Moderate	Yes
i3	t3.nano	2	0.5	EBS only	Yes	Up to 5 Gigabit	Yes
i3	t3.micro	2	1	EBS only	Yes	Up to 5 Gigabit	Yes
i3	t3.small	2	2	EBS only	Yes	Up to 5 Gigabit	Yes
i3	t3.medium	2	4	EBS only	Yes	Up to 5 Gigabit	Yes
i3	t3.large	2	8	EBS only	Yes	Up to 5 Gigabit	Yes
i3	t3.xlarge	4	16	EBS only	Yes	Up to 5 Gigabit	Yes
i3	t3.2xlarge	8				Up to 5 Gigabit	Yes
i3a	t3a.nano	2				Up to 5 Gigabit	Yes
i3a	t3a.micro	2				Up to 5 Gigabit	Yes
i3a	t3a.small	2				Up to 5 Gigabit	Yes
i3a	t3a.medium	2				Up to 5 Gigabit	Yes
i3a	t3a.large	2				Up to 5 Gigabit	Yes
i3a	t3a.xlarge	4				Up to 5 Gigabit	Yes
i3a	t3a.2xlarge	8				Up to 5 Gigabit	Yes

using Rstudio, a 2 core and 8GB of RAM is the minimal option.

The cost of the 4 core 16GB RAM “t2.xlarge” instance type is 0.2144 USD per Hour

Cancel Previous Review and Launch Next: Configure Instance Details

1. Choose AMI

2. Choose Instance Type

3. Configure Instance

4. Add Storage

5. Add Tags

6. Configure Security Group

7. Review

Step 3: Configure Instance Details

Configure the instance to suit your requirements. You can launch multiple instances from the same AMI, request Spot instances to take advantage of the lower pricing, assign an access management role to the instance, and more.

Number of instances

1

Launch into Auto Scaling Group

Purchasing option

 Request Spot instances

Network

vpc-[REDACTED] (default)

 Create new VPC

Subnet

No preference (default subnet in any Availability Zone)

 Create new subnet

Auto-assign Public IP

 Use subnet setting (Enable)

Hostname type

 Use subnet setting (IP name)

DNS Hostname

- Enable IP name IPv4 (A record) DNS requests
- Enable resource-based IPv4 (A record) DNS requests
- Enable resource-based IPv6 (AAAA record) DNS requests

Placement group

 Add instance to placement group

Capacity Reservation

 Open

Domain join directory

No directory

 Create new directory

IAM role

None

 Create new IAM role

Shutdown behavior

Stop

Stop - Hibernate behavior

 Enable hibernation as an additional stop behavior

Enable termination protection

 Protect against accidental termination

Monitoring

 Enable CloudWatch detailed monitoring

Additional charges apply.

Tenancy

Shared - Run a shared hardware instance

for this tutorial, these preferences
can be left as the precompiled
default

[Cancel](#)[Previous](#)[Review and Launch](#)[Next: Add Storage](#)

1. Choose AMI

2. Choose Instance Type

3. Configure Instance

4. Add Storage

5. Add Tags

6. Configure Security Group

7. Review

Step 4: Add Storage

Your instance will be launched with the following storage device settings. You can attach additional EBS volumes and instance store volumes to your instance, or edit the settings of the root volume. You can also attach additional EBS volumes after launching an instance, but not instance store volumes. [Learn more](#) about storage options in Amazon EC2.

Volume Type	Device	Snapshot	Size (GiB)	Volume Type	IOPS	Throughput (MB/s)	Delete on Termination	Encryption
Root	/dev/xvda	snap	8	General Purpose SSD (gp2)	100 / 3000	N/A	<input checked="" type="checkbox"/>	Not Encrypted

[Add New Volume](#)

Free tier eligible customers can get up to 30 GB of EBS General Purpose (SSD) or Magnetic storage. [Learn more](#) about free usage tier eligibility and usage restrictions.

▼ Shared file systems

You currently don't have any file systems on this instance. Select "Add file system" button below to add a file system.

[Add file system](#)

for this tutorial, these preferences can be left as the precompiled default

[Cancel](#)[Previous](#)[Review and Launch](#)[Next: Add Tags](#)

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Add Tags 6. Configure Security Group 7. Review

Step 5: Add Tags

A tag consists of a case-sensitive key-value pair. For example, you could define a tag with key = Name and value = Webserver.

A copy of a tag can be applied to volumes, instances or both.

Tags will be applied to all instances and volumes. [Learn more](#) about tagging your Amazon EC2 resources.

Key (128 characters maximum)

Value (256 characters maximum)

Instances

Volumes

Network
Interfaces

This resource currently has no tags

Choose the [Add tag](#) button or [click to add a Name tag](#).

Make sure your [IAM policy](#) includes permissions to create tags.

[Add Tag](#)

(Up to 50 tags maximum)

for this tutorial, these preferences
can be left as the precompiled
default

[Cancel](#)[Previous](#)[Review and Launch](#)[Next: Configure Security Group](#)



Services

Search for services, features, blogs, docs, and more

[Alt+S]

EC2 Billing Batch

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Add Tags 6. Configure Security Group 7. Review

Step 6 for a free linux (ubuntu) account no RStudio

Step 6: Configure Security Group

A security group is a set of firewall rules that control the traffic for your instance. On this page, you can add rules to allow specific traffic to reach your instance. For example, if you want to set up a web server and allow Internet traffic to reach your instance, add rules that allow unrestricted access to the HTTP and HTTPS ports. You can create a new security group or select from an existing one below. [Learn more](#) about Amazon EC2 security groups.

Assign a security group: Create a new security group
 Select an existing security group

Security Group ID	Name	Description	Actions
sg-00d7894cab1cf5f64	default	default VPC security group	Copy to new
sg-00d7894cab1cf5f64	nameTutorial	description tutorial	Copy to new



Rules with source of 0.0.0.0/0 allow all IP addresses to access your instance. We recommend setting security group rules to allow access from known IP addresses only.

for this tutorial, choose the security group previously created

Inbound rules for sg-00d7894cab1cf5f64 (Selected security groups: sg-00d7894cab1cf5f64)

Type	Protocol	Port Range	Source	Description
SSH	TCP	22	0.0.0.0/0	

[Cancel](#) [Previous](#) [Review and Launch](#)

Step 6 for using RStudio

ATTENTION: a certain amount will be charged to your account

aws Services Search for services, features, blogs, docs, and more [Alt+S]

1. Choose AMI 2. Choose Instance Type 3. Configure Instance 4. Add Storage 5. Add Tags 6. Configure Security Group 7. Review

Step 6: Configure Security Group

A security group is a set of firewall rules that control the traffic for your instance. On this page, you can add rules to allow specific traffic to reach your instance. For example, if you want to set up a web server and allow Internet traffic to reach your instance, add rules that allow unrestricted access to the HTTP and HTTPS ports. You can create a new security group or select from an existing one below. Learn more about Amazon EC2 security groups.

Assign a security group: Create a new security group
 Select an existing security group

Security group name: launch-RStudio-try

Description: launch-wizard-1 created 2022-01-21T15:34:00.754+01:00

Type	Protocol	Port Range	Source	Description
SSH	TCP	22	Custom	0.0.0.0/0
HTTP	TCP	80	Custom	0.0.0.0/0, ::/0

Add Rule

Warning
Rules with source of 0.0.0.0/0 allow all IP addresses to access your instance. We recommend setting security group rules to allow access from known IP addresses only.

create a new group for this Rstudio instance

leave SSH on port 22 for terminal access of our virtual server

ensure that your 'security group' settings allow incoming HTTP (port 80), to access Rstudio GUI from browser

Cancel Previous Review and Launch

Step 7: Review Instance Launch

Please review your instance launch details. You can go back to edit changes for each section. Click **Launch** to assign a key pair to your instance and complete the launch process.

⚠ Improve your instances' security. Your security group, nameTutorial, is open to the world.

Your instances may be accessible from any IP address. We recommend that you update your security group rules to allow access from known IP addresses only.

You can also open additional ports in your security group to facilitate access to the application or service you're running, e.g., HTTP (80) for web servers. [Edit security groups](#)

AMI Details

[Edit AMI](#)

Amazon Linux 2 AMI (HVM) - Kernel 5.10, SSD Volume Type - ami-05cafdf7c9f772ad2

Free tier eligible

Amazon Linux 2 comes with five years support. It provides Linux kernel 5.10 tuned for optimal performance on Amazon EC2, systemd 219, GCC 7.3, Glibc 2.26, Binutils 2.29.1, and the latest software packages through extras. This AMI is the successor of the Amazon Linux AMI that is n...

Root Device Type: ebs Virtualization type: hvm

Instance Type

[Instance type](#)

Instance Type	ECUs	vCPUs	Memory (GiB)	Instance Storage (GB)	EBS-Optimized Available
t2.micro	-	1	1	EBS only	-

this final page lets us see all the components of the instance that we are creating

Security Groups

[Edit security groups](#)

Security Group ID	Name	Description
sg-00d7894cab1cf5f64	nameTutorial	description tutorial

All selected security groups inbound rules

Type	Protocol	Port Range	Source	Description
SSH	TCP	22	0.0.0.0/0	

[Cancel](#)[Previous](#)[Launch](#)

Select an existing key pair or create a new key pair

X

A key pair consists of a **public key** that AWS stores, and a **private key file** that you store. Together, they allow you to connect to your instance securely. For Windows AMIs, the private key file is required to obtain the password used to log into your instance. For Linux AMIs, the private key file allows you to securely SSH into your instance. Amazon EC2 supports ED25519 and RSA key pair types.

Note: The selected key pair will be added to the set of keys authorized for this instance. Learn more about [removing existing key pairs from a public AMI](#).

Choose an existing key pair

Select a key pair

nameTutorial | RSA

I acknowledge that I have access to the corresponding private key file, and that without this file, I won't be able to log into my instance.

for this tutorial, choose the key pair previously created

Cancel

Launch Instances

Launch Status

Your instances are now launching

The following instance launches have been initiated: i-0ab9d85694318f132 [View launch log](#)

Get notified of estimated charges

Create billing alerts to get an email notification when estimated charges on your AWS bill exceed an amount you define (for example, if you exceed the free usage tier).

How to connect to your instances

Your instances are launching, and it may take a few minutes until they are in the **running** state, when they will be ready for you to use. Usage hours on your new instances will start immediately and continue to accrue until you stop or terminate your instances.

Click [View Instances](#) to monitor your instances' status. Once your instances are in the **running** state, you can **connect** to them from the Instances screen. [Find out](#) how to connect to your instances.

▼ Here are some helpful resources to get you started

- [How to connect to your Linux instance](#)
- [Amazon EC2: User Guide](#)
- [Learn about AWS Free Usage Tier](#)
- [Amazon EC2: Discussion Forum](#)

While your instances are launching you can also

- [Create status check alarms to be notified when these instances fail status checks. \(Additional charges may apply\)](#)
- [Create and attach additional EBS volumes \(Additional charges may apply\)](#)
- [Manage security groups](#)

a confirmation page lets you know
if the instance has been created
correctly

[View Instances](#)



Services

Search for services, features, blogs, docs, and more

[Alt+S]



Frankfurt ▾

Ichiudinelli ▾

EC2 Billing Batch

New EC2 Experience X
Tell us what you think

EC2 Dashboard

EC2 Global View

Events

Tags

Limits

Instances

Instances New

Instance Types

Launch Templates

Spot Requests

Savings Plans

Reserved Instances New

Dedicated Hosts

Capacity Reservations

Images

AMIs New

AMI Catalog

Elastic Block Store

Volumes NewSnapshots NewLifecycle Manager New

Network & Security

Security Groups

Elastic IPs

Placement Groups

Feedback English (US) ▾



Connect

Instance state ▾

Actions ▾

Launch instances

< 1 > (1)Instances (1/1) Info

Search

<input checked="" type="checkbox"/>	Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IPv4 DNS
<input checked="" type="checkbox"/>	-	i-0ab9d85694318f132	Pending	t2.micro	-	No alarms	+ eu-central-1c	ec2-18-156-200-55.eu-central-1.compute.amazonaws.com

here you can see in details the instances that are present in the account, in the current region

Instance: i-0ab9d85694318f132

Details Security Networking Storage Status checks Monitoring Tags▼ Instance summary Info

Instance ID	<input type="text"/> i-0ab9d85694318f132	Public IPv4 address	<input type="text"/> 18.156.200.55 open address	Private IPv4 addresses	<input type="text"/> 172.31.8.255
IPv6 address	<input type="text"/> -	Instance state	<input type="text"/> Pending	Public IPv4 DNS	<input type="text"/> ec2-18-156-200-55.eu-central-1.compute.amazonaws.com open address
Hostname type	<input type="text"/> IP name: ip-172-31-8-255.eu-central-1.compute.internal	Private IP DNS name (IPv4 only)	<input type="text"/> ip-172-31-8-255.eu-central-1.compute.internal	Answer private resource DNS name	<input type="text"/> IPv4 (A)
Instance type		Elastic IP addresses		VPC ID	

© 2022, Amazon Web Services, Inc. or its affiliates.

Privacy

Terms

Cookie preferences

AWS Services Search for services, features, blogs, docs, and more [Alt+S] Frankfurt Ichudinelli

EC2 Billing Batch

New EC2 Experience Tell us what you think

EC2 Dashboard EC2 Global View Events Tags Limits Instances Instances New Instance Types Launch Templates Spot Requests Savings Plans Reserved Instances New Dedicated Hosts Capacity Reservations Images AMIs New AMI Catalog Elastic Block Store Volumes New Snapshots New Lifecycle Manager New Network & Security Security Groups Elastic IPs Placement Groups Feedback English (US) ▾

Instances (1/1) Info

Search Connect

Name	Instance ID	Instance state	Instance type	Status check	Alarm status
-	i-0ab9d85694318f132	Running	t2.micro	2/2 checks passed	No alarms

Actions ▾ Launch Instances

Instance state ▾ Actions ▾ Launch Instances ▾

Stop instance Start instance Reboot instance Hibernate instance Terminate instance

Zone Public IPv4 DNS

ec2-18-156-200-55.eu-central-1.compute.amazonaws.com

by default, new instances go into a “running state”.

The instance state can be changed in every moment

Remember, the user pays during the running time of each instance (except for free tier!)

Instance: i-0ab9d85694318f132

Details Security

Instance summary

Instance ID i-0ab9d85694318f132	Public IPv4 address 18.156.200.55 open address	Private IPv4 addresses 172.31.8.255
IPv6 address -	Instance state Running	Public IPv4 DNS ec2-18-156-200-55.eu-central-1.compute.amazonaws.com open address
Hostname type IP name: ip-172-31-8-255.eu-central-1.compute.internal	Private IP DNS name (IPv4 only) ip-172-31-8-255.eu-central-1.compute.internal	Answer private resource DNS name IPv4 (A)
Instance type	Elastic IP addresses	VPC ID

© 2022, Amazon Web Services, Inc. or its affiliates. Privacy Terms Cookie preferences

Instance lifecycle

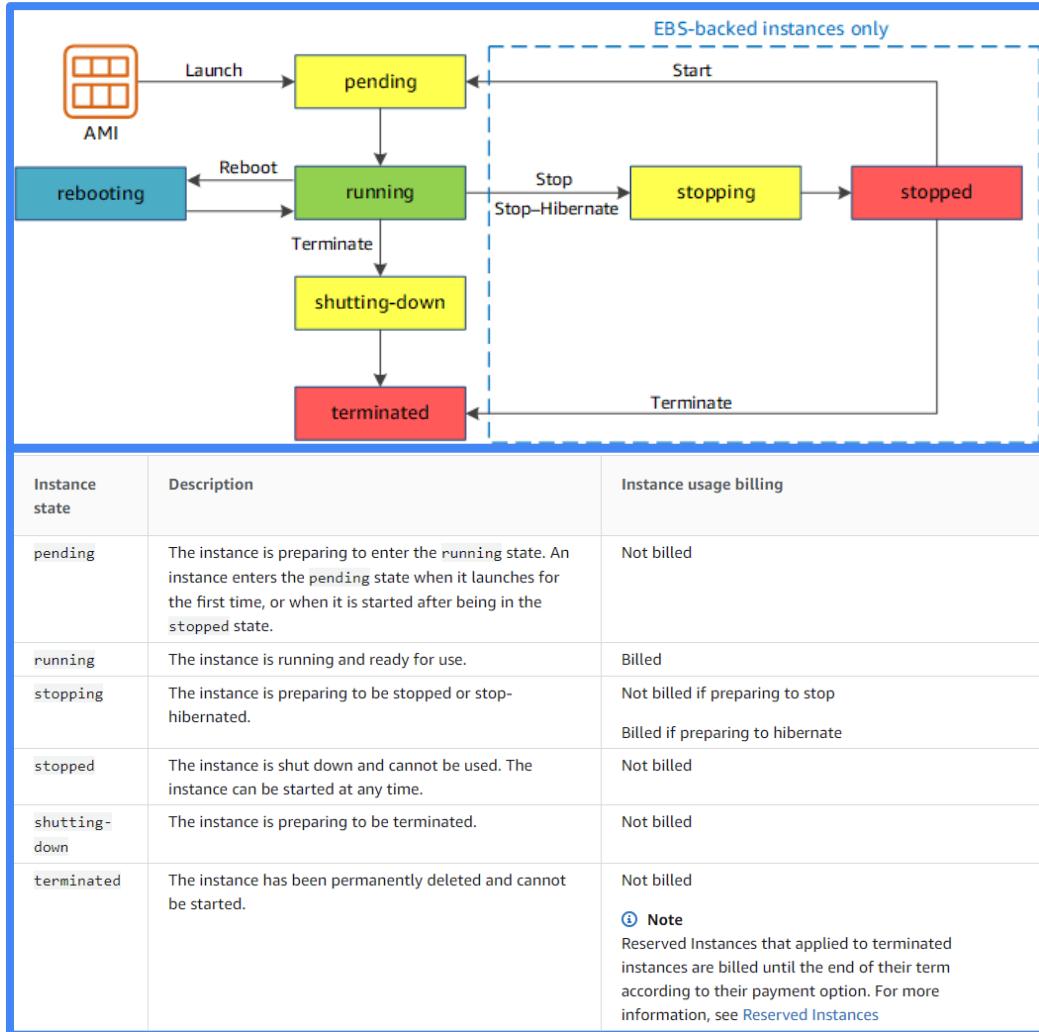
(link: [Instance lifecycle - Amazon Elastic Compute Cloud](#))

An Amazon EC2 instance transitions through different states from the moment you launch it through to its termination.

The following illustration represents the transitions between instance states.

Notice that you can't stop and start an instance that is "store-backed". For more information about these types of instances, please see [Storage for the root device](#).

In this tutorial, we won't see store-backed instances.



Using AWS accessing an instance

Accessing an instance

- Now we have created an instance that is running on a given region. Our next step is to use that instance.
- If you have followed the steps regarding the creation of an instance running RStudio, there are two ways of accessing it:
 - a. **Via secure shell (SSH)**: with this approach it is possible to access the instance via shell and work with it by launching commands from the terminal. This approach can be used with the free instance as well. In this tutorial, we will use **PuTTY**, a free implementation of SSH.
 - b. **Via IPv4**: it is possible to use the IPv4 of the instance to access to Rstudio from the browser. This step is relatively straightforward, the IPv4 of the instances (accessible through the EC2 dashboard, instance page, by selecting the desired instance) should be copied and pasted a browser window.
- **For using nlmixr**, we will need to install “cmake” on our instance, therefore we will need to access it via SSH before running RStudio by accessing the instance using the IPv4.

Access the instance via SSH

- Before you connect to your Linux instance using PuTTY, complete the following prerequisites.
 - a. **Verify that the instance is ready:** after you launch an instance, it can take a few minutes for the instance to be ready so that you can connect to it. Check that your instance has passed its status checks. You can view this information in the **Status check** column on the **Instances** page. An instance is ready when its status is “**Running**”.
 - b. **Install PuTTY on your local computer:** download and install PuTTY from the [PuTTY download page](#). If you already have an older version of PuTTY installed, we recommend that you download the latest version. Be sure to install the entire suite.
 - c. **Your private key:** Locate the private key (.ppk file) that was generated before to access the instance via PuTTY.

Some useful screenshots are in the next slides...

AWS Services Search for services, features, blogs, docs, and more [Alt+S] Frankfurt ▾ Ichiudinelli ▾

EC2 Billing Batch

EC2 Dashboard EC2 Global View Events Tags Limits Instances Instances New Instance Types Launch Templates Spot Requests Savings Plans Reserved Instances New Dedicated Hosts Capacity Reservations Images AMIs New AMI Catalog Elastic Block Store Volumes New Snapshots New Lifecycle Manager New Network & Security Security Groups Elastic IPs Placement Groups Key Pairs

Instances (1/1) Info

Search

Name Instance ID Instance state Instance type Status check Alarm status Availability Zone Public IPv4 DNS

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IPv4 DNS
<input checked="" type="checkbox"/>	i-0ab9d85694318f132	Running	t2.micro	2/2 checks passed	No alarms	+ eu-central-1c	ec2-18-156-200-55.eu-central-1.compute.amazonaws.com

Annotate the information of your instance (Instance ID, public IPv4 address, public IPv4 DNS)

Also, for “Amazon Linux 2” or the “Amazon Linux” AMI, the user name is **ec2-user**

For RStudio AMI, the default username is **ubuntu**.

Instance: i-0ab9d85694318f132

Details Security Networking Storage Status checks Monitoring Tags

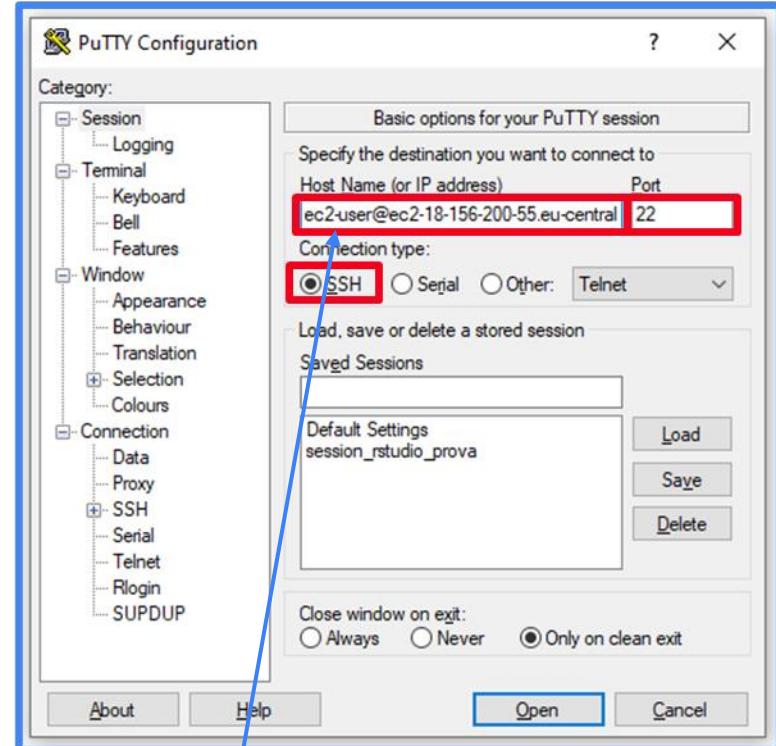
Instance summary Info

Instance ID i-0ab9d85694318f132	Public IPv4 address 18.156.200.55 open address	172.31.8.255
IPv6 address -	Instance state Running	Public IPv4 DNS ec2-18-156-200-55.eu-central-1.compute.amazonaws.com open address
Hostname type IP name: ip-172-31-8-255.eu-central-1.compute.internal	Private IP DNS name (IPv4 only) ip-172-31-8-255.eu-central-1.compute.internal	Answer private resource DNS name IPv4 (A)
Instance type	Elastic IP addresses	VPC ID

Feedback English (US) © 2022, Amazon Web Services, Inc. or its affiliates. Privacy Terms Cookie preferences

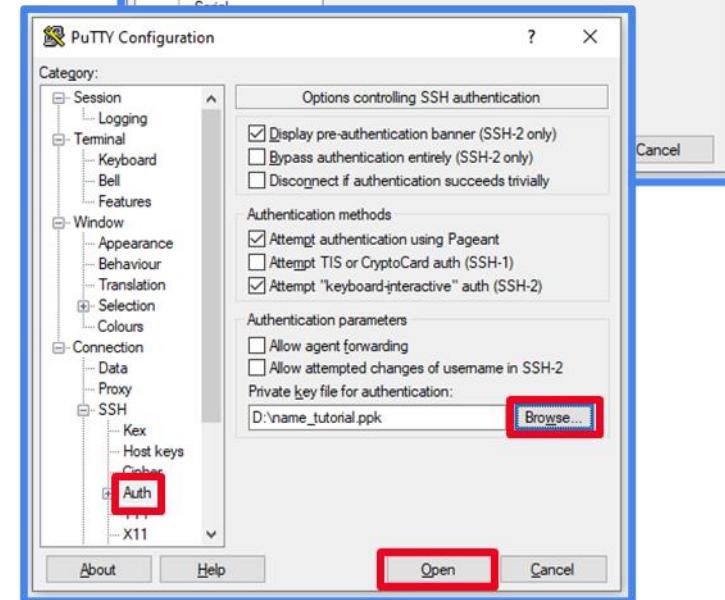
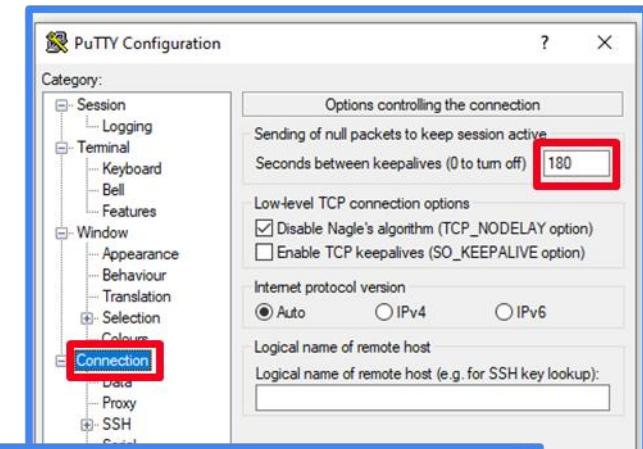
To connect to your instance using PuTTY

1. Start PuTTY (from the **Start** menu, choose **All Programs**, **PuTTY**, **PuTTY**).
2. In the **Category** pane, choose **Session** and complete the following fields:
 - a. In the **Host Name** box, do one of the following:
 - (Public DNS) To connect using your instance's public DNS name, enter *my-instance-user-name@my-instance-public-dns-name*.
 - (IPv6) Alternatively, if your instance has an IPv6 address, to connect using your instance's IPv6 address, enter *my-instance-user-name@my-instance-IPv6-address*.
 - *my-instance-user-name* for the free account should be *ec2-user*, while if you followed the steps for creating an instance running RStudio, it should be *ubuntu*.
 - b. For information about how to get the user name for your instance, and the public DNS name or IPv6 address of your instance, see [Get information about your instance](#).
 - c. Ensure that the **Port** value is 22.
 - d. Under **Connection type**, select **SSH**.



For RStudio AMI instances, the default username is *ubuntu* and not *ec2-user*.

3. **(Optional)** You can configure PuTTY to automatically send 'keepalive' data at regular intervals to keep the session active. This is useful to avoid disconnecting from your instance due to session inactivity. In the **Category** pane, choose **Connection**, and then enter the required interval in the **Seconds between keepalives** field. For example, if your session disconnects after 10 minutes of inactivity, enter 180 to configure PuTTY to send keepalive data every 3 minutes.
4. In the **Category** pane, expand **Connection**, expand **SSH**, and then choose **Auth**. Complete the following:
- Choose **Browse**.
 - Select the **.ppk** file that you generated for your key pair and choose **Open**.
 - (Optional) If you plan to start this session again later, you can save the session information for future use. Under **Category**, choose **Session**, enter a name for the session in **Saved Sessions**, and then choose **Save**.
 - Choose **Open**.



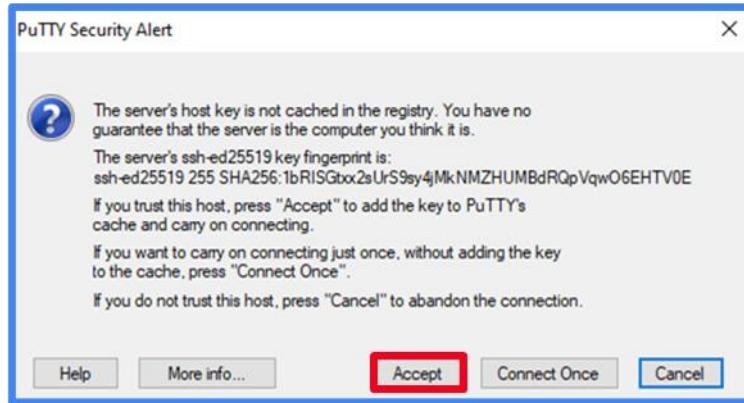
5. If this is the first time you have connected to this instance, PuTTY displays a security alert dialog box that asks whether you trust the host to which you are connecting.

- a. (Optional) Verify that the fingerprint in the security alert dialog box matches the fingerprint that you previously obtained in [\(Optional\) Get the instance fingerprint](#). If these fingerprints don't match, someone might be attempting a "man-in-the-middle" attack. If they match, continue to the next step.
- b. Choose **Yes**. A window opens and you are connected to your instance.

Note

If you specified a passphrase when you converted your private key to PuTTY's format, you must provide that passphrase when you log in to the instance.

If you receive an error while attempting to connect to your instance, see [Troubleshoot connecting to your instance](#).



Using AWS installing cmake and using RStudio and nlmixr

Install cmake

- To run nlmixr on the AWS instance, *cmake* needs to be installed.
- First, we need to access the instance via SSH, in our case we used PuTTY.
- Install cmake by following the steps described at the link below under “Method 2: installing cmake using command line”.
 - <https://www.fosslinux.com/38392/how-to-install-cmake-on-ubuntu.htm>
- Commands for installing cmake via command line:
 - `sudo apt update` (to update the system)
 - `sudo apt upgrade` (to update the system)
 - `sudo snap install cmake -classic` (to install cmake)
 - `cmake --version` (to check cmake version)

Using RStudio via AWS

- To use RStudio we will connect to the instance via IPv4.
- Go to your AWS account, EC2 dashboard, instance page and select the desired instance.
- Copy the public IPv4 address and paste it in a new browser window.
- Sign in to RStudio by using the following credentials:
 - Username: rstudio
 - Password: instance ID (it can be obtained on the instance page by selecting the desired instance).
- Now a web page with RStudio should be open: install all the packages that you need. If you have installed cmake, nlmixr installation should be successful.
- It would be good to change the password, this can be easily done by following the steps reported in Welcome.R file already present in the instance.
- It is possible to easily upload and download files by using “upload” and “export” functions of RStudio, as explained in the next slides.

AWS Services Search for services, features, blogs, docs, and more [Alt+S] Frankfurt Ichiudinelli

EC2 Billing Batch

EC2 Dashboard EC2 Global View Events Tags Limits Instances Instances New Instance Types Launch Templates Spot Requests Savings Plans Reserved Instances New Dedicated Hosts Capacity Reservations Images AMIs New AMI Catalog Elastic Block Store Volumes New Snapshots New Lifecycle Manager New Network & Security Security Groups Elastic IPs Placement Groups Key Pairs

Instances (1/1) Info

Search

Name Instance ID Instance state Instance type Status check Alarm status Availability Zone Public IPv4 DNS

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IPv4 DNS
<input checked="" type="checkbox"/>	i-0ab9d85694318f132	Running	t2.micro	2/2 checks passed	No alarms	+ eu-central-1c	ec2-18-156-200-55.eu-central-1.compute.amazonaws.com

To access the instance via IPv4, copy the Public IPv4 address and paste it in a new browser window.

Clicking the link “open address” may not work (it opens an https link, our RStudio wants an http)

Instance: i-0ab9d85694318f132

Details Security Networking Storage Status checks Monitoring Tags

Instance summary Info

Instance ID i-0ab9d85694318f132	Public IPv4 address 18.156.200.55 open address	Private IPv4 addresses 172.31.8.255
IPv6 address -	Instance state Running	Public IPv4 DNS ec2-18-156-200-55.eu-central-1.compute.amazonaws.com open address
Hostname type IP name: ip-172-31-8-255.eu-central-1.compute.internal	Private IP DNS name (IPv4 only) ip-172-31-8-255.eu-central-1.compute.internal	Answer private resource DNS name IPv4 (A)
Instance type	Elastic IP addresses	VPC ID

Feedback English (US) © 2022, Amazon Web Services, Inc. or its affiliates. Privacy Terms Cookie preferences

RStudio login and GUI

Sign in to RStudio

Username:

Password:

You will automatically be signed out after 60 minutes of inactivity.

Stay signed in when browser closes

Sign In

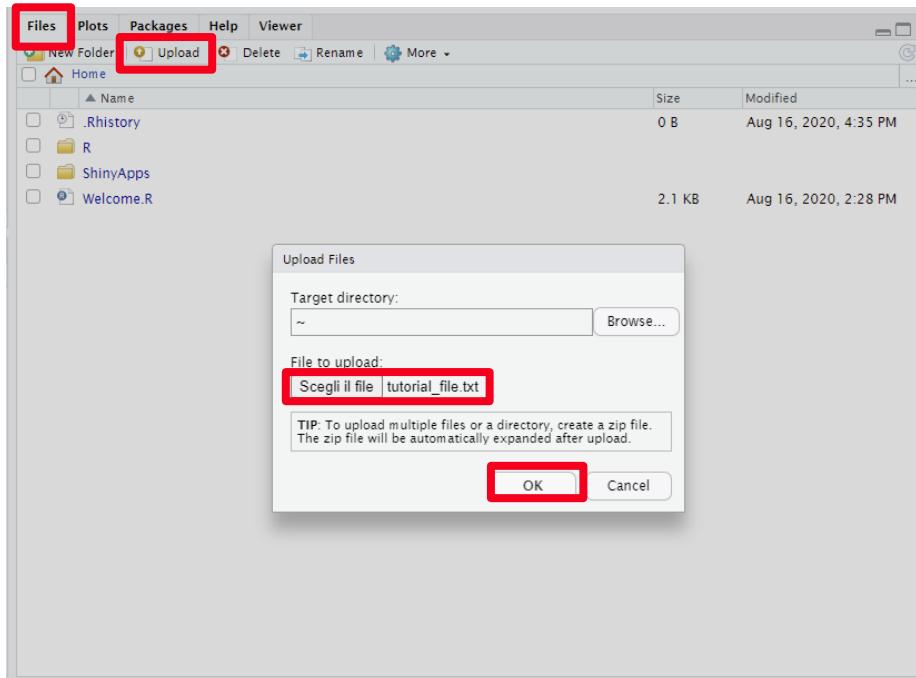
The screenshot shows the RStudio Server interface. The top navigation bar includes File, Edit, Code, View, Plots, Session, Build, Debug, Profile, Tools, and Help. The main window has several panes:

- Code Editor:** Displays the file "Welcome.R" which contains a welcome message for the RStudio Server version 1.3.1073, running on Ubuntu 18.04 LTS. It also includes instructions for changing the password via the terminal or R package "RStudioAMI".
- Environment:** Shows the Global Environment pane where it is noted that the environment is empty.
- Files:** Shows the file structure under "Home": .Rhistory (0 B, modified Aug 16, 2020, 4:35 PM), R (2.1 kB, modified Aug 16, 2020, 2:28 PM), ShinyApps (empty), and Welcome.R (2.1 kB, modified Aug 16, 2020, 2:28 PM).
- Console:** Displays the R version 4.0.2 startup message and the command prompt > |.

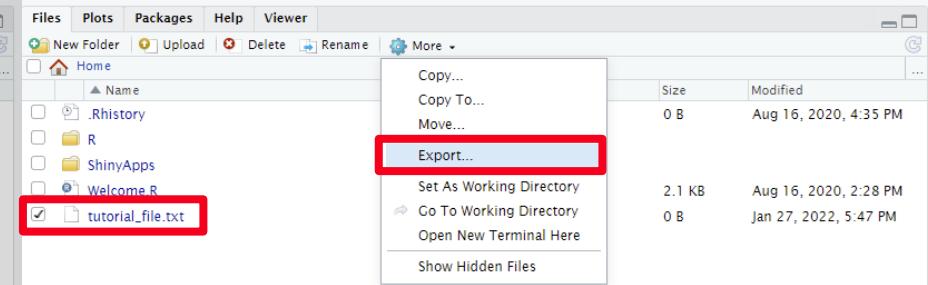
Exchange Data locally < - - - > Rstudio

Import

works with zipped folders if needed



Export



Save template/AMI/volumes/snapshots

It is possible to save a snapshot of the AMI. This can be useful to:

- replicate instance configuration quickly
- save important additions in the Ubuntu environment (like cmake)
- **Important:** control the costs of volumes, storing snapshots etc.

Final remarks - **Important**

- Pricing model for AWS is pay-per-use.
- Remember to stop and instance when not using it!

Contacts

Dr Lorenzo Chiudinelli (linkedin.com/in/lorenzo-chiudinelli-2ba2b7107)

Dr Nicola Melillo (linkedin.com/in/nicola-melillo-4868ba107)

Dr Hitesh Mistry (linkedin.com/in/hitesh-mistry-1ba60121)

Systems Forecasting UK